



Water Infrastructure Improvements (Phase 1)

CFDA No. 10.770

Former Naval Station Roosevelt Roads, Ceiba & Naguabo, PR

Improvements to the existing potable water treatment plant, raw water intake and reservoir, distribution tank and distribution system at former Naval Station Roosevelt Roads in Naguabo and Ceiba, PR.



United States Department of Agriculture
Rural Development

TABLE OF CONTENTS

- 1. Water Infrastructure Improvements Phase 1- Plans**
- 2. Technical Specifications Construction Documents**
- 3. Permits and Edorsements**
- 4. Environmental Report**
- 5. Geotechnical Report**

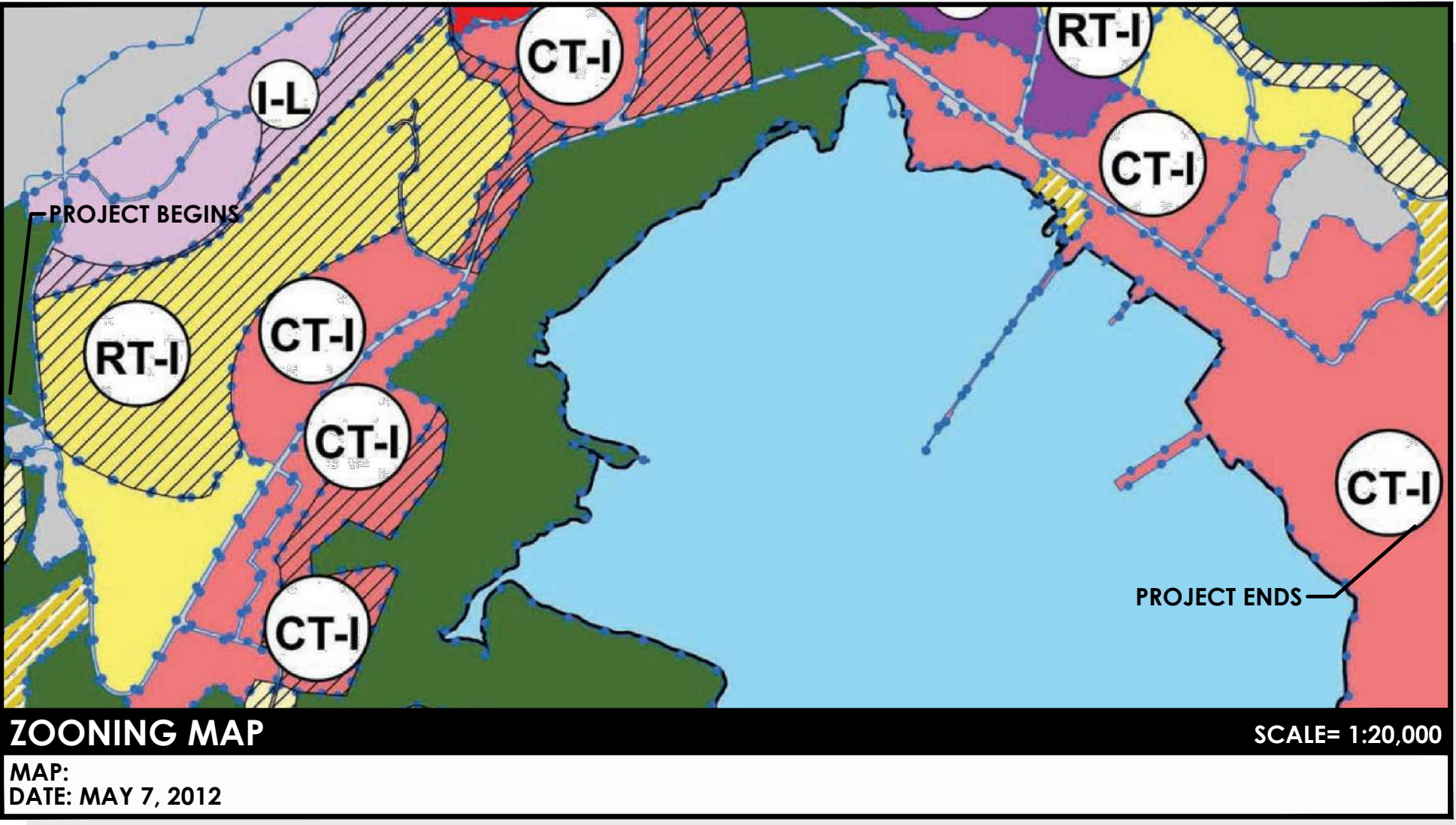
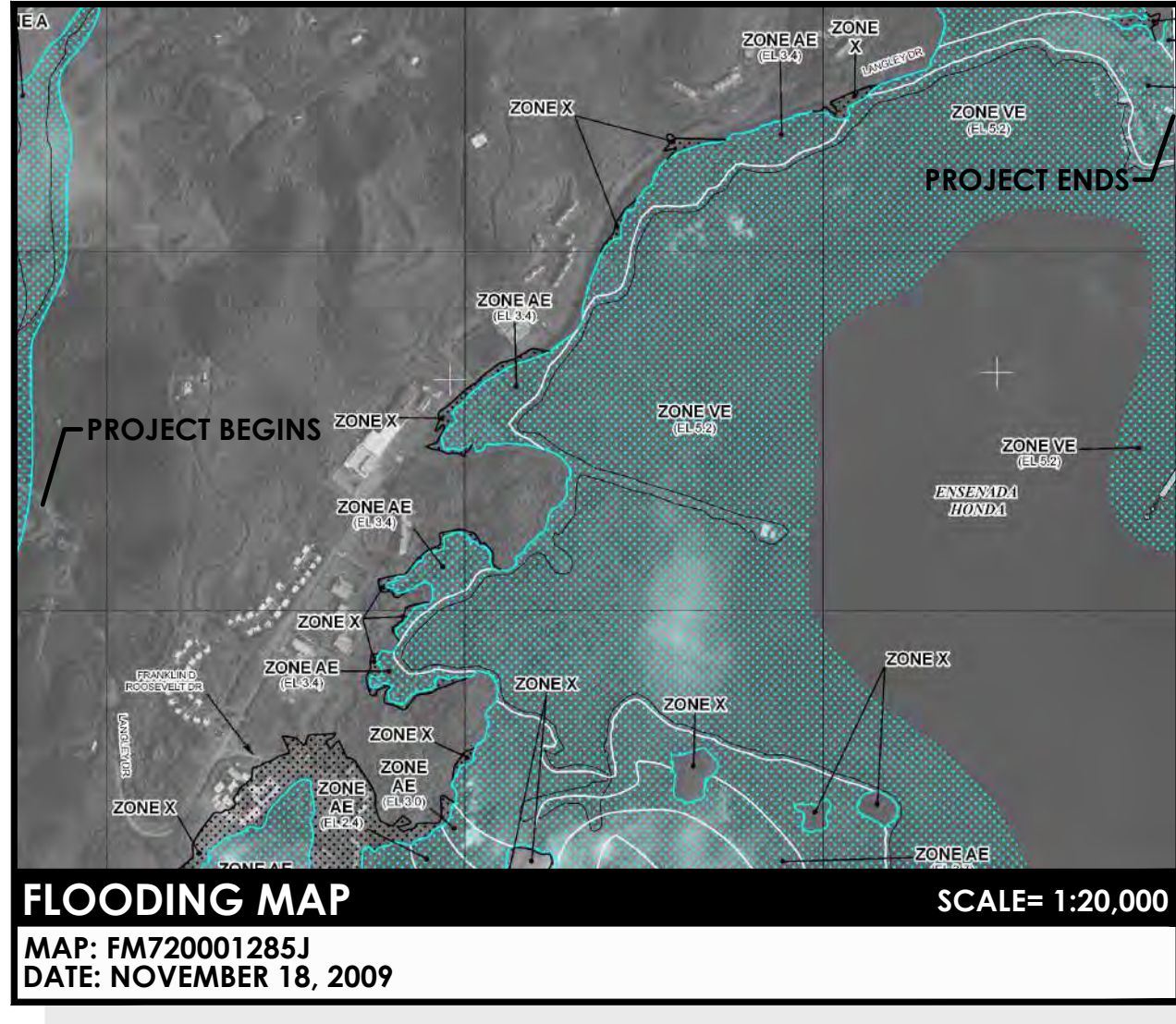
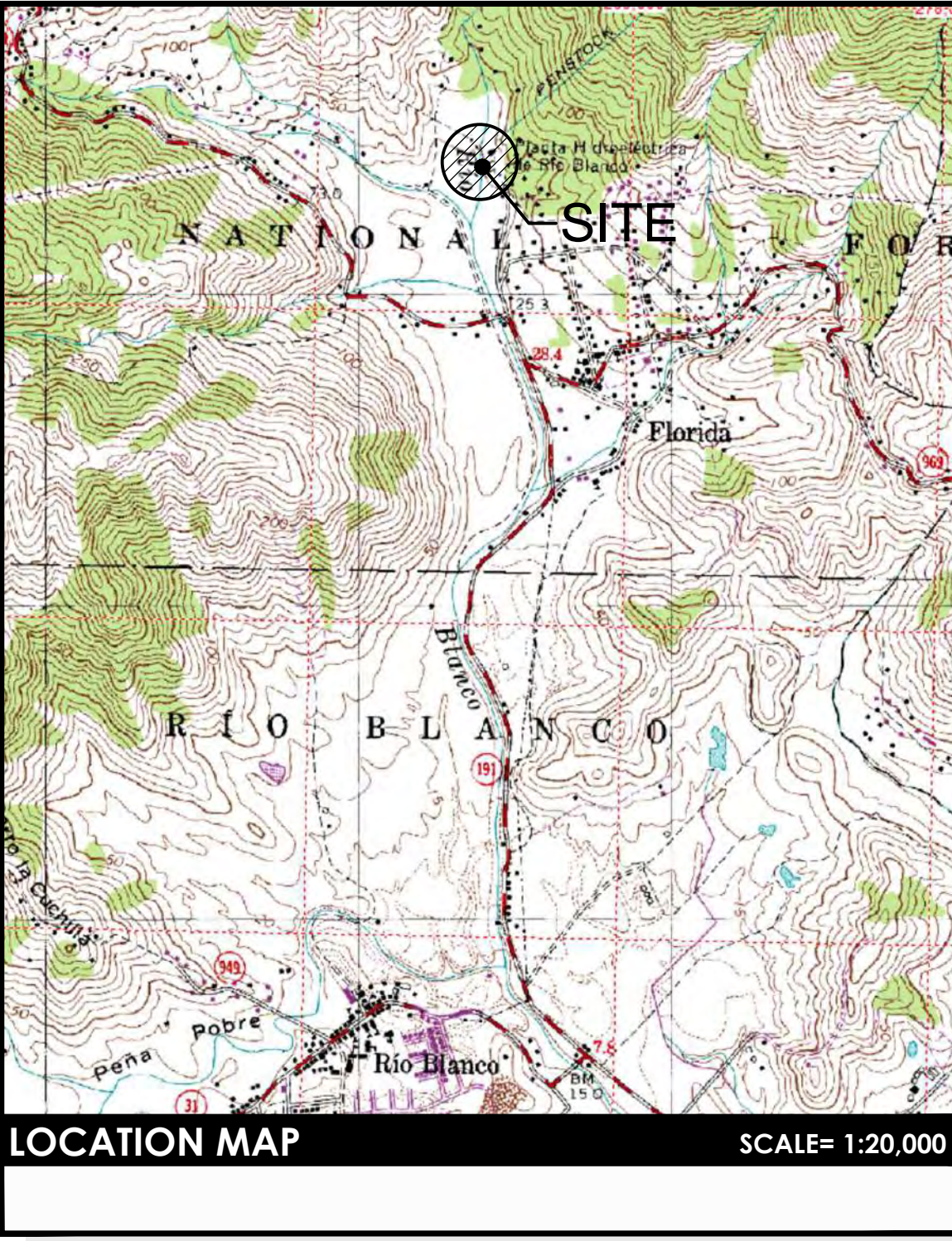
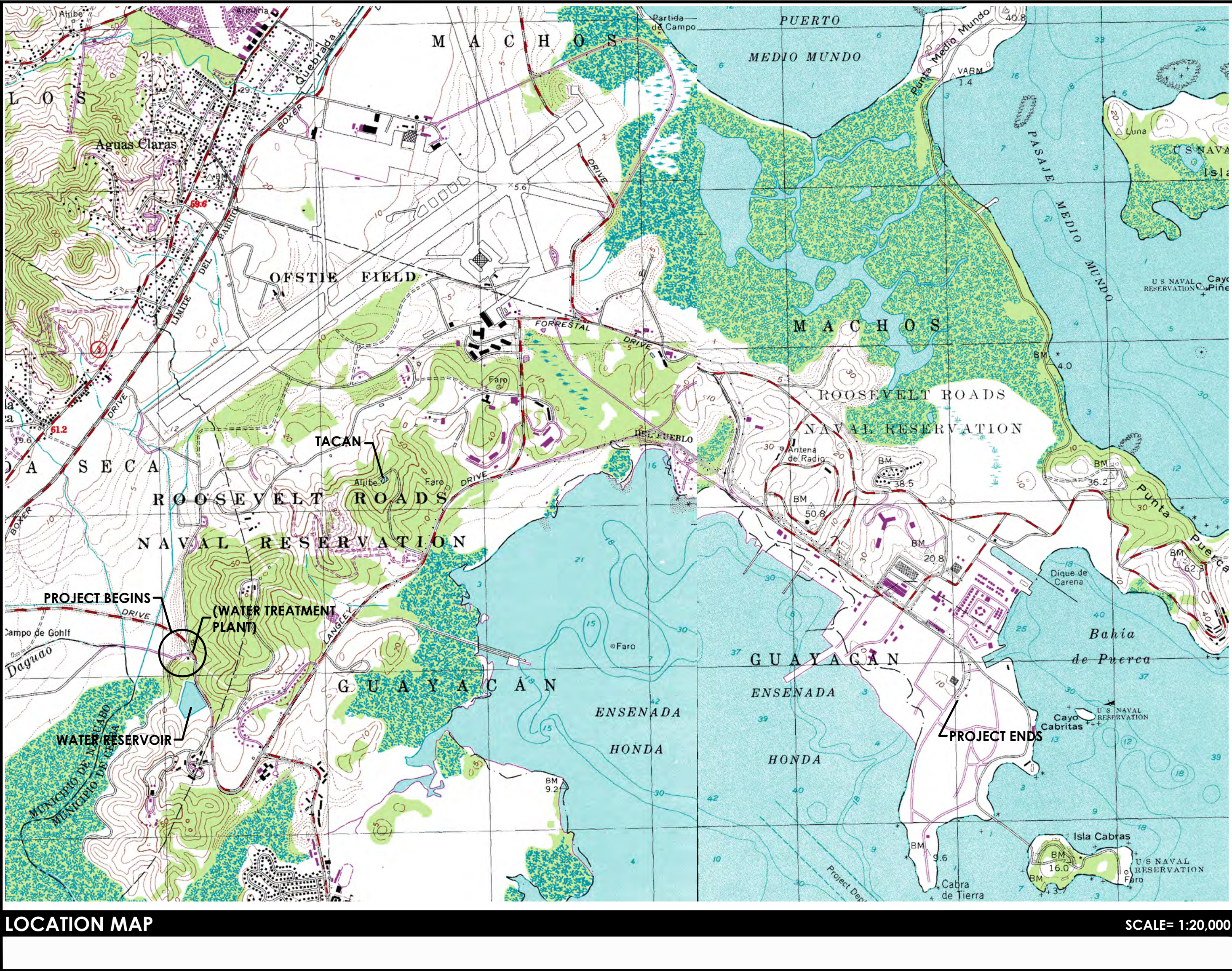
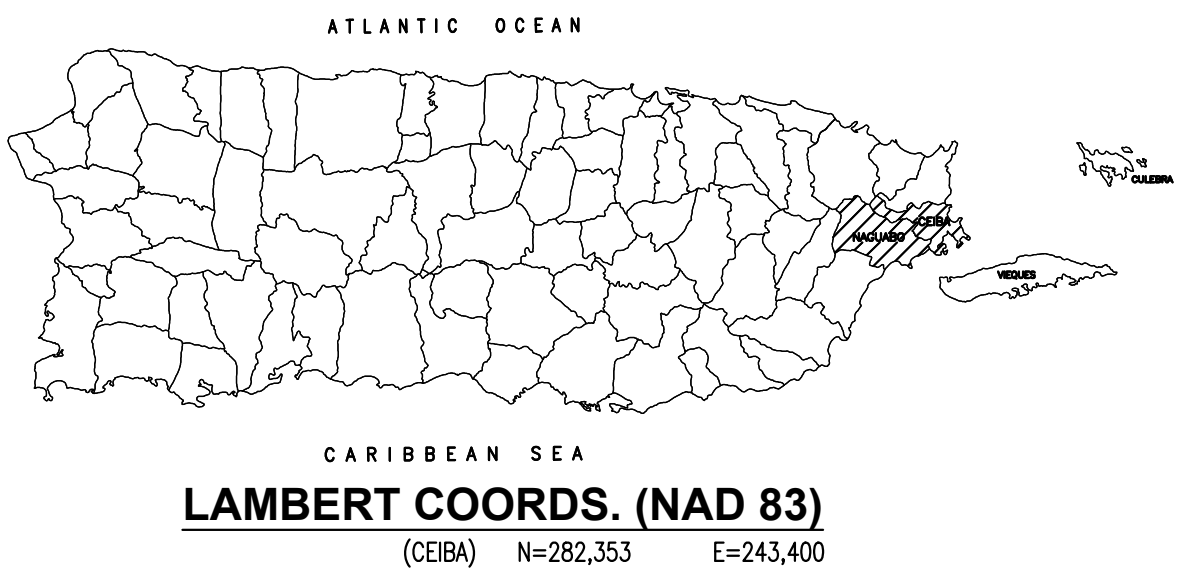
1. WATER INFRASTRUCTURE IMPROVEMENT PHASE 1- PLANS



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

REVISED BID SET DRAWINGS
NOVEMBER 30, 2021



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO CARLOS I. BAEZ DOTE, LICENCIA 17371. CERTIFICADO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICADO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date: 2016/11/29	

Project Title:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Drawing Title:

TITLE, INDEX & LOCATION MAPS PLAN

Sheet:

T100

File: P:\19-Ceiba\1837.0 RR WATER SYSTEM IMPROVEMENTS PHASE I\06-BidPhase\00-General Sheets\001-T100 TITLE SHEET; Plotted: 11/15/2022 11:13 a.m. by SVAZQUEZ; Saved: 3/11/2022 7:37 a.m. by SVAZQUEZ

SYMBOLS GENERAL LEGEND:

	REINFORCED CONCRETE WALL OR COLUMNS
	4" TO 8" BLOCK WALL CONCRETE MASONRY UNIT - (CMU)
	GYPSUM BOARD WALL (SEE DESCRIPTION NOTES FOR CLASSIFICATION)
	GYPSUM BOARD WALL WITH INSULATION (SEE DESCRIPTION NOTES FOR CLASSIFICATION)
	SPECIAL CONSTRUCTION WALL (AS NOTED)
	LOW WALL
	INDICATES DIRECTION OF SECTION
	INDICATES GENERAL SECTION LETTER
	INDICATES NUMBER OF SHEET OR SHEETS DESIGNATION
	INDICATES GENERAL SECTION LETTER
	INDICATES NUMBER OF SHEET OR SHEETS DESIGNATION
	INDICATES INTERIOR ELEVATION NUMBER
	INDICATES NUMBER OF SHEET DESIGNATION
	INDICATES ROOM SPACES NUMBER
	INDICATES ROOM FINISH NUMBER (REFER TO DRAWING FOR SCHEDULE OR DETAILS)
	SECTION LEADER (SIMPLE SECTION WITH LEADER)
	DOORS IDENTIFICATION NUMBER (REFER TO DRAWING A600 FOR SCHEDULE)
	WINDOWS IDENTIFICATION LETTER (REFER TO DRAWING A600 FOR SCHEDULE)
	INDICATES WALL TYPE NUMBER FOR DETAILS (REFER TO DRAWING FOR SCHEDULE OR DETAILS)
	INDICATES EQUIPMENT NUMBER FOR BATHROOMS OR KITCHEN (REFER TO DRAWING A400 FOR SCHEDULE)
	INDICATES ROOF OR FLOOR <u>SLOPE</u>
	FINISH FLOOR LEVEL CHANGE
	FINISH FLOOR LEVEL CHANGE
	FINISHED FLOOR ELEVATION
	INDICATES FINISH FLOOR LEVEL CHANGE (EXACT LOCATION TO BE COORDINATED IN THE FIELD WITH ARCH./ENG.)
	GROUND FLOOR LEVEL F.F.E. 0'-0"
	LEVEL LINE OF FINISHED FLOOR ELEVATION INDICATES NAME AND HEIGHT OF LEVELS
	THICKNESS SLAB SYMBOL
	BUILDING AXIS
	EXISTING BUILDING AXIS
	EXISTING CONCRETE WALL OR COLUMNS
	EXISTING BLOCK WALL
	EXISTING AREA TO BE DEMOLISHED OR REMOVED
	INDICATES REVISION NUMBER
	REVISION IDENTIFICATION INDICATE REVISION DATE & DESCRIPTION AT REVISION TABLE (SHEET STAMP)
	INDICATES REVISION CLOUD IN REVISED AREA

INDEX OF DRAWINGS

SHEET NUMBER	SHEET TITLE
General Sheet	
1	T100 Title, Index & Location Maps Plan
2	G100 Index & Legend
3	K100 Key Plan
4	K101 Rio Blanco Intake Key Plan
5	G101 General Demolition and Other Notes
6	G102 Health & Safety Notes
7	G103 General Structural Notes
Environmental Concern Areas Key Plan	
8	BC-100 Biological Concern Areas Key Plan
9	WDS-EC100 Environmental Concern Areas Key Plan
10	WDS-EC101 Environmental Concern Areas Schedule

Raw Water Intake, Reservoir, Treatment Plant & Sludge Lagoons Topographic & Hydrographic

11	VF-01	Title Sheet ,Index, Maps, Legend, Notes & Controls
12	VF-02	General Site Plan
13	VF-03	Existing Conditions, Topographic & Hydrographic Survey
14	VF-04	Existing Conditions, Topographic & Hydrographic Survey
15	VF-05	Existing Conditions, Topographic & Hydrographic Survey
16	VF-06	Existing Conditions, Topographic & Hydrographic Survey

Water Distribution System Topographic Survey

17	S-01	Topography & As-Built Key Plan
18	S-02	Topographic & As-Built Plan
19	S-03	Topography & As-Built Plan
20	S-04	Topography & As-Built Plan
21	S-05	Topography & As-Built Plan
22	S-06	Topography & As-Built Plan
23	S-07	Topography & As-Built Plan
24	S-08	Topography & As-Built Plan
25	S-09	Topography & As-Built Plan
26	S-10	Topography & As-Built Plan
27	S-11	Topography & As-Built Plan
28	S-12	Topography & As-Built Plan
29	S-13	Topography & As-Built Plan
30	S-14	Topography & As-Built Plan
31	S-15	Topography & As-Built Plan
32	S-16	Topography & As-Built Plan
33	S-17	Topography & As-Built Plan
34	S-18	Topography & As-Built Plan
35	S-19	Topography & As-Built Plan
36	S-20	Topography & As-Built Plan
37	S-21	Topography & As-Built Plan
38	S-22	Topography & As-Built Plan
39	S-23	Topography & As-Built Plan
40	S-24	Topography & As-Built Plan
41	S-25	Topography & As-Built Plan
42	S-26	Topography & As-Built Plan

Rio Blanco Raw Water Intake Grit Chamber

Civil	
43	RWI-C100 Improvement Site Plan
44	RWI-C101 Existing + Demolition Site Plan
45	RWI-C201 Proposed Site Plan
Mechanical	
46	RWI-MD101 Grit Chamber Existing + Demolition Plan & Sections
47	RWI-M101 Grit Chamber Improvements Plan & Sections
48	RWI-M201 Grit Chamber Improvements Details
49	RWI-M202 Access Door Details
50	RWI-M203 Proposed Platform Details
51	RWI-M204 Raw Water Line Hydraulic Profile

Raw Water Flow Meter & Valve Vault

Mechanical	
52	RWM-M101 Vault Existing + Demolition Plan & Sections
53	RWM-M201 Vault Improvements Plan & Sections
54	RWM-M202 Schedules & Details
Electrical	
55	RWM-E100 Electrical Site Plan
56	RWM-E101 Electrical Distribution Plan

Raw Water Reservoir

Civil	
57	RWR-C101 Site Plan
58	RWR-C201 Reservoir Dredging Plan
59	RWR-C301 Dredging Sections
60	RWR-C401 Civil Details
Structural	
61	RWR-S101 Existing + Demolition Intake Chamber Roof Canopy
62	RWR-S102 Proposed Intake Chamber Canopy Structural Plan & Details
63	RWR-S201 Existing Walkway Replacement Plan & Details
64	RWR-S202 Walkway Replacement Structural Plan, Details & Section
65	RWR-S301 Slope Slab and Swale Replacement Details
Mechanical	
66	RWR-M101 Drain + Effluent Chamber Improvements
Electrical	
67	RWR-E100 Electrical Distribution Plan

SHEET NUMBER	SHEET TITLE	SHEET NUMBER	SHEET TITLE
Water Treatment Plant		Plumbing	
Civil		175	WTP-PL201 Partial First Floor Plumbing Plans and Isometric
Electrical		HVAC	
68	WTP-C101 Existing + Demolition Site Plan	176	WTP-AC201 HVAC Proposed First Floor, Basement Plan and Section
69	WTP-C201 Proposed Site Plan	177	WTP-AC301 Schedules & Details
70	WTP-C202 Proposed Site Details	Electrical	
71	WTP-C203 New Perimeters Filters Low Wall Details & Access Door Details	178	WTP-E100 Electrical Master Off-Site Plan
72	WTP-C204 New Generator Room Concrete Pad Area Site Plan and Details	179	WTP-E101 Electrical Site Plan and Legend
73	WTP-C301 Site Details	180	WTP-E102 Proposed Electrical Site Plan
74	WTP-C400 Proposed Clearwell Improvements Details	181	WTP-E103 Electrical Riser Diagram Legend
75	WTP-C500 Maintenance of Traffic Plan	182	WTP-E104 Site Notes and Electrical Site Details
76	WTP-C501 Maintenance of Traffic Details- I	183	WTP-E105 Emergency Generator Description and Details
77	WTP-C502 Maintenance of Traffic Details- II	184	WTP-E200 Existing Basement Floor Level Electrical Distribution Plan
78	WTP-CE1 Erosion & Sedimentation Control Plan	185	WTP-E201 Existing First Floor Level Electrical Distribution Plan
79	WTP-CE2 Erosion & Sedimentation Control Details	186	WTP-E202 Existing Second Floor Level Electrical Distribution Plan
80	WTP-CE3 Erosion & Sedimentation Control Details	187	WTP-E203 Existing Roof Level Electrical Distribution Plan
81	WTP-CE4 Erosion & Sedimentation Control Details	188	WTP-E204 Sedimentation Basin Electrical Distribution Plan
Architecture		189	WTP-E205 Proposed Basement Floor Level Lighting Distribution Plan
82	WTP-AB101 Existing + Demolition Basement Floor Plan	190	WTP-E206 Proposed Basement Floor Level Power & Control Distribution Plan
83	WTP-AB102 Existing + Demolition First Floor Plan	191	WTP-E207 Proposed First Floor Level Lighting Distribution Plan
84	WTP-AB103 Existing + Demolition Second Floor Plan	192	WTP-E208 Proposed First Floor Level Power & Control Distribution Plan
85	WTP-AB104 Existing + Demolition Roof Floor	193	WTP-E209 Proposed Second Floor Level Lighting Distribution Plan
86	WTP-AB105 Existing + Demolition Basement Reflected Ceiling Plan	194	WTP-E210 Proposed Second Floor Level Power & Control Distribution Plan
87	WTP-AB106 Existing + Demolition First Floor Reflected Ceiling Plan	195	WTP-E211 Proposed Roof Level Electrical Distribution Plan
88	WTP-AB107 Existing + Demolition Second Floor Reflected Ceiling Plan	196	WTP-E212 Motor Control Center Description
89	WTP-AB201 Existing + Demolition Elevations	197	WTP-E213 Motor Control Center Details
90	WTP-AB202 Existing + Demolition Elevations	198	WTP-E214 Schedules and Details
91	WTP-AB301 Existing + Demolition Section A	199	WTP-E215 Notes, Legend and Details
92	WTP-AB302 Existing + Demolition Section B	200	WTP-E216 Control Rough Diagram
93	WTP-A101 Proposed Basement Floor Plan	201	WTP-E217 Schedules and Details
94	WTP-A102 Proposed First Floor Plan	202	WTP-E218 Notes, Legend and Details
95	WTP-A103 Proposed Second Floor Plan	Sludge Lagoons	
96	WTP-A104 Proposed Roof Plan	203	WSL-C101 Existing + Demolition Site Plan
97	WTP-A105 Proposed First Floor Reflected Ceiling Plan	204	WSL-C201 Proposed Site Plan
98	WTP-A201 Proposed Elevations	205	WSL-C202 Dredging Sections
99	WTP-A202 Proposed Elevations	206	WSL-C301 Proposed Force Line Plan
100	WTP-A301 Proposed Section A	207	WSL-C302 Proposed Force Line Profile
101	WTP-A302 Proposed Section B	208	WSL-C303 Proposed Force Line Profile & Details
102	WTP-A401 Proposed Restroom & Kitchenette Details	209	WSL-M101 Decant Pumps Plan & Sections
103	WTP-A402 Proposed Handrail Details	Electrical	
104	WTP-A403 Enlarged Chlorine & Electrical Room Plan & Interior Elevations	210	WSL-E100 Electrical Distribution Plan
105	WTP-A404 Proposed Platform Details	211	WSL-E101 Electrical Distribution and Details
106	WTP-A405 Proposed Exterior Stairs Details	212	WSL-E102 Control Panel Description
107	WTP-A406 Storage Room Floor Plan	Backwash Tank	
108	WTP-A601 Door & Window Schedule	213	WBT-C101 Existing + Demolition Site Plan
109	WTP-A602 Storage Room Schedules & Details	214	WBT-C102 Existing + Demolition Plan & Section
Lead & Asbestos Abatement		215	WBT-C201 Proposed Plan & Section
110	WTP-LA101 Lead & Asbestos Abatement Basement Floor Plan	Potable Water Storage Tank (TACAN)	
111	WTP-LA102 Lead & Asbestos Abatement First Floor Plan	Civil	
112	WTP-LA103 Lead & Asbestos Abatement Second Floor Plan	216	WST-C101 Proposed Site Plan
113	WTP-LA201 Lead & Asbestos Abatement Basement Sections	Architecture	
114	WTP-LA202 Lead & Asbestos Abatement Basement Sections	217	WST-AB101 Existing + Demolition Bottom Plan
Process		218	WST-AB102 Existing + Demolition Roof Plan
115	WTP-PG100 Proposed Process Flow Diagram and Mass Balance	219	WST-AB201 Existing + Demolition Elevations
116	WTP-PG101 Proposed Hydraulic Profile	220	WST-AB301 Existing + Demolition Sections
117	WTP-PC101 Existing and Demolition Plan Site Plan	221	WST-A101 Proposed Bottom Plan
118	WTP-PC102 Existing and Demolition Basins and Clearwell Sections	222	WST-A102 Proposed Roof Plan
119	WTP-PC103 Existing and Demolition Filters Pipe Gallery Plan	223	WST-A201 Proposed Elevations
120	WTP-PC104 Existing and Demolition Filters Pipe Gallery Sections A,B & C	224	WST-A301 Proposed Sections
121	WTP-PC105 Existing and Demolition Filters Pipe Gallery Sections D & E	225	WST-A401 Improvements Details
122	WTP-PC106 Existing + Demolition Clearwell Top & Bottom Plan	Electrical	
123	WTP-PC107 Existing + Demolition Clearwell Sections	226	WST-E100 Electrical Distribution Plan
124	WTP-PC201 Proposed Plan Site Plan	227	WST-E101 Photovoltaic, Telemetry and Instrumentation System Description
125	WTP-PC202 Proposed Filter Pipe Gallery Plan	228	WST-E102 Proposed Site Plan
126	WTP-PC203 Proposed Filter Pipe Gallery Plan	Water Distribution System	
127	WTP-PC204 Proposed Sedimentation Basin Improvement Plan	Civil	
128	WTP-PC205 Proposed Sedimentation Basin Improvement Section	229	WDS-C100 Water Distribution Key Plan
129	WTP-PC206 Proposed Filter Improvements Plan, Sections and Details	230	WDS-C101 Water Distribution Site Plan
130	WTP-PC207 Proposed Blowers Improvement Plan and Sections	231	WDS-C102 Water Distribution Site Plan
131	WTP-PC208 Proposed Clearwell Improvement Plant	232	WDS-C103 Water Distribution Site Plan
132	WTP-PC209 Proposed Clearwell Improvement Sections	233	WDS-C104 Water Distribution Site Plan
133	WTP-PC210 Proposed Chemical and Chlorine Room	234	WDS-C105 Water Distribution Site Plan
134	WTP-PC211 Mechanical Details	235	WDS-C106 Water Distribution Site Plan
135	WTP-P101 P&ID Diagram Lead Sheet 1	236	WDS-C107 Water Distribution Site Plan
136	WTP-P102 P&ID Diagram Lead Sheet 2	237	WDS-C108 Water Distribution Site Plan
137	WTP-P103 P&ID Coagulation, Flocculation and Sedimentation Basins	238	WDS-C109 Water Distribution Site Plan
138	WTP-P104 P&ID Filters	239	WDS-C110 Water Distribution Site Plan
139	WTP-P105 P&ID Clearwell, Backwash and Distribution Tank	240	WDS-C111 Water Distribution Site Plan
140	WTP-P106 P&ID Sludge Lagoons	241	WDS-C112 Water Distribution Site Plan
141	WTP-P107 P&ID Chemical Injection Systems	242	WDS-C113 Water Distribution Site Plan
142	WTP-IC100 Control Architecture	243	WDS-C114 Water Distribution Site Plan
143	WTP-IC101 CP-05 Layout and Bill of Material	244	WDS-C115 Water Distribution Site Plan
144	WTP-IC102 CP-05 Power Distribution	245	WDS-C116 Water Distribution Site Plan
145	WTP-IC103 CP-05 Analog Input Cards 1 of 4	246	WDS-C117 Water Distribution Site Plan
146	WTP-IC104 CP-05 Analog Input Cards 2 of 4	247	WDS-C118 Water Distribution Site Plan
147	WTP-IC105 CP-05 Analog Input Cards 3 of 4	248	WDS-C119 Water Distribution Site Plan
148	WTP-IC106 CP-05 Analog Input Cards 4 of 4	249	WDS-C120 Water Distribution Site Plan
149	WTP-IC107 CP-05 Analog Output Cards 1 of 2	250	WDS-C121 Water Distribution Site Plan
150	WTP-IC108 CP-05 Analog Output Cards 2 of 2	251	WDS-C122 Water Distribution Site Plan
151	WTP-IC109 CP-05 Digital Output Cards 1 of 1	252	WDS-C123 Water Distribution Site Plan
152	WTP-IC110 CP-05 Digital Output Cards 1 of 5	253	WDS-C124 Water Distribution Site Plan
153	WTP-IC111 CP-05 Digital Output Cards 2 of 5	254	WDS-C125 Water Distribution Site Plan
154	WTP-IC112 CP-05 Digital Output Cards 3 of 5	255	WDS-C201 Water Distribution System Details
155	WTP-IC113 CP-05 Digital Output Cards 4 of 5	256	WDS-C202 Water Main Horizontal Thrust Restraint Details
156	WTP-IC114 CP-05 Digital Output Cards 5 of 5	257	WDS-C203 Water Main Vertical Thrust Restraint Details
157	WTP-IC115 CP-05 Profibus Network A	Structural	
158	WTP-IC116 CP-05 Profibus Network B	167	WTP-S101 Second Floor Slab Retrofit Structural Plan & Sections
159	WTP-IC117 LCP-09 Panel Layout & Bill Of Material	168	WTP-S201 Miscellaneous Structural Details
160	WTP-IC118 LCP-09 Panel Power Distribution	Mechanical	
161	WTP-IC119 LCP-09 Panel Analog Input Card	169	WTP-MD101 Existing + Demolition Basement Floor Plan
162	WTP-IC120 LCP-09 Panel Digital Input Card	170	WTP-MD102 Existing + Demolition Basement Sections
163	WTP-IC121 Filters Local Panel Layout & Bill Of Material	171	WTP-M201 Proposed Basement Floor Plan
164	WTP-IC122 Filters Local Panel Electrical Distribution	172	WTP-M202 Partial Piping Basement Floor Plans, Sections and Legend
165	WTP-IC123 Installation Details 1 of 2	173	WTP-M203 Proposed Basement Sections and Details
166	WTP-IC124 Installation Details 2 of 2	174	WTP-M301 Basement Floor Drainage Sump Pump Plans, Sections and Details

Integra Design Group
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DO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL
"PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS"
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Revisions

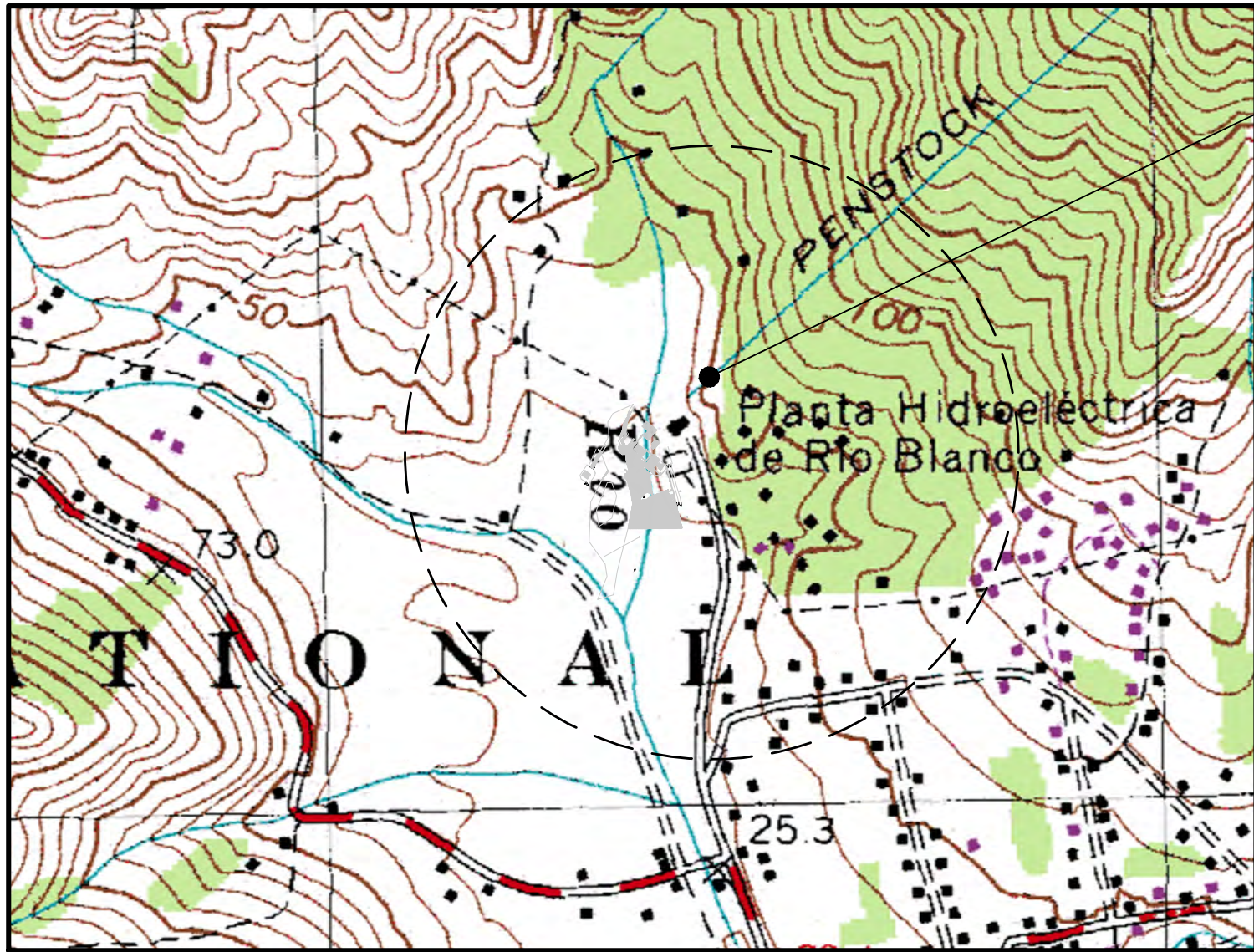
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GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

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AT ROOSEVELT ROADS RE-DEVELOPMENT
Owner:

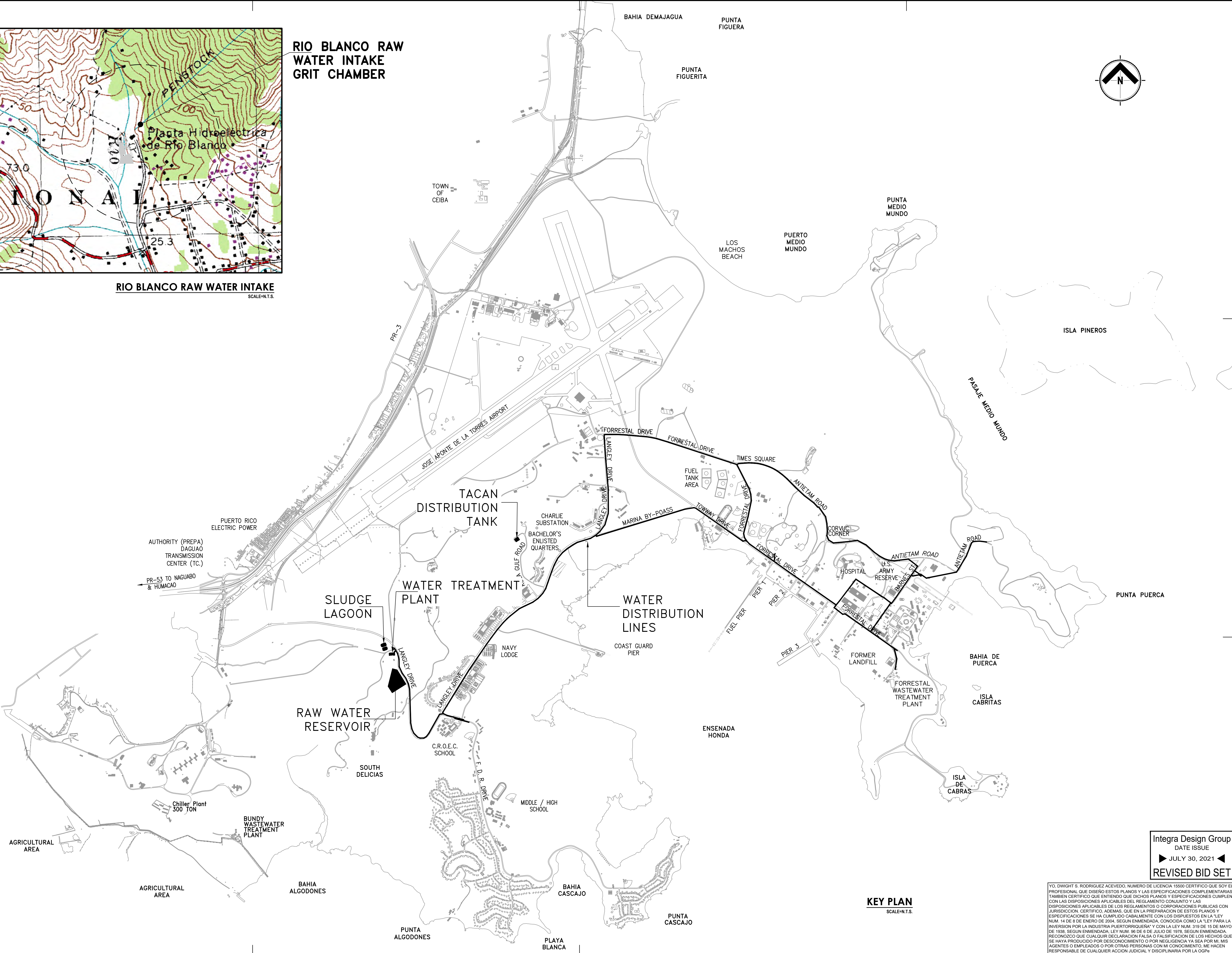
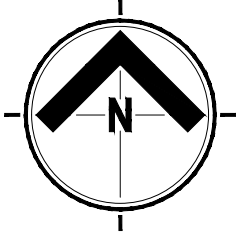
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INDEX & LEGEND

Sheet:
G100



RIO BLANCO RAW WATER INTAKE
SCALE=N.T.S.

RIO BLANCO RAW
WATER INTAKE
GRIT CHAMBER



KEY PLAN
SCALE=N.T.S.

Integra Design Group
DATE ISSUE
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YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOCIENDO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

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Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT
CERRA & NAGUABO, PUERTO RICO
Drawing Title: WATER DISTRIBUTION SYSTEM
KEY PLAN

Sheet: K100



RIO BLANCO RAW
WATER INTAKE
GRIT CHAMBER

RIO BLANCO RAW WATER INTAKE
SCALE=N.T.S.



RIO BLANCO INTAKE KEY PLAN
SCALE=N.T.S.

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JULY 30, 2021
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YO, DWIGHT S. RODRIGUEZ AGEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1988, SEGUN ENMIENDADA. LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Client:

Owner:

WATER RAW SYSTEM

Drawing Title:

RIO BLANCO INTAKE KEY PLAN

Revisions

Number

Date

Description

SHEET INFO

Project No. 19-1837.0

Set Date: 2021/07/28

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Dwg. Date:

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads



Sheet:

K101

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GENERAL NOTES:

1. THE CONTRACTOR SHALL VERIFY & COORDINATE ALL NEW AND EXISTING CONDITIONS & DIMENSIONS AT JOB SITE FOR COMPARISON WITH DRAWINGS AND SPECIFICATIONS PRIOR TO BIDDING & START OF CONSTRUCTION. IF ANY DISCREPANCIES, INCONSISTENCIES OR OMISSIONS ARE FOUND, THE OWNER'S ENGINEER SHALL BE NOTIFIED IN WRITING FOR CLARIFICATION PRIOR TO PROCEEDING WITH WORK.
2. DO NOT SCALE DRAWINGS. THE CONTRACTOR SHALL RELY ON WRITTEN DIMENSIONS AS GIVEN. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT FOR CLARIFICATIONS. ALL DIMENSIONS SHALL BE FIELD VERIFIED BY CONTRACTOR AND COORDINATED WITH ALL OF THE WORK OF ALL TRADES. IF DISCREPANCIES ARE FOUND, THE CONTRACTOR SHALL NOTIFY THE OWNER'S ENGINEER IN WRITING FOR CLARIFICATION BEFORE THE COMMENCEMENT OR RESUMPTION OF WORK.
3. THE SPECIFICATIONS AND ALL CONSULTANT DRAWINGS ARE SUPPLEMENTAL TO THE ARCHITECTURAL DRAWINGS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH THE ARCHITECTURAL DRAWINGS BEFORE THE INSTALLATION OF ANY OF THE CONSULTANT'S WORK AND TO BRING ANY DISCREPANCIES OR CONFLICTS TO THE ARCHITECT'S ATTENTION IN WRITING FOR CLARIFICATION. IMPROPERLY INSTALLED WORK SHALL BE CORRECTED BY THE GENERAL CONTRACTOR AT HIS EXPENSE AND AT NO EXPENSE TO THE OWNER'S ENGINEER, HIS CONSULTANT, OR THE OWNER.
4. IN THE CASE OF A CONFLICT BETWEEN THE DRAWINGS AND THE SPECIFICATIONS, THE SPECIFICATIONS SHALL TAKE PRECEDENCE. THE CONTRACTOR SHALL NOTIFY THE OWNER'S ENGINEER OF ANY CONFLICT BEFORE PROCEEDING WITH THE WORK.
5. THE CONTRACTOR SHALL FURNISH ALL MATERIALS, LABOR, EQUIPMENT, TRANSPORTATION AND SERVICES NECESSARY FOR THE SATISFACTORY COMPLETION OF WORK UNLESS DESIGNATED (N.I.C.) OR (O.F.O.I.). ALL OWNER'S ENGINEER EQUIPMENT, WORK AND MATERIALS SHALL COMPLY WITH ALL CURRENT AND LOCAL APPLICABLE CODES AND GOVERNING REGULATIONS, AND CONTRACT DOCUMENTS.
6. THE CONTRACTOR SHALL PROTECT ALL FINISH WORK AND SURFACES FROM DAMAGE DURING THE COURSE OF CONSTRUCTION AND REPLACE AND/OR REPAIR ALL DAMAGED SURFACES CAUSED BY CONTRACTOR OR SUBCONTRACTOR PERSONNEL TO THE SATISFACTION OF THE OWNER AND OWNER'S ENGINEER.
7. ALL PENETRATIONS THRU FIRE-RATED WALLS AND CEILINGS SHALL BE INSTALLED WITH FIRE DAMPERS, FIRE SEAL, ETC., SO AS TO MAINTAIN THE FIRE-RESISTIVE RATINGS AND STRUCTURAL INTEGRITY OF WALL OR CEILING ASSEMBLY.
8. BIDDERS SHALL VISIT THE SITE AND ACQUAINT THEMSELVES WITH THE CONDITIONS AS THEY ACTUALLY EXIST AND VERIFY DIMENSIONS, LOCATIONS, CONDITIONS AND DETAILS REQUIRED TO COMPLETE THE WORK. FAILURE TO VISIT THE PROJECT AREA WILL IN NO WAY RELIEVES THE SUCCESSFUL BIDDER OF FURNISHING ALL MATERIAL AND PERFORMING ALL WORK REQUIRED FOR THE COMPLETION OF THE CONTRACT. VISITS TO THE PROJECT AREA SHALL BE ARRANGED THROUGH THE CONTRACTING OFFICER.
9. CONTRACTOR SHALL DISPOSE OF THE REMOVED ITEMS SELECTED BY OWNER FOR DISPOSAL, AND SHALL STORE THE ITEMS SELECTED FOR SALVAGE IN THE PLACE INDICATED BY CONTRACTING OFFICER. DISPOSAL SHALL BE PERFORMED IN ACCORDANCE WITH CURRENT LAWS AND REGULATIONS.
10. CONTRACTOR SHALL CONSULT THE CONTRACTING OFFICER AS TO WORKING SPACE AND AREA FOR THE LOCATION OF STORING SHACK OR TRAILER. CONTRACTOR SHALL PROVIDE A TRAILER OR CONSTRUCT A STORAGE SHACK FOR SAFEKEEPING OF HIS MATERIAL AND TOOLS.
11. THE CONTRACTOR SHALL VERIFY THE LOCATION AND COORDINATE THE REMOVAL, ABANDONMENT, AND/OR RELOCATION OF ALL EXISTING UTILITIES ABOVE OR BELOW GRADE WITH THE RESPECTIVE UTILITIES COMPANIES.
12. THE CONTRACTOR SHALL SUBMIT COMPLETE SETS OF SHOP DRAWINGS AND SUBMITTALS FOR REVIEW WELL IN ADVANCE OF SCHEDULED WORK AS TO ALLOW FOR ADEQUATE TIME FOR SUCH REVIEW.
13. ALL WORK MUST COMPLY WITH RESPECTIVE SECTIONS IN TECHNICAL SPECIFICATIONS AND DRAWINGS.
14. ALL MATERIAL AND LABOR REQUIRED FOR ROAD DEMOLITION AND UTILITIES RELOCATION AND/OR REPLACEMENT SHALL BE PROVIDED BY THE CONTRACTOR.
15. ROADWAY PAVEMENT SHALL BE SAW CUT PRIOR TO TRENCH EXCAVATION.
16. THE CONTRACTOR SHALL TAKE EXTREME CARE AS NOT TO DISRUPT THE EXISTING WATER, WASTEWATER, TELEPHONE, CABLE TV AND/OR ELECTRICAL SERVICE DURING THE CONSTRUCTION.
17. FENCES, DRIVEWAYS, SIDEWALKS, CURBS AND OTHER PRIVATE OR PUBLIC PROPERTY DISTURBED OR DAMAGE DURING CONSTRUCTION SHALL BE RESTORED TO ITS ORIGINAL CONDITION BY THE CONTRACTOR ONCE THE WORK IN THE AREA HAS BEEN COMPLETED.
18. PRIOR TO BEGINNING ANY EXCAVATION WORK, THE CONTRACTOR SHOULD OBTAIN THE "COMISION DE SERVICIO PUBLICO, CERTIFICACION DE TRAMITE DE AVISO DE EXCAVACION Y/O DEMOLICION". THE CONTRACTOR SHALL FOLLOW THE "COMISION DE SERVICIO PUBLICO" REQUIREMENTS AT ALL TIMES.
19. ALL EXISTING MANHOLES AND VALVES SHALL BE RESET TO FINAL GRADE ELEVATIONS.
20. THE CONTRACTOR SHALL RESTORE TO ITS ORIGINAL CONDITION ANY PAVEMENT OR APPURTENANCES, INCLUDING PAVEMENT MARKINGS, REMOVED OR DAMAGE DURING CONSTRUCTION.
21. CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER & LEGAL DISPOSAL OF ALL DEBRIS GENERATED AS PART OF THIS PROJECT.

RECYCLING NOTES:

RECYCLING PLAN:

1. AT CONSTRUCTION START, CONTRACTOR SHALL COMPLY WITH LAW #411 OF OCTOBER 8TH 2000, WHICH AMEND LAW #70 OF SEPTEMBER 18th 1992, "LEY PARA LA REDUCCION Y RECICLAJE DE LOS DESPERDICIOS SOLIDOS", WHICH STATES IN ART. 6, A, SEPARACION EN LA FUENTE, THAT: "TODAS LAS INDUSTRIAS, FABRICAS, TIENDAS, COMERCIOS Y CUALQUIER OTRO TIPO DE INSTITUCION QUE EMPLEE MAS DE 10 PERSONAS TENDRAN QUE IMPLANTAR UN PLAN DE RECICLAJE".

DEMOLITION & SITE NOTES:

GENERAL:

1. CONTRACTOR SHALL DISPOSE PROPERLY OF ALL EXISTING DEBRIS AND SCRAP MATERIAL OF DEMOLITION WORK (INCLUDES, BUT IS NOT LIMITED TO ELECTRICAL MATERIALS AND/OR EQUIPMENT'S LIKE POLES, METER, RECEPTACLES, ETC.) FROM THE PROJECT ACCORDING TO MUNICIPAL, STATE AND FEDERAL REGULATIONS. SEE SPECIFICATIONS FOR HAZARDOUS MATERIALS ABATEMENT REMOVAL AND DISPOSAL.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE INFLICTED TO AVP OR ADJACENT PROPERTY OR OTHER PROJECT AREAS TO REMAIN DURING THE DEMOLITION AND CONSTRUCTION PHASES. DAMAGED ITEMS SHALL BE RESTORED TO IT'S ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE AND OWNER'S SATISFACTION. THIS CONDITION ALSO COVERS ANY DAMAGE INFLICTED TO PROPERTY OR STRUCTURES DURING REMOVAL AND DISPOSAL OF HAZARDOUS MATERIAL. DAMAGE TO SUBSTRATE SURFACES DURING REMOVAL PROCEDURES SHALL BE REPAIRED TO OWNER'S SATISFACTION BY CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
3. DEMOLITON AND REMOVAL SHALL BE CONDUCTED IN A MANNER THAT ELIMINATES HAZARDS TO PERSONS, THE ENVIRONMENT AND PROPERTY IN THE SURROUNDING AREA AND SHALL PREVENT THE RELEASE OF DUST LEAD CONTAINING DUST AND ASBESTOS FIBER INTO THE AIR AND SOIL. SEE SPECIFICATIONS FOR HAZARDOUS MATERIALS ABATEMENT.
4. THE CONTRACTOR SHALL MAINTAIN STREETS, PARKINGS, SIDEWALKS AND GROUNDS CLEAN AT ALL TIMES. WASHING WITH WATER IS REQUIRED TO PREVENT DUST CONTAMINATION AND HEALTH HAZARDS. WATER CONSUMPTION FOR CLEANING CAN NOT BE TAKEN FROM PUBLIC FIRE HYDRANTS OR RESIDENTS SERVICE.
5. THE CONTRACTOR SHALL SUBMITT, PROCURE AND OBTAIN THE FOLLOWING DOCUMENTS AND PERMITS FROM THE ENVIRONMENTAL QUALITY BOARD OF PUERTO RICO IN ORDER TO PROCEED WITH CONTRACTOR WORK:
- a. PERMISO UNICO INCIDENTAL (OGPE)
b. LEAD BASED PAINT ABATEMENT PLAN
c. ASBESTOS CONTAINING MATERIALS ABATEMENT PLAN
d. DISPOSITION AND TRANSPORTATION OF ASBESTOS AND LEAD BASED PAINT CONTAINING MATERIALS.
e. HAZARDOUS OR NON-HAZARDOUS MATERIALS WASTE MANIFEST.
6. THE CONTRACTOR WILL NOTIFY AND OBTAIN PERMIT FROM THE PUBLIC SERVICE COMMISSION (C.S.P.) FOR ALL THE EXCAVATION AND DEMOLITION WORK OF THE PROJECT. PERMIT MUST BE SUBMITTED TO THE OWNER AND TO THE PROJECT INSPECTOR BEFORE PROCEEDING WITH ANY EXCAVATION OR DEMOLITION WORK.
7. THE DEMOLITION DRAWINGS ARE INTENDED TO GIVE THE CONTRACTOR A GENERAL SCOPE OF THE DEMOLITION WORK. THE CONTRACTOR IS RESPONSIBLE FOR COMPLETING ALL DEMOLITION'S NECESSARY TO PERFORM THE CONSTRUCTION WORK AS DEMONSTRATED IN CONTRACT DRAWINGS AND WRITTEN SPECIFICATIONS, EVEN IF IT IS NOT SPECIFICALLY SHOWN IN THE DEMOLITION DRAWINGS. NO ADDITIONAL COST TO OWNER WILL BE CHARGED FOR DEMOLITION'S NOT SHOWN IN DRAWINGS.
8. UTILITIES AND/OR SERVICES (CONSISTING BUT NOT LIMITED TO WATER, SEWER, ELECTRICITY, GAS, CABLE TV, AND TELEPHONE) CAN NOT BE SUSPENDED TO ANY BUILDING THAT IS BEING USED. IN ALL SITUATIONS CONTRACTOR SHALL MAKE NECESSARY TEMPORARY CONNECTIONS TO MAINTAIN SERVICES CONNECTED AND/OR UTILITIES AT ALL TIME AND AT HIS OWN EXPENSE. PLANNING AND COORDINATION BETWEEN CONTRACTOR AND THE AGENCIES PROVIDING THE UTILITIES AND/OR SERVICES ARE HIS SOLE RESPONSIBILITY AND AT HIS OWN COST.
9. EXISTING CONCRETE WALL AND CONCRETE BLOCK WALL NOTED IN DEMOLITION PLANS TO BE DEMOLISHED; PATCH AND PLASTER ALL AFFECTED SURFACES TO MATCH SURROUNDING SURFACES. SEE SPECIFICATIONS FOR THE REMOVAL OF LEAD BASED PAINT COVERED EXTERIOR AND INTERIOR WALL SPECIFIED.
10. FLOOR SURFACES AT LOCATIONS WHERE WALLS HAVE BEEN DEMOLISHED SHALL BE PATCHED SMOOTH, REPAIRED AND CLEANED IN PREPARATION FOR NEW FLOOR FINISH AS SPECIFIED IN IMPROVEMENT NOTES.
11. PRIOR TO COMMENCING THE DEMOLITION OF ANY SPECIFIED WALL(S), CONTRACTOR SHALL VERIFY ITS CONDITION. IN THE CASE THE CONTRACTOR ENCOUNTERS ANY UNDETECTED STRUCTURAL CONCRETE WALL(S), CONTRACTOR SHALL CONTACT OWNER'S ENGINEER BEFORE PERFORMING THE DEMOLITION. REMOVE LEAD BASED PAINT BEFORE DEMOLISHING ANY WALL SURFACE CONTAINING THIS HAZARDOUS MATERIAL.
12. CONTRACTOR SHALL SUBMITT, PROCURE AND OBTAIN THE NPDES CONSTRUCTION GENERAL PERMIT FROM THE EPA IN ORDER TO PROCEED WITH SITE WORKS.

DOORS AND WINDOWS

1. IN ALL BUILDINGS, ALL EXISTING ALUMINUM JEALOUSIES WINDOWS AND PROTECTIVE GRILLES, SHALL BE REMOVED AND DISPOSED OF ACCORDING TO GENERAL DEMOLITION NOTES.

BATHROOMS

1. ALL EXISTING BATHROOM FIXTURES ACCESSORIES AND FITTINGS INCLUDING BUT NOT LIMITED TO LAVATORY, TOILETS, BATHTUBS, SHOWERS AND FAUCETS SHALL BE REMOVED AND DISPOSED OF ACCORDING TO SPECIFICATIONS. SEAL PIPE LINES TO BE ABANDONED.
2. ALL IDENTIFIED BATHROOMS' LAVATORIES SHALL BE REMOVED AND DISPOSED AS A NON-HAZARDOUS LEAD CONTAINING MATERIAL AS SPECIFICATIONS FOR HAZARDOUS MATAREIAL ABATEMENT REQUIREMENTS.
3. EXISTING CERAMIC TILES AT ALL BATHROOM WALLS AND FLOORS SHALL BE REMOVED AND DISPOSED AS A NON-HAZARDOUS LEAD CONTAINING MATERIAL ACCORDING TO SPECIFICATIONS. ADHESIVE AND GROUT SHALL ALSO BE REMOVED.
4. WHERE THERE EXIST WATER HEATERS, CONTRACTOR SHALL REMOVE AND DELIVER THEM TO THE OWNER.

STAIRS

1. REMOVE ALL RAILINGS AND HANDRAIL AND DISPOSE THEM ALL ACCORDING TO SPECIFICATIONS.

IMPROVEMENT NOTES:

GENERAL:

1. APPLICATION OF THESE NOTES IS FOR ALL BUILDINGS AND STRUCTURES UNLESS OTHERWISE NOTED.
2. CLEAN ALL INTERIOR/EXTERIOR WALLS AND CEILINGS BY HYDROBLASTING (3 KSI); EXCEPT AREAS WITH LEAD BASED PAINT AND ASBESTOS CONTAINING MATERIAL.
3. BEFORE PAINTING WORK, CLEAN FUNGUS AND DARK SPOTS IN WALL AND CEILINGS WITH AN INDUSTRIAL CHLORINE SOLUTION. (NO METHYLENE-CHLORIDE CONTAINING)
4. REPAIR ALL CRACKS, SCRAPE, PATCH AND/OR REMOVE EXISTING IMPERFECTIONS IN ALL INTERIOR/EXTERIOR CEMENT PLASTER WALLS AND CEILINGS. USE CONCRETE REHABILITATION PRODUCTS EQUAL OR SIMILAR TO AS SPECIFIED. COLORS TO BE SELECTED BY ARCHITECT. REFER TO SPECIFICATIONS.
5. APPLY A HIGH QUALITY SURFACE CONDITIONS AT ALL INTERIOR/EXTERIOR CEMENT PLASTER WALLS AND CEILINGS BEFORE
6. PAINT ALL INTERIOR/EXTERIOR CEMENT PLASTER SURFACES, FRAMES, DOORS, WINDOW, ETC. AS SPECIFIED. COLORS TO BE SELECTED BY ARCHITECT AS INDICATED IN TECHNICAL SPECIFICATIONS. NO LEAD-BASED PAINT SHALL BE UTILIZED IN THIS PROJECT.
7. FINISH ALL NEW AND EXISTING BUILDING SURFACES AND WITH SMOOTH CEMENT PLASTER AND PAINT.
8. INSTALL NEW ALUMINUM WINDOWS ACCORDING TO WINDOW SCHEDULE, SPECIFICATIONS AND DRAWINGS.
9. REPAIR ALL WINDOWS AND DOORS OPENINGS EDGES TO A TRUE CORNER USING PLASTIC CORNER GUARDS.
10. BEFORE NEW DOOR INSTALLATION VERIFY STRUCTURAL STABILITY AND PHYSICAL CONDITION IN AREAS OF DOOR FRAME. IF NECESSARY, REPLACE WITH NEW CAST-IN-PLACE CONCRETE WITH BAR REINFORCEMENT.
11. ALL DOORS SHALL BE INSTALLED USING NEW HARDWARE ACCORDING TO HARDWARE SCHEDULE AND SPECIFICATIONS. ALL DOORS AND FRAMES MUST BE PAINTED BEFORE INSTALLING HARDWARE. NO PAINTING AND/OR RETOUCHING WILL BE ALLOWED UNLESS HARDWARE IS REMOVED AND LATER REINSTALLED.
12. REPAIR ALL TRENCHES AND CUTS IN EXISTING FLOOR AND WALLS AFTER PLUMBING OF ELECTRICAL INSTALLATIONS. PATCH AND CONDITION SURFACES TO MATCH SURROUNDING SURFACES FINISHES.
13. AFTER CONSTRUCTION WORK IS FINISHED, THE WHOLE PROJECT SHALL BE PAINTED ACCORDING TO SPECIFICATIONS.

WALLS AND CEILINGS

1. CEMENT PLASTER ALL NEW CONCRETE AND CONCRETE BLOCK SURFACES TO MATCH SURROUNDING FINISHES.
2. REMOVE AND DISPOSE ALL CEILING FINISHES UP TO THE EXPOSED ORIGINAL CONCRETE SLAB AS SPECIFIED AND RE-PLASTER ALL CEILINGS WITH CEMENT PLASTER AFTER APPLYING BONDING OR ADHESIVE COATING. IF CEILINGS SURFACES HAVE BEEN PAINTED, REMOVE PAINT WITH HYDROBLASTING AND THEN APPLY THE ABOVE MENTIONED PROCEDURE.
3. BEFORE PAINTING ALL SURFACES MUST BE STONE GRINDED AND THEN APPLY A HIGH QUALITY SURFACE CONDITIONER AT INTERIOR SMOOTH CEMENT PLASTER WALLS AND CEILINGS BEFORE PAINTING. SEE TECHNICAL SPECIFICATIONS.
4. APPLY TWO (2) COATS OF PAINT AT INTERIOR/EXTERIOR SMOOTH CEMENT PLASTER WALLS AND CEILINGS AS SPECIFIED. COLORS TO BE SELECTED BY ARCHITECT.

BATHROOMS

1. BATHROOM WALLS MUST BE SCRAPED AND PLASTERED WITH NEW CEMENT MORTAR TO PROVIDE NEW LEVELED SURFACES THAT WILL BE COVERED WITH TILES. ANY SURFACE DEFECTS WILL BE CORRECTED WITH THE NEW PLASTER TO ENSURE GOOD QUALITY TILE WORK. IF NECESSARY, SCRAPE OR USE ETCHING PRODUCTS TO PROVIDE ADHERENCE OF NEW PLASTER.
2. INSTALL NEW STANDARD GRADE 6"x6" GLAZED TILES AT SHOWER WALLS (6'-0" HIGH WAINSCOT), INCLUDING INTERNAL SANITARY COVES AND BULL NOSE TILES.
3. INSTALL NEW PLUMBING FIXTURES WITH FITTINGS AS INDICATED ON PLANS ACCORDING TO SCHEDULES.
4. INSTALL NEW 2"x2" PATTERN STANDARD GRADE NON-SLIP MOSAIC UNGLAZED AT SHOWER FLOOR. BEFORE TILE INSTALLATION, A WATERPROOFING MEMBRANE SHALL BE APPLIED, EQUAL OR APPROVED EQUAL TO VANDEX. SEE SPECIFICATIONS AND DRAWINGS. A LEAKING TEST MUST BE COMPLETED FOR EVERY SHOWER FLOOR. BEFORE TILE INSTALLATION, A COMPLETE FLOODING OF THE SHOWERS FOR TWO (2) DAYS AFTER WATERPROOFING IS REQUIRED TO ASSURE NO LEAKS ARE PRESENT. PROJECT INSPECTOR MUST CERTIFY THIS TEST.

STAIRS AND LANDINDS

1. INSTALL NEW HANDRAILS. SEE STAIR ENLARGED DRAWINGS DETAILS.
2. INSTALL NEW LIGHTING FIXTURES IN STAIR CASES. SEE ELECTRICAL DRAWINGS FOR LOCATION AND SPECIFICATIONS.
3. INSTALL NEW ROOF HATCHES AS PER DRAWINGS DETAILS IN A301.
4. INSTALL CEMENT TOPPING AT ALL STAIRS AND LANDINGS. REPAIR ALL TREADS AND RISERS AND INSTALL NEW CAST-IRON NOSINGS AS IN DETAIL DRAWINGS.
5. VERIFY STAIR HEIGHT ACCORDING TO NEW FLOOR ELEVATIONS AT BUILDINGS. FILL OR REDUCE RISER HEIGHT TO MAKE ALL THE RISERS THE SAME HEIGHT. MAXIMUM RISER HEIGHT IS 7 INCHES. A MAXIMUM TOLERANCE OF 3/8" WILL BE ALLOWED BETWEEN RISERS IN THE SAME FLIGHT. RUN SHALL NOT BE LESS THAN 11 INCHES.

UTILITIES NOTES:

1. THESE DRAWINGS DO NOT DEPICT THE EXACT LOCATION OF EXISTING STRUCTURES AND UTILITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING ALL OF THE EXISTING STRUCTURES AND UTILITIES THAT AFFECT THE CONSTRUCTION, PRIOR TO BEGINNING THE WORK.
2. BEFORE BEGINNING THE WORK, THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THE SET OF DRAWINGS THAT COULD IMPACT THE CONTRACTOR'S WORK.
3. ANY UTILITIES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR AT HIS EXPENSE.
4. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY DISCREPANCY BETWEEN THE DRAWINGS AND THE ACTUAL FIELD CONDITIONS BEFORE PROCEEDING WITH ANY WORK AFFECTED BY THE DISCREPANCY.

MAINTENANCE OF TRAFFIC:

1. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS AND LABOR REQUIRED FOR THE TRAFFIC MAINTENANCE DURING THE CONSTRUCTION. MAINTENANCE OF TRAFFIC SHALL BE PERFORMED AS REQUIRED BY THE PRHTA AND THE MUNICIPALITY OF LAJAS.
2. AT ALL TIMES, THE CONTRACTOR SHALL MAINTAIN ACCESS TO PUBLIC AND PRIVATE PROPERTIES.
3. CONTRACOTR SHALL OBTAIN THE CORRESPONDING PR DTPW PERMIT FOR WORKS ON STATE ROADS.

GEOTECHNICAL NOTES:

1. CONTRACTOR SHALL FOLLOW AND COMPLY WITH ALL GEOTECHNICAL RECOMMENDATIONS INCLUDED IN THE SUB-SOIL REPORT PREPARED BY MGV GEOTECHNICAL GROUP, JOB NO. 1963 ON DECEMBER 3, 2019.
2. DEWATERING EQUIPMENT SHALL BE PROVIDED TO REMOVE AND DISPOSE OF ALL SURFACE AND GROUND WATER ENTERING EXCAVATIONS, TRENCHES, OR OTHER PARTS OF THE WORK DURING CONSTRUCTION. EACH EXCAVATION SHALL BE KEPT DRY DURING SUBGRADE PREPARATION AND CONTINUALLY THEREAFTER UNTIL THE STRUCTURE TO BE BUILT, OR THE PIPE TO BE INSTALLED THEREIN, IS COMPLETED TO THE EXTENT THAT NO DAMAGE FROM HYDROSTATIC PRESSURE, FLOTATION, OR OTHER CAUSE WILL RESULT.

PIPE INSTALLATION NOTES:

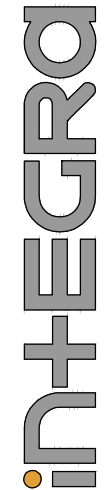
1. POTABLE WATER PIPES SHALL NOT CROSS OR BE IN CONTACT WITH SANITARY OR STORM SEWER MANHOLES.
2. WHEREVER WATER PIPELINES ARE TO BE PARALLEL TO WASTEWATER OR STORM WATER PIPELINES, THE DISTANCES BETWEEN THE TWO SHALL BE AT LEAST 3.05 METERS. THIS DISTANCE CAN BE REDUCED IF THE POTABLE WATER PIPE IS INSTALLED AT LEAST 0.50 METERS ABOVE THE WASTEWATER OR STORM WATER PIPELINE.
3. CONTRACTOR SHALL NOT LEAVE AN OPEN TRENCH AFTER DAILY END OF CONSTRUCTION.
4. IF GROUNDWATER IS ENCOUNTERED, THE CONTRACTOR SHALL TAKE MEASURES TO PREVENT AND NOT TO PROMOTE THE MIGRATION OF GROUNDWATER INTO THE TRENCH.
5. COMBINATION AIR REALEASE VALVES SHALL BE INSTALLED AS SHOWN ON DRAWINGS ALONG THE PIPELINE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN THE WATER FOR THE PIPELINE INFILTRATION AND EXFILTRATION TEST. CONTRACTOR SHALL PAY FOR ALL THE WATER USED TO PERFORM ALL PIPE TEST.
7. THE CONTRACTOR SHALL PERFORM A 150 P.S.I. PRESSURE TEST ON THE NEW PIPELINES, VALVES & HYDRANTS ACCORDING TO SPECIFICATIONS AND IN COORDINATION WITH THE PROJECT ENGINEER.
8. CONTRACTOR SHALL PERFORM PIPELINES CHLORINATION ON NEW PIPES, HYDRANTS AND VALVES INSTALLATIONS,

EXCAVATION NOTES:

1. TRENCHES FOR THE PIPE INSTALLATION MAY LIKELY STAY OPEN WITH A 1V:1H SLOPE OR SOMETIMES STEEPER WHERE HIGH EFFORT EXCAVATION MATERIAL IS ENCOUNTERED. ALL EXCAVATIONS FOR PIPES AND STRUCTURES SHOULD BE PERFORMED IN ACCORDANCE WITH 29 CFR- PART 1926, OCCUPATIONAL SAFETY AND HEALTH STANDARDS-EXCAVATIONS: FINAL RULE, PUBLISHED BY THE US FEDERAL DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA). FOR TRENCHES 20 FEET DEEP OR GREATER, THE CONTRACTOR SHALL PROVIDE A PROTECTIVE SYSTEM DESIGN BY A REGISTERED PROFESSIONAL ENGINEER.
2. CONTRACTOR SHALL DISPOSE ACCORDINGLY ALL EXCAVATED MATERIAL EXCAVATED MATERIAL SHALL NOT BR USED FOR BACKFILL, UNLESS EXPLICITLY AUTHORIZED BY OWNER OR PROJECT INSPECTOR.

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GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

Drawing Title:

GENERAL DEMOLITION AND OTHER NOTES

G101

HEALTH & SAFETY NOTES:

1. THE CONTRACTOR SHALL PROVIDE A RISK FREE ENVIRONMENT FOR ALL EMPLOYEES AND THEIR SURROUNDING. HE MUST GUARANTEE THE SAFETY AND HEALTH OF ALL EMPLOYEES, SUBCONTRACTORS AND VISITORS.

2. THE CONTRACTOR SHALL PROVIDE A SAFETY AND HEALTH PLAN.

3. SAFETY MEASURES AND PRECAUTIONS DURING DEMOLITION / CONSTRUCTION (ALL O.S.H.A. AND E.P.A. UPDATED COMPLIANCE IS UNDER EFFECT).

o. GENERAL WORK RELATED TO THE DEMOLITION OR ALTERATION OF A BUILDING OR STRUCTURE MUST BE UNDERTAKEN IN CONFORMITY WITH THIS SAFETY PLAN.

b. SAFETY MEETINGS – THE CONTRACTOR WILL PERFORM WEEKLY SAFETY TOURS AND MEETINGS WITH HIS PERSONNEL TO TRAIN AND DISCUSS THE BEST PRACTICES AND SAFETY MEASURES TO BE IMPLEMENTED IN THE PROJECT.

c. THE CONTRACTOR WILL PERFORM CONTINUOUS JOB SITE INSPECTIONS TO CONFIRM ANY POTENTIAL SAFETY HAZARDS

d. IF A POTENTIAL HAZARD IS SUSPECTED OR FOUND, THE CONTRACTOR WILL USE THE APPROPRIATE METHODS, EQUIPMENT, DEVICES AND MATERIAL TO ASSURE A SAFE WORKPLACE, SAFETY TOURS. AND TO MAINTAIN A SAFE AND ACCIDENT FREE JOB.

e. THE CONTRACTOR WILL PROVIDE TRAINED AND EXPERIENCED PERSONNEL TO ASSURE A JOB PROPERLY DONE AND SAFE. THE CONTRACTOR SHALL PROVIDE A HEALTH & SAFETY COORDINATOR.

f. THE CONTRACTOR WILL BE RESPONSIBLE FOR FIRE PROTECTION IN THE WORK AND OPERATIONAL AREAS:

• NO BUILDING WILL BE USE FOR THE STORAGE OF COMBUSTIBLE MATERIAL UNLESS IT IS FIRE PROOF.

• THE CONTRACTOR WILL PROVIDE FIRE EXTINGUISHERS FOR THE ENTIRE DEMOLITION / CONSTRUCTION AREA.

• ALL HEAVY EQUIPMENT, WELDING MACHINE OR CUTTING EQUIPMENT SHOULD HAVE ITS OWN FIRE EXTINGUISHERS OR HAVE ONE AVAILABLE IN A 100 FEET RADIUS FROM IT.

• DURING DEMOLITION / CONSTRUCTION PERIOD FREE ACCESS TO FIRE HYDRANTS, OR TO OTHER FIRE EXTINGUISHING EQUIPMENT, WILL BE PROVIDED AND MAINTAINED AT ALL TIMES.

g. CLOTHING:

• PERSONNEL FROM THE CONTRACTOR WILL BE REQUIRED TO DRESS PROPERLY WHILE PERFORMING THEIR JOB.

• EACH WORKER WILL USE APPROPRIATE WORKING SAFETY SHOES.

• PROPER RESPIRATORY PROTECTION WILL BE USE WHENEVER REQUIRED.

• PROPER HAND PROTECTION WILL BE USE WHEN REQUIRED.

• PROPER HEARING PROTECTION WILL BE USED IN AREAS WHERE SOUNDS ARE HIGHER THAN 80 DBS.

• THE USE OF SAFETY HELMETS IS MANDATORY FOR ALL PERSONNEL ENTERING THE WORKING AREA.

• ALL EMPLOYEES WILL WEAR SAFETY BELTS WHEN WORKING 10 FEET OR MORE ABOVE THE GROUND OR WHEN WORKING IN A PRECARIOUS POSITION.

• SAFETY BELTS WILL BE PROPERLY ANCHORED TO FIXED STRUCTURE TO ASSURE THE WORKER SAFETY.

• SAFETY GLASSES WITH SIDE SHIELDS WILL BE USED WHENEVER EXPOSED TO FREE PARTICLES OR DUST.

h. WELDING AND CUTTING:

• PROPER RESPIRATORY PROTECTION WILL BE USE WHENEVER REQUIRED.

• WHEN GAS WELDING OR CUTTING IS DONE, ABOVE OR WITHIN A RADIUS OF TEN FEET OF COMBUSTIBLE MATERIAL OR IN A PLACE WHERE WORKERS ARE EMPLOYED, OR WHERE PERSONS ARE LIKE TO PASS, NON COMBUSTIBLE SHIELD WILL BE INTERPOSED TO PROTECT SUCH MATERIALS OR PERSONS AGAINST SPARKS AND HOT METAL.

i. GAS AND FUEL DEPOSITS:

• FUEL GAS DEPOSITS WILL NOT BE MOVED FROM ONE PLACE TO ANOTHER, NOR WILL THEY BE STORED UNLESS THE CAPS OF SUCH DEPOSITS ARE IN PLACE.

• SUITABLE CRADLES WILL BE USED FOR LIFTING OR LOWERING OXYGEN OR FUEL TANKS TO REDUCE TO MINIMUM THE POSSIBILITY OF DROPPING TANKS.

• ORDINARY ROPE SLINGS WILL NOT BE USED.

• TANKS SUPPLYING GAS FOR WELDING OR CUTTING WILL BE LOCATED AT NO GREATER DISTANCE FROM THE WORK AREA THAN NECESSARY FOR SAFETY. SUCH TANKS WILL BE SECURELY FASTENED IN PLACE IN UPRIGHT POSITION.

• CLOSED SPACES WILL BE VENTILATED PROPERLY WHILE WELDING OR CUTTING IS BEING PERFORMED THEREIN.

j. SIGNS, SIGNALS, BARRICADES: GAS AND FUEL DEPOSITS:

• SIGNS, SIGNALS AND BARRICADES WILL BE VISIBLE AT ALL TIMES WHERE A HAZARD EXISTS AND TO LIMIT ACCESS TO WORK AREAS. • EFFECTIVE BARRICADES WILL PROTECT ALL PEOPLE, STREETS, ROADS, HIGHWAYS, AND OTHER PUBLIC THOROUGHFARES, WHICH ARE CLOSED TO TRAFFIC, ON WHICH WILL BE PLACED ACCEPTABLE AND HIGHLY VISIBLE WARNING SIGNS.

• BARRICADES AND SIGNS WILL BE USED TO MAINTAIN A PROPER AND SAFE WORKING ENVIRONMENT.

k. HAND & POWER TOOLS:

• ALL HAND AND POWER TOOLS WHETHER FURNISHED BY THE CONTRACTOR OR BY ITS EMPLOYEES, WILL BE MAINTAINED IN SAFE CONDITION. NO ELECTRIC CORDS WILL BE RUN OVER GROUND OR FLOORS. PROPER HANGERS WILL BE REQUIRED.

• THE CONTRACTOR WILL NOT PERMIT THE USE OF UNSAFE HAND OR POWER TOOLS.

• ELECTRICAL POWER TOOLS WILL BE GROUNDED OR DOUBLE INSULATED.

• PNEUMATIC POWER TOOLS WILL BE SECURED TO HOSE OR WHIP BY SOME POSITIVE MEANS.

• ONLY PROPERLY TRAINED OR EXPERIENCE EMPLOYEES WILL OPERATE POWER – ACTUATED TOOLS.

l. COMPRESSED GAS CYLINDERS:

• COMPRESSED GAS CYLINDERS WILL BE SECURED IN AN UPRIGHT POSITION AT ALL TIMES.

• WHEN TRANSPORTING, MOVING OR STORING CYLINDERS VALVE PROTECTION CAPS WILL BE IN PLACE AND SECURED.

• CYLINDERS WILL BE KEPT AWAY FROM SPARKS, HOT SLAG AND FLAMES, OR BE ADEQUATELY PROTECTED.

• CYLINDERS WILL NOT BE PLACED WHERE THEY CAN BE AFFECTED OR IN THE WAY OF AN ELECTRIC CIRCUIT.

• CYLINDERS WILL BE LABELED AS TO THE NATURE OF THEIR CONTENTS.

m. SCAFFOLDS:

• SCAFFOLDS WILL BE USED IN PRECARIOUS SITUATIONS AND WHEN WORKING ABOVE 10 FEET FROM THE GROUND.

• PROPER ANCHORAGE WILL BE USED TO MAINTAIN THE SCAFFOLD AND WORKERS SAFETY.

• WORKERS WILL USE THE APPROPRIATE SAFETY BELTS WHEN WORKING ON SCAFFOLDS.

• MOBILE SCAFFOLD CASTERS WILL BE SECURED AND LOCKED PRIOR TO MOUNTING.

• NO PERSONNEL WILL BE ON A MOBILE SCAFFOLD WHEN IT IS BEING RELOCATED.

n. CRANES AND DERRICKS:

• ALL CRANES AND DERRICKS WILL BE CERTIFIED AS BEING IN SAFE OPERATING CONDITION PRIOR TO USING THE CRANE OR DERRICK ON THE JOB SITE.

• THE CRANE OR DERRICKS WILL HAVE PROPER SAFETY EQUIPMENT AND CERTIFICATIONS FOR THE PROPER USE OF IT

• TRAINED, EXPERIENCED AND QUALIFIED OPERATORS WILL BE USED DEPENDING OF THE SPECIFIC MAKE AND MODEL OF THE CRANE.

• THE MANUFACTURE’S OPERATION MANUAL SHALL BE KEPT WITH THE CRANE WHILE IT IS ON SITE.

o. LADDERS:

• THE USE OF LADDERS WITH BROKEN OR MISSING RUNGS OR STEPS, BROKEN OR SPLIT RAILS OR OTHER DEFECTIVE CONSTRUCTION IS PROHIBITED.

• LADDERS WILL EXTEND NO LESS THAN 36 INCHES ABOVE LANDING AND BE SECURED TO PREVENT DISPLACEMENT

• PORTABLE LADDERS WILL BE EQUIPPED WITH SAFETY SHOES.

• WOODEN LADDERS WILL NOT BE PAINTED.

p. EQUIPMENT AND MOTOR VEHICLES:

• ALL EQUIPMENT WILL BE INSPECTED DAILY BEFORE USE.

• DEFECTIVE EQUIPMENT WILL BE REPAIRED OR REMOVED FOR PROPER SERVICE.

3. MINIMUM FIRST AID AND MEDICAL PROCEDURES:

o. FIRST AID (MINOR CUTS, SCRATCHES, BRUISES, ETC.)

• EACH OCCUPATIONAL ILLNESS OR INJURY WILL BE REPORTED IMMEDIATELY BY THE EMPLOYEE TO THE FOREMAN.

• ALL PERSONAL INJURIES AND ILLNESSES (JOB RELATED) TREATED OR REPORTED (ACTUAL OR ALLEGED) WILL BE RECORDED ON DAILY FIRST AID LOG.

• TRAINED FIRST AID ATTENDANT WILL TREAT THE INJURED EMPLOYEE AS OFTEN AS NECESSARY TO ENSURE RECOVERY, OR TO MAKE THE DECISION TO SEEK MEDICAL TREATMENT.

b. MEDICAL CASES (NOT REQUIRING AMBULANCE SERVICE)

• MEDICAL CASES NORMALLY NOT REQUIRING AMBULANCE SERVICES ARE INJURIES SUCH AS MINOR LACERATIONS, MINOR EMBEDDED FOREIGN BODIES, MINOR SPRAINS, ETC.

• THE CONTRACTOR WILL PROVIDE PROPER EQUIPMENT FOR PROMPT TRANSPORTATION OF THE INJURED PERSON TO THE NEAREST HOSPITAL FACILITY. A MAP OF THE NEAREST MEDICAL ASSISTANCE FACILITY AND AMBULANCE SERVICE PHONE NUMBERS WILL BE PRESENTED AND POSTED AT ALL TIMES IN THE CONTRACTOR’S OFFICE.

c. EMERGENCY CASES REQUIRING AMBULANCE SERVICES:

• MEDICAL CASES SUCH AS SEVERE HEAD INJURIES, AMPUTATIONS, HEART ATTACKS, ETC., CALL 911 AND HAVE READY PHONE NUMBERS OF AT LEAST 2 AMBULANCE SERVICES.

• WHEN AMBULANCE SERVICES ARE NECESSARY, THE FOLLOWING PROCEDURES WILL BE TAKEN IMMEDIATELY:

1. CALL 911 TO ASK FOR ASSISTANCE

2. CONTACT EMPLOYEE TRAINED IN FIRST AID.

3. WHILE FIRST AID IS BEING ADMINISTERED MAKE SURE THE AMBULANCE AND PARAMEDICS ARE ON THE WAY

4. AFTER PARAMEDICS HAVE STABILIZED THE INJURED, ONE DESIGNATED REPRESENTATIVE WILL ACCOMPANY THE INJURED EMPLOYEE IN THE AMBULANCE TO THE MEDICAL FACILITY AND REMAIN AT THE FACILITY UNTIL FINAL DIAGNOSIS AND OTHER RELEVANT INFORMATION IS OBTAINED

5. NOTIFY CONTACT PERSON OR FAMILY MEMBER OF INJURED PERSON.

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS; TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMENDADA, RECONOCIENDO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OTRA.

Sheet: Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Owner:

Drawing Title:

HEALTH & SAFETY NOTES

Revisions		SHEET INFO.	
Number	Date	Description	

Project No.: 18-1837-0
Set Date: 20210728
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Dwg. Date:

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G102

ABBREVIATION:

SYMBOL	DEFINITION
AB	ANCHOR BOLT
ADD'L	ADDITIONAL
ALT	ALTERNATE
ARCH	ARCHITECT, ARCHITECTUAL
BF	BOTH FACES
BLDG	BUILDING
BM (s)	BEAMS (S)
B	BOTTOM
BP	BASE PLATE
BRDG	BRIDGING
BOF	BOTTOM OF FOOTING
BOM	BOTTOM OF BEAM
CANT	CANTILEVER
CJ	CONTROL OR CONSTRUCTION JOINT
CL	CENTERLINE
CLR	CLEAR, CLEARANCE
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
C.C.	CENTER TO CENTER
CPS	CONCRETE PIPE SUPPORT
DEG	DIGREES
DIA	DIAMETERS
DIAG	DIAGONAL
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DTL	DETAIL
DWG	DRAWING
DWL	DOWEL
DL	DEAD LOAD
E	EAST
EA	EACH
EMB	EMBEDMENT
EF	EACH FACE
EJ	EXPANSION JOINT
EL	ELEVATION
ELEV	ELEVATION, ELEVATOR
EQ	EQUAL
EXIST	EXISTING
EXP BOLT	EXPANSION BOLT
EXT	EXTERIOR
EW	EACH WAY
ETC	ETCETERA
FF	FAR FACE, FINISHED FLOOR
FLG	FLANGE
FND	FOUNDATION
FT	FOOT, FEET
FTG	FOOTING
GA	GAGE OR GAUGE
GALV	GALVANIZED
GR	GRADE
HORIZ	HORIZONTAL
ID	INSIDE DIAMETER
INFO	INFORMATION
JOINT	JOINT
K	KIPS
KLF	KIPS PER LINEAR FOOT
KSF	KIPS PER SQUARE FOOT
KSI	KIPS PER SQUARE INCH
LBS	POUNDS
LEV	LEVEL
LWT	LIGHTWEIGHT
LL	LIVE LOAD
MAX	MAXIMUM
MECH	MECHANICAL
MEZZ	MEZZANINE
MID	MIDDLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MTL	MATERIAL, METAL
N	NORTH
NIC	NOT IN CONTRACT
NO OF #	NUMBER
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
OPNG	OPENING
PL	PLATE
PC	PRE-CAST
PCF	POUNDS PER CUBIC FOOT
PERIM	PERIMETER
PERP	PERPENDICULAR
PLF	POUNDS PER LINEAR FOOT
PROJ	PROJECTION
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
QTY	QUANTITY
R	RADIUS, RISER (STAIRS)
RECT	RECTANGULAR
REINF	REINFORCEMENT/ REINFORCE
REV	REVISION
REQD	REQUIRED
SECT	SECTION
SHT	SHEET
SPCG	SPACING
SPEC	SPECIFICATION
SQ	SQUARE
STD	STANDARD
STIFF	STIFFENER
SOG	SLAB ON GRADE
STL	STEEL
STR	STRUCTURE
THK	THICKNESS
TOPG	TOPPING
TYP	TYPICAL
T.O.B.	TOP OF BEAM
T.O.C.	TOP OF CONCRETE
T.O.COL	TOP OF COLUMN
T.O.F.	TOP OF FOOTING
T.O.OP	TOP OF OPENING
T.O.P.	TOP OF PARAPET
T.O.S.	TOP OF SLAB OR STEEL
T.O.W.	TOP OF WALL
T & B	TOP AND BOTTOM
U	UNITS
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
WT	WEIGHT
W/	WITH
WO	WITHOUT
WIS	WATERSTOP
WWM	WELDED WIRE MESH
&	AND

GENERAL NOTES:

GENERAL NOTES:

1.

ALL CONSTRUCTION WORK SHALL COMPLY WITH THE REQUIREMENTS AND PROVISIONS OF THE FOLLOWING:

1.

AMERICAN CONCRETE INSTITUTE 318-05 (ACI)

2.

INTERNATIONAL BUILDING CODE (IBC-2009).

3.

AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM).

4.

CONCRETE REINFORCING STEEL INSTITUTE (CRSI).

5.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).

6.

AMERICAN WELDING SOCIETY (AWS).

7.

MINIMUM DESIGN LOAD FOR BUILDINGS (ASCE 7-05).
2.

THE NOTES AND SPECIFICATIONS GIVEN ON THE STRUCTURAL DRAWINGS ARE EXCERPTS FROM THE RELATING PROJECT SPECIFICATIONS. THEY ARE NEITHER COMPLETE NOR DO THEY REPLACE THE CONTRACT SPECIFICATIONS.
3.

GENERAL DETAILS:

AND NOTES ON THESE SHEETS SHALL APPLY UNLESS SPECIFICALLY SHOWN OR NOTED OTHERWISE. CONSTRUCTION DETAILS NOT FULLY SHOWN OR NOTED SHALL BE SIMILAR TO DETAILS SHOWN FOR SIMILAR CONDITIONS. ALL WORK OR CONSTRUCTION SHALL COMPLY WITH ALL APPLICABLE BUILDING CODES, REGULATION AND SAFETY REQUIREMENTS.
4.

DISCREPANCIES:

THE CONTRACTOR SHALL INFORM THE ENGINEER IN WRITING OF ANY DISCREPANCIES OR OMISSIONS NOTED ON THE DRAWINGS OR IN THE SPECIFICATIONS OR OF ANY VARIATIONS NEEDED IN ORDER TO CONFORM TO CODES, RULES AND REGULATIONS. UPON RECEIPT OF SUCH INFORMATION, THE ENGINEER WILL SEND WRITTEN INSTRUCTIONS TO ALL CONCERNED. ANY SUCH DISCREPANCY, OMISSION, OR VARIATION NOT REPORTED SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND WORK SHALL BE PERFORMED IN A MANNER AS DIRECTED BY THE ENGINEER.
5.

SHORING:

IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO DESIGN AND PROVIDE ADEQUATE SHORING, BRACING, AND FORMWORK, AS REQUIRED FOR THE PROTECTION OF LIFE AND PROPERTY DURING THE CONSTRUCTION OF THIS BUILDING. EXCESS LOAD CAPACITY OF SLAB SHALL NOT EXCEED LOADS EQUIVALENT TO THE DESIGN SUPERIMPOSED LOADS LESS CONSTRUCTION DEAD AND LIVE LOADS. DESIGN SUPERIMPOSED LOADS INCLUDE LIVE LOAD, PARTITION LOAD, AND ANY OTHER LOAD NOT IN PLACE AT THE TIME OF SHORING.
6.

EXCAVATION:

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL EXCAVATION PROCEDURE INCLUDING LAGGING, SHORING, AND PROTECTION OF ADJACENT PROPERTY, STRUCTURES, STREETS AND UTILITIES IN ACCORDANCE WITH THE LOCAL BUILDING DEPARTMENT. THIS EXCAVATIONS SHALL COMPLY WITH SECTION 1804 AND CHAPTER 33 OF IBC 2009.
7.

OTHER TRADES:

SEE ARCHITECTURAL, ELECTRICAL, CIVIL AND MECHANICAL DRAWINGS FOR SIZE AND LOCATION OF PIPE, VENT, DUCT AND OTHER OPENINGS AND DETAILS NOT SHOWN ON THESE STRUCTURAL DRAWINGS. ALL DIMENSIONS ARE TO BE CHECKED AND VERIFIED WITH THE ARCHITECTURAL AND MECHANICAL DRAWINGS.
8.

BACKFILL:

BACKFILL AROUND THE EXTERIOR PERIMETER OF WALL SHALL NOT BE PLACED UNTIL AFTER THE WALLS ARE SUPPORTED BY THE COMPLETION OF INTERIOR FLOOR SYSTEMS. DO NOT PROCEED WITH BACKFILL UNTIL SEVEN (7) DAYS AS A MINIMUM AFTER THE COMPLETION OF INTERIOR FLOOR SYSTEMS UNLESS WALLS ARE ADEQUATELY BRACED. BACKFILL SHALL NOT BE PLACED UNTIL AFTER COMPLETION AND INSPECTION OF WATERPROOFING WHERE WATERPROOFING OCCURS.
9.

BRACING:

TEMPORARY BRACING SHALL BE PROVIDED AS REQUIRED TO HOLD ALL COMPONENTS OF THE STRUCTURE IN PLACE UNTIL FINAL SUPPORT IS SECURELY ANCHORED.
10.

SIDEWALK PROTECTION:

PEDESTRIAN TRAFFIC SHALL BE PROTECTED AS SPECIFIED IN SECTION 1804 AND CHAPTER 33 OF IBC 2009.
11.

SAFETY:

THE CONTRACTOR SHALL ADEQUATELY PROTECT HIS WORK, ADJACENT PROPERTY, AND THE PUBLIC, AND BE RESPONSIBLE FOR DAMAGE OR INJURY DUE TO HIS ACT OR NEGLECT.
12.

INSPECTIONS:

ANY INSPECTIONS, SPECIAL OR OTHERWISE, THAT ARE REQUIRED BY THE BUILDING CODES, LOCAL BUILDING DEPARTMENTS, OR THESE PLANS, SHALL BE DONE BY AN INDEPENDENT INSPECTION COMPANY. JOB SITE VISITS BY THE ENGINEER DO NOT CONSTITUTE, OR SUBSTITUTE, INSPECTIONS UNLESS SPECIFICALLY CONTRACTED FOR.
13.

SHOP DRAWINGS:

SHOP DRAWINGS ARE AN AID FOR FIELD PLACEMENT, AND ARE SUPERSEDED BY THE STRUCTURAL DRAWINGS. IT SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO MAKE CERTAIN THAT ALL CONSTRUCTION IS IN FULL AGREEMENT WITH THE LATEST STRUCTURAL DRAWINGS.
14.

SHOP DRAWING CHECK:

THE CONTRACTOR SHALL SUPPLY THE ENGINEER WITH A MINIMUM OF TWO COPIES OF CHECKED SHOP DRAWINGS BEARING THE CONTRACTOR'S STAMP OF APPROVAL AND SIGNATURE A MINIMUM OF THREE WEEKS PRIOR TO FABRICATION. THE REVIEW OF SHOP DRAWINGS BY THE ENGINEER IS ONLY FOR GENERAL COMPLIANCE WITH THE STRUCTURAL DRAWINGS AND SPECIFICATIONS. THIS REVIEW DOES NOT GUARANTEE IN ANY WAY THAT THE SHOP DRAWINGS ARE CORRECT, COMPLETE, NOR DOES IT INFER THAT THEY SUPERCEDE THE STRUCTURAL DRAWINGS.

MASONRY:

1.

THE GROSS COMPRESSIVE STRENGTH OF CONCRETE MASONRY SHALL BE 1200 PSI. (ASTM C-90, 2 CELL, GRADE N, TYPE I).
2.

CONCRETE MASONRY UNITS SHALL BE LAID WITH FULL MORTAR BEDDING.
3.

CONCRETE MASONRY UNITS SHALL BE LAID IN A RUNNING BOND PATTERN.
4.

HORIZONTAL JOINT REINFORCEMENT SHALL BE STANDARD "DUR-O-WAL" TRUSS TYPE GA. 9 REGULAR MILL GALVANIZED FINISH OR EQUIVALENT.
5.

HORIZONTAL JOINT REINFORCEMENT SHALL BE INSTALLED IN THE TWO JOINTS IMMEDIATELY BELOW AND ABOVE WINDOW AND DOOR OPENINGS AND EVERY SECOND COURSE SPLICED 1'-0" WITH CORRESPONDING DOWELS IN TO THE STRUCTURE.
6.

ALL BLOCK WALLS SHALL BE ANCHORED TO THE STRUCTURE BY MEANS OF DOWELS OR REBAR WITH EPOXY INTO EACH WALL AND STRUCTURE, MEMBER AND SPACED 16" MAXIMUM.
7.

MORTAR TYPE S, GROUT 28 DAY STRENGTH OF 2500 PSI.

INSPECTION NOTES:

1.

FOUNDATIONS:

A.

COMPACTED FILL INCLUDING UTILITY TRENCHES

B.

VISUAL EXAMINATION & APPROVAL OF ALL FOUNDATION EXCAVATIONS
2.

CONCRETE:

CONTINUOUS INSPECTION & TEST CYLINDERS FOR CONCRETE OVER 2500 PSI
3.

REINFORCING STEEL:

A.

PLACING OF REINFORCING

B.

PLACING OF TENDONS

C.

SAMPLING & TESTING OF STEEL (MILL REPORTS & IDENTIFICATION OF STEEL)

D.

CONTINUOUS INSPECTION OF INSTALLATION OF REBAR COUPLERS
4.

MASONRY:

A.

SAMPLING & TESTING OF MASONRY

B.

SAMPLING & TESTING OF GROUT & MORTAR

C.

CONTINUOUS INSPECTION
5.

INSULATING CONCRETE FILL:

TEST & INSPECTIONS
6.

WELDING:

A.

ALL STRUCTURAL FIELD WELDING (INCLUDES DECKING)

B.

NON-DESTRUCTIVE TESTING OF MOMENT-RESISTING SPACE FRAMES
7.

BOLTING:

A.

HIGH STRENGTH BOLTING

B.

EXPANSION BOLTS IN CONCRETE OR MASONRY
8.

STRUCTURAL STEEL:

A.

MILL REPORTS & IDENTIFICATION OF STEEL (AFFIDAVIT OF COMPLIANCE)

B.

SAMPLING & TESTING
9.

ALL TESTS & INSPECTIONS SHALL BE PERFORMED BY AN INDEPENDENT INSPECTION AGENCY. JOB SITE VISITS BY THE STRUCTURAL ENGINEER DO NOT CONSTITUTE AND ARE NOT A SUBSTITUTE FOR INSPECTIONS UNLESS THE STRUCTURAL ENGINEER IS CONTRACTED TO DO SO.

CONCRETE AND REINFORCEMENT

1.

CONCRETE PLACEMENT AND QUALITY:

SPECIFIED IN PROJECT SPECIFICATIONS.
2.

DEBRIS:

REMOVE ALL DEBRIS FROM FORMS BEFORE POURING.
3.

SEGREGATION OF AGGREGATES:

CONCRETE SHALL NOT BE DROPPED THROUGH REINFORCING STEEL (AS IN WALLS, COLUMNS AND DROP CAPITALS) SO AS TO CAUSE SEGREGATION OF AGGREGATES.
4.

INSERTS:

ALL ITEMS TO BE CAST IN CONCRETE SUCH AS REINFORCING, DOWELS, BOLTS, ANCHORS, PIPES, SLEEVES, ETC., SHALL BE SECURELY POSITIONED IN THE FORMS BEFORE PLACING
5.

SPLICES:

SPLICE BARS IN MEMBERS SUCH AS SPANDRELS, BEAMS, ETC., AS FOLLOWS: TOP BARS AT CENTERLINE OF SPAN, BOTTOM BARS AT THE SUPPORT. ALL REINFORCING STEEL SHALL BE SECURELY WIRED AND PROPERLY SUPPORTED ABOVE GROUND AND AWAY FROM THE FORMS.
6.

CONSTRUCTION JOINTS:

CONSTRUCTION JOINTS SHALL HAVE ENTIRE SURFACE REMOVED TO EXPOSE CLEAN, SOLIDLY EMBEDDED AGGREGATE. THE CONTRACTOR SHALL OBTAIN THE ENGINEER'S APPROVAL OF CONSTRUCTION JOINT LOCATION IN SLABS AND BEAMS.
7.

TEMPERATURE AND SHRINKAGE REINFORCEMENT:

SHALL HAVE A LAP OF THIRTY (30) BAR DIAMETERS, BUT NOT LESS THAN 18 INCHES, AND THE SPLICES IN ADJACENT BARS SHALL BE NOT LESS THAN FIVE (5) FEET APART.
8.

REBAR GRADES:

ALL REINFORCING STEEL SHALL BE NEW STOCK DEFORMED BARS CONFORMING TO ASTM A615 AS FOLLOWS:

#3 & SMALLER BARS.....GRADE 60

#4 & LARGER BARS.....GRADE 60
9.

WELDED WIRE FABRIC:

WELDED WIRE FABRIC SHALL CONFORM TO ASTM A82 AND A185.
10.

WELDING:

TACK WELDING OF REBAR IS NOT PERMITTED UNLESS CALLED FOR OR APPROVED BY THE ENGINEER. ALL APPROVED WELDING TO CONFORM TO SECTION 2625 (d)2D AND (e)3B. WELDING SHALL COMPLY WITH UNIFORM BUILDING CODE STANDARD NO. 28-8. WELDING OF STIRRUPS, TIES, INSERTS OR OTHER SIMILAR ELEMENTS TO LONGITUDINAL REINFORCING BARS SHALL NOT BE PERMITTED.
11.

REBAR COVER:

MINIMUM REBAR COVER FOR REINFORCED CONCRETE SHALL BE AS SHOWN IN THIS TABLE:

EXPOSURE CONDITION	MINIMUM COVER	TOLERANCE (-)
CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH:	3"	3/8 INCH
EXPOSED TO EARTH OR WEATHER:		
NO. 5 AND SMALLER BARS	1-1/2"	1/4 INCH
NO. 6 AND LARGER BARS	2"	1/4 INCH
NOT EXPOSED TO WEATHER OR IN CONTACT WITH THE GROUND:		
ROOF SLAB	1"	1/8 INCH
STRUCTURAL SLABS & WALLS	3/4"	1/8 INCH
BEAMS AND COLUMNS (PRIMARY REINFORCEMENT, TIES, STIRRUPS & SPIRALS)	1-1/2"	1/4 INCH
SLABS ON GRADE	1-1/2"	1/4 INCH

12.

TOLERANCES FOR REBAR PLACEMENT:

TOLERANCE FOR LONGITUDINAL LOCATION OF BENDS AND ENDS OF REINFORCEMENT SHALL BE PLUS OR MINUS TWO (2) INCHES, EXCEPT AT DISCONTINUOUS ENDS OF MEMBERS WHERE TOLERANCES SHALL BE ±1/2 INCH.
13.

CONCRETE QUALITY:

SHALL BE AS SHOWN IN TABLE BELOW:

CONCRETE USE	STRENGTH AT 28 DAYS	SLUMP		AIR	AGGREGATE SIZE	AGGREGATE TYPE
		MAX.	MIN.			
EXTERIOR WALKS AND CURBS	3000	3"	1"	1%	1 1/2"	HARDROCK
GRADE SLAB	4000	3"	1"	1.5%	1"	HARDROCK
FOOTINGS	4000	3"	1"	1%	1 1/2"	HARDROCK
COLUMNS, BEAMS AND WALLS	4000	4"	1"	2%	3/4"	HARDROCK

* SLUMP MAY BE INCREASED TO A MAXIMUM OF 6 INCHES WHEN CHEMICAL ADMIXTURES ARE USED, PROVIDED THAT THE ADMIXTURE-TREATED CONCRETE HAS THE SAME OR LOWER WATER-CEMENT OR WATER-CEMENTITIOUS MATERIAL RATIO AND DOES NOT EXHIBIT SEGREGATION POTENTIAL OR EXCESSIVE BLEEDING.

14.

CONCRETE WEIGHT:

ALL CONCRETE SHALL BE OF REGULAR WEIGHT OF 150 POUNDS PER CUBIC FOOT UNLESS NOTED OTHERWISE.
15.

AGGREGATE:

SIZE OF AGGREGATE SHALL CONFORM TO ASTM C33-85.

3/4".....ASTM SIZE C67

1".....ASTM SIZE C57
16.

CEMENT:

SHALL BE TYPE I
17.

CONCRETE AGE:

NO MORE THAN 90 MINUTES SHALL ELAPSE BETWEEN CONCRETE BATCHING AND CONCRETE PLACEMENT UNLESS APPROVED BY TESTING AGENCY.
18.

WET SET:

REINFORCEMENT MAY NOT BE WET SET IN CONCRETE POURS.
19.

ROUGHENED SURFACES:

WHERE INDICATED ON THE DRAWINGS, ROUGHENED SURFACES SHALL BE PROVIDED BY MEANS OF HEAVY RAKING OR GROOVING. OTHER METHODS MAY BE ACCEPTABLE PENDING WRITTEN APPROVAL FROM THE ENGINEER. ALL INTERFACING SURFACES MUST BE CLEAN AND FREE OF LOOSE MATERIALS.

CONCRETE AND REINFORCEMENT (CONT.)

20.

ADMIXTURES:

NO ADMIXTURES SHALL BE ADDED TO THE CONCRETE MIX WITHOUT THE APPROVAL OF THE ENGINEER, UNLESS NOTED OTHERWISE. ADMIXTURES OR CONCRETE CONTAINING CHLORIDES SHALL NOT BE USED.
21.

WATER/CEMENT:

WATER/CEMENT RATIO OF ALL CONCRETE SHALL BE:

0.68 MAXIMUM FOR CONCRETE WITH f'c = 3000 PSI.

0.58 MAXIMUM FOR CONCRETE WITH f'c = 4000 PSI.

0.48 MAXIMUM FOR CONCRETE WITH f'c = 5000 PSI.
- FOUNDATIONS:
1.

DESIGN OF FOOTINGS IS BASED ON AN ASSUMED ALLOWABLE SOIL BEARING CAPACITY
q ALL = 2000 PSF. IT IS THE CONTRACTORS RESPONSIBILITY TO VERIFY SOIL BEARING CAPACITY FOR THIS PROYECT.

2.

SHOULD THE CONTRACTOR ENCOUNTER SOIL THAT IS WEAKER THAN THE ABOVE,HE/SHE SHALL NOTIFY THE ENGINEER OF RECORD IMMEDIATELY.
- LOADING:
- DEAD LOAD:**
SELF WEIGHT 150 PCF
SUPERIMPOSED DEAD FLOORS 15 PSF
- LIVE LOAD:**
WALKWAY 40 PSF
STORAGE ROOM SECOND FLOOR 60 PSF
- SEISMIC LOADS:**
PER IBC 2009, SITE CLASS D
Ss =0.88, S1=0.28
SEISMIC DESIGN CATEGORY D
I = 1.0
- WIND LOADS:**
PER ASCE 7-05
V=145 MPH
EXPOSURE TYPE C
Γ = 1.0
- Revisions

Number	Date	Description

SHEET INFO

Project No.:19-1837.0
Set Date: 2021/07/28
Drawn by: _____
Dwg. Date: _____

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads

GOVERNMENT OF PUERTO RICO

GOVERNMENT OF PUERTO RICO

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

RR WATER SYSTEM IMPROVEMENTS

Project Title:

Drawing Title:

Integra Design Group

DATE ISSUE

► JULY 30, 2021 ◀

REVISED BID SET
- YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COPIA
- G103



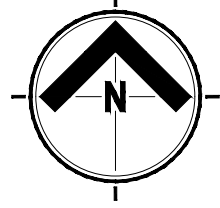
PARCEL	Area	Threatened or Endangered Species	Conservation Measures
18	Communications Operation ASBROCK	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
19	Behind Water Treatment Plant & Reservoir	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
20	Water Treatment Plant & Reservoir	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
24	Health Clinic	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
25	Langley Drive Commercial Area	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
29	Residential Area on Langley Drive	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
29	PRAMI and Langley Drive	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
42	Marina and Recreational Facilities	Yellow shouldered Blackbird and Sea Turtle	Establish a 50m buffer zone between any construction area and the land edge of the sea turtle nesting beach. Notify USFWS of any observed injured or dead turtle.
47	US Homeland Security & National Guard	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
49	Port Area	Yellow shouldered Blackbird and Sea Turtle	Establish a 50m buffer zone between any construction area and the land edge of the sea turtle nesting beach. Notify USFWS of any observed injured or dead turtle.
50	Hospital	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
52	Forensic Drive	Yellow shouldered Blackbird	Conduct survey of buildings and nearby trees for yellow shouldered blackbird nests prior to construction works. No trimming or cutting of palms and trees. Consult with USFWS if a nest is found.
59	Forested Drive and All Lands Beach Area	Yellow shouldered Blackbird and Sea Turtle	Establish a 50m buffer zone between any construction area and the land edge of the sea turtle nesting beach. Notify USFWS of any observed injured or dead turtle.

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 155000 CERTIFICO QUE SOY EL DUEÑO DE LA EMPRESA QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LOS REQUISITOS DE LA LEY 155000, CERTIFICO QUE LOS PLANOS Y ESPECIFICACIONES SON LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES NO SE HA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE QUE CUALQUIER DECLARACION FALSA DE JALISCO DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE.


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Revisions		SHEET INFO.	
Number	Date	Description	
			Project No.: 19-1837.0
			Set Date: 2021/0728
			Drawn by:
			Dwg. Date:



LEGEND:

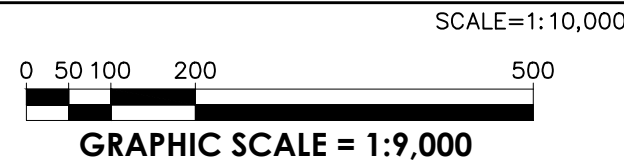
 SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

NOTES:

- 1) SOLID WASTE MANAGEMENT UNIT (SWMU) MEANS ANY DISCERNIBLE UNIT AT WHICH SOLID WASTES HAVE BEEN PLACED AT ANY TIME, REGARDLESS OF WHETHER THE UNIT WAS INTENDED FOR THE MANAGEMENT OF SOLID OR HAZARDOUS WASTE.
- 2) AREA OF CONCERN (AOC) MEAN ANY AREA HAVING A PROBABLE RELEASE OF A HAZARDOUS WASTE OR HAZARDOUS CONSTITUENT WHICH IS NOT FROM A SOLID WASTE MANAGEMENT UNIT (SWMU) AND IS DETERMINED BY THE DEPARTMENT TO POSE A CURRENT OR POTENTIAL THREAT TO HUMAN HEALTH OR THE ENVIRONMENT.
- 3) A TOTAL OF 82 "SITES" HAVE BEEN IDENTIFIED AT NAPR (FORMERLY NAVAL STATION ROOSEVELT ROADS), WHICH REQUIRE ASSESSMENTS AND/OR INVESTIGATIONS UNDER THE CORRECTIVE ACTION AUTHORITIES OF RCRA. THESE INCLUDE 76 SWMUS AND SIX AOCs. THESE SWMUS AND AOCs WERE IDENTIFIED BASED ON THE 1988 RCRA FACILITY ASSESSMENT (RFA) PERFORMED FOR EPA; THE 1993 "FOLLOW-UP" VISUAL SITE INSPECTION (FOLLOW-UP VSI) ALSO PERFORMED FOR EPA; AND THE 2005 PHASE I/II ENVIRONMENTAL CONDITIONS OF PROPERTY (ECP) REPORT PREPARED FOR THE U.S. NAVY IN CONJUNCTION WITH CLOSURE AND SALE/TRANSFER OF THE FACILITY TO THE LOCAL REUSE AUTHORITY.
- 4) ON JANUARY 29, 2007, THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) ENTERED INTO AN ADMINISTRATIVE ORDER ON CONSENT (7003 - CONSENT ORDER) WITH THE UNITED STATES DEPARTMENT OF THE NAVY (THE NAVY). THE CONSENT ORDER ESTABLISHES THE NAVY'S OBLIGATIONS FOR COMPLETING THE CLEANUP OF THIS LARGE, CLOSED MILITARY BASE, PURSUANT TO THE AUTHORITY OF THE FEDERAL RESOURCE CONSERVATION AND RECOVERY ACT ("RCRA").
- 5) SOME OF THE WORKS OF THIS PROJECT REQUIRE ACTIVITIES ON AREAS IDENTIFIED AS SWMU'S AND AOC'S. THE CONTRACTOR SHALL PERFORM ACTIVITIES ON THOSE AREAS FOLLOWING THE EPA AND US NAVY CONSENT DECREE AND SPECIAL INSTRUCTIONS IN ORDER TO HANDLE AND DISPOSE OF ANY CONTAMINATED MATERIAL INCLUDING SOIL AND PIPING MATERIAL (SEE TECHNICAL SPECIFICATION 31, 23, 17 EXCAVATION AND DISPOSAL OF CONTAMINATED SOILS).
- 6) THE SWMU'S AND AOC'S THAT COULD BE AFFECTED ARE INDICATED ON THE SWMU AND AOC TABLE ON SHEET WDS-EC101.
- 7) THERE ARE ENVIRONMENTAL MONITORING WELLS ALONG THE PROPOSED PROJECT AREA. CONTRACTOR SHALL PROTECT ALL EXISTING MONITORING WELLS FROM EXCAVATION AND CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL NOTIFY OWNER IF A MONITORING WELL COULD BE AFFECTED, TO DETERMINE THE PROPER ACTION. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE INFLECTED TO THESE MONITORING WELLS. THE CONTRACTOR SHALL DO NOT INTERFERE WITH ANY MONITORING WELL.



ENVIRONMENTAL CONCERN AREAS KEY PLAN



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMENDADA, RECONOCIENDO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER DISTRIBUTION SYSTEM

ENVIRONMENTAL CONCERN AREAS KEY PLAN

Project Title:

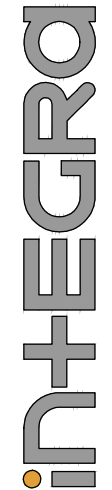
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Revisions

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SWMU's AND AOC SCHEDULE			
VAIVES ID/WORK TO BE PERFORMED	AFFECTING SWMU (YES/NO)	SWMU ID	LAND USE RESTRICTIONS
LV8-1	NO	SWMU 42 ¹	-
LV8-3	NO	SWMU 42 ¹	-
LV8-4	NO	SWMU 42 ¹	-
PROPOSED REPAIR (L-1) ON PIPE TAPPING AT MANHOLE	NO	SWMU 42 ¹	-
LV8-9	NO	SWMU 42 ¹	-
LV8-10	NO	SWMU 42 ¹	-
MV8-7	NO	N/A	-
PROPOSED LEAKAGE REPAIR (L-2) ON AIR RELEASE VALVE AT MANHOLE	NO	N/A	-
MV8-8	NO	N/A	-
MV8-5	NO	N/A	-
MV8-3	NO	N/A	-
MV8-2	NO	N/A	-
MV8-6	NO	N/A	-
LV9-2	NO	N/A	-
LH9-1	NO	N/A	-
LV9-9	NO	N/A	-
LH9-6	NO	SWMU 1 ¹	-
REPLACEMENT OF 4" PVC LINE (LEAKAGE REPAIR L-3)	NO	SWMU 1 ¹	-
LV9-25	NO	SWMU 1 ¹	-
LV9-26	NO	SWMU 1 ¹	-
LH9-5	NO	SWMU 1 ¹	-
LV9-11	NO	SWMU 1 ¹	-
LV9-27	NO	SWMU 1 ¹	-
LV9-15	NO	SWMU 1 ¹	-
LV9-2	NO	SWMU 1 ¹	-
LV9-16	NO	SWMU 1 ¹	-
LV9-17	NO	SWMU 1 ¹	-
LV9-18	NO	SWMU 1 ¹	-
LV9-19	NO	SWMU 1 ¹	-
LV9-22	NO	SWMU 1 ¹	-
LV9-23	NO	SWMU 1 ¹	-
LV9-24	NO	SWMU 1 ¹	-
KV9-2	NO	SWMU 1/ SWMU 71 ¹	-
KV10-1	YES	SWMU 71	RESTRICTED, SEE SPECS
KV10-2	YES	SWMU 71	RESTRICTED, SEE SPECS
KV10-3	NO	SWMU 2 ¹	-
KH10-1	NO	SWMU 71 ¹	-
KV10-4	YES	SWMU 2	RESTRICTED, SEE SPECS
KV10-5	YES	SWMU 2	RESTRICTED, SEE SPECS
KV10-6	YES	SWMU 2	RESTRICTED, SEE SPECS
KV10-7	NO	N/A	-
KV10-8	NO	N/A	-
KV10-9	NO	N/A	-
KV10-10	NO	N/A	-
KV10-11	NO	N/A	-
JV10-1	NO	SWMU 2 ¹	-
JV11-1	NO	N/A	-
JV11-2	NO	N/A	-
JV11-3	NO	N/A	-
JV11-7	NO	N/A	-
JV11-6	NO	N/A	-
JV11-8	NO	N/A	-
LV11-1	NO	N/A	-
LH11-7	NO	SWMU 67 ¹	-
LV11-2	NO	SWMU 67 ¹	-
LV11-15	YES	SWMU 67 ¹	NOT RESTRICTED, SEE SPECS
LV11-7 & REPLACEMENT OF 6" PVC LINE	NO	SWMU 67 ¹	-
LH11-6 & REPLACEMENT OF CONNECTING LINE	NO	SWMU 67 ¹	-
LV11-9 & REPLACEMENT OF 12" PVC LINE	NO	SWMU 67 ¹	-
HV11-14	NO	SWMU 67 ¹	-
HV11-13	NO	SWMU 67 ¹	-
HV11-15	NO	SWMU 67 ¹	-
LV12-4	YES	SWMU 74	RESTRICTED, SEE SPECS
LV12-3 & REPLACEMENT OF 8" PVC LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
LV12-5	YES	SWMU 74	RESTRICTED, SEE SPECS
LV12-2 & REPLACEMENT OF 6" PVC LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
LH12-4 & REPLACEMENT OF 6" PVC LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
LH12-5 & REPLACEMENT OF CONNECTING LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
LV12-1 & REPLACEMENT OF 8" PVC LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
LV13-5 & REPLACEMENT OF 8" PVC LINE	NO	SWMU 74 ¹	-
LV13-3	NO	SWMU 74 ¹	-
LV13-4	YES	SWMU 74/AOC F-1738	RESTRICTED, SEE SPECS
LV13-2	YES	SWMU 74	RESTRICTED, SEE SPECS
LV13-6	NO	SWMU 74 ¹	-
LV13-8	NO	SWMU 74 ¹	-
LV13-7	NO	SWMU 74 ¹	-
LH13-10	NO	SWMU 74 ¹	-
LV13-9	YES	SWMU 74	RESTRICTED, SEE SPECS
LV13-10	NO	SWMU 74 ¹	-
REPLACEMENT OF 8" PVC LINE	YES	SWMU 74	RESTRICTED, SEE SPECS
REPLACEMENT OF 8" PVC LINE	YES	SWMU 59	RESTRICTED, SEE SPECS
LV13-7	YES	SWMU 59	RESTRICTED, SEE SPECS
JH13-1 & REPLACEMENT OF CONNECTING LINE	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
JV13-6	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
LV13-12	YES	SWMU 59	RESTRICTED, SEE SPECS

SWMU's AND AOC SCHEDULE			
VAIVES ID/WORK TO BE PERFORMED	AFFECTING SWMU (YES/NO)	SWMU ID	LAND USE RESTRICTIONS
REPLACEMENT OF 8" PVC LINE			
JV13-5	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
REPLACEMENT OF 8" PVC LINE			
JH13-2 & REPLACEMENT OF CONNECTING LINE	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
LV13-11	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
JH13-3	NO	SWMU 74 ¹	-
JH13-3B	NO	SWMU 74 ¹	-
JV13-7	NO	SWMU 74 ¹	-
JV13-4	NO	SWMU 74 ¹	-
JV13-1	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
JV13-2	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
JV13-3	YES	SWMU 74/AOC F-1995	RESTRICTED, SEE SPECS
JH13-5	YES	SWMU 7/8/ SWMU 74	RESTRICTED, SEE SPECS
JV14-1	YES	SWMU 7/8	RESTRICTED, SEE SPECS
JV14-2	YES	SWMU 7/8	RESTRICTED, SEE SPECS
JV14-3	YES	SWMU 7/8	RESTRICTED, SEE SPECS
KV14-1	YES	SWMU 7/8	RESTRICTED, SEE SPECS
JV14-1B	YES	SWMU 7/8	RESTRICTED, SEE SPECS
PRESSURE REGULATING VALVE	YES	SWMU 7/8	RESTRICTED, SEE SPECS
KH14-1	YES	SWMU 7/8	RESTRICTED, SEE SPECS
KH14-3	YES	SWMU 7/8	RESTRICTED, SEE SPECS
KV14-2	YES	SWMU 7/8	RESTRICTED, SEE SPECS
KV14-8	YES	SWMU 10	RESTRICTED, SEE SPECS
KV14-9	YES	SWMU 10	RESTRICTED, SEE SPECS
KV14-10	YES	SWMU 10	RESTRICTED, SEE SPECS
KH14-12	NO	SWMU 74 ¹	-
KV14-13	NO	SWMU 74 ¹	-
KV15-10	NO	SWMU 74 ¹	-
KV15-11	NO	SWMU 74 ¹	-
KV15-12	YES	SWMU 74	RESTRICTED, SEE SPECS
KV15-13	YES	SWMU 74	RESTRICTED, SEE SPECS
KH15-1	YES	SWMU 74	RESTRICTED, SEE SPECS
KV15-16	NO	SWMU 70 ¹	-
KV15-17	NO	SWMU 70 ¹	-
KH15-4	NO	SWMU 70 ¹	-
NEW VALVE 8"	NO	SWMU 70 ¹	-
NEW 8" PVC LINE (L=340.80m)			
NEW TEE 10X10X8	NO	SWMU 70 ¹	-
KH15-6	NO	SWMU 70 ¹	-
KV15-9	YES	SWMU 70	RESTRICTED, SEE SPECS
CUT PIPE AND INSTALL 8" PLUG CAP	NO	SWMU 70 ¹	-
KH15-10	NO	SWMU 70 ¹	-
LV15-11	NO	SWMU 45 ¹	-
LV15-12	NO	SWMU 45 ¹	-
LV15-13	NO	SWMU 45 ¹	-
KV15-25	NO	SWMU 73 ¹	-
KV15-26	NO	SWMU 73 ¹	-
KH15-7	NO	SWMU 73 ¹	-
CUT PIPE AND INSTALL 8" PLUG CAP	NO	SWMU 73 ¹	-
KH15-6	NO	SWMU 73 ¹	-
NEW VALVE 8"	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
NEW 8" PVC LINE (L=340.80m)			
NEW TEE 12X12X8	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KH15-9	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KV15-6	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KH15-11	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KV15-27	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KV15-8	NO	SWMU 74 ¹	-
KH15-2	NO	SWMU 74 ¹	-
KV15-9	NO	SWMU 74 ¹	-
KH15-12	YES	AOC F 2842 B	RESTRICTED, SEE SPECS
NEW 8" LINE (L=340 M)	YES	SWMU 72	NOT RESTRICTED, SEE SPECS
KH15-8	NO	SWMU 73 ¹	-
KV15-28	NO	SWMU 73 ¹	-
KV15-29	NO	SWMU 6 ¹	-
KV15-30	NO	SWMU 70 ¹	-
KV15-31	NO	SWMU 74 ¹	-
KH16-3	NO	SWMU 6 ¹	-
KV16-4	NO	SWMU 6 ¹	-
KH16-2	YES	SWMU 6	NOT RESTRICTED, SEE SPECS
KH16-1	YES	SWMU 6	NOT RESTRICTED, SEE SPECS
KV16-1	NO	SWMU 6	SEE SPECS
JH16-1	YES	SWMU 73	RESTRICTED, SEE SPECS
JH15-5	NO	SWMU 73 ¹	-
JV16-1	NO	SWMU 6 ¹	-
JV15-7	NO	N/A	-
JV15-5	NO	N/A	-
JV15-6	NO	N/A	-
JV15-7	NO	N/A	-
JV14-5	NO	N/A	-
JV14-6	NO	N/A	-
JV14-7	NO	N/A	-
JH14-3	NO	N/A	-
JH14-1	NO	SWMU 7/8 ¹	-
JV14-4	NO	SWMU 7/8 ¹	-
JV14-8	NO	SWMU 7/8 ¹	-
JH14-2	NO	SWMU 7/8 ¹	-
LV14-1	NO	SWMU 74 ¹	-
KV15-5	NO	N/A	-
JV17-1	NO	N/A	-
¹ DO NOT USE SWMU DESIGNATED AREAS AS/FOR CONSTRUCTION STAGING AREAS. NO ADDITIONAL MEASURES ARE NEEDED.			

Integra Design Group
DATE ISSUE
▶ JULY 30, 2021 ◀
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZZO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DESPE.

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Revisions

Number	Date	Description

SHEET INFO:
Project No.: 19-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Sheet:

WDS-EC101

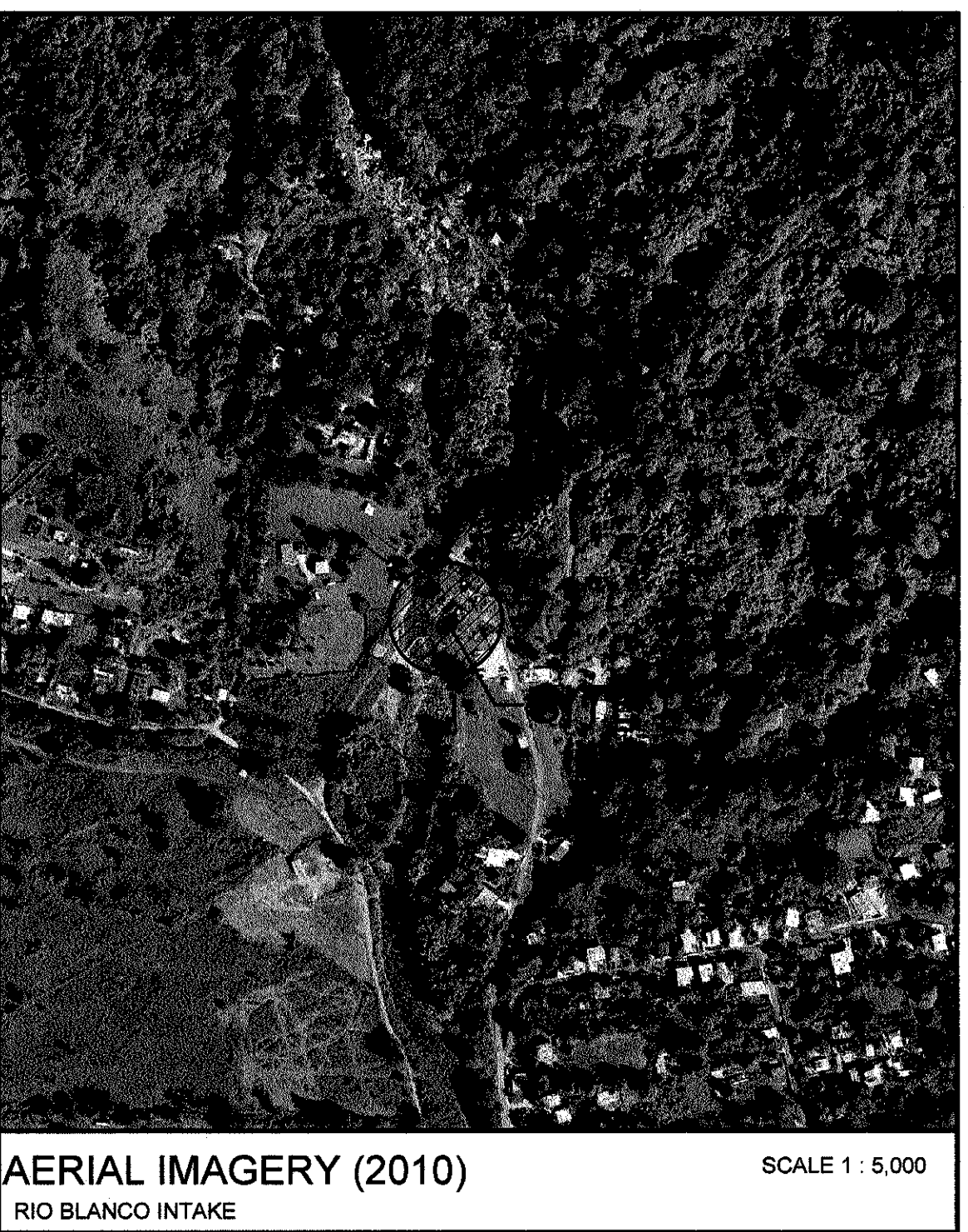
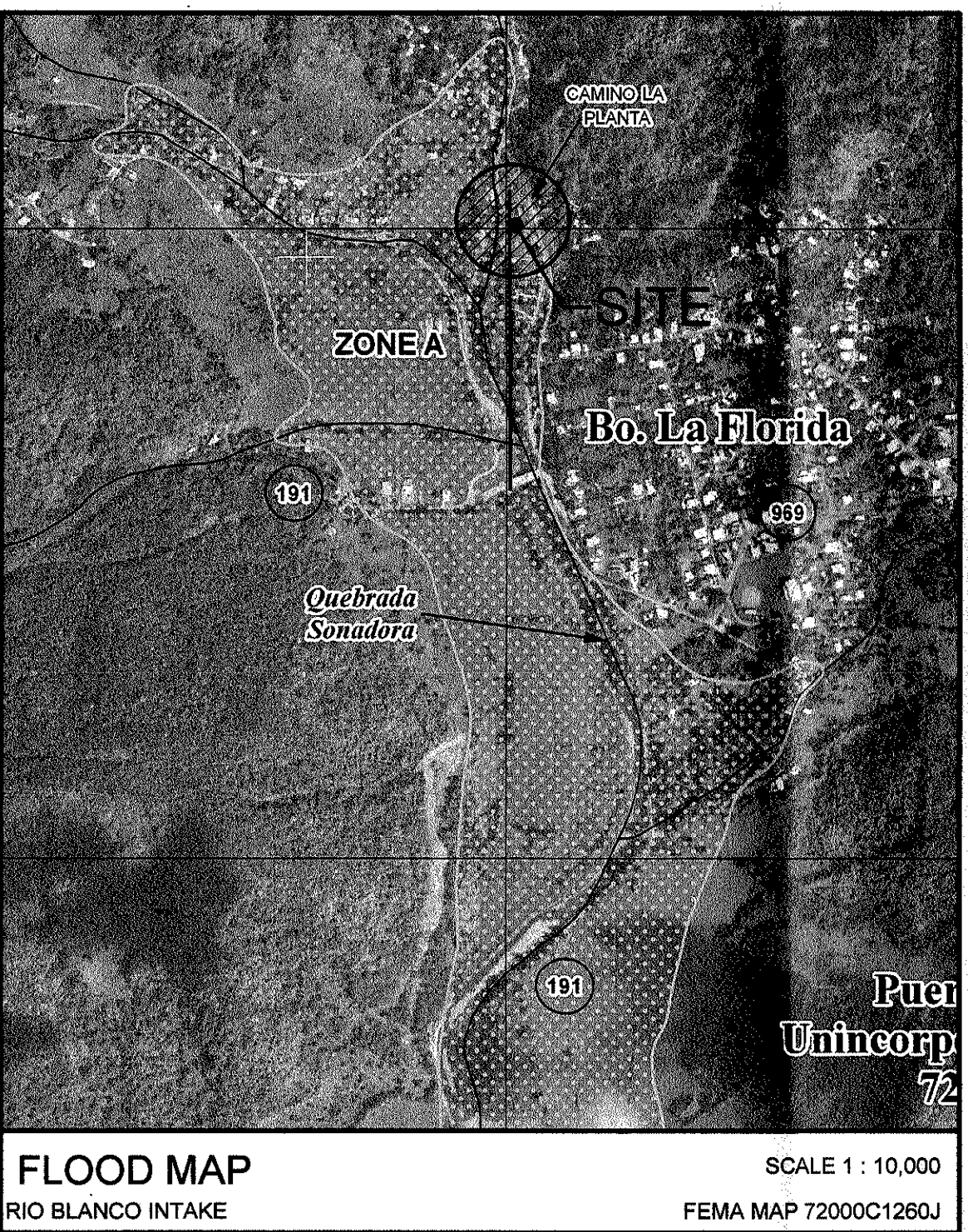
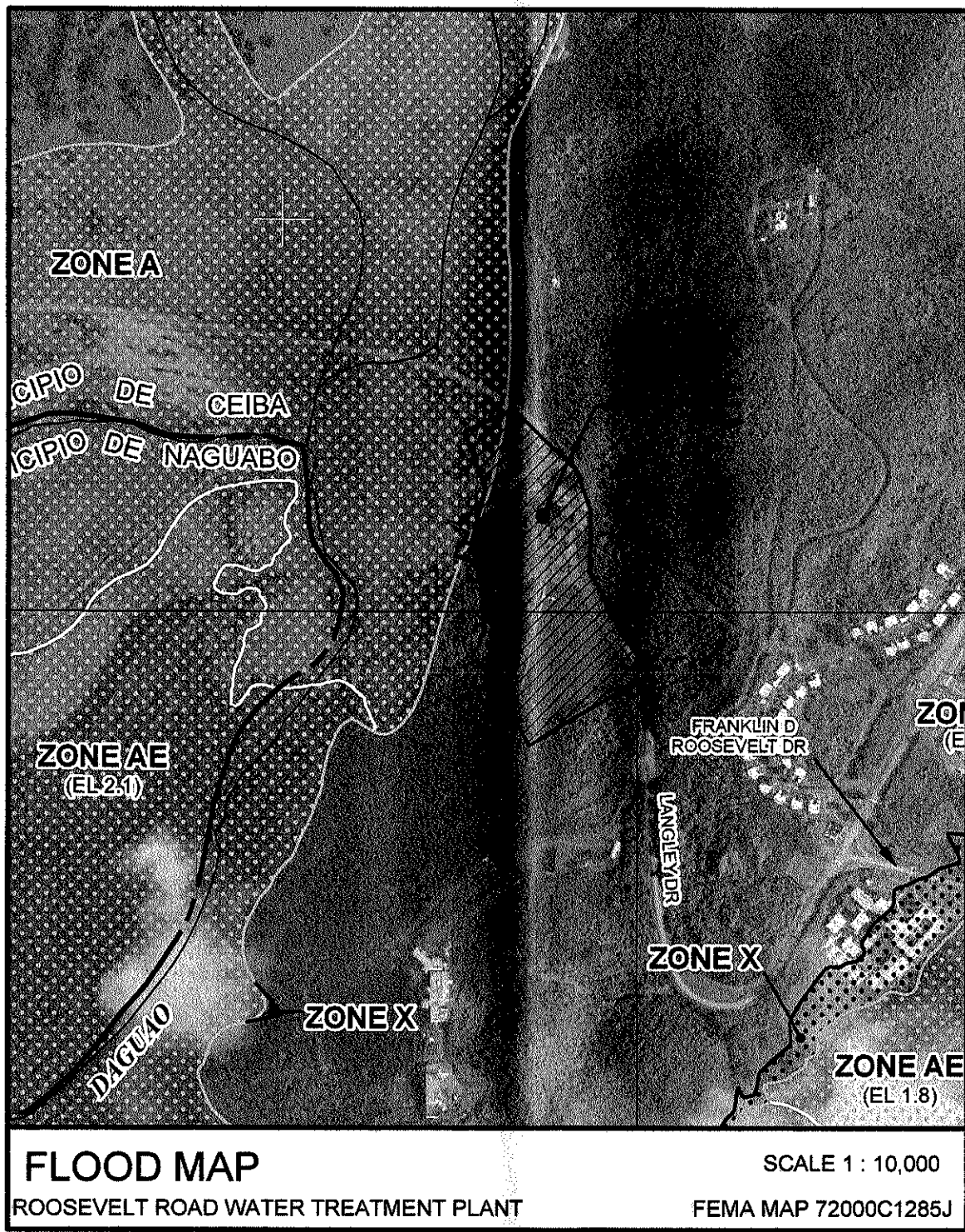
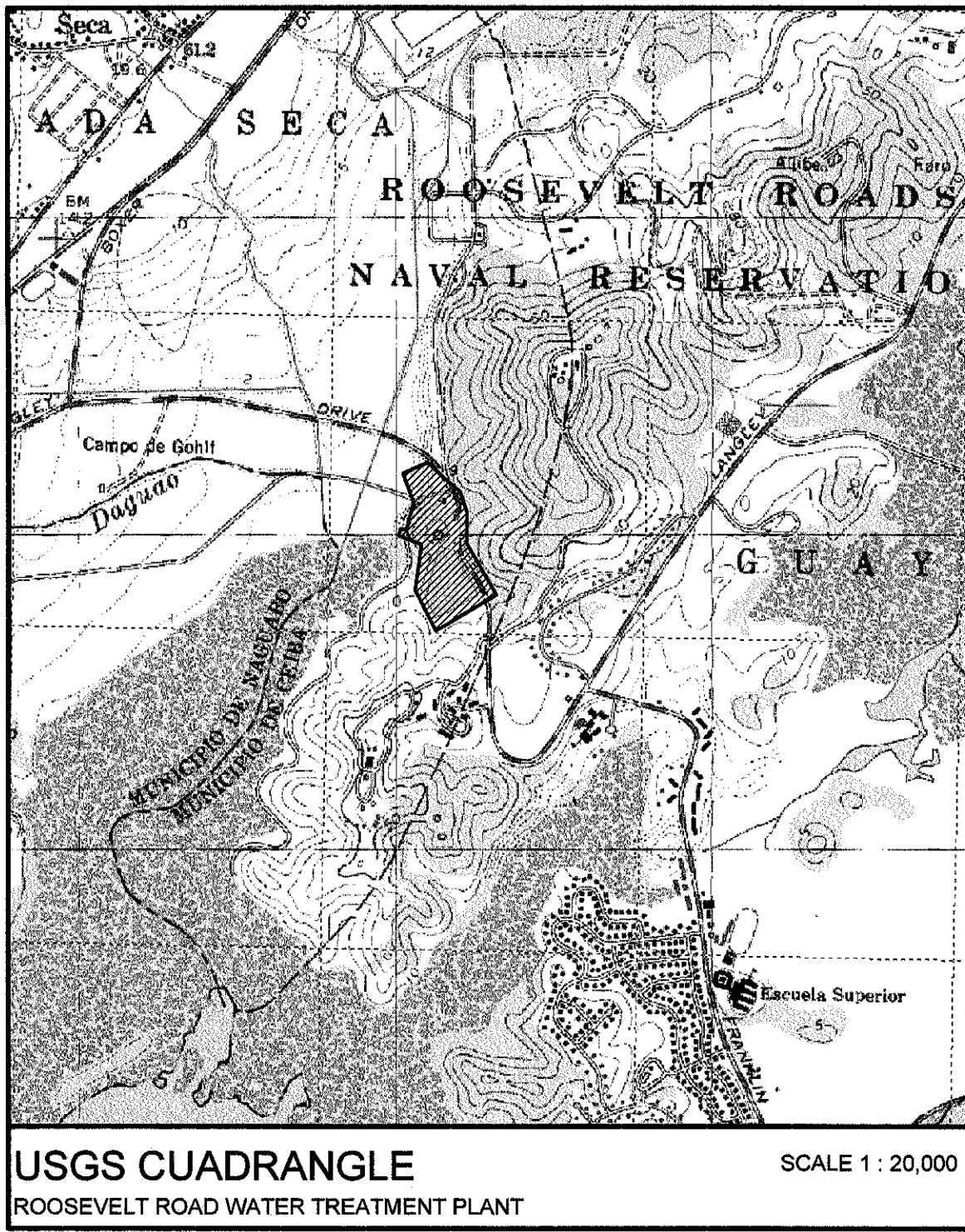
Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Drawing Title:

WATER DISTRIBUTION SYSTEM

ENVIRONMENTAL CONCERN AREAS SCHEDULE



EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY FOR ROOSEVELT ROADS WATER TREATMENT PLANT IMPROVEMENTS PROJECT LOCATED AT US NAVAL STATION ROOSEVELT ROADS MUNICIPALITY OF CEIBA, PUERTO RICO

INDEX :

SHEET NO.	DESCRIPTION
VF-01	TITLE, LOCATION PLAN, NOTES, LEGEND & CONTROLS.
VF-02	GENERAL SITE PLAN
VF-03 @ VF-05	EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
VF-06	RIO BLANCO INTAKE

LEGEND:

	CONTROL STATION		TWO SIDE METAL LIGHT POLE		SANITARY SEWER LINE
	PROPERTY POINT		METAL POWER POLE		STORM SEWER LINE
	SANITARY SEWER MANHOLE		STREET LIGHT POLE		WATER LINE
	STORM SEWER MANHOLE		KM ID		AERIAL TELEPHONE LINE
	ELECTRIC UTILITY MANHOLE		CLEAN OUT		AERIAL POWER LINE
	TELEPHONE MANHOLE		FIRE HYDRANT		AERIAL POWER AND TELEPHONE LINE
	WATER MANHOLE		CURB INLET		CHAIN LINK FENCE
	HEAD WALL		PUBLIC TELEPHONE BOOTH		BARBED WIRE FENCE
	CATCH BASINS		STREET LIGHT BOX		UNDERGROUND POWER LINE
	WATER METER		HANDICAP RAMP		UNDERGROUND TELECOMMUNICATION
	WATER VALVE		SIGN		GUARDRAIL
	CONCRETE LIGHT POLE		GUY WIRE		SPOT ELEVATIONS
	CONCRETE POWER POLE		EXISTING TREE		CONTOUR INTERVAL EVERY 1.0 METER
	CONCRETE POWER & TELEPHONE POLE		PALM TREE		CONTOUR INTERVAL EVERY 5.0 METER
	UTILITY POLE		VENT		UNKNOWN UNDERGROUND PIPE LINE
	WOODEN POWER/TELEPHONE POLE		BOLLARDS		1/2" UNKNOWN PIPE
	TELEPHONE POLE		VERTICAL PIPE		3/4" UNKNOWN PIPE
	WOODEN POWER POLE		EXISTING STRUCTURES		1" UNKNOWN PIPE
	WOODEN LIGHT POLE		CONCRETE SLAB		2" UNKNOWN PIPE
	ELECTRIC BOX		PAVEMENT PATCH		3" UNKNOWN PIPE
	METAL CAP		CONCRETE GUTTER		WATER DISTRIBUTION LINE (AS REPORTED)
	HOSE BIBB		CROSS INLET		SANITARY FORCE MAIN (AS REPORTED)
	GUY POLE				RAW WATER (AS REPORTED)
	ANTENNA				
	CABLE TV POLE				
	METAL LIGHT POLE				

ABBREVIATIONS :

C.B.	CATCH BASIN
S.M.H.	SANITARY SEWER MANHOLE
STMH	STORM SEWER MANHOLE
EMH	ELECTRIC MANHOLE
CONC.	CONCRETE
C.S.	CONCRETE SLAB
B.S.	BUS STOP
F.F.E.	FINISH FLOOR ELEVATION
P.R.H.T.A.	PUERTO RICO HIGHWAY AND TRANSPORTATION AUTHORITY
A.E.P.	PUBLIC BUILDING AUTHORITY
J.P.	"JUNTA DE PLANIFICACION DE PUERTO RICO"
N/A	NO ACCESS
PREPA	PUERTO RICO ELECTRIC POWER AUTHORITY
PRASA	PUERTO RICO AQUEDUCT AND SEWER AUTHORITY
T.W.	TOP OF WALL ELEVATION
I.E.	INVERT ELEVATION
T.E.	TOP ELEVATION
Ø	PIPE DIAMETER
HW	HEADWALL
C.I.	CURB INLET
UNK	UNKNOWN
S.F.M.	SANITARY FORCE MAIN
G.I.S.	GEOGRAPHIC INFORMATION SYSTEMS
S.U.S.	SUBSURFACE UTILITY SURVEY
S.L.P.	STREET LIGHT POST
M.C.	METAL CAP
S.L.	STREET LIGHTING
H	HEIGHT

NOTES :

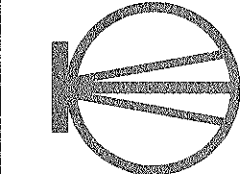
- ALL DISTANCES ARE EXPRESSED IN METERS, UNLESS OTHERWISE NOTED.
- FIELDWORK PERFORMED FROM JUNE 22ND THRU JULY 3, 2017 AND AUGUST 3, 2017.
- HORIZONTAL CONTROLS ARE REFERRED TO NAD 83 (2011/PA11MA11) EPOCH 2010.00.
- VERTICAL DATUM IS REFERRED TO PRVD02, GEOID 12B.
- PLEASE REFER TO SURVEY JEB-3040.
- THE INFORMATION DEPICTED ON THIS MAP REPRESENTS THE RESULT OF THE SURVEY MADE ON THE DATE INDICATED AND CAN ONLY BE CONSIDERED AS AN INDICATION OF THE GENERAL CONDITIONS EXISTING AT THAT TIME.
- CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS AND MEASUREMENTS AND ADVISE ARCHITECT OR OWNER OF ANY DIFFERENCES.
- UNDERGROUND UTILITIES WERE LOCATED TO A QUALITY LEVEL C OF SPECIFICATION ASCE 3802. THIS DRAWING NEITHER DEPICTS NOR INTEND TO DEPICT ALL UNDERGROUND UTILITIES. "AS REPORT" UTILITIES ARE DEPICTED ACCORDING TO REFERENCE DOCUMENTS AS PROVIDED BY CLIENT AND WERE NOT CONFIRMED ON FIELD. CONTRACTOR SHALL NOTIFY ALL UTILITY COMPANIES PRIOR TO ANY WORK.

PROJECT LOCATION :

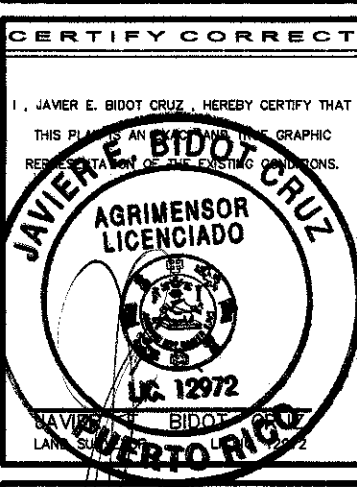


STA	COORDINATES		ELEVATION	DESCRIPTION
	NORTHING	EASTING		
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3040-2	243,393.795	282,426.477	13.116	1/4" BRONZE DISK
3040-3	243,421.028	282,383.290	9.884	1/4" BRONZE DISK

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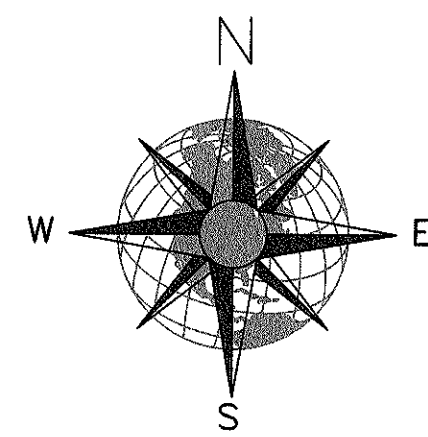
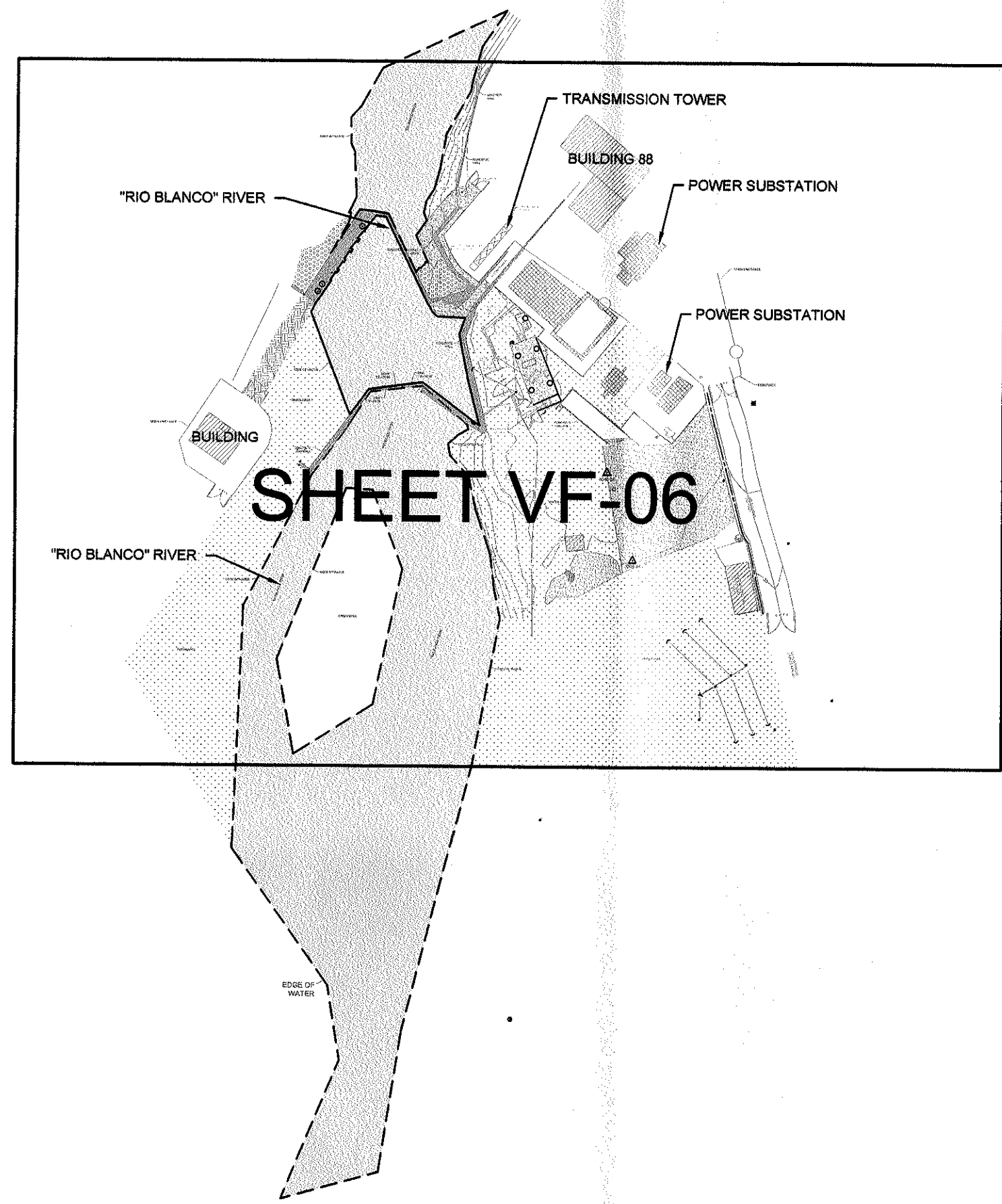


EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
FOR ROOSEVELT ROADS WATER TREATMENT PLANT IMPROVEMENTS PROJECT
LOCATED AT US NAVAL STATION ROOSEVELT ROADS
MUNICIPALITY OF CEIBA, PUERTO RICO



DRAWING TITLE:
TITLE SHEET
INDEX, MAPS,
LEGEND, NOTES
& CONTROLS

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DRAWING BY: J.C.	
DATE: SEP. 18, 2017	
PAPER SIZE: 30x42	

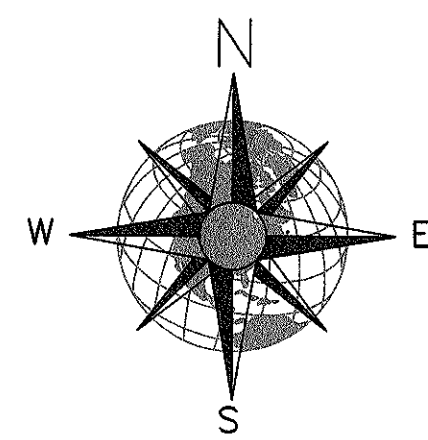
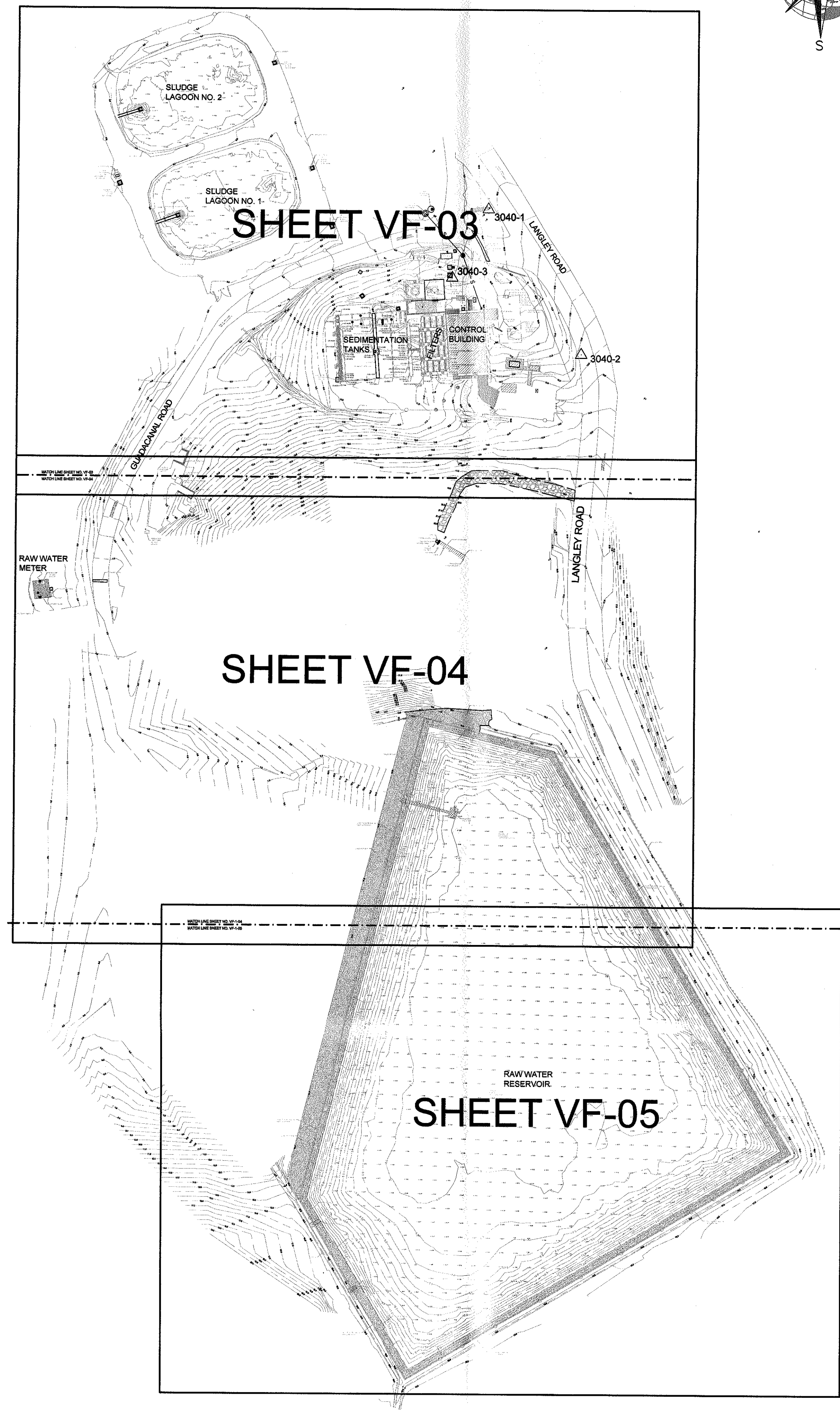
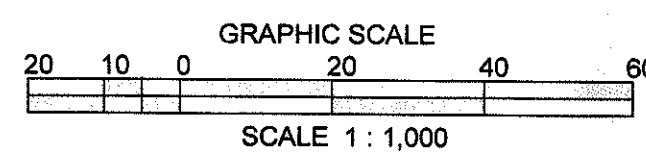


RIO BLANCO INTAKE (NAGUABO)

GENERAL SITE PLAN

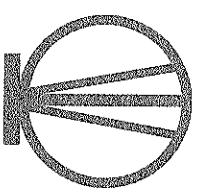
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FOR LEGEND AND GENERAL NOTES SEE DRAWING NO. VF-01

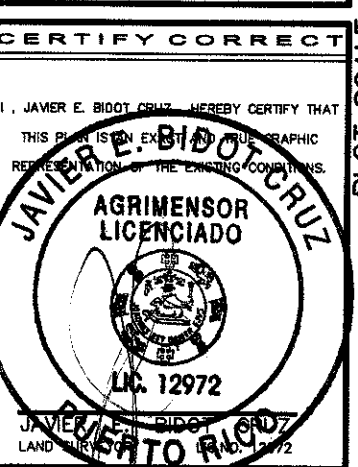


ROOSEVELT ROAD WATER TREATMENT PLANT (CEIBA)

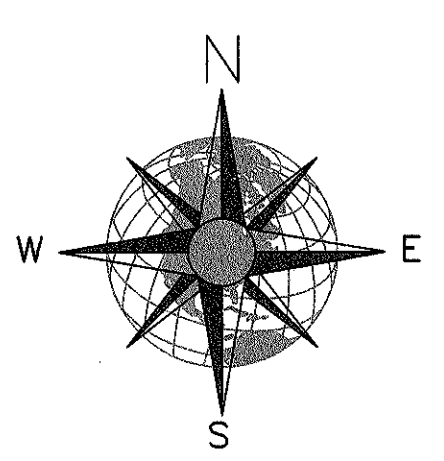
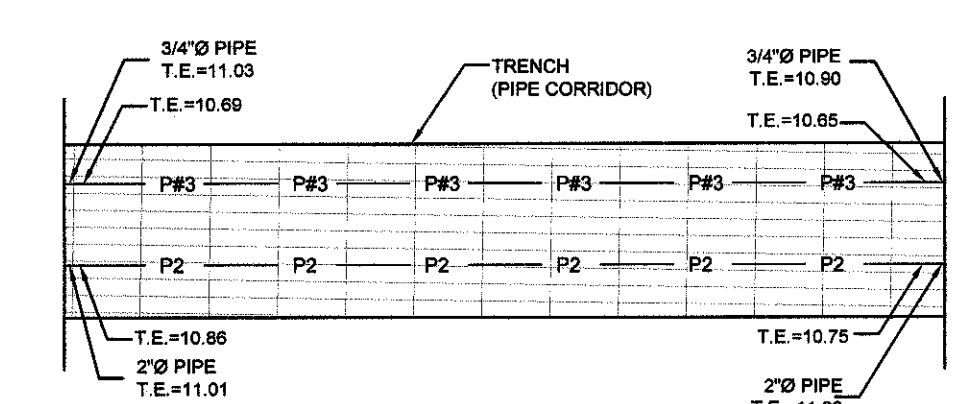
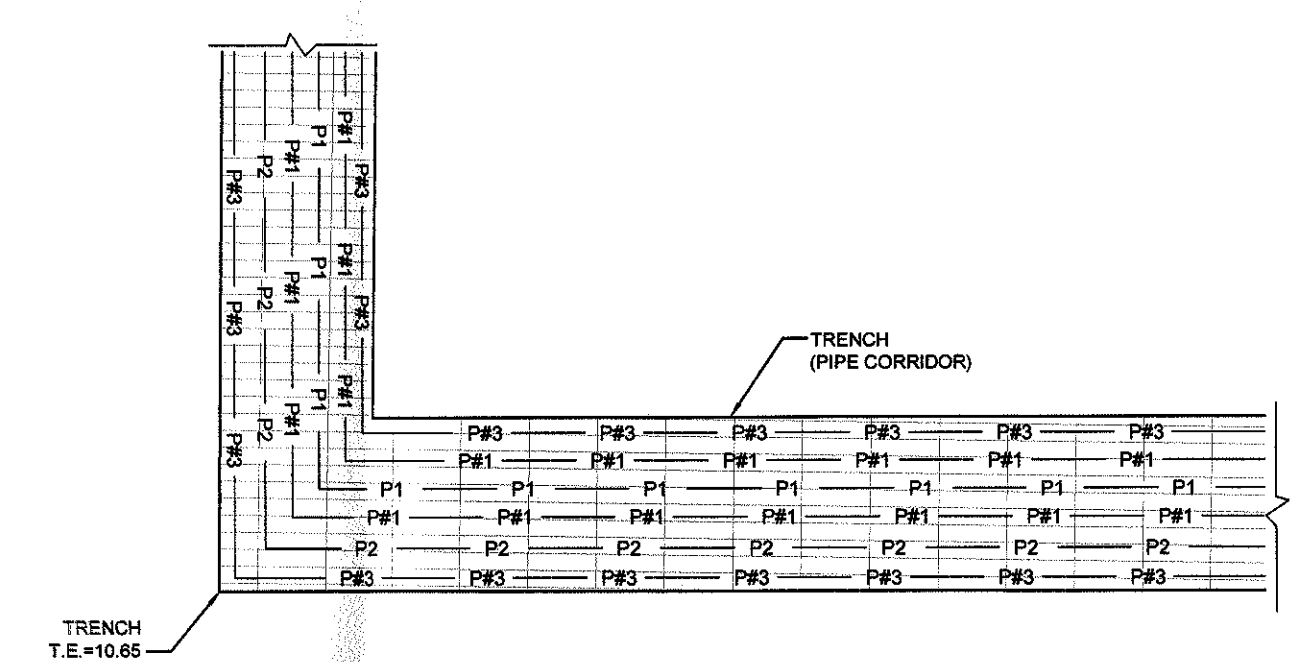
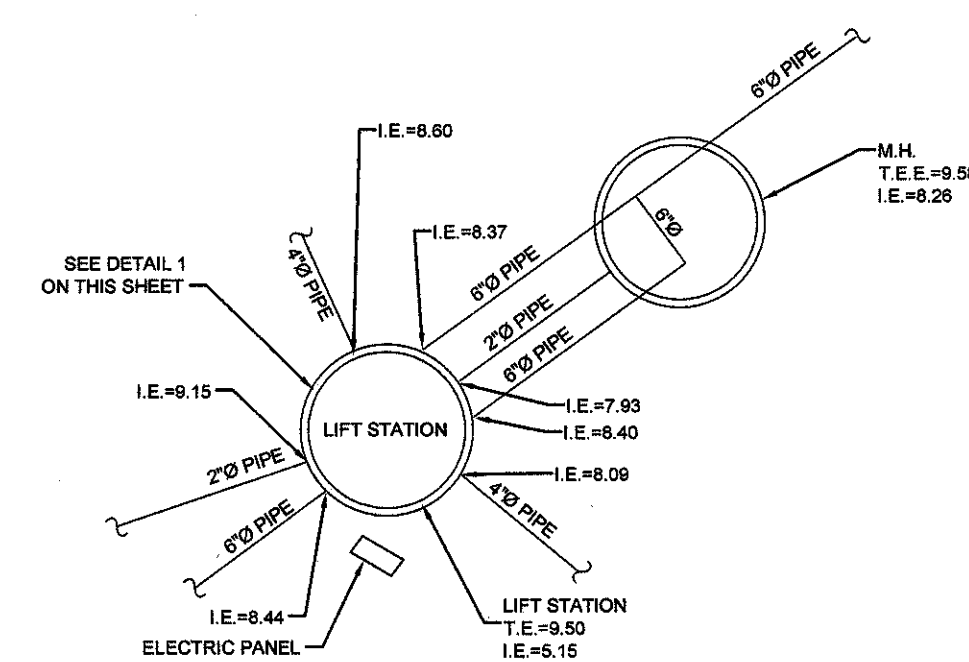
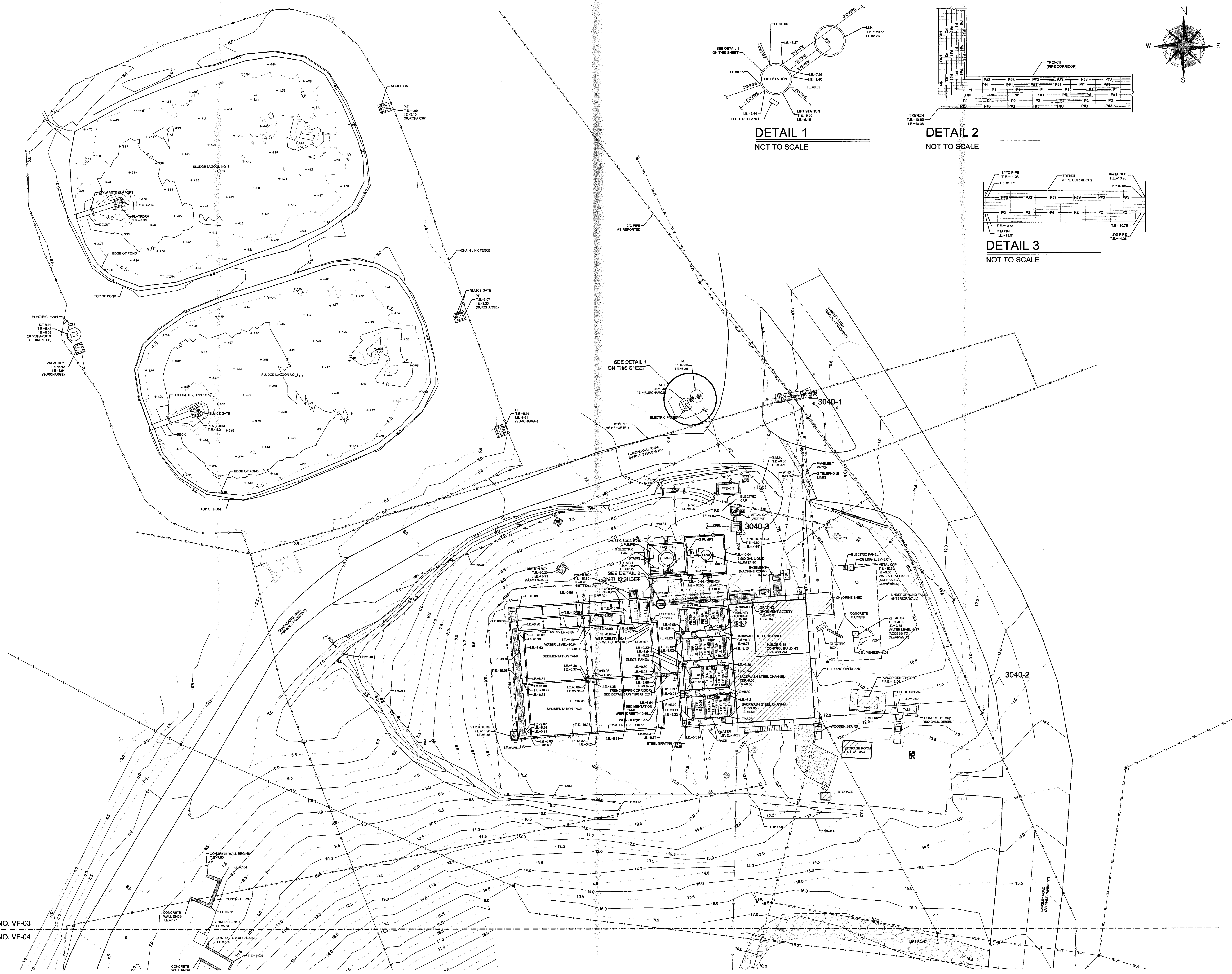
JAVIER E. BIDOT
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16 Cordova St., Terminal 1, Ceiba, PR 00727
Phone: (787) 865-5888 Fax: (787) 706-6215
www.jebidot.com




**EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
FOR ROOSEVELT ROADS WATER TREATMENT PLANT IMPROVEMENTS PROJECT
LOCATED AT US NAVAL STATION ROOSEVELT ROADS
MUNICIPALITY OF CEIBA, PUERTO RICO**



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SCALE: 1 : 1,000	DWG. NO. VF-02
PROJECT: 489-3040	SHEET No. 2
CHECKED BY: J.C.	DATE: SEP. 18, 2017
DRAWING BY: J.C.	PAPER SIZE: 30x42

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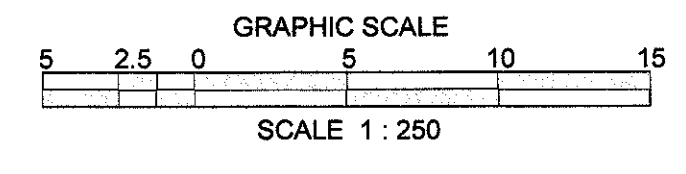
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FOR ROOSEVELT ROADS, WATER TREATMENT PLANT IMPROVEMENTS PROJECT
LOCATED AT US NAVAL STATION ROOSEVELT ROADS
MUNICIPALITY OF CEIBA, PUERTO RICO



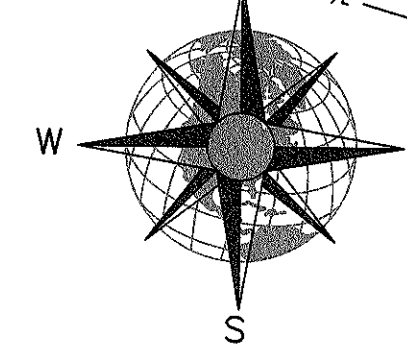
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DATE: SEP. 18, 2017	
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PLOT DATE : JUNE 11, 2018

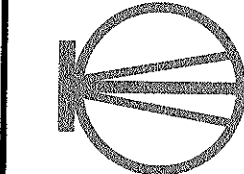
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SCALE 1 : 250 FOR LEGEND AND GENERAL NOTES SEE DRAWING NO. VF-01



MATCH LINE SHEET NO. VF-03
MATCH LINE SHEET NO. VF-04

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Phone: (787)746-5486 Fax: (787)704-6215
www.jebpr.com



EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
FOR ROOSEVELT ROADS, WATER TREATMENT PLANT IMPROVEMENTS PROJECT
LOCATED AT US NAVAL STATION ROOSEVELT ROADS
MUNICIPALITY OF CEIBA, PUERTO RICO

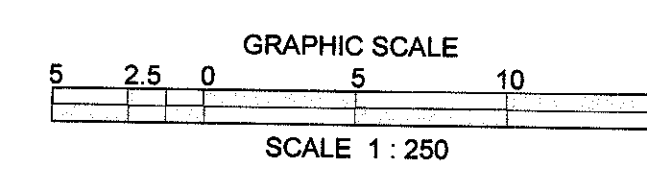
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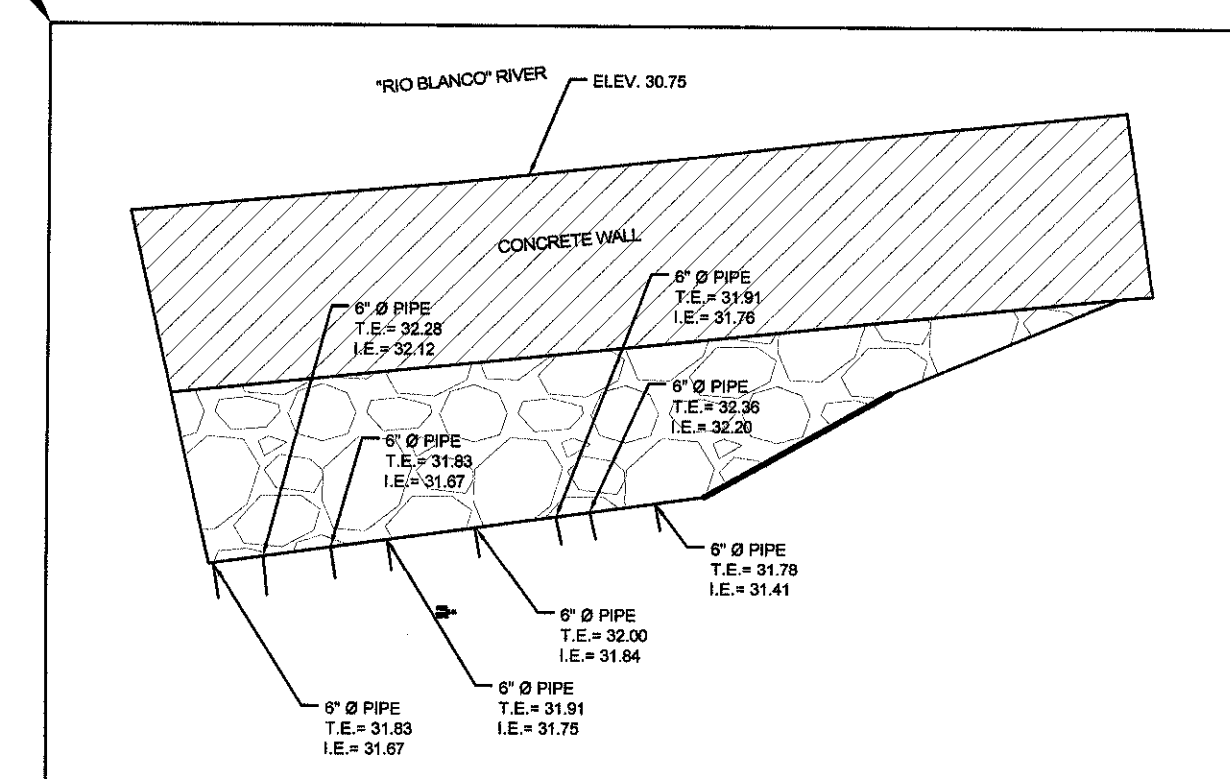
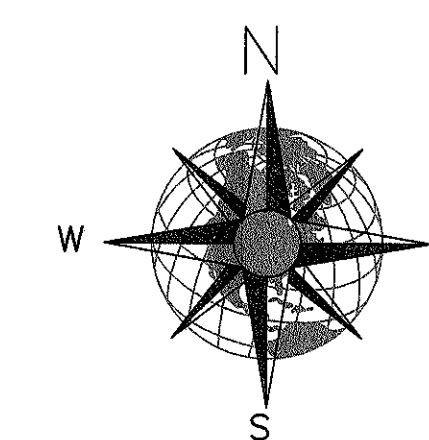
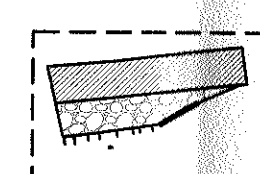
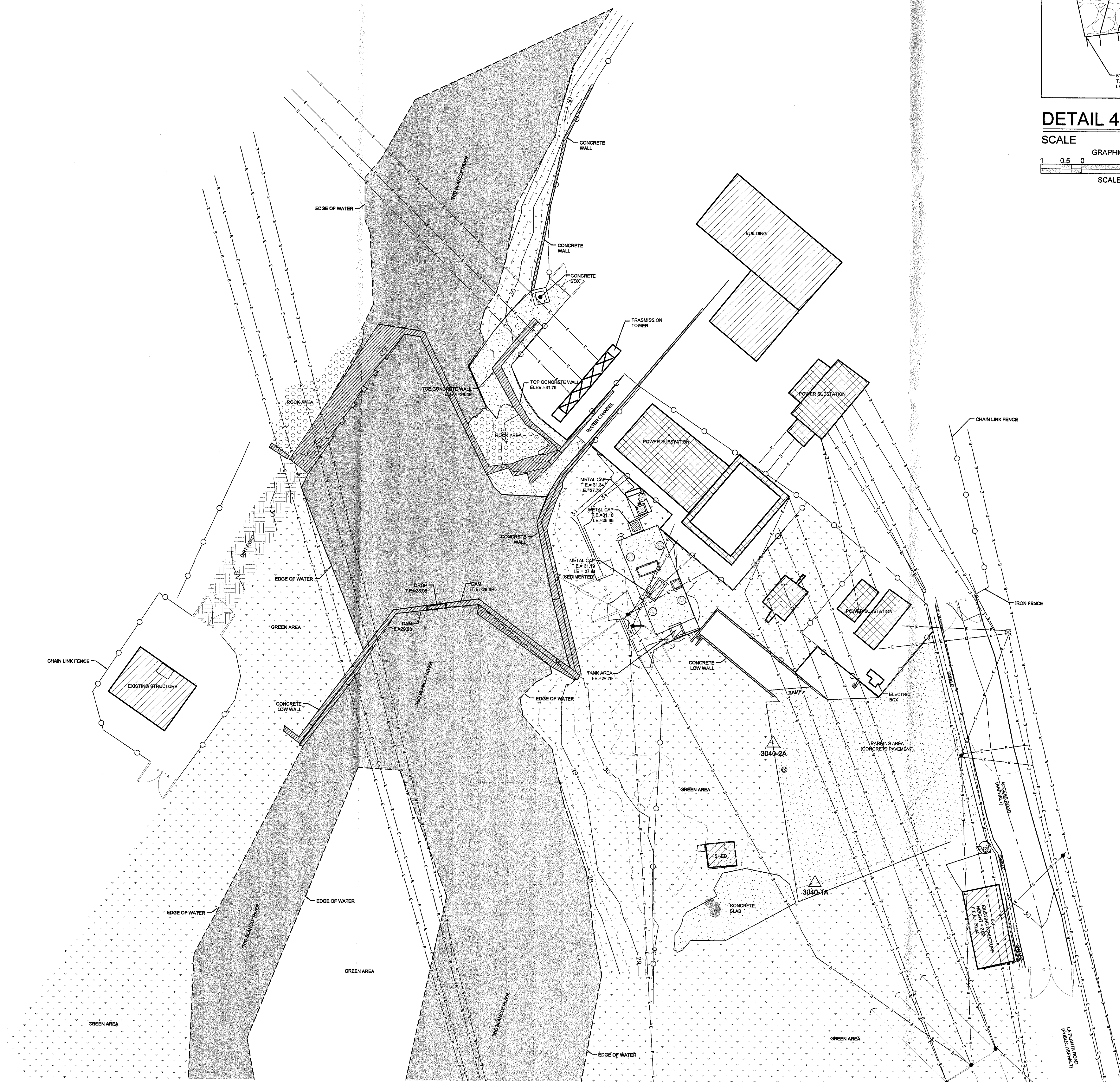


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CHECKED BY J.BIDOT	SHEET No. 4
DRAWING BY: J.C.	6
DATE: 10-18-2017	

EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
SCALE 1 : 250 FOR LEGEND AND GENERAL NOTES SEE DRAWING NO. VF-01

FOR LEGEND AND GENERAL NOTES SEE DRAWING NO. VE-01





DETAIL 4

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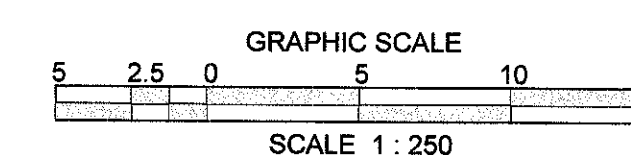
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HORIZONTAL AND VERTICAL CONTROL				
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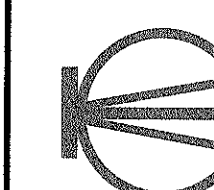
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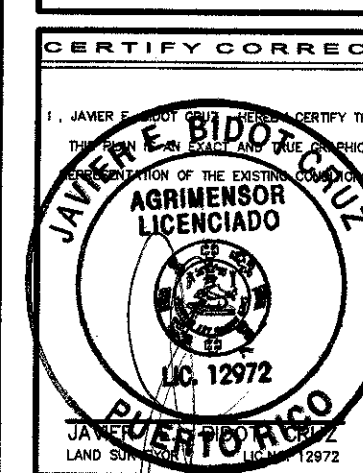
FOR LEGEND AND GENERAL NOTES SEE DRAWING NO. VF-01



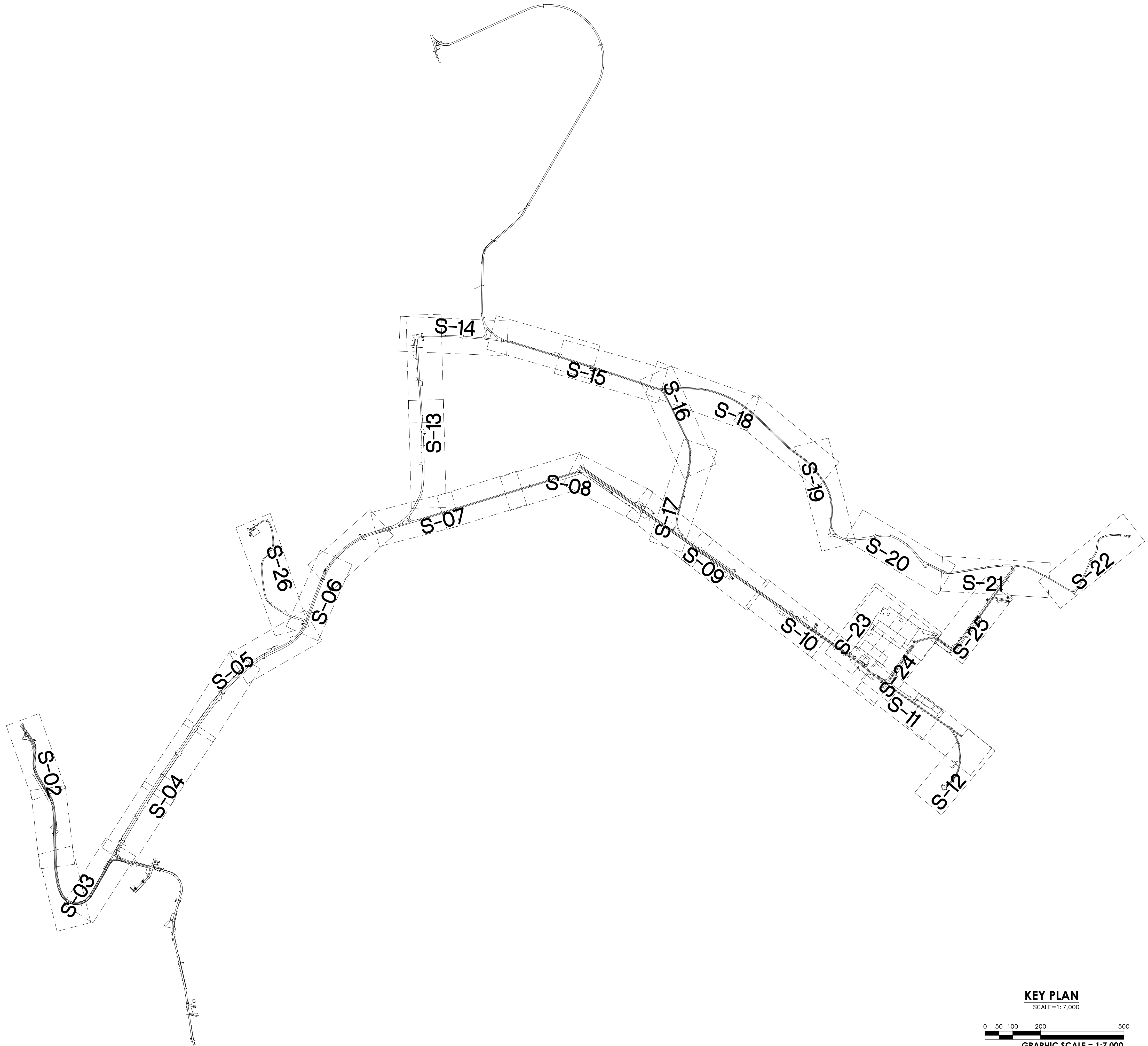
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and Surveyors & Consultants
16 Cordova St., Terrillville | Caguas, PR 00727
Phone: (787)746-5486 Fax: (787)704-6215



EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY
FOR ROOSEVELT ROADS WATER TREATMENT PLANT IMPROVEMENTS PROJECT
LOCATED AT US NAVAL STATION ROOSEVELT ROADS
MUNICIPALITY OF CEIBA, PUERTO RICO



DRAWING TITLE: EXISTING CONDITIONS, TOPOGRAPHIC & HYDROGRAPHIC SURVEY	
SCALE: 1 : 250	
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CHECKED BY: J.BIDOT	SHEET NO.
DRAWING BY: VMDM	6
DATE: SEP. 18, 2017	6



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AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	
NO.	DESCRIPTION

PROJECT NAME: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE: TOPOGRAPHY & AS-BUILT KEY PLAN

DRAWN BY:
A. BERMUDEZ

DATE : **APRIL, 2015**

SCALE : **1:500**

DESIGN BY:

APP'D BY:
INTEGRA

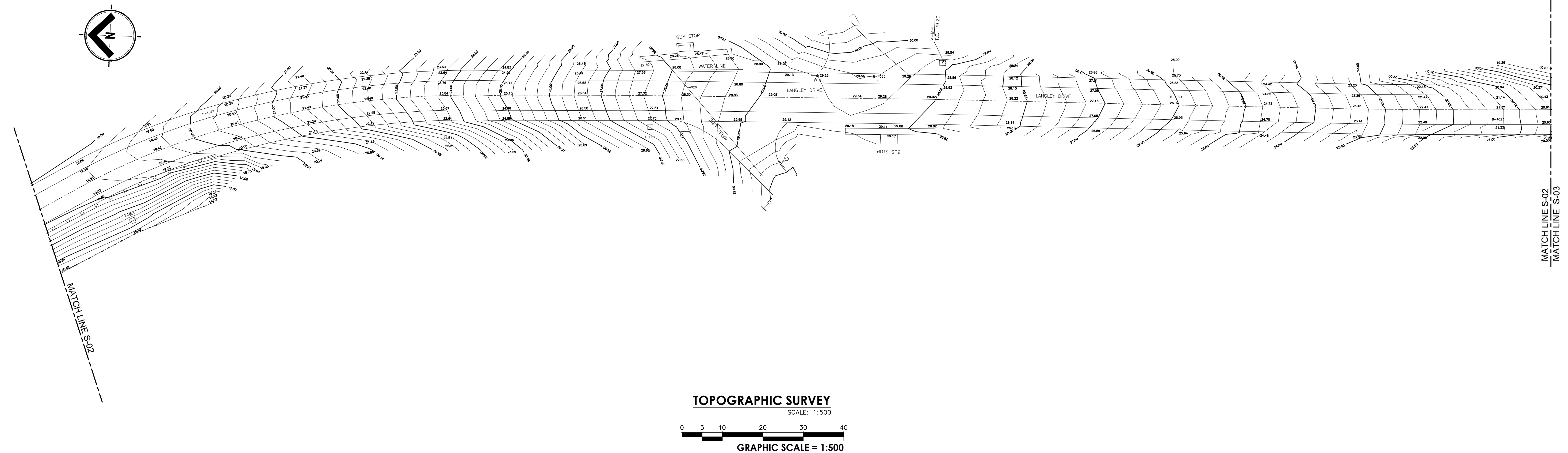
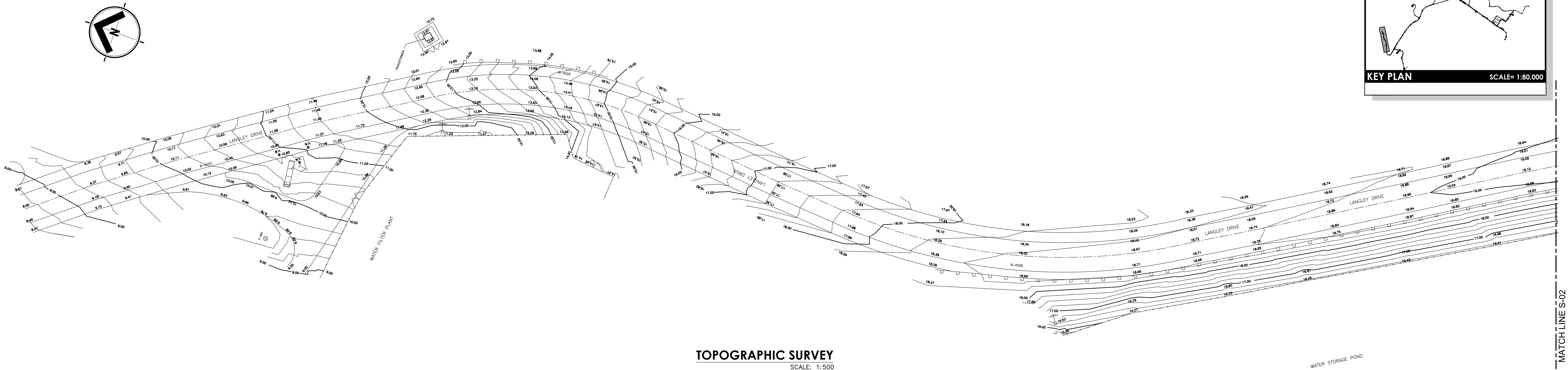
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SHEET NO.	OF
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1	20
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AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, PUERTO RICO 00916
TEL. (787) 726-0860

A

B

CERTIFY CORRECT

AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME:

WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:

TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:

A. BERMUDEZ

DATE :

APRIL, 2015

SCALE :

1:500

DESIGN BY:

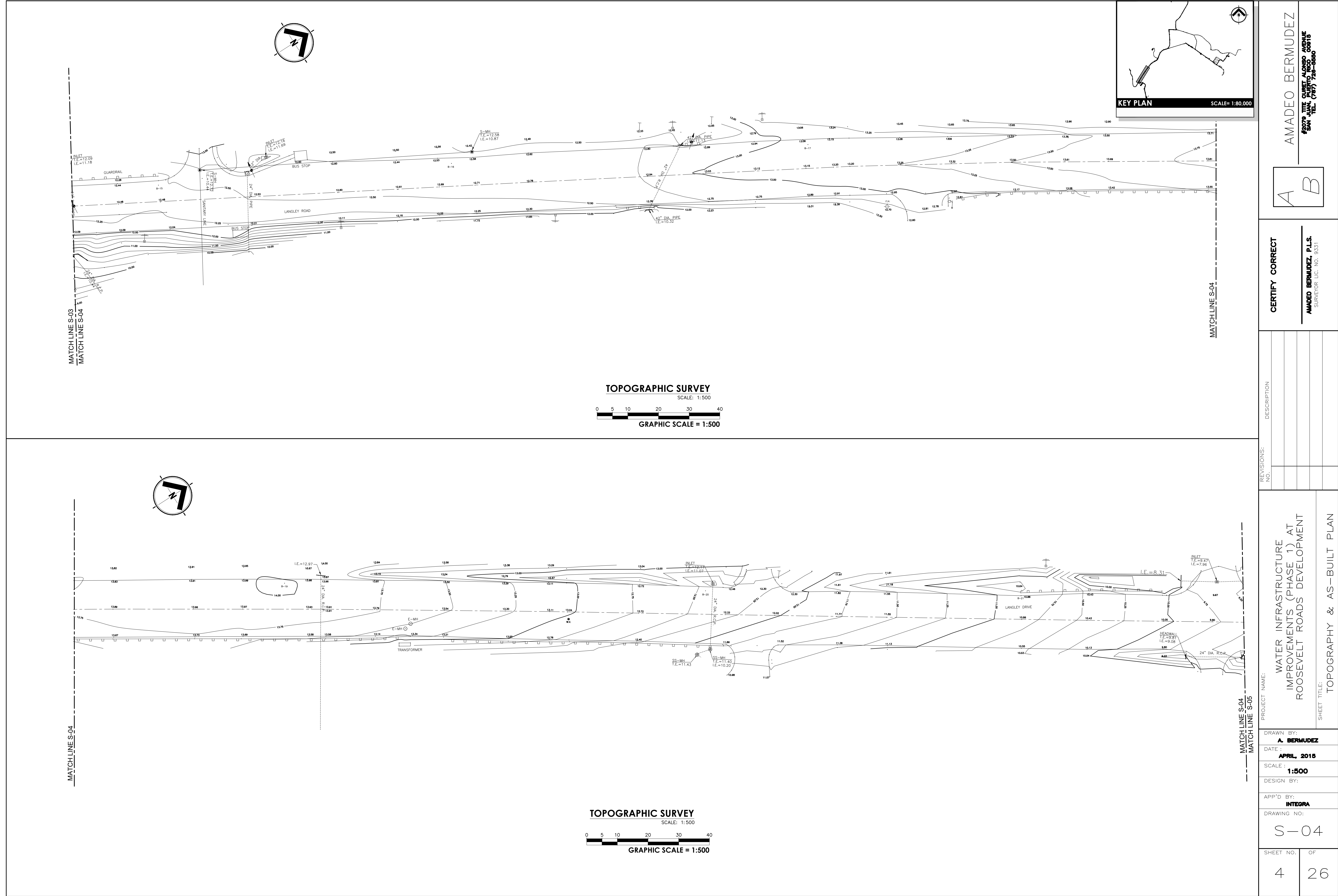
APP'D BY:

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DRAWING NO:

S-02

SHEET NO.	OF
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AMADEO BERMUDEZ
#2579 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00906
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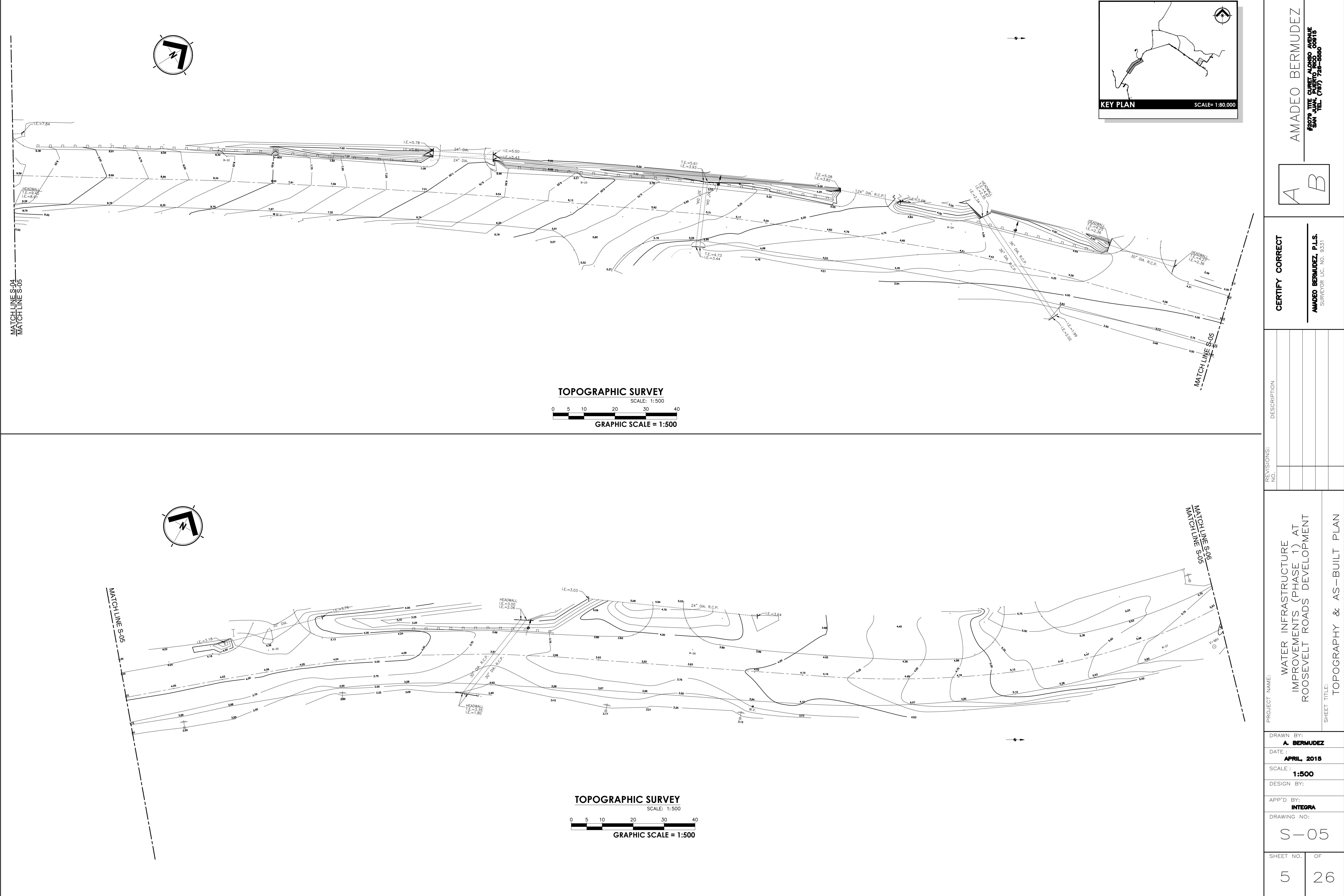
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CERTIFY CORRECT
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT
SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ
DATE:
APRIL, 2015
SCALE:
1:500
DESIGN BY:
APP'D BY:
INTEGRA
DRAWING NO:
S-04
SHEET NO. OF
4 26



AMADEO BERMUDEZ

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TEL. (787) 725-0800

A

B

CERTIFY CORRECT

AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME:

WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:

TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:

A. BERMUDEZ

DATE :

APRIL, 2015

SCALE :

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DESIGN BY:

APP'D BY:

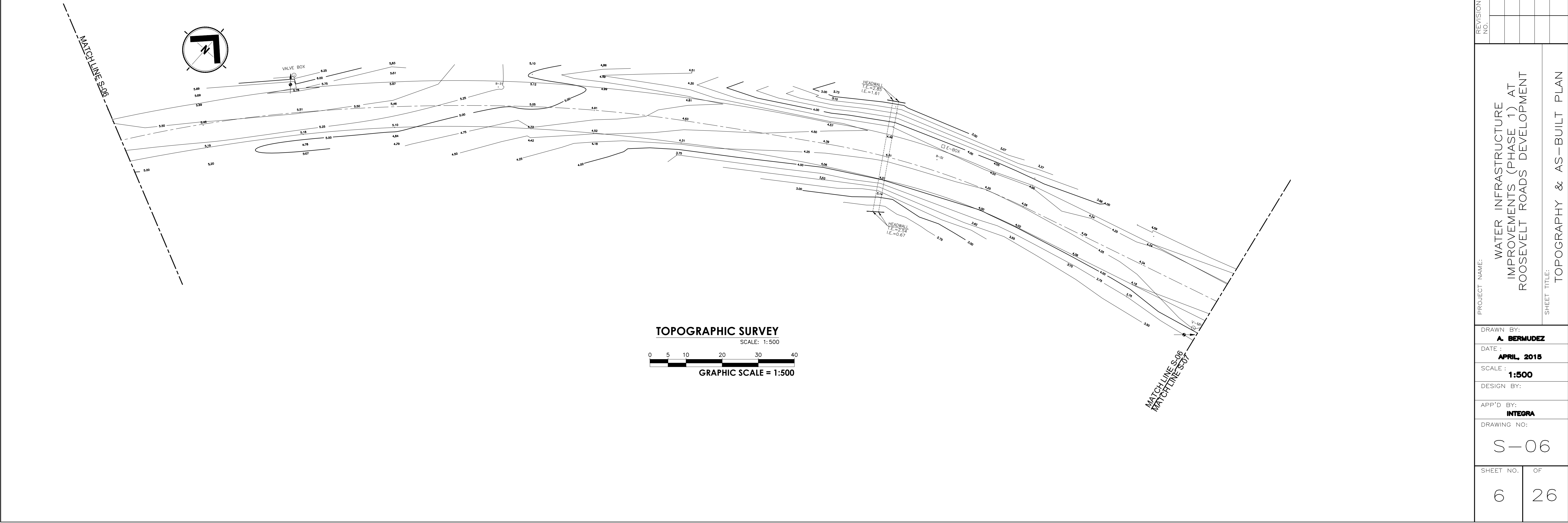
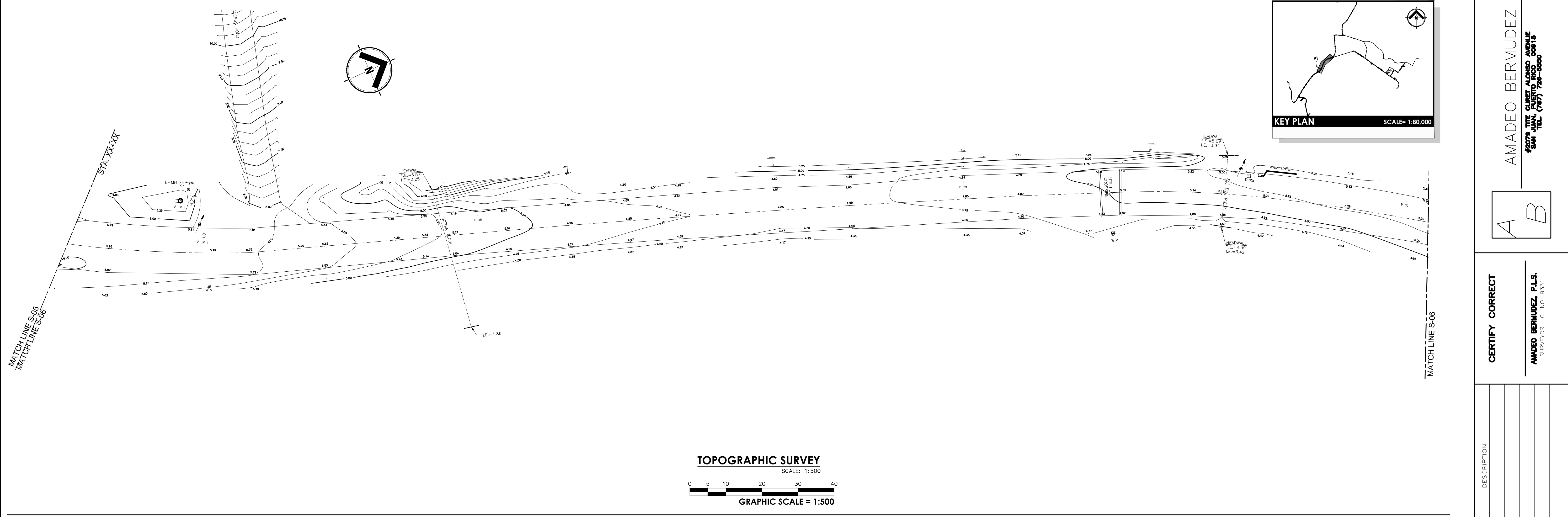
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DRAWING NO:

S-05

SHEET NO. OF

5 26



AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, PUERTO RICO 00916
TEL. (787) 720-0800

CERTIFY CORRECT

AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME:

WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:

TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:

A. BERMUDEZ

DATE:

APRIL, 2015

SCALE:

1:500

DESIGN BY:

APP'D BY:

INTEGRA

DRAWING NO:

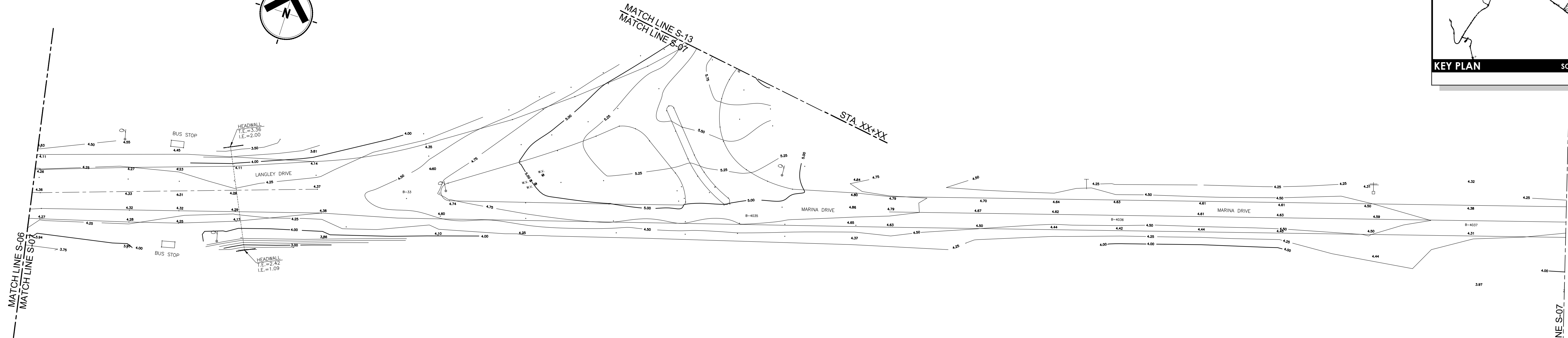
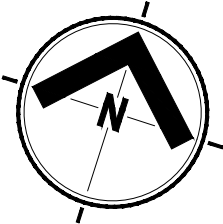
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SHEET NO.

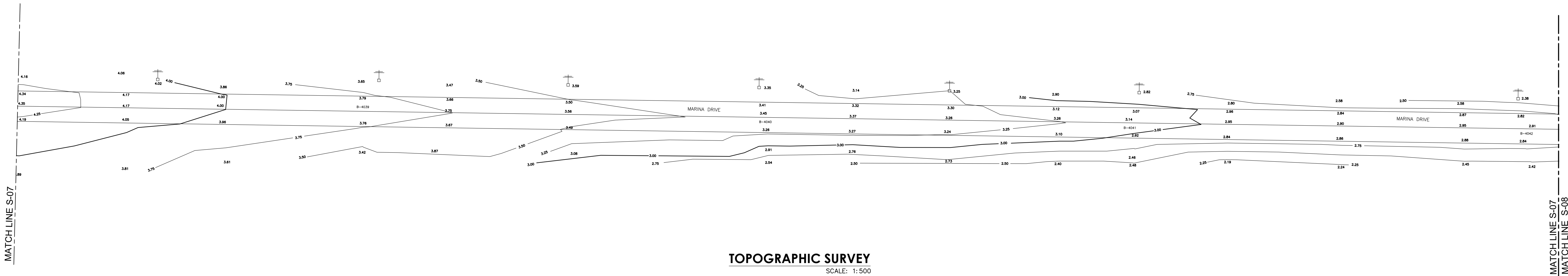
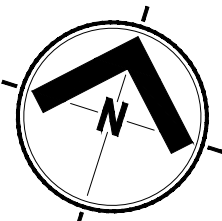
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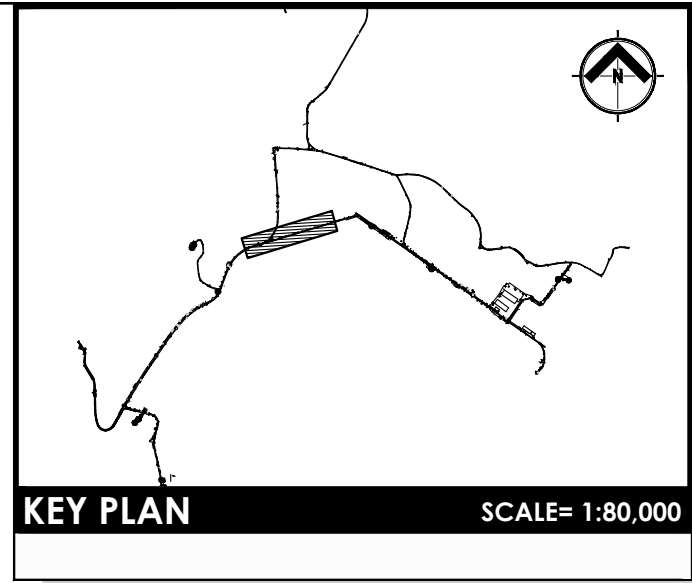
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GRAPHIC SCALE = 1:500



TOPOGRAPHIC SURVEY
SCALE: 1:500
0 5 10 20 30 40
GRAPHIC SCALE = 1:500



AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
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TEL. (787) 726-8868

A B

CERTIFY CORRECT

AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE :
APRIL, 2015

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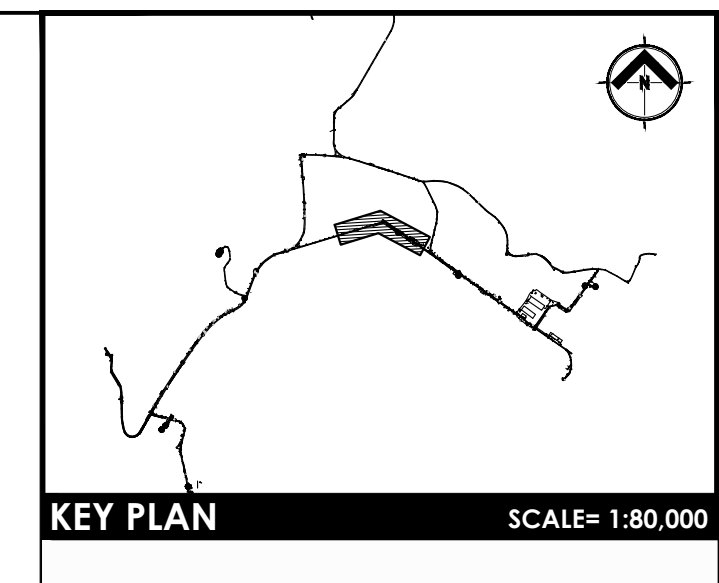
DESIGN BY:

APP'D BY:
INTEGRA

DRAWING NO:
S-07

SHEET NO. OF

7 26



AMADEO BERMUDEZ

GENIUS CONNECT

MADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

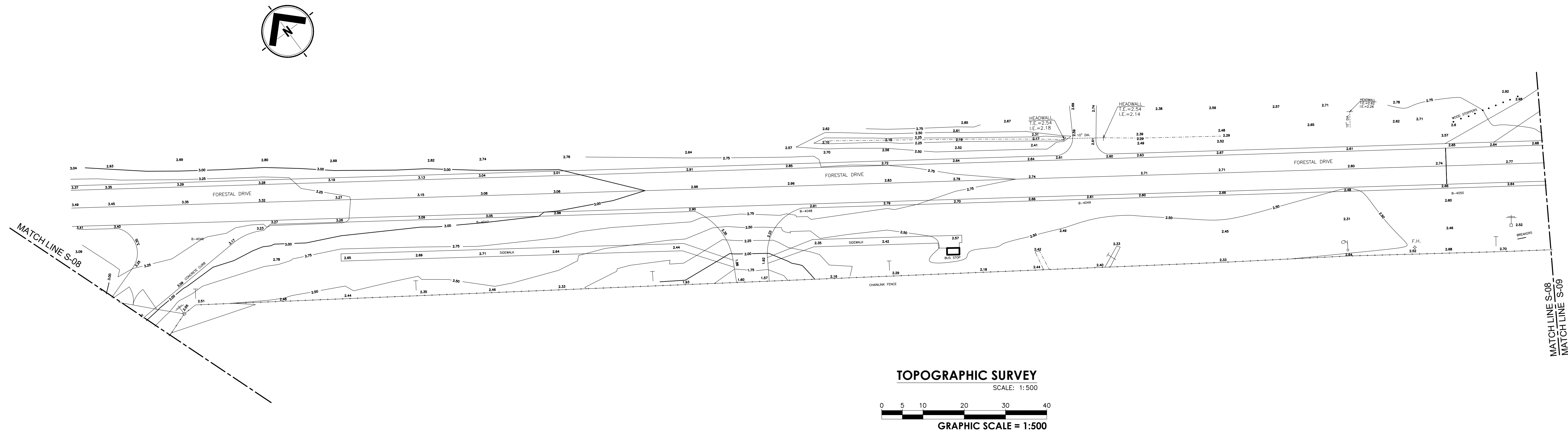
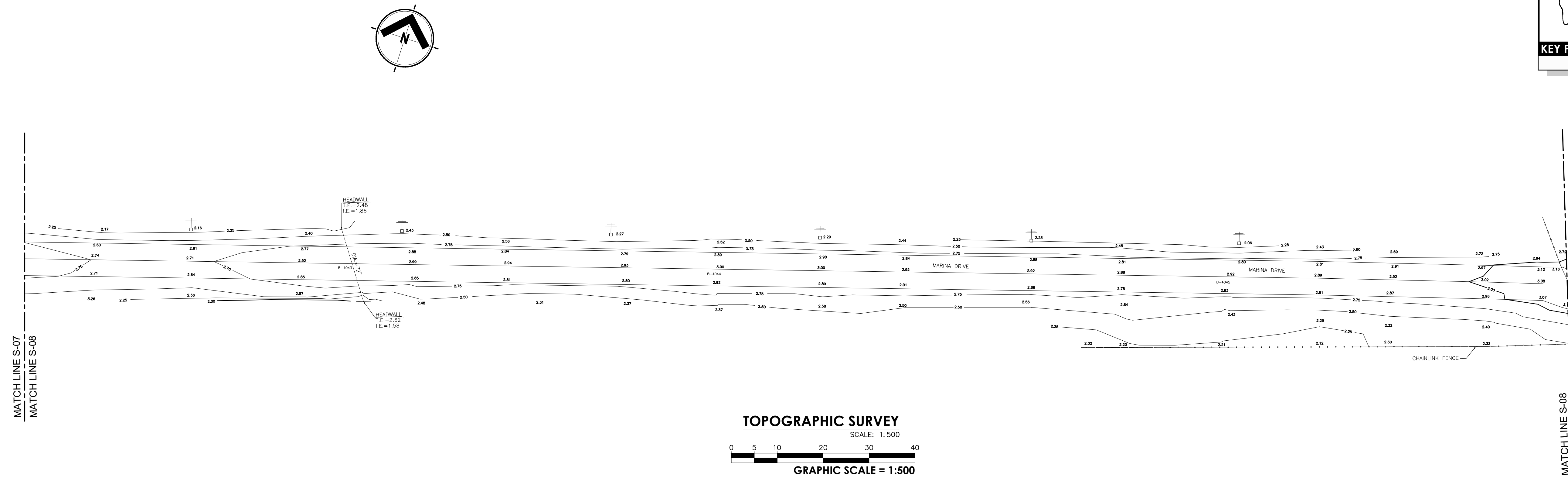
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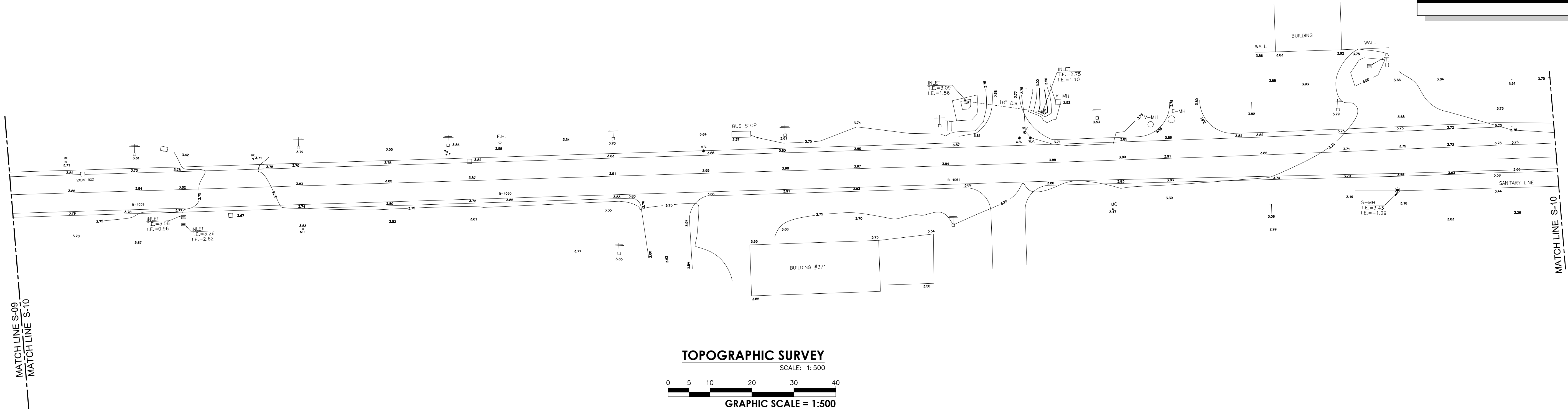
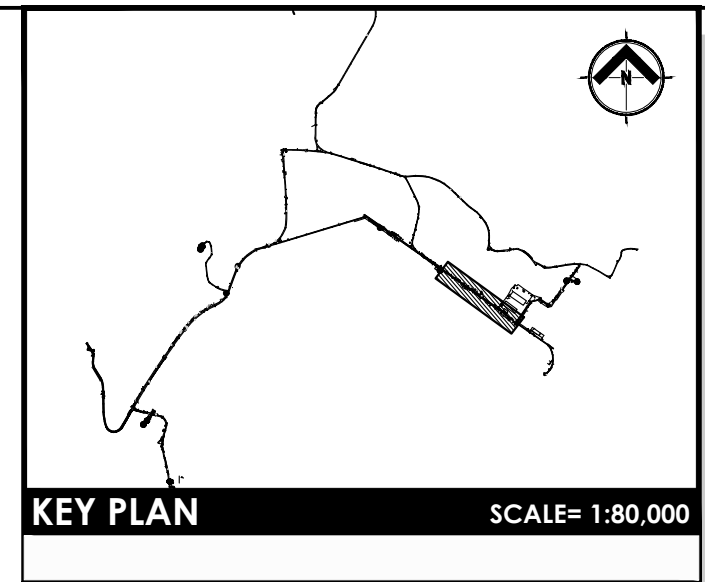
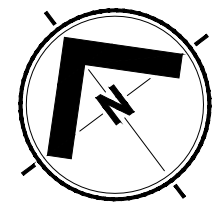
PROJECT NAME: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE: TOPOGRAPHY & AS-BUILT PLAN

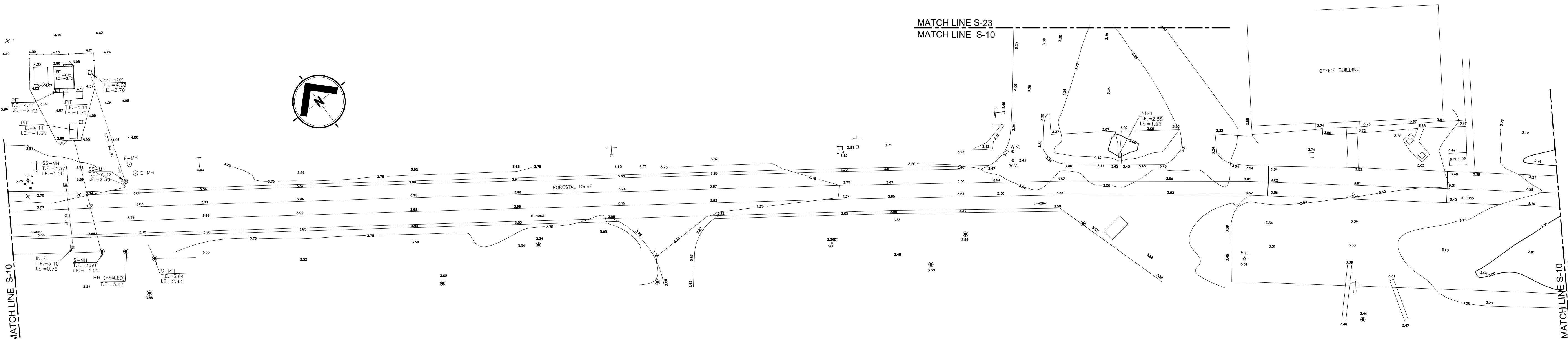
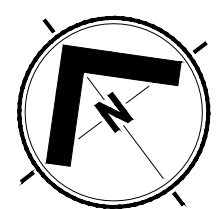
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APP'D BY:	INTEGRA
DRAWING NO:	

SHEET NO.	OF
8	26





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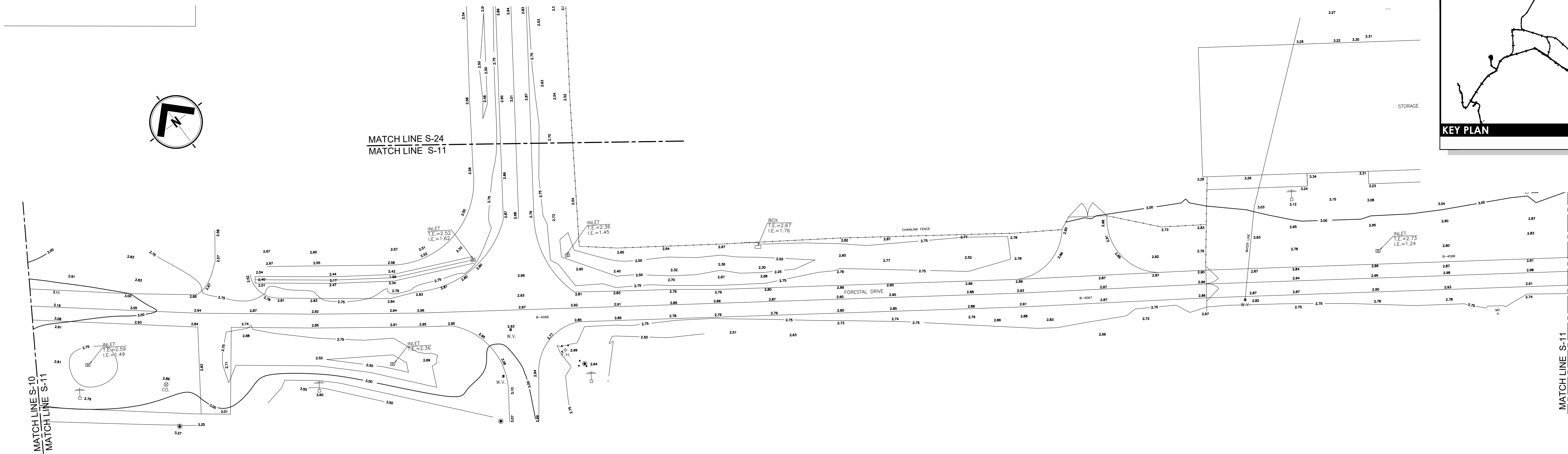
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SCALE: 1:500
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AMADEO BERMUDEZ
#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 725-0860

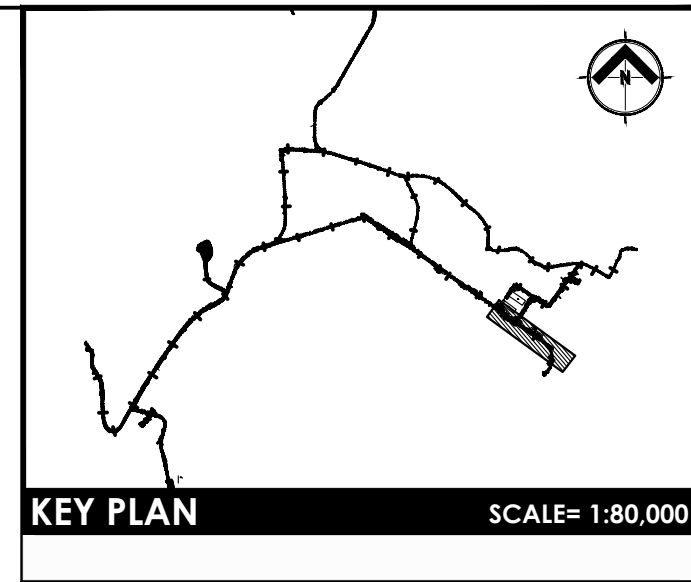
CERTIFY CORRECT
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT
SHEET TITLE: TOPOGRAPHY & AS-BUILT PLAN
DRAWN BY: A. BERMUDEZ
DATE: APRIL, 2015
SCALE: 1:500
DESIGN BY:
APP'D BY: INTEGRA
DRAWING NO: S-10
SHEET NO. 10 OF 26



TOPOGRAPHIC SURVEY
SCALE: 1:500
GRAPHIC SCALE = 1:500



AMADEO BERMUDEZ
#2579 TTE CURET ALONSO AVENUE
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TEL. (787) 725-0865

A B

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AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE:
APRIL, 2015

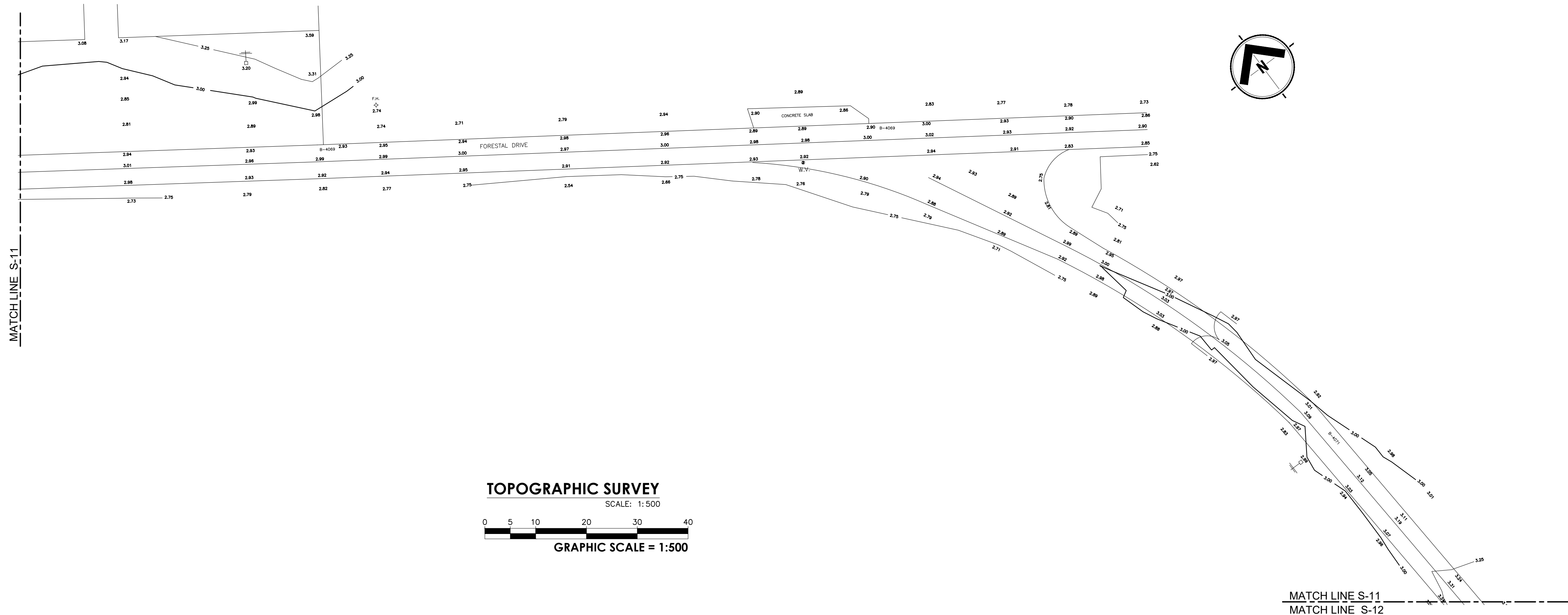
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APP'D BY:
INTEGRA

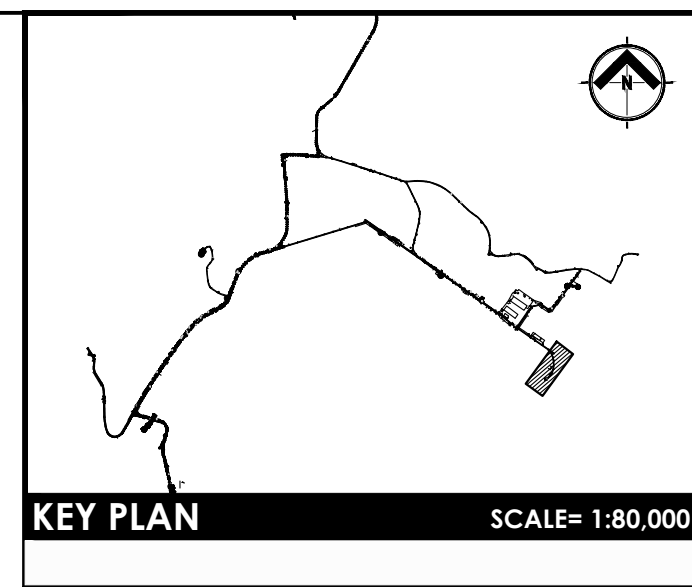
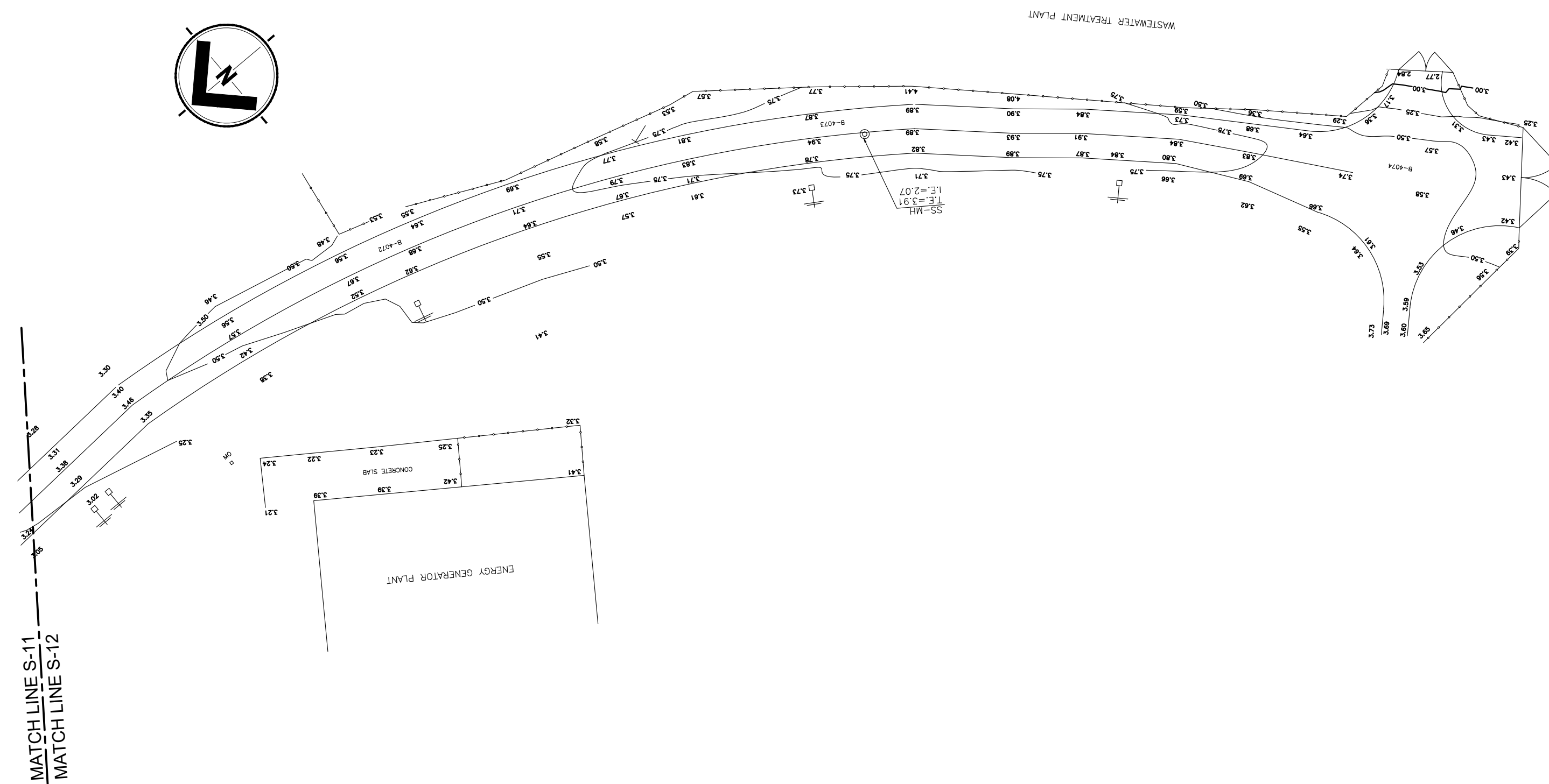
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SHEET NO. OF
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MATCH LINE S-11
MATCH LINE S-12



CERTIFY CORRECT

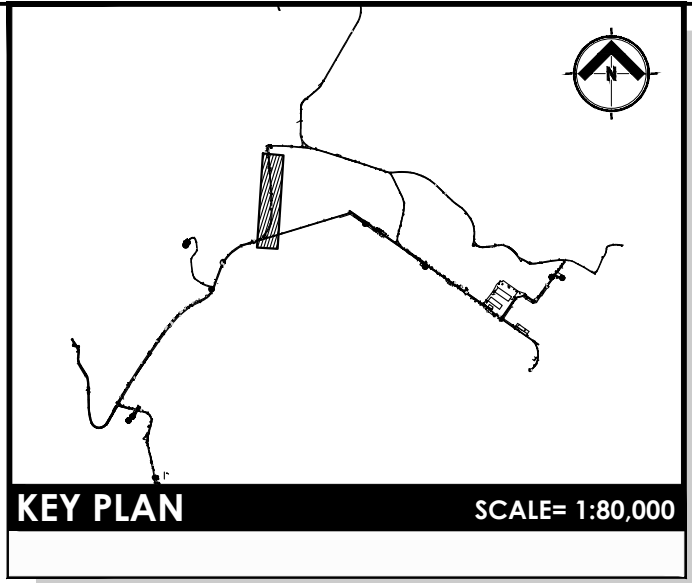
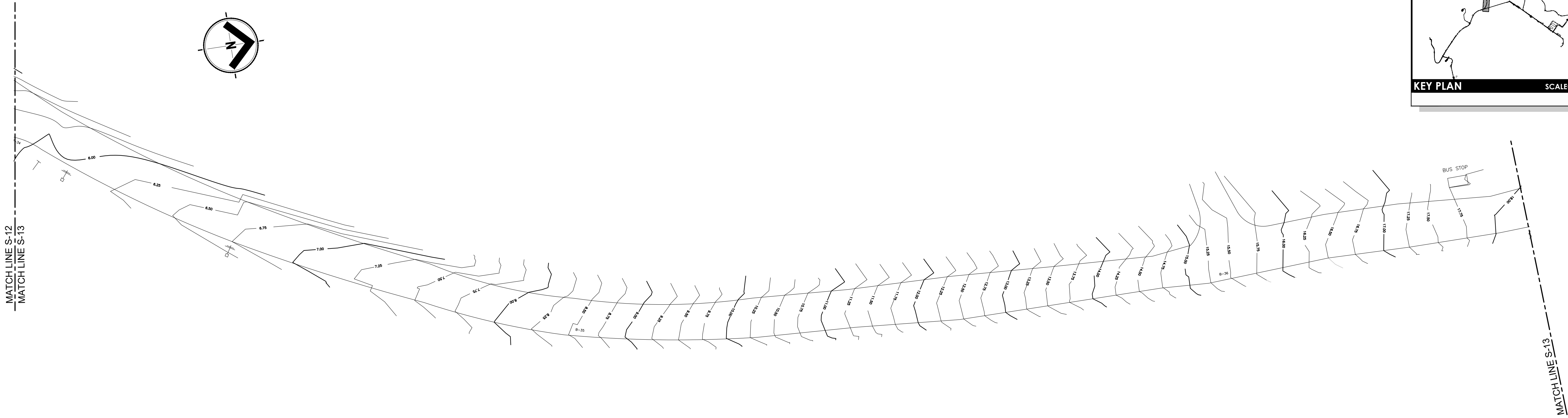
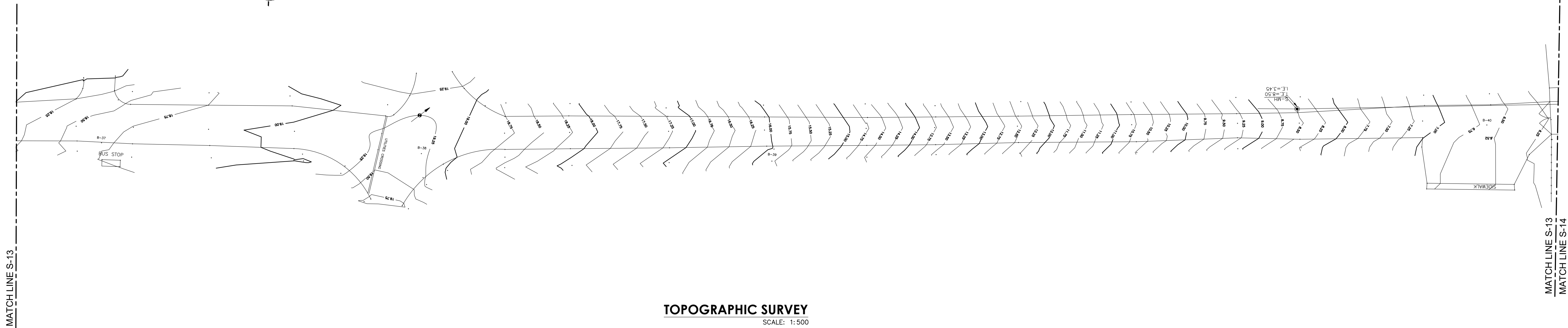
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:		DESCRIPTION

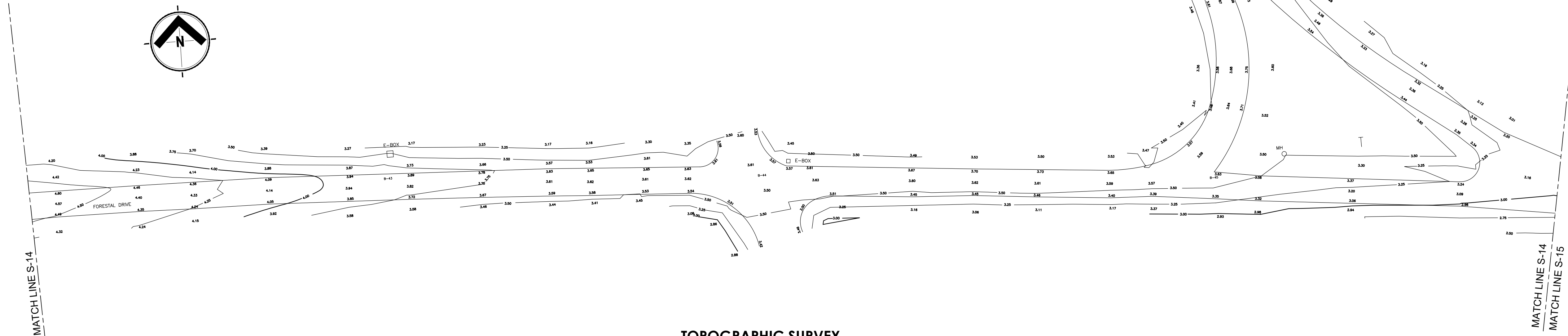
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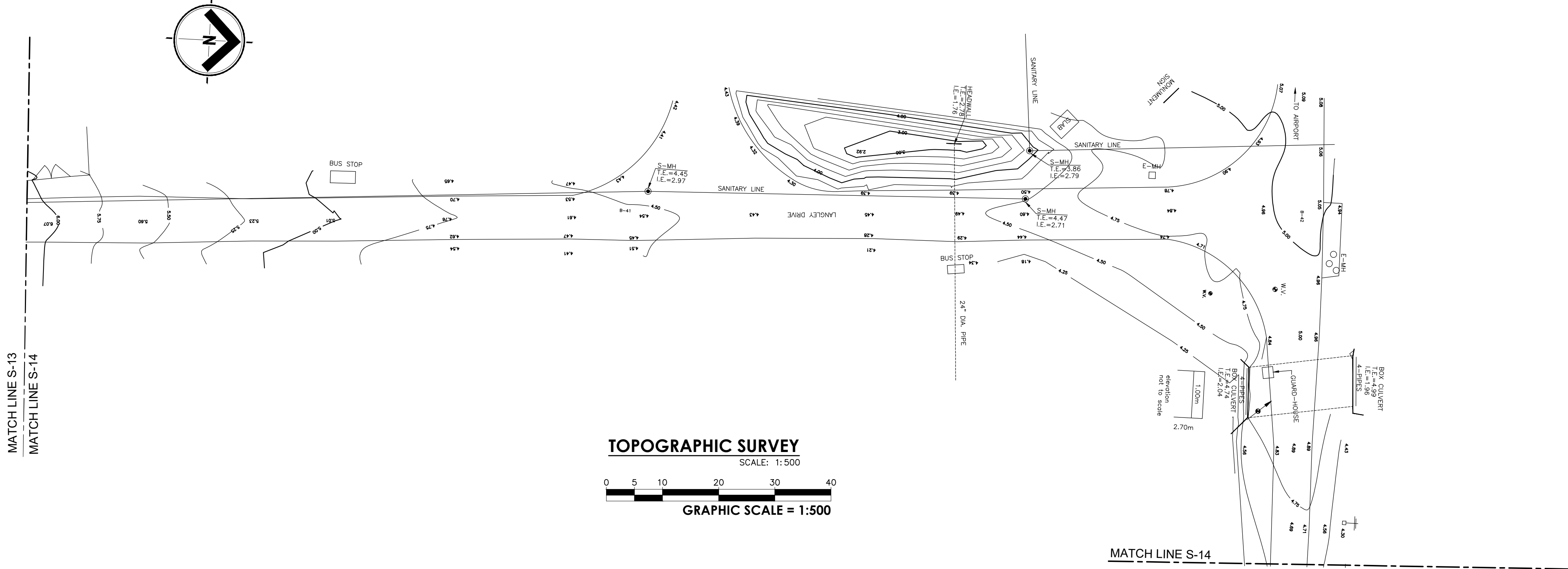
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SHEET NO. 12	OF 26



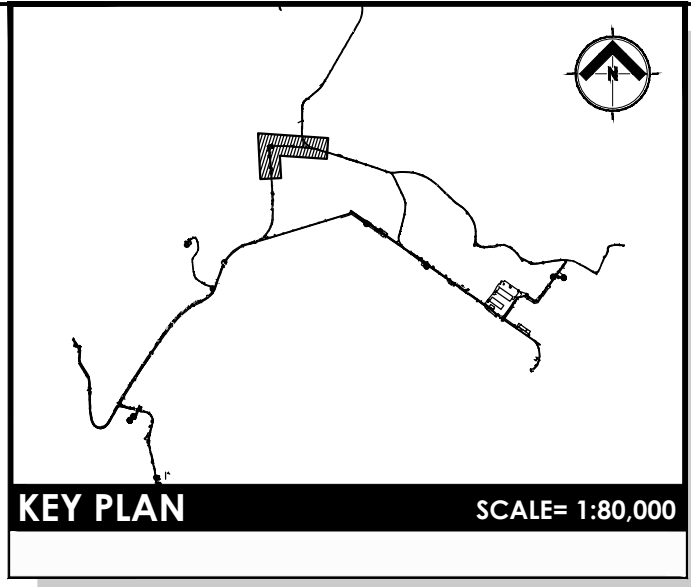
AMADEO BERMUDEZ	
#2079 THE CURT ALONSO AVENUE SAN JUAN, P.R. 00915 TEL. (787) 720-0800	
A B	
CERTIFY CORRECT	
AMADEO BERMUDEZ, P.L.S. SURVEYOR LIC. NO. 9331	
REVISIONS:	
NO.	DESCRIPTION
PROJECT NAME:	
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT	
SHEET TITLE:	
TOPOGRAPHY & AS-BUILT PLAN	
DRAWN BY:	
A. BERMUDEZ	
DATE:	
APRIL, 2015	
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APP'D BY:	
INTEGRA	
DRAWING NO:	
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SHEET NO.	OF
13	26



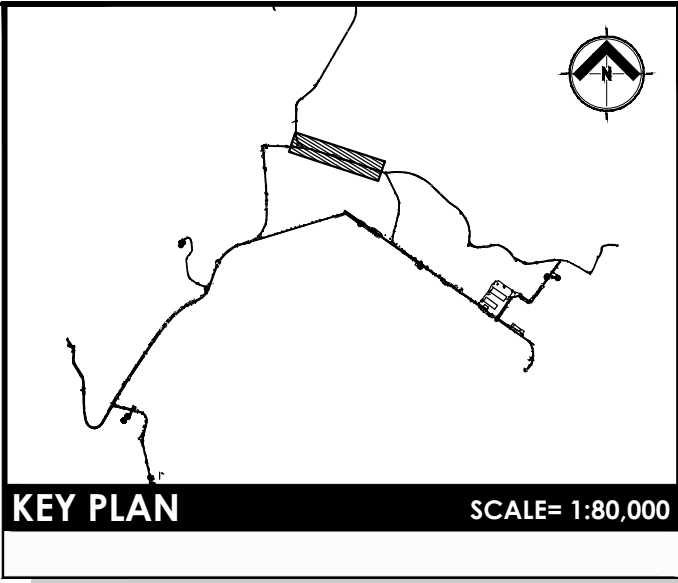
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GRAPHIC SCALE = 1:500



TOPOGRAPHIC SURVEY
SCALE: 1:500
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<div>AMADEO BERMUDEZ</div> <div>#2079 JTE CURT ALONSO AVENUE SAN JUAN, P.R. 00915 TEL. (787) 720-0860</div>		<div>A</div> <div>B</div>		<div>CERTIFY CORRECT</div> <div>AMADEO BERMUDEZ, P.L.S. SURVEYOR LIC. NO. 9331</div>		REVISIONS:		PROJECT NAME:		<div>WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT</div> <div>SHEET TITLE: TOPOGRAPHY & AS-BUILT PLAN</div>					
						NO.		DESCRIPTION							
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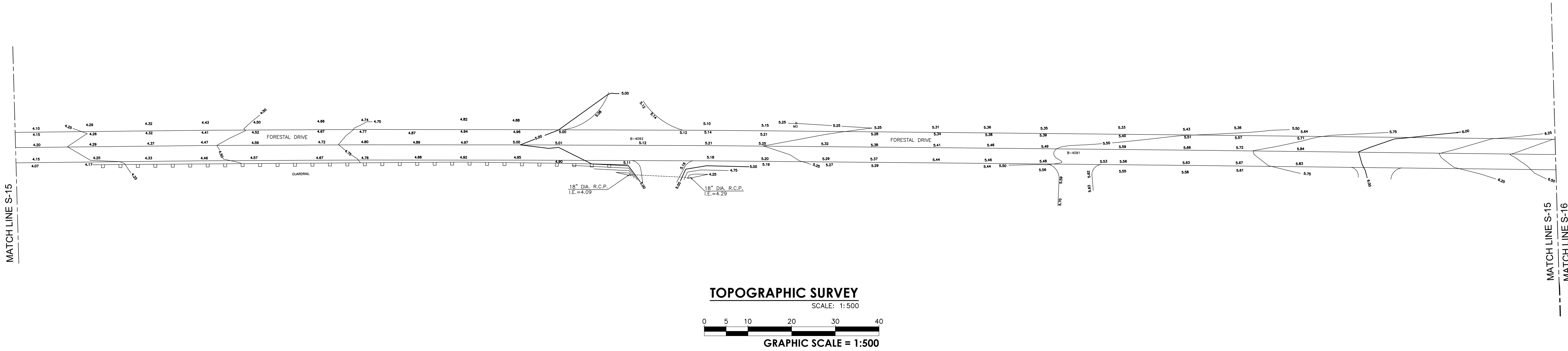
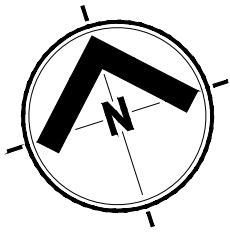
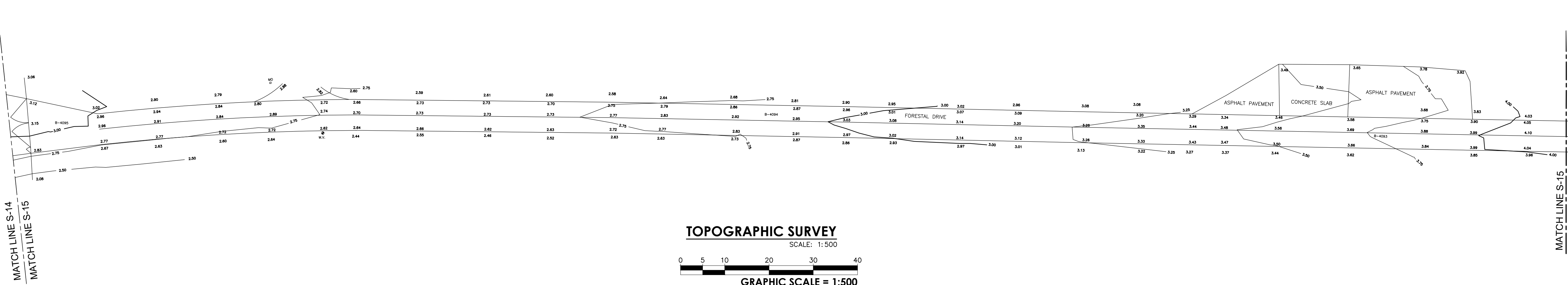
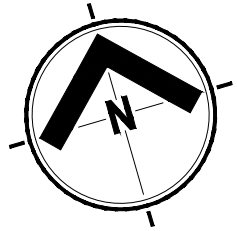
AMADEO BERMUDEZ
#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 720-0860

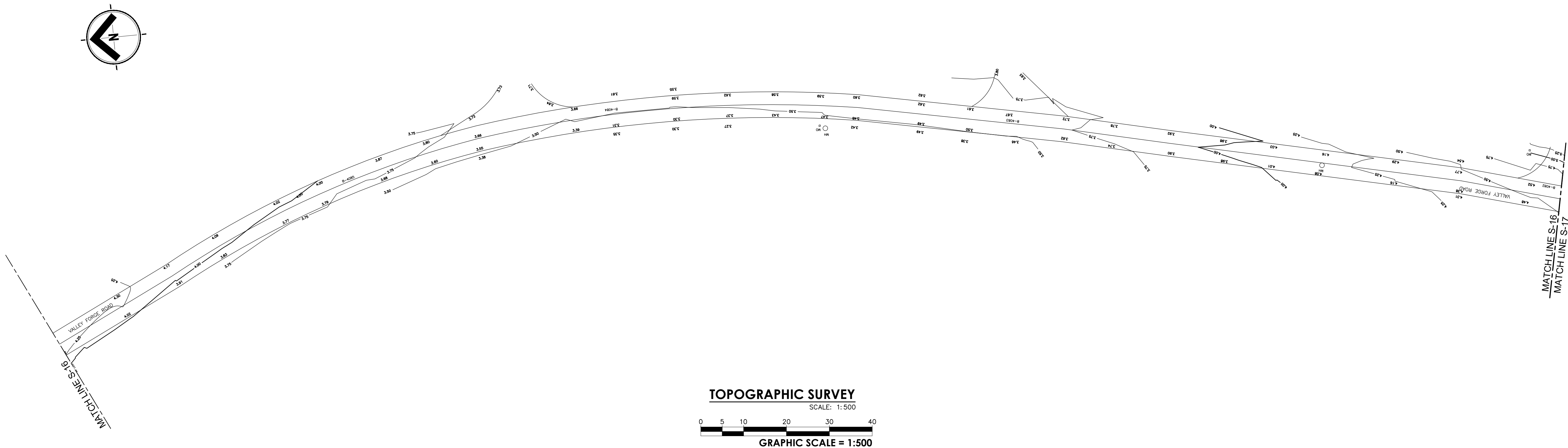
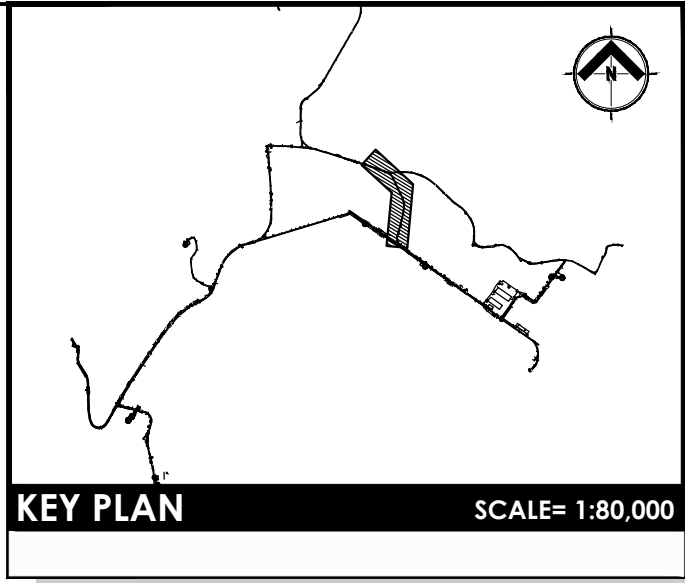
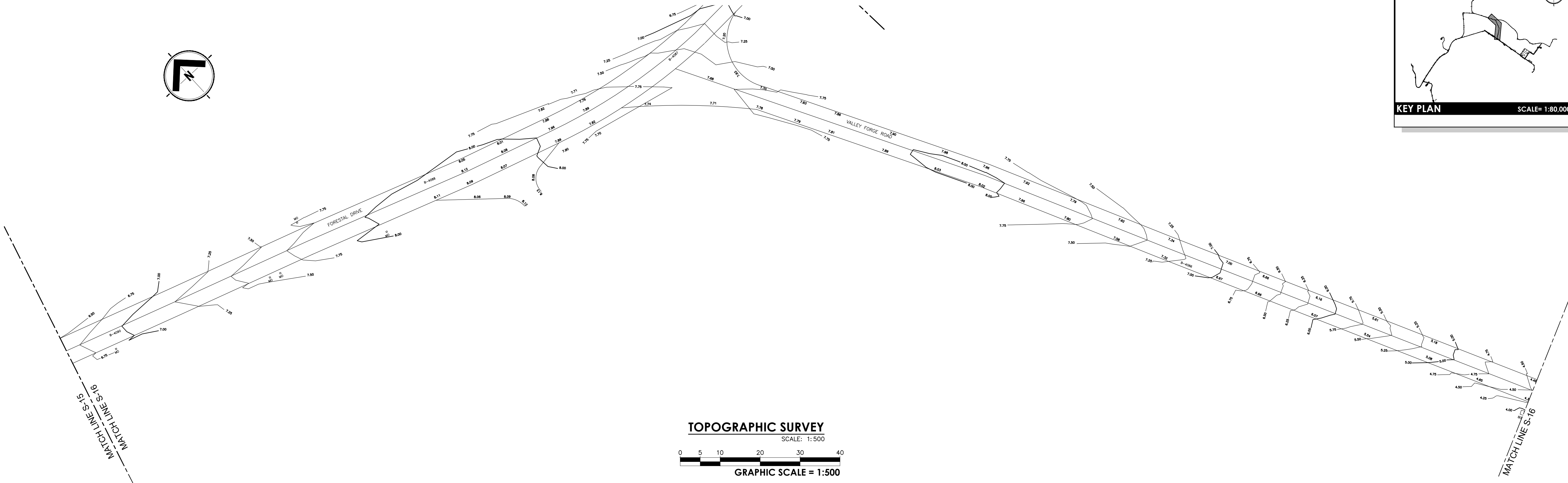
CERTIFY CORRECT
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT
SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ
DATE :
APRIL, 2015
SCALE :
1:500
DESIGN BY:
INTEGRA
APP'D BY:
INTEGRA
DRAWING NO:
S-15
SHEET NO. 15 OF 26





AMADEO BERMUDEZ
#2079 THE CURT ALONSO AVENUE
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TEL. (787) 720-0860

A B

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AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE :
APRIL, 2015

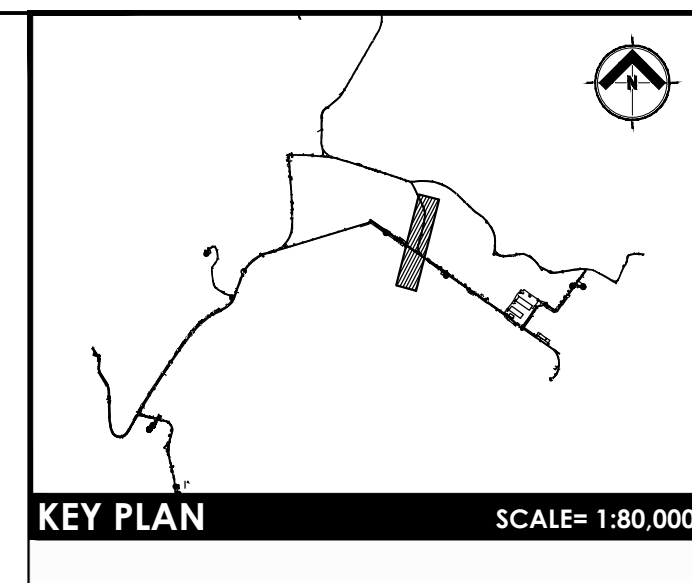
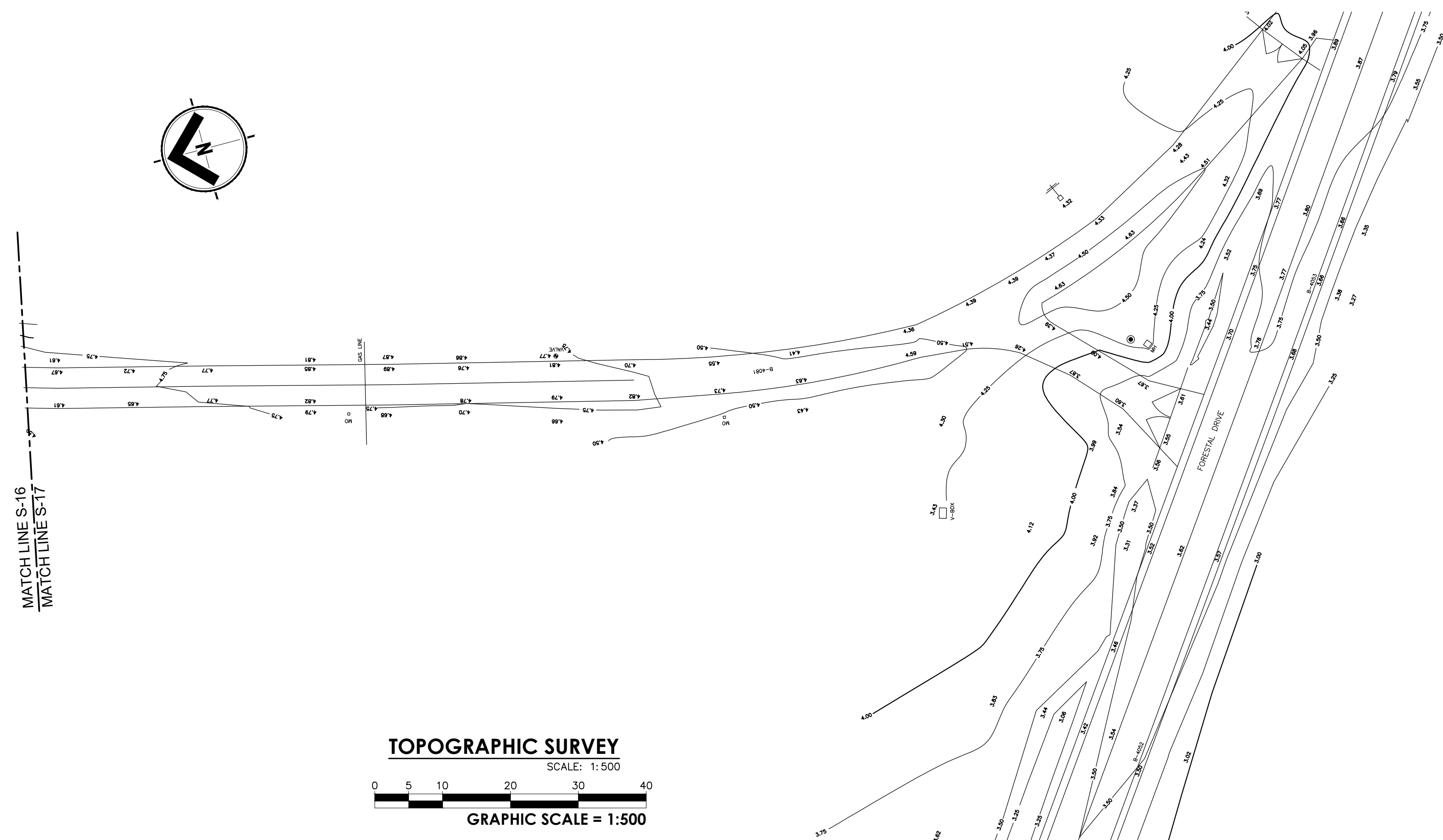
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DRAWING NO:
S-16

SHEET NO. OF
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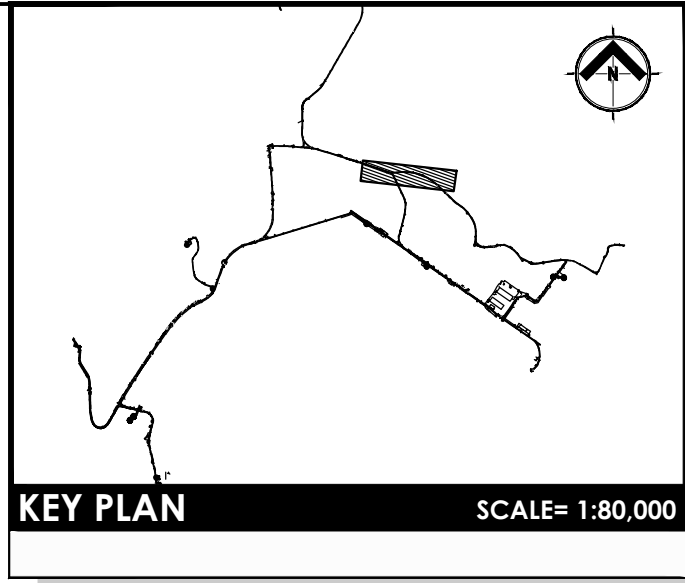


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MADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

AMADEO BERMUDEZ

PROJECT NAME:		WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT	
DRAWN BY:		A. BERMUDEZ	
DATE :		APRIL, 2015	
SCALE :		1:500	
DESIGN BY:			
APP'D BY:		INTEGRA	
DRAWING NO:		S-17	
SHEET NO.	OF	17	26



AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 726-8868

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AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE :
APRIL, 2015

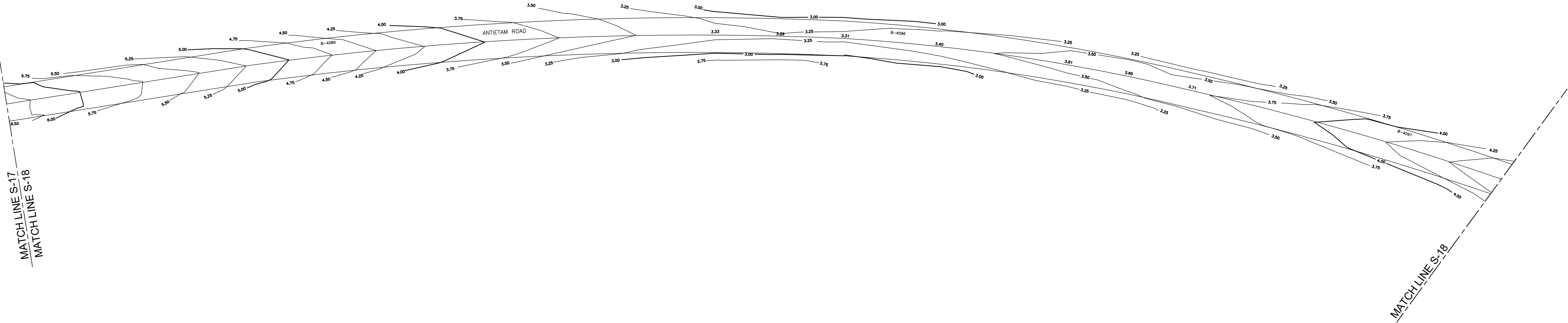
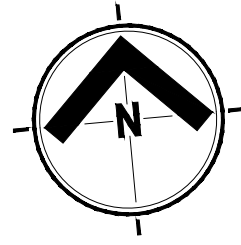
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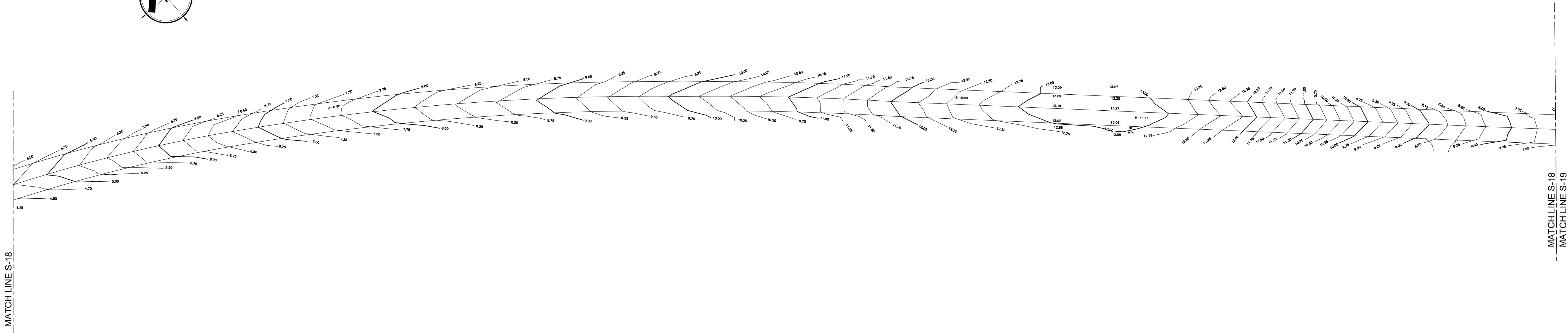
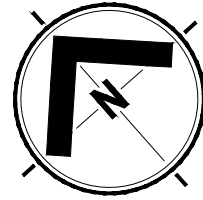
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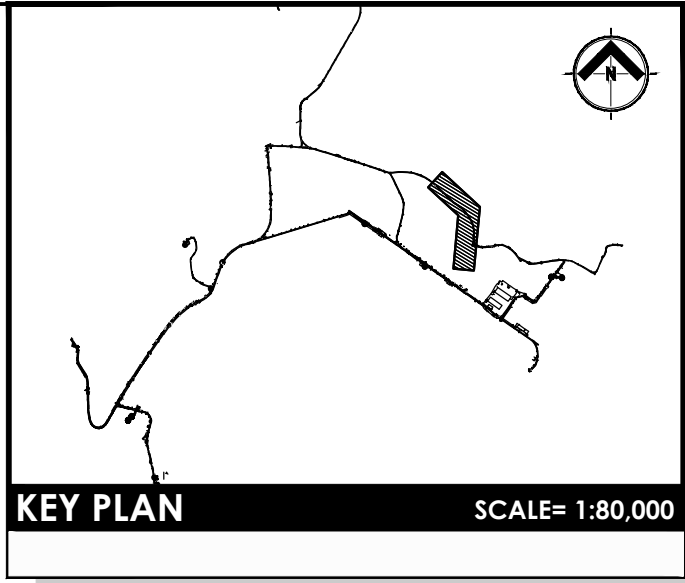
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GRAPHIC SCALE = 1:500



TOPOGRAPHIC SURVEY
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GRAPHIC SCALE = 1:500



KEY PLAN SCALE= 1:80,000

AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 720-0860

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AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

PROJECT NAME:
WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE :
APRIL, 2015

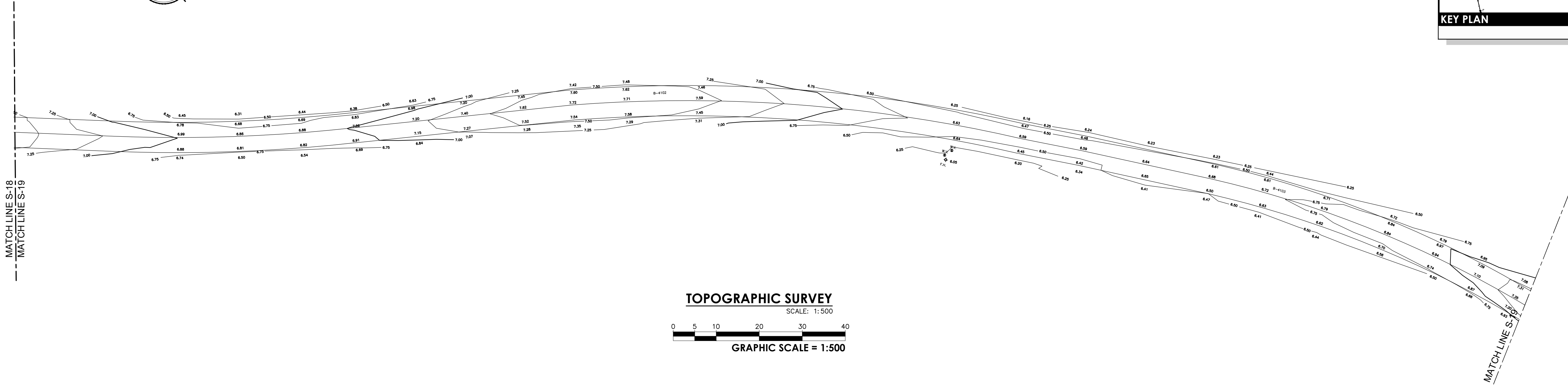
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APP'D BY:
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DRAWING NO:
S-19

SHEET NO. OF
19 26

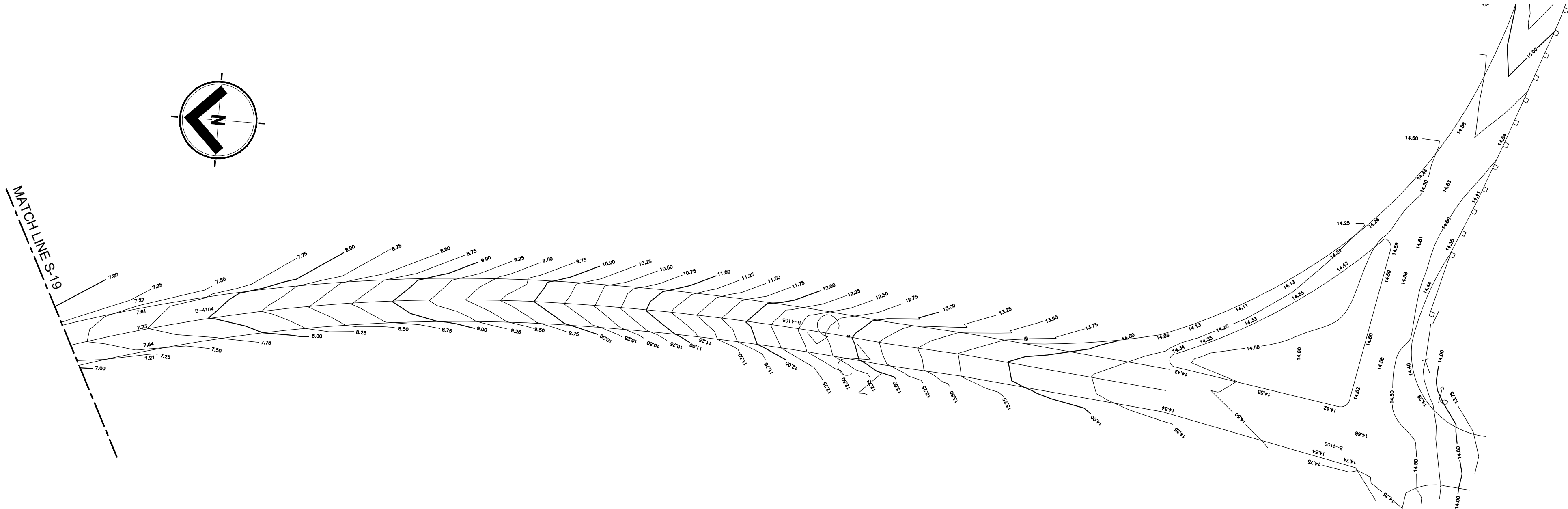


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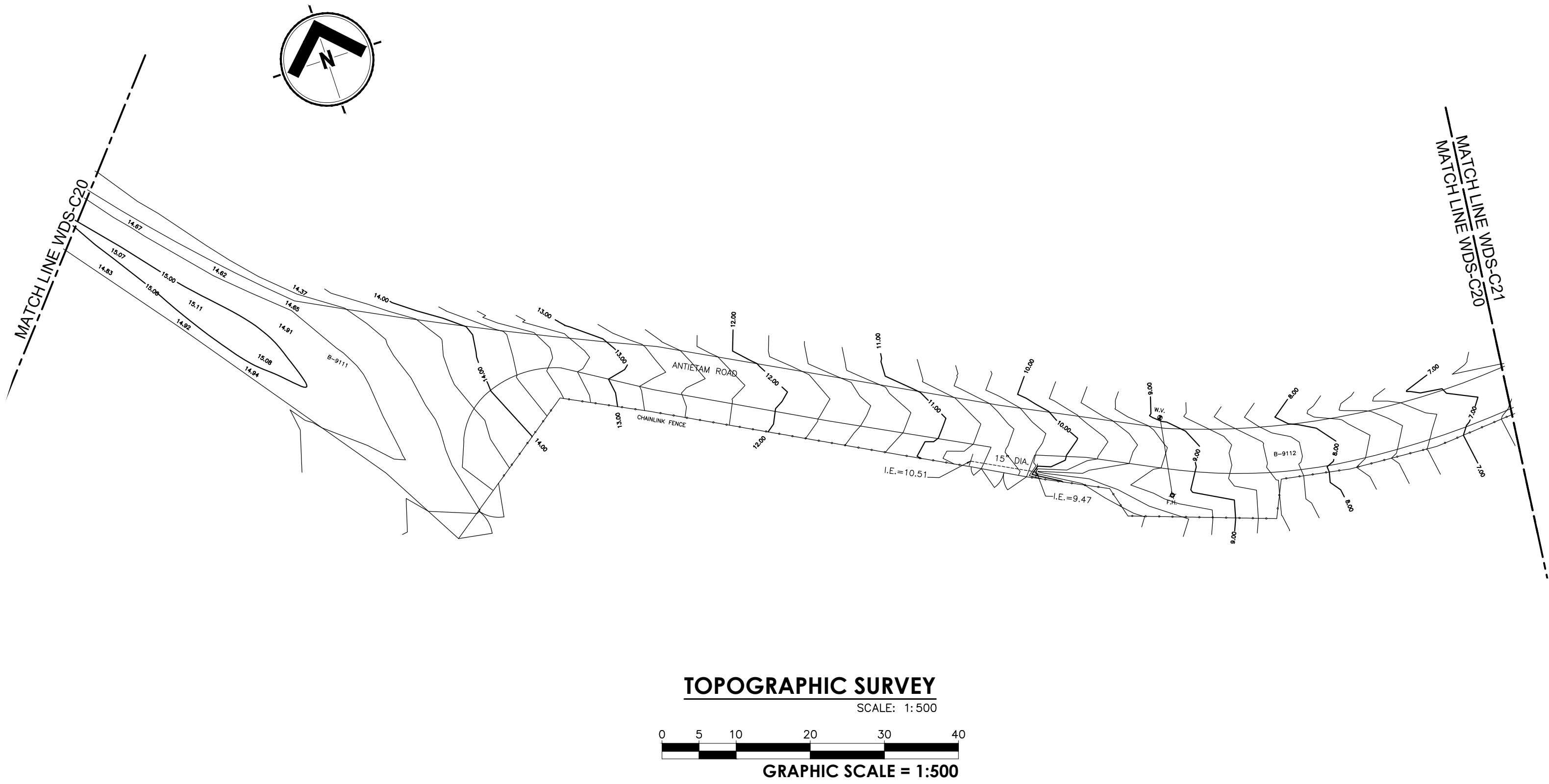
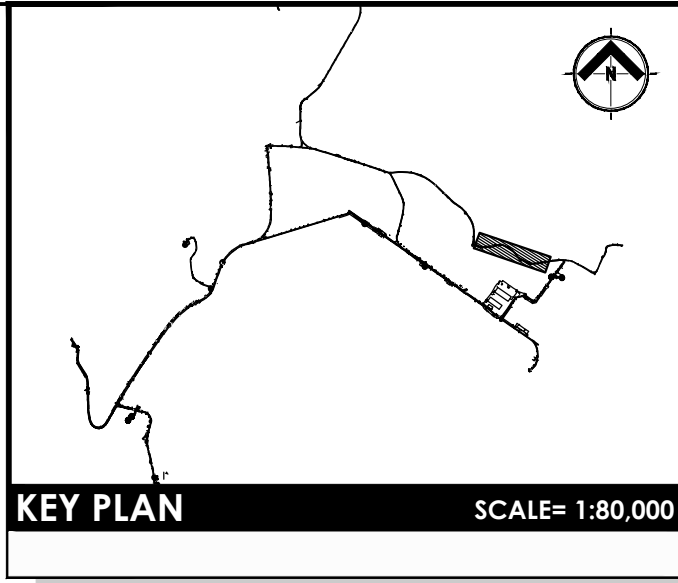
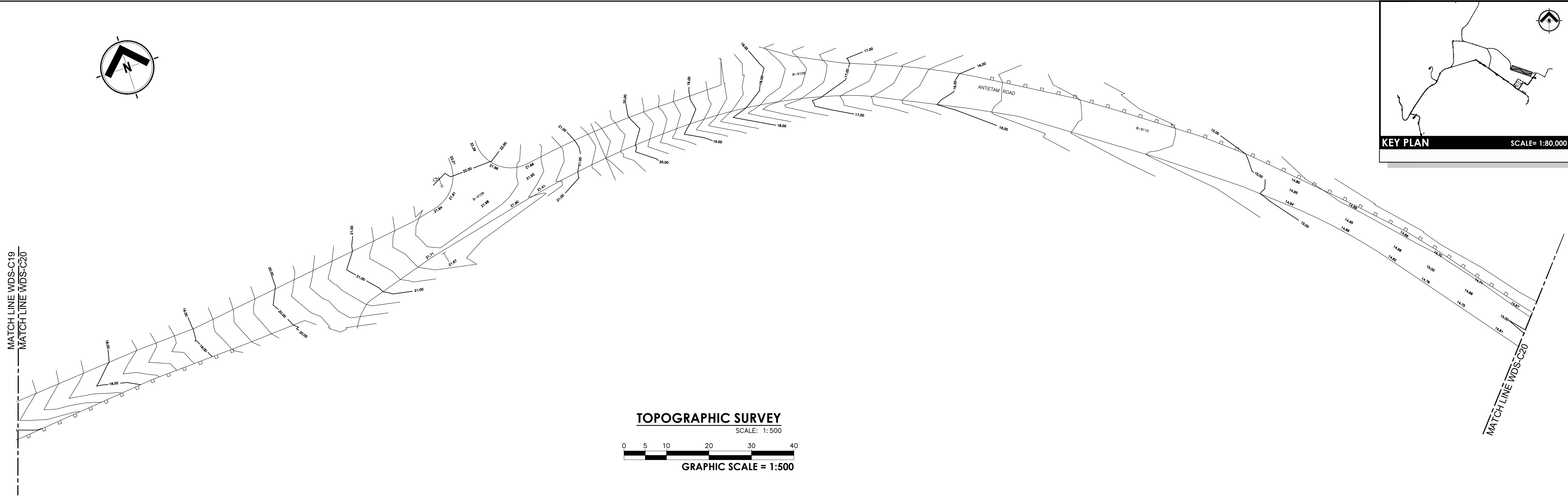


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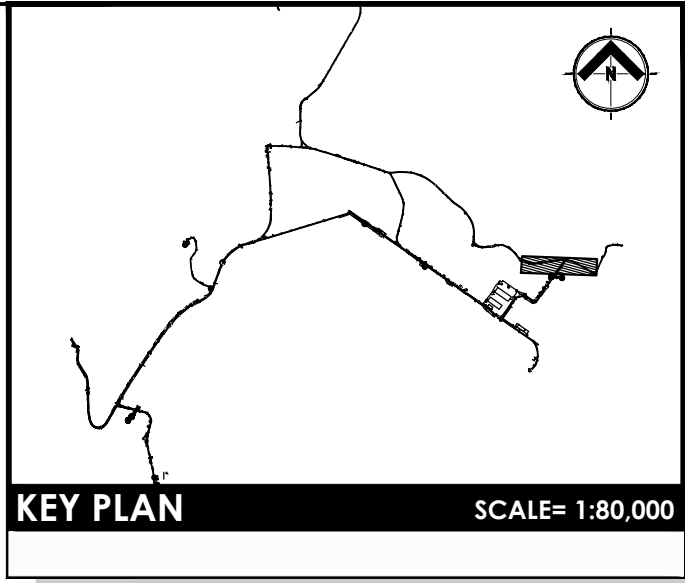
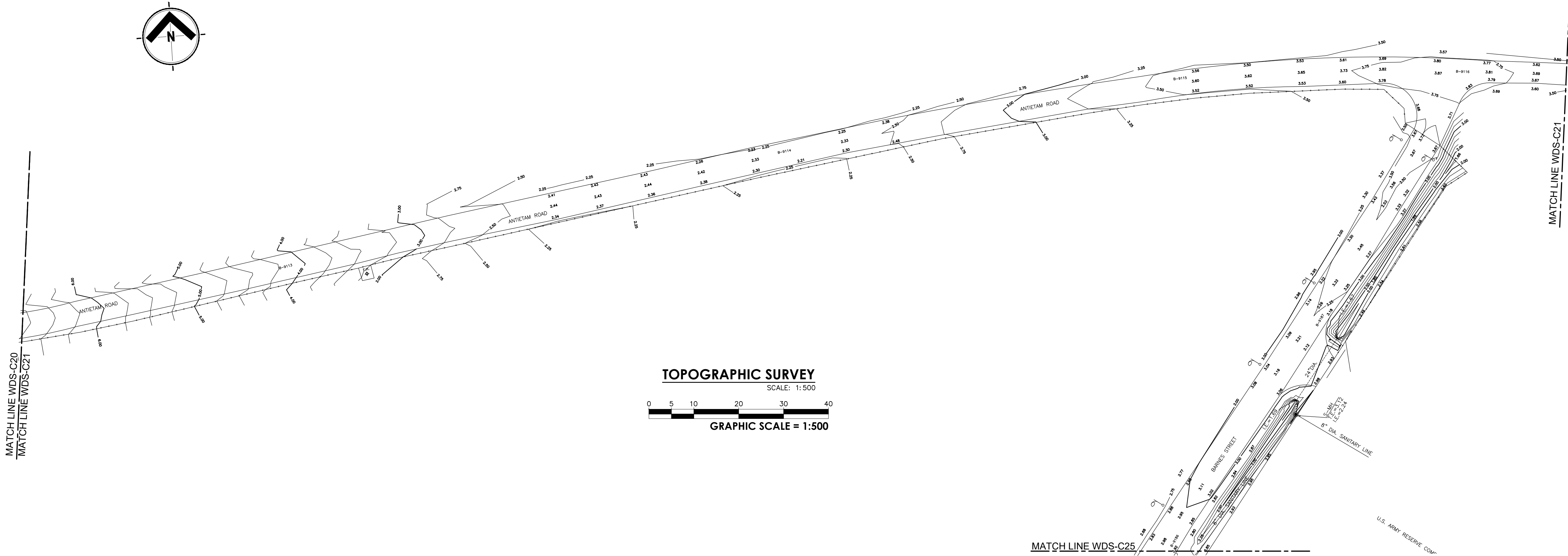
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AMADEO BERMUDEZ #2079 THE CURT ALONSO AVENUE SAN JUAN, P.R. 00915 TEL. (787) 726-8868	
<div>A</div> <div>B</div>	
CERTIFY CORRECT AMADEO BERMUDEZ, P.L.S. SURVEYOR LIC. NO. 9331	
REVISIONS:	DESCRIPTION
NO.	
PROJECT NAME: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT	
SHEET TITLE: TOPOGRAPHY & AS-BUILT PLAN	
DRAWN BY: A. BERMUDEZ	
DATE : APRIL, 2015	
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DESIGN BY:	
APP'D BY: INTEGRA	
DRAWING NO: S-20	
SHEET NO. 20	OF 26



AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 726-8860

A B

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SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	

PROJECT NAME:
WATER INFRASTRUCTURE
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ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

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APRIL, 2015

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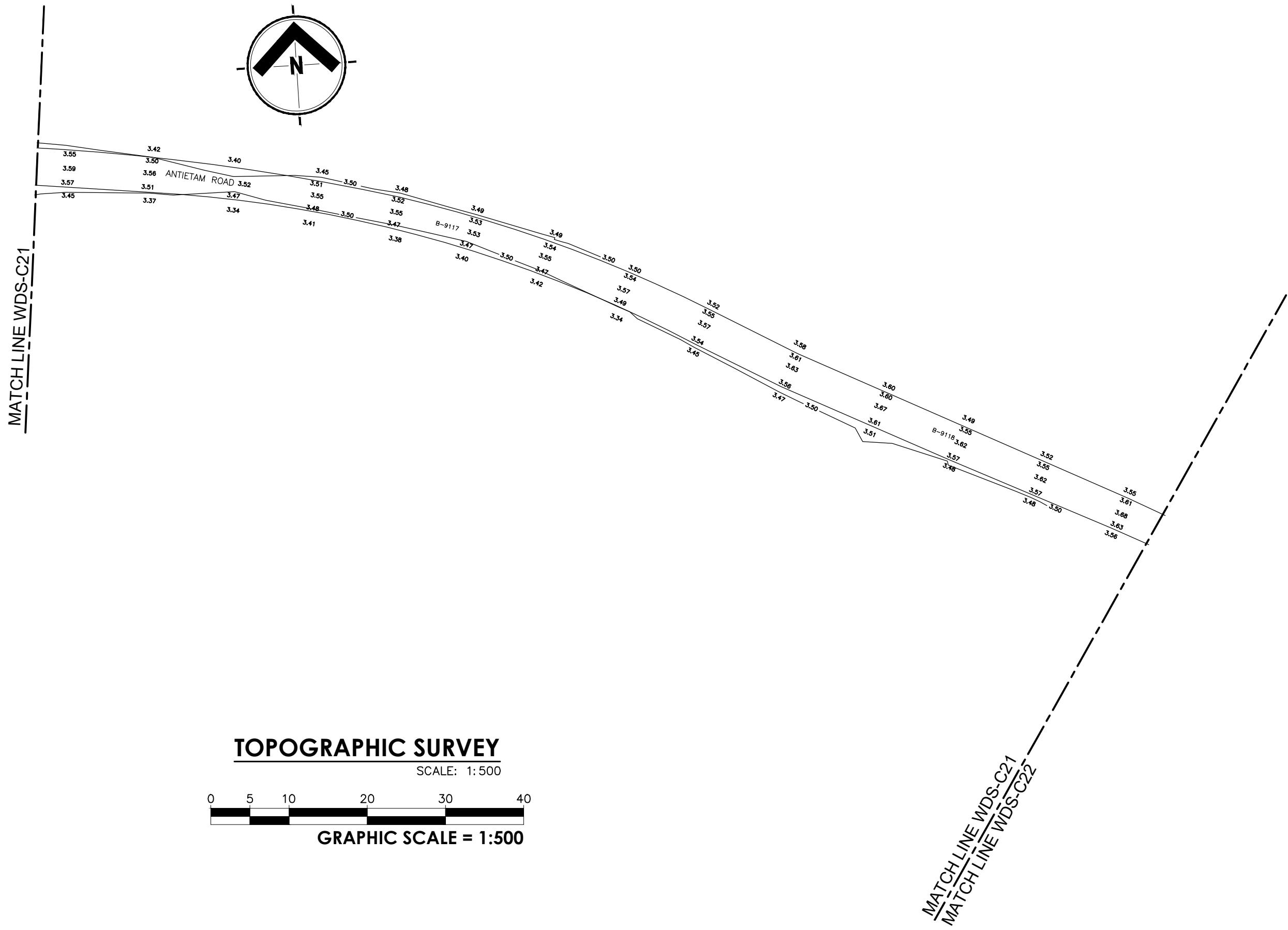
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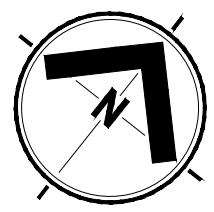
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S-21

SHEET NO. OF

21 26

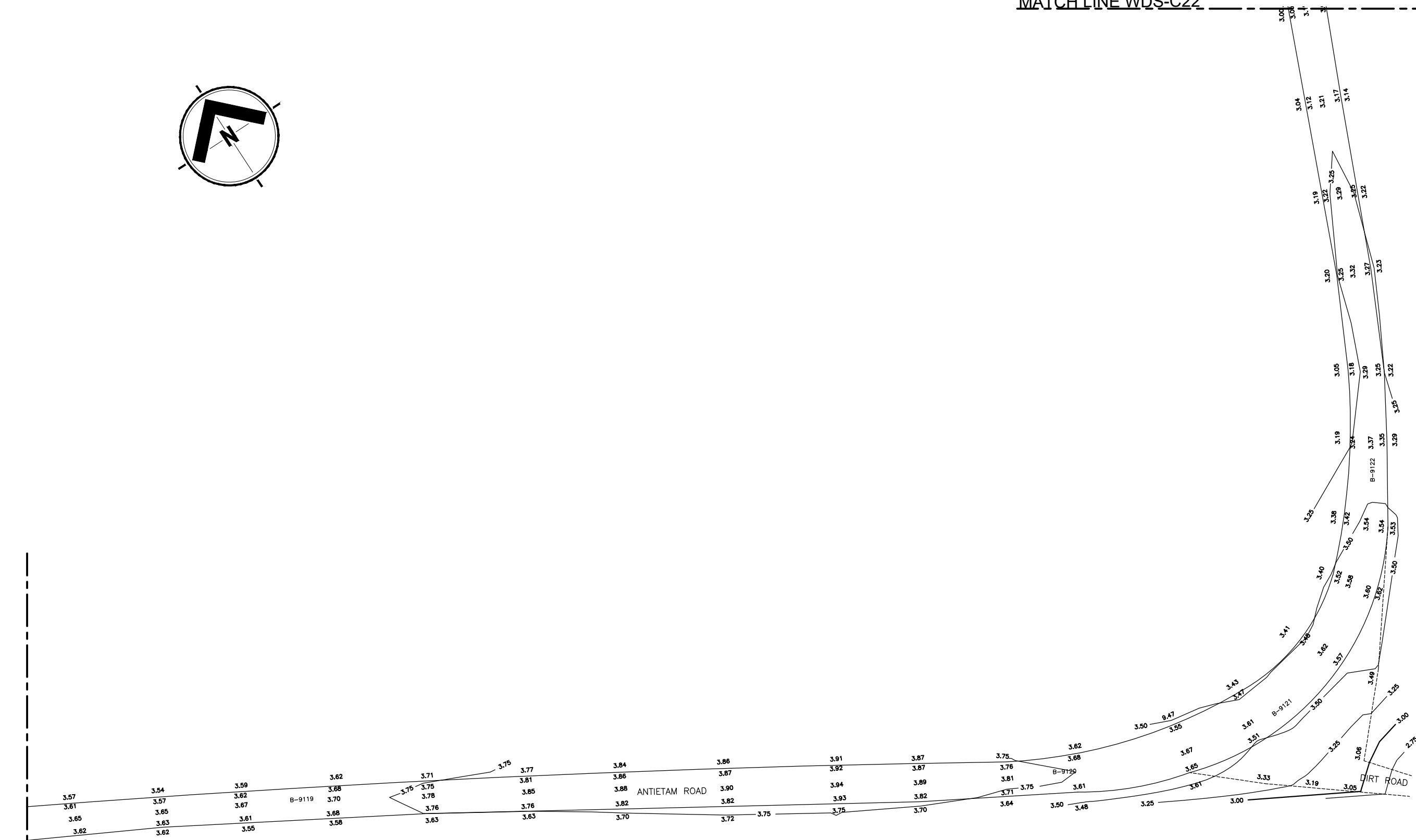
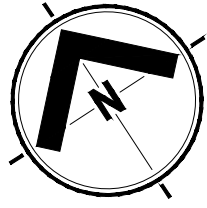


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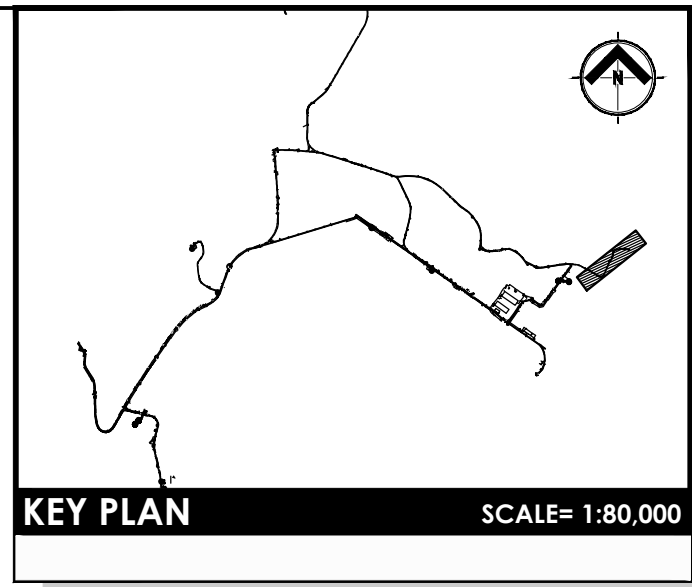


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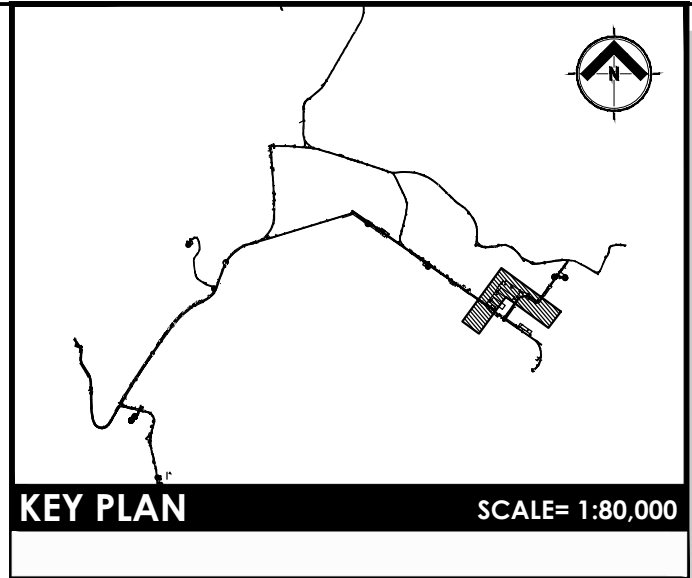
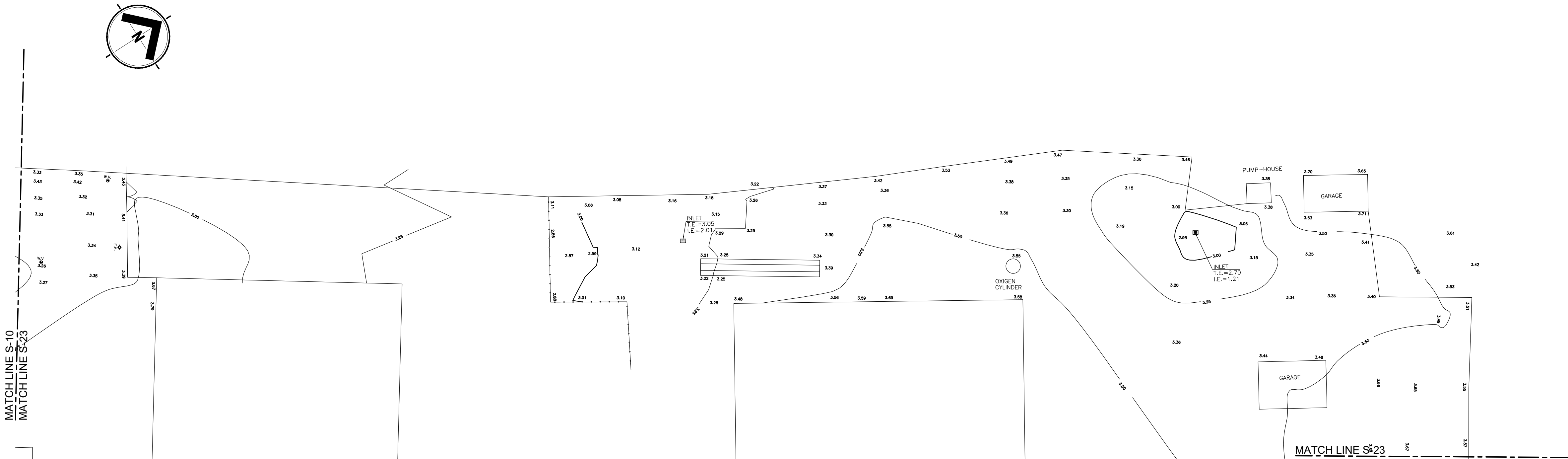
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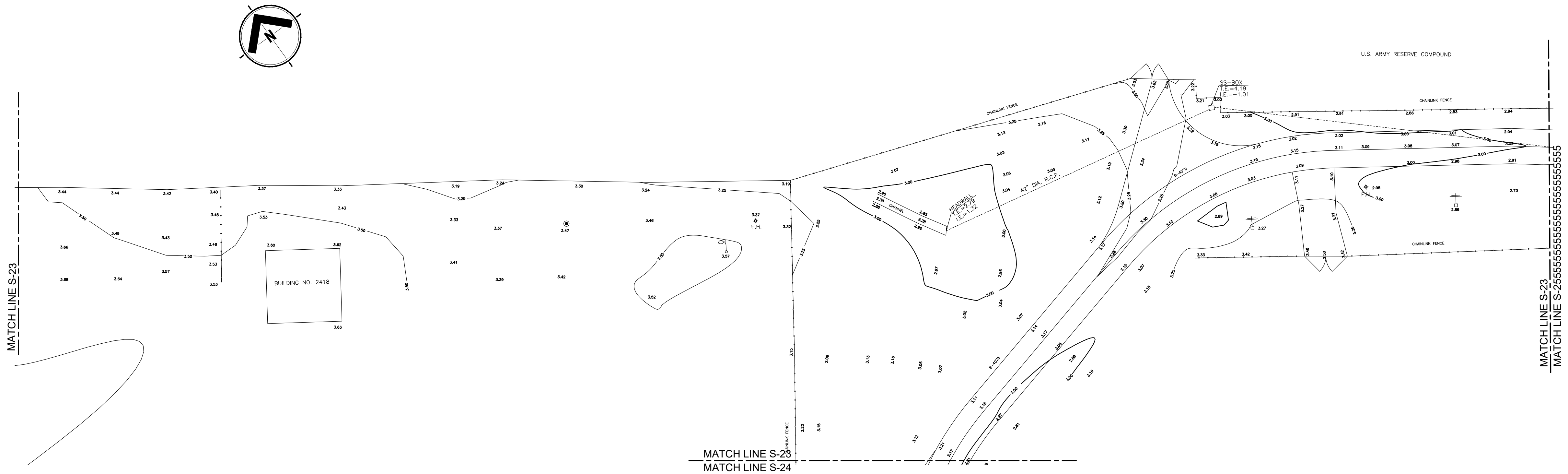
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DRAWN BY: A. BERMUDEZ			
DATE: APRIL, 2015			
SCALE: 1:500			
DESIGN BY:			
APP'D BY: INTEGRA			
DRAWING NO: S-22			
SHEET NO. 22		OF 26	
REVISIONS: NO.		DESCRIPTION	
CERTIFY CORRECT		MATCHLINE STA-XX-XX	
AMADEO BERMUDEZ, P.L.S. SURVEYOR LIC. NO. 9331		AMADEO BERMUDEZ #2079 THE CURT ALONSO AVENUE SAN JUAN, P.R. 00906 TEL. (787) 726-8866	



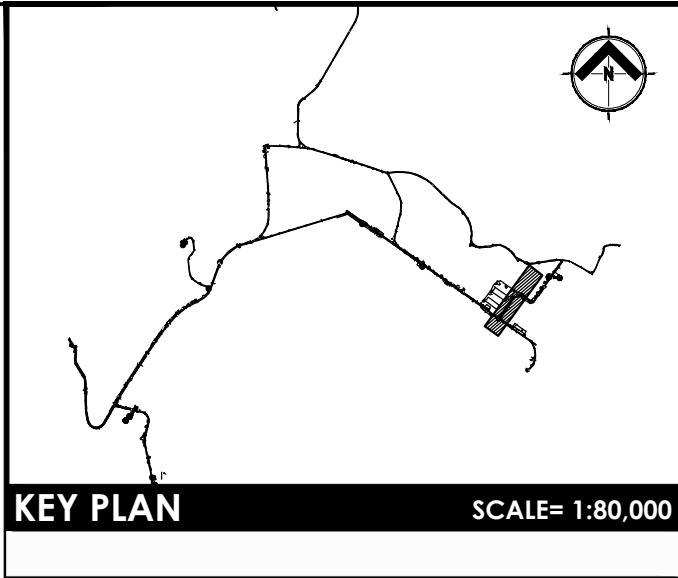
AMADEO BERMUDEZ
#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 720-0860

CERTIFY CORRECT
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS:	DESCRIPTION
NO.	



PROJECT NAME: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE 1) AT ROOSEVELT ROADS DEVELOPMENT
SHEET TITLE: TOPOGRAPHY & AS-BUILT PLAN
DRAWN BY: A. BERMUDEZ
DATE: APRIL, 2015
SCALE: 1:500
DESIGN BY:
APP'D BY: INTEGRA
DRAWING NO: S-23
SHEET NO. 23 OF 26



AMADEO BERMUDEZ
#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 720-8860

A B

CERTIFY CORRECT

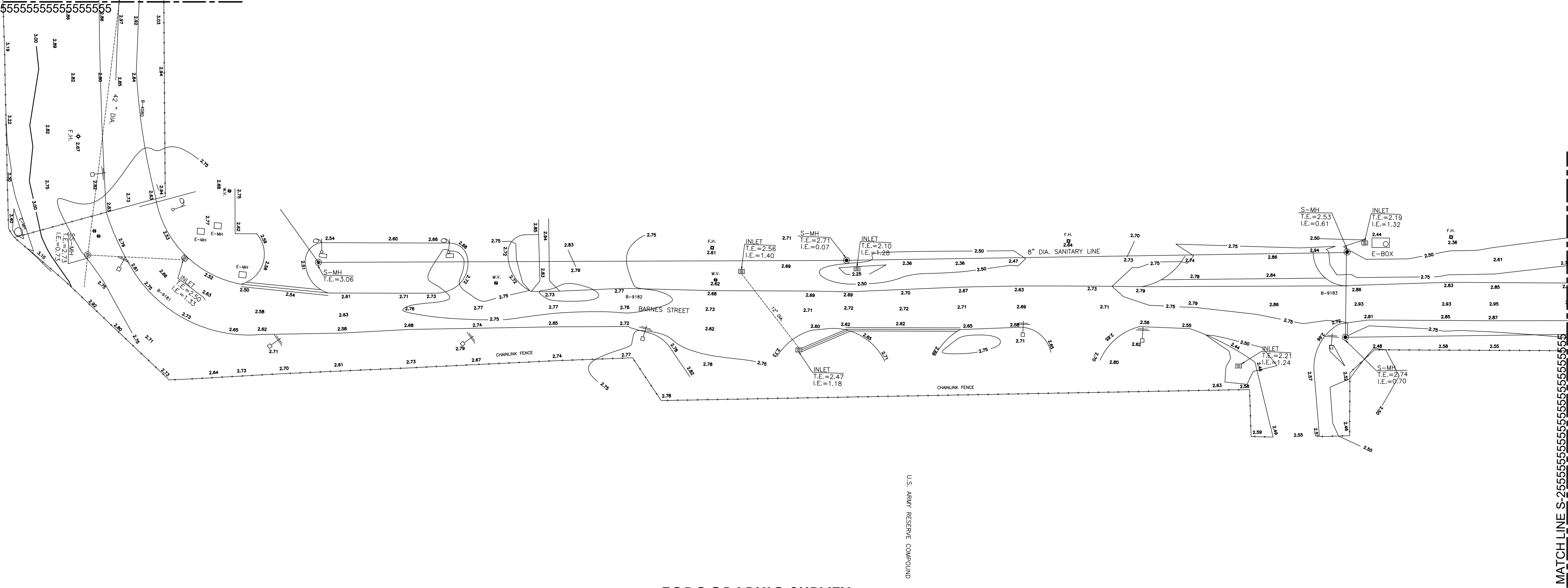
AMADEO BERMUDEZ, P.L.S.
SURVEYOR LIC. NO. 9331

REVISIONS: NO.	DESCRIPTION

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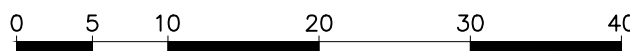
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DATE : APRIL, 2015	
SCALE : 1:500	
DESIGN BY:	
APP'D BY: INTEGRA	
DRAWING NO: S-24	
SHEET NO. 24	OF 26

MATCH LINE S-24
MATCH LINE S-25



TOPOGRAPHIC SURVEY

SCALE: 1:500



GRAPHIC SCALE = 1:500

KEY PLAN

SCALE= 1:80,000

AMADEO BERMUDEZ

#2079 THE CURT ALONSO AVENUE
SAN JUAN, P.R. 00915
TEL. (787) 720-0860

A B

CERTIFY CORRECT

AMADEO BERMUDEZ, P.L.S.

SURVEYOR LIC. NO. 9331

REVISIONS: DESCRIPTION

PROJECT NAME:

WATER INFRASTRUCTURE
IMPROVEMENTS (PHASE 1) AT
ROOSEVELT ROADS DEVELOPMENT

SHEET TITLE:
TOPOGRAPHY & AS-BUILT PLAN

DRAWN BY:
A. BERMUDEZ

DATE:
APRIL, 2015

SCALE:
1:500

DESIGN BY:

APP'D BY:
INTEGRA

DRAWING NO:

S-25

SHEET NO.

25

OF

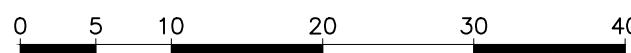
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MATCH LINE
STA. XX+XX

U.S. ARMY RESERVE COMPOUND

TOPOGRAPHIC SURVEY

SCALE: 1:500



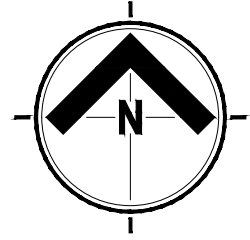
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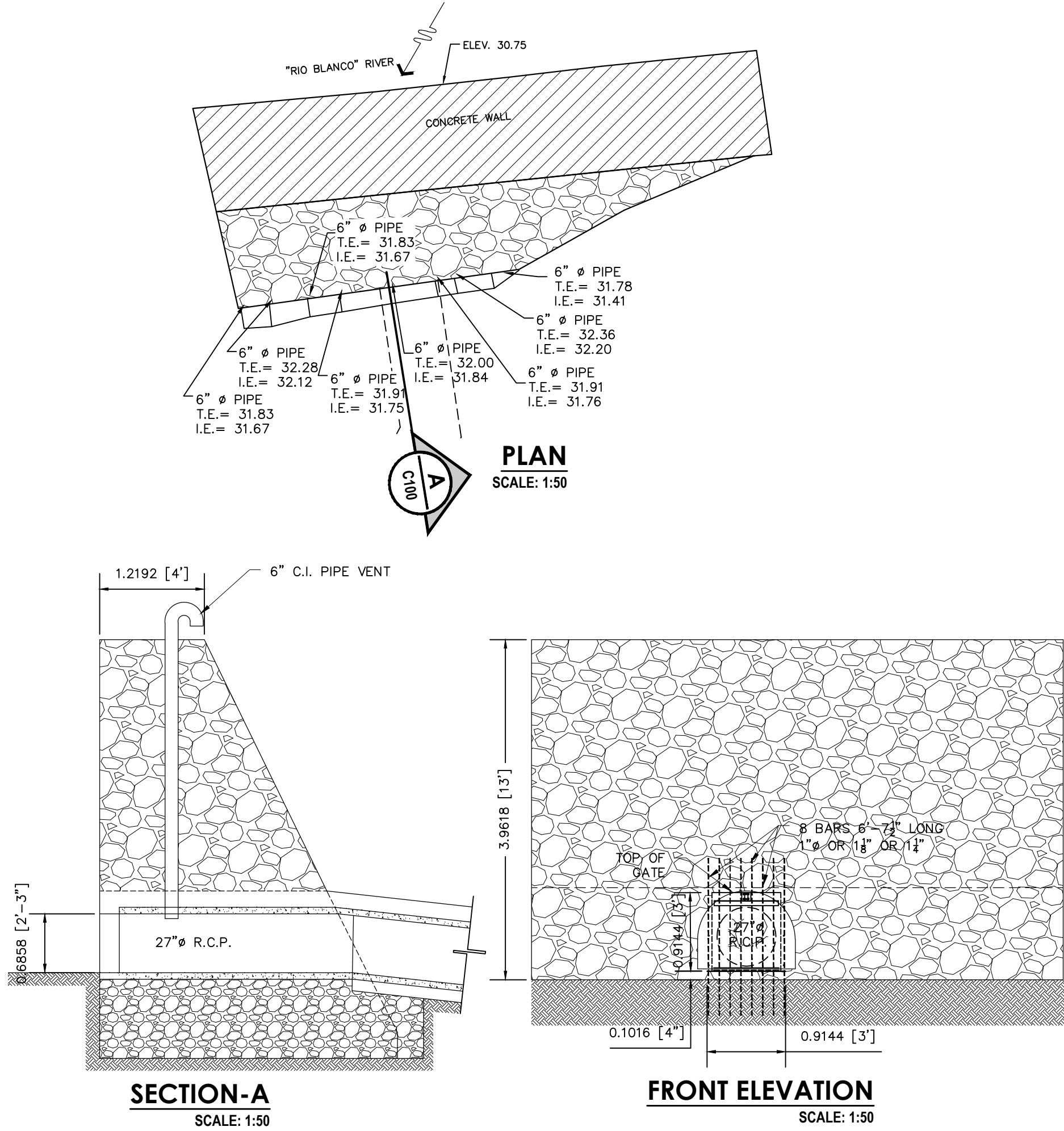
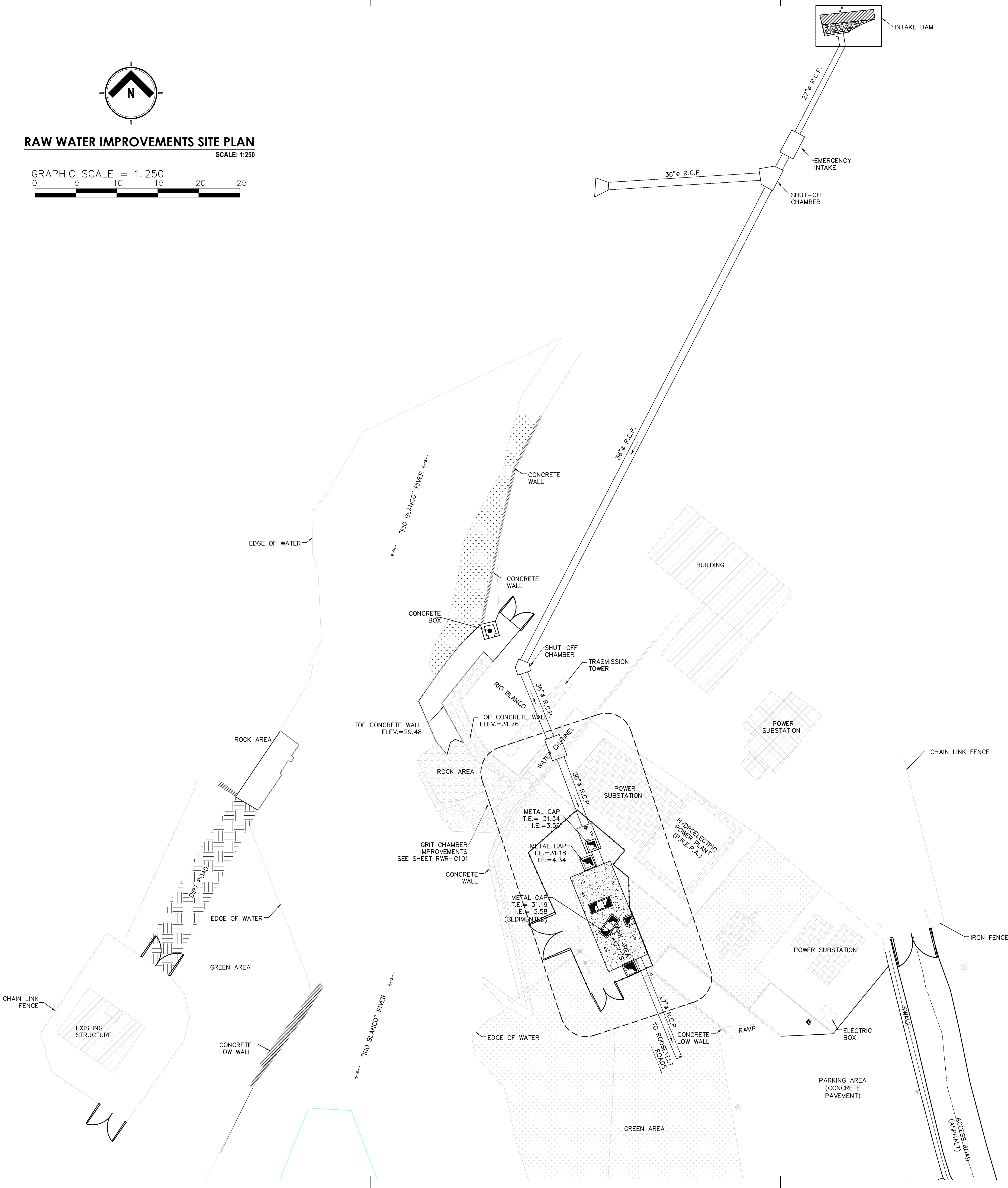
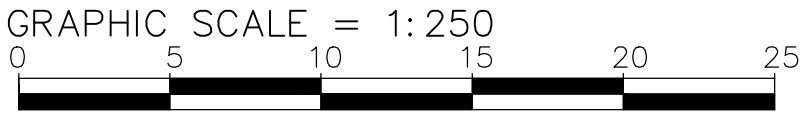
U.S. ARMY RESERVE COMPOUND

MATCH LINE S-24
MATCH LINE S-25

MATCH LINE S-26



RAW WATER IMPROVEMENTS SITE PLAN
SCALE: 1:250



EXISTING INTAKE DAM DETAILS

1

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLEs DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLEs DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADAMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DGP.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT
		Set Date: 20210728	Owner: CEBRA & NAGUABO, PUERTO RICO
		Drawn by:	Author: CEBRA & NAGUABO, PUERTO RICO
		Dwg. Date:	Owner: CEBRA & NAGUABO, PUERTO RICO

Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

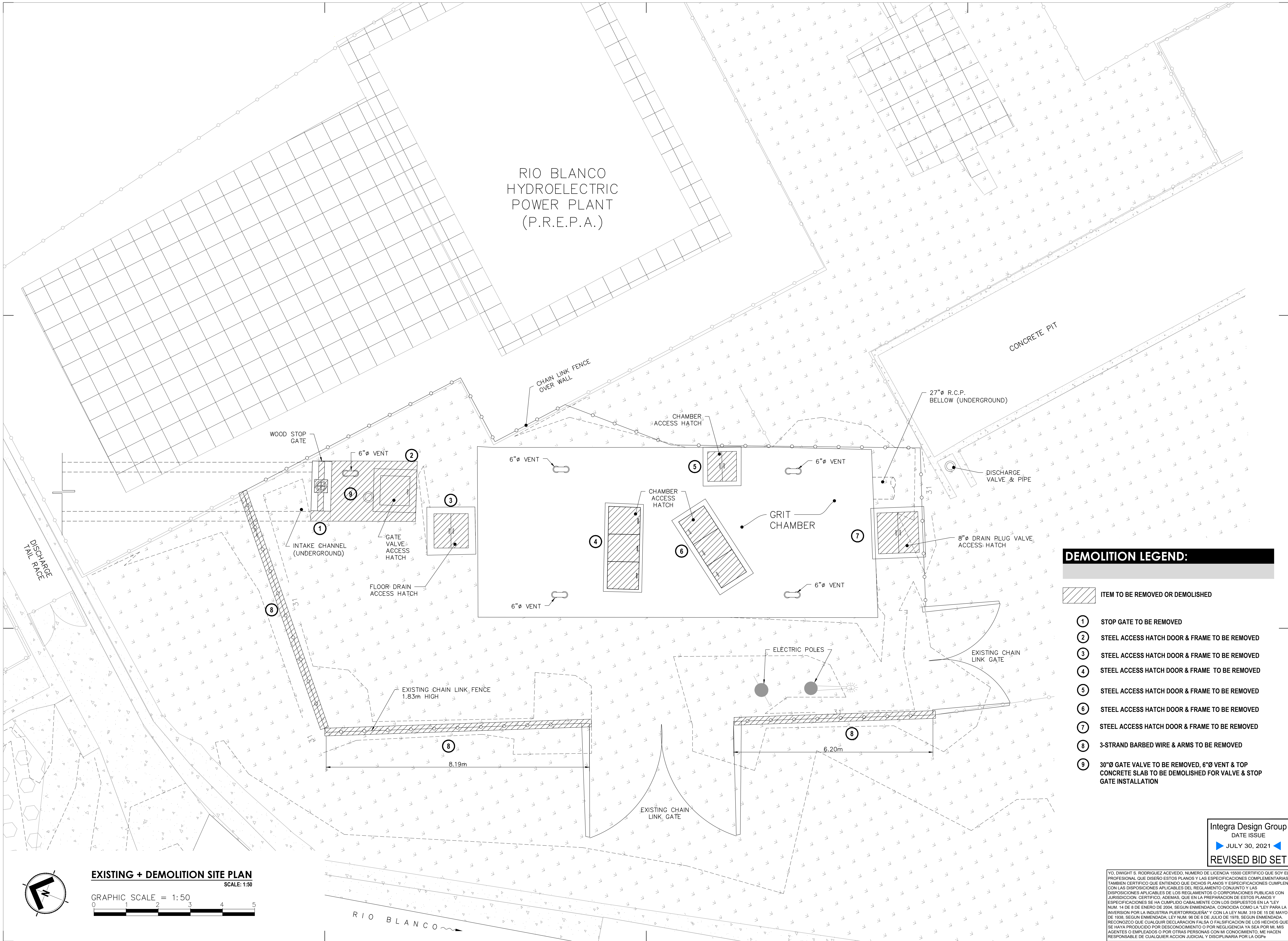
Owner: CEBRA & NAGUABO, PUERTO RICO

Local Redevelopment Authority for Roosevelt Roads

RIO BLANCO RAW WATER INTAKE GRIT CHAMBER

Drawing Title: IMPROVEMENTS SITE PLAN

Sheet: RWI-C100



SHEET INFO.		
Project No.	18-1837.0	
Set Date:	2021/07/28	
Drawn by:		
Dwg. Date:		

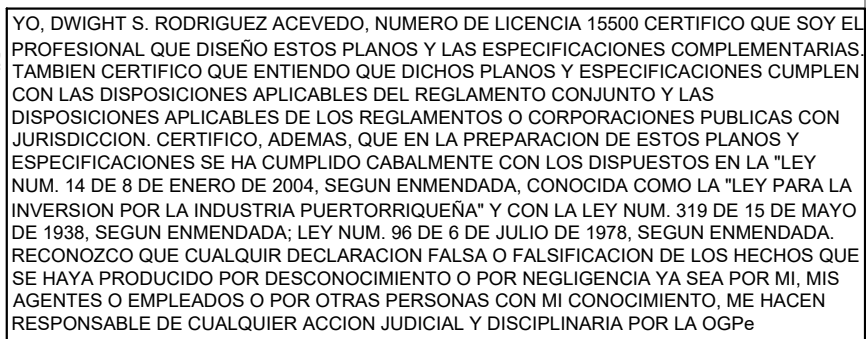
Revisions	Number	Date	Description

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

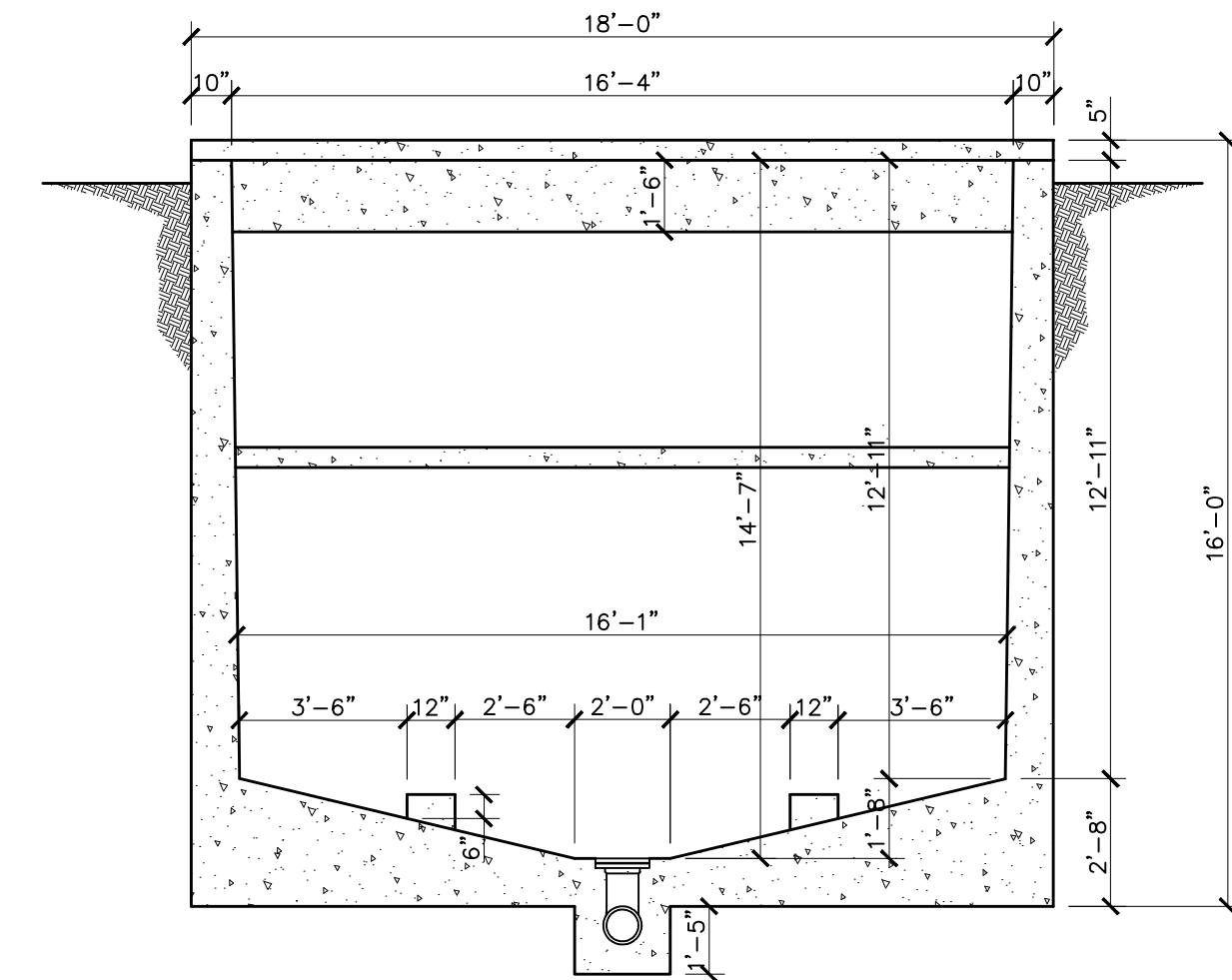
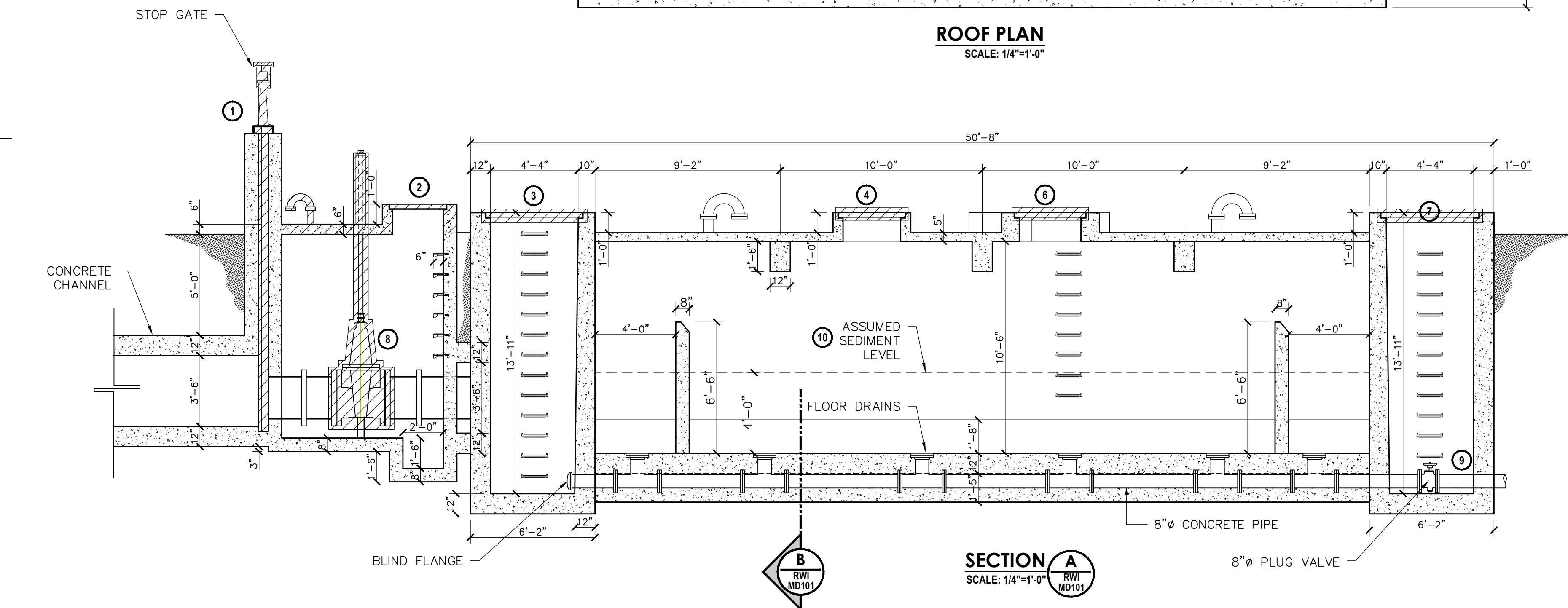
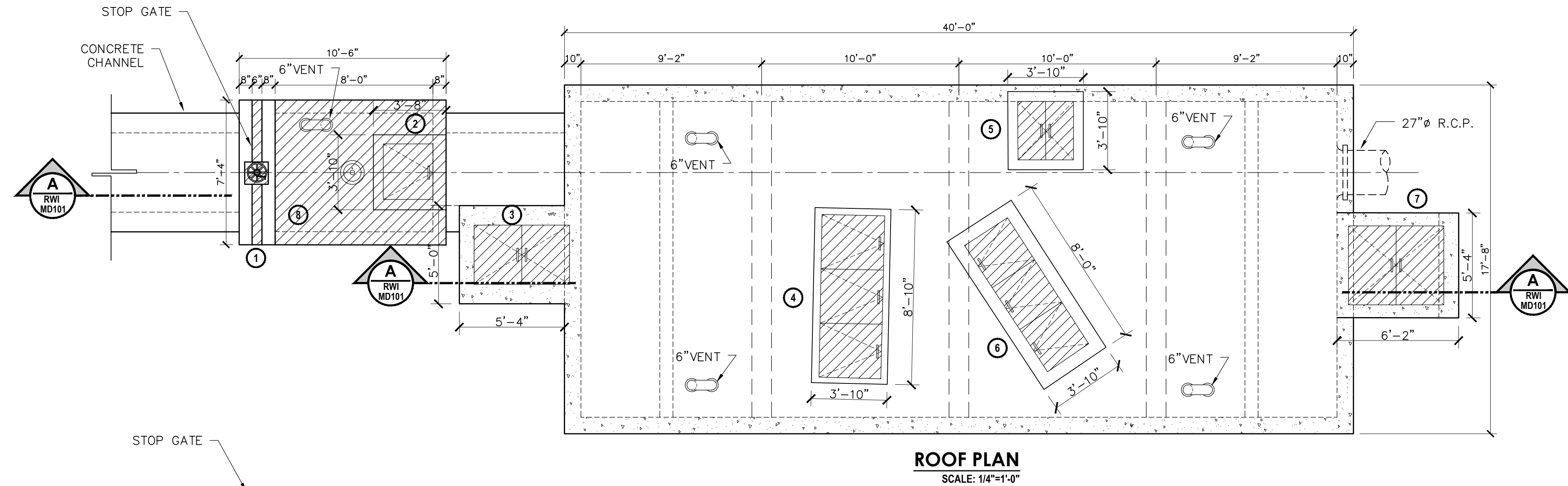
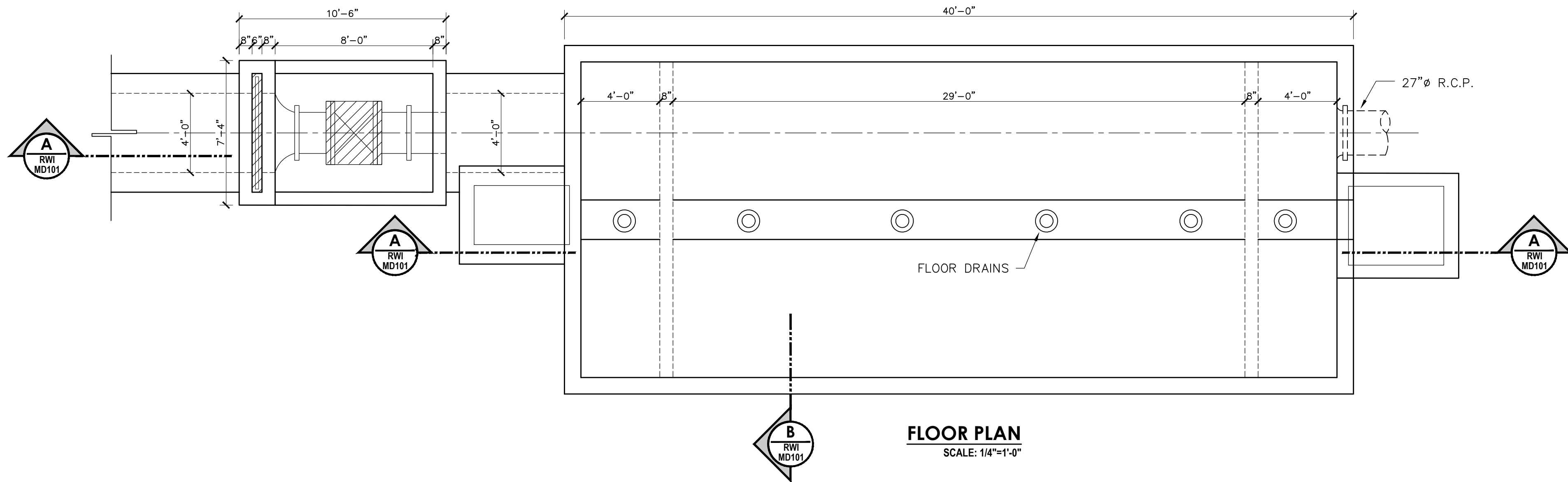
**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**



RIO BLANCO RAW WATER INTAKE GRIT CHAMBER
Drawing Title:
EXISTING + DEMOLITION SITE PLAN

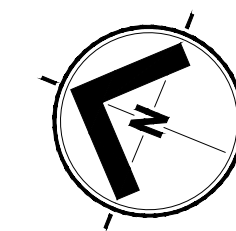


File: P:\or\19-Ceiba\18370 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BidPhase\01-Site\Raw Water Intake\046-RW-MD101 GRIT CHAMBER PLANS & SECTIONS; Plotted: 5/25/2023 1:47 p.m. by SVAZQUEZ; Saved: 8/13/2021 4:34 p.m. by SVAZQUEZ



DEMOLITION LEGEND:

- ITEM TO BE REMOVED OR DEMOLISHED
- STOP GATE TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- STEEL ACCESS HATCH DOOR & FRAME TO BE REMOVED
- 30" GATE VALVE TO BE REMOVED, TOP CONCRETE SLAB & 6" VENT TO BE DEMOLISHED FOR GATE VALVE INSTALLATION
- 8" PLUG VALVE TO BE REMOVED
- REMOVE & DISPOSE ACCUMULATED SEDIMENT / SAND.



GRAPHIC SCALE = 1/4"=1'-0"

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions	Number	Date	Description	SHEET INFO.
Project No.: 18-1837-0				Project No.: 18-1837-0
Set Date: 2021/07/28				Set Date: 2021/07/28
Drawn by:				Drawn by:
Dwg. Date:				Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT



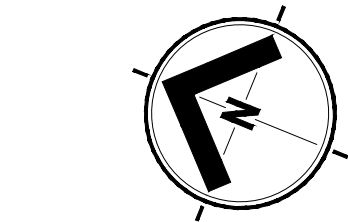
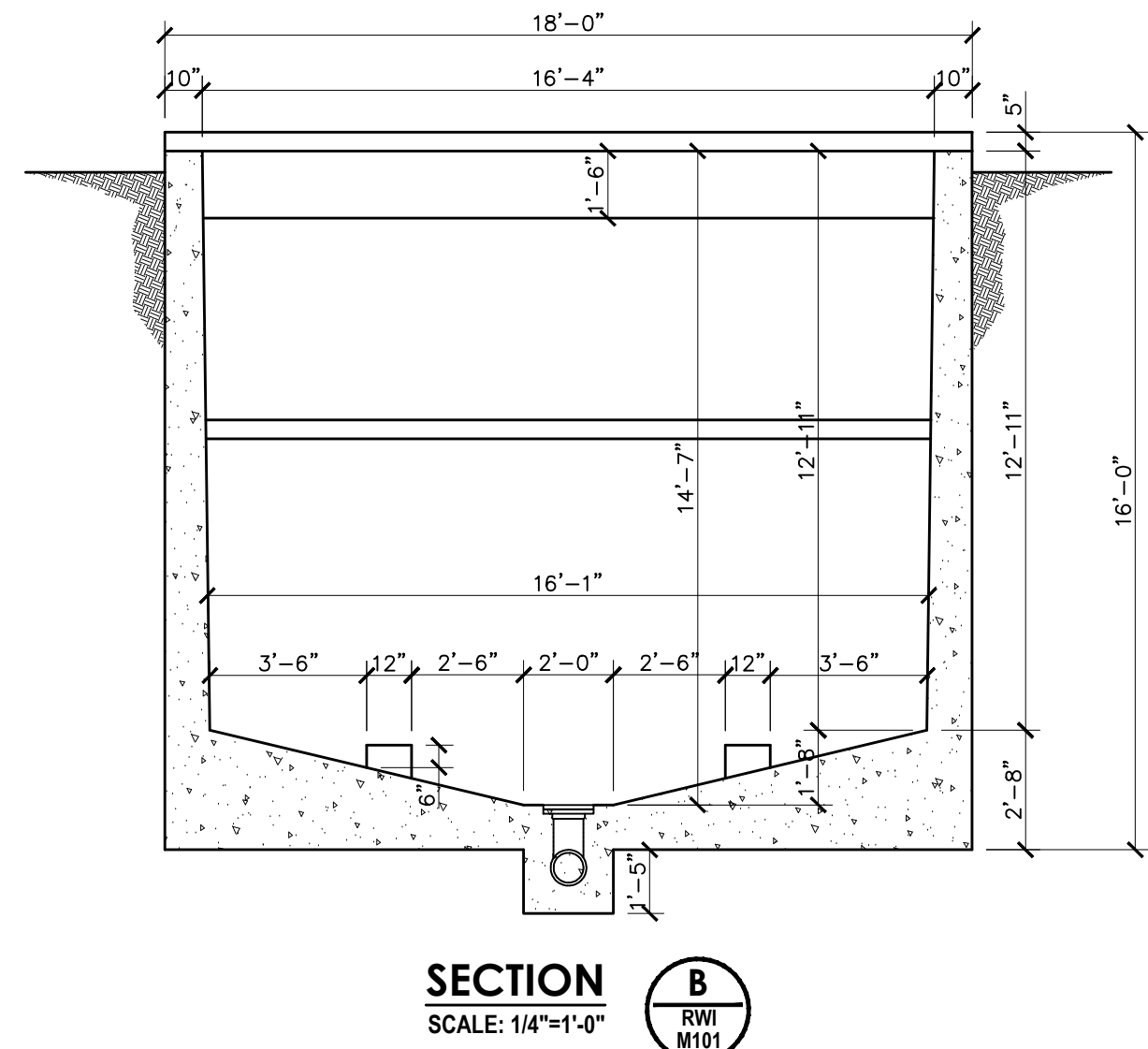
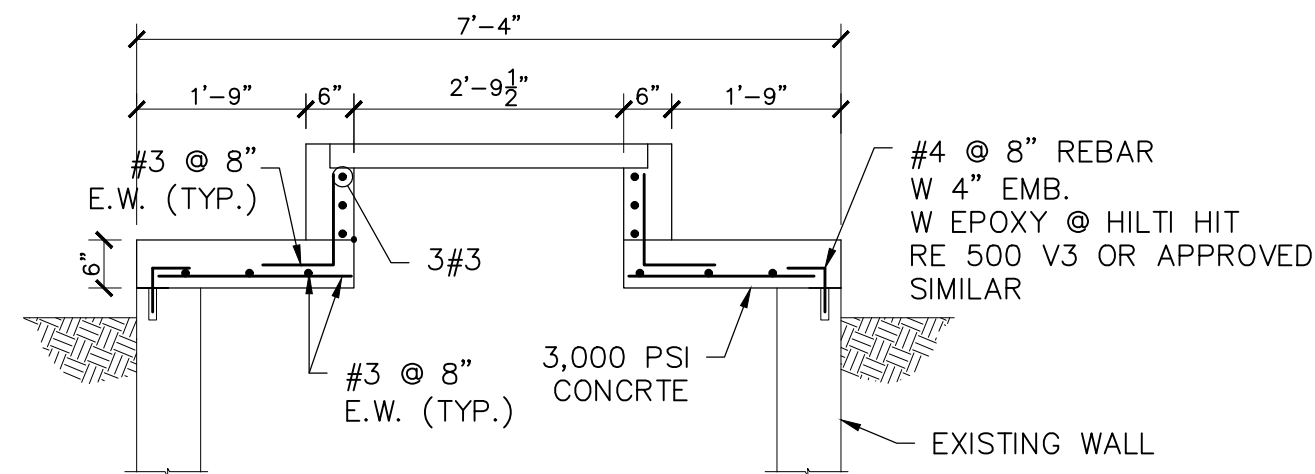
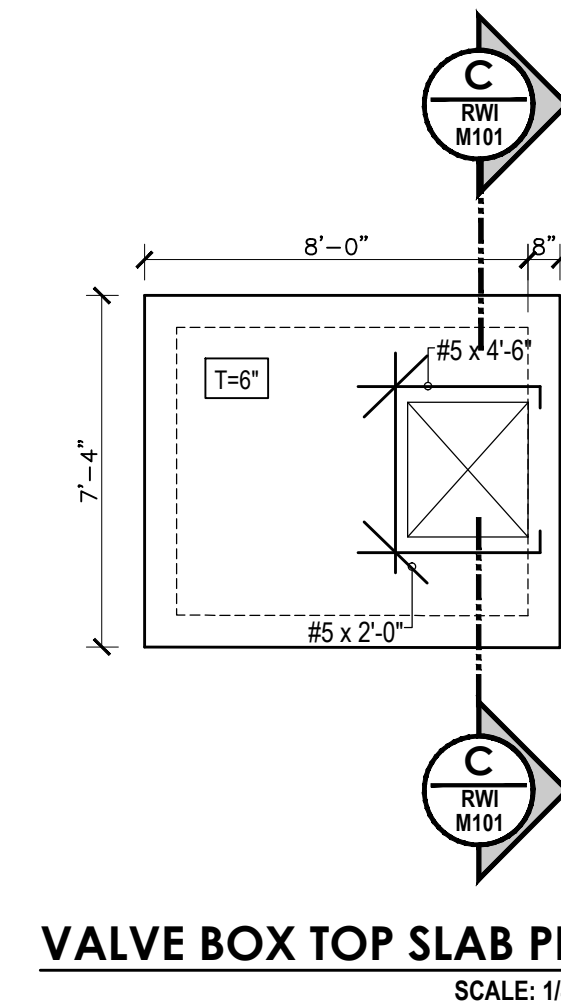
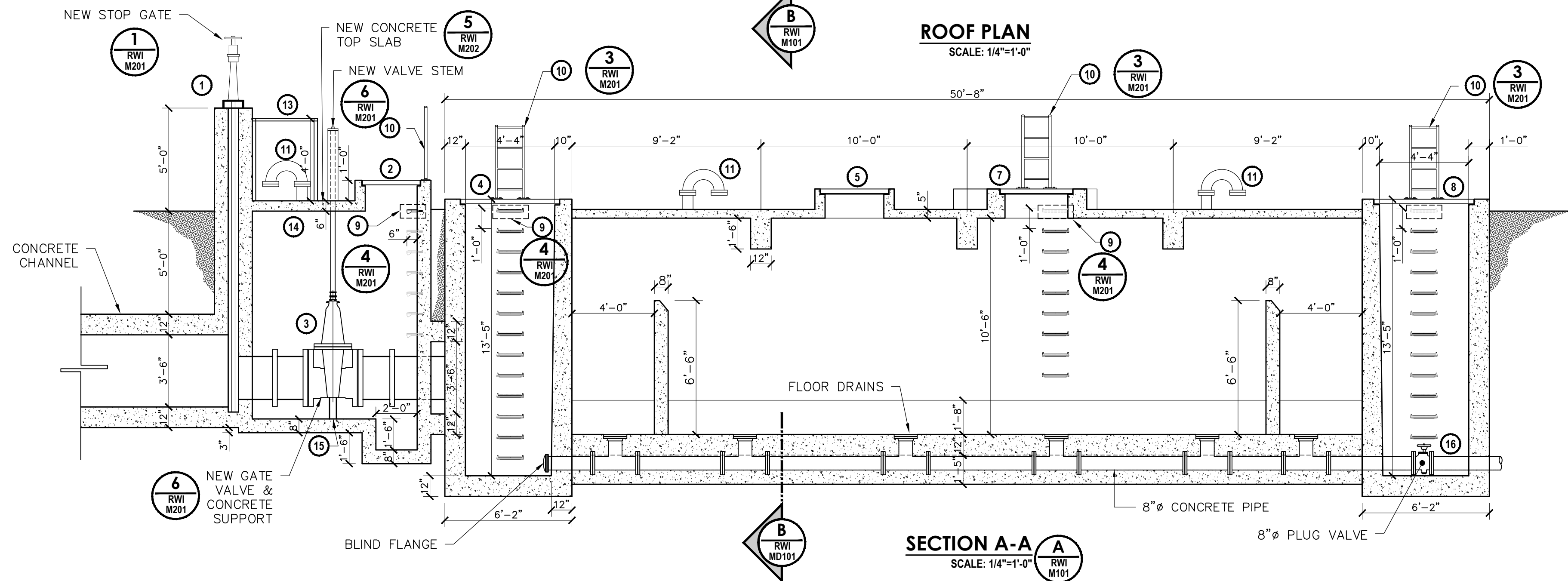
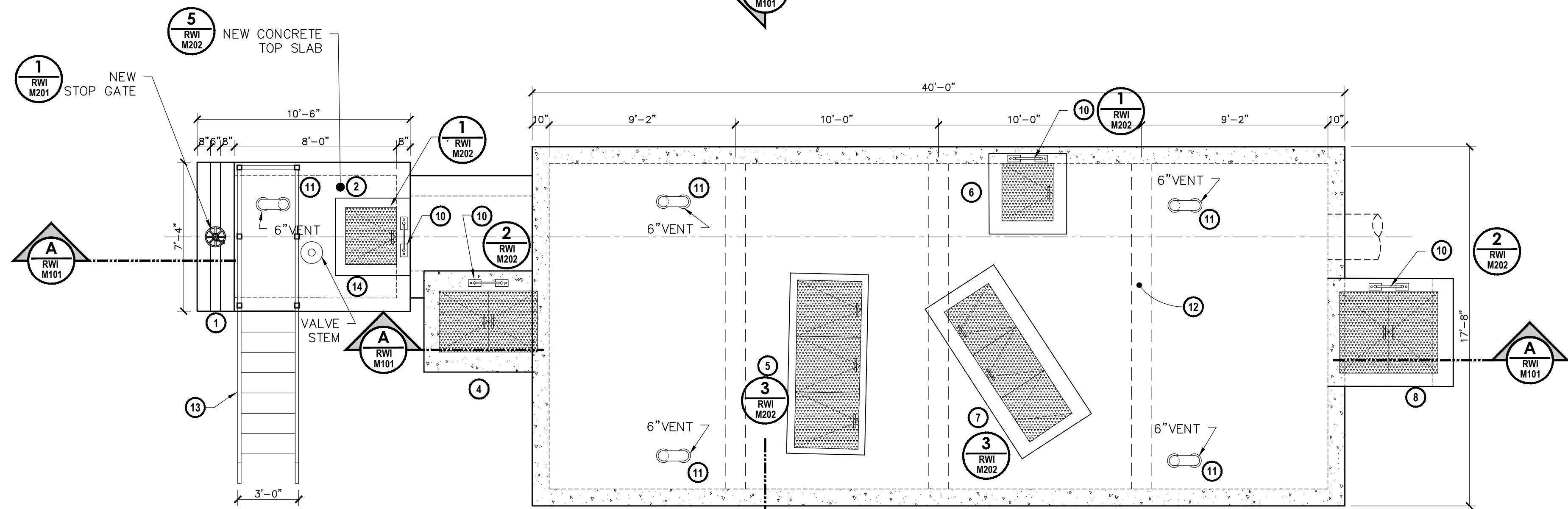
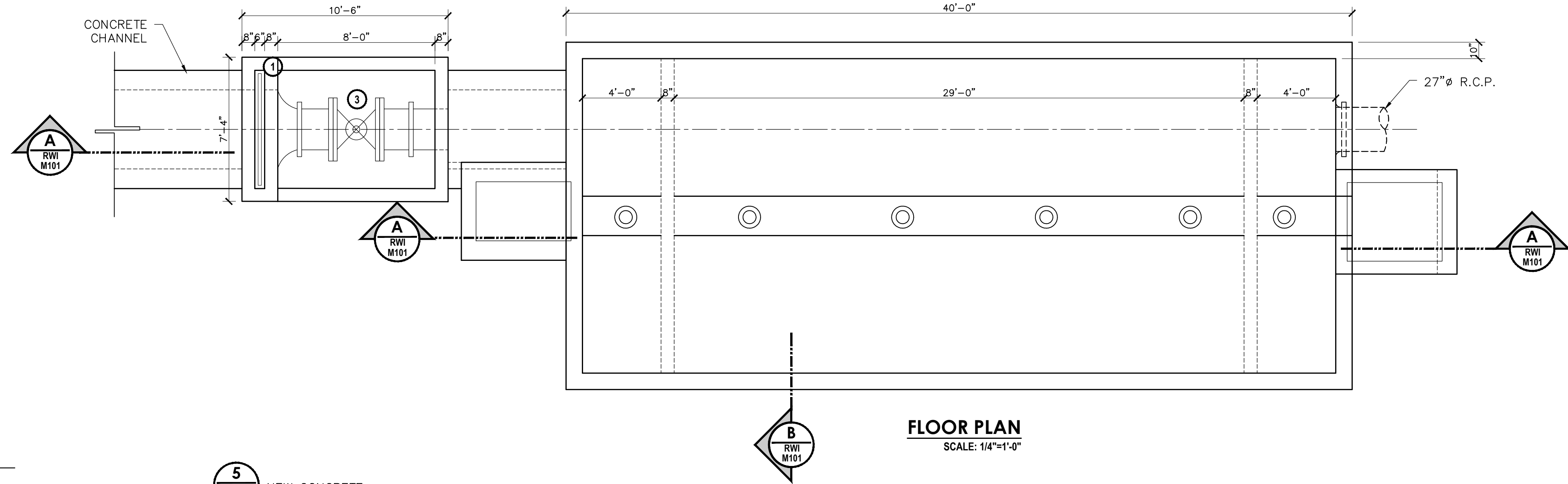
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

RIO BLANCO RAW WATER INTAKE GRIT CHAMBER

GRIT CHAMBER EXISTING + DEMOLITION PLAN & SECTIONS

RWI-MD101

File: P:\19-Ceiba\1837.0 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BioPhase\01-Site\Raw Water Intake\047-RW-M101 GRIT CHAMBER IMPROVEMENT PLANS & SECTIONS; Plotted: 5/25/2023 1:51 p.m. by SV4ZOUJZ; Saved: 7/29/2021 4:07 p.m. by SV4ZOUJZ



GRAPHIC SCALE = 1/4"=1'-0"

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

SCOPE OF WORKS:

- 1 NEW STOP GATE
- 2 NEW 36"x 36" ALUMINUM HATCH DOOR & FRAME
- 3 NEW 30" GATE VALVE M.J. WITH VALVE STEM & OPERATOR
- 4 NEW 42"x 42" ALUMINUM DOUBLE LEAF HATCH DOOR & FRAME
- 5 NEW 96"x 36" ALUMINUM TRIPLE LEAF HATCH DOOR & FRAME
- 6 NEW 36"x 36" ALUMINUM HATCH DOOR & FRAME
- 7 NEW 96"x 36" ALUMINUM TRIPLE LEAF HATCH DOOR & FRAME
- 8 NEW 48"x 48" DOUBLE LEAF HATCH WIRE ARMS
- 9 NEW COPOLYMER MANHOLE STEP
- 10 NEW STAINLESS STEEL GRAB BAR
- 11 NEW 6" Ø DUCTILE IRON GOOSE NECK VENT WITH S.S. MESH
- 12 PRESSURE WASH ALL ABOVE GROUND CONCRETE SLABS
- 13 PROPOSED FIBERGLASS PLATFORM (SEE SHEET RWI-M203)
- 14 NEW CONCRETE TOP SLAB ON VALVE BOX
- 15 NEW VALVE CONCRETE SUPPORT
- 16 NEW 8" Ø C.I. PLUG VALVE WITH HANDWHEEL

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

RIO BLANCO RAW WATER INTAKE GRIT CHAMBER

Drawing Title:

GRIT CHAMBER IMPROVEMENTS PLAN & SECTIONS

Revisions

Number	Date	Description

SHEET INFO:
Project No.: 18-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

INTEGRA

INTEGRA DESIGN GROUP PSC

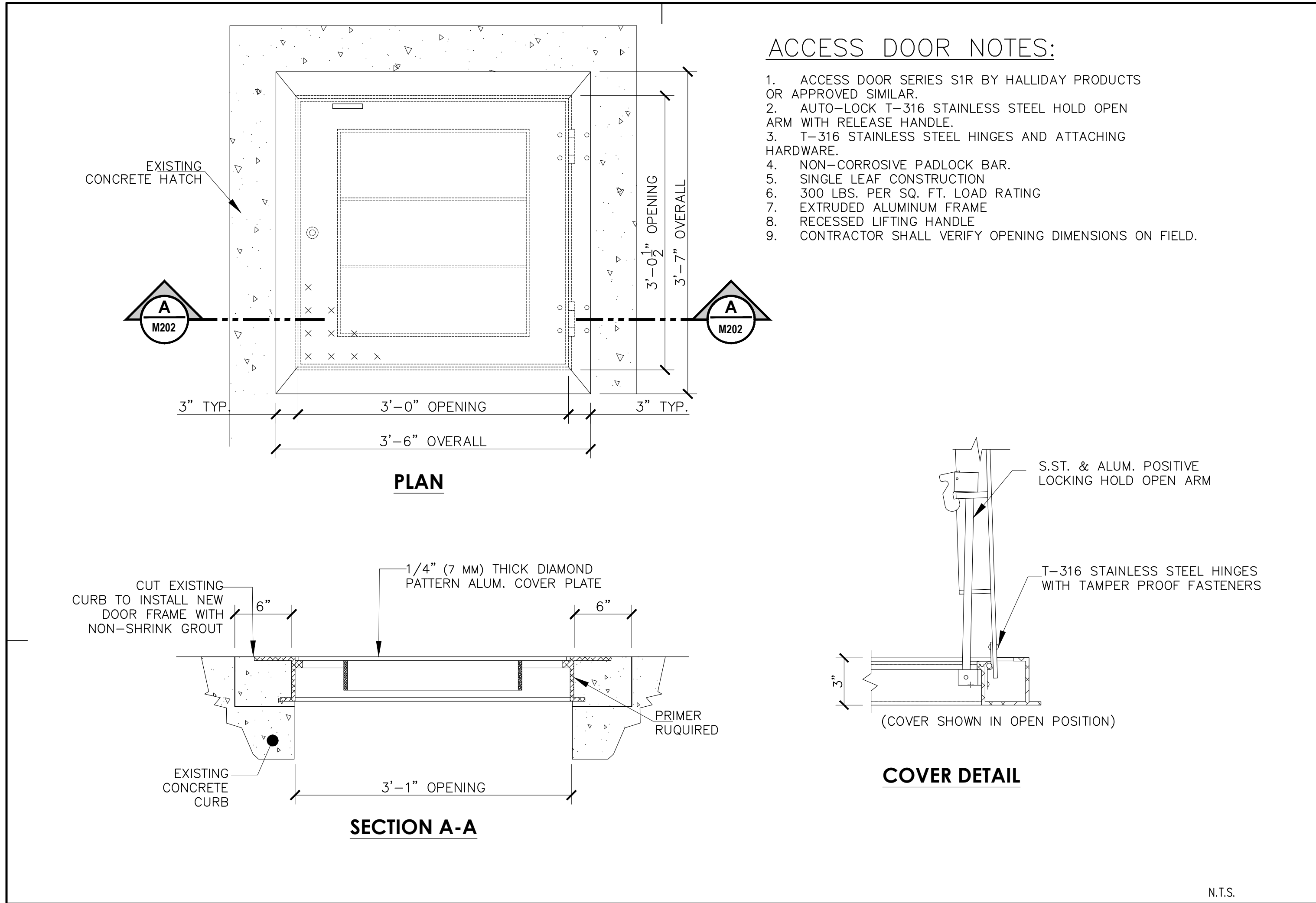
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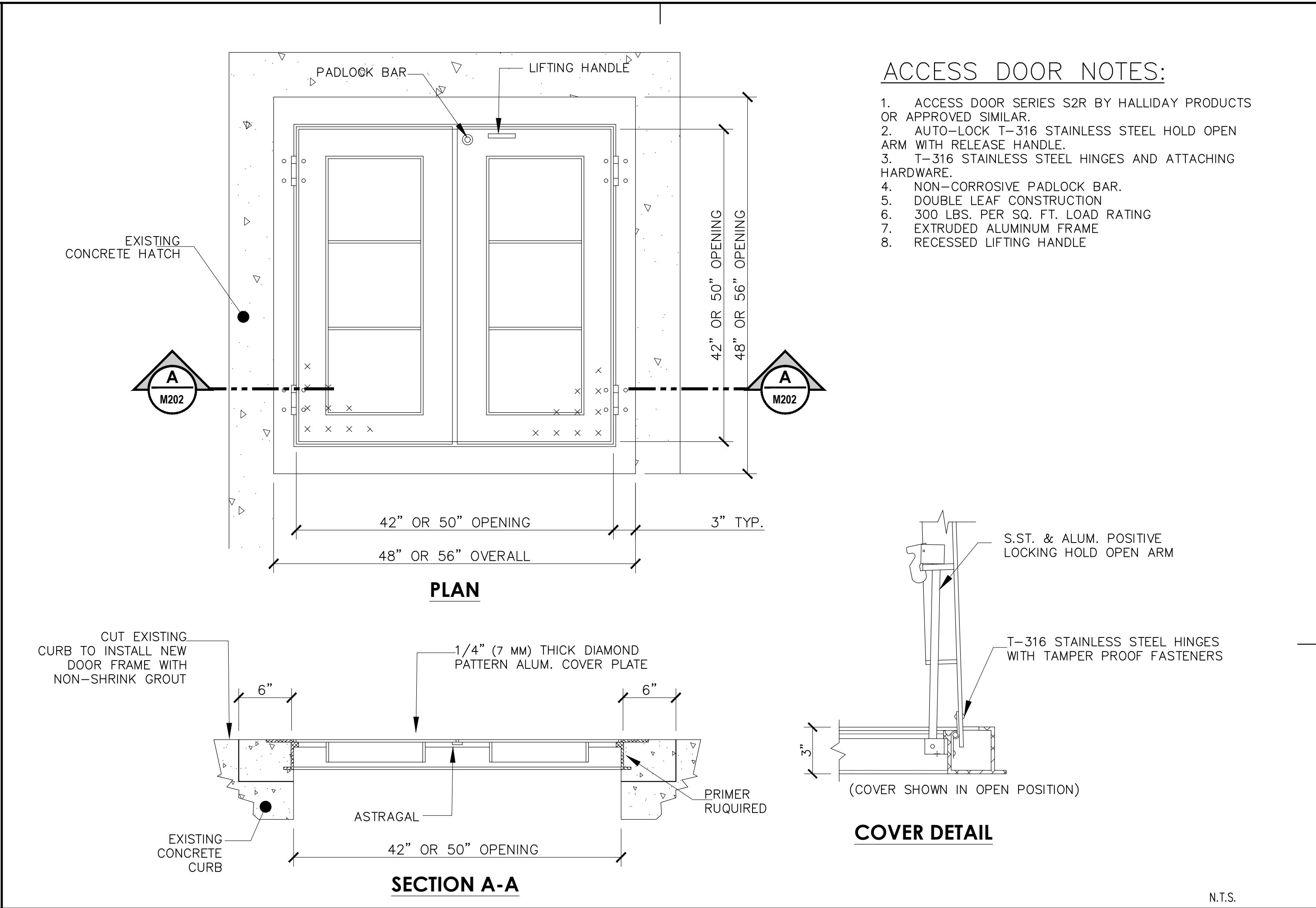
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RWI-M101



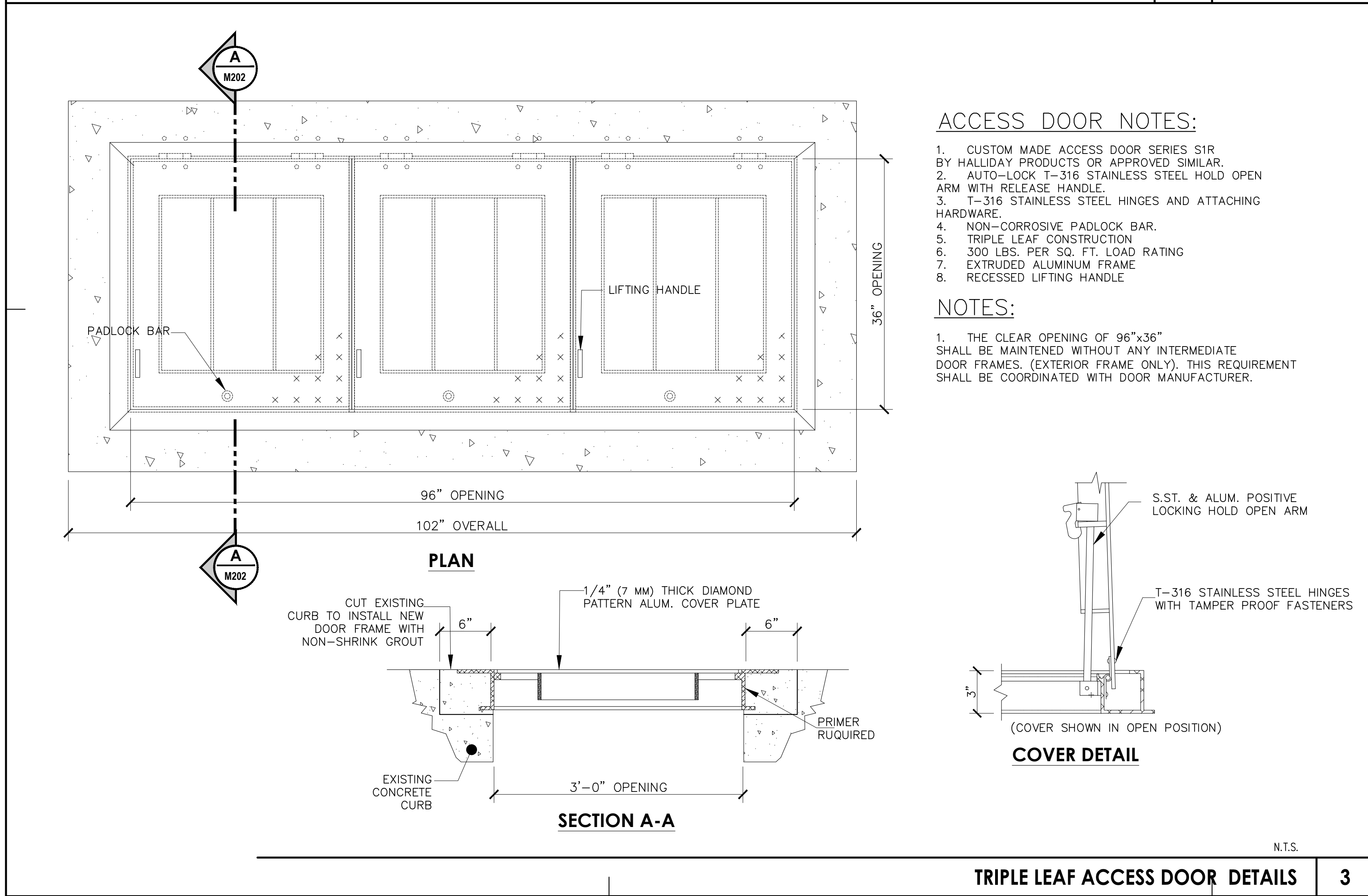
SINGLE LEAF ACCESS DOOR DETAILS

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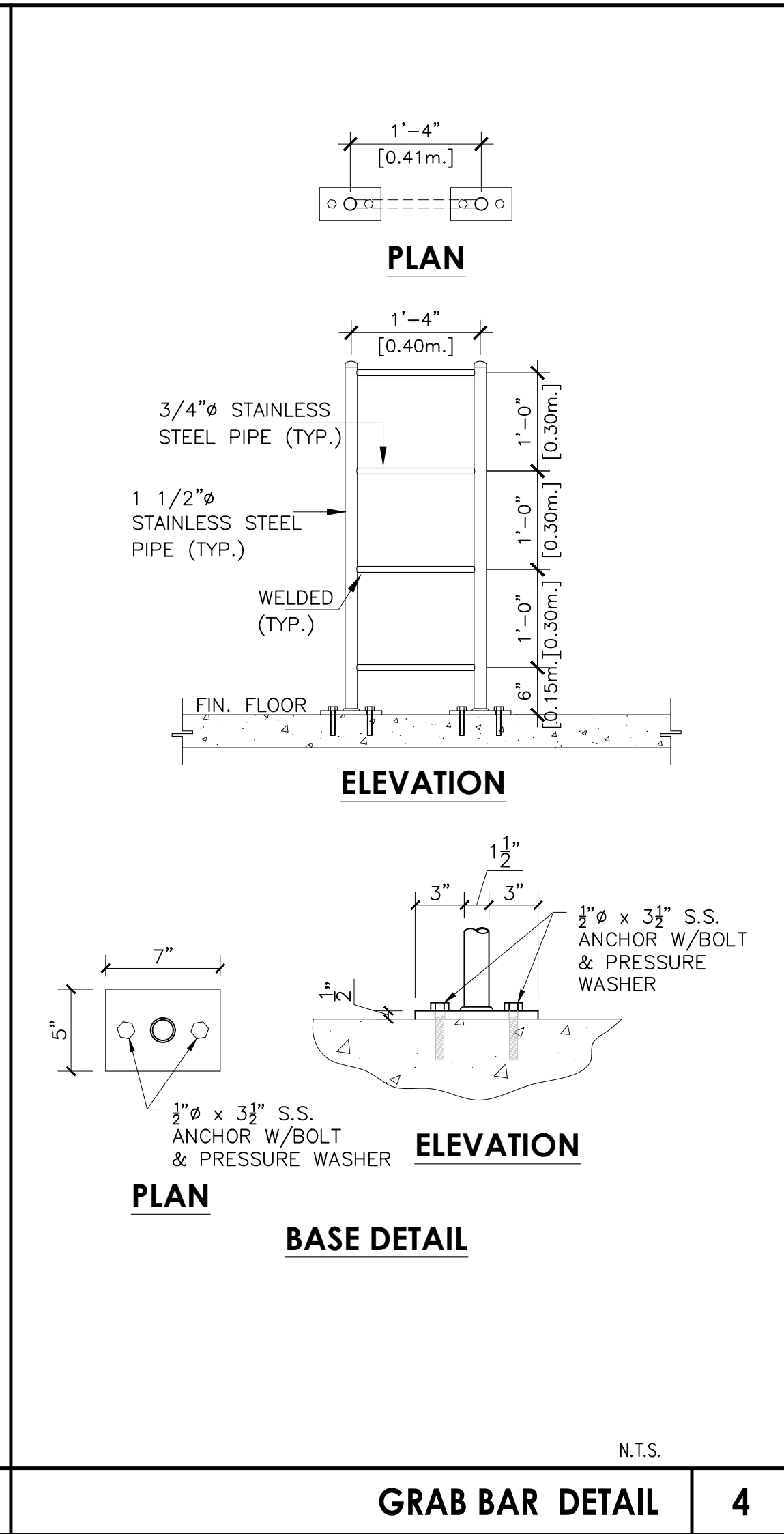
DOUBLE LEAF ACCESS DOOR DETAILS

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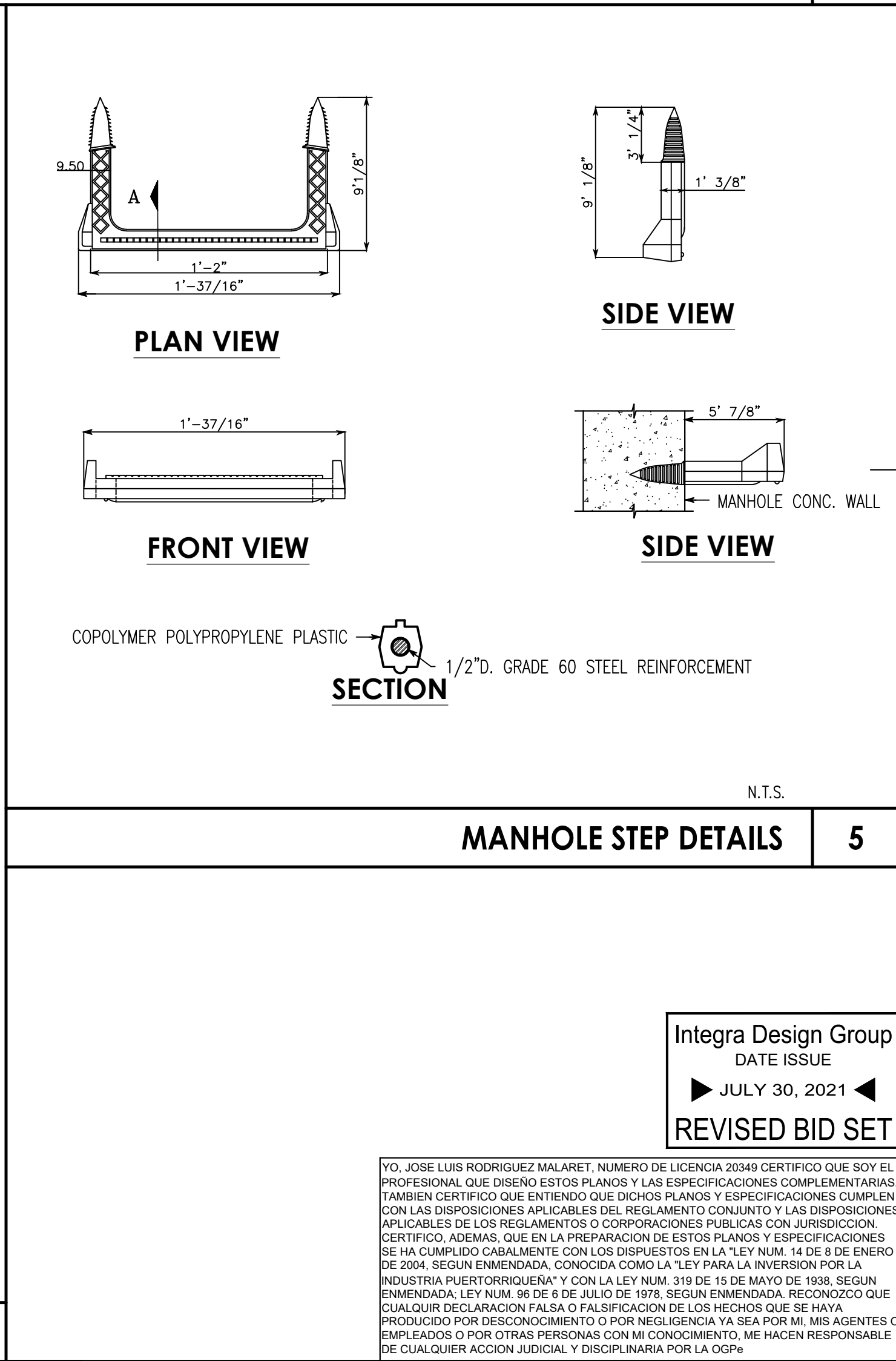
TRIPLE LEAF ACCESS DOOR DETAILS

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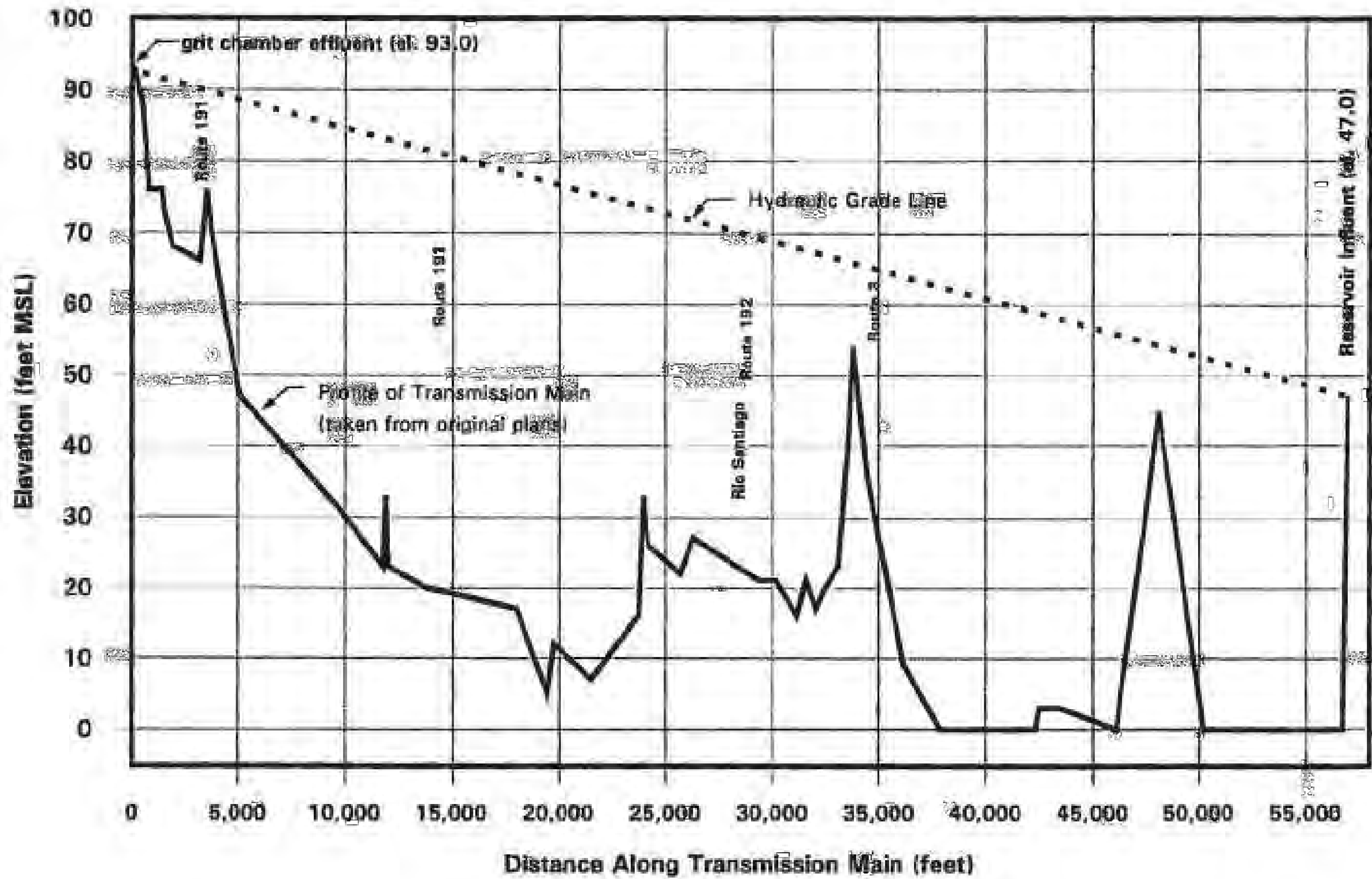
GRAB BAR DETAIL

4



MANHOLE STEP DETAILS

5



RAW WATER LINE HYDRAULIC PROFILE

SCALE: N.T.S.

NOTE:

1. HYDRAULIC PROFILE GRAPH OBTAINED FROM POTABLE WATER SYSTEM EVALUATION STUDY U.S. NAVAL STATION ROOSEVELT ROADS, P.R. PREPARED BY BAKER ENVIRONMENTAL & ROY F. WESTON INC. ON MARCH 1993.

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCURRIR.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

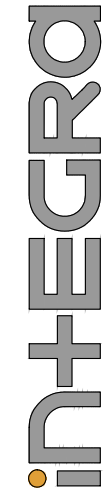
RIO BLANCO WATER INTAKE GRIT CHAMBER

Drawing Title:

RAW WATER LINE HYDRAULIC PROFILE

Sheet:

RWI-M204



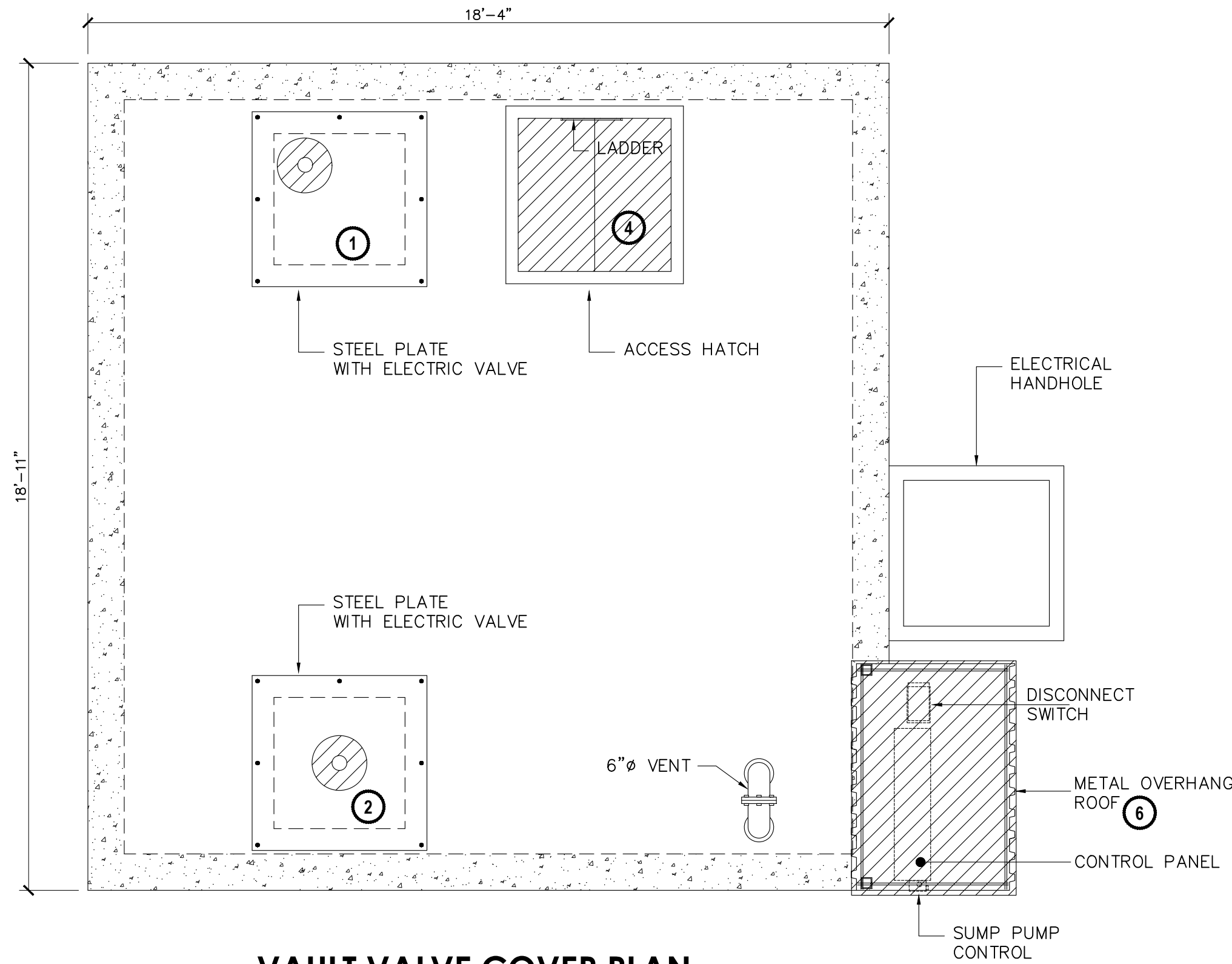
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Revisions

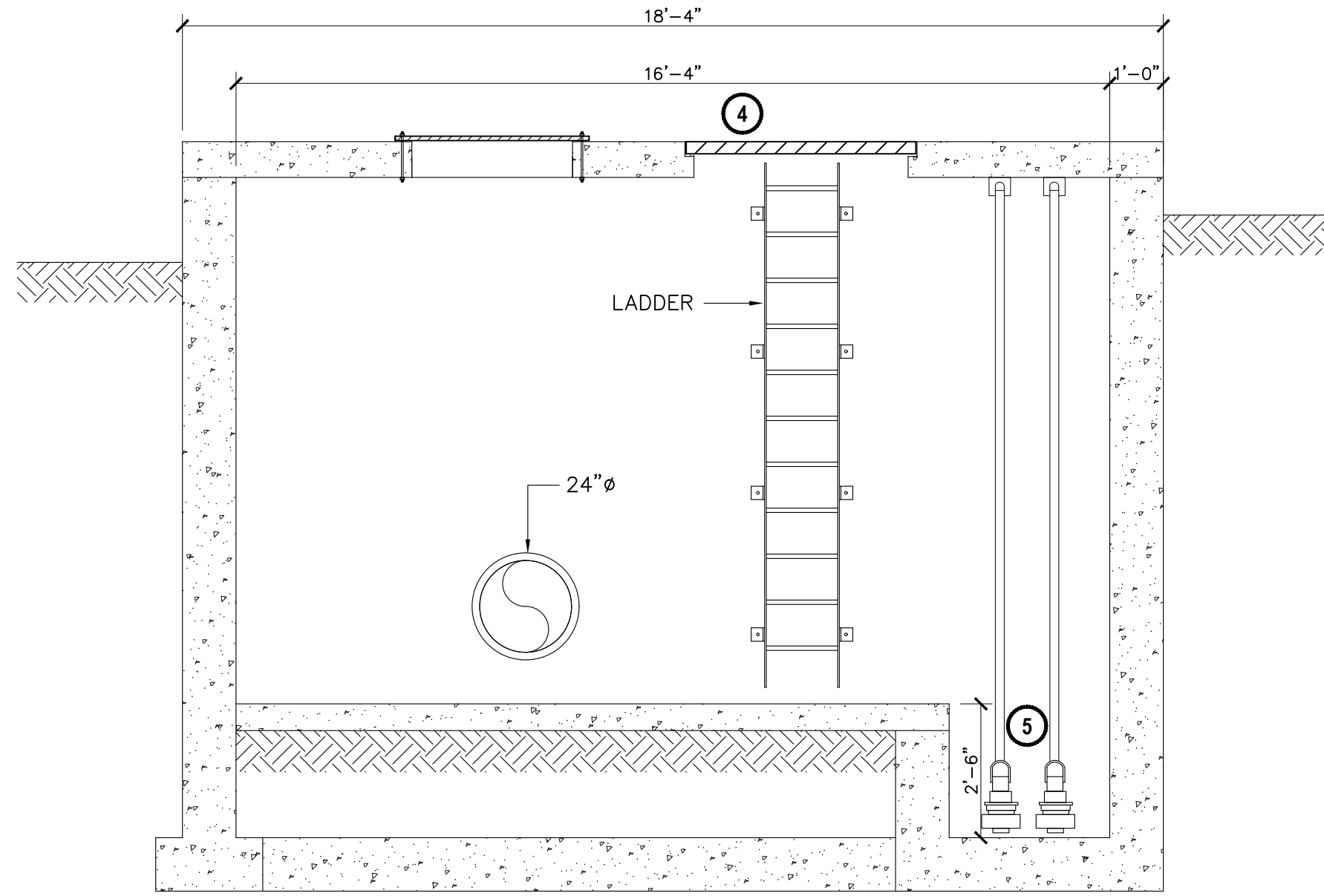
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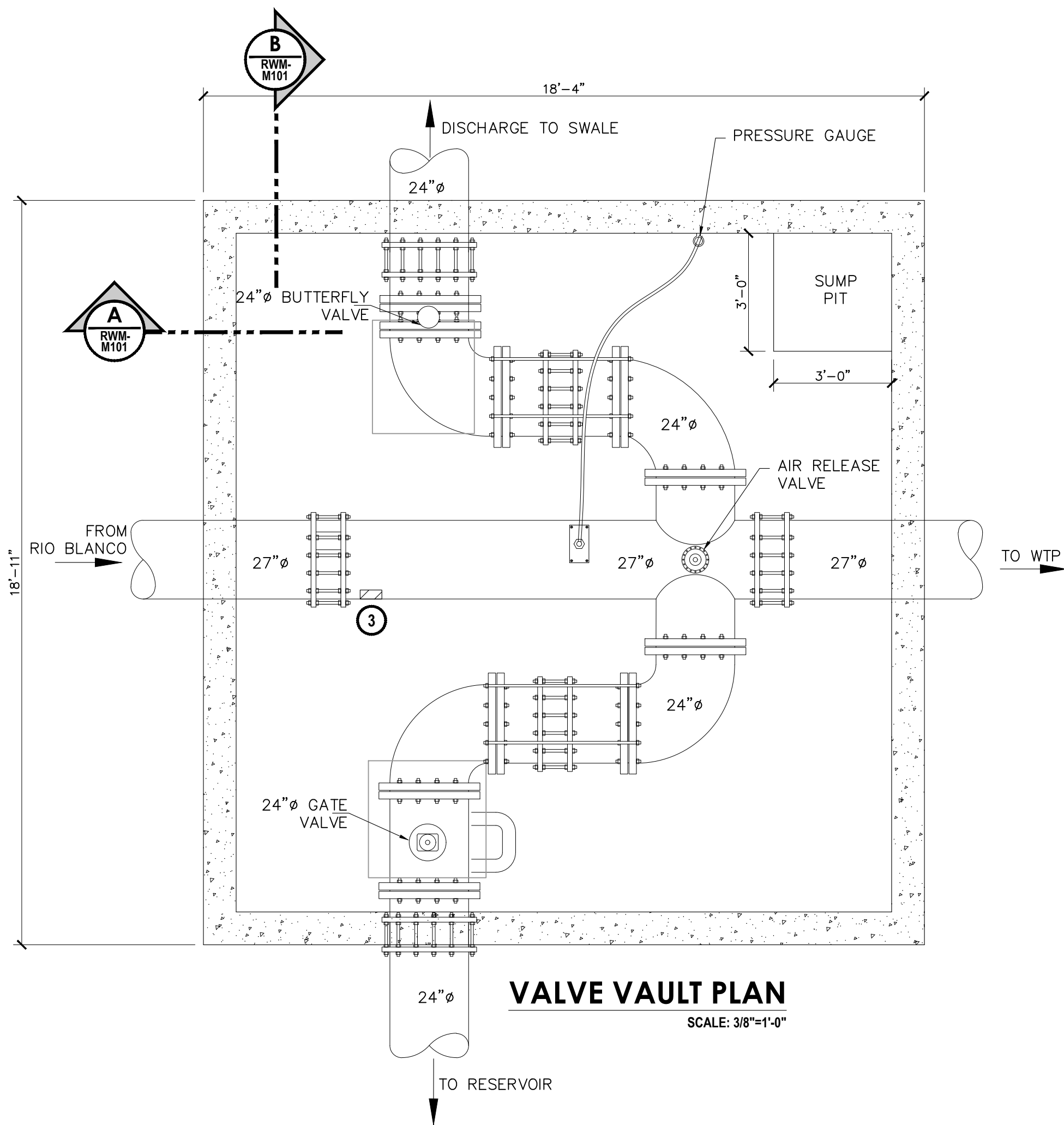
Project No.: 19-1837-0
Set Date: 2021/07/28
Drawn by:
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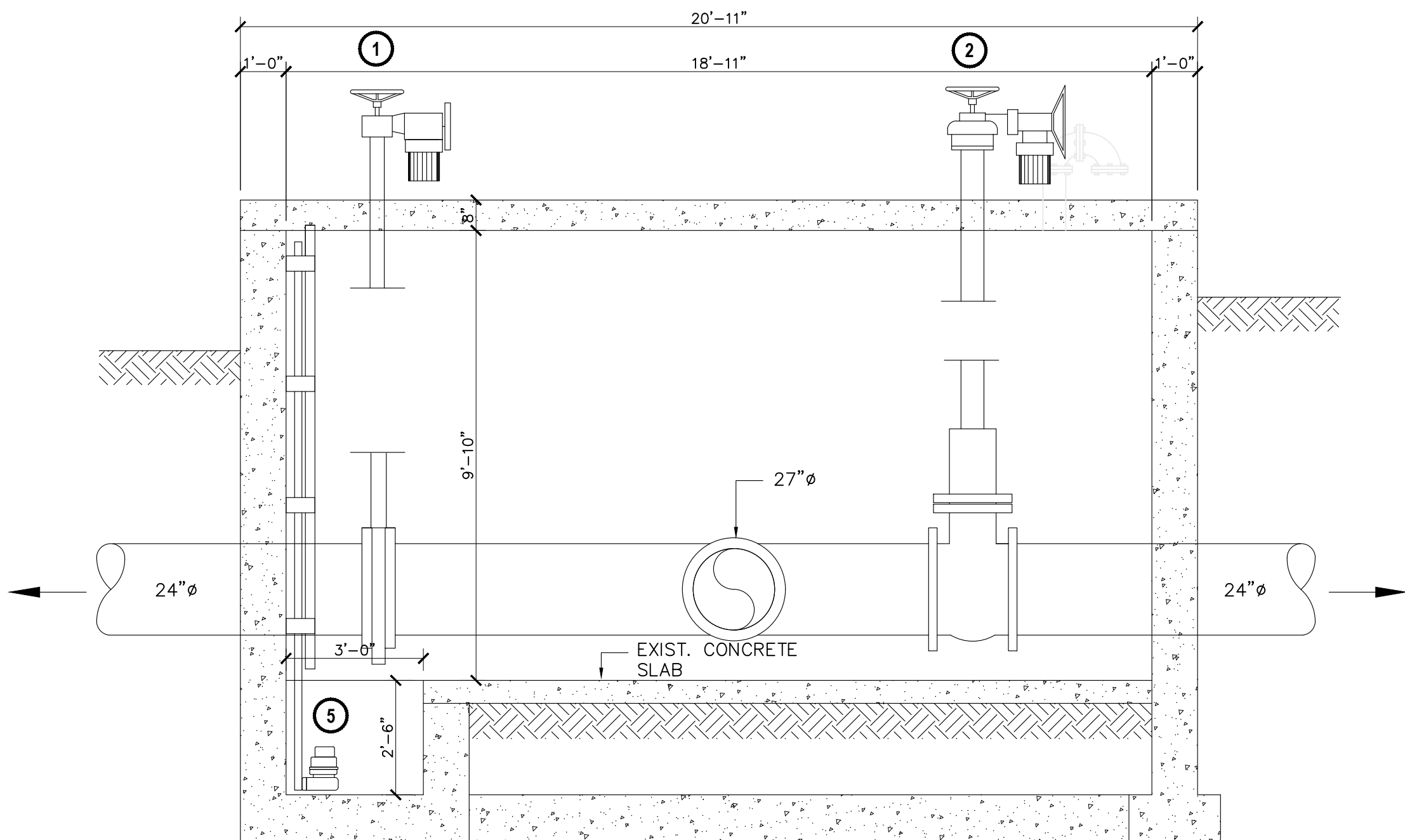
VAULT VALVE COVER PLAN
SCALE: 3/8"=1'-0"



SECTION A
SCALE: 3/8"=1'-0"



VALVE VAULT PLAN
SCALE: 3/8"=1'-0"



SECTION B
SCALE: 3/8"=1'-0"

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- 1 ELECTRIC VALVE ACTUATOR
- 2 ELECTRIC VALVE
- 3 DOPPLER FLOW METER
- 4 ACCESS HATCH DOOR & FRAME
- 5 SUMP PUMPS (2) & ACCESORIES
- 6 METAL OVERHANG ROOF STRUCTURE

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODGP.

GRAPHIC SCALE = 1/4"=1'-0"

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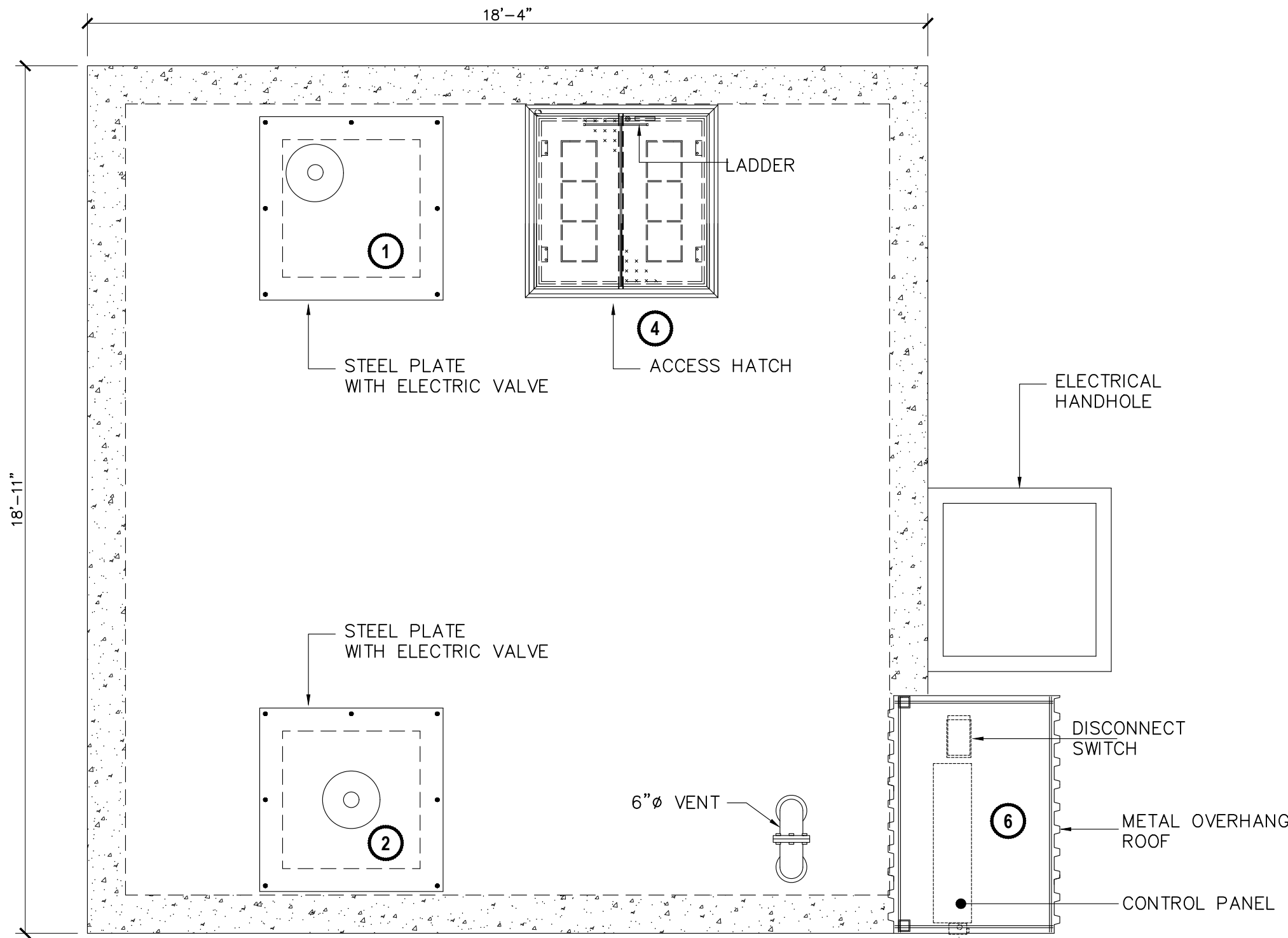
**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

CERBA & NAGUABO, PUERTO RICO
Owner:

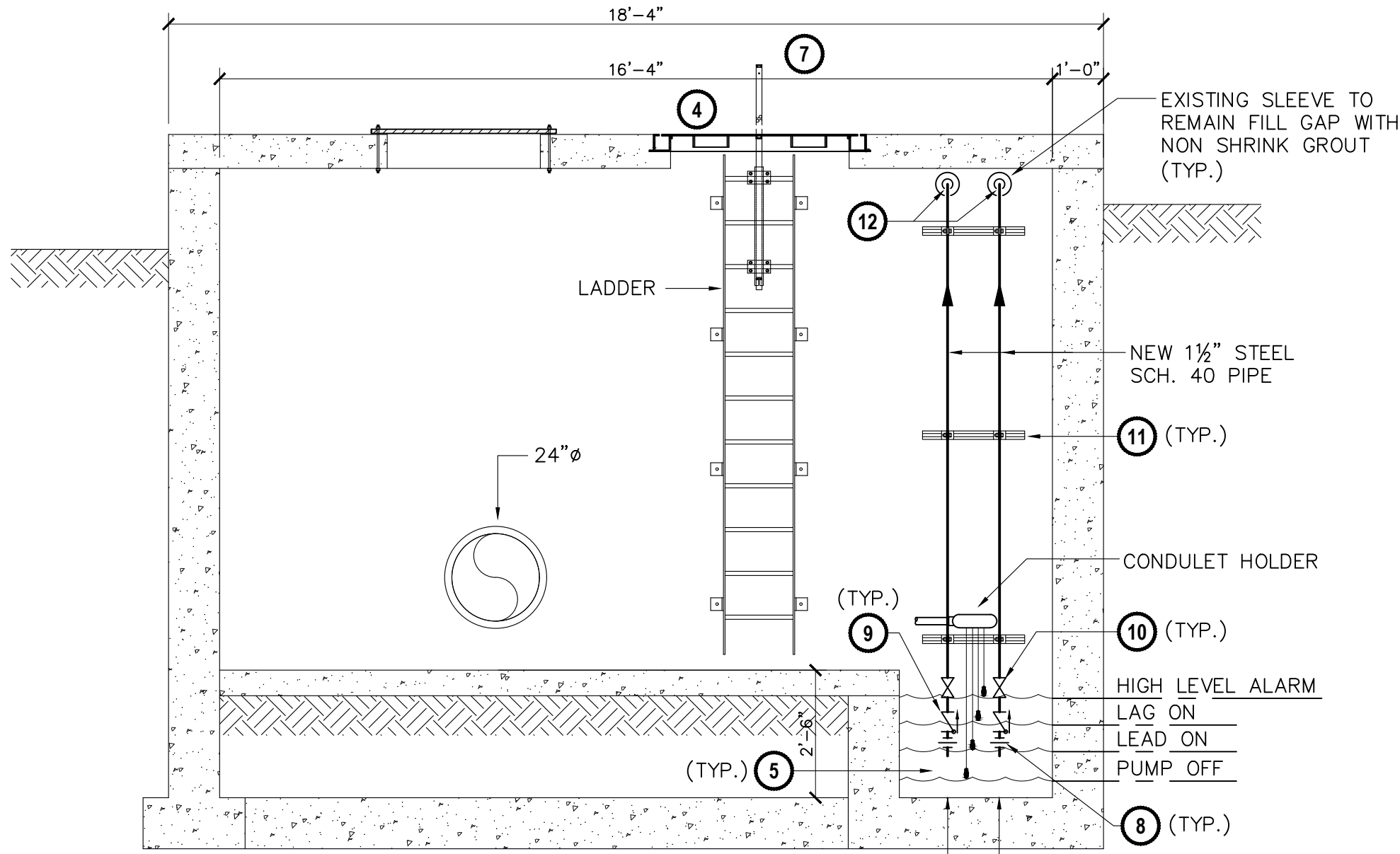
RAW WATER FLOW METER VAULT
Drawing Title:

VAULT EXISTING + DEMOLITION PLAN & SECTIONS

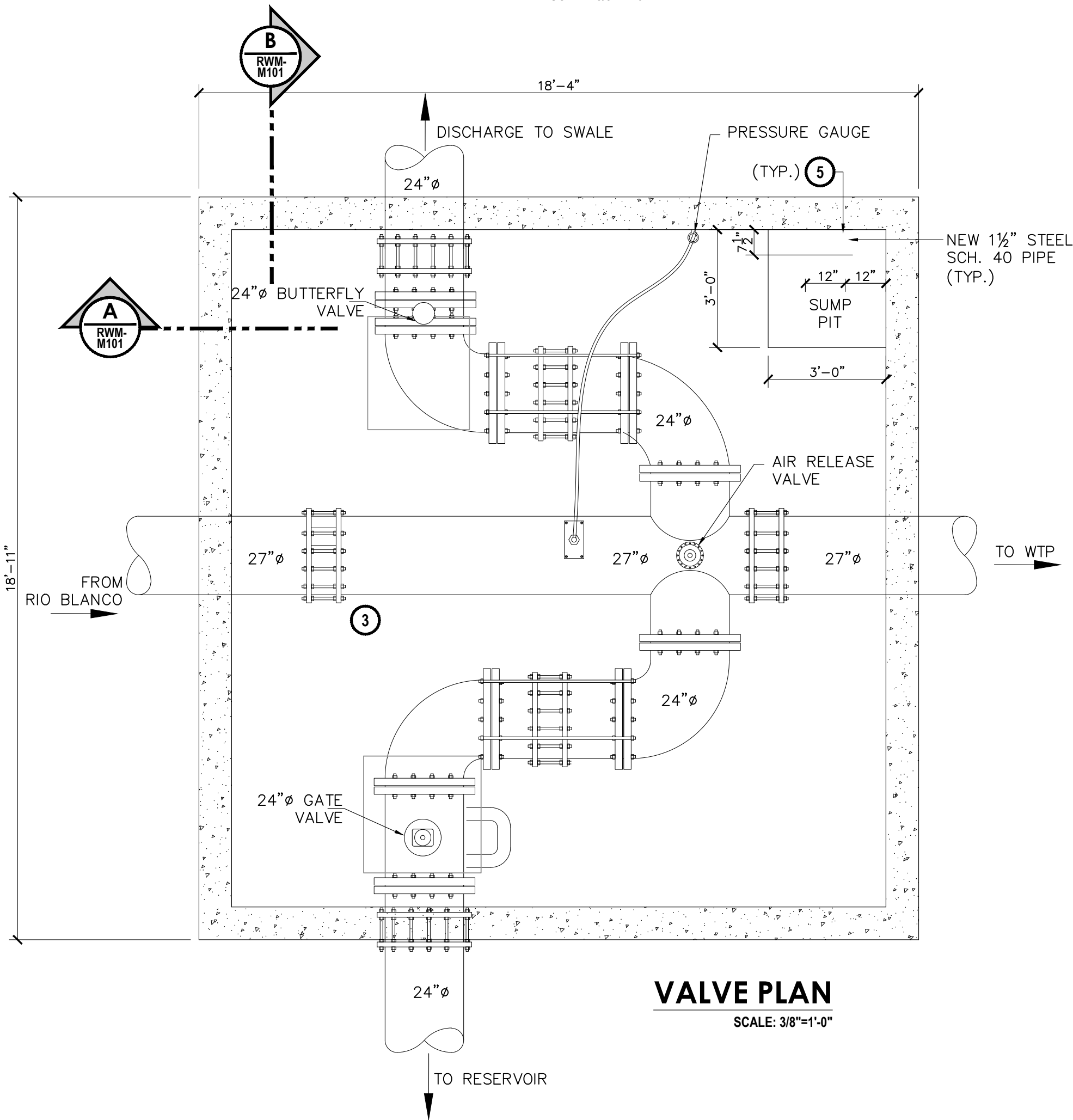
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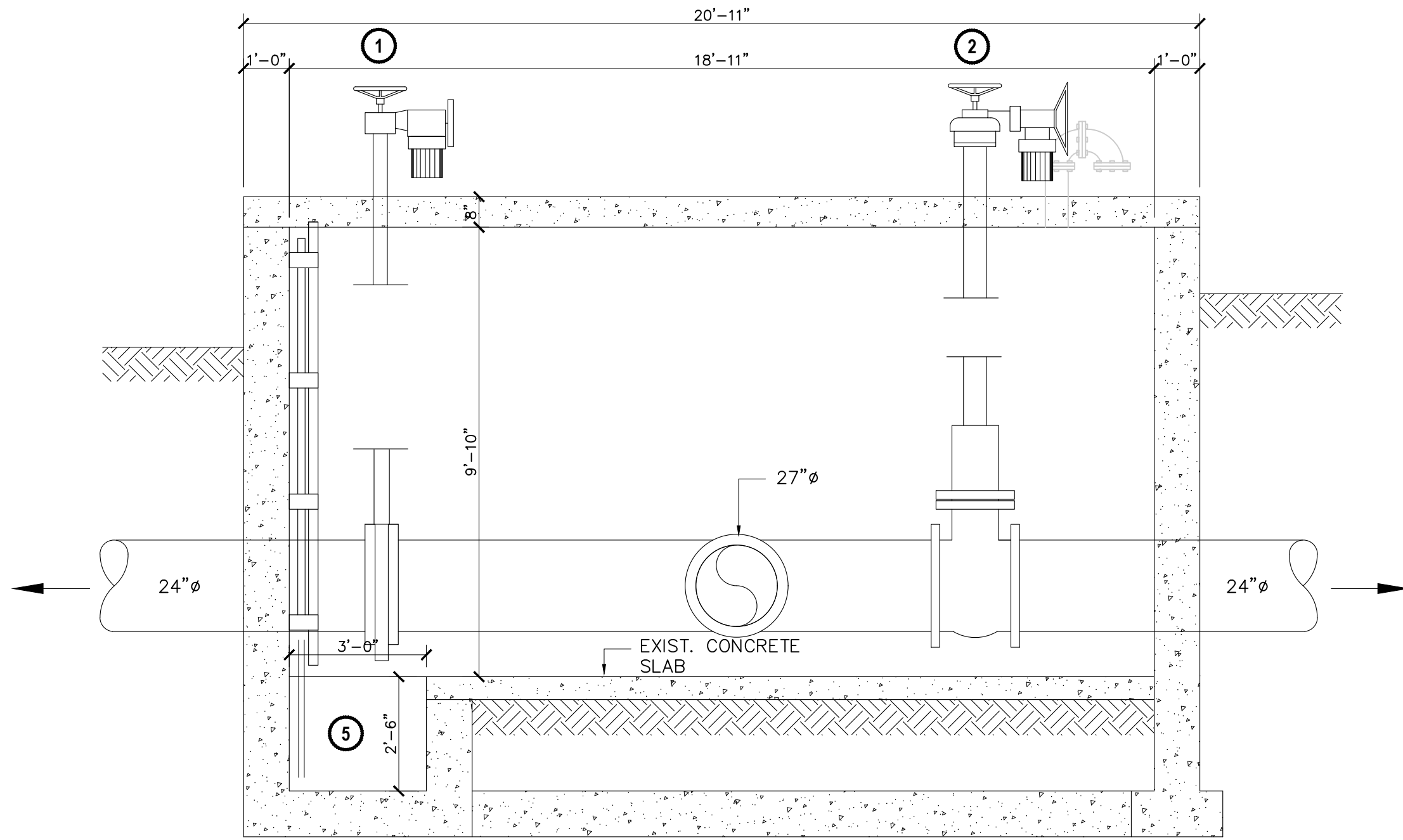
COVER PLAN
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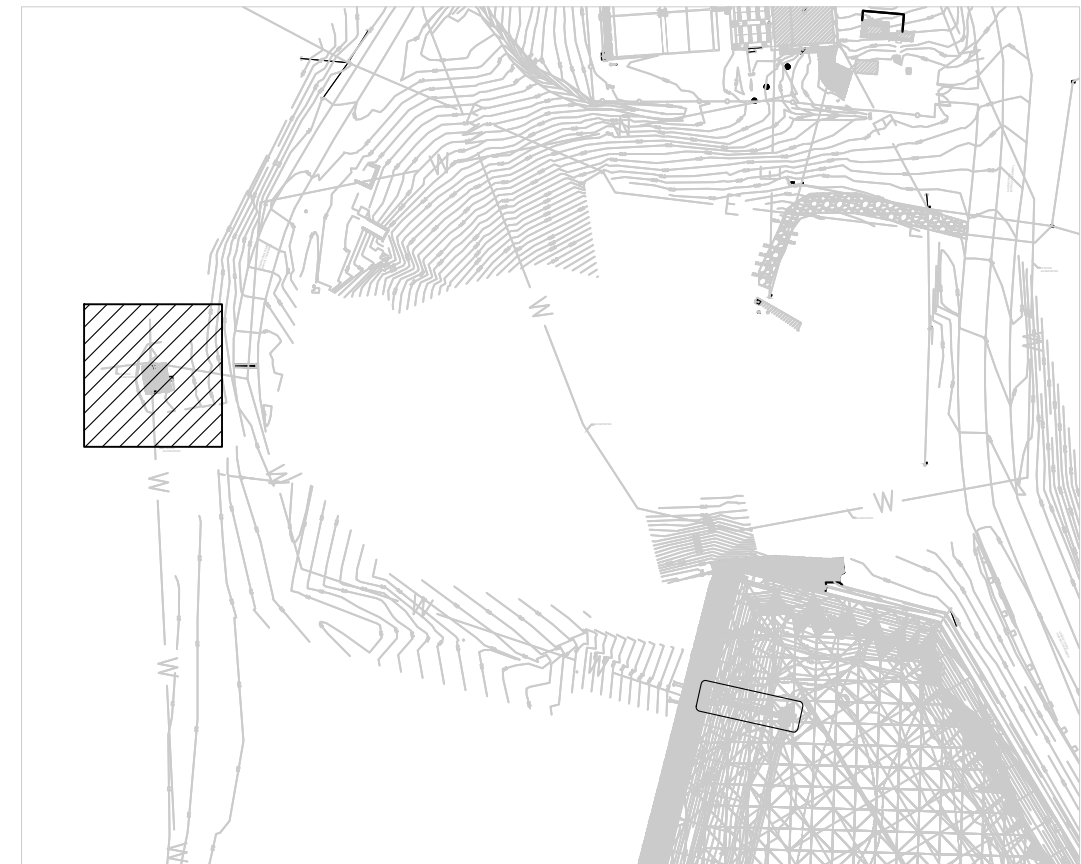
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SCALE: 3/8"=1'-0"
RWM-M201



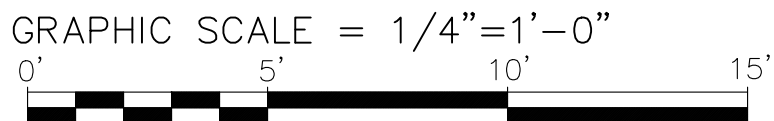
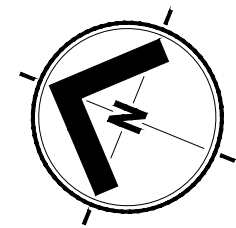
VALVE PLAN
SCALE: 3/8"=1'-0"



SECTION B
SCALE: 3/8"=1'-0"
RWM-M201



KEY PLAN
SCALE: N.T.S.



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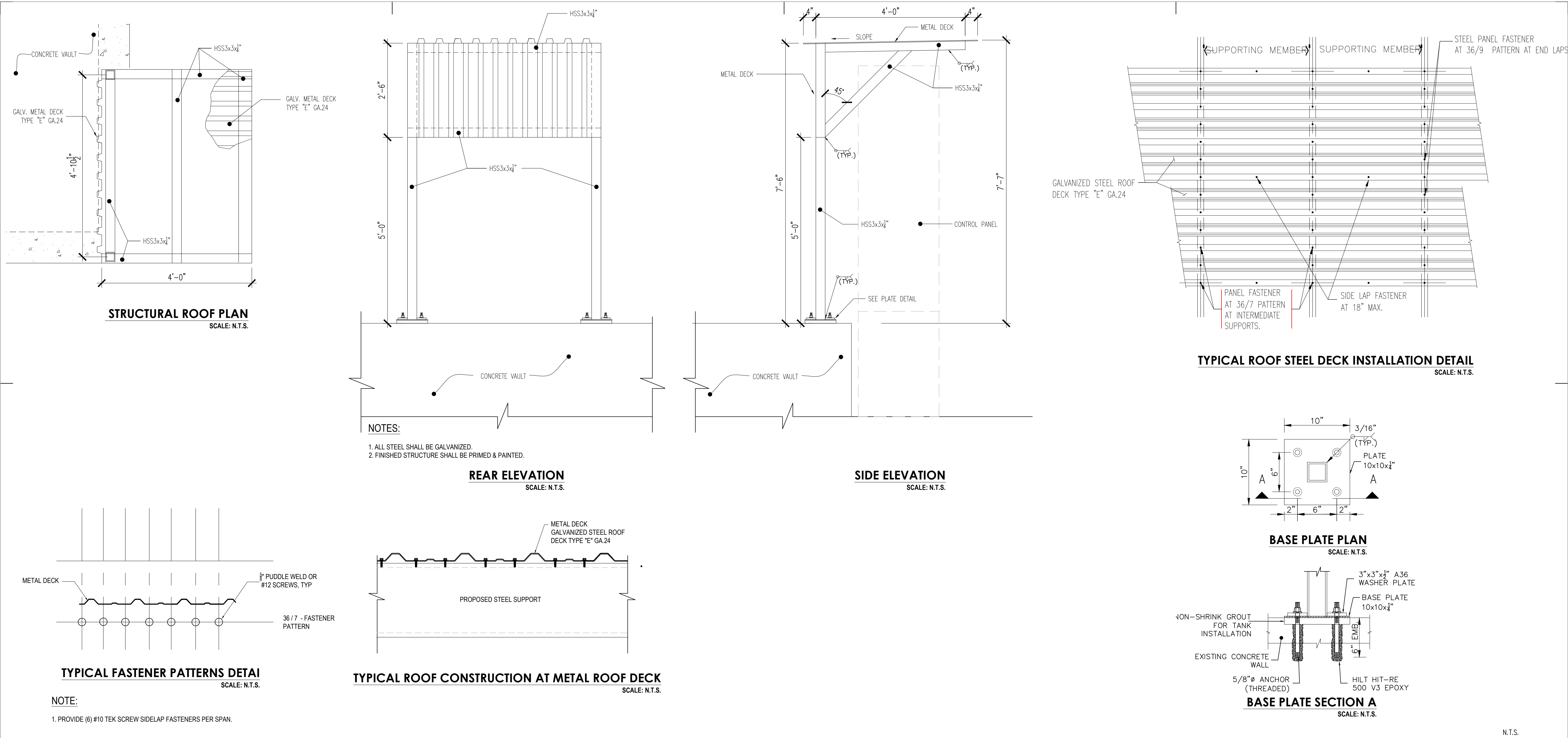
GENERAL NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO ORDERING MATERIALS, EQUIPMENTS AND ACCESSORIES OR BEGINNING CONSTRUCTION.
2. DEMOLITION OR CONSTRUCTION SHALL NOT BE STARTED ON METER VAULT PIPING OR VAULT TOP SLAB UNTIL ALL NEW MATERIALS, EQUIPMENTS AND ACCESSORIES ARE AT THE SITE.
3. MATERIALS, EQUIPMENTS AND ACCESSORIES SHALL BE PRE ASSEMBLED AT THE SITE PRIOR TO INSTALLATION.
4. ALL METERS SHALL BE CALIBRATED AND CERTIFIED PRIOR TO SHIPMENT TO SITE.

SCOPE OF WORKS:

- 1 NEW VALVE PEDESTAL WITH ELECTRIC ACTUATOR FOR 24"Ø BUTTERFLY VALVE.
- 2 NEW VALVE PEDESTAL WITH ELECTRIC ACTUATOR FOR 24" Ø GATE VALVE.
- 3 NEW DOPPLER ULTRASONIC FLOWMETER
- 4 NEW ALUMINUM ACCESS HATCH COVER
- 5 SUMP PUMPS (REFER TO SCHEDULE SEE DWG. RWM-202)
- 6 NEW METAL ROOF (SEE DWG. RWM-M202)
- 7 NEW LADDER EXTENSION
- 8 1½" UNIVERSAL UNION
- 9 1½" CHECK VALVE
- 10 1½" GATE VALVE
- 11 PROVIDE UNISTRUT CHANNEL P5500 WITH PIPE CLAMP
- 12 1½" 90° STEEL ELBOW

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 18-1837-0	Set Date: 20210728
		Drawn by:	Dwg. Date:



NEW METAL ROOF DETAILS

1

ELECTRICAL VALVE ACTUATORS SCHEDULE					
TAG NUM.	MODEL	BRAND	POWER	USE	REMARK
①	LIMITORQUE L-120-7.5WTRA-48	FLOW SERVE	3/60/440	FOR 24" BUTTERFLY VALVE	INTEGRAL CONTROLS W/PUSH BUTTONS
②	LIMITORQUE L-120-10-7.5/B-320-50	FLOW SERVE	3/60/440	FOR 24" GATE VALVE	INTEGRAL CONTROLS W/PUSH BUTTONS

FLOWMETER SCHEDULE					
TAG NUM.	MODEL	BRAND	POWER	USE	REMARK
③	BE 6300 (SENSORS) L1 SENSORS (2)	FLOWMOTION SYSTEM	N/A	FOR 24"Ø STEEL PIPE	INSTALL NEW SENSOR TRANSDUCERS ON EXISTING FLOWMETER COMPUTER

ACCESS COVER SHCHEDULE										
TAG NUM.	OPENING		FRAME		COVER		LEAF	MODEL	BRAND	REMARK
	LENGTH	WIDTH	MATERIAL	GAUGE	MATERIAL	GAUGE				
④	42"	42"	ALUMINUM	-	ALUMINUM	1/4"	DOUBLE	W2R4242	HALLIDAY	-

PUMPS SCHEDULE																	
GENERAL DESCRIPTION						PUMP DATA							MOTOR DATA			REMARKS	QTY.
UNIT NO.	SERVICE	LOCATION	MODEL	MANUFACTURER	REMARKS	TYPE	Q (GPM)	TDH (FT)	IMP. DIA. (IN)	CURVE NO.	WEIGHT (LBS)	BHP	MOTOR HP	MOTOR RPM	V-PH-HZ		
SP-1 & SP-2	SUMP PIT	RAW WATER FLOW METER VALVE PIT	MC1033M	MYERS	CONSTANT	CENTRIFUGAL	20	18	N/A	N/A	22	22	1/3	1,550	115/160	NOTE 1 & 2	2

NOTES:

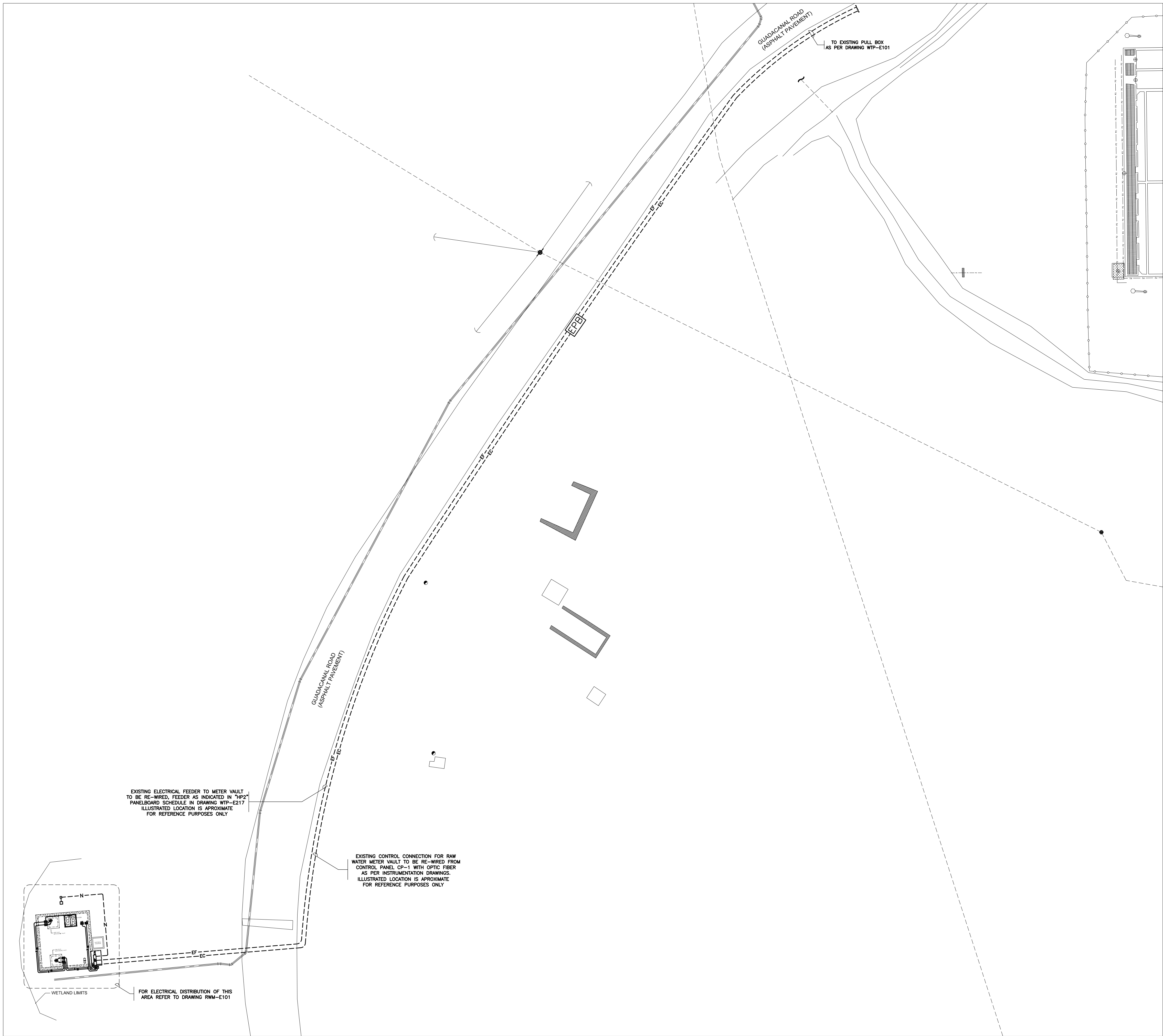
- PUMP SHALL BE FABRICATED AS FOLLOWS:
 - HOUSING/VOLUTE: HEAVY CAST IRON
 - IMPELLER: FIBERGLASS-REINFORCED NYRUL W/ THREADED BRASS INSERT
 - EXTERIOR HARDWARE: STAINLESS STEEL
 - VOLUTE BASE: FIBERGLASS REINFORCED POLYPROPYLENE
 - THERMAL OVERLOAD
 - CARBON/CERAMIC SEALS
- PROVIDE AND INSTALL DUPLEX ELECTRICAL CONTROL PANEL WITH THE FOLLOWING FEATURES:
 - NEMA 4X FIBERGLASS ENCLOSURE
 - ALUMINUM BACK PANEL
 - MAIN CIRCUIT BREAKER
 - HAND-OFF-AUTO SWITCH
 - ALARM TEST SWITCH
 - PUMP(S) RUN LIGHT
 - ALARM BUZZER
 - ALARM LIGHT
 - ALTERNATOR RELAY
 - TIME METER
 - SILENCE SWITCH
 - OVERRIDE RELAY
 - SUITABLE FOR 4 LEVEL FLOATS OPERATION (PUMP OFF, LEAD ON, LAG ON, HIGH LEVEL ALARM)
 - 24 VOLT CONTROL CIRCUITRY

Integra Design Group
DATE ISSUE
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YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA.

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		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	





RAW WATER FLOW METER VAULT
ELECTRICAL SITE PLAN
SCALE: 1:200

IMPORTANT NOTES

- EXISTING OUT OF SERVICE CONTROL PANEL FOR EXISTING RAW WATER METER VAULT SHALL BE REMOVED, EXISTING ELECTRIC CONDUITS FOR ELECTRIC AND CONTROL CONNECTIONS SHALL BE EXTENDED UP TO PANELBOARD "HP2" FOR ELECTRIC CONNECTION AND UP TO "CP-1" FOR CONTROL CONNECTION. ELECTRIC CONNECTION SHALL BE RE-WIRED FROM "HP-2" PANELBOARD UP TO RAW WATER METER VAULT AS DESCRIBED ON PANELBOARD SCHEDULE. CONTROL CONNECTION SHALL BE RE-WIRED FROM "CP-1" UP TO RAW WATER METER VAULT WITH OPTIC FIBER AS DESCRIBED ON INSTRUMENTATION DRAWINGS.
- EXISTING ELECTRICAL FACILITIES SHALL BE REMOVED AND DISPOSED EXCEPT INDICATED TRANSFORMERS TO BE RE-INSTALLED.
- FOR SITE SYMBOLS REFER TO DRAWINGS WTP-E100 AND FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION SYMBOLS REFER TO DRAWING WTP-E218.



Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIACION 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by:
Dwg. Date:

Ing. Ricardo Ortiz Garcia
Lic. no. 12448 P.R.
P.O. Box 1286, San Juan, P.R. 00954-1 Tel. (787) 810-3100 Fax. (787) 810-6800

Revisions

Number	Date	Description
1		
2		
3		
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SHEET INFO.

Project No.: 19-1637.0

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Drawn by:

Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads



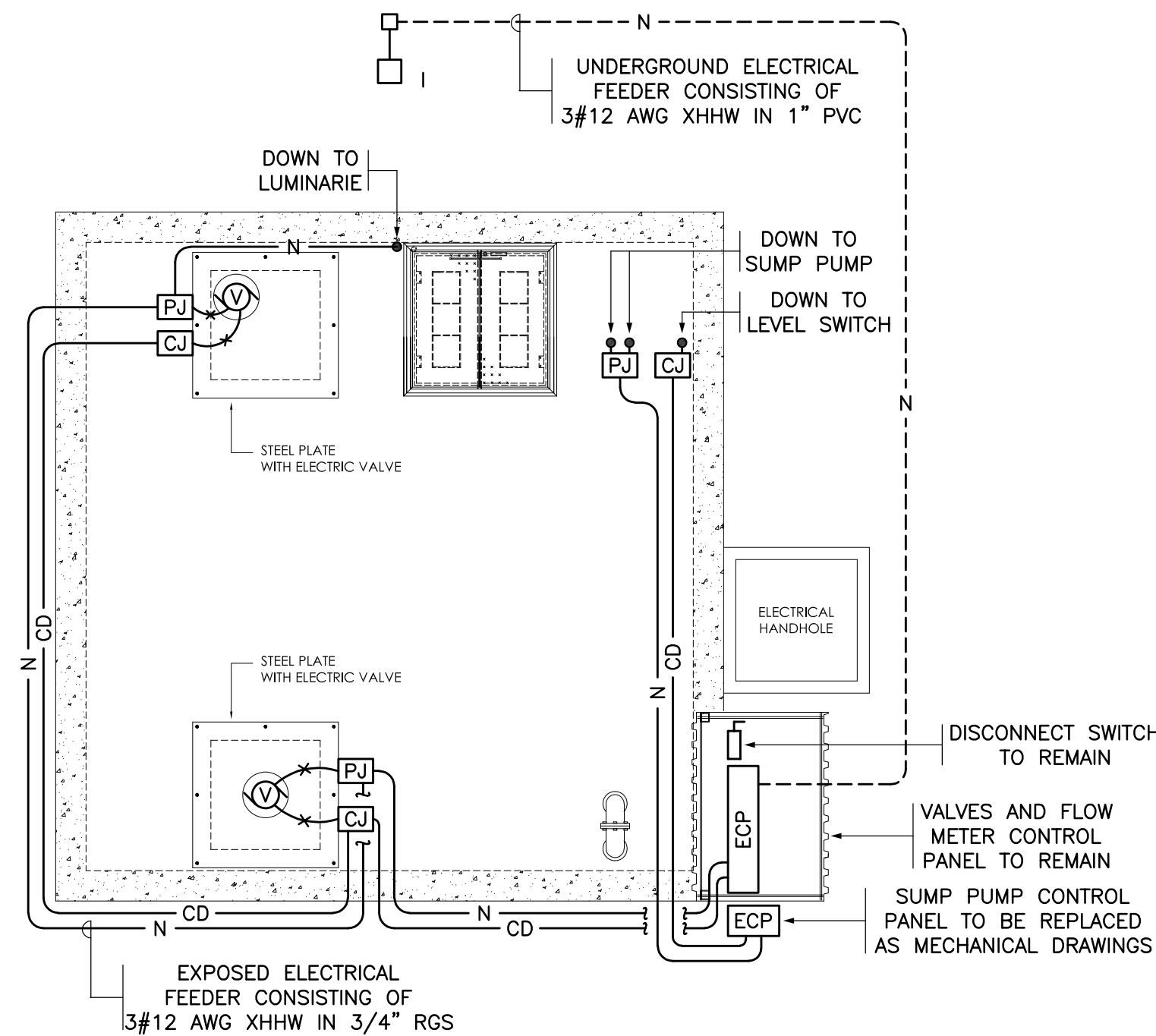
RAW WATER FLOW METER VAULT

Drawing Title:

ELECTRICAL SITE PLAN

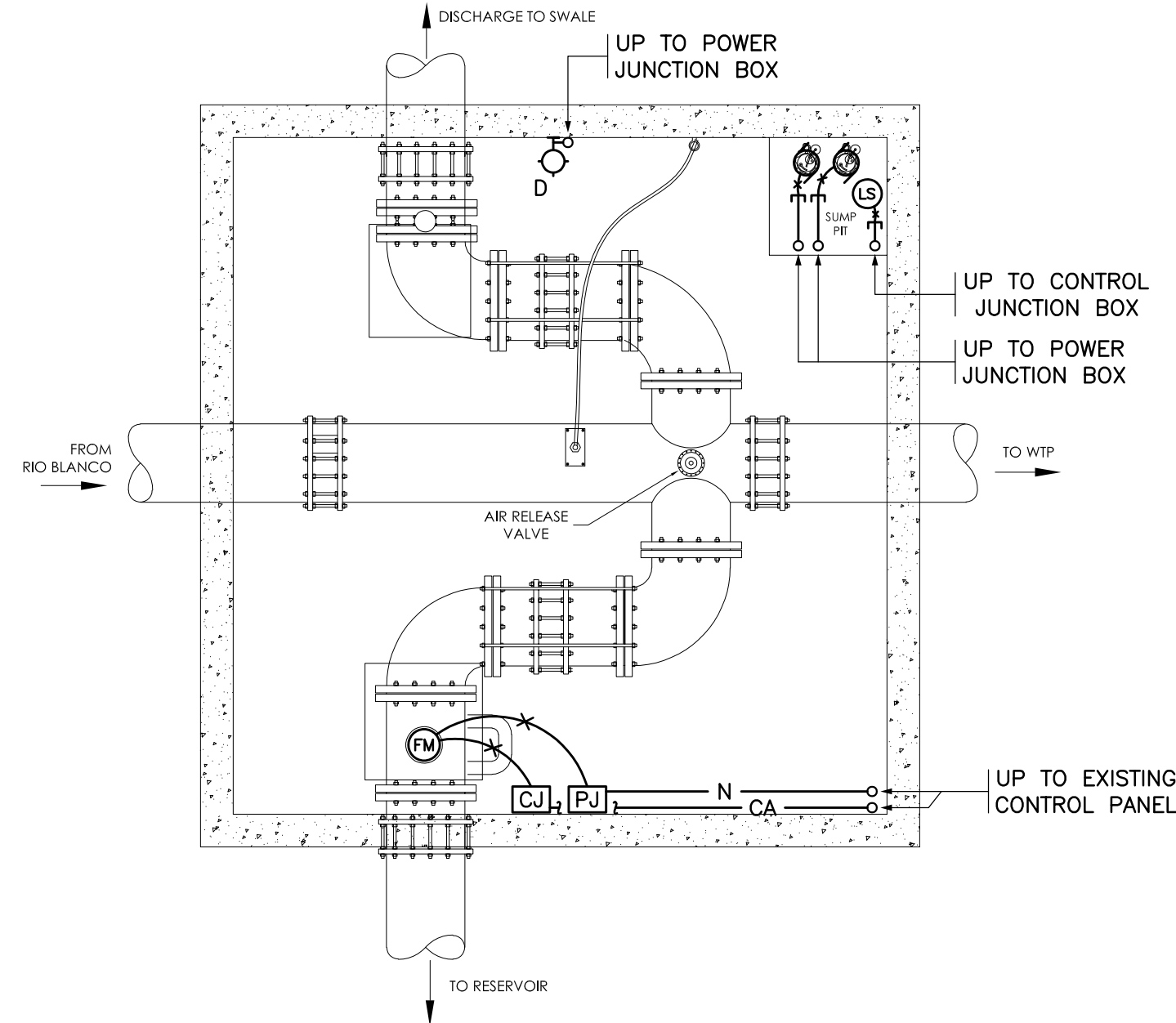
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RWM-E100



RAW WATER FLOW METER VAULT TOP PLAN
ELECTRICAL DISTRIBUTION

SCALE: 1/4"=1'-0"



RAW WATER FLOW METER VAULT BOTTOM PLAN
ELECTRICAL DISTRIBUTION

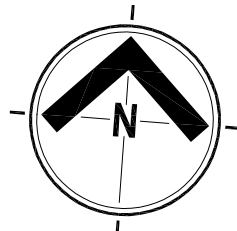
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IMPORTANT NOTES

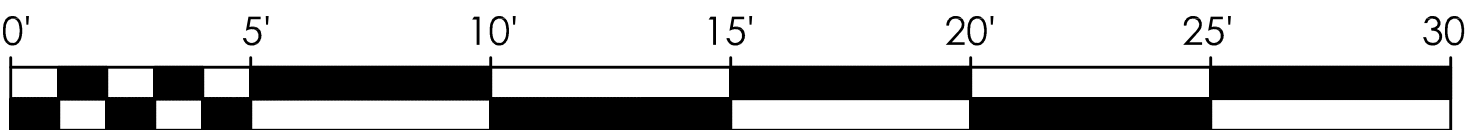
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- EXISTING ELECTRICAL FACILITIES SHALL BE REMOVED AND DISPOSED EXCEPT INDICATED EQUIPMENTS TO BE RE-INSTALLED OR REMAIN.
- FOR SITE SYMBOLS REFER TO DRAWINGS WTP-E100 AND FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION SYMBOLS REFER TO DRAWING WTP-E218.



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DATE ISSUE
JULY 30, 2021
BID SET



GRAPHIC SCALE = 1/4"=1'-0"



Ricardo Ortiz Garcia & Assoc., P.S.C.

Consulting Engineers

Project No.: 19-1637.0

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Dwg. Date:

Ing. Ricardo Ortiz Garcia

Lic. no. 12448 P.E.

P.O. Box 1286 San Juan, P.R. 00954-1 Tel. (787) 810-3100 Fax. (787) 810-6060

Revisions

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GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

Owner

RAW WATER FLOW METER VAULT

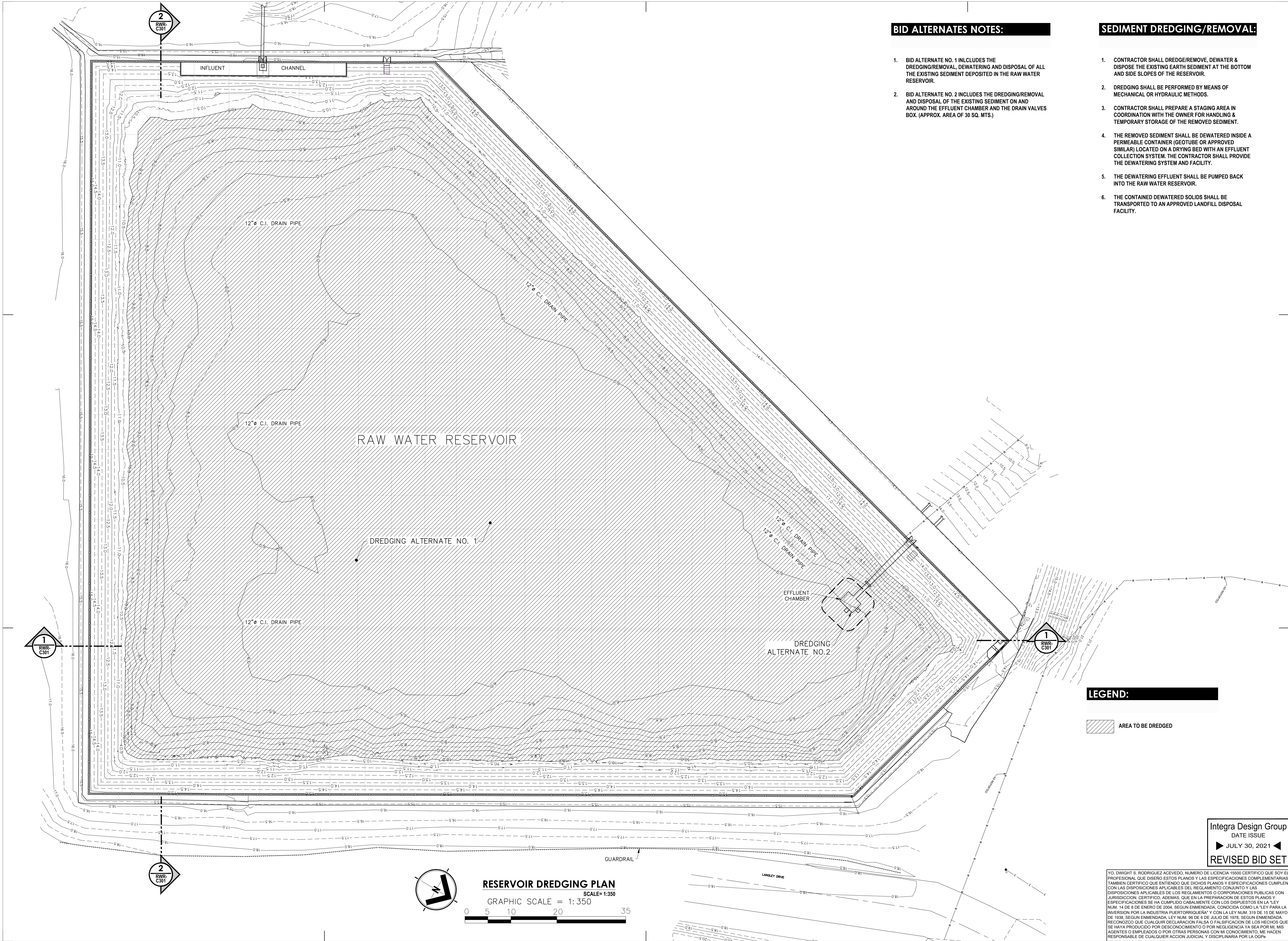
Drawing Title:

ELECTRICAL DISTRIBUTION PLAN

Project Title:

Sheet:

RWM-E101



BID ALTERNATES NOTES:

- BID ALTERNATE NO. 1 INCLUDES THE DREDGING/REMOVAL, DEWATERING AND DISPOSAL OF ALL THE EXISTING SEDIMENT DEPOSITED IN THE RAW WATER RESERVOIR.
- BID ALTERNATE NO. 2 INCLUDES THE DREDGING/REMOVAL AND DISPOSAL OF THE EXISTING SEDIMENT ON AND AROUND THE EFFLUENT CHAMBER AND THE DRAIN VALVES BOX. (APPROX. AREA OF 30 SQ. MTS.)

SEDIMENT DREDGING/REMOVAL:

- CONTRACTOR SHALL DREDGE/REMOVE, DEWATER & DISPOSE THE EXISTING EARTH SEDIMENT AT THE BOTTOM AND SIDE SLOPES OF THE RESERVOIR.
- DREDGING SHALL BE PERFORMED BY MEANS OF MECHANICAL OR HYDRAULIC METHODS.
- CONTRACTOR SHALL PREPARE A STAGING AREA IN COORDINATION WITH THE OWNER FOR HANDLING & TEMPORARY STORAGE OF THE REMOVED SEDIMENT.
- THE REMOVED SEDIMENT SHALL BE DEWATERED INSIDE A PERMEABLE CONTAINER (GEOTUBE OR APPROVED SIMILAR) LOCATED ON A DRYING BED WITH AN EFFLUENT COLLECTION SYSTEM. THE CONTRACTOR SHALL PROVIDE THE DEWATERING SYSTEM AND FACILITY.
- THE DEWATERING EFFLUENT SHALL BE PUMPED BACK INTO THE RAW WATER RESERVOIR.
- THE CONTAINED DEWATERED SOLIDS SHALL BE TRANSPORTED TO AN APPROVED LANDFILL DISPOSAL FACILITY.

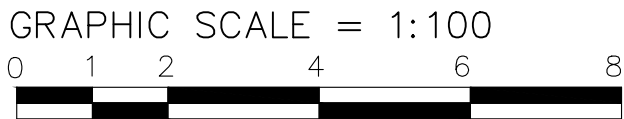
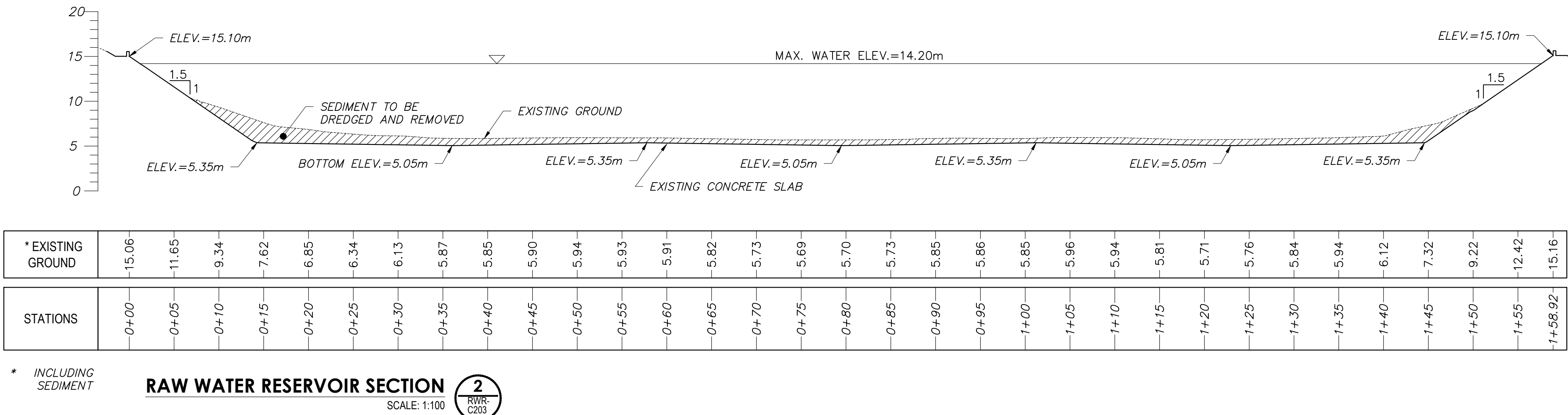
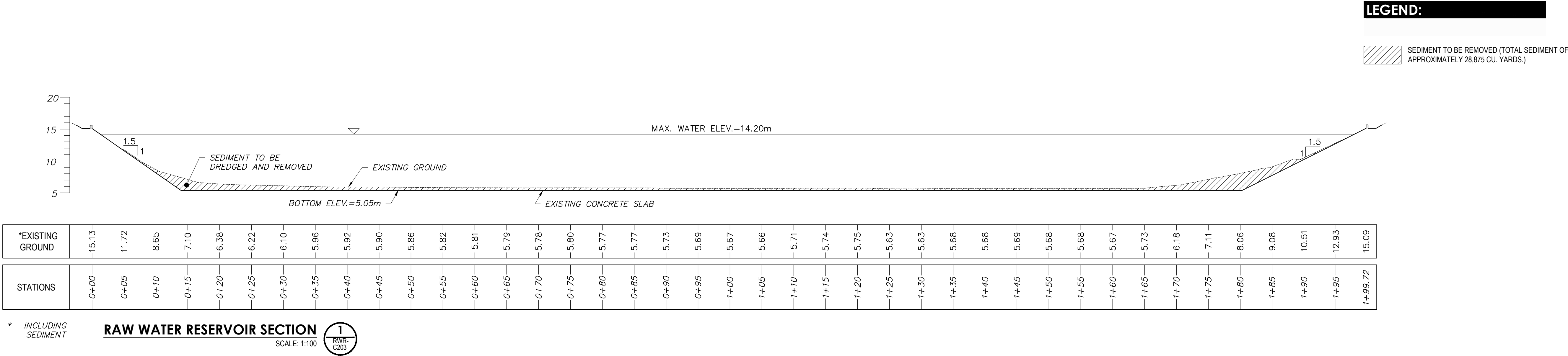
LEGEND:

AREA TO BE DREDGED

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YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADAMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 9 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OSPA.

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GOVERNMENT OF PUERTO RICO

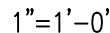
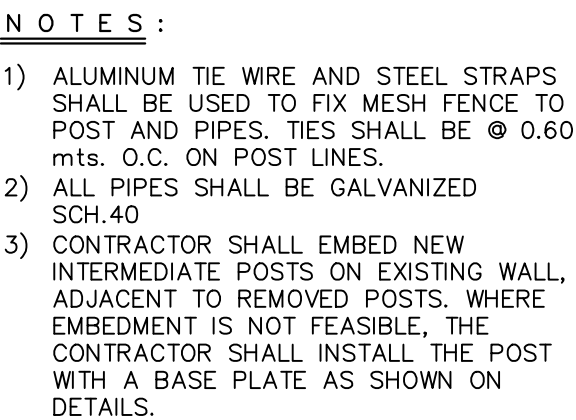
Local Redevelopment Authority
for Roosevelt Roads

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CERRA & NAGUARO, PUERTO RICO

RAW WATER RESERVOIR

Drawing Title:



1

2



3



4

(9) 3 STRAND BARBED WIRE (WHERE APPLIES)

REVISÉD BID SE

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY E PROFESIONAL, QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS PARA EL PROYECTO DE CONSTRUCCION DEL EDIFICIO ANTES MENCIONADO, EN SU CUMPLIMIENTO CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADAMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES NO HE INCURRIDO EN FALSA DECLARACION NI EN FALSIFICACION. LEY N° 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO "LA LEY PARA LA INVERSION POR LA INDUSTRIA PRODUCTORRIQUENA" Y CON LA LEY N° 319 DE 15 DE MAYO DE 2006, CONOCIDA COMO "LA LEY PARA EL DESARROLLO ECONOMICO". RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONECIMIENTO O POR NEGLIGENCIA YA SEA POR MI PARTE, ME HARIA RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OFERTA.

Revisions

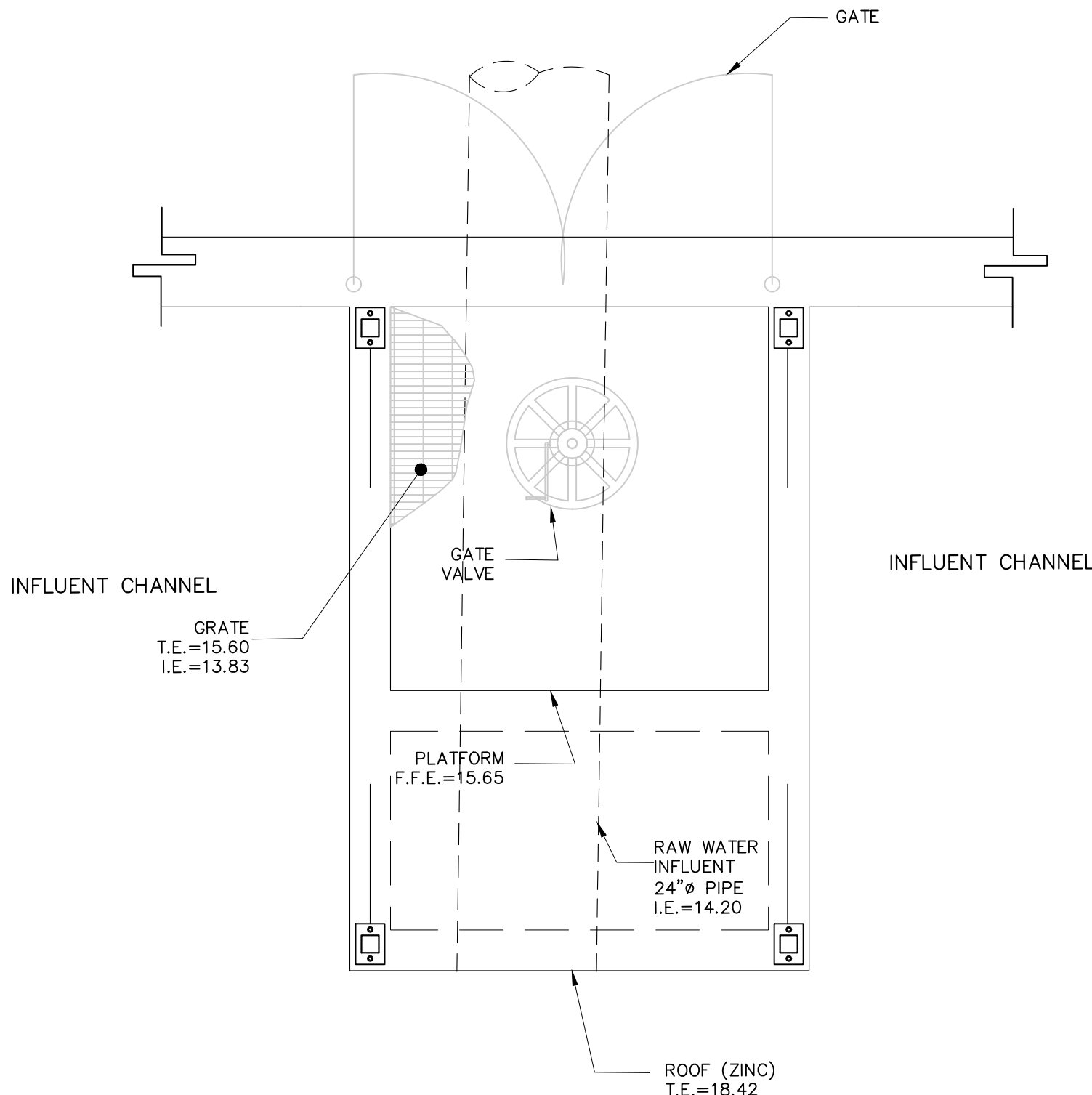


WATER INFRASTRUCTURE IMPROVEMENTS AT ROOSEVELT ROADS RE-DEVELOPMENT

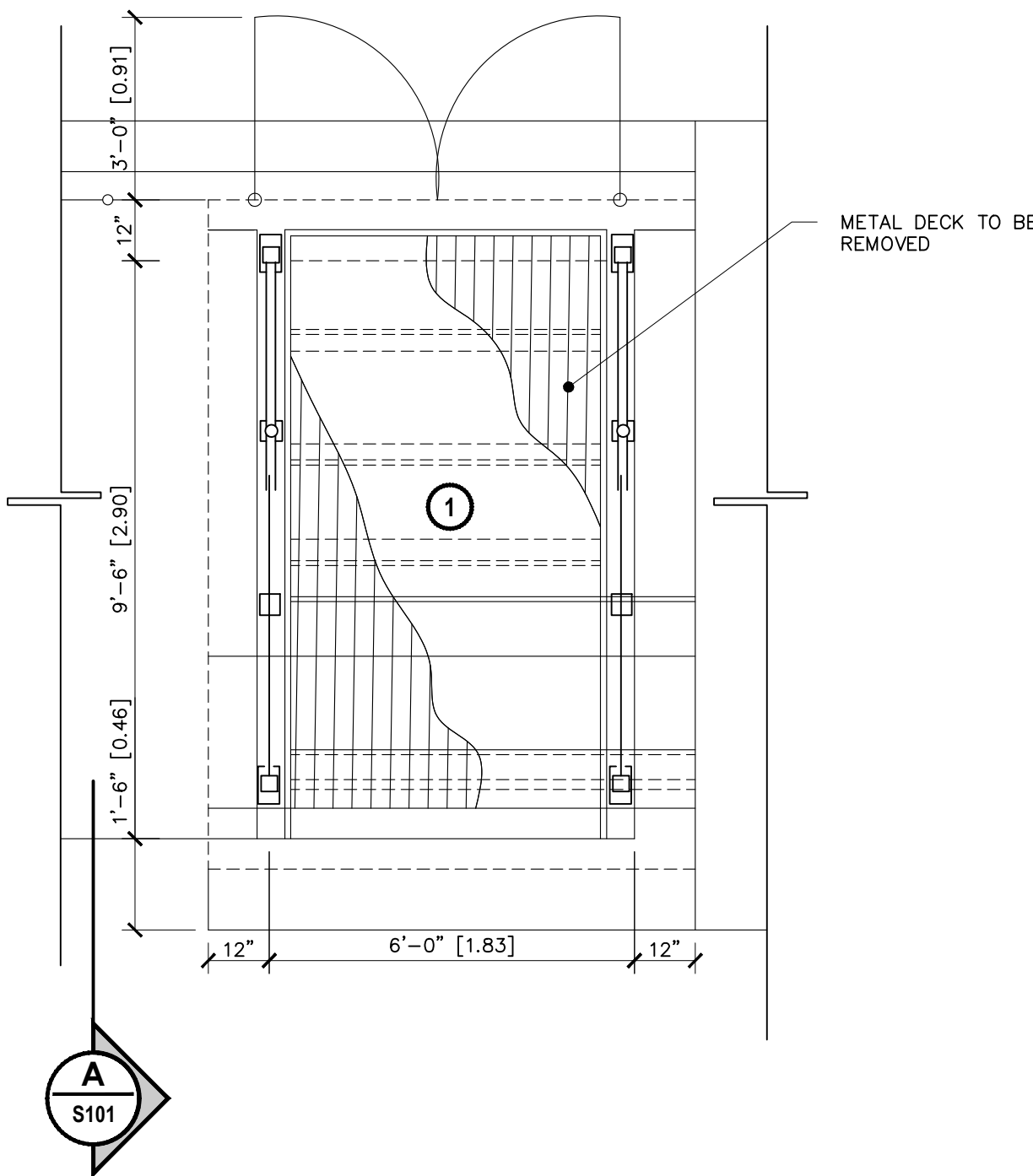
RAW WATER RESERVOIR

CIVIL DETAILS

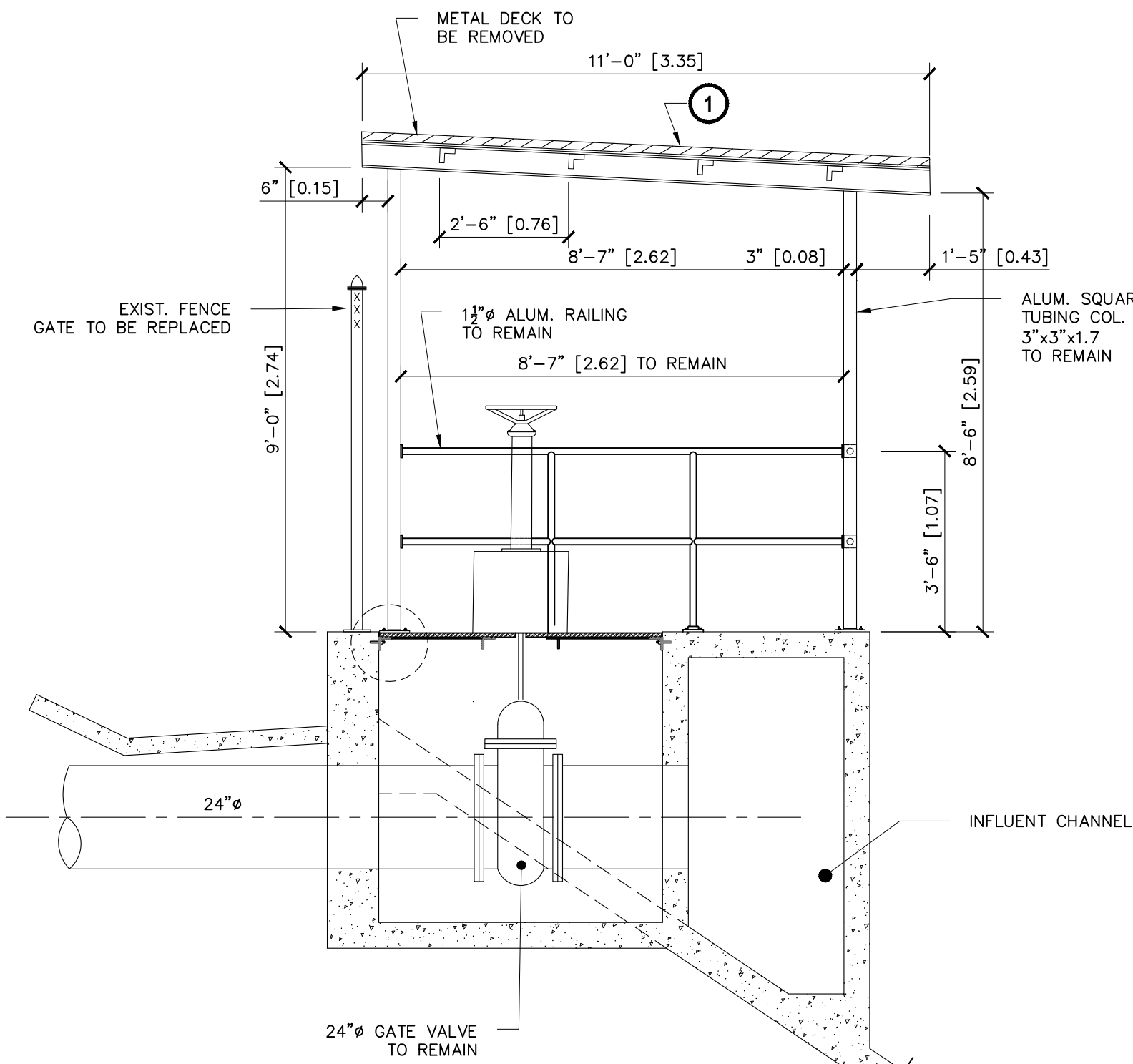
RWR-C401



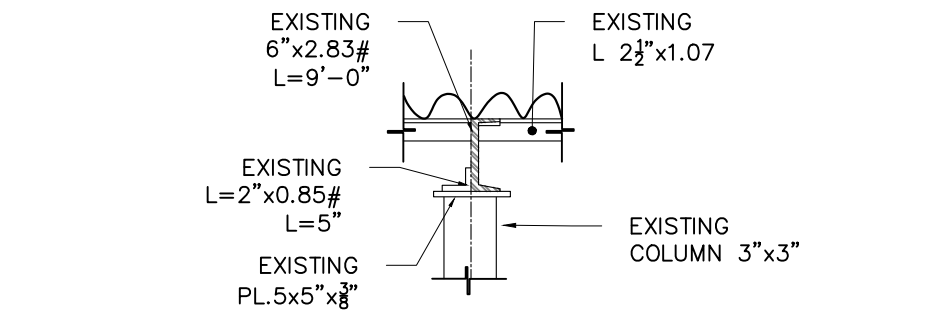
INTAKE CHAMBER FLOOR PLAN
SCALE= 3/8"=1'-0"



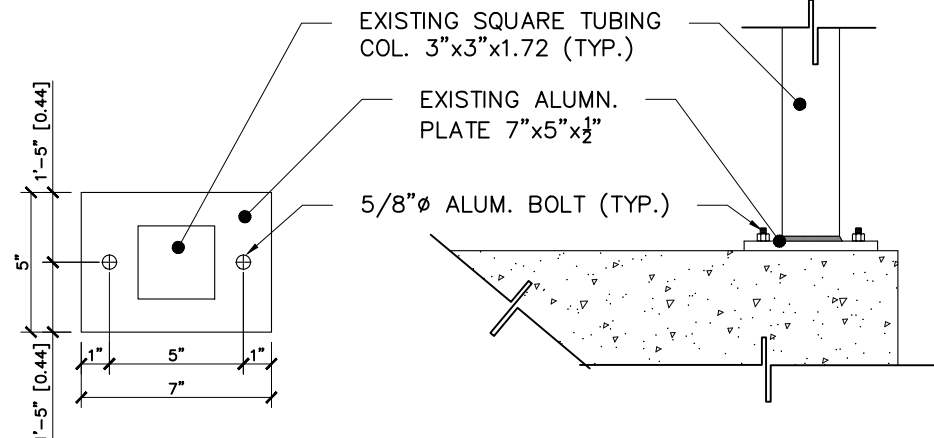
INTAKE CHAMBER ROOF CANOPY PLAN
SCALE= 3/8"=1'-0"



INTAKE CHAMBER ROOF CANOPY SECTION
SCALE= 3/8"=1'-0"



ROOF CONNECTION DETAIL
SCALE= 1/4"=1'-0"



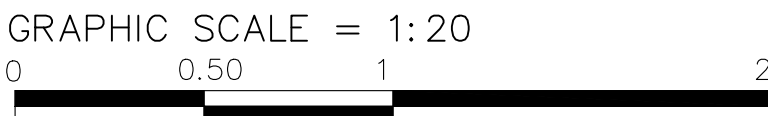
COLUMN CONNECTION
SCALE= 1/4"=1'-0"

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- METAL ROOF DECK TO BE REMOVED (PURLINS AND BEAMS TO REMAIN)



INTAKE CHAMBER AREA
SCALE= 1:20



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 86 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA

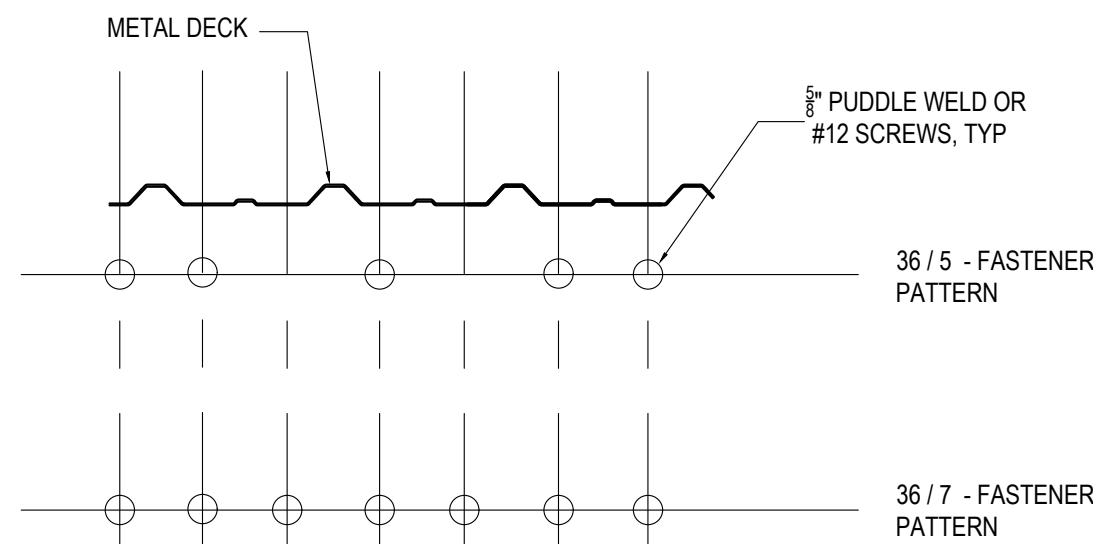
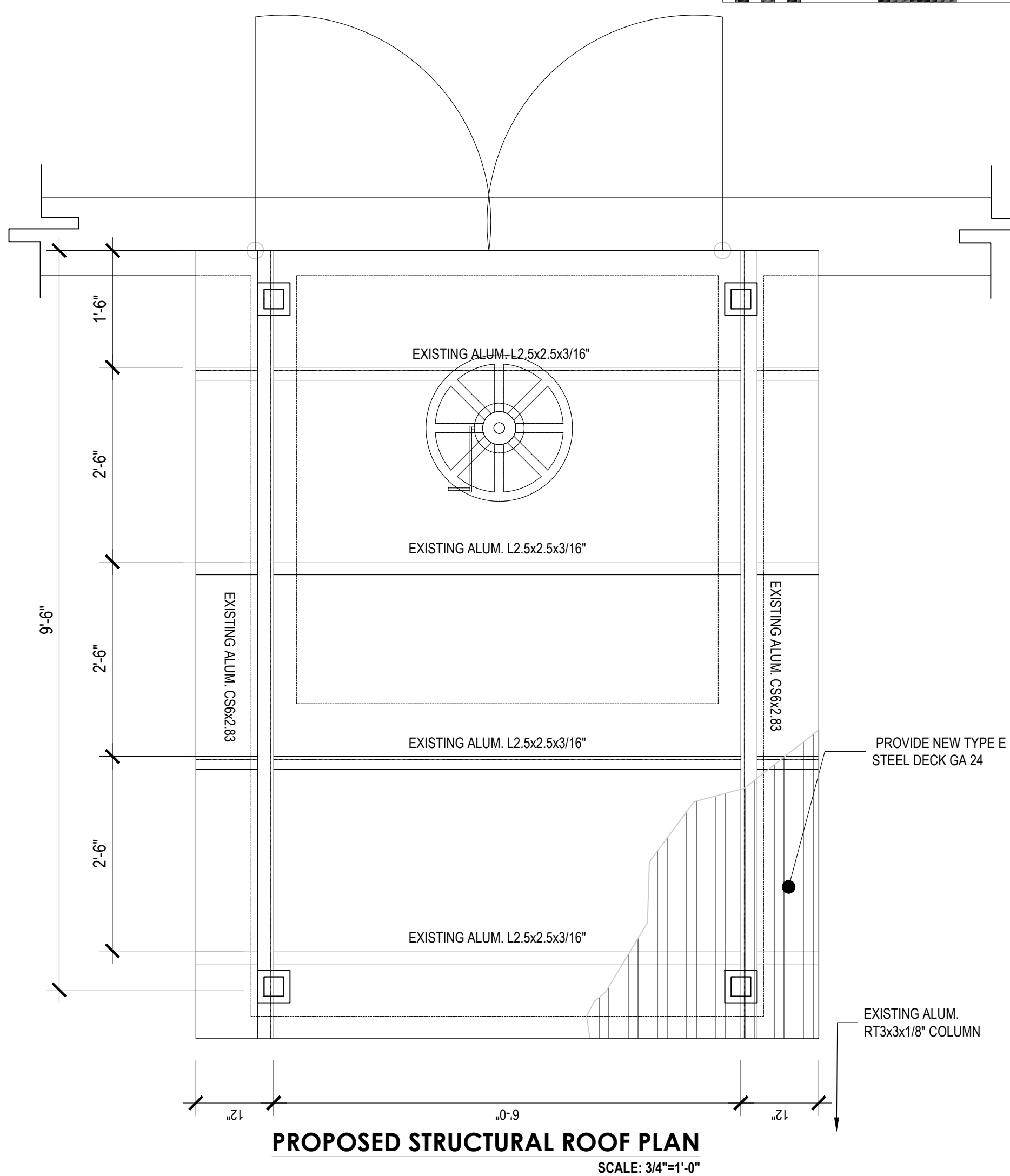
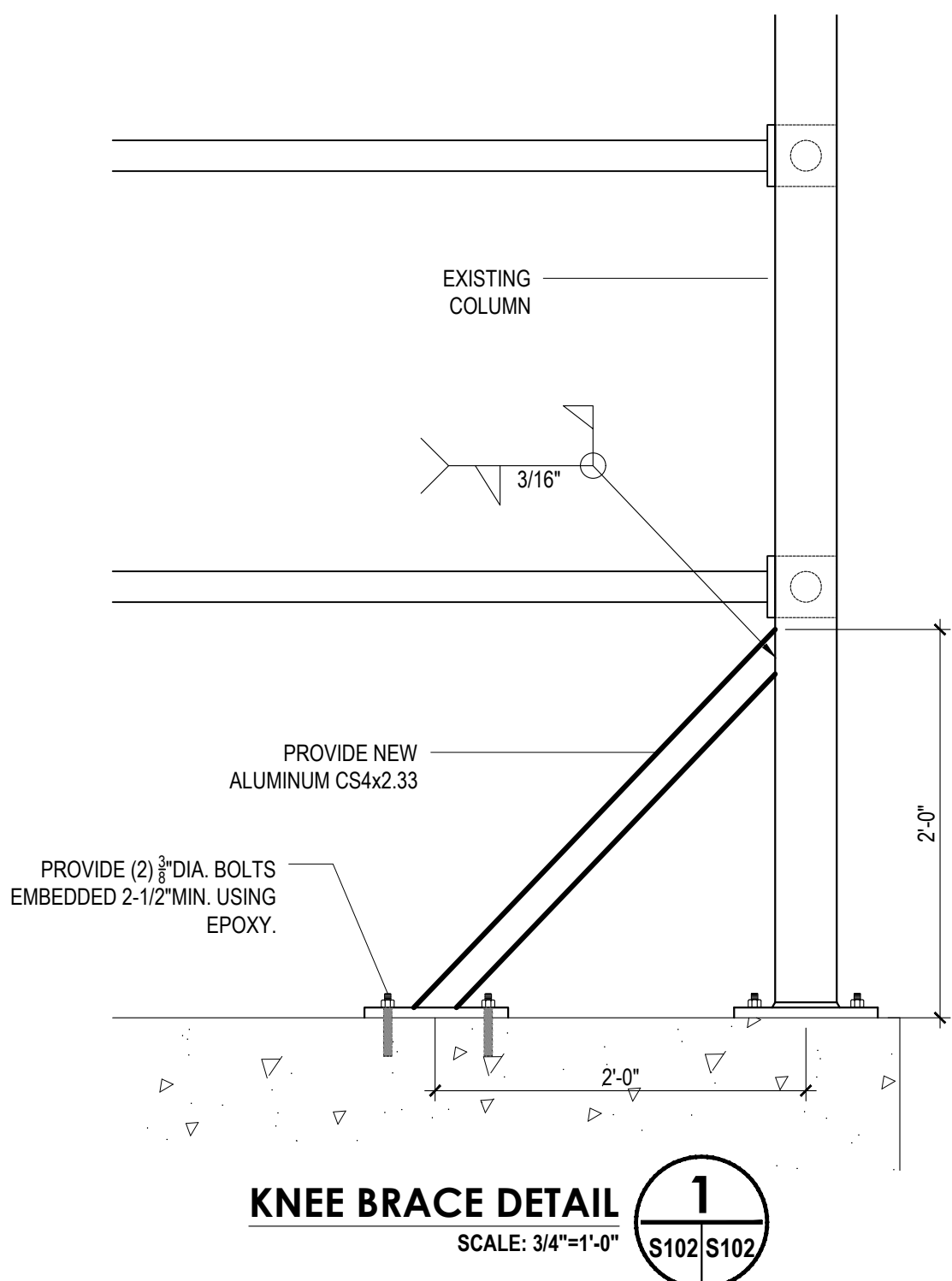
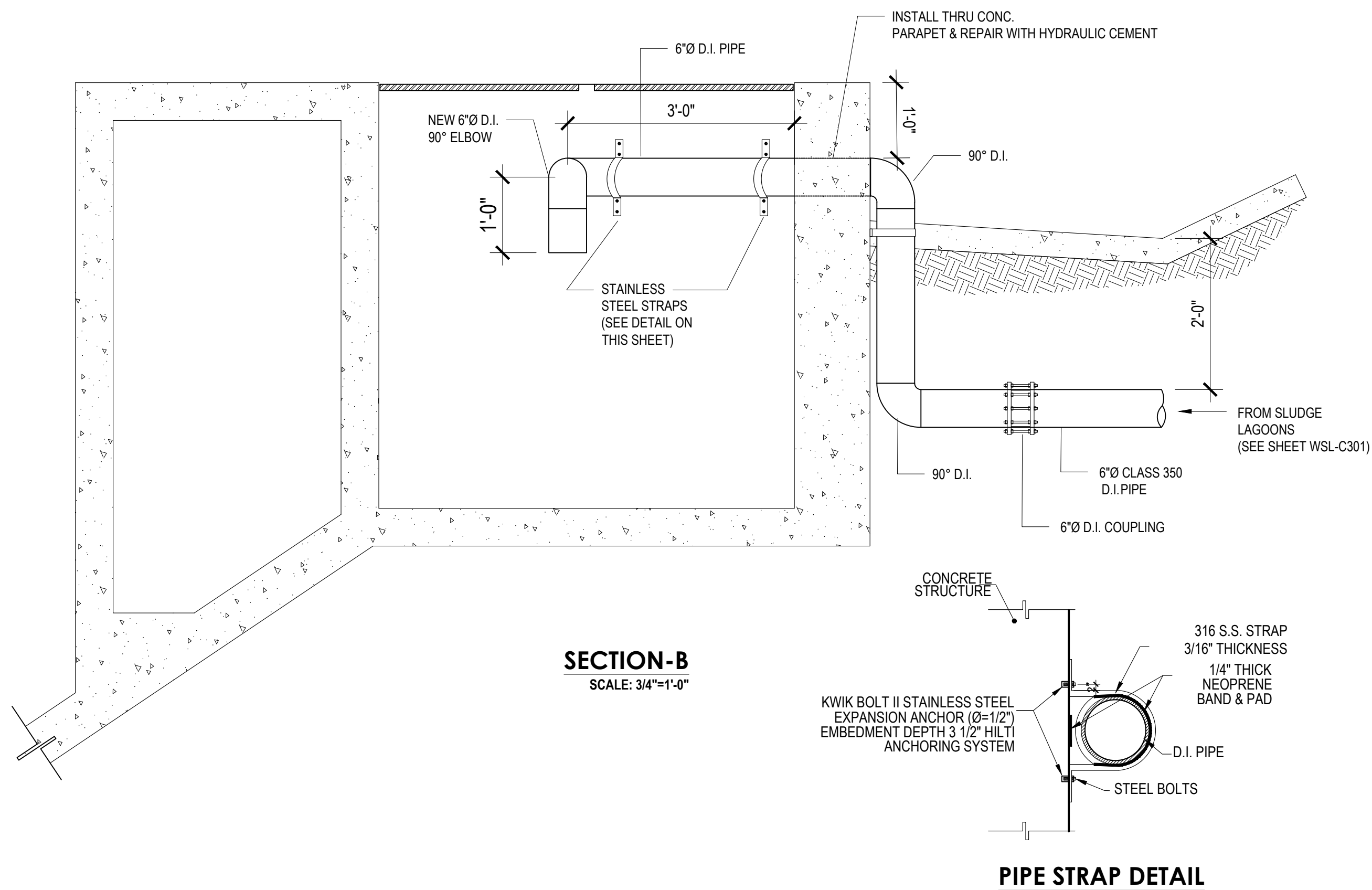
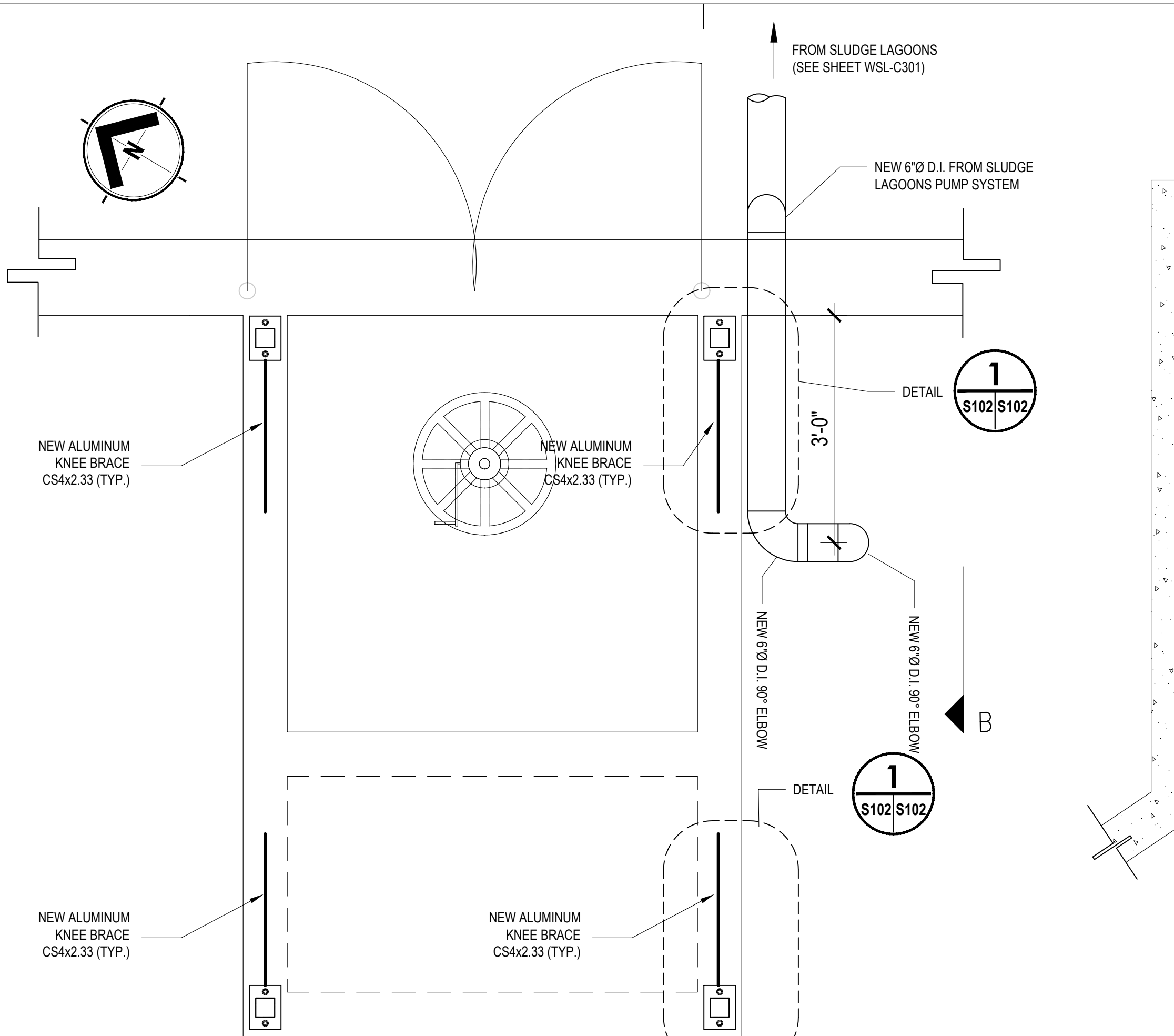
Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837-0	Set Date: 20210728
		Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

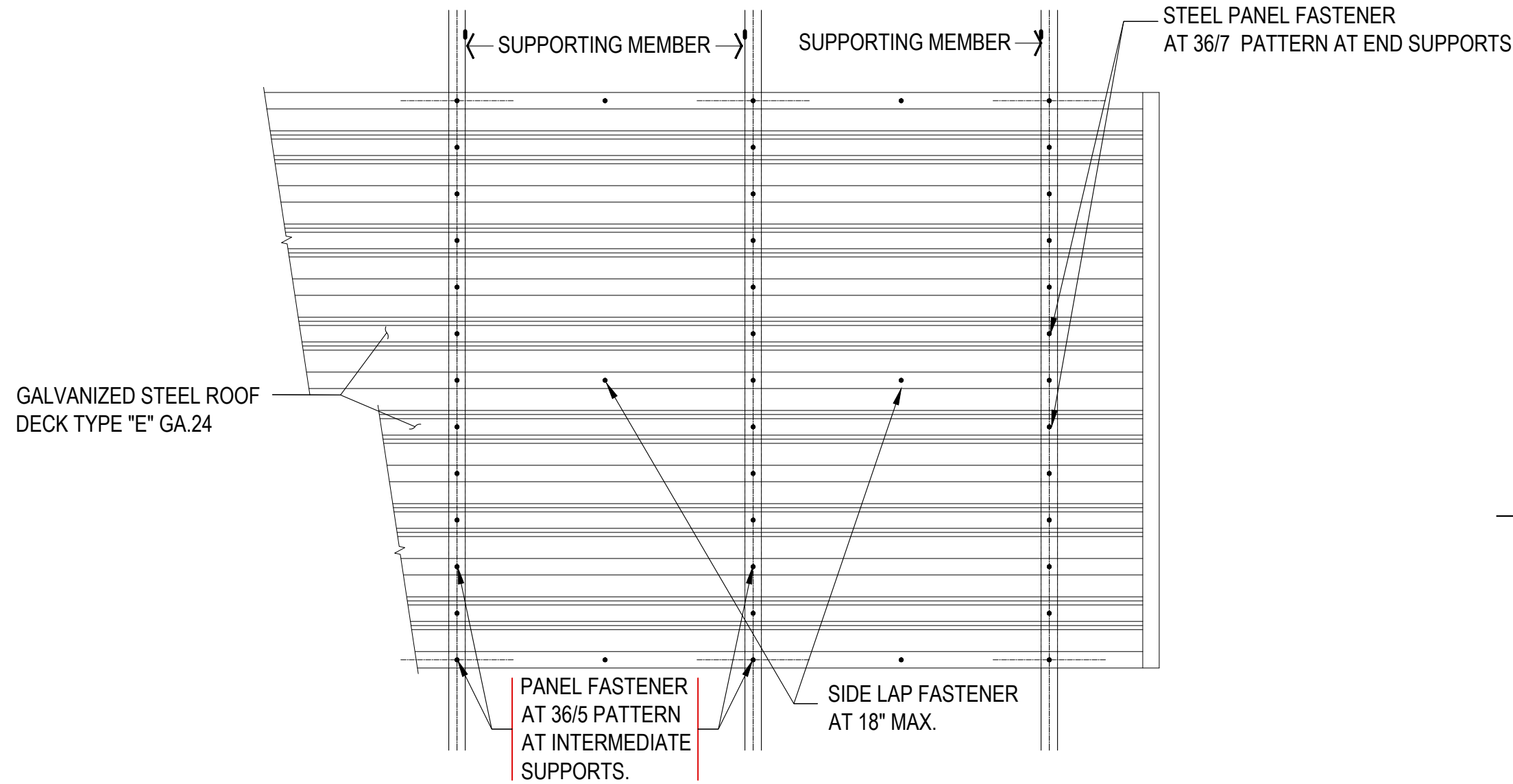
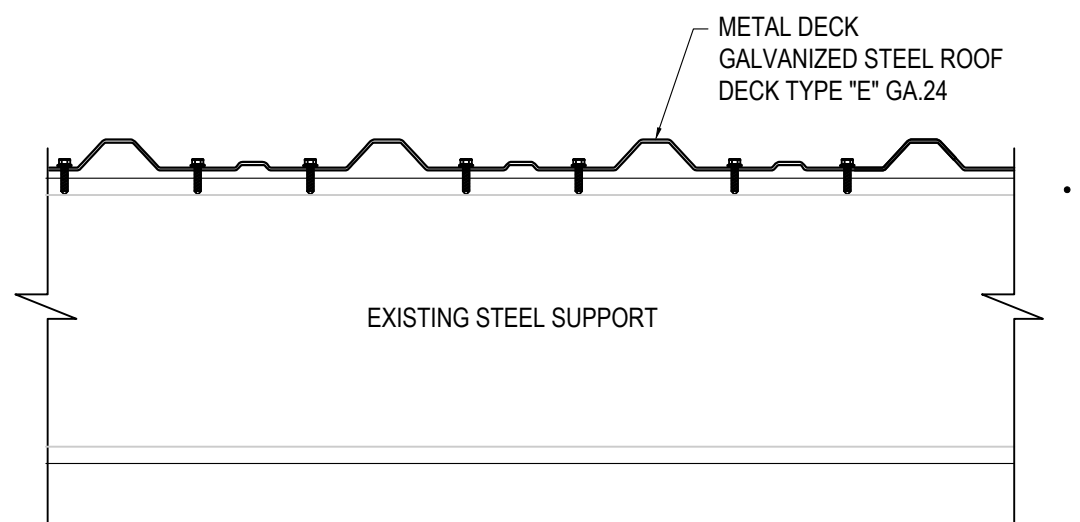


RAW WATER RESERVOIR
Drawing Title:



NOTE:

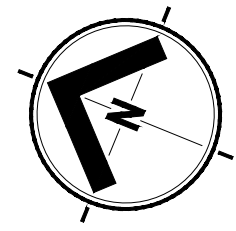
1. PROVIDE (6) #10 TEK SCREW SIDELAP FASTENERS PER SPAN.
2. DISSIMILAR METALS SHALL BE ISOLATED.



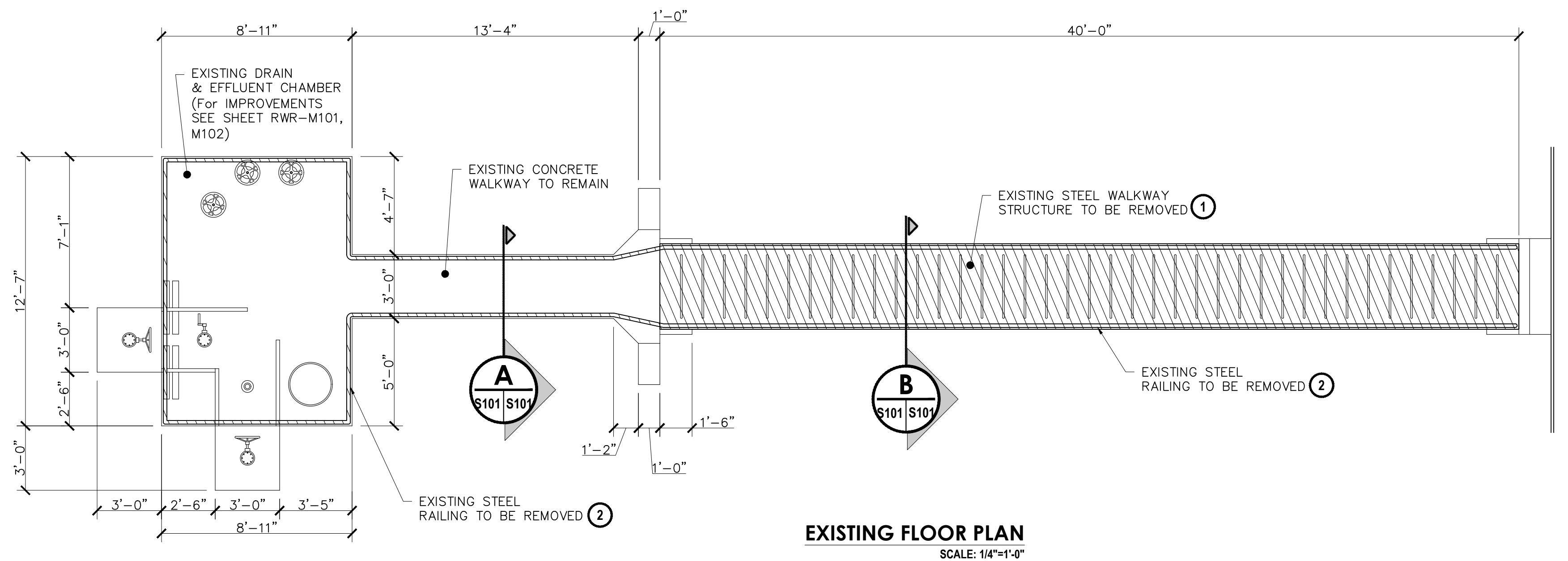
Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA

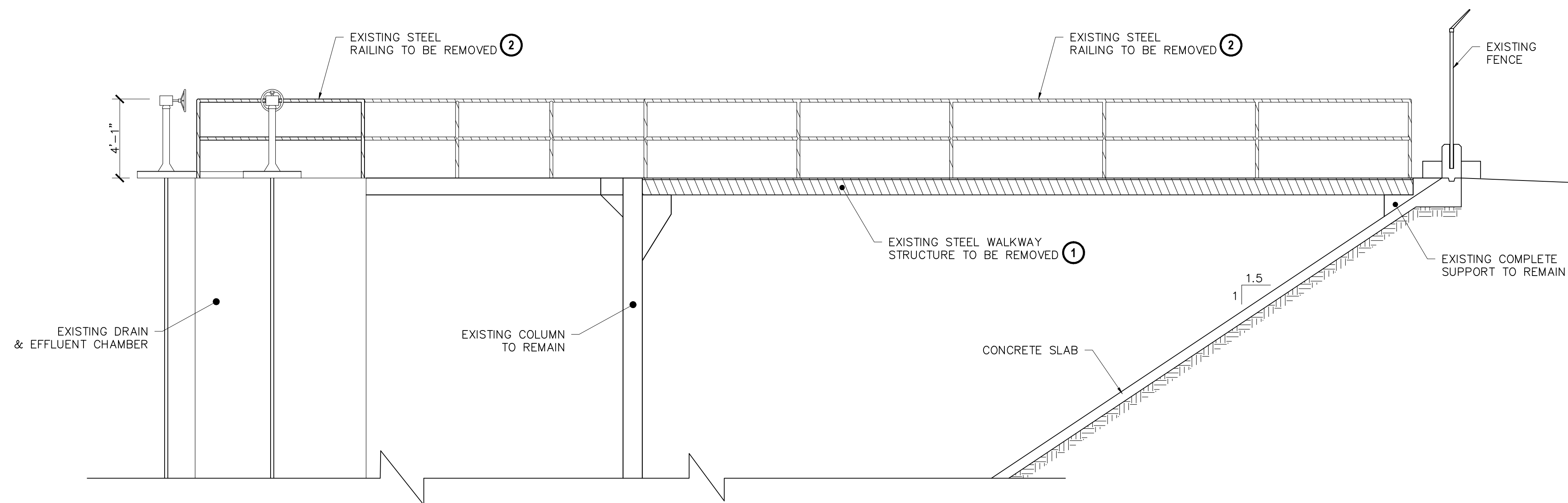
Revisions		SHEET INFO.	
Number	Date	Description	
Project No.: 19-1837.0		Set Date: 20210728	
Drawn by:		Dwg. Date:	



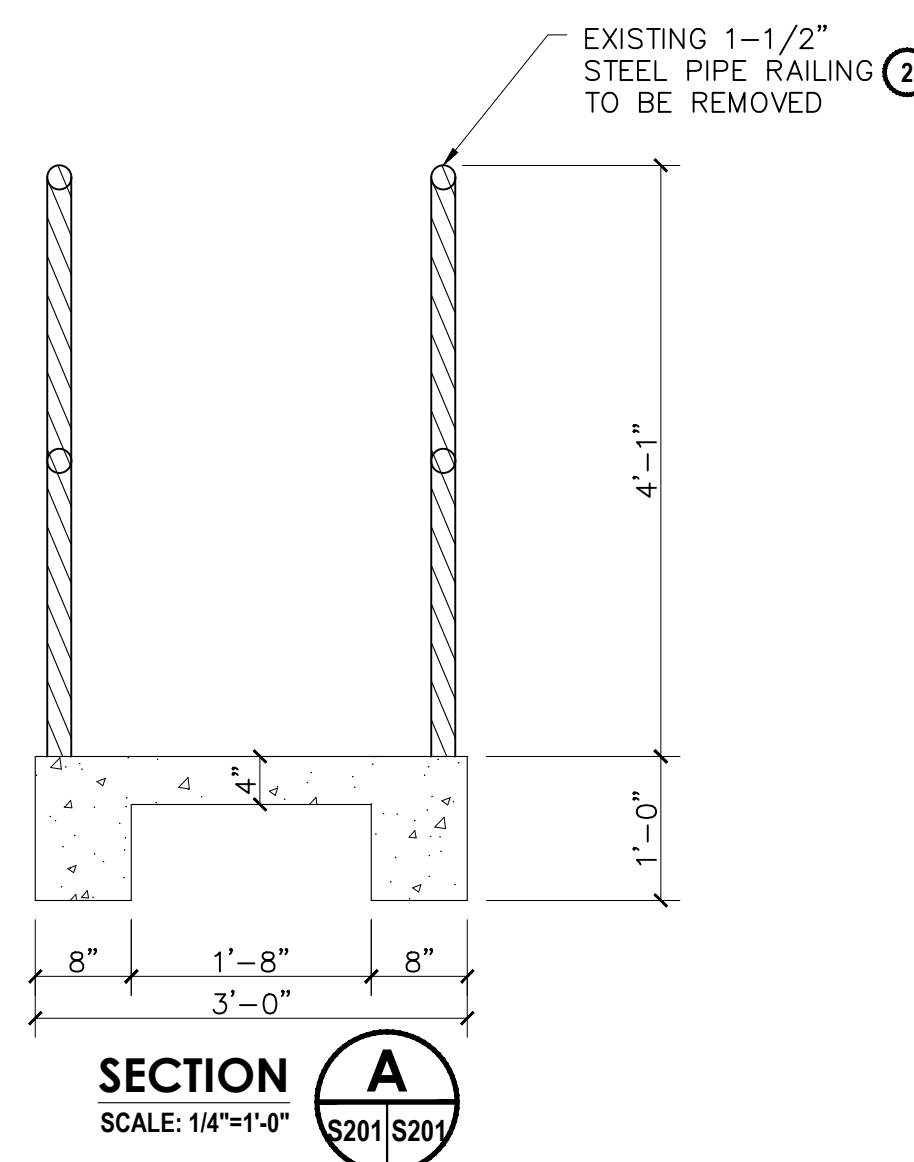
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0' 5' 10' 15'



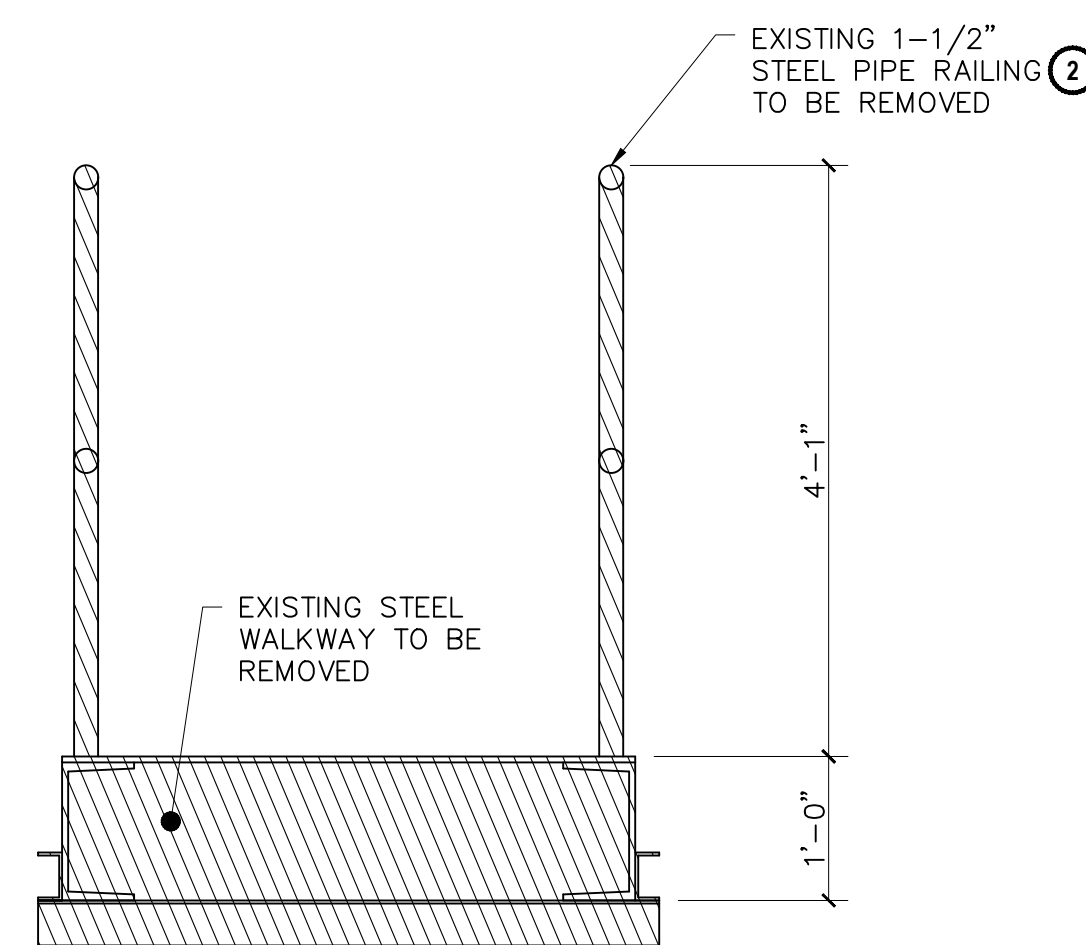
EXISTING FLOOR PLAN
SCALE: 1/4"=1'-0"



EXISTING ELEVATION
SCALE: 1/4"=1'-0"



SECTION A
SCALE: 1/4"=1'-0"
S201 S201



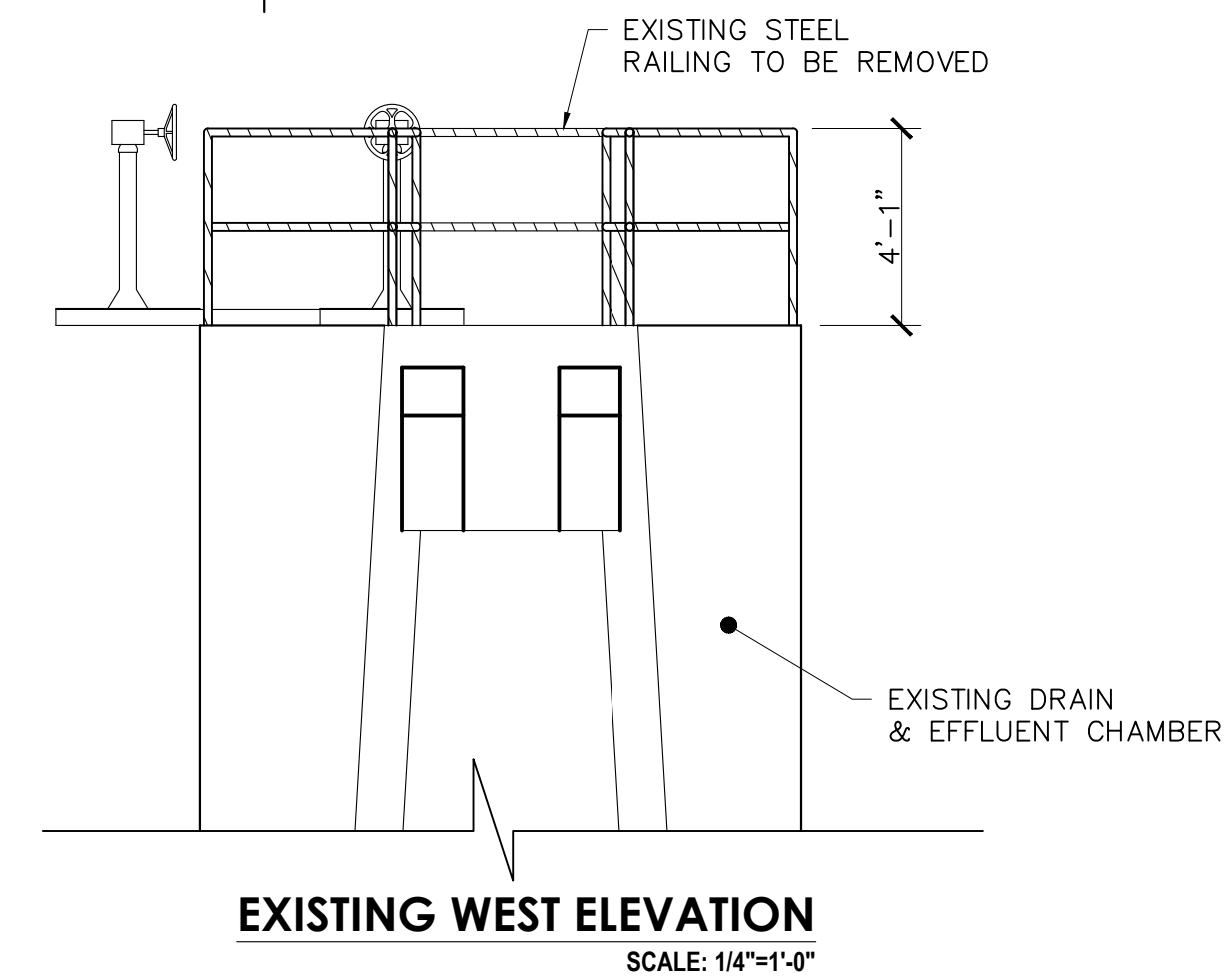
SECTION B
SCALE: 1/4"=1'-0"
S201 S201

DEMOLITION LEGEND:

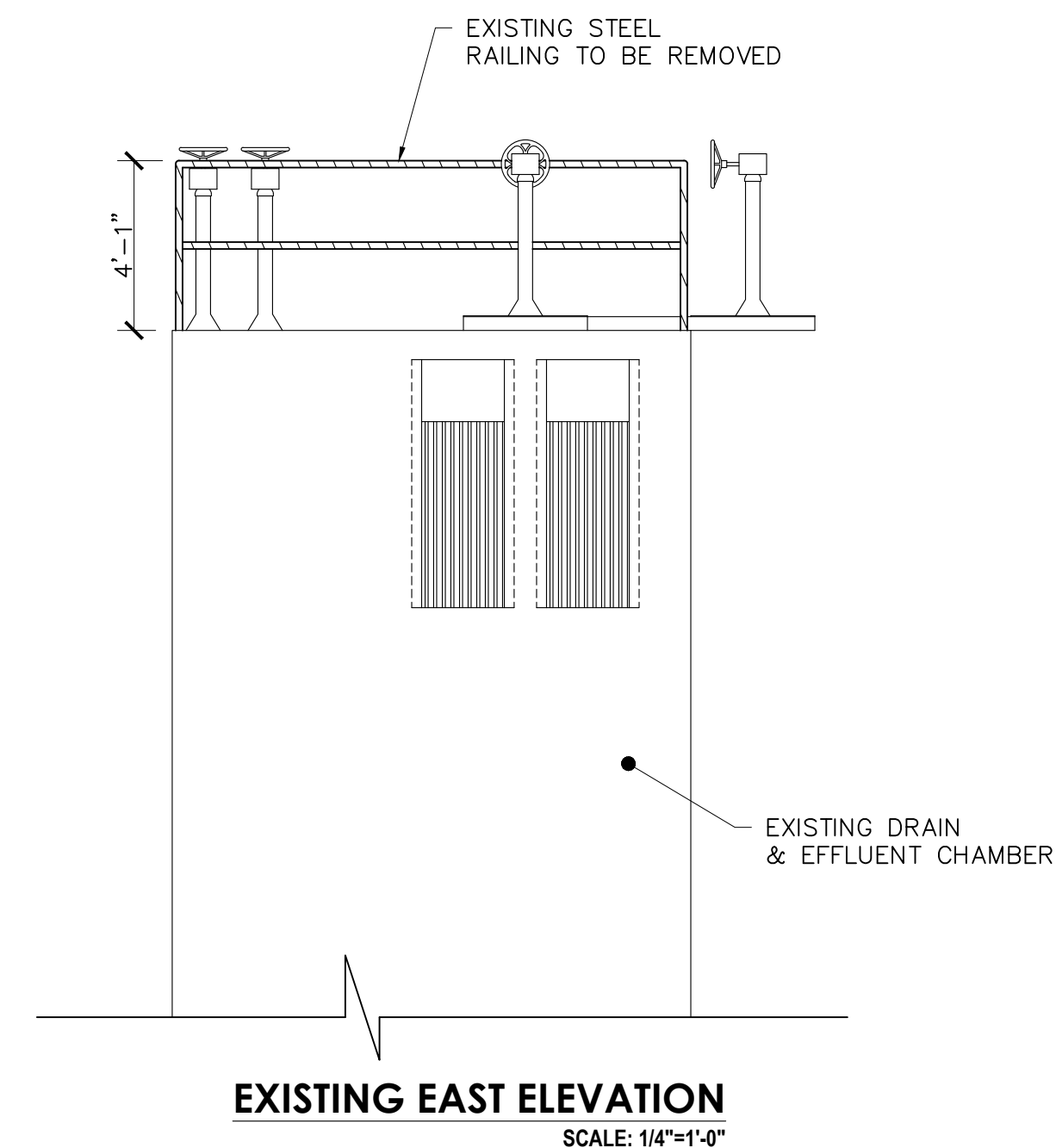
- ITEM TO BE REMOVED OR DEMOLISHED
- 1 STEEL WALKWAY
 - 2 STEEL RAILING

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COPIA.



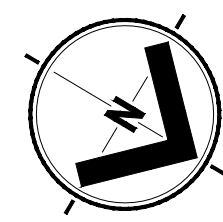
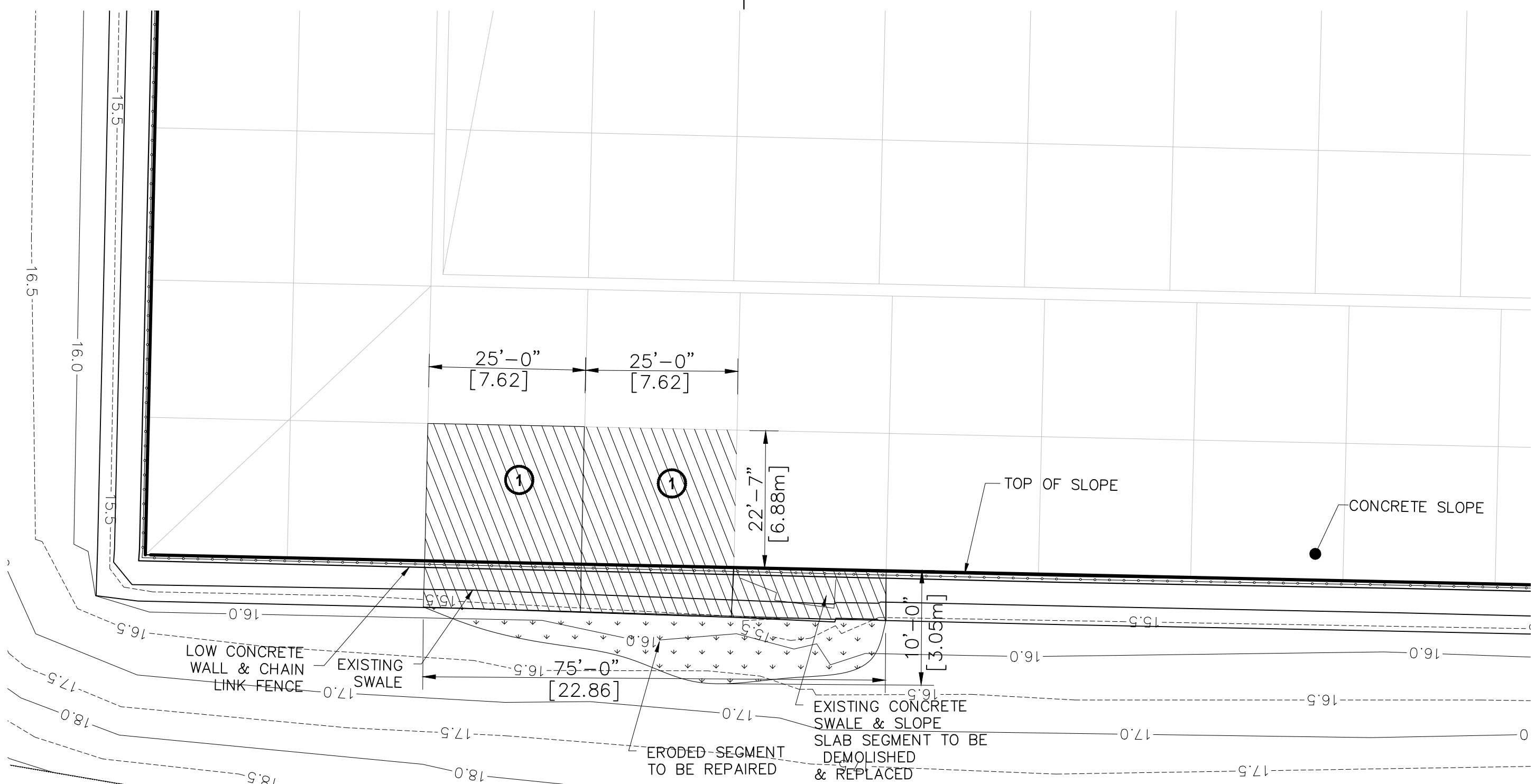
EXISTING WEST ELEVATION
SCALE: 1/4"=1'-0"



EXISTING EAST ELEVATION
SCALE: 1/4"=1'-0"

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

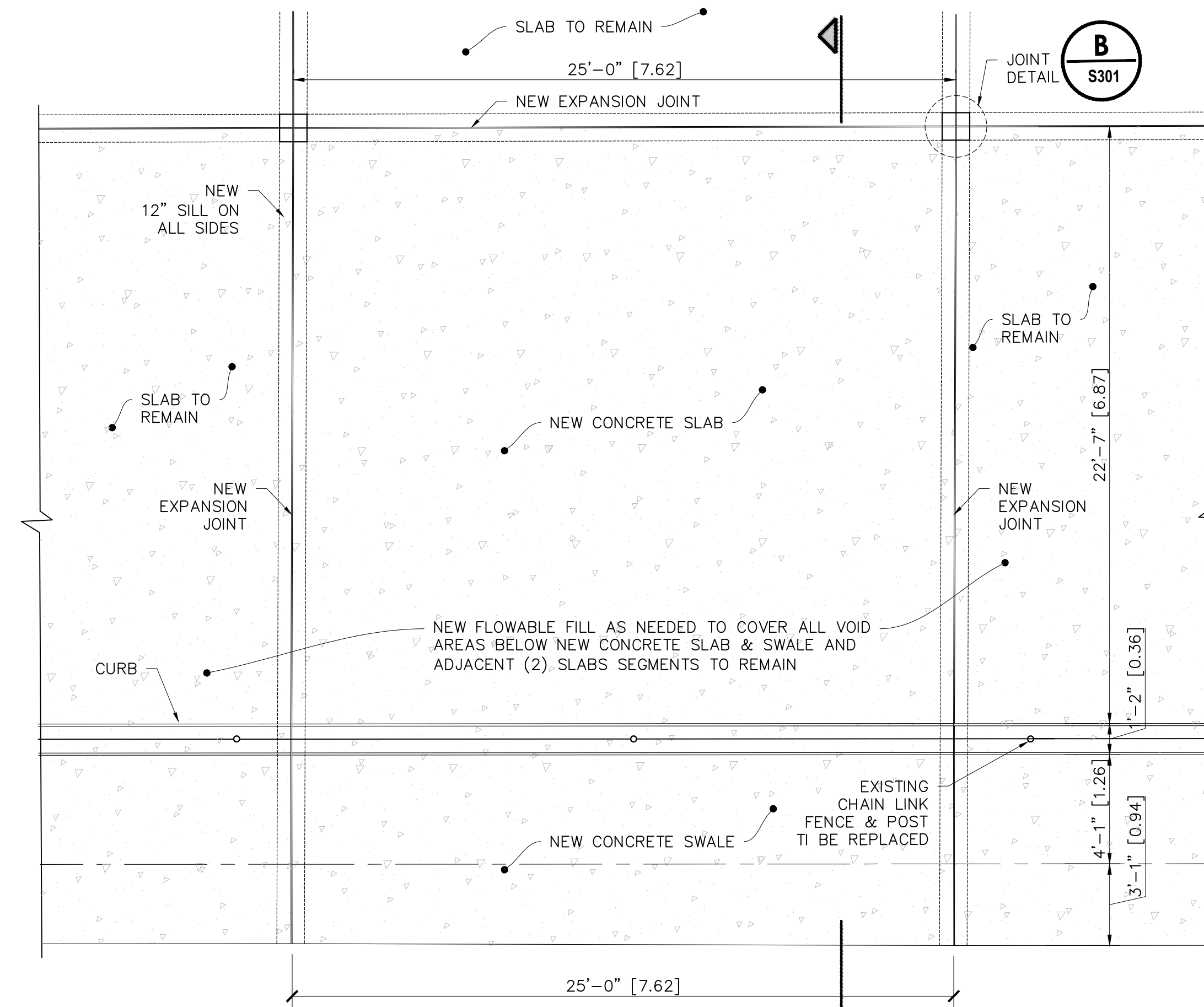




SIDE SLAB & SWALE IMPROVEMENTS AREA

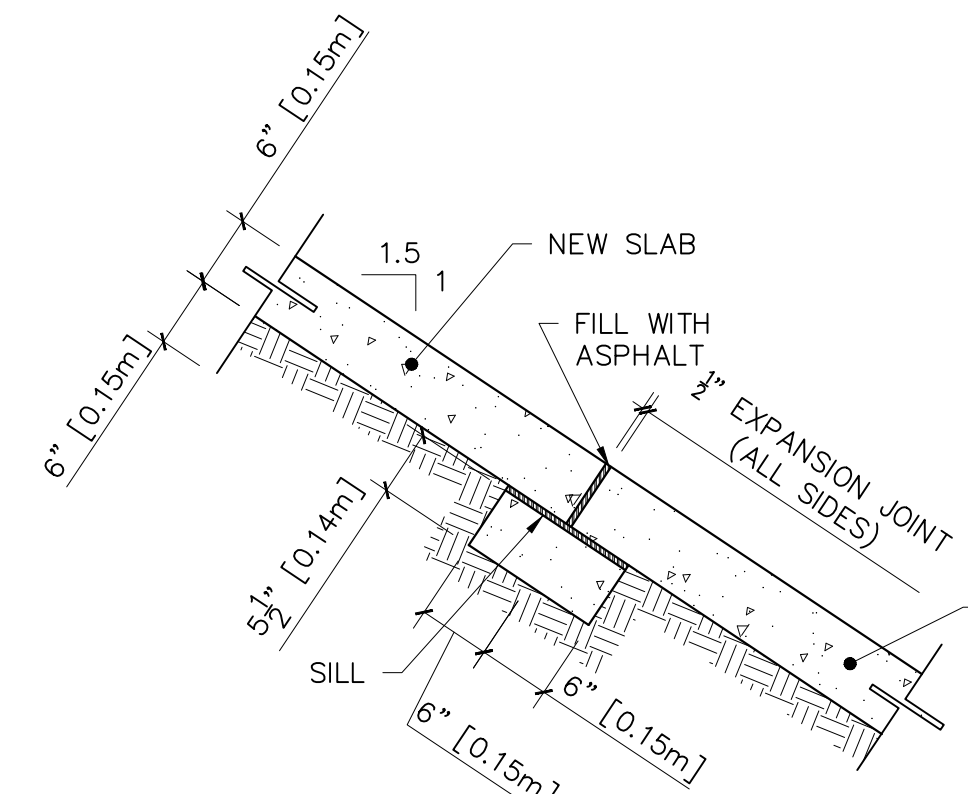
SCALE= 1:200

GRAPHIC SCALE = 1:350



TYPICAL SLAB PLAN

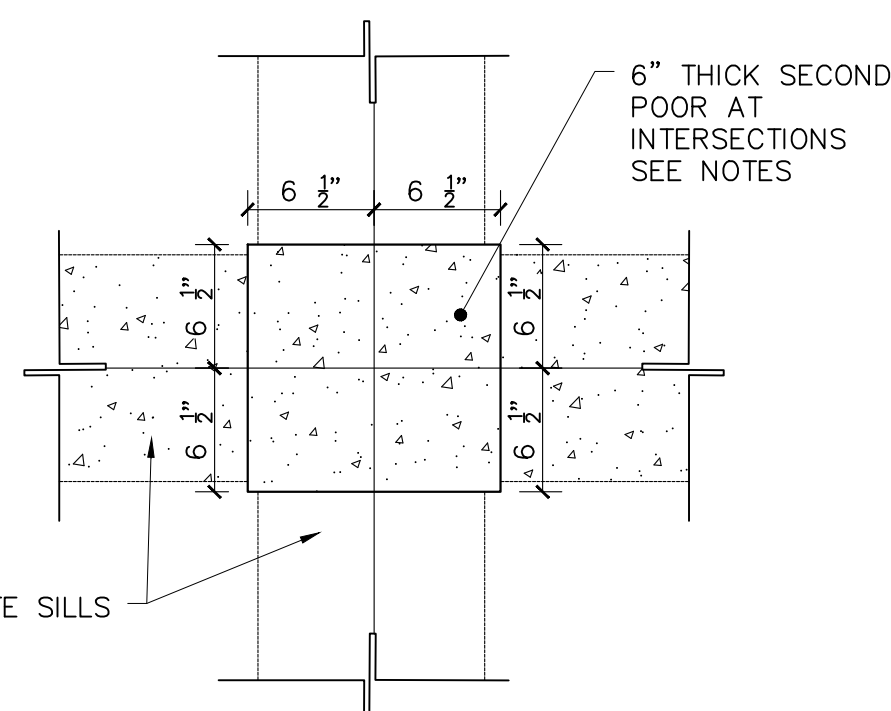
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SLABS JOINT DETAIL

SCALE= 3/8"=1'-0"

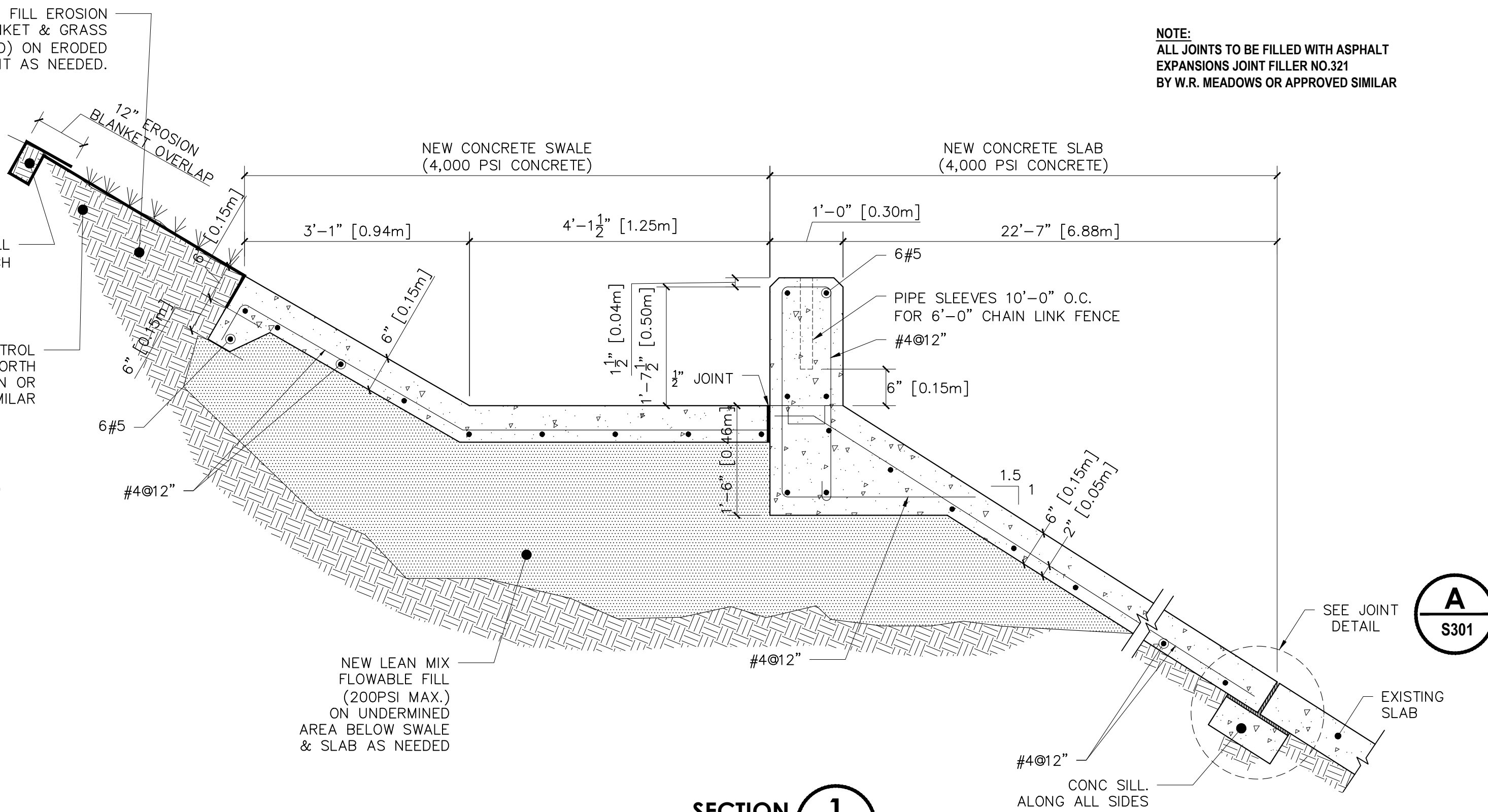
A
S301



SILLS JOINT PLAN

SCALE= 3/8"=1'-0"

B
S301



NOTE:
ALL JOINTS TO BE FILLED WITH ASPHALT
EXPANSIONS JOINT FILLER NO.321
BY W.R. MEADOWS OR APPROVED SIMILAR

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- CONCRETE SLABS & SWALE TO BE REMOVED & REPLACED

Integra Design Group
DATE ISSUE
JULY 30, 2021

REVISED BID SET

YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CERRA & NAGUARO, PUERTO RICO

RAW WATER RESERVOIR

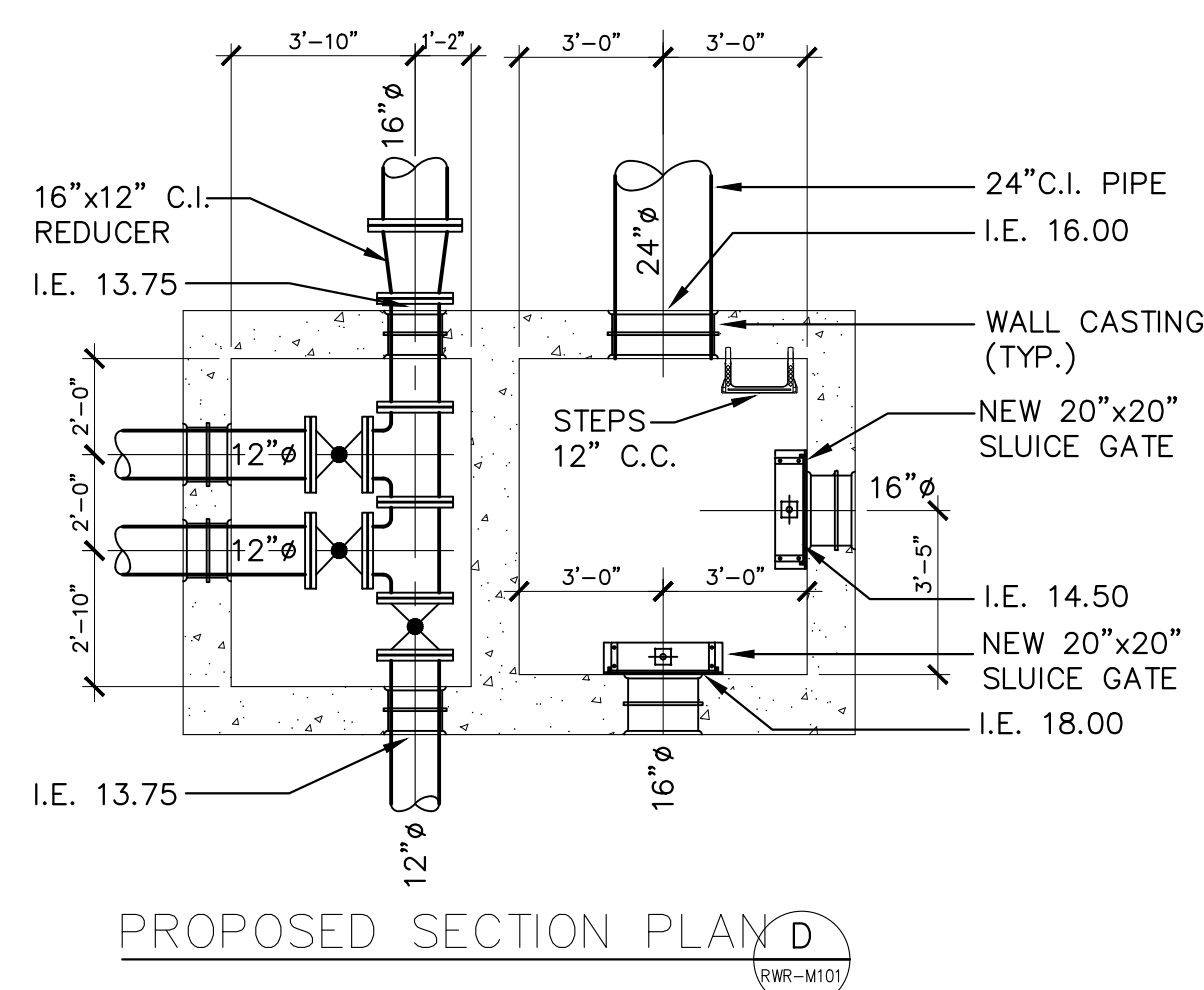
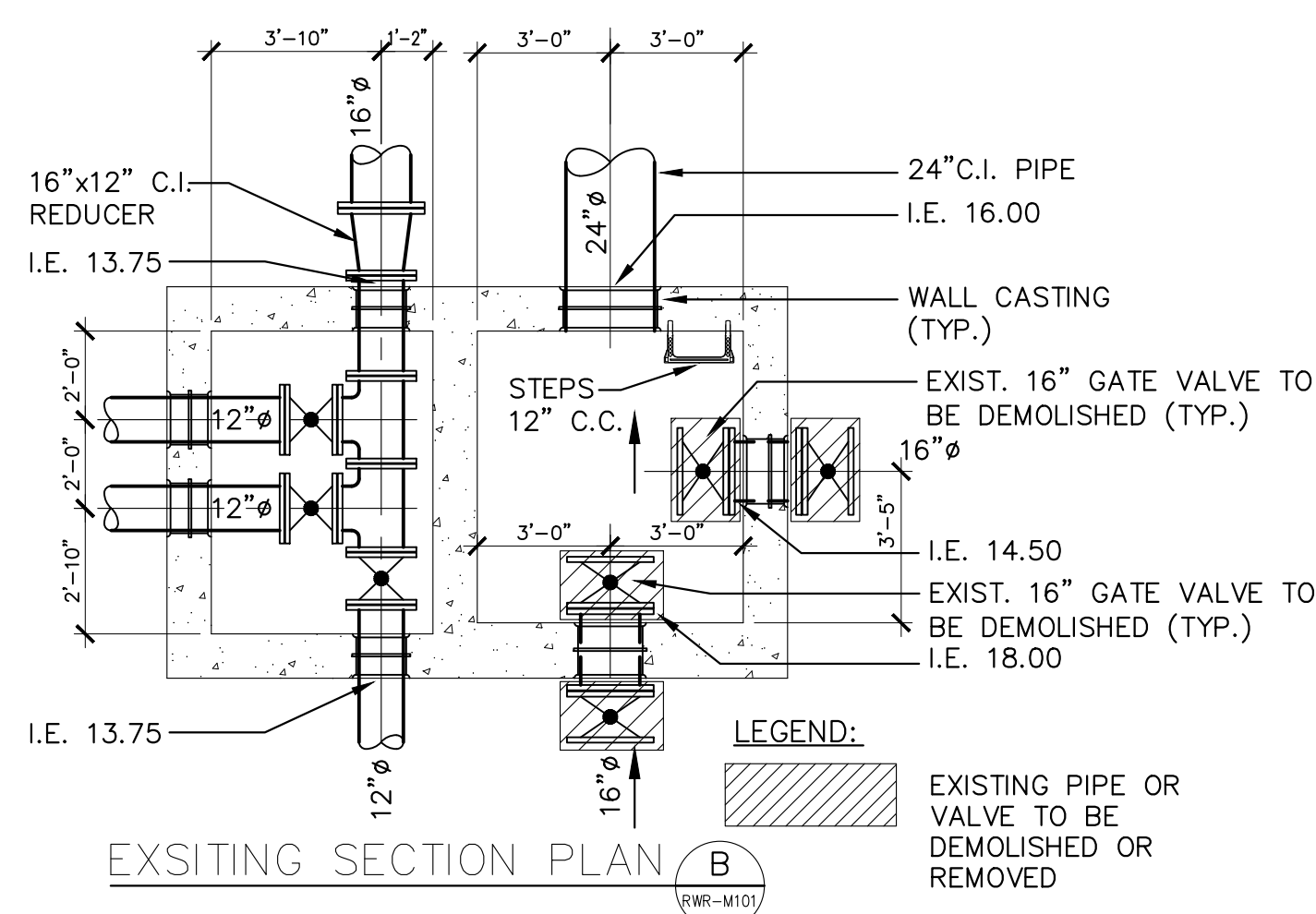
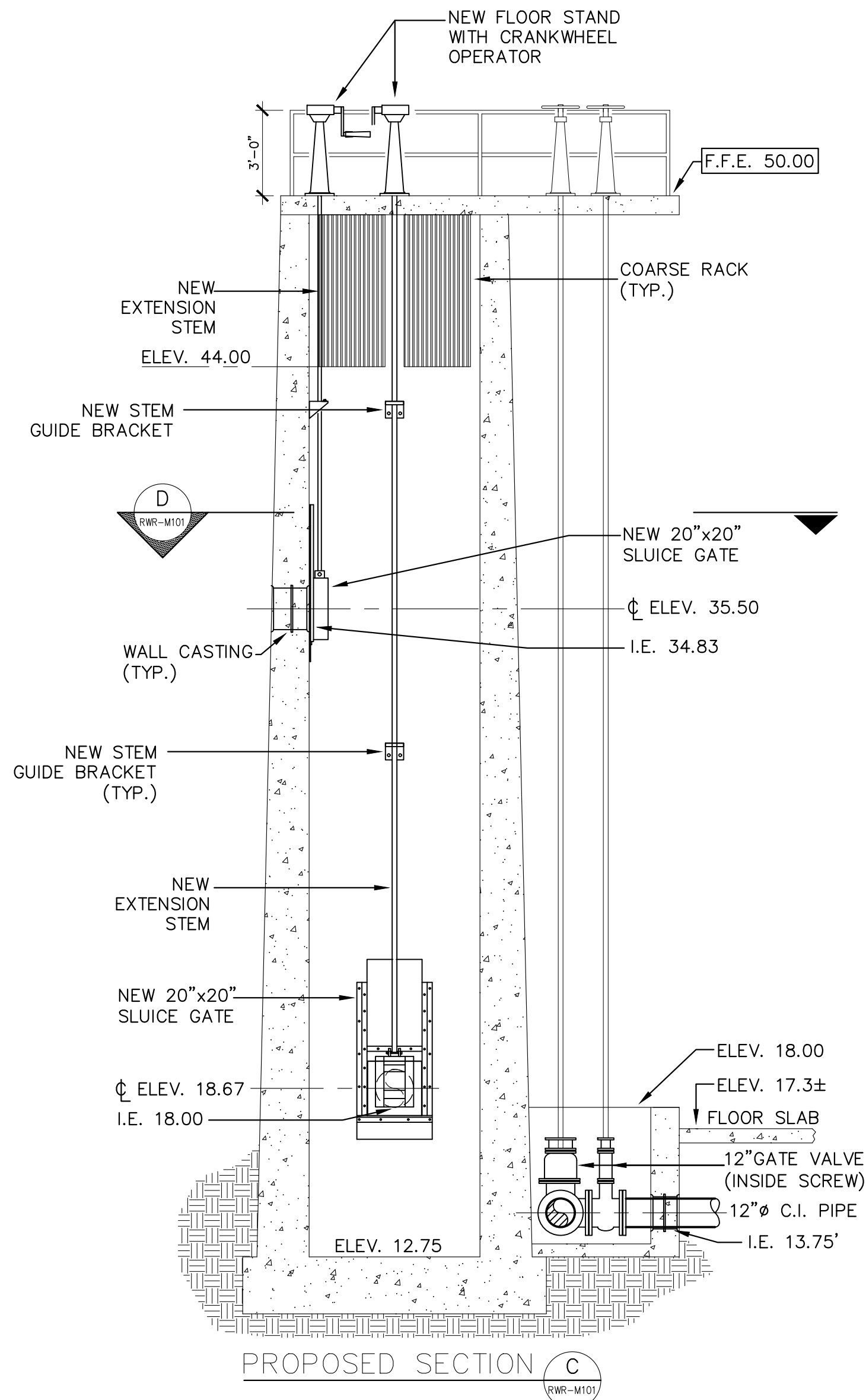
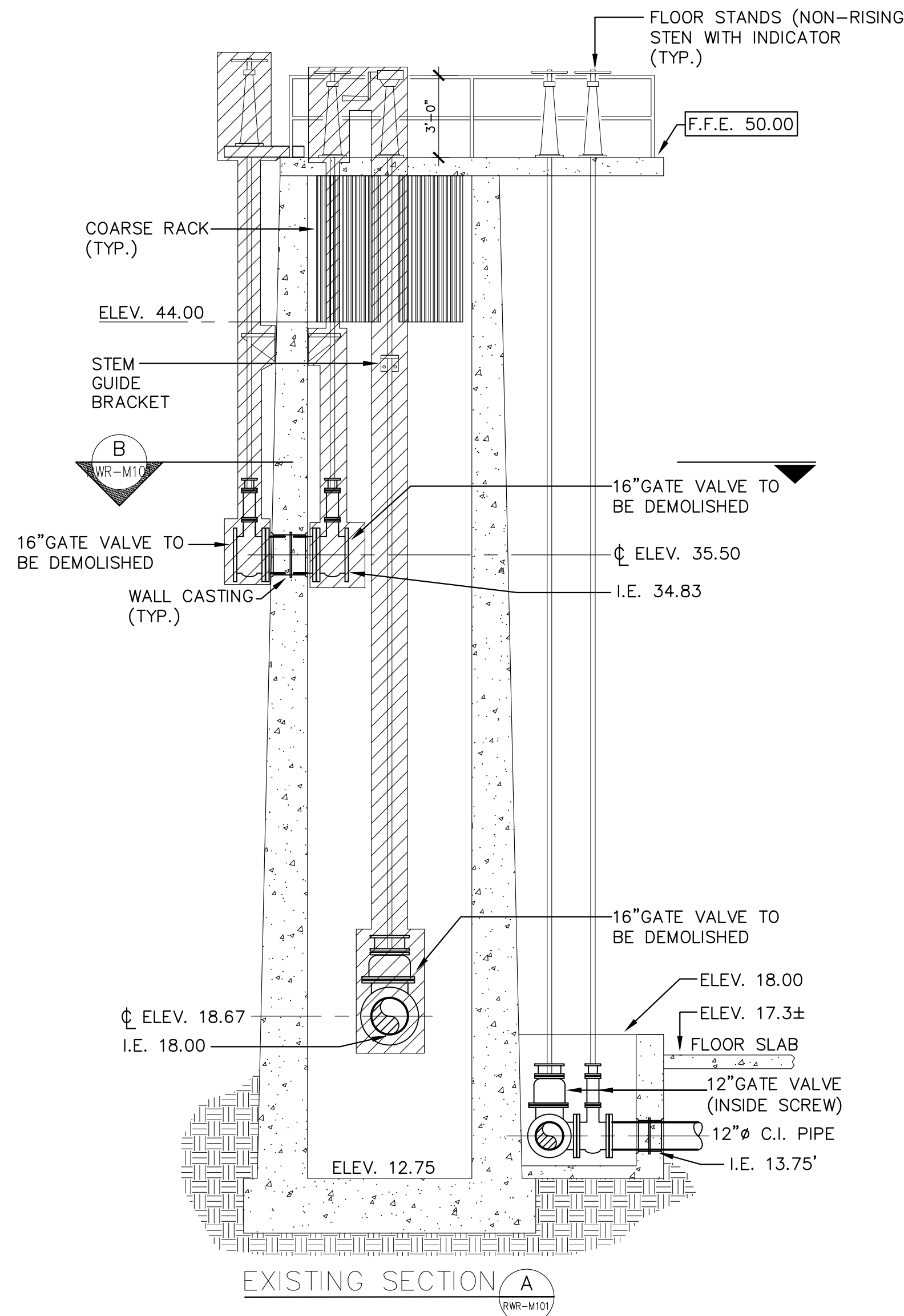
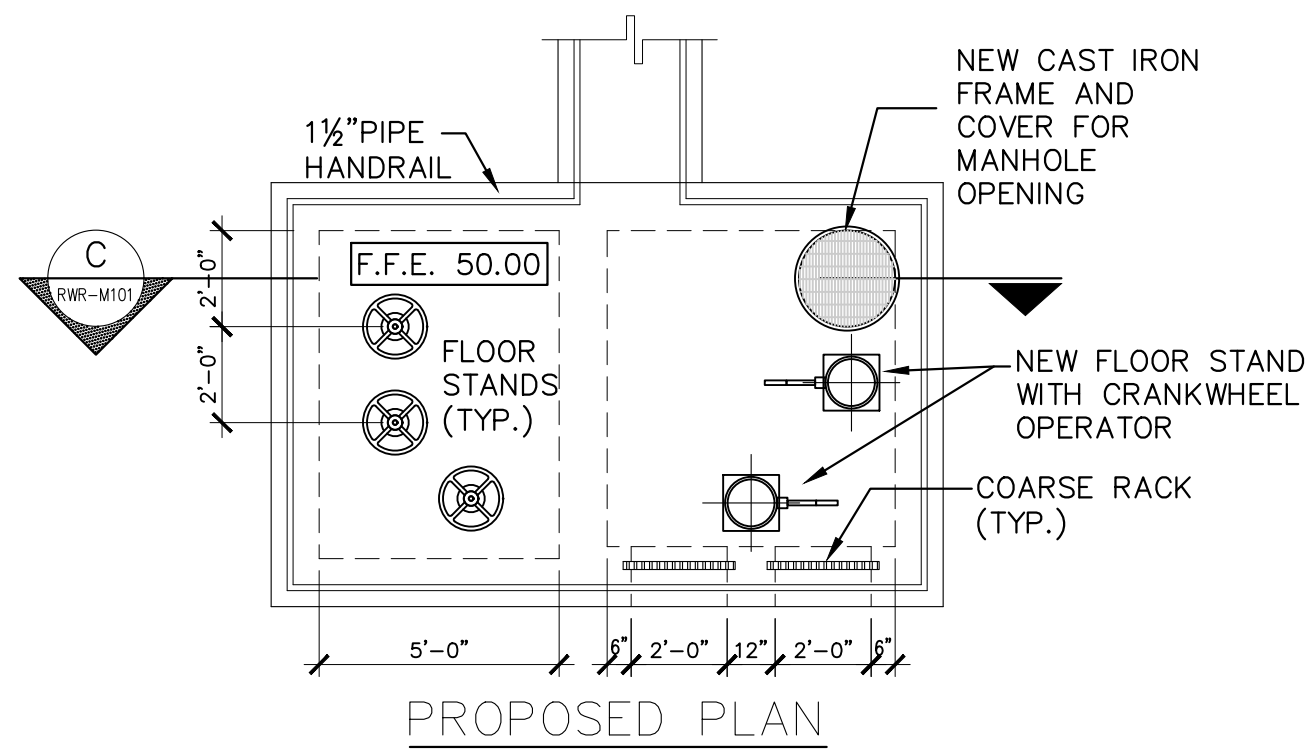
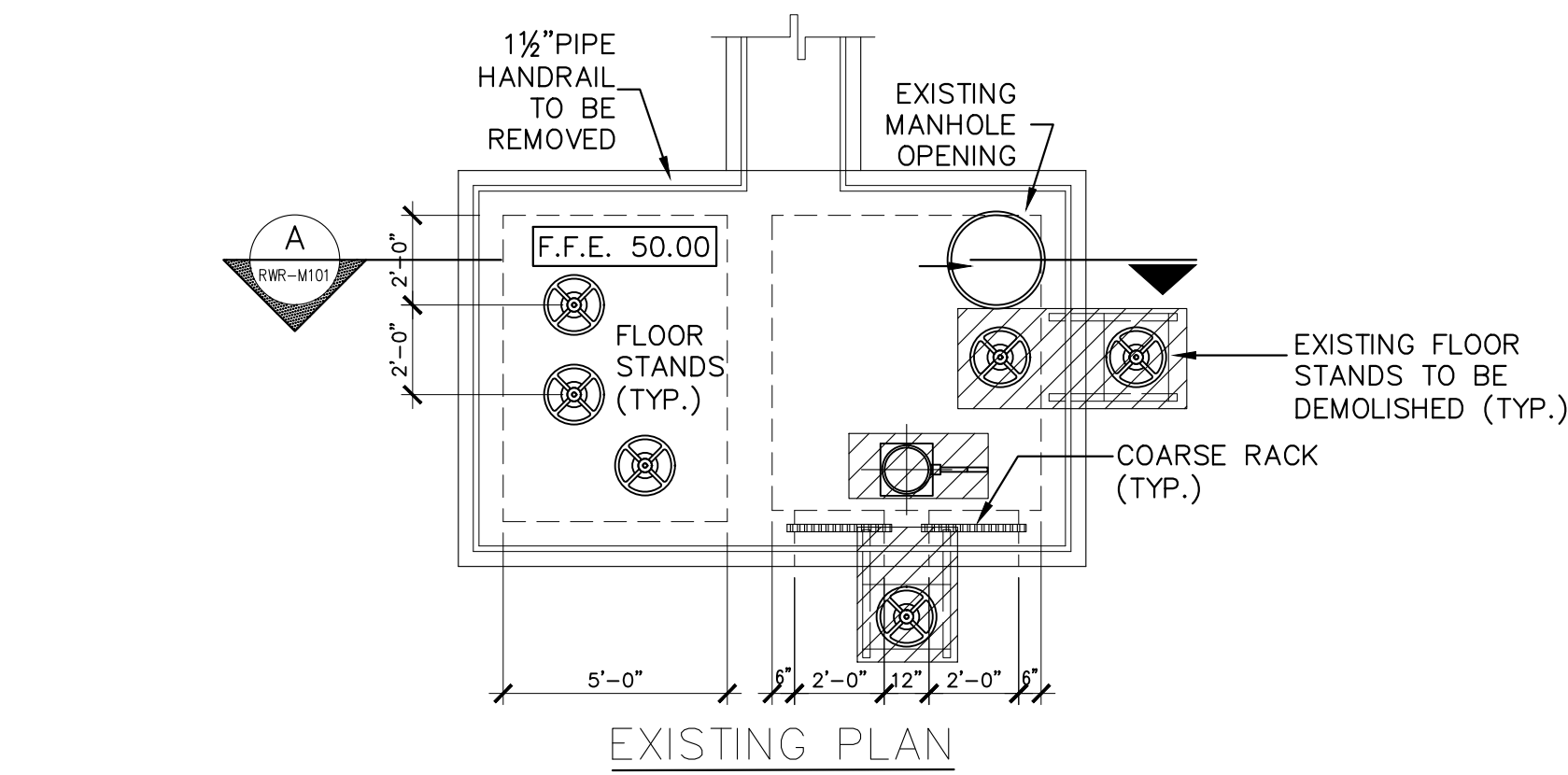
Drawing Title:

SLOPE SLAB AND SWALE REPLACEMENT DETAILS

Project Title:

Sheet:

RWR-S301



NOTES:

- CONTRACTOR SHALL REPAIR ALL CONCRETE STRUCTURE SEGMENT AFFECTED BY REMOVAL AND REPLACEMENT OF VALVES, PIPES, FITTINGS OR RAILINGS WITH HIGH STRENGTH HYDRAULIC CEMENT MIXTURE.
- CONTRACTOR SHALL MAKE ANY ADJUSTMENTS AS NEEDED TO THE EXISTING INTAKE STRUCTURE IN ORDER TO INSTALL THE REPLACEMENT SLUICE GATES AND OPERATORS.
- NEW SLUICE GATES SHALL BE IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS 35, 2, 26 SLUICE GATES.
- VALVES & RESERVOIR SLABS WORKS SHALL BE PERFORMED UNDERWATER. CONTRACTOR SHALL PROVIDE CERTIFIED DIVERS FOR UNDERWATER INSTALLATIONS AND REPAIRS AS WELL AS PROVIDE INSTALLATION PHOTOS AND VIDEOS.

SHEET INFO.		
Project No.	19-1637.0	
Set Date	2021/07/28	
Drawn by		
Dwg. Date		

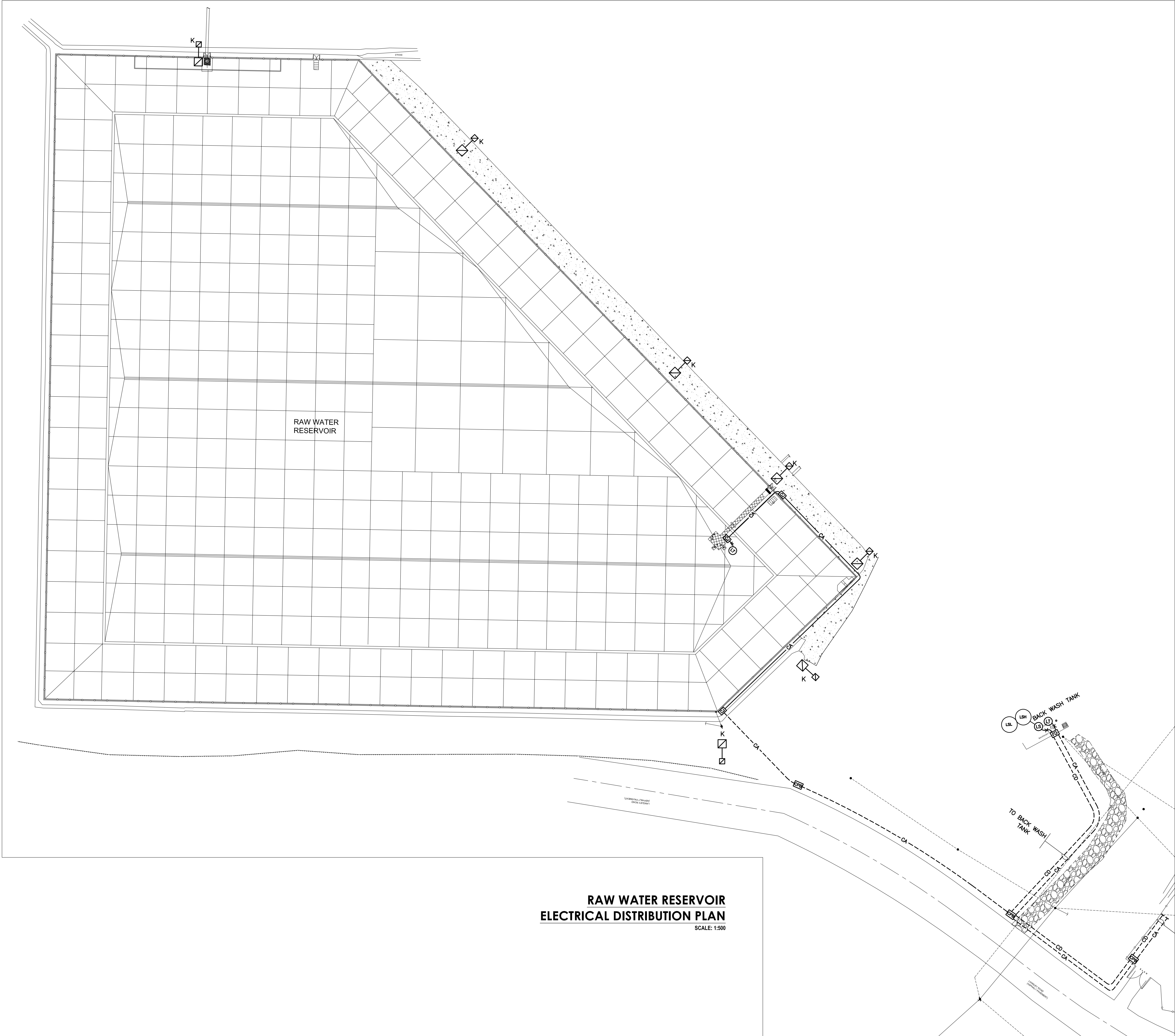
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

RAW WATER RESERVOIR
 Drawing Title:

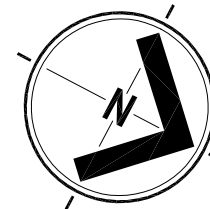
DRAIN + EFFLUENT CHAMBER IMPROVEMENTS

Integra Design Group
 DATE ISSUE
 JULY 30, 2021
 REVISED BID SET

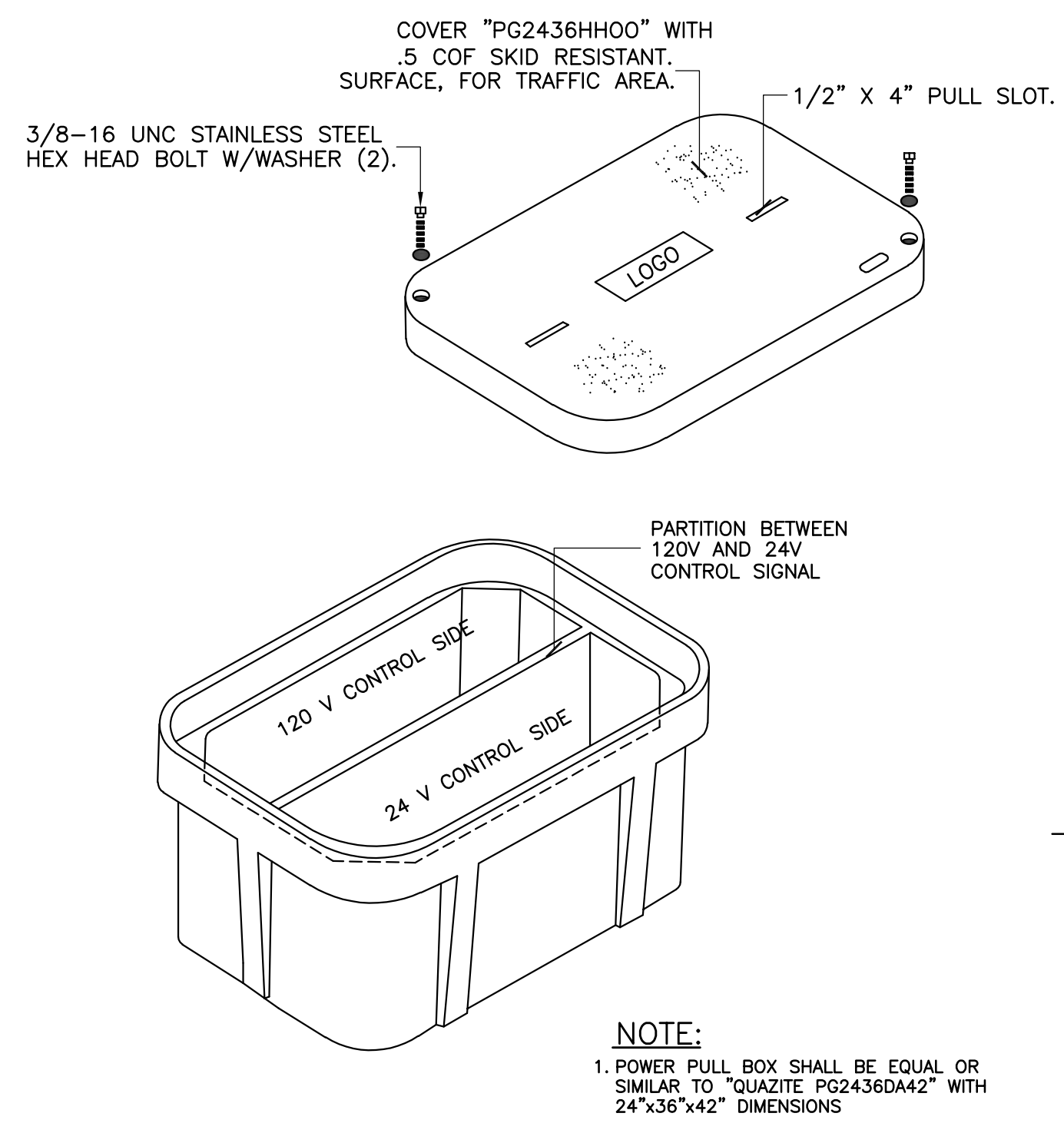
YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCURRIR.



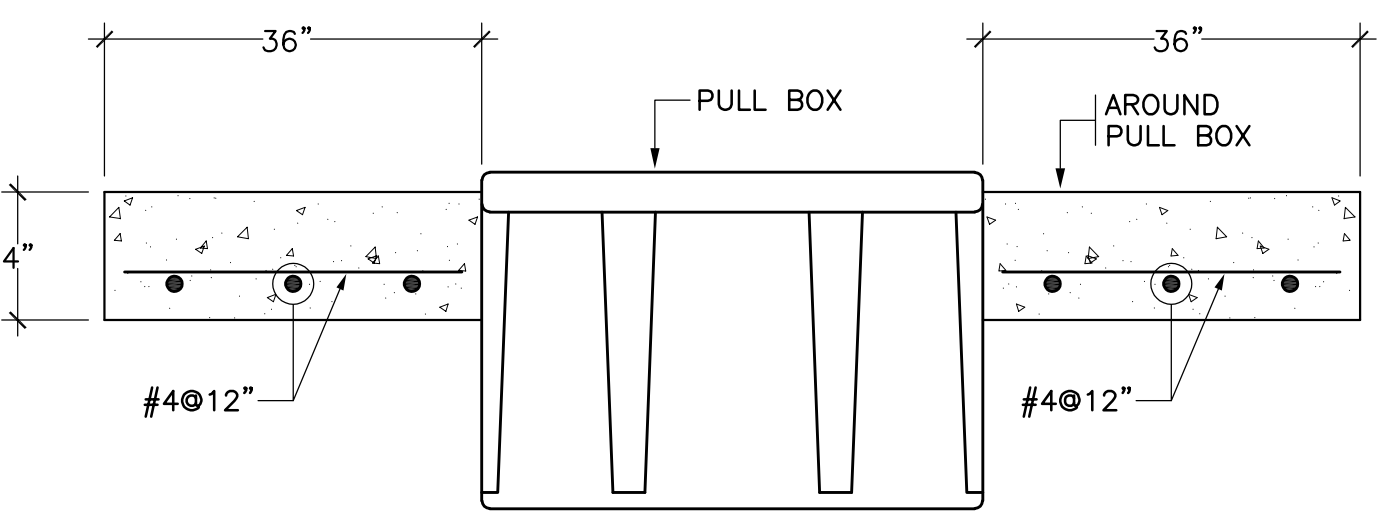
**RAW WATER RESERVOIR
ELECTRICAL DISTRIBUTION PLAN**
SCALE: 1:500



GRAPHIC SCALE = 1:500
0 5 10 20 35



CONTROL PULL BOX DETAIL
NOT TO SCALE



PULL BOX CONCRETE SLAB DETAIL
NOT TO SCALE

NOTE:
1. FOR ALL PULL BOXES, CONTROL AND POWER.

NOTE:
FOR SITE SYMBOLS REFER TO DRAWING WTP-E100 AND FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION SYMBOLS REFER DRAWING WTP-E218.



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIATURA 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODPE.

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INTEGRA
architects & engineers, P.S.C.
(787) 767.2111 www.integralps.com

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by:
Dwg. Date:


Ing. Ricardo Ortiz Garcia
Lic. no. 12448 P.R.
P.O. Box 1286, San Juan, P.R. 00954 • Tel. (787) 817-3100 • Fax. (787) 817-6000

Revisions

No.	Description	By	Date

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

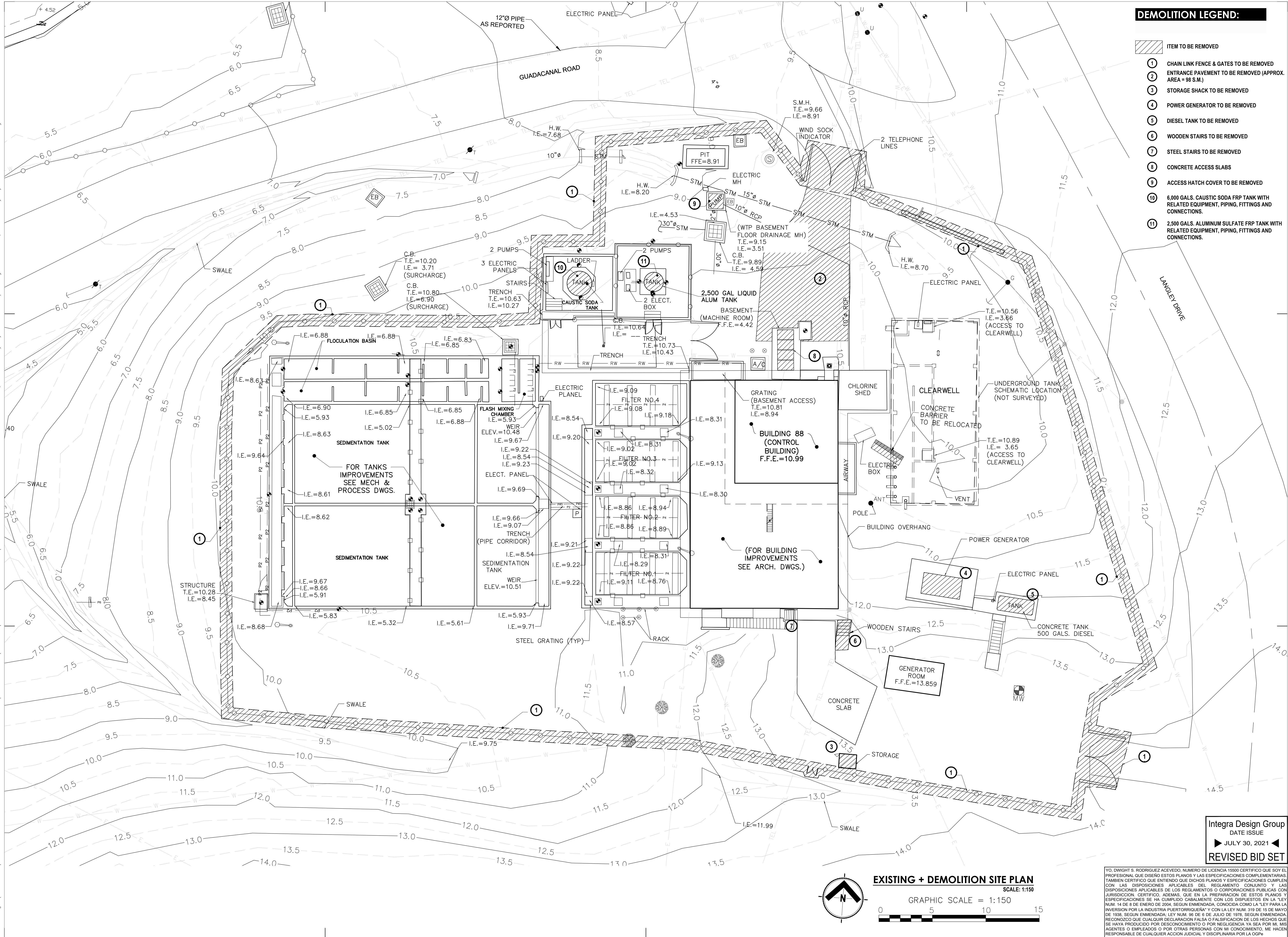
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



RAW WATER RESERVOIR
Drawing Title:
ELECTRICAL DISTRIBUTION PLAN

Project Title:
RWR-E100

File: P:\or\19-Celba\18370 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BldPhase\01-Site\Water Treatment Plant\068-WTP-C101 EXISTING + DEMOLITION SITE PLAN; Plotted: 5/31/2023 2:22 p.m. by SVIAZQUEZ; Saved: 8/18/2021 10:29 a.m. by SVIAZQUEZ



Revisions

Number	Date	Description
1	20210728	Project No. 18-1837.0
2	20210728	Set Date: 20210728
3		Drawn by:
4		Dwg. Date:

Project Info

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GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)

AT ROOSEVELT ROADS RE-DEVELOPMENT

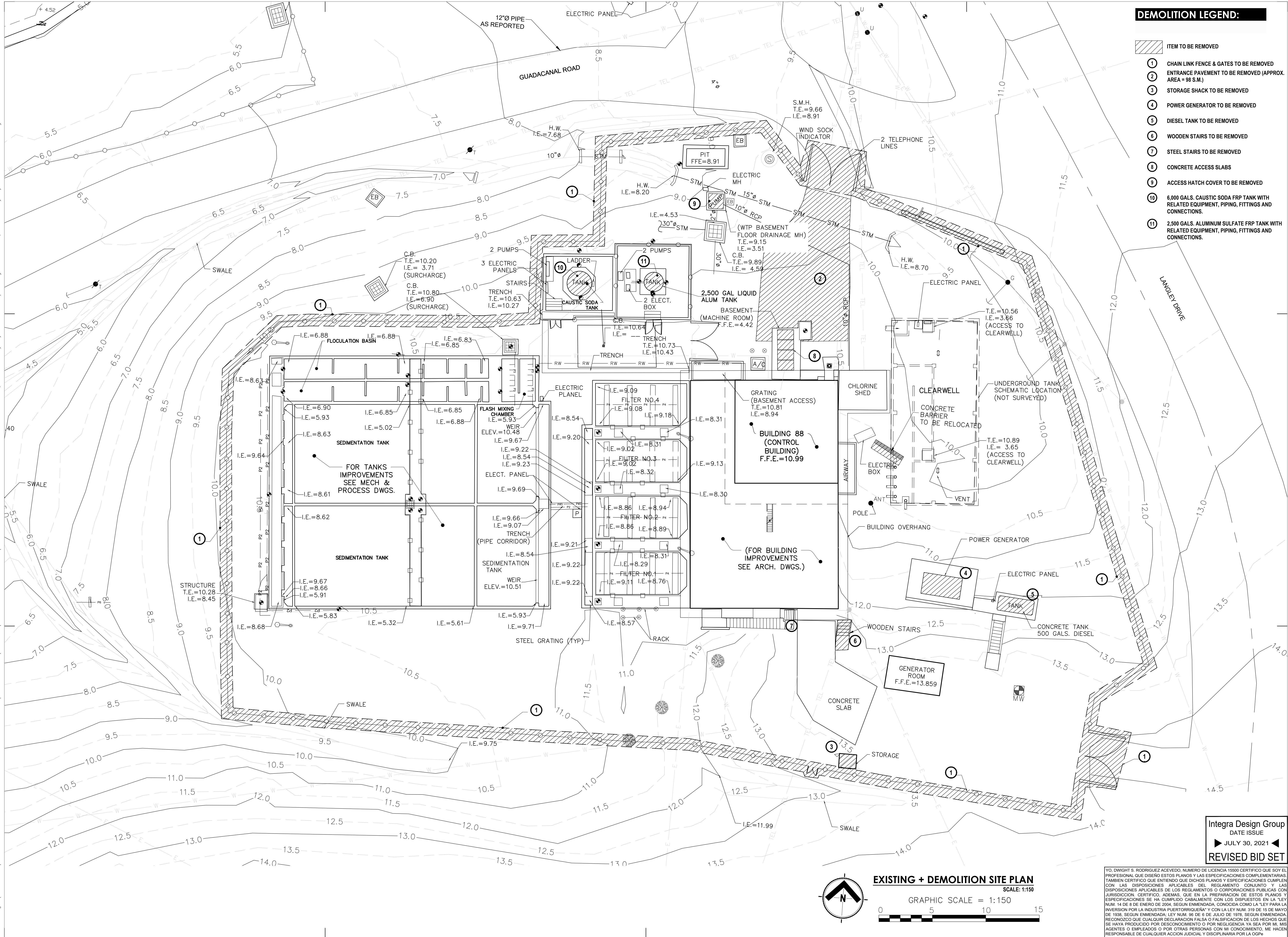
WATER TREATMENT PLANT

Drawing Title:

Sheet:

WTP-C101

File: P:\or\19-Celba\1837.0 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BldPhase\01-Site\Water Treatment Plant\068-WTP-C101 EXISTING + DEMOLITION SITE PLAN; Plotted: 5/31/2023 2:22 p.m. by SVIAZQUEZ; Saved: 8/18/2021 10:29 a.m. by SVIAZQUEZ



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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

Drawing Title:
EXISTING + DEMOLITION SITE PLAN

Sheet:

WTP-C101

TYPICAL FRP TANK ELEVATION

SCALE: N.T.S.

TYPICAL FRP TANK DETAIL
SCALE: N.T.S.

SCALE: N.T.S.

FRP TANKS NOTES:

1. ALL TANKS INSTALLATION SHALL INCLUDE 316 S.S SEISMIC RESTRAINT CLIPS AND CABLE WIND RESTRAINTS WITH WIND & SEISMIC RESISTANCE AS PER P.R. BUILDING CODE 2018.
2. CONTRACTOR SHALL SUBMIT CERTIFIED CALCULATIONS & SHOP DRAWINGS.

FRP TANKS LEGEND:

- | | | | | | |
|---|--|---|-----------------------------------|----|-----------------------------------|
| 1 | 2"Ø STAINLESS STEEL GLOBE VALVE | 5 | 3/4" - 90° PVC BEND | 9 | 3/4" TEE WITH SCREWED PLUG |
| 2 | 2"Ø STAINLESS STEEL STRAINER | 6 | 2"Ø PVC PIPE | 10 | 3/4"Ø PRESSURE RELIEF VALVE |
| 3 | 3/4" STAINLESS STEEL WASHOUT GLOBE VALVE | 7 | 2" x 3/4" PVC REDUCER | 11 | 3/4" BACK PRESSURE VALVE |
| 4 | 2" x 2" x 3/4" PVC TEE | 8 | 3/4"Ø STAINLESS STEEL GLOBE VALVE | 12 | CALIBRATION CHAMBER & GLOVE VALVE |




NOTES:

1. CONTRACTOR SHALL FILL AND LEVEL PROPOSED PAVEMENT AREA WITH COMPACTED CRUSH STONE AS NEEDED BEFORE APPLYING ASPHALT SURFACE.
2. CONTRACTOR SHALL ALL REPLACE EXISTING CHAIN LINK FENCE & GATE WITH SAME WIDTH AND HEIGHT AS EXISTING.

LEGEND:

+ (13.81) PROPOSED ELEVATIONS
+ 13.04 EXISTING ELEVATIONS

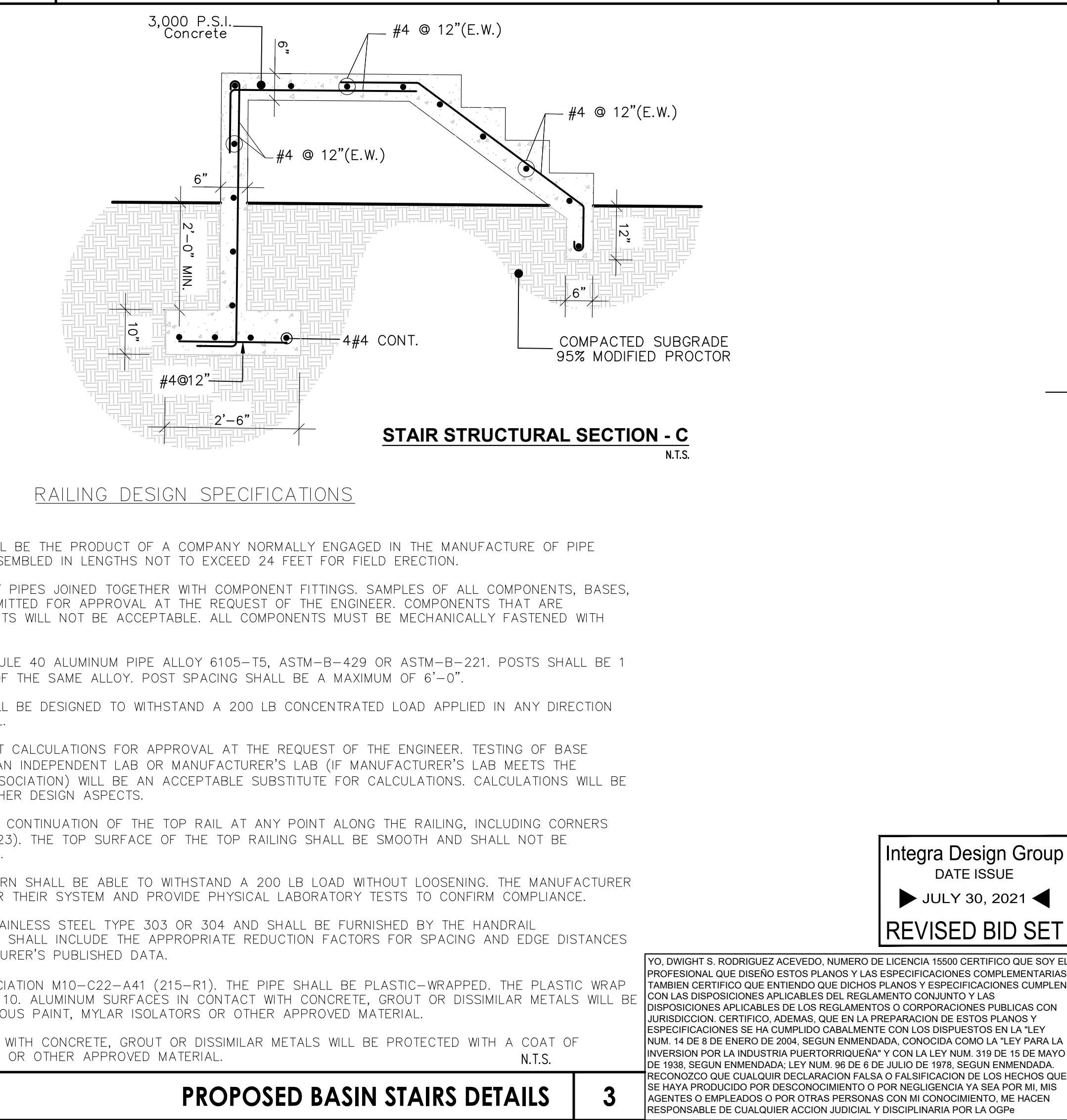
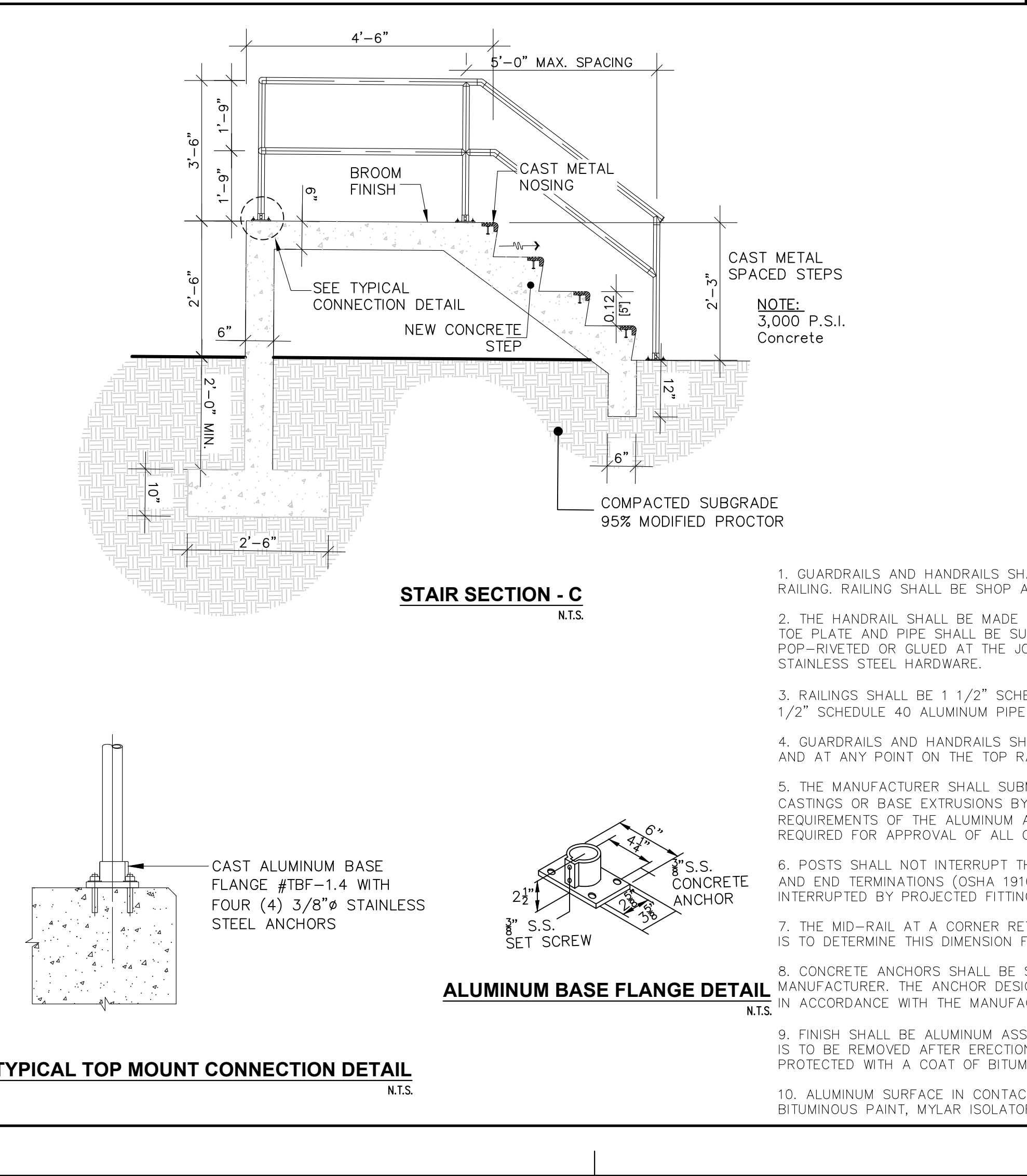
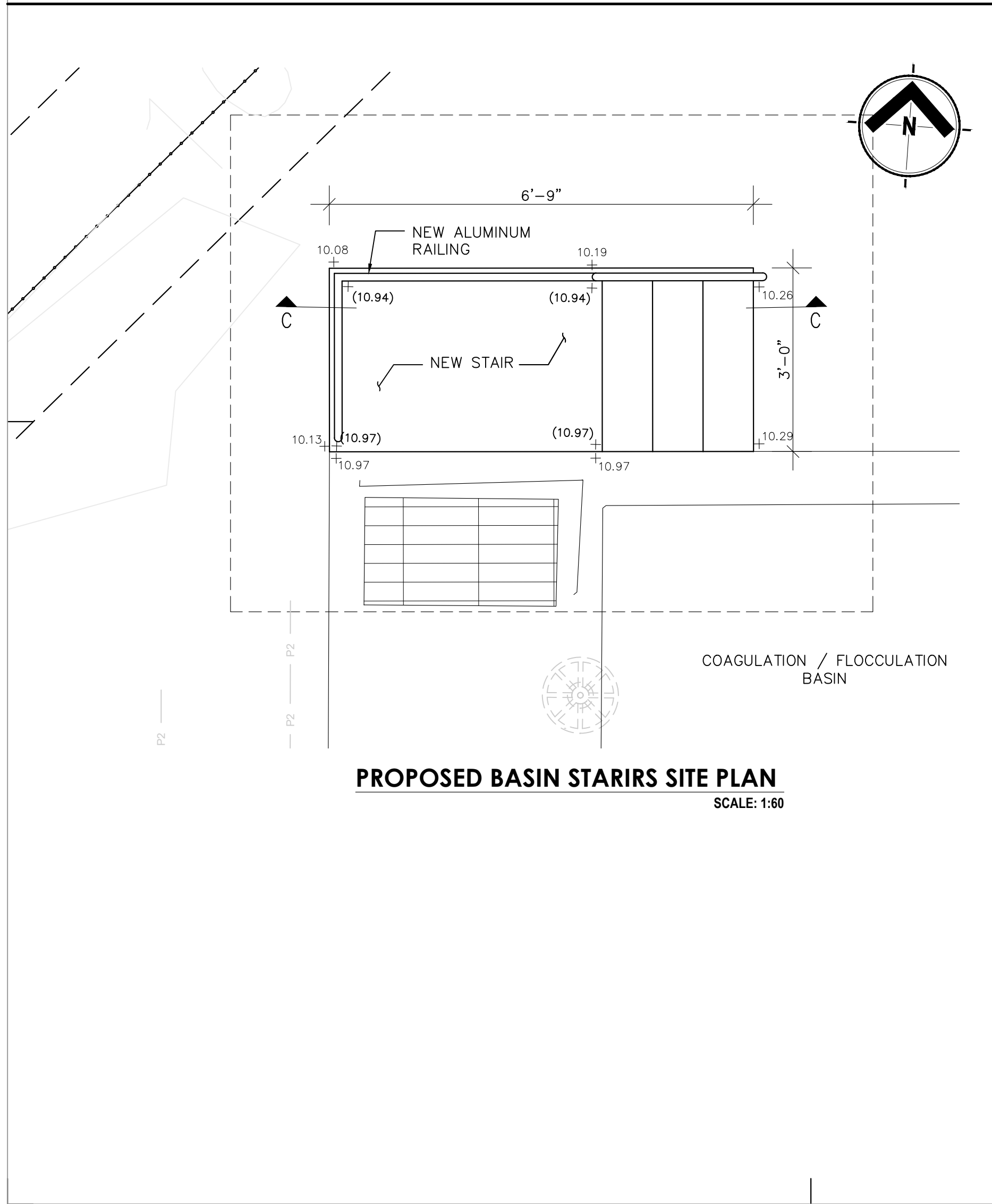
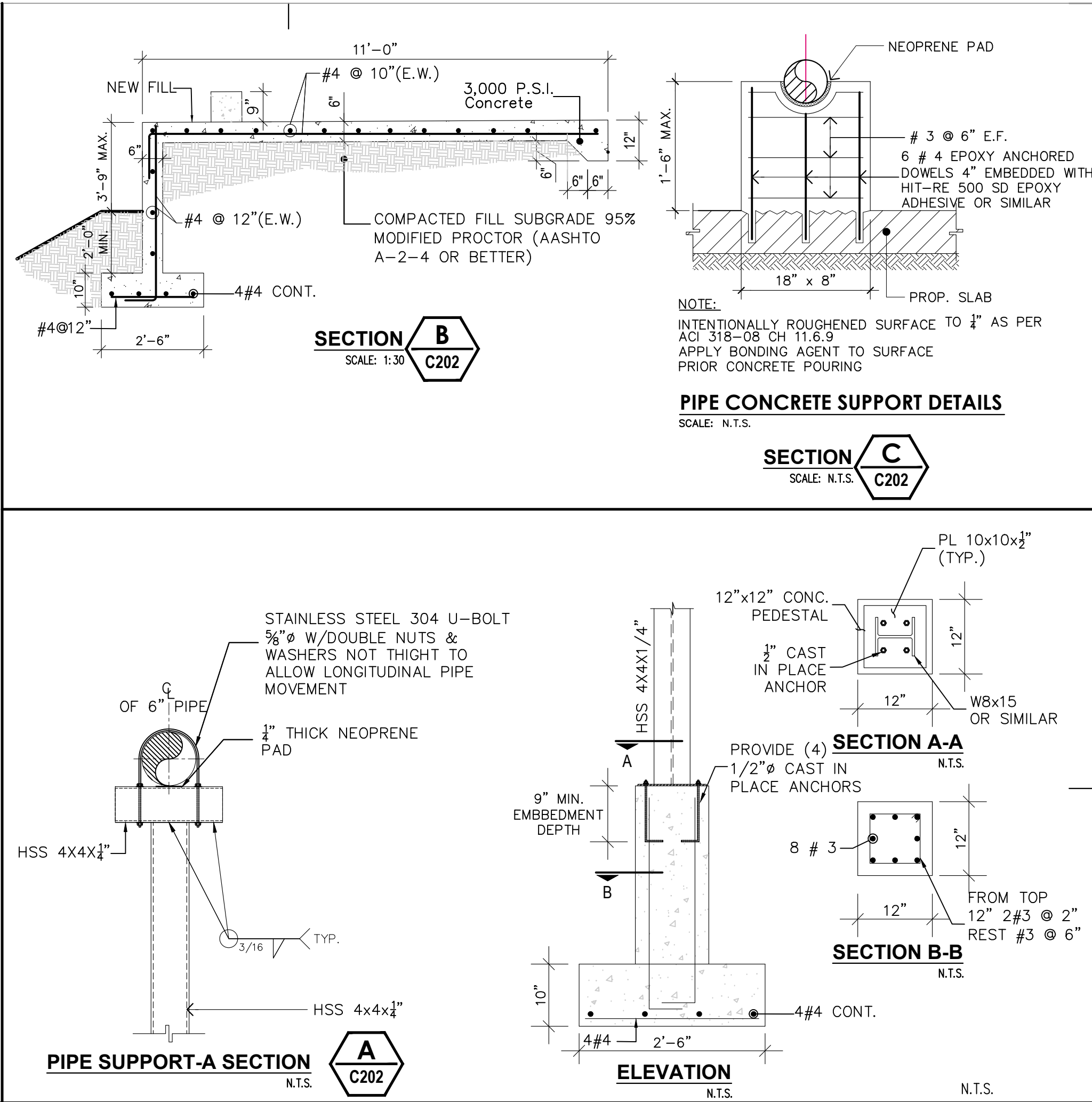
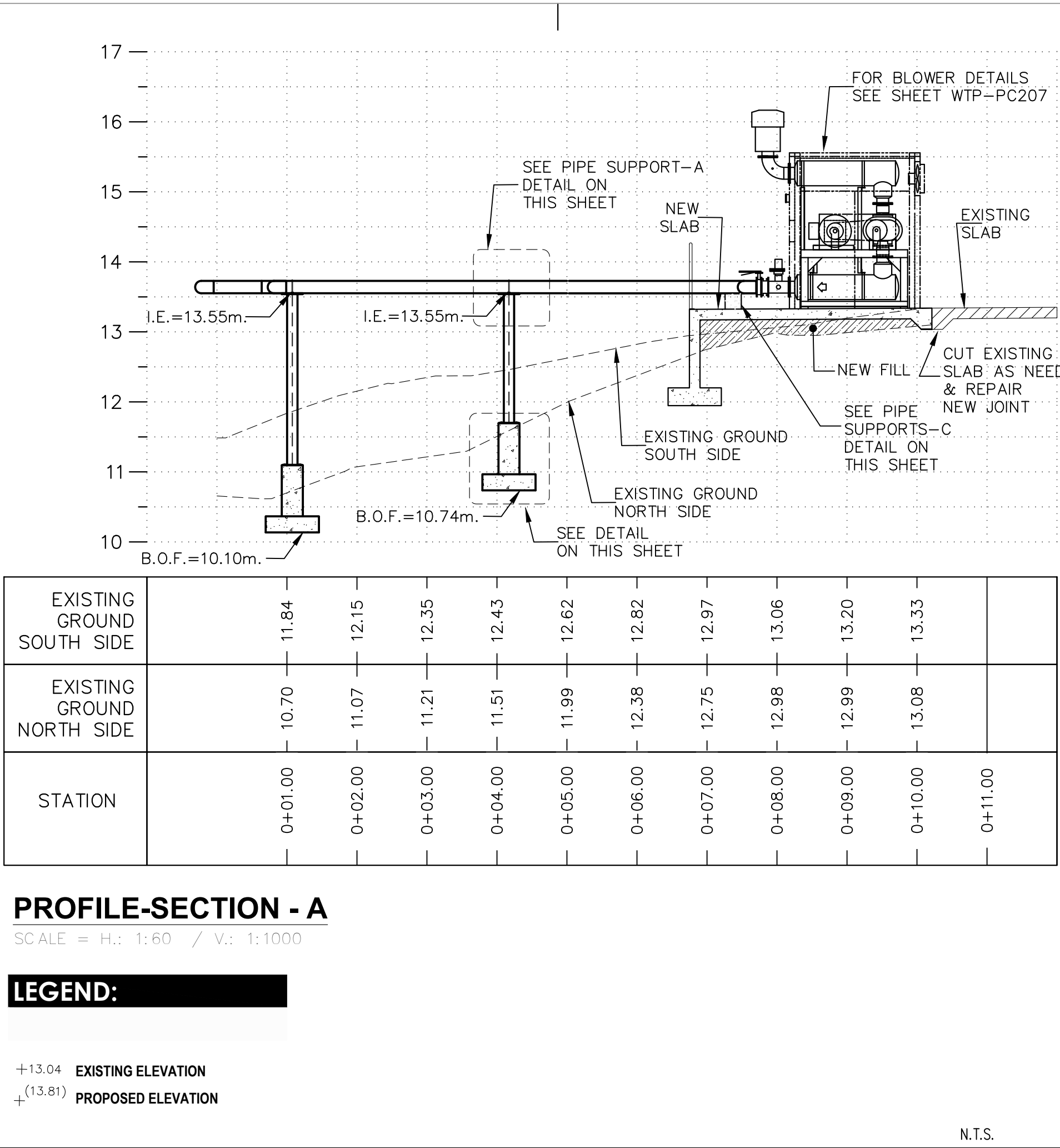
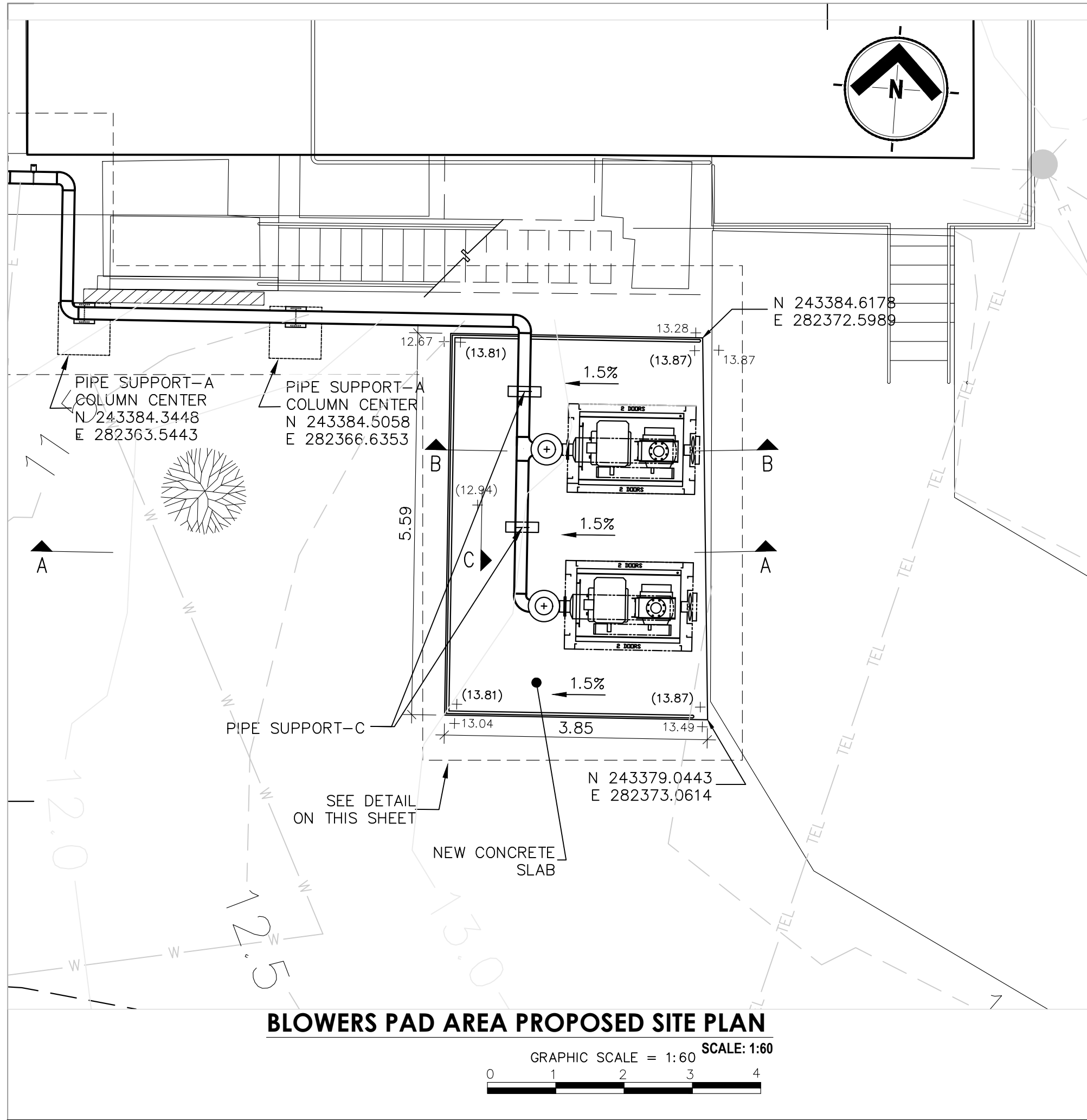
SCOPE OF WORKS:

- 1 NEW CHAIN LINK FENCE 
- 2 NEW ENTRANCE PAVEMENT  
- 3 NEW POWER GENERATOR
(SEE ELECTRICAL DWGS.)
- 4 NEW DIESEL TANK
(SEE ELECTRICAL DWGS.)
- 5 NEW STAIRS
(SEE ARCH. DWGS.)
- 6 NEW BLOWERS PAD AREA
- 7 NEW WINDSOCK & POLE
- 8 BASEMENT ACCESS DOORS REPLACEMENT
- 9 BASEMENT FLOOR DRAINAGE MH
IMPROVEMENTS, SEE SHEET WTP-M301
- 10 NEW BASIN STAIRS
- 11 NEW CONCRETE LOW WALL
- 12 REPAIR BENT FENCE POLES AND GATES, REPAIR
TOP RAILS, ADD CAPS AND INSTALL ANY MISSING
FENCE FITTING AND BARBED WIRE AS NEEDED,
INSTALL NEW GATE PADLOCK LATCHES.
- 13 NEW GENERATOR ROOM CONCRETE PAD AREA
- 14 STORAGE ROOM IMPROVEMENTS (SEE ARCH.
DRAWING)
- 15 NEW 6,000 GALS. CAUSTIC SODA FRP TANK WITH
ALL REQUIRED PIPING AND CONNECTIONS (SAME
DIAMETERS AS EXISTING)
- 16 NEW 2,500 GALS. ALUMINUM SULFATE FRP TANK
WITH ALL REQUIRED PIPING AND CONNECTIONS
(SAME DIAMETER AS EXISTING)

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

PROPOSED SITE PLAN



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Revisions

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1	2021/07/28	Project No. 19-1637.0
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3		Drawn by: Dwg. Date:

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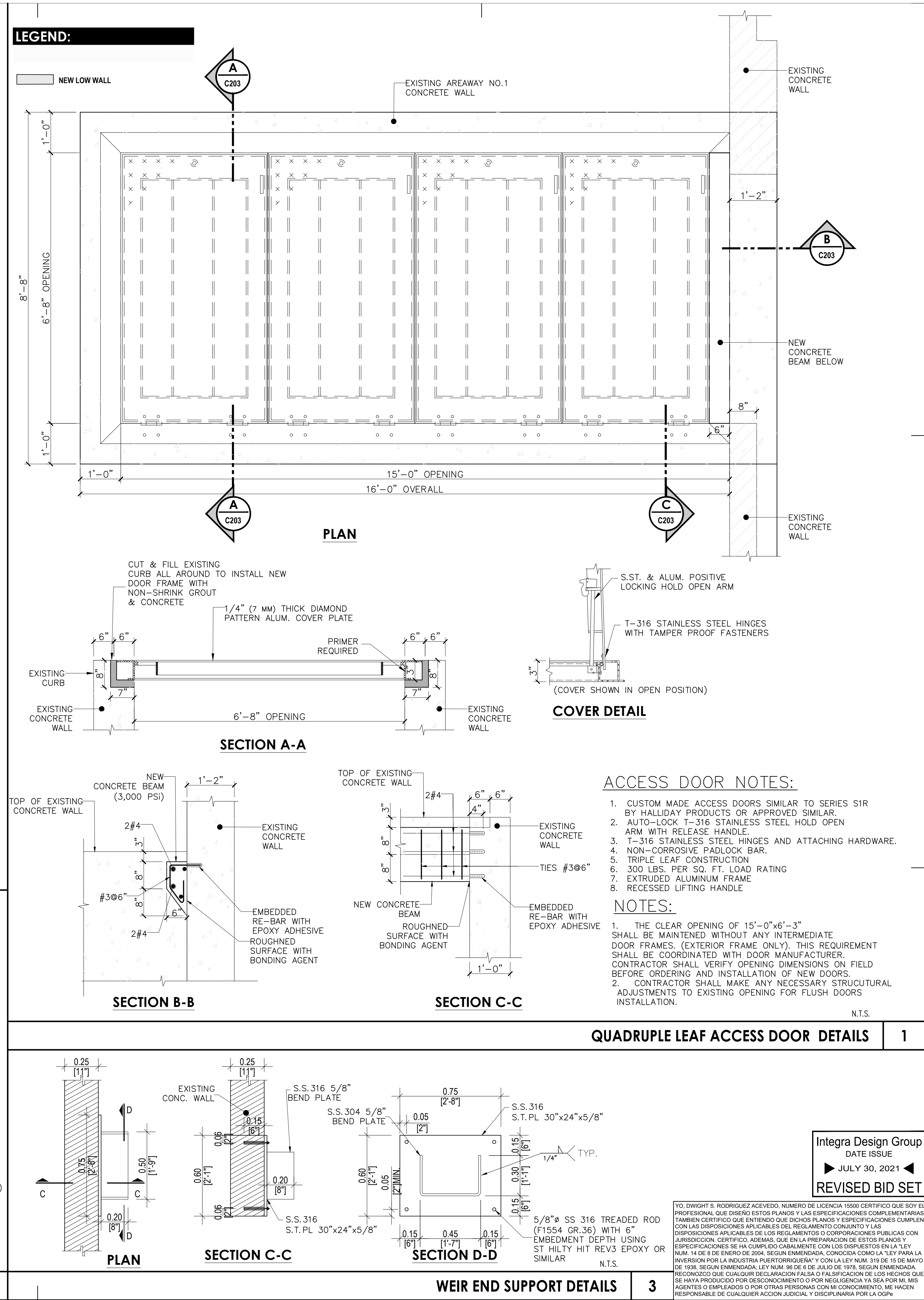
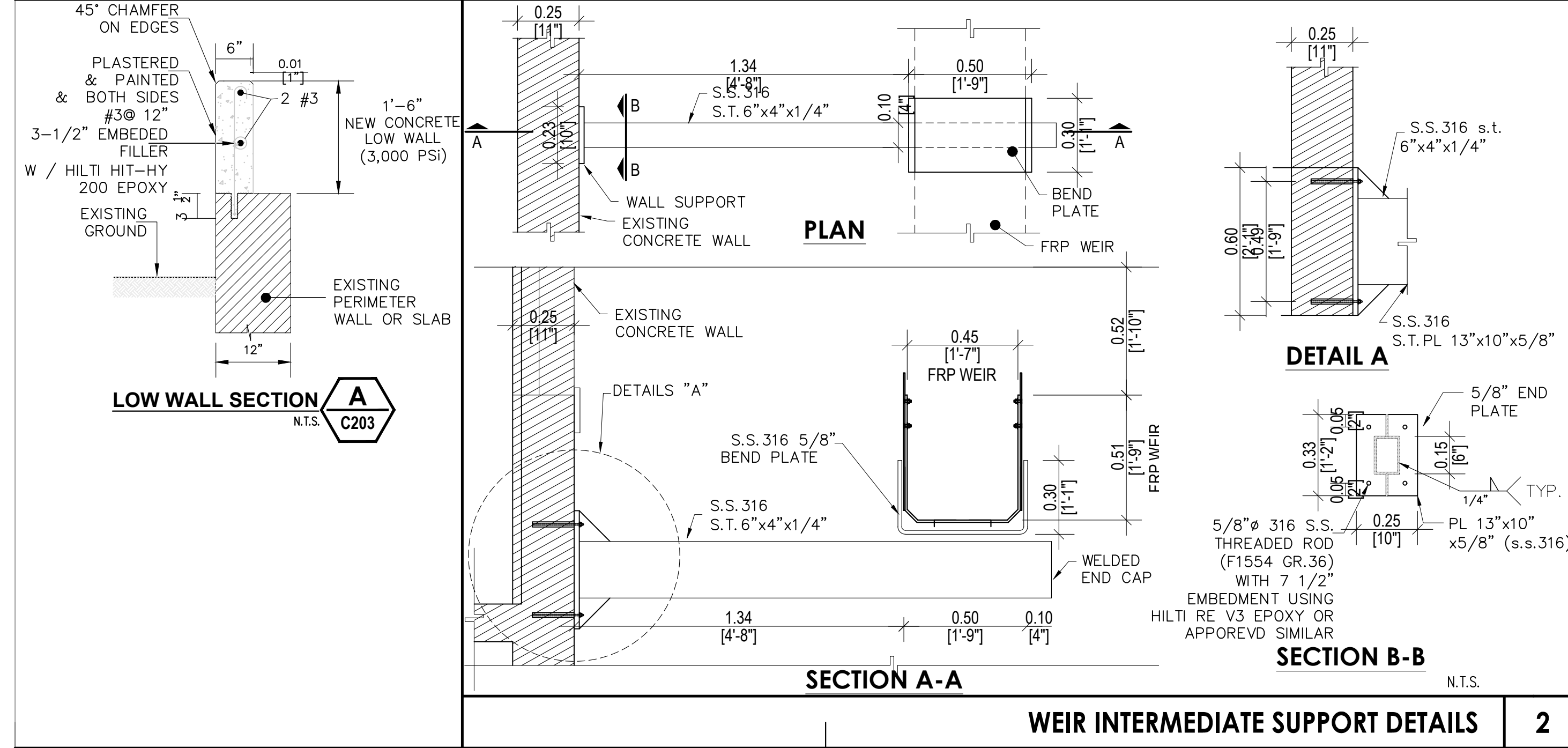
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Local Redevelopment Authority
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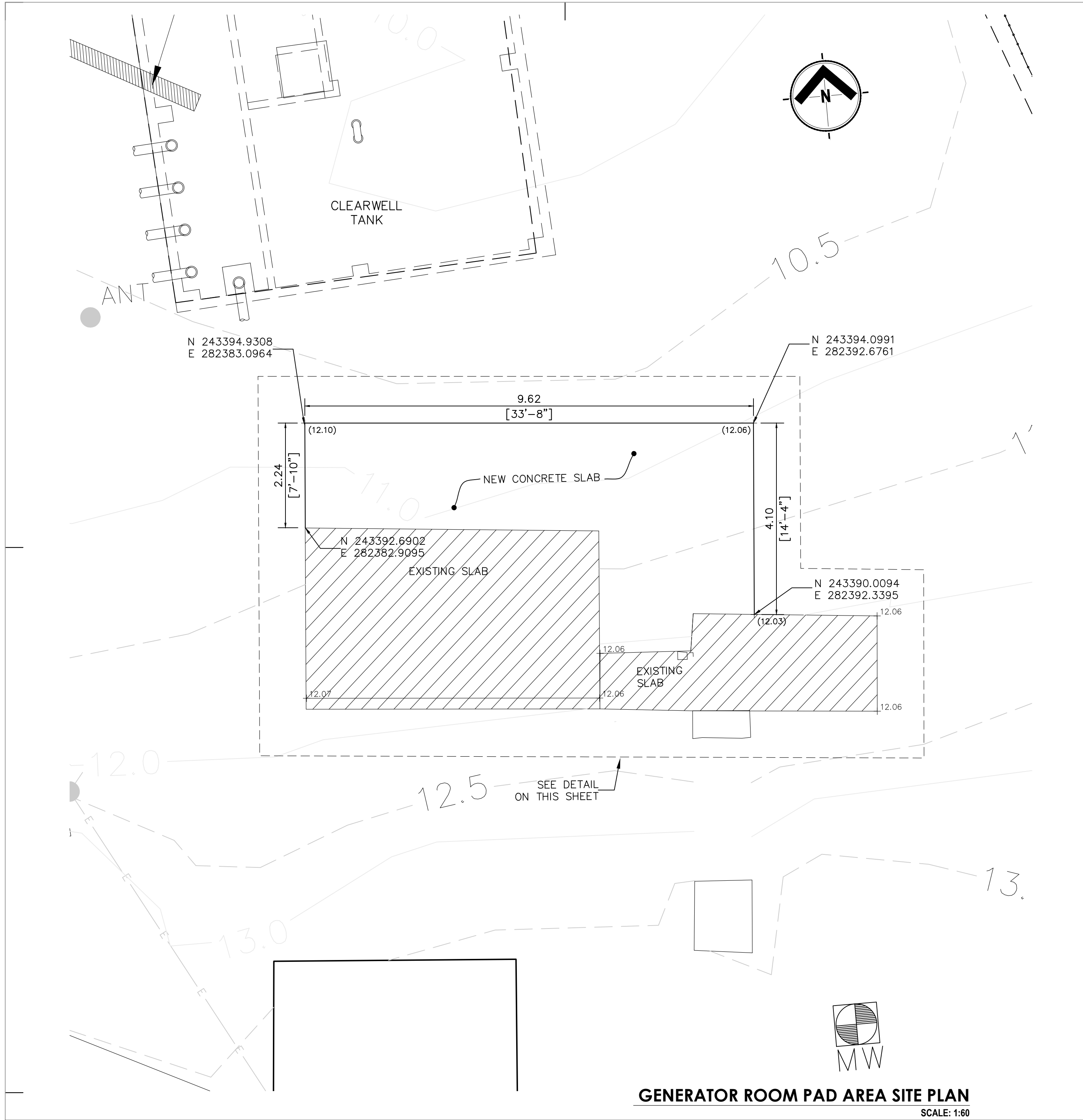
WATER TREATMENT PLANT

Drawing Title: WTP-C202

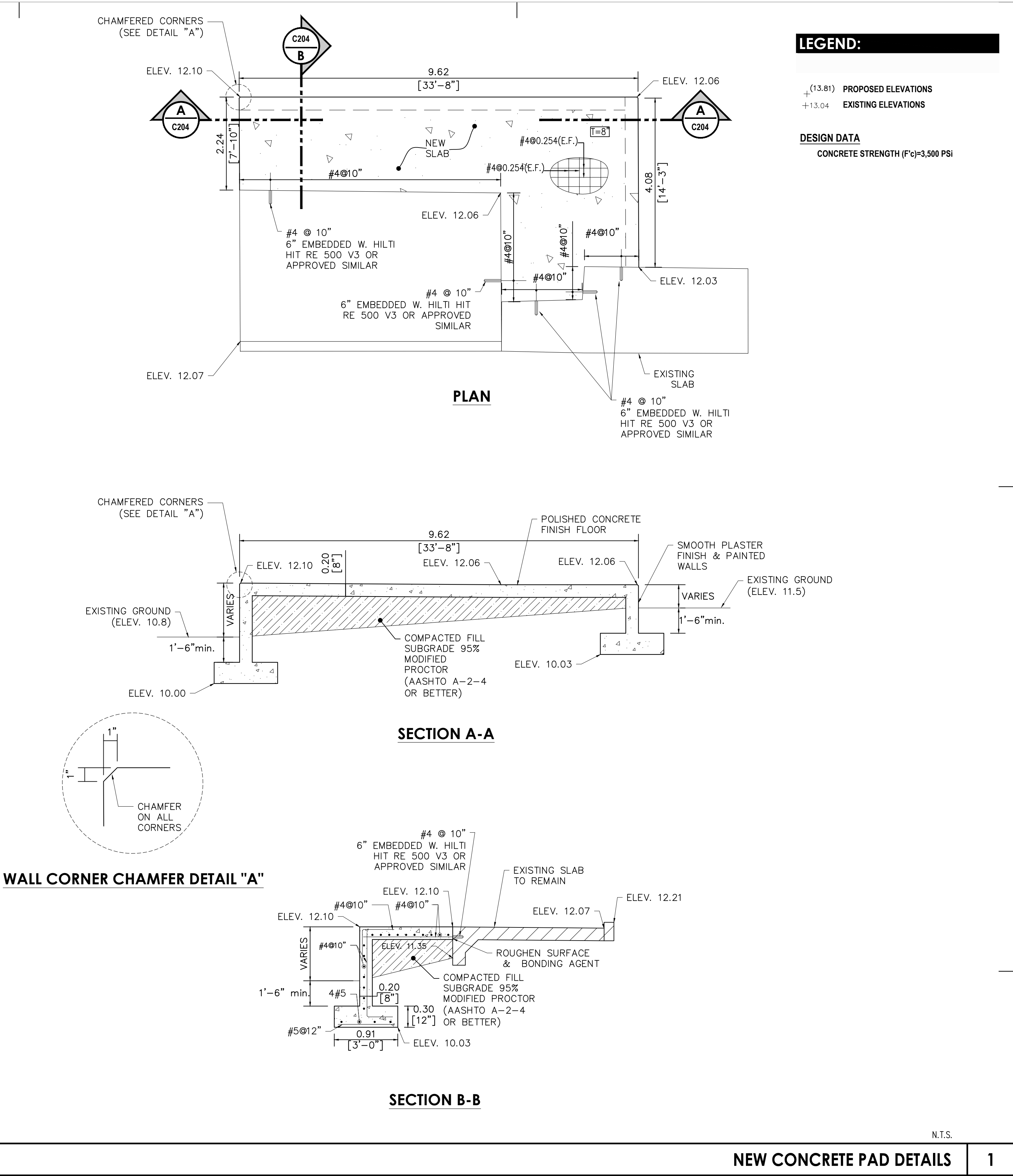
Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUENA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.





GENERATOR ROOM PAD AREA SITE PLAN
SCALE: 1:60



LEGEND:

(13.81) PROPOSED ELEVATIONS
+13.04 EXISTING ELEVATIONS

DESIGN DATA
CONCRETE STRENGTH (F'c)=3,500 PSI

N.T.S.

NEW CONCRETE PAD DETAILS

1

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Revisions		SHEET INFO.	
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		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

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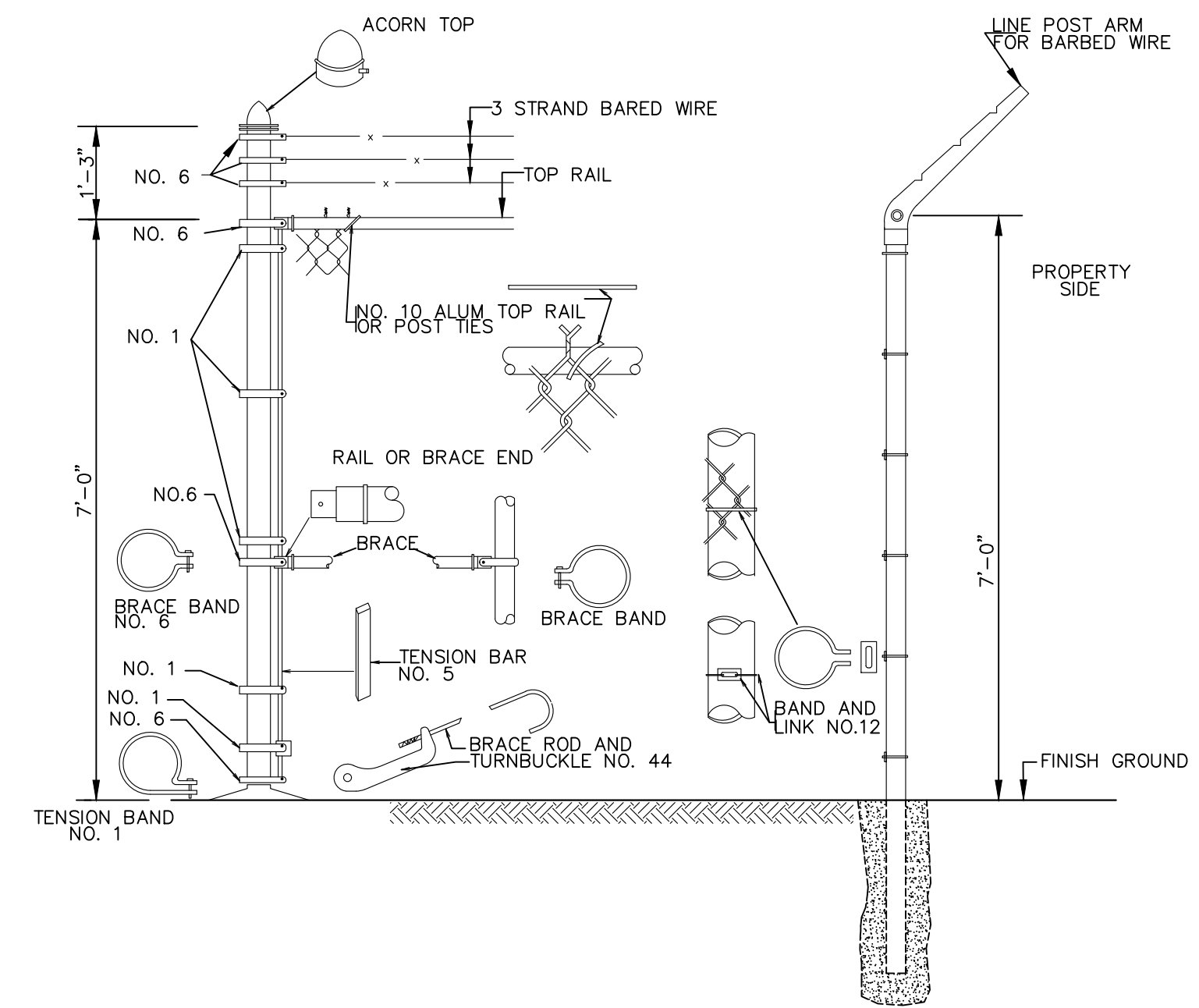
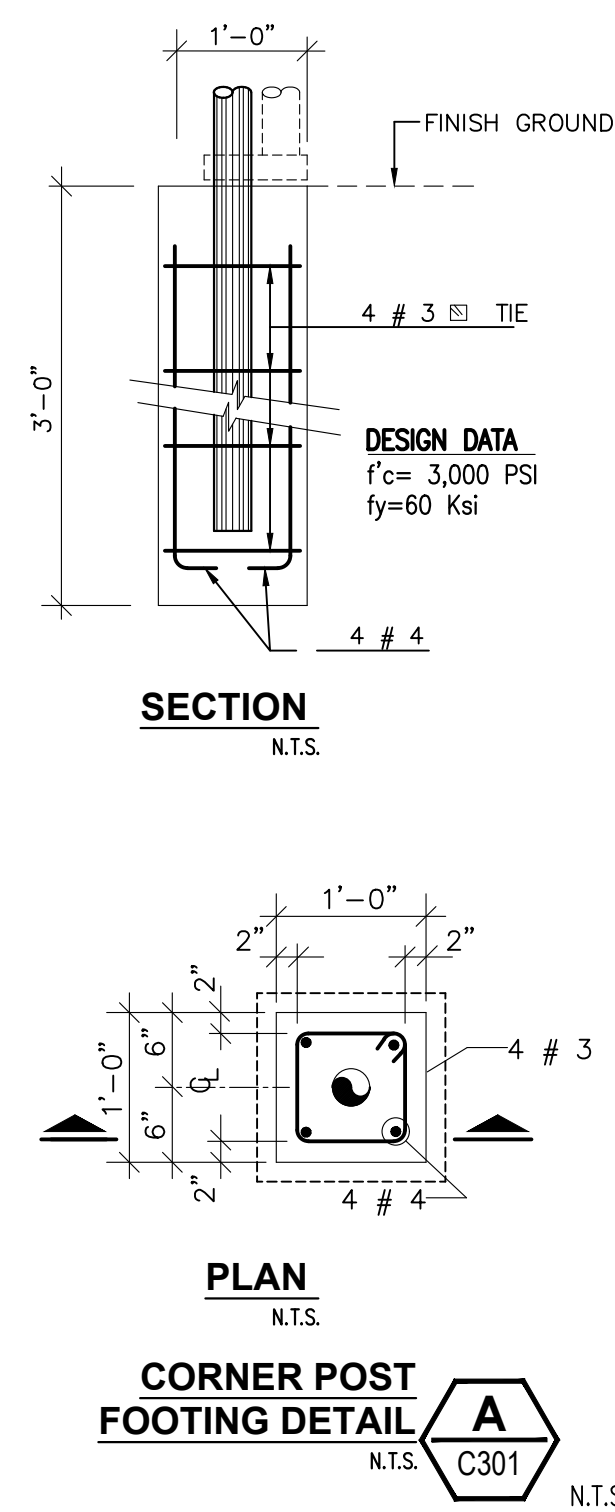
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Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

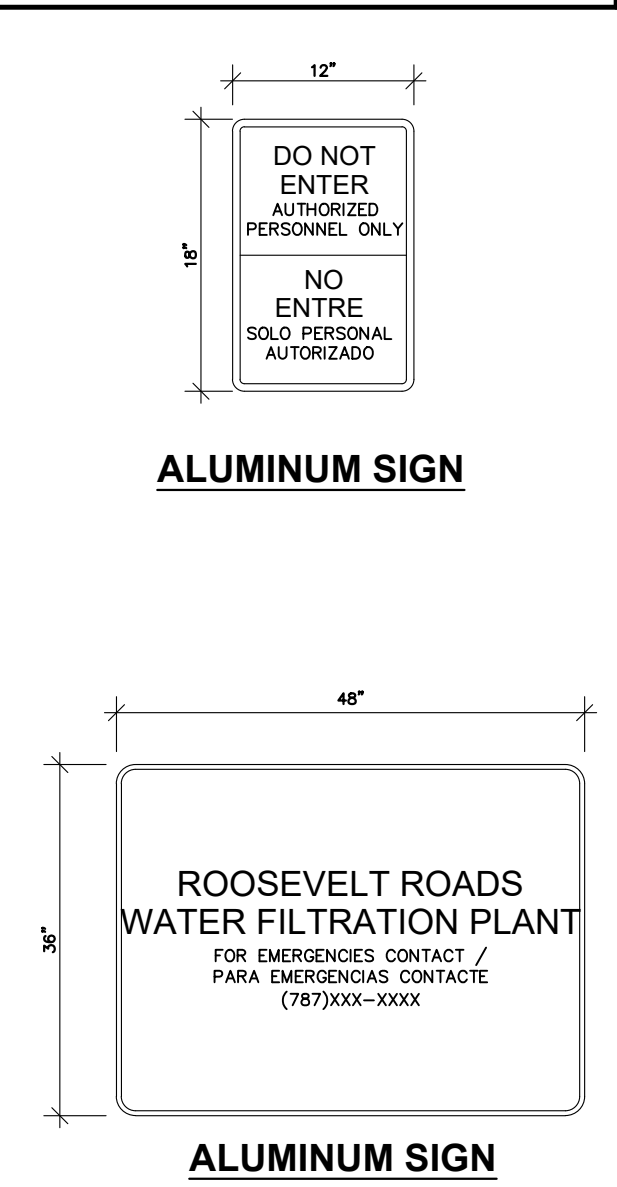
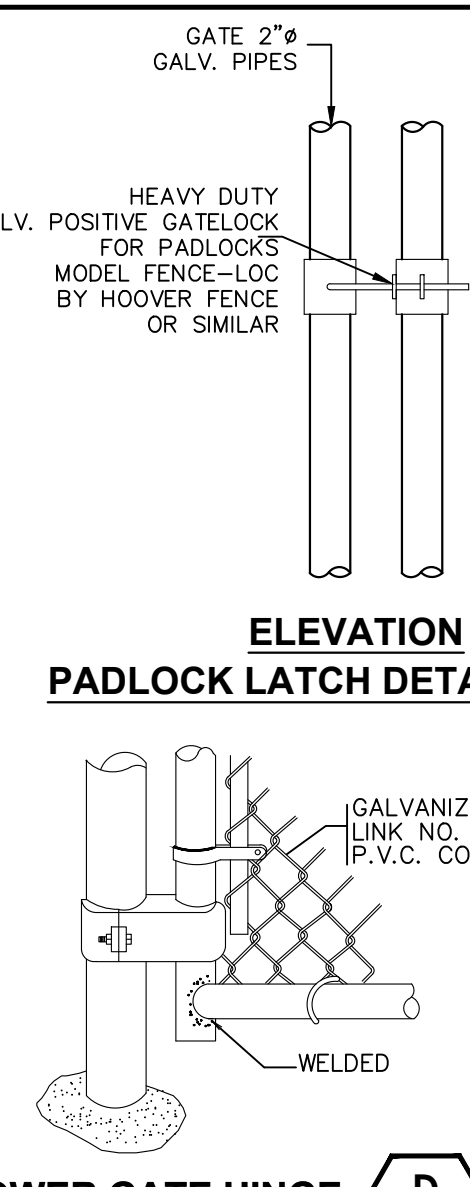
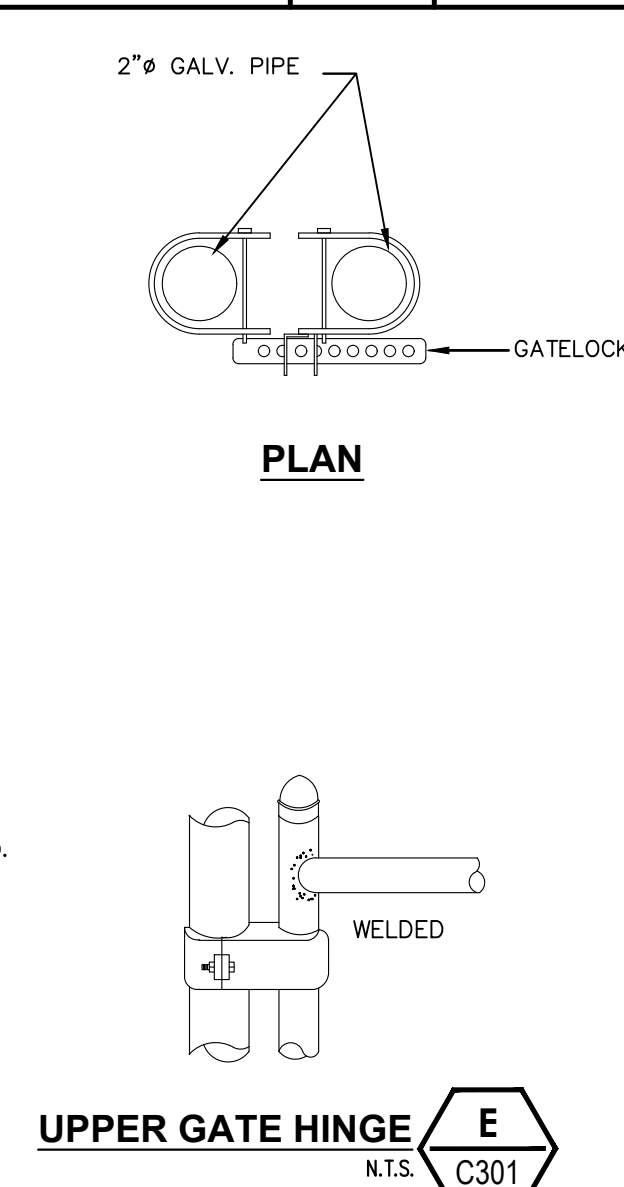
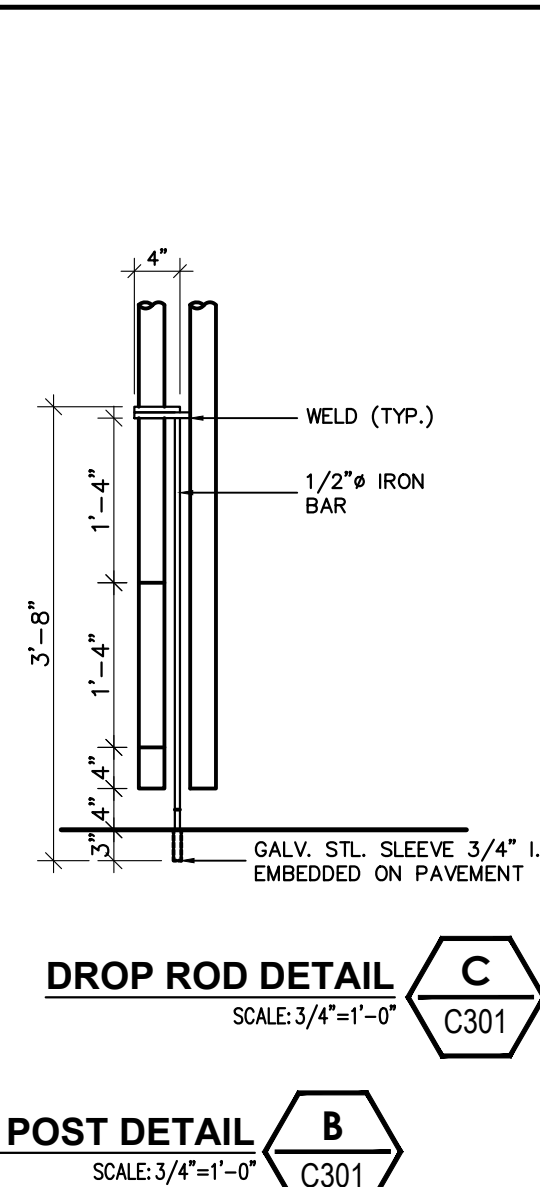
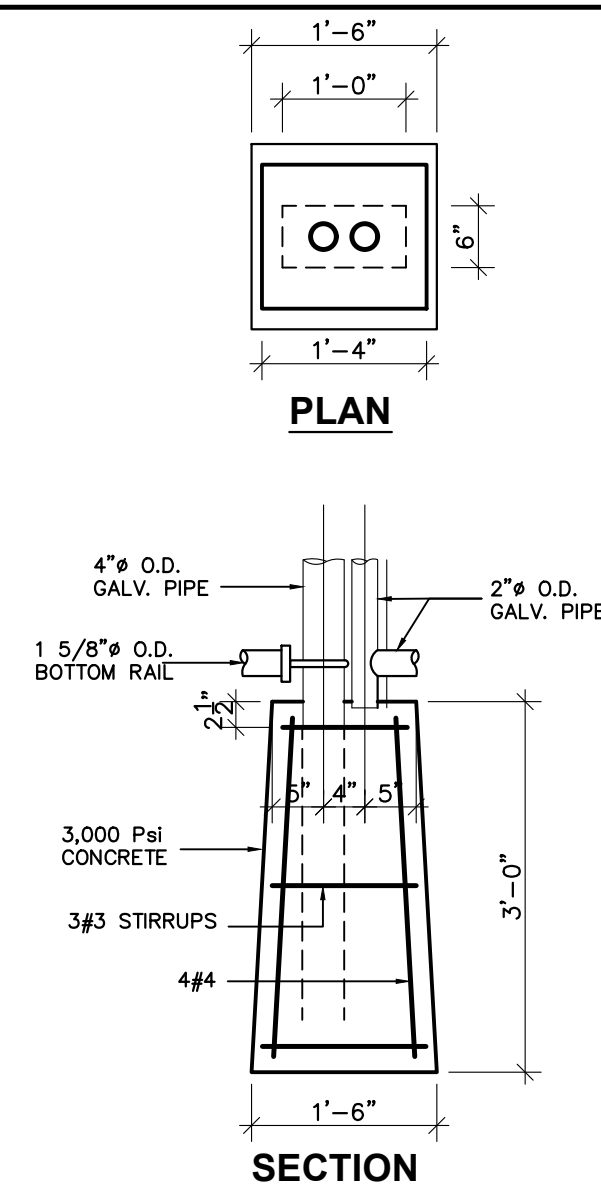
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NEW GENERATOR ROOM CONCRETE PAD PLAN AND DETAILS

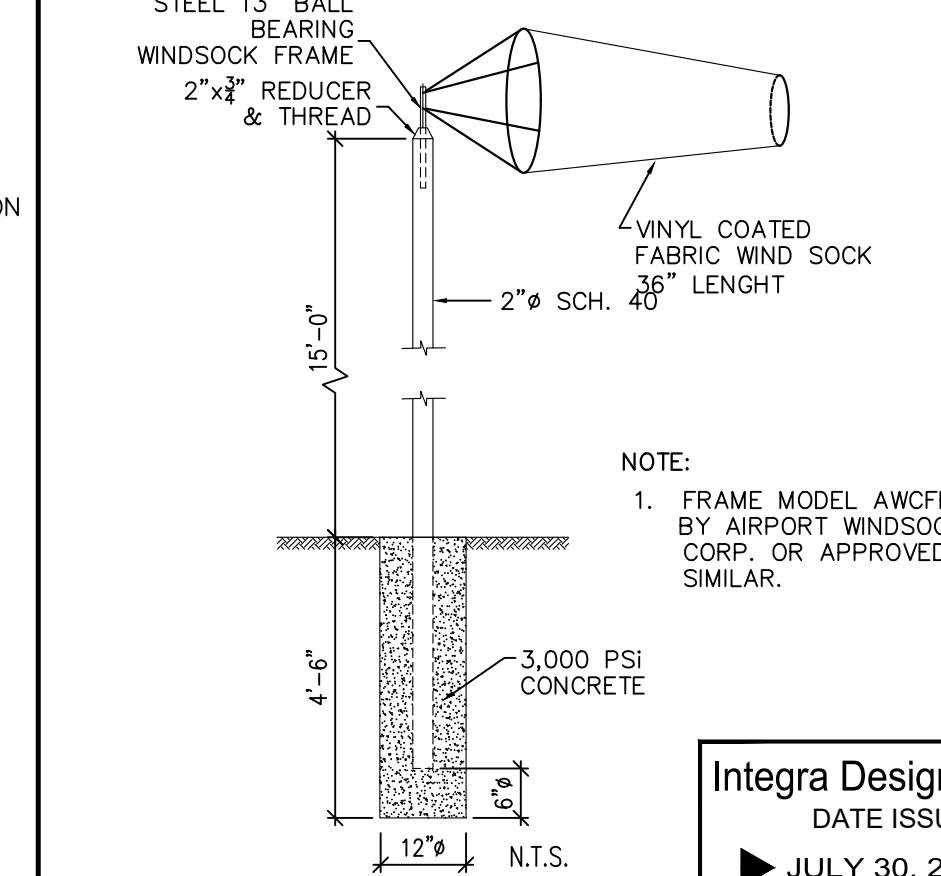
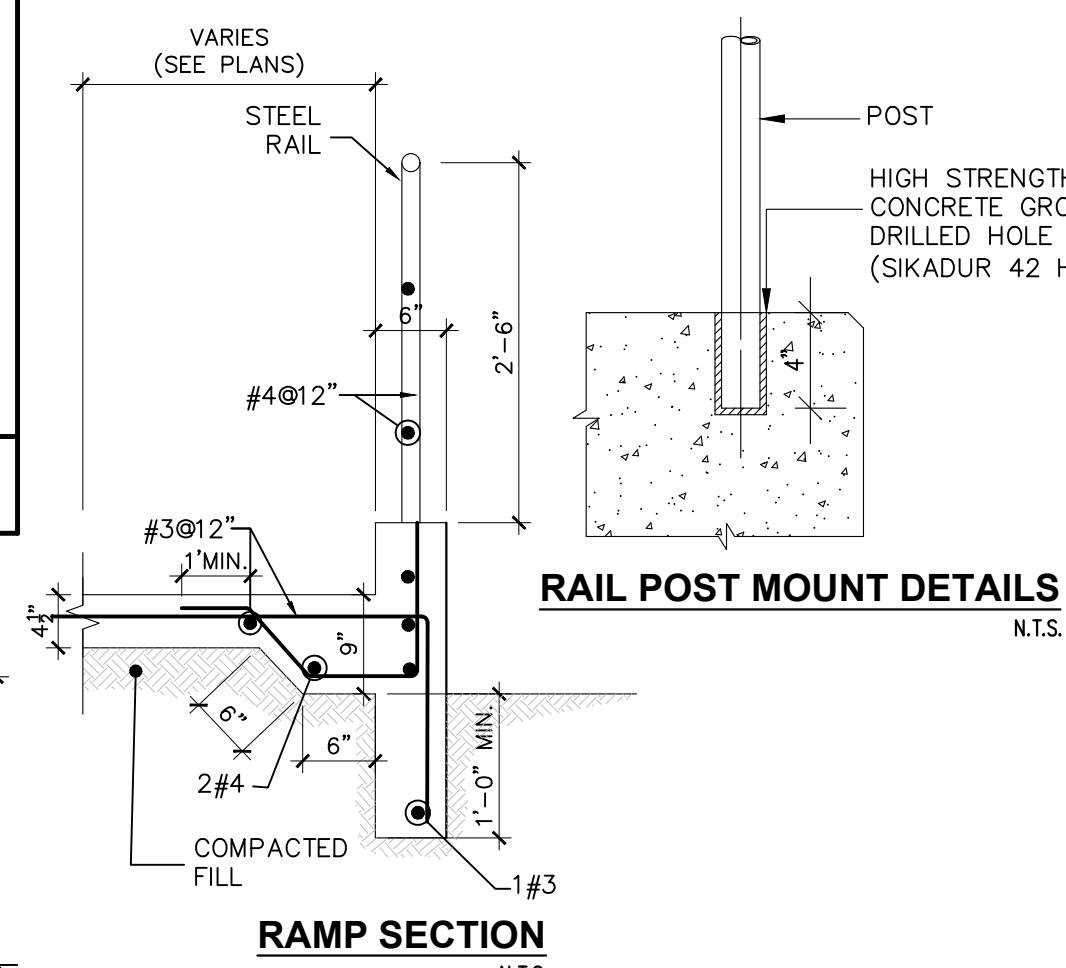
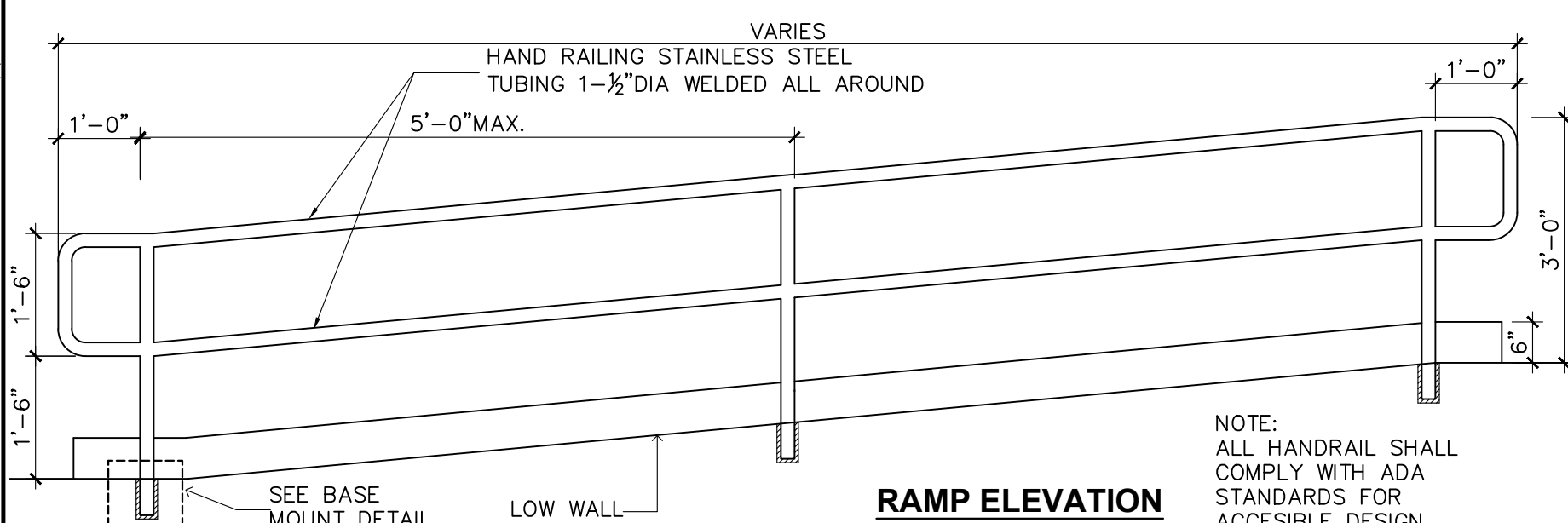
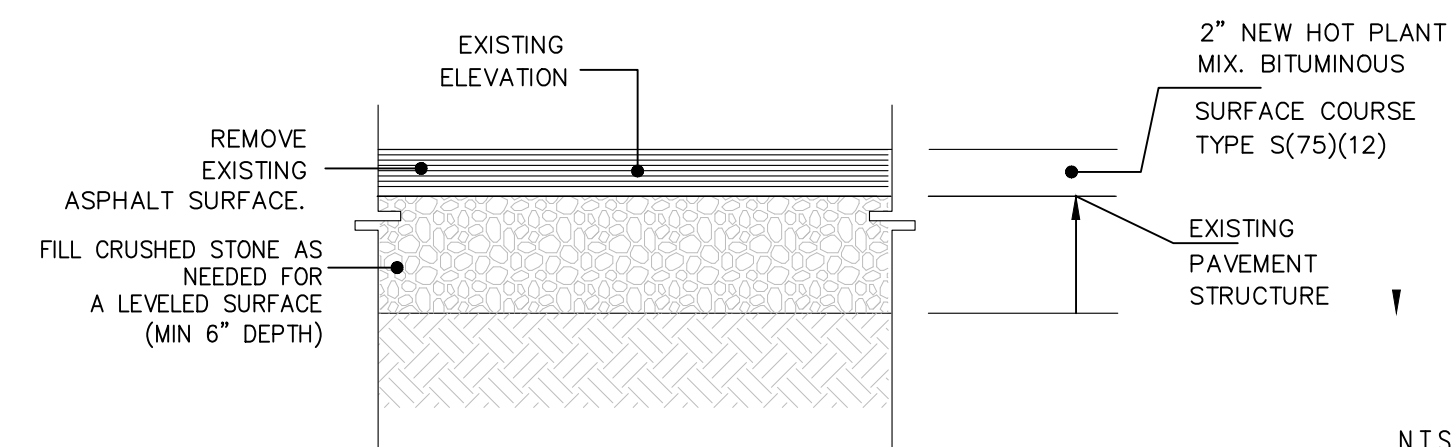
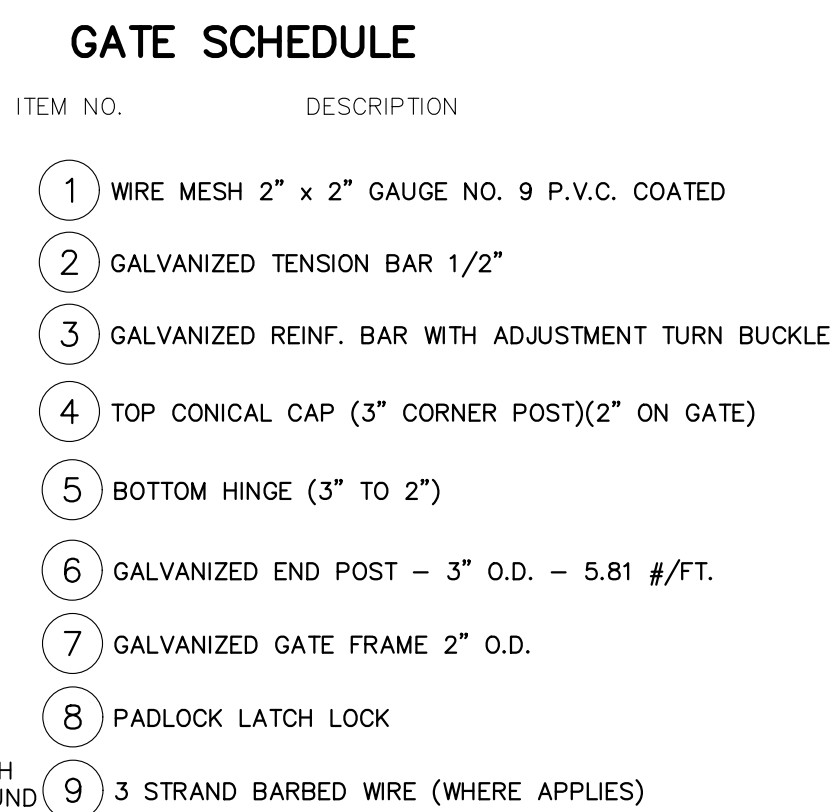
WTP-C204



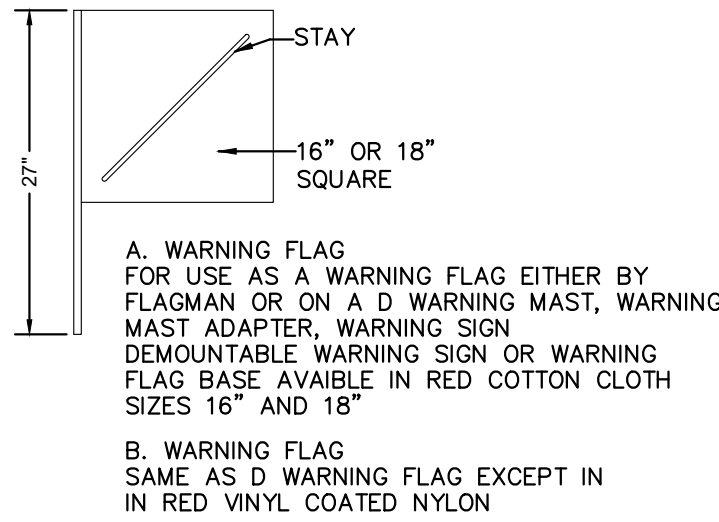
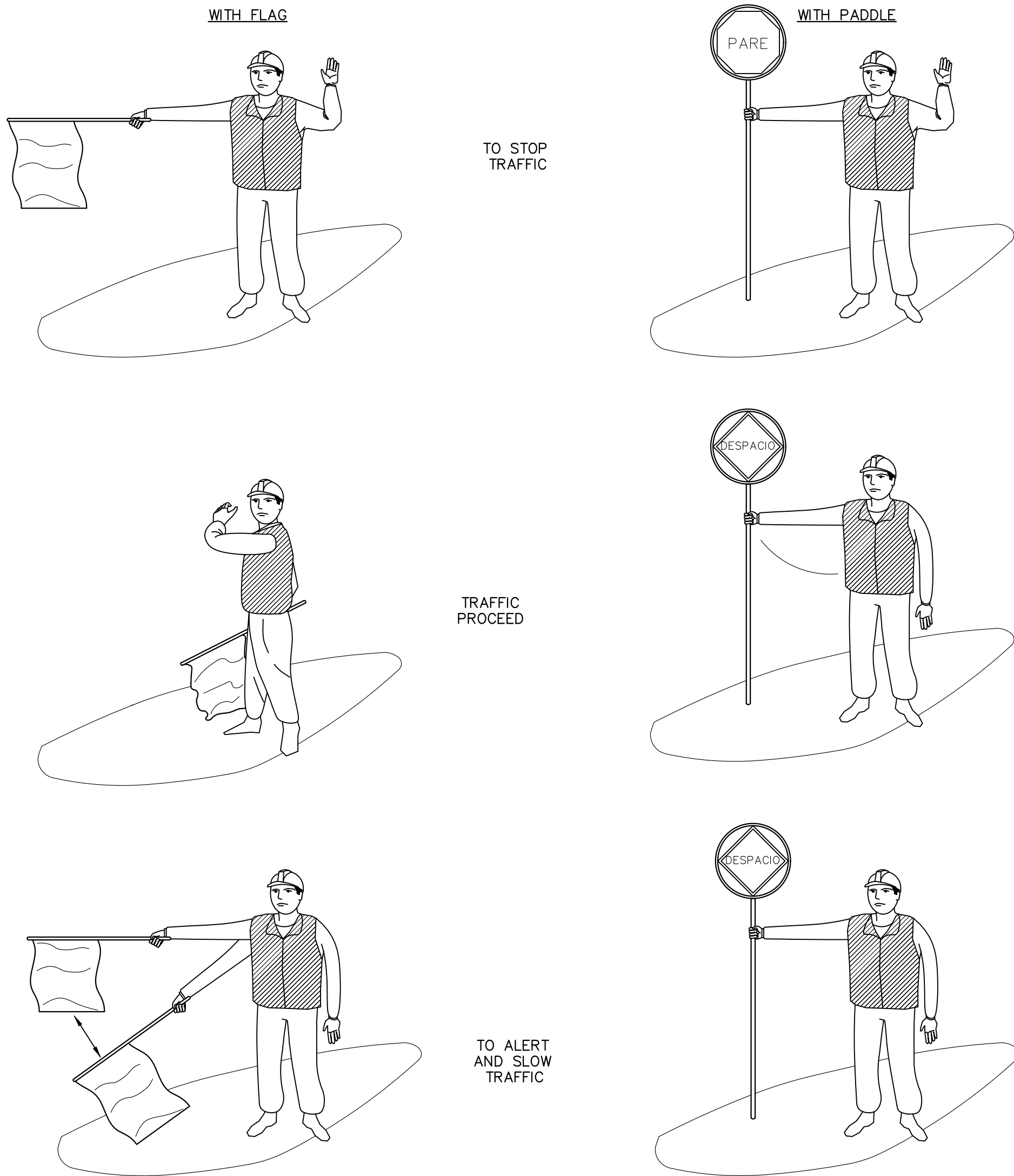
CHAIN LINK FENCE DETAILS | 2



ENTRANCE GATE DETAILS | 3



TYPICAL RAMP DETAIL	6
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A. WARNING FLAG (COTTON) AND
B. WARNING FLAG (NYLON)

USE OF HAND SIGNALING DEVICES BY FLAGMAN

CONSTRUCTION SIGNS:

CODE No.	LOCATION No.	LEGEND	LETTER SIZE	SIZE OF SIGN PANELS	SIGN CODE	OVERHEAD STRUCTURE TYPE	TOTAL ITEM
1	AS NEEDED		SEE D.T.P.W. MANUAL	36"x36"	W20-1	GROUND	AS NEEDED
2	AS NEEDED		SEE D.T.P.W. MANUAL	36"x36" 24"x24"	W20-4 W13-1	GROUND	AS NEEDED
3	AS NEEDED		SEE D.T.P.W. MANUAL	36"x36" 18"x24"	W20-7(A) W16-2P	GROUND	AS NEEDED
4	AS NEEDED		SEE D.T.P.W. MANUAL	48"x24"	G20-2	GROUND	AS NEEDED
5	AS NEEDED		SEE D.T.P.W. MANUAL	30"x24"	R4-7	GROUND	AS NEEDED

MAINTENANCE OF TRAFFIC

1. THE CONSTRUCTION SCHEDULE SHOWN ON THIS SHEET SHALL BE FOLLOWED IN ORDER TO MAINTAIN THE TRAFFIC FLOW WITH THE LEAST INTERFERENCE TO THE CONSTRUCTION WORK WHILE PROVIDING SAFE CONDITIONS TO MOTORISTS, PEDESTRIANS AND WORKERS. ANY CHANGE TO THIS SCHEDULE SHALL BE SUBMITTED IN WRITING FOR APPROVAL TO THE DESIGNER PRIOR TO APPLICATION.
2. TRAFFIC CONTROL DEVICES SHALL BE INSTALLED FROM THE COMMENCEMENT OF THE CONSTRUCTION AND BE MAINTAINED DURING THE PERTINENT PHASE. ALL TRAFFIC CONTROL DEVICES NOT APPLICABLE TO THE CONSTRUCTION PHASE BEING PERFORMED SHALL BE REMOVED OR RELOCATED AS REQUIRED BY THE PROJECT ENGINEER.
3. THE CONTRACTOR SHALL MAINTAIN ACCESS TO ADJACENT PROPERTIES DURING CONSTRUCTION. THE ROADWAY SHALL BE FREE OF MATERIALS, OBJECTS AND EQUIPMENT. FLAGMEN SHALL BE UTILIZED ON THOSE POINTS OF ACCESS FOR HEAVY EQUIPMENT TO AND FROM THE CONSTRUCTION AREA, AS DIRECTED BY THE CONTRACTOR.
4. WHEN PERFORMING EXCAVATION ADJACENT TO ACTIVE ROADWAYS, ROADWAY USERS SHALL BE PROPERLY PROTECTED.

TRAFFIC FLOW

1. TRAFFIC WILL BE MAINTAINED IN BOTH DIRECTIONS AT ALL TIMES.
2. TRAFFIC FLOW WILL BE OPERATED ONE LANE PER DIRECTION AS NECESSARY.
3. CONSTRUCTION SIGNS SHALL BE MOVED AS CONSTRUCTION PROGRESSES.

CONSTRUCTION SCHEDULE (PHASE-A)

1. INSTALL TRAFFIC DEVICES ON LANE EDGE.
2. CONSTRUCT IMPROVEMENTS ON SIDEWALKS & CURBS.
3. MAINTAIN TWO WAY TRAFFIC OPEN.
4. REMOVE TRAFFIC DEVICES AFTER FINISHING IMPROVEMENTS.

CONSTRUCTION SCHEDULE (PHASE-B)

1. INSTALL TRAFFIC DEVICES ON LANE EDGE.
2. CONSTRUCT IMPROVEMENTS ON SIDEWALKS & CURBS.
3. MAINTAIN TWO WAY TRAFFIC OPEN.
4. REMOVE TRAFFIC DEVICES AFTER FINISHING IMPROVEMENTS.

CONSTRUCTION SIGNS:

1. CONSTRUCTION SIGNS SHALL BE RETROREFLECTIVE AND COMPLY WITH SHAPE, SIZE AND LETTERING ACCORDING TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), 2009 EDITION AND THE PR DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS (D.T.P.W.) REQUIREMENTS.

DAYTIME CONSTRUCTION NOTES:

1. PROVIDE TEMPORARY SIGNS AS SHOWN ON DRAWINGS.
2. CONSTRUCT FORCE LINE AS INDICATED.
3. LANE CLOSURES SHALL ONLY BE PERMITTED BETWEEN THE HOURS OF 9:00 AM TO 3:00 PM.

CONSTRUCTION NOTES:

1. CONSTRUCTION DURING ALL PHASES SHALL BE PERFORMED DURING DAYLIGHT.
2. NO OBSTRUCTIONS CAUSED BY EQUIPMENT, PERSONNEL AND MATERIALS SHALL BE ALLOWED.
3. NO OPEN EXCAVATION SHALL REMAIN UNATTENDED AT THE END OF THE WORKING DAY. EXCAVATIONS SHALL BE BACKFILLED UP TO THE SUBGRADE OTHERWISE PROPERLY PROTECTED.
4. CONTRACTOR SHALL PAINT NEW PAVEMENT MARKING AS REQUIRED.
5. TRAFFIC CONTROL DEVICES SHALL COMPLY WITH THE SUPPLEMENTAL SPECIFICATION NUMBER 638- "MAINTENANCE AND PROTECTION OF TRAFFIC" OF SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, PRHTA 2005 EDITION.
6. MATERIALS AND OTHER DEVICES USED FOR CONSTRUCTION SHALL BE REMOVED FROM THE ROADWAY AFTER WORK HOURS AND SHALL BE STAGED A MINIMUM DISTANCE FROM THE TRAVEL WAY.
7. PLASTIC DRUM SPACING SHALL BE 5 METERS.
8. DURING THE CONSTRUCTION OPERATION, THE CONTRACTOR SHALL TAKE ALL THE NECESSARY PRECAUTIONS AND MEASURES TO AVOID FALLING DEBRIS, TOOLS EQUIPMENT OR ANY OTHER MATERIALS INTERFERE OR IMPACT THE MOTORING PUBLIC IN THE ROADWAY. ALL THE MATERIALS, LABOR EQUIPMENT, AND WORK NECESSARY FOR IMPLEMENTING THIS REQUIREMENT IS SUBSIDIARY OBLIGATION OF THE CONTRACT UNDER EXISTING PAY ITEMS.
9. WORK ON ROAD PR-14 SHALL BE COORDINATED WITH THE DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS REGIONAL OFFICE.
10. THE CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE PERTINENT AGENCIES OF FOR THE RELOCATION OR REPAIRS OF ALL THE UTILITIES THAT ARE AFFECTED BY THE PROJECT.
11. THE CONTRACTOR SHALL PROVIDE TEMPORARY PEDESTRIAN ROUTES AT ALL TIMES DURING THE CONSTRUCTION OF THE PROJECT. THIS PLAN SHALL COMPLY WITH ALL THE REQUIREMENTS OF THE MUTCD AND ADA ACT. PEDESTRIAN PATHWAYS SHALL BE AT LEAST 1.1 METERS WIDE AND BE PROTECTED FROM THE WORK AREA BY USING A BARRIER SIMILAR TO AN ORANGE SAFETY NET AND DRUMS.

NIGHTTIME CONSTRUCTION NOTES:

1. NIGHTTIME CONSTRUCTION SHALL ONLY BE PERMITTED BETWEEN THE HOURS OF 8:00 PM AND 5:00 AM MONDAY THROUGH THURSDAY.
2. THE CONTRACTORS VEHICLES SHALL BE EQUIPPED WITH ROTATING AMBER LIGHTS WHEN IN USE ON THE ROADWAY DURING NIGHT WORK.
3. LIGHTING SHALL BE PROVIDED FOR NIGHTTIME OPERATIONS.
4. LANE CLOSURES SHALL BE STARTED AT LOCATIONS PROVIDING OPTIMUM VISIBILITY.
5. FLAGGERS SHALL BE STATIONED AT AREAS THAT ARE BRIGHTLY ILLUMINATED BY TEMPORARY FLOODLIGHTS OR ROADWAY LIGHTING. VEHICLE LIGHTS ARE NOT ACCEPTABLE FOR FLAGGER STATION ILLUMINATION.
6. CONSTRUCTION ACTIVITY WILL NOT BE ALLOWED FRIDAY OR SATURDAY NIGHT.

LEGEND:

- WORK AREA
- TRAFFIC DIRECTION
- CHANNELING DEVICE (PLASTIC DRUMS)
- CONSTRUCTION SIGNS
- FLAGGER
- PIPE INSTALLATION AREA
- MANHOLE INSTALLATION
- TRAFFIC DIRECTION

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Revisions	Number	Date	Description

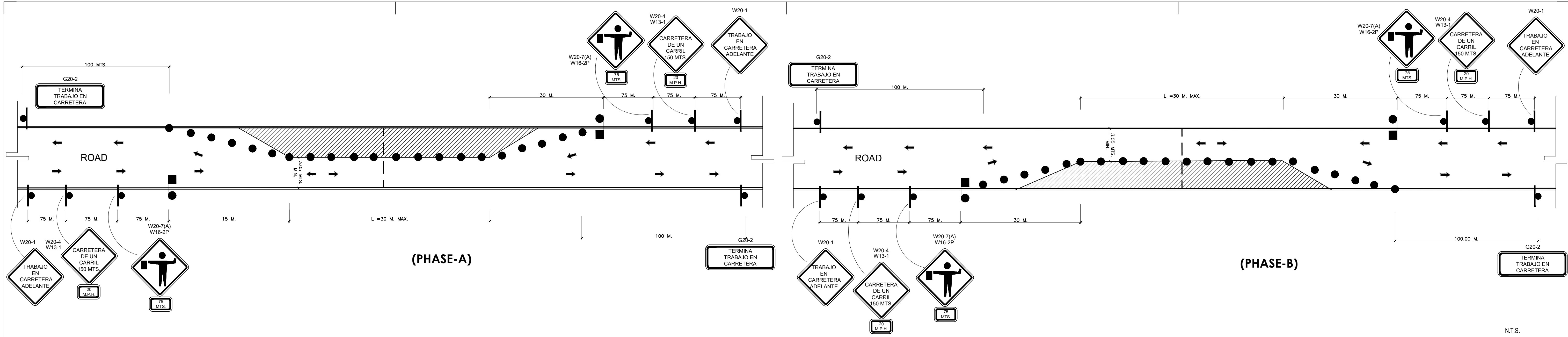
GOVERNMENT OF PUERTO RICO
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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WTP-C500

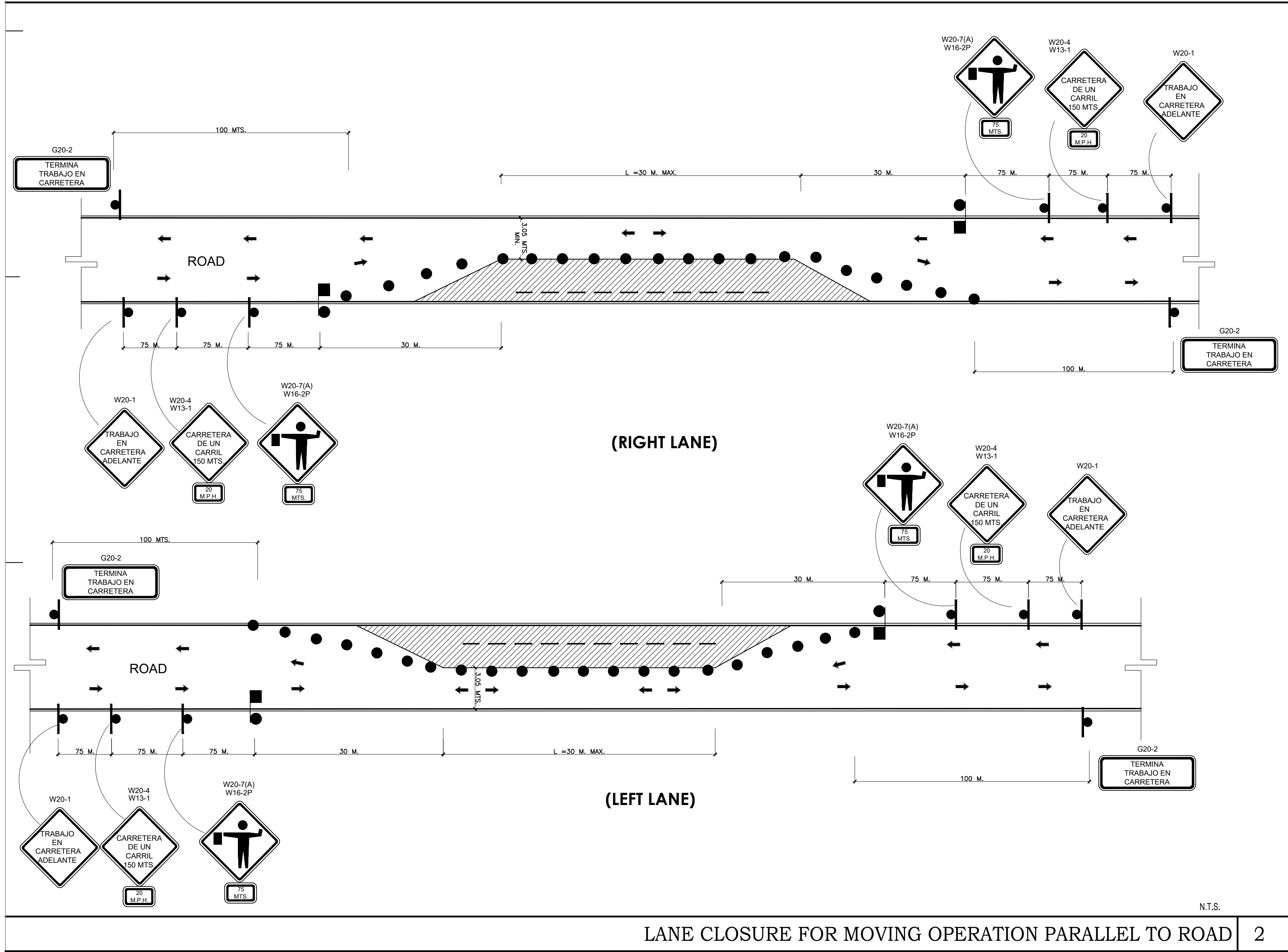
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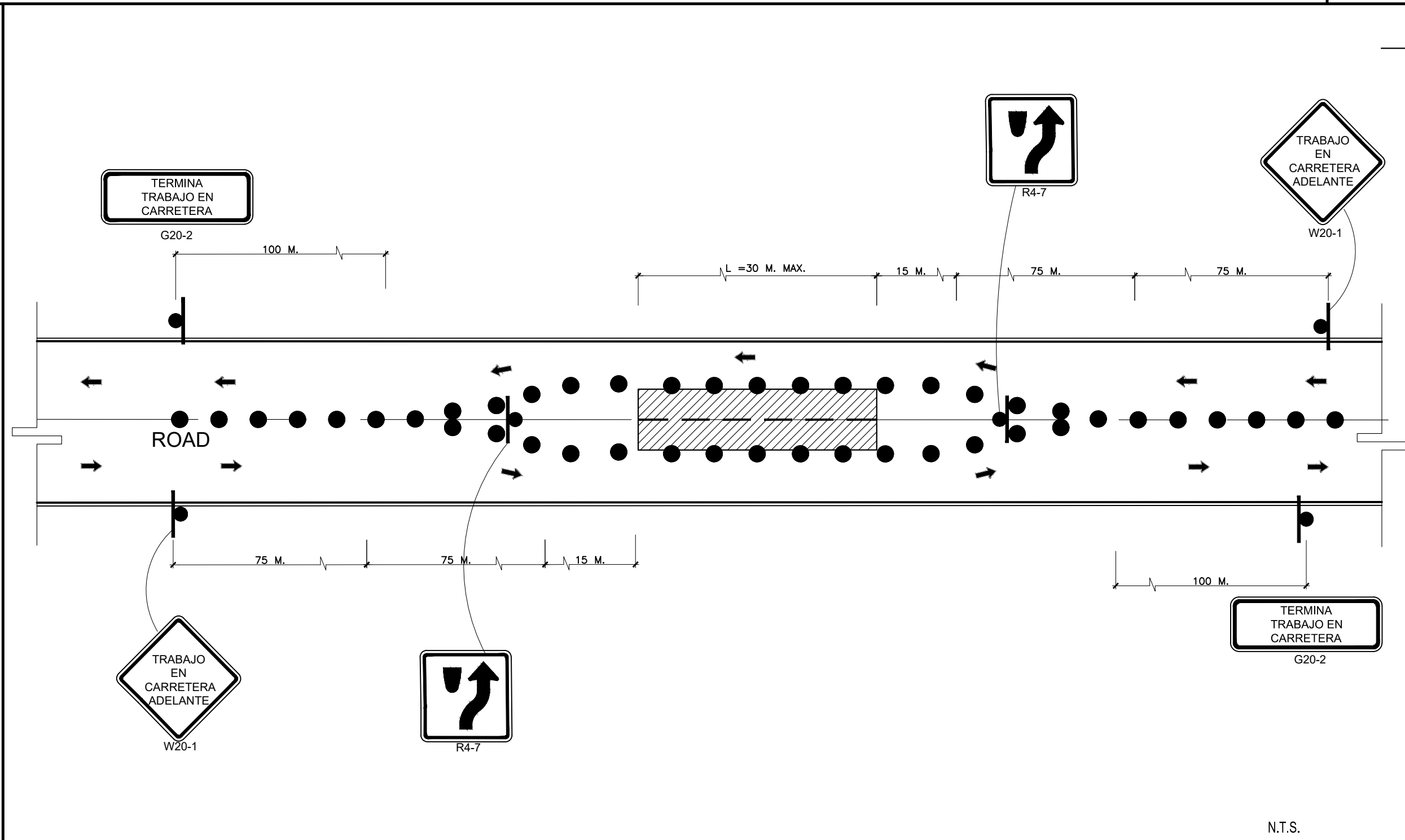


TWO PHASE LANE CLOSURE FOR PIPE INSTALLATION ACROSS ROAD

1



2



WORK AT CENTER OF ROAD

3

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DATE: JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OSEA.

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Project Title:
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CERBA & NAGUABO, PUERTO RICO

Drawing Title:
MAINTENANCE OF TRAFFIC DETAILS - I

Revisions

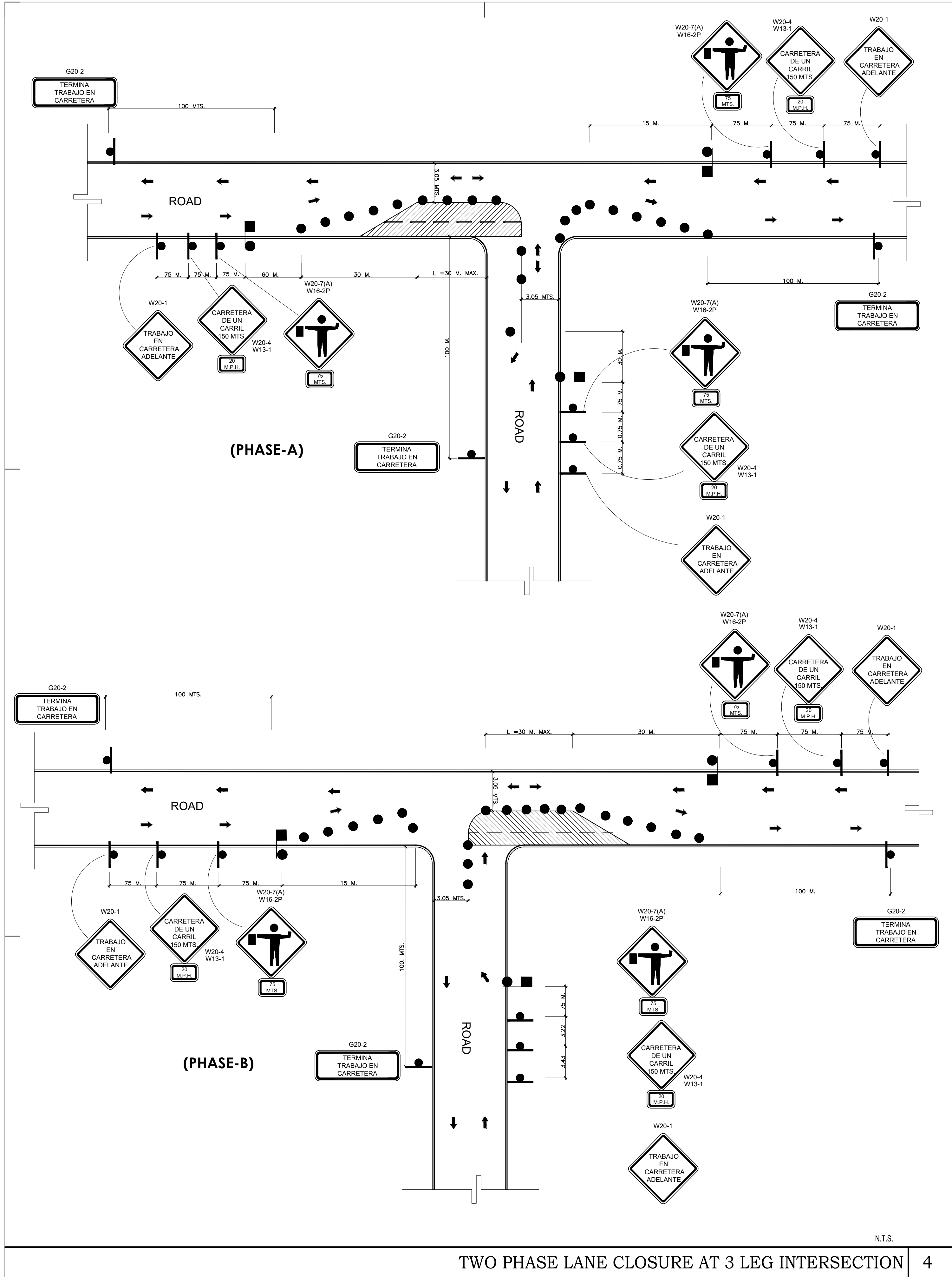
Number	Date	Description
1	2021/07/28	Project No. 18-1837.0
2	2021/07/28	Set Date: 2021/07/28
3		Drawn by:
4		Dwg. Date:

SHEET INFO.

Project No. 18-1837.0
Set Date: 2021/07/28
Drawn by:
Dwg. Date:

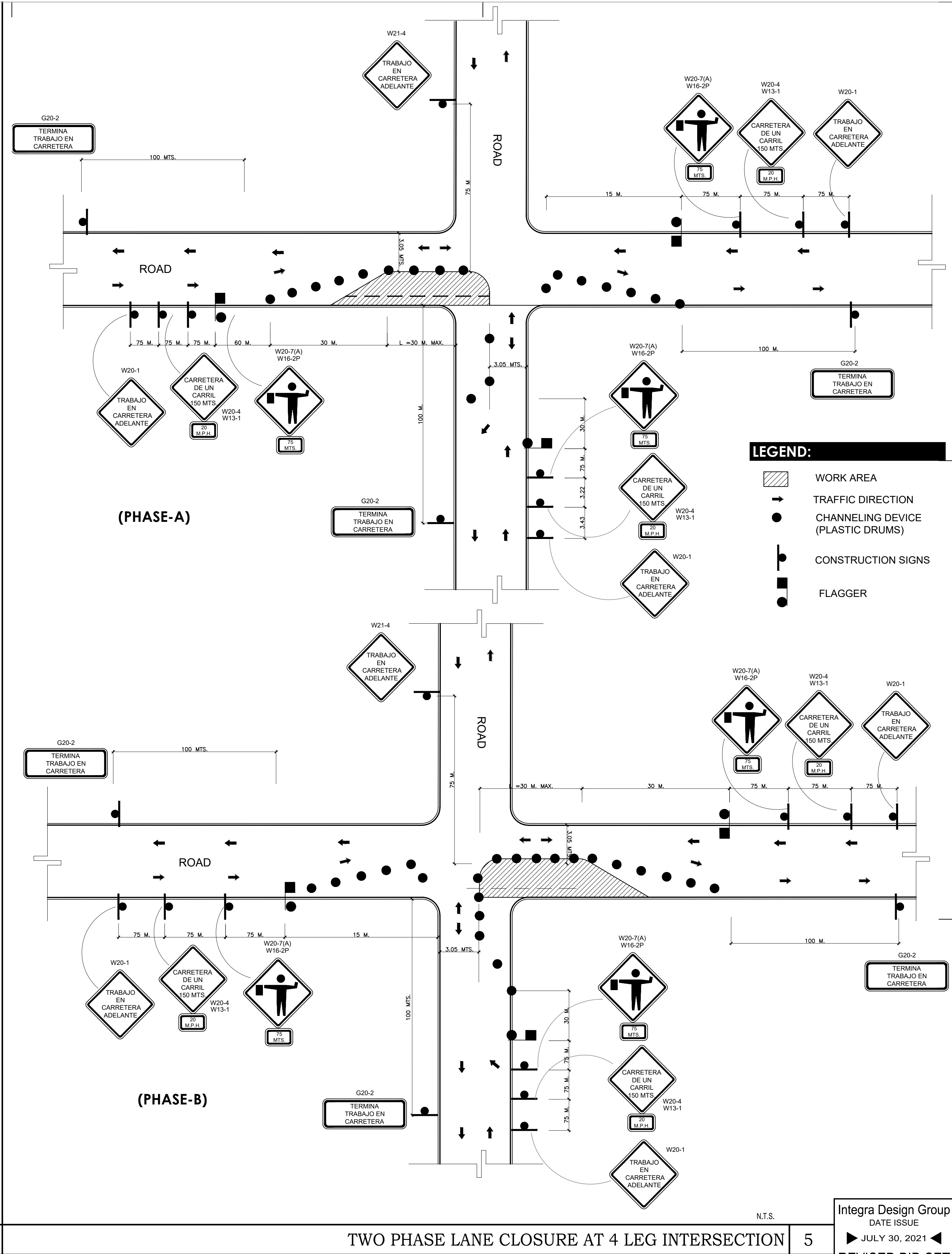
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WTP-C501



TWO PHASE LANE CLOSURE AT 3 LEG INTERSECTION

4

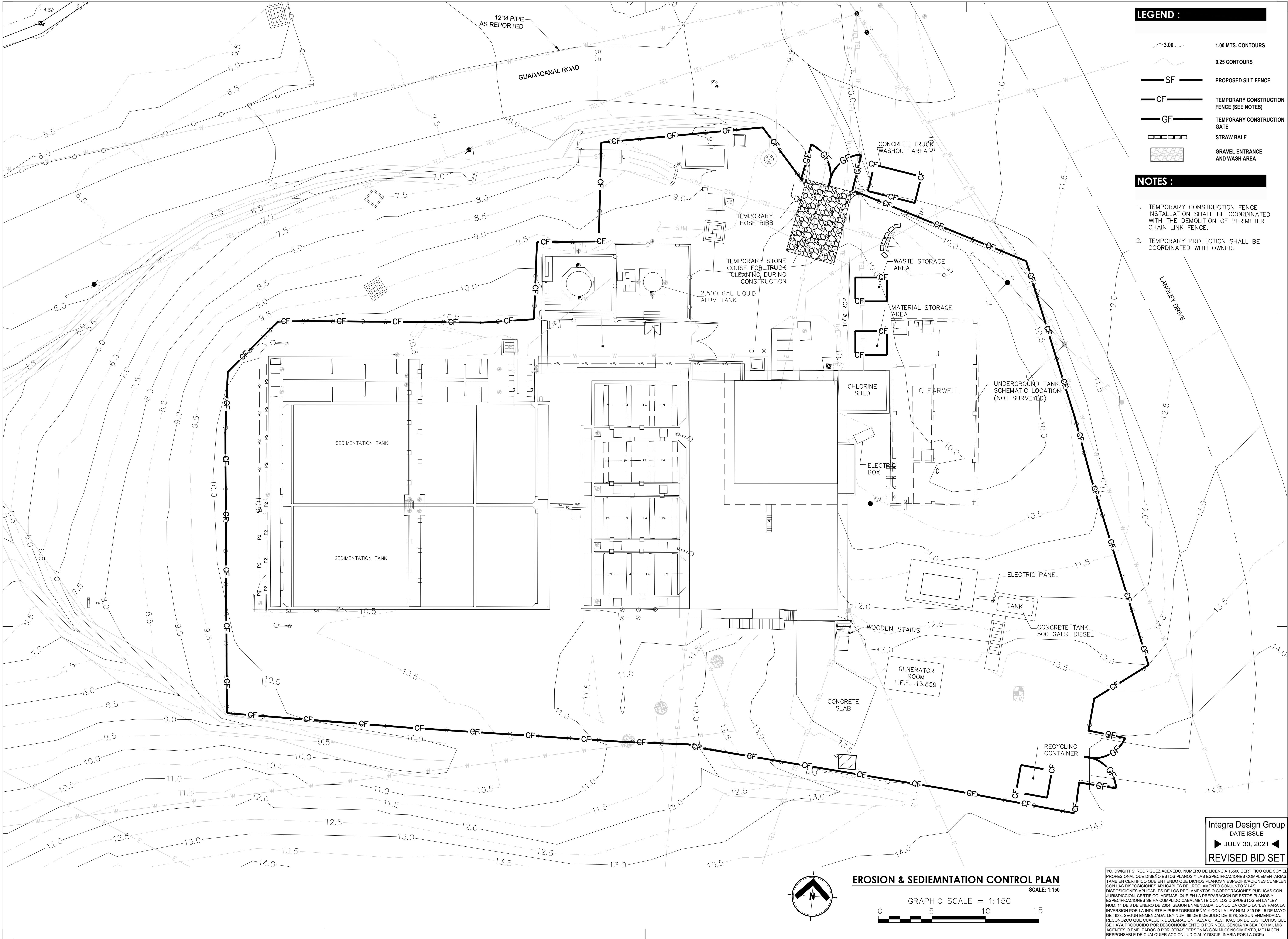


TWO PHASE LANE CLOSURE AT 4 LEG INTERSECTION

5

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMIENDADA. LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.



LEGEND :

- 3.00 1.00 MTS. CONTOURS
0.25 CONTOURS
- SF PROPOSED SILT FENCE
CF TEMPORARY CONSTRUCTION FENCE (SEE NOTES)
GF TEMPORARY CONSTRUCTION GATE
- STRAW BALE
GRAVEL ENTRANCE AND WASH AREA

NOTES :

1. TEMPORARY CONSTRUCTION FENCE INSTALLATION SHALL BE COORDINATED WITH THE DEMOLITION OF PERIMETER CHAIN LINK FENCE.
2. TEMPORARY PROTECTION SHALL BE COORDINATED WITH OWNER.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

Drawing Title: EROSION & SEDIEMNTATION CONTROL PLAN

Project Title:

Revisions	Number	Date	Description	SHEET INFO.
				Project No.: 19-1837.0 Set Date: 20210728 Drawn by: Dwg. Date:

INTEGRADesign Group

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WTP-CE1

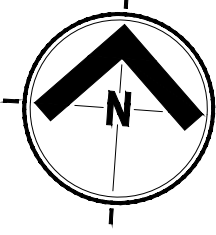
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Integra Design Group
DATE ISSUE
JULY 30, 2021
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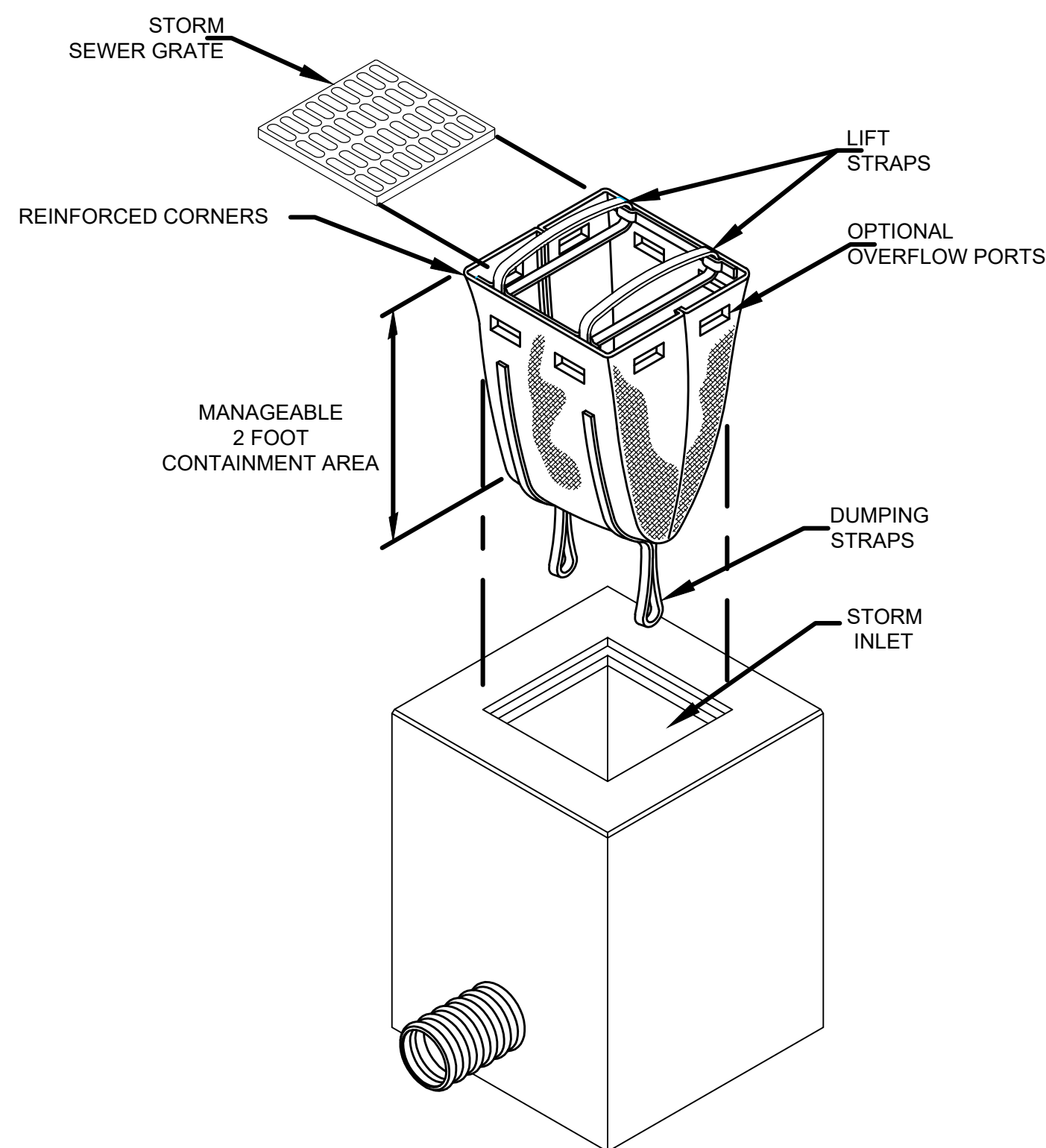
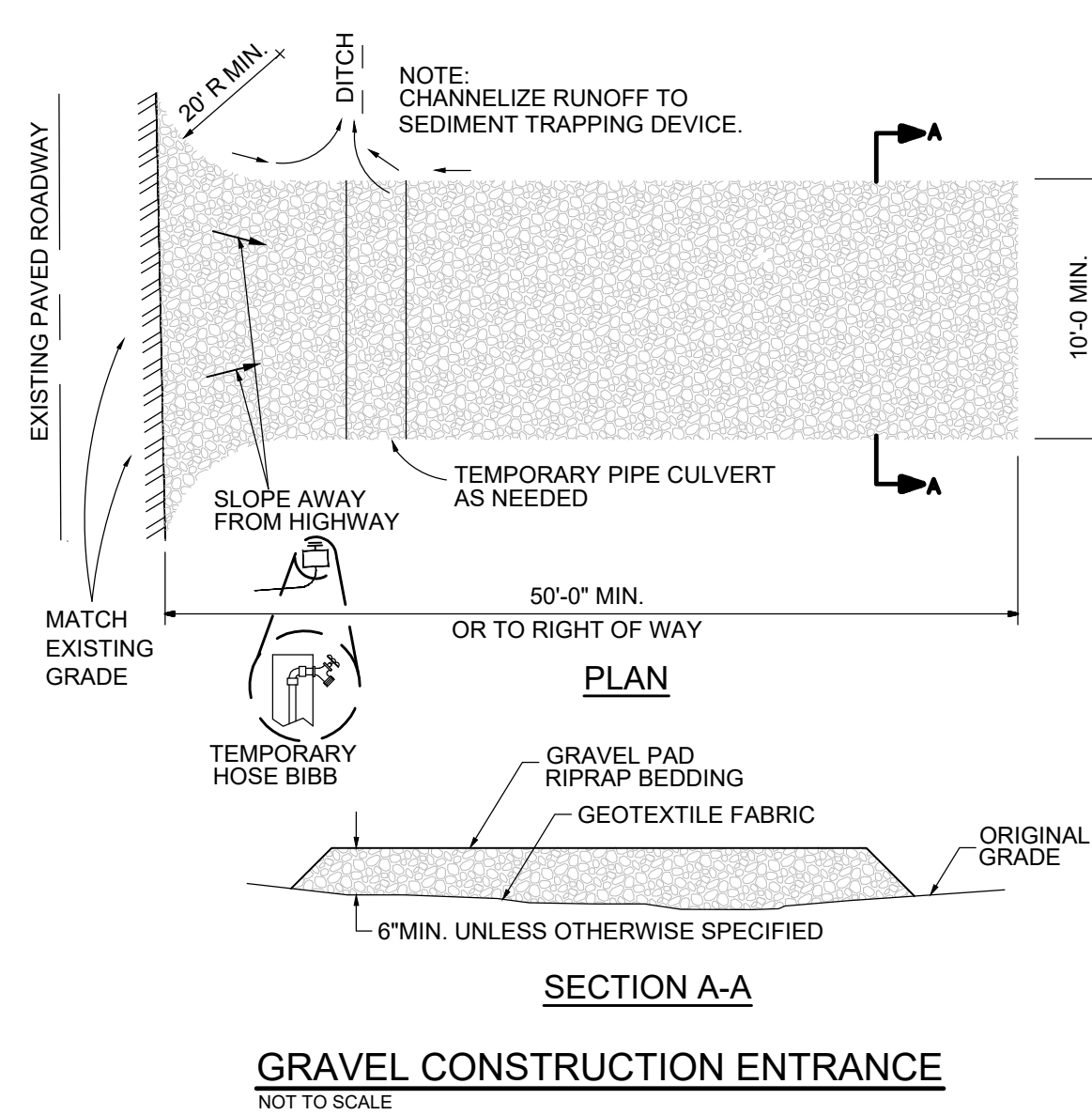
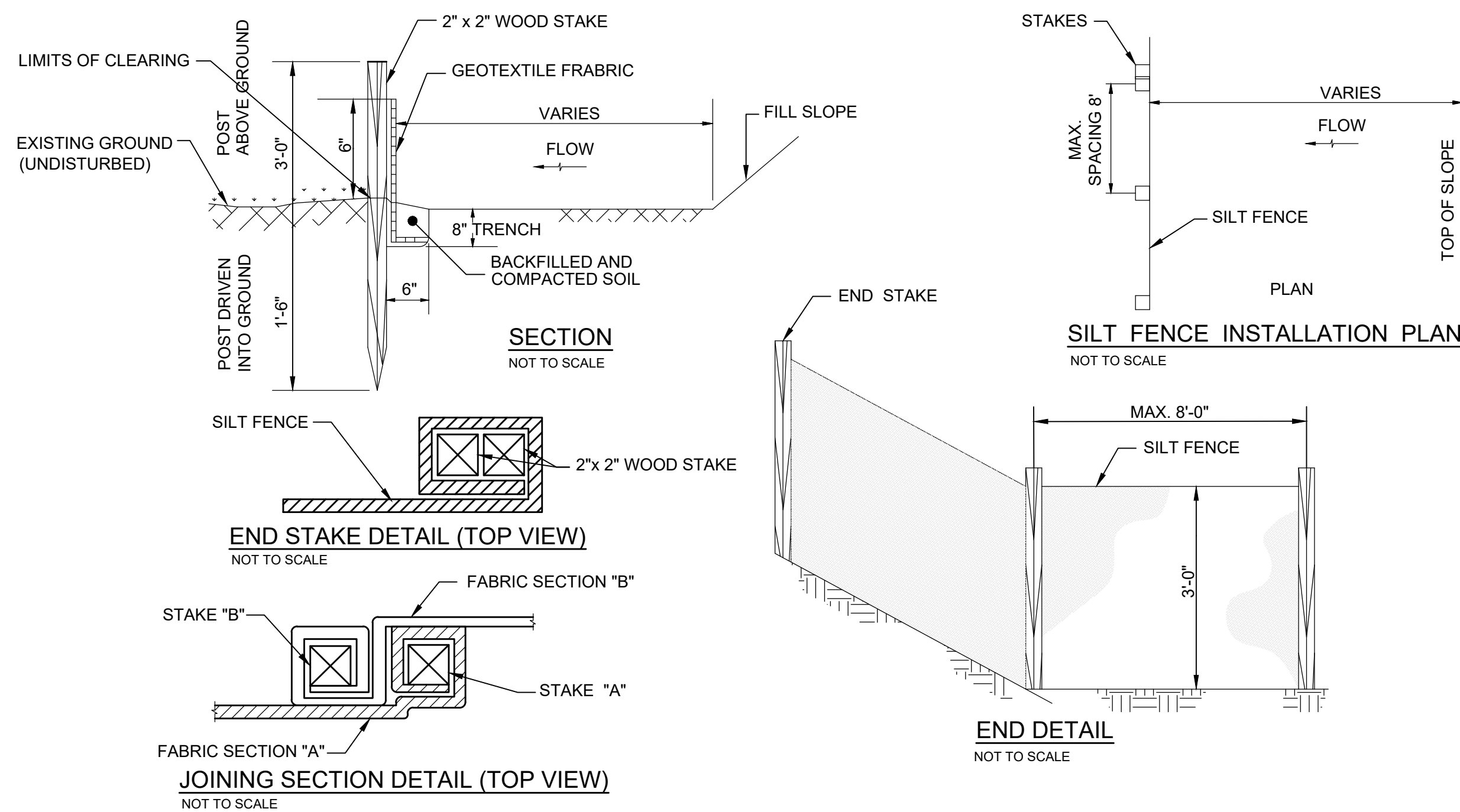
EROSION & SEDIEMNTATION CONTROL PLAN

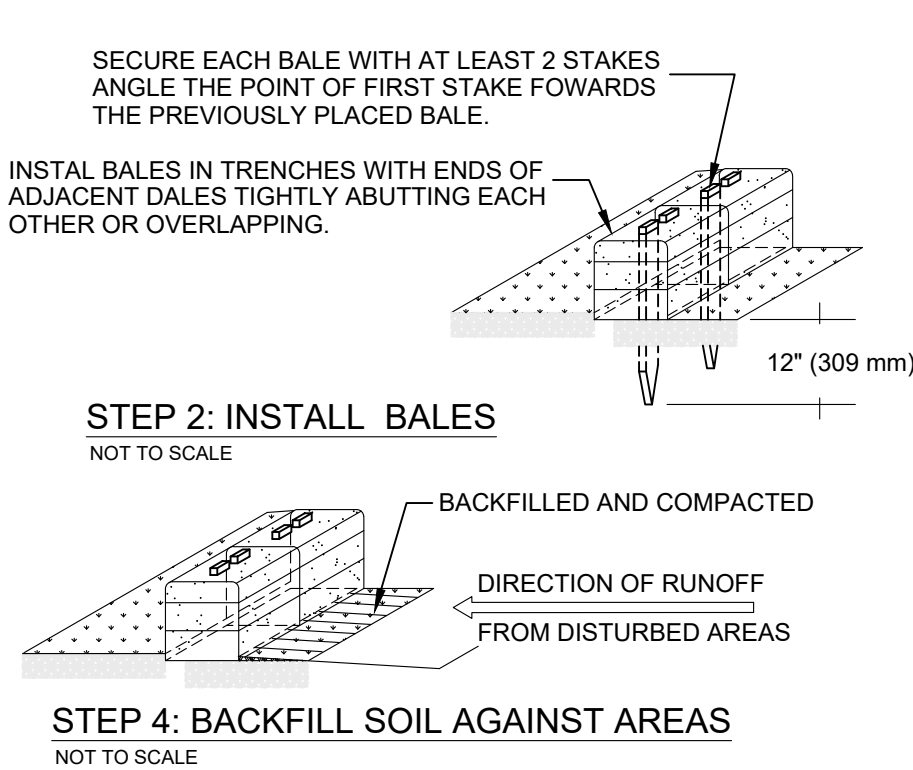
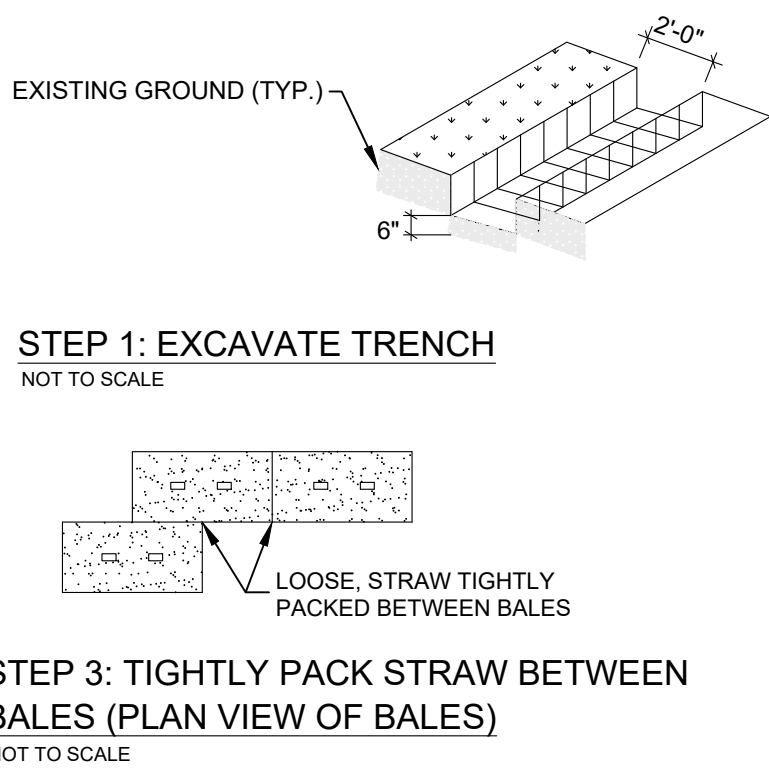
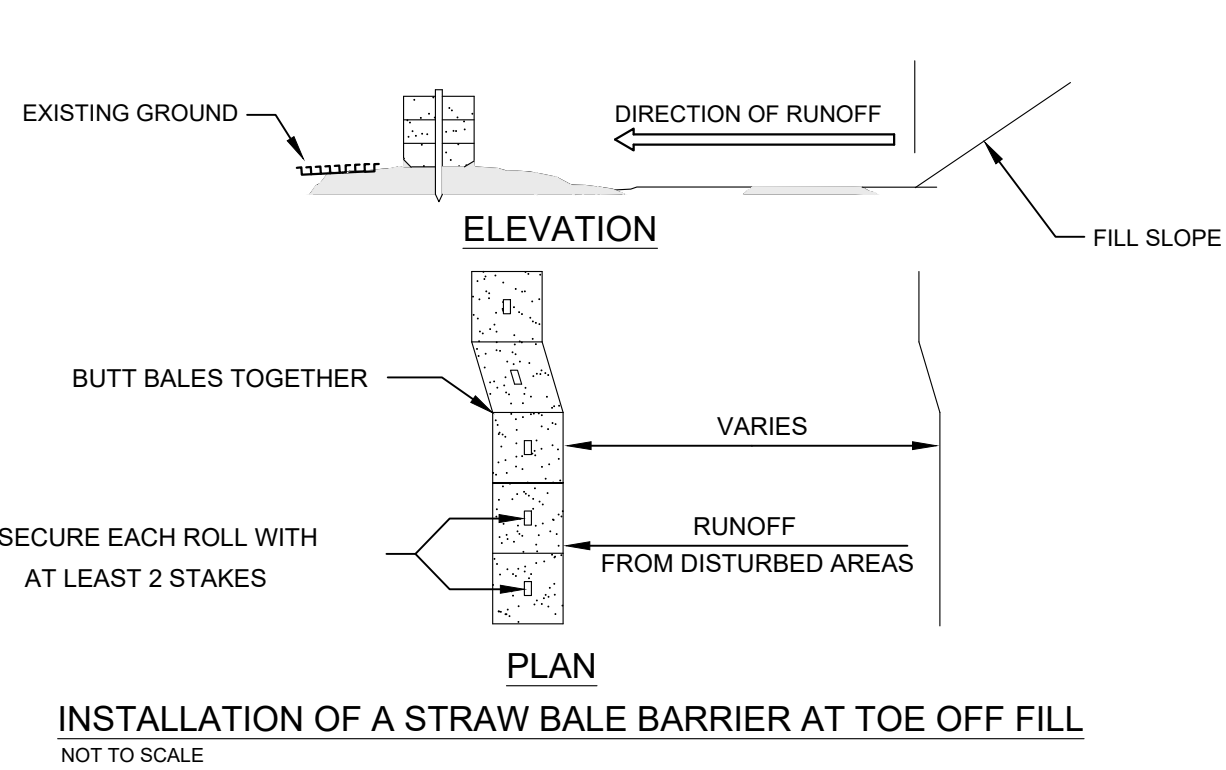
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GRAPHIC SCALE = 1:150

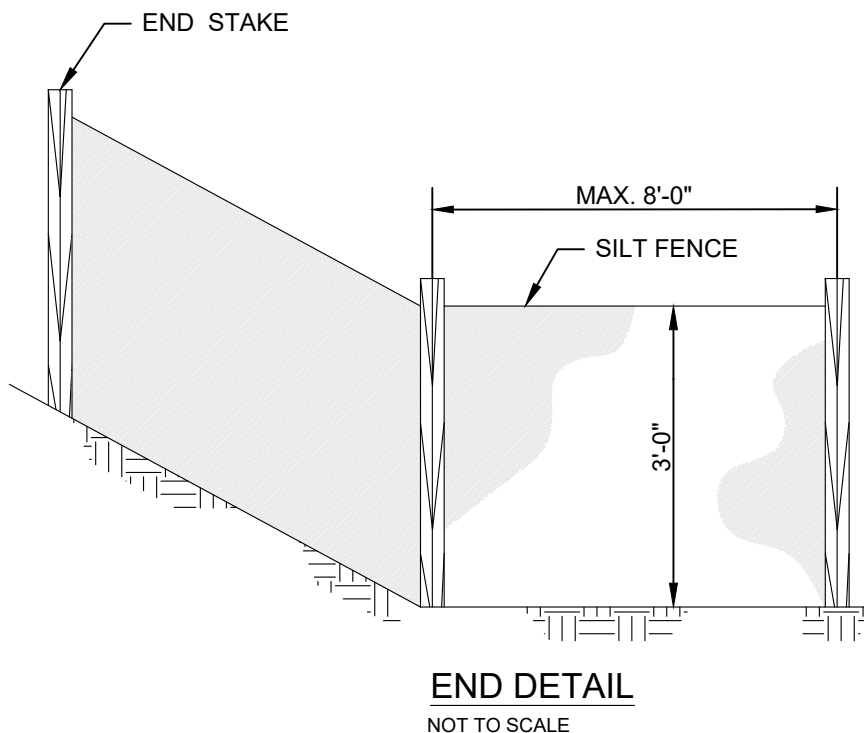
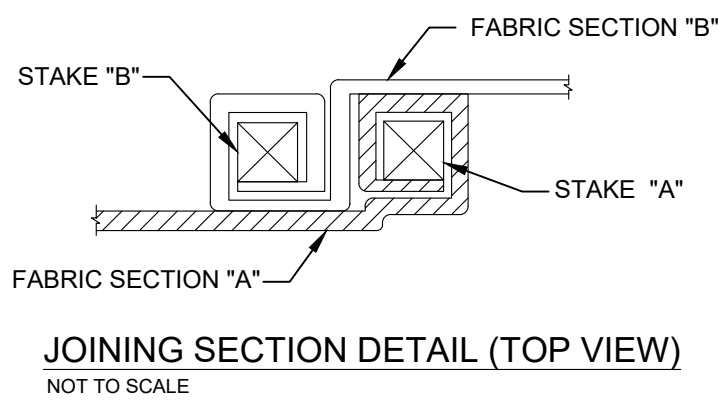
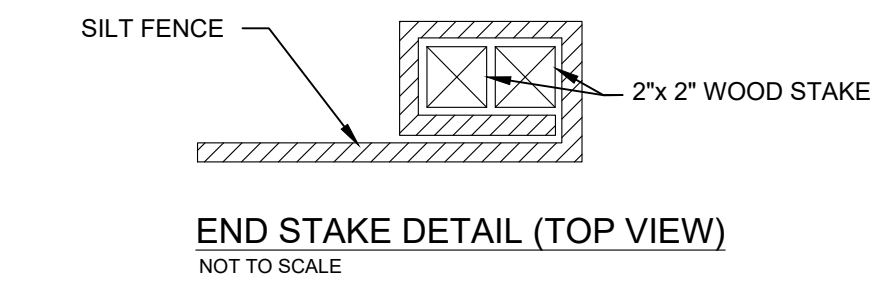
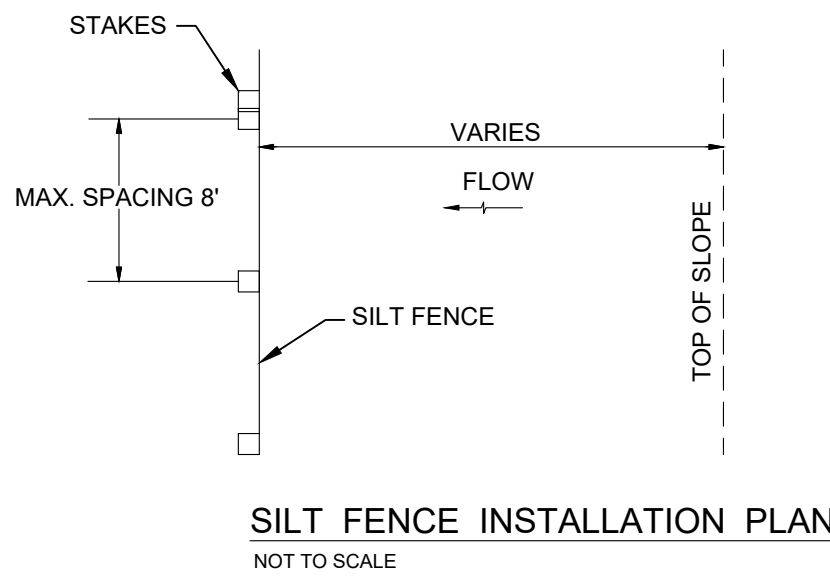
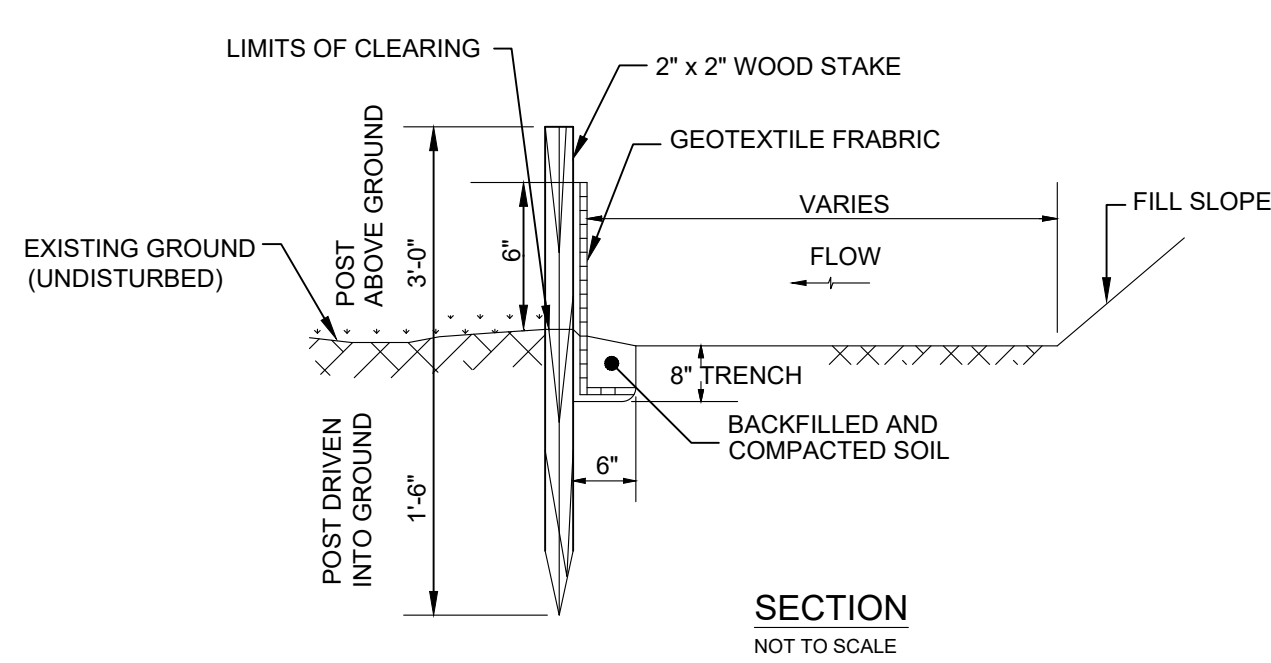


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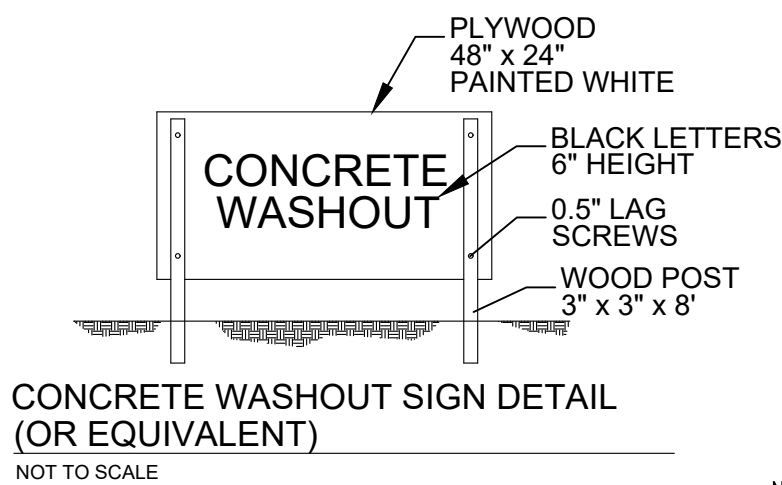
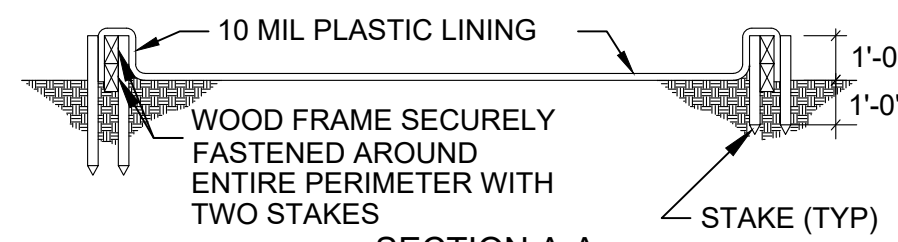
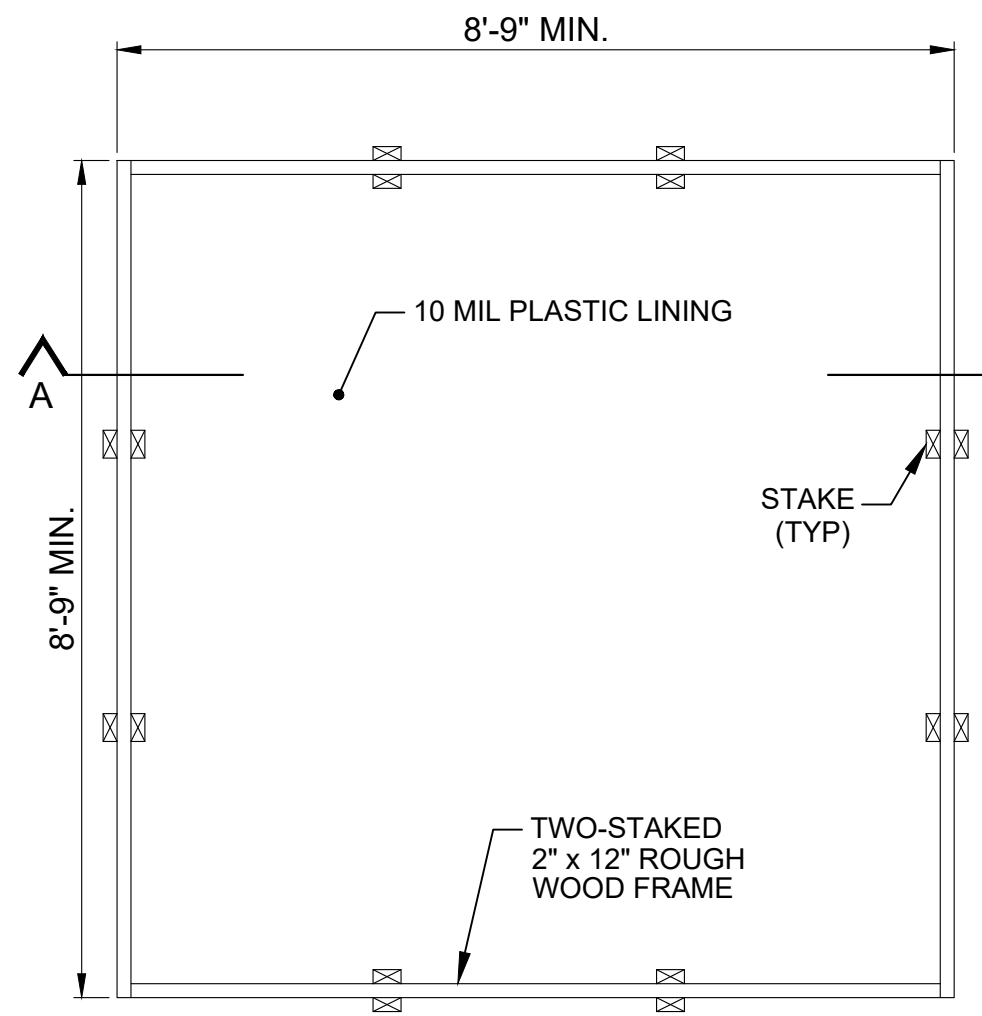




STRAW BALE INSTALLATION DETAILS 1



SILT FENCE INSTALLATION DETAILS 2



CONCRETE TRUCK WASHOUT AREA 3

CONSTRUCTION SEQUENCE

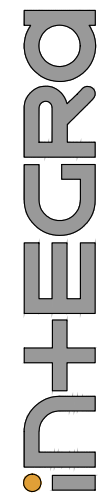
THE CONSTRUCTION SEQUENCE HAS BEEN DIVIDED IN TWO STAGES. STAGE I INCLUDES THE CONSTRUCTION AND INSTALLATION OF ALL THE NECESSARY MEASURES TO CONTROL EROSION AND SEDIMENTATION WITHIN THE PROJECT SITE ; IMMEDIATELY AFTER SITE CLEARING. STAGE 2 INCLUDES EATHWORK AND ALL RELATED ACTIVITIES. DURING THIS STAGE FILLING OF SELECTED AREAS SHALL TAKE PLACE.

STAGE - I

1. ALL CONSTRUCTION OF EROSION AND SEDIMENT CONTROL SHALL CONFORM TO EQB STANDARDS AND AS DESCRIBED HEREIN.
2. AREAS TO BE GRADED SHALL BE CLEARED AND GRUBBED IN ACCORDANCE WITH SPECIFICATIONS. PRESERVE AND PROTECT ALL EXISTING GROUND VEGETATION AND TREES OUTSIDE OF THE CONSTRUCTION LIMITS OR SPECIFICALLY DESIGNATED TO REMAIN.
3. ALL EROSION CONTROL MEASURES SHALL BE PLACED IMMEDIATELY FOLLOWING SITE CLEARING AND GRUBBING AS SHOWN ON THE DRAWING. NO GRADING SHALL BE DONE UNTIL SILT BARRIER INSTALLATION IS COMPLETED.
4. TOPSOIL SHALL BE REMOVED, STOCKPILED, AND SEEDED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.
5. THE CONSTRUCTION AREA SHALL BE ROUGH GRADED AS SHOWN ON THE DRAWINGS.
6. THE TEMPORARY SEDIMENT TRAPS AND THE STONE OUTLET STRUCTURES (IF REQUIRED) SHALL BE CONSTRUCTED AND GRASSED.
7. DIVERSION DITCHES , SWALES , AND SLOPES SHALL BE CONSTRUCTED AND GRASSED AS SOON AS POSSIBLE TO MINIMIZE EROSION. RIP RAP SHALL BE PLACED AS SHOWN ON THE PLANS OR AS REQUIRED.

STAGE - II

1. ROUGH GRADE THE REMAINDER OF THE SITE TO THE APPROXIMATE SUBGRADE ELEVATION AS SHOWN ON PLANS.



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Revisions

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GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: CERRA & NAGUARO, PUERTO RICO

EROSION & SEDIMENTATION CONTROL DETAILS

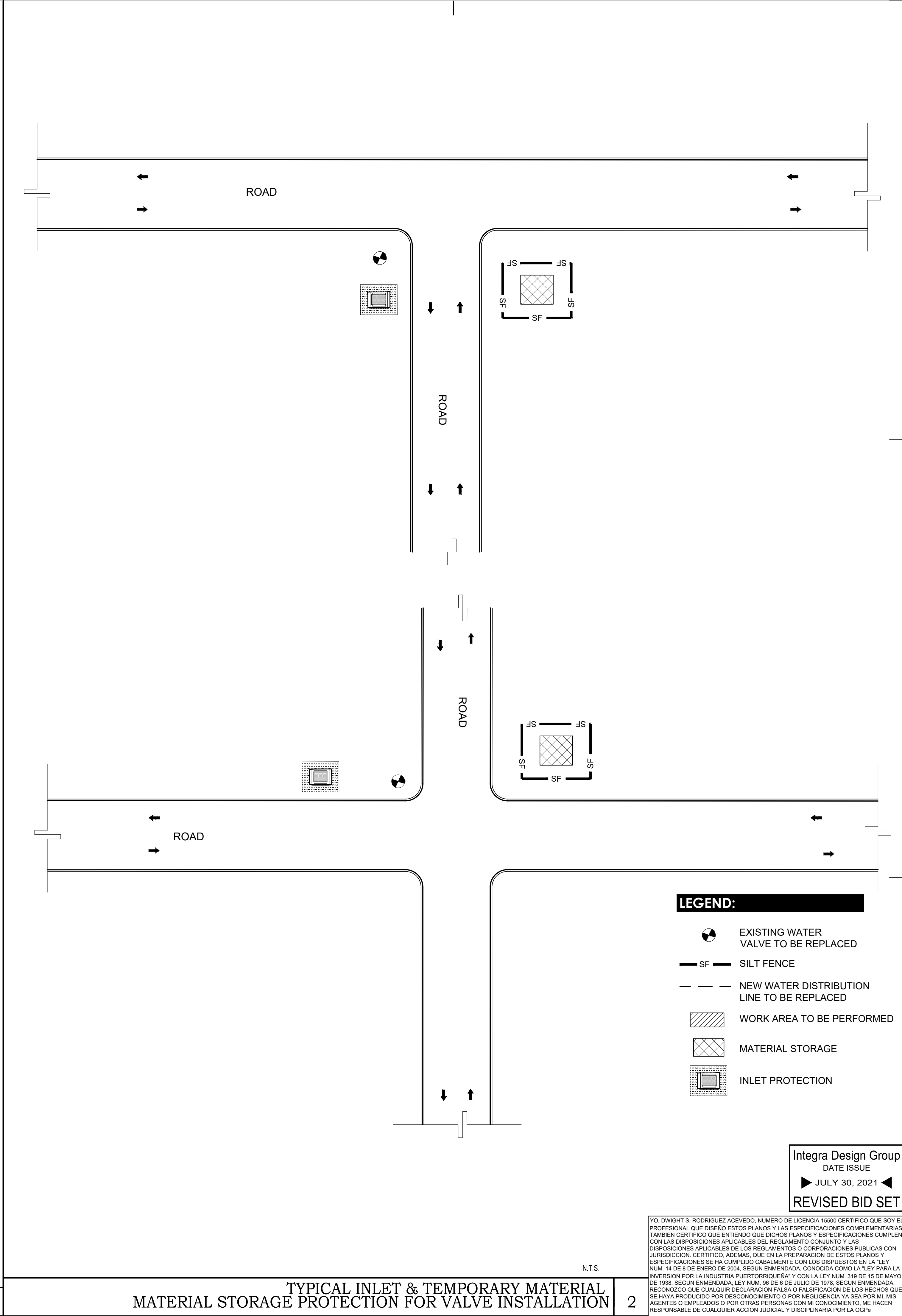
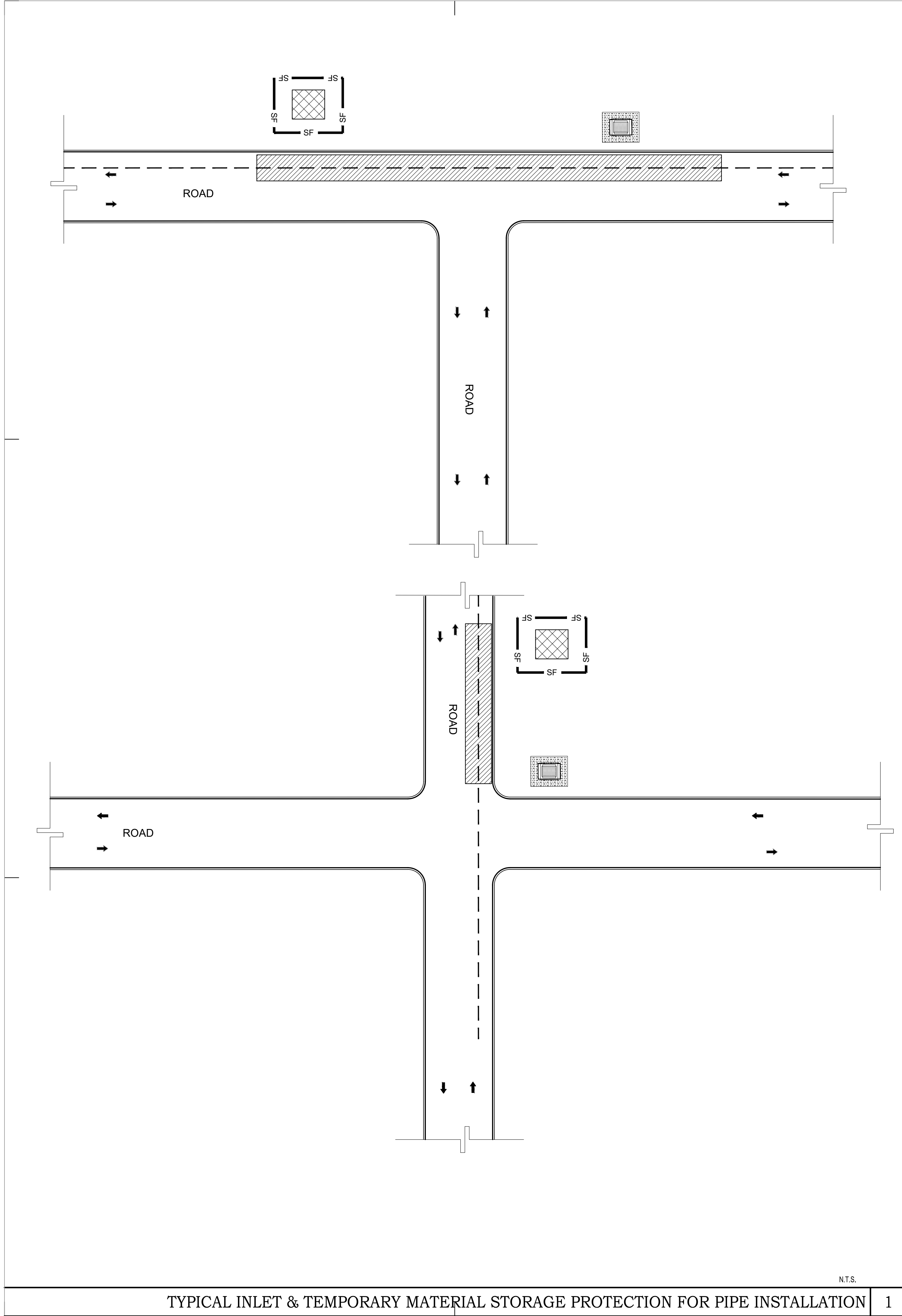
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Project Title:

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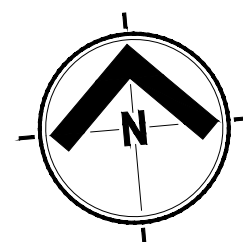
Integra Design Group
DATE ISSUE
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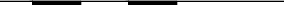


**DEMOLITION NOTES:**

1. CONTRACTOR SHALL TAKE ALL REQUIRED PRECAUTIONS TO PREVENT DAMAGE TO THE EXISTING CONSTRUCTION TO REMAIN DURING THE DEMOLITION WORK. ANY DAMAGED AREAS SHALL BE REBUILT TO ORIGINAL CONDITION AS REQUIRED.
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3. CONTRACTOR SHALL CONSTRUCT TEMPORARY ENCLOSURES AND BARRICADES AS REQUIRED TO MAINTAIN SECURITY OF THE BUILDING AND TO CONTROL DUST AND DEBRIS DAMAGE TO THE EXISTING BUILDING.
4. ALL DEBRIS SHALL BE REMOVED FROM THE SITE IN A MANNER APPROVED BY THE MUNICIPALITY.
5. THE CONTRACTOR SHALL PROCURE ALL PERMITS REQUIRED BY THE MUNICIPALITY.
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7. CONTRACTOR SHALL DISPOSE OF THE REMOVED ITEMS SELECTED BY THE OWNER FOR DISPOSAL, AND SHALL STORE THE ITEMS SELECTED FOR SALVAGE OR REUSE IN THE PLACE INDICATED.



GRAPHIC SCALE = $1/4" = 1'$

A horizontal graphic scale bar. It is divided into four segments. The first segment is black and labeled '5'' above it. The second segment is white and labeled '0'' above it. The third segment is black and labeled '5'' above it. The fourth segment is white and labeled '10'' above it. The segments are separated by thin white lines.

Integra Design Group
 DATE ISSUE
 ► JULY 30, 2021 ◄
 REVISED BID SET

YO, LUIS GALAZA BERRIOS, NUMERO DE LICENCIA 1972 CERTIFICADO QUE SOY EL
PROPIETARIO, QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS
PLUMBEN CERTIFICADO QUE ENTENDIENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN
CON LOS REQUISITOS DE LA LEY NÚMERO 139 DE 15 DE MAYO DE 1938, SEGUN
APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION
CERTIFICADO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES
NO SE HA CAIDO EN CUALQUIER CLASE DE FALSA FALSIFICACION DE LOS DICHOS
DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA
INDUSTRIA PUERTORRIQUENA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN
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PUERTORRIQUENA", QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS DICHOS QUE SE HAYA
PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES
EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLES

SCALE: 1/4"=1'-0"

Revisions		SHEET INFO.	
Number	Date	Description	
			Project No.: 19-1837.0
			Set Date: 2021/07/28
			Drawn by:
			Dwg. Date:

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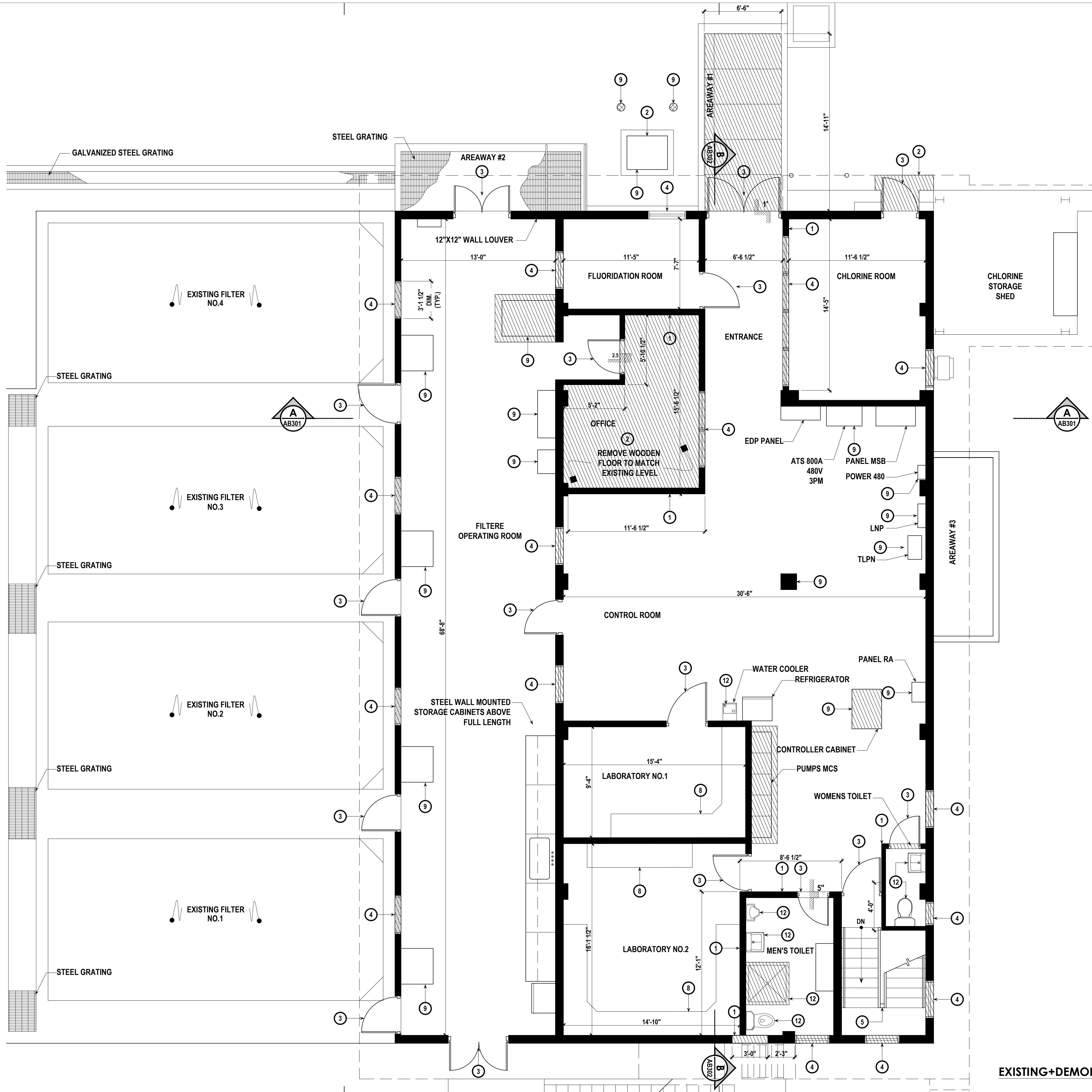
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO
Client:
Owner:

WATER TREATMENT PLANT

Drawing Title:
EXISTING +DEMOLITION BASEMENT FLOOR PLAN

WTP-AB101



DEMOLITION LEGEND:

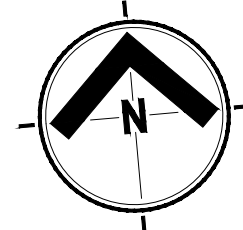
EXISTING TO BE DEMOLISHED

DEMOLITION KEYNOTES:

- DEMOLISH WALL AS INDICATED ON PLAN
- DEMOLISH FLOOR SLAB
- REMOVE DOOR
- REMOVE WINDOW
- REMOVE RAILINGS
- REMOVE STAIR & PLATFORM
- REMOVE GATE & FENCE
- REMOVE WOOD CABINET
- EXISTING EQUIPMENT
- REMOVE SUSPENDED CEILING, LIGHTING AND HVAC FIXTURES
- REMOVE OUTDOOR LIGHTING
- REMOVE PLUMBING FIXTURE

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GRAPHIC SCALE = 1/4" = 1'

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EXISTING+DEMOLITION FIRST FLOOR PLAN
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

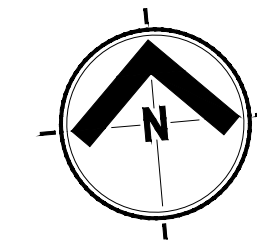
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GRAPHIC SCALE = 1/4" = 1'



Integra Design Group
DATE ISSUE
JULY 30, 2021
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Project Title:

Sheet:

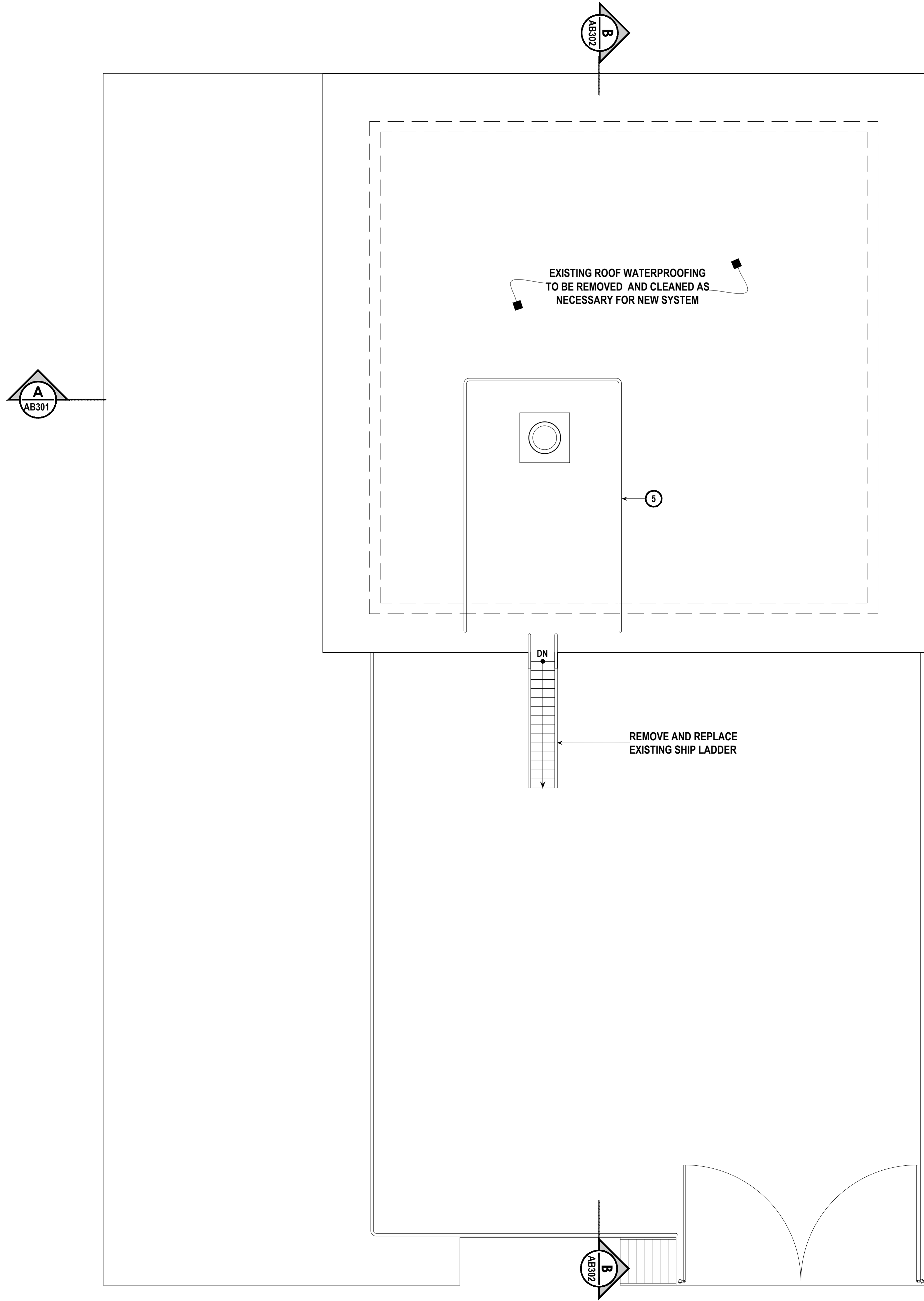
FOR FLOOR SLAB DEMOLITION
(SEE STRUCTURAL DRAWINGS)

REMOVE AND REPLACE
EXISTING SHIP LADDER

EXISTING ROOF WATERPROOFING
TO BE REMOVED AND CLEANED AS
NECESSARY FOR NEW SYSTEM

PIPE
SHAFT

EXISTING+DEMOLITION SECOND FLOOR PLAN
SCALE: 1/4"=1'-0"



DEMOLITION LEGEND:

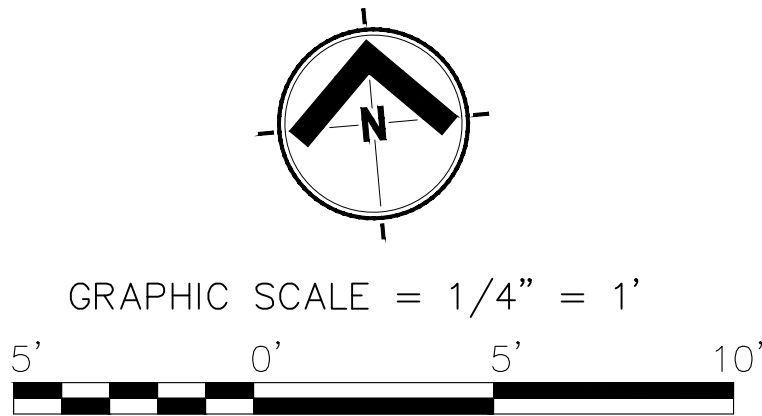
EXISTING TO BE DEMOLISHED

DEMOLITION KEYNOTES:

- 1 DEMOLISH WALL AS INDICATED ON PLAN
- 2 DEMOLISH FLOOR SLAB
- 3 REMOVE DOOR
- 4 REMOVE WINDOW
- 5 REMOVE RAILING
- 6 REMOVE STAIR
- 7 REMOVE GATE & FENCE
- 8 REMOVE WOOD CABINET
- 9 EXISTING EQUIPMENT
- 10 REMOVE SUSPENDED CEILING, LIGHTING AND HVAC FIXTURES
- 11 REMOVE OUTDOOR LIGHTING

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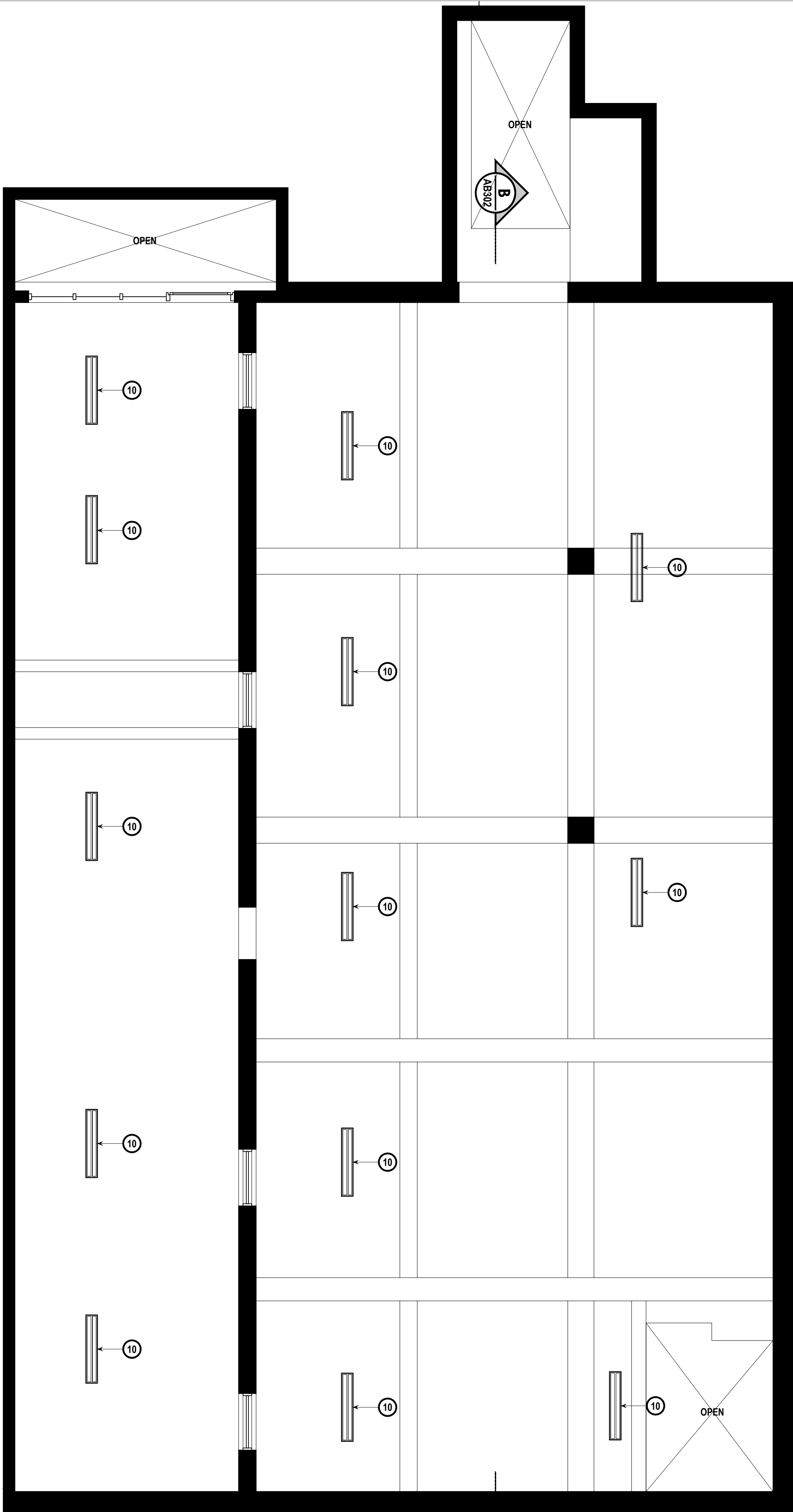
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Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837-0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER TREATMENT PLANT Drawing Title:

EXISTING +DEMOLITION ROOF PLAN



DEMOLITION NOTES:

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DEMOLITION LEGEND:

EXISTING TO BE DEMOLISHED

DEMOLITION KEYNOTES:

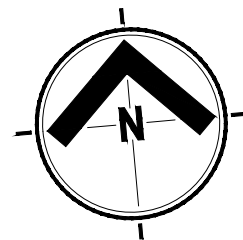
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- 11 REMOVE OUTDOOR LIGHTING
- 12 REMOVE PLUMBING FIXTURE

RCP SYMBOLS LEGEND:

SYMBOL	DESCRIPTION
	4' X 2' RECESSED MOUNT LIGHT FIXTURE
	SUSPENDED LIGHTING
	PENDANT LIGHT FIXTURE
	OUTDOOR LIGHTING
	EXIT SIGN
	RETURN AIR GRILLE OR SUPPLY AIR DIFFUSER

RCP FINISHES LEGEND:

SYMBOL	DESCRIPTION
	4' X 2' ACOUSTIC TILE



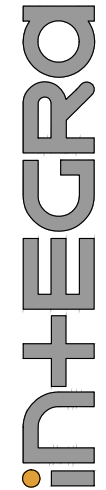
GRAPHIC SCALE = 1/4" = 1'

Integra Design Group
DATE ISSUE
JULY 30, 2021
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EXISTING+DEMOLITION BASEMENT REFLECTED CEILING PLAN

SCALE: 1/4"=1'-0"



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Revisions	Number	Date	Description

SHEET INFO.	Project No.: 19-1837-0
Set Date:	2021/07/28
Drawn by:	
Dwg. Date:	

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



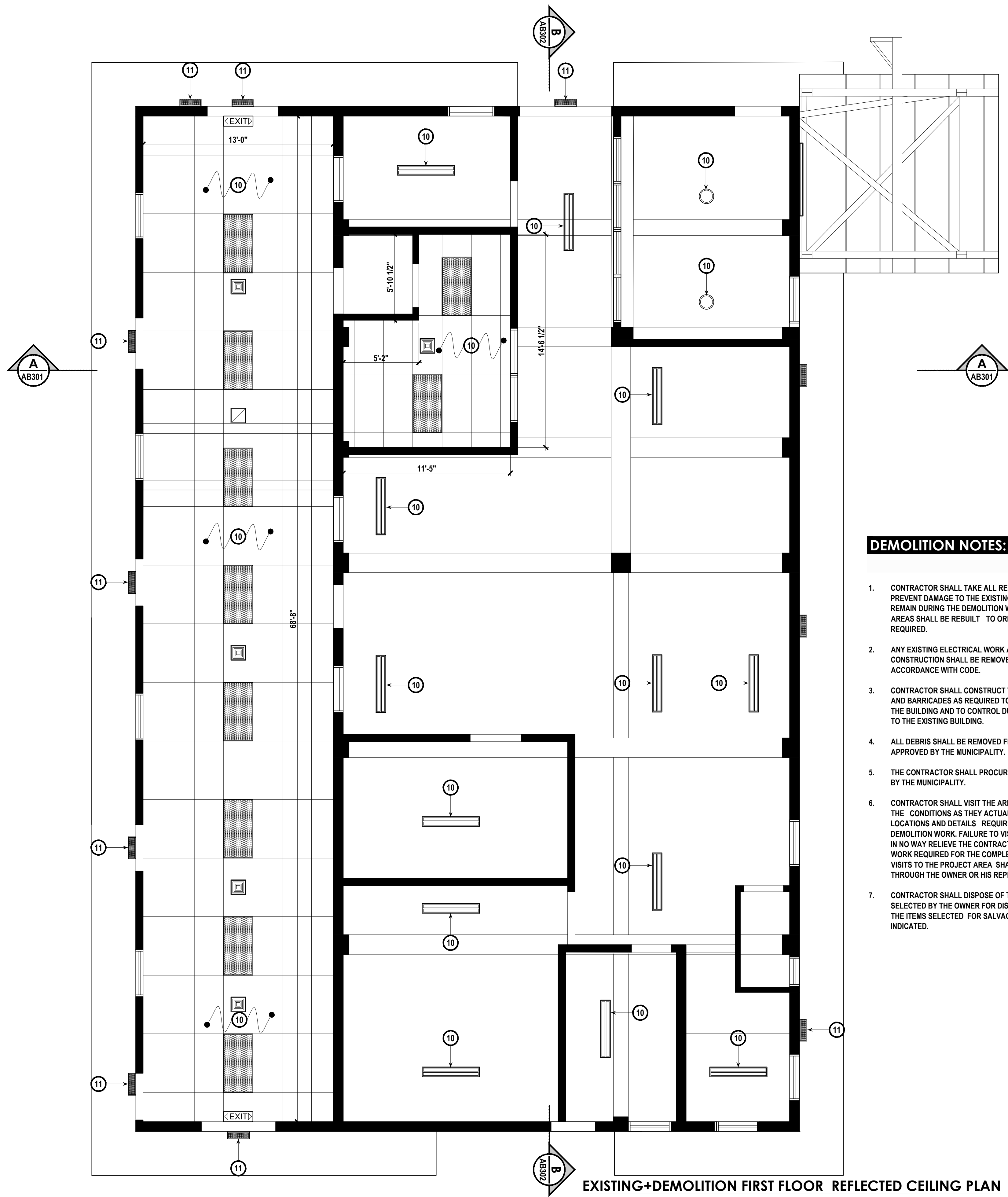
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER TREATMENT PLANT

Drawing Title:

EXISTING + DEMOLITION BASEMENT REFLECTED CEILING PLAN

WTP-AB105



DEMOLITION LEGEND:

EXISTING TO BE DEMOLISHED

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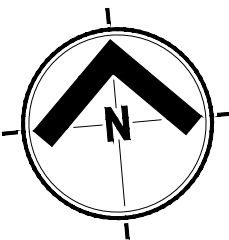
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	SUSPENDED LIGHTING
	PENDANT LIGHT FIXTURE
	OUTDOOR LIGHTING
	EXIT SIGN
	RETURN AIR GRILLE OR SUPPLY AIR DIFFUSER

RCP FINISHES LEGEND:

SYMBOL	DESCRIPTION
	4' X 2' ACOUSTIC TILE



GRAPHIC SCALE = 1/4" = 1'

5' 0' 5' 10'

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JULY 30, 2021
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Revisions	Number	Date	Description	SHEET INFO.
				Project No.: 19-1837-0 Set Date: 20210728 Drawn by: Dwg. Date:

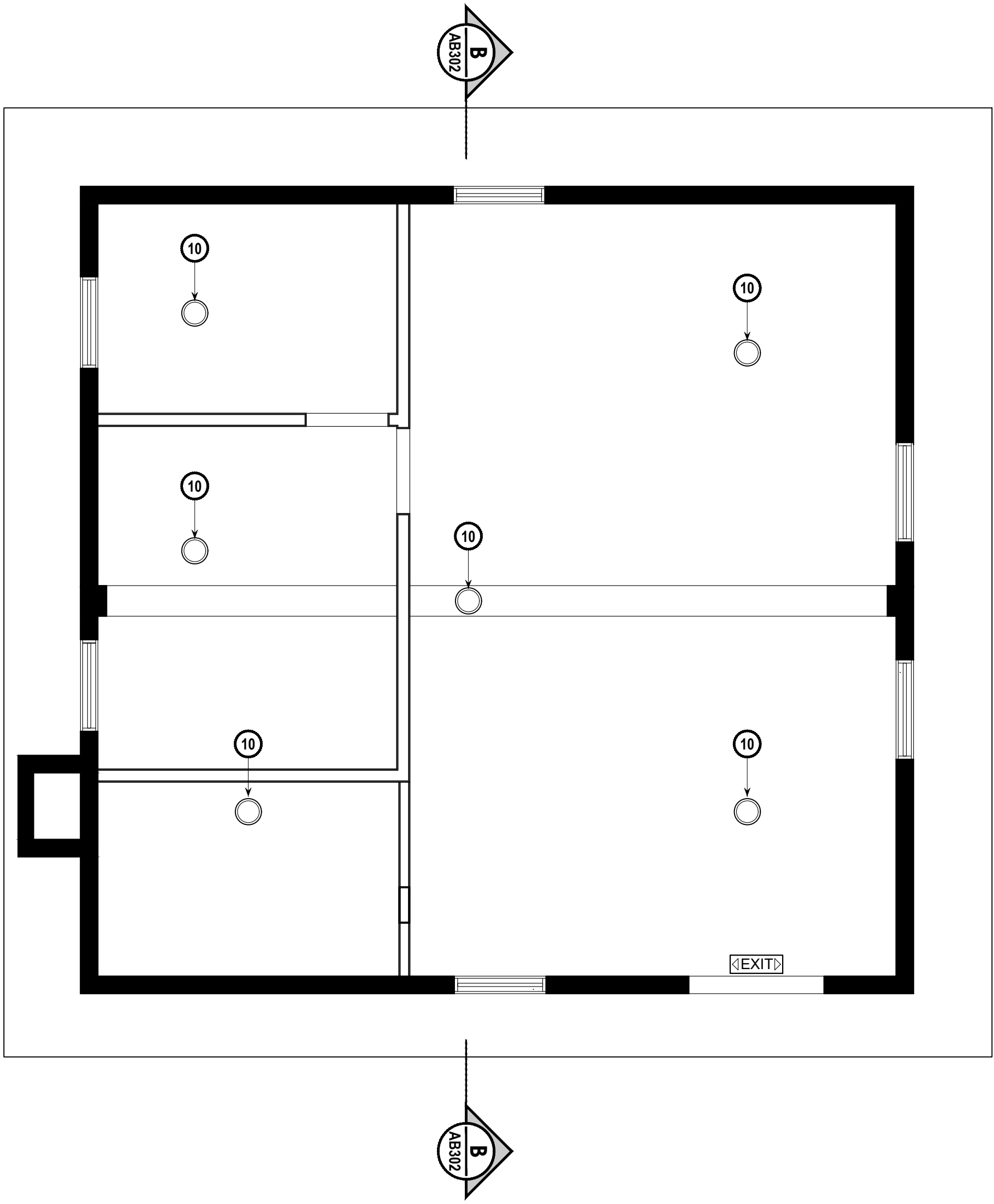
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CEREA & NAGUARO, PUERTO RICO

WATER TREATMENT PLANT
Drawing Title:

EXISTING + DEMOLITION FIRST FLOOR REFLECTED CEILING PLAN

WTP-AB106



DEMOLITION NOTES:

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EXISTING TO BE DEMOLISHED

DEMOLITION KEYNOTES:

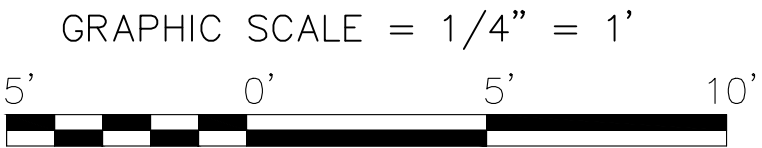
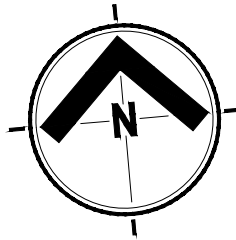
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- REMOVE OUTDOOR LIGHTING
- REMOVE PLUMBING FIXTURE

RCP SYMBOLS LEGEND:

SYMBOL	DESCRIPTION
	4' X 2' RECESSED MOUNT LIGHT FIXTURE
	SUSPENDED LIGHTING
	PENDANT LIGHT FIXTURE
	OUTDOOR LIGHTING
	EXIT SIGN
	RETURN AIR GRILLE OR SUPPLY AIR DIFFUSER

RCP FINISHES LEGEND:

SYMBOL	DESCRIPTION
	4' X 2' ACOUSTIC TILE



Integra Design Group
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EXISTING+DEMOLITION SECOND FLOOR REFLECTED CEILING PLAN

SCALE: 1/4"=1'-0"



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Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837-0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

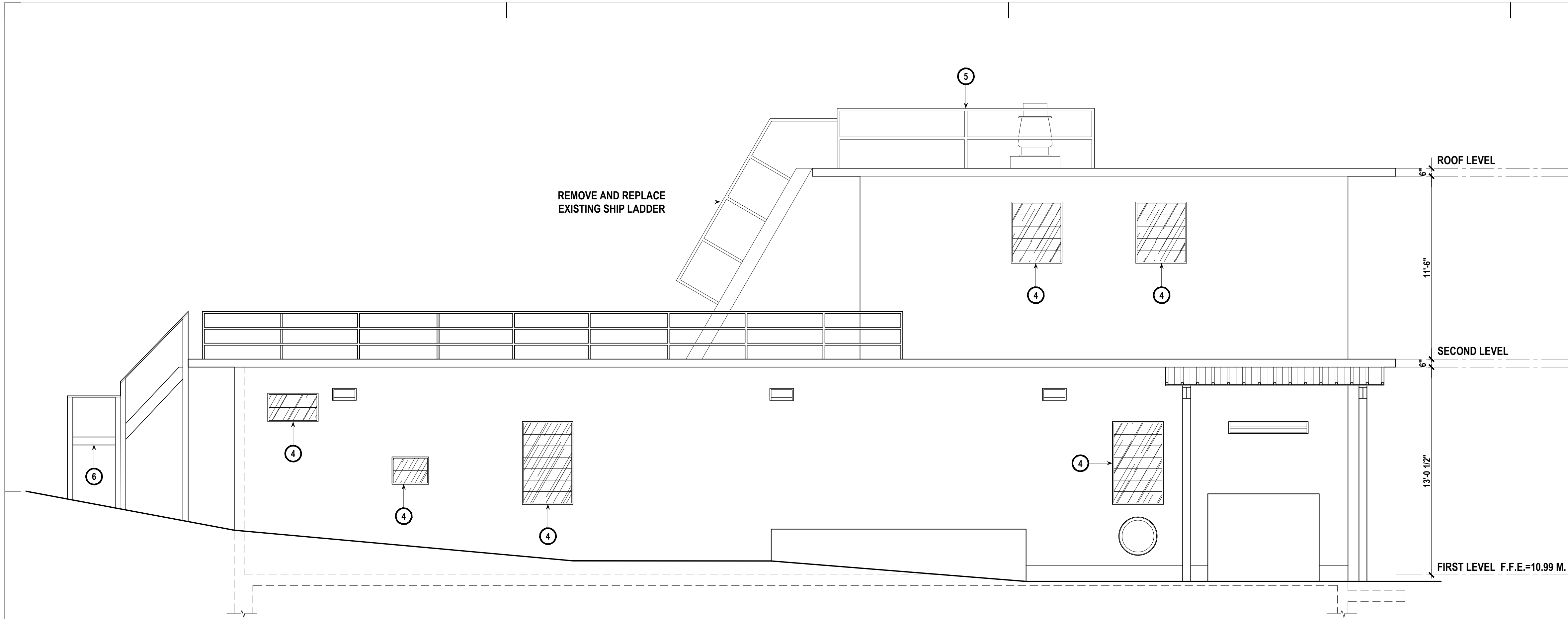


WATER TREATMENT PLANT

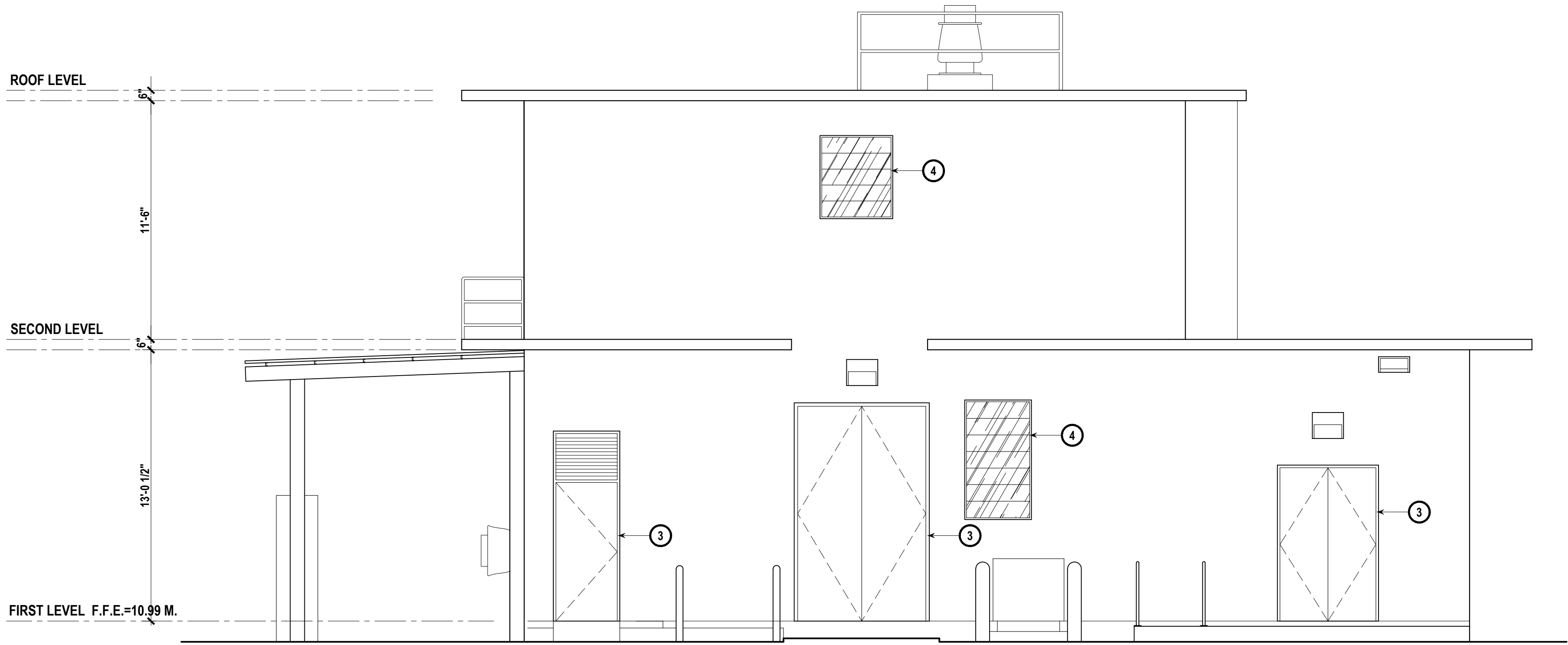
Drawing Title:

EXISTING + DEMOLITION SECOND FLOOR REFLECTED CEILING PLAN

WTP-AB107



EXISTING+DEMOLITION EAST ELEVATION
SCALE: 1/4"=1'-0"



EXISTING+DEMOLITION NORTH ELEVATION
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

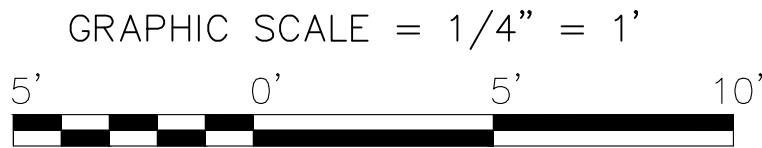
EXISTING TO BE DEMOLISHED

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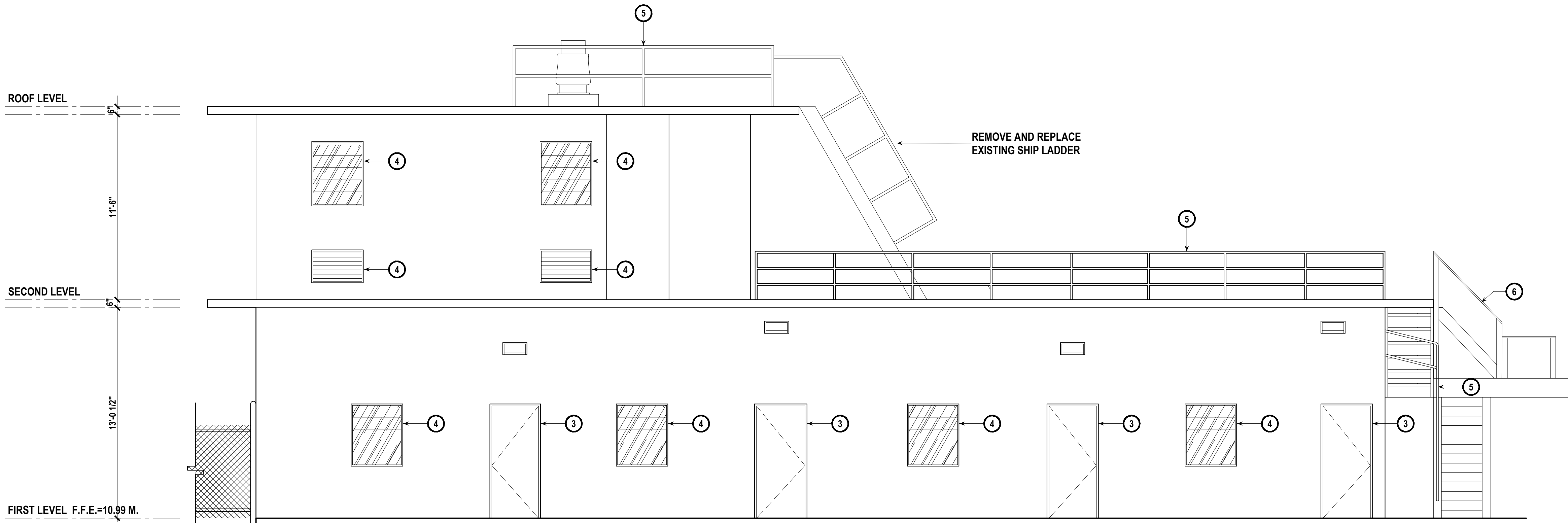
Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

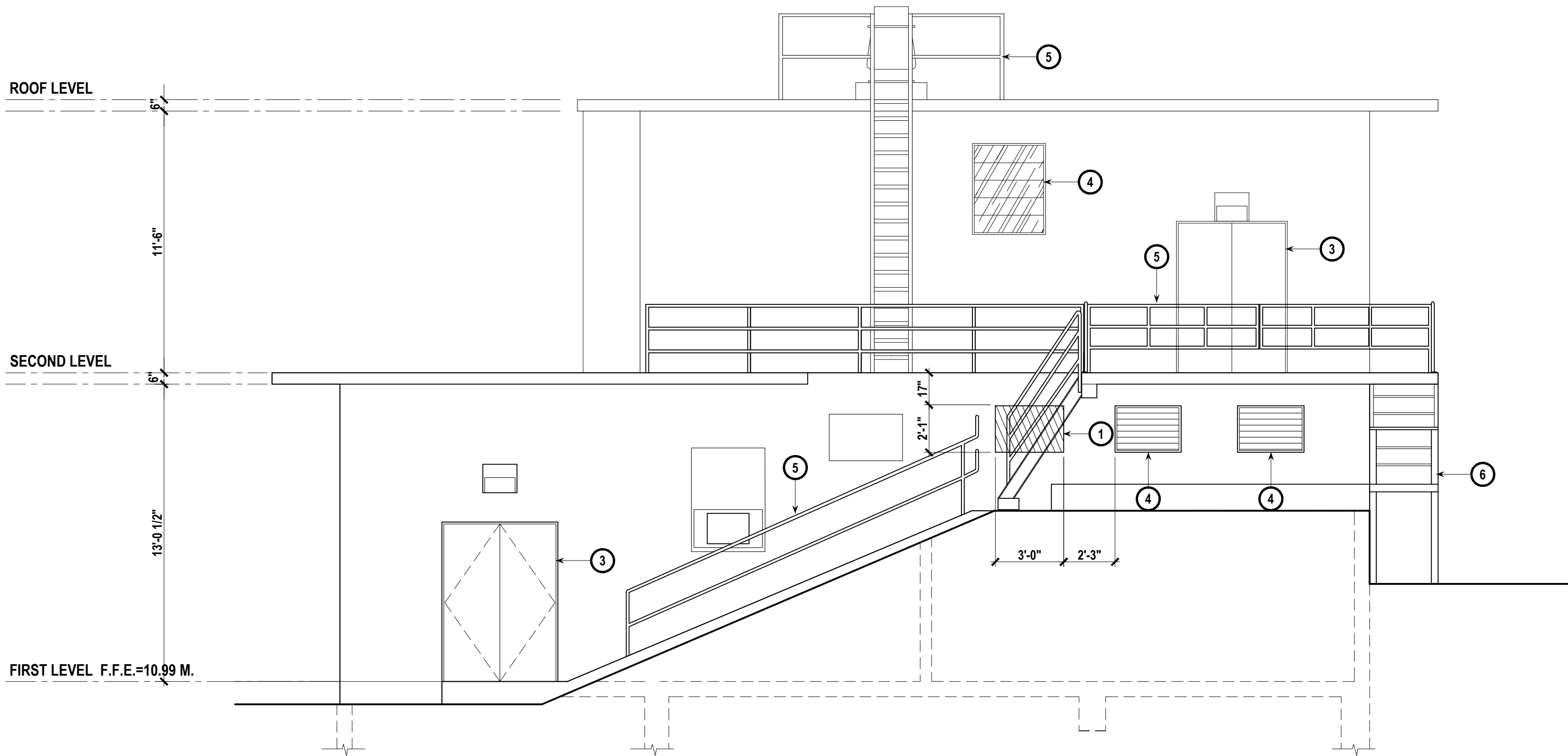
WATER TREATMENT PLANT

Drawing Title:

EXISTING + DEMOLITION ELEVATIONS



EXISTING+DEMOLITION WEST ELEVATION
SCALE: 1/4"=1'-0"



EXISTING+DEMOLITION SOUTH ELEVATION
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

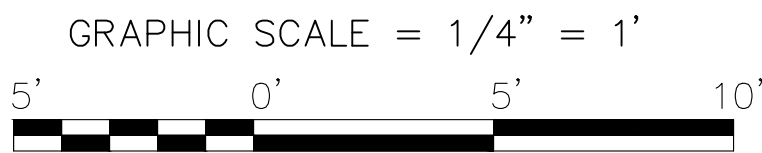
EXISTING TO BE DEMOLISHED

DEMOLITION KEYNOTES:

- 1 DEMOLISH WALL AS INDICATED ON PLAN
- 2 DEMOLISH FLOOR SLAB
- 3 REMOVE DOOR
- 4 REMOVE WINDOW
- 5 REMOVE RAILING
- 6 REMOVE STAIR
- 7 REMOVE GATE & FENCE
- 8 REMOVE WOOD CABINET
- 9 EXISTING EQUIPMENT
- 10 REMOVE SUSPENDED CEILING, LIGHTING AND HVAC FIXTURES
- 11 REMOVE OUTDOOR LIGHTING
- 12 REMOVE PLUMBING FIXTURE

DEMOLITION NOTES:

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7. CONTRACTOR SHALL DISPOSE OF THE REMOVED ITEMS SELECTED BY THE OWNER FOR DISPOSAL, AND SHALL STORE THE ITEMS SELECTED FOR SALVAGE OR REUSE IN THE PLACE INDICATED.



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

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		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

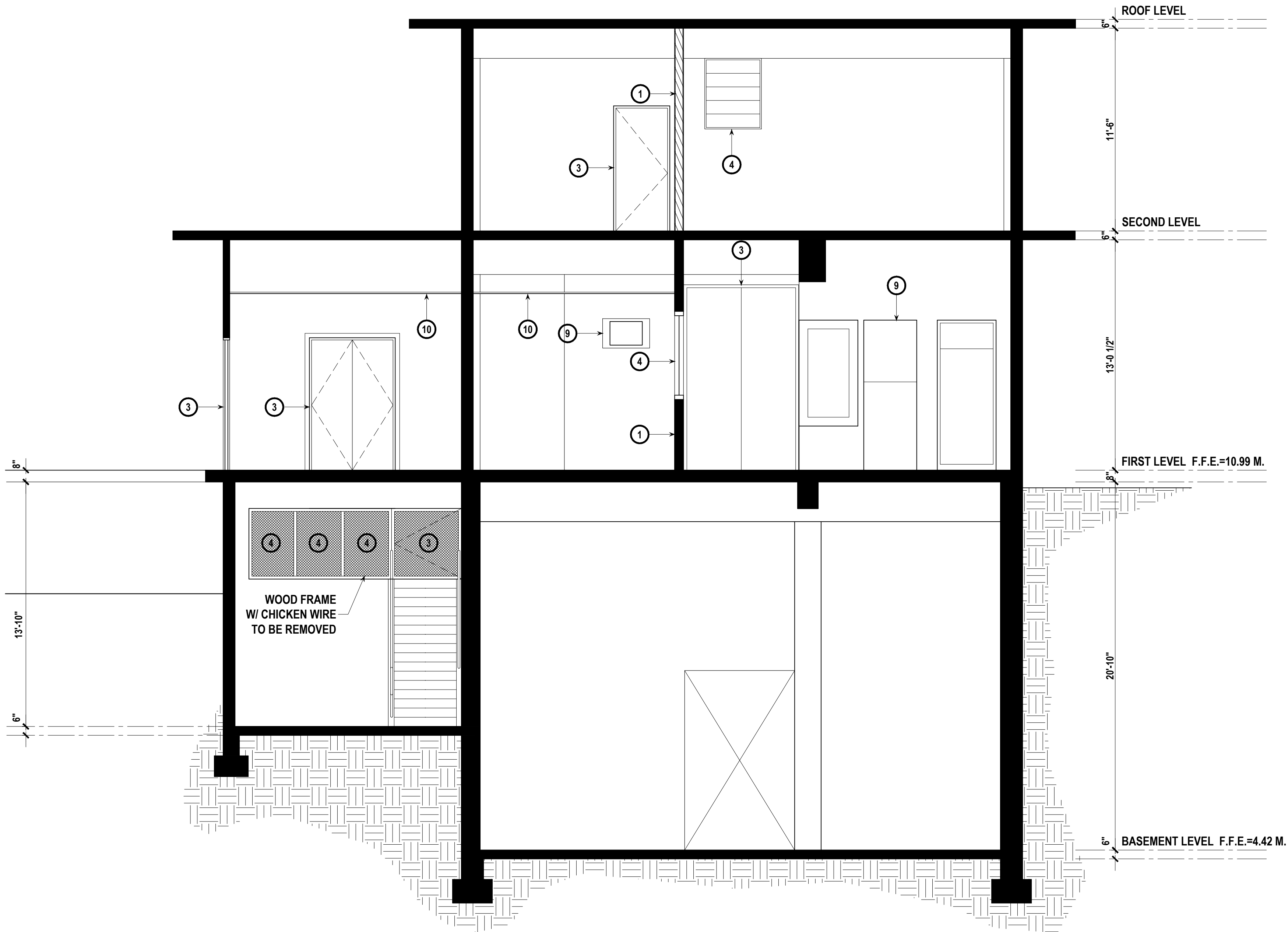
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CERRA & NAGUARO, PUERTO RICO

WATER TREATMENT PLANT

Drawing Title:

EXISTING + DEMOLITION ELEVATIONS



EXISTING+DEMOLITION SECTION A
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

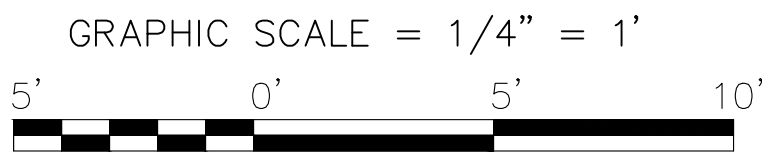
EXISTING TO BE DEMOLISHED

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		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

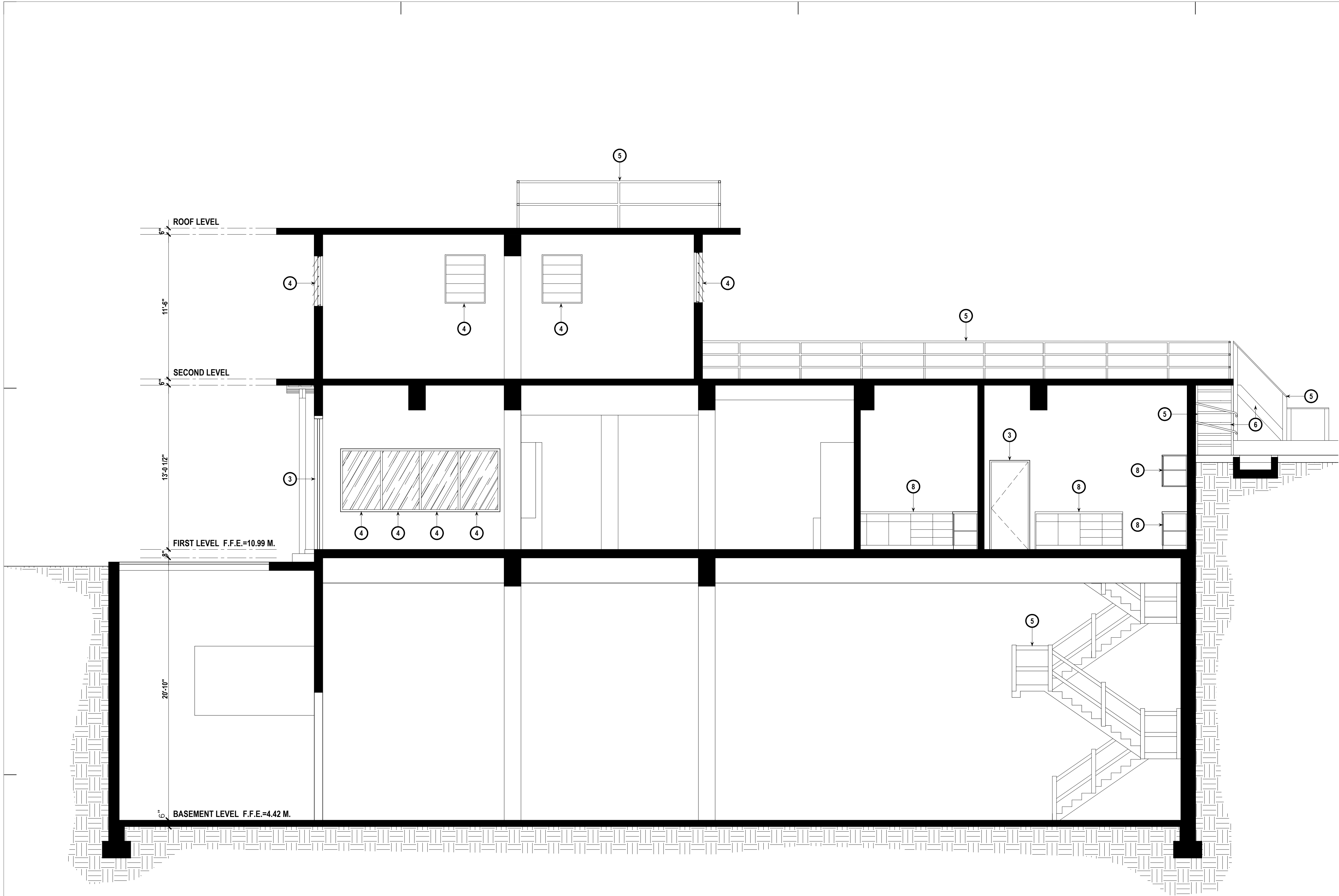
Owner:
CBERA & NAGUABO, PUERTO RICO

Project Title:

EXISTING+DEMOLITION SECTION A

Drawing Title:

WTP-AB301



EXISTING+DEMOLITION SECTION B
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

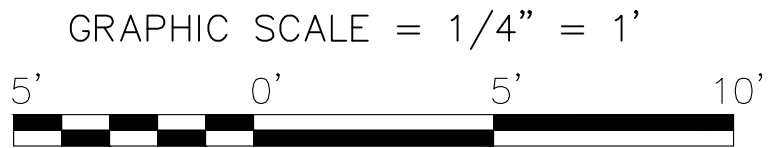
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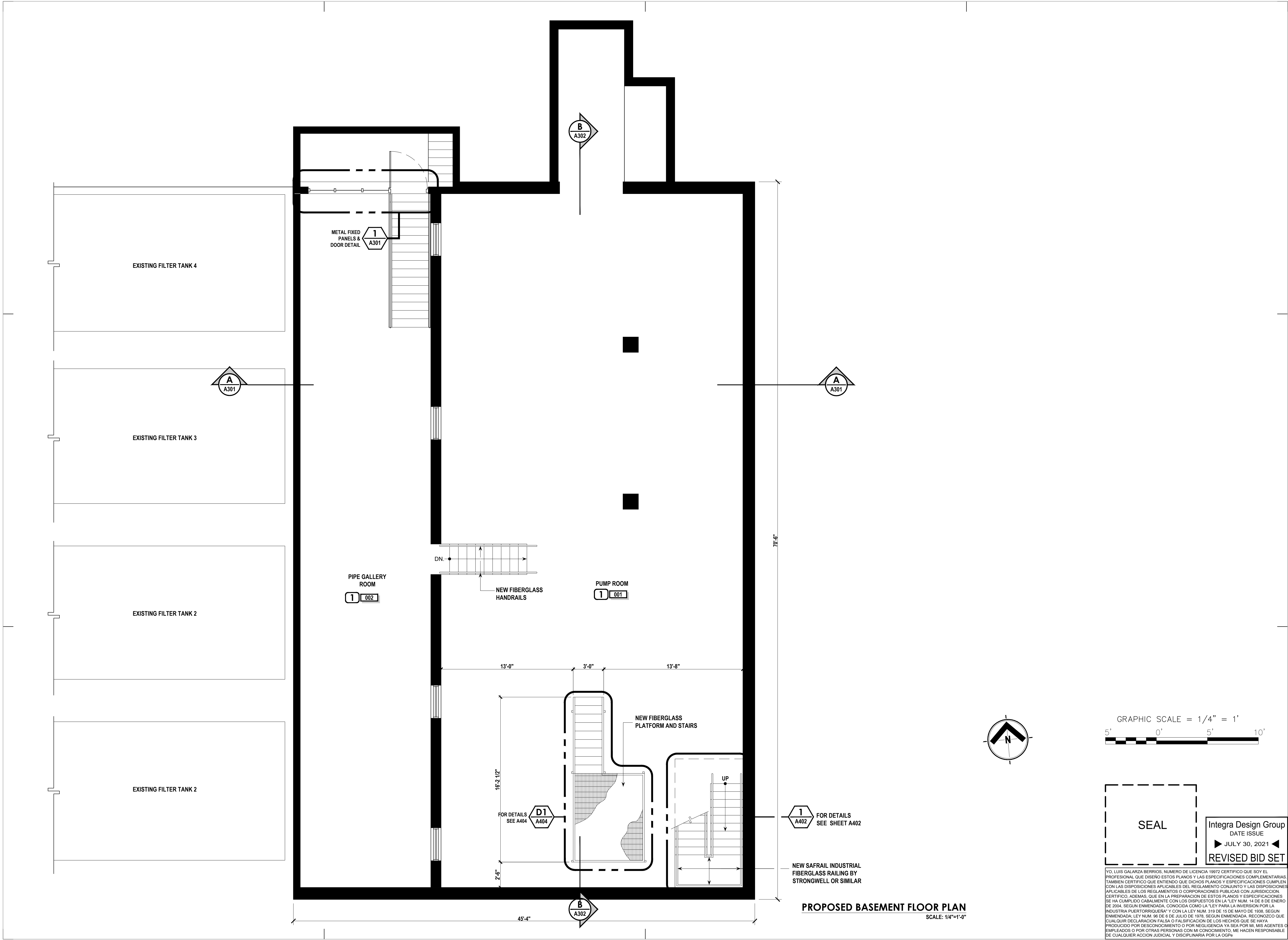
Revisions		SHEET INFO.	
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		Project No.: 19-1837-0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

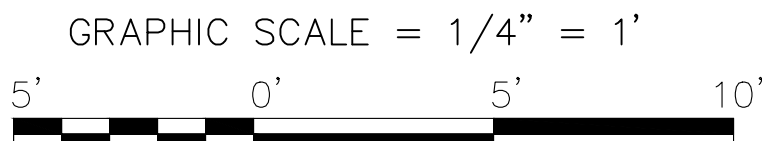
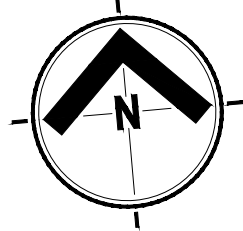
Owner:
CERRA & NAGUARO, PUERTO RICO

WATER TREATMENT PLANT
Drawing Title:
EXISTING+DEMOLITION SECTION B

Sheet:
WTP-AB302



PROPOSED BASEMENT FLOOR PLAN
SCALE: 1/4"=1'-0"



SEAL

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

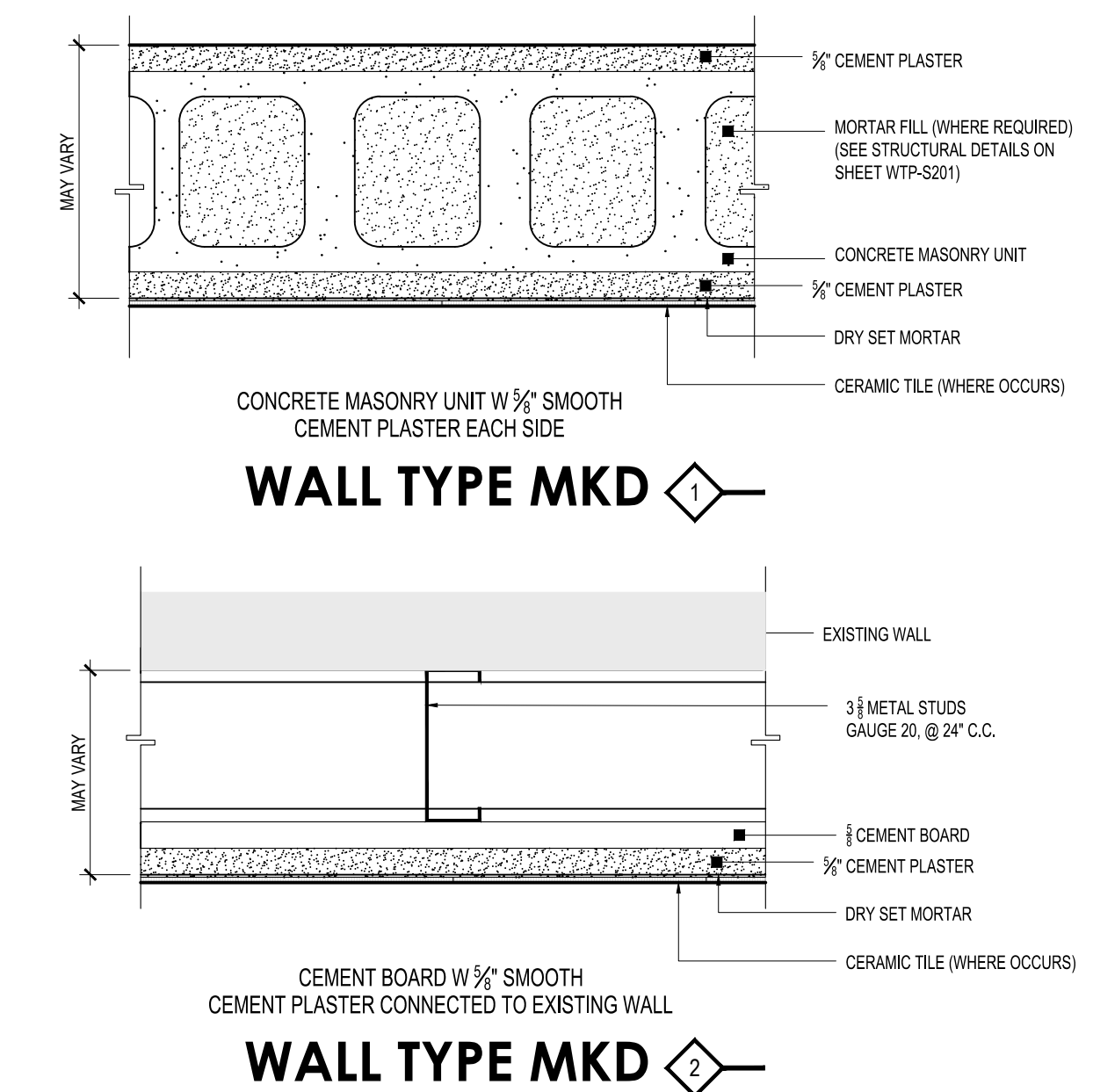
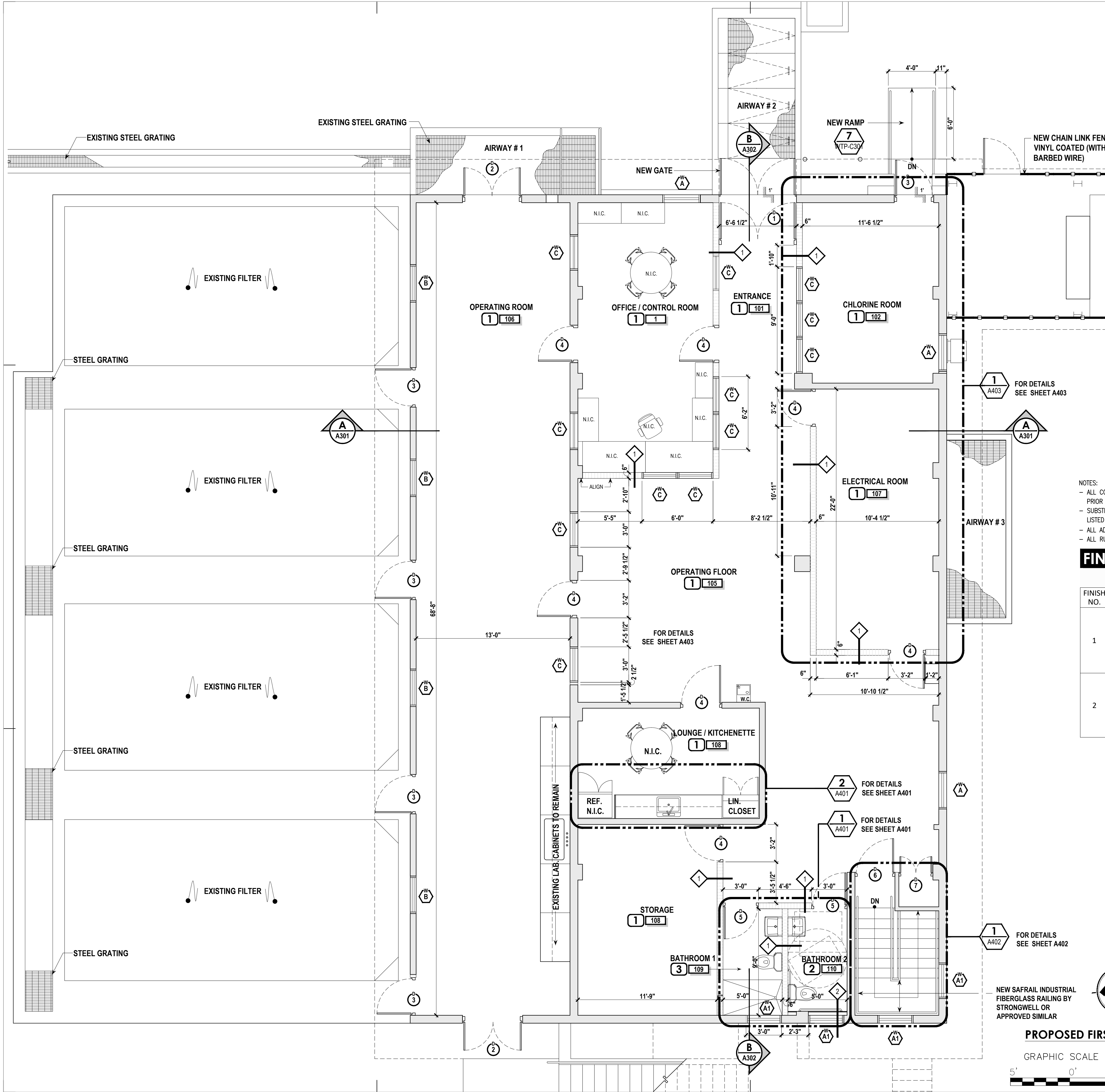
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Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1637-0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

Project Title:
**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

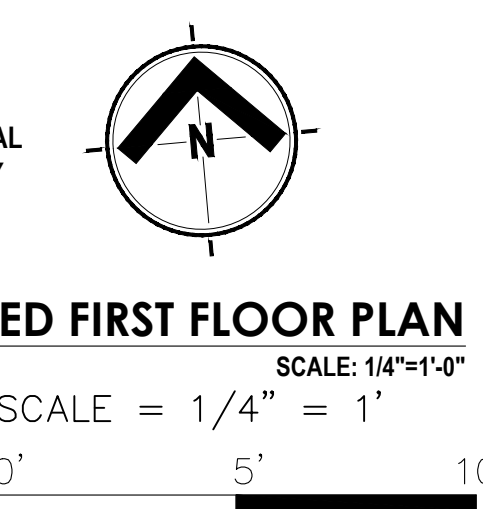
WATER TREATMENT PLANT
Drawing Title:



- NOTES:
- ALL COLORS, TEXTURES AND FINISHES TO BE SELECTED BY ARCHITECT. THE CONTRACTOR SHALL SUBMIT FULL SIZE SAMPLES FOR APPROVAL PRIOR TO INSTALLATION.
 - SUBSTITUTIONS SHALL CONFORM TO THE SPECIFICATIONS AND BE EQUAL IN QUALITY, PERFORMANCE AND APPEARANCE TO THE MATERIALS LISTED ABOVE.
 - ALL ADHESIVES, PAINTS AND SEALERS SHALL BE NON-TOXIC, SOLVENT FREE, AND LOW IN VOLATILE ORGANIC COMPOUNDS. (LOW VOC)
 - ALL RUBBER BASED MATERIALS SHALL BE PVC FREE AND HAVE A T LEAST 20% POST CONSUMER RECYCLED CONTENT.

FINISHES SCHEDULE:

FINISH NO.	FLOOR	WALL	CEILING	BASE
1	EXISTING TO REMAIN: CLEAN PATCH & SEAL SURFACE AS NEEDED W/ TREAD-PLEX ACRYLIC WATER BASED LIGHT FOOT TRAFFIC ARMORSEAL BY SHERWIN WILLIAMS OR FOR SMOOTH FINISH OR APPROVED SIMILAR	PAINTED: CEAN, PATCH & SEAL SURFACE AS NEEDED, APPLY PRIMER AND TWO COATS OF HARMONY INTERIOR LATEX BY SHERWIN WILLIAMS OR APPROVED SIMILAR	PAINTED: CLEAN, PATCH & SEAL SURFACE AS NEEDED, APPLY PRIMER AND TWO COATS OF HARMONY INTERIOR LATEX BY SHERWIN WILLIAMS OR APPROVED SIMILAR	NONE
2	12"12" INTEGRAL TILE EQUAL TO ITALCRAFT OXFORD BY DAL TILE OR APPROVED SIMILAR	6"X6" FIELD TILE, MANUFACTURER: DAL-TILE FINISH: MATTE BISCUIT K775	PAINTED: CLEAN, PATCH & SEAL SURFACE AS NEEDED, APPLY PRIMER AND TWO COATS OF HARMONY INTERIOR LATEX BY SHERWIN WILLIAMS OR APPROVED SIMILAR	FLAT TOP COVE 6X6 BY DAL TILE OR APPROVED SIMILAR



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INTEGRA DESIGN GROUP PSC
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Project Title: **WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT**

Sheet: **WTP-A102**

Revisions

Number	Date	Description

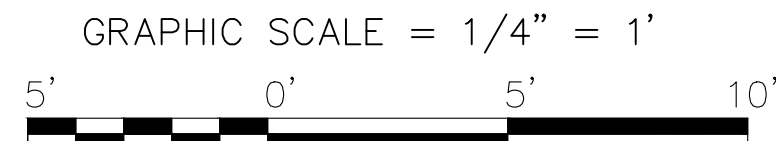
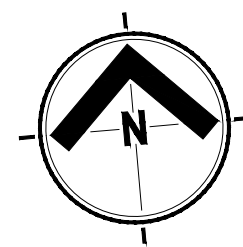
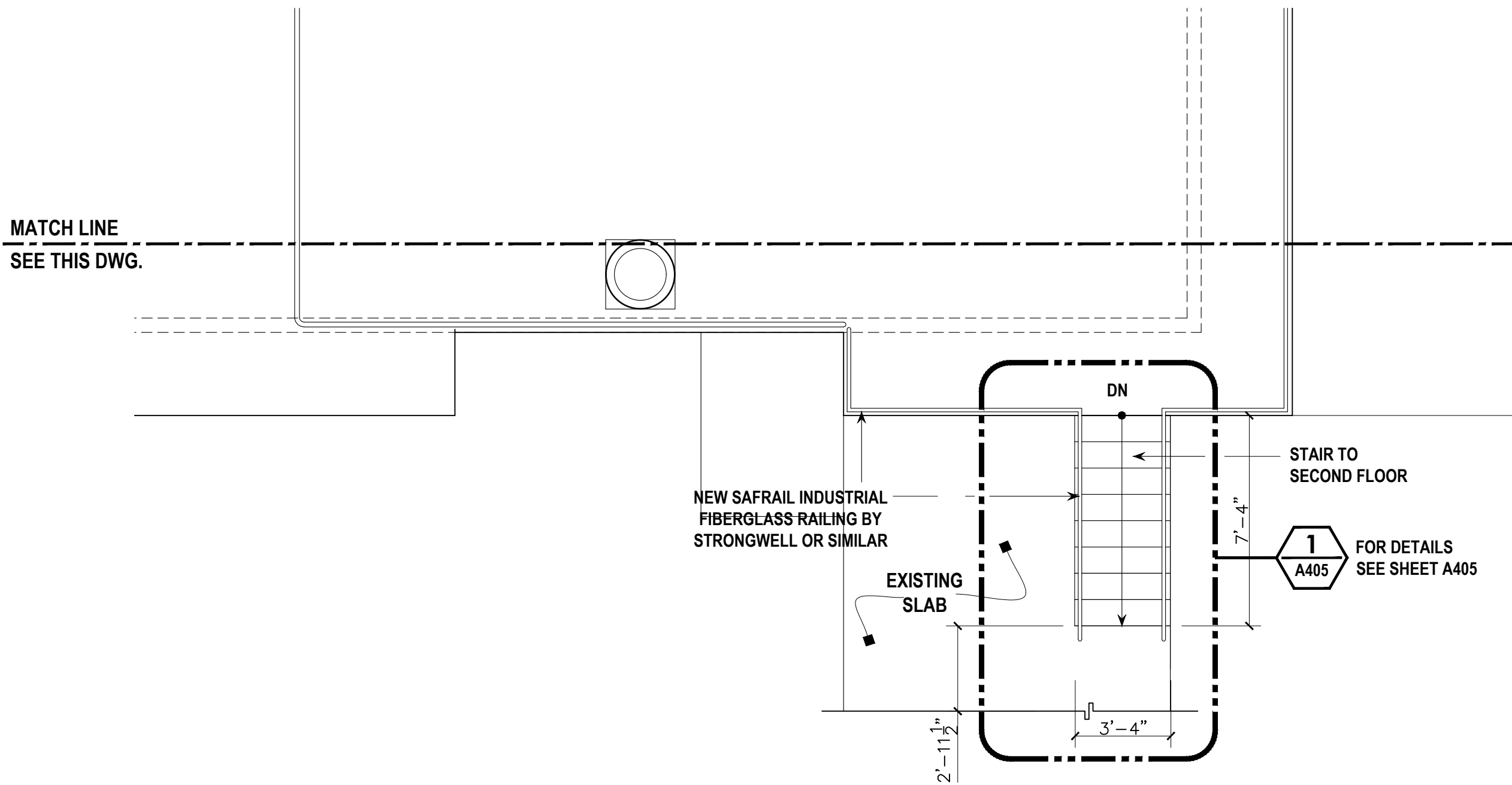
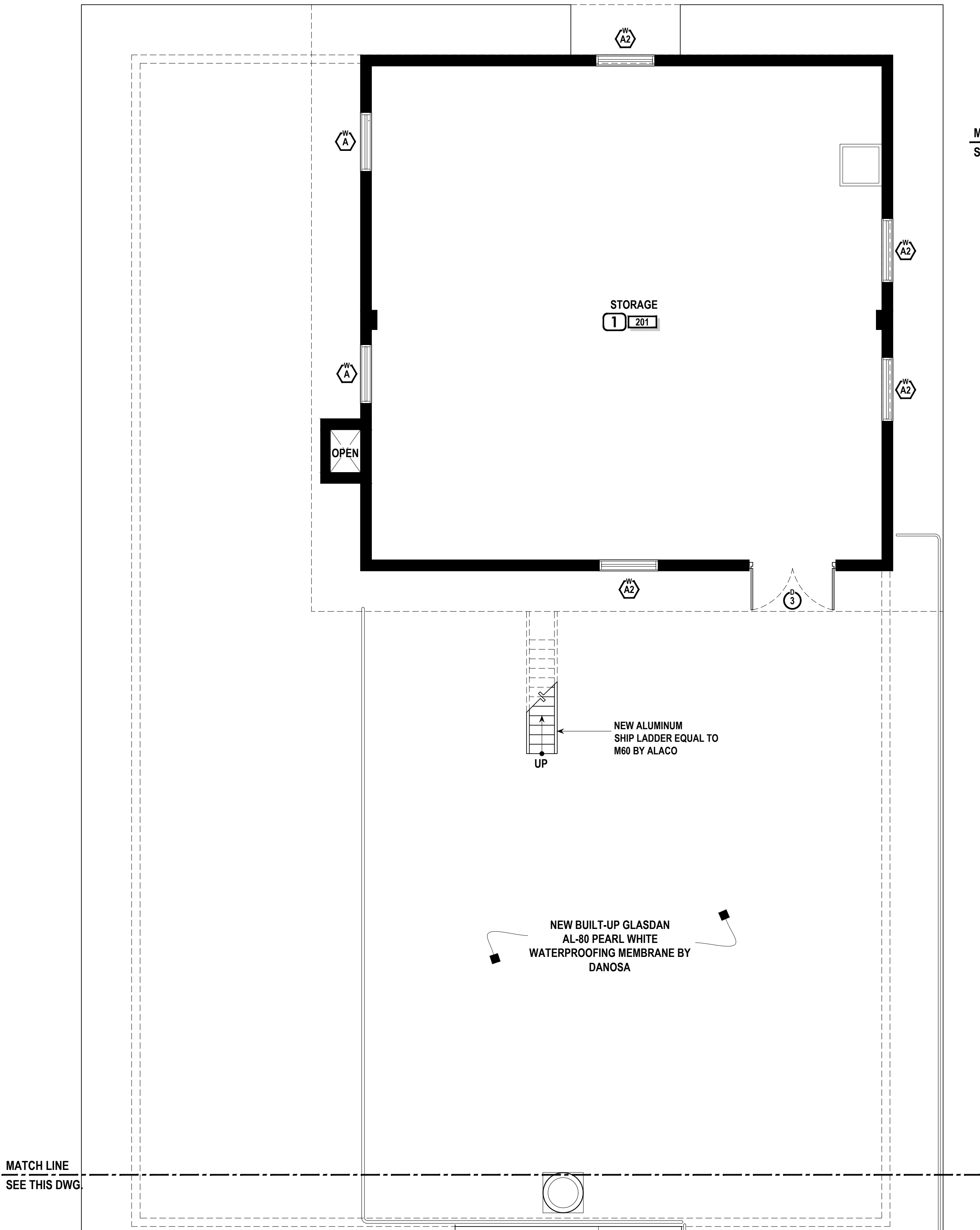
SHEET INFO.

Project No.: 19-1837-0
Set Date: 20210728
Drawn by:
Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

Water Treatment Plant
Drawing Title: **PROPOSED FIRST FLOOR PLAN**



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

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PROPOSED SECOND FLOOR PLAN
SCALE: 1/4"=1'-0"

Revisions		SHEET INFO.	
Number	Date	Description	
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		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

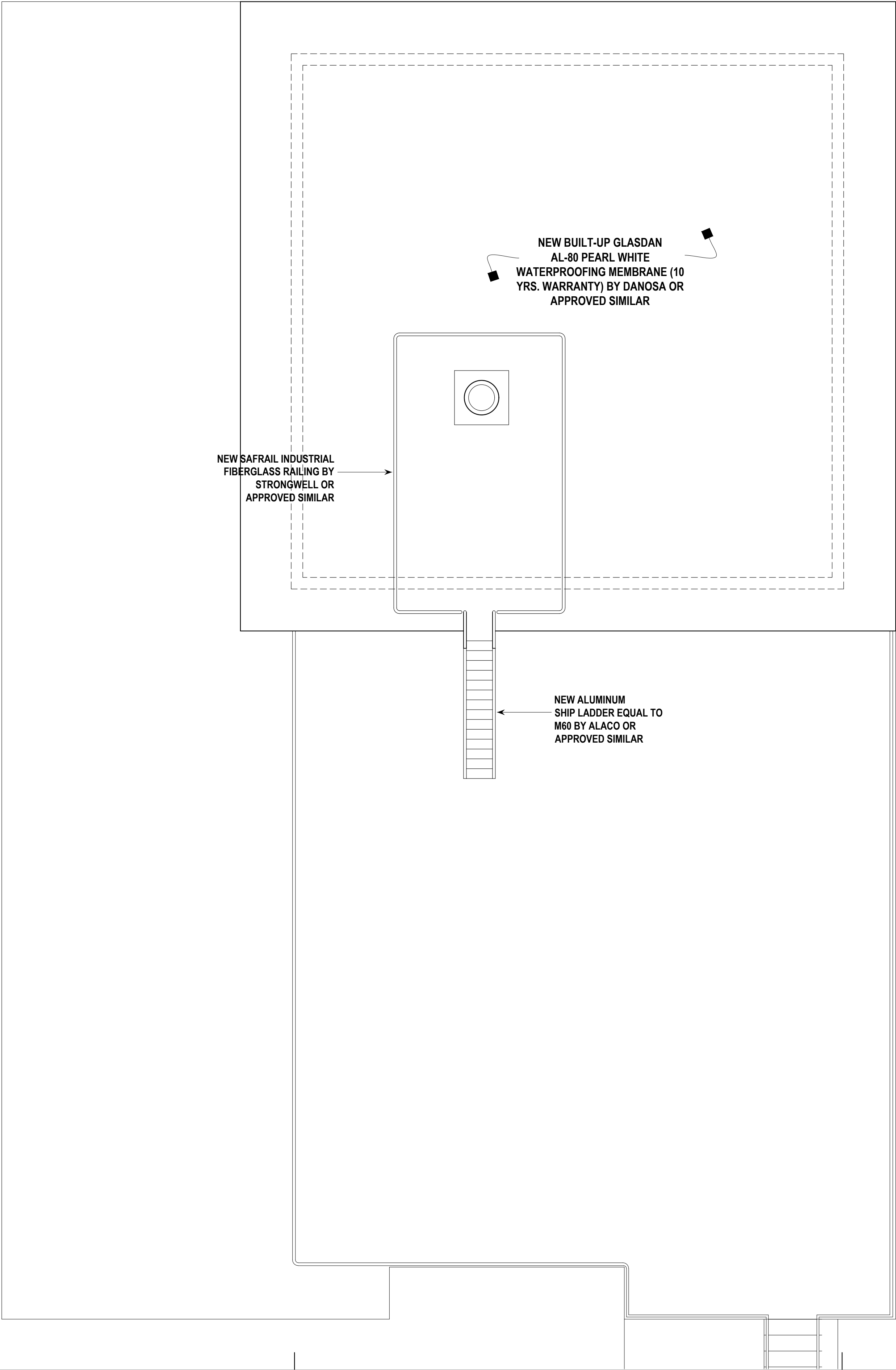
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

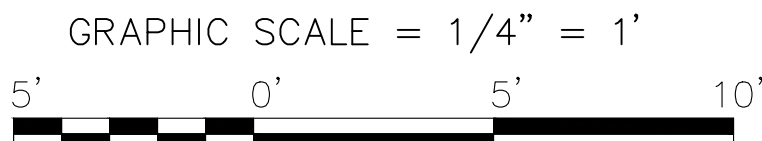
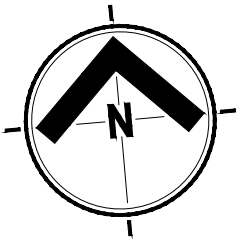
Drawing Title:

Project Title:

WTP-A103



PROPOSED ROOF PLAN
SCALE: 1/4"=1'-0"



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPB.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

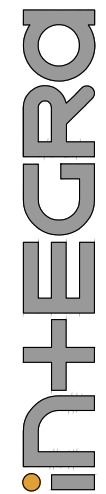
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



WATER TREATMENT PLANT
Drawing Title:

PROPOSED ROOF PLAN

WTP-A104



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RCP NOTES:
SEISMIC DESIGN CATEGORY "D"

1. IBC 2009 § 601.1.1 SUSPENDED ACOUSTICAL CEILINGS: SUSPENDED ACOUSTICAL CEILING SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH THE PROVISIONS OF ASTM C 635 AND ASTM C 636.

• CONTRACTOR SHALL PROVIDE TECHNICAL DATA SHEETS FOR DEMONSTRATING THAT THE METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE AND LAY-IN PANEL CEILINGS IS IN COMPLIANCE WITH ASTM C 635.

• ASTM C 636, SUMMARY OF STANDARD PRACTICE FOR SUSPENSION CEILING INSTALLATION:

1. HANGERS FOR CARRYING CHANNELS OR MAIN RUNNERS 4" O.C.
2. EACH SUSPENSION WIRE SHALL NOT HAVE MORE THAN ONE IN SIX OUT OF PLUMB UNLESS A COUNTERSLOPING WIRE OR HORIZONTAL BRACING IS PROVIDED. SUSPENSION WIRES SHOULD NOT PRESS AGAINST DUCTS OR PIPES.
3. WIRE HANGERS SHALL BE A MINIMUM OF #12 GA. GALVANIZED, SOFT-ANNEALED, MILD STEEL WIRE.
4. LOCAL KINKS OR BENDS SHALL NOT BE MADE IN HANGER WIRES AS A MEANS OF LEVELING CARRYING CHANNELS.
5. IN INSTALLATIONS WHERE HANGER WIRES ARE WRAPPED AROUND CARRYING CHANNELS, THE WIRE LOOPS SHALL BE TIGHTLY FORMED TO PREVENT ANY VERTICAL MOVEMENT OR ROTATION OF THE MEMBER WITHIN THE LOOP.
6. MAIN RUNNERS
- 6.1. INSTALL MAIN RUNNERS SO THAT THEY ARE LEVEL TO WITHIN 1/8" IN 10'-0" AFTER COMPLETION OF THE CEILING INSTALLATIONS BUT PRIOR TO BUILDING OCCUPANCY.
- 6.2. LOCAL KINKS OR BENDS SHALL NOT BE MADE IN HANGER WIRES AS A MEANS OF LEVELING MAIN RUNNERS.
- 6.3. IN INSTALLATIONS WHERE HANGER WIRES ARE WRAPPED THROUGH OR AROUND MAIN RUNNERS, THE WIRE LOOPS SHALL BE TIGHTLY WRAPPED AND SHARPLY BENT TO PREVENT ANY VERTICAL MOVEMENT OR ROTATION OF THE MEMBER WITHIN THE LOOPS. THE WIRE MUST BE WRAPPED AROUND ITSELF A MINIMUM OF THREE FULL TURNS (360° EACH) WITHIN A 3" LENGTH. FOR SAFETY PURPOSES, THE BOTTOM OF THE HANGER WIRES SHALL EITHER BE CUT CLOSE TO THE VERTICAL PORTION OF THE WIRE OR SHALL BE BENT UPWARD PARALLEL TO THE VERTICAL PORTION OF THE HANGER WIRE.

7. CROSS RUNNERS

- 7.1. INSTALL CROSS RUNNERS SUPPORTED BY EITHER MAIN RUNNERS OR BY OTHER CROSS RUNNERS TO WITHIN 1/8" OF THE REQUIRED CENTER DISTANCES. THIS TOLERANCE SHALL BE NONCUMULATIVE BEYOND 12'-0".
- 7.2. THE EXPOSED SURFACES OF THE TWO INTERSECTING RUNNERS SHALL LIE WITHIN A VERTICAL DISTANCE OF 0.015" OF EACH OTHER WITH THE ABUTTING (CROSS) MEMBER ALWAYS ABOVE THE CONTINUOUS (MAIN) MEMBER.
8. ASSEMBLY DEVICES
- 8.1. JOIN ABUTTING SECTIONS OF THE MAIN RUNNER BY MEANS OF SUITABLE CONNECTION SUCH AS SPLICES, INTERLOCKING ANDS, TAB LOCKS, PIN LOCKS, AND SO FORTH. A JOINT CONNECTION SHALL BE JUDDIED SUITABLE BOTH BEFORE AND AFTER CEILING LOADS ARE IMPOSED IF THE JOINT PROVIDES SUFFICIENT ALIGNMENT SO THAT THE EXPOSED SURFACES OF TWO ABUTTING MAIN RUNNERS LIE WITHIN A VERTICAL DISTANCE OF 0.015" OF EACH OTHER.
- 8.2. THERE SHALL BE NO VISUALLY APPARENT ANGULAR DISPLACEMENT OF THE LONGITUDINAL AXIS OF ONE RUNNER WITH RESPECT TO THE OTHER.
- 8.3. ASSEMBLY DEVICES SHALL PROVIDE SUFFICIENT SPACING CONTROL SO THAT HORIZONTAL GAPS BETWEEN EXPOSED SURFACES OF EITHER ABUTTING OR INTERSECTING MEMBER SHALL NOT EXCEED 0.020".
- 8.4. FIXTURES SHALL NOT BE SUPPORTED FROM MAIN RUNNERS OR CROSS RUNNERS IF THE WEIGHT OF THE FIXTURE CAUSES THE TOTAL DEAD LOAD TO EXCEED THE DEFLECTION CAPABILITY OF THE CEILING SUSPENSION SYSTEM. IN SUCH CASES, THE FIXTURE LOAD SHALL BE SUPPORT BY SUPPLEMENTAL HANGERS WITHIN 1'-0" OF EACH CORNER, OR THE FIXTURES SHALL BE SEPARATELY SUPPORTED.

9. INSPECTION

- 9.1. CEILING INSPECTION SHALL BE MADE WITH FINAL BUILDING OCCUPANCY LIGHTING CONDITIONS. IF TEMPORARY LIGHTING MUST BE USED, TEMPORARY CONDITIONS WILL APPROXIMATE THE FINAL LIGHTING CONDITION.
2. IBC 2009 § 1613.1 EARTHQUAKE LOADS, SCOPE: EVERY STRUCTURE, AND PORTION THEREOF, INCLUDING NONSTRUCTURAL COMPONENTS THAT ARE PERMANENTLY ATTACHED TO STRUCTURES AND THEIR SUPPORTS AND ATTACHMENTS, SHALL BE DESIGNED AND CONSTRUCTED TO RESIST THE EFFECTS OF EARTHQUAKE MOTIONS IN ACCORDANCE WITH ASCE 7 WITH ALL THE MODIFICATIONS INCORPORATED HEREIN, EXCLUDING CHAPTER 14 AND APPENDIX 11A. THE SEISMIC DESIGN CATEGORY FOR A STRUCTURE SHALL BE DETERMINED IN ACCORDANCE WITH SECTION 1613.

3. ASCE/SEI 7 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, § 13.5.6.2.2 SEISMIC DESIGN CATEGORIES D, E, AND F: ACOUSTICAL TILE OR LAY-IN PANEL CEILINGS IN SEISMIC DESIGN CATEGORIES D, E, AND F SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH ASTM C 635, ASTM C 636, AND ASTM E580, SECTION 5 - SEISMIC DESIGN CATEGORIES D, E AND F AS MODIFIED BY THIS SECTION. ACOUSTICAL TILE OR LAY-IN PANEL CEILINGS SHALL ALSO COMPLY WITH THE FOLLOWING:

- THE WIDTH OF THE PERIMETER SUPPORTING CLOSURE ANGLE OR CHANNEL SHALL BE NOT LESS THAN 2". WHERE PERIMETER SUPPORTING CLIPS ARE USED, THEY SHALL BE QUALIFIED IN ACCORDANCE WITH APPROVED TEST CRITERIA. IN EACH ORTHOGONAL HORIZONTAL DIRECTION, ONE END OF THE CEILING GRID SHALL BE ATTACHED TO THE CLOSURE ANGLE OR CHANNEL. THE OTHER END IN EACH HORIZONTAL DIRECTION SHALL HAVE A 0.75" CLEARANCE FROM THE WALL AND SHALL REST UPON AND BE FREE TO SLIDE ON A CLOSURE ANGLE OR CHANNEL.

- FOR CEILING AREAS EXCEEDING 2,500 SF, A SEISMIC SEPARATION JOINT OR FULL HEIGHT PARTITION THAT BREAKS THE CEILING UP INTO AREAS NOT EXCEEDING 2,500 SF, EACH WITH A RATIO OF THE LONG TO SHORT DIMENSION LESS THAN OR EQUAL TO 4:1, SHALL BE PROVIDED UNLESS STRUCTURAL ANALYSES ARE PERFORMED OF THE CEILING BRACING SYSTEM FOR THE PRESCRIBED SEISMIC FORCES THAT DEMONSTRATE CEILING PENETRATIONS AND CLOSURE ANGLES OR CHANNELS PROVIDE SUFFICIENT CLEARANCE TO ACCOMMODATE THE ANTICIPATED LATERAL DISPLACEMENT. EACH AREA SHALL BE PROVIDED WITH CLOSURE ANGLES OR CHANNELS IN ACCORDANCE WITH SECTION 13.5.6.2.2.a AND HORIZONTAL RESTRAINTS OR BRACING.

4. ASTM E580 SUMMARY OF STANDARD PRACTICE FOR SUSPENSION CEILING INSTALLATION IN SEISMIC ACTIVITY ZONES, IN ADDITION TO ASTM C 636

- CEILING AREAS OF 1,000 SF OR LESS ARE EXEMPT FROM LATERAL FORCE BRACING REQUIREMENTS.

• SUSPENSION SYSTEM COMPONENTS

- 1.1.1. THE MAIN RUNNERS AND CROSS RUNNERS OF THE CEILING SYSTEM AND THEIR SPLICES, INTERSECTION CONNECTORS, AND EXPANSION DEVICES SHALL BE DESIGNED TO CARRY A MEAN ULTIMATE TEST LOAD OF NOT LESS THAN 1,800 LB IN COMPRESSION AND IN TENSION. THE TENSILE TEST SHALL ALLOW FOR A 5° OFFSET OF THE CONNECTION IN ANY DIRECTION. INSTEAD OF A 5° MISALIGNMENT, THE LOAD CAN BE APPLIED WITH A 1" ECCENTRICITY ON A SAMPLE NOT MORE THAN 24" LONG ON EACH SIDE OF THE SPLICE OR INTERSECTION. THE CONNECTORS AT SPLICES AND INTERSECTION SHALL BE THE MECHANICAL INTERLOCKING TYPE.
- 1.1.2. THE PERIMETER SUPPORT ANGLE SHALL SUPPLY A SUPPORT LEDGE OF NOT LESS THAN 2". MAIN RUNNER AND/OR CROSS RUNNER ENDS SHALL BE ATTACHED TO THE PERIMETER ON TWO ADJACENT WALLS. A CLEARANCE OF 1" SHALL BE MAINTAINED BETWEEN THE MAIN RUNNER AND CROSS RUNNER ENDS AND THE PERIMETER MEMBERS ON THE TWO OPPOSITE WALLS. ON THE WALLS WHERE THE TERMINAL END RUNNERS ARE NOT FIXED TO THE PERIMETER SUPPORTING CLOSURE, ALLOW FOR 1" OF AXIAL MOVEMENT.
- 1.1.3. TERMINAL ENDS OF THE MAIN RUNNERS AND CROSS MEMBERS SHALL BE TIED TOGETHER OR HAVE SOME OTHER APPROVED MEANS TO PREVENT THEIR SPREADING. STABILIZER BARS, CROSS TEES OR OTHER MEANS TO PREVENT SPREADING SHALL OCCUR WITHIN 8" OF EACH WALL.
- 1.1.4. DIRECT CONCEALED SUSPENDED CEILING SYSTEMS SHALL HAVE POSITIVELY CONNECTED STABILIZER BARS OR MECHANICALLY CONNECTED CROSS RUNNERS AT A MAXIMUM SPACING OF 60" PERPENDICULAR TO THE MAIN RUNNERS. STABILIZATION SHALL OCCUR WITHIN 24" OF EACH WALL.
- 1.1.5. THE TERMINAL END OF EACH CROSS RUNNER AND MAIN RUNNER SHALL BE SUPPORTED INDEPENDENTLY, A MAXIMUM OF 9" FROM EACH WALL OR CEILING DISCONTINUITY WITH #12 GA. WIRE OR APPROVAL WALL SUPPORT.

• SUSPENSION WIRE APPLICATION

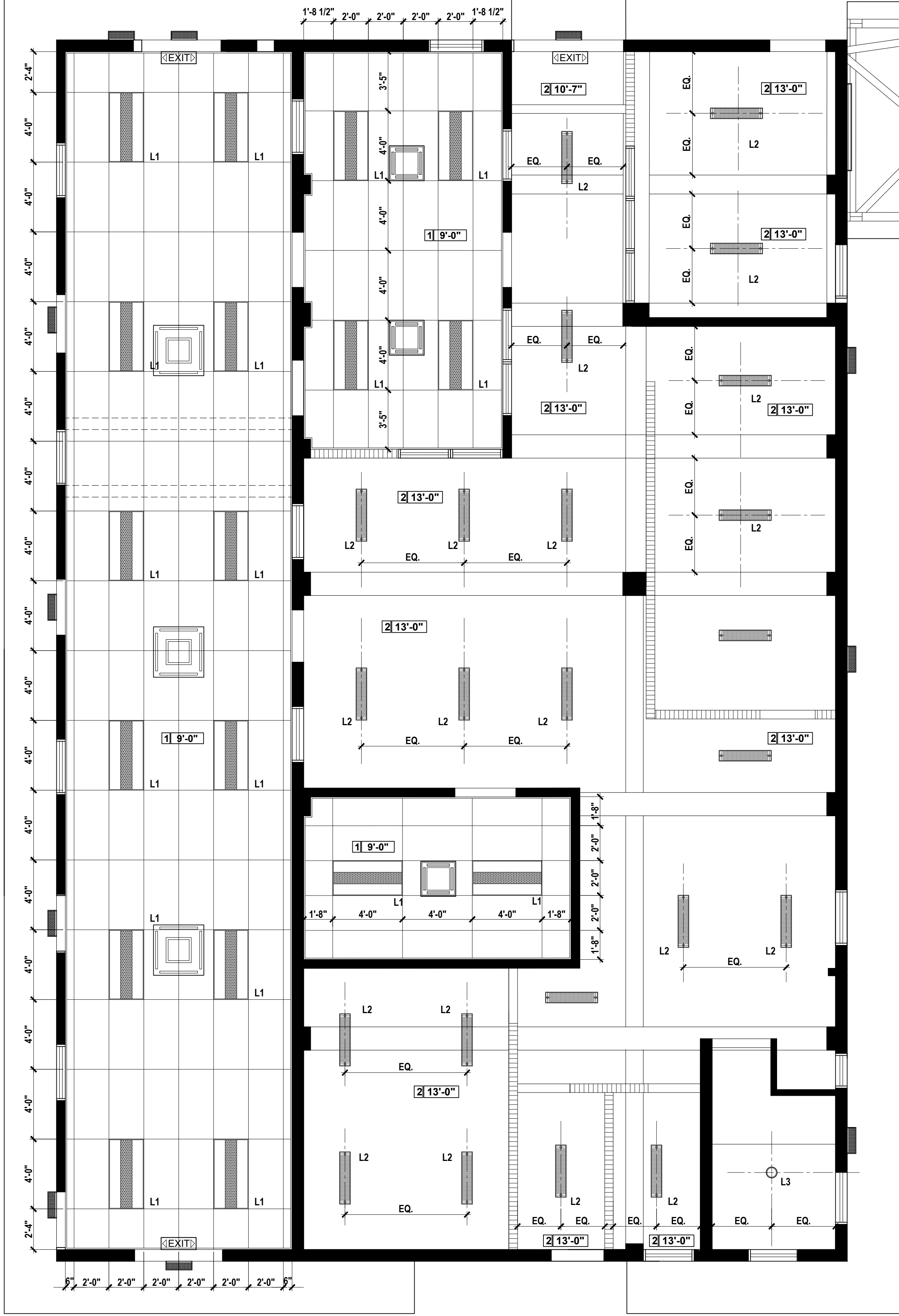
1. CONNECTION DEVICES TO THE SUPPORTING CONSTRUCTION SHALL BE CAPABLE OF CARRYING NOT LESS THAN A 100 LB ALLOWABLE LOAD.
2. WIRES SHALL NOT ATTACH TO OR BEND AROUND INTERFERING MATERIAL OR EQUIPMENT. A TRAPEZE OR EQUIVALENT DEVICE SHALL BE USED WHERE DISTRIBUTIONS PRECLUDE DIRECT SUSPENSION. TRAPEZE SUSPENSIONS SHALL BE SIZED TO RESIST THE DEAD LOAD AND LATERAL FORCES APPROPRIATE FOR THE SEISMIC DESIGN CATEGORY.

• LATERAL FORCE BRACING

1. LATERAL FORCE BRACING IS REQUIRED FOR ALL CEILING AREAS GREATER THAN 1,000 SF HORIZONTAL RESTRAINTS SHALL BE EFFECTED BY FOUR #12 GA. WIRES SECURED TO THE MAIN RUNNER WITHIN 2" OF THE CROSS RUNNER INTERSECTION AND SPACED 90" FROM EACH OTHER AT AN ANGLE NOT EXCEEDING 45° FROM THE PLANE OF THE BRACING WIRES SHALL BE EXTENDED TO AND FASTENED TO THE STRUCTURAL MEMBERS SUPPORTING THE ROOF OR FLOOR ABOVE. THE STRUT SHALL BE ADEQUATE TO RESIST THE VERTICAL COMPONENT INDUCED BY THE BRACING WIRES. THESE HORIZONTAL RESTRAINT POINTS SHALL BE PLACED 12'-0" O.C. IN BOTH DIRECTIONS WITH THE FIRST POINT WITHIN 6'-0" FROM EACH WALL. ATTACHMENT OF THE RESTRAINT WIRES TO THE STRUCTURE ABOVE AND TO THE MAIN RUNNER SHALL BE ADEQUATE FOR THE LOAD IMPOSED.
2. LATERAL FORCE BRACING MEMBERS SHALL BE SPACED A MINIMUM OF 6" FROM ALL HORIZONTAL PIPING OR DUCT WORK THAT IS NOT PROVIDED WITH BRACING RESTRAINTS FOR HORIZONTAL FORCES. BRACING WIRE SHALL BE ATTACHED TO THE GRID AND TO THE STRUCTURE IN SUCH A MANNER THAT THEY CAN SUPPORT A LOAD OF NOT LESS THAN 200 LB OR TWO TIMES THE ACTUAL DESIGN LOAD, WHICHEVER IS GREATER.
3. GRID BRACES THAT HAVE BEEN DESIGNED TO LIMIT RELATIVE LATERAL DEFLECTIONS AT THE POINT OF ATTACHMENT OF THE CEILING GRID TO LESS THAN 0.25" ARE PERMITTED TO BE USED IN PLACE OF DIAGONAL SPAY WIRES.

• SERVICES WITHIN THE CEILING

1. FLEXIBLE SPRINKLER HOSE FITTINGS, CEILING-MOUNTED AIR TERMINALS OR OTHER SERVICES WEIGHING LESS THAN 20 LB SHALL BE POSITIVELY ATTACHED TO THE CEILING SUSPENSION MAIN RUNNERS OR TO CROSS RUNNERS THAT HAVE THE SAME CARRYING CAPACITY AS THE MAIN RUNNERS.
2. FLEXIBILITY SPRINKLER HOSE FITTINGS, AIR TERMINALS OR OTHER SERVICES WEIGHING MORE THAN 20 LB BUT LESS THAN 50 LB SHALL HAVE, IN ADDITION TO THE REQUIREMENTS IN 3.4.1, TWO #12 GA. HANGER WIRES CONNECTED FROM THE TERMINAL OR SERVICE TO THE CEILING SYSTEM HANGERS OR TO THE STRUCTURE ABOVE THAT ACT AS SAFETY WIRES. IT IS NOT NECESSARY FOR THESE WIRES TO BE TIED.
3. FLEXIBLE SPRINKLER HOSE FITTINGS, CEILING-MOUNTED AIR TERMINALS OR OTHER SERVICES WEIGHING MORE THAN 50 LB SHALL BE SUPPORTED DIRECTLY FROM THE STRUCTURE ABOVE BY APPROVED HANGERS.



PROPOSED FIRST FLOOR PLAN REFLECTED CEILING PLAN

SCALE: 1/4\"=1'-0"

RCP FINISHES LEGEND:

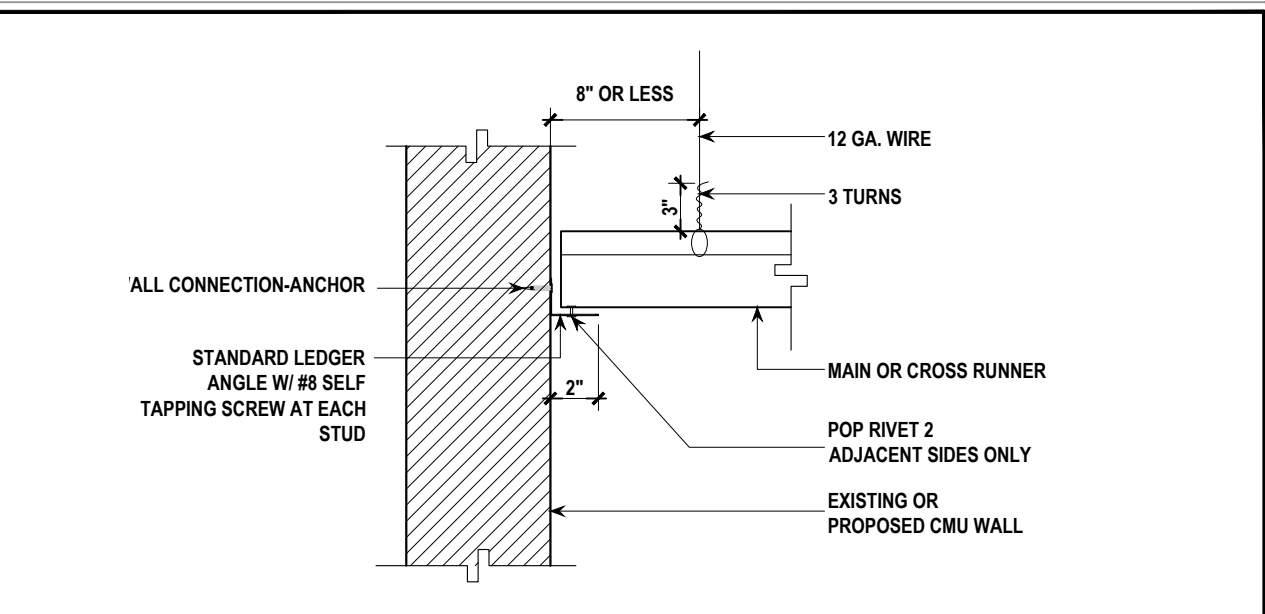
SYMBOL	DESCRIPTION
	1 2' x 4' ACOUSTIC TILE. MANUFACTURER: ARMSTRONG WORLD INDUSTRIES, INC. MODEL: HOMESTYLE / FINISH: SAHARA 271 - BEVELED REGULAR
	2 CLEAN AND PATCHED PAINTED CEILING SURFACE

NOTES:

1. CONTRACTOR TO COORDINATE LOCATION OF MECHANICAL AND ELECTRICAL FIXTURES WITHIN CEILING. FINAL LOCATION TO BE APPROVED BY ARCHITECT.
2. FOR LIGHTING FIXTURES SCHEDULE REFER TO ELECTRICAL DRAWINGS.
3. FOR HVAC, FIRE PROTECTION FIXTURES AND DETAILS SEE MECHANICAL DRAWINGS.

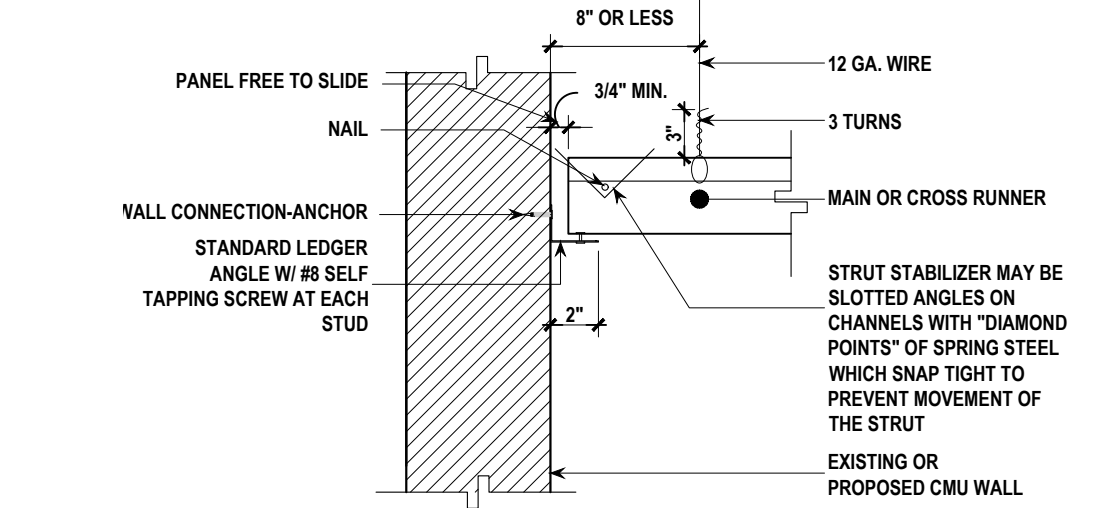
RCP SYMBOLS LEGEND:

SYMBOL	DESCRIPTION
	L1 2' x 4' RECESSED MOUNT LED LINEAR TROFFER LIGHT FIXTURE
	L2 LINEAR SURFACE LED LIGHT FIXTURE
	L3 SURFACE LED LIGHT FIXTURE
	EXIT SIGN - ► DENOTES TRAVEL PATH
	AIR HANDLING UNIT



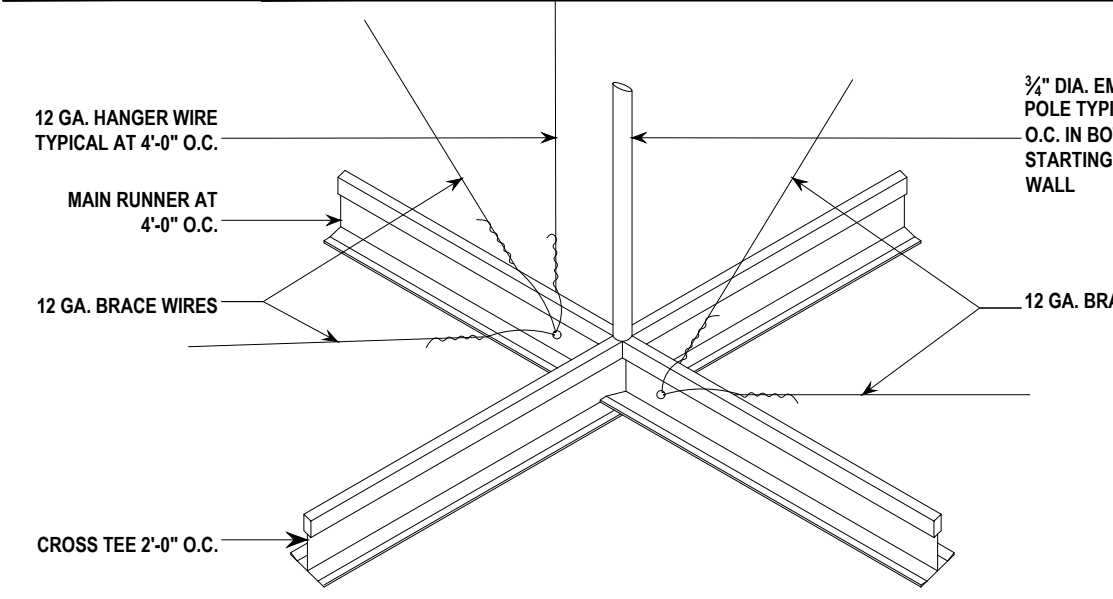
"SUSPENDED CEILING FIXED" CONNECTION DETAIL

SCALE: 1-1/2\"=1'-0"



"FREE" CONNECTION-WITH STRUT STABILIZER DET.

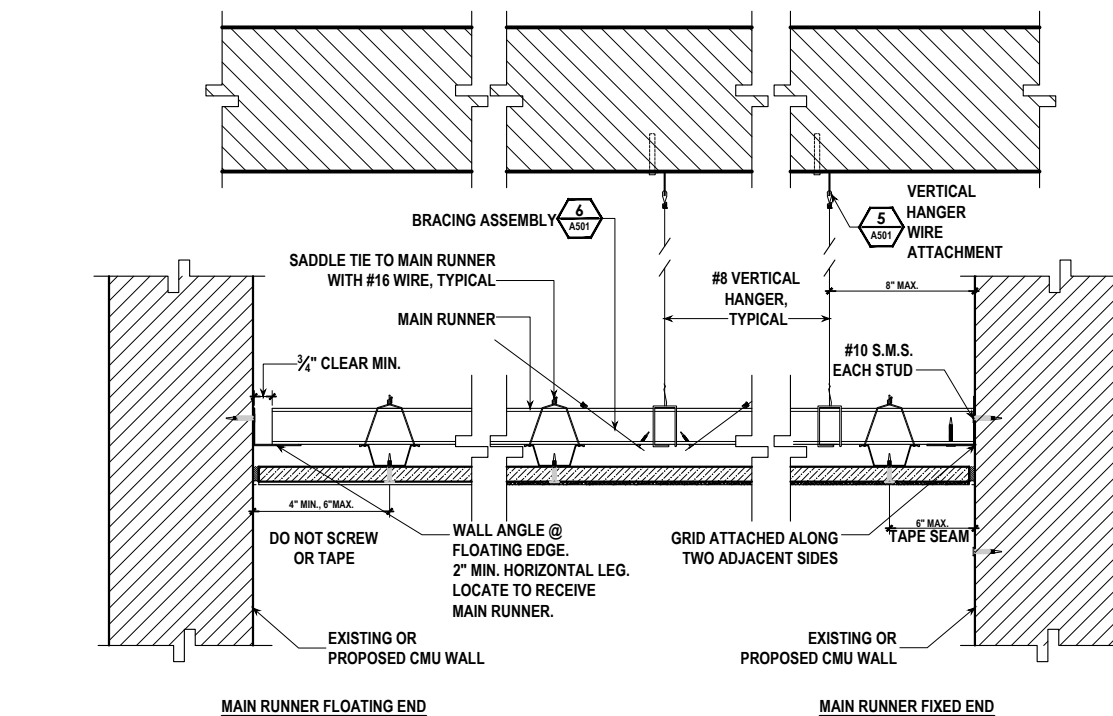
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NOTE: ATTACH BRACING WIRES AT A MINIMUM OF 30° AND A MAXIMUM OF 45 DEGREES TO THE PLANE OF THE CEILING AND PARALLEL TO THE COMPONENTS INTER-SPACING AT THE BRACE LOCATION. BRACE WIRES SHALL BE TAUT AND TIED BOTH ENDS IN A MINIMUM 3 TIGHT WRAPS.

LATERAL BRACING ASSEMBLY DETAIL

N.T.S.



"SUSPENDED CEILING FIXED" CONNECTION DETAIL

SCALE: 3/4\"=1'-0"

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Revisions

Number Date Description

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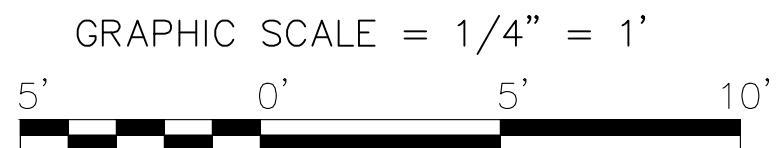
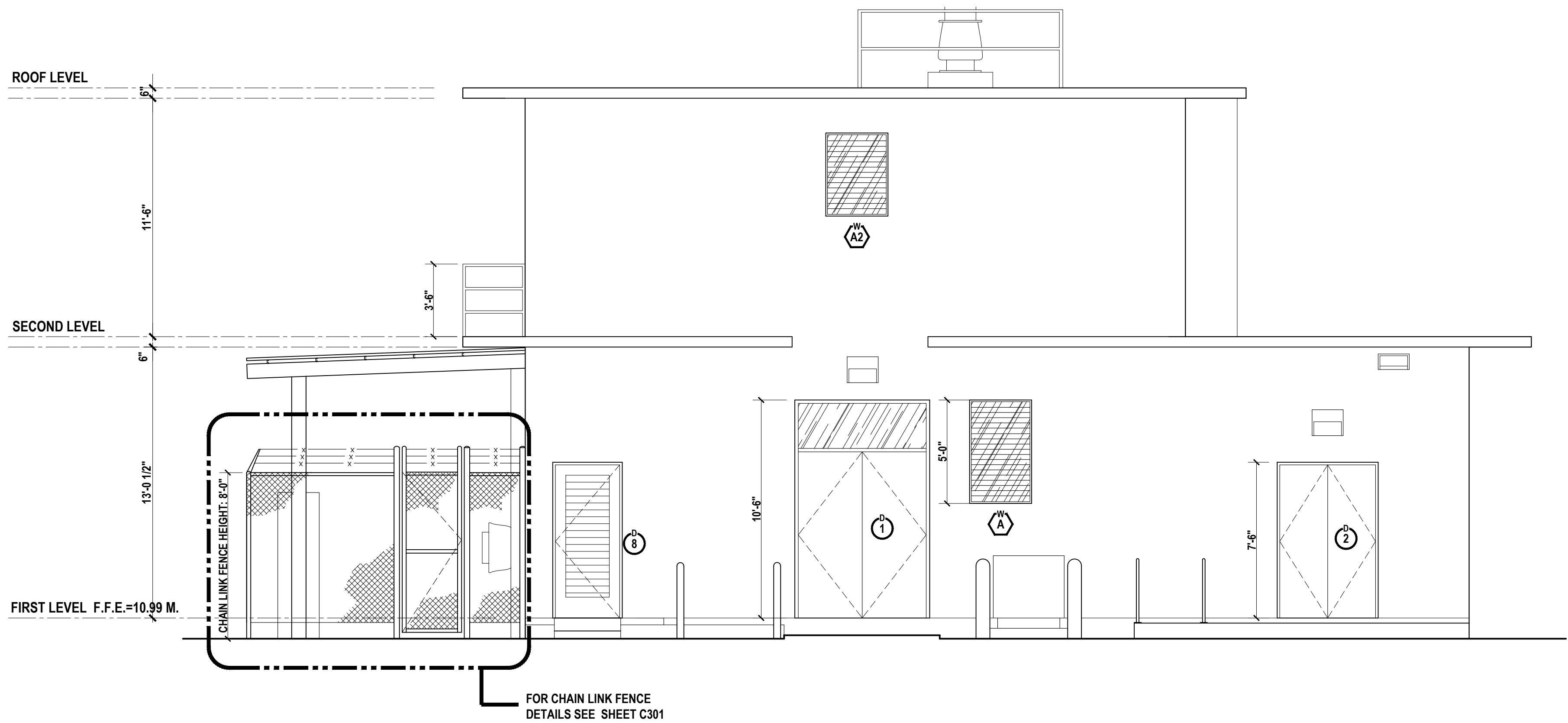
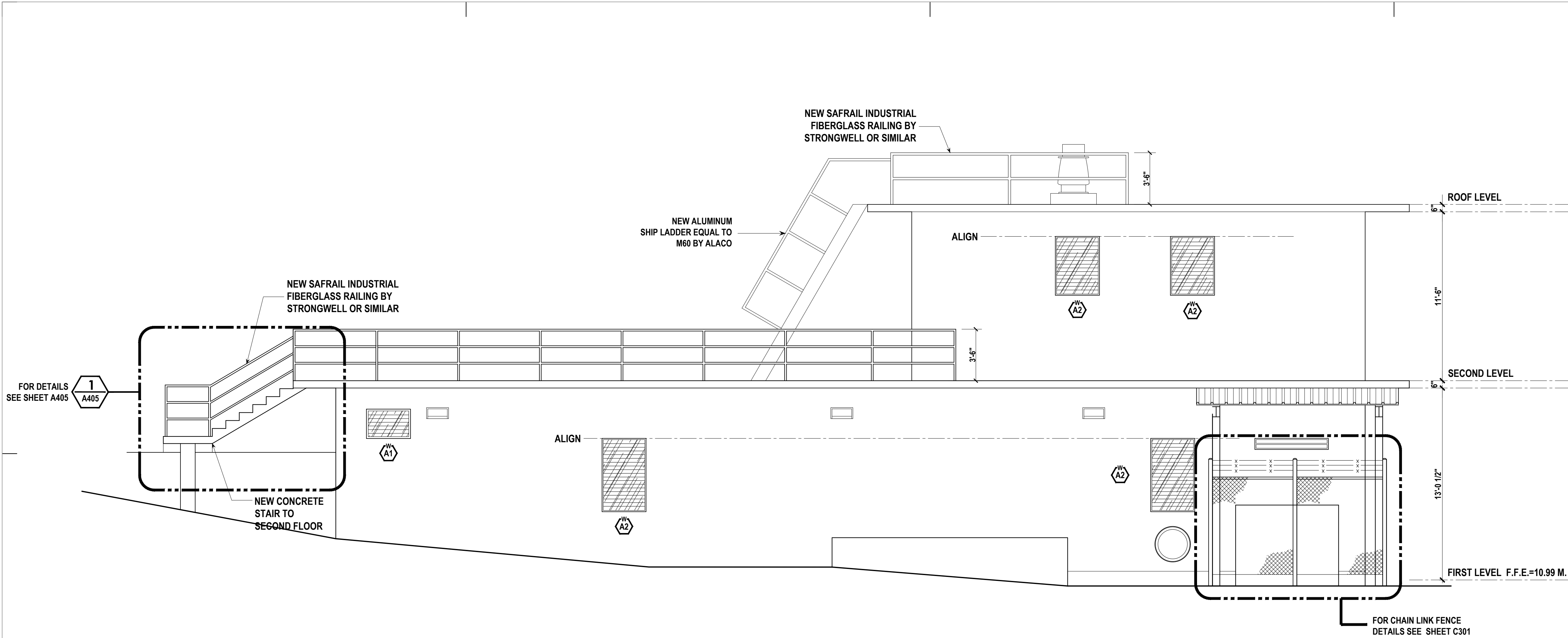
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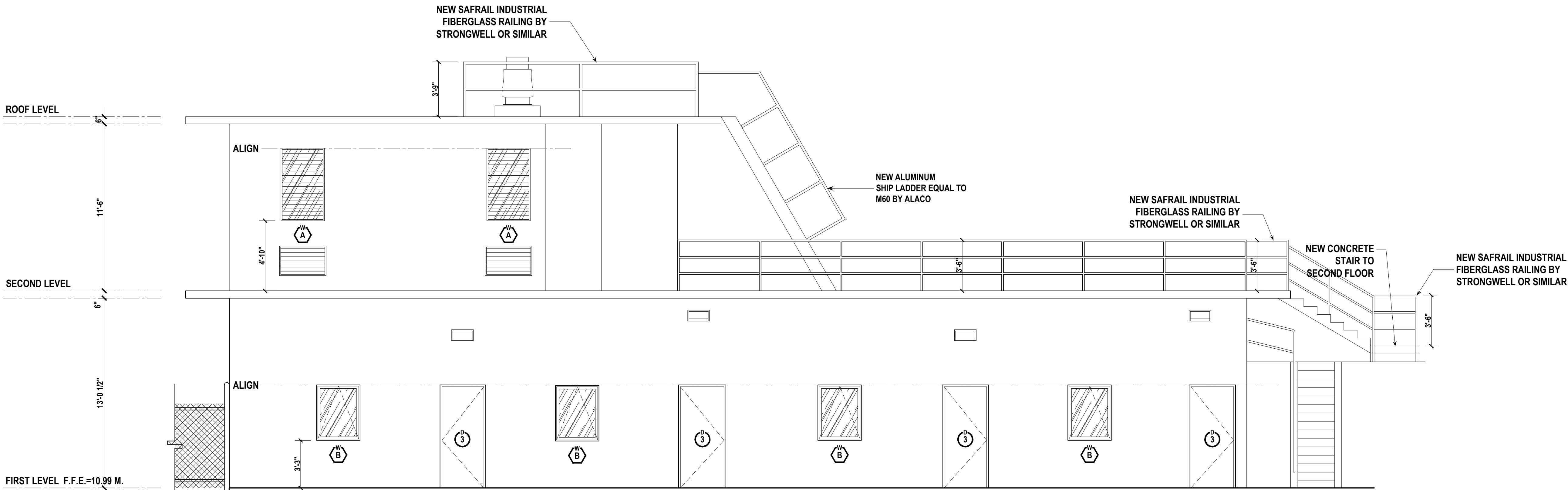
Revisions		SHEET INFO.	
Number	Date	Description	
1	2021/07/28	Project No.: 19-1837-0	Set Date: 2021/07/28
		Drawn by:	Dwg. Date:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

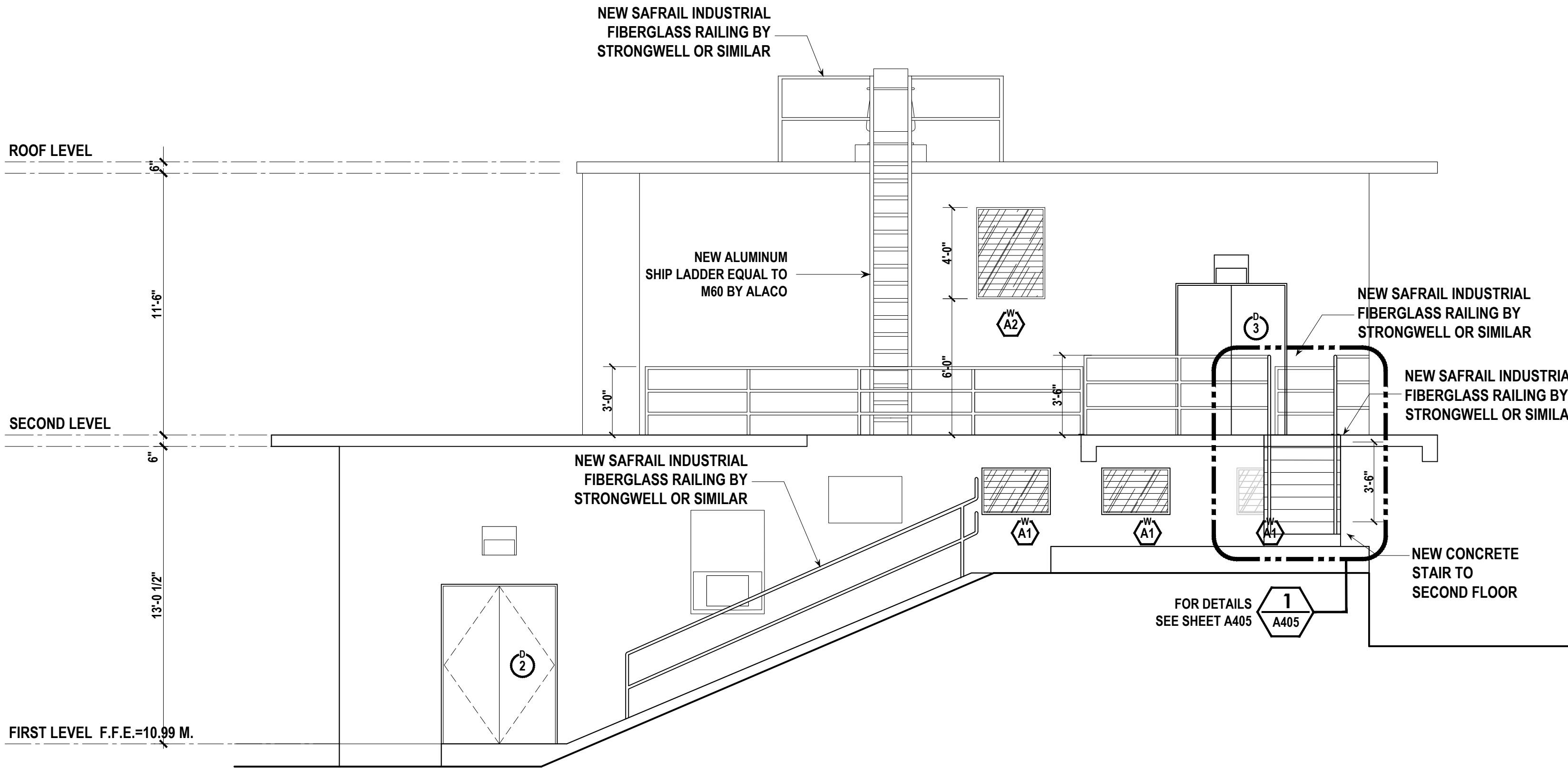


WATER TREATMENT PLANT
Drawing Title:

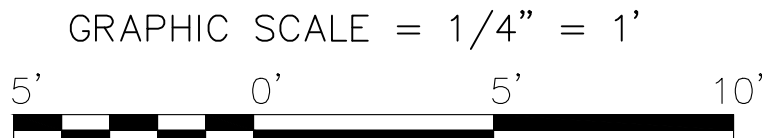
PROPOSED ELEVATIONS



WEST ELEVATION
SCALE: 1/4"=1'-0"



SOUTH ELEVATION
SCALE: 1/4"=1'-0"



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JULY 30, 2021
REVISED BID SET

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Number	Date	Description	
		Project No.: 19-1637-0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

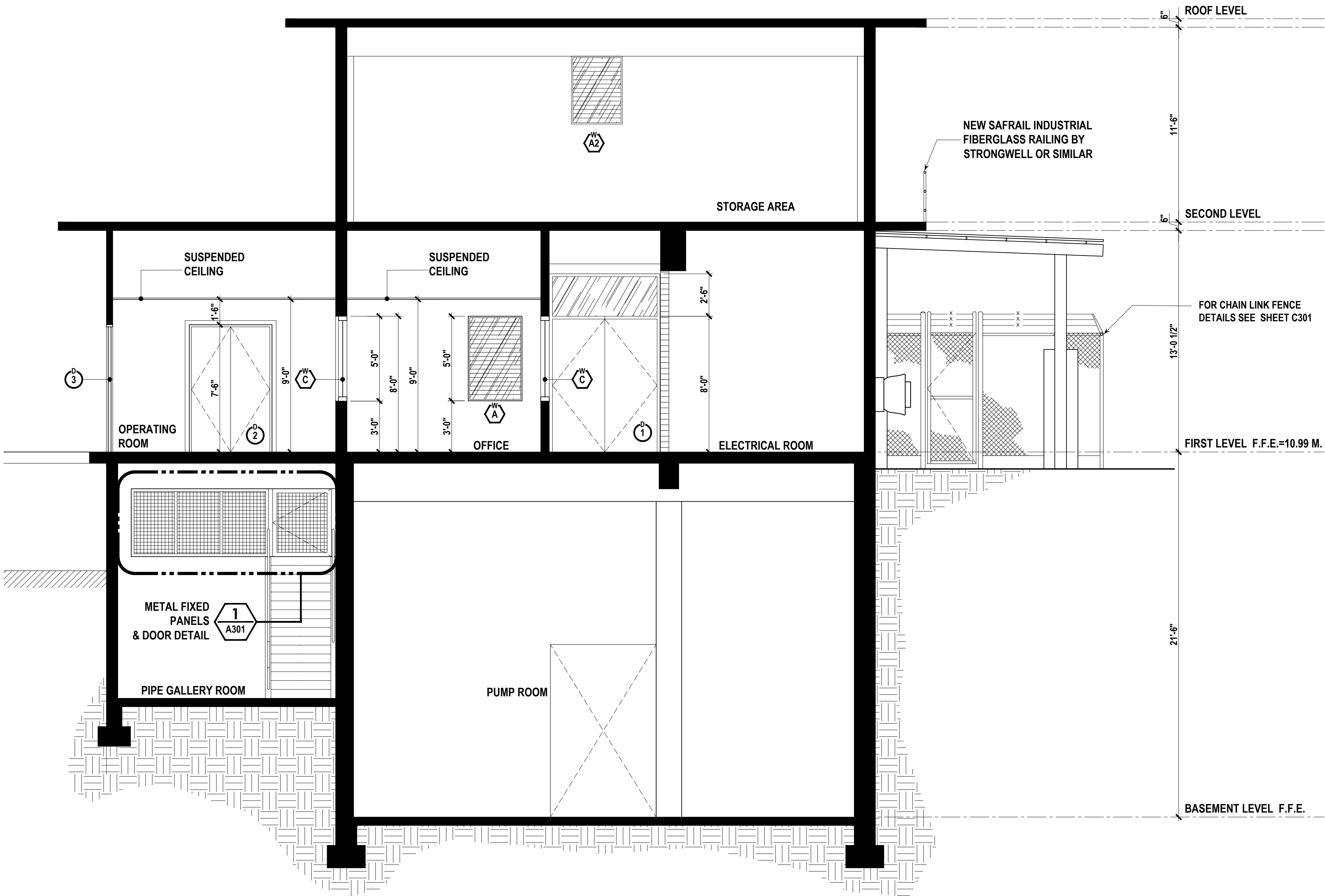
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

GOVERNMENT OF PUERTO RICO
LOCAL REDEVELOPMENT AUTHORITY
FOR ROOSEVELT ROADS

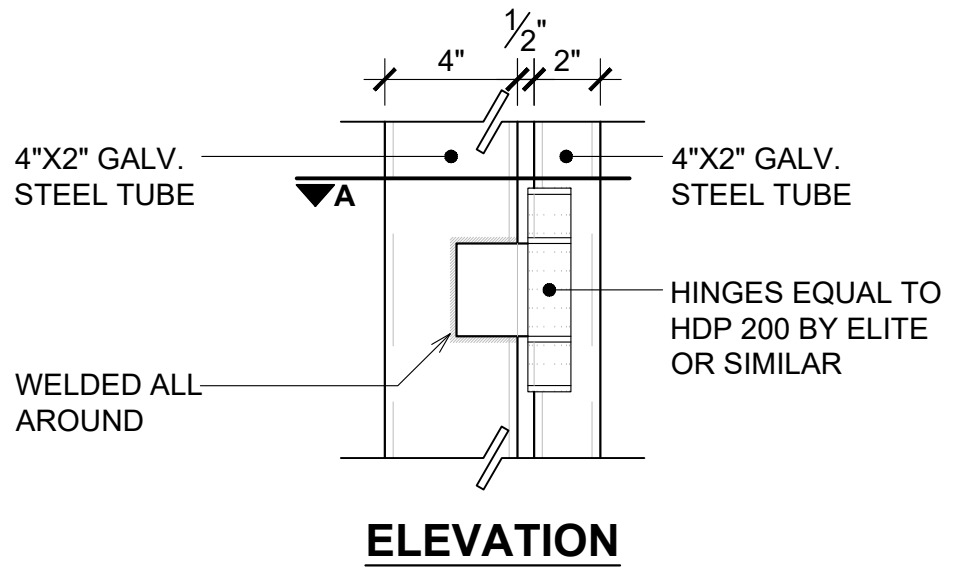
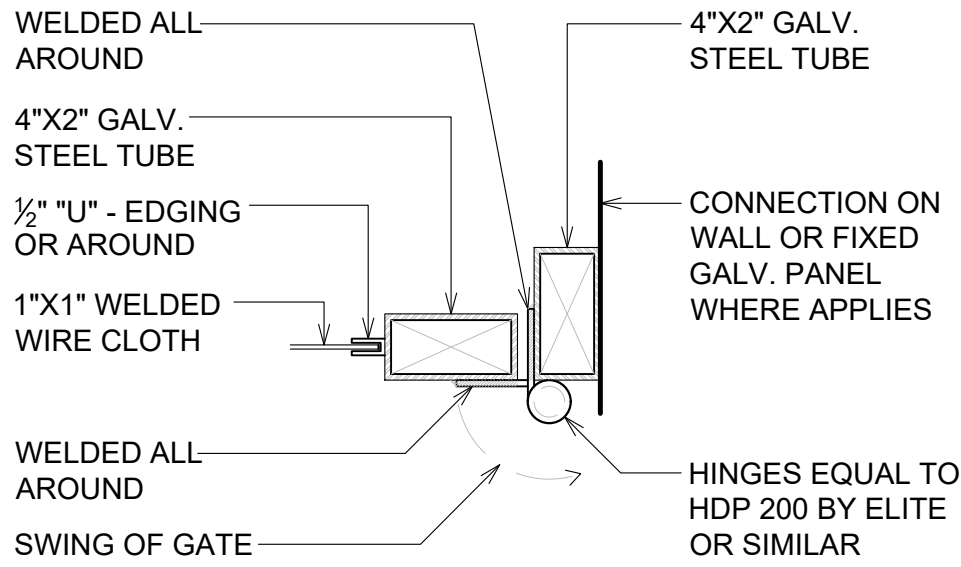
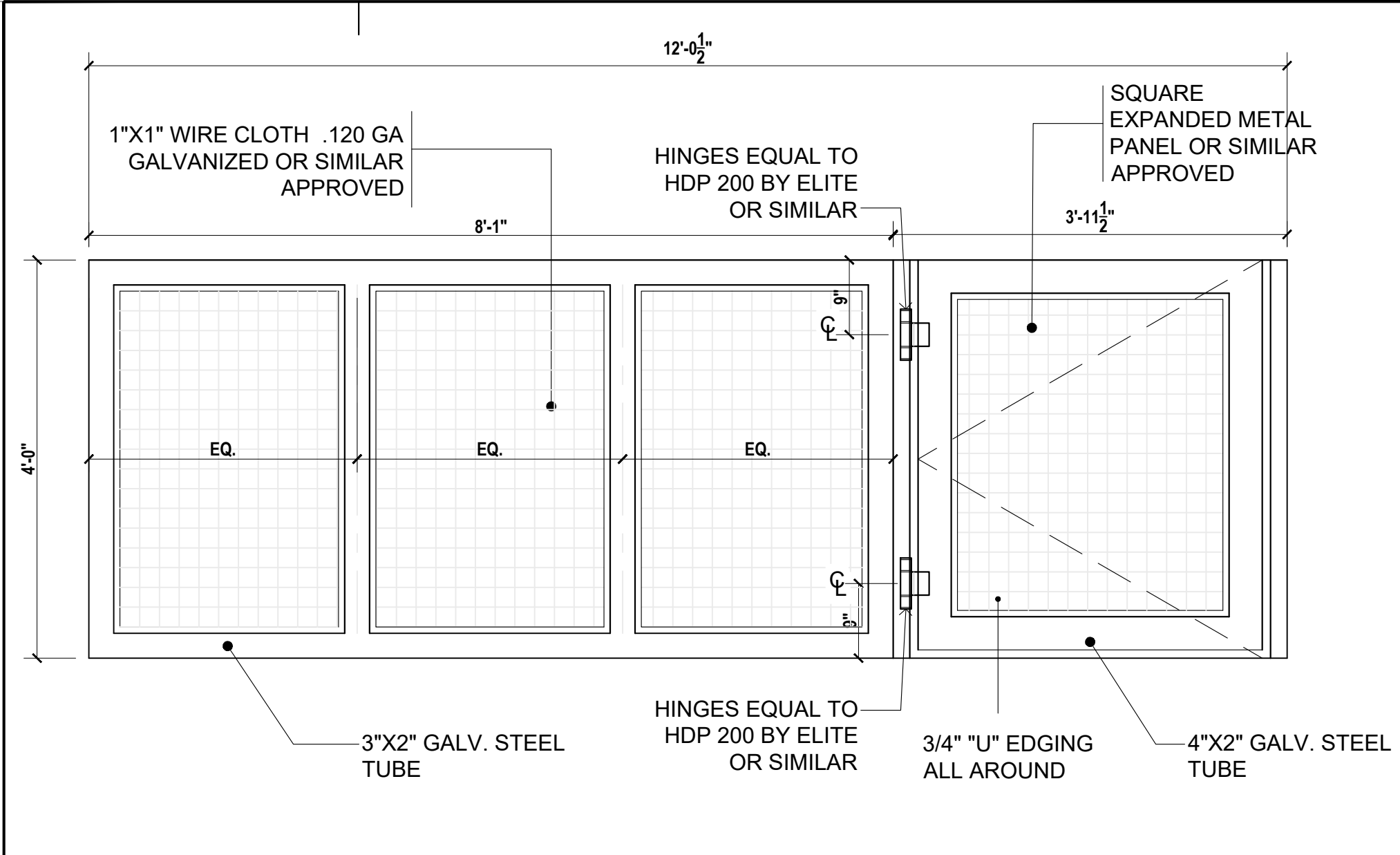
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER TREATMENT PLANT

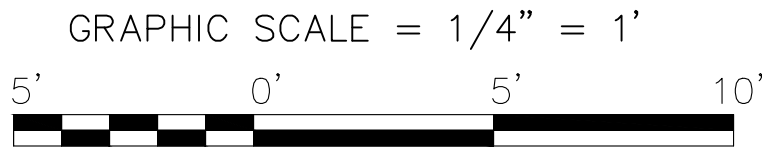
PROPOSED ELEVATIONS



PROPOSED SECTION A
SCALE: 1/4"=1'-0"



OPERABLE EXPANDED METAL FIXED PANELS & DOOR DETAIL
NTS



Integra Design Group
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		Dwg. Date:	

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



Project Title:

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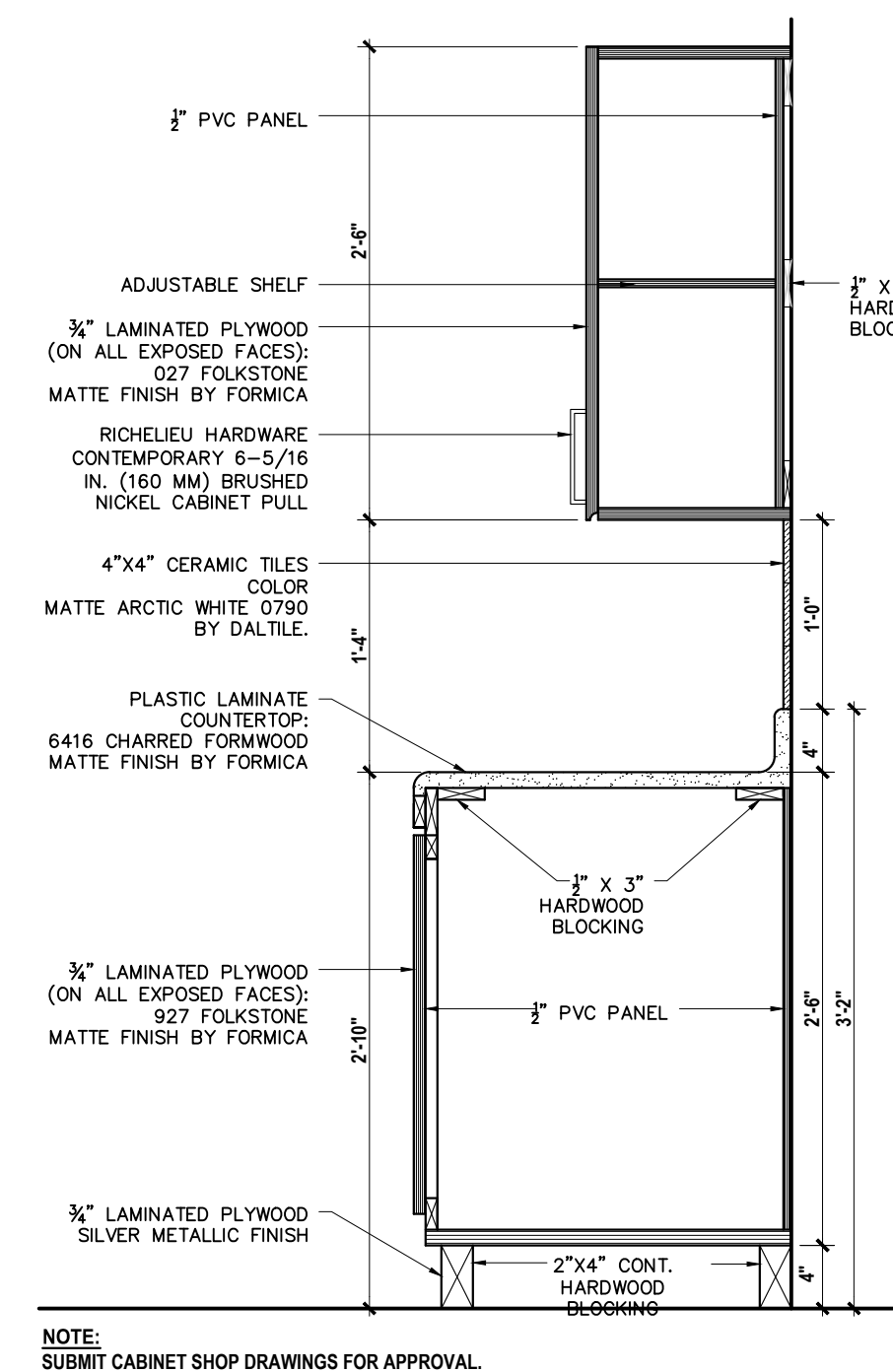
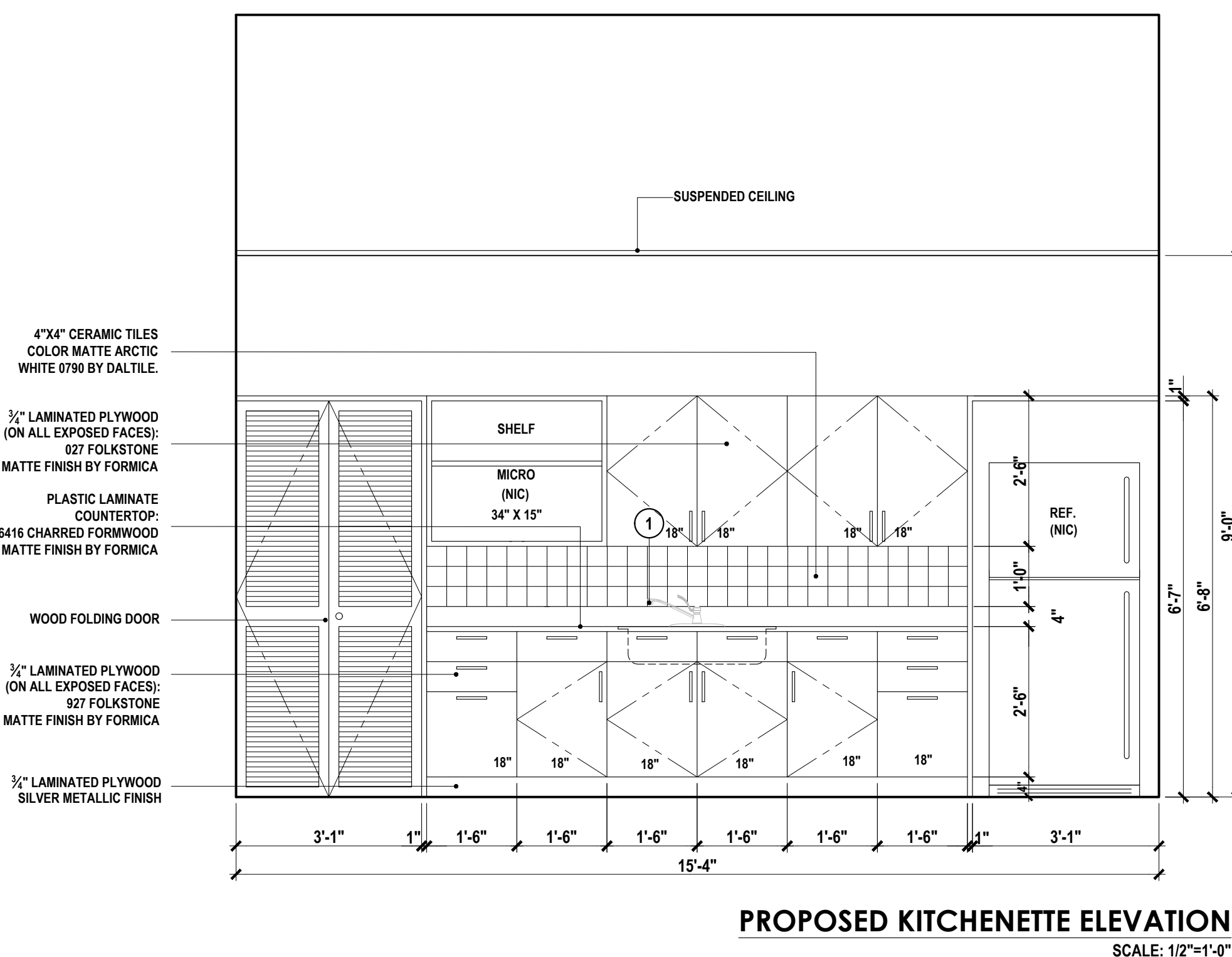
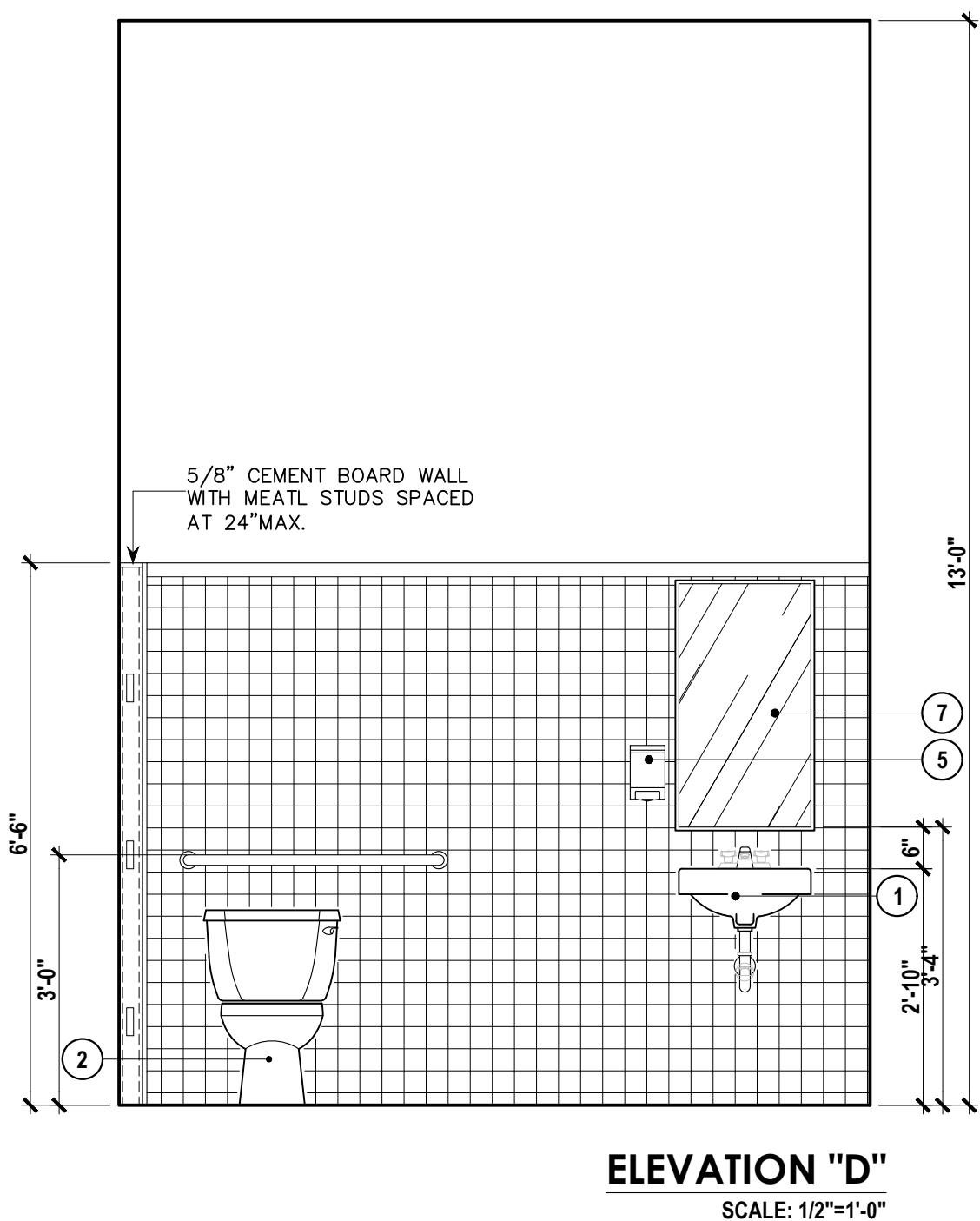
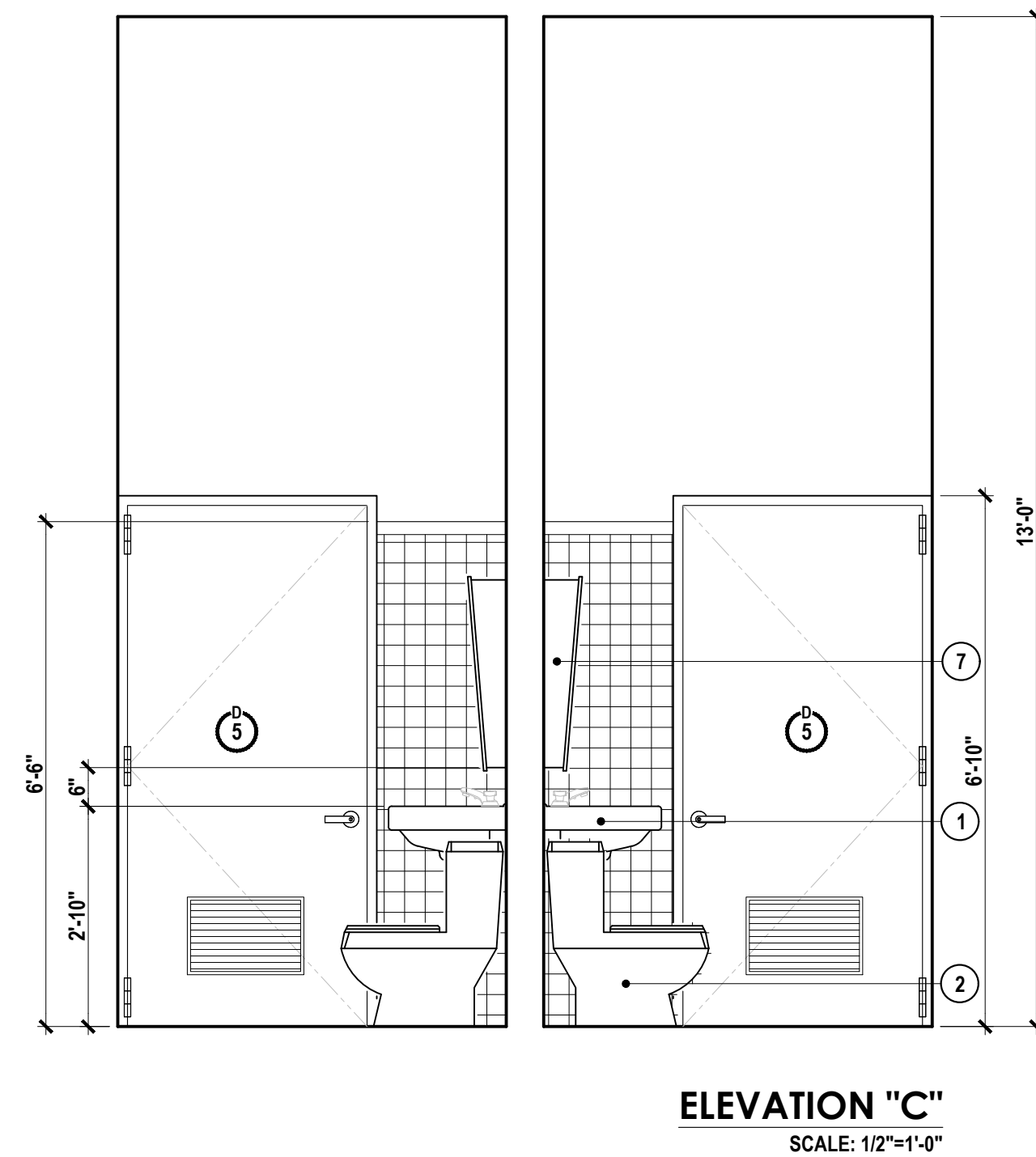
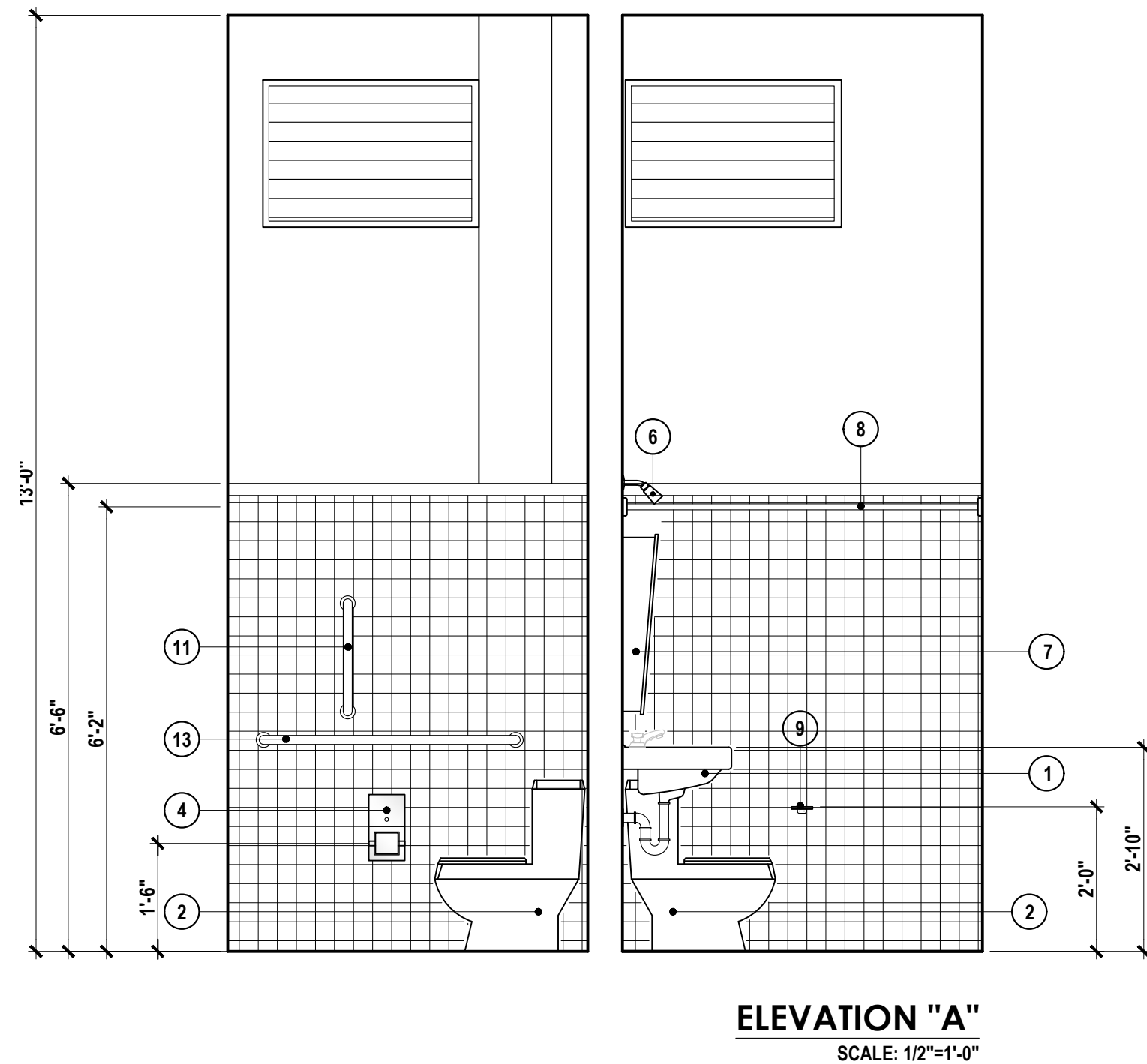
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Drawing Title:
PROPOSED SECTION A



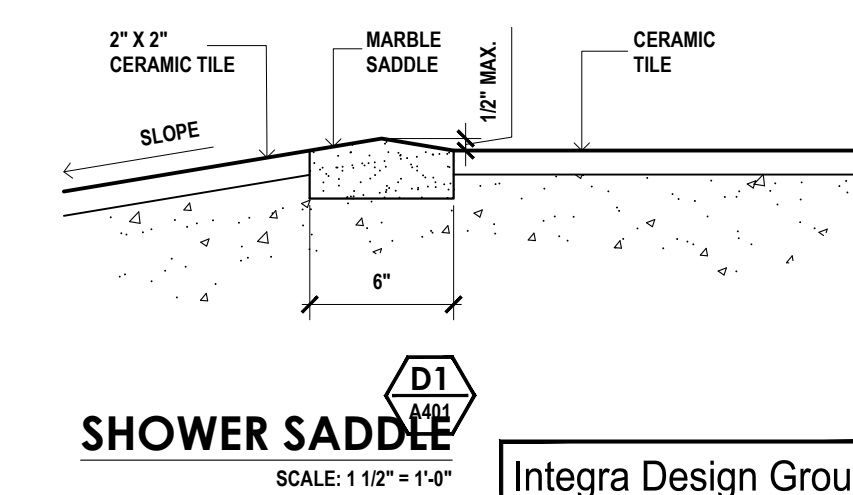
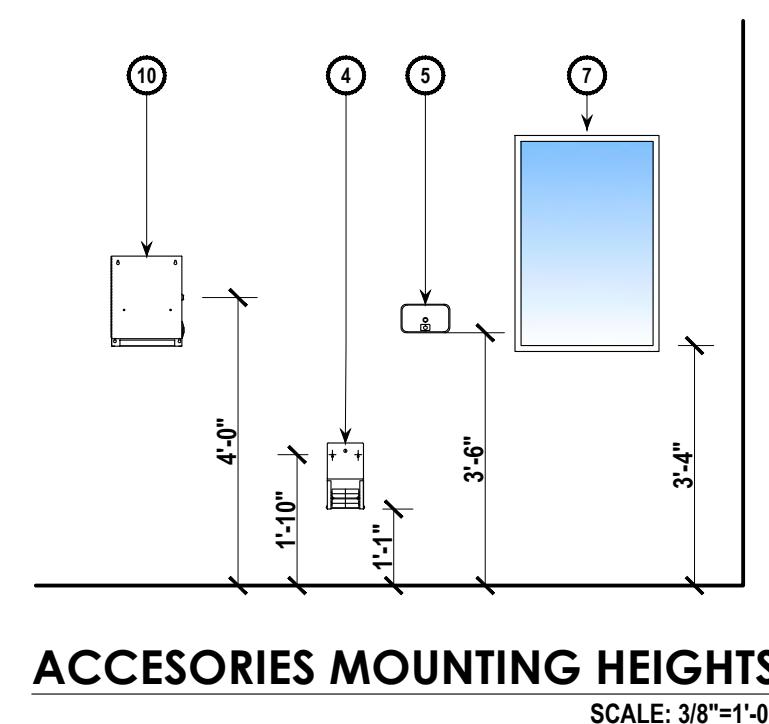
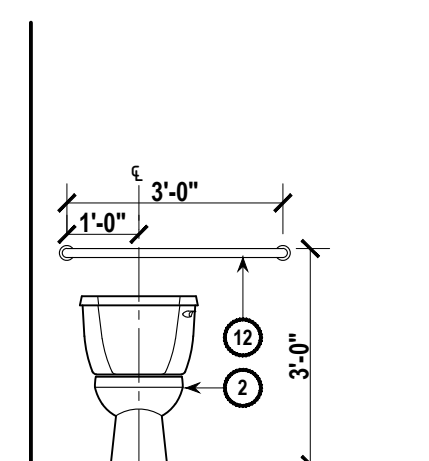
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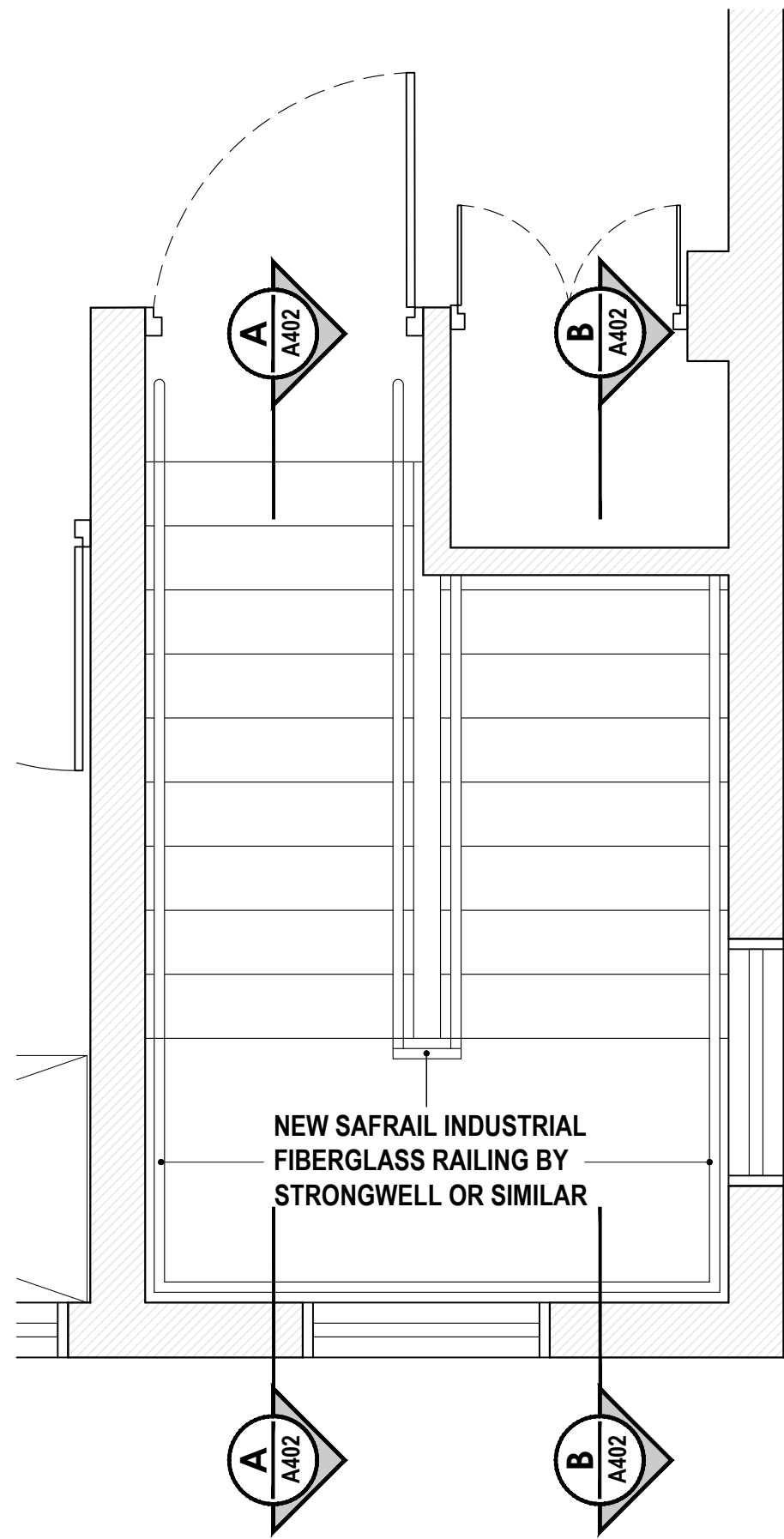
PROPOSED SECTION B



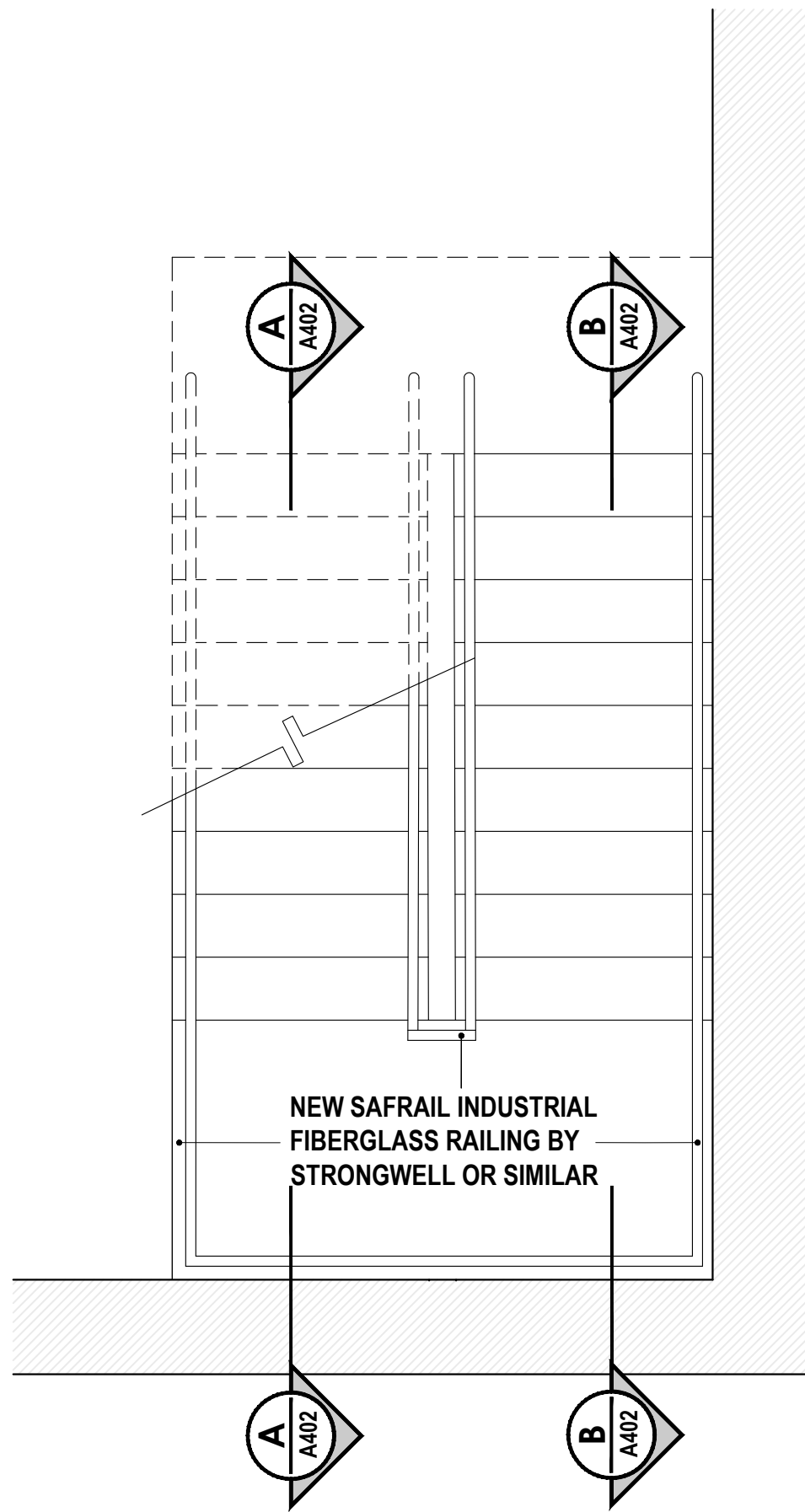
BATHROOM ACCESSORIES SCHEDULE				
ITEM	NAME	MODEL	MFR.	DESCRIPTION
1	LAVATORY	LUCERNE 356.0421	AMERICAN STANDARD	6531.17
2	TOILET	CADET PRO	AMERICAN STANDARD	215FA.004 - TANK 4188B.005
3	SHOWER	-	-	
4	TISSUE HOLDER	B-2888	BOBRICK	STAINLESS STEEL SATIN FINISH, 40 OZ. CAPACITY
5	WALL MOUNTED LIQUID SOAP DISPENSER	B-4112	BOBRICK	STAINLESS STEEL SATIN FINISH, 40 OZ. CAPACITY
6	SHOWER SET	COLONY SOFT BATH	AMERICAN STANDARD	T675.501 - FAUCET VALVE
7	24" X 36" MIRROR	B-165.2436	BOBRICK	24"W X 36"H CHANNEL FRAME MIRROR, STAINLESS STEEL WITH BRIGHT POLISHED FINISH
8	CURTAIN ROD	B-6107	BOBRICK	VERIFY CURTAIN ROD LENGTH ON THE FIELD
9	SOAP HOLDER	B-6807	BOBRICK	
10	PAPER TOWEL DISPENSER	B-2860	BOBRICK	SURFACE MOUNTED, STAINLESS STEEL SATIN FINISH
11	18" GRAB BAR	B-6806X18	BOBRICK	1 1/2" DIA. STAINLESS STEEL GRAB BAR
12	36" GRAB BAR	B-6806X36	BOBRICK	1 1/2" DIA. STAINLESS STEEL GRAB BAR
13	42" GRAB BAR	B-6806X42	BOBRICK	1 1/2" DIA. STAINLESS STEEL GRAB BAR

Diagram of a kitchen layout showing a sink, stove, and refrigerator. Dimensions are indicated: 3'-4" for the sink width, 3'-0" for the sink depth, 3'-4" for the stove width, and 1'-0" for the stove depth. Numbered callouts (11, 13, 2) are present near the sink, stove, and refrigerator respectively.

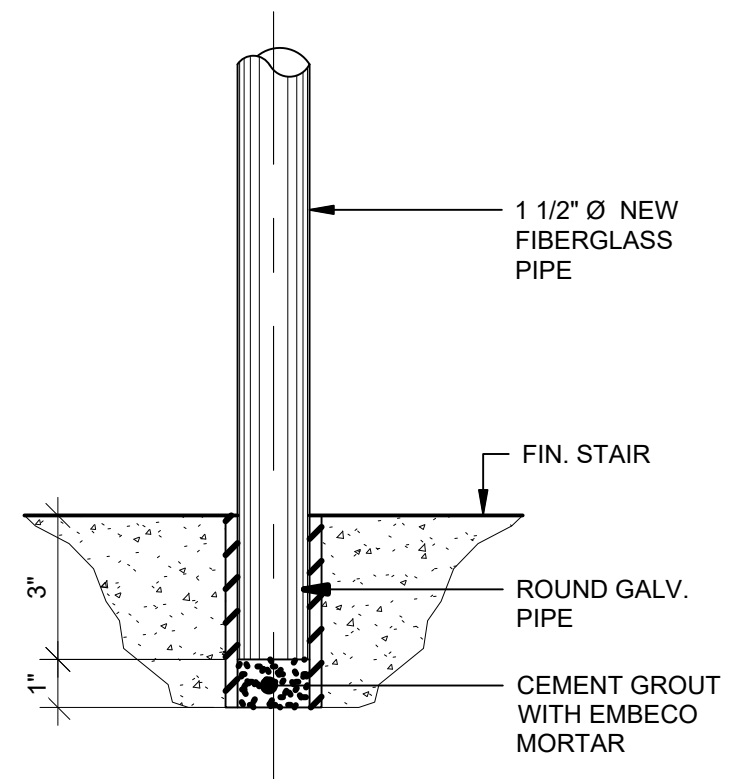
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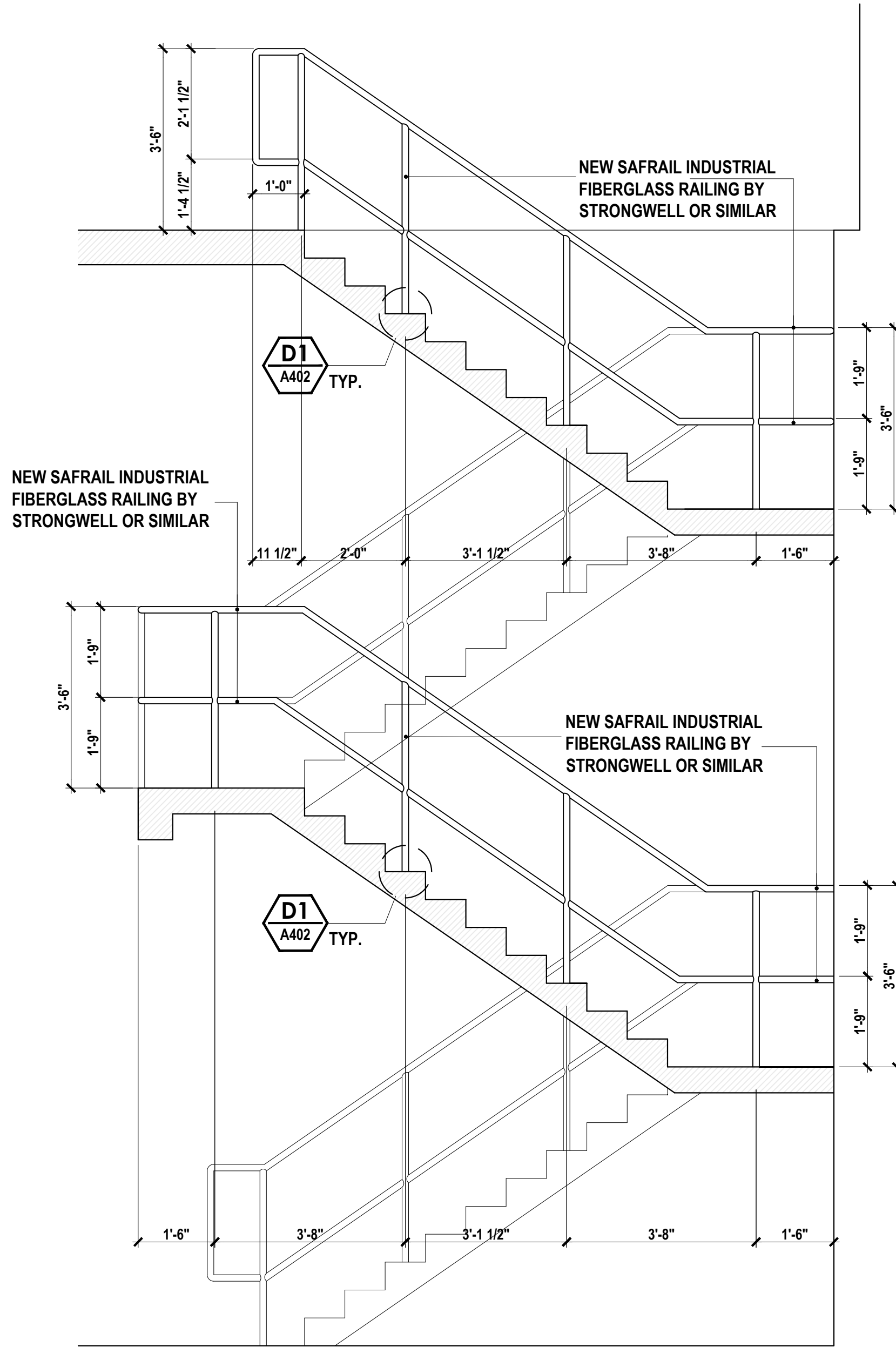
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A402
EXISTING GROUND STAIR PLAN
SCALE: 1/2"=1'-0"



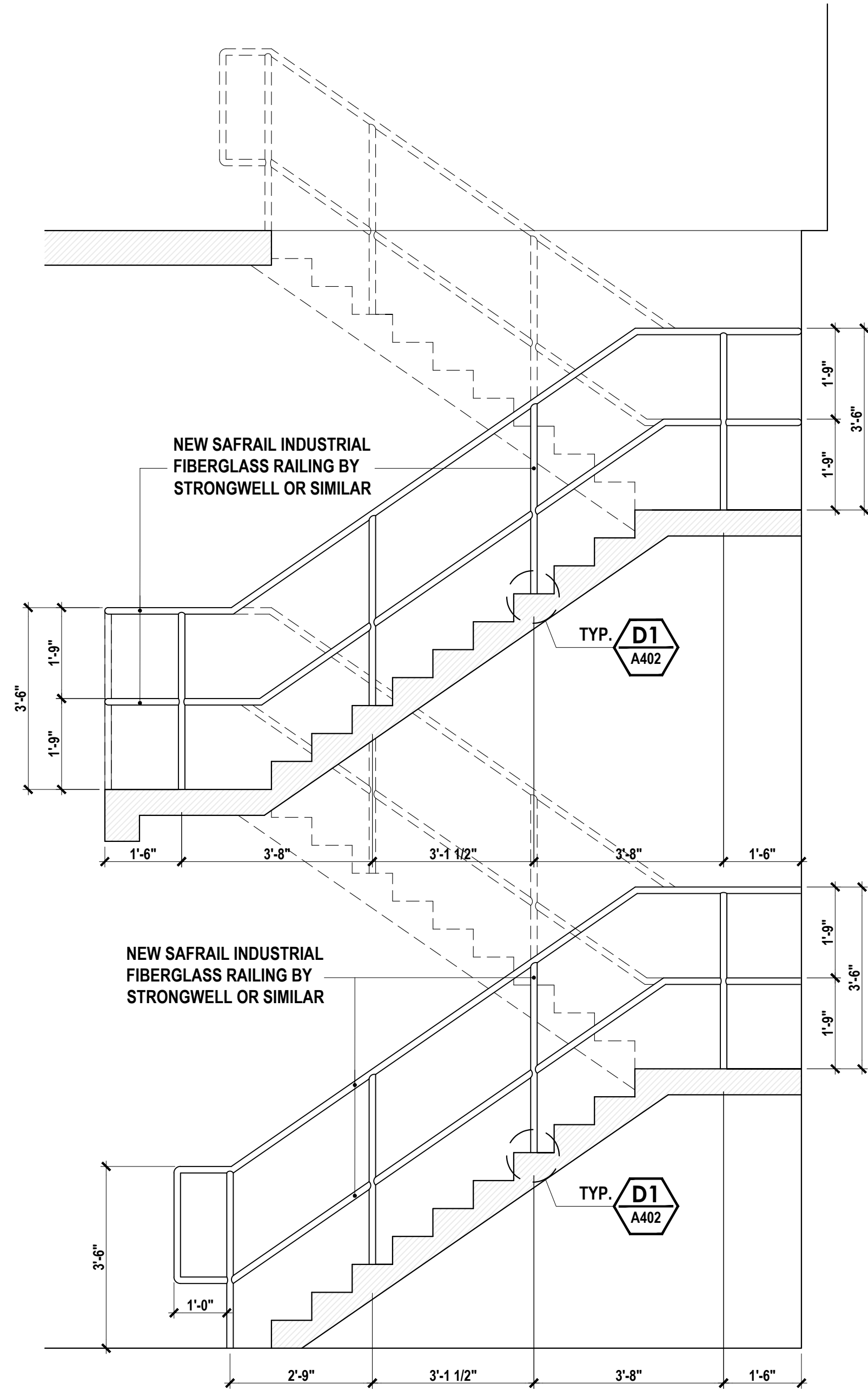
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EXISTING BASEMENT STAIR PLAN
SCALE: 1/2"=1'-0"



D1
A402
HANDRAIL DETAIL
SCALE: 3"=1'-0"



EXISTING STAIR SECTION A
SCALE: 1/2"=1'-0"



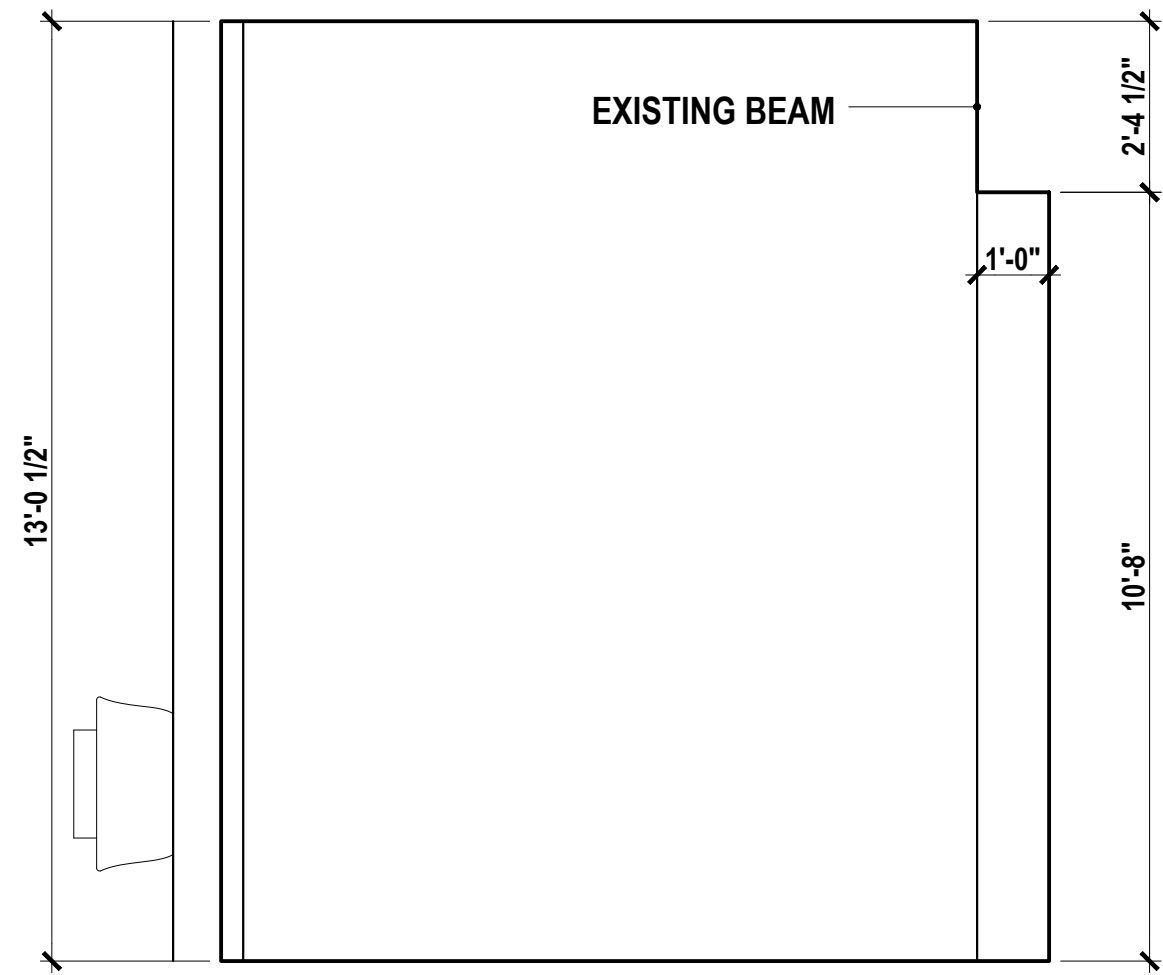
EXISTING STAIR SECTION B
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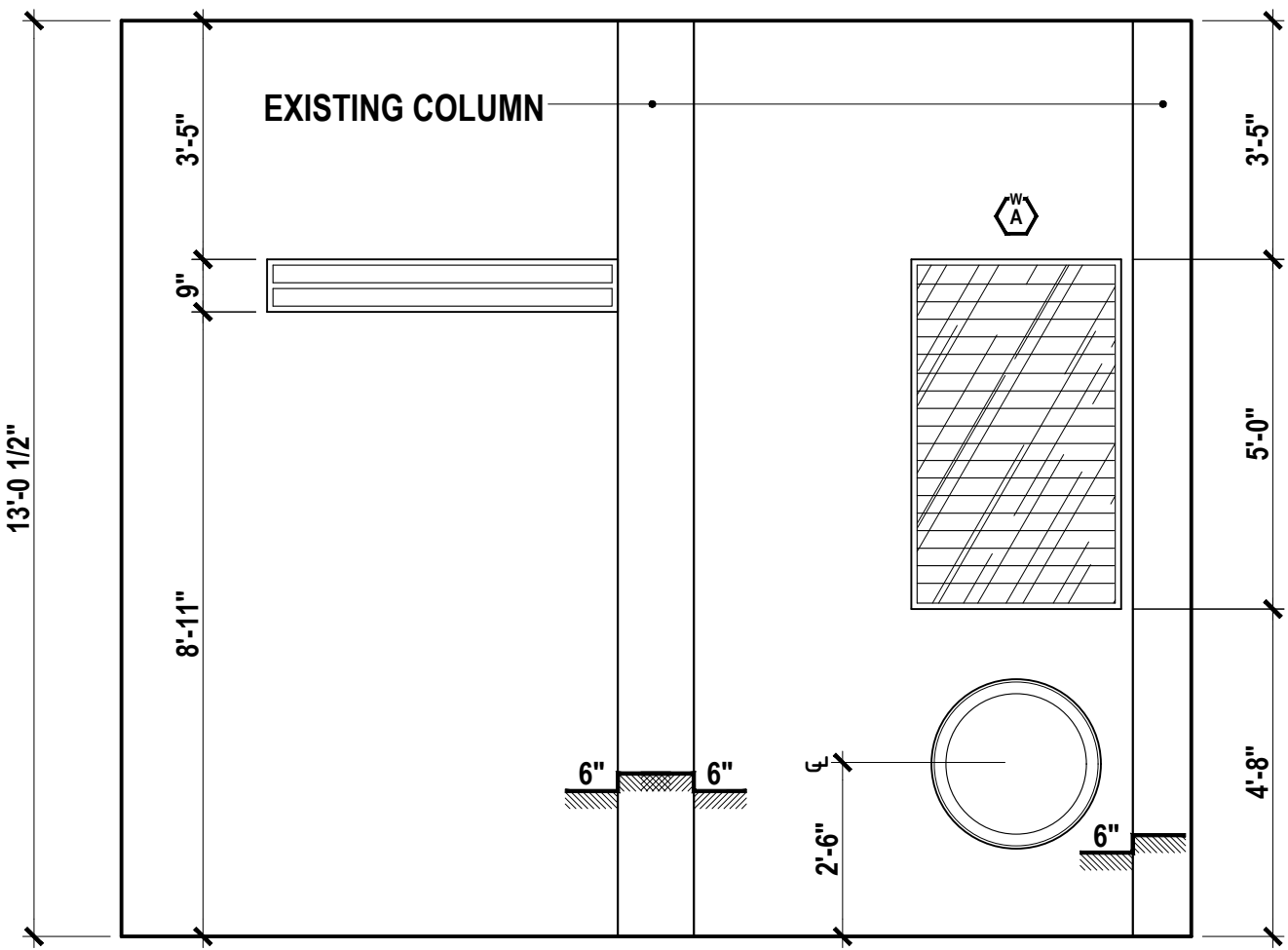
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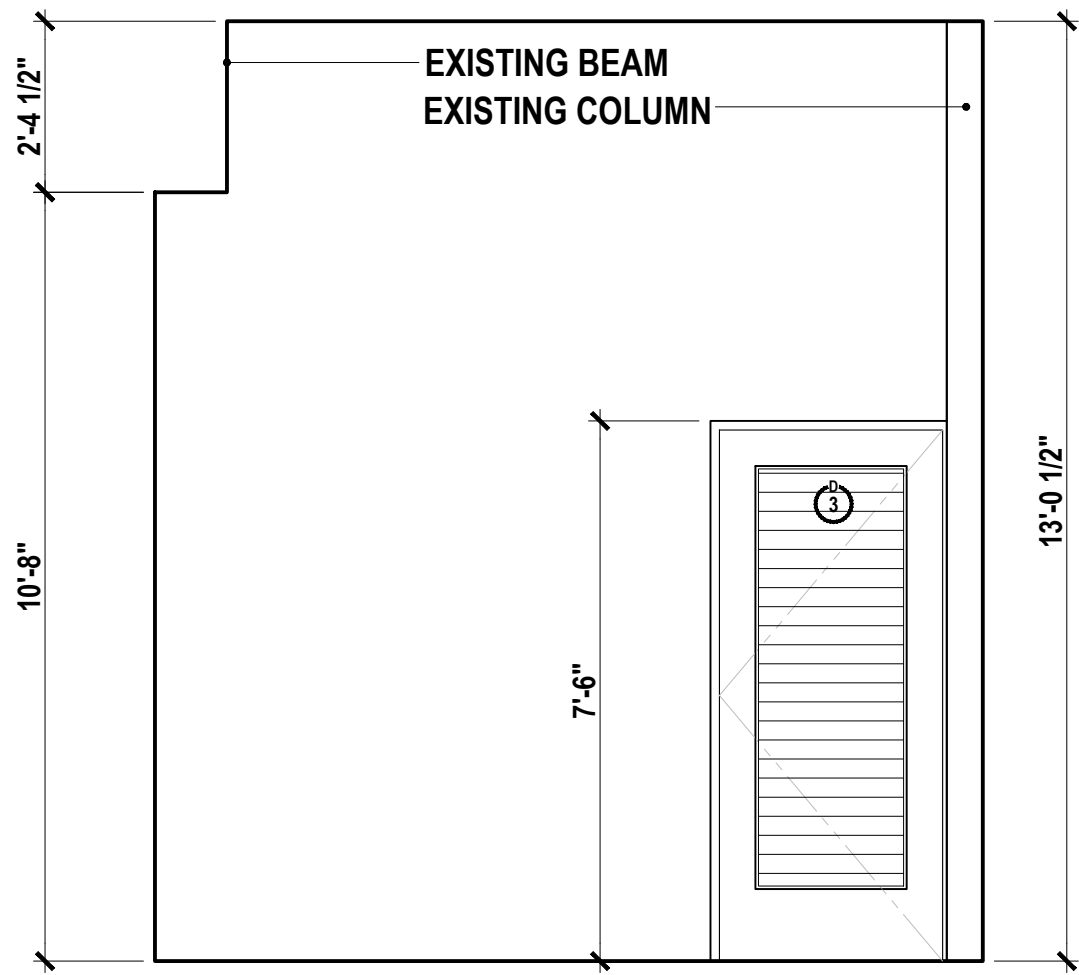




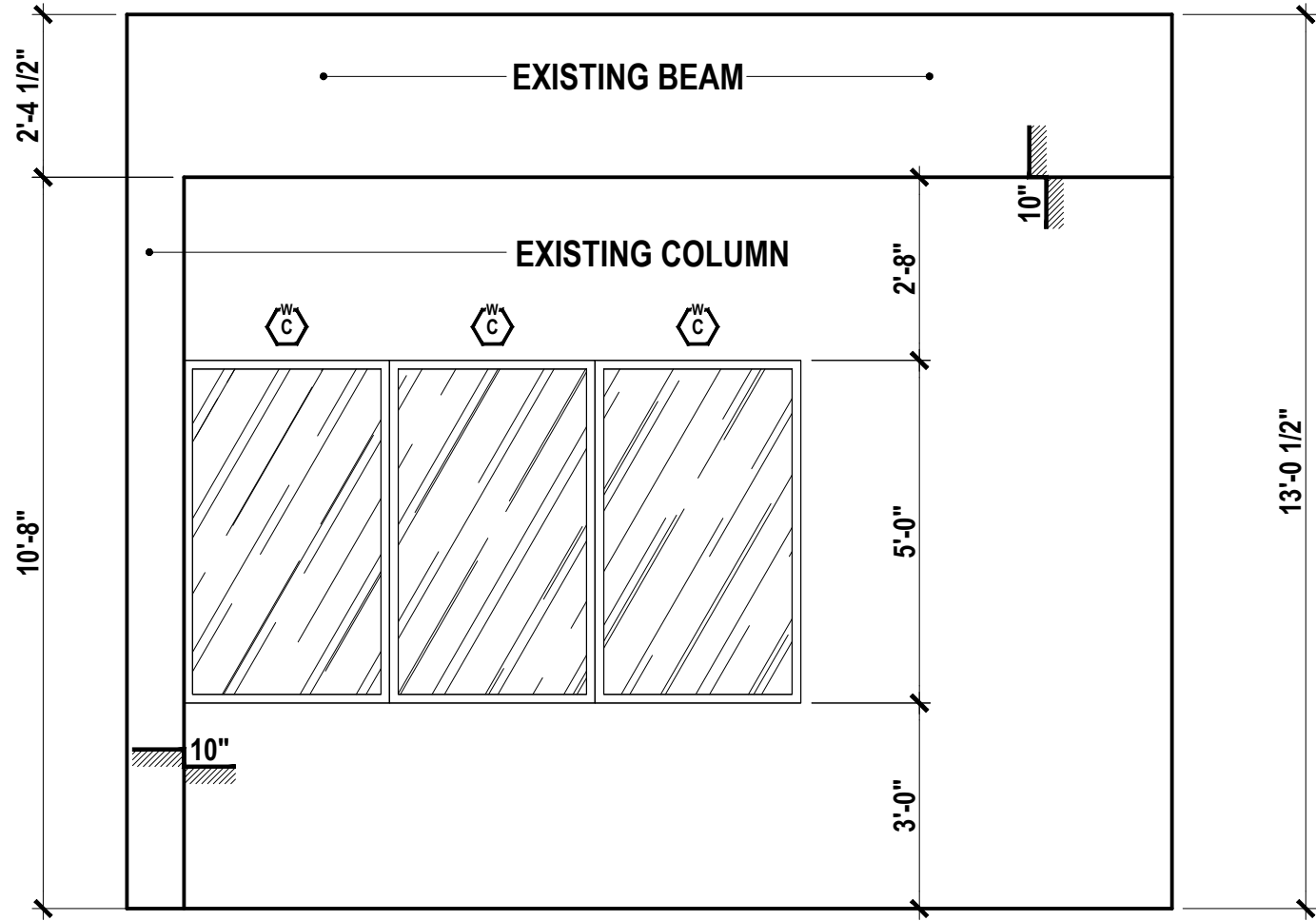
INTERIOR ELEVATION "A"
SCALE: 3/8"=1'-0"



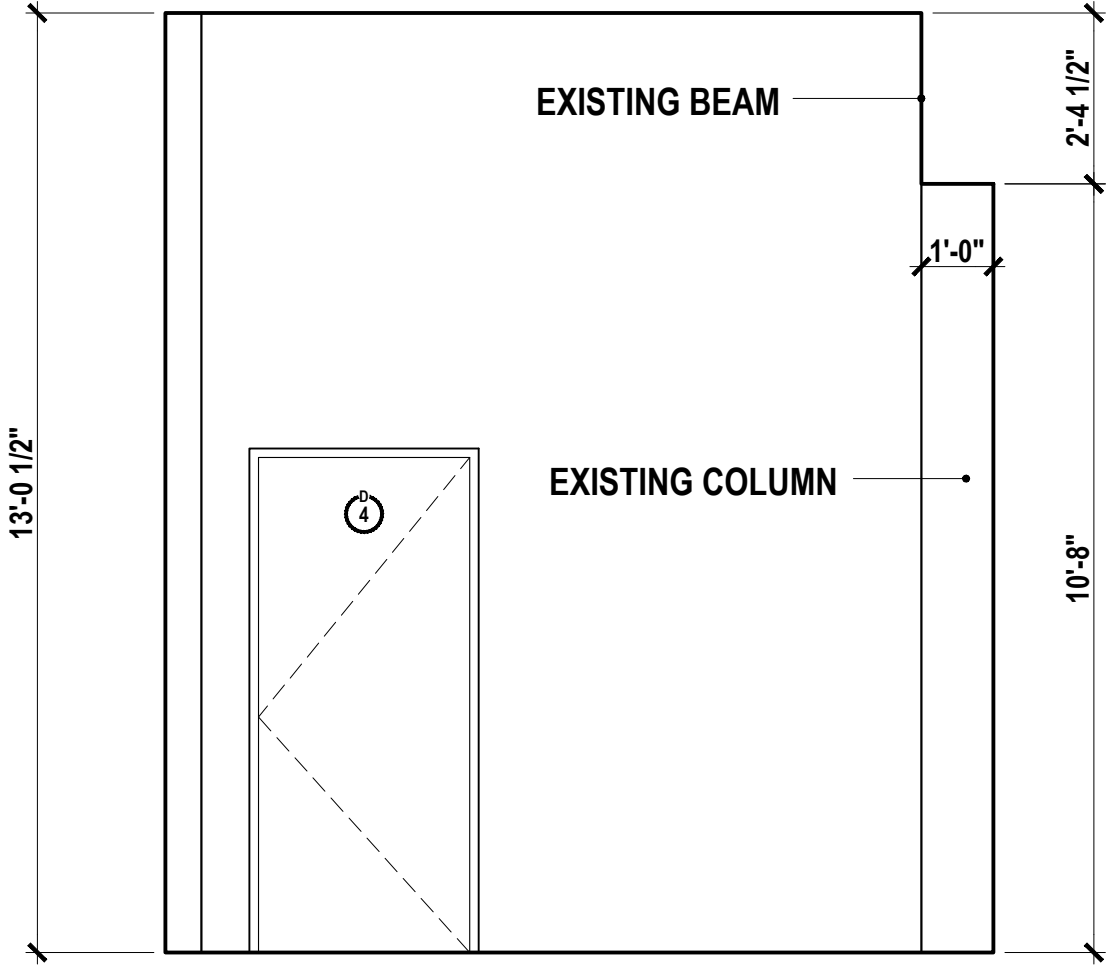
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SCALE: 3/8"=1'-0"



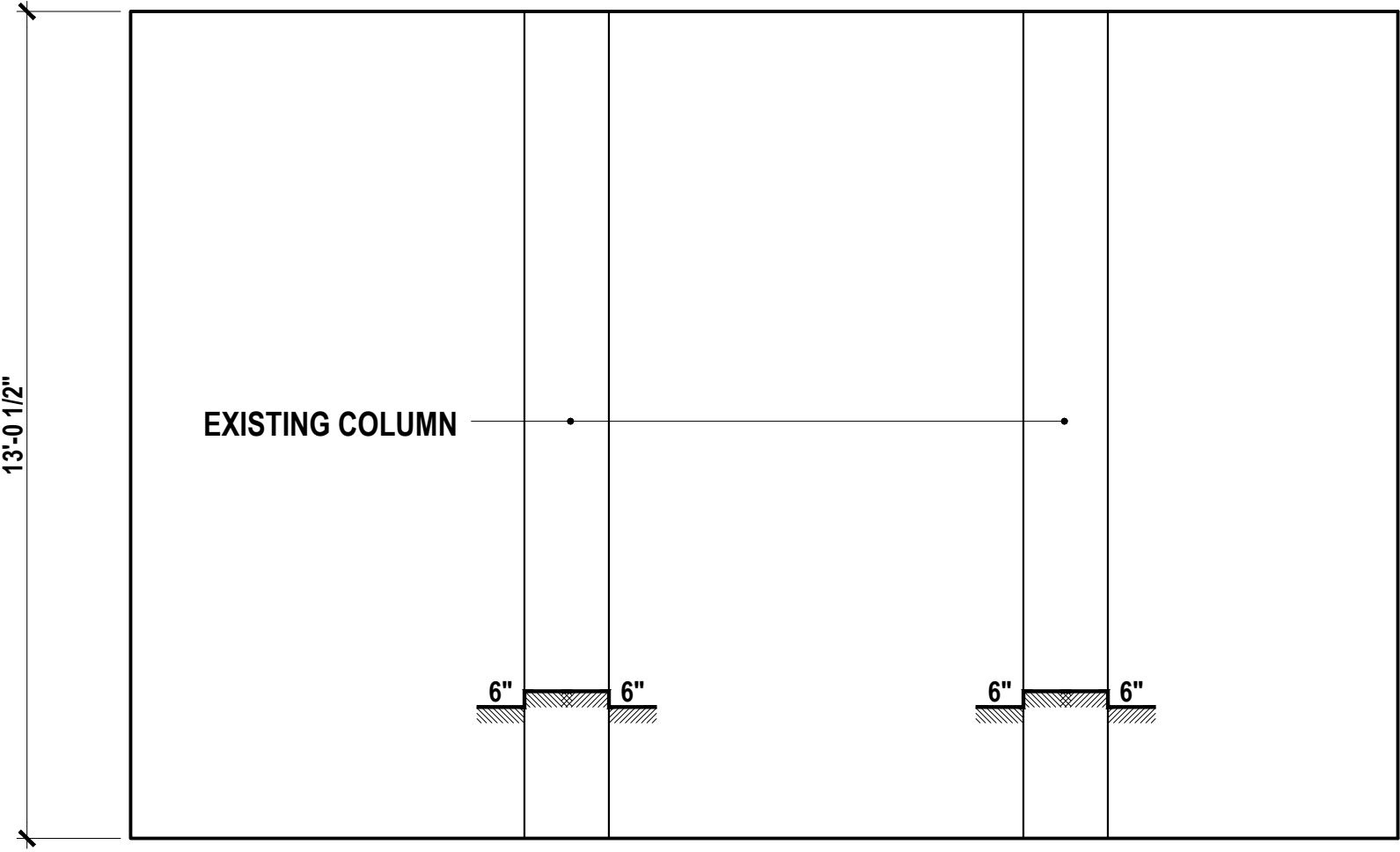
INTERIOR ELEVATION "C"
SCALE: 3/8"=1'-0"



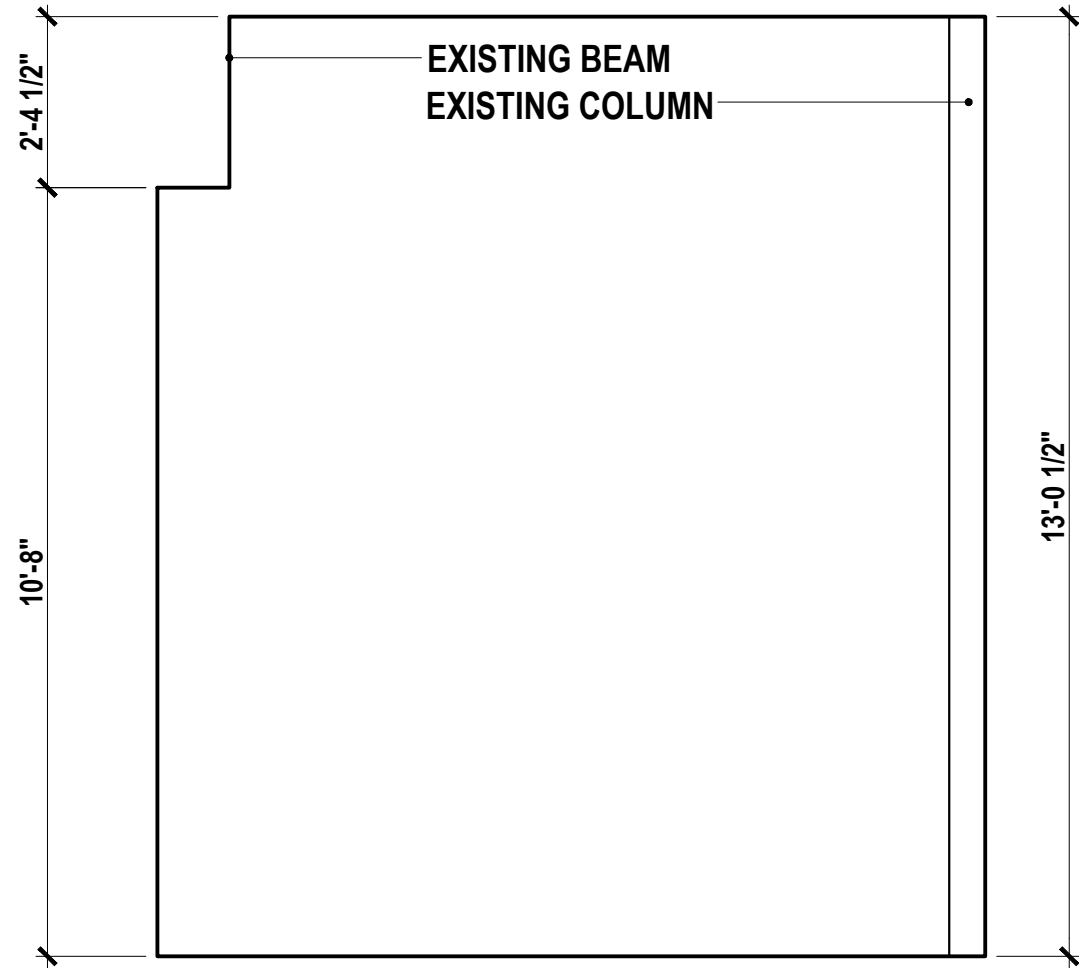
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SCALE: 3/8"=1'-0"



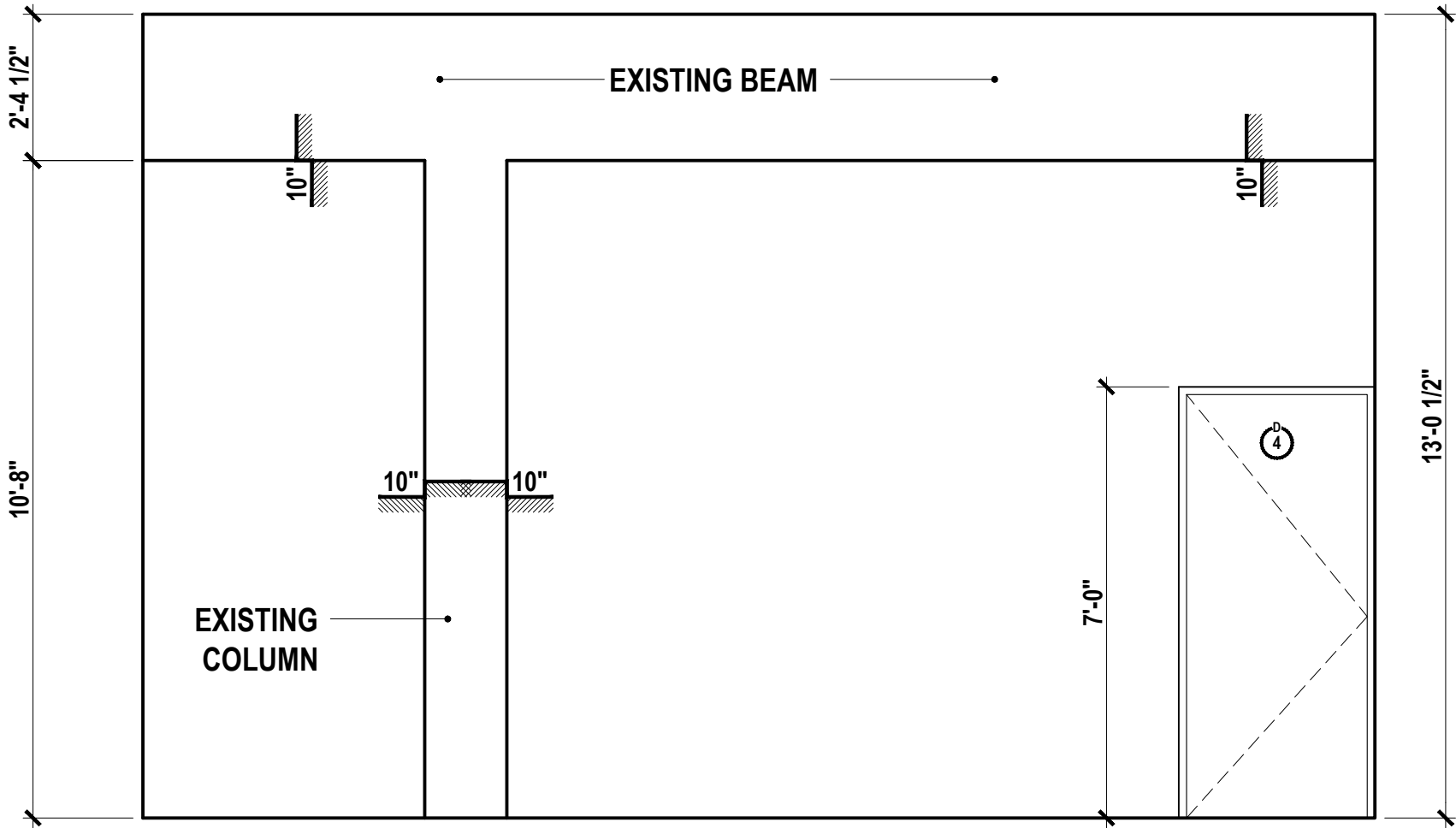
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SCALE: 3/8"=1'-0"



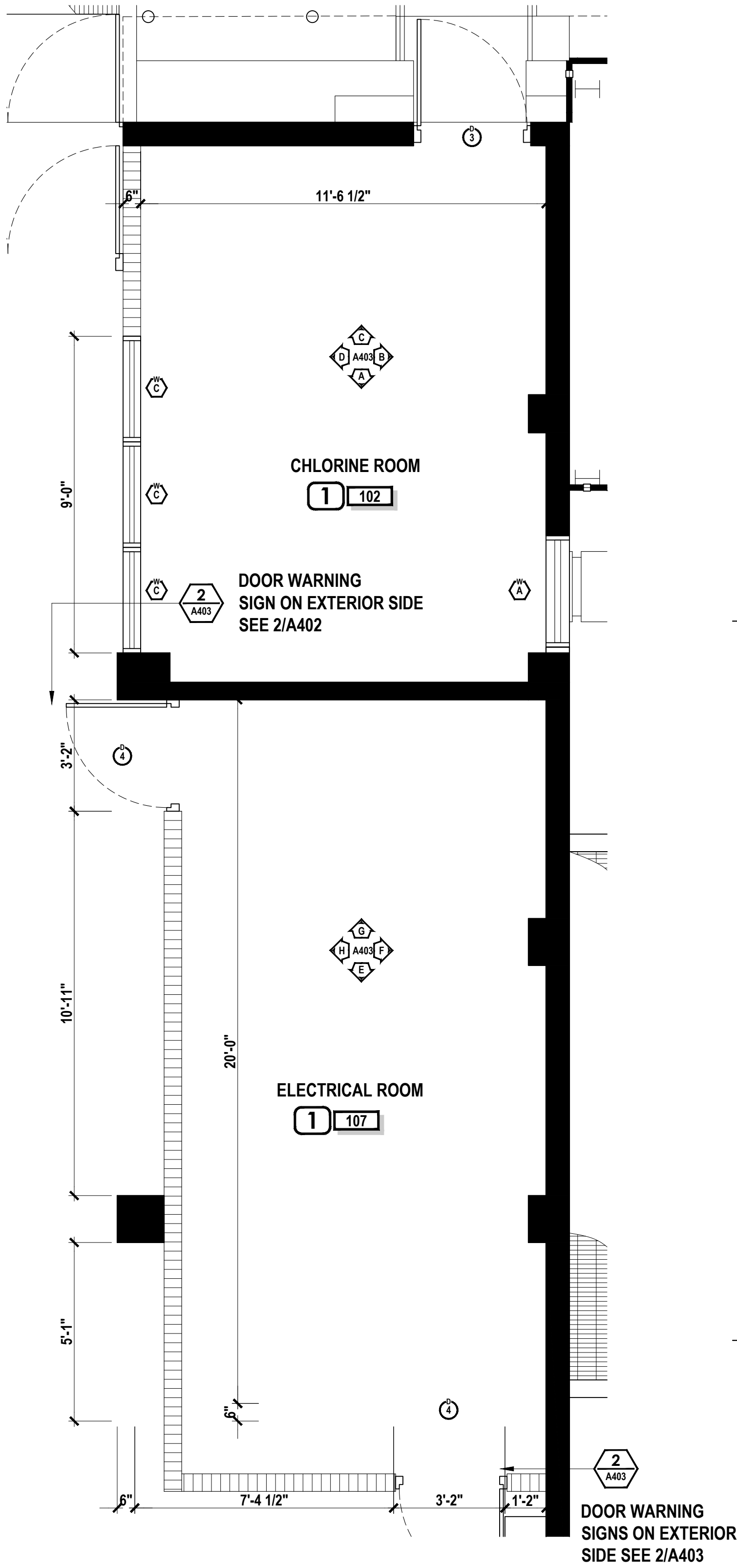
INTERIOR ELEVATION "F"
SCALE: 3/8"=1'-0"



INTERIOR ELEVATION "G"
SCALE: 3/8"=1'-0"

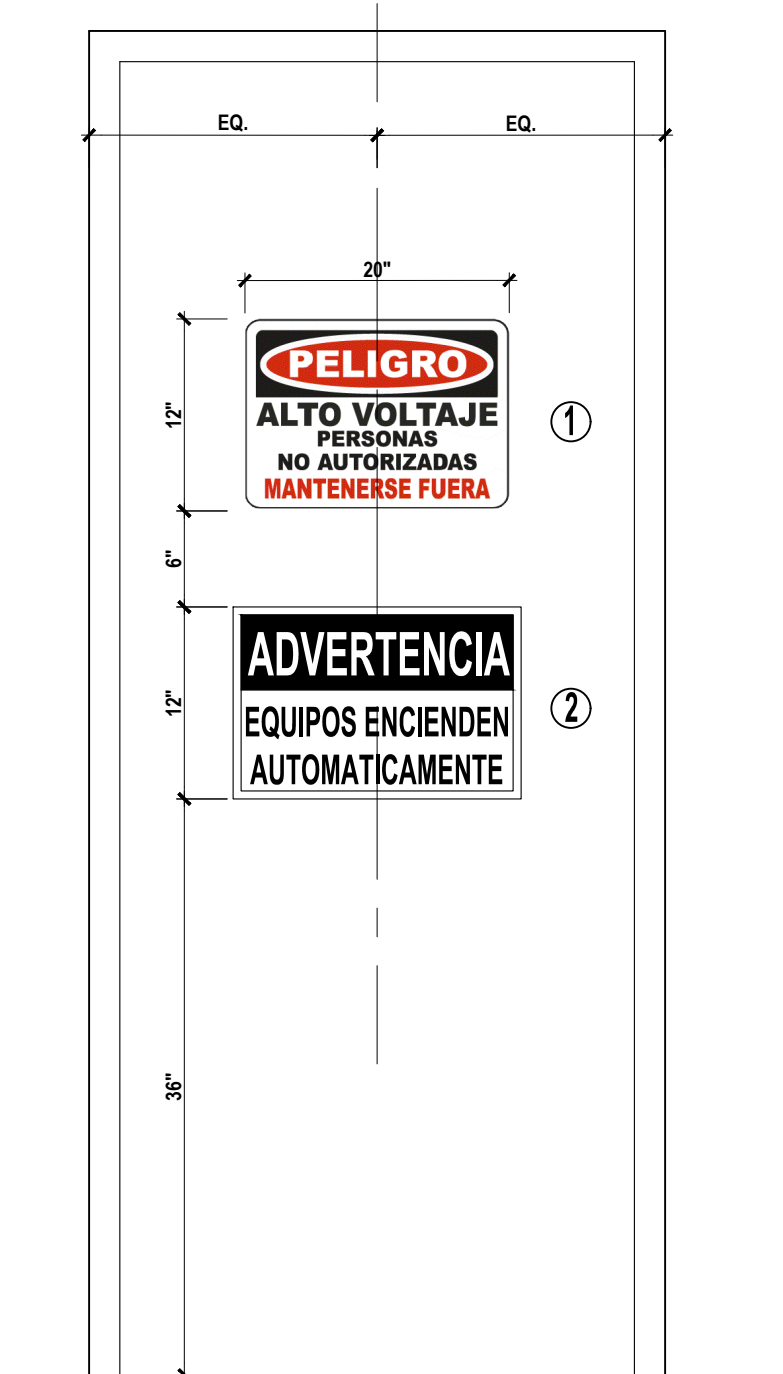


INTERIOR ELEVATION "H"
SCALE: 3/8"=1'-0"



ENLARGED CHLORINE & ELECTRICAL FLOOR PLAN
SCALE: 3/8"=1'-0"

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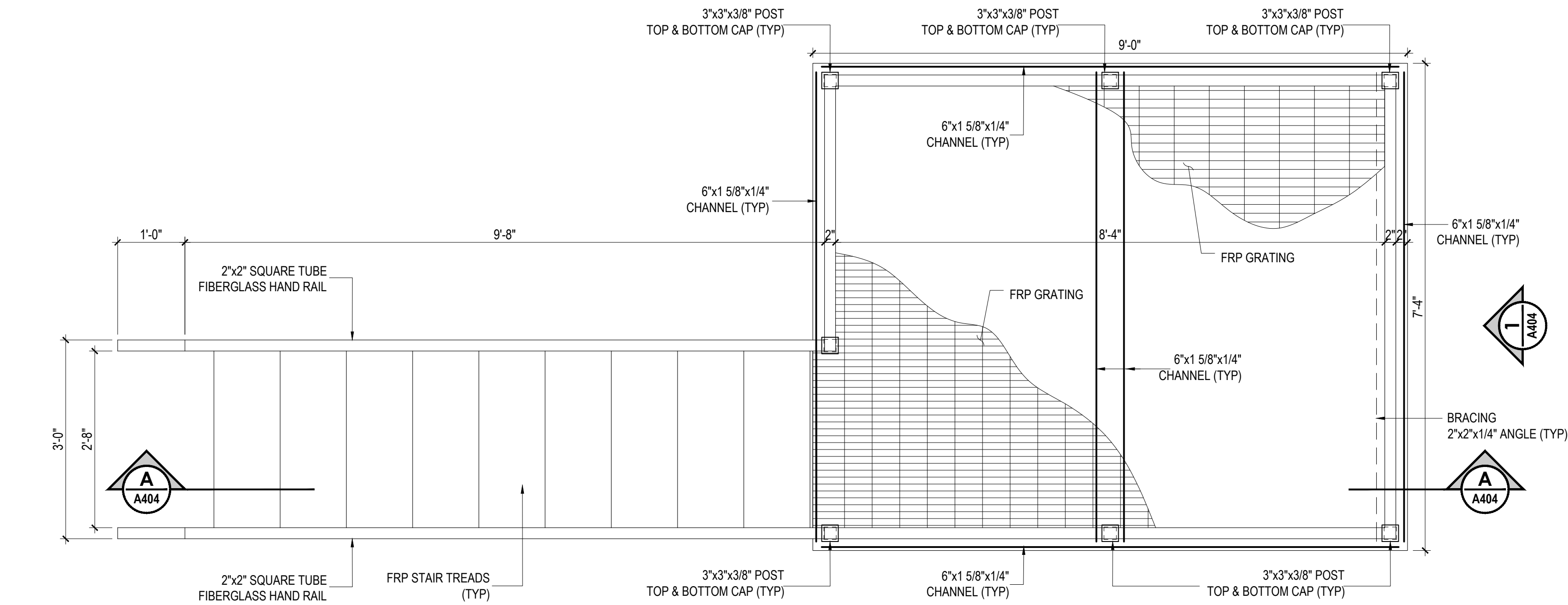


NOTE: FIBERGLASS SIGN

2 WARNING SIGN DETAILS
N.T.S.

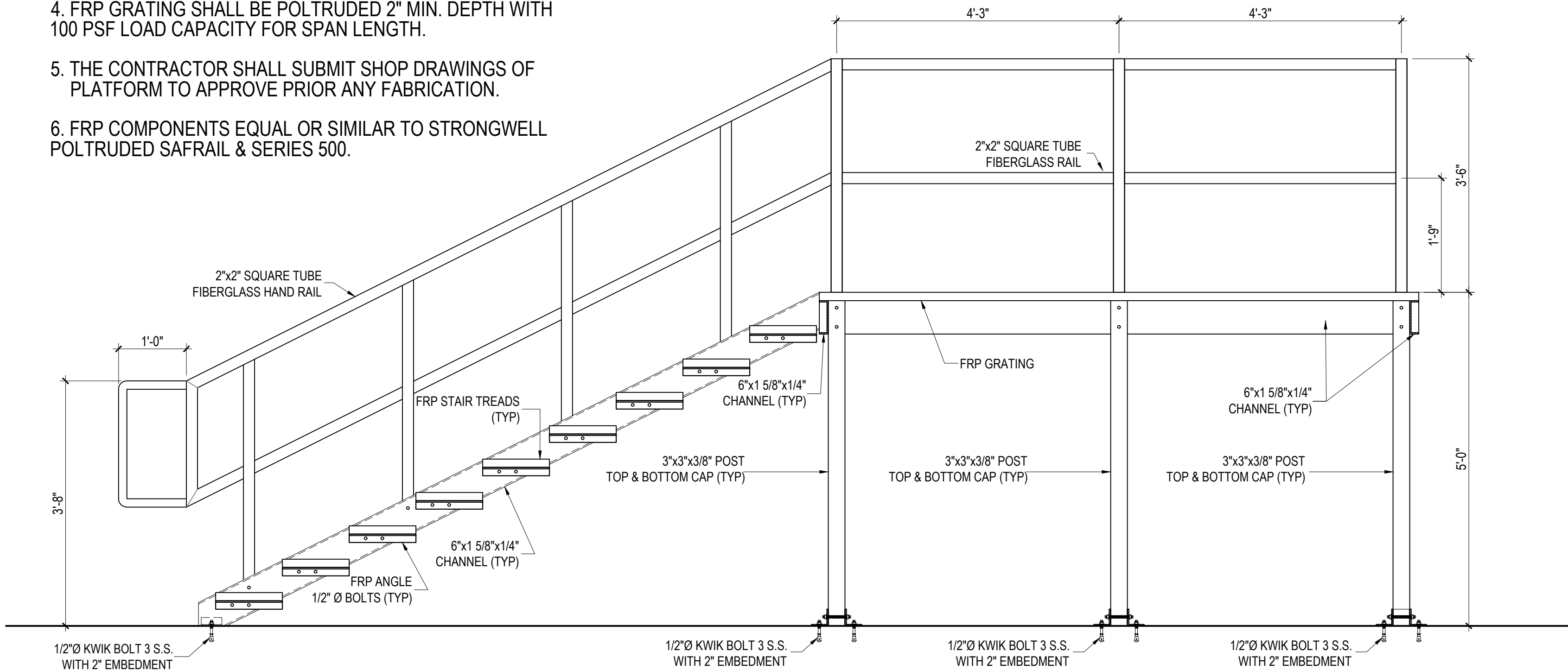
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EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE
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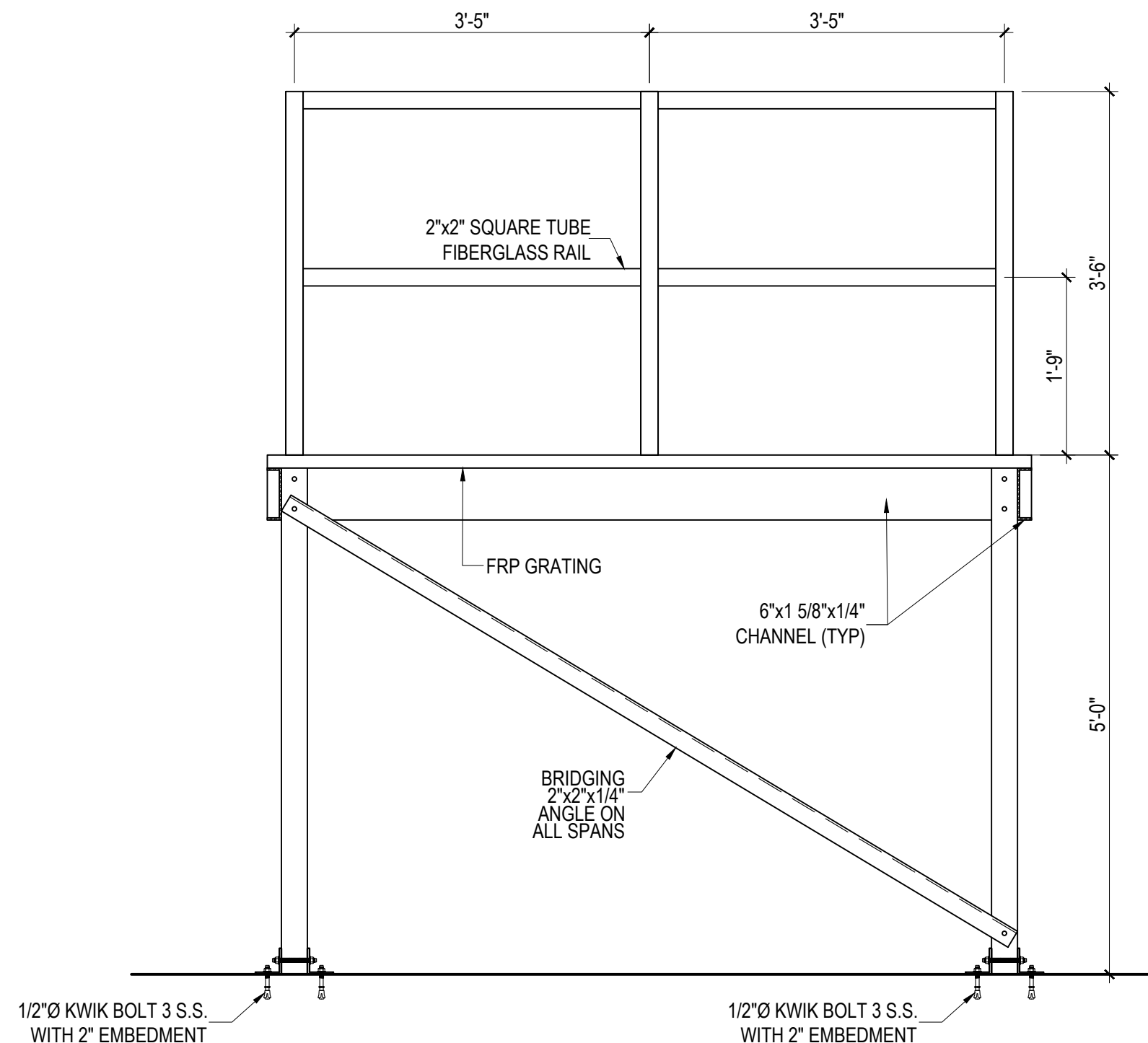


D1 PROPOSED PLATFORM PLAN
SCALE: 3/4"=1'-0"

- NOTE:**
1. ALL PLATFORM DIMENSIONS SHALL BE COORDINATED WITH ON-SITE FINAL DIMENSION.
 2. ALL PLATFORM ELEMENTS SHALL BE FRP STRUCTURAL.
 3. ALL BOLTS SHALL BE STAINLESS STEEL.
 4. FRP GRATING SHALL BE POLTRUDED 2" MIN. DEPTH WITH 100 PSF LOAD CAPACITY FOR SPAN LENGTH.
 5. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF PLATFORM TO APPROVE PRIOR ANY FABRICATION.
 6. FRP COMPONENTS EQUAL OR SIMILAR TO STRONGWELL POLTRUDED SAFRAIL & SERIES 500.



A PROPOSED PLATFORM SECTION
SCALE: 3/4"=1'-0"

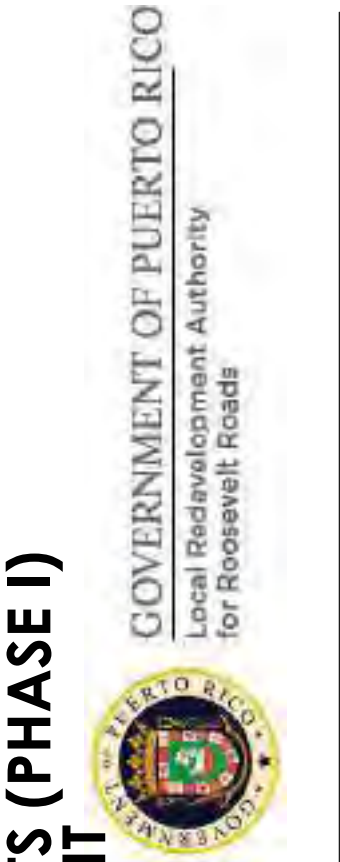


1 PROPOSED PLATFORM ELEVATION
SCALE: 3/4"=1'-0"

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**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

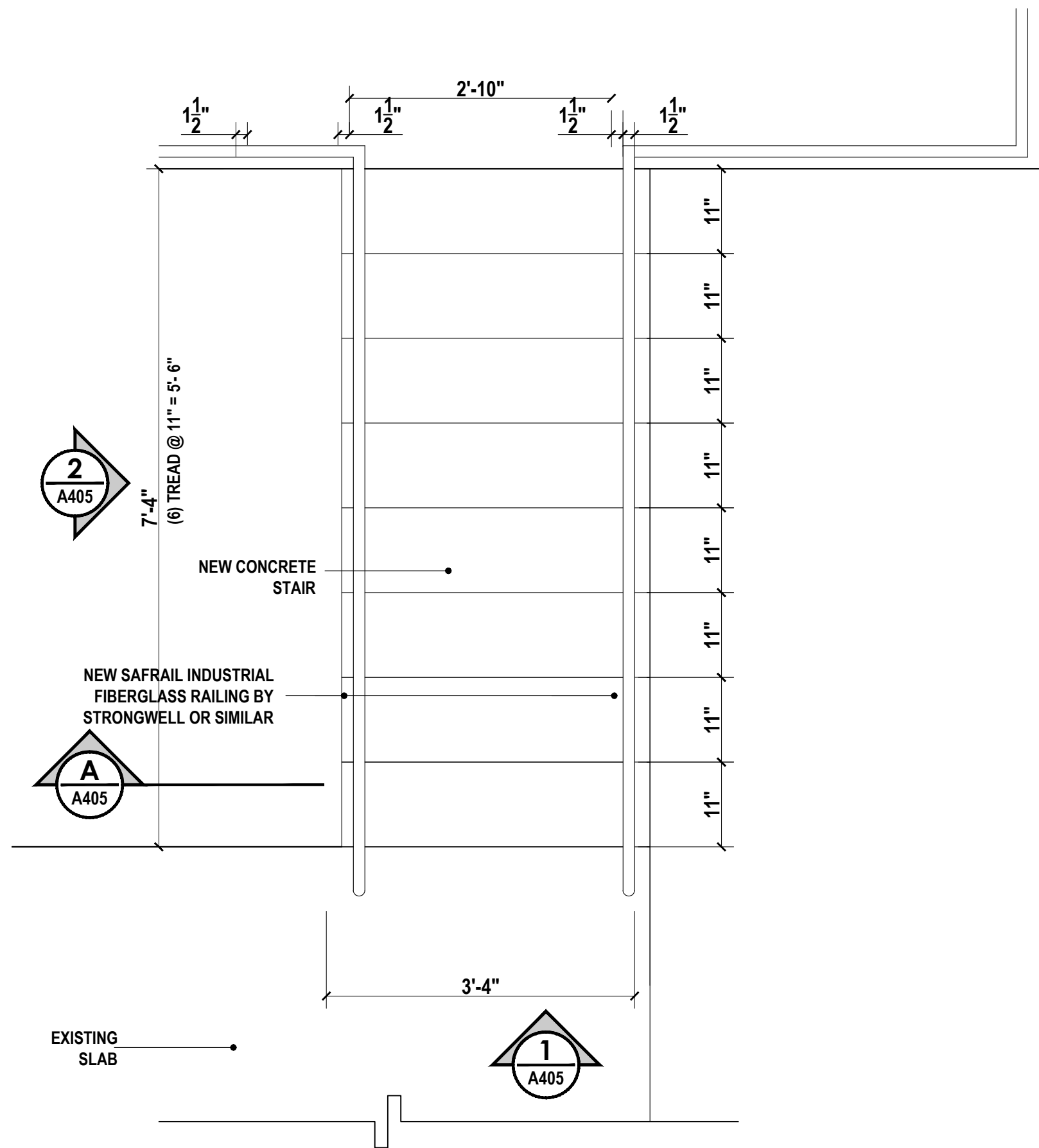
WATER TREATMENT PLANT

PROPOSED PLATFORM DETAILS

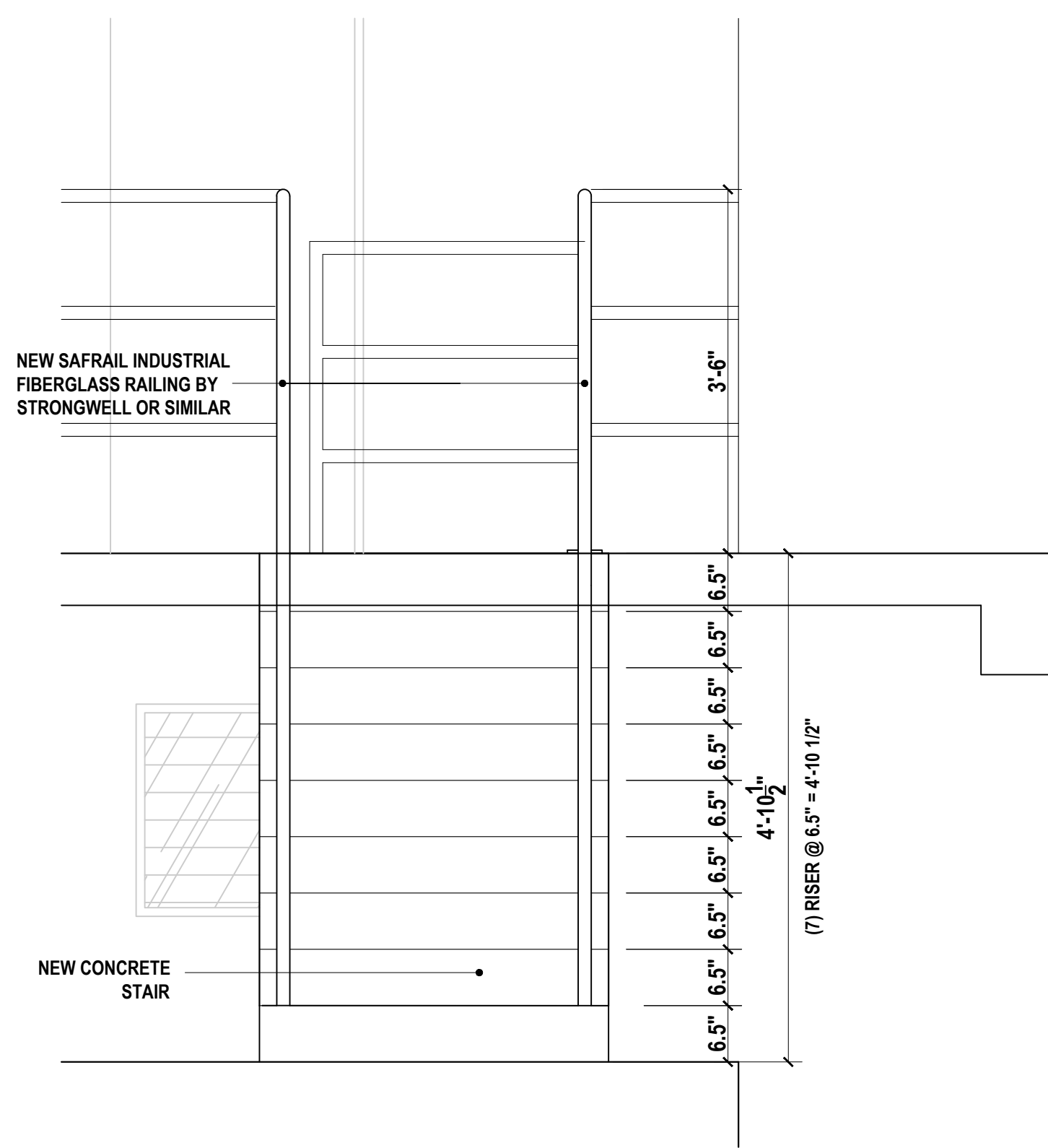
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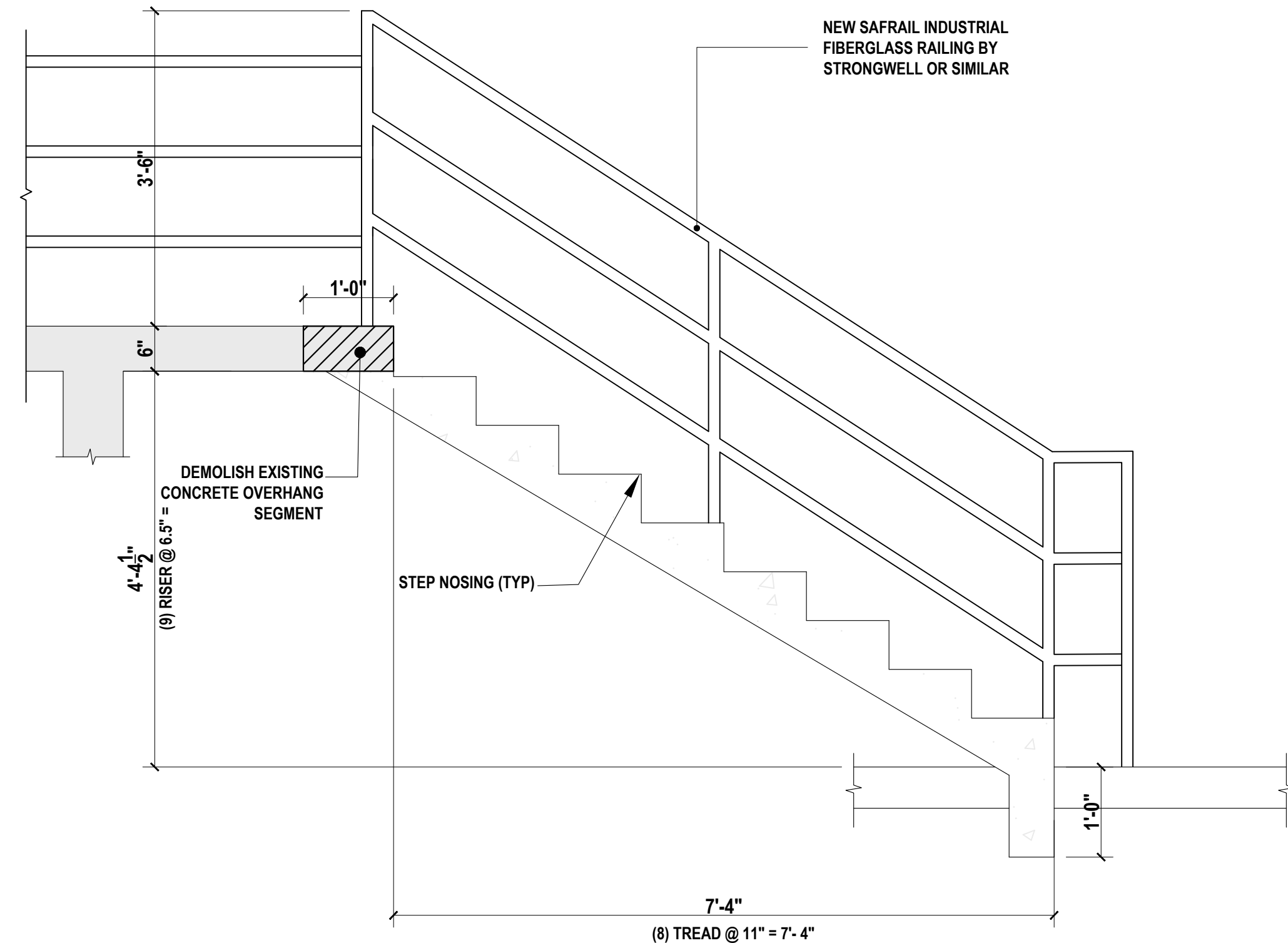
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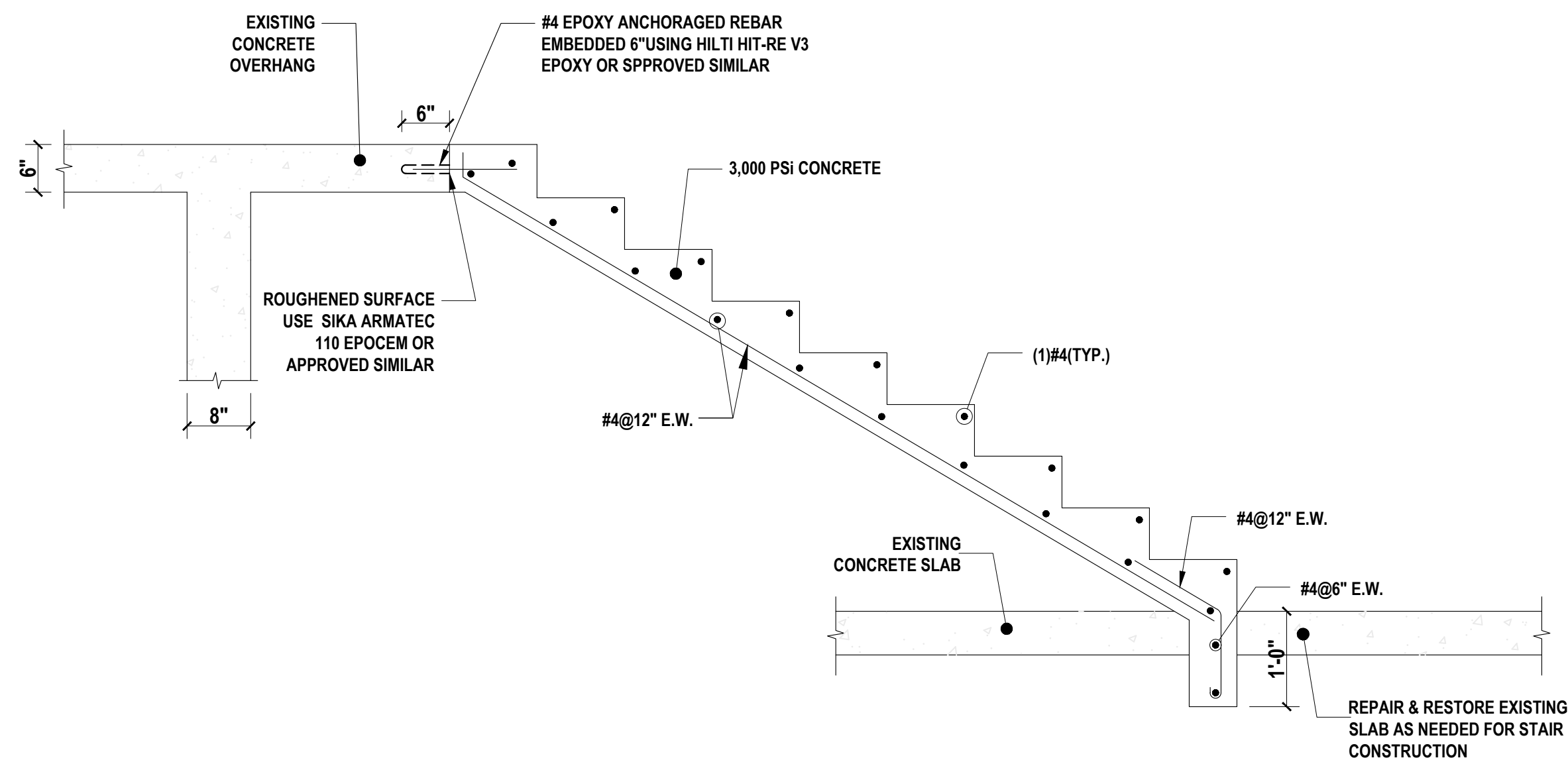
D1 PROPOSED EXTERIOR STAIR PLAN
SCALE: 3/4"=1'-0"



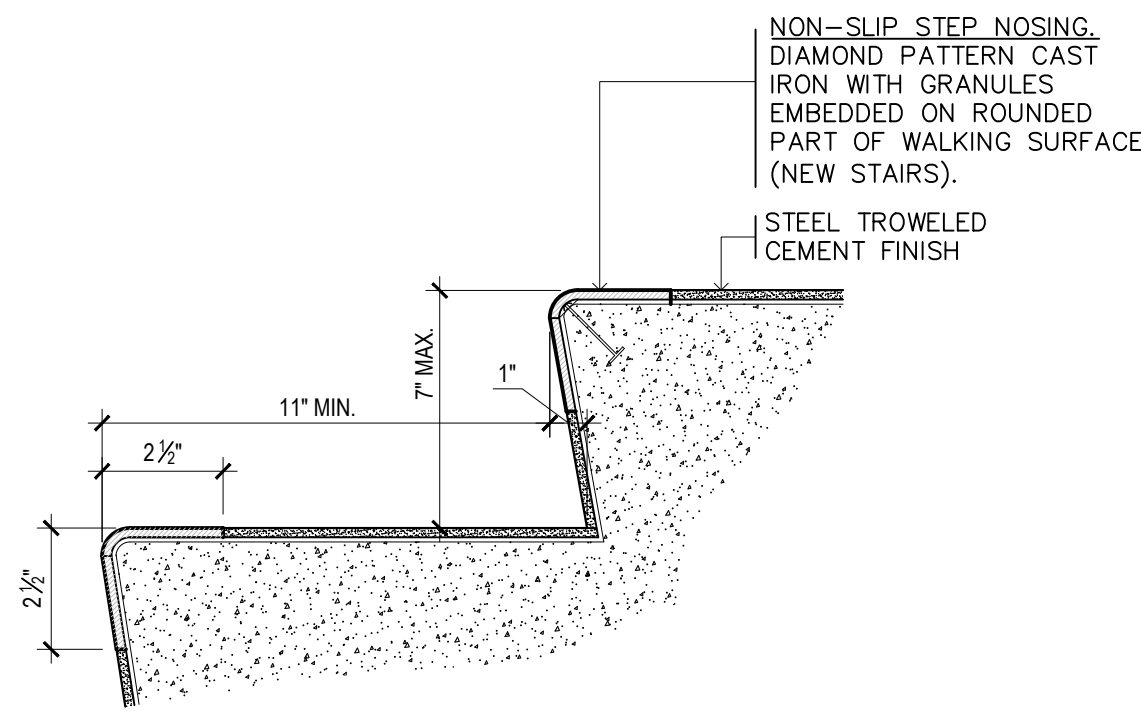
1 PROPOSED EXTERIOR STAIR ELEVATION NO.1
SCALE: 3/4"=1'-0"



2 PROPOSED EXTERIOR STAIR ELEVATION NO.2
SCALE: 3/4"=1'-0"



PROPOSED EXTERIOR STAIR STRUCTURAL SECTION
SCALE: 3/4"=1'-0"



TYPICAL CONCRETE STEP DETAIL
SCALE: N.T.S.

NOTE:
INSTALL ON ALL INTERIOR
(BUILDINGS) AND EXTERIOR (SITE)
STAIRS / STEPS ON THE PROJECT.

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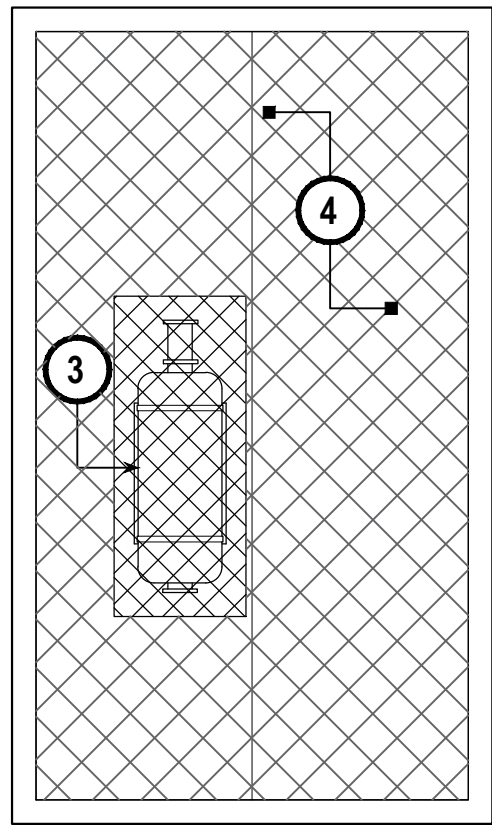
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AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

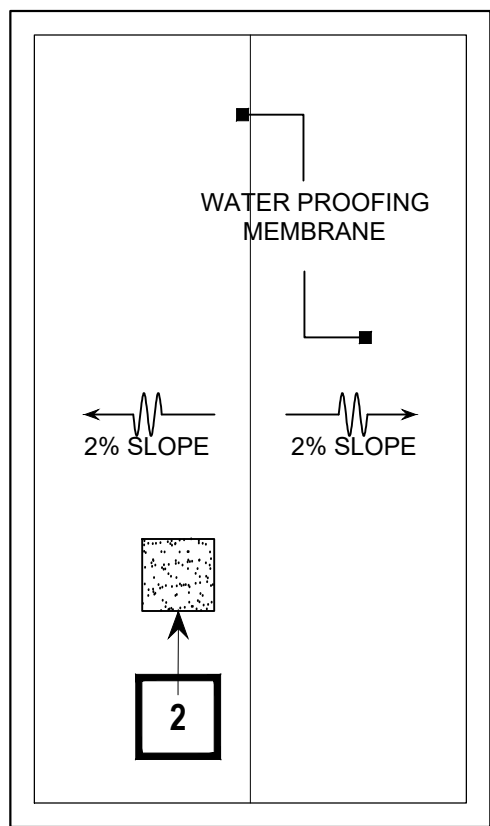
WATER TREATMENT PLANT
Drawing Title:

Project Title:

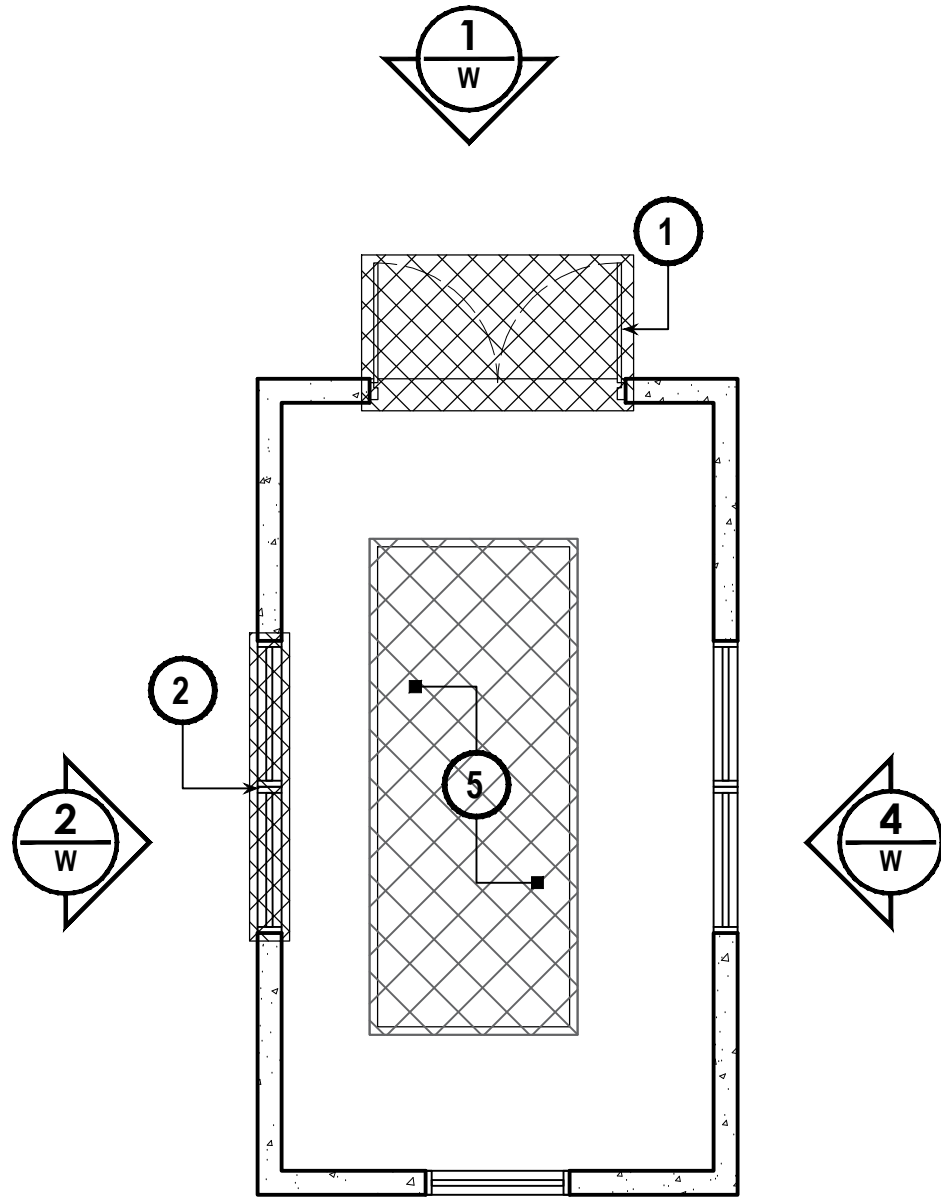
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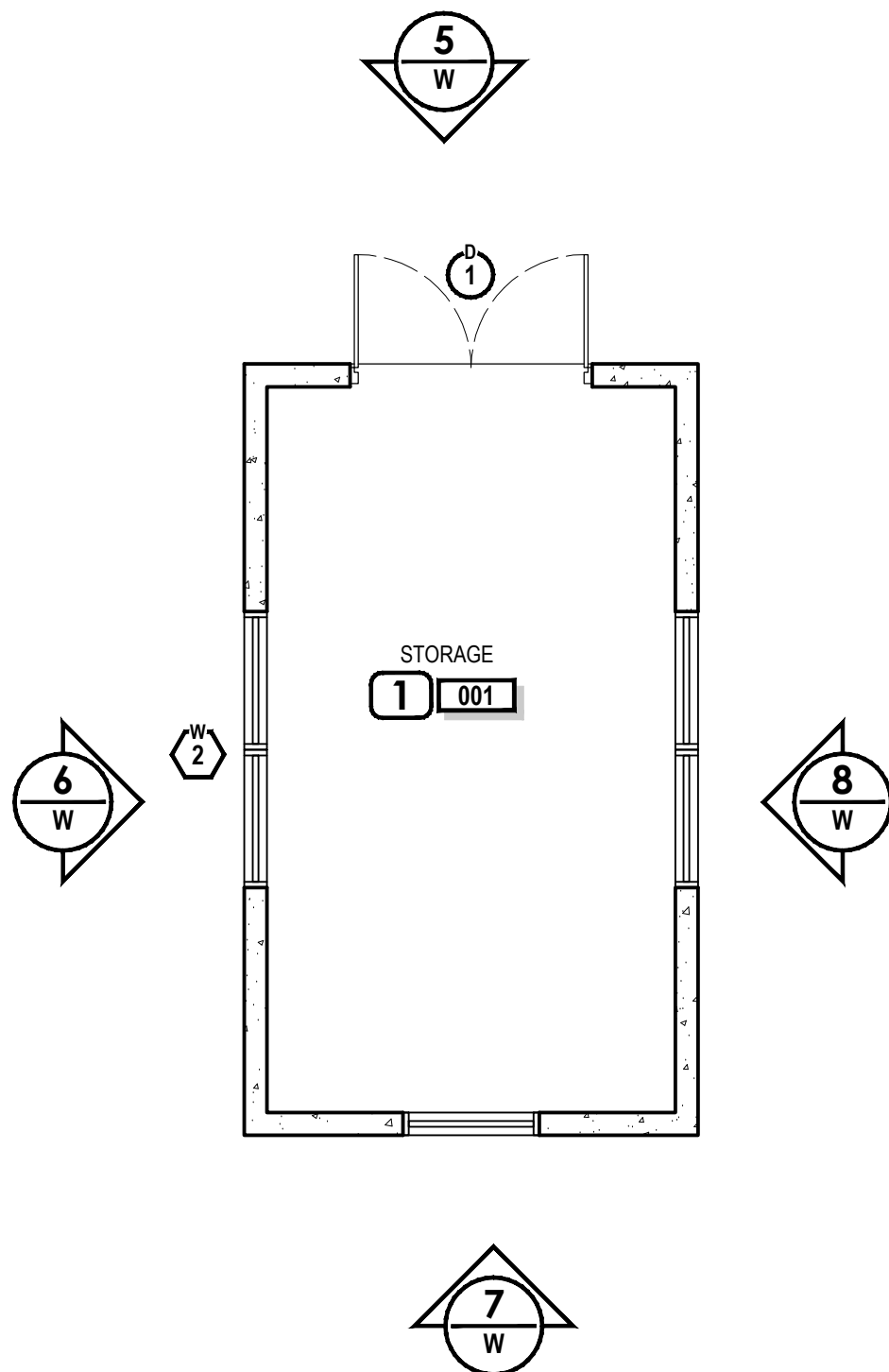
DEMOLISH ROOF PLAN
SCALE: 1/4"=1'-0"



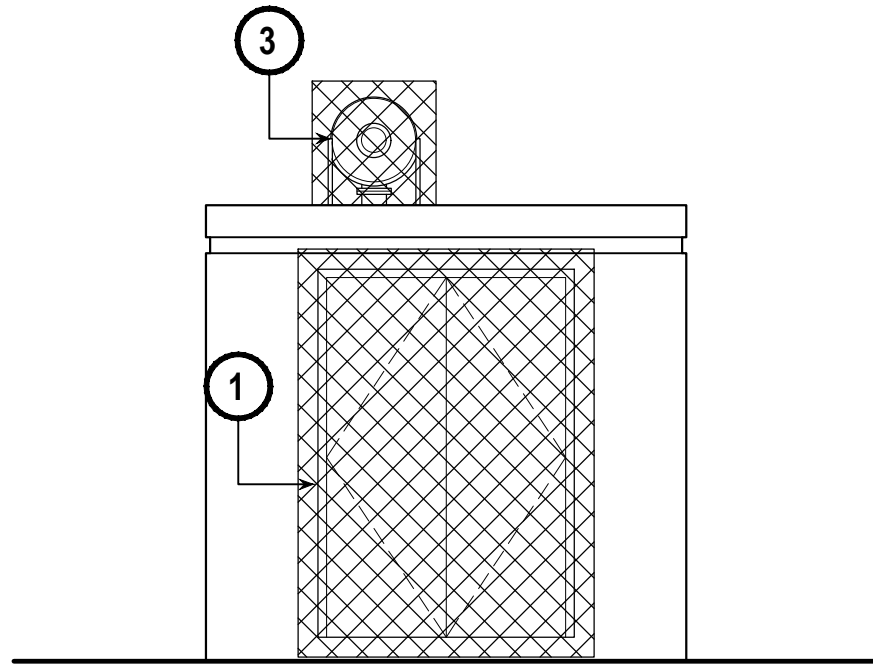
PROPOSED ROOF PLAN
SCALE: 1/4"=1'-0"



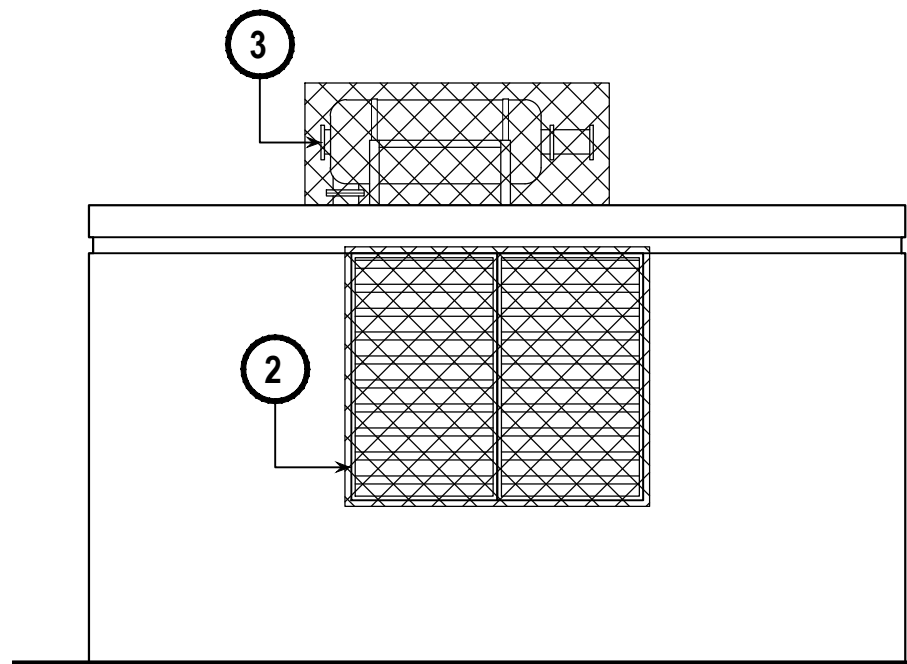
DEMOLISHD FIRST FLOOR PLAN
SCALE: 1/4"=1'-0"



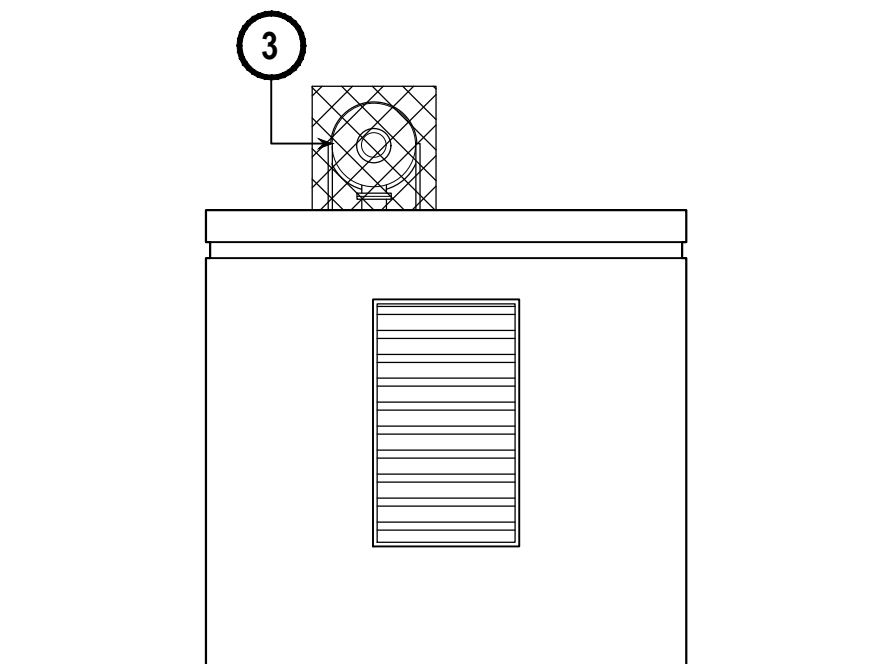
PROPOSED FIRST FLOOR PLAN
SCALE: 1/4"=1'-0"



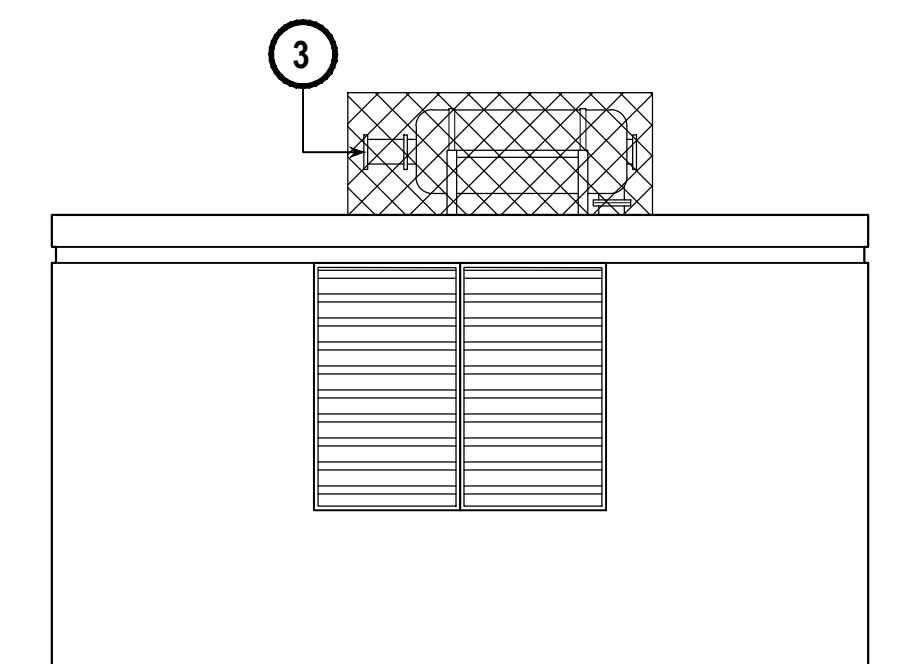
DEMOLISHD ELEVATION 1
SCALE: 1/4"=1'-0"



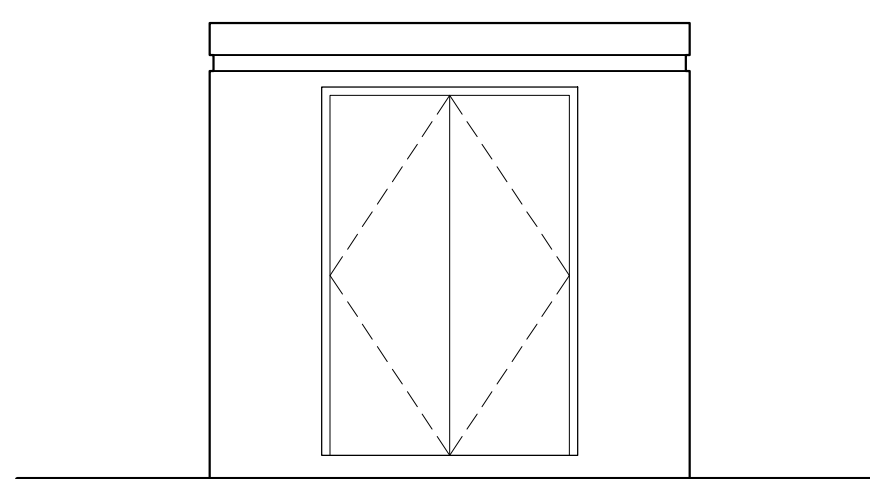
DEMOLISHD ELEVATION 2
SCALE: 1/4"=1'-0"



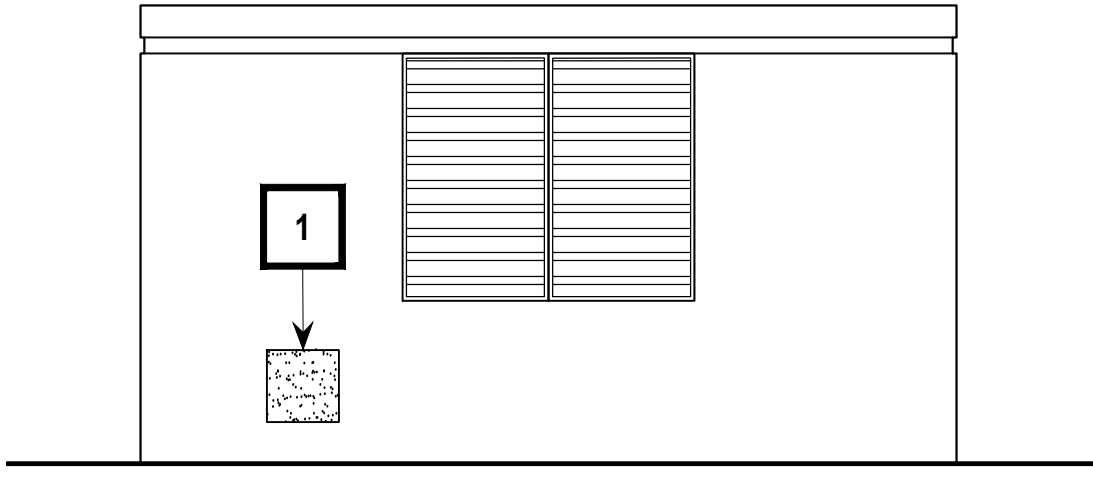
DEMOLISHD ELEVATION 3
SCALE: 1/4"=1'-0"



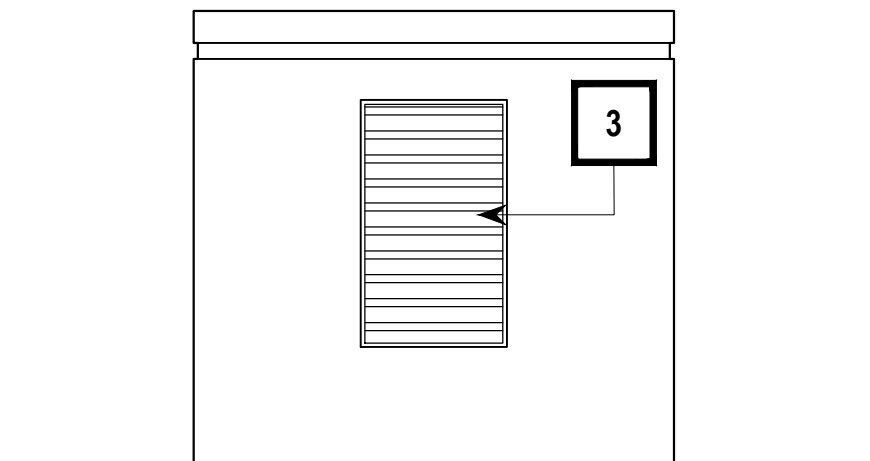
DEMOLISHD ELEVATION 4
SCALE: 1/4"=1'-0"



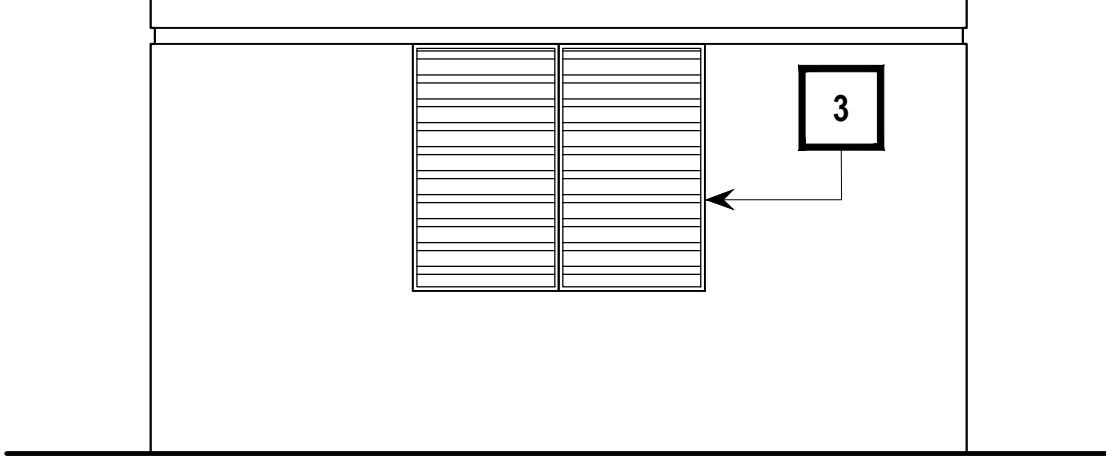
PROPOSED ELEVATION 5
SCALE: 1/4"=1'-0"



PROPOSED ELEVATION 6
SCALE: 1/4"=1'-0"



PROPOSED ELEVATION 7
SCALE: 1/4"=1'-0"



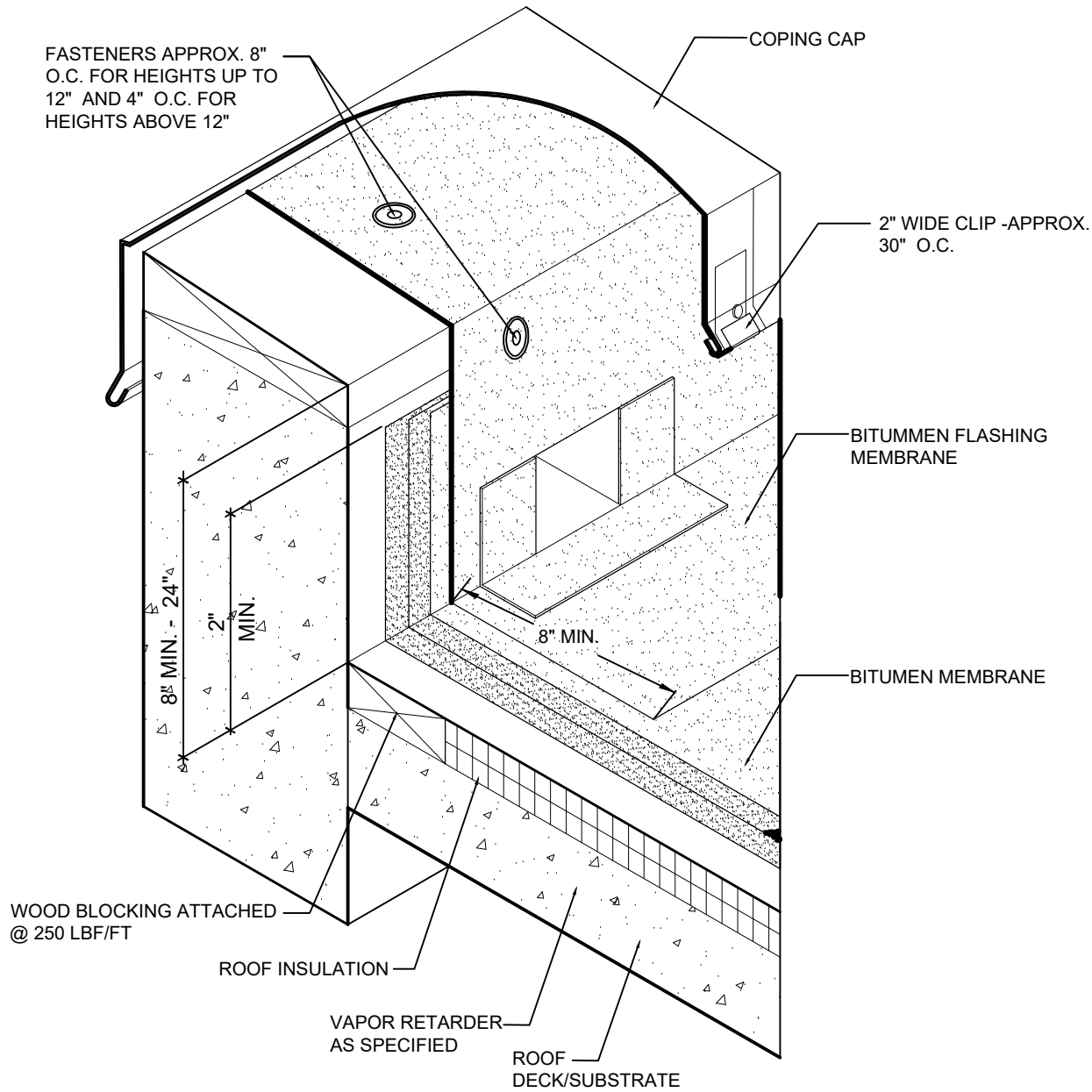
PROPOSED ELEVATION 8
SCALE: 1/4"=1'-0"

- NOTES:
- ALL COLORS, TEXTURES AND FINISHES TO BE SELECTED BY ARCHITECT. THE CONTRACTOR SHALL SUBMIT FULL SIZE SAMPLES FOR APPROVAL PRIOR TO INSTALLATION.
 - SUBSTITUTIONS SHALL CONFORM TO THE SPECIFICATIONS AND BE EQUAL IN QUALITY, PERFORMANCE AND APPEARANCE TO THE MATERIALS LISTED ABOVE.
 - ALL ADHESIVES, PAINTS AND SEALERS SHALL BE NON-TOXIC, SOLVENT FREE, AND LOW IN VOLATILE ORGANIC COMPOUNDS. (LOW VOC)
 - ALL RUBBER BASED MATERIALS SHALL BE PVC FREE AND HAVE A T LEAST 20% POST CONSUMER RECYCLED CONTENT.

FINISHES SCHEDULE:

FINISH NO.	FLOOR	WALL	CEILING	BASE
1	EXISTING TO REMAIN. CLEAN PATCH & SEAL SURFACE AS NEEDED W/ TREAD-PLATE ACRYLIC WATER-BASED LIGHT FOOT TRAFFIC ARMORSEAL BY SHERWIN WILLIAMS. FOR SMOOTH FINISH	PAINTED: CLEAN, PATCH & SEAL SURFACE AS NEEDED. APPLY PRIMER AND TWO COATS OF HARMONY INTERLOCKED BY SHERWIN WILLIAMS	PAINTED: CLEAN, PATCH & SEAL SURFACE AS NEEDED. APPLY PRIMER AND TWO COATS OF HARMONY INTERLOCKED BY SHERWIN WILLIAMS	N/A

- 1 REMOVE DOOR
2 REMOVE WINDOW
3 REMOVE TANK
4 WATERPROOF MEMBRANE AND FLASHING
5 DEMOLISH 2" CONCRETE SLAB
6 REPAIR CMU WALL, PAT & FINISH
7 REPAIR ROOF CONCRETE SLAB
8 EXISTING WINDOW TO REMAIN



DETAILS WATER PROOF SYSTEM
SCALE: 1-1/2"=1'-0"

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions	Number	Date	Description

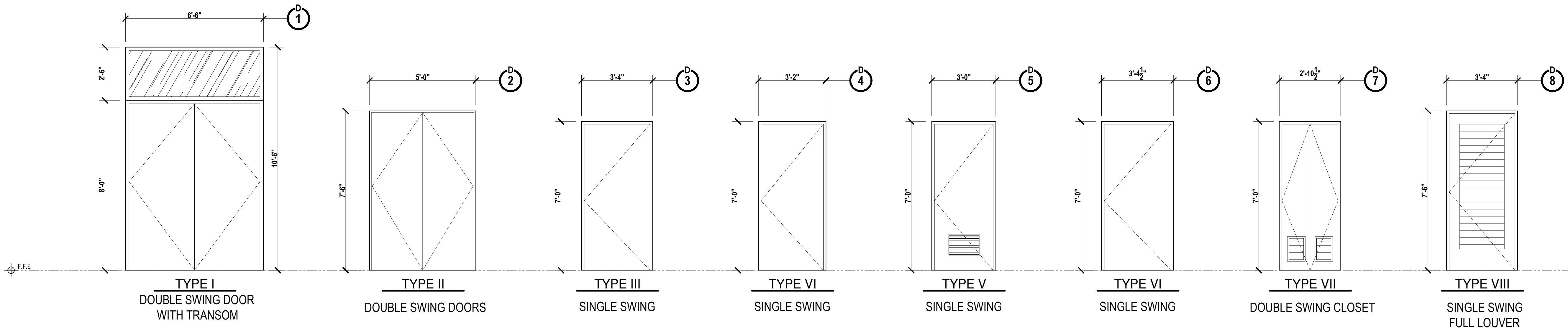
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER TREATMENT PLANT
Drawing Title: STORAGE ROOM FLOOR PLAN

WTP-A406



DOOR SCHEDULE														
TYPE	OPENING		MATERIAL	THICK	FRAME MATERIAL	GAUGE		VIEW PANEL	LOUVER	HARDWARE SET	CORE	FINISH	REMARKS	MANUFACTURER
	WIDTH	HEIGHT				DOOR	FRAME							
1	6'-6"	10'-6"	GALVANIZED STEEL	-	GALVANIZED STEEL	18	16	80"X30"	-	SET A	-	ENAMEL	-	TAMCOR
2	5'-0"	7'-6"	GALVANIZED STEEL	-	GALVANIZED STEEL	18	16	-	-	SET A	-	ENAMEL	-	TAMCOR
3	3'-4"	7'-0"	GALVANIZED STEEL	-	GALVANIZED STEEL	18	16	-	-	SET A	-	ENAMEL	-	TAMCOR
4	3'-2"	7'-0"	WOOD	1 3/8"	WOOD	-	-	-	-	SET A	SEMI-SOLID	VARNISH	-	3C
5	3'-0"	7'-0"	WOOD	1 3/8"	WOOD	-	-	-	18"X12"	SET A	SEMI-SOLID	VARNISH	-	3C
6	3'-4 1/2"	7'-0"	GALVANIZED STEEL	-	GALVANIZED STEEL	18	16	-	-	SET A	-	ENAMEL	-	TAMCOR
7	2'-10 1/2"	7'-0"	WOOD	1 3/8"	WOOD	-	-	-	(2)10"X14"	SET B	SEMI-SOLID	VARNISH	DOUBLE SWING CLOSET	3C
8	3'-4"	7'-6"	GALVANIZED STEEL	-	GALVANIZED STEEL	18	16	-	FULL LOUVER	SET A	-	ENAMEL	-	TAMCOR

NOTES: ALL HARDWARE TO BE EQUAL OR SIMILAR TO BE APPROVED. SUBMIT SAMPLES FOR APPROVAL.
ALL HANDLES TO BE LEVER TYPE D. SUBMIT KEYING AND FUNCTION TO BE APPROVED.
ALL HARDWARE FINISHES TO BE SATIN STAINLESS STEEL, BRUSHED NICKEL, OR MILL ALUMINUM AS APPLIES.

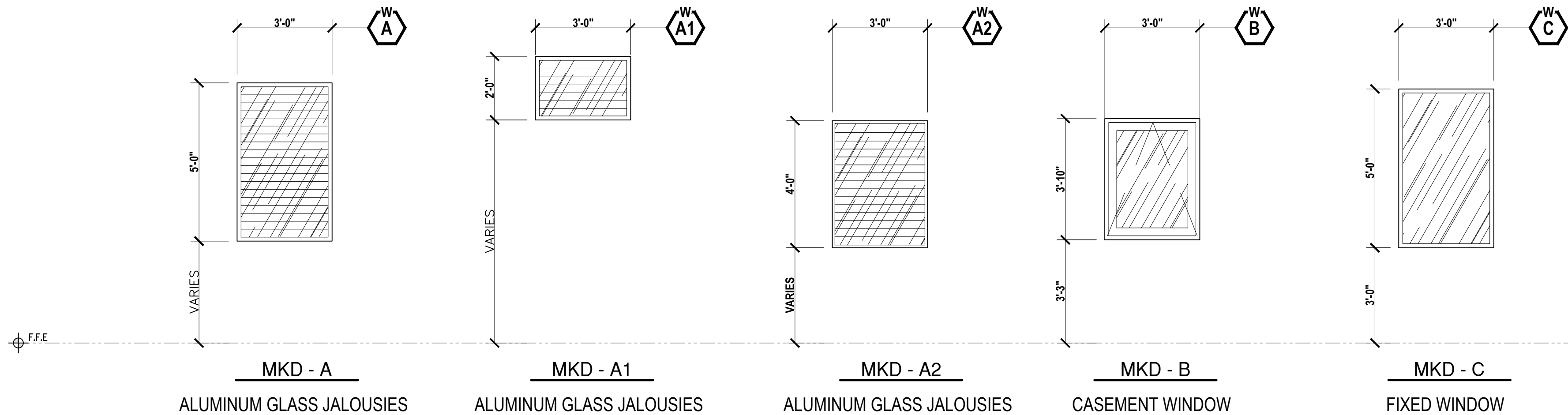
HARDWARE SETS:

SET A:

- GRADE 2 ENTRANCE LOCKSET EQUAL TO MODEL A53 LEVON BY SHACLAG.
- GRADE 2 SINGLE CYLINDER DEADBOLT EQUAL TO MODEL B560P BY SHACLAG.
- LIGHT DUTY DOOR CLOSER EQUAL TO MODEL SC90A BY FALCON.
- GRADE 2 STANDARD WEIGHT BALL & CONCEALED BEARING HINGE BY IVES.
- CONCAVE DOOR WALL STOP EQUAL TO SERIES 102 BY PDQ.

SET B:

- GRADE 2 ENTRANCE LOCKSET EQUAL TO MODEL A53 LEVON BY SHACLAG.
- GRADE 2 SINGLE CYLINDER DEADBOLT EQUAL TO MODEL B560P BY SHACLAG.
- GRADE 2 STANDARD WEIGHT BALL & CONCEALED BEARING HINGE BY IVES.
- CONCAVE DOOR WALL STOP EQUAL TO SERIES 102 BY PDQ.
- DOOR HOLDER EQUAL TO SERIES 119 BY PDQ.



WINDOW SCHEDULE									
MKD	OPENING			MATERIAL	GLASS	FINISH	REMARKS	MANUFACTURER	QTY.
	FROM FLOOR	WIDTH	HEIGHT						
A	VARIES	3'-0"	5'-0"	EXTRUDED ALUMINUM	1/4" SOLEX LAMINATED	GRAY ELECTROSTATIC POWDER COATING	MASTER VIEW 4"	AIRMASTER	5
A1	VARIES	3'-0"	2'-0"	EXTRUDED ALUMINUM	1/4" SOLEX LAMINATED	GRAY ELECTROSTATIC POWDER COATING	MASTER VIEW 4"	AIRMASTER	4
A2	VARIES	3'-0"	4'-0"	EXTRUDED ALUMINUM	1/4" SOLEX LAMINATED	GRAY ELECTROSTATIC POWDER COATING	MASTER VIEW 4"	AIRMASTER	4
B	3'-3"	3'-0"	3'-10"	EXTRUDED ALUMINUM	1/4" SOLEX LAMINATED	GRAY ELECTROSTATIC POWDER COATING	PROJECTED	AIRMASTER	4
C	3'-0"	3'-2"	5'-0"	EXTRUDED ALUMINUM	1/4" SOLEX LAMINATED	GRAY ELECTROSTATIC POWDER COATING	FIXED GLASS	AIRMASTER	12

Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADICIONALMENTE, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCURRIR.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	Set Date: 2021/07/28
		Drawn by:	Dwg. Date:

DOORS SCHEDULE:

MKD	TYPE	OPENING		MATERIAL	THICK.	FRAME MATERIAL	GAUGE		VIEW PANEL	LOUVER	HARDWARE SET	CORE	FINISH	MANUFACTURER	REMARKS
		WIDTH	HEIGHT				DOOR	FRAME							
1	I	5'-4"	7'-8"	GALVANIZED STEEL	1 3/4"	GALVANIZED STEEL	18	16	-	-	SET A	-	ENAMELED	TAMCOR	-

HARDAWARE SETS:

SET A:

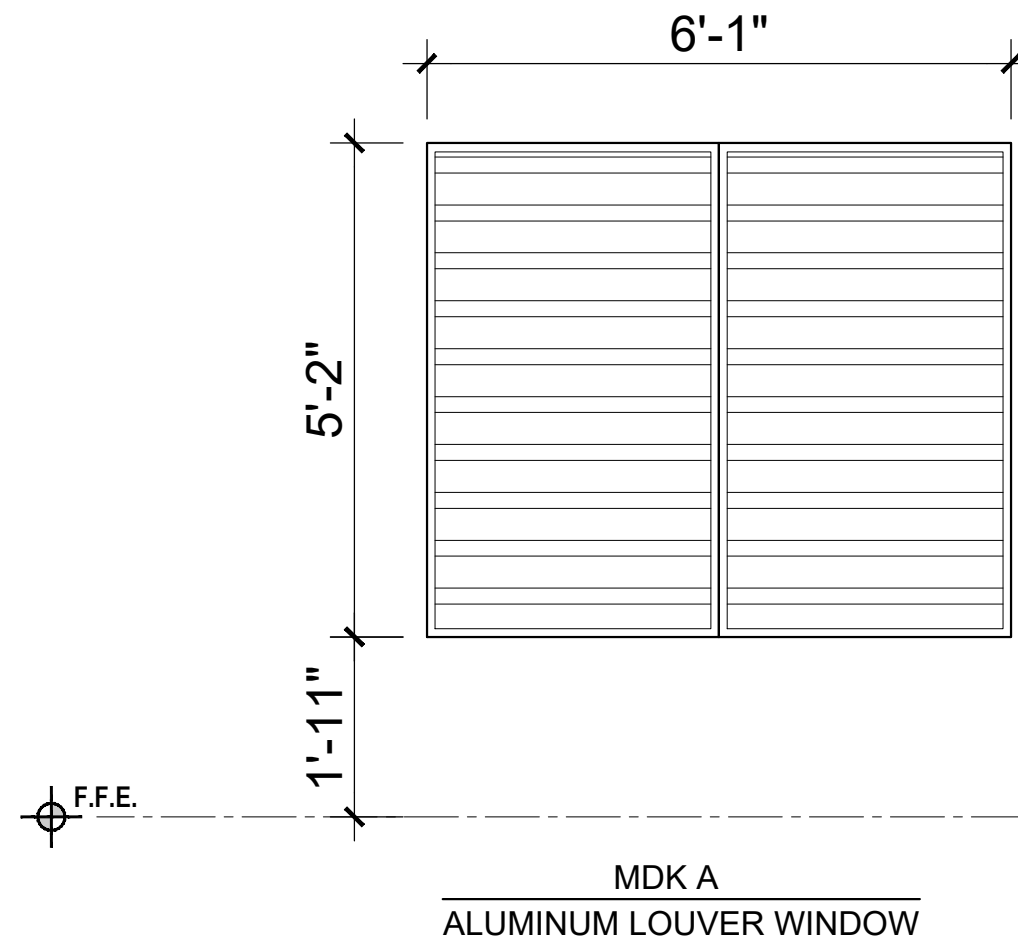
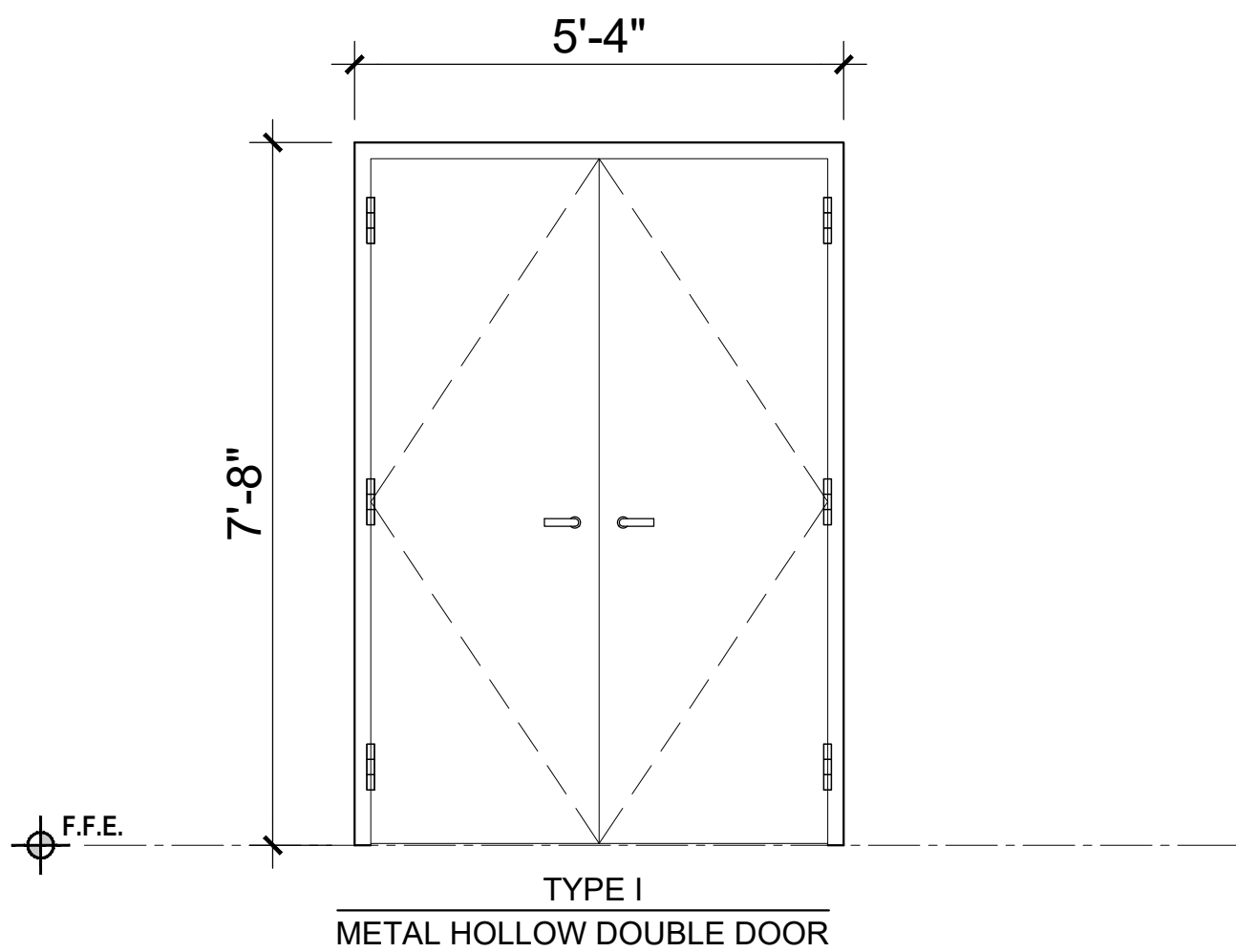
- GRADE 2 ENTRANCE LOCKSET EQUAL TO MODEL. A53 LEVON BY SHACLAGE.
- GRADE 2 SINGLE CYLINDER DEADBOLT EQUAL TO MODEL B560P BY SHACLAGE.
- LIGHT DUTY DOOR CLOSER EQUAL TO MODEL SC90A BY FALCON.
- GRADE 2 STANDARD WEIGHT BALL & CONCEALED BEARING HINGE BY IVES.
- CONCAVE DOOR WALL STOP EQUAL TO SERIES 102 BY PDQ.

SET B:

- GRADE 2 ENTRANCE LOCKSET EQUAL TO MODEL. A53 LEVON BY SHACLAGE.
- GRADE 2 SINGLE CYLINDER DEADBOLT EQUAL TO MODEL B560P BY SHACLAGE.
- GRADE 2 STANDARD WEIGHT BALL & CONCEALED BEARING HINGE BY IVES.
- CONCAVE DOOR WALL STOP EQUAL TO SERIES 102 BY PDQ.
- DOOR HOLDER EQUAL TO SERIES 119 BY PDQ.

WINDOWS SCHEDULE:

MKD	OPENING			MATERIAL	GLASS	FINISH	MANUFACTURER	REMARKS
	FROM FLOOR	WIDTH	HEIGHT					
A	1'-11"	6'-1"	5'-2"	EXTRUDED ALUMINUM	-	GRAY ELECTROSTATIC POWDER COATING	AIRMASTER	-



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DATE ISSUE
JULY 30, 2021
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Revisions		SHEET INFO.	
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			Project No.: 19-1837-0
			Set Date: 2021/07/28
			Drawn by:
			Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: JERRA & NAGUARO, PUERTO RICO

WATER TREATMENT PLANT

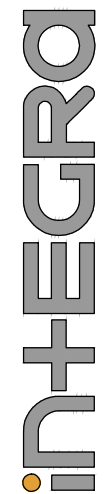
Drawing Title:

STORAGE ROOM SCHEDULES & DETAILS

Project Title:

Sheet:

WTP-A602



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EXISTING AND DEMOLITION BASEMENT FLOOR PLAN
SCALE: 1/32

BOTTOM VIEW

FILTER GALLERY TOP VIEW

LEGEND:

PIPES PROPER REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.

PIPES PERIMETER PAINT ENCAPSULATION SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PERFORMED BY THE CONTRACTOR.

NO WORKS SUCH AS SCRAPING OR REMOVAL OF EXISTING PAINT IN WALLS AND COLUMNS LOCATED AT THE PIPE GALLERY ROOM, PUMP AND HEADER ROOM SHALL BE PERFORMED AT A HEIGHT BETWEEN 0'-0" TO 5'-0" PAINT ENCAPSULATION AND NEW SURFACE PAINT SHALL BE PERFORMED UNLESS DEMOLITION IS SPECIFIED.

NO WORKS SUCH AS SCRAPING OR REMOVAL OF EXISTING PAINT IN STAIRS STEPS, HAND RAILS AND WALLS LOCATED BETWEEN FIRST FLOOR AND PUMP AND HEADER ROOM STAIRS SHALL BE PERFORMED PAINT ENCAPSULATION SHALL BE PERFORMED AND NEW SURFACE PAINT UNLESS DEMOLITION IS SPECIFIED.

NOTES:

- CONTRACTOR SHALL PREPARE AND SUBMIT FOR OWNER AND PR ENVIRONMENTAL QUALITY BOARD APPROVAL, A LEAD BASED PAINT REMOVAL ABATEMENT PLAN.
- CONTRACTOR SHALL FOLLOW INDICATIONS ON ASBESTOS AND LEAD BASED PAINT INSPECTION REPORT PREPARED BY NORTOL ENVIRONMENTAL ON SEPTEMBER 2019.
- CONTRACTOR SHALL REMOVE ENCAPSULATE AND OR DISPOSE AS REQUIRED OF LEADBASED PAINTED MATERIALS ACCORDING TO CURRENT STATE AND FEDERAL REGULATIONS.
- ENCAPSULATION SHALL BE PERFORMED WITH APPROVED U.S. HOUSING DEPT. (HUD) LEAD ENCAPSULANT COATING AND THEN NEW SURFACED PAINT APPLIED ON PIPES AND WALLS.
- NO WORKS SUCH AS SCRAPING OR REMOVAL OF EXISTING PAINT IN WALLS LOCATED AT SECOND FLOOR SHALL BE PERFORMED AT A HEIGHT BETWEEN 0'-0" TO 4'-0".
- WOOD COMPONENTS REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.

Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DOPM.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 18-1837.0	Set Date: 20210728
		Drawn by:	Dwg. Date:

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WATER TREATMENT PLANT
Drawing Title:



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions		SHEET INFO.	
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for Roosevelt Roads

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for Roosevelt Roads

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for Roosevelt Roads

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		Drawn by:	Dwg. Date:

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Sheet:

WATER TREATMENT PLANT
Drawing Title:



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 18-1837.0	Set Date: 20210728
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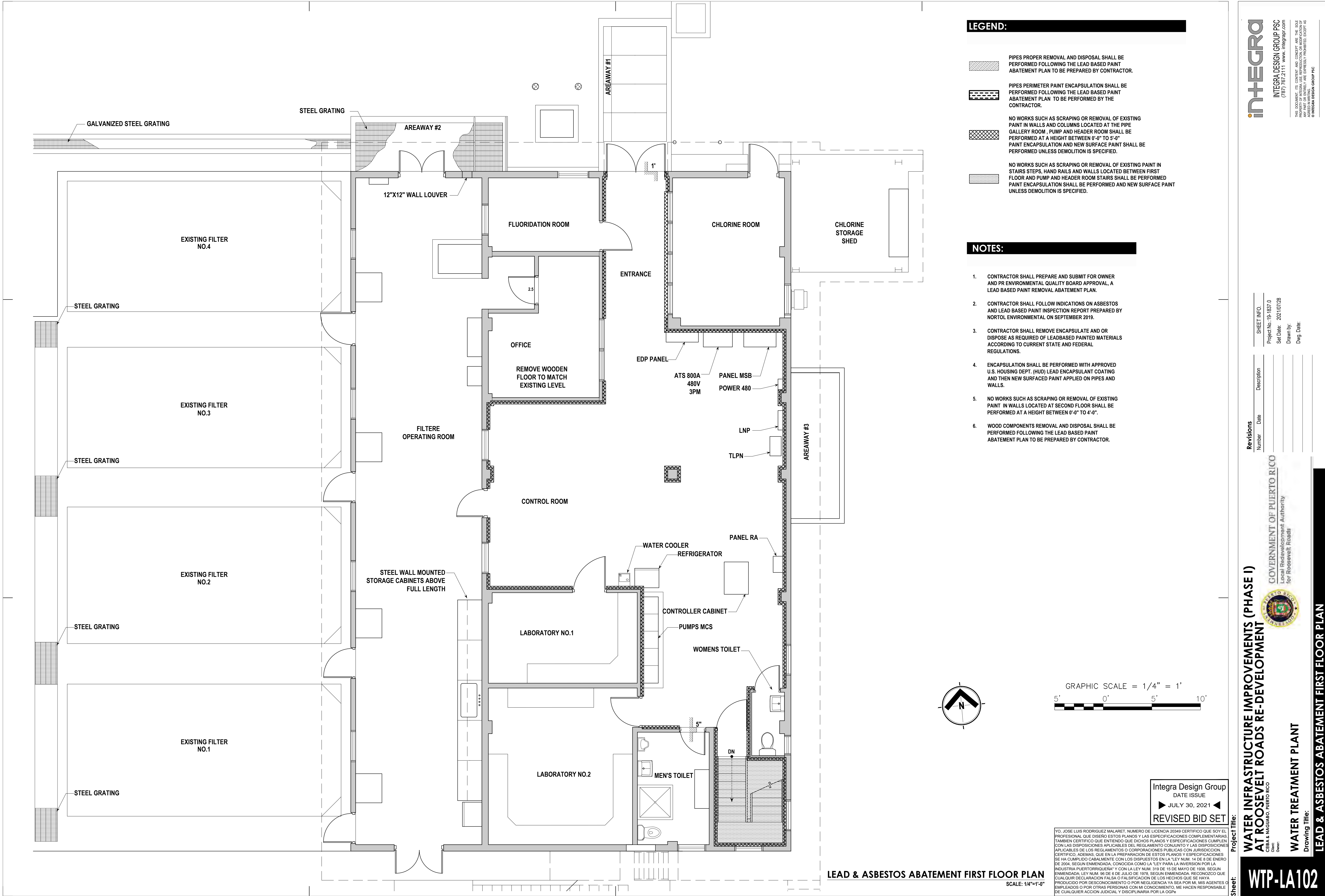
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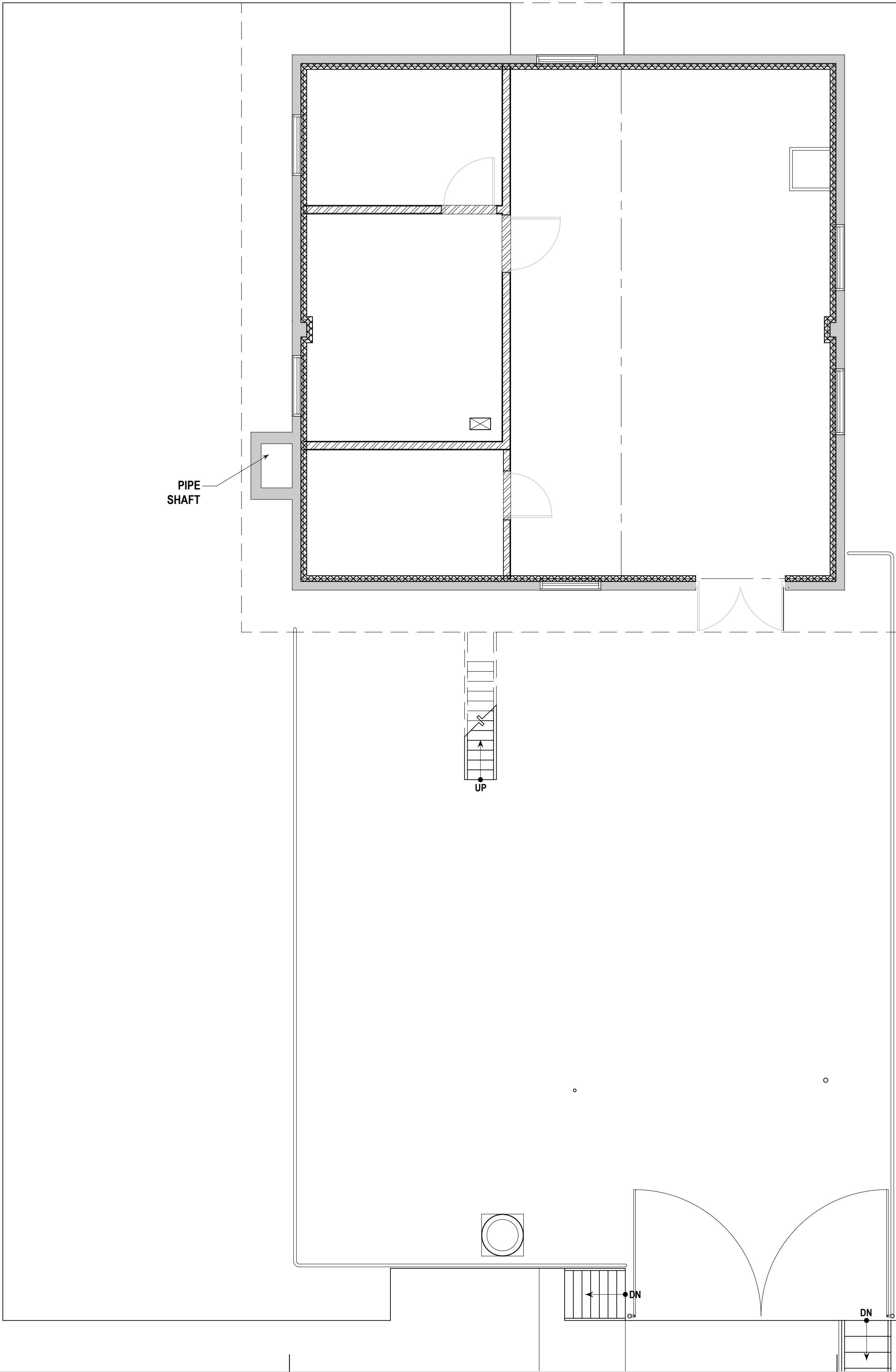
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GOVERNMENT OF PUERTO RICO
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Revisions		SHEET INFO.	
Number	Date	Description	
			Project No.: 19-1837.0
			Set Date: 2021/07/28
			Drawn by:
			Dwg. Date:





LEAD & ASBESTOS ABATEMENT SECOND FLOOR PLAN
SCALE: 1/4"=1'-0"

LEGEND:

- PIPES PROPER REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.
- PIPES PERIMETER PAINT ENCAPSULATION SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PERFORMED BY THE CONTRACTOR.
- NO WORKS SUCH AS SCRAPPING OR REMOVAL OF EXISTING PAINT IN WALLS AND COLUMNS LOCATED AT THE PIPE GALLERY ROOM , PUMP AND HEADER ROOM SHALL BE PERFORMED AT A HEIGHT BETWEEN 0'-0" TO 5'-0" PAINT ENCAPSULATION AND NEW SURFACE PAINT SHALL BE PERFORMED UNLESS DEMOLITION IS SPECIFIED.
- NO WORKS SUCH AS SCRAPPING OR REMOVAL OF EXISTING PAINT IN STAIRS STEPS, HAND RAILS AND WALLS LOCATED BETWEEN FIRST FLOOR AND PUMP AND HEADER ROOM STAIRS SHALL BE PERFORMED PAINT ENCAPSULATION SHALL BE PERFORMED AND NEW SURFACE PAINT UNLESS DEMOLITION IS SPECIFIED.

NOTES:

- CONTRACTOR SHALL PREPARE AND SUBMIT FOR OWNER AND PR ENVIRONMENTAL QUALITY BOARD APPROVAL, A LEAD BASED PAINT REMOVAL ABATEMENT PLAN.
- CONTRACTOR SHALL FOLLOW INDICATIONS ON ASBESTOS AND LEAD BASED PAINT INSPECTION REPORT PREPARED BY NORTOL ENVIRONMENTAL ON SEPTEMBER 2019.
- CONTRACTOR SHALL REMOVE ENCAPSULATE AND OR DISPOSE AS REQUIRED OF LEADBASED PAINTED MATERIALS ACCORDING TO CURRENT STATE AND FEDERAL REGULATIONS.
- ENCAPSULATION SHALL BE PERFORMED WITH APPROVED U.S. HOUSING DEPT. (HUD) LEAD ENCAPSULANT COATING AND THEN NEW SURFACED PAINT APPLIED ON PIPES AND WALLS.
- NO WORKS SUCH AS SCRAPPING OR REMOVAL OF EXISTING PAINT IN WALLS LOCATED AT SECOND FLOOR SHALL BE PERFORMED AT A HEIGHT BETWEEN 0'-0" TO 5'-0".
- WOOD COMPONENTS REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.

GRAPHIC SCALE = 1/4" = 1'

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DATE ISSUE
JULY 30, 2021
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YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DGPM.

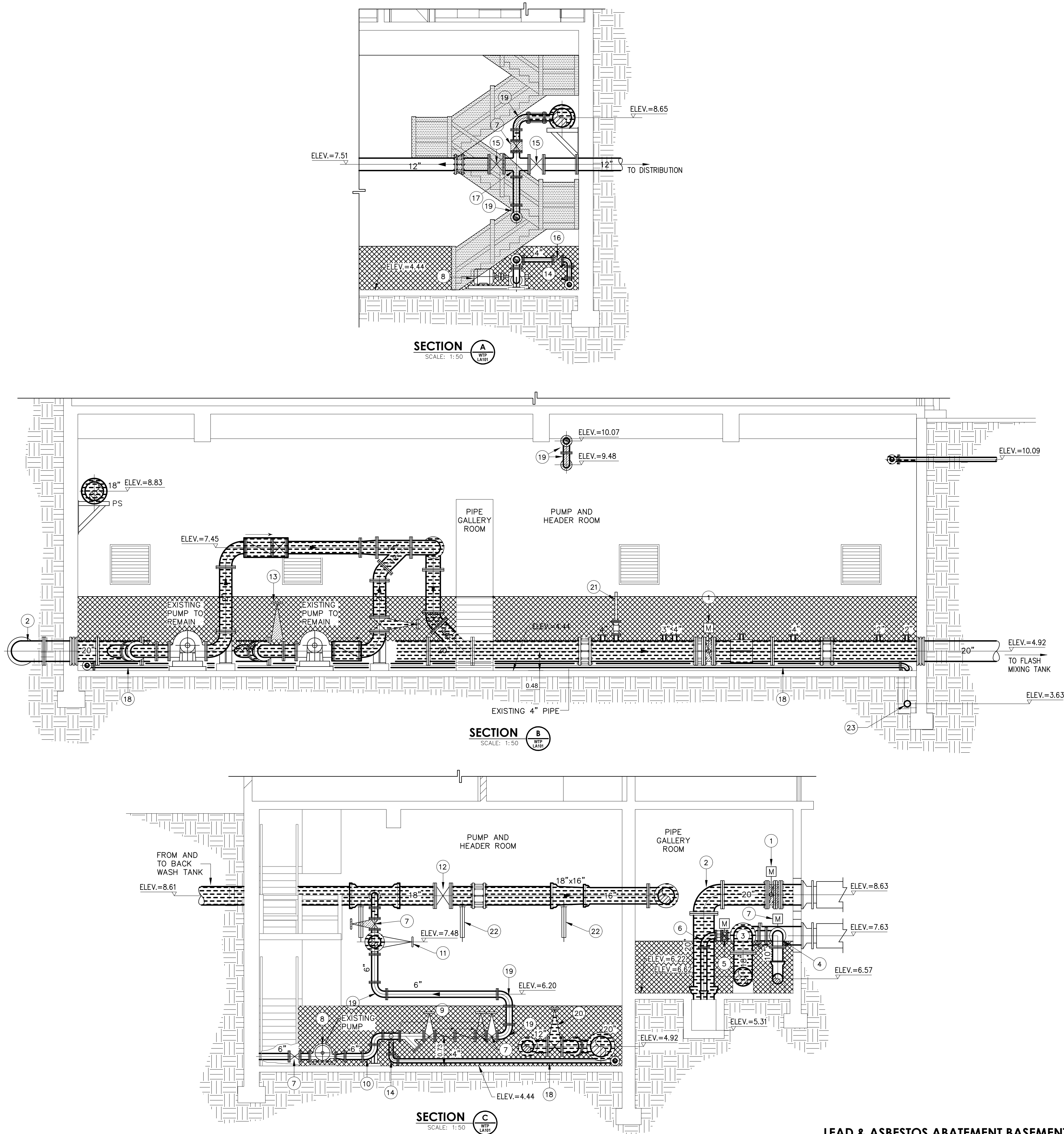
Revisions		SHEET INFO.	
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		Project No.: 19-1837-0	Set Date: 20210728
		Drawn by:	Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

Drawing Title:



- LEGEND:**
- PIPES PROPER REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.
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Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: CERRA & NAGUARO, PUERTO RICO

Drawing Title: WATER TREATMENT PLANT

Sheet: WTP-LA201

Revisions

Number	Date	Description
1	2021/07/28	CONTRACTOR SHALL PREPARE AND SUBMIT FOR OWNER AND PR ENVIRONMENTAL QUALITY BOARD APPROVAL, A LEAD BASED PAINT REMOVAL ABATEMENT PLAN.
2	2021/07/28	CONTRACTOR SHALL FOLLOW INDICATIONS ON ASBESTOS AND LEAD BASED PAINT INSPECTION REPORT PREPARED BY NORTOL ENVIRONMENTAL ON SEPTEMBER 2019.
3	2021/07/28	CONTRACTOR SHALL REMOVE ENCAPSULATE AND OR DISPOSE AS REQUIRED OF LEADBASED PAINTED MATERIALS ACCORDING TO CURRENT STATE AND FEDERAL REGULATIONS.
4	2021/07/28	ENCAPSULATION SHALL BE PERFORMED WITH APPROVED U.S. HOUSING DEPT. (HUD) LEAD ENCAPSULANT COATING AND THEN NEW SURFACED PAINT APPLIED ON PIPES AND WALLS.
5	2021/07/28	NO WORKS SUCH AS SCRAPING OR REMOVAL OF EXISTING PAINT IN WALLS LOCATED AT SECOND FLOOR SHALL BE PERFORMED AT A HEIGHT BETWEEN 0'-0" TO 5'-0".
6	2021/07/28	WOOD COMPONENTS REMOVAL AND DISPOSAL SHALL BE PERFORMED FOLLOWING THE LEAD BASED PAINT ABATEMENT PLAN TO BE PREPARED BY CONTRACTOR.

SHEET INFO.

Project No.: 19-1637.0

Set Date: 2021/07/28

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Doc. Date: [blank]

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Local Redevelopment Authority

for Roosevelt Roads

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Local Redevelopment Authority

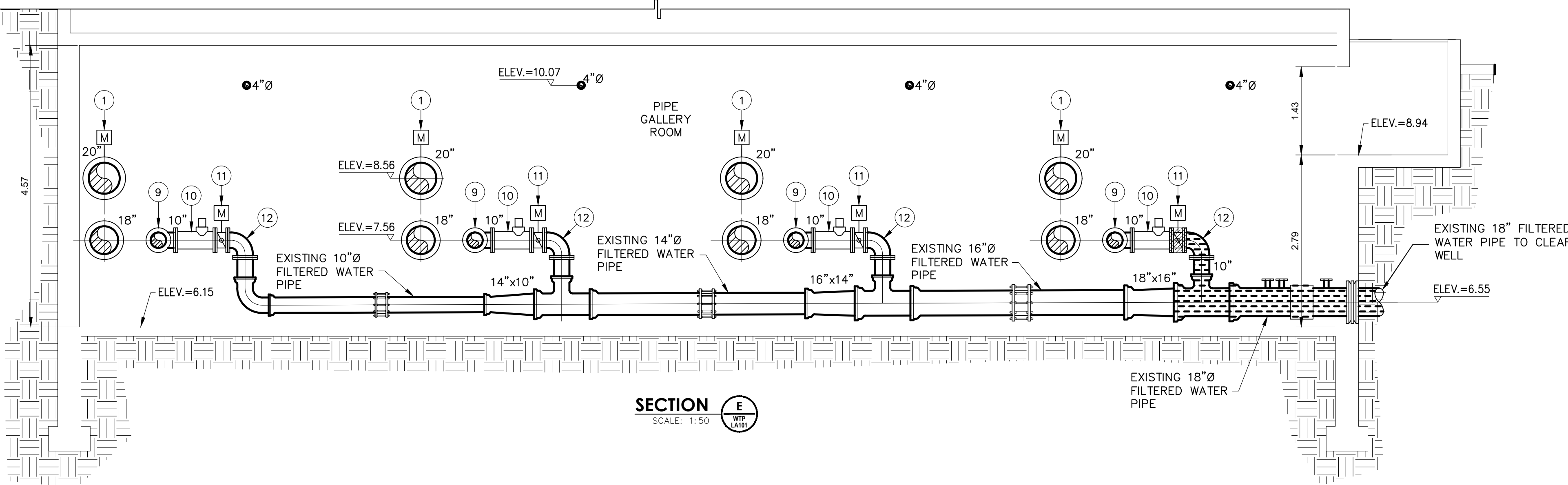
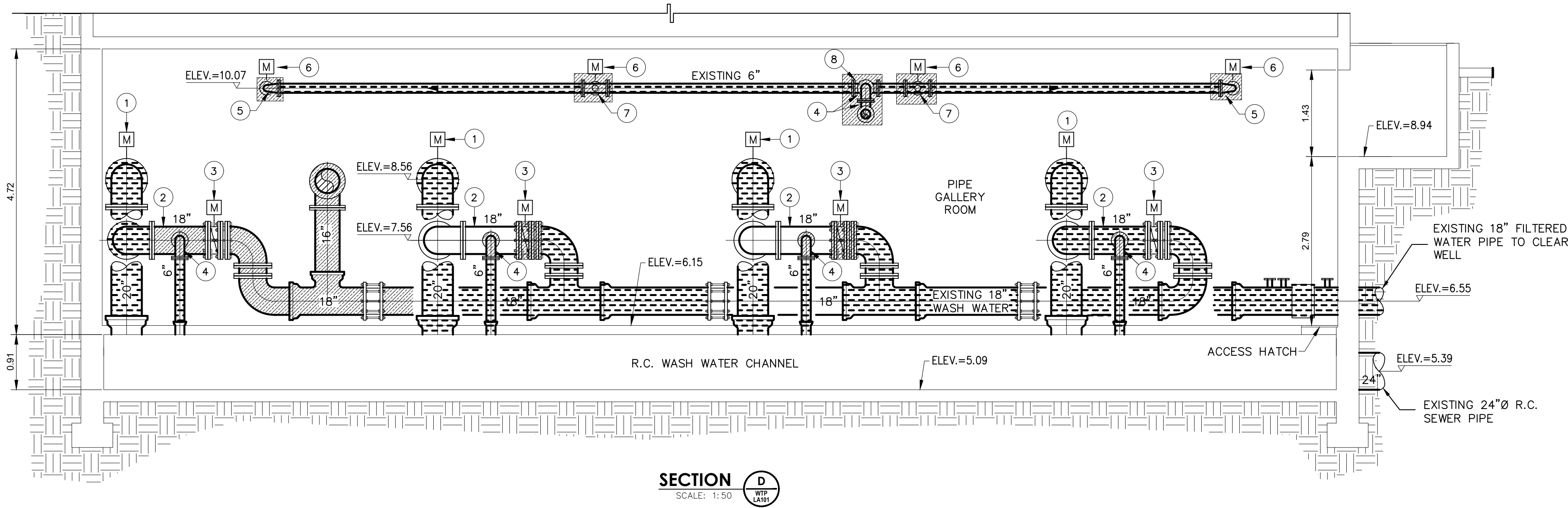
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DATE ISSUE

► JULY 30, 2021 ◀

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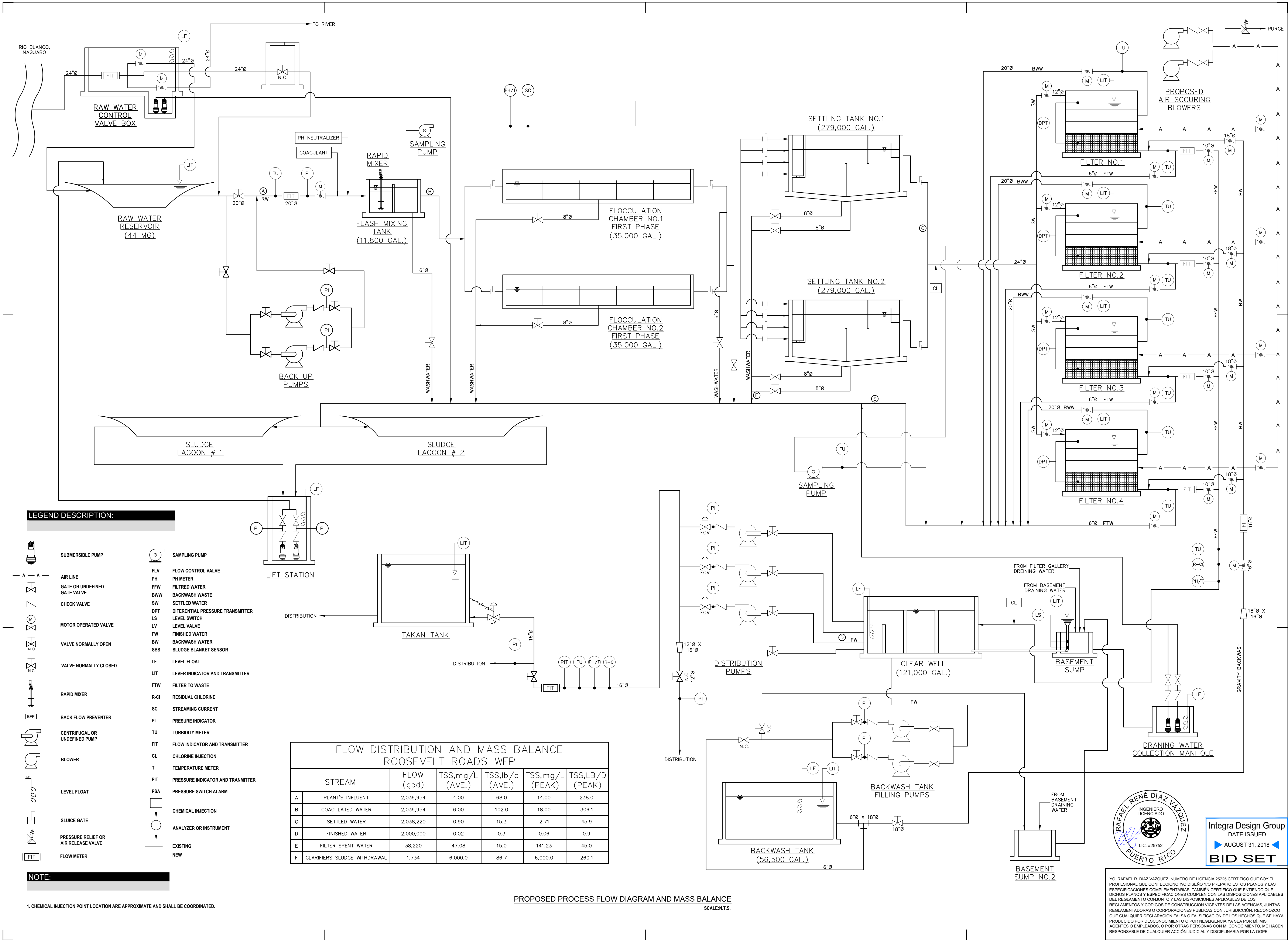
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LEAD & ASBESTOS ABATEMENT BASEMENT SECTIONS
SCALE: 1/4"=1'-0"

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1637.0	Set Date: 20210728
		Drawn by:	Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions

Number	Date	Description
1	2018/08/31	Project Ndg-1837.0 Set Date 2018/08/31 Drawn by RDV Dwg. Date:

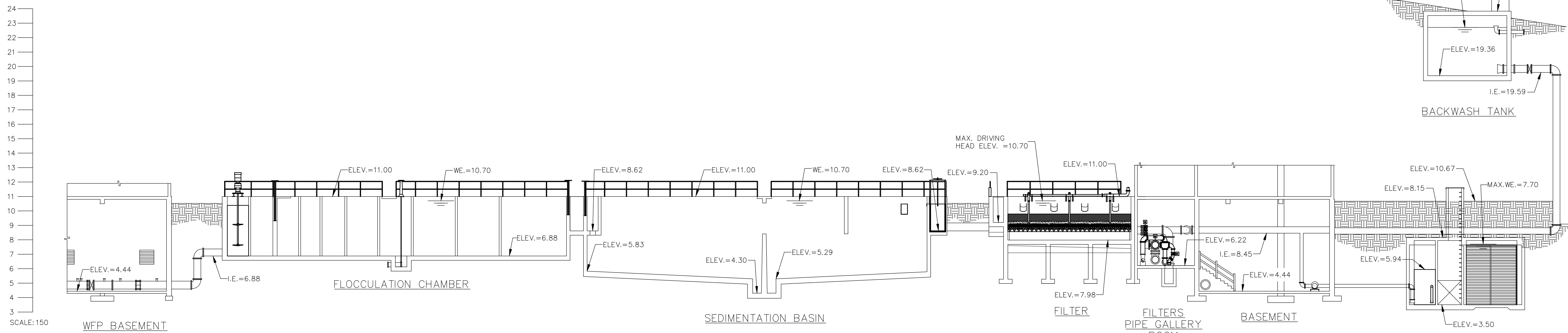
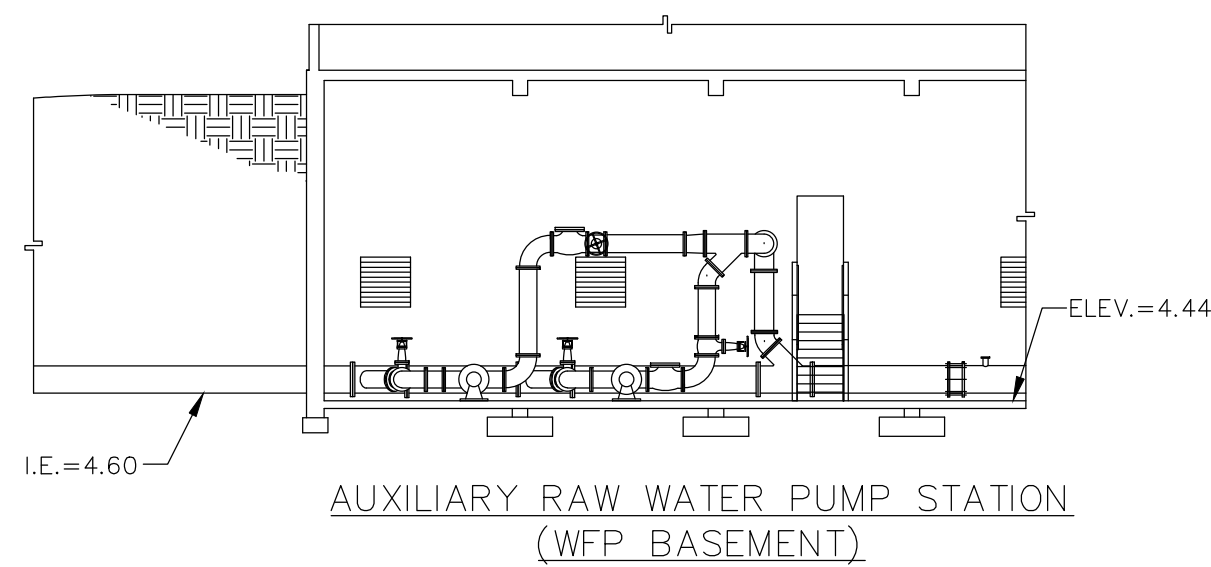
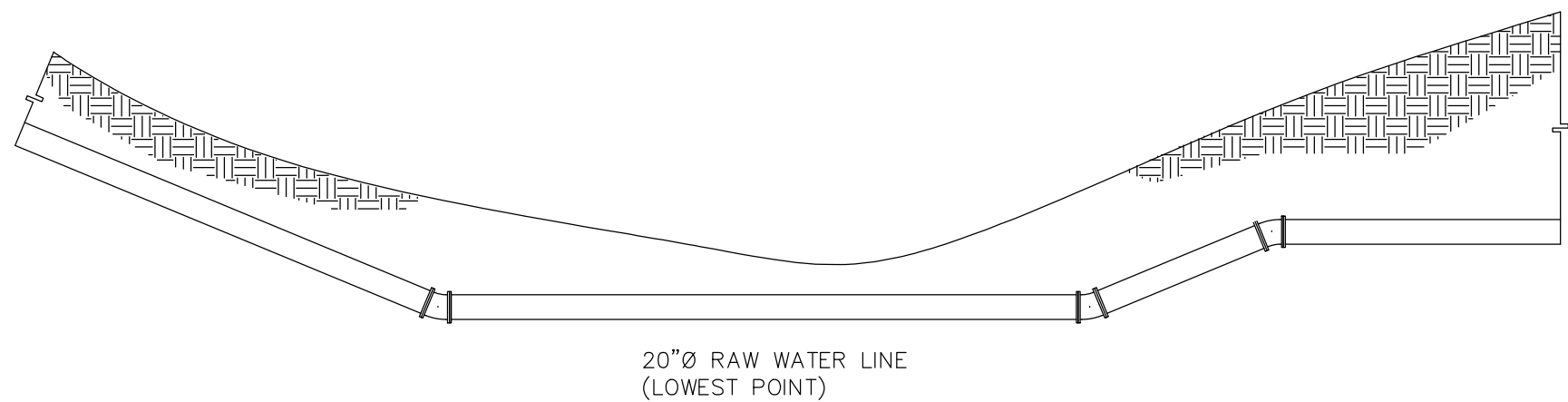
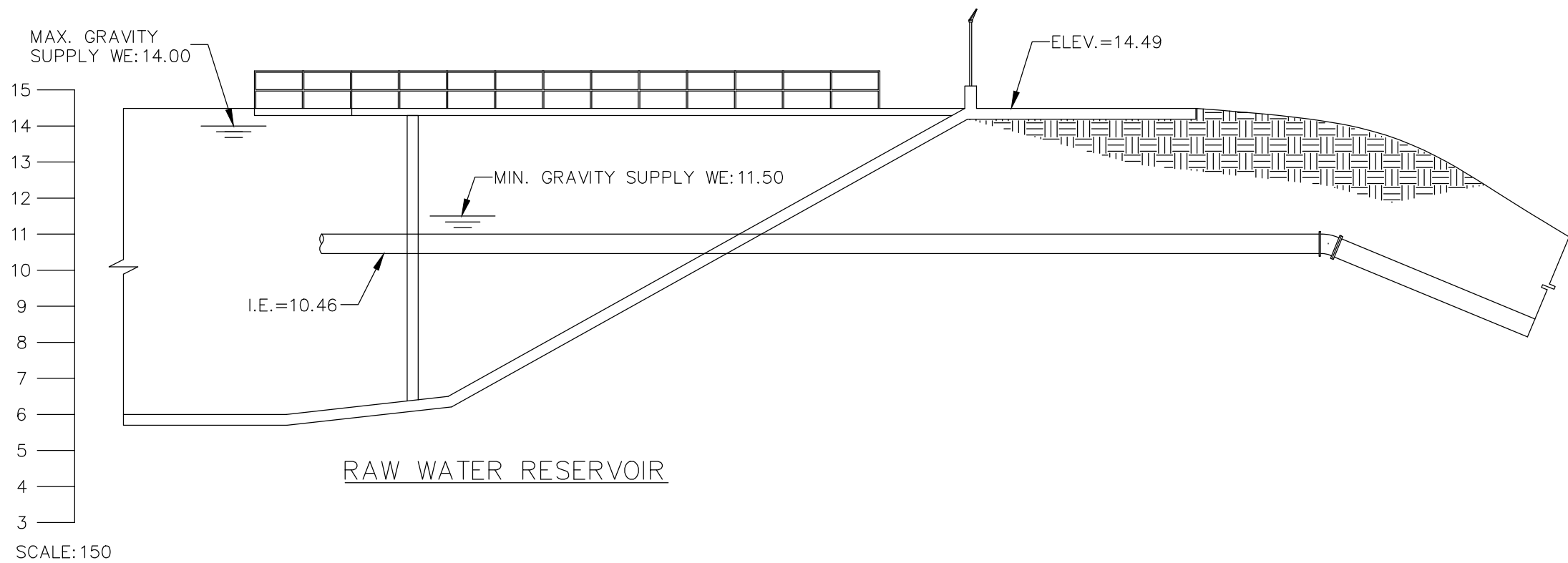
Integral Design Group
DATE ISSUED
AUGUST 31, 2018
BID SET

RAFAEL RENÉ DIAZ VÁZQUEZ
INGENIERO LICENCIADO
LIC. #25752
PUERTO RICO

YO, RAFAEL R. DIAZ VÁZQUEZ, NUMERO DE LICENCIA 25752 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PÚBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCUIDO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

WTP-PG100

PROPOSED PROCESS FLOW DIAGRAM AND MASS BALANCE



PROPOSED HYDRAULIC PROFILE
SCALE: 1:150



Integra Design Group
DATE ISSUED
JULY 30, 2021
BID SET

YO, RAFAEL R. DÍAZ VÁZQUEZ, NUMERO DE LICENCIA 28725 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACIÓN FALSA O FALSIFICACIÓN DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCIÓN JUDICIAL Y DISCIPLINARIA POR LA OGPE.

SHEET INFO.		
Project No.:	18-1637.0	
Set Date:	2018/08/31	
Drawn by:		
Dwg. Date:		

Revisions		
Number	Date	Description

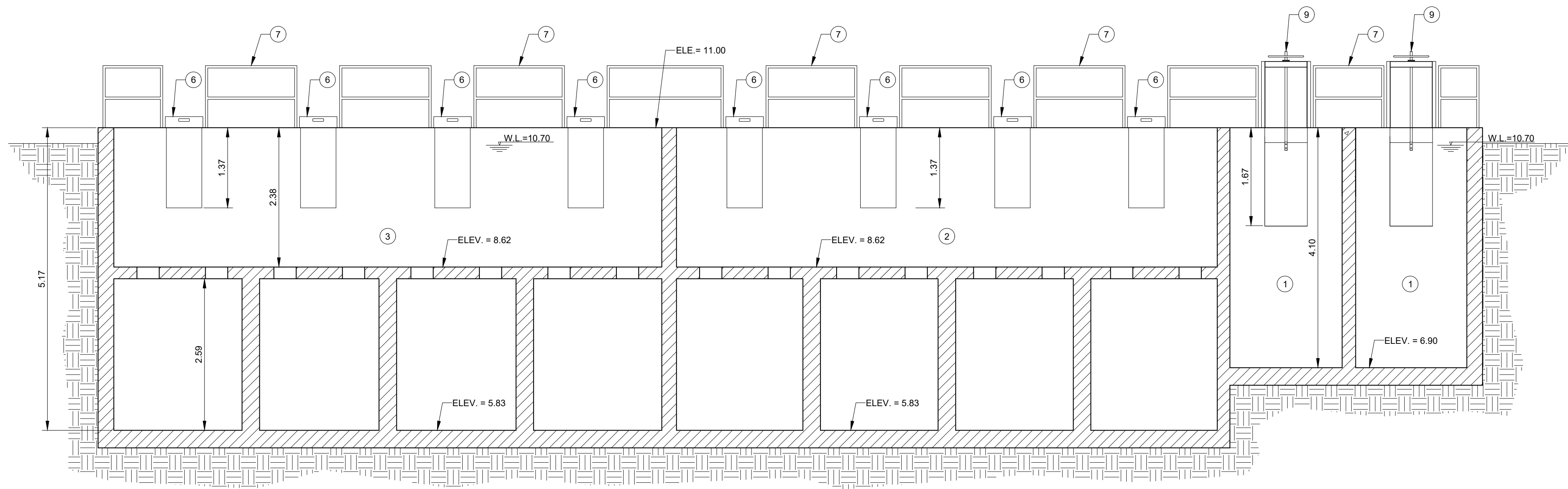
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



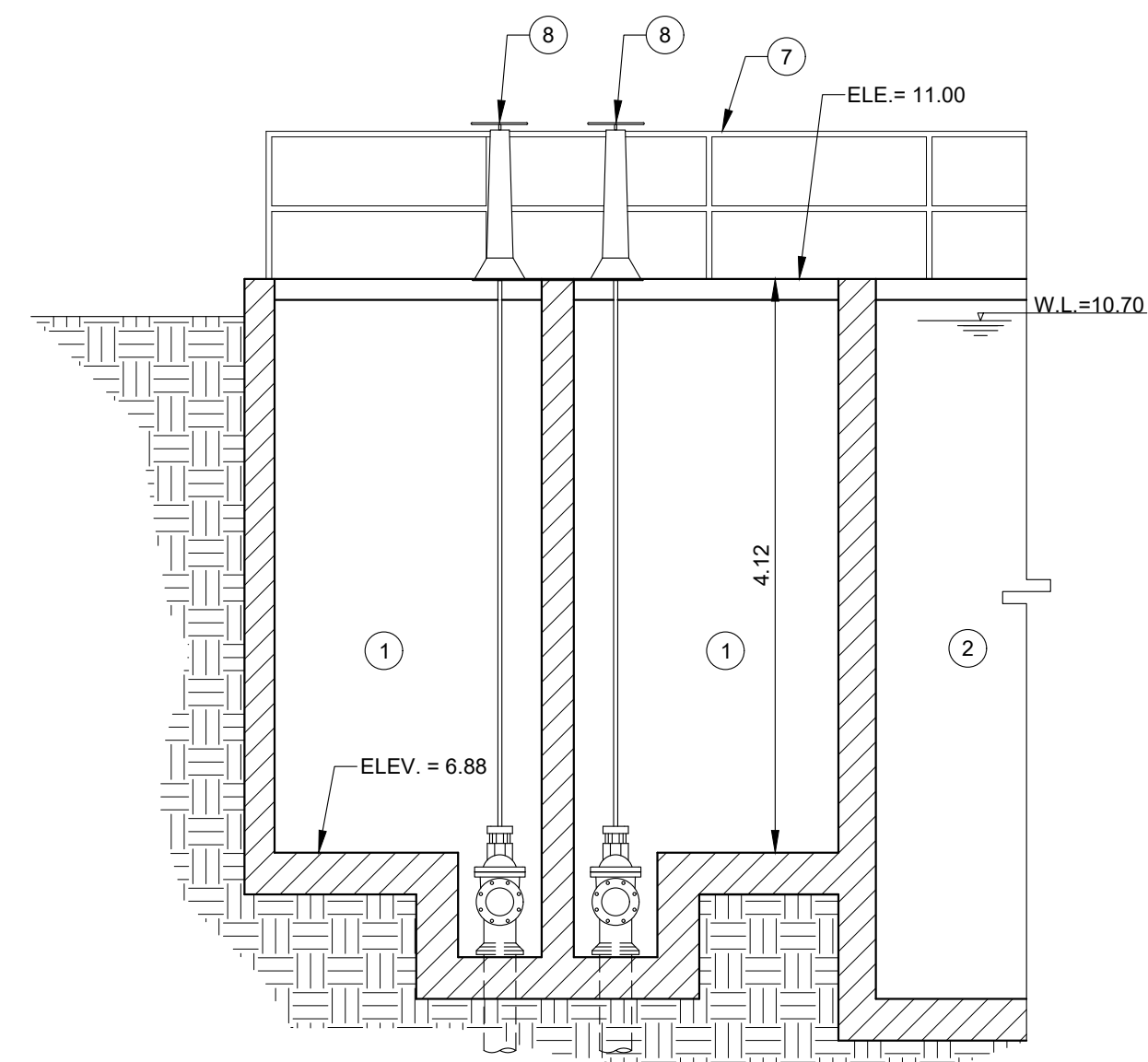
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Project Title:
Sheet:

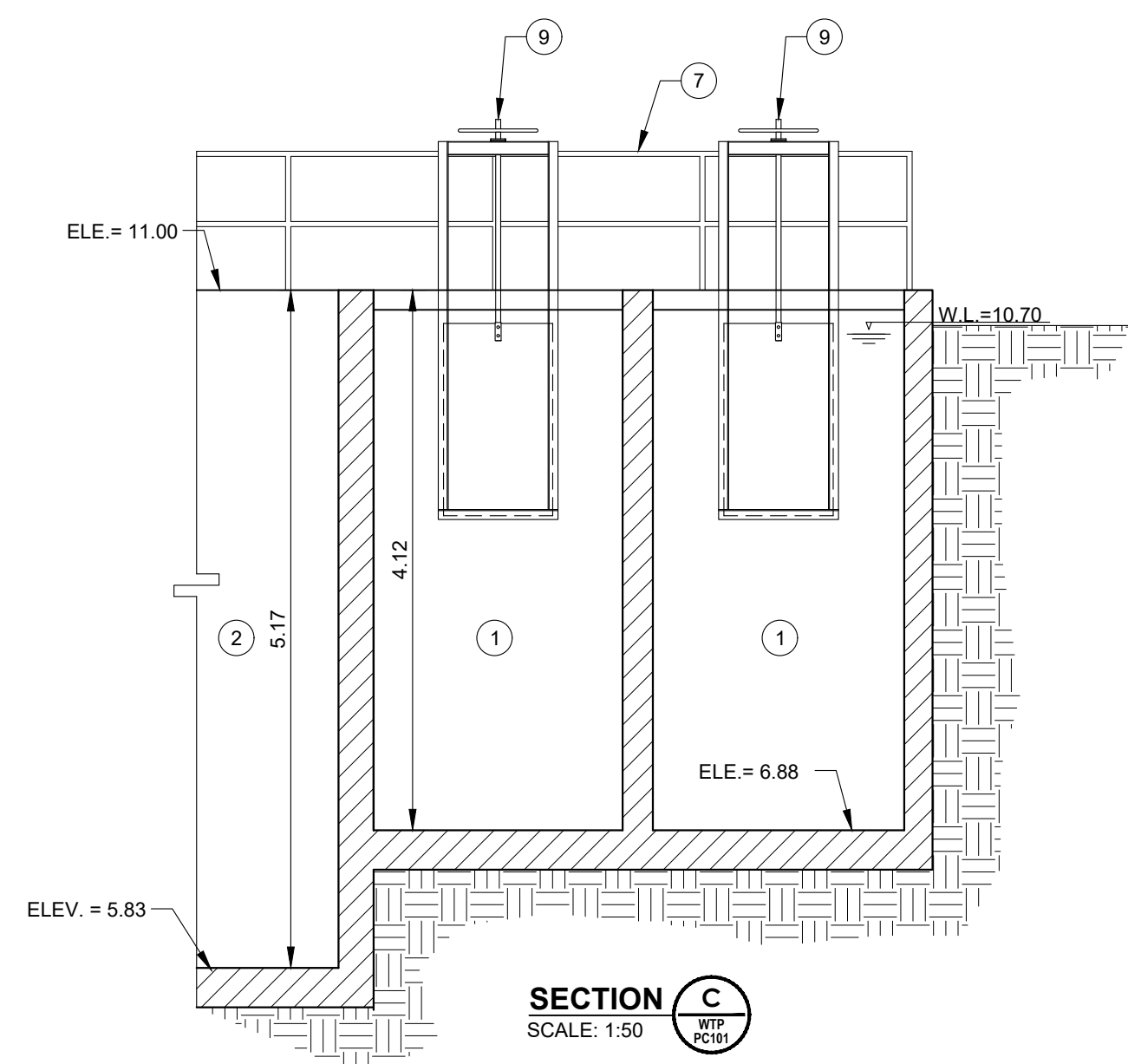
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PROPOSED HYDRAULIC PROFILE



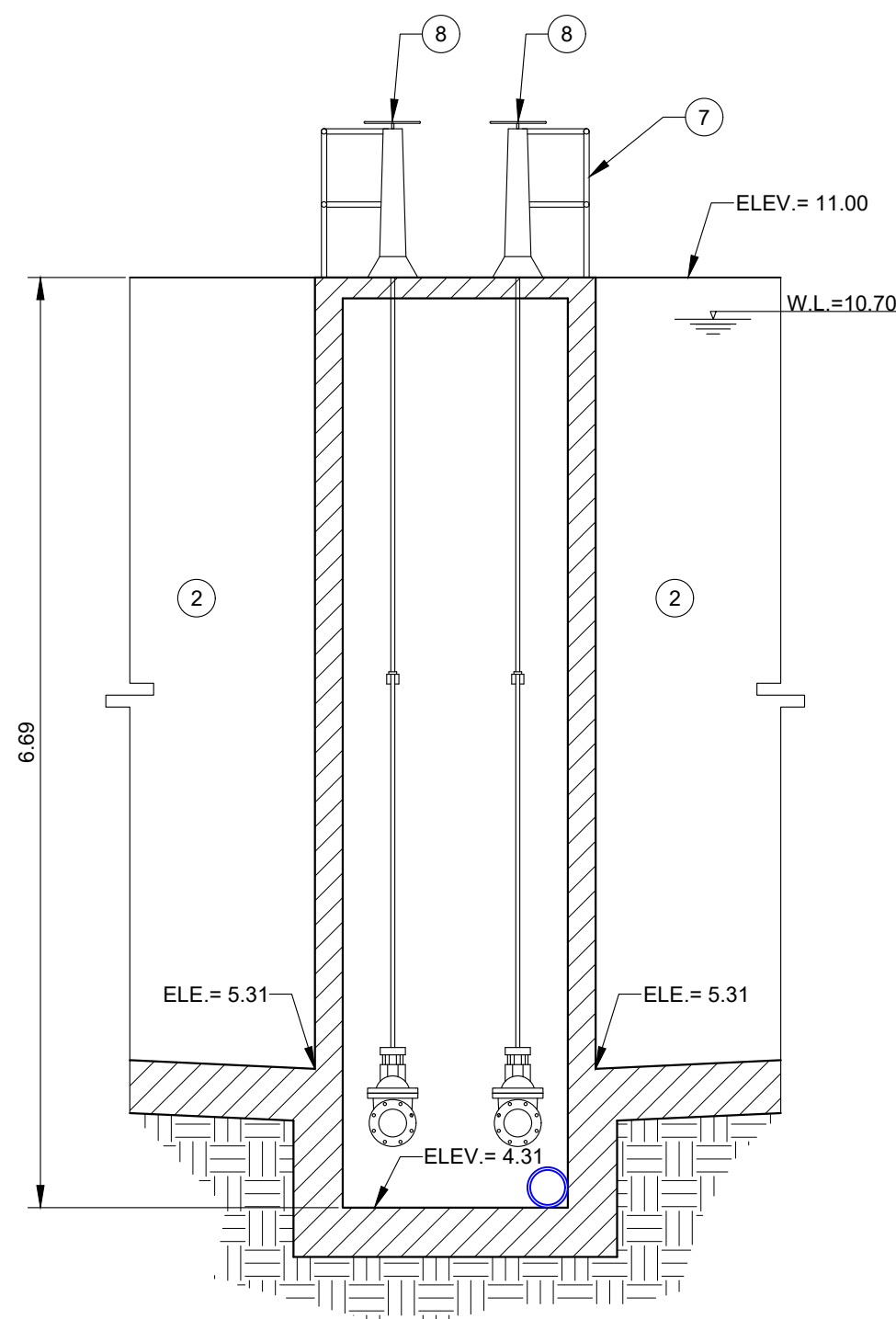
SECTION A
SCALE: 1:50
WTP-PC109



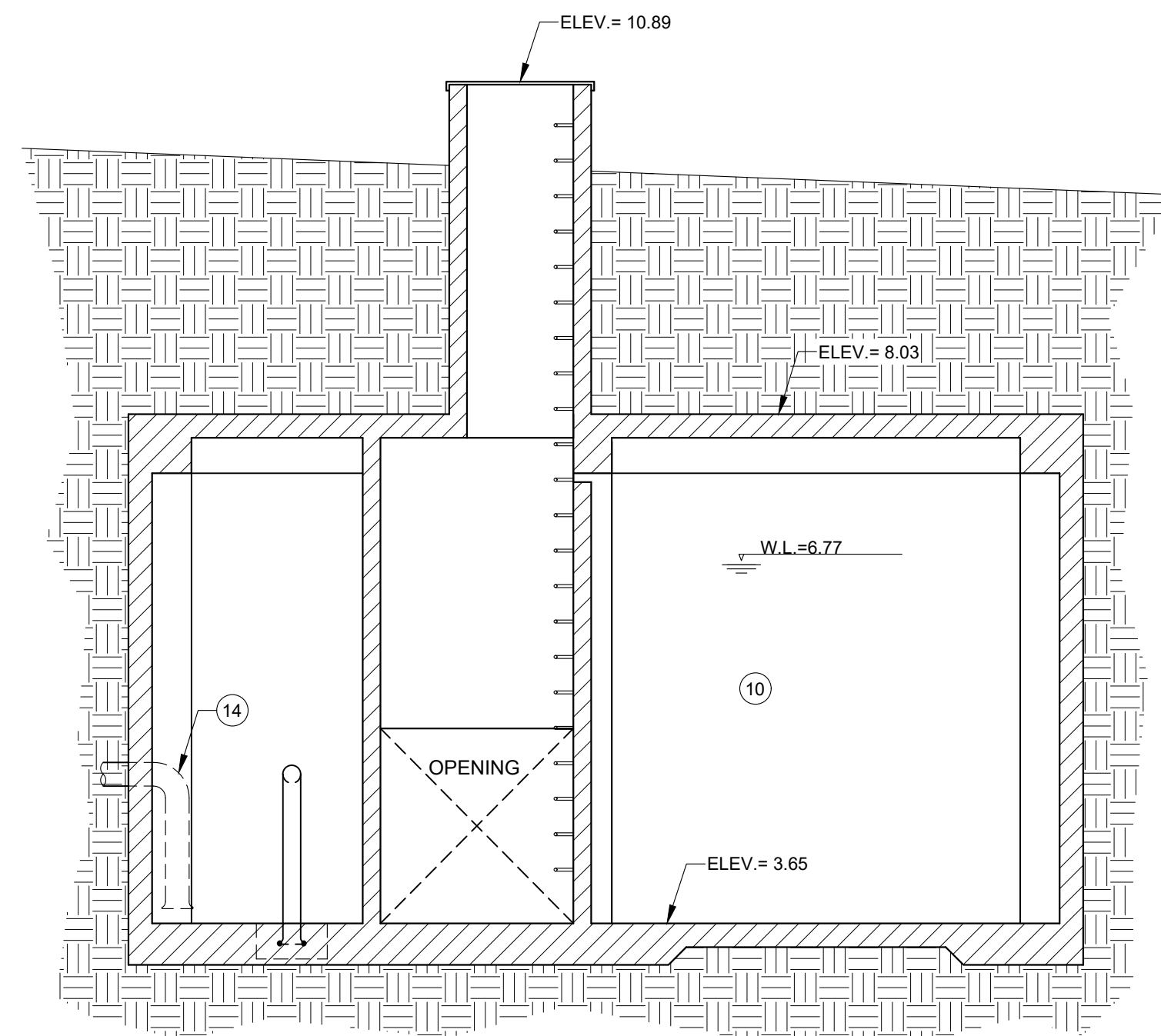
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WTP-PC110



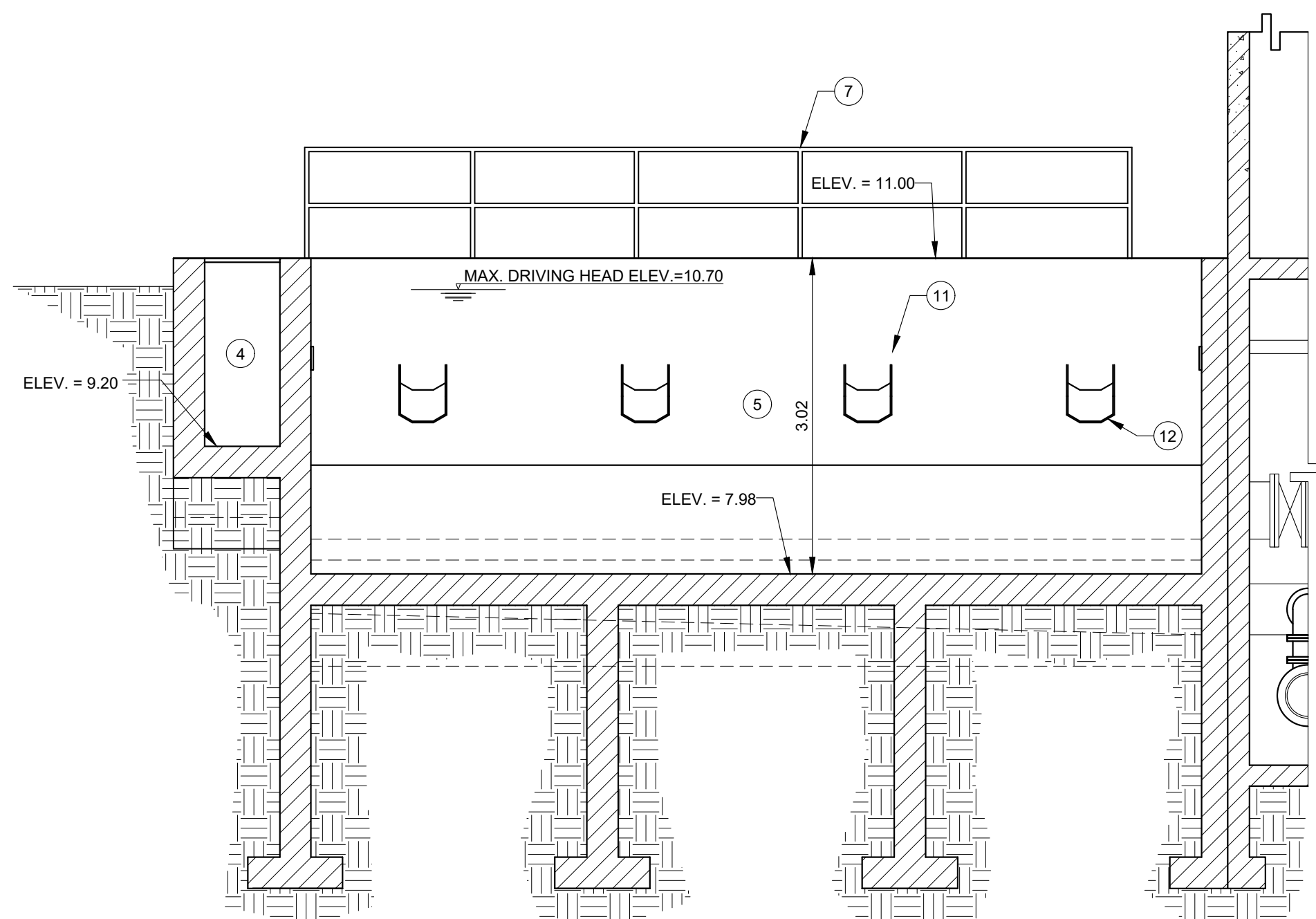
SECTION C
SCALE: 1:50
WTP-PC111



SECTION D
SCALE: 1:50
WTP-PC112



SECTION E
SCALE: 1:50
WTP-PC113



SECTION F
SCALE: 1:50
WTP-PC114

LEGEND DESCRIPTION:

- 1 FLOCCULATION BASINS TO REMAIN
- 2 SEDIMENTATION BASIN NO.1 TO REMAIN
- 3 SEDIMENTATION BASIN NO.2 TO REMAIN
- 4 FILTERS FLOW DISTRIBUTION CHANNELS TO REMAIN
- 5 FILTER TYPICAL SECTION
- 6 STOP PLATES TO BE REMOVED
- 7 RAILINGS TO BE REMOVED
- 8 DRAIN VALVES TO BE REMOVED
- 9 STOP GATES TO BE REMOVED
- 10 CLEARWELL TANK TO BE RETROFITTED
- 11 SURFACE WATER WASHER TO BE REMOVED
- 12 FILTER CHANNELS
- 13 10"Ø DRAIN PIPE
- 14 DISTRIBUTION PUMPS SUCTION PIPE TO BE MODIFIED



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, EXEL F. COLÓN RIVERA, NUMERO DE LICENCIA 20794 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHA DECLARACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.



Integra Design Group
DATE ISSUE
▶ JULY 30, 2021 ◀
REVISED BID SET

Sheet: Project Title:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

WTP-PC103

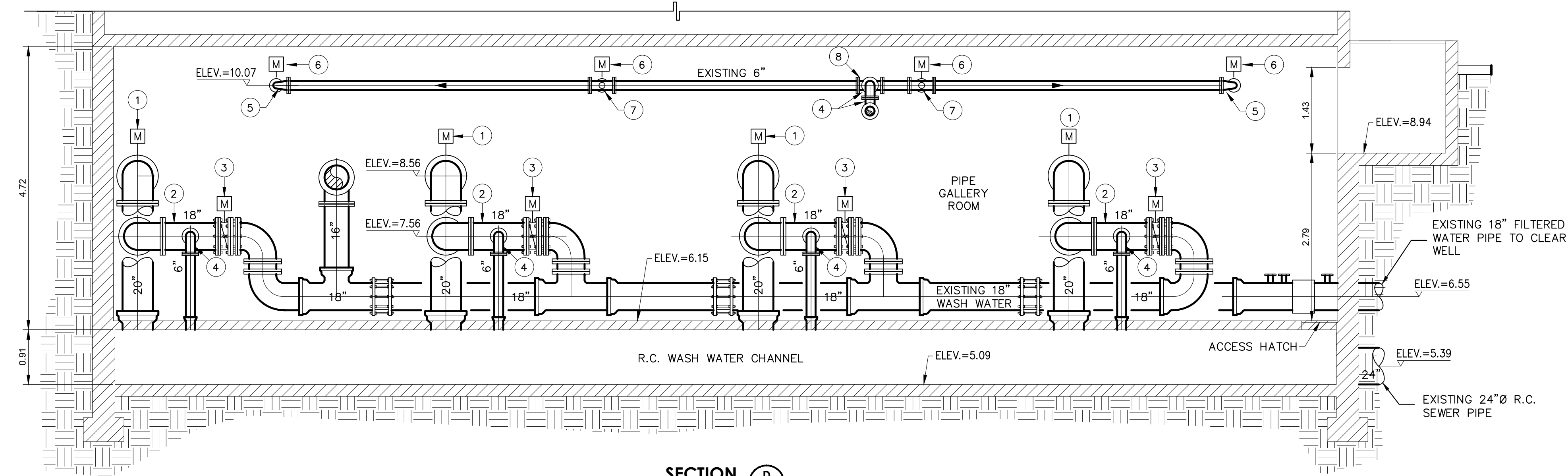
Drawing Title:

EXISTING AND DEMOLITION FILTERS PIPE GALLERY PLAN

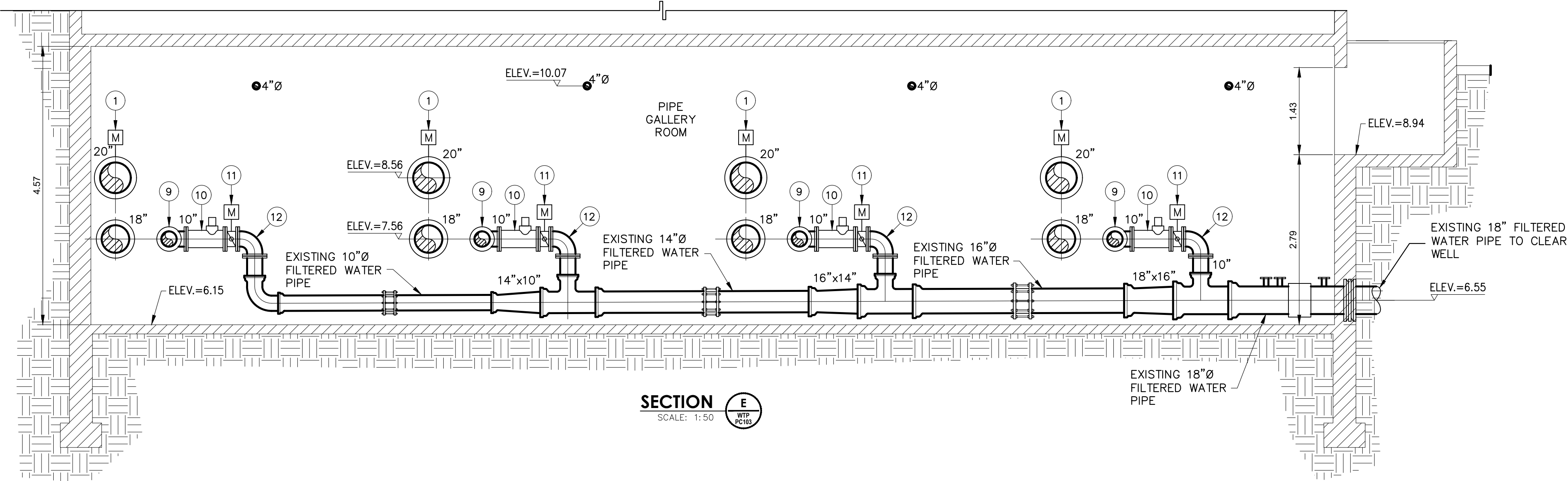
Revisions		SHEET INFO.	
Number	Date	Description	
			Project Nd9-1837.0
			Set Date: 2018/08/31
			Drawn by:
			Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
For Development Needs





SECTION D
SCALE: 1:50



SECTION E
SCALE: 1:50

LEGEND DESCRIPTION:

- 1 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED, TO BE REMOVED
- 2 18"x18"x10"x6" CROSS TEE, FL, TO BE ROTATED
- 3 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED, TO BE REMOVED
- 4 6"Ø 90° BEND, FL, TO BE REMOVED
- 5 6"x4" TO REDUCING ELBOW, FL, TO REMOVED
- 6 4"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED, TO BE REMOVED
- 7 6" x 6" x 4" TEE, FL, TO REMOVED
- 8 6" x 6" x 6" TEE, FL, TO BE REMOVED
- 9 10"Ø 90° BEND, FL TO BE REMOVED
- 10 10"Ø FLOW METER TO BE REMOVED
- 11 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED, TO BE REMOVED
- 12 10"Ø 90° BEND, FL, TO REMAIN

NOTE:

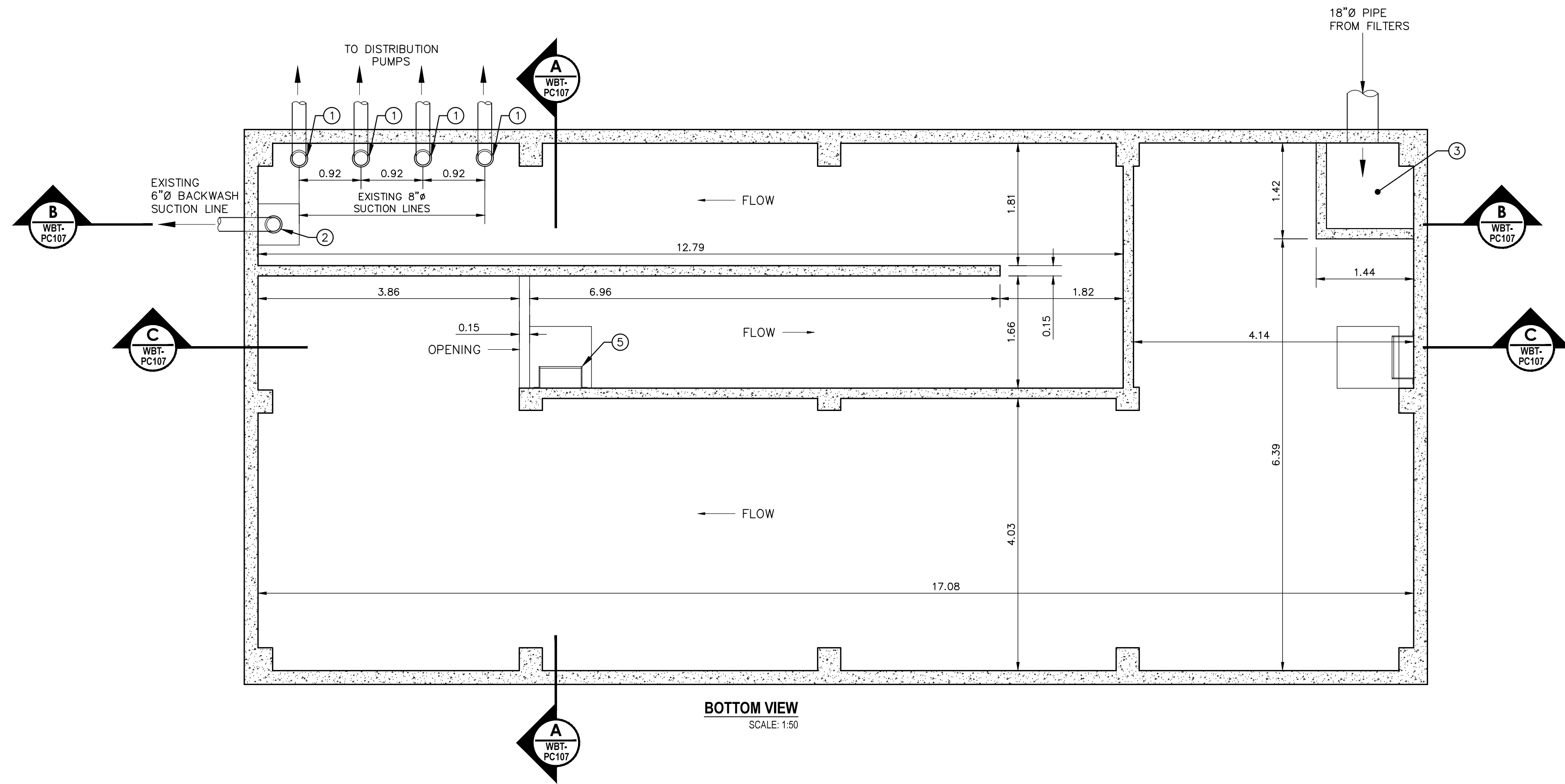
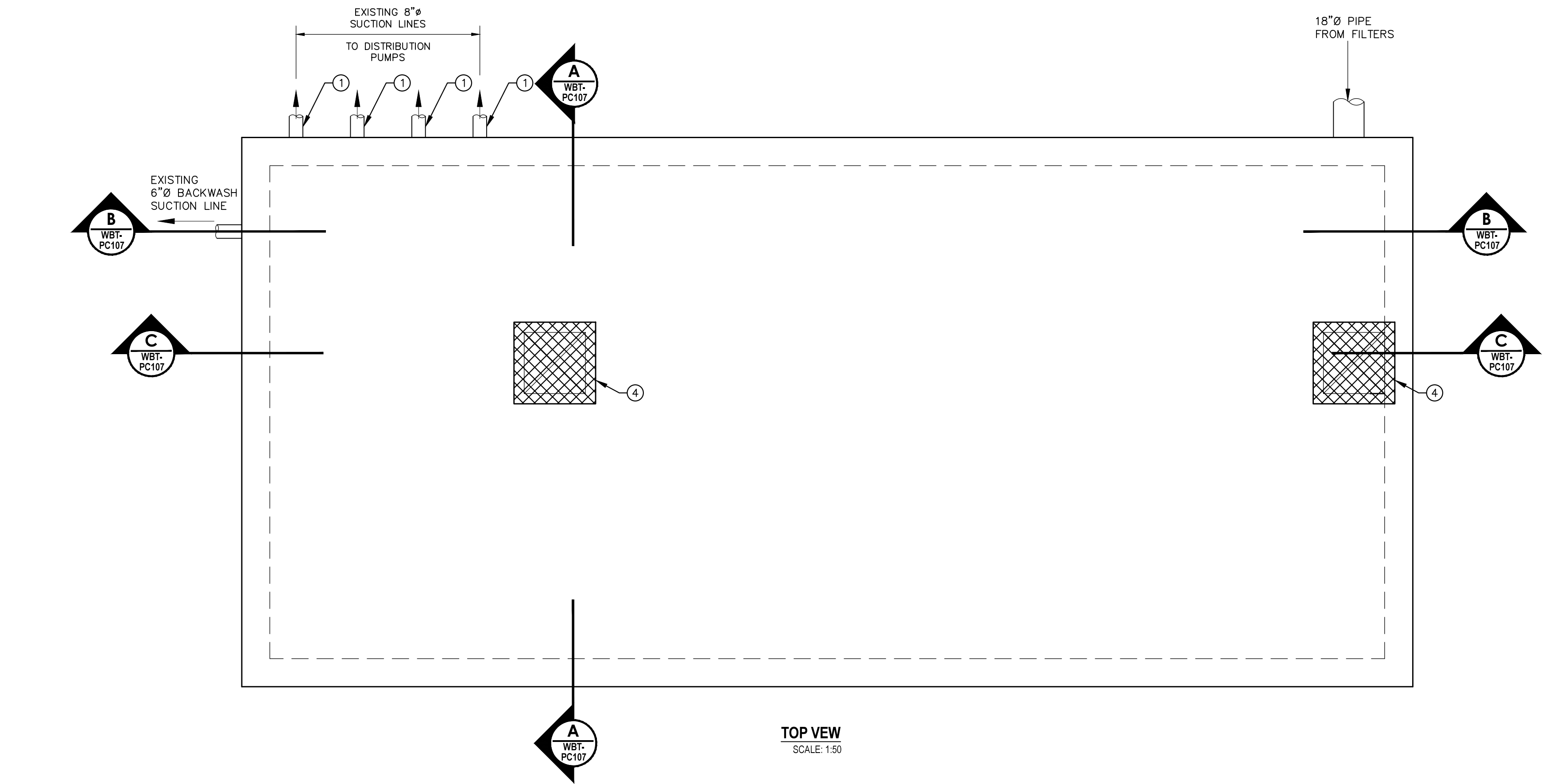
1. ALL MATERIAL AND EQUIPMENT REMOVED FROM EXISTING WORK SHALL BECOME PROPERTY OF THE OWNER. ALL MATERIAL AND EQUIPMENT MARKED BY THE ENGINEER AS PROPERTY OF THE OWNER SHALL BE CAREFULLY REMOVED AND DELIVERED BY THE CONTRACTOR TO A PLANT SITE DESIGNATED BY THE OWNER. REFER TO TECHNICAL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. THIS DRAWING IS THE RESULT OF A SITE INVESTIGATION AND HISTORICAL CONSTRUCTION DRAWING COMPILATION. CONTRACTOR SHALL BE RESPONSIBLE TO REVISE EXISTING INFRASTRUCTURE AT SITE.



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YO, EXEL F. COLÓN RIVERA, NUMERO DE LICENCIA 20794 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA; Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions	Number	Date	Description	SHEET INFO.
				Project Ndg-1837.0
				Set Date 2018/09/31
				Drawn by:
				Dwg. Date:



LEGEND DESCRIPTION:

- 1 8"Ø SUCTION LINE TO BE REMOVED
- 2 6"Ø SUCTION LINE TO BE REMOVED
- 3 INFLUENT BOX TO REMAIN
- 4 ACCESS HATCH TO BE REMOVED
- 5 LADDER STEPS TO BE REMOVAL

ITEM TO BE REMOVED

NOTE:

1. THIS DRAWING IS THE RESULT OF A SITE INVESTIGATION AND HISTORICAL CONSTRUCTION DRAWING COMPILATION. CONTRACTOR SHALL BE RESPONSIBLE TO REVISE EXISTING INFRASTRUCTURE AT SITE.



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JULY 30, 2021
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Revisions	
Number	Date

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



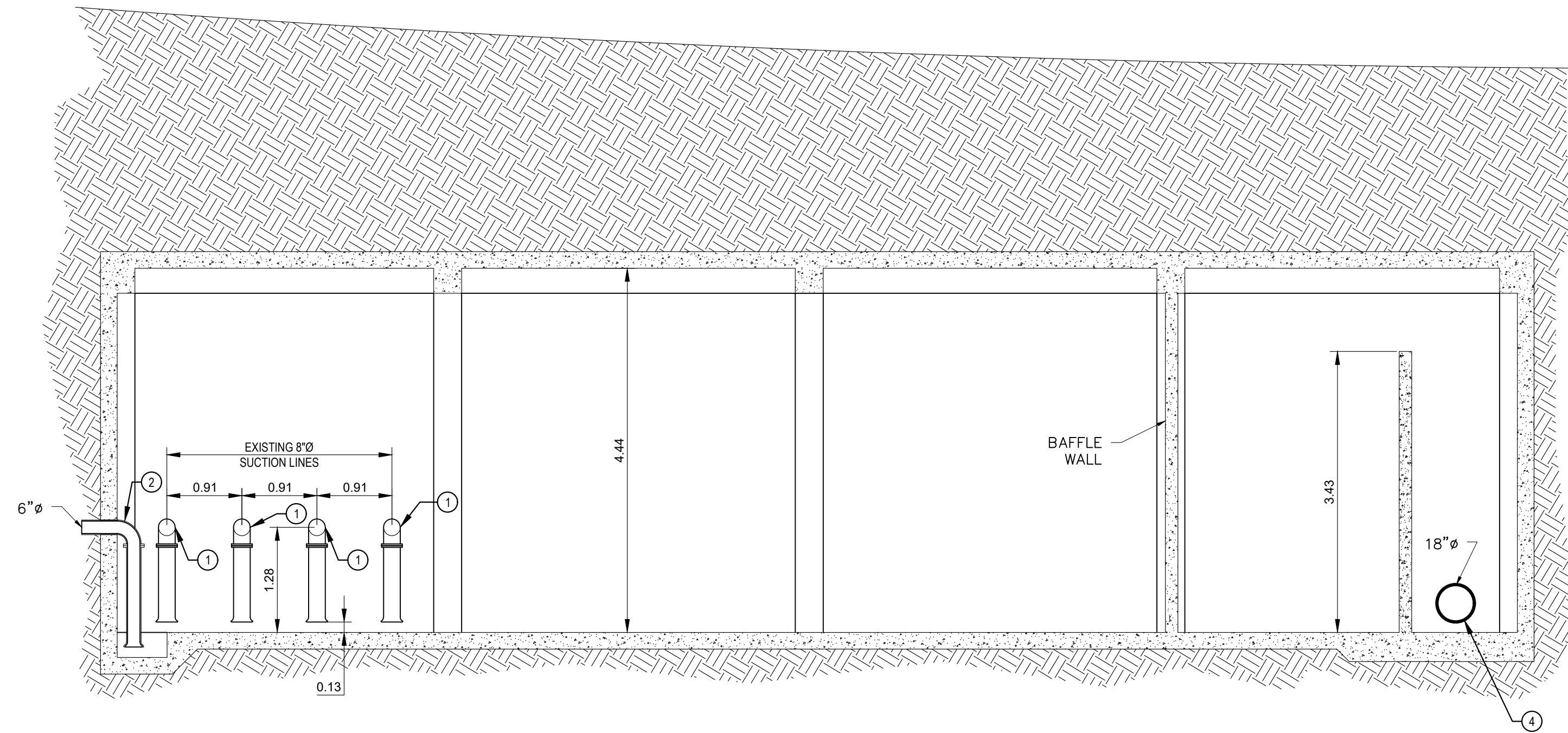
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Project Title:

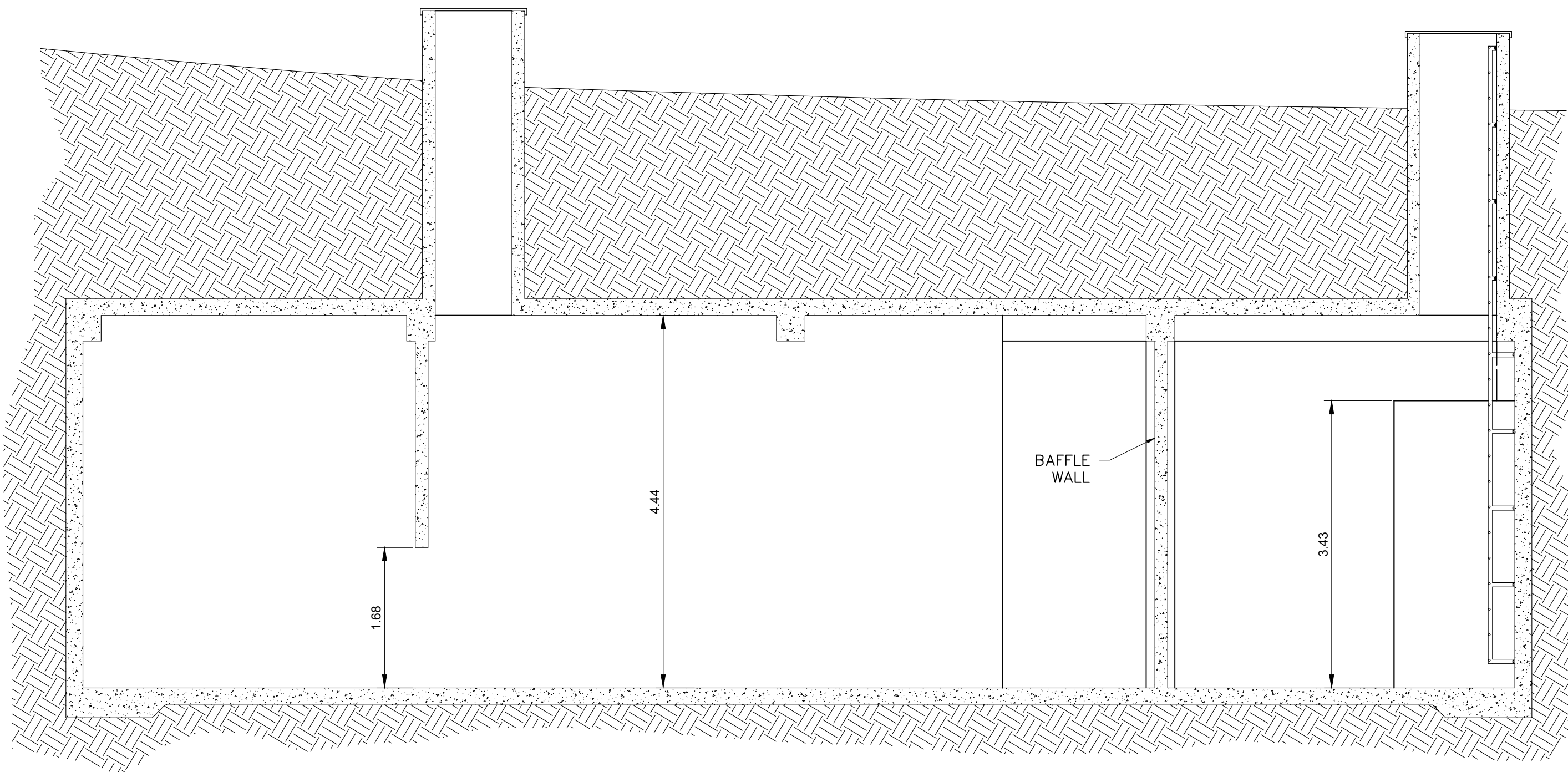
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Drawing Title:
EXISTING + DEMOLITION CLEARWELL TOP & BOTTOM PLAN

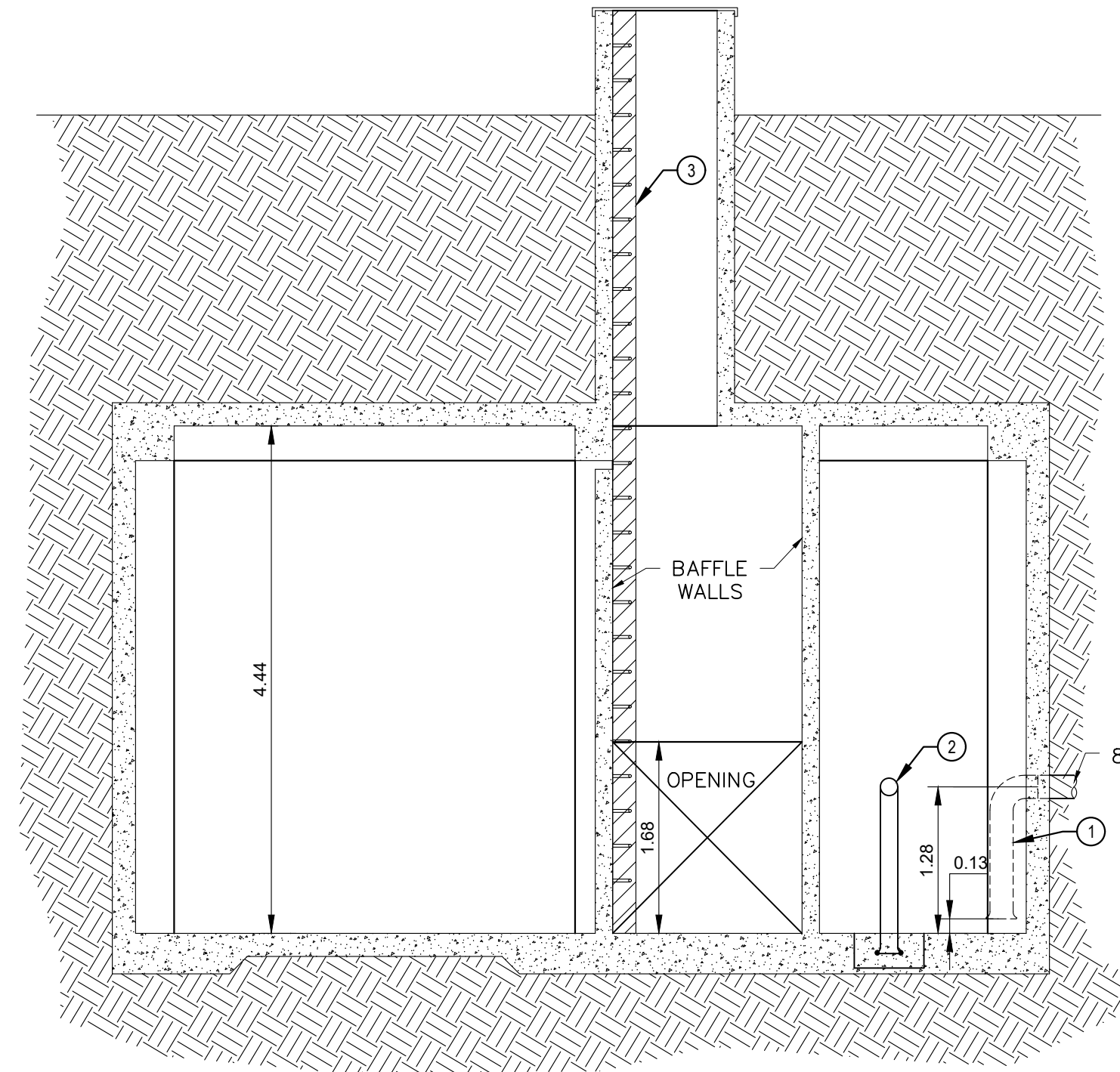
WTP-PC106



SECTION **B**
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WTP-PC107



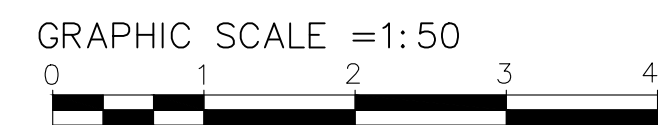
SECTION **C**
SCALE: 1:50
WTP-PC107



SECTION **A**
SCALE: 1:50
WTP-PC107

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- ① 8"ø SUCTION PIPE TO BE MODIFIED
- ② 6"ø SUCTION PIPE TO BE MODIFIED
- ③ STAIR TO BE REMOVED
- ④ INFLUENT PIPE TO REMAIN



Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, EXEL F. COLÓN RIVERA, NUMERO DE LICENCIA 20794 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA; Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No: 1837.0	
		Set Date: 2019/09/31	
		Drawn by:	
		Dwg. Date:	

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

Project Title:

Sheet:

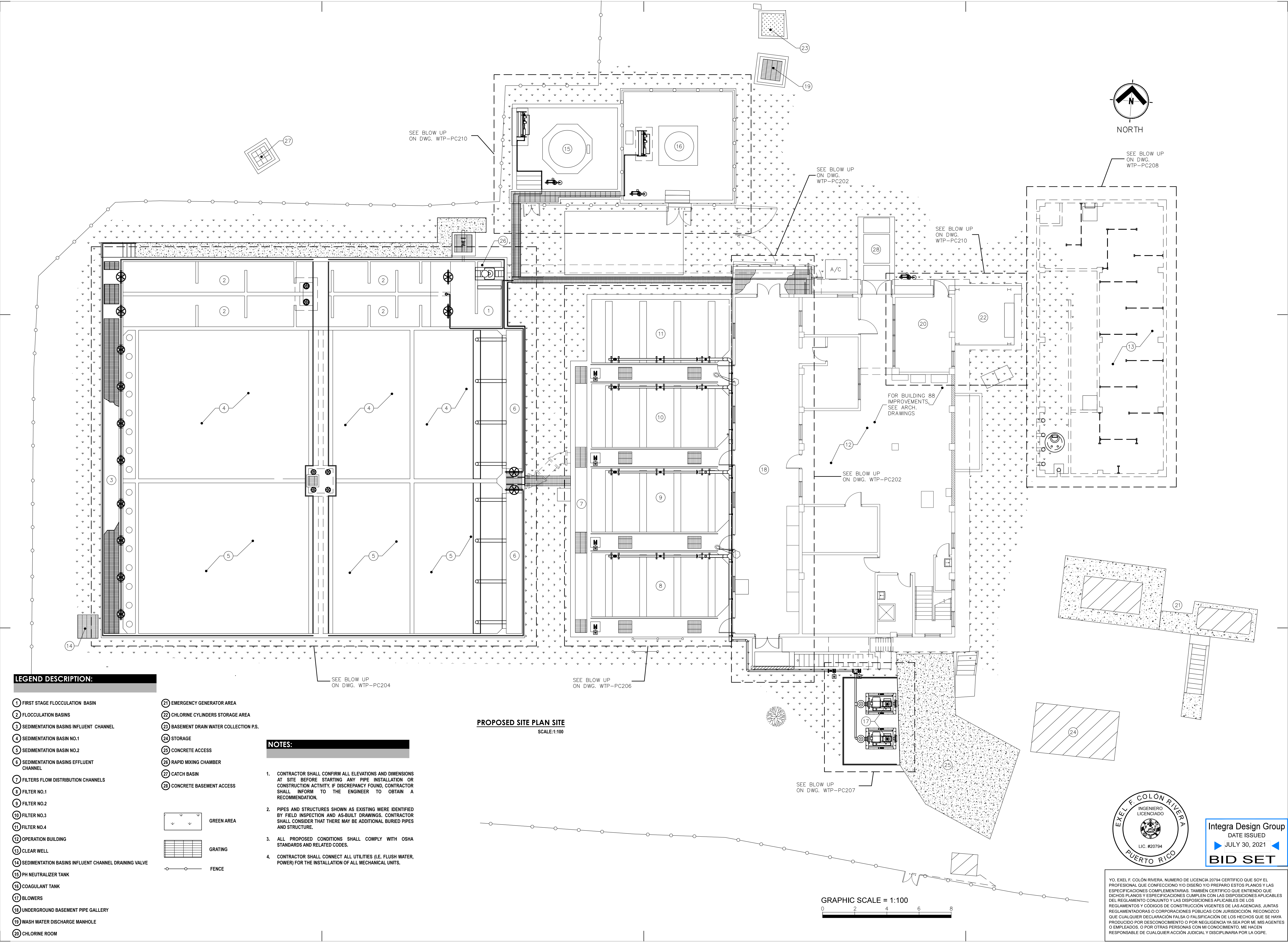
Drawing Title:

EXISTING + DEMOLITION SECTIONS

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WTP-PC107



LEGEND DESCRIPTION:

- 1 FIRST STAGE FLOCCULATION BASIN
- 2 FLOCCULATION BASINS
- 3 SEDIMENTATION BASINS INFLUENT CHANNEL
- 4 SEDIMENTATION BASIN NO.1
- 5 SEDIMENTATION BASIN NO.2
- 6 SEDIMENTATION BASINS EFFLUENT CHANNEL
- 7 FILTERS FLOW DISTRIBUTION CHANNELS
- 8 FILTER NO.1
- 9 FILTER NO.2
- 10 FILTER NO.3
- 11 FILTER NO.4
- 12 OPERATION BUILDING
- 13 CLEAR WELL
- 14 SEDIMENTATION BASINS INFLUENT CHANNEL DRAINING VALVE
- 15 PH NEUTRALIZER TANK
- 16 COAGULANT TANK
- 17 BLOWERS
- 18 UNDERGROUND BASEMENT PIPE GALLERY
- 19 WASH WATER DISCHARGE MANHOLE
- 20 CHLORINE ROOM

- 21 EMERGENCY GENERATOR AREA
- 22 CHLORINE CYLINDERS STORAGE AREA
- 23 BASEMENT DRAIN WATER COLLECTION P.S.
- 24 STORAGE
- 25 CONCRETE ACCESS
- 26 RAPID MIXING CHAMBER
- 27 CATCH BASIN
- 28 CONCRETE BASEMENT ACCESS

- GREEN AREA
- GRATING
- FENCE

NOTES:

- CONTRACTOR SHALL CONFIRM ALL ELEVATIONS AND DIMENSIONS AT SITE BEFORE STARTING ANY PIPE INSTALLATION OR CONSTRUCTION ACTIVITY. IF DISCREPANCY FOUND, CONTRACTOR SHALL INFORM TO THE ENGINEER TO OBTAIN A RECOMMENDATION.
- PIPES AND STRUCTURES SHOWN AS EXISTING WERE IDENTIFIED BY FIELD INSPECTION AND AS-BUILT DRAWINGS. CONTRACTOR SHALL CONSIDER THAT THERE MAY BE ADDITIONAL BURIED PIPES AND STRUCTURE.
- ALL PROPOSED CONDITIONS SHALL COMPLY WITH OSHA STANDARDS AND RELATED CODES.
- CONTRACTOR SHALL CONNECT ALL UTILITIES (I.E. FLUSH WATER, POWER) FOR THE INSTALLATION OF ALL MECHANICAL UNITS.

PROPOSED SITE PLAN SITE
SCALE:1:100

GRAPHIC SCALE = 1:100



Integra Design Group
DATE ISSUED
JULY 30, 2021
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YO, EXEL F. COLON RIVERA, NUMERO DE LICENCIA 20794 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions		
Number	Date	Description
SHEET INFO.		
Project No.: 18-1637.0		
Set Date: 2018/08/31		
Drawn by:		
Dwg. Date:		



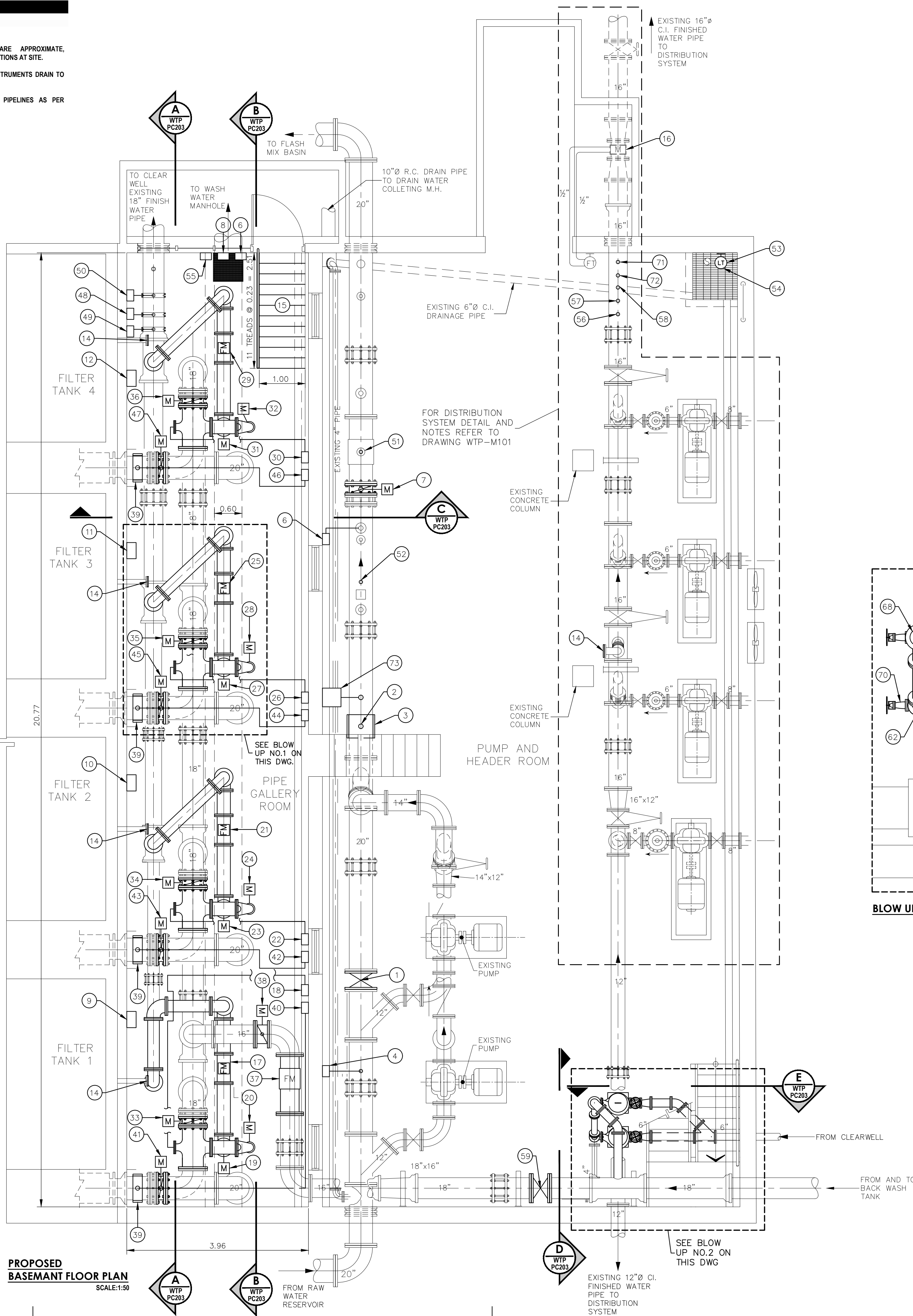
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

LEGEND DESCRIPTION:

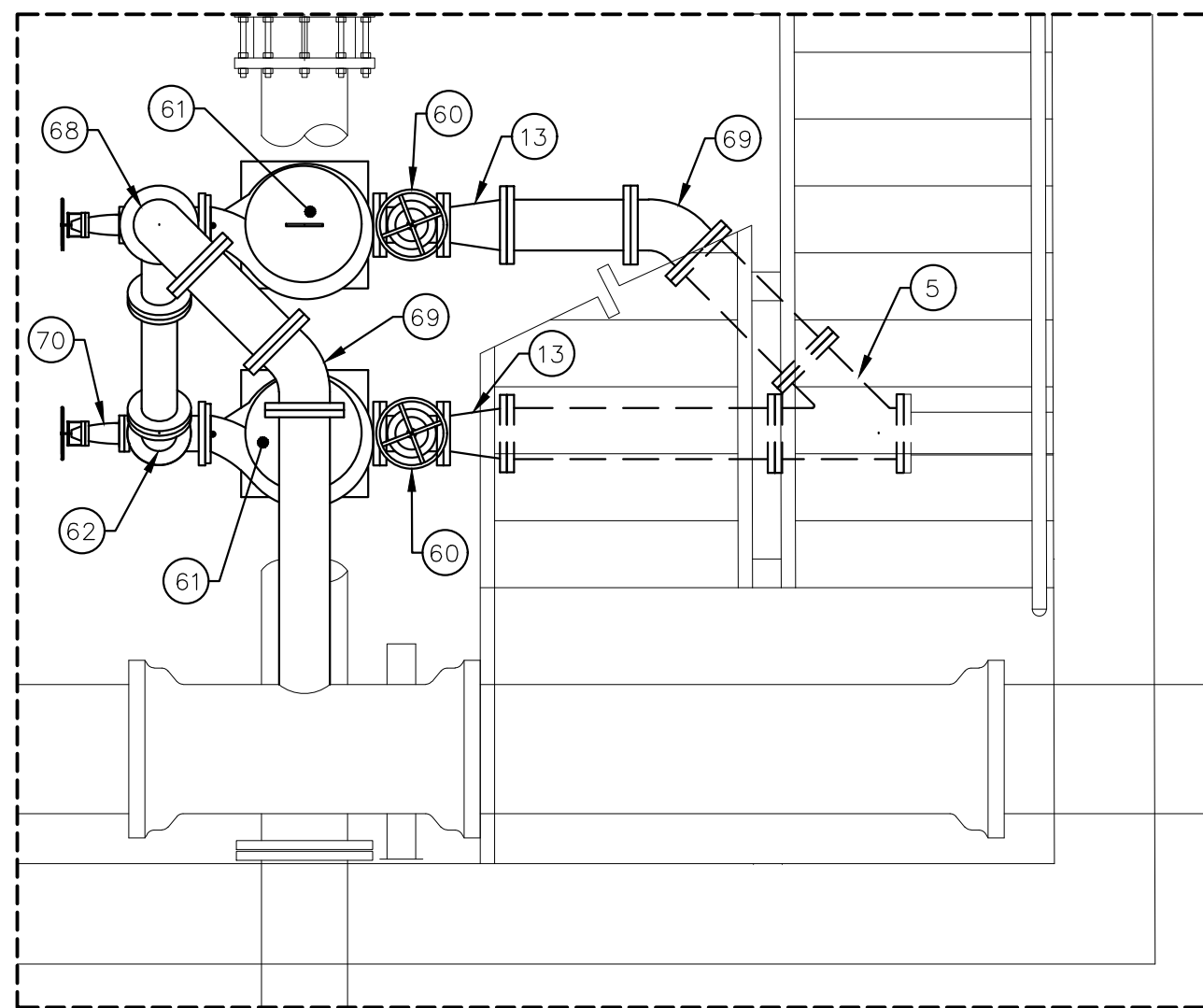
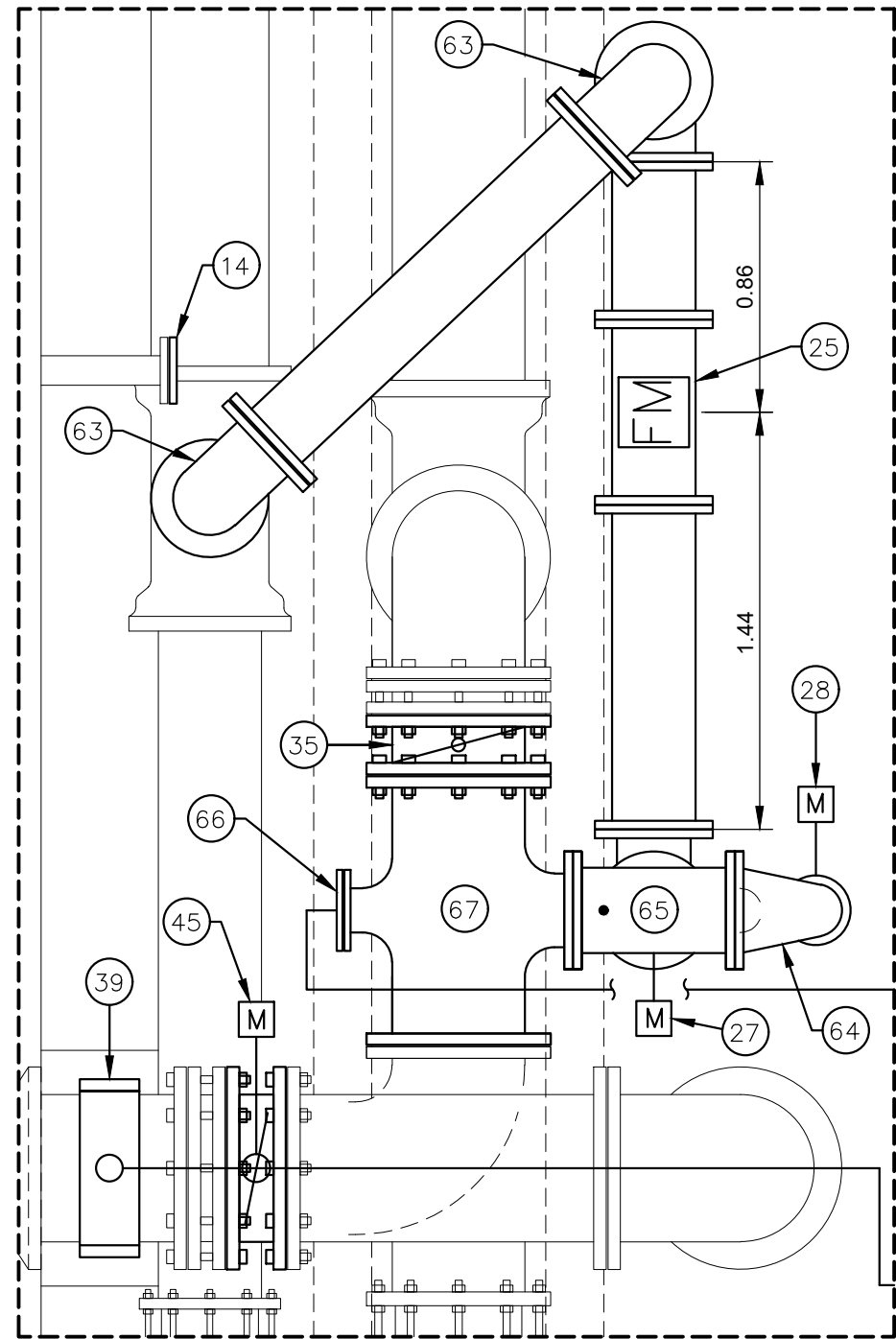
- 1 NEW 20"Ø GATE VALVE, FL (TAG NO. V-01-100)
2 NEW 20"Ø INSERTION ELECTROMAGNETIC FLOW METER
3 NEW 20"Ø X 4"Ø TAPPING SADDLE
4 NEW TURBIDITY ANALYZER (TAG NO. AIT-02-91)
5 NEW 6"Ø X 6"Ø D.I. WYE
6 NEW STREAMING CURRENT ANALYZER (TAG NO. AIT-02-50)
7 NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-01-20)
8 NEW PH / TEMP SENSOR (TAG NO. AIT-02-83)
9 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-104)
10 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-204)
11 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-304)
12 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-404)
13 NEW 6"Ø X 4"Ø D.I. REDUCER
14 NEW 4"Ø BLIND FLANGE
15 NEW STEEL STAIR
16 EXISTING EFFLUENT VENTURI FLOW METER TO REMAIN (TAG NO. FIT-05-77)
17 NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-102)
18 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-101)
19 NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-109)
20 NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-110)
21 NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-202)
22 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-201)
23 NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-209)
24 NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-210)
25 NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-302)
26 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-301)
27 NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-309)
28 NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-310)
29 NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-402)
30 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-401)
31 NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-409)
32 NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-410)
33 NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-111)
34 NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-211)
35 NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-311)
36 NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-411)
37 NEW ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-702)
38 NEW 16"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-701)
39 NEW 20" X 1"Ø PIPE SADDLE
40 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-105)
41 NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-106)
42 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-205)
43 NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-206)
44 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-305)
45 NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-306)
46 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-405)
47 NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-406)
48 NEW TURBIDITY ANALYZER (TAG NO. AIT-04-601)
49 NEW RESIDUAL CHLORINE ANALYZER (TAG NO. AIT-04-602)
50 NEW PH / TEMP SENSOR (TAG NO. AIT-04-603)
51 NEW PH NEUTRALIZER INJECTION PORT
52 NEW COAGULANT INJECTION PORT
53 NEW LEVEL INDICATOR AND TRANSMITTER (TAG NO. LIT-05-82)
54 TWO NEW LEVEL TRANSDUCER (TAG NO. LSL-05-90 / LSHH-05-83)
55 LOCAL PANELS FOR AIT-05-75, AIT-05-76, AIT-05-74 AND LIT-05-82
56 NEW TURBIDITY ANALYZER (TAG NO. AIT-05-74)
57 NEW RESIDUAL CHLORINE ANALYZER (TAG NO. AIT-05-75)
58 NEW PH SENSOR (TAG NO. AIT-05-76)
59 NEW 18"Ø GATE VALVE, FL (TAG NO. V-05-66)
60 NEW 4"Ø D.I. GATE VALVE (TAG NO. V-05-43 AND V-05-44)
61 NEW SUBMERSIBLE CENTRIFUGAL PUMP FOR BACKWASH SYSTEM. OPERATING POINT TO BE 600 GPM AT 70 FT (TAG NO. PU-05-19 AND PU-05-18)
62 NEW 4"Ø 45° D.I. BEND
63 NEW 10"Ø 90° D.I. BEND
64 NEW 10"Ø X 6"Ø D.I. BEND
65 NEW 10"Ø X 10"Ø D.I. TEE
66 NEW 6"Ø BLIND FLANGE WITH SAMPLING POINT
67 EXISTING 18"Ø X 10"Ø X 6"Ø CROSS TO BE ROTATED 180°
68 NEW 6"Ø 90° D.I. BEND
69 NEW 6"Ø 45° D.I. BEND
70 NEW 4"Ø D.I. GATE VALVE
71 NEW PRESSURE INDICATOR AND TRANSMITTER (TAG NO. PIT-05-409)
72 NEW PRESSURE SWITCH ALARM (TAG NO. PSA-05-410)
73 NEW PRESSURE INDICATOR AND TRANSMITTER (TAG NO. PIT-01-02)

NOTES:

1. INSTRUMENT LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL COORDINATE LOCATIONS AT SITE.
2. CONTRACTOR SHALL CONNECT THE INSTRUMENTS DRAIN TO THE EXISTING WASH WATER CHANNEL.
3. CONTRACTOR SHALL IDENTIFY ALL PIPELINES AS PER SECTION 09 91 00.



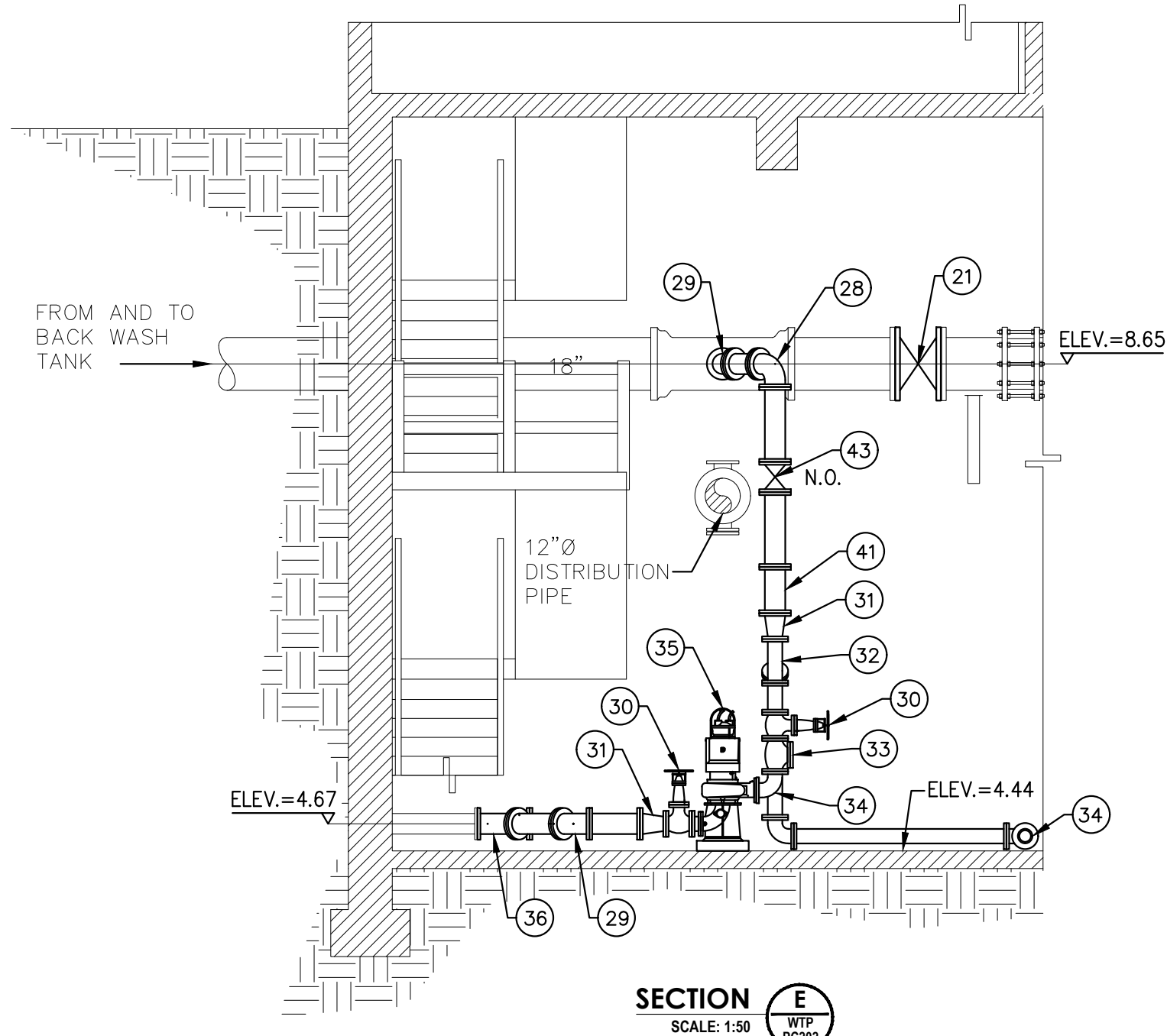
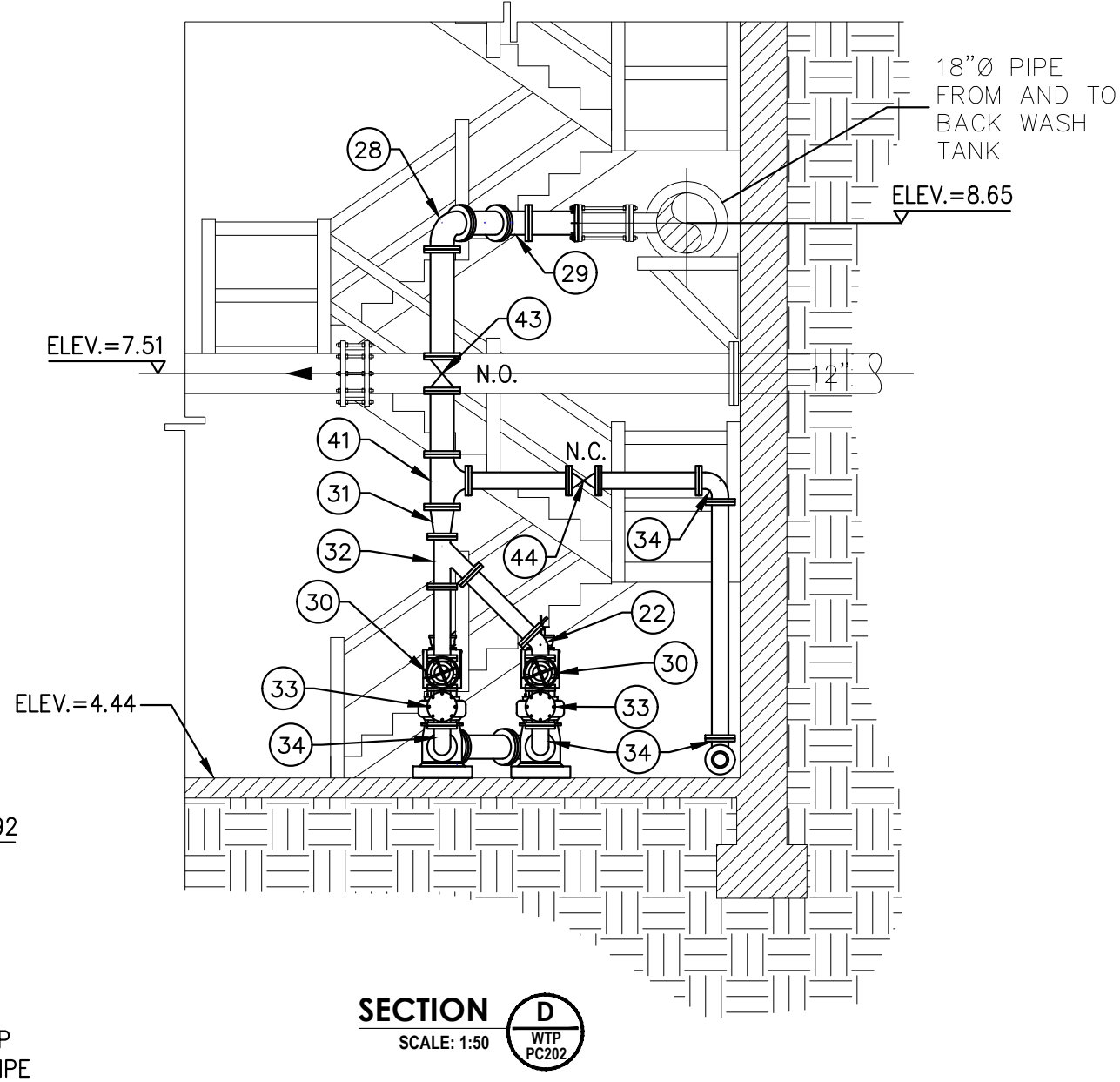
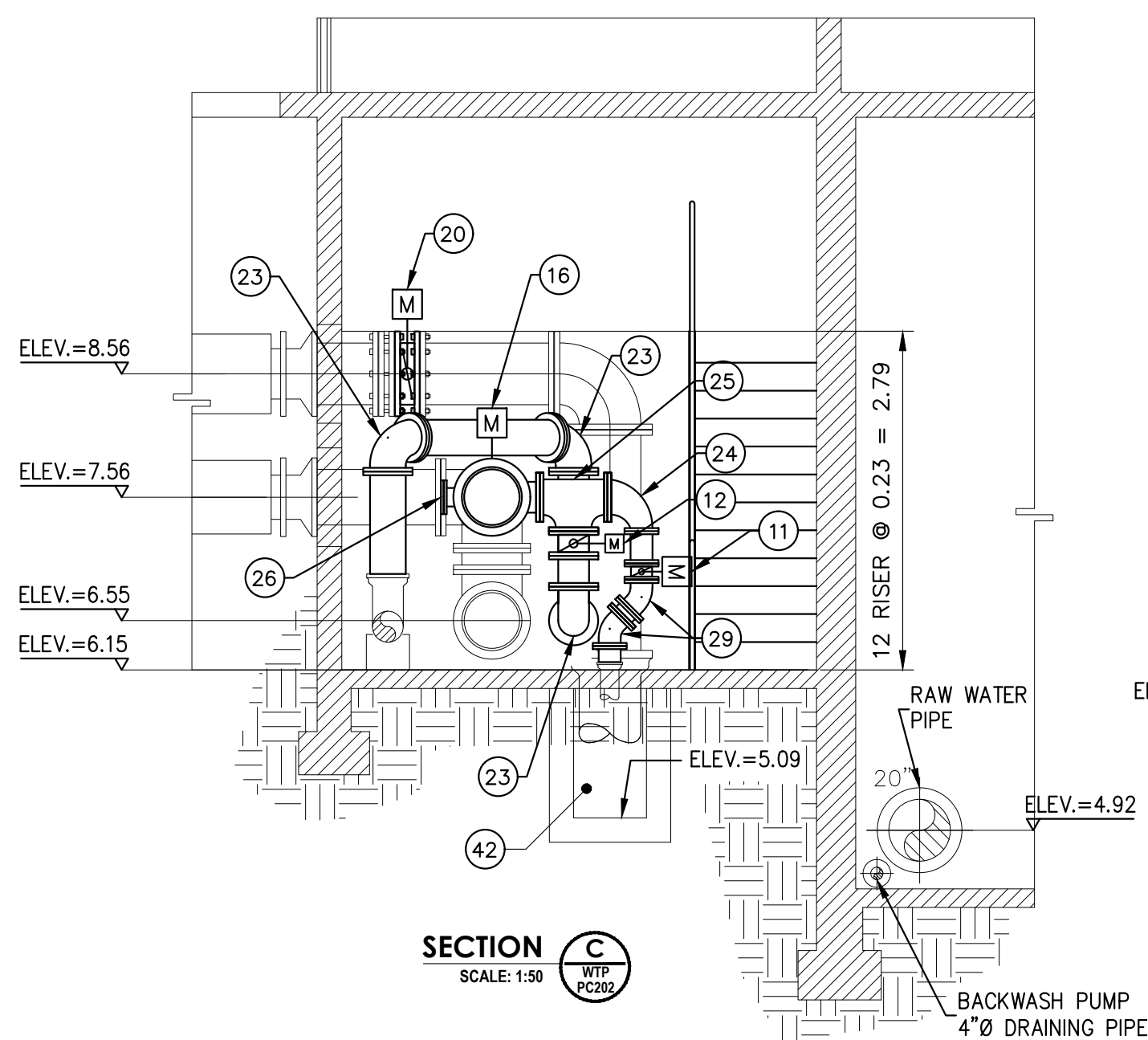
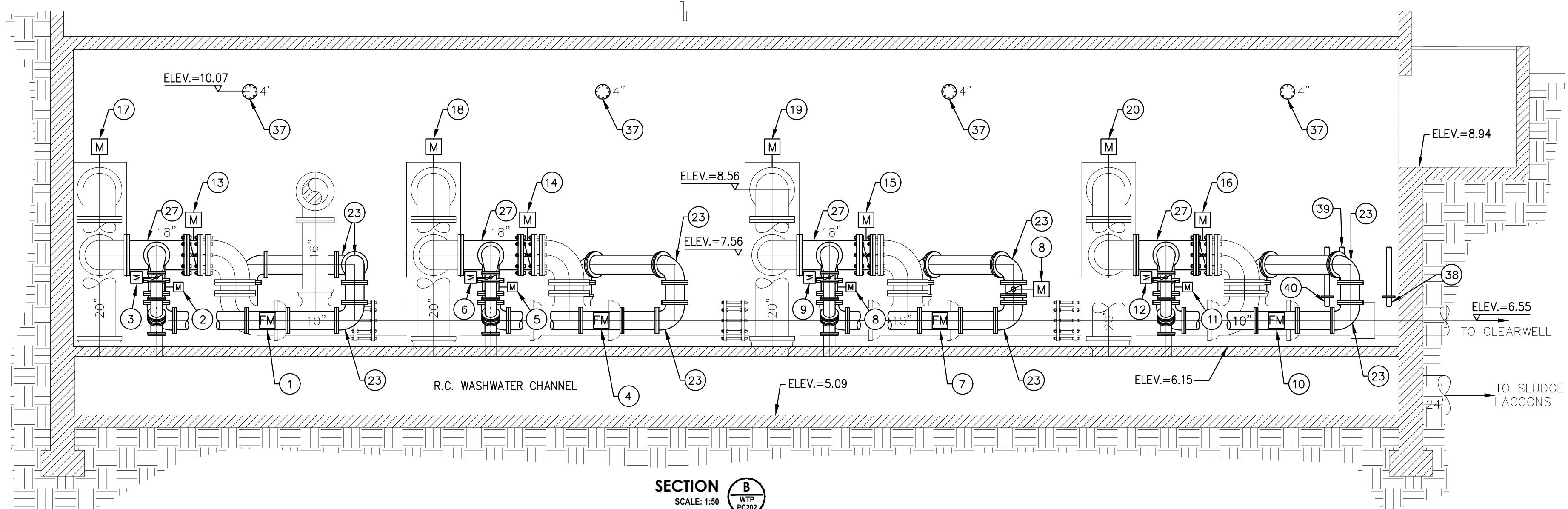
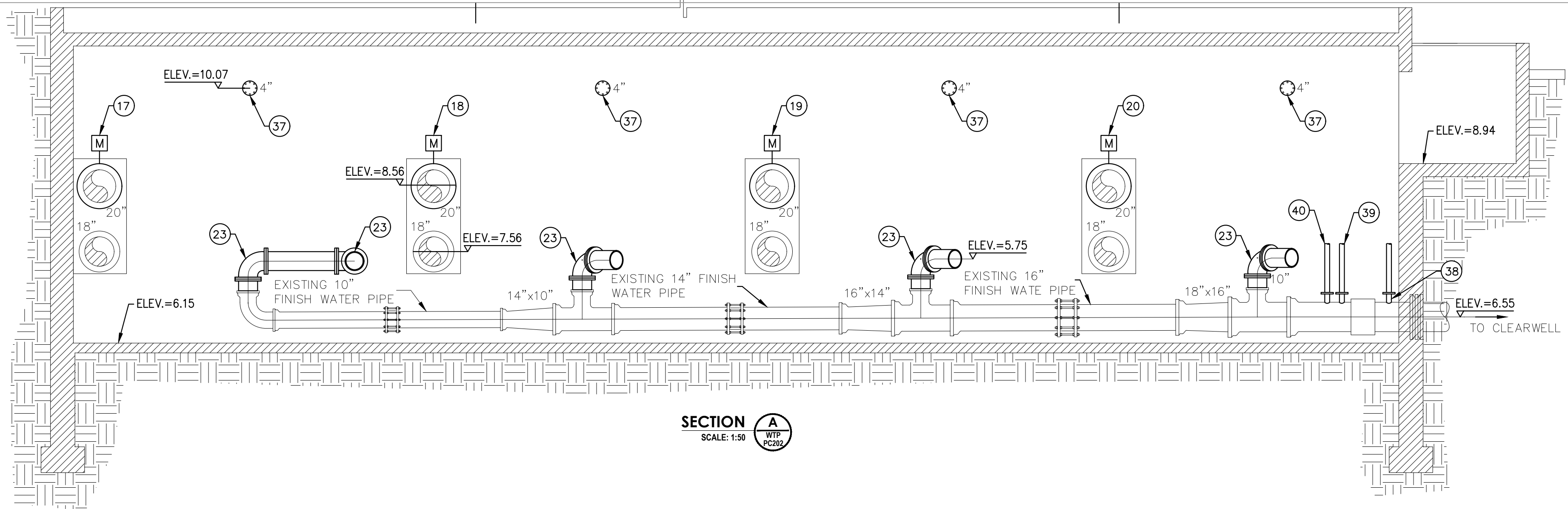
PROPOSED
BASEMENT FLOOR PLAN
SCALE: 1"=50'



Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 86 DE 9 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOCIDO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No. 19-1837.0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	



PUMPS SCHEDULE

PUMPS SCHEDULE																	
GENERAL DESCRIPTION						PUMP DATA							MOTOR DATA			REMARKS	QTY.
UNIT NO.	SERVICE	LOCATION	MODEL	MANUFACTURER	REMARKS	TYPE	Q (GPM)	TDH (FT)	IMP. DIA. (IN)	CURVE NO.	WEIGHT (LBS)	BHP	MOTOR HP	MOTOR RPM	V-PH-HZ		
PU-05-18 AND PU-05-19	BACKWASH WATER	WATER TREATMENT PLANT	SEAWATEC	KSB	CONSTANT	CENTRIFUGAL SUBMERSIBLE	600	70	-	-	-	15	15	1,800-2,400	460-3-60	-	3

LEGEND DESCRIPTION:

- NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-102)
- NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-109)
- NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-110)
- NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-202)
- NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-209)
- NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-210)
- NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-302)
- NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-309)
- NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-310)
- NEW 10"Ø ELECTROMAGNETIC FLOW METER (TAG NO. FIT-04-402)
- NEW 10"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-409)
- NEW 6"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-410)
- NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-111)
- NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-211)
- NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-311)
- NEW 18"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-411)
- NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-106)
- NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-206)
- NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-306)
- NEW 20"Ø BUTTERFLY VALVE, FL, ELECTRICALLY ACTUATED (TAG NO. V-04-406)
- NEW 18"Ø GATE VALVE, FL (TAG NO. V-05-66)
- NEW 4"Ø 45° D.I. BEND, FL
- NEW 10"Ø 90° D.I. BEND, FL
- NEW 10"Ø X 6"Ø D.I. BEND
- NEW 10"Ø X 10"Ø D.I. TEE, FL
- NEW 6"Ø BLIND FLANGE
- EXISTING 18"Ø X 10"Ø X 6"Ø CROSS TO BE ROTATED 180°
- NEW 6"Ø 90° D.I. BEND, FL
- NEW 6"Ø 45° D.I. BEND, FL
- NEW 4"Ø D.I. GATE VALVE
- NEW 6"Ø X 4"Ø D.I. REDUCER
- NEW 4"Ø X 4"Ø D.I. WYE
- NEW 4"Ø D.I. SWING CHECK VALVE, FL
- NEW 4"Ø 90° D.I. BEND, FL
- NEW 6"Ø X 6"Ø D.I. WYE, FL
- NEW 4"Ø BLIND FLANGE
- NEW PH / TEMP. SENSOR (TAG NO. AIT-04-603)
- NEW TURBIDITY ANALYZER (TAG NO. AIT-04-601)
- NEW RESIDUAL CHLORINE ANALYZER (TAG NO. AIT-04-602)
- NEW 4"Ø X 4"Ø D.I. TEE
- R.C. WASHWATER CHANNEL
- NORMALLY OPEN GATE VALVE WITH CHAIN OPERATION SEE DETAIL ON DWG. WTP-PC203
- NORMALLY CLOSE GATE VALVE WITH CHAIN OPERATION SEE DETAIL ON DWG. WTP-PC203

NOTES:

- CONTRACTOR SHALL REPLACE ALL VALVES AND ACTUATORS. REFER TO TECHNICAL SPECIFICATION 40 05 65 AND 40 05 57.
- ALL PROPOSED CONDITIONS SHALL COMPLY WITH OSHA STANDARDS AND RELATED CODES.
- ALL PROPOSED OR NEW EXPOSED PROCESS PIPING SHALL BE PAINTED ACCORDING TO THE INTERNATIONAL CODE OF PIPING AS FOLLOWS:
A. RAW WATER: OLIVE GREEN
B. SETTLED WATER: LIGHT BLUE
C. FILTERED WATER: LIGHT BLUE
D. FINISHED WATER OR POTABLE WATER: DARK BLUE
E. PRIMARY OR SECONDARY COAGULANT: ORANGE
F. CHLORINE GAS OR SOLUTION: YELLOW
G. WASHWATER: LIGHT BROWN
H. WASTED SLUDGE: DARK GRAY
- CONTRACTOR SHALL PROVIDE TRANSITION COUPLING ADAPTERS BETWEEN D.I. AND C.I. PIPES CONNECTIONS.
- THIS DRAWING IS THE RESULT OF A SITE INVESTIGATION AND HISTORICAL CONSTRUCTION DRAWING COMPILATION. CONTRACTOR SHALL BE RESPONSIBLE TO REVISE EXISTING INFRASTRUCTURE AT SITE.
- CONTRACTOR SHALL IDENTIFY ALL PIPELINES AS PER SECTION 09 9100.
- ALL DIMENSION ARE IN METERS UNLESS SPECIFIED OTHERWISE.

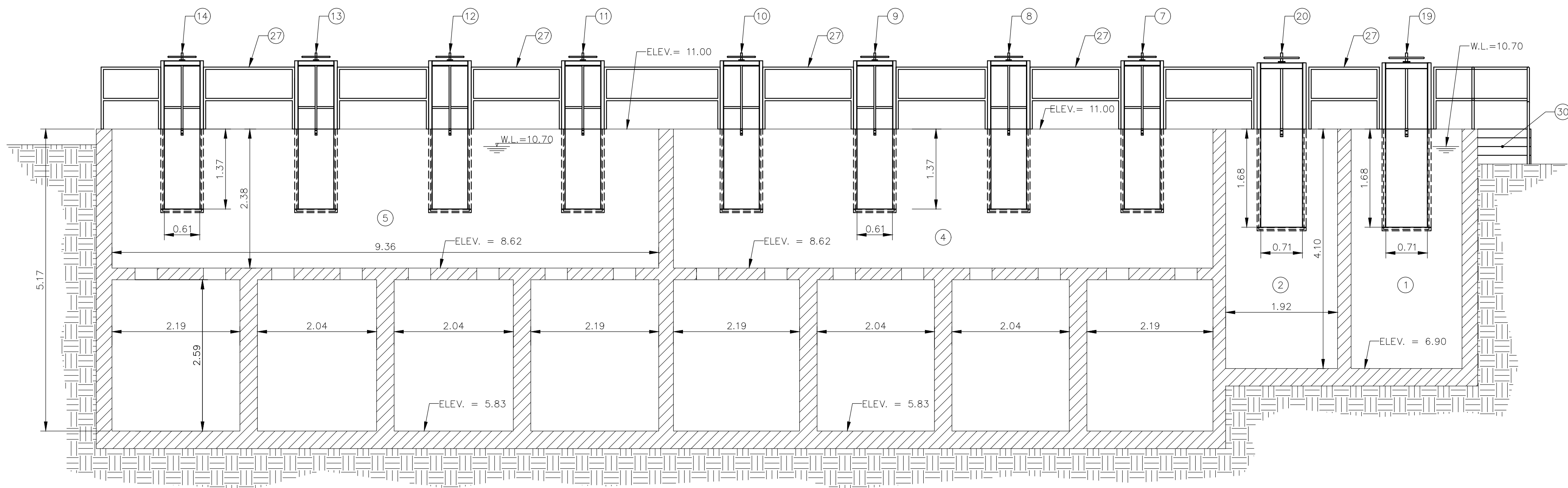


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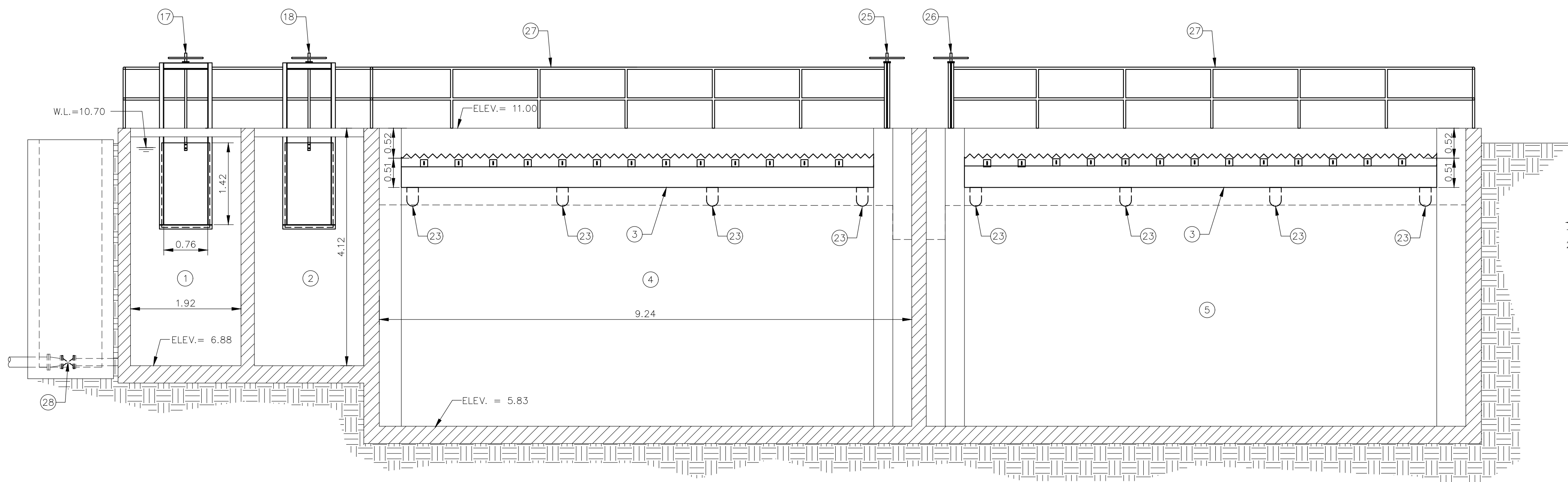
YO, EXCEL F. COLON RIVERA, NUMERO DE LICENCIA 20794, CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA. LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1637.0	Set Date: 2021/07/28
		Drawn by:	Dwg. Date:

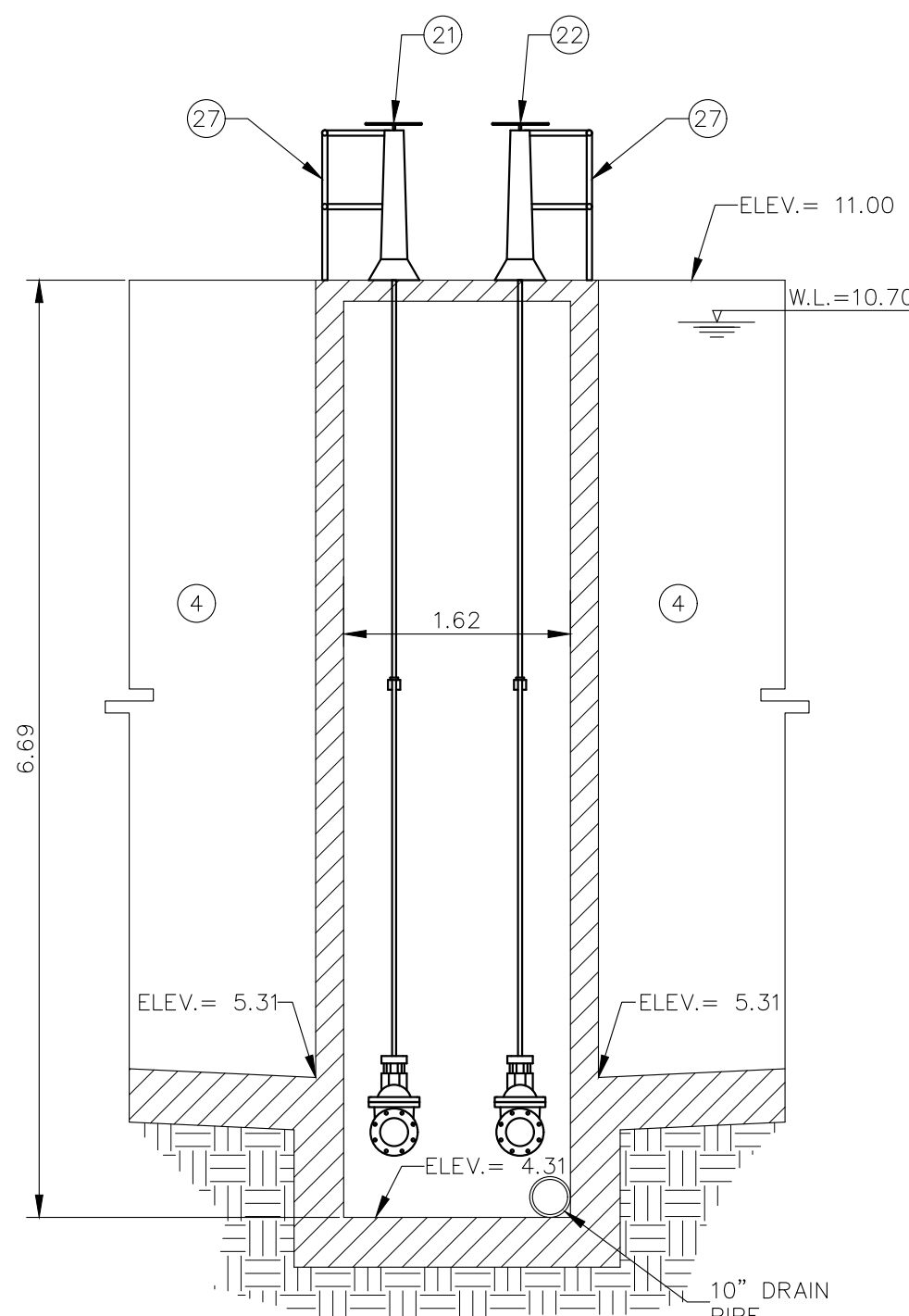
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



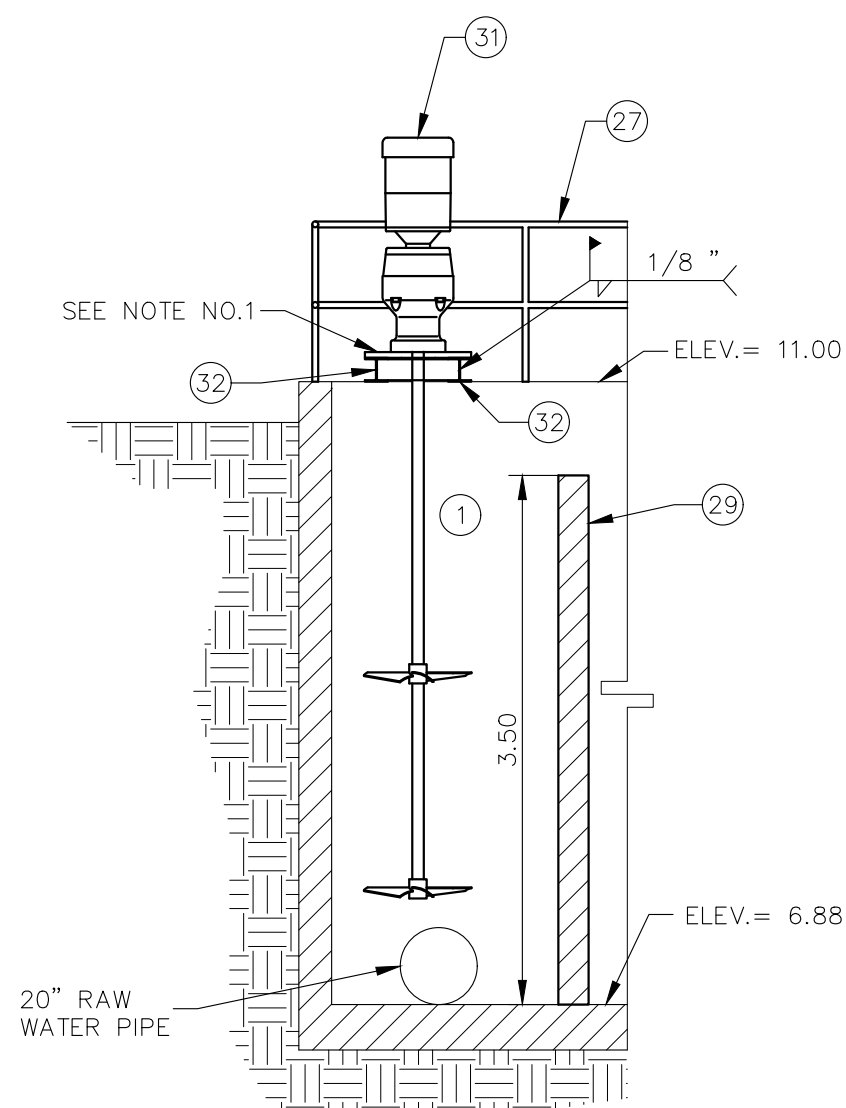
SECTION A
SCALE: 1:50
WTP
PC205



SECTION B
SCALE: 1:50
WTP
PC205



SECTION C
SCALE: 1:50
WTP
PC205



SECTION D
SCALE: 1:50
WTP
PC205

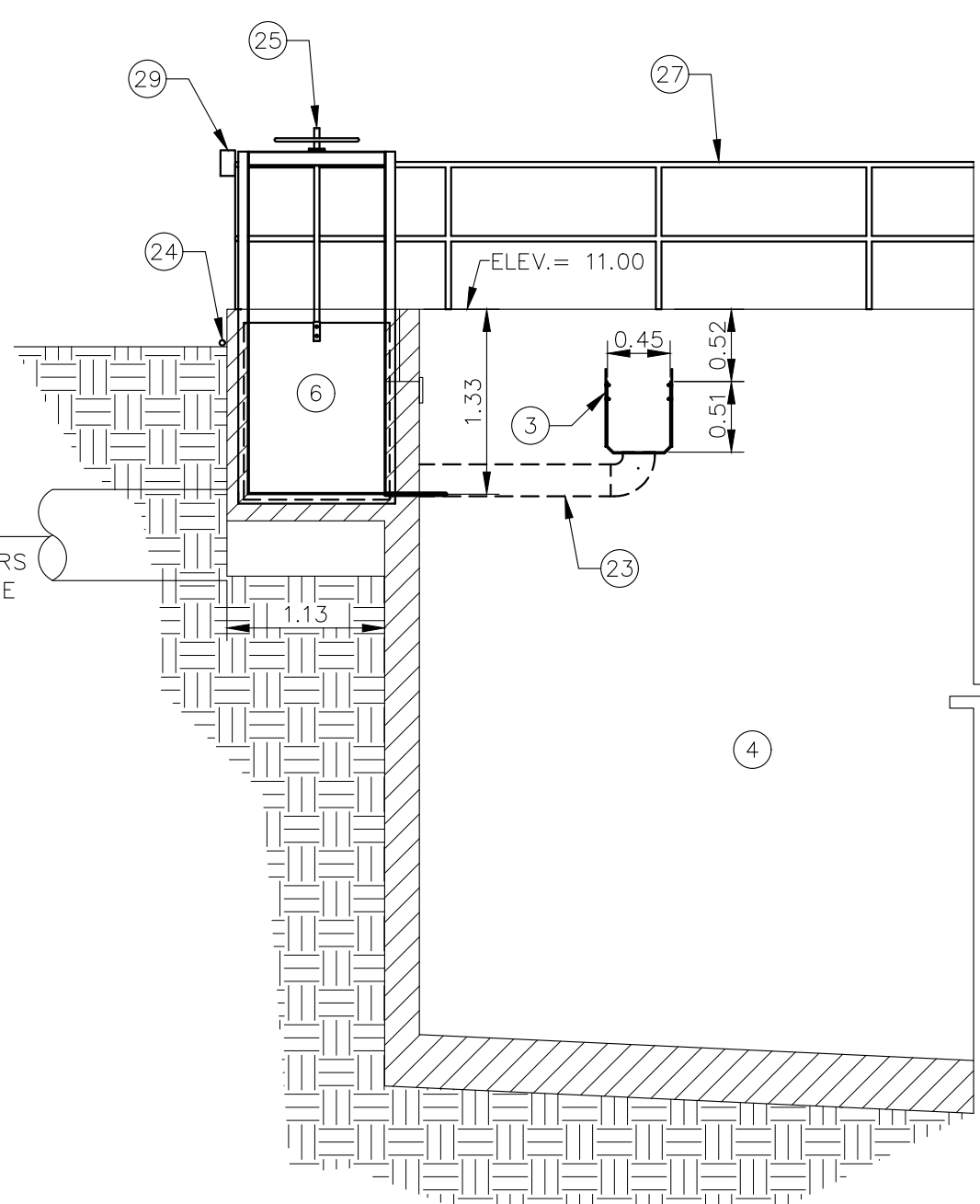
LEGEND DESCRIPTION:

- ① FLOCCULATION CHAMBER NO. 1 (TAG NO. FB-02-85)
- ② FLOCCULATION CHAMBER NO. 2 (TAG NO. FB-02-86)
- ③ NEW FRP COLLECTING CHANNELS AND WEIRS
- ④ SEDIMENTATION BASIN NO. 1 (TAG NO. SB-03-84)
- ⑤ SEDIMENTATION BASIN NO. 2 (TAG NO. SB-03-83)
- ⑥ SEDIMENTATION BASINS EFFLUENT CHANNEL
- ⑦ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-07)
- ⑧ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-08)
- ⑨ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-09)
- ⑩ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-10)
- ⑪ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-13)
- ⑫ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-14)
- ⑬ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-15)
- ⑭ NEW 54"H x 24"W 316 SS SLIDE GATE (TAG NO. V-03-16)
- ⑮ NEW DRAINING 8" DIAM. GATE VALVE (TAG NO. V-02-72)
- ⑯ NEW DRAINING 8" DIAM. GATE VALVE (TAG NO. V-02-71)
- ⑰ NEW 54"H x 30"W 316 SS SLIDE GATE (TAG NO. V-02-02)
- ⑱ NEW 54"H x 30"W 316 SS SLIDE GATE (TAG NO. V-02-01)

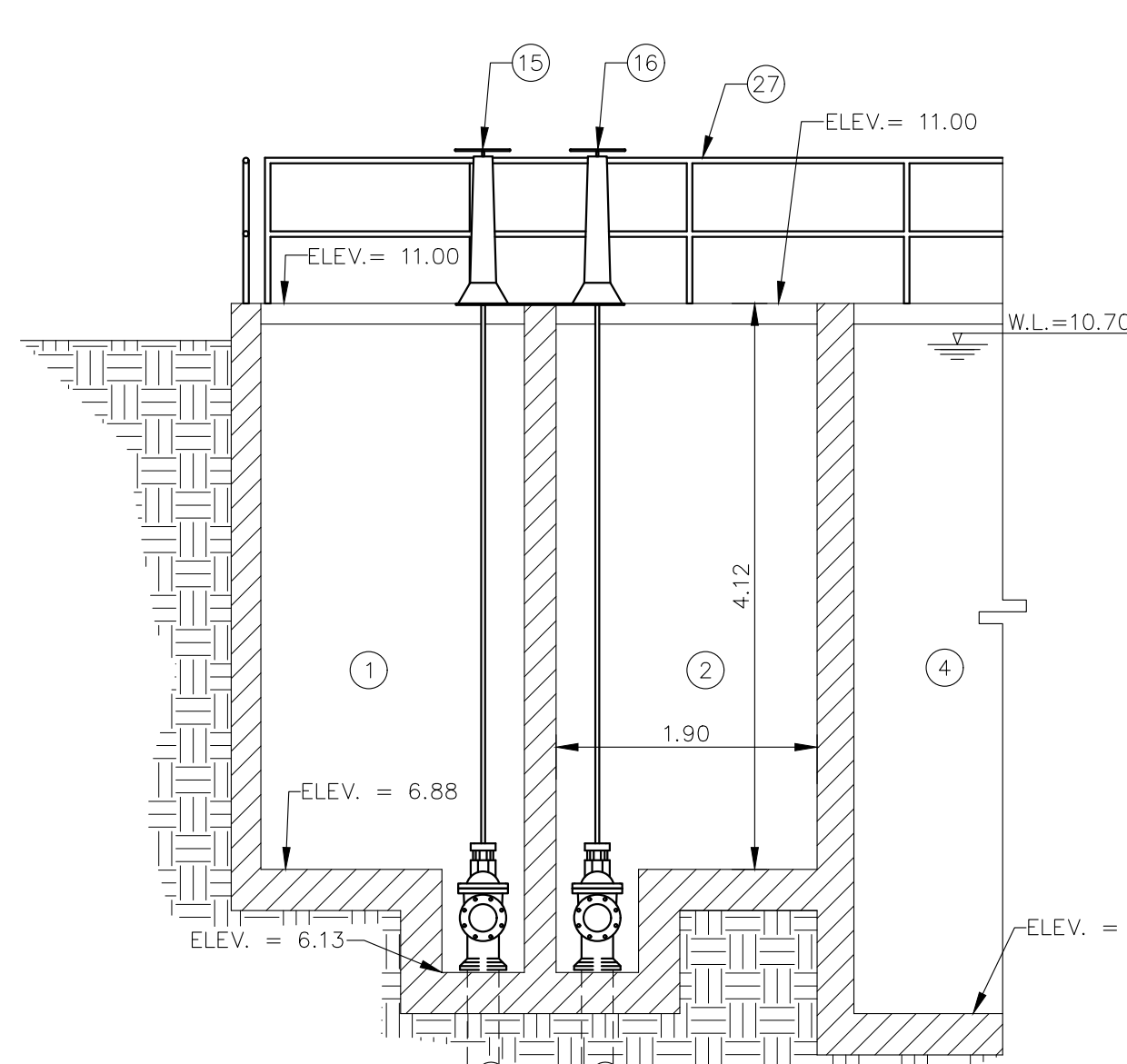
- ⑲ NEW 54"H x 30"W 316 SS SLIDE GATE (TAG NO. V-02-73)
- ⑳ NEW 54"H x 30"W 316 SS SLIDE GATE (TAG NO. V-02-74)
- ㉑ NEW DRAINING 8" DIAM. GATE VALVE (TAG NO. V-03-11)
- ㉒ NEW DRAINING 8" DIAM. GATE VALVE (TAG NO. V-03-76)
- ㉓ NEW 8"Ø WEIR DISCHARGE PIPE (SEE DETAIL ON DWG. WTP-PC212)
- ㉔ NEW 1"Ø CHLORINE INJECTION DIFFUSER PIPE
- ㉕ NEW 51"H x 36"W 316 SS SLIDE GATE (TAG NO. V-03-12)
- ㉖ NEW 51"H x 36"W 316 SS SLIDE GATE (TAG NO. V-03-18)
- ㉗ NEW ALUMINUM HANDRAILS (SEE DETAIL ON DWG. PC213)
- ㉘ NEW DRAINING 6" DIAM. GATE VALVE (TAG NO. V-02-97)
- ㉙ NEW CONCRETE BAFFLE (SEE DETAIL ON DWG. WTP-S102)
- ㉚ NEW CONCRETE STAIRS (SEE DETAIL ON DWG. WTP-S102)
- ㉛ NEW RAPID MIXER (TAG NO. MX-01-100) AS SPECIFIED IN SECTION 46 41 11
- ㉜ BEAMS TO BE W6 X 21 ANCHORED TO CONCRETE WALL WITH FOUR (4) 5/8"Ø KWIK BOLT TZ SS 304 EXPANSION ANCHOR WITH 6" EMBEDMENT.

NOTES:

1. CONTRACTOR SHALL COORDINATE WITH MIXER MANUFACTURER STEEL SUPPORTS PERFORATION FOR DRIVE MOUNTING FLANGE.
2. ALL DIMENSION ARE IN METERS UNLESS SPECIFIED OTHERWISE.



SECTION E
SCALE: 1:50
WTP
PC205



SECTION F
SCALE: 1:50
WTP
PC205



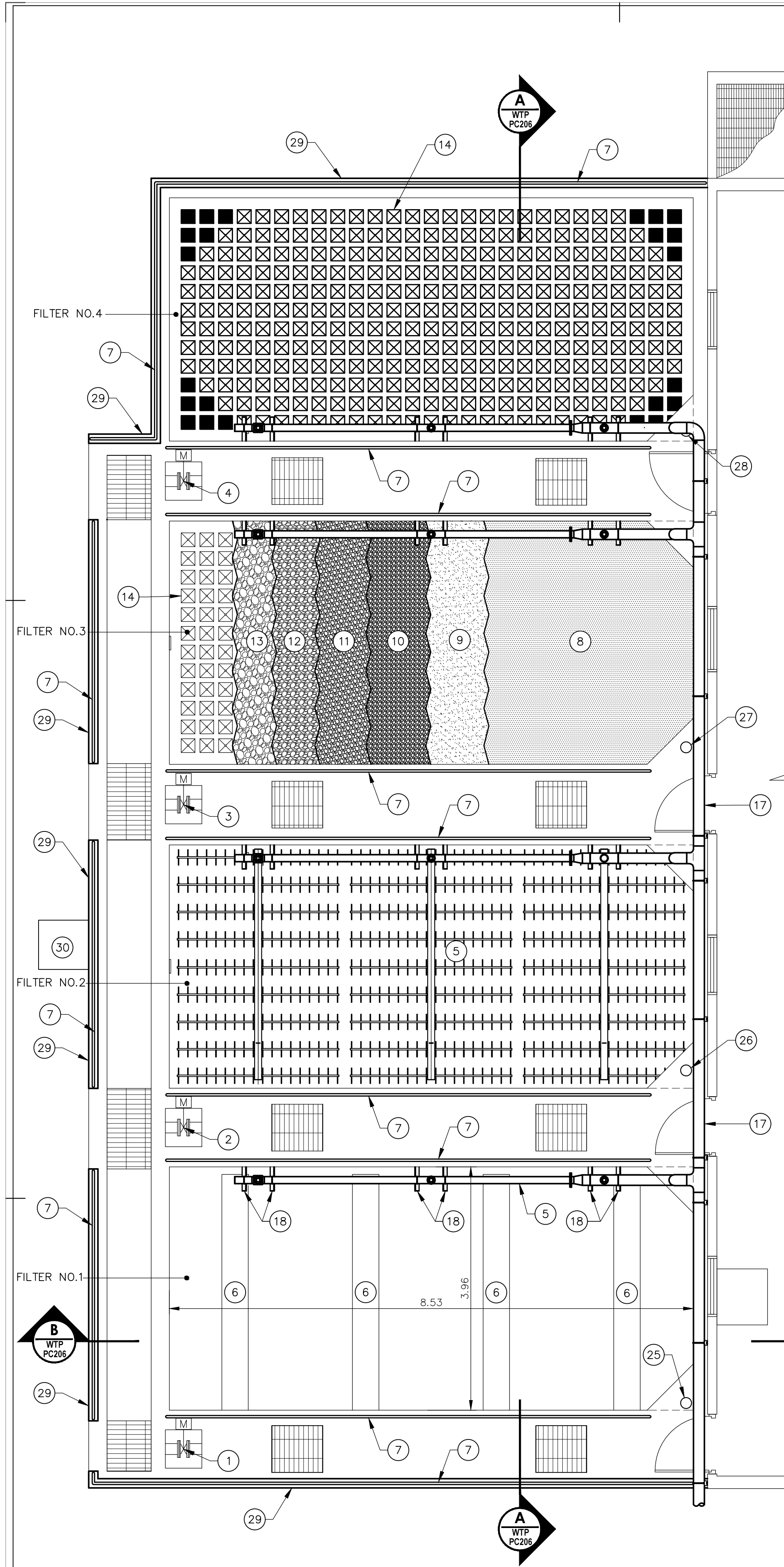
Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, ROLANDO PACHECO COLON, NUMERO DE LICENCIA 23752 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

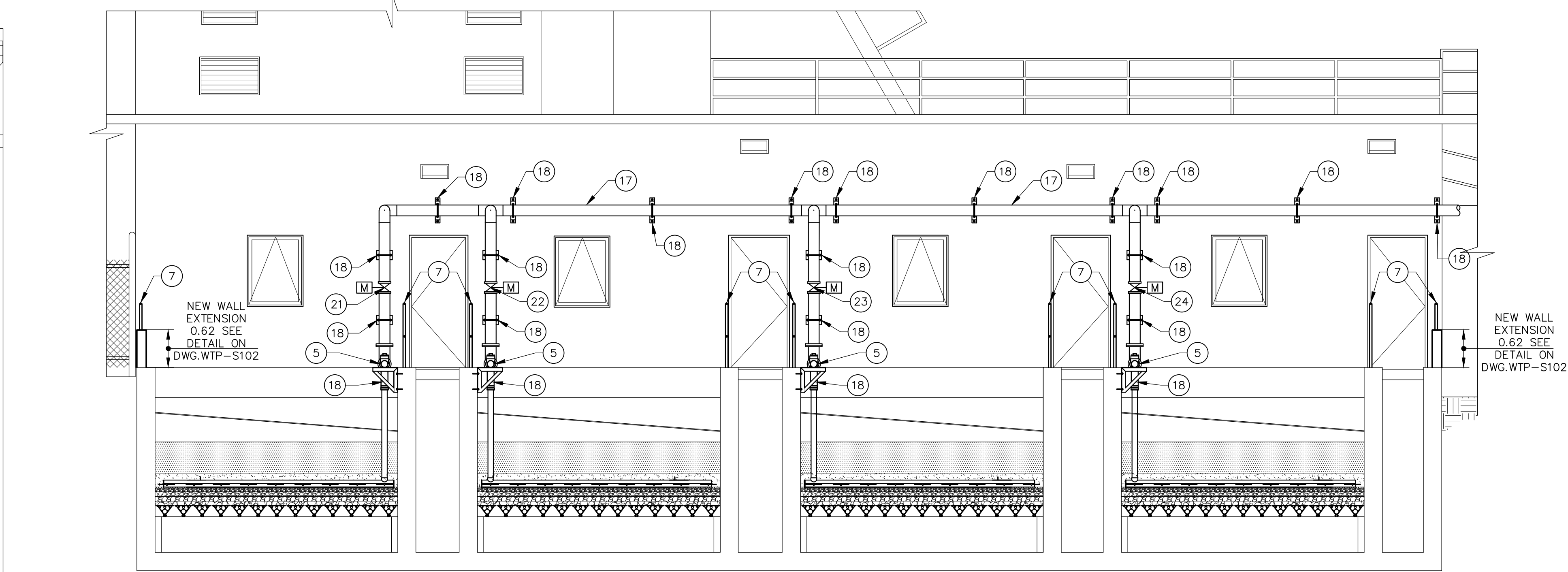
Revisions	Number	Date	Description

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

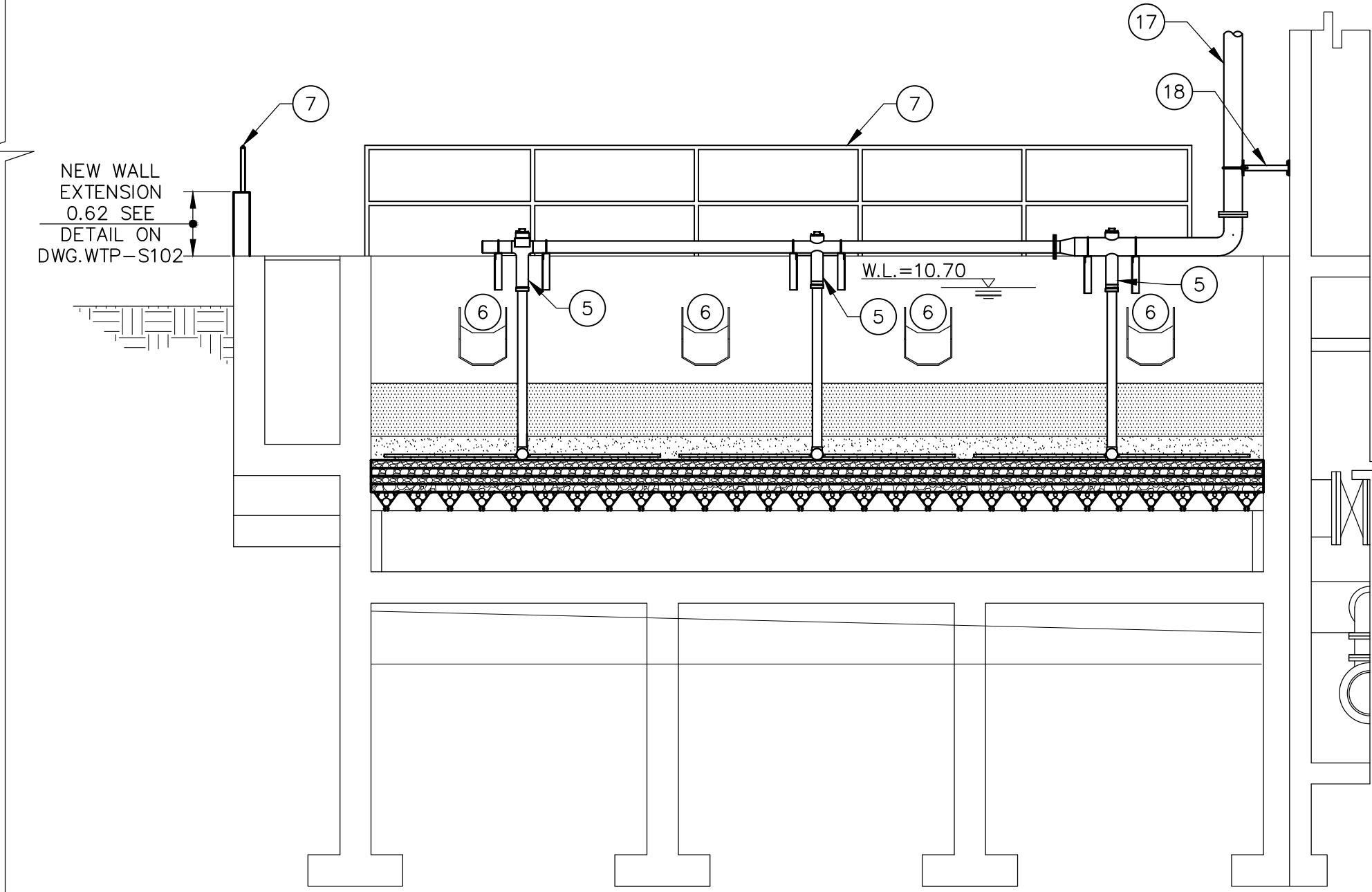
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CEIBA & INGENIERIA, PUERTO RICO



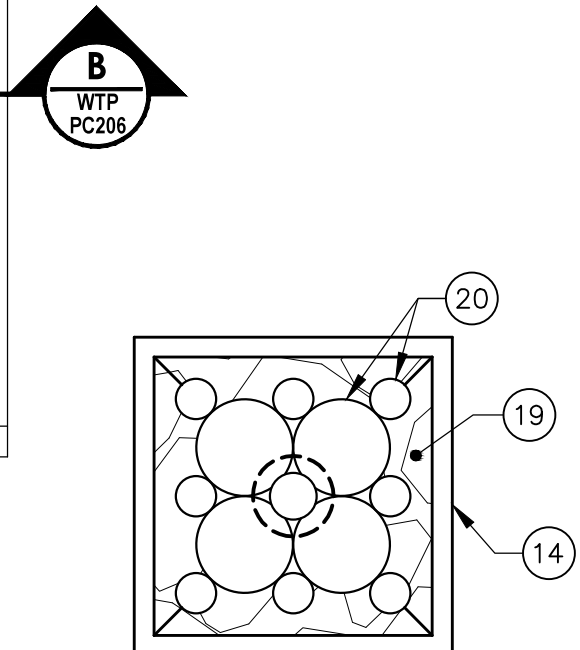
PROPOSED FILTERS IMPROVEMENTS PLAN
SCALE: 1:50



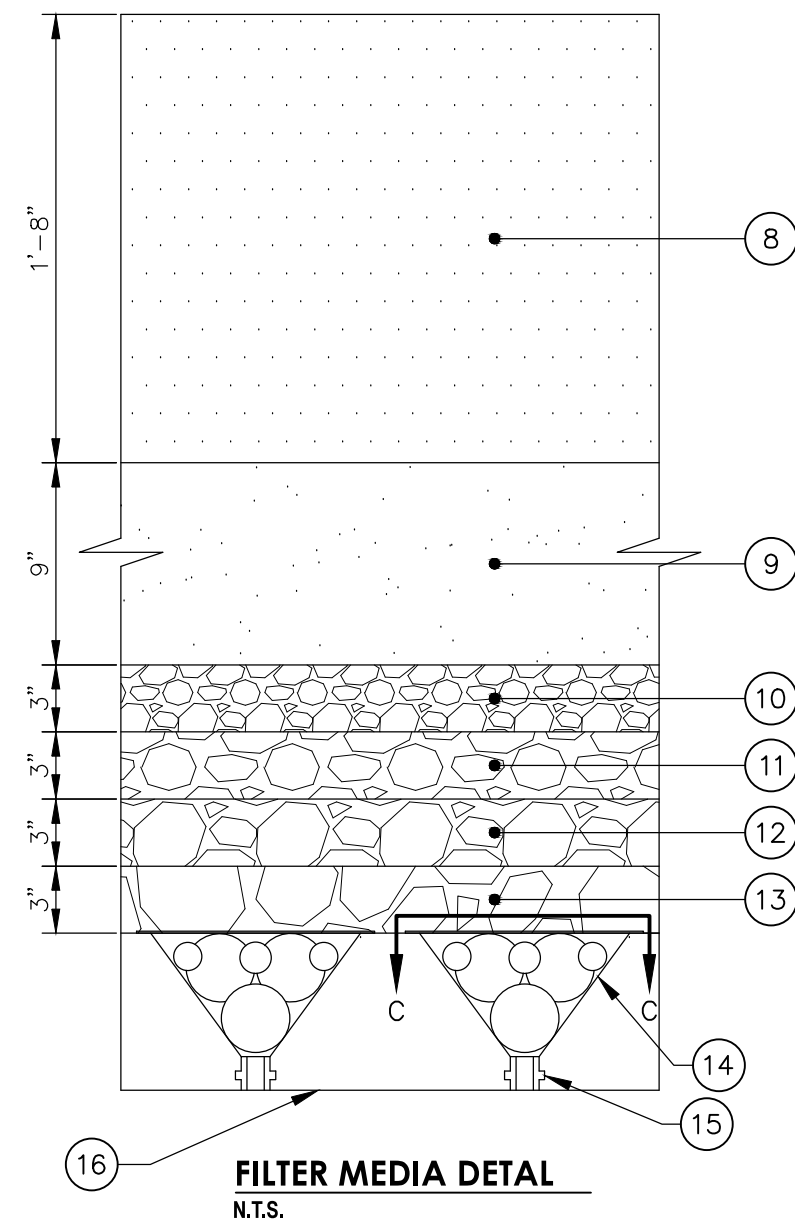
SECTION A
SCALE: 1:50



SECTION B
SCALE: 1:50



SECTION C-C
N.T.S.



FILTER MEDIA DETAIL
N.T.S.

NOTES:

1. SAND BLASTING SHALL BE APPLIED TO PREPARE AN ADEQUATE PROFILE ON ALL WETTED SURFACE OF FILTER OVERFLOW CHANNELS. COATING SHALL BE AWWA COMPLIANCE.
2. LINER SYSTEM FOR EXISTING UNDERDRAIN SYSTEM SHALL INCLUDE ALL SPHERES REPLACEMENT.
3. OPERATION LEVELS PRESENTED ON THIS DRAWING ARE FOR REFERENCE ONLY AND SHALL BE EVALUATED AND CORRECTED AT FIELD CONDITIONS.
4. CONTRACTOR SHALL REMOVE EXISTING FILTER MEDIA IN ALL FILTERS AND INSTALL NEW FILTER MEDIA IN ALL FILTERS. REFER TO TECHNICAL SPECIFICATION 46 61 13.
5. CONTRACTOR SHALL REMOVE EXISTING CERAMIC SPHERES IN ALL FILTERS AND INSTALL NEW CERAMIC SPHERES IN ALL FILTERS. REFER TO TECHNICAL SPECIFICATION 46 61 10.
6. ALL PROPOSED CONDITIONS SHALL COMPLY WITH OSHA STANDARDS AND RELATED CODES.
7. CONSTRUCTION ACTIVITIES IN FILTER WILL REQUIRE SHUTDOWN OF THESE UNITS. ONLY ONE UNIT SHALL BE SHUTTED DOWN AT THE TIME.
8. CONTRACTOR SHALL COORDINATE WITH OPERATOR TO VERIFY THAT THE FILTER THAT REMAIN IN OPERATION IS FULLY OPERATIONAL.
9. ONCE A FILTER IS SHUTDOWN, CONTRACTOR SHALL PERFORM ALL CONSTRUCTION ACTIVITIES RELATED TO THIS UNIT.
10. CONTRACTOR SHALL MINIMIZE SHUTDOWN PERIODS AT ITS LENGTH.
11. THE PLANT SHALL REMAIN OPERATIONAL DURING ITS OPERATION PERIOD. NO PLANT FULL SHUTDOWNS IS ALLOWED DURING ITS OPERATION PERIOD.
12. ALL EQUIPMENT AND INSTRUMENTS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS IN ACCORDANCE WITH CONSTRUCTION DRAWINGS AND TECHNICAL SPECIFICATIONS.
13. CONTRACTOR SHALL PROVIDE MANUFACTURES SERVICES AND TRAINING DURING START-UP.
14. CONTRACTOR SHALL SUBMIT FILTER MEDIA INFORMATION FOR APPROVAL PRIOR TO THE INSTALLATION.
15. FILTERS SHALL BE DISINFECTED PRIOR TO BE IN OPERATION. REFER TO TECHNICAL SPECIFICATION FOR DISINFECTION REQUIREMENTS. SECTION 33 01 10.60
16. NEW AIR SCOURING SYSTEM ARIES FOR ALL FILTERS AS MANUFACTURED BY ROBERT FILTER OR APPROVED EQUAL.
17. ALL REPAIRS TO FILTERS' BOTTOM HOPPERS SHALL BE PERFORMED USING HYDRAULIC CEMENT MIX AS MANUFACTURED BY ROBERT FILTERS CM-120 OR APPROVED EQUAL.
18. PORCELAIN THIMBLES SHALL BE REPLACED AS REQUIRED.
19. INSPECTION AND PERFORMING OF THE REPAIR WORK SHALL BE PERFORM BY THE MANUFACTURER.

20. PORCELAIN SPHERES AND REPLACEMENT THIMBLES SHALL BE DRY PROCESS POURED AND SHALL MEET OR EXCEED THE FOLLOWING SPECIFICATIONS
 - a. LESS THAN 0.05% WATER ABSORPTION.
 - b. FLEXURAL STRENGTH OF 10,000 PSI.
 - c. COMPRESSIVE STRENGTH OF 50,000 PSI.
21. ALL EQUIPMENTS TO BE INSTALLED IN FILTERS SHALL BE ANSISNF STD. 61 LISTED, INCLUDING BUT NOT LIMITED TO HYDRAULIC CEMENT MIX, PORCELAIN THIMBLES, FILTER MEDIA AND PORCELAIN SPHERES.
22. NEW SUPPORT GRAVEL AND FILTER MEDIA SHALL MEET THE REQUIREMENTS OF AWWA STANDARD B100-LATEST EDITION AND SHALL BE ANSISNF STD. 61 LISTED.
23. ALL WORKS INSIDE THE FILTERS OR THEIR SURROUNDINGS SHALL BE PERFORMED CAREFULLY, SO NONE OF THE FILTERS PART AFFECTED IF PARTS OR EQUIPMENTS ARE AFFECTED DURING WORKS. THEY SHALL BE REPAIRED AT NO EXTRA COST.
24. ALL DIMENSION ARE IN METERS UNLESS SPECIFIED OTHERWISE.

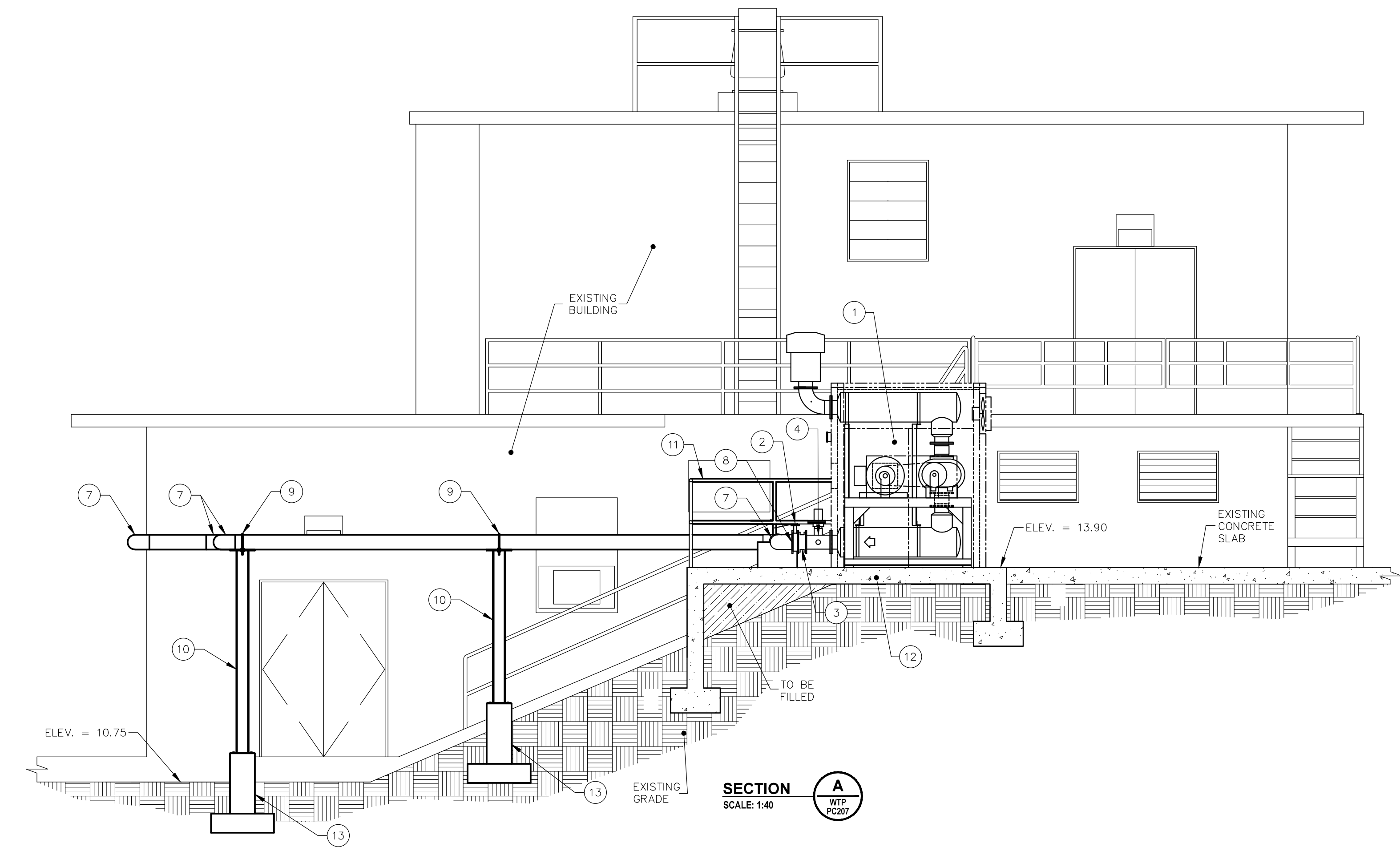
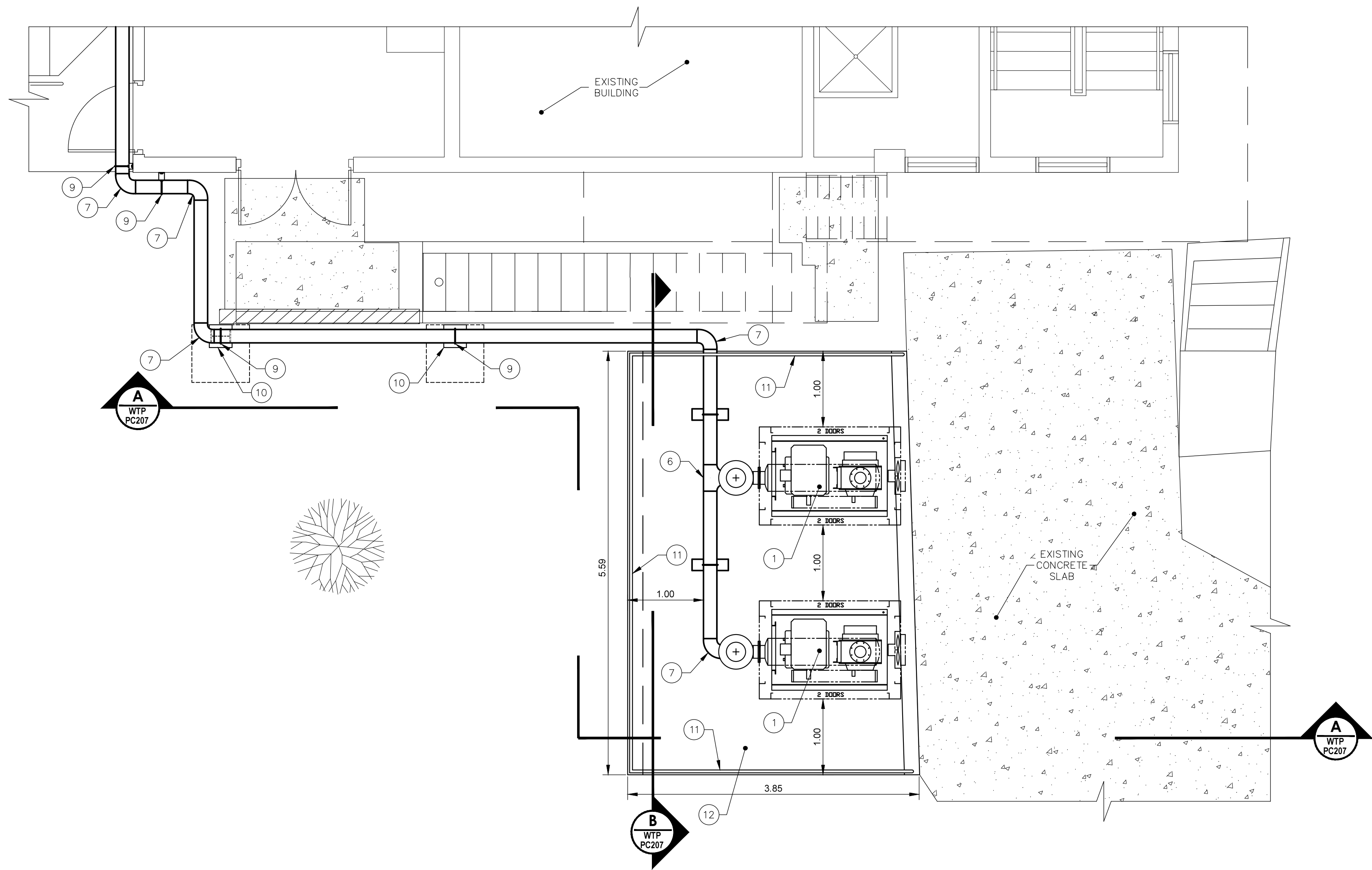
LEGEND DESCRIPTION:

- 1 NEW 14"Ø BUTTERFLY VALVE, FL. ELECTRICALLY ACTUATED (TAG NO. V-04-21)
- 2 NEW 14"Ø BUTTERFLY VALVE, FL. ELECTRICALLY ACTUATED (TAG NO. V-04-22)
- 3 NEW 14"Ø BUTTERFLY VALVE, FL. ELECTRICALLY ACTUATED (TAG NO. V-04-23)
- 4 NEW 14"Ø BUTTERFLY VALVE, FL. ELECTRICALLY ACTUATED (TAG NO. V-04-24)
- 5 NEW SCOURING SYSTEM AIR SUPPLY PIPE AS SPCHIED IN SECTION 46 61 17
- 6 NEW FRP FILTER THROUGH AS MANUFACTURED BY FIBERGLASS FABRICATION OR APPROVED EQUAL
- 7 ALUMINUM RAILING SEE DETAIL ON WTP-C401
- 8 1'-8" HEIGHT FILTER MEDIA ANTHRACITE
- 9 9" HEIGHT FILTER MEDIA SAND
- 10 3" HEIGHT FILTER MEDIA 3/16" GRAVEL
- 11 3" HEIGHT FILTER MEDIA 3/8" GRAVEL
- 12 3" HEIGHT FILTER MEDIA 5/8" GRAVEL
- 13 3" HEIGHT FILTER MEDIA 1" GRAVEL
- 14 LINER SYSTEM FOR EXISTING WOODSTOCK UNDERDRAIN SYSTEM RETROFIT, AS PER MANUFACTURED BY ROBERT SERVICES, INC. OR APPROVED EQUAL APPLIES TO ALL FILTERS
- 15 PORCELAIN THIMBLE
- 16 EXISTING MONOLITHIC WHEELER BOTTOM
- 17 6"Ø AIR SUPPLY PIPE
- 18 PIPE SUPPORT REFER TO DETAIL ON DWG. _____
- 19 1 1/2" X 3/4" GRAVEL
- 20 (5) 3"Ø (1) 1 3/8"Ø AND (8) 1 1/4" Ø PORCELAIN SPHERES TO BE SUPPLIED AND INSTALLED FOR EACH HOPPER AS MANUFACTURED BY ROBERT FILTERS OR APPROVED EQUAL. AS SPECIFIED IN SECTION 46 61 10
- 21 NEW 6"Ø BUTTERFLY ELECTRICALLY ACTUATED VALVE (TAG NO. V-04-38)
- 22 NEW 6"Ø BUTTERFLY ELECTRICALLY ACTUATED VALVE (TAG NO. V-04-39)
- 23 NEW 6"Ø BUTTERFLY ELECTRICALLY ACTUATED VALVE (TAG NO. V-04-32)
- 24 NEW 6"Ø BUTTERFLY ELECTRICALLY ACTUATED VALVE (TAG NO. V-04-74)
- 25 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-104)
- 26 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-204)
- 27 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-304)
- 28 NEW DIFFERENTIAL PRESSURE TRANSMITTER (TAG NO. DPT-04-404)
- 29 NEW CONCRETE WALL EXTENSION
- 30 NEW SAMPLING PUMP (TAG NO. PU-01-501)

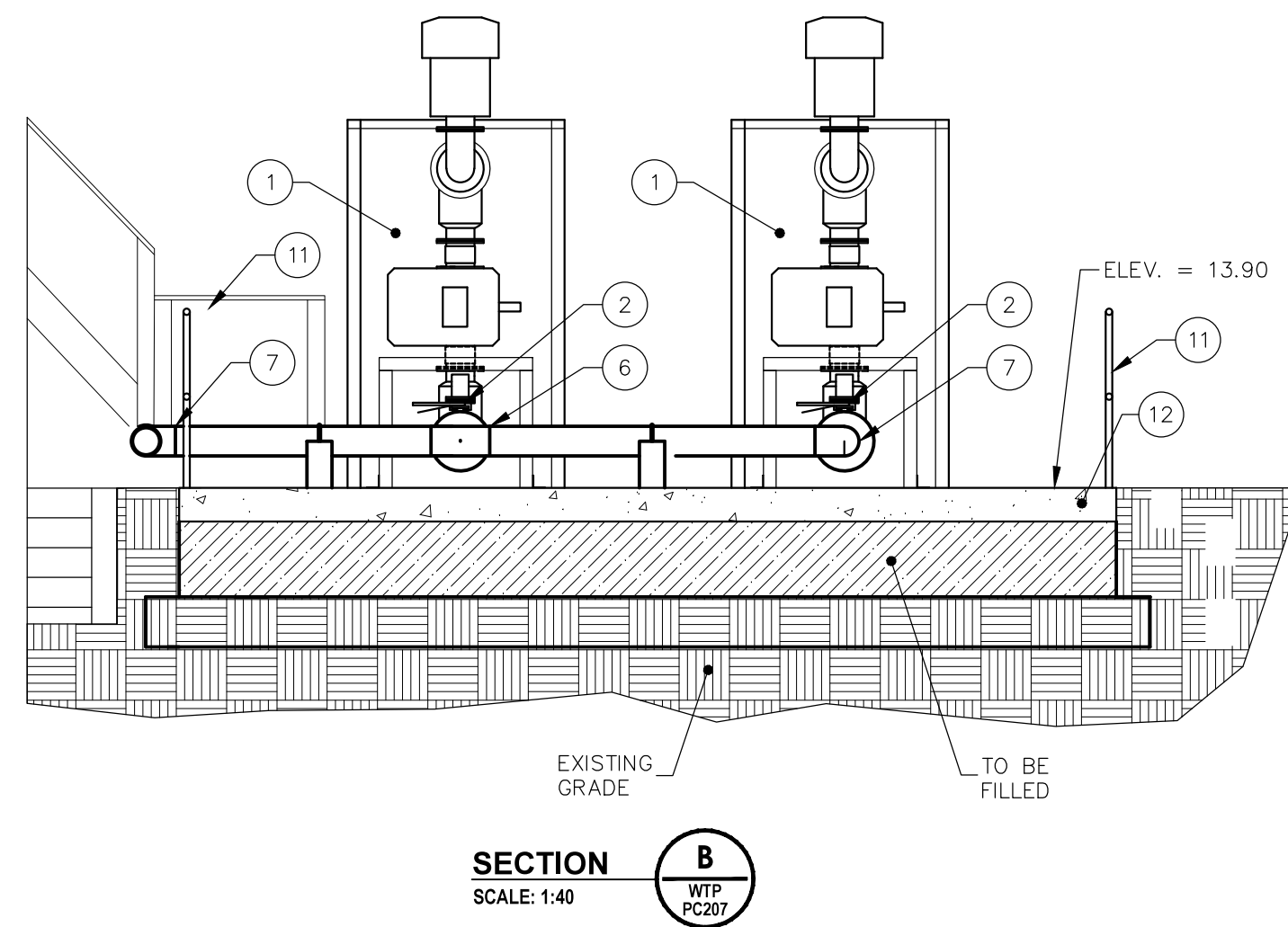


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JULY 30, 2021
BID SET

YO, EXEL F. COLON RIVERA, NUMERO DE LICENCIA 20794 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACIÓN FALSA O FALSIFICACIÓN DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCIÓN JUDICIAL Y DISCIPLINARIA POR LA OGP.



PROPOSED BLOWER IMPROVEMENT PLAN
SCALE: 1:50



SECTION
SCALE: 1:40

LEGEND DESCRIPTION:

- 50 HP POSITIVE DISPLACEMENT BLOWER WITH ENCLOSURE, TO BE SUPPLIED BY FILTERS SCOURING SYSTEM'S MANUFACTURER
- NEW 6" Ø ISOLATION VALVE, TO BE SUPPLIED BY FILTERS SCOURING SYSTEM'S MANUFACTURER
- NEW 6" Ø CHECK VALVE, TO BE SUPPLIED BY FILTERS SCOURING SYSTEM'S MANUFACTURER
- NEW 6" Ø RELIEF VALVE, TO BE SUPPLIED BY FILTERS SCOURING SYSTEM'S MANUFACTURER
- NEW 6" Ø STAINLESS STEEL PIPE, 304-L SCHED. 105, WELD.
- NEW 6"x6" Ø STAINLESS STEEL TEE, 304-L SCHED. 105, WELD.
- NEW 6" Ø STAINLESS STEEL 90 DEG. BEND, 316-L SCHED. 10, WELD.
- NEW 6" Ø STAINLESS STEEL FLANGE, 316-L, WELD.
- NEW 6" Ø S.S. U BOLT AND NUTS 316 FOR PIPE SUPPORT
- NEW PIPE SUPPORT SEE DETAIL ON WTP-S102
- NEW ALUMINUM RAILING SEE DETAIL ON WTP-C401
- NEW CONCRETE SLAB SEE DETAIL ON WTP-S102
- NEW PIPE SUPPORT FOUNDATION, SEE DETAIL ON WTP-S102

NOTES:

1. ALL DIMENSION ARE IN METERS UNLESS SPECIFIED OTHERWISE.



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Revisions

Number	Date	Description

SHEET INFO
Project No.: 19-1837.0
Set Date: 2018/08/31
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Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Client: CTRA & INACAPAG, PUERTO RICO
Owner:

Drawing Title:

PROPOSED BLOWERS IMPROVEMENTS PLAN & SECTIONS

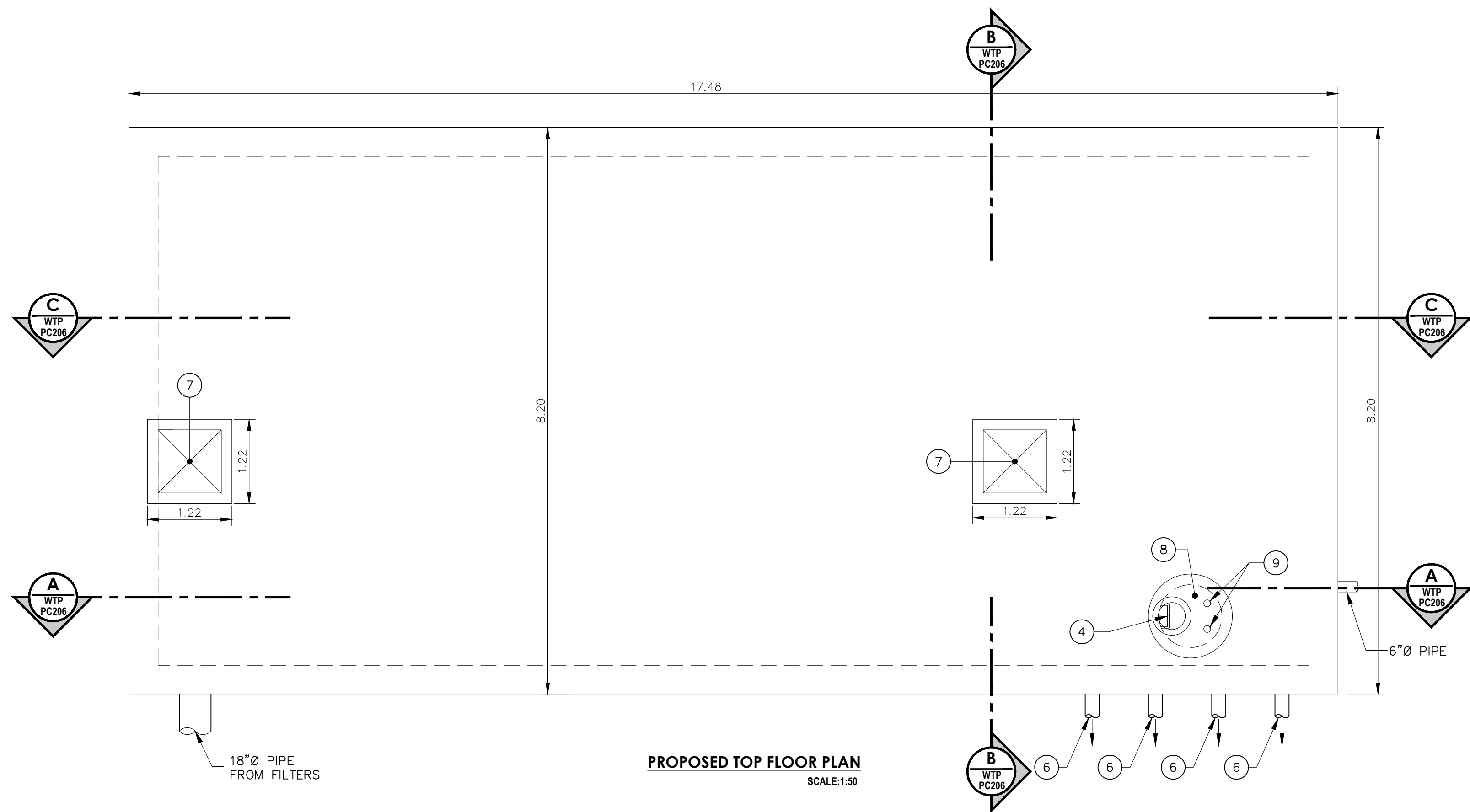
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WTP-PC207

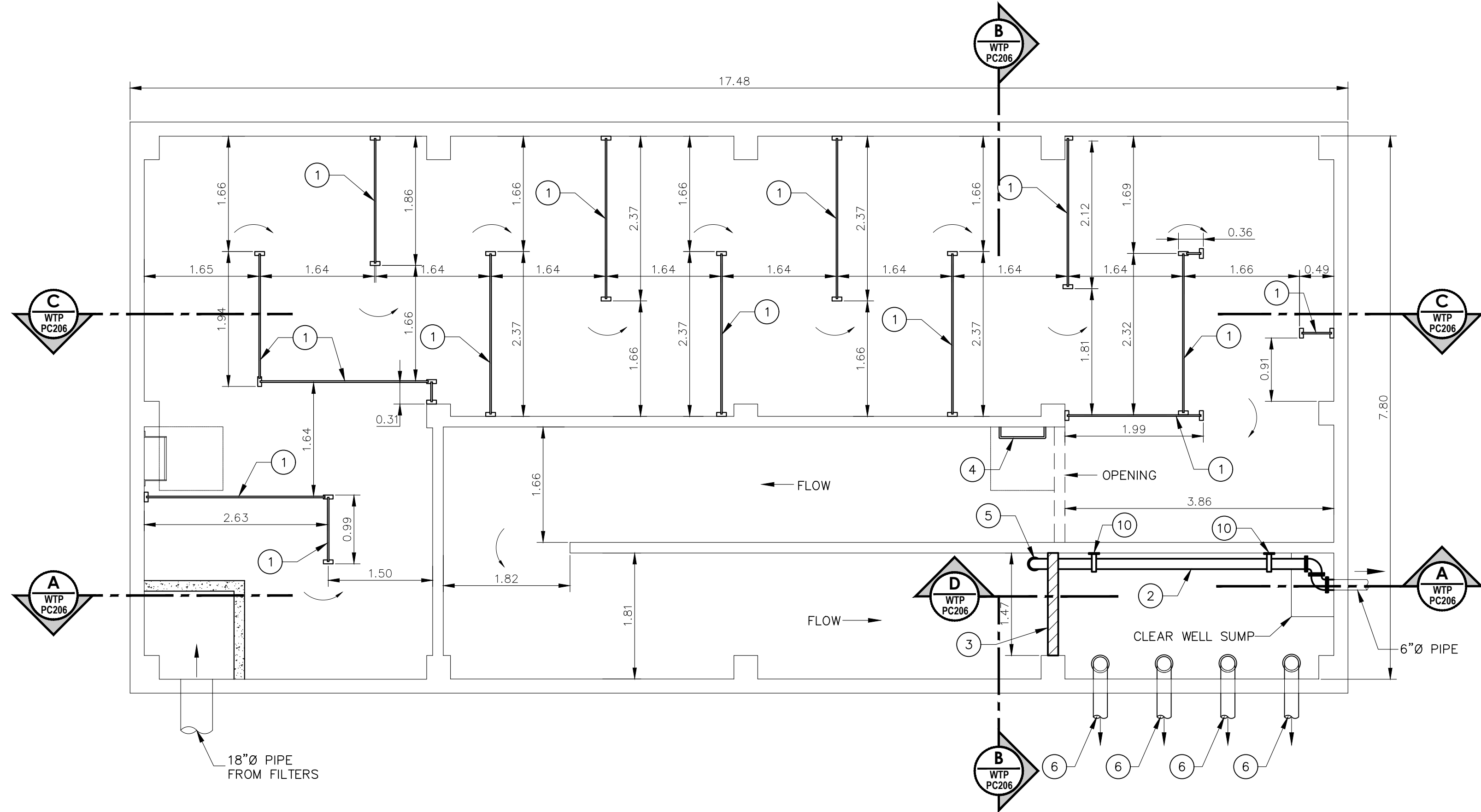
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PROPOSED TOP FLOOR PLAN
SCALE:1:50



PROPOSED BOTTOM FLOOR PLAN
SCALE:1:50

LEGEND DESCRIPTION:

1. FIBERGLASS BAFFLE WALL SYSTEM, AS PER MANUFACTURED BY FIBERGLASS FABRICATION INC. OR APPROVED EQUAL. REFER TO SECTION 46 41 80 FOR DETAILS.
2. 6"Ø BACKWASH PUMP SUCTION PIPE EXTENSION.
3. NEW CONCRETE WALL (SEE DETAIL ON DWG. WTP-S103)
4. NEW LADDER RUNGS REFER TO CIVIL DETAILS
5. NEW 6"Ø FLARE
6. NEW DISTRIBUTION PUMPS 8" SUCTION PIPES
7. NEW ACCESS HATCH
8. NEW MANHOLE TO BE WATER TIGHT
9. NEW INSTRUMENT WELL
10. PIPE SUPPORTS, SEE DETAIL ON DWG

NOTES:

1. CONTRACTOR SHALL COORDINATE REQUIRED ACCESS TO LOCATE FIBERGLASS BAFFLE UNITS AND MATERIAL FOR THE CONSTRUCTION OF THE NEW CONCRETE WALL AND FIBERGLASS / BAFFLE INSIDE THE TANK.
2. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE FEDERAL STATE OR LOCAL SAFETY REQUIREMENTS. IN NO EVENT THE OMISSION OF ANY REQUIREMENT IN THESE NOTES WILL WAIVE THE CONTRACTOR TO COMPLY WITH THEM.
3. THE CONTRACTOR SHALL TAKE REASONABLE PRECAUTIONS FOR THE SAFETY OF EMPLOYEES AND COMPLY WITH ALL APPLICABLE FEDERAL, COMMONWEALTH AND MUNICIPAL SAFETY LAWS, BUILDING AND CONSTRUCTION CODES. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE PUERTO RICO OCCUPATIONAL SAFETY AND HEALTH ACT (LAW NUMBER 16 APPROVED ON AUGUST 5, 1975).
4. THE CONTRACTOR SHALL PROVIDE EQUIPMENT FOR PERSONAL PROTECTION, MATERIALS, TOOLS AND APPROVED WORK PROCEDURES ACCORDING TO THE DISPOSITION OF THE GENERAL INDUSTRY OSHA SAFETY AND HEALTH STANDARDS (29 CFR 1910) AND THE SAFETY AND HEALTH STANDARDS APPLICABLE TO THE CONSTRUCTION INDUSTRY (29 CFR 1926).
5. ALL DIMENSION ARE IN METERS UNLESS SPECIFIED OTHERWISE.



Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, ROLANDO PACHECO COLON, NUMERO DE LICENCIA 23752 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

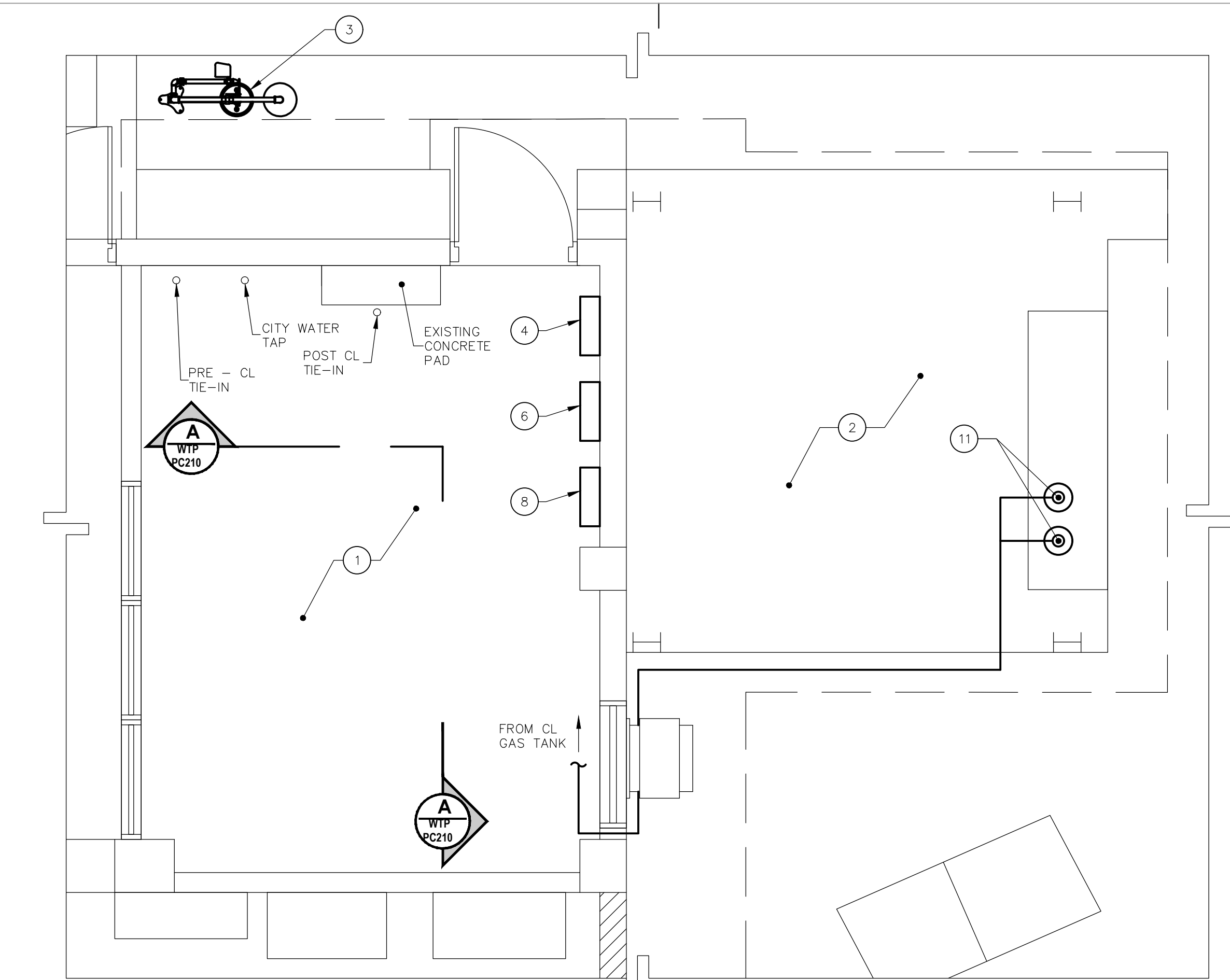
Revisions		SHEET INFO:	
Number	Date	Description	
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		Set Date: 2018/09/31	
		Drawn by:	
		Dwg. Date:	



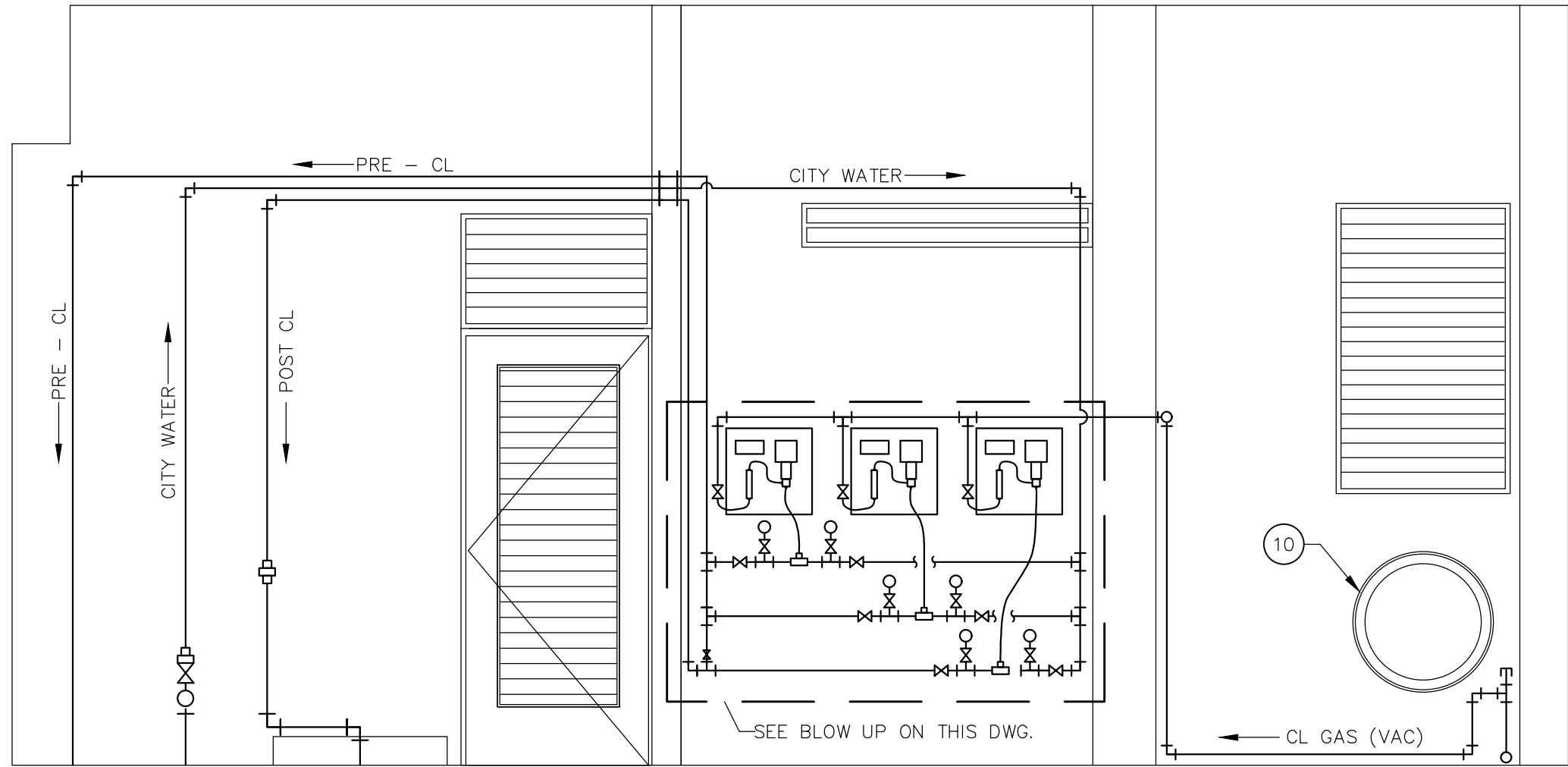
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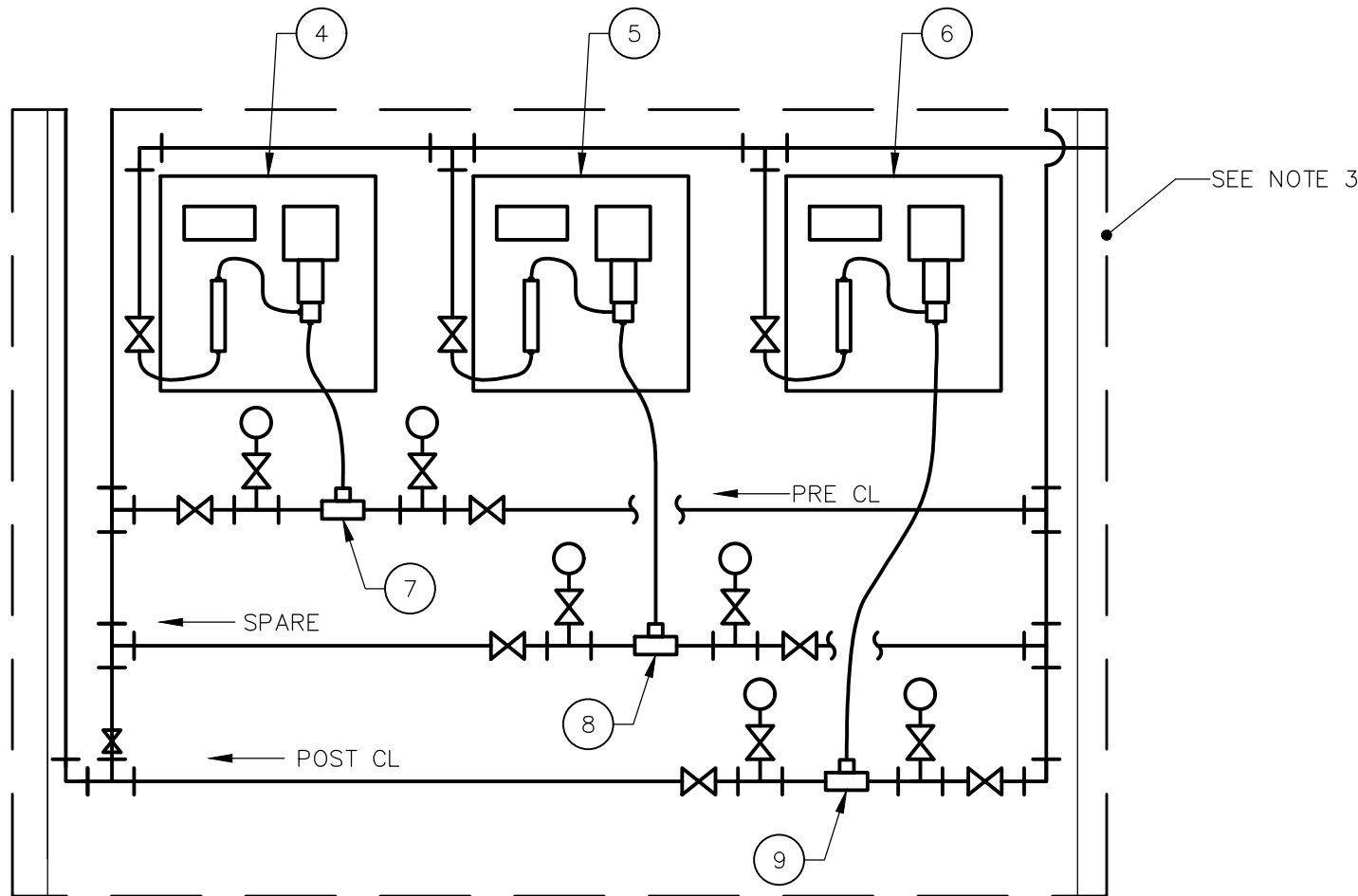
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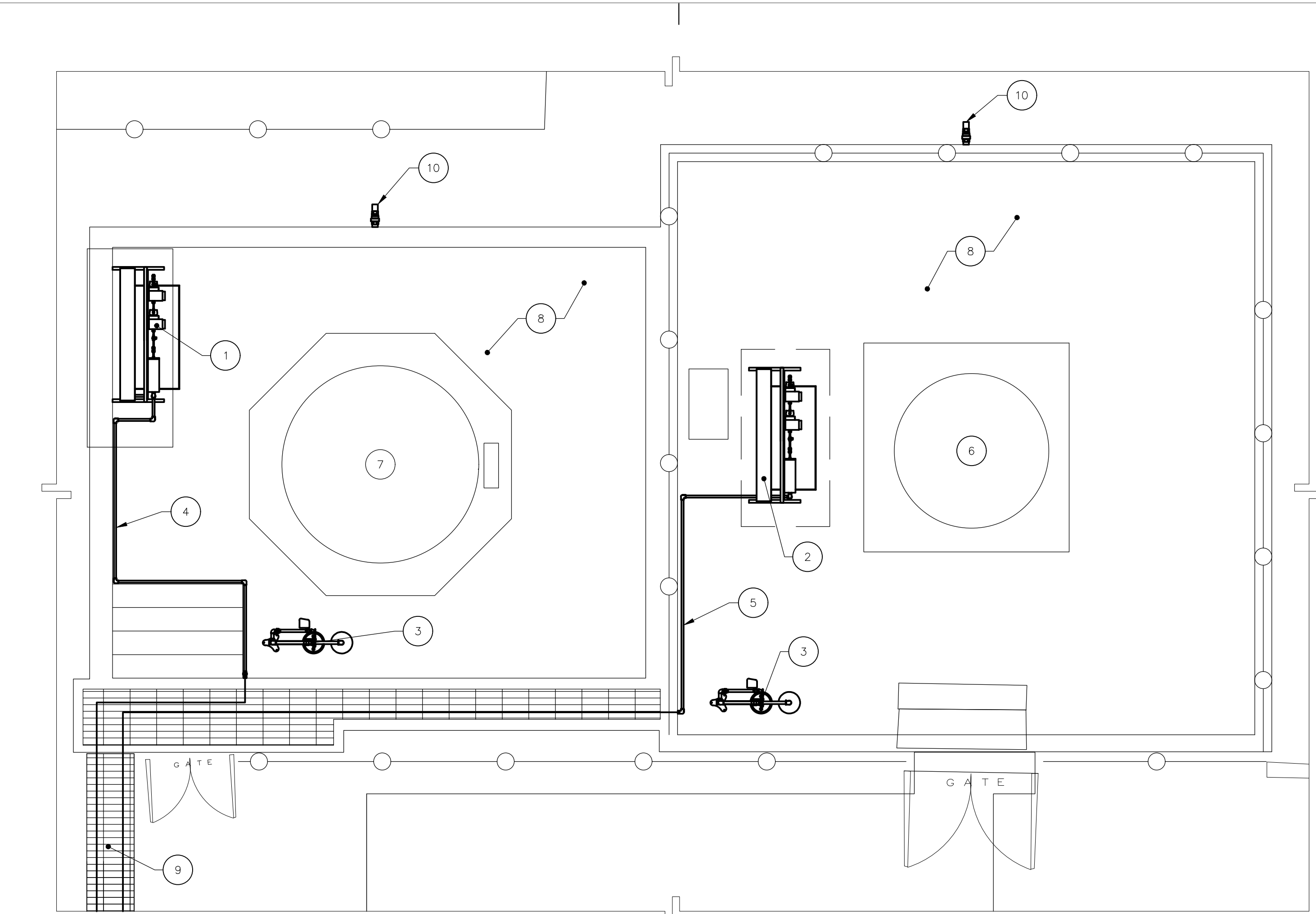
PROPOSED CHLORINE ROOM IMPROVEMENT PLAN
SCALE:1:30



SECTION A
SCALE: 1:30



BLOW UP
N.T.S.



PROPOSED CHEMICAL AREA IMPROVEMENT PLAN
SCALE:1:40

LEGEND DESCRIPTION:

- EXISTING CHLORINE ROOM
- EXISTING CHLORINE TANKS STORAGE AREA
- NEW EMERGENCY EYE WASHER AND SHOWER (SEE DETAIL ON DWG. WTP-PC212)
- PRE-CHLORINATION AUTOMATIC DOSER, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- SPARE-CHLORINATION AUTOMATIC DOSER, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- POST-CHLORINATION AUTOMATIC DOSER, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- PRE-CHLORINATION EJECTOR, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- POST-CHLORINATION EJECTOR, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- SPARE-CHLORINATION EJECTOR, AS PER MANUFACTURED BY SUPERIOR OR APPROVED EQUAL
- NEW EXTRACTOR, EXISTING SHALL BE REPLACED, REFER TO SECTION 46 31 11 FOR DETAILS

○ STAINLESS STEEL CASE PRESSURE INDICATOR

✕ 1 1/2" DIA. PVC SCHED 80 ISOLATION BALL VALVE.

NOTES:

- ALL CHEMICAL PIPE SHALL BE PVC SCH-80.
- ALL CHEMICAL PIPING SHALL BE PROPERLY PAINTED AND IDENTIFIED.
- EXISTING CHLORINE INJECTION UNITS TO BE REMOVED.

LEGEND DESCRIPTION:

- NEW PH NEUTRALIZER CHEMICAL SKID (SEE DETAIL ON DWG. WTP-PC212)
- COAGULANT CHEMICAL SKID (SEE DETAIL ON DWG. WTP-PC212)
- NEW EYE WASHER AND SHOWER (SEE DETAIL ON DWG. WTP-PC212)
- NEW PH NEUTRALIZER CHEMICAL PIPE TO NEW INJECTION PORT
- NEW COAGULANT CHEMICAL PIPE TO NEW INJECTION PORT
- NEW ALUM TANK
- NEW CAUSTIC SODA TANK
- EXISTING CONCRETE DIKE
- EXISTING CHEMICAL PIPE TRENCH
- NEW 3"Ø PAD LOCK DRAIN VALVE
- NEW CHLORINE GAS CYLINDERS

NOTES:

- ALL CHEMICAL PIPE SHALL BE CPVC SCH-80.
- ALL CHEMICAL PIPING SHALL BE PROPERLY PAINTED AND IDENTIFIED.
- REFER TO SECTION 41 31 11 FOR DETAILS



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Revisions	Number	Date	Description	SHEET INFO:
	Project	Ndg-1837.0		
	Set Date	2018/08/31		
	Drawn by:			
	Dwg. Date:			

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

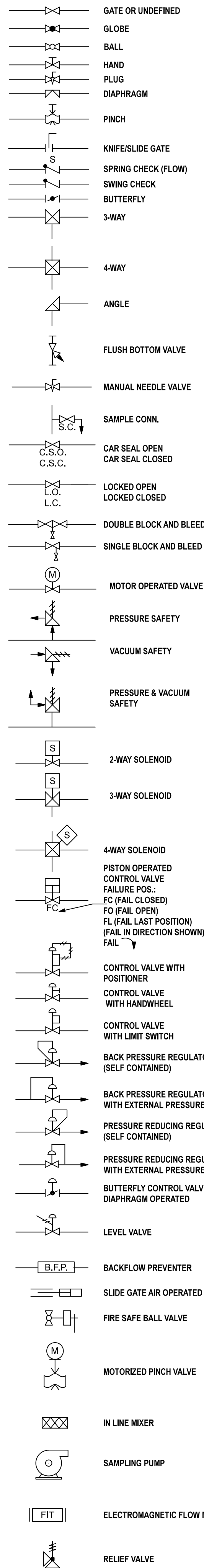
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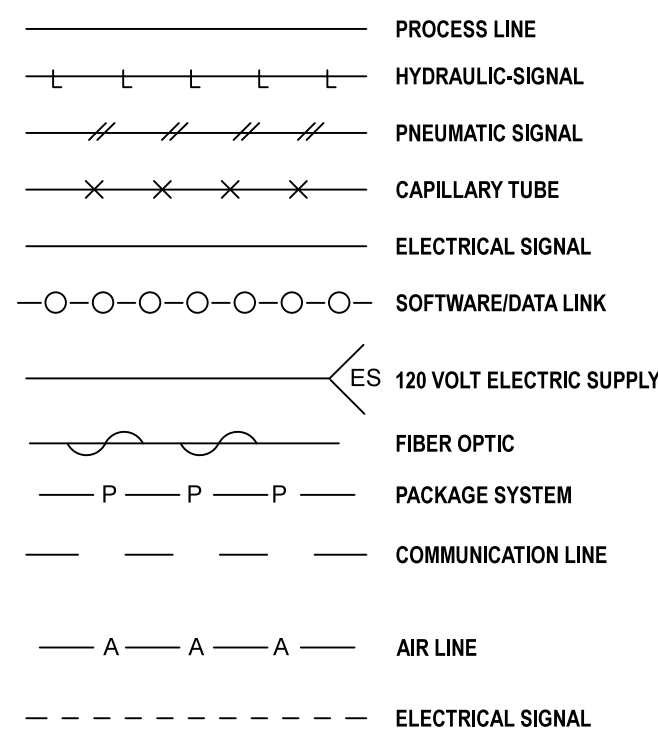
PROPOSED CHEMICAL AND CHLORINE ROOM

WTP-PC210

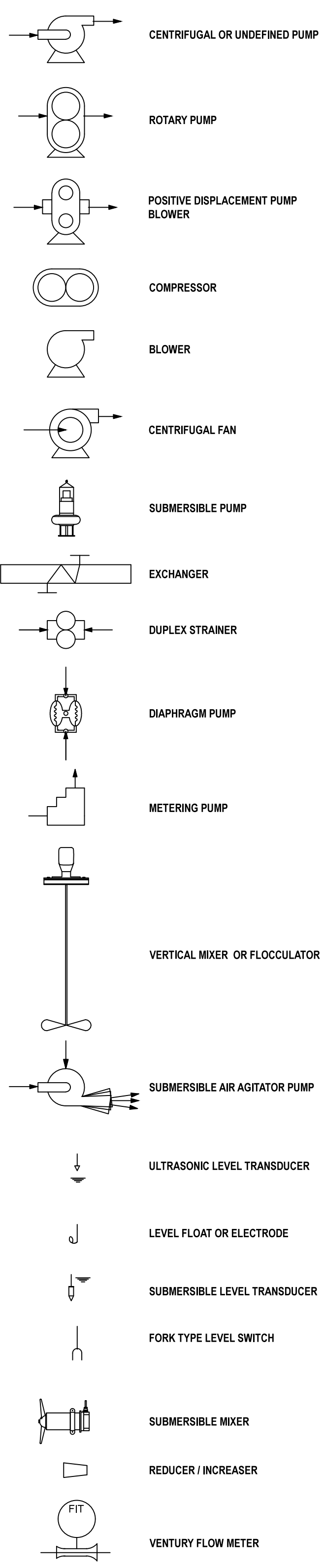
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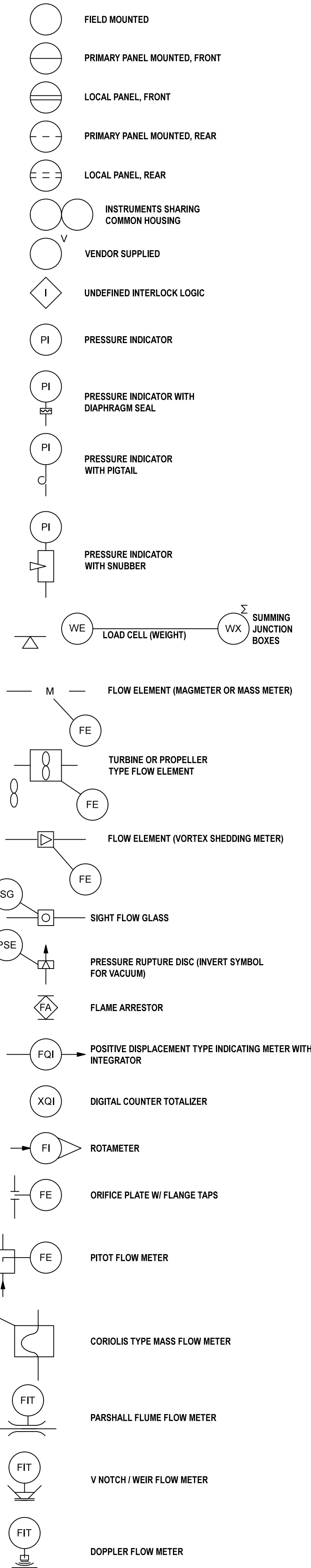
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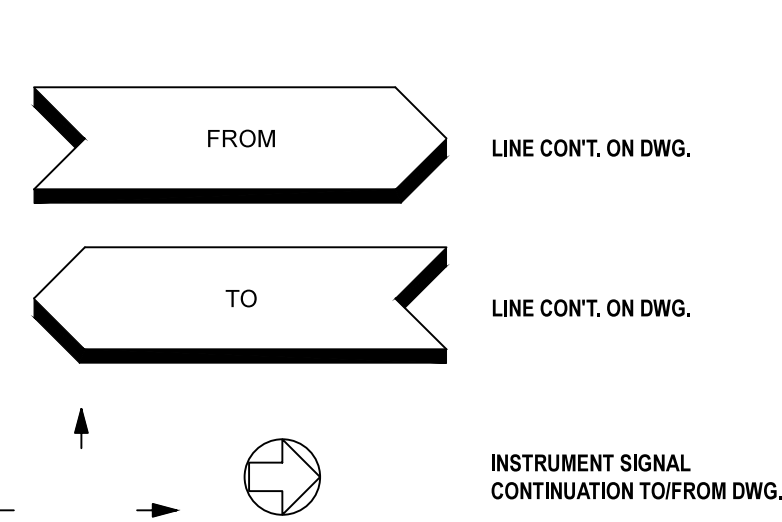
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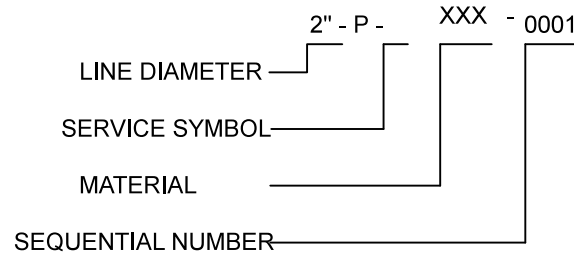
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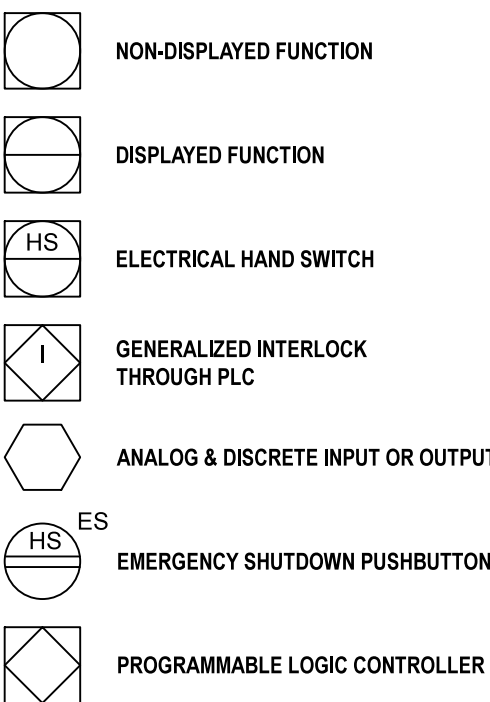
FLOW SHEET AND PIPING SYMBOLS



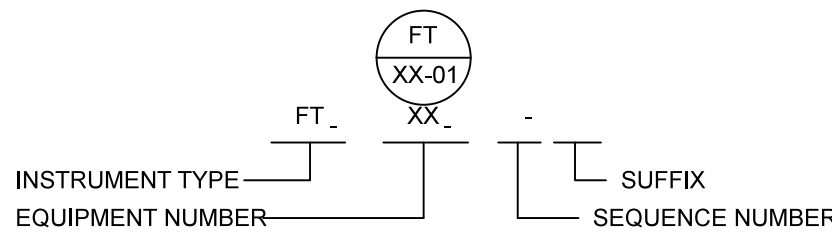
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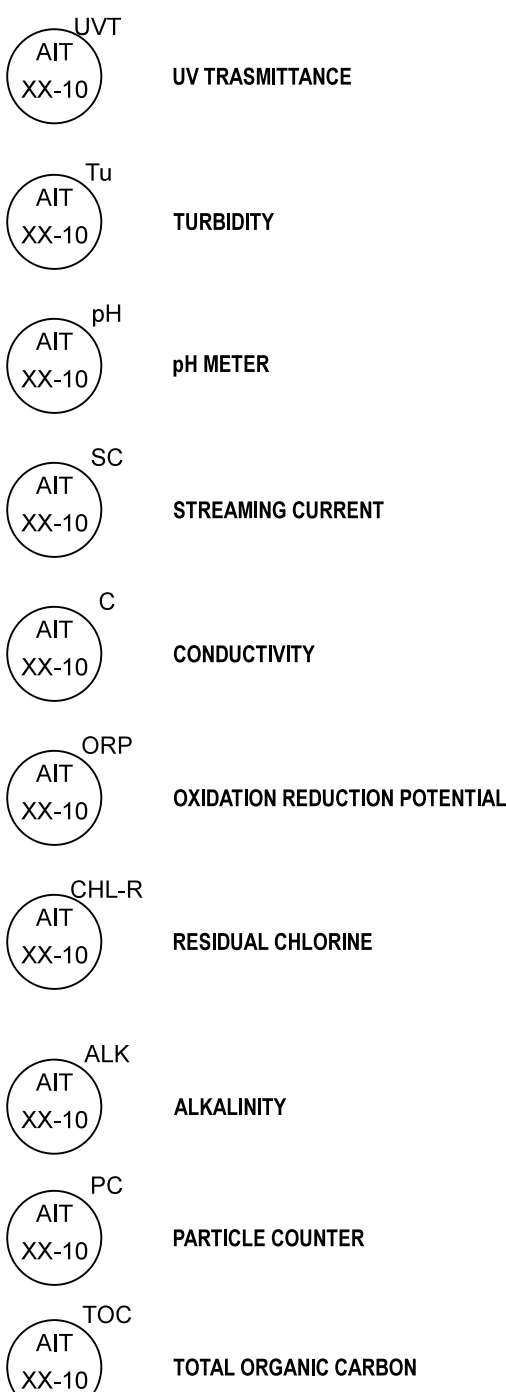
PROCESS CONTROL SOFTWARE PLC SYMBOLS



TYPICAL INSTRUMENT TAG NUMBER



ANALYZERS



INSTRUMENTATION ABBREVIATION

FIRST LETTER		SECOND LETTER		
MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYSIS (5,19)		ALARM		
B BURNER COMBUSTION		USER'S CHOICE (1)	USER'S CHOICE (1)	USER'S CHOICE (1)
C CONDUCTIVITY (I) (ELECTRICAL)			CONTROL (13)	
D DENSITY (MASS) OR SPECIFIC GRAVITY (I)	DIFFERENTIAL (4)			
E VOLTAGE (EMF)		SENSOR (PRIMARY ELEMENT)		
F FLOW RATE	RATIO (FRACTION) (4)			
G GAGING (I) (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H HAND (MANUALLY INITIATED)				HIGH (15,16)
I CURRENT (ELECTRICAL)		INDICATE (10)		
J POWER	SCAN (7)			
K TIME OR TIME SCHEDULE	TIME RATE OF CHANGE (4,21)		CONTROL STATION (22)	
L LEVEL		LIGHT (PILOT) (11)		LOW
M MOISTURE OR HUMIDITY	MOMENTARY (4)			MIDDLE OR (7,15) INTERMEDIATE
N USER'S CHOICE (I)		USER'S CHOICE	USER'S CHOICE (1)	USER'S CHOICE (1)
O USER'S CHOICE (I)		ORIFICE (RESTRICTION)		
P PRESSURE OR VACUUM		POINT (TEST) CONNECTION		
Q QUANTITY OR EVENT	INTEGRATE OR TOTALIZE (4)			
R RADIATION		RECORD OR PRINT (17)		
S SPEED, FREQUENCY	SAFETY (8)		SWITCH (13)	
T TEMPERATURE			TRANSMIT (18)	
U MULTIVARIABLE (16)		MULTIFUNCTION (12)	MULTIFUNCTION (12)	MULTIFUNCTION (12)
V VISCOSITY VIBRATION, MECH. ANALYSIS (19)			VALVE, DAMPER OR LOUVER (13)	
W WEIGHT OR FORCE		WELL		
X UNCLASSIFIED (2)	X AXIS	UNCLASSIFIED (2)	UNCLASSIFIED (2)	UNCLASSIFIED (2)
Y EVENT, STATE OR PRESENCE (20)	Y AXIS		RELAY, COMPUTE OR CONVERT (13,14,18)	
Z POSITION, DIMENSION	Z AXIS		DRIVE, ACTUATOR OR UNCLASSIFIED FINAL CONTROL ELEMENT	

(X) SEE ISA STD. S5.1

EQUIPMENT CATEGORY NUMBER ASSIGNMENTS

CATEGORY NUMBER	DESCRIPTION
01	RAW WATER
02	COAGULATION AND FLOCCULATION UNITS
03	SEDIMENTATION BASINS
04	FILTRATION UNIT & BACK WASH SYSTEM
05	CLEAR WELL & DISTRIBUTION SYSTEM
06	SLUDGE LAGOONS
07	CHEMICALS



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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



Project Title:

Sheet:

WTP-PI101

Revisions

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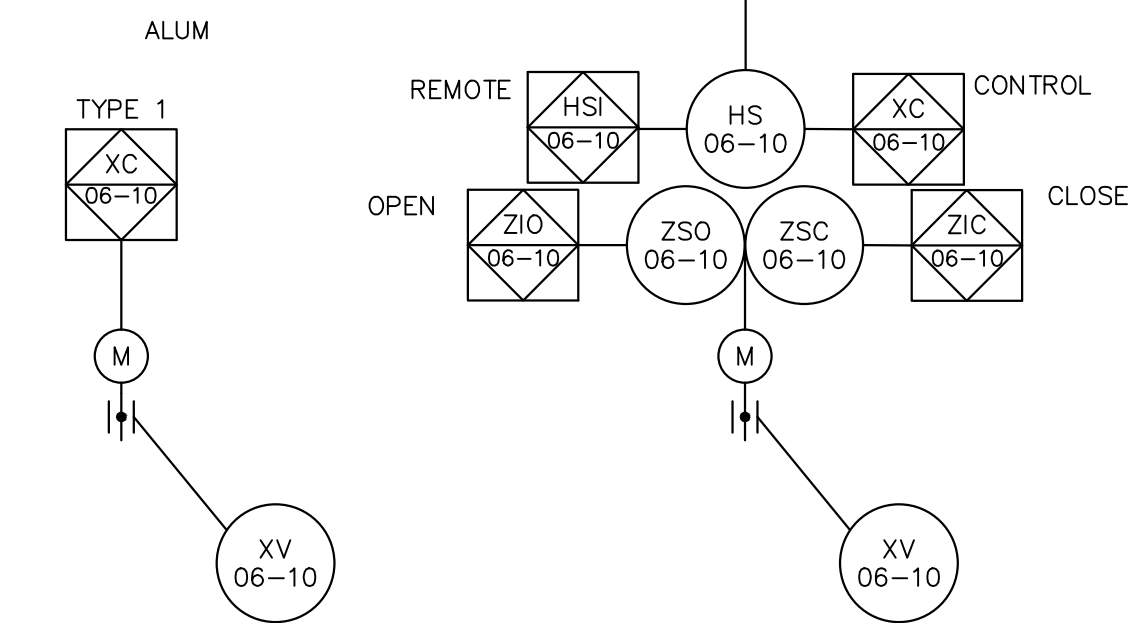
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Drawing Title:
P&ID DIAGRAM LEAD SHEET 1

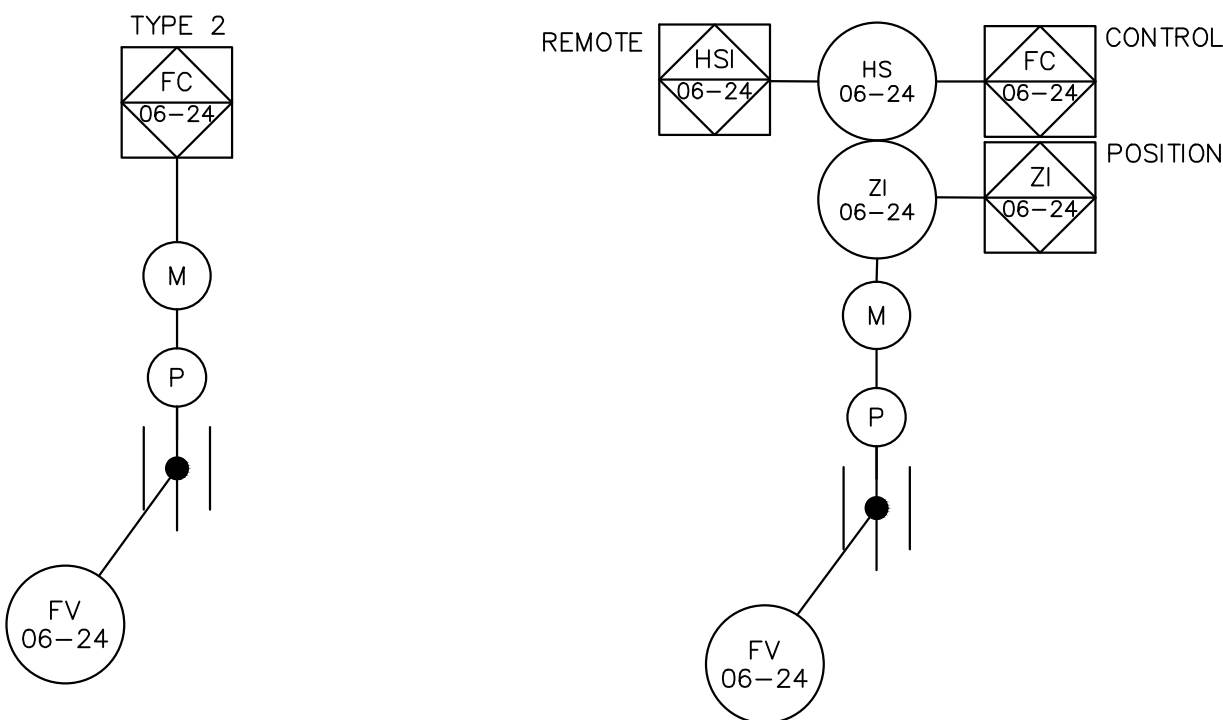
VALVES

TYPE 1



MOTORIZED VALVES
WITH NON MODULATING
ACTUATOR

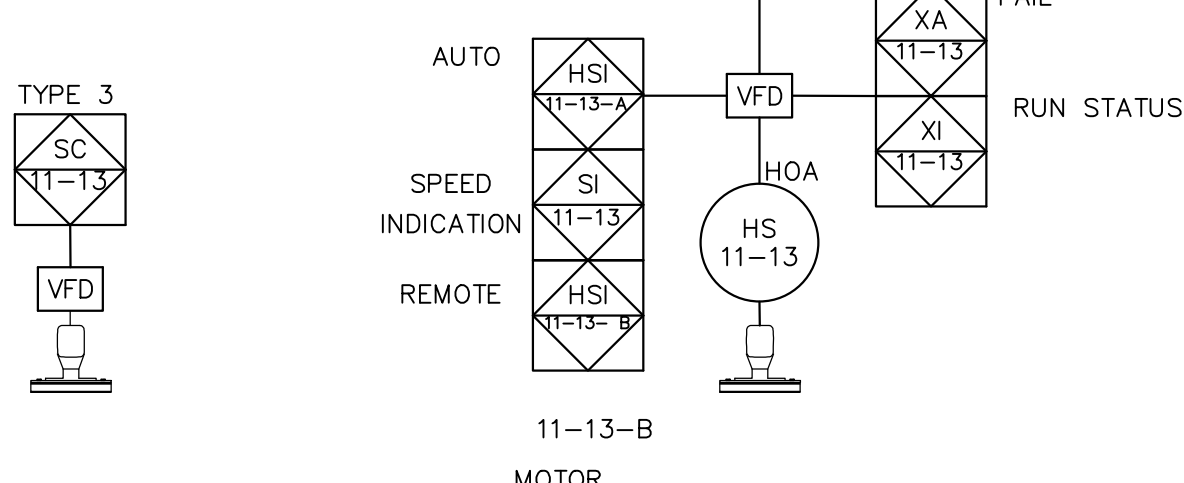
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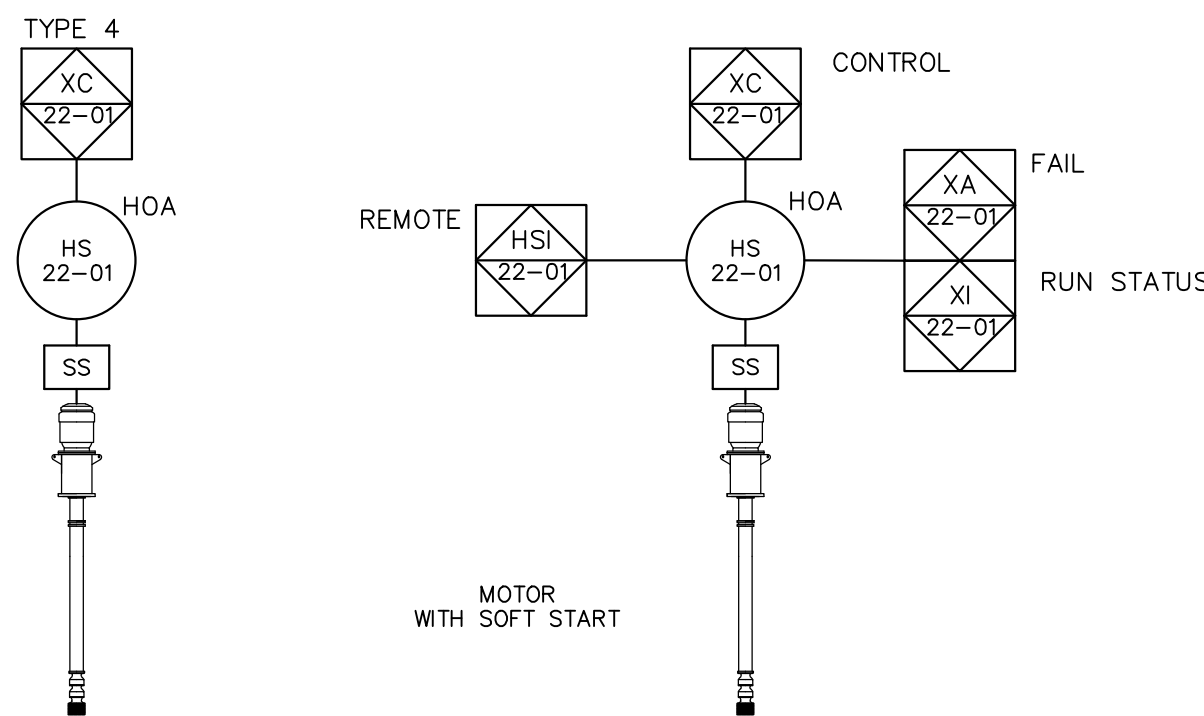
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WITH MODULATING
ACTUATOR

MOTORS

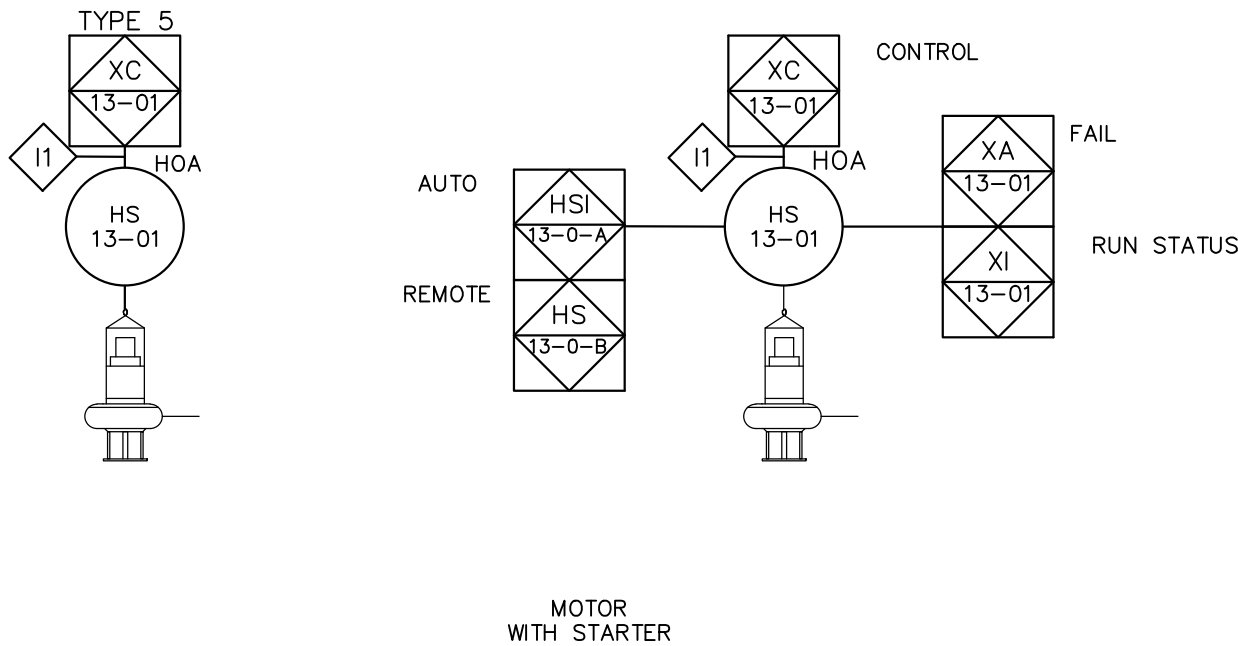
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TYPE 4

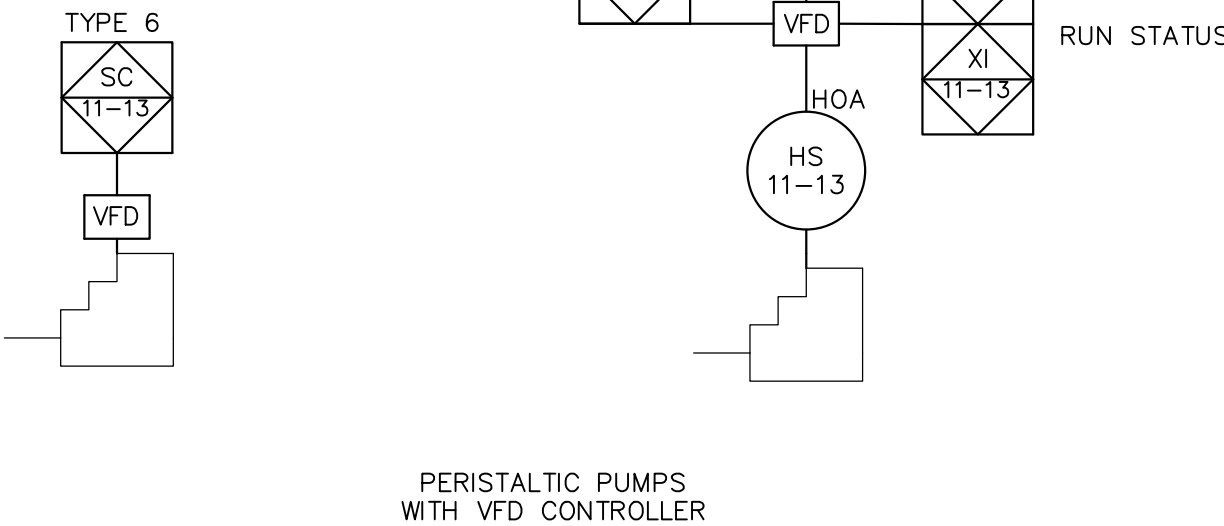


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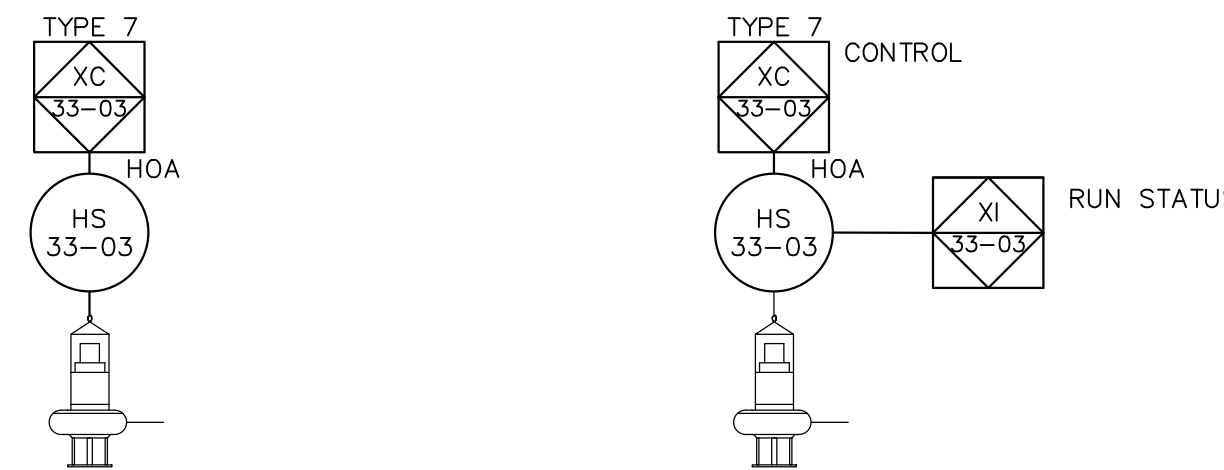
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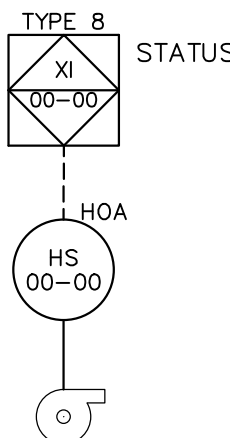


PERISTALTIC PUMPS
WITH VFD CONTROLLER

TYPE 7



MOTOR
WITH LOCAL STARTER



SAMPLING PUMP WITH LOCAL
DISCONNECT SWITCH AND CURRENT
SWITCH FOR MONITORING

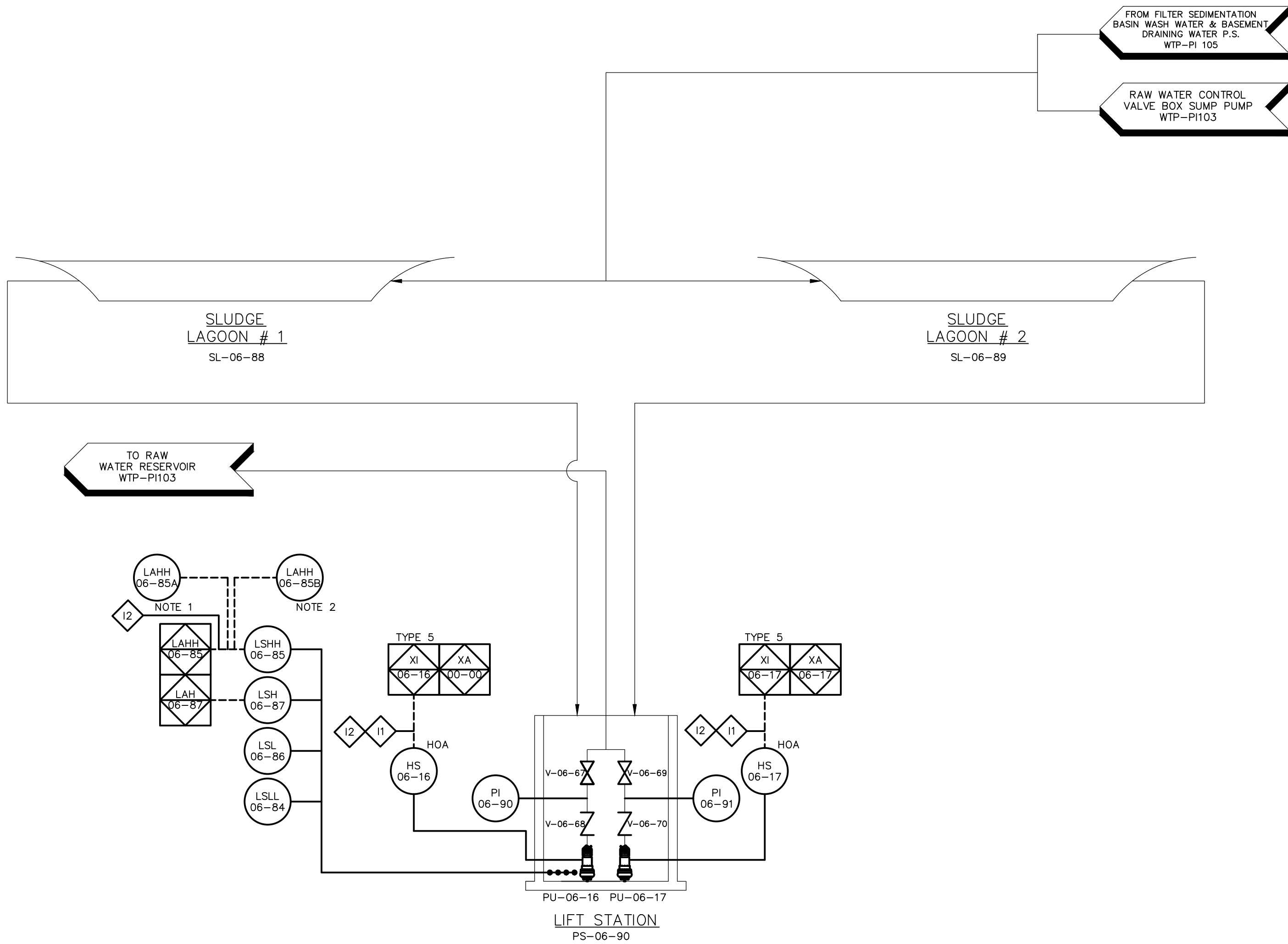
ABBREVIATIONS

HV	MANUAL VALVE	MX	MIXER	HX	HEATER
XV	ACTUATED VALVE (ON-OFF)	SB	SEDIMENTATION BASIN	FL	FILTERS
FV	MODULATING VALVE	PU	PUMP	CEF	CENTRIFUGE
CV	CHECK VALVE	TK	TANK	FB	FLOCCULATION BASIN
TU	TURBIDIMETER	PH	PH SENSOR	(E)	EXISTING
CHL-R	RESIDUAL CHLORINE	C	CONDUCTIVITY ANALYZER	ALK	ALKALINITY
TOC	TOTAL ORGANIC CONTENT	ORP	REDOX ANALYZER	PC	PARTICLE COUNTER
VFD	VARIABLE FREQUENCY DEVICE	SCM	STREAMING CURRENT MONITOR	SMX	SUBMERSIBLE MIXER
SS	SOFT START	RTD	RESISTANCE TEMP DEVICE	BW	BACKWASH
BWW	BACKWASH WASTE	EFF	EFFLUENT	CL2	CHLORINE INJECTION
FTW	FILTER TO WASTE	INF	INFLUENT	TEMP	TEMPERATURE
DG	DEGRITTING UNIT	SBS	SLUDGE BLANKET SENSOR	GC	GRIT CLASSIFIER
WR	WATER RESERVOIR	BL	BLOWER	SL	SLUDGE LAGOON
VB	VALVE BOX	CI	CAST IRON	AS	AIR SCOURING
SS1	304 STAINLESS STEEL	RW	RAW WATER	FW	FINISHED WATER OR DRAINAGE
FFW	FILTERED WATER	AE	AIR EXTRACTOR	LV	LEVEL VALVE
				FCV	FLOW CONTROL VALVE



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DATE ISSUE
▶ JULY 30, 2021 ◀
REVISED BID SET

[illegible]



PU-06-16 AND
PU-06-12
REFER TO TECHNICAL
SPECS

INTERLOCKS

- 11 PU-06-16 AND PU-06-17 WILL SHUTDOWN AT LALL-06-84.
- 12 PU-06-16 AND PU-06-17 WILL BOTH TURNED ON AT LAHH-06-85.

NOTES

1. AUDIBLE ALARM AT LAHH-06-85.
2. VISIBLE ALARM AT LAHH-06-85.



Integra Design Group
DATE ISSUED
JULY 30, 2021
BID SET

YO, RAFAEL RENÉ DIAZ VAZQUEZ, INGENIERO LICENCIADO, NUMERO DEL LICENCIADO: 25752, CERTIFICADO QUE ENTiendo QUE DICHOS PLANOS Y ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPPE.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions

Number	Date	Description

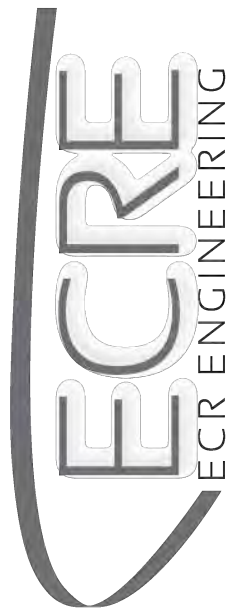
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Project No.: 18-1637.0
Set Date: 2018/08/31
Drawn by: RDV
Dwg. Date:

Project Title:

Drawing Title:

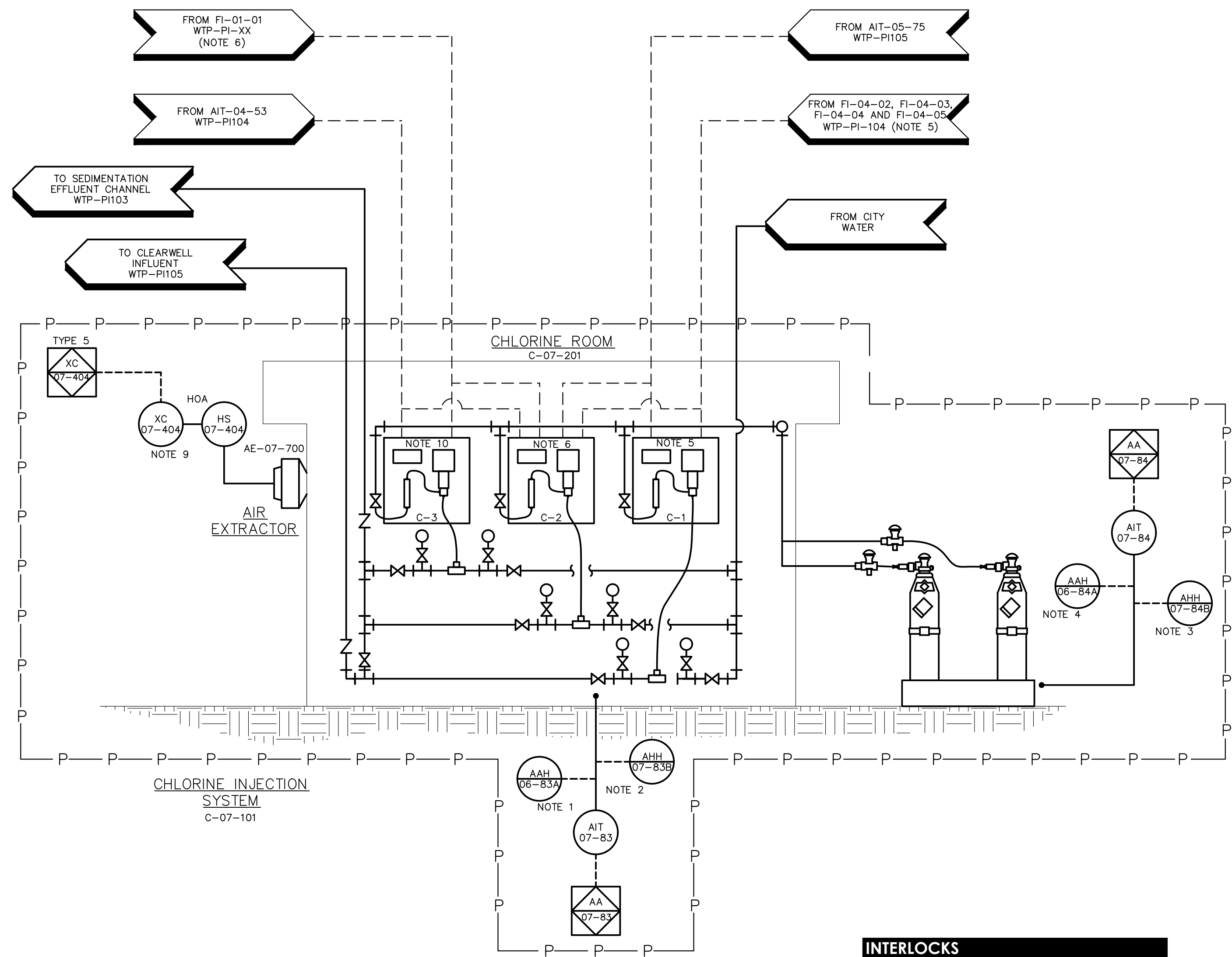
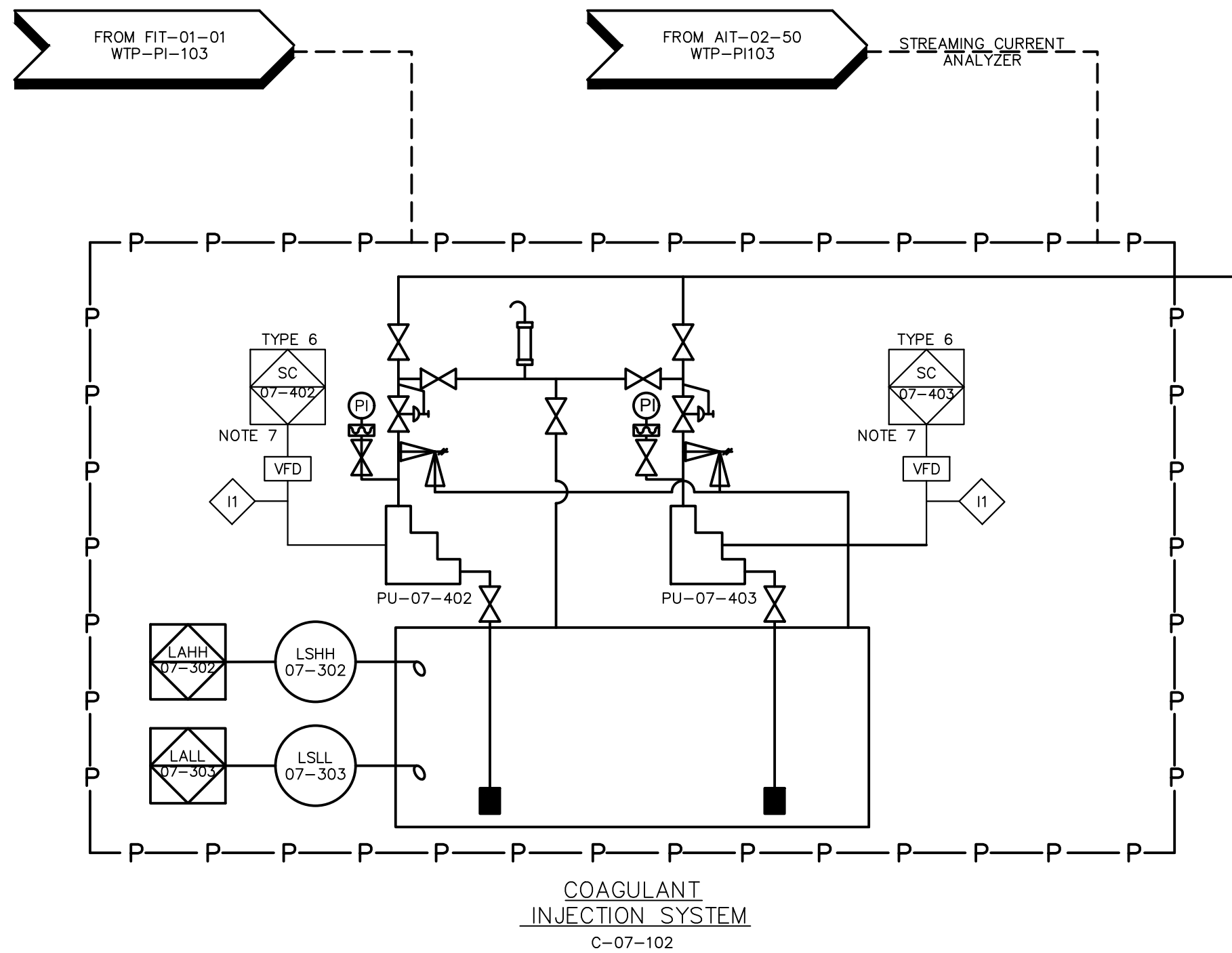
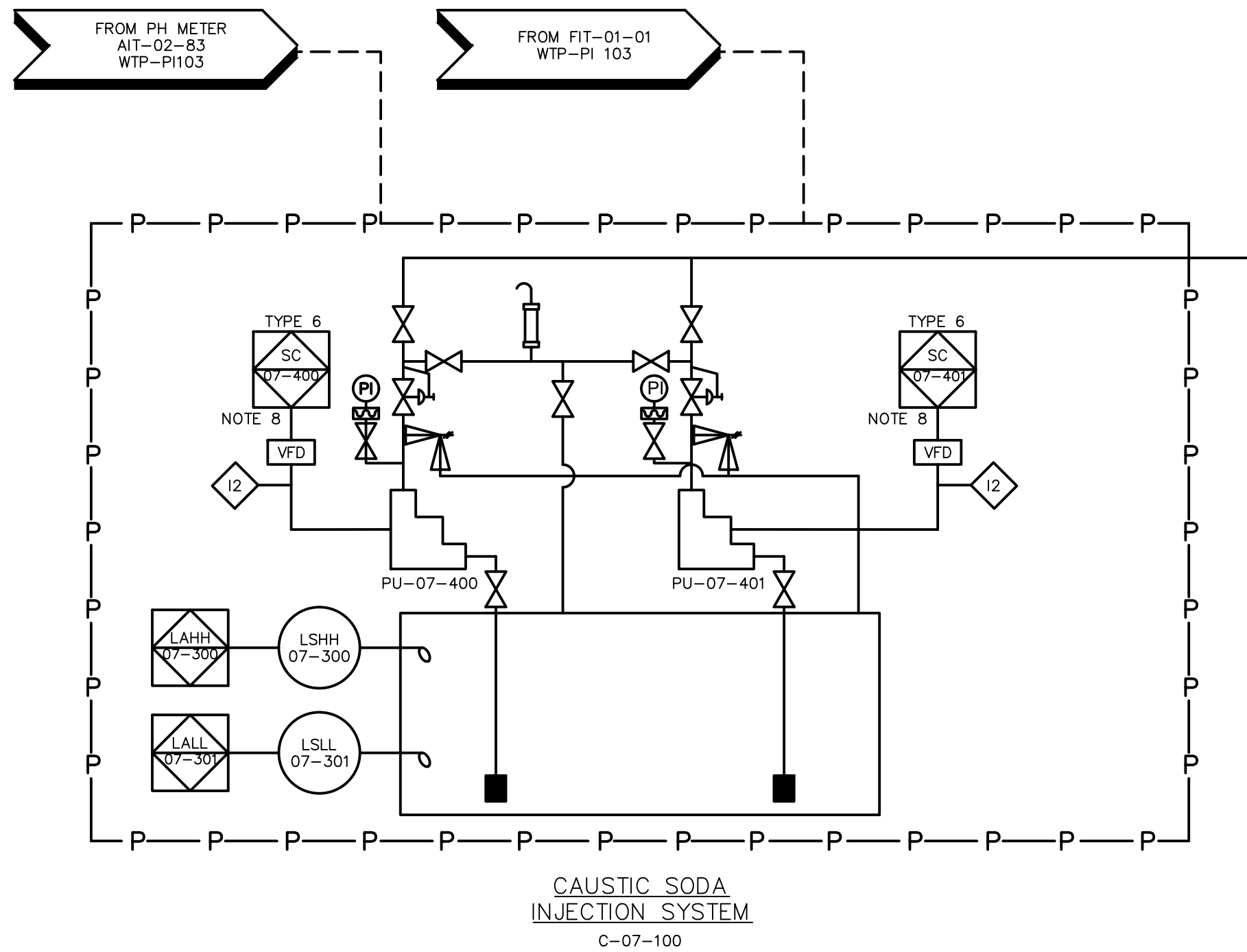
P&ID SLUDGE LAGOONS

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WTP-PI106



INTERLOCKS

- 11 PU-07-402 AND PU-07-403 WILL SHUTDOWN AT LALL-07-303
- 12 PU-07-401 AND PU-07-400 WILL SHUTDOWN AT LALL-07-301

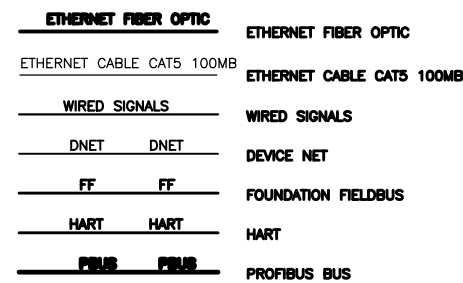
NOTES

1. VISIBLE ALARM AT AI-07-83 HIGH
2. AUDIBLE ALARM AT AI-03-83 HIGH.
3. VISIBLE ALARM AT AI-07-84 HIGH
4. AUDIBLE ALARM AT AI-03-84 HIGH.
5. FILTER CHLORINE INJECTION TO BE CONTROLLED BY FI-01-01 AND FI-02-50. THE SUM OF ALL FILTERS' FLOW IN SERVICE (FI-04-02, FI-04-03, FI-04-04 AND FI-04-05).
6. SEDIMENTATION BASIN EFFLUENT CHLORINE INJECTION TO BE CONTROLLED BY FI-01-01 AND FI-02-50.
7. PU-07-403 AND PU-04-402 TO BE CONTROLLED BY FI-01-01 AND FI-02-50.
8. PU-07-400 AND PU-07-401 TO BE CONTROLLED BY FI-01-01 AND FI-02-83.
9. AE-07-700 TO BE TURNED ON AT WITH DOOR SWITCH AND MANUALLY.
10. SPARE CHLORINE INJECTION TO BE CONTROLLED BY EITHER THE SIGNALS CONTROLLING C-1 OR SIGNALS CONTROLLING C-2.



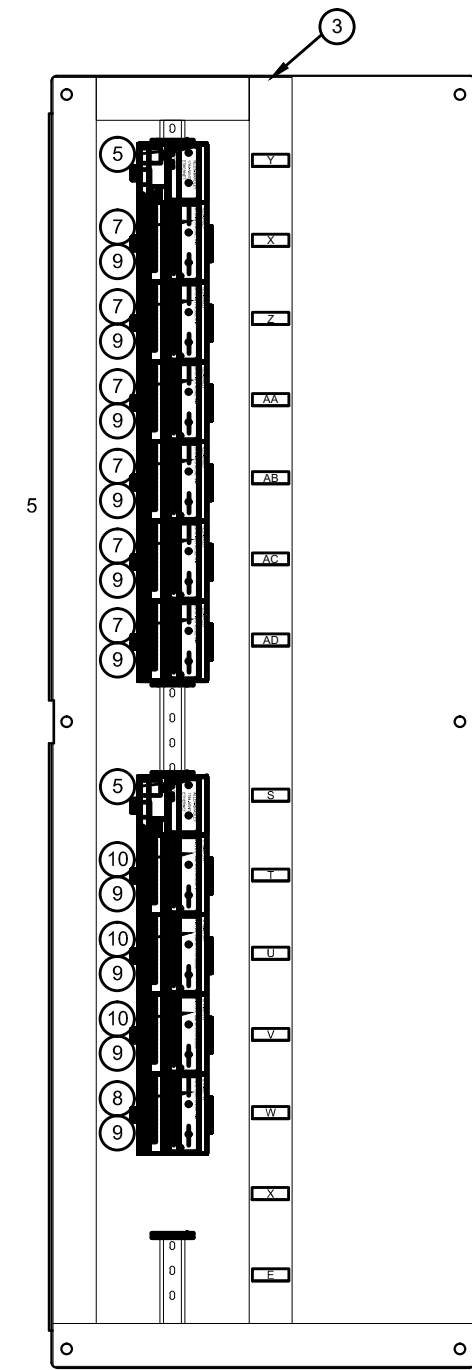
Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, RAFAEL R. DÍAZ VÁZQUEZ, NUMERO DE LICENCIA 25752 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ASIMISMO, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA; Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

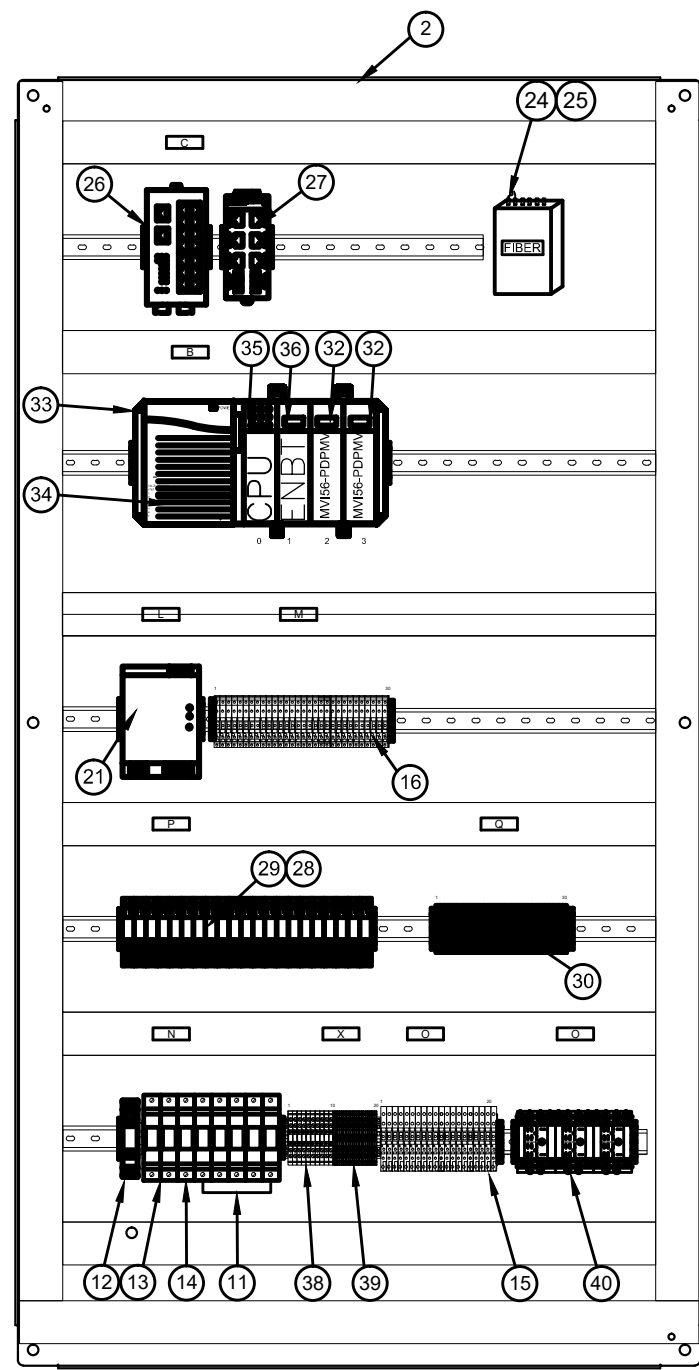


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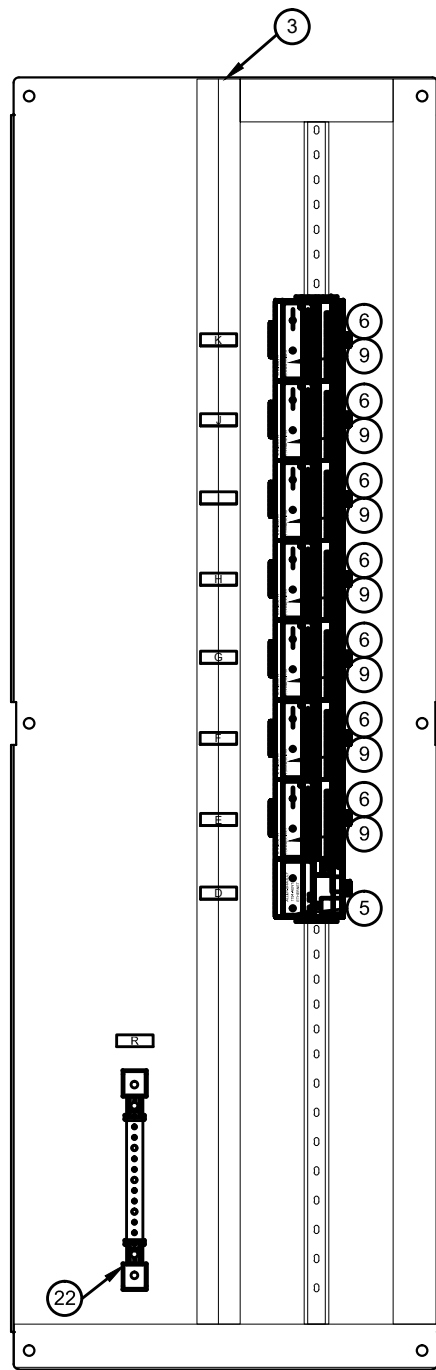
Revisions		SHEET INFO.	
Number	Date	Description	
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			Set Date: 2021/07/28
			Drawn by:
			Drawn Date:



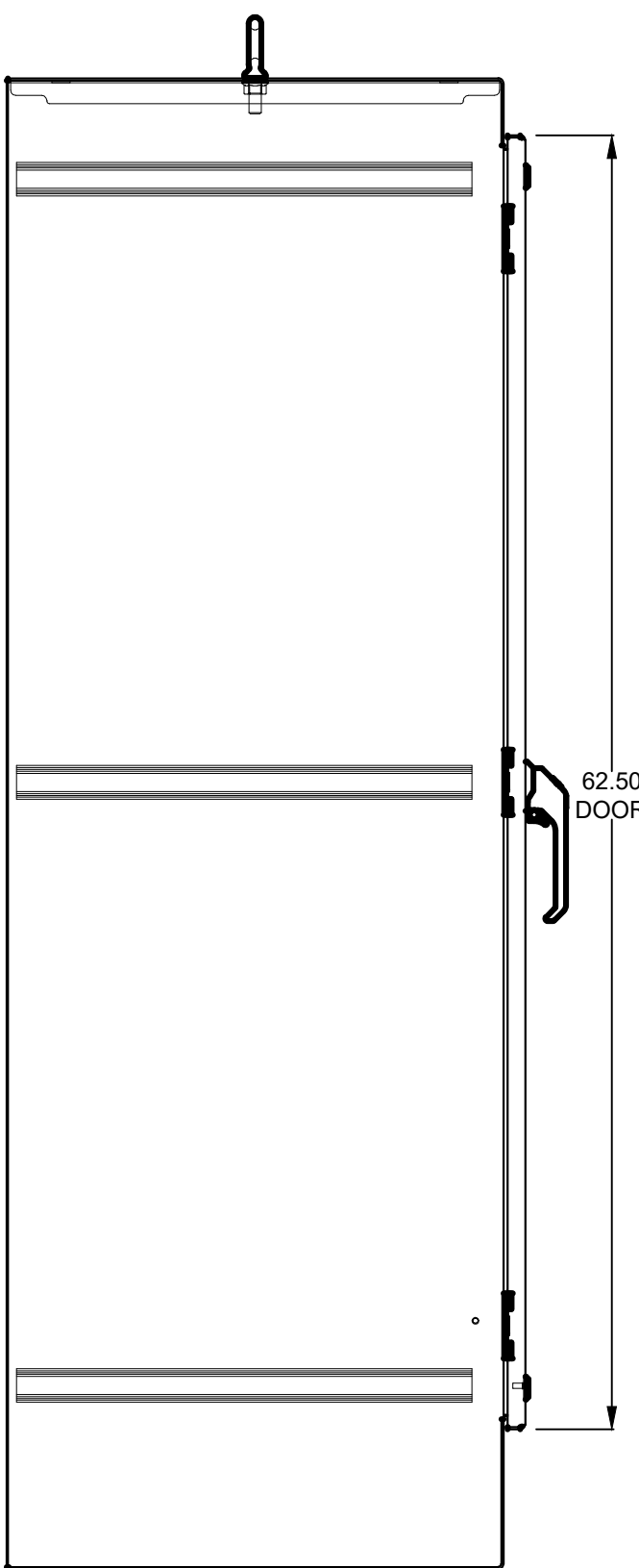
LEFT SIDE VIEW



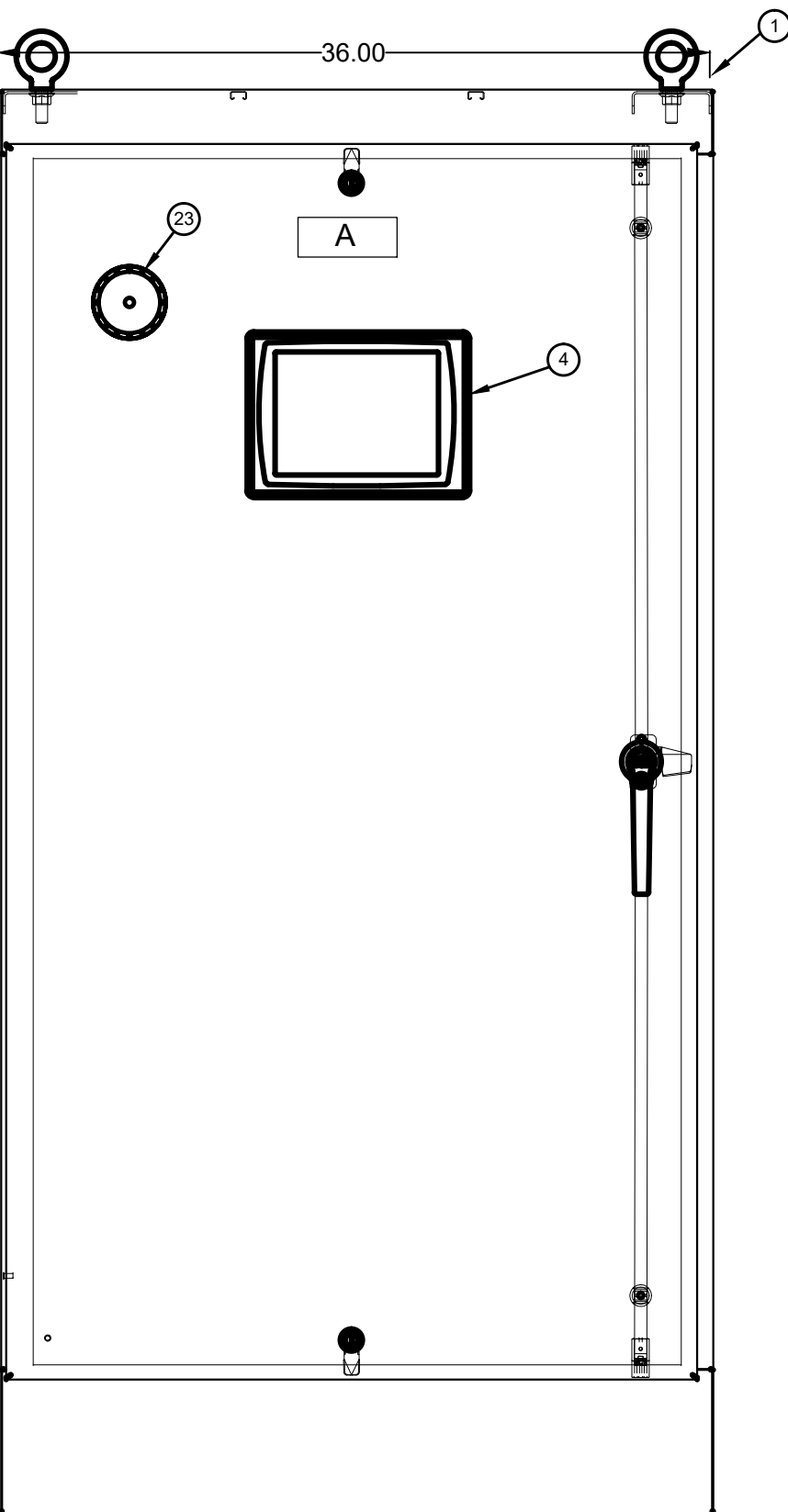
FULL PANEL FRONT VIEW



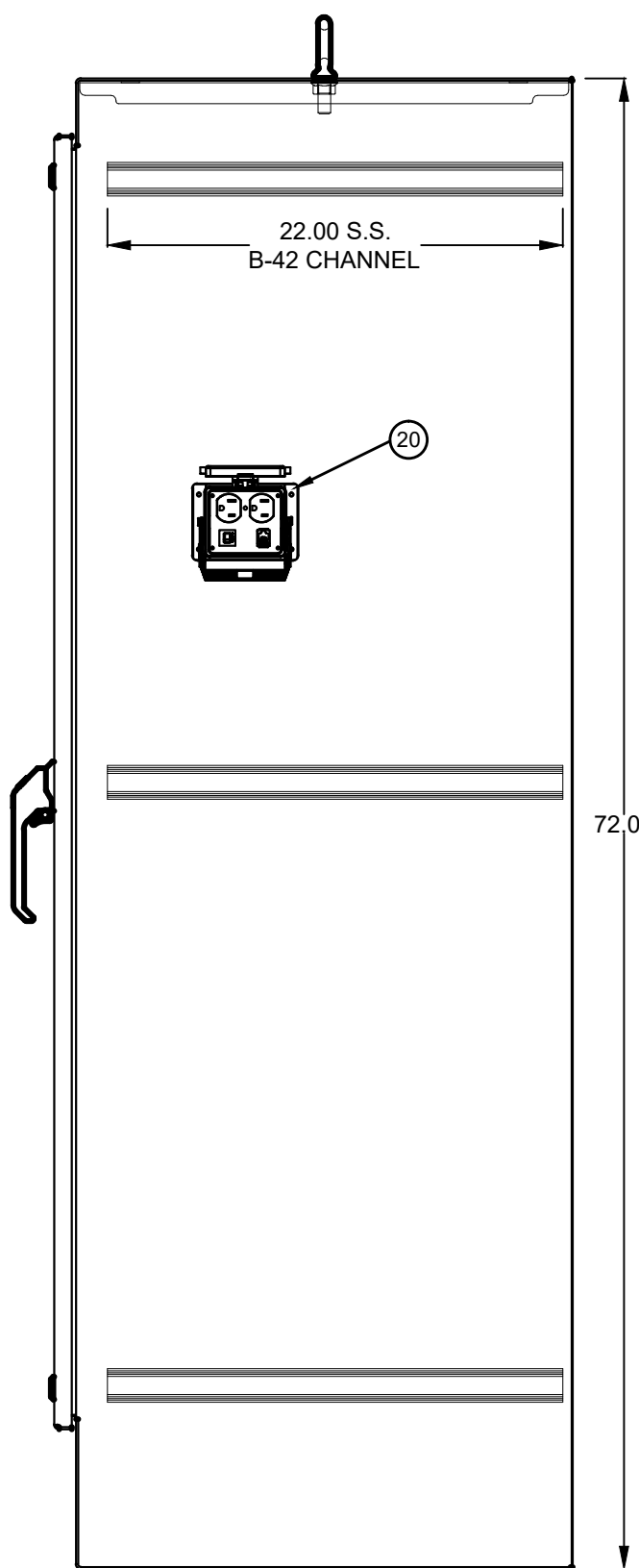
RIGHT SIDE VIEW



FRONT VIEW



FRONT VIEW



RIGHT SIDE VIEW

NAMEPLATE SCHEDULE				
ITEM NO.	TEXT SIZE	NAMEPLATE SIZE	1st. LINE	2nd. LINE
A	1/4"	2" x 5"	CP-05	MAIN CONTROL PANEL
B	3/16"	3" x 1"	CONTROLLOGIX	PLC-05
C	3/16"	3" x 1"	ETHERNET SWITCH	-
D	3/32"	1 3/8" x 1/2"	RIO-01	FLEX I/O CHASSIS
E	3/32"	1 3/8" x 1/2"	TBAI-100	-
F	3/32"	1 3/8" x 1/2"	TBAI-101	-
G	3/32"	1 3/8" x 1/2"	TBAI-102	-
H	3/32"	1 3/8" x 1/2"	TBAI-103	-
I	3/32"	1 1/8" x 1/2"	TBAI-104	-
J	1/8"	1 1/8" x 1/2"	TBAI-105	-
K	1/8"	1 1/8" x 1/2"	TBAI-106	-
L	1/8"	1 1/8" x 1/2"	24V-DC	POWER SUPPLY
M	1/8"	1 1/8" x 1/2"	TB-DC	-
N	1/8"	1 1/8" x 1/2"	CIRCUIT BREAKERS	CB-1 CB-2
O	1/8"	1 1/8" x 1/2"	TB-AC	-
P	1/8"	1 1/8" x 1/2"	RELAYS	R1- R21
Q	1/8"	1 1/8" x 1/2"	TB-R	-
R	1/8"	1 1/8" x 1/2"	INSTRUMENTS	GROUND BAR
S	1/8"	1 1/8" x 1/2"	RIO-02	FLEX I/O CHASSIS
T	1/8"	1 1/8" x 1/2"	TBAO-200	-
U	1/8"	1 1/8" x 1/2"	TBAO-201	-
V	1/8"	1 1/8" x 1/2"	TBAO-202	-
W	1/8"	1 1/8" x 1/2"	TBDO-203	-
X	1/8"	1 1/8" x 1/2"	TB1	-
Y	1/8"	1 1/8" x 1/2"	RIO-03	FLEX I/O CHASSIS
Z	1/8"	1 1/8" x 1/2"	TBDI-300	-
AA	1/8"	1 1/8" x 1/2"	TBDI-301	-
AB	1/8"	1 1/8" x 1/2"	TBDI-302	-
AC	1/8"	1 1/8" x 1/2"	TBDI-303	-
AD	1/8"	1 1/8" x 1/2"	TBDI-204	-
AE	1/8"	1 1/8" x 1/2"	INTERLOCK RELAYS	R22- R24
AF	1/8"	1 1/8" x 1/2"		

WIRING REQUIREMENTS:

- ALL AC CIRCUITS MUST BE ROUTED AT A MINIMUM DISTANCE OF 6" FROM ANY CURRENT LOOP AND LOW VOLTAGE AND A MINIMUM OF 5 FT. FROM HIGH VOLTAGE ENCLOSURE OR SOURCE OF RF/MICROWAVE RADIATION.
- ANALOG SIGNALS SHALL BE SHIELDED, WITH THE SHIELDED TERMINATED AT THE ISOLATED GROUND IN THE PANEL ONLY. THE OTHER END SHOULD BE CUT, FOLDED BACK AND TAPED OFF.
- ALL WIRING SHALL BE PLACED IN WIRE THROUGH, PREFERABLY WIRE DUCT, WITH A COVER AND A MINIMUM OF 20% EXTRA SPACE FOR EASY ACCESS AND TROUBLESHOOTING.
- ANALOG I/O LINES, DC POWER LINES FOR ANALOG CIRCUITS AND COMMUNICATIONS CABLE SHOULD BE PROPERLY SHIELDED AND ROUTED IN A RACEWAY SEPARATED FROM AC POWER LINES.
- FOR POWER SUPPLIES AND I/O CIRCUITS, CONDUCTORS MUST BE RUN WITHOUT SPLICES FROM TERMINAL TO TERMINAL.
- ALL CONDUCTORS AND CABLES MUST BE IDENTIFIED WITH A PERMANENT TAG IN ACCORDANCE WITH THE ELECTRICAL AND I/O WIRING LOOPS DEFINITIONS.
- THE FOLLOWING ARE THE MINIMUM AWG SIZES TO BE USED:
 - MAIN POWER CIRCUITS: NO. 12
 - BRANCH POWER CIRCUITS: NO. 14
 - CONTROL CIRCUITS: NO. 16
 - CURRENT LOOPS: NO. 16 (SHIELDED)
- ALL TERMINAL BLOCKS MUST BE RAISED FROM THE BACK PLATE FOR EASE OF WIRING.
- TERMINAL JUMPERS MUST BE USED IN PLACE OF THE WIRED JUMPERS, WHERE SUCH JUMPERS ARE NECESSARY.
- WIRING STANDARD AND CONVENTIONS SHOULD CONFIRM TO THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 300.
- ALL SINGLE CONDUCTORS MUST BE CODED AS FOLLOWS:
 - BLACK—LINE, LOAD AND CONTROL CIRCUIT AT LINE VOLTAGE
 - RED—ALL CONTROL CIRCUIT
 - BLUE OR PURPLE—DC CONTROL CIRCUIT (POSITIVE)
 - WHITE—AC GROUNDED CIRCUITS (NEUTRAL)
 - GRAY—DC GROUNDED CIRCUIT CONDUCTOR
 - GREEN—EQUIPMENT GROUNDED CONDUCTOR
 - LIGHT BLUE—INTRINSICALLY SAFE CONDUCTORS.

BILL OF MATERIALS			
ITEM NO.	QTY.	MANUFACTURER & MODEL NO.	DESCRIPTION
1	1	SAGINAW SCE-72P36F1	NEMA 4X SS WALL MOUNT 72"X36"X2" ENCL.
2	1	SAGINAW SCE-72P36F1	BACK PANEL 72" X 36"
3	2	SAGINAW SCE-72SPM20	SIDE PANELS 72" X 20"
4	1	MAPLE SYSTEM HMS104TH	10.4 inch Graphic HMI TOUCHSCREEN
5	3	ALLEN BRADLEY 1794-AENT	ETHERNET COMMUNICATION ADAPTER CARD
6	7	ALLEN BRADLEY 1794-EB	ANALOG INPUT CARD 8 CHANNELS DIFFERENTIAL 4-20 MA
7	6	ALLEN BRADLEY 1794-IB16	DISCRETE INPUT CARD 24 VDC 16 CHANNELS
8	1	ALLEN BRADLEY 1794-OB16	DISCRETE OUTPUT CARD 24 VDC 16 CHANNELS
9	17	ALLEN BRADLEY 1794-TS3	TERMINAL BASE SCREW TYPE
10	3	ALLEN BRADLEY 1794-OF4I	ANALOG OUTPUT CARD 4 CHANNELS 4-20 MA
11	5	ALLEN BRADLEY 1492-SP1C050	CIRCUIT BREAKER 1 POLE 120 VAC 5 AMP
12	1	PHOENIX CONTACTS 2898812	AC SURGE SUPPRESSOR PT-3-PE-2-120
13	1	ALLEN BRADLEY 1492-SP1C300-N	CIRCUIT BREAKER 1 POLE + NEUTRAL 120 VAC 30 AMP
14	1	ALLEN BRADLEY 1492-SP1C100	CIRCUIT BREAKER 1 POLE 120 VAC 10 AMP
15	15	ALLEN BRADLEY 1492-JD3FB	3 LEVEL FUSED TERMINAL 24 V DC WITH FUSES
16	30	ALLEN BRADLEY 1492-JD3FB	2 LEVEL FUSED TERMINAL 24 V DC WITH FUSES
17	AS REQ	WEIDMULLER 950333 / AP KDKS 1	END PLATE FOR
18	AS REQ	WEIDMULLER 38356 / EW 35	END BRACKET
19	AS REQ	WEIDMULLER 23641 / BLT TS 30x15	DIN RAIL SLOTTED
20	1	AUTOMATION DIRECT ZP-PDA-32-201	PANEL 120VAC DUPLEX OUTLET WITH RJ45/3 NEMA 4X
21	1	PHOENIX CONTACT 2320988	24 VDC POWER SUPPLY QUINT-PS-IAC/24DC/20V CO
22	1	HOFFMAN P-GS3K	GROUNDING BAR SYSTEM
23	1	FEDERAL LP4-09-028	24 VDC NEMA 4X ALARM SOUNDER
24	1	BELDEN A064306 / 131 A0649254	SURFACE MOUNT BOX FIBER OPTIC FOR 8 PAIR
25	2	BELDEN AX200056	FIBER OPTIC PATCH CORD 6 FT. MULTIMODE FX300, 62.5um SC DUPLEX
26	1	PHOENIX CONTACTS 2891987	FL SWITCH SFN 16TX 16 RJ45
27	1	PHOENIX CONTACTS 2891987	FL SWITCH SFN 6GT2LX 6 RJ45 2 SC FIBER
28	21	PHOENIX CONTACTS 2861192	24 VDC CONTROL RELAY 2PDT 2AMP AT 24 V
29	21	PHOENIX CONTACTS 2867015	24 VDC CONTROL RELAY BASE PLC-BSC-24DC/21-21
30	30	PHOENIX CONTACTS 2770011	2 LEVEL FEED THRU TERMINAL BLOCK TYPE UKK-3
31	100	PHOENIX CONTACT 2838186	Surge protection device TT-2-PE-24DC
32	2	PROSOFT TECHNOLOGY MV56-PPPMV1	PROFIBUS DP/1 Master Communication Module
33	1	ALLEN BRADLEY 1756-A4	CONTROL LOGIX CHASSIS 4 SLOTS
34	1	ALLEN BRADLEY 1756-PAT5	CONTROL LOGIX POWER SUPPLY
35	1	ALLEN BRADLEY 1756-L62	CONTROL LOGIX CONTROLLER 4 MBYTES
36	1	ALLEN BRADLEY 1756-ENBT/A	ETHERNET COMMUNICATION CARD
37	0	ALLEN BRADLEY 1756-KC	CONTROL LOGIX CHASSIS EMPTY SLOT COVER
38	10	PHOENIX CONTACTS UDK 3	SINGLE LEVEL FEED THRU TERMINAL #12AWG
39	10	PHOENIX CONTACTS UDK 3 PE	SINGLE LEVEL FEED THRU GROUND GREEN TERMINAL #12AWG
40	2	IDEC RH4B-ULD24V	MINIATURE RELAY 4PDT 24VDC WITH SOCKET SH4B-05
41			
42			
43			
44			
45			
46			
47			

NOTES:

- THE NAMEPLATES WILL HAVE BLACK BACKGROUND WITH WHITE LETTERS.
- PANEL CONTRACTOR SHALL IDENTIFY CORRESPONDING TAG NUMBER TO ALL TERMINAL BLOCKS AND WIRES.
- PANEL CONTRACTOR WILL PROVIDE TAGS FOR ALL DEVICES INSIDE THE PANEL.
- ALL PANEL ARRANGEMENT DETAILS NEED TO BE COORDINATED WITH THE DESIGNATED ENGINEER BEFORE THE PANEL CONSTRUCTION HAS BEGUN.
- USE ONLY CONDUIT HUBS WHICH ARE COMPATIBLE WITH THE NEMA RATING OF SUBJECTED PANEL & ITS LOCATION.
- ALL CONDUIT TO BE INSTALLED AT BOTTOM OF THE PANEL.
- TO BE INSTALLED ON THE SIDE OF THE PANEL WITH SOLDER SCREWS.



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCUIDO O POR NEGLIGENCIA YA SEA POR MI MISMO AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

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ECRE
ECR ENGINEERING

SHEET INFO.
Project No: 19-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31

Revisions	Description
Number	Date

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

IC-101

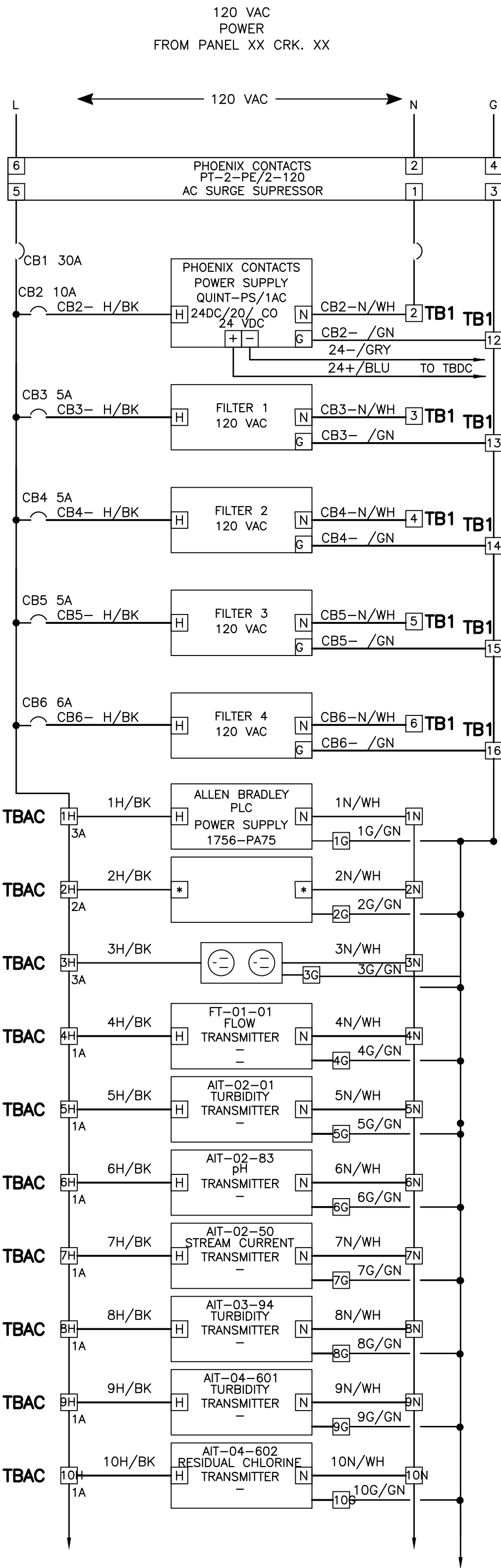
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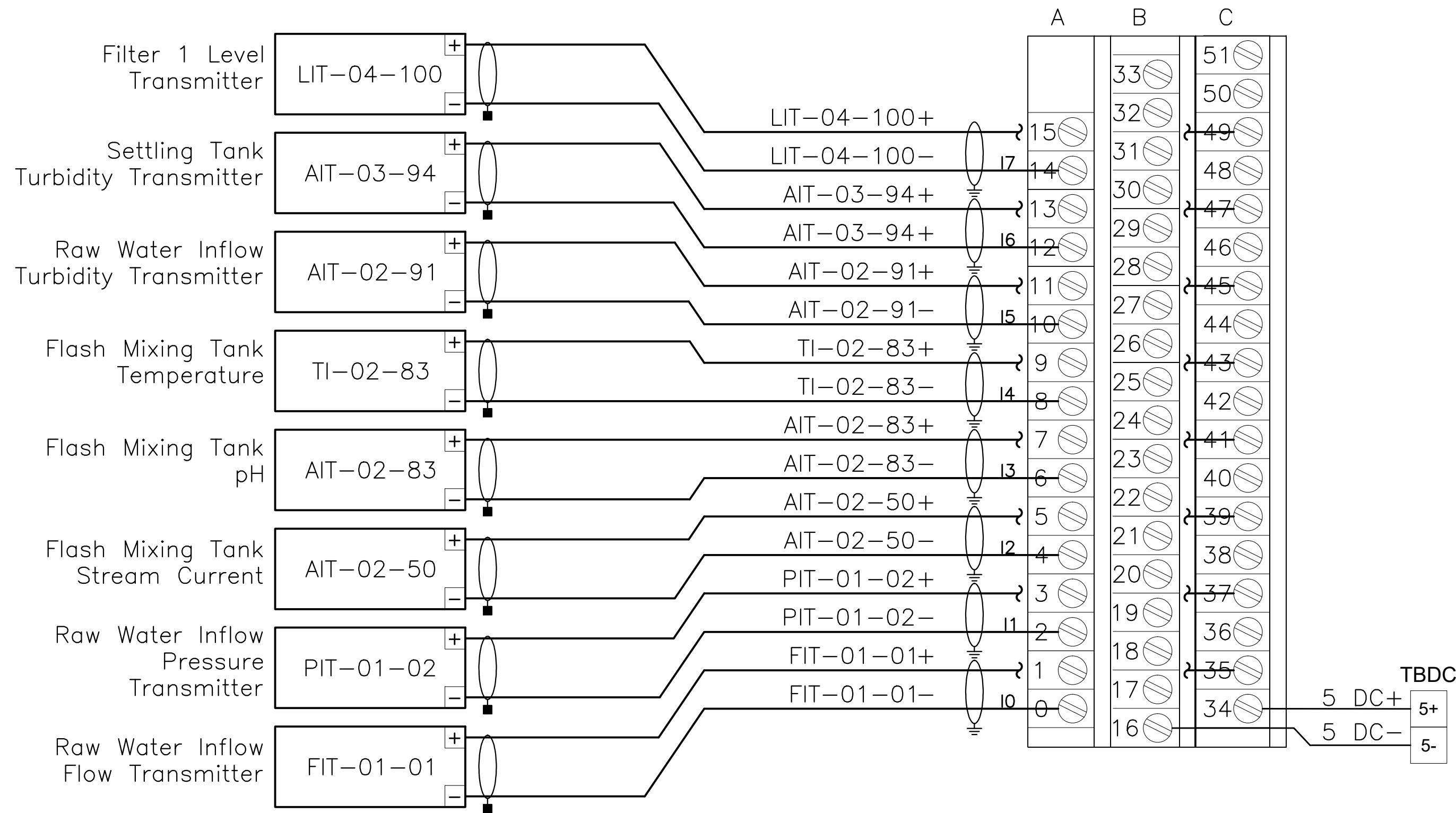
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Date Issued: JULY 30, 2021

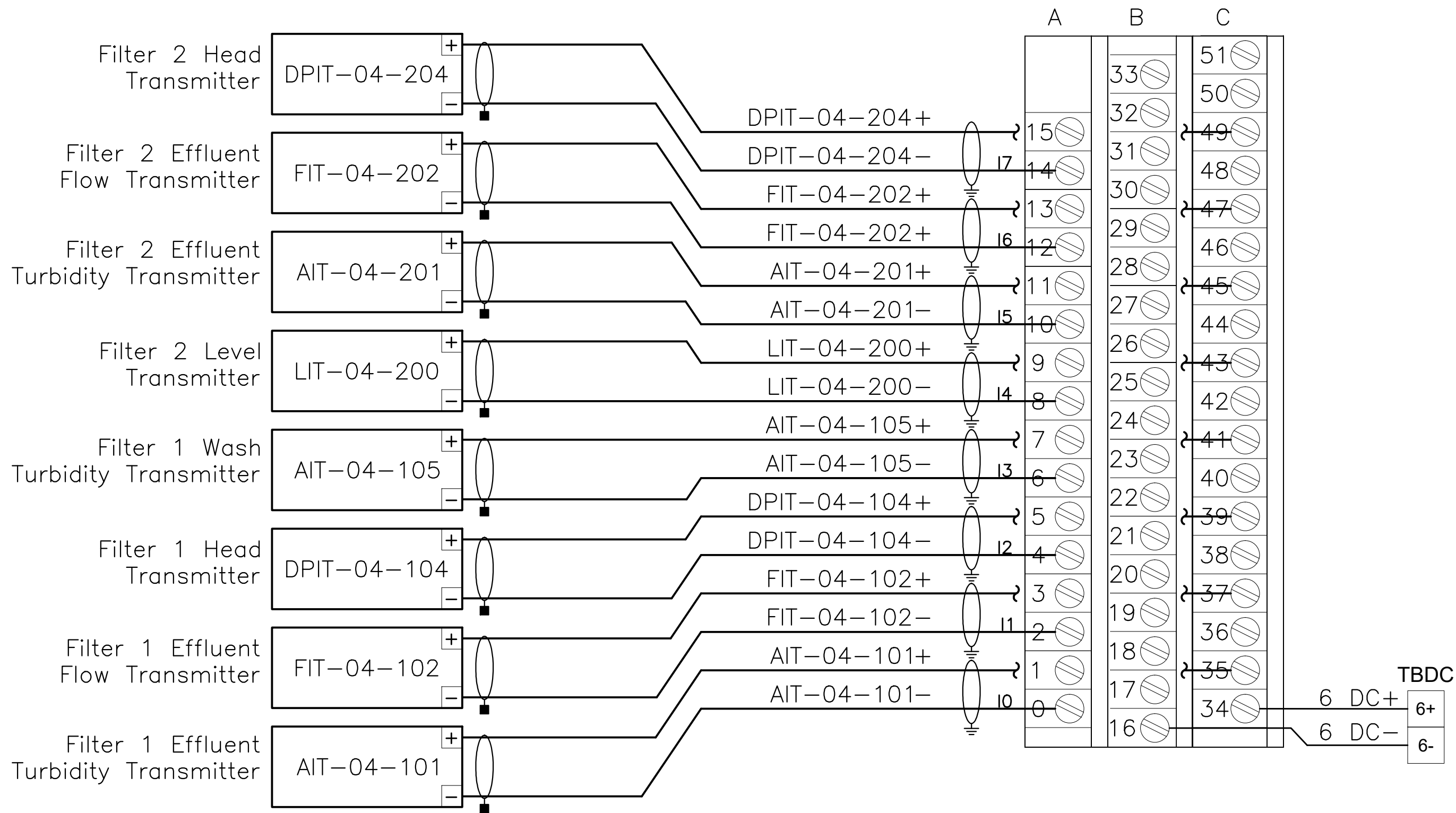
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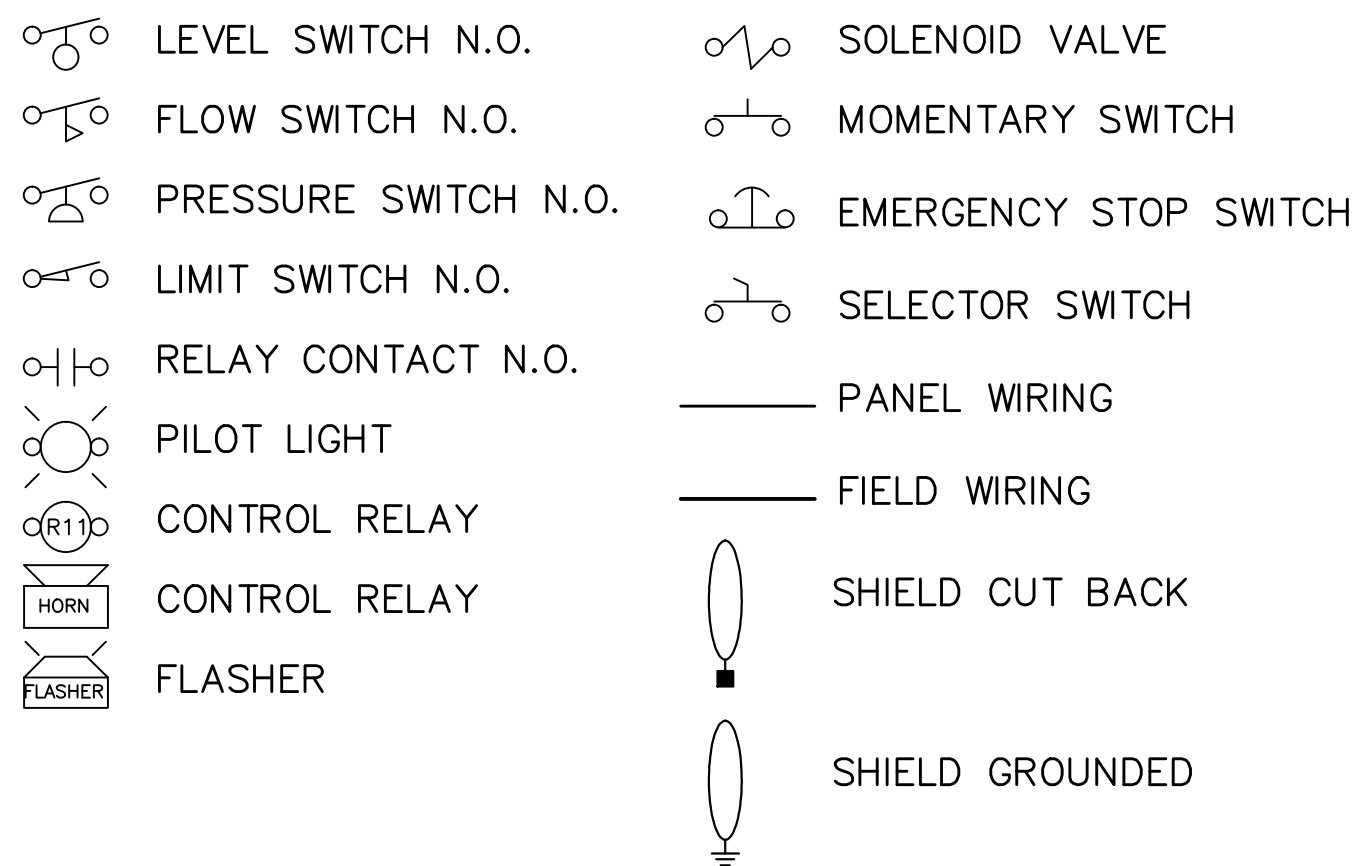
1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 00
TBAI-100



1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 01
TBAI-101



LEGEND:



Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

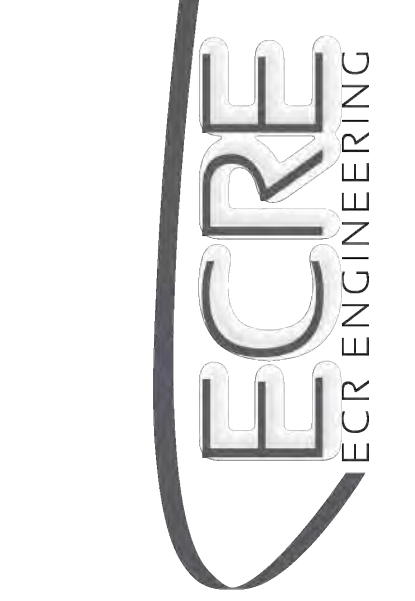


GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions		Description	
Number	Date		

SHEET INFO.
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Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31

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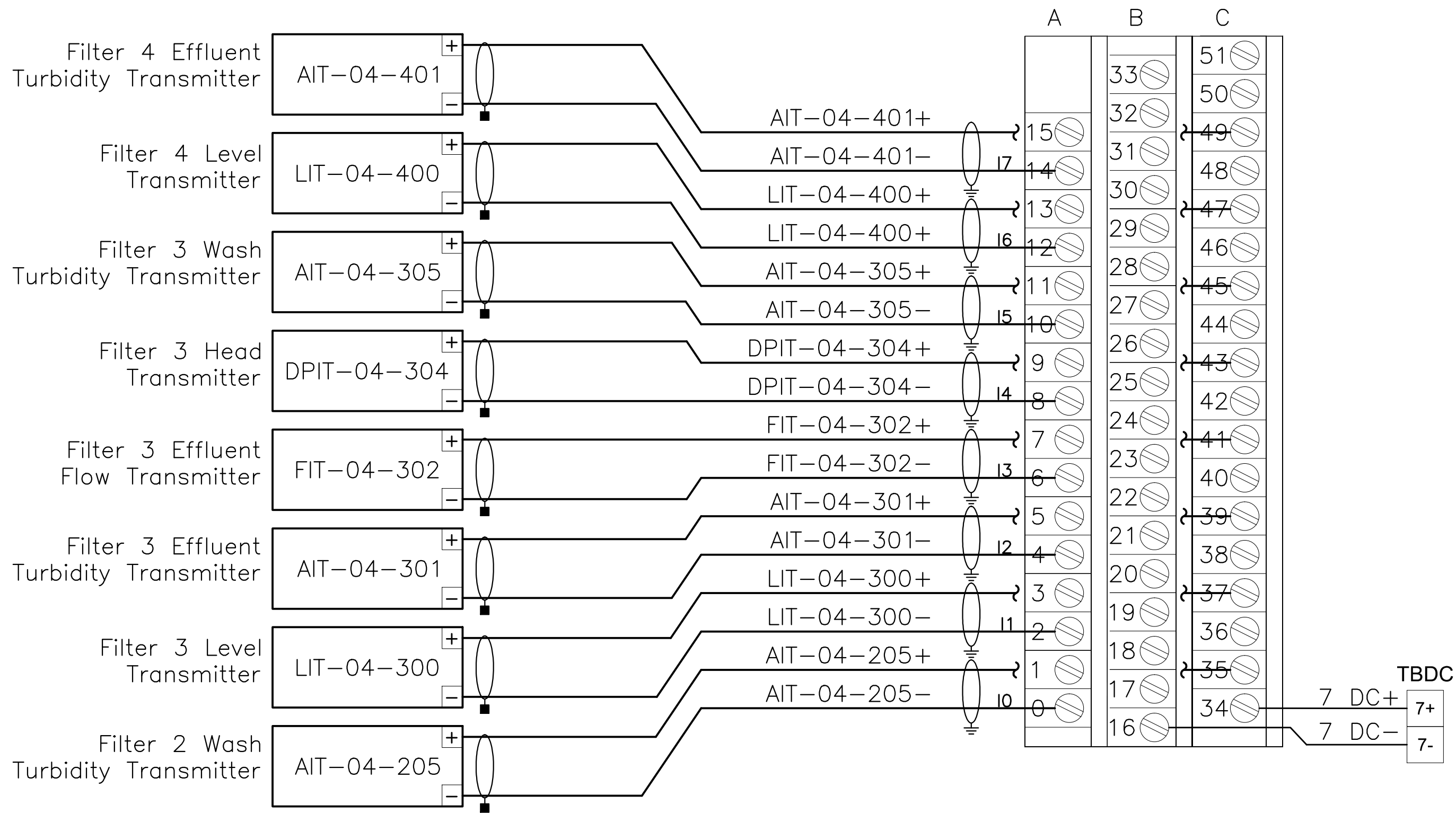


Sheet: 1 of 4

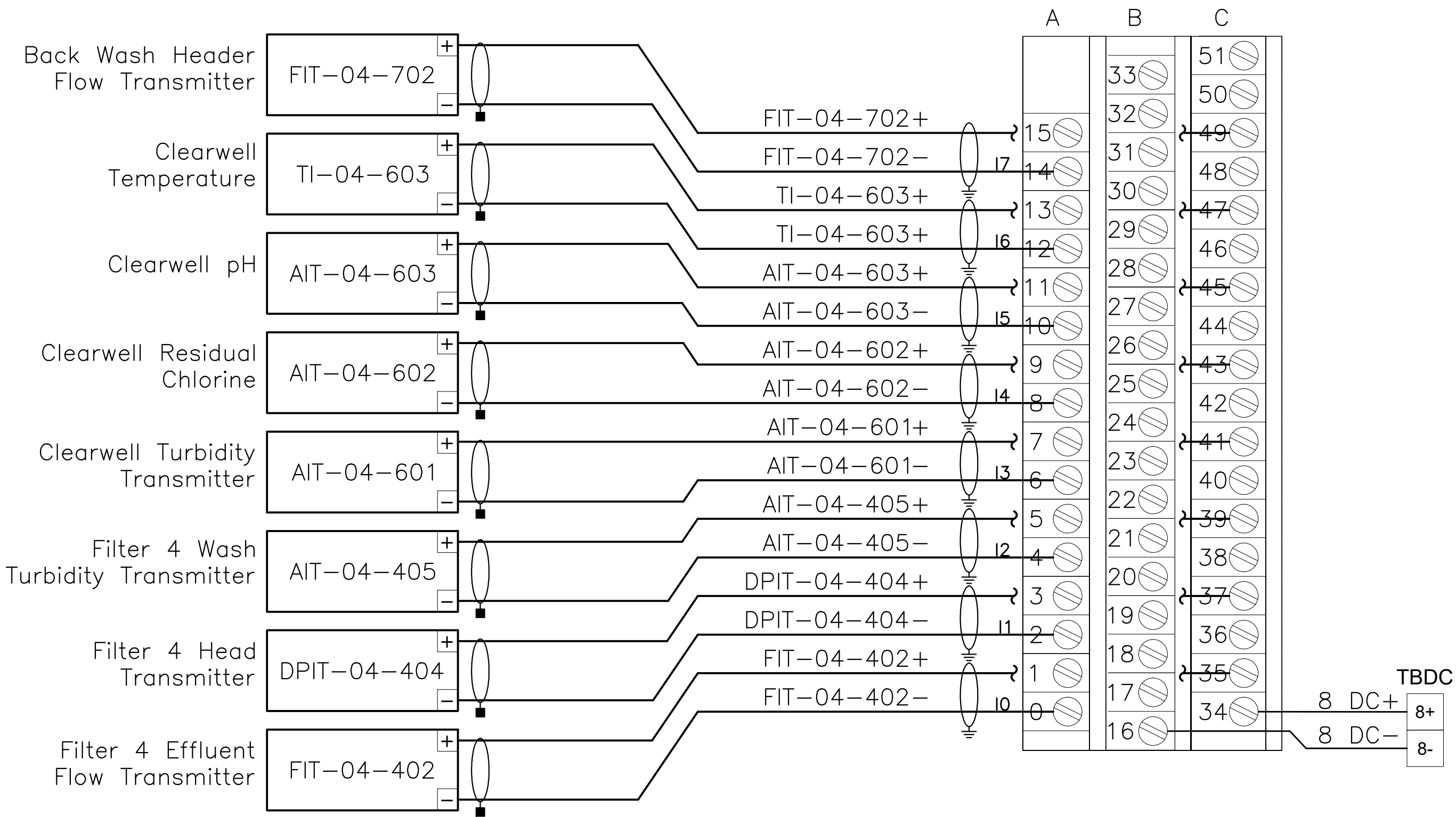
IC-103

Drawing Title: CP-05 ANALOG INPUT CARDS 1 OF 4

1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 02
TBAI-102



1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 03
TBAI-103



LEGEND:

- LEVEL SWITCH N.O.
FLOW SWITCH N.O.
PRESSURE SWITCH N.O.
LIMIT SWITCH N.O.
RELAY CONTACT N.O.
PILOT LIGHT
CONTROL RELAY
CONTROL RELAY
FLASHER
- SOLENOID VALVE
MOMENTARY SWITCH
EMERGENCY STOP SWITCH
SELECTOR SWITCH
PANEL WIRING
FIELD WIRING
SHIELD CUT BACK
SHIELD GROUNDED

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions

Number	Date	Description

SHEET INFO.
Project No. 19-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31



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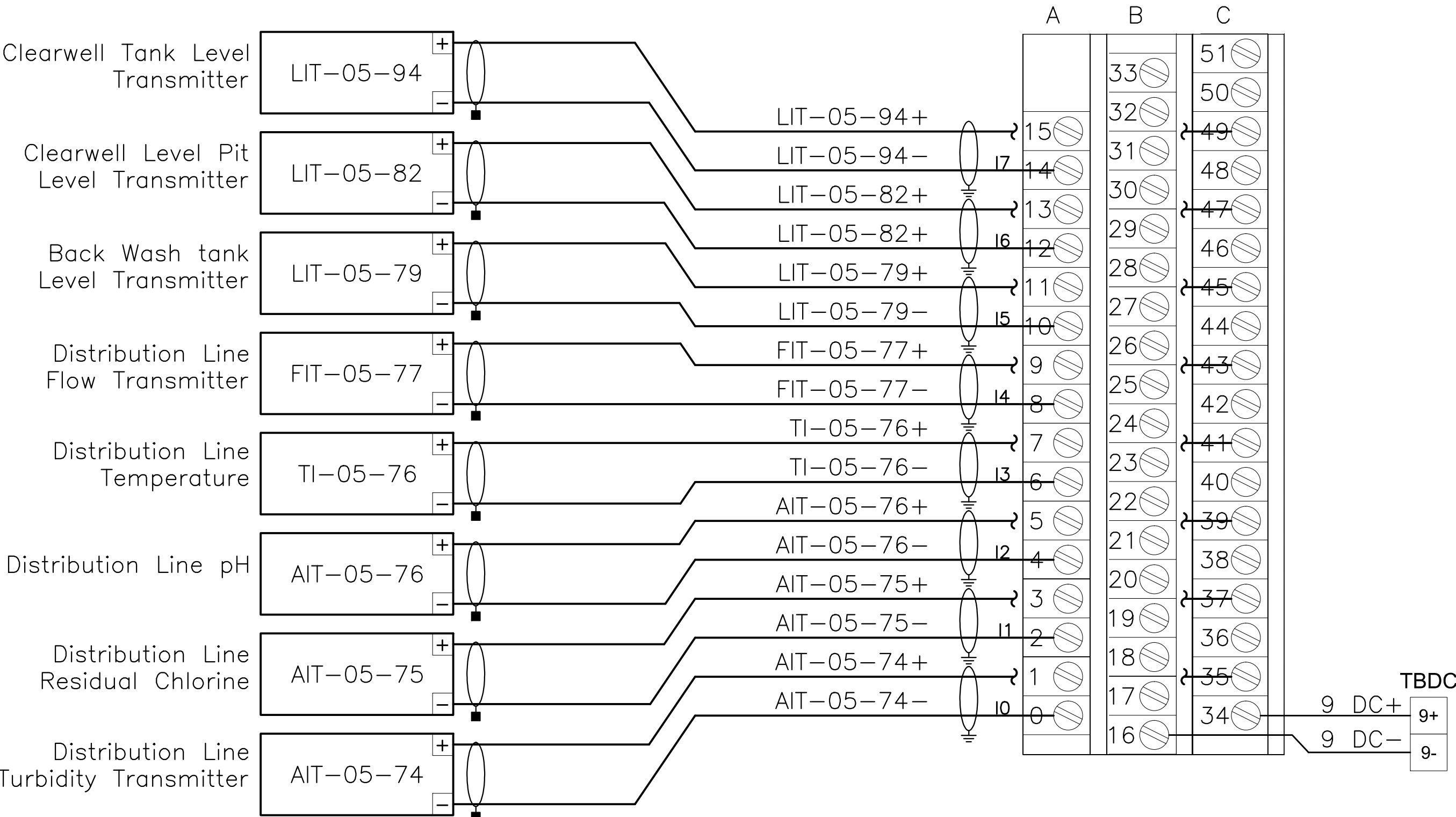
Project Title:

Drawing Title:

CP-05 ANALOG INPUT CARDS 2 OF 4

IC-104

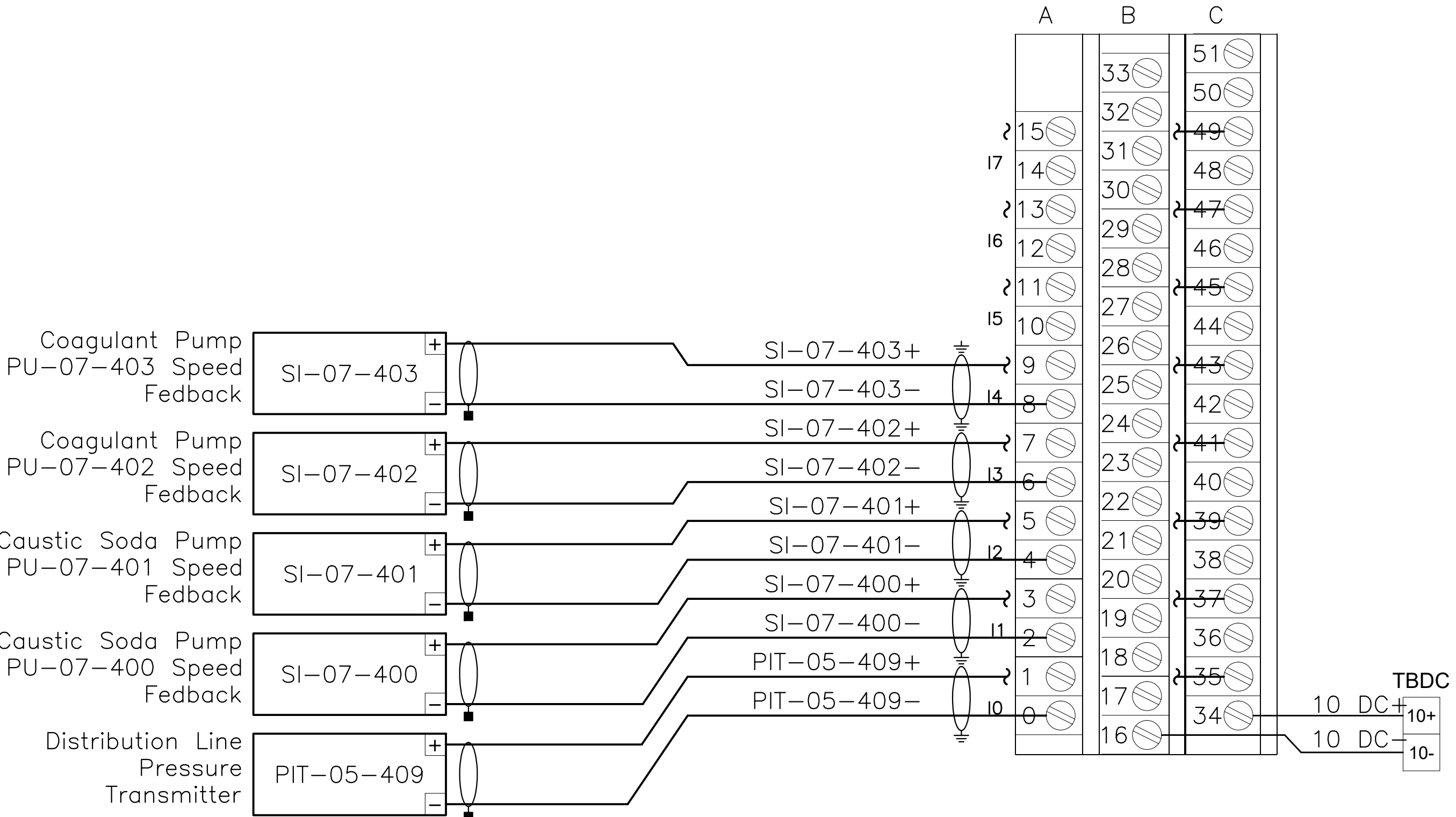
1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 04
TBAI-104



LEGEND:

- | | | | |
|--|----------------------|--|-----------------------|
| | LEVEL SWITCH N.O. | | SOLENOID VALVE |
| | FLOW SWITCH N.O. | | MOMENTARY SWITCH |
| | PRESSURE SWITCH N.O. | | EMERGENCY STOP SWITCH |
| | LIMIT SWITCH N.O. | | SELECTOR SWITCH |
| | RELAY CONTACT N.O. | | PANEL WIRING |
| | PILOT LIGHT | | FIELD WIRING |
| | CONTROL RELAY | | SHIELD CUT BACK |
| | CONTROL RELAY | | SHIELD GROUND |
| | FLASHER | | |

1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 05
TBAI-105



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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

SHEET INFO.
Project No. 19-1537.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31

Revisions	Number	Date	Description

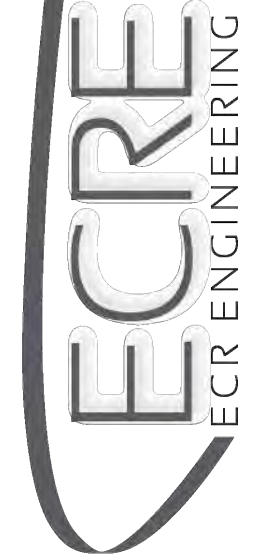
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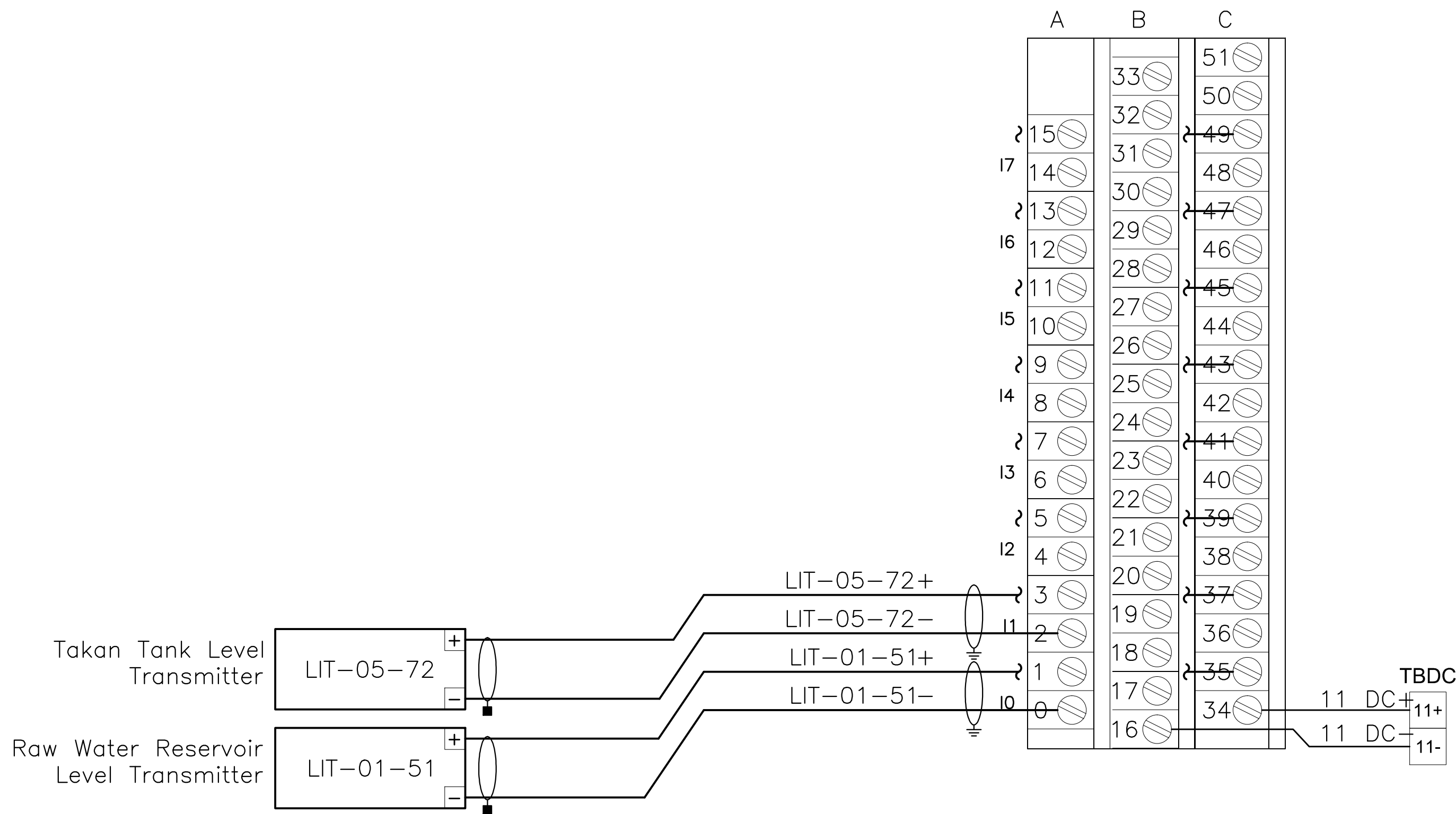
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Drawing Title:
CP-05 ANALOG INPUT CARDS 3 OF 4

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1794-IE8
ANALOG INPUT CARD
8 CHANNELS
CHASSIS RIO-01 MODULE 06
TBAI-106



LEGEND:

- | | | | |
|--|----------------------|--|-----------------------|
| | LEVEL SWITCH N.O. | | SOLENOID VALVE |
| | FLOW SWITCH N.O. | | MOMENTARY SWITCH |
| | PRESSURE SWITCH N.O. | | EMERGENCY STOP SWITCH |
| | LIMIT SWITCH N.O. | | SELECTOR SWITCH |
| | RELAY CONTACT N.O. | | PANEL WIRING |
| | PILOT LIGHT | | FIELD WIRING |
| | CONTROL RELAY | | SHIELD CUT BACK |
| | CONTROL RELAY | | SHIELD GROUND |
| | FLASHER | | |



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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

SHEET INFO.
Project No. 18-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31

Revisions	Number	Date	Description

Project Title:

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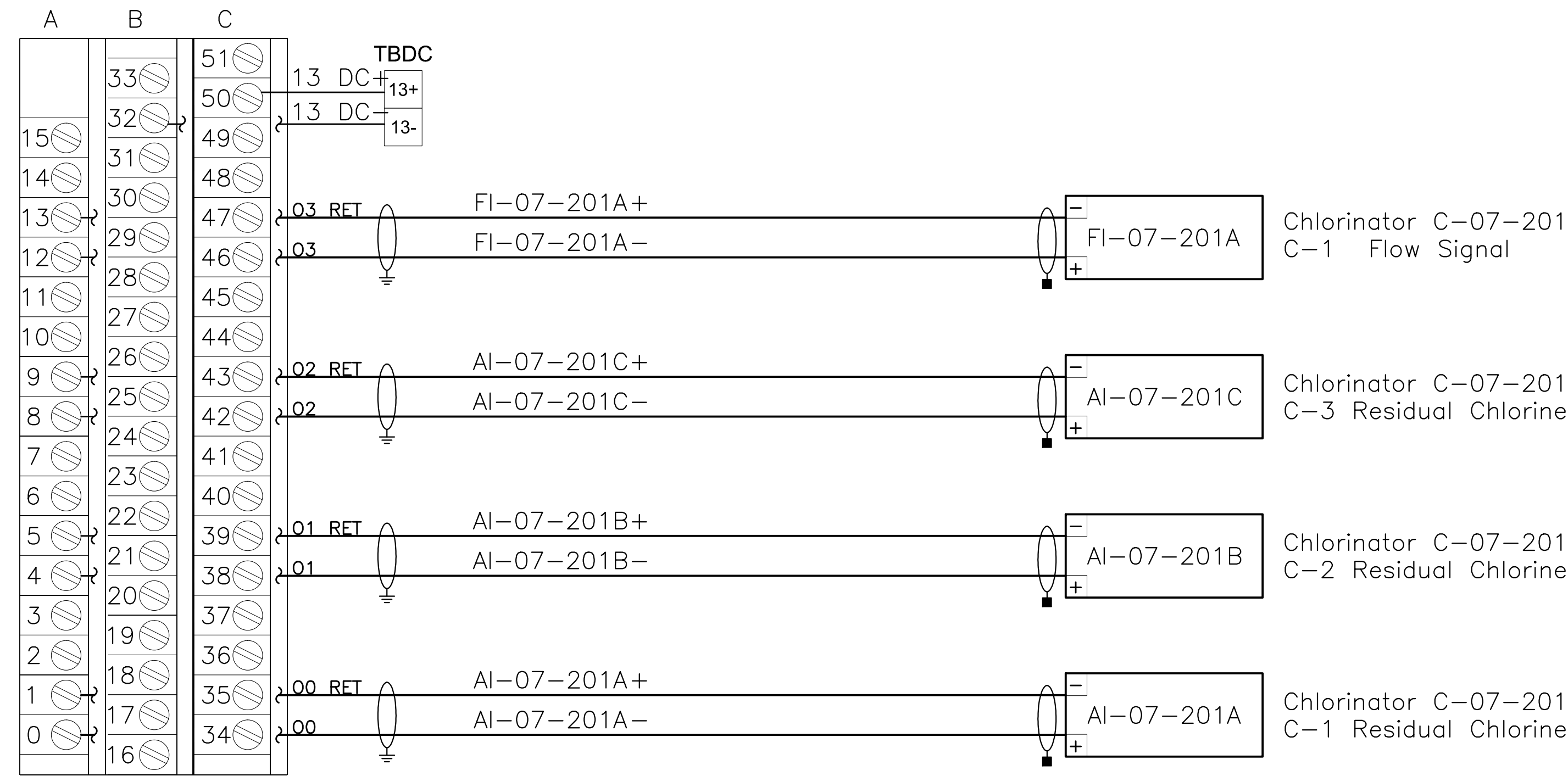
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Drawing Title:
CP-05 ANALOG INPUT CARDS 4 OF 4

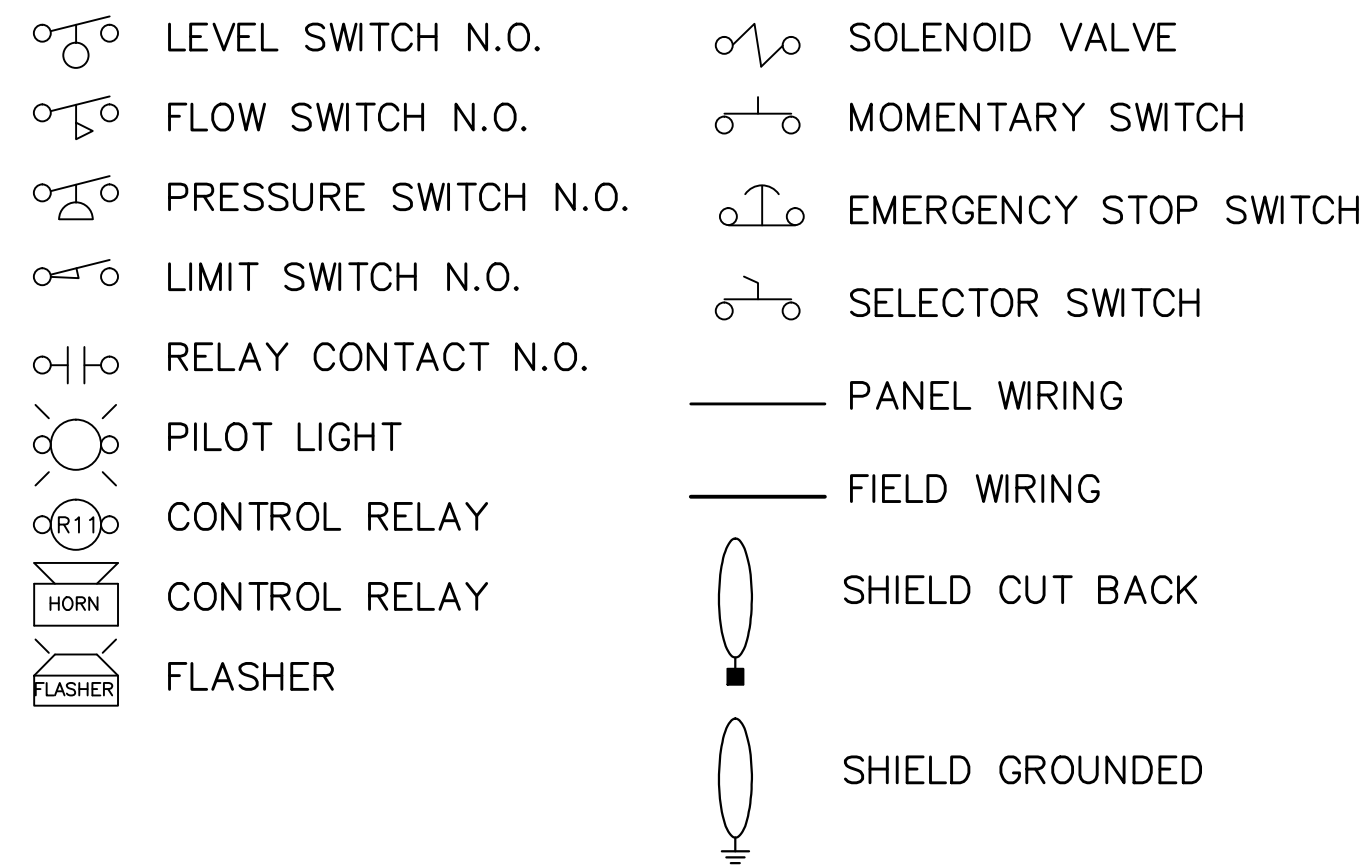


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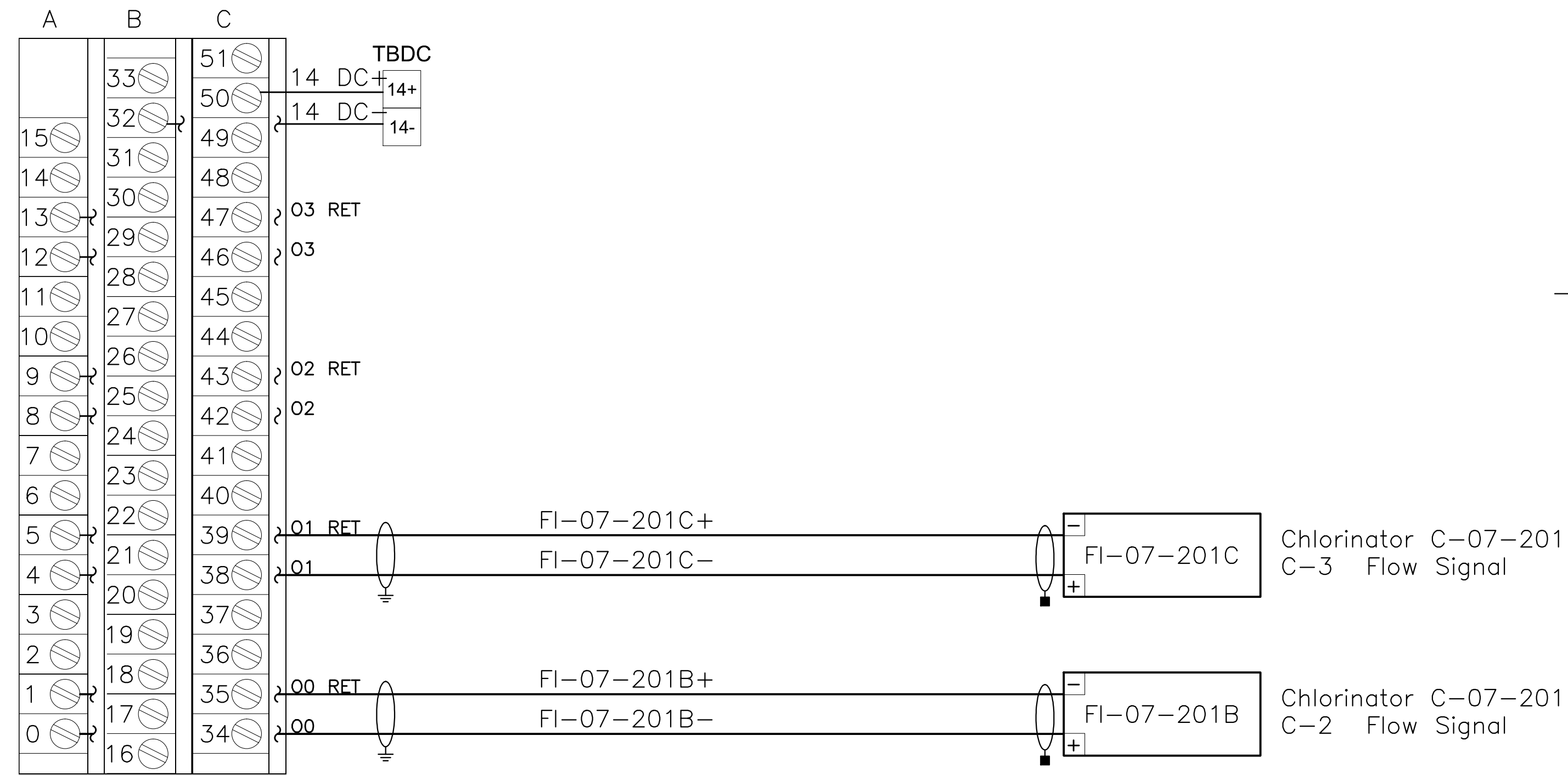
1794-OF4I
ANALOG OUTPUT CARD
4 CHANNELS
RIO-02 MODULE 00
TBAO-200



LEGEND:



1794-OF4I
ANALOG OUTPUT CARD
4 CHANNELS
RIO-02 MODULE 01
TBAO-201



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCUIDO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Project Title:

Sheet:

IC-107

Drawing Title:

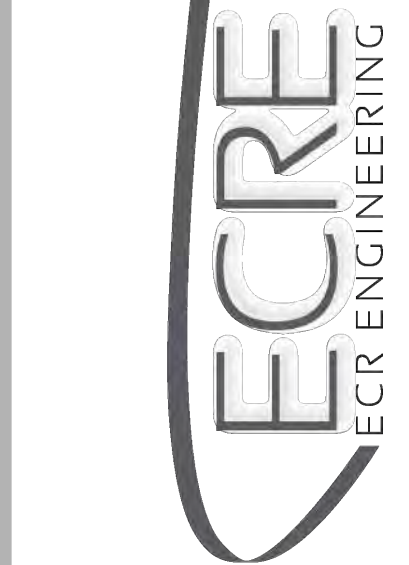
CP-05 ANALOG OUTPUT CARDS 1 OF 2

Revisions

Number	Date	Description
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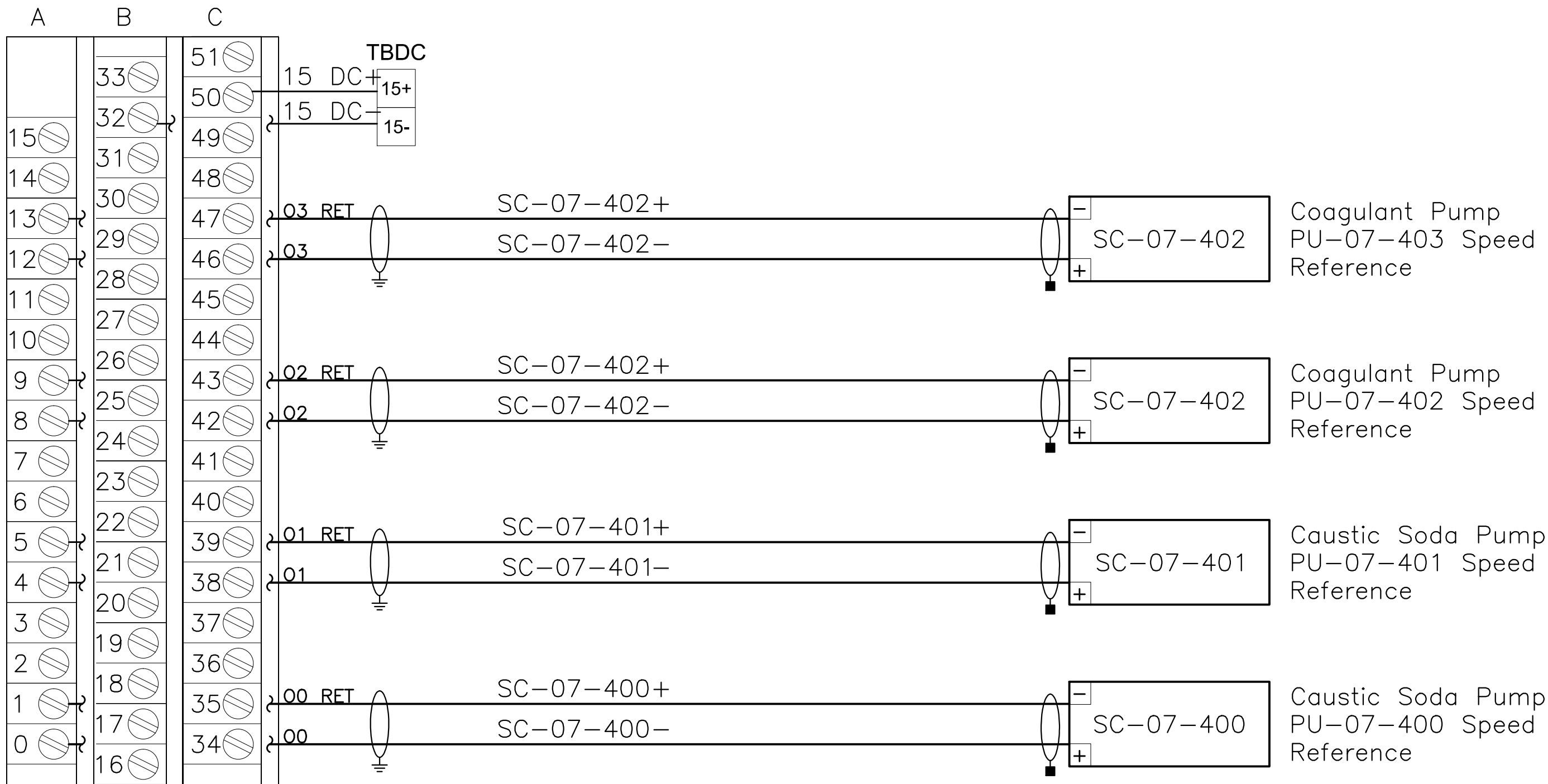
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Set Date: 20180831
Drawn by: Y. ARZUAGA
Dwg. Date: 20180831



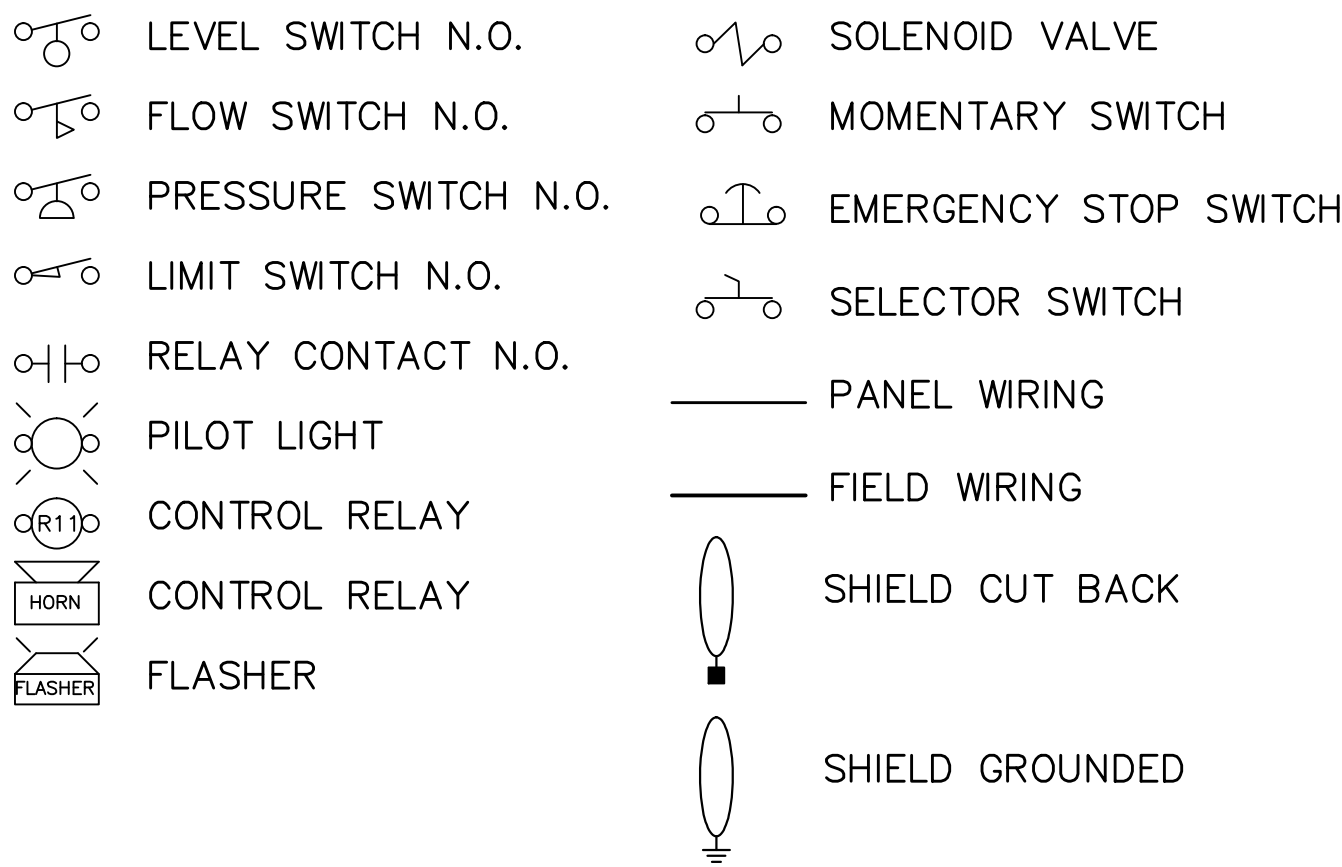
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1794-OF4I
ANALOG OUTPUT CARD
4 CHANNELS
RIO-02 MODULE 02
TBAO-202



LEGEND:



YO, YORIVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



Drawing Title:

CP-05 ANALOG OUTPUT CARDS 2 OF 2

Sheet:

IC-108

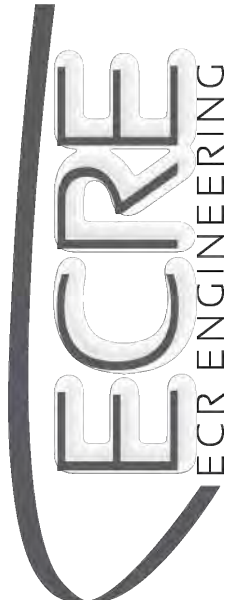
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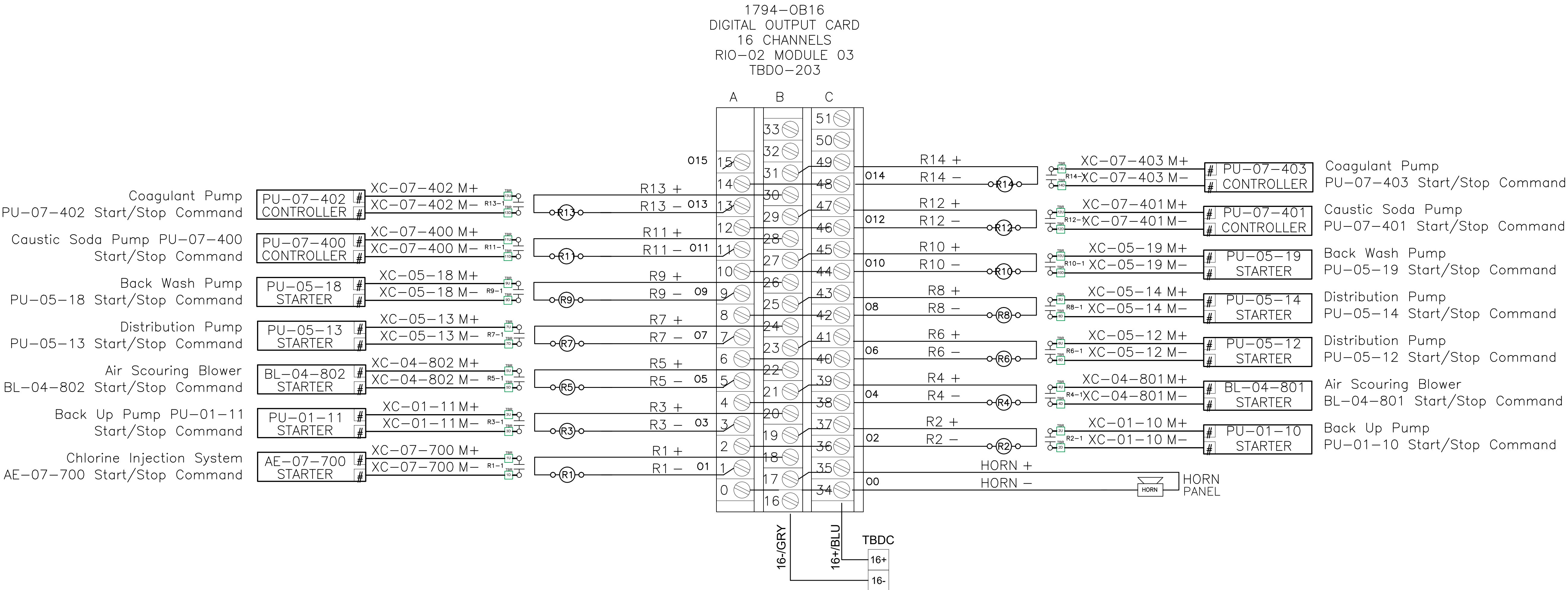
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Set Date: 20180831
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Dwg. Date: 20180831

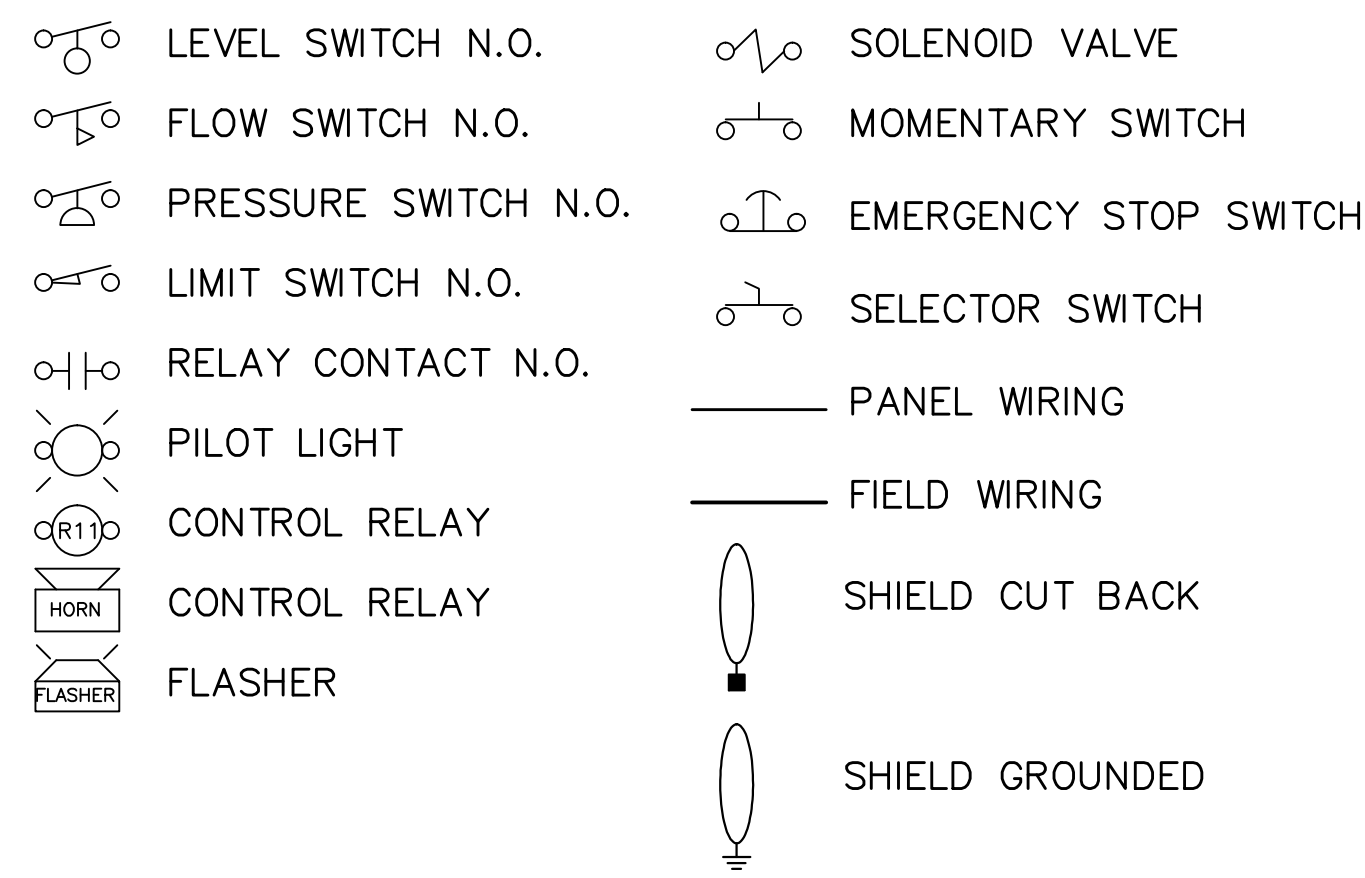
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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Project Title:

Sheet:

IC-109

Drawing Title:

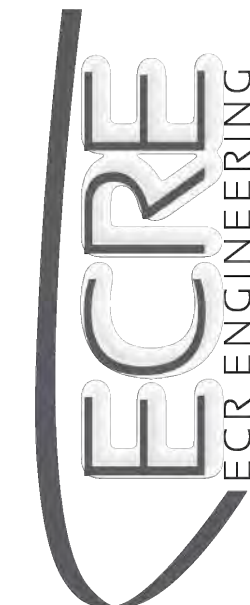
CP-05 DIGITAL OUTPUT CARD 1 OF 1

Revisions

Number	Date	Description

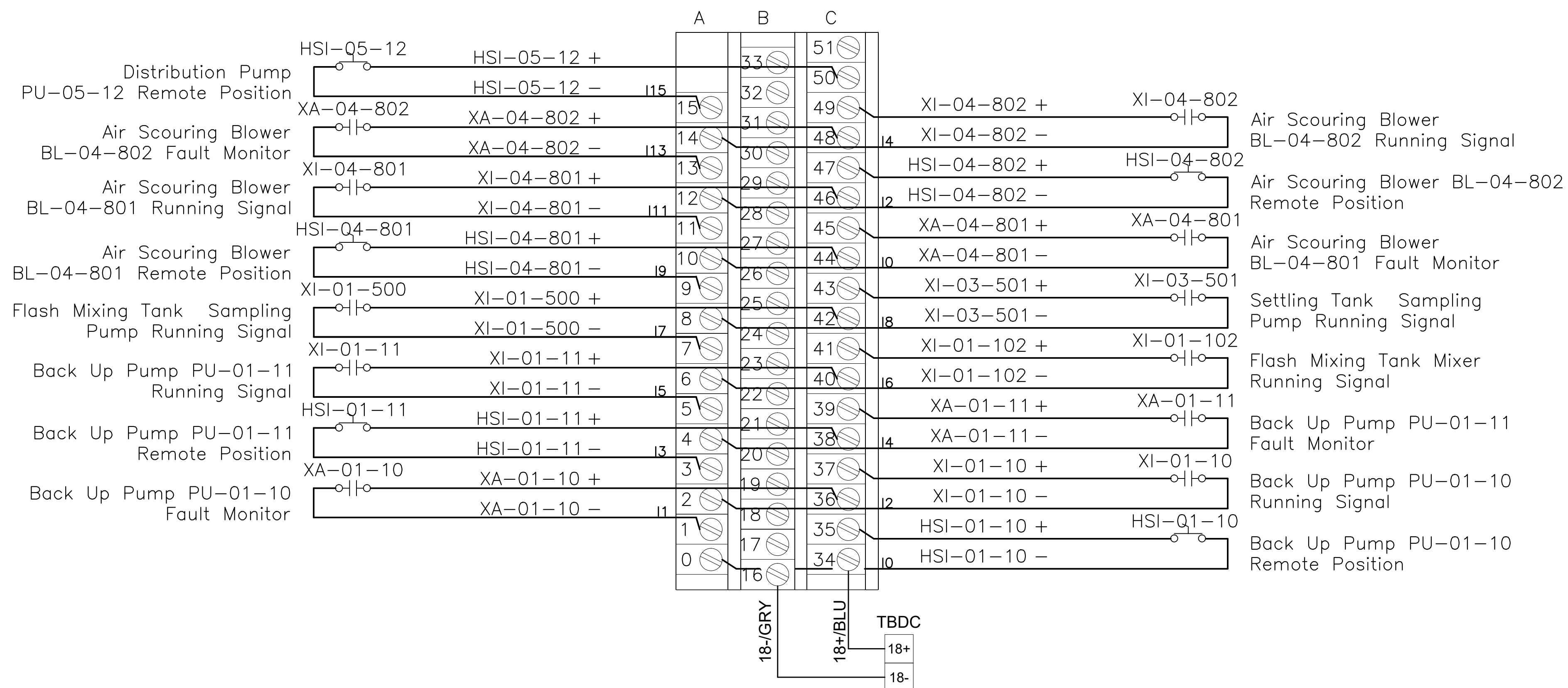
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Project No. 19-1537.0
Set Date: 20180831
Drawn by: Y. ARZUAGA
Dwg. Date: 20180831

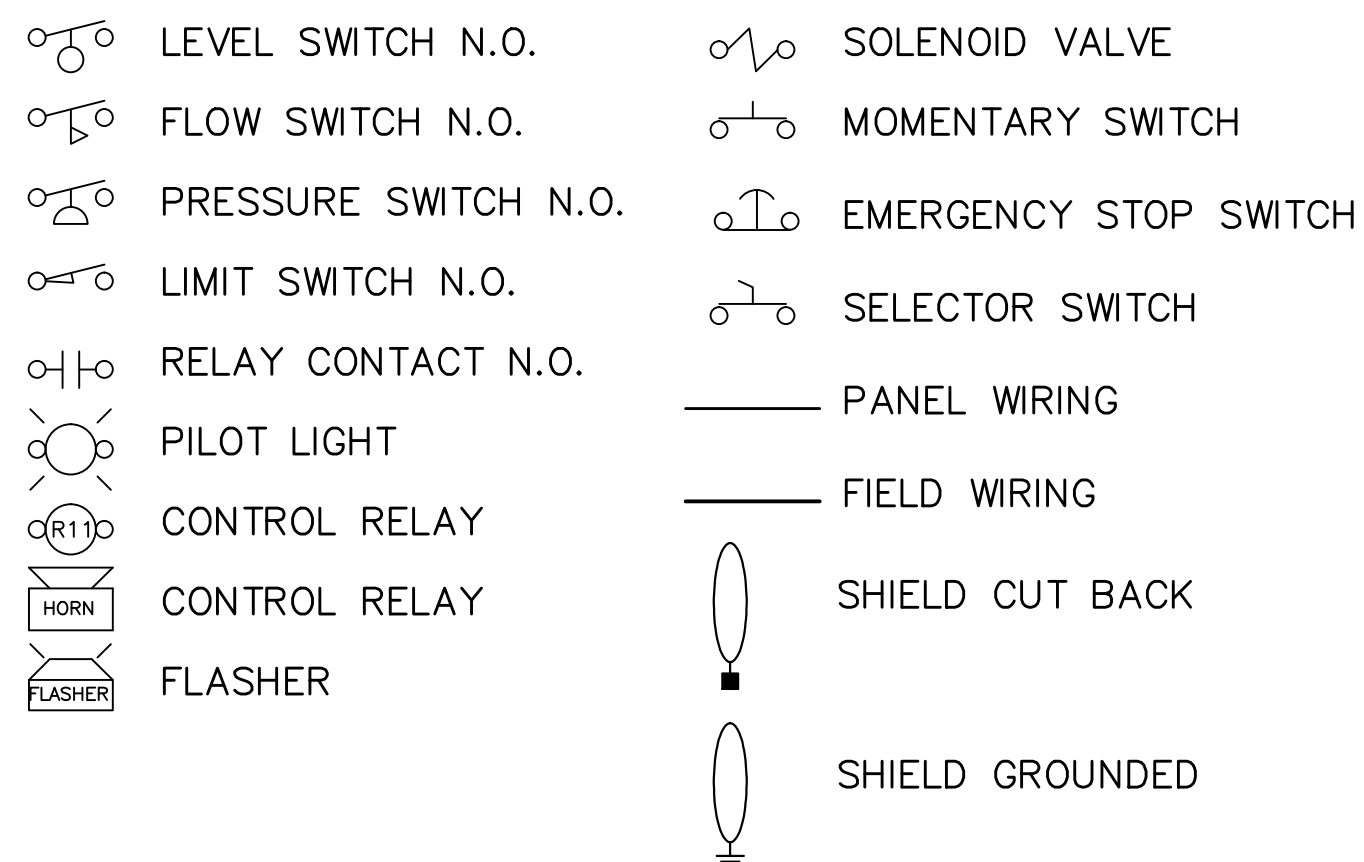


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1794-IB16
DIGITAL INPUT CARD
CHASSIS RIO-03 MODULE 00
16 CHANNELS
TBDI-300



LEGEND:



YO, YORVANI ARZULANA NUMERO DE LICENCIA 109090 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA POR EL PRESENTE PARA OBTENER EL DISEÑO O PLANO, O PARA OBTENER LOS PLANOS AGENTES O EMPLEADOS, O POR OTAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OSGPE.

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DATE ISSUED
JULY 30, 2021
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Sheet: Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT



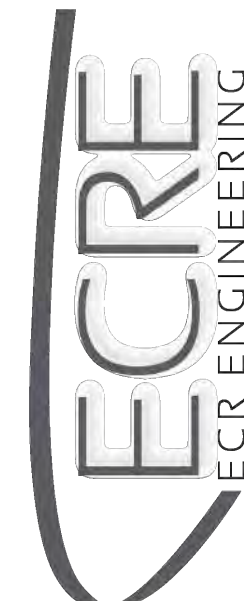
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions

Revisions	Number	Date	Description

SHEET INFO.

Project No.19-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31



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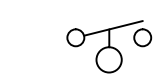
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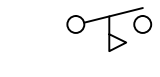
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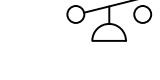
CP-05 DIGITAL INPUT CARDS 1 OF 5


IC-110

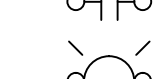
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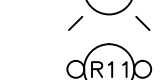
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LEVEL SWITCH N.O.
- 


FLOW SWITCH N.O.
- 


PRESSURE SWITCH N.O.
- 


LIMIT SWITCH N.O.
- 

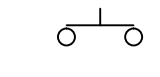
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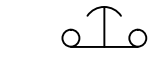
PILOT LIGHT
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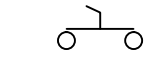
CONTROL RELAY
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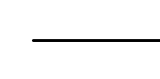
CONTROL RELAY
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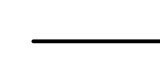
FLASHER
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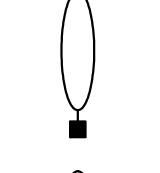
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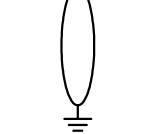
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EMERGENCY STOP SWITCH
- 

SELECTOR SWITCH
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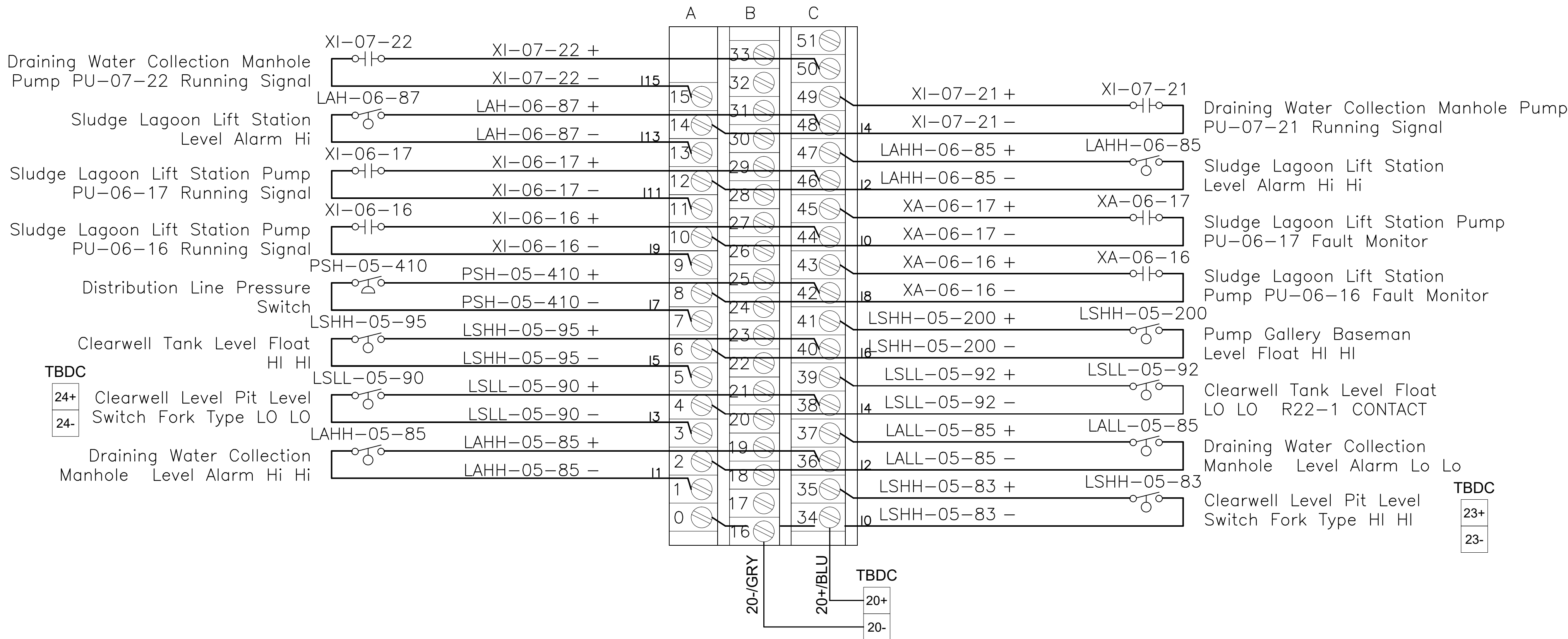
PANEL WIRING
- 

FIELD WIRING
- 

SHIELD CUT BACK
- 

SHIELD GROUND

1794-IB16
DIGITAL INPUT CARD
CHASSIS RIO-03 MODULE 02
16 CHANNELS
TBDI-302



TBDC
23+
23-



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS

Sheet: Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Client: GOVERNMENT OF PUERTO RICO



Local Redevelopment Authority
for Roosevelt Roads

Revisions
Number Date

Description

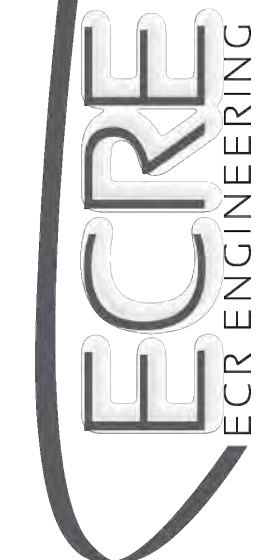
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Project No. 19-1837.0

Set Date: 2018/08/31

Drawn by: Y. ARZUAGA

Dwg. Date: 2018/08/31



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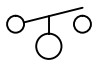
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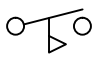
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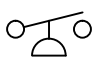
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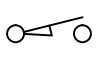
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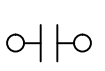
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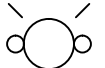
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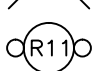
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FLOW SWITCH N.O.
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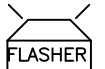
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LIMIT SWITCH N.O.
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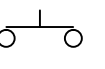
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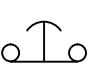
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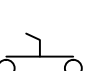
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CONTROL RELAY
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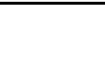
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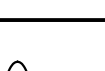
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MOMENTARY SWITCH
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EMERGENCY STOP SWITCH
- 

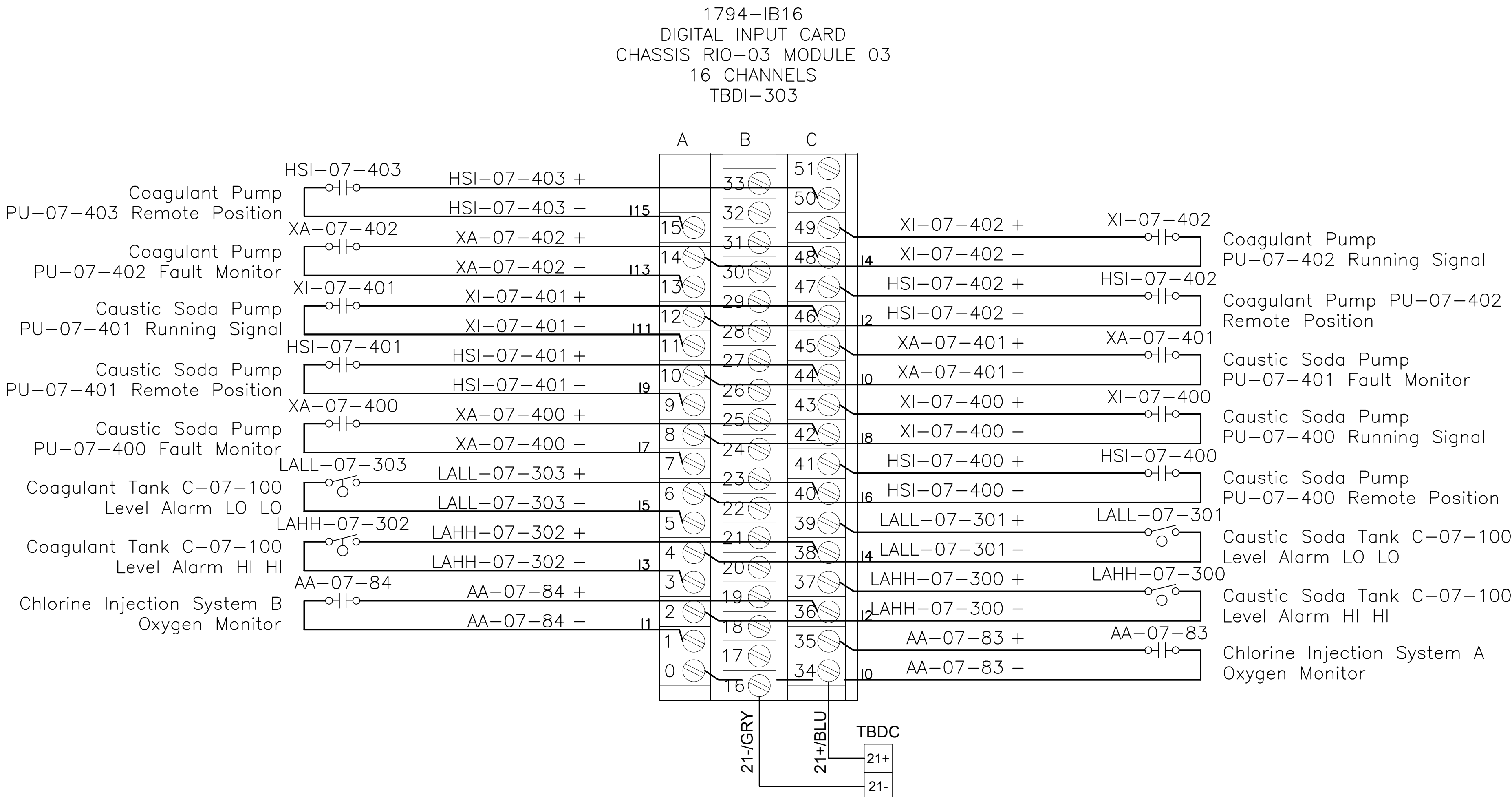
SELECTOR SWITCH
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PANEL WIRING
- 

FIELD WIRING
- 

SHIELD CUT BACK
- 

SHIELD GROUND



YO, YORIVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: GOVERNMENT OF PUERTO RICO



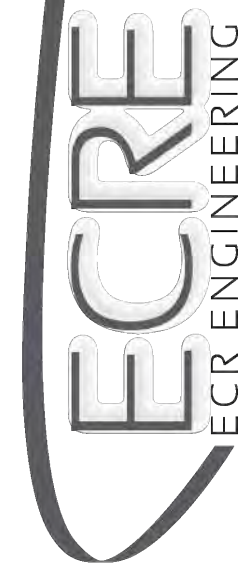
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Local Redevelopment Authority
for Roosevelt Roads

Revisions

Number	Date	Description

SHEET INFO.

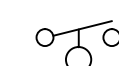
Project No: 19-1837.0
Set Date: AUGUST 31 2018
Drawn by: Y. ARZUAGA
Dwg. Date: AUGUST 31 2018

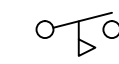


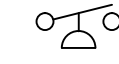
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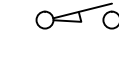
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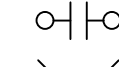
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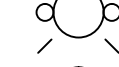
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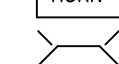
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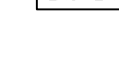
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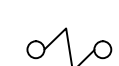
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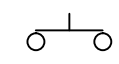
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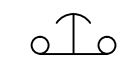
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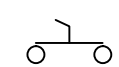
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CONTROL RELAY
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FLASHER
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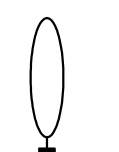
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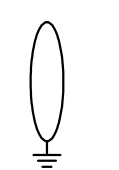
MOMENTARY SWITCH
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EMERGENCY STOP SWITCH
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SELECTOR SWITCH
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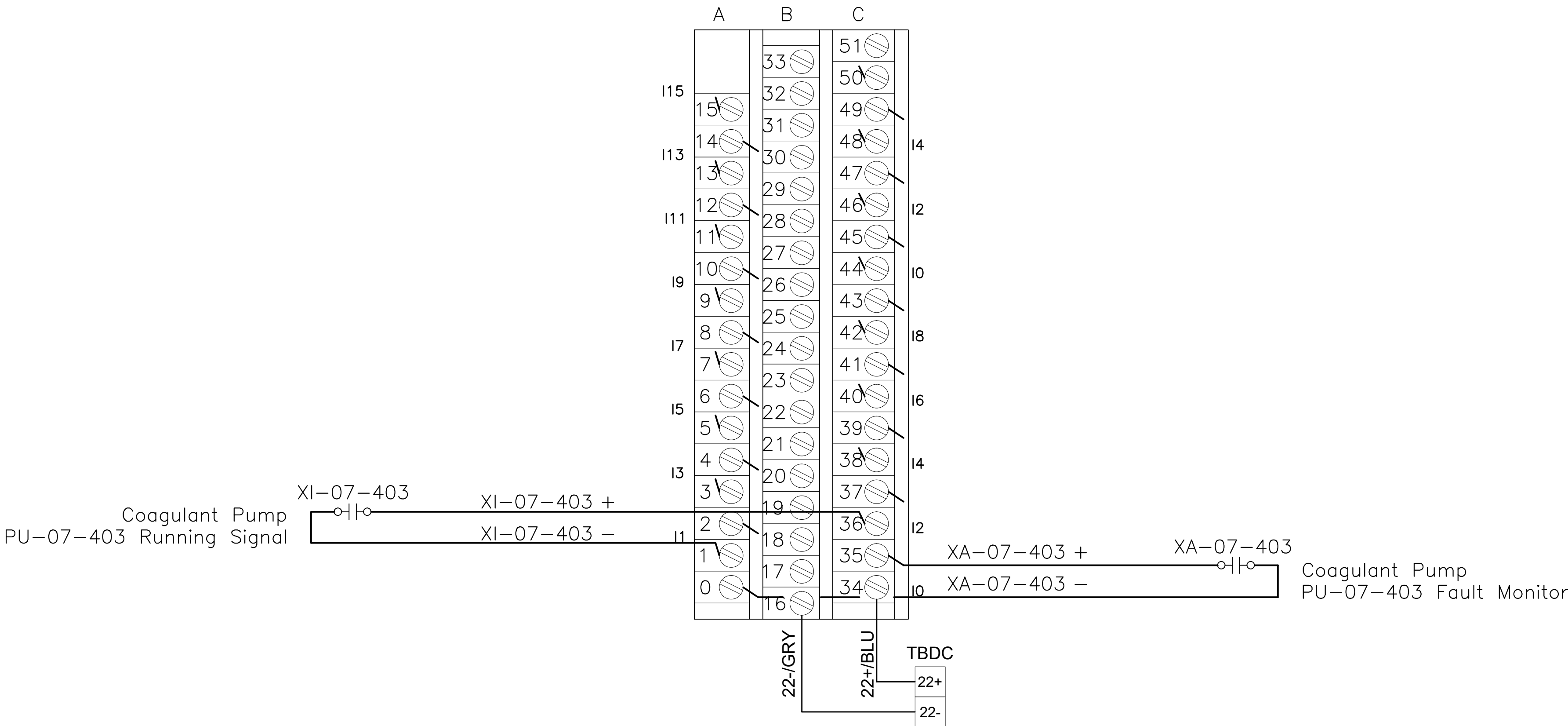
PANEL WIRING
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FIELD WIRING
- 

SHIELD CUT BACK
- 

SHIELD GROUND

1794-IB16
DIGITAL INPUT CARD
CHASSIS RIO-03 MODULE 04
16 CHANNELS
TBDI-304



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS

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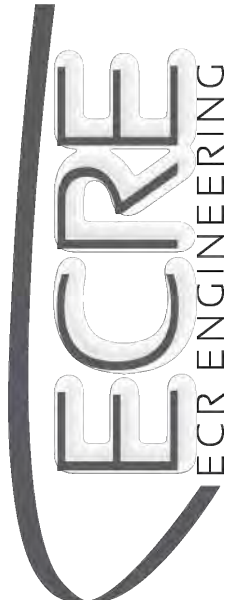
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions	Number	Date	Description

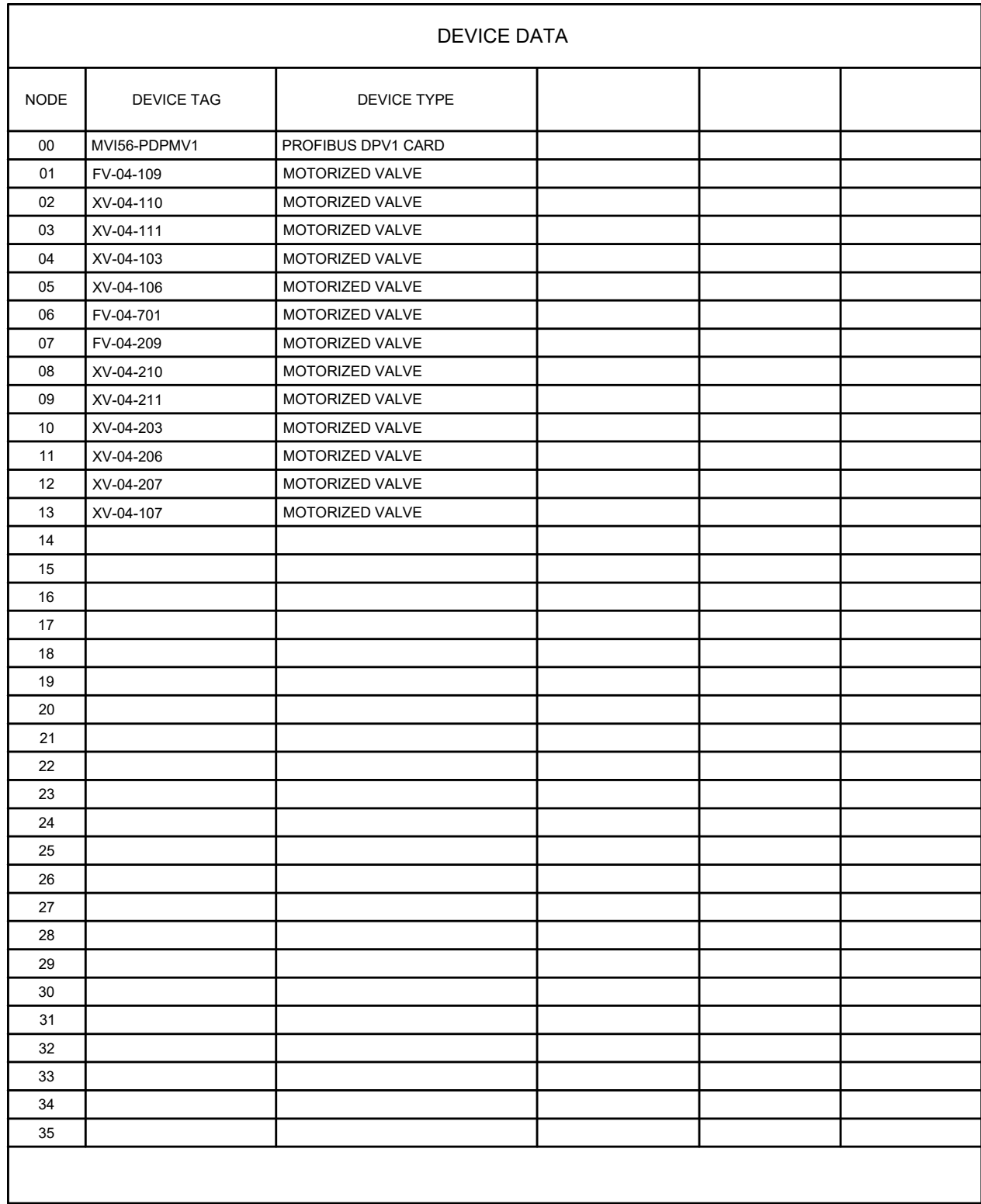
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Drawing Title:

CP-05 DIGITAL INPUT CARDS 5 OF 5

IC-114



YORVANI ARZUAGA REYES
INGENIERO
LICENCIADO
LIC. #10990
PUERTO RICO

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS

Sheet:



Drawing Title:
CP-05 PROFIBUS NETWORK A

Number	Date
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Project No.19-1837.0

Set Date: 2018/08/31

Drawn by: Y. ARZUAG


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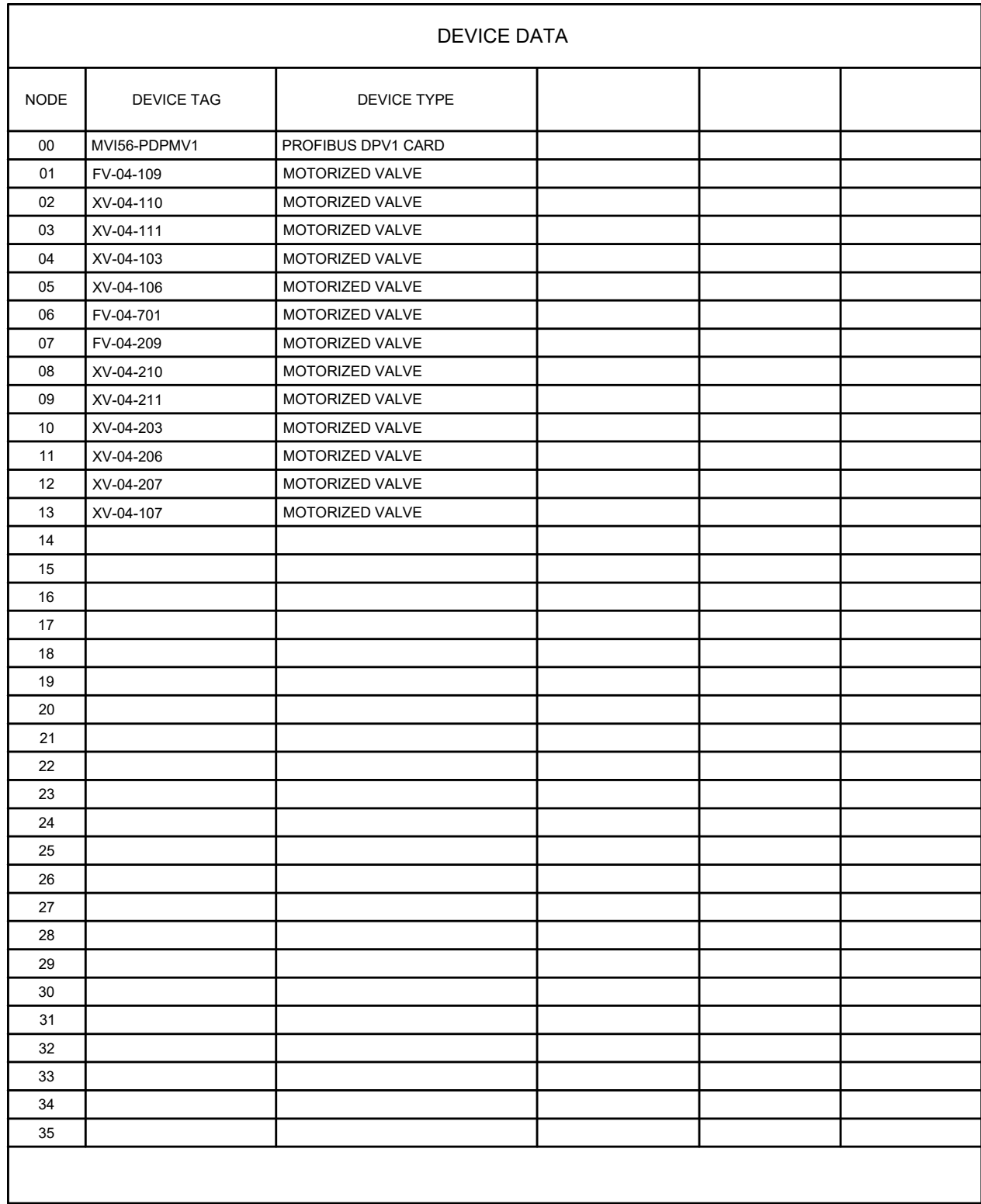
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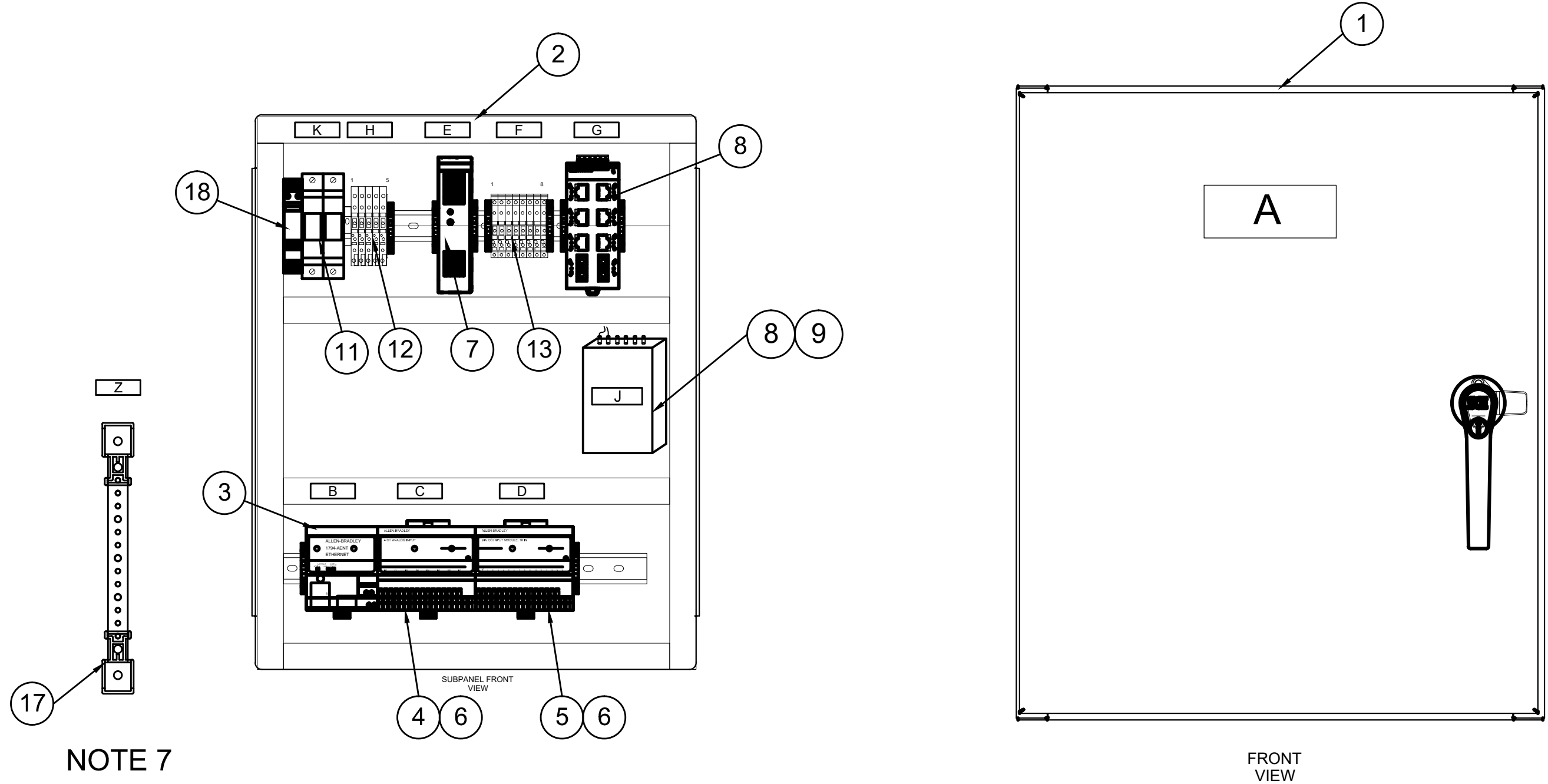
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The logo for ECRE Engineering, featuring the letters "ECRE" in a large, bold, sans-serif font, with "ENGINEERING" in a smaller font to the right. A stylized, curved line arches over the text.



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PROPIETARIO QUE CONFECIONEYO YU DISEÑO YU PREPARO ESTOS PLANOS Y LAS
ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIO QUE
DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES
DE LA LEY DE LA CONSTRUCCION YU LOS REGLAMENTOS YU CODIGOS DE LA
CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS
REGLEMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO
QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA
PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS
AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN
RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPB.



NAMEPLATE SCHEDULE				
ITEM NO.	TEXT SIZE	NAMEPLATE SIZE	1st. LINE	2nd. LINE
A	1/4"	2" x 5"	RAW WATER CONTROL BOX	LCP-09
B	3/16"	3" x 1"	FLEX I/O CHASSIS 09	-
C	3/16"	3" x 1"	TBAI-900	-
D	3/32"	1 3/8" x 1/2"	TBDI-901	-
E	3/32"	1 3/8" x 1/2"	24V-DC	POWER SUPPLY
F	3/32"	1 3/8" x 1/2"	TB-DC	-
G	3/32"	1 3/8" x 1/2"	ETHERNET SWITCH	-
H	3/32"	1 3/8" x 1/2"	TB-AC	-
I	3/32"	1 1/8" x 1/2"	INSTRUMENTS	GROUND BAR
J	1/8"	1 1/8" x 1/2"	FIBER OPTIC TO	CP-05
K	1/8"	1 1/8" x 1/2"	CIRCUIT BREAKER	CB-1
L	1/8"	1 1/8" x 1/2"		
M	1/8"	1 1/8" x 1/2"		
N	1/8"	1 1/8" x 1/2"		
O	1/8"	1 1/8" x 1/2"		
P	1/8"	1 1/8" x 1/2"		
Q	1/8"	1 1/8" x 1/2"		
R	1/8"	1 1/8" x 1/2"		
S	1/8"	1 1/8" x 1/2"		
T	1/8"	1 1/8" x 1/2"		
U	1/8"	1 1/8" x 1/2"		
V	1/8"	1 1/8" x 1/2"		
W	1/8"	1 1/8" x 1/2"		
X	1/8"	1 1/8" x 1/2"		
Y	1/8"	1 1/8" x 1/2"		
Z	1/8"	1 1/8" x 1/2"		
AA	1/8"	1 1/8" x 1/2"		
AB	1/8"	1 1/8" x 1/2"		
AC	1/8"	1 1/8" x 1/2"		

WIRING REQUIREMENTS:

- 1- ALL AC CIRCUITS MUST BE ROUTED AT A MINIMUM DISTANCE OF 6" FROM ANY CURRENT LOOP AND LOW VOLTAGE AND A MINIMUM OF 5 FT. FROM HIGH VOLTAGE ENCLOSURE OR SOURCE OF RF/MICROWAVE RADIATION.
- 2- ANALOG SIGNALS SHALL BE SHIELDED, WITH THE SHIELDED TERMINATED AT THE ISOLATED GROUND IN THE PANEL ONLY. THE OTHER END SHOULD BE CUT, FOLDED BACK AND TAPED OFF.
- 3- ALL WIRING SHALL BE PLACED IN WIRE THROUGH, PREFERABLY WIRE DUCT, WITH A COVER AND A MINIMUM OF 20% EXTRA SPACE FOR EASY ACCESS AND TROUBLESHOOTING.
- 4- ANALOG I/O LINES, DC POWER LINES FOR ANALOG CIRCUITS AND COMMUNICATIONS CABLE SHOULD BE PROPERLY SHIELDED AND ROUTED IN A RACEWAY SEPARATED FROM AC POWER LINES.
- 5- FOR POWER SUPPLIES AND I/O CIRCUITS. CONDUCTORS MUST BE RUN WITHOUT SPLICES FROM TERMINAL TO TERMINAL.
- 6- ALL CONDUCTORS AND CABLES MUST BE IDENTIFIED WITH A PERMANENT TAG IN ACCORDANCE WITH THE ELECTRICAL AND I/O WIRING LOOPS DEFINITIONS.
- 7- ALL TERMINALS ON THE TERMINAL BLOCKS MUST BE CLEARLY IDENTIFIED WITH A PERMANENT LABEL TO CORRESPOND WITH THE IDENTIFICATION OF THE DRAWINGS.
- 8- THE FOLLOWING ARE THE MINIMUM AWG SIZES TO BE USED:
A. MAIN POWER CIRCUITS: NO. 12
B. BRANCH POWER CIRCUITS: NO. 14
C. CONTROL CIRCUITS: NO. 16
D. CURRENT LOOPS: NO. 16 (SHIELDED)
- 9- ALL TERMINAL BLOCKS MUST BE RAISED FROM THE BACK PLATE FOR EASE OF WIRING.
- 10-TERMINAL JUMPERS MUST BE USED IN PLACE OF THE WIRED JUMPERS, WHERE SUCH JUMPERS ARE NECESSARY.
- 11- WIRING STANDARD AND CONVENTIONS SHOULD CONFIRM TO THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 300.
- 12- ALL SINGLE CONDUCTORS MUST BE CODED AS FOLLOWS:
A. BLACK--LINE, LOAD AND CONTROL CIRCUIT AT LINE VOLTAGE
B. RED--ALL CONTROL CIRCUIT
C. BLUE OR PURPLE--DC CONTROL CIRCUIT (POSITIVE)
D. WHITE--AC GROUNDED CIRCUITS (NEUTRAL)
E. GRAY--DC GROUNDED CIRCUIT CONDUCTOR
F. GREEN--EQUIPMENT GROUNDED CONDUCTOR
G. LIGHT BLUE--INTRINSICALLY SAFE CONDUCTORS.

BILL OF MATERIALS				
ITEM NO.	QTY.	MANUFACTURER & MODEL NO.	FURNISHED BY	DESCRIPTION
1	1	SAGINAW SCE-24EL2010SSLPL	PANEL VENDOR	NEMA 4X SS WALL MOUNT 24"x20"x10"D ENCL.
2	1	SAGINAW SCE-24P20	PANEL VENDOR	SIDE PANELS 24 x 20
3	1	ALLEN BRADLEY 1794-AENT	PANEL VENDOR	ETHERNET COMMUNICATION ADAPTER CARD
4	1	ALLEN BRADLEY 1794-IB9	PANEL VENDOR	ANALOG INPUT CARD 8 CHANNELS DIFFERENTIAL 4-20 MA
5	1	ALLEN BRADLEY 1794-IB16	PANEL VENDOR	DISCRETE INPUT CARD 24 VDC 16 CHANNELS
6	2	ALLEN BRADLEY 1794-TS3	PANEL VENDOR	TERMINAL BASE SCREW TYPE
7	1	PHOENIX CONTACTS 2866268	PANEL VENDOR	24 V DC POWER SUPPLY 2.5 AMP TRIO-PS/1AC/24DC/ 2.5
8	1	PHOENIX CONTACTS 2891187	PANEL VENDOR	FL SWITCH SFN 6072LX 6 RJ45 2 SC FIBER
9	1	BELDEN A0643206 / (3) A0649254	INST. CONTRACTOR	SURFACE MOUNT BOX FIBER OPTIC FOR 6 PAIR
10	2	BELDEN A2000056	INST. CONTRACTOR	FIBER OPTIC PATCH CORD 6 FT. MULTIMODE F3000, 62.5um SC DUPLEX
11	1	ALLEN BRADLEY 1492-SP1C100-N	PANEL VENDOR	CIRCUIT BREAKER 1 POLE + NEUTRAL 120 VAC 10 AMP
12	5	ALLEN BRADLEY 1492-JD3FB	PANEL VENDOR	3 LEVEL FUSED TERMINAL 120 VAC WITH FUSES
13	8	ALLEN BRADLEY 1492-JD3FB	PANEL VENDOR	2 LEVEL FUSED TERMINAL 24 V DC WITH FUSES
14				
15	AS REQ	WEIDMULLER 38356 / EW 35	PANEL VENDOR	END BRACKET
16	AS REQ	WEIDMULLER 23841 / SLT TS 35x15	PANEL VENDOR	DIN RAIL SLOTTED
17	1	HOFFMAN P-GSZK	PANEL VENDOR	GROUNDING BAR SYSTEM
18	1	PHOENIX CONTACTS 2856812	PANEL VENDOR	AC SURGE SUPPRESSOR FT-2-ME/2-120
19	AS REQ	PANDUIT PANDUIT G1X3LG6	PANEL VENDOR	WIRING DUCT GRAY 1"W x 3.12"H
20	AS REQ	PANDUIT PANDUIT C1LGG	PANEL VENDOR	WIRING DUCT COVER GRAY 1" W
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NOTES:

- 1- THE NAMEPLATES WILL HAVE BLACK BACKGROUND WITH WHITE LETTERS.
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- 3- PANEL CONTRACTOR WILL PROVIDE TAGS FOR ALL DEVICES INSIDE THE PANEL.
- 4- ALL PANEL ARRANGEMENT DETAILS NEED TO BE COORDINATED WITH THE DESIGNATED ENGINEER BEFORE THE PANEL CONSTRUCTION HAS BEGUN.
- 5- USE ONLY CONDUIT HUBS WHICH ARE COMPATIBLE WITH THE NEMA RATING OF SUBJECTED PANEL & ITS LOCATION.
- 6- ALL CONDUIT TO BE INSTALLED AT BOTTOM OF THE PANEL.
- 7- TO BE INSTALLED ON THE SIDE OF THE PANEL WITH SOLDER SCREWS.



YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads



Revisions

Number Date

Description

SHEET INFO.

Project No. 19-1837.0

Set Date: 2018/08/31

Drawn by: Y. ARZUAGA

Dwg. Date: 2018/08/31

ECRE

ECR ENGINEERING

architects & engineers, PSC

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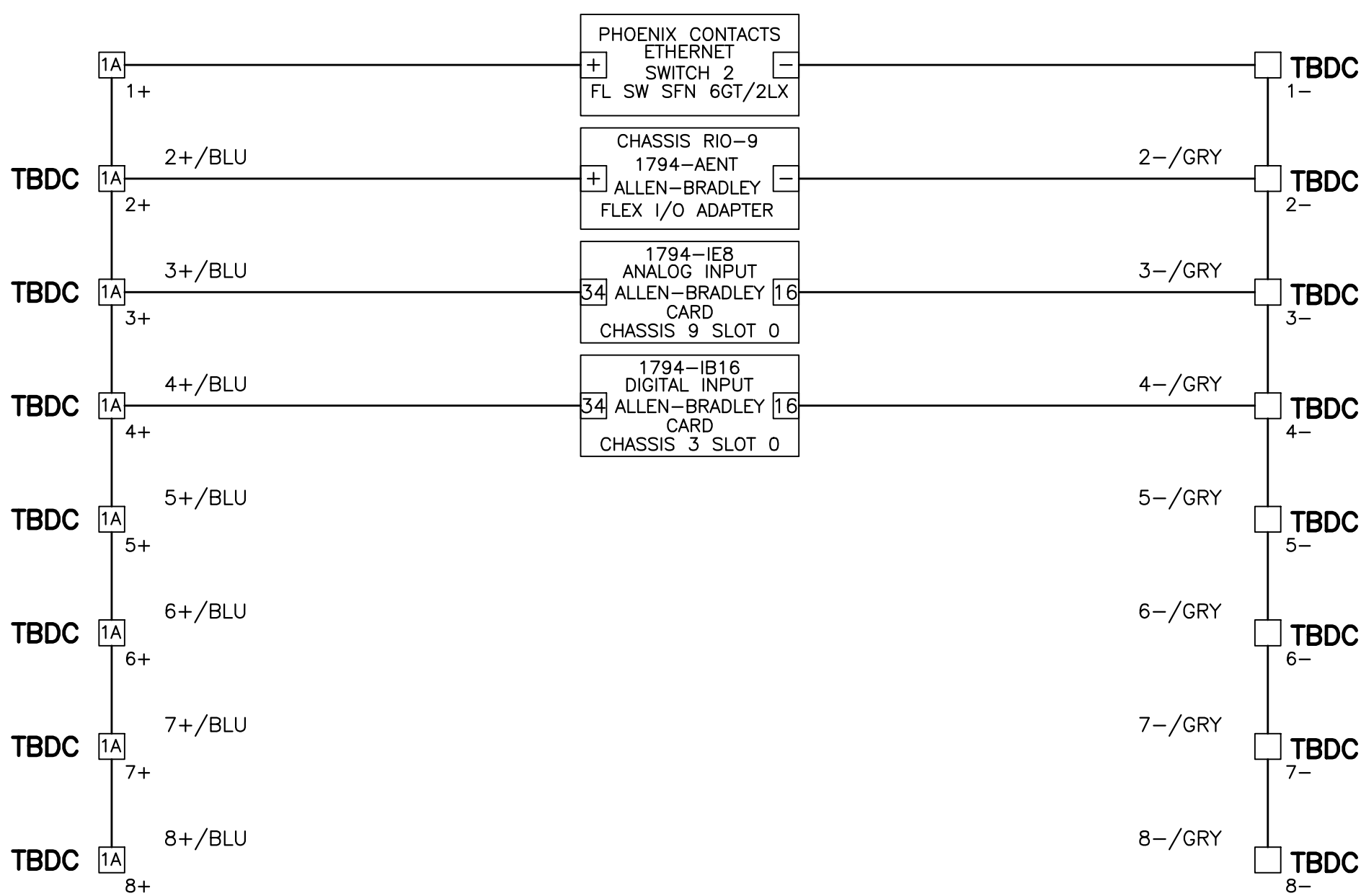
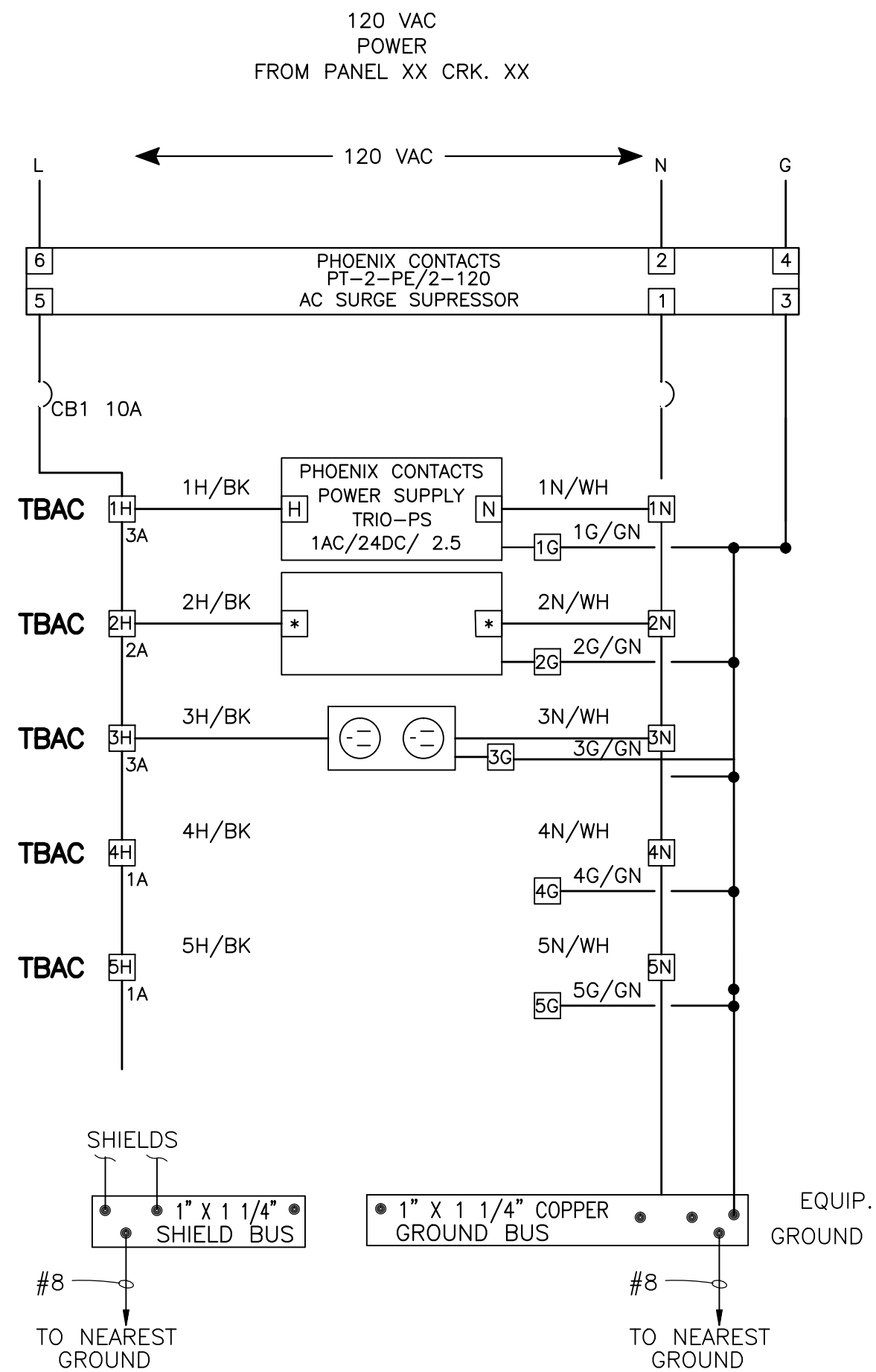
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Sheet:

IC-117

LCP-09 PANEL LAYOUT & BILL OF MATERIAL



24 VDC POWER DISTRIBUTION



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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: AGUAS & MAGUARO, PUERTO RICO



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Project Title:

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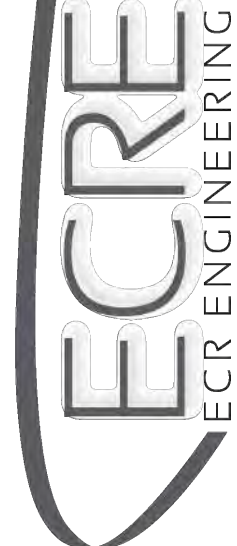
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IC-118

LCP-09 PANEL POWER DISTRIBUTION

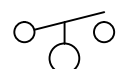
Revisions	
Number	Description

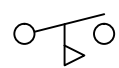
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Project No. 19-1537.0
Set Date: 20180831
Drawn by: Y. ARZUAGA
Dwg. Date: 20180831

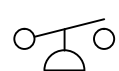


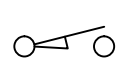
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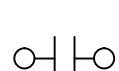
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-  LEVEL SWITCH N.O.


 FLOW SWITCH N.O.


 PRESSURE SWITCH N.O.

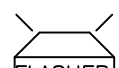
 LIMIT SWITCH N.O.



 RELAY CONTACT N.O.

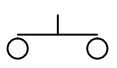
 PILOT LIGHT


 CONTROL RELAY

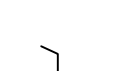
 CONTROL RELAY


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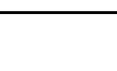
 FLASHER
-  SOLENOID VALVE

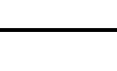
 MOMENTARY SWITCH


 EMERGENCY STOP SWITCH

 SELECTOR SWITCH

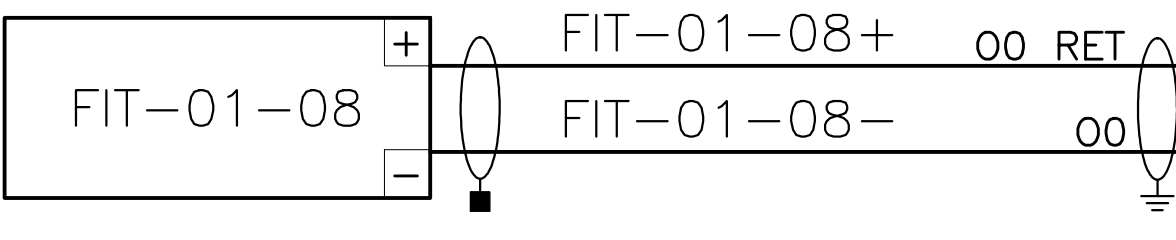
 PANEL WIRING

 FIELD WIRING

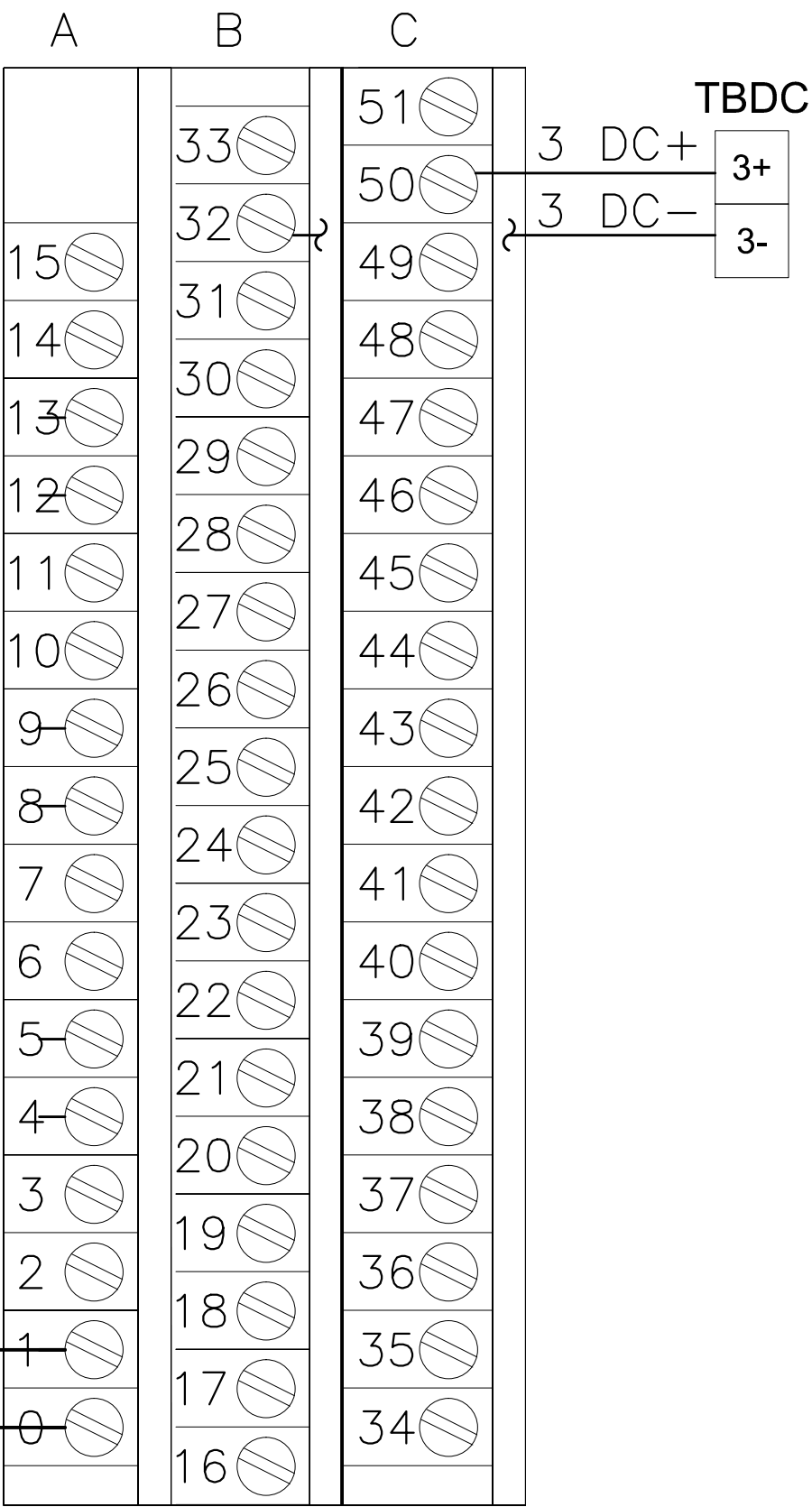
 SHIELD CUT BACK

 SHIELD GROUND

Raw Water Control
Valve Box Ultrasonic
Flow Transmitter



1794-IF4I
ANALOG OUTPUT CARD
4 CHANNELS
CHASSIS RIO-9 MODULE 00
TBAI-900



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Integra Design Group
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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

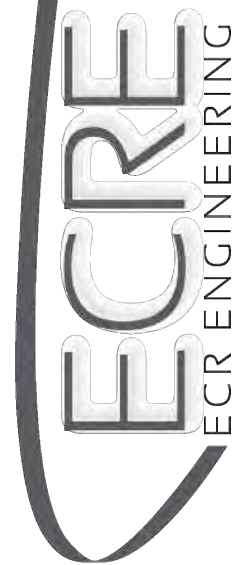


Revisions

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SHEET INFO.

Project No: 19-1537.0
Set Date: 20180831
Drawn by: Y. ARZUAGA
Dwg. Date: 20180831



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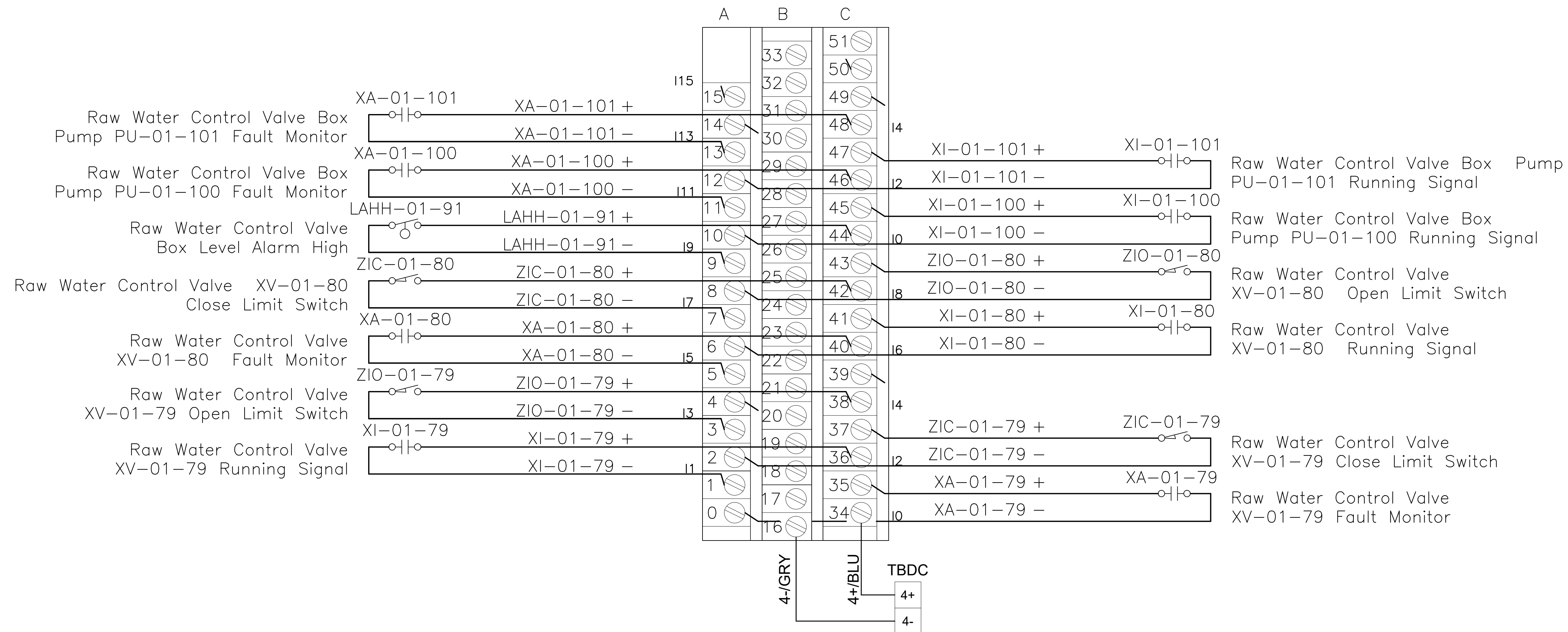
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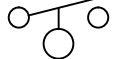

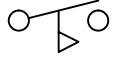
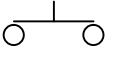
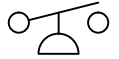


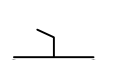
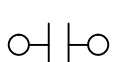







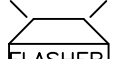
Drawing Title:

LCP-09 PANEL ANALOG INPUT CARD

1794-IB16
DIGITAL INPUT CARD
CHASSIS RIO-9 MODULE 01
16 CHANNELS
TBDI-901



LEGEND:

- | | | | |
|---|----------------------|---|-----------------------|
|  | LEVEL SWITCH N.O. |  | SOLENOID VALVE |
|  | FLOW SWITCH N.O. |  | MOMENTARY SWITCH |
|  | PRESSURE SWITCH N.O. |  | EMERGENCY STOP SWITCH |
|  | LIMIT SWITCH N.O. |  | SELECTOR SWITCH |
|  | RELAY CONTACT N.O. |  | PANEL WIRING |
|  | PILOT LIGHT |  | FIELD WIRING |
|  | CONTROL RELAY |  | SHIELD CUT BACK |
|  | CONTROL RELAY |  | SHIELD GROUNDED |
|  | FLASHER | | |

Integra Design Group
DATE ISSUED
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**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**



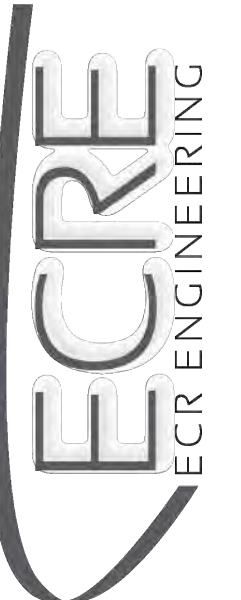
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

REVISIONS	Number	Date
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REVISIONS	
Number	Date Description

SHEET INFO.

Project No.19-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAG
Dwg. Date: 2018/08/31

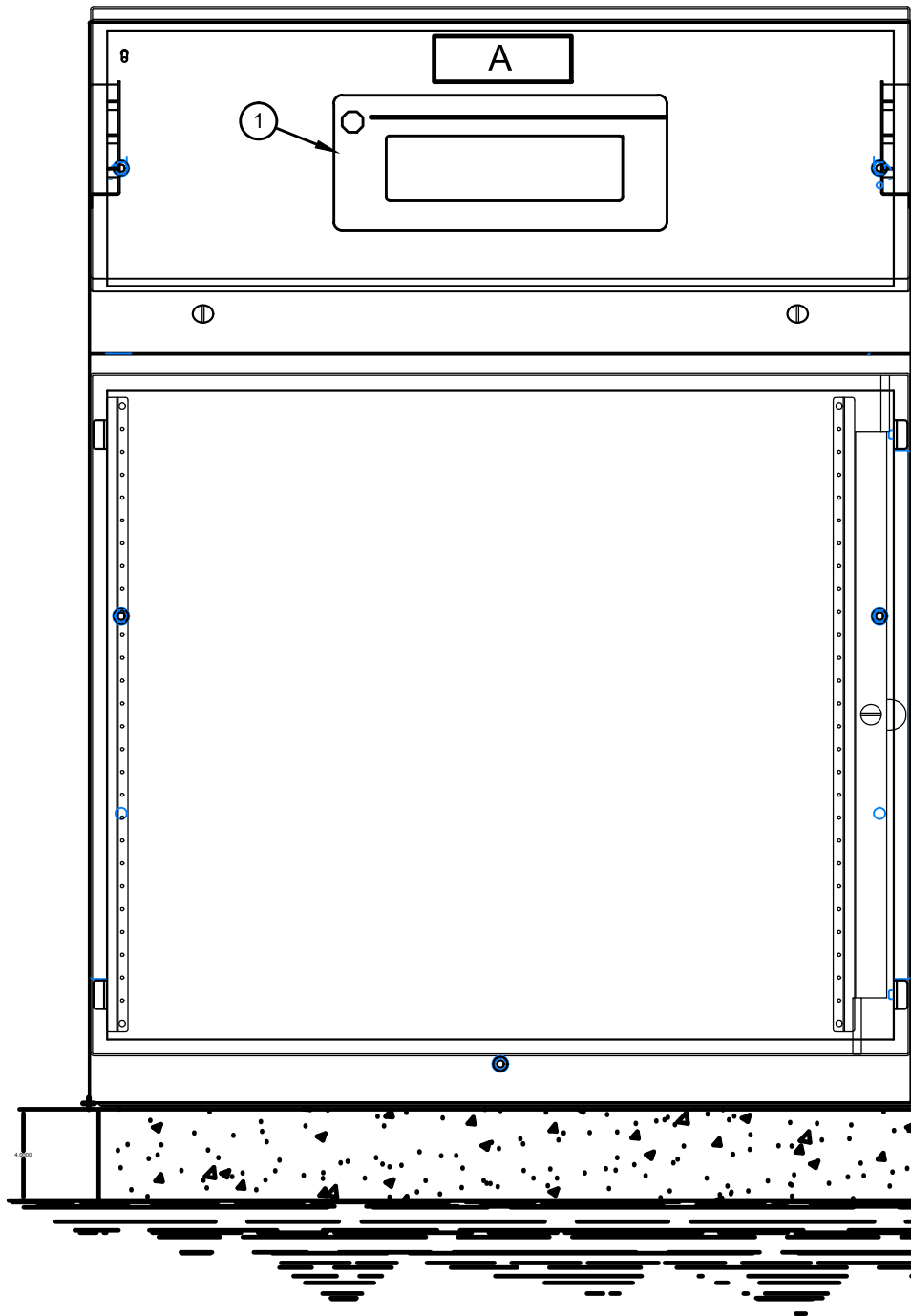


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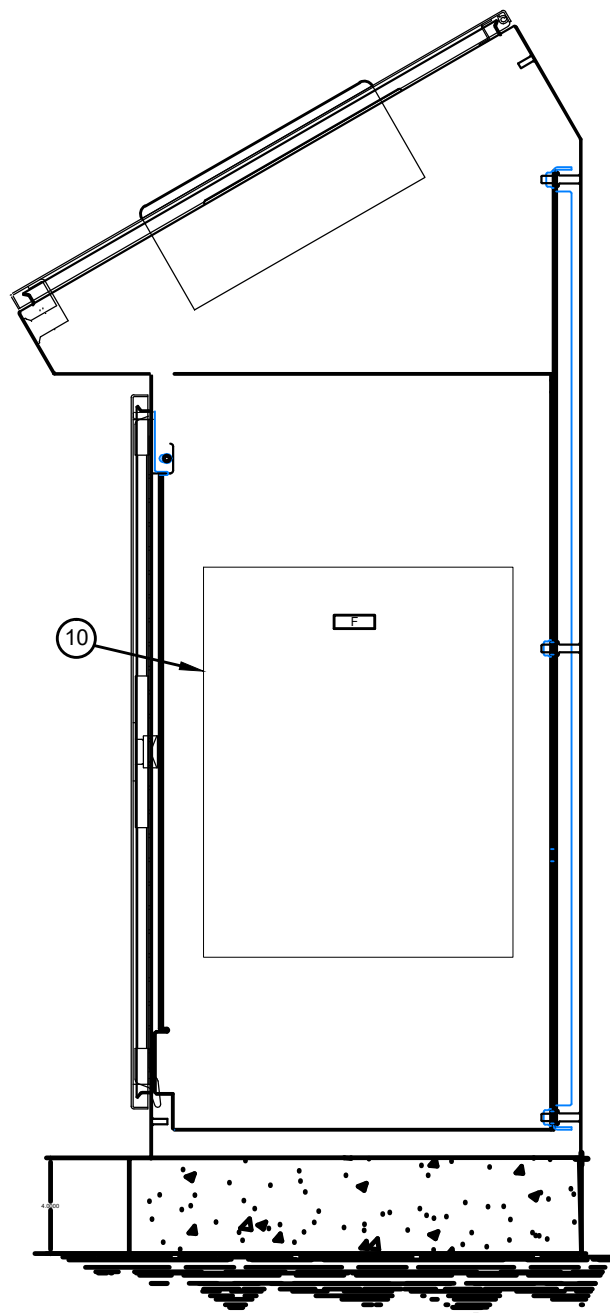
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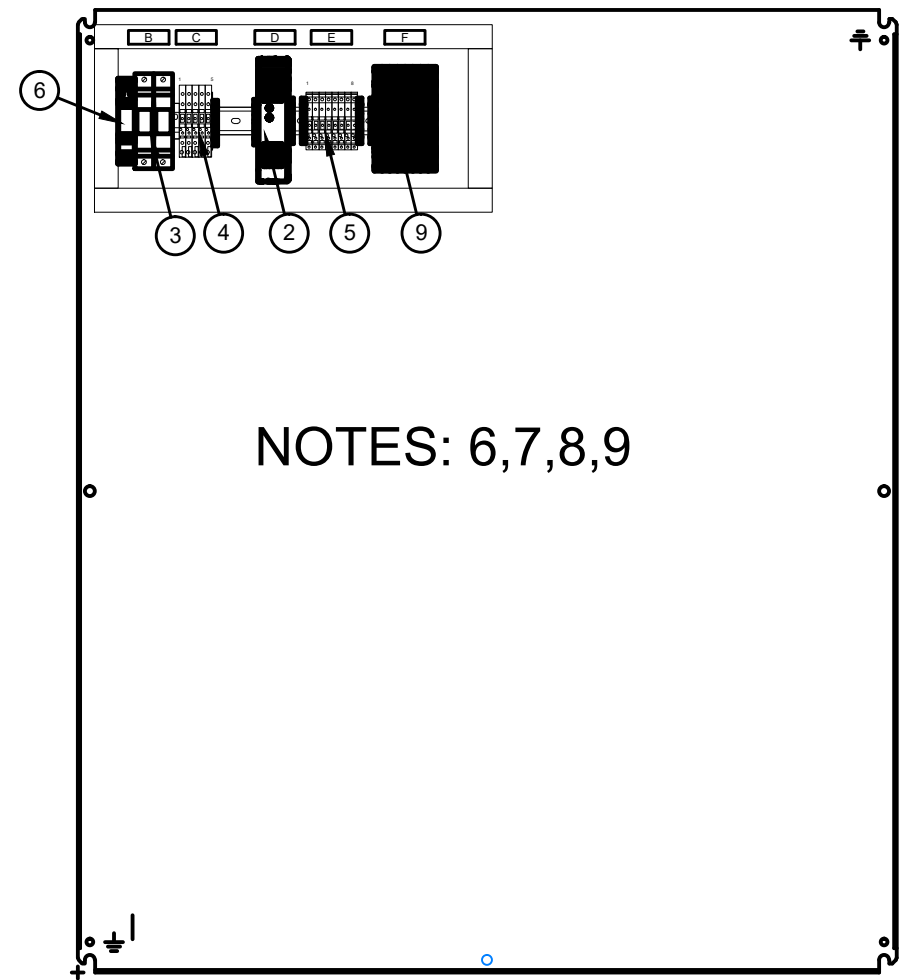
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ENCLOSURE FRONT VIEW X 4



ENCLOSURE SIDE VIEW X4



BACK PANEL LAYOUT X 4

NAMEPLATE SCHEDULE				
ITEM NO.	TEXT SIZE	NAMEPLATE SIZE	1st. LINE	2nd. LINE
A	1/4"	2" x 5"	FILTER 1	LOCAL PANEL
B	3/16"	3" x 1"	CIRCUIT BREAKER	CB-1
C	3/16"	3" x 1"	TBAC	-
D	3/32"	1 3/8" x 1/2"	24V-DC	POWER-SUPPLY
E	3/32"	1 3/8" x 1/2"	TB-DC	-
F	3/32"	1 3/8" x 1/2"	TBF1	-
G	3/32"	1 3/8" x 1/2"	ELECTRICAL BOX	FILTERS VALVES POWER
H	3/32"	1 3/8" x 1/2"		
I	3/32"	1 1/8" x 1/2"		
J	1/8"	1 1/8" x 1/2"		
K	1/8"	1 1/8" x 1/2"		
L	1/8"	1 1/8" x 1/2"		
M	1/8"	1 1/8" x 1/2"		
N	1/8"	1 1/8" x 1/2"		
O	1/8"	1 1/8" x 1/2"		
P	1/8"	1 1/8" x 1/2"		
Q	1/8"	1 1/8" x 1/2"		
R	1/8"	1 1/8" x 1/2"		
S	1/8"	1 1/8" x 1/2"		
T	1/8"	1 1/8" x 1/2"		
U	1/8"	1 1/8" x 1/2"		
V	1/8"	1 1/8" x 1/2"		
W	1/8"	1 1/8" x 1/2"		
X	1/8"	1 1/8" x 1/2"		
Y	1/8"	1 1/8" x 1/2"		
Z	1/8"	1 1/8" x 1/2"		
AA	1/8"	1 1/8" x 1/2"		
AB	1/8"	1 1/8" x 1/2"		
AC	1/8"	1 1/8" x 1/2"		

WIRING REQUIREMENTS:

- 1- ALL AC CIRCUITS MUST BE ROUTED AT A MINIMUM DISTANCE OF 6" FROM ANY CURRENT LOOP AND LOW VOLTAGE AND A MINIMUM OF 5 FT. FROM HIGH VOLTAGE ENCLOSURE OR SOURCE OF RF/MICROWAVE RADIATION.
- 2- ANALOG SIGNALS SHALL BE SHIELDED, WITH THE SHIELDED TERMINATED AT THE ISOLATED GROUND IN THE PANEL ONLY. THE OTHER END SHOULD BE CUT, FOLDED BACK AND TAPED OFF.
- 3- ALL WIRING SHALL BE PLACED IN WIRE THROUGH, PREFERABLY WIRE DUCT, WITH A COVER AND A MINIMUM OF 20% EXTRA SPACE FOR EASY ACCESS AND TROUBLESHOOTING.
- 4- ANALOG I/O LINES, DC POWER LINES FOR ANALOG CIRCUITS AND COMMUNICATIONS CABLE SHOULD BE PROPERLY SHIELDED AND ROUTED IN A RACEWAY SEPARATED FROM AC POWER LINES.
- 5- FOR POWER SUPPLIES AND I/O CIRCUITS, CONDUCTORS MUST BE RUN WITHOUT SPLICES FROM TERMINAL TO TERMINAL.
- 6- ALL CONDUCTORS AND CABLES MUST BE IDENTIFIED WITH A PERMANENT TAG IN ACCORDANCE WITH THE ELECTRICAL AND I/O WIRING LOOPS DEFINITIONS.
- 7- ALL TERMINALS ON THE TERMINAL BLOCKS MUST BE CLEARLY IDENTIFIED WITH A PERMANENT LABEL TO CORRESPOND WITH THE IDENTIFICATION OF THE DRAWINGS.
- 8- THE FOLLOWING ARE THE MINIMUM AWG SIZES TO BE USED:
 - A. MAIN POWER CIRCUITS: NO. 12
 - B. BRANCH POWER CIRCUITS: NO. 14
 - C. CONTROL CIRCUITS: NO. 16
 - D. CURRENT LOOPS: NO. 16 (SHIELDED)
- 9- ALL TERMINAL BLOCKS MUST BE RAISED FROM THE BACK PLATE FOR EASE OF WIRING.
- 10-TERMINAL JUMPERS MUST BE USED IN PLACE OF THE WIRED JUMPERS, WHERE SUCH JUMPERS ARE NECESSARY.
- 11- WIRING STANDARD AND CONVENTIONS SHOULD CONFIRM TO THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 300.
- 12- ALL SINGLE CONDUCTORS MUST BE CODED AS FOLLOWS:
 - A. BLACK--LINE, LOAD AND CONTROL CIRCUIT AT LINE VOLTAGE
 - B. RED--ALL CONTROL CIRCUIT
 - C. BLUE OR PURPLE--DC CONTROL CIRCUIT (POSITIVE)
 - D. WHITE--AC GROUNDED CIRCUITS (NEUTRAL)
 - E. GRAY--DC GROUNDED CIRCUIT CONDUCTOR
 - F. GREEN--EQUIPMENT GROUNDED CONDUCTOR
 - G. LIGHT BLUE--INTRINSICALLY SAFE CONDUCTORS.

BILL OF MATERIALS				
ITEM NO.	QTY.	MANUFACTURER & MODEL NO.	FURNISHED BY	DESCRIPTION
1	4	MAPLE SYSTEM HMI5104TH	PANEL VENDOR	10.4 inch Graphic HMI TOUCHSCREEN
2	4	PHOENIX CONTACTS 2856588	PANEL VENDOR	24 V DC POWER SUPPLY 2.5 AMP TRIO-PS1AC/24DC/2.5
3	4	ALLEN BRADLEY 1492-SP1C050-N	PANEL VENDOR	CIRCUIT BREAKER 1 POLE + NEUTRAL 120 VAC 5 AMP
4	20	ALLEN BRADLEY 1492-JD3FB	PANEL VENDOR	3 LEVEL FUSED TERMINAL 120 VAC WITH FUSES
5	20	ALLEN BRADLEY 1492-JD3FB	PANEL VENDOR	2 LEVEL FUSED TERMINAL 24 V DC WITH FUSES
6	4	PHOENIX CONTACTS 2856812	PANEL VENDOR	AC SURGE SUPPRESSOR PT-2-PE/2-120
7	AS REQ	PANDUIT PANDUCT 61X3LG6	PANEL VENDOR	WIRING DUCT GRAY 1" W x 3.12" H
8	AS REQ	PANDUIT PANDUCT C1LG6	PANEL VENDOR	WIRING DUCT COVER GRAY 1" W
9	32	PHOENIX CONTACTS 3046703	PANEL VENDOR	THREE LEVEL TERMINAL BLOCK UT 6-3L
10	4	BY ELECTRICAL	PANEL VENDOR	CIRCUIT BREAKER BOX
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- 5- USE ONLY CONDUIT HUBS WHICH ARE COMPATIBLE WITH THE NEMA RATING OF SUBJECTED PANEL & ITS LOCATION.
- 6- PANEL TO BE REFURBISH INSTALLING A TOP SS PLATE ON TOP FOR HMI INSTALLATION.
- 7- REMOVE ALL COMPONENTS INSIDE PANEL.
- 8- INSTALL NEW SUBPANEL WITH NEW COMPONENTS AS SHOWN.
- 9- ELECTRICAL CIRCUIT BREAKER BOX TO BE INSTALLED AT SIDE PANEL.

Integra Design Group
DATE ISSUED
JULY 30, 2021
BID DRAWINGS



YO. YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCUIDO O POR NEGLIGENCIA YA SEA POR MI MISMO, AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Revisions

Number	Date	Description

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Project No: 19-1837.0
Set Date: 2018/08/31
Drawn by: Y. ARZUAGA
Dwg. Date: 2018/08/31

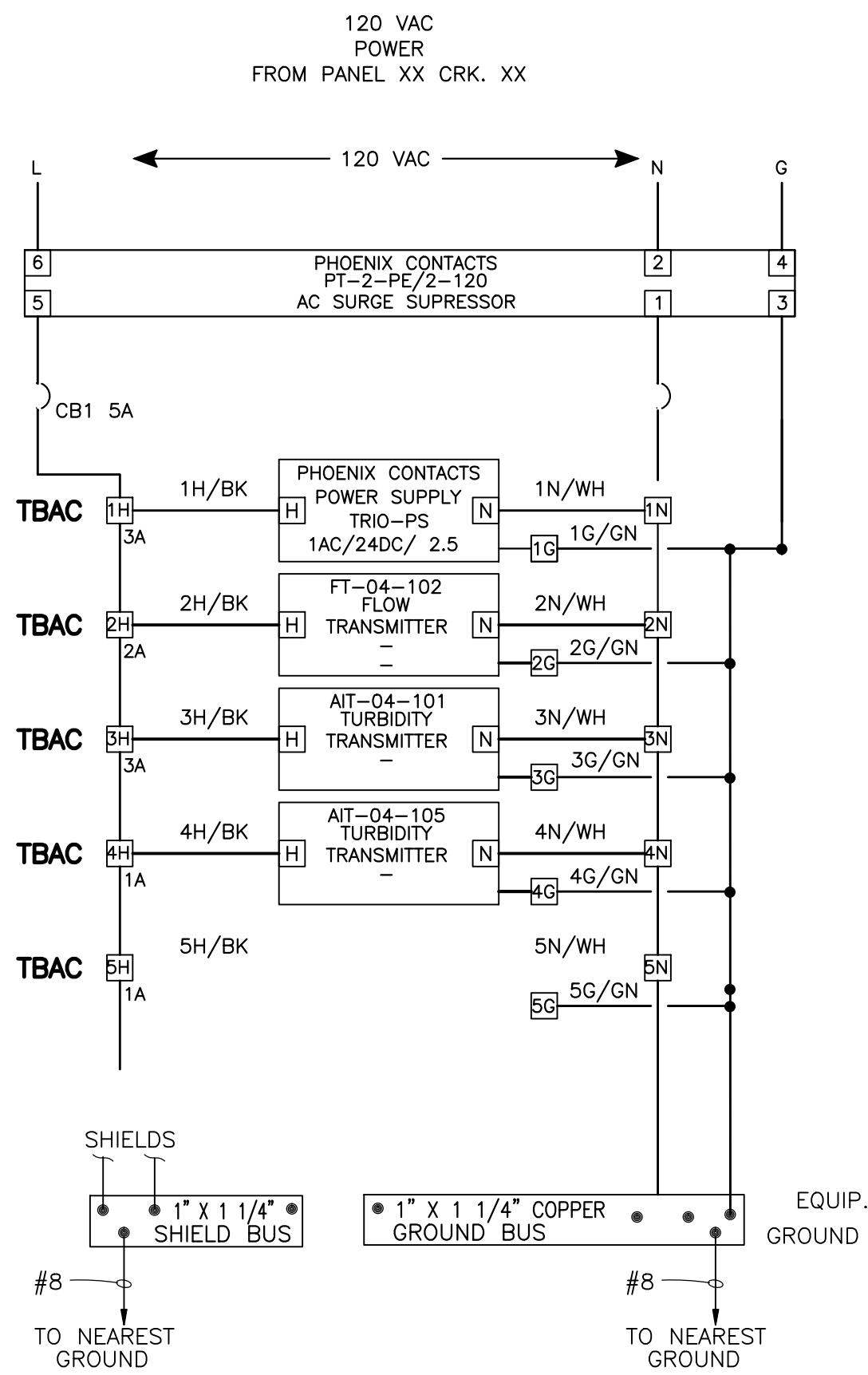
ECRE
ECR ENGINEERING

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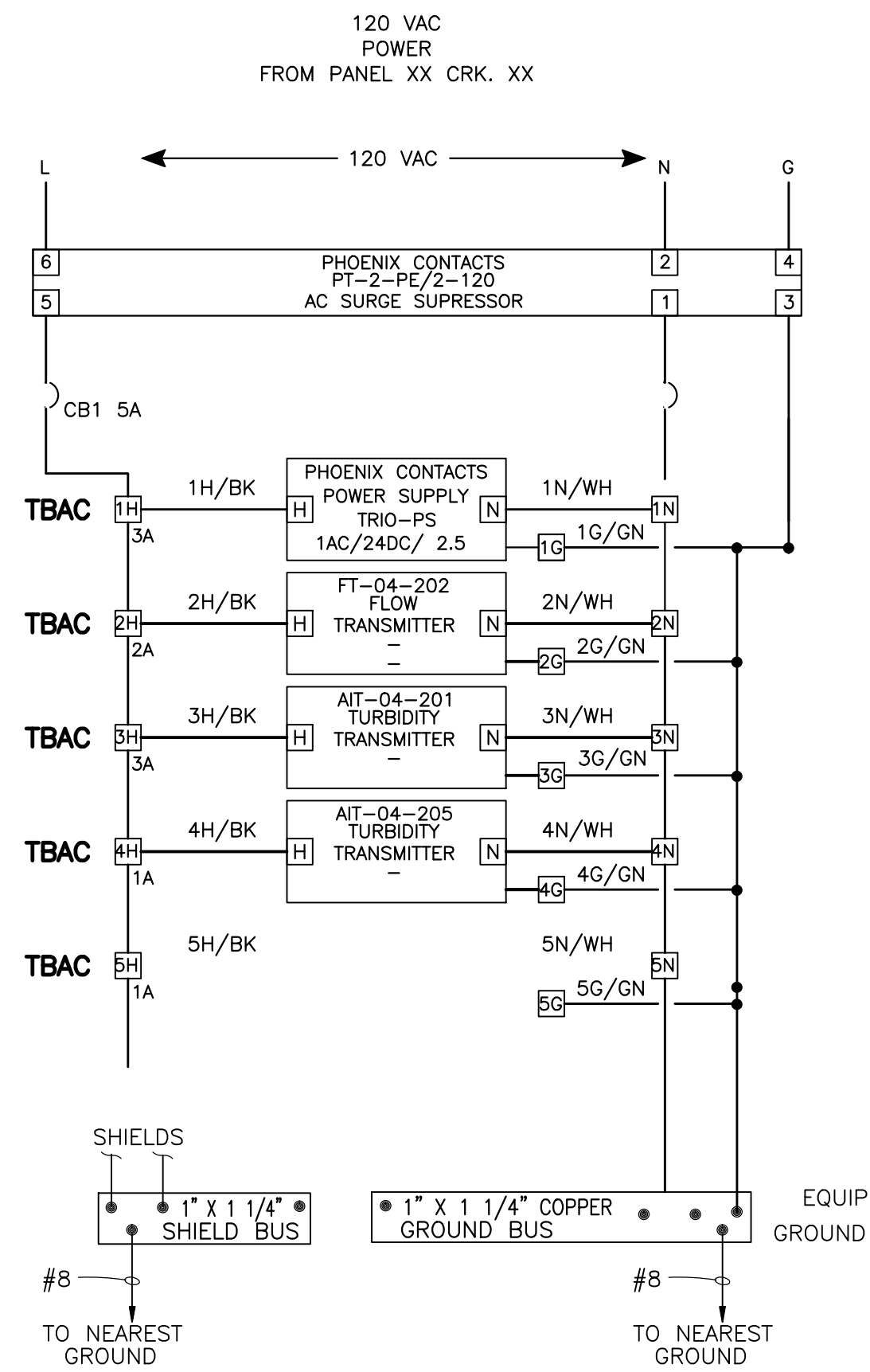
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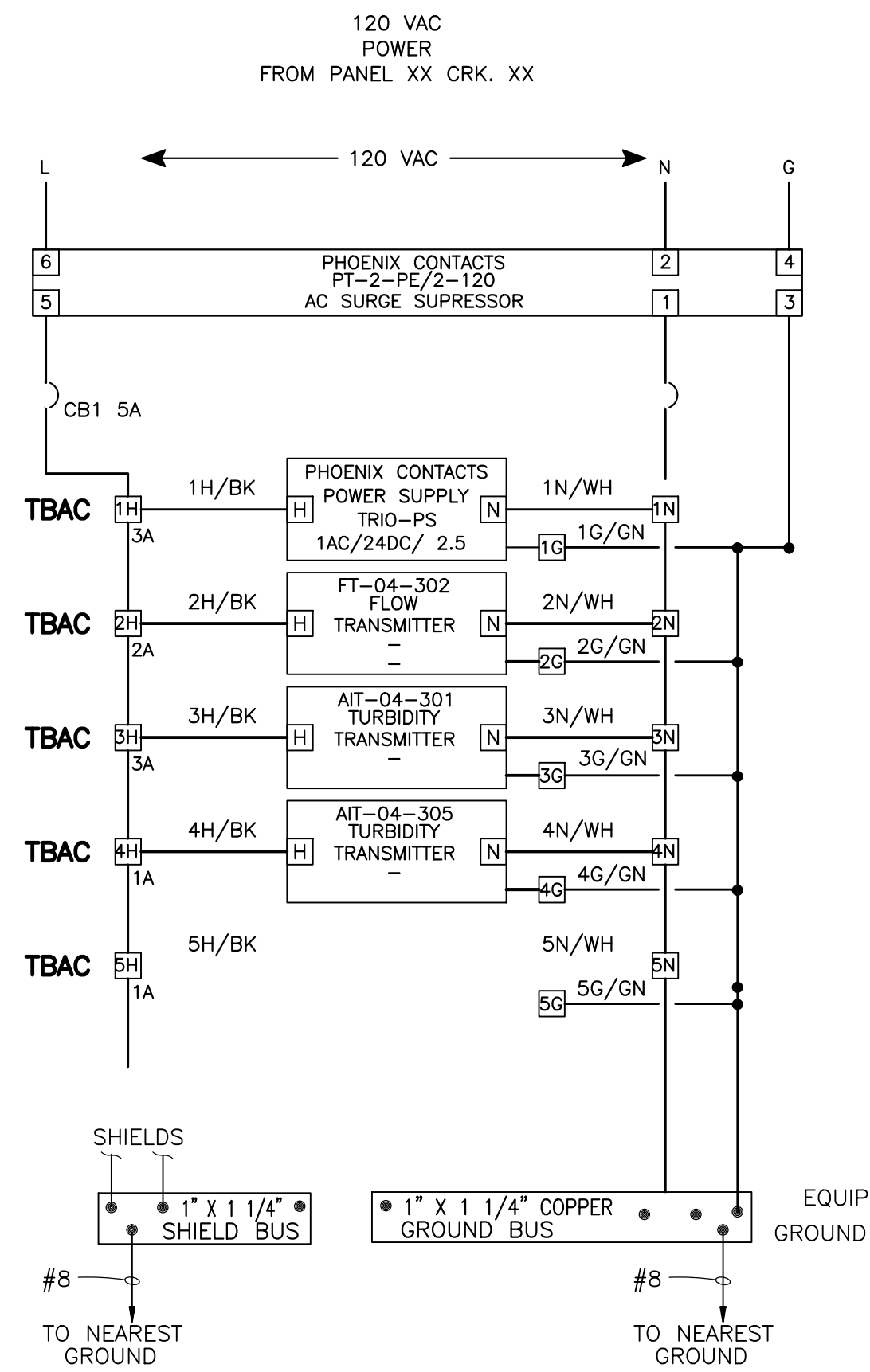
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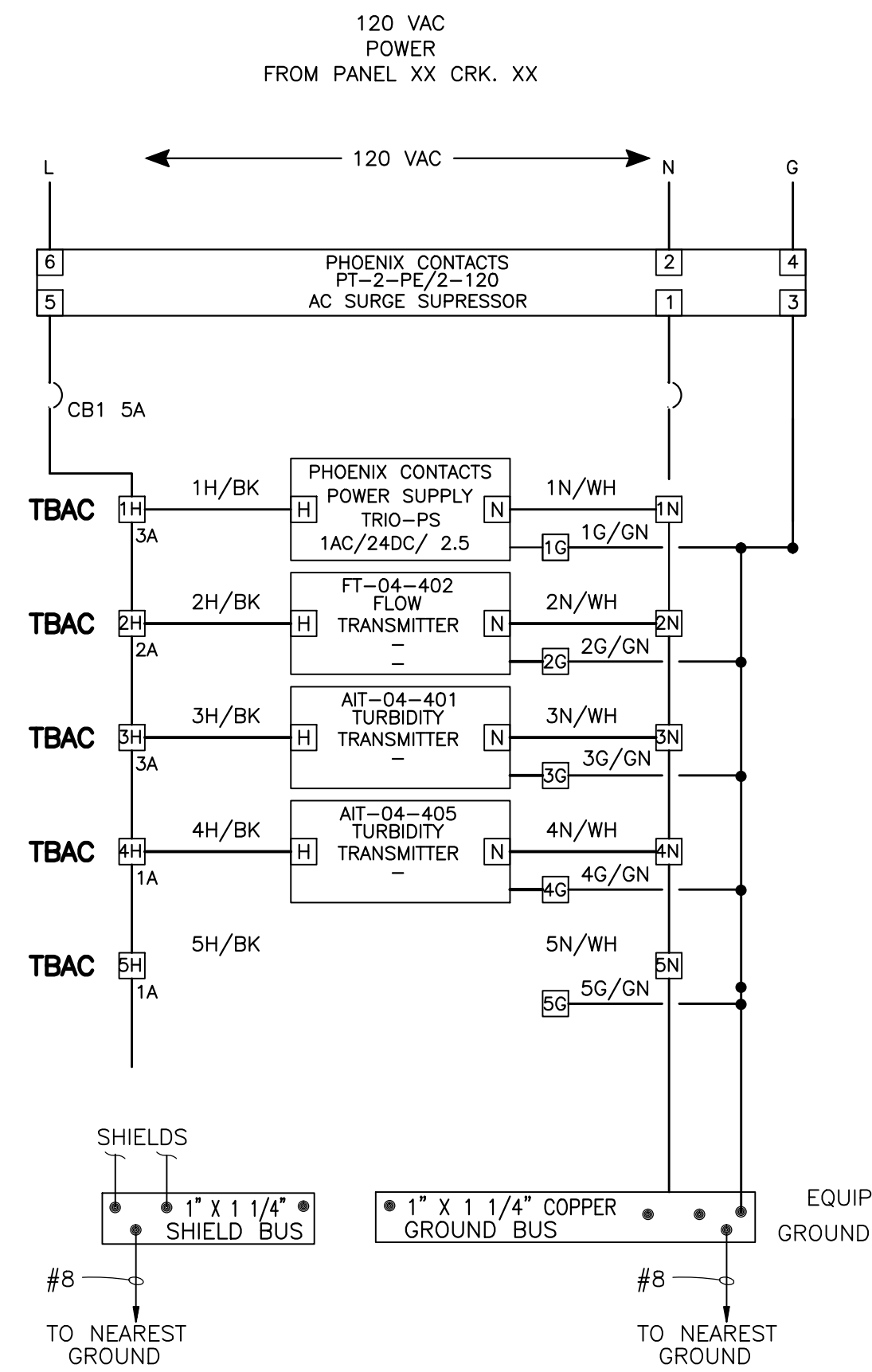
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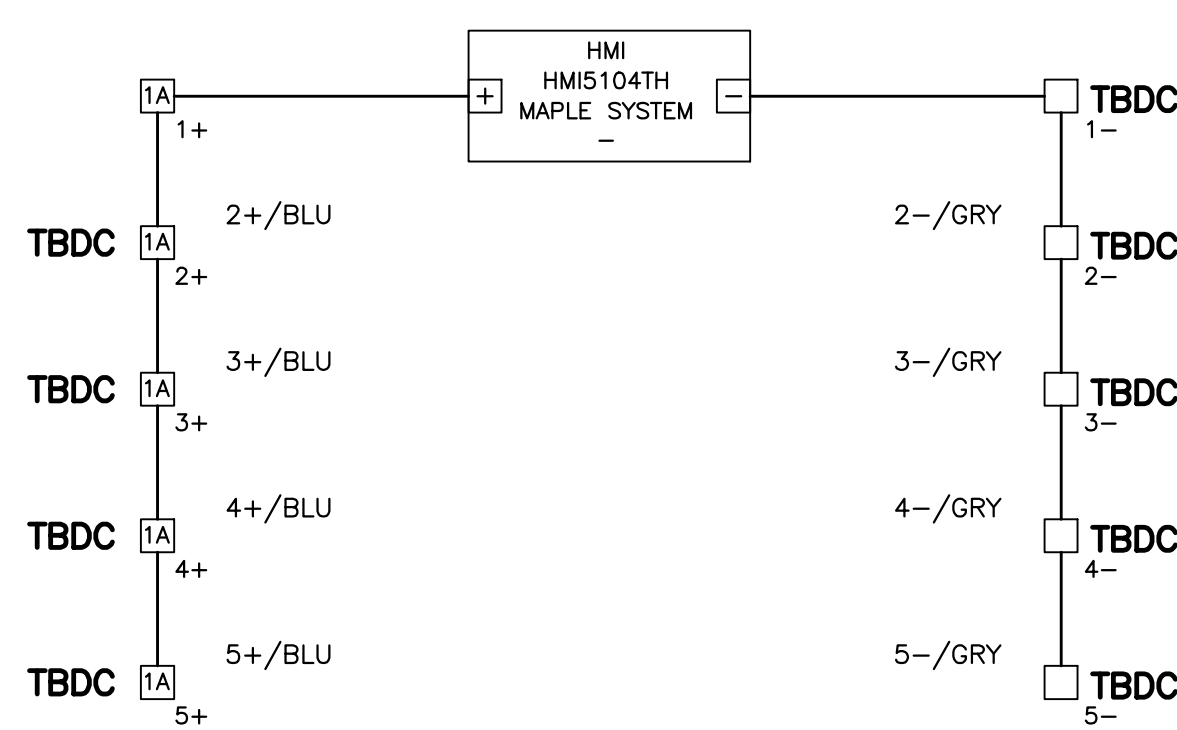
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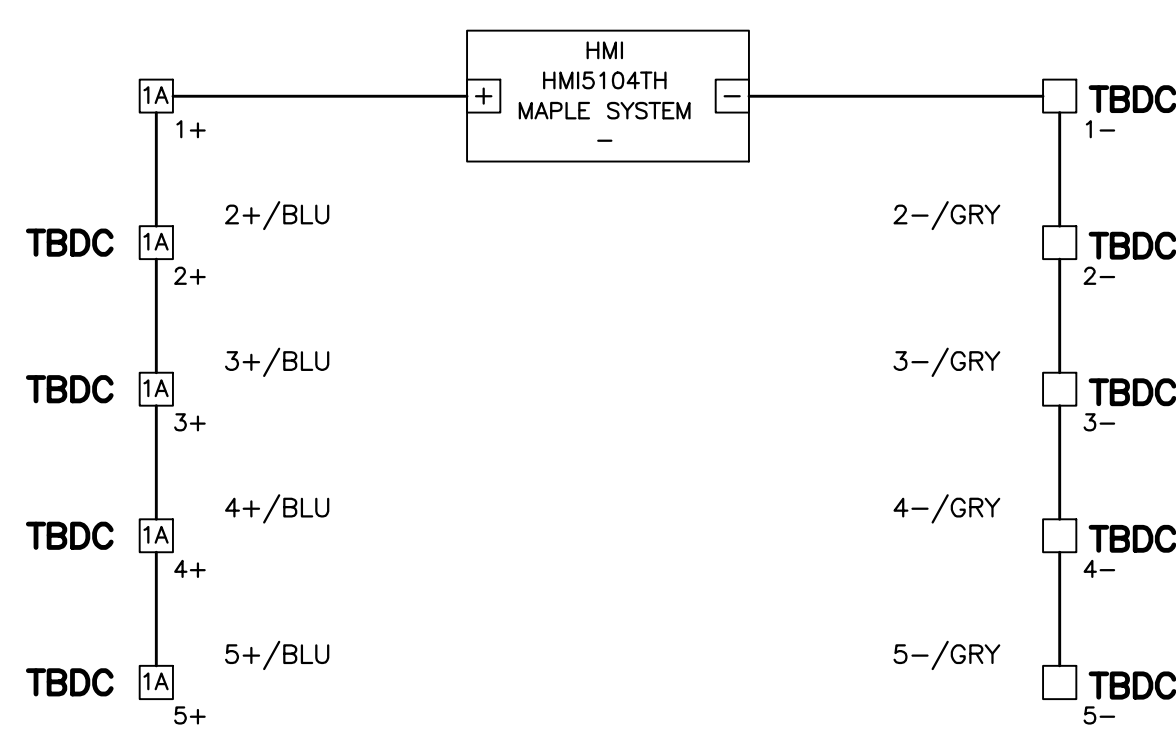
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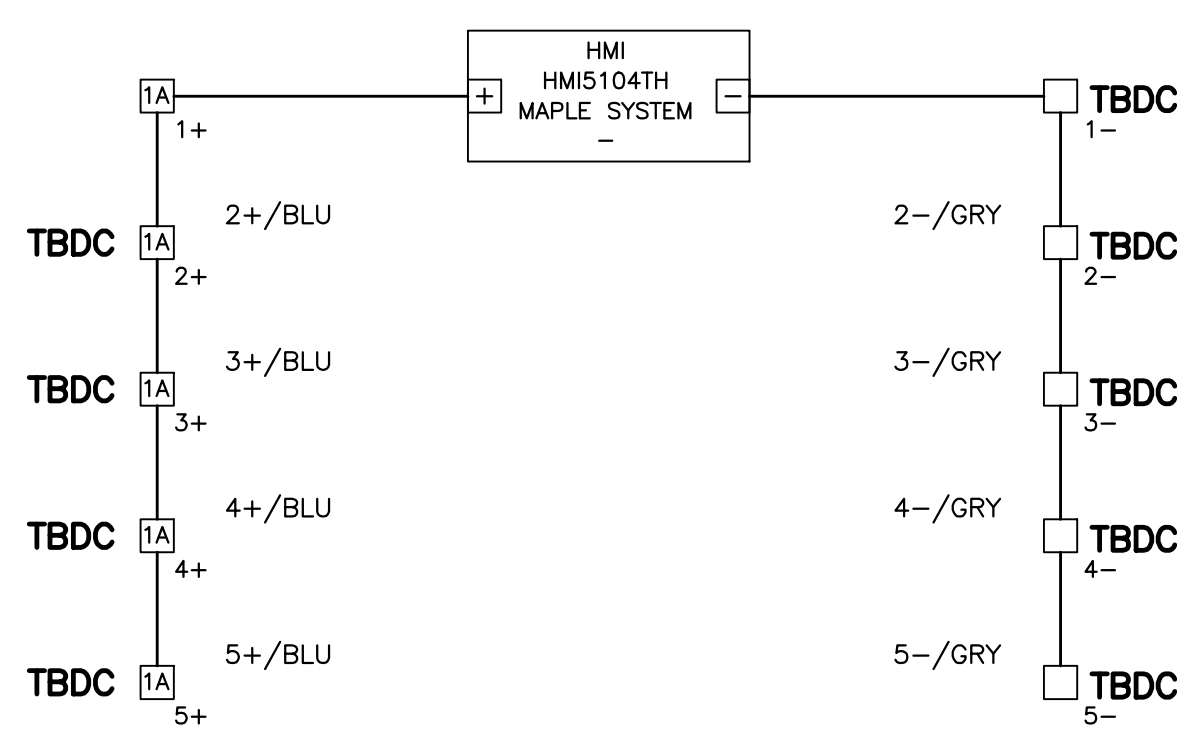
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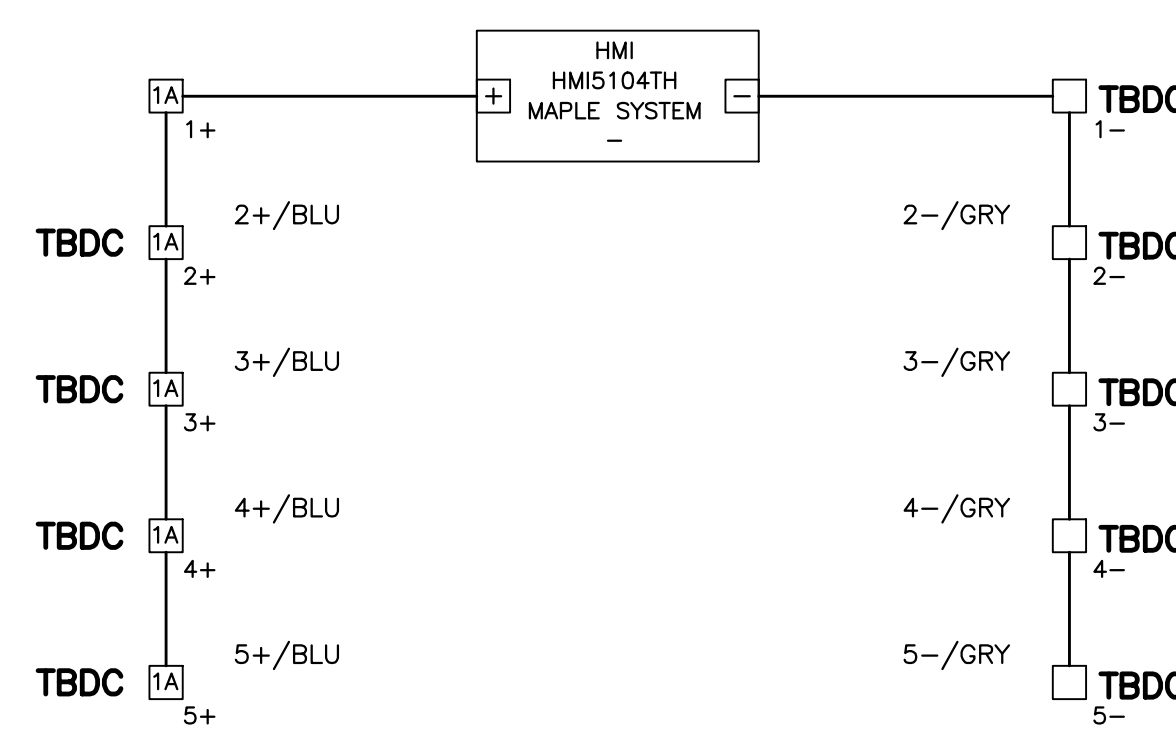
FILTER 1 24 VDC POWER DISTRIBUTION



FILTER 2 24 VDC POWER DISTRIBUTION



FILTER 3 24 VDC POWER DISTRIBUTION



FILTER 4 24 VDC POWER DISTRIBUTION

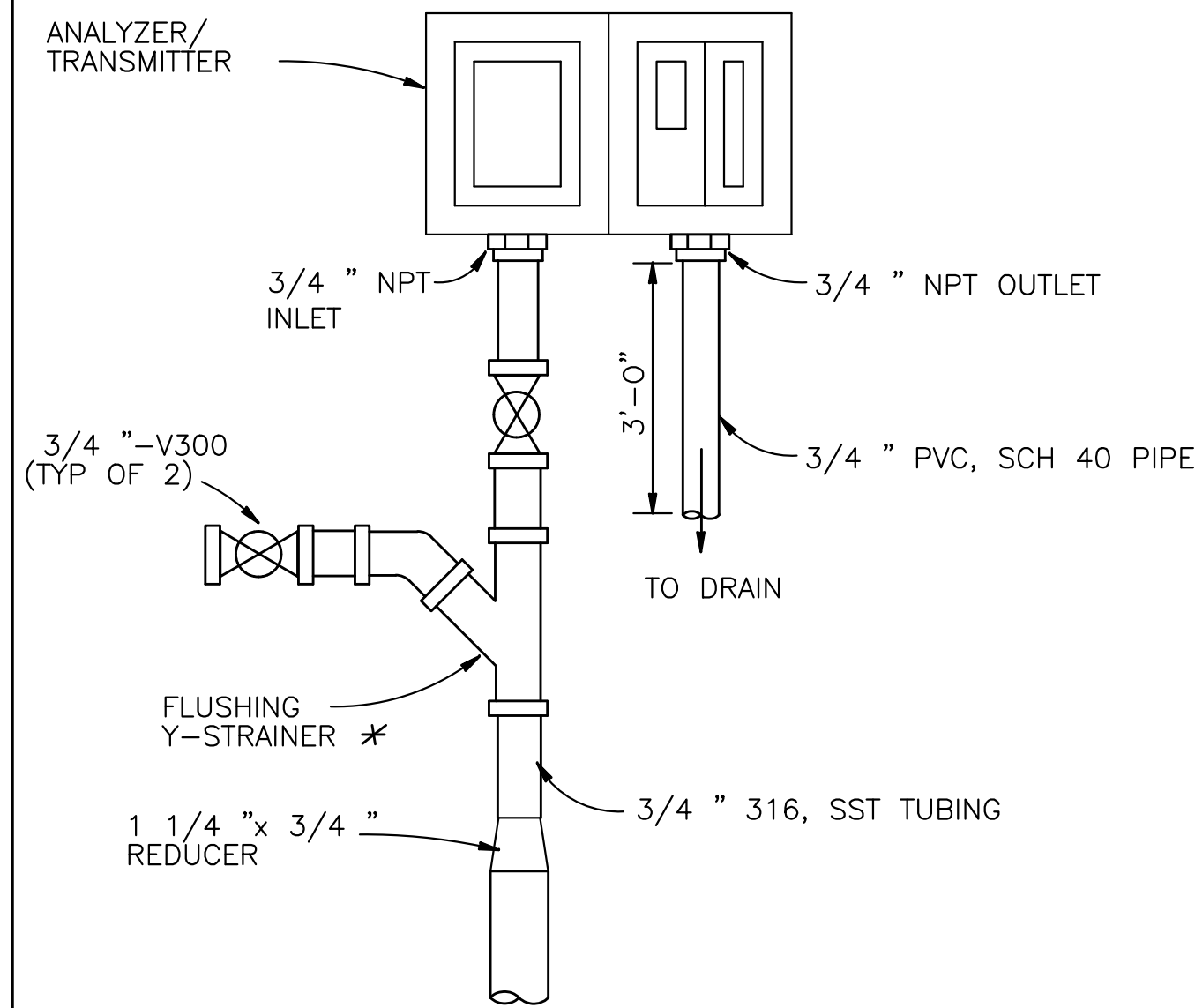
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DATE ISSUED
JULY 30, 2021
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YO, YORVANI ARZUAGA NUMERO DE LICENCIA-10990 CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIÉN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CÓDIGOS DE CONSTRUCCIÓN VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PÚBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPE.

SHEET INFO.		
Revisions	Date	Description
Number	Date	Description
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Set Date: 20180831		
Drawn by: Y. ARZUAGA		
Dwg. Date: 20180831		

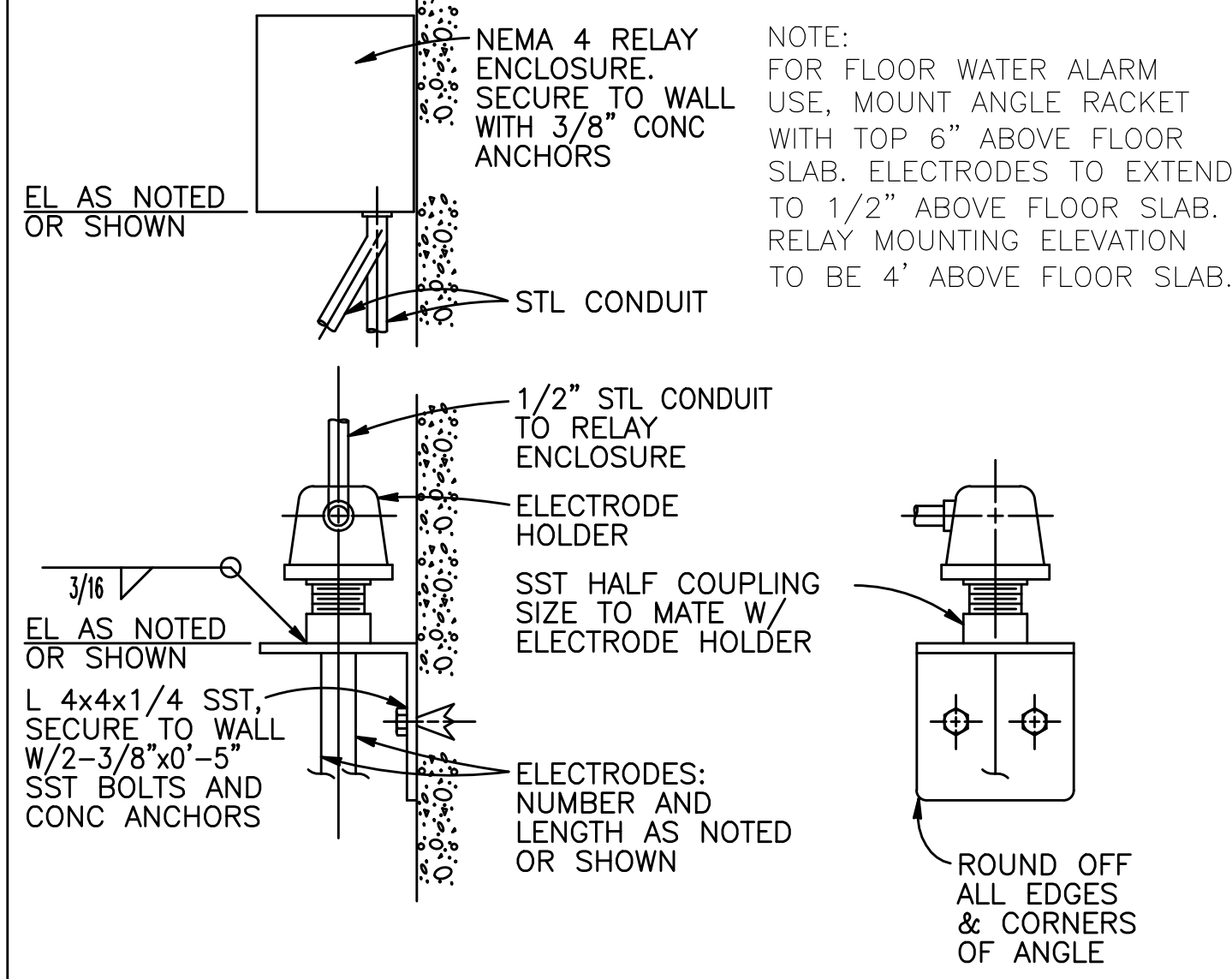




NOTE:
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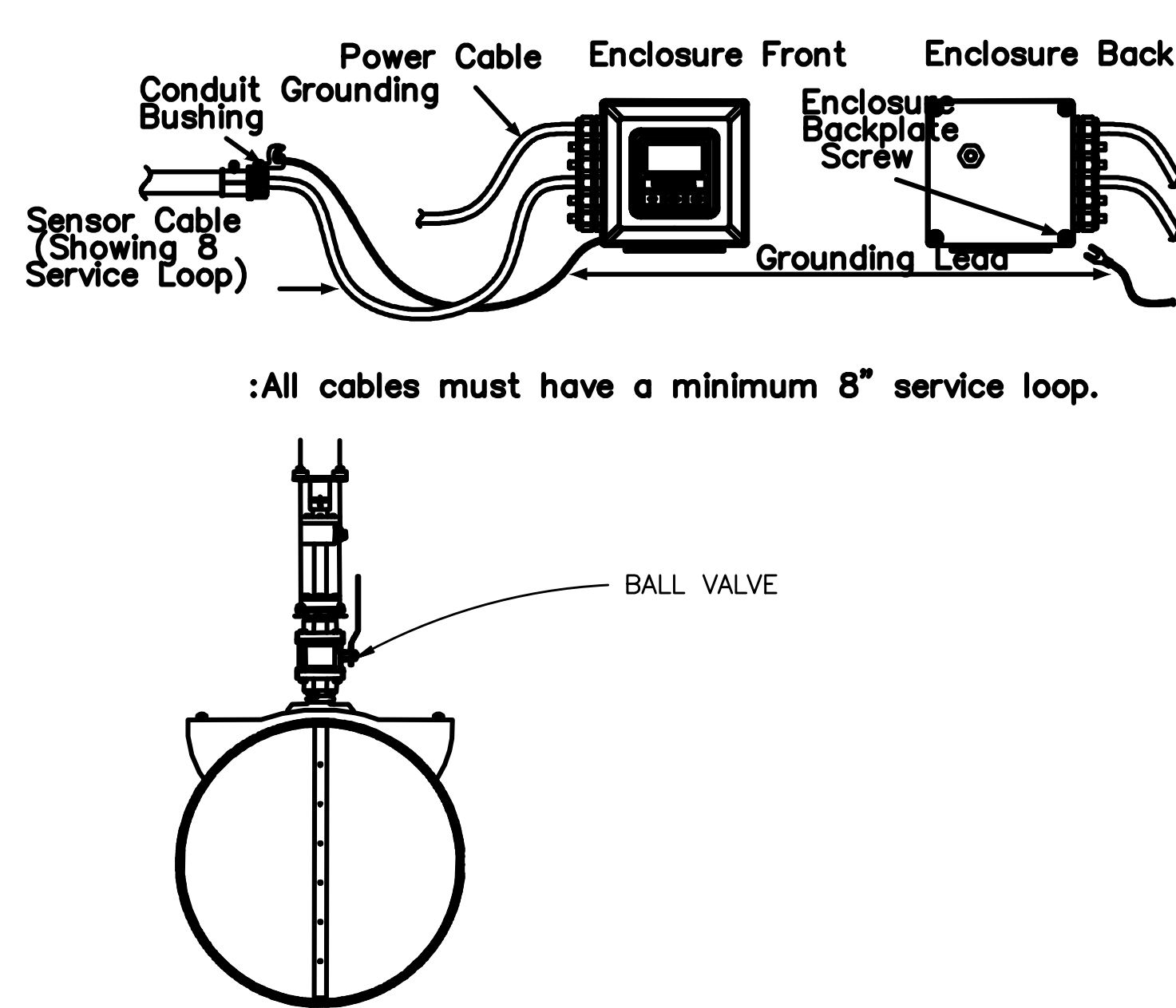
RESIDUAL CHLORINE ANALYZER INSTALLATION

NTS



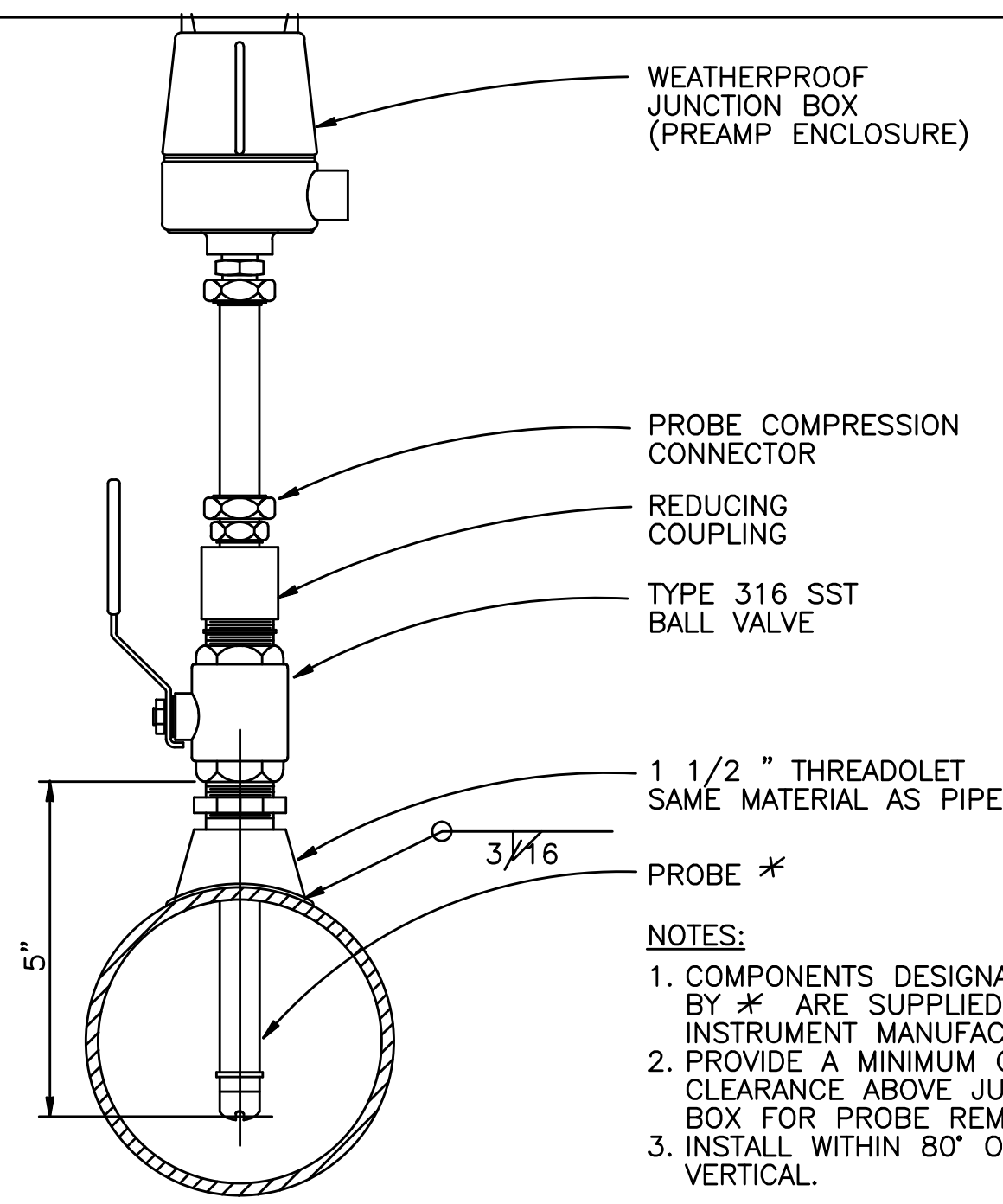
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TYPICAL ELECTRODE TYPE LEVEL
SWITCH INSTALLATION

NTS



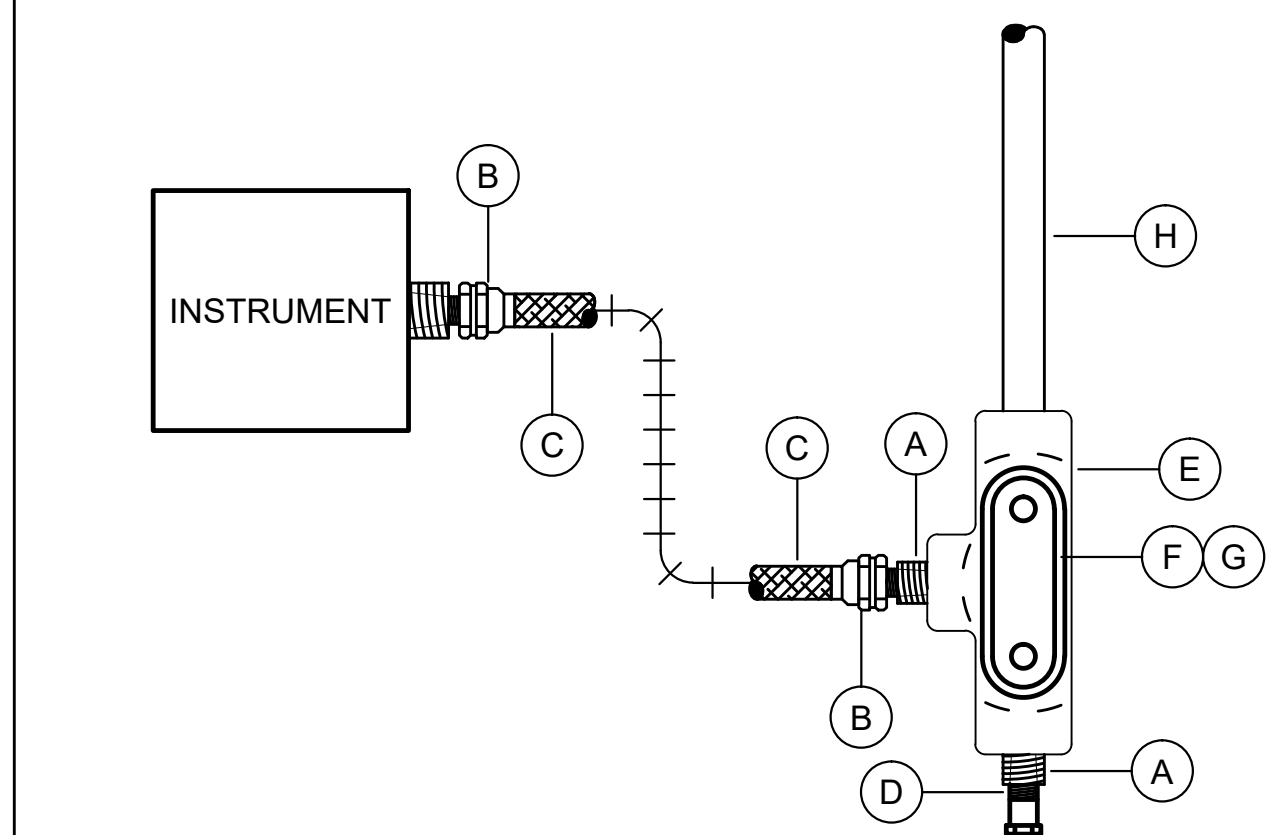
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ELECTROMAGNETIC
FLOW METER

NTS

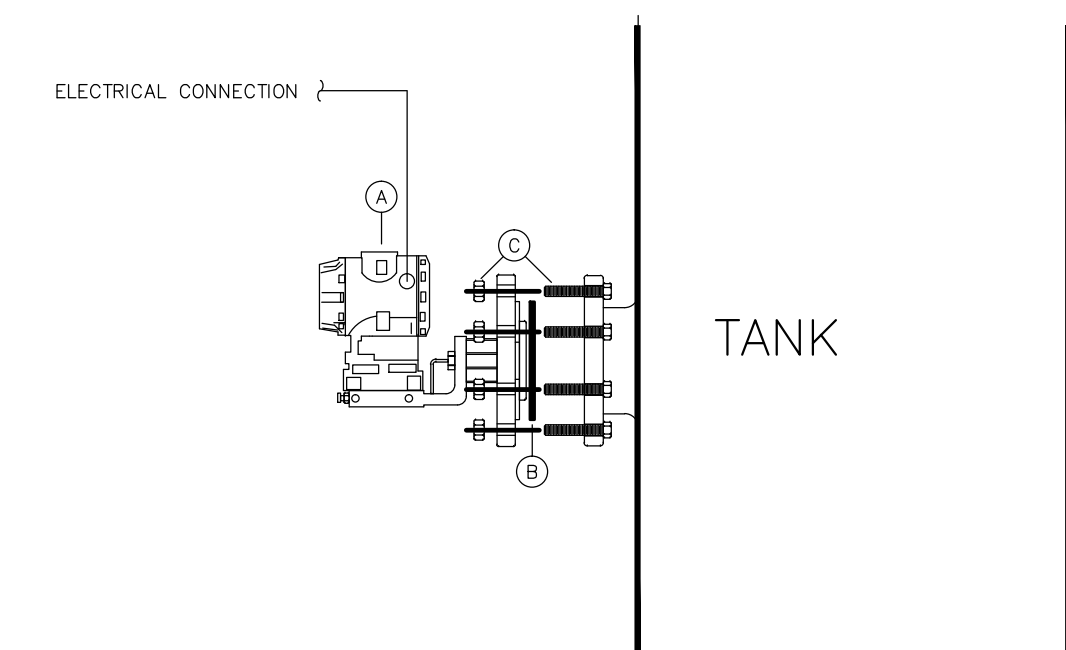


RETRACTABLE pH OR CONDUCTIVITY
SENSOR INSTALLATION-INLINE
MOUNTING

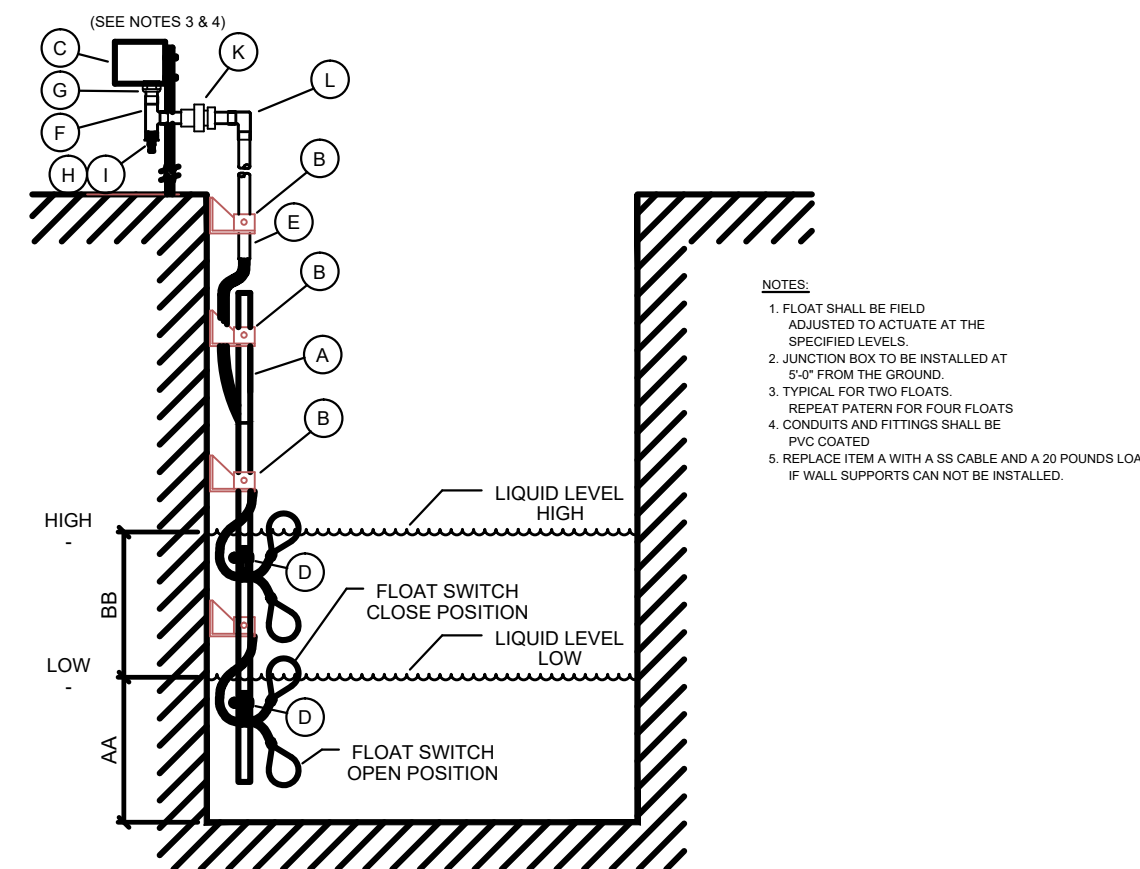
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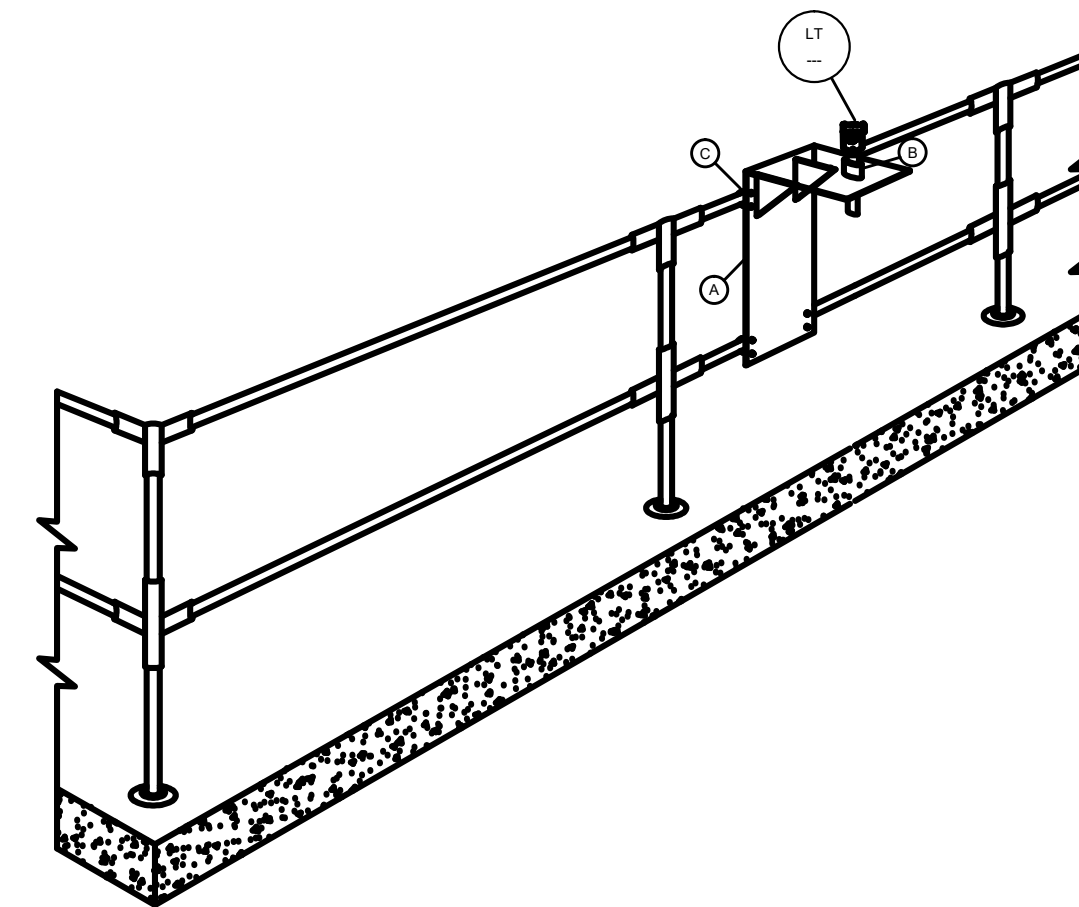
INSTRUMENT AND SENSORS
CONDUIT INSTALLATION



LEVEL TRANSMITTER DIAPHRAGM SEAL
INSTALLATION



LEVEL FLOATS
INSTALLATION



LEVEL TRANSMITTER
INSTALLATION

PART NO.	DESCRIPTION	QTY
A	REDUCER, 3/4" x 1/2" STEEL	2
B	STRAIGHT CONNECTOR, FLEXIBLE CONDUIT 1/2" HUB SIZE x 1/2" CONDUIT SIZE.	2
C	FLEXIBLE CONDUIT, 1/2", SEAL TITE	AS REQ'D
D	BREATHER & DRAIN MAT'L: STAINLESS STEEL 1/2" SIZE	1
E	TEE, CONDULET 3/4 INCH	1
F	GASKET, 3/4" SIZE	1
G	COVER, 3/4" SIZE	1
H	CONDUIT, 3/4"	AS REQ'D

PART NO.	DESCRIPTION	QTY
A	LEVEL TRANSMITTER WITH 2" FLANGE DIAPH SEAL	1
B	GASKET - 1", 150#, SPIRAL WOND, FLEXITALLIC	2
C	MACHINE BOLTS & NUTS, 5/8"x3"	AS REQ'D
D		
E		
F	-	-
G	-	-
H	-	-

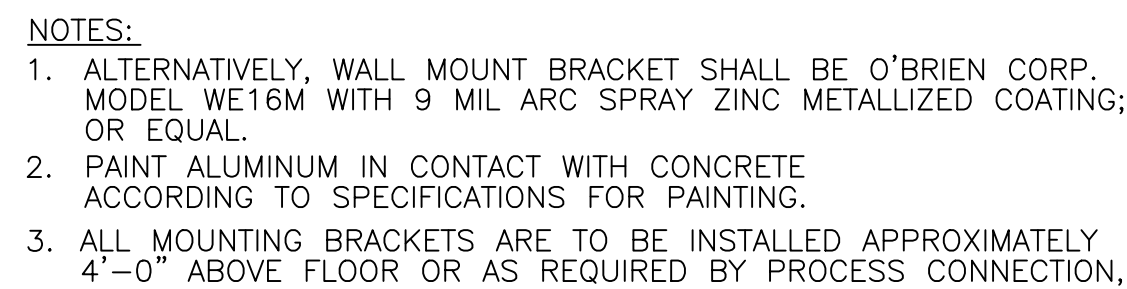
PART NO.	DESCRIPTION	QTY
A	FRP PIPE, SCH. 80, 1"	AS REQ'D
B	PIPE WALL MOUNT SUPPORT	5
C	SS JUNCTION BOX, NEMA 4X	1
D	CLAMP	1
E	RIGID CONDUIT, PVC COATED, 2" DIA	AS REQ'D
F	2" TEE, CROUSE-HINDS T78	1
G	2" HUB, CROUSE-HINDS HUB6	1
H	2"x1/2" REDUCER, CROUSE-HINDS RE61	1

PART NO.	DESCRIPTION	QTY
A	1/2" DRAIN, CROUSE-HINDS ECD17	1
B	2" STAINLESS STEEL ELBOW	2
C	2" UNION, CROUSE-HINDS UNY606	1
D	2" ELBOW, CROUSE-HINDS LB68	1
E	-	-
F	-	-
G	-	-
H	-	-

Integra Design Group
DATE ISSUED
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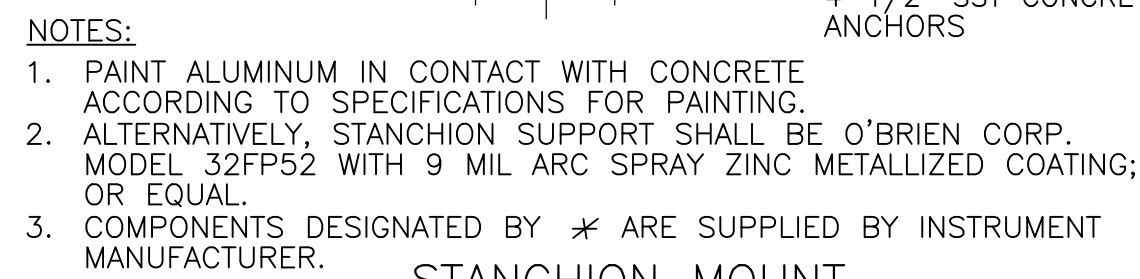
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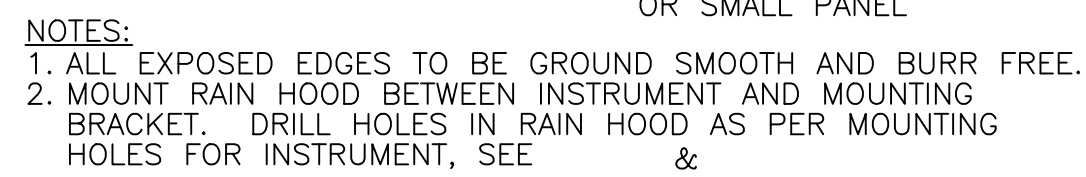
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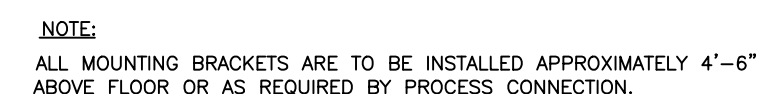
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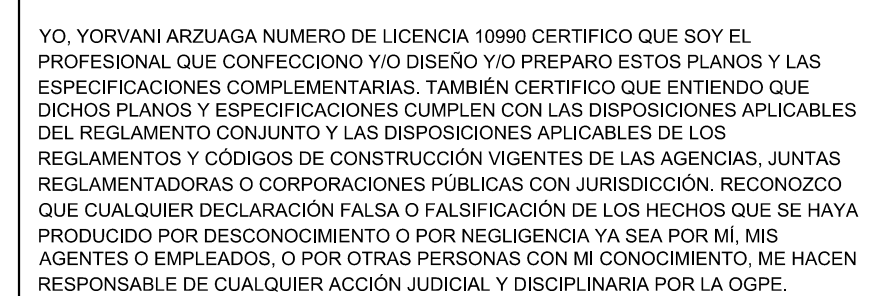
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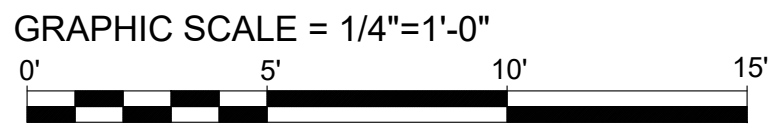
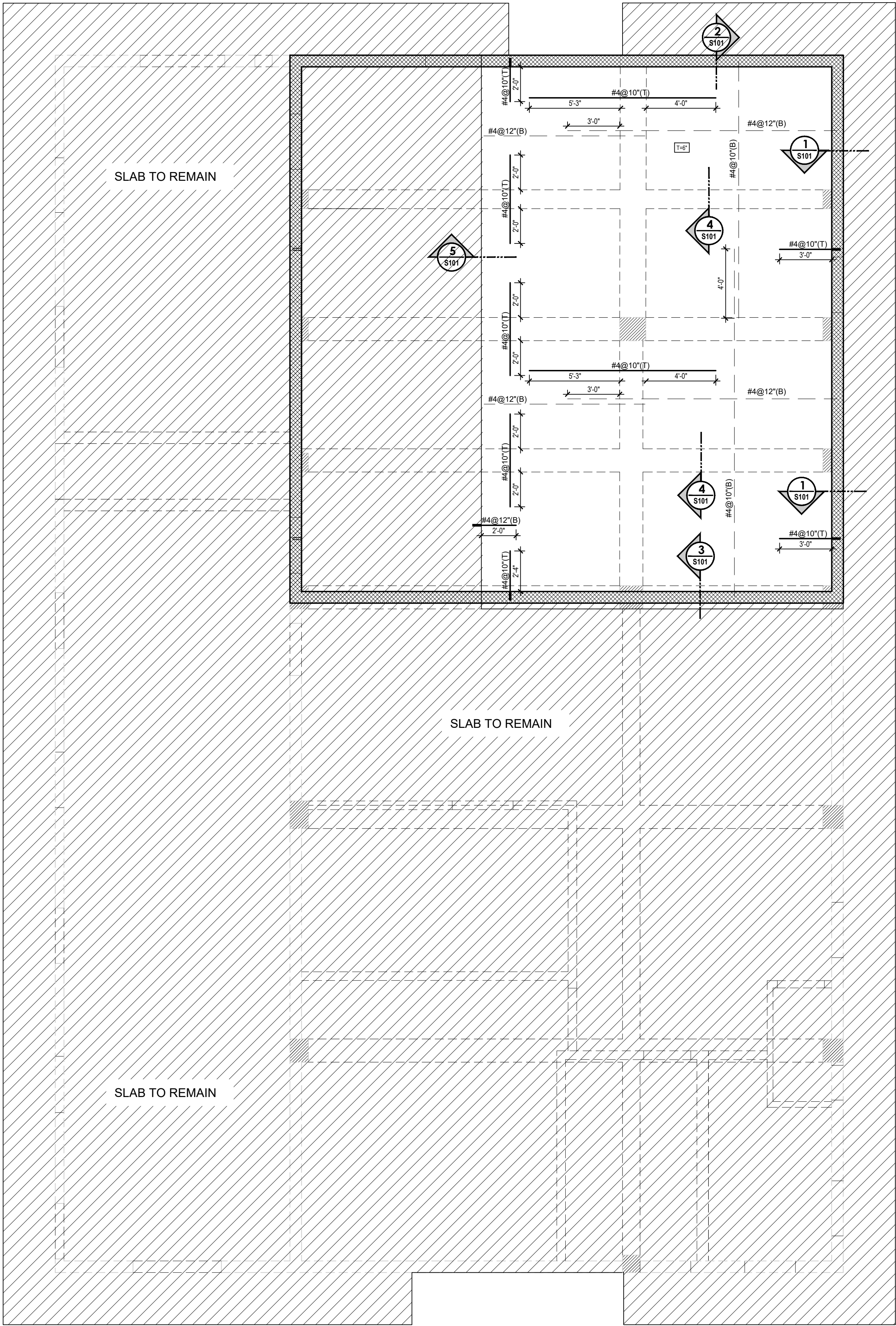


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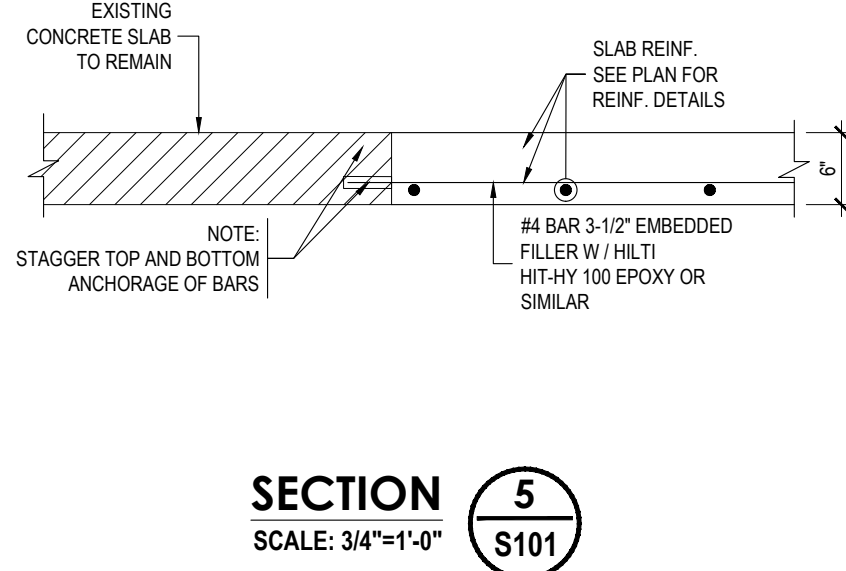
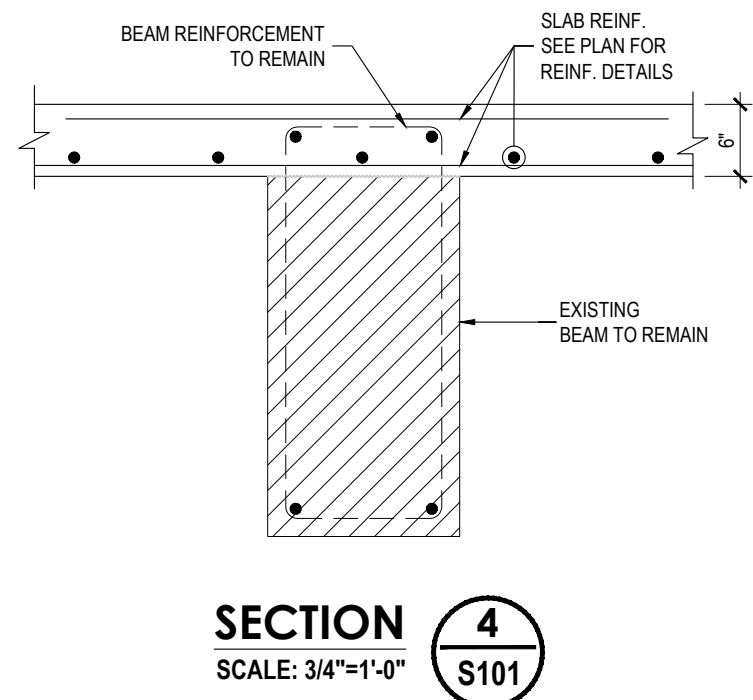
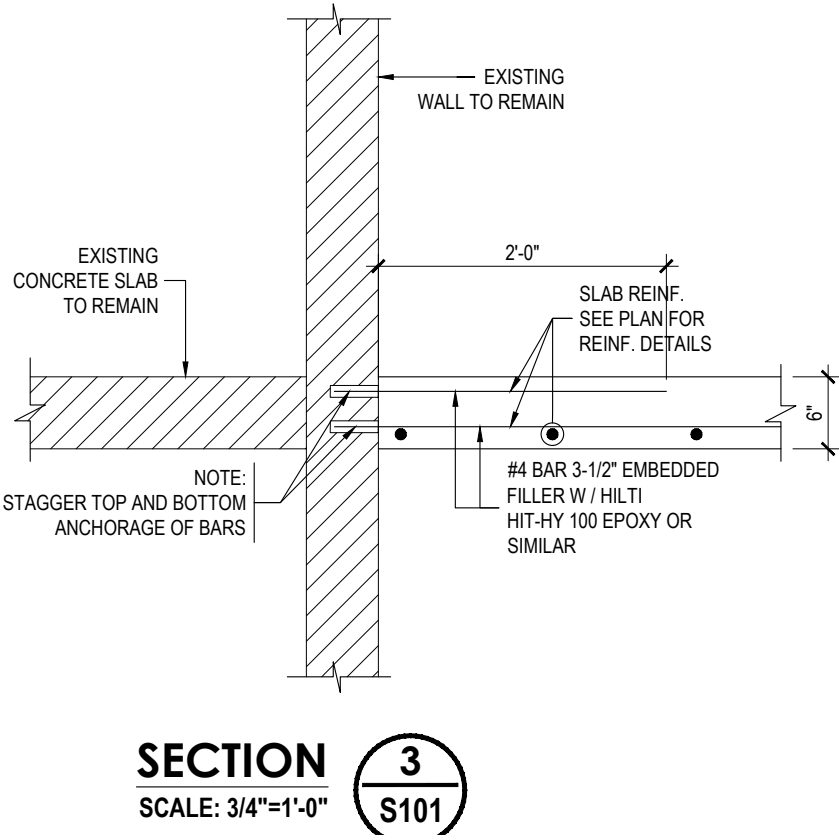
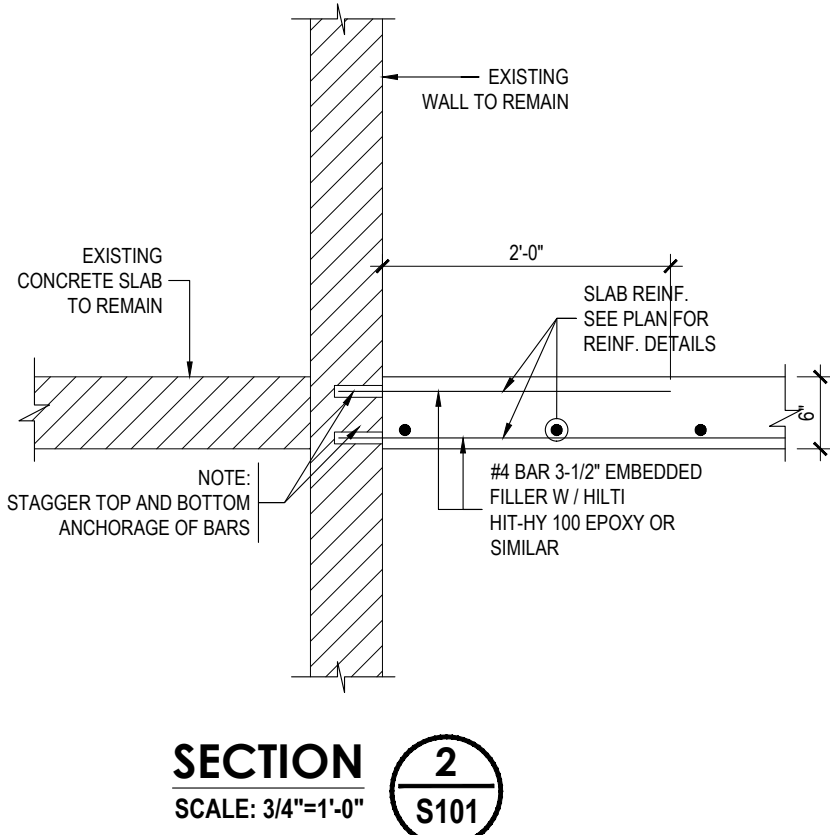
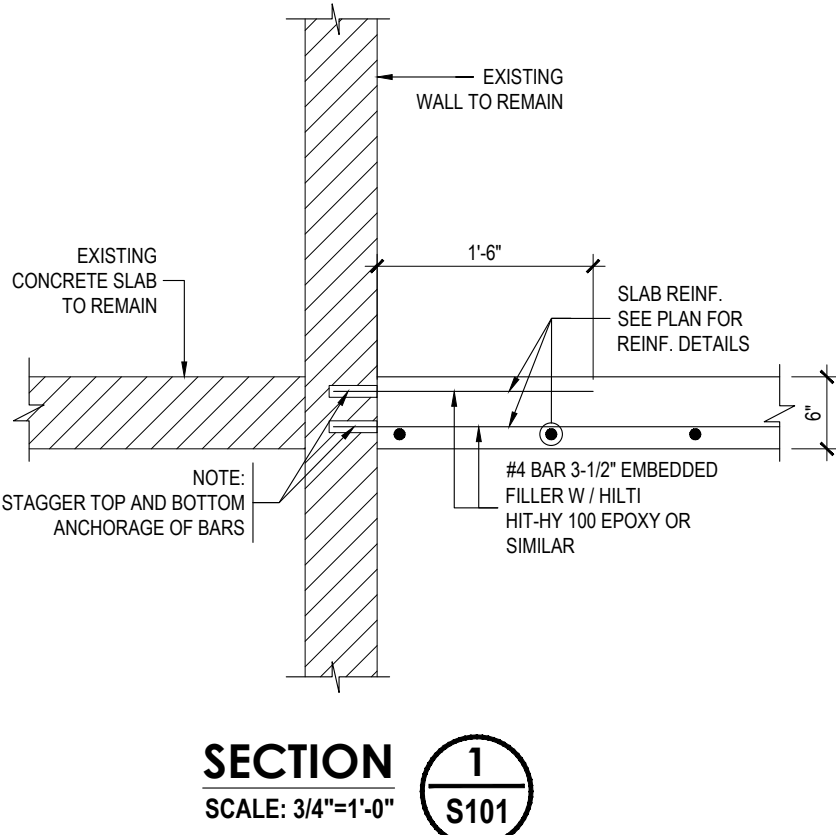
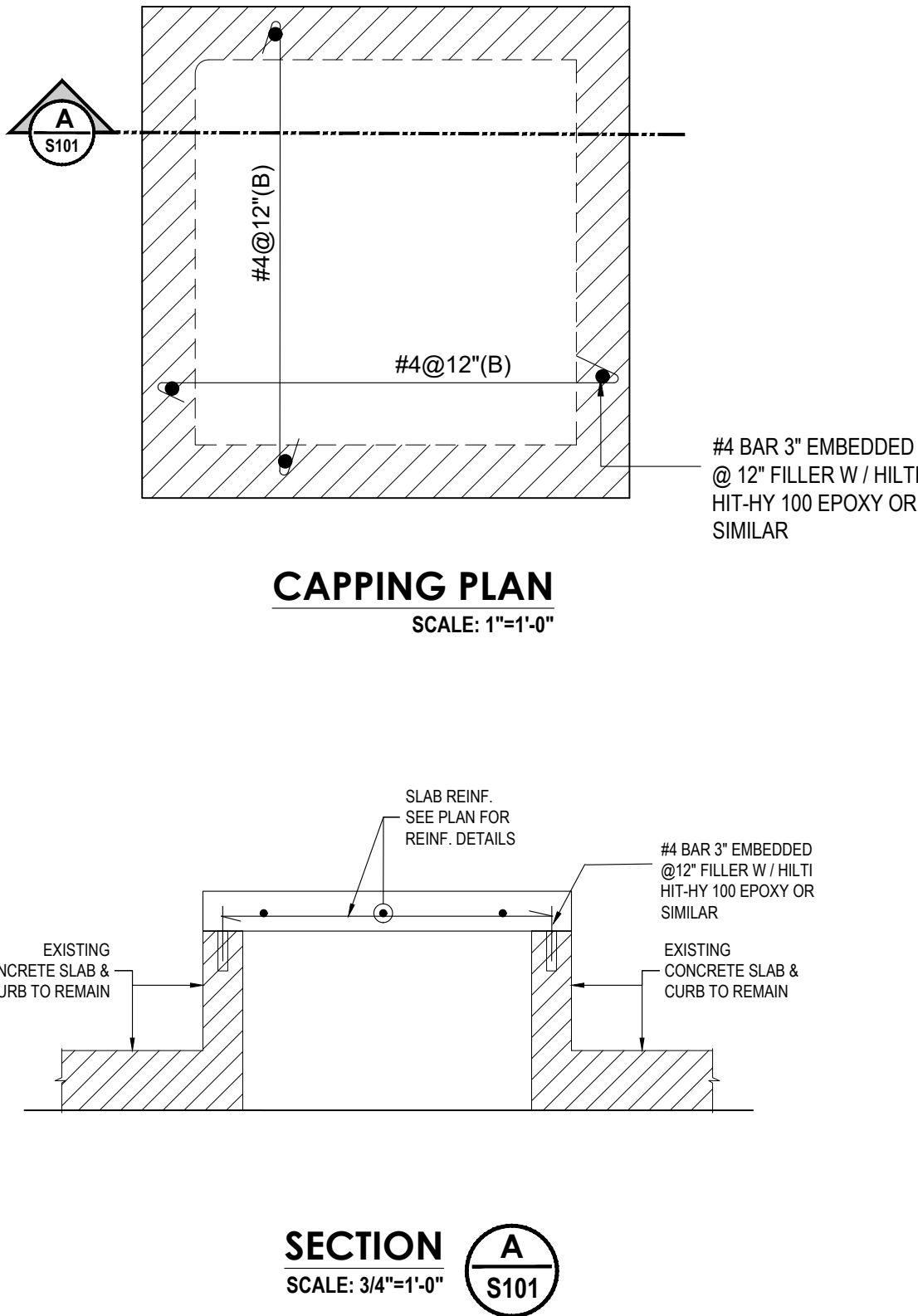
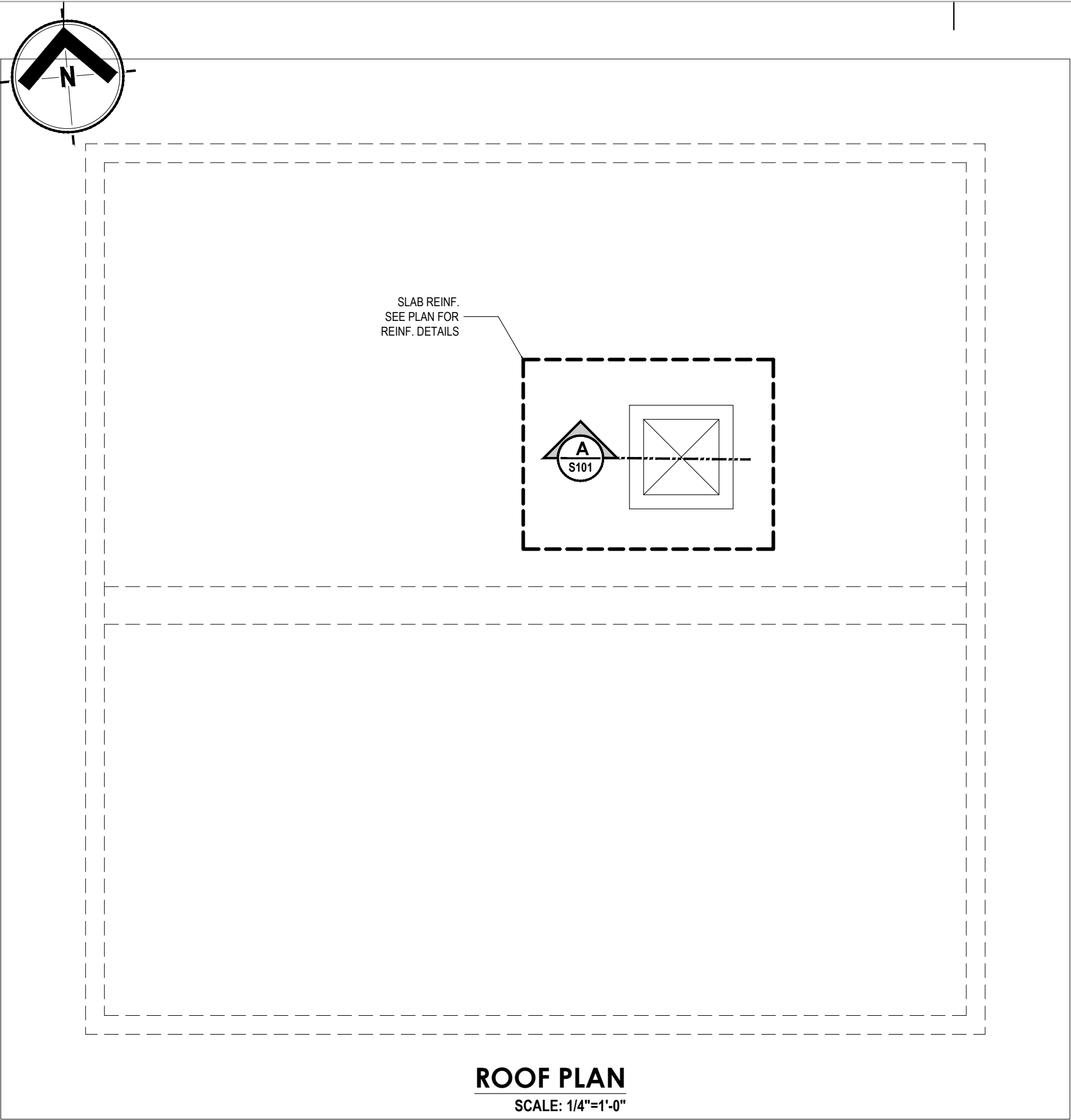


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WATER TREATMENT PLANT SECOND FLOOR SLAB RETROFIT STRUTURAL PLAN
SCALE: 1/4"=1'-0"



Integra Design Group
DATE: JULY 30, 2021
REVISED BID SET

YO, ROBERTO C. RIVERA DEL VALLE, NUMERO DE LICENCIA 27373 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA.

Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: CEBRA & NAGUABO, PUERTO RICO

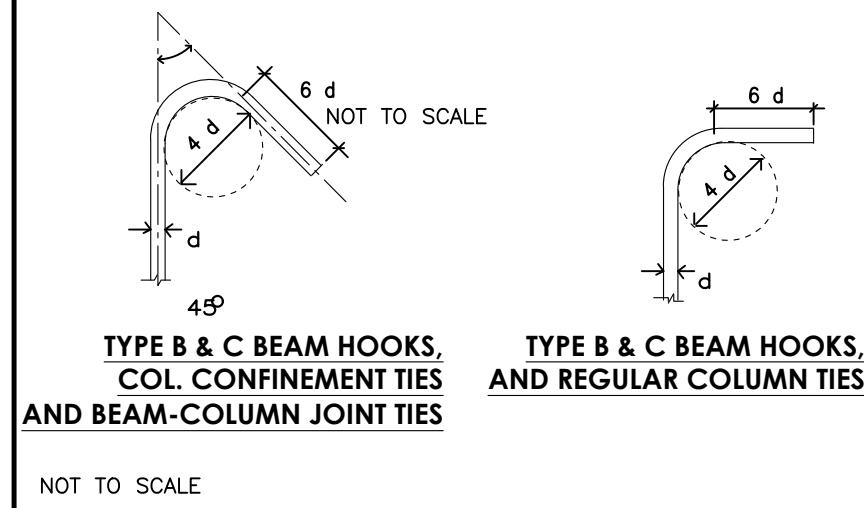
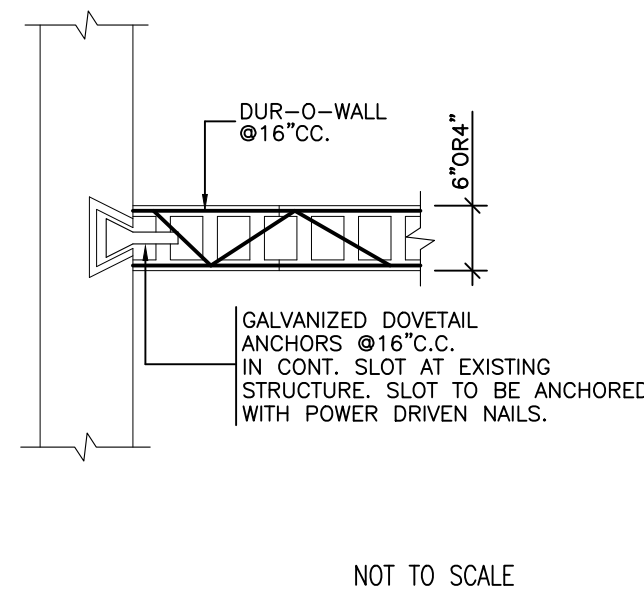
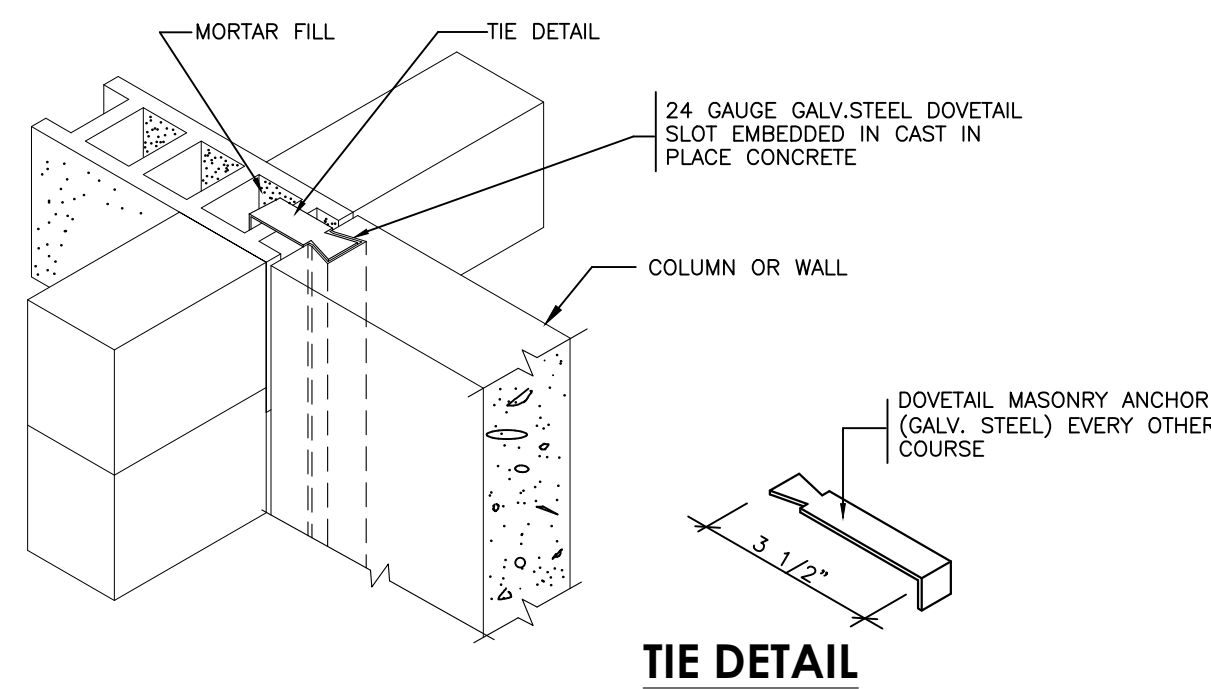
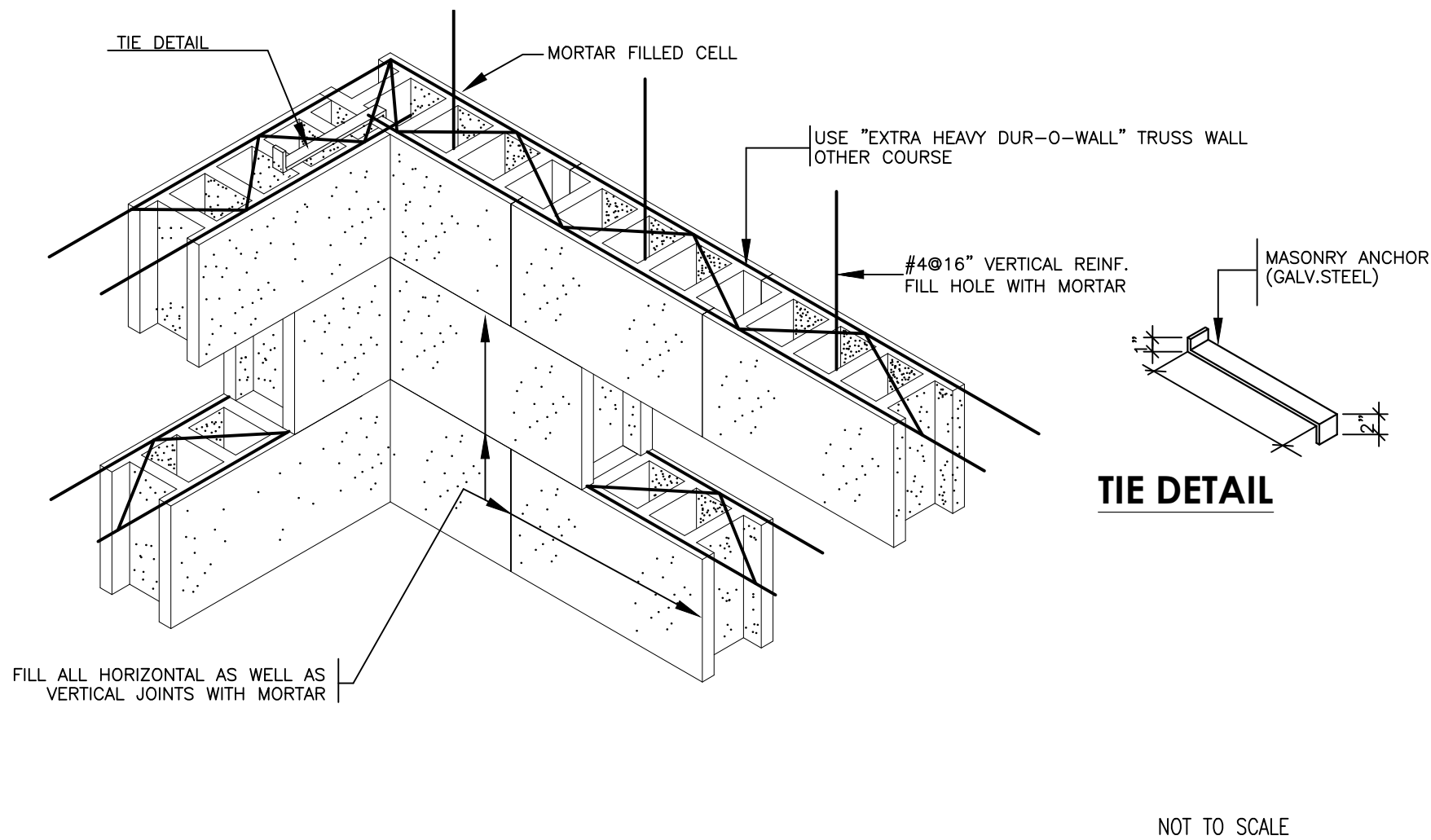
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SECOND FLOOR SLAB RETROFIT STRUTURAL PLAN & SECTIONS

Revisions	Number	Date	Description

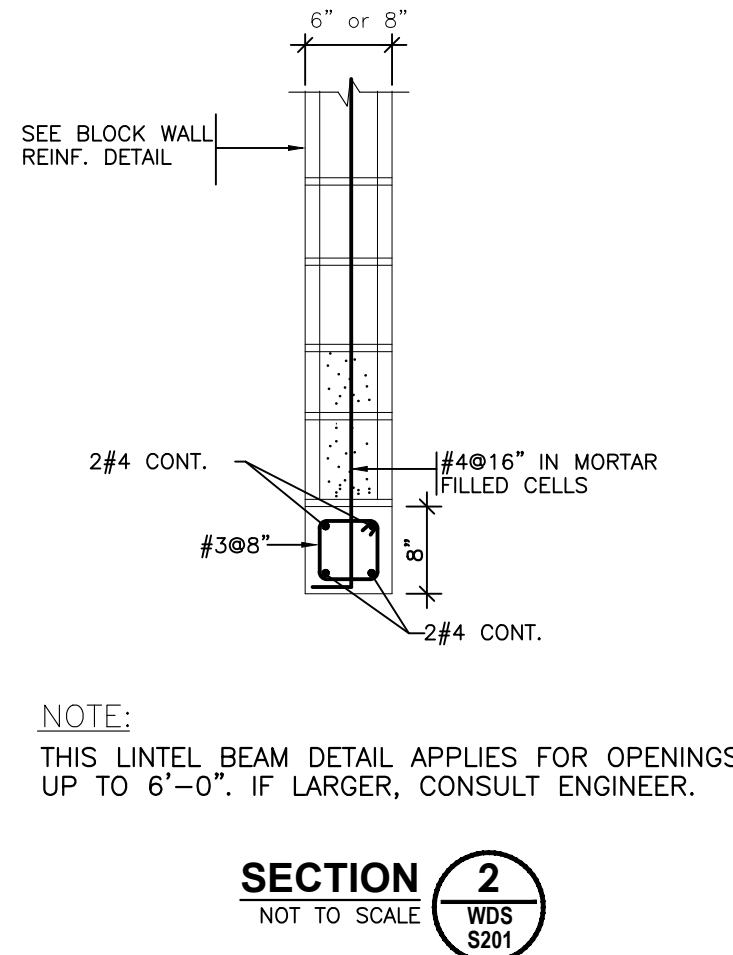
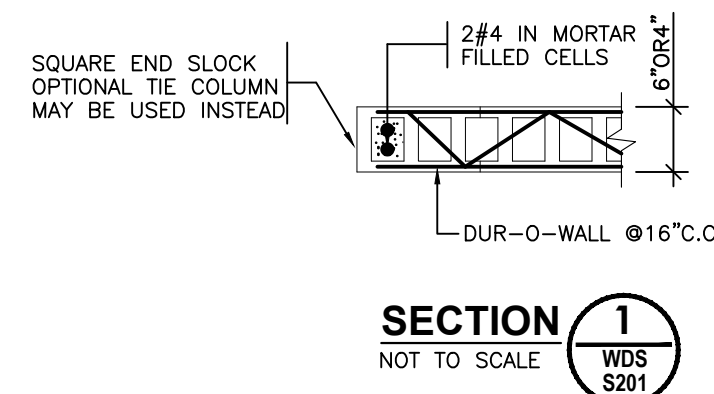
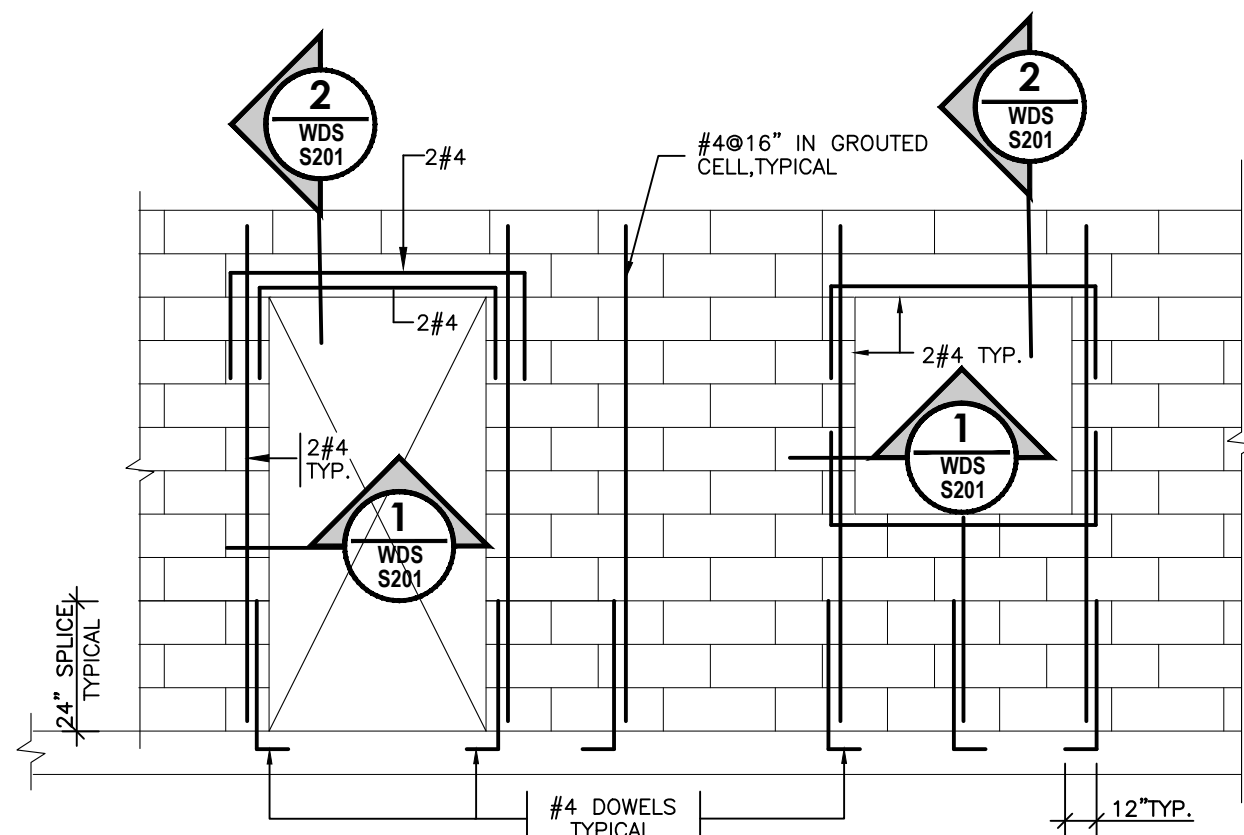
SHEET INFO.
Project No.: 18-1837-0
Set Date: 2021/07/28
Drawn by:
Dwg. Date:

Diagram illustrating the maximum overlap of lap splices for reinforcement bars. The overlap length is specified as 12d OR 12" MAX. The diagram also indicates "LAP SPlice SEE SCHEDULE" on both sides of the overlap. Below the diagram, it says "NOT TO SCALE".

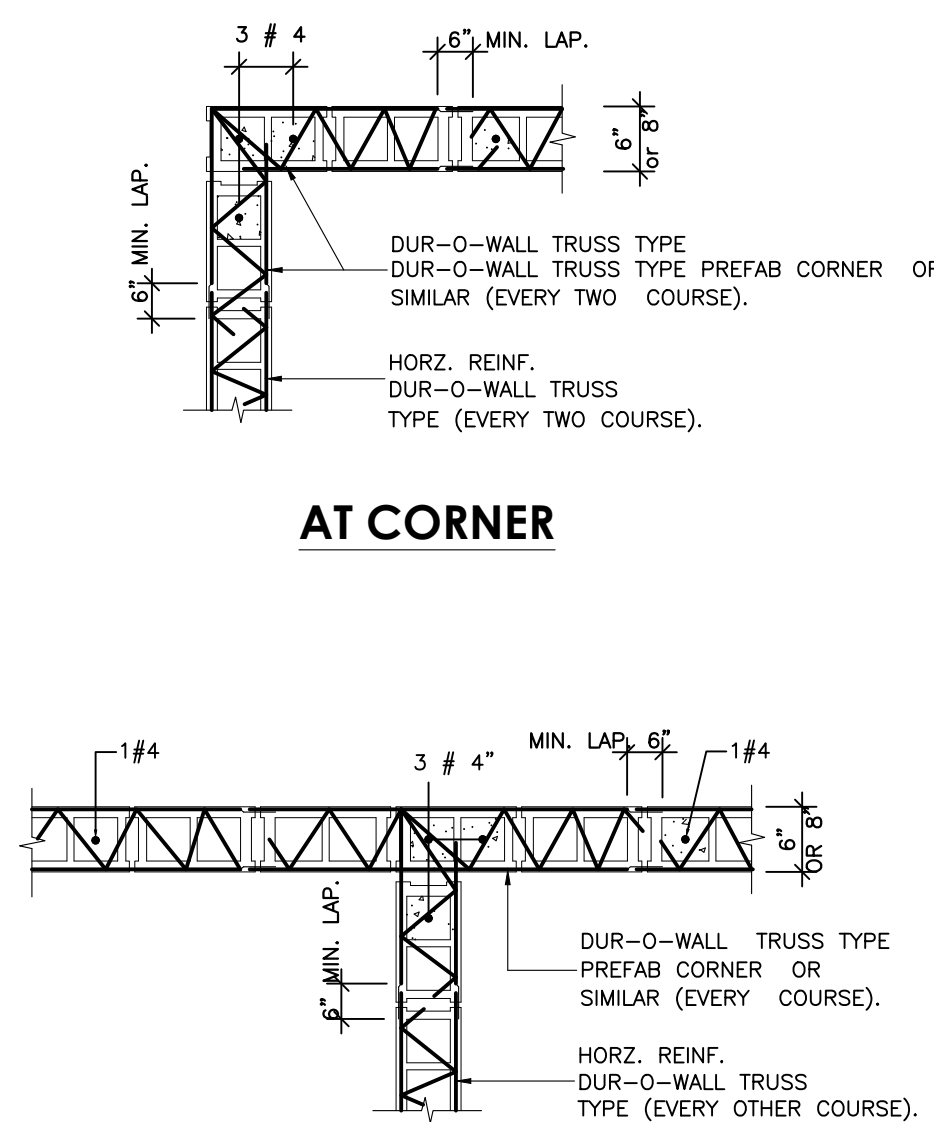


BLOCK WALL END ANCHORING DETAIL

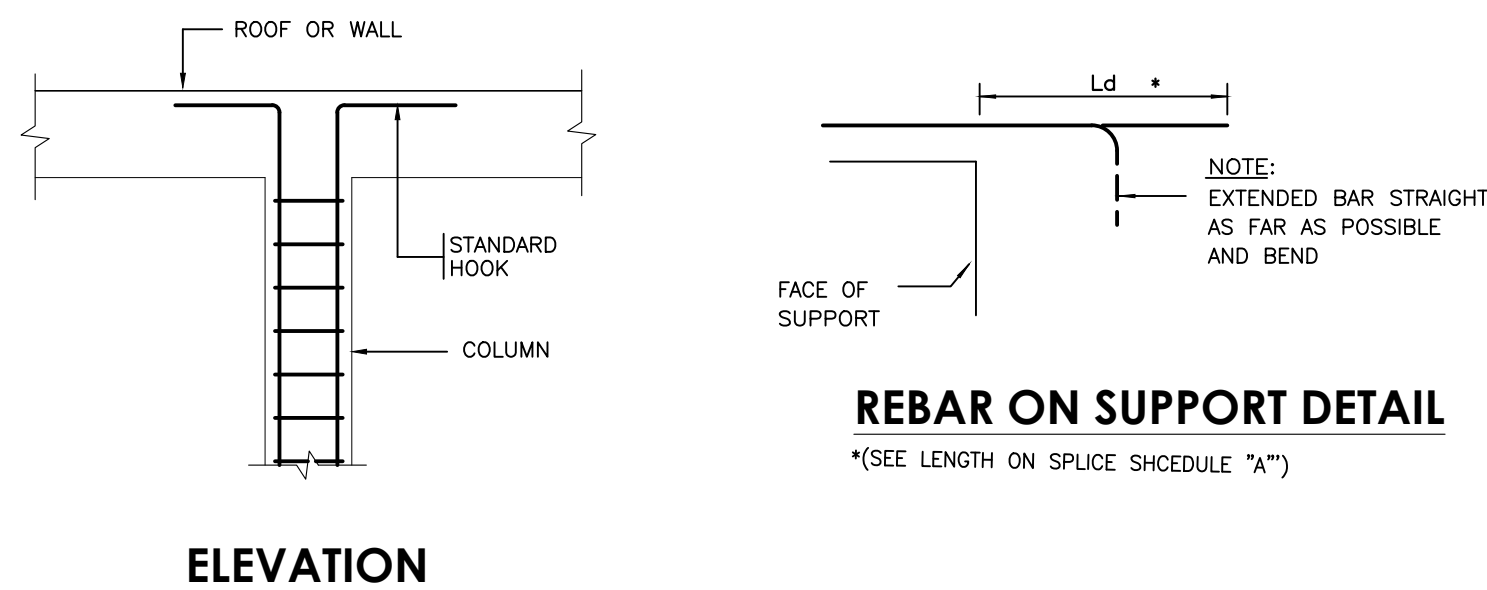
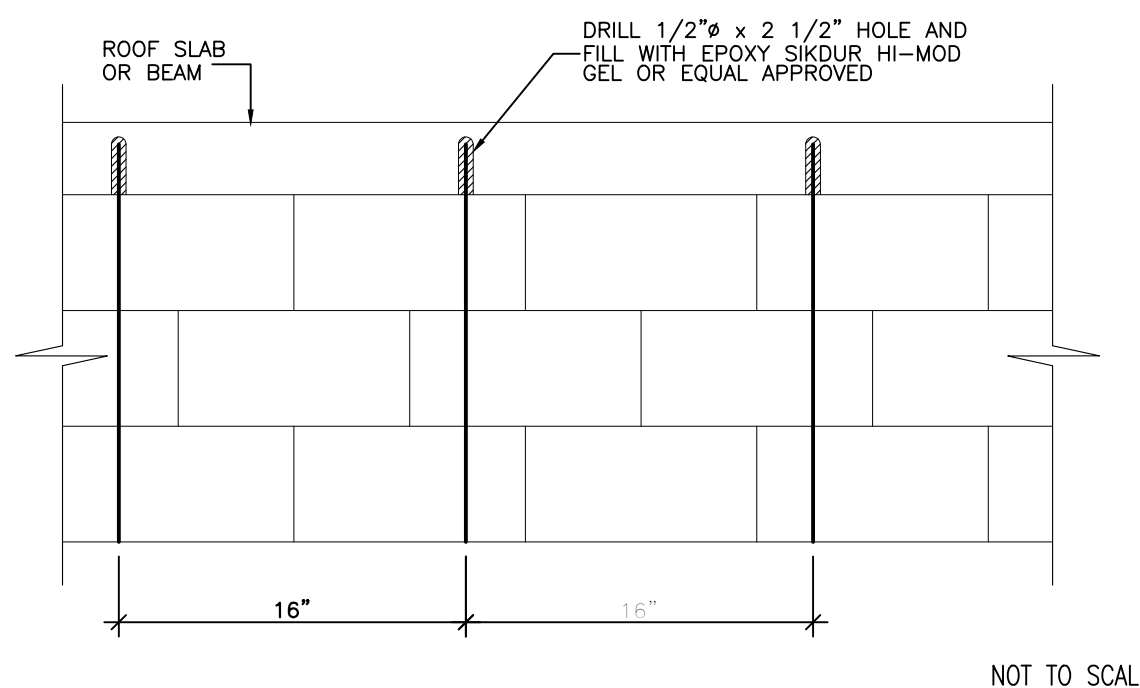
BEAM HOOKS & COLUMN TIES DETAILS



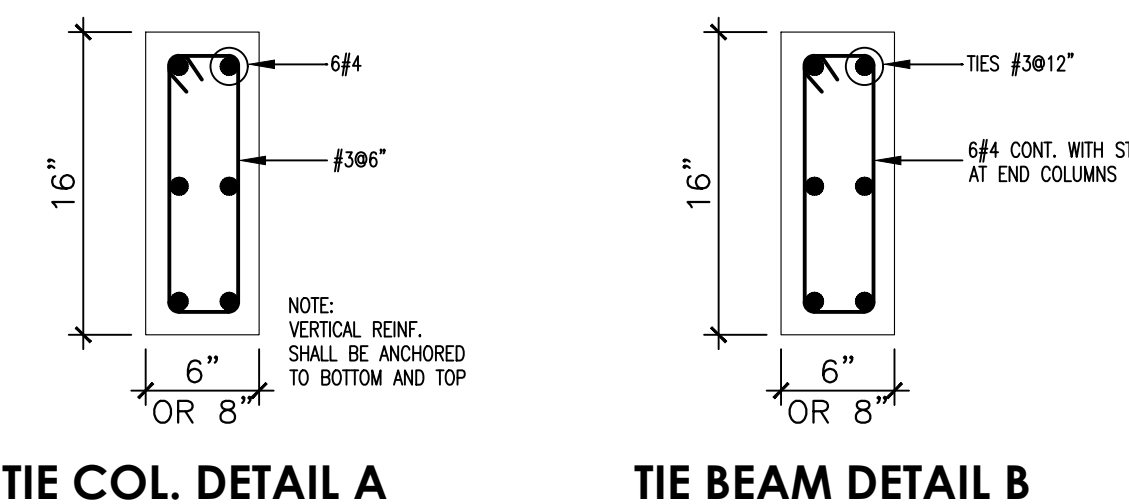
TYPICAL BLOCK WALL OPENING DET.OR WALL END



TYPICAL CONCRTE BLOCK WALL REINFORCEMENT DETAILS



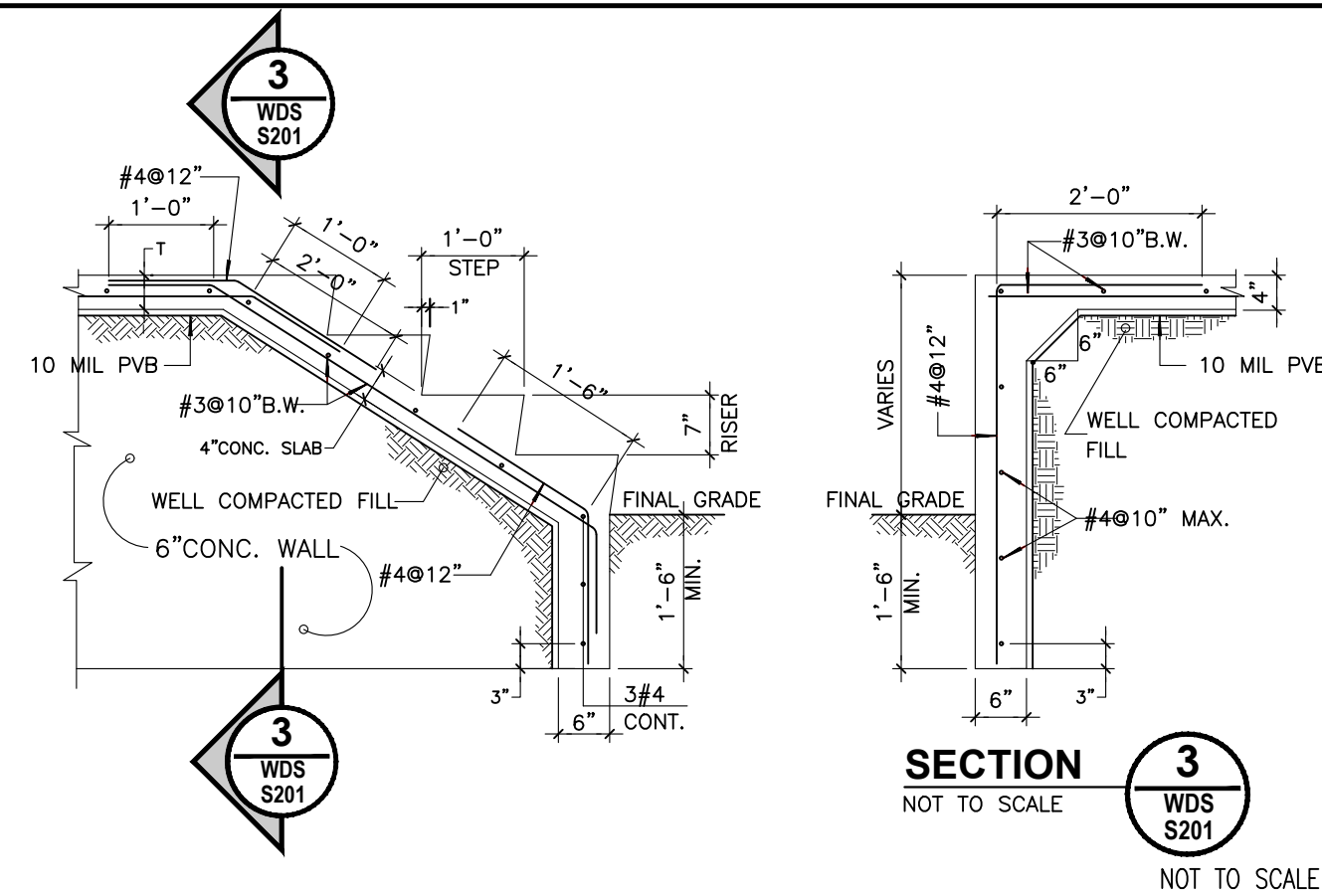
COLUMN OR WALL ROOF ENDING DETAIL



NOTE:
1-THE TIE-COLUMNS SPACING SHALL NOT EXCEED 14'-0"
2-THE TIE-BEAMS SPACING SHALL NOT EXCEED 10'-0"

TIE BEAM DETAIL B

TYPICAL BLOCK WALL END ANCHORING DETAIL



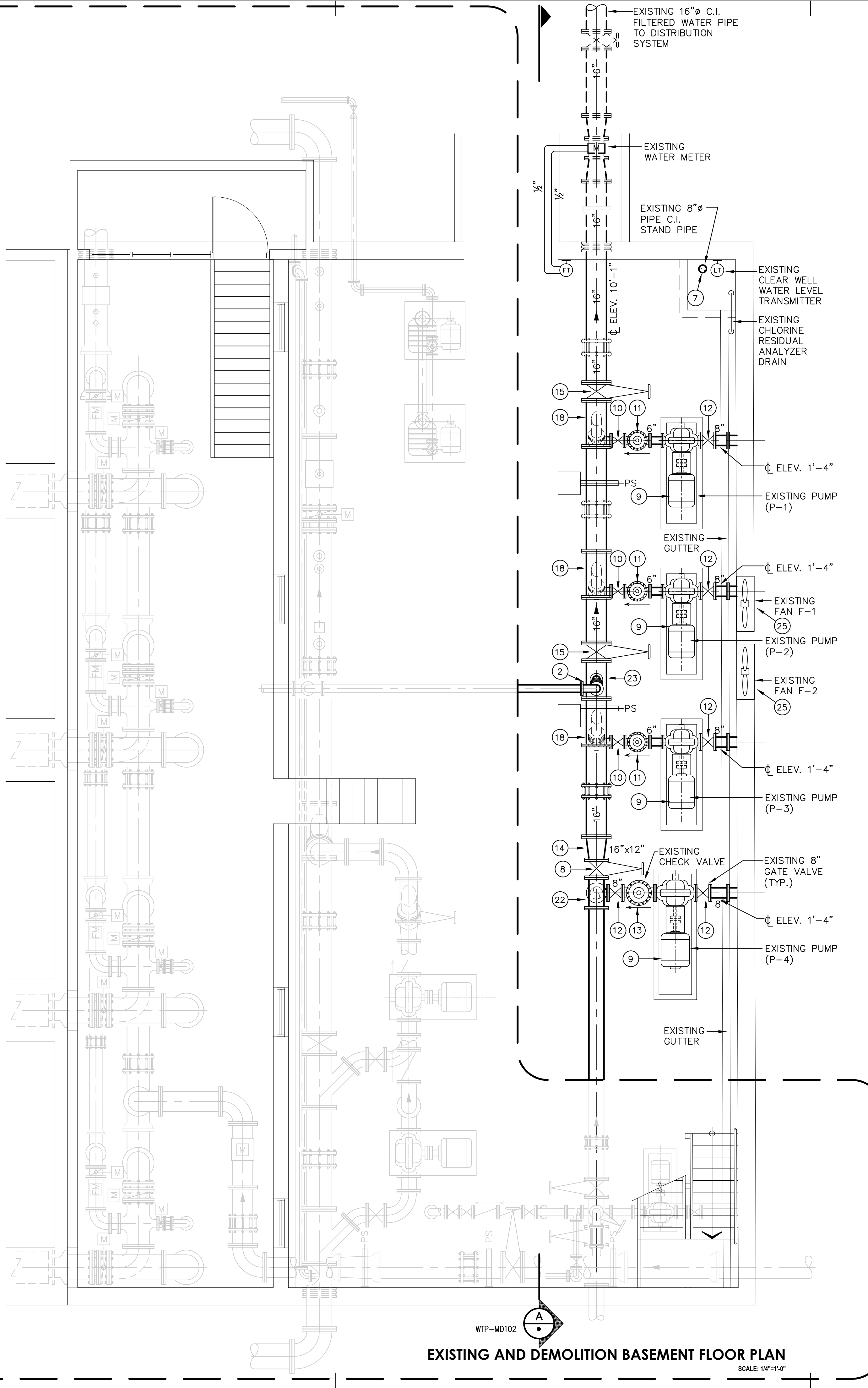
COLUMN OR WALL ROOF ENDING DETAIL

TIE COLUMNS AND TIE BEAM FOR MANSONRY WALL

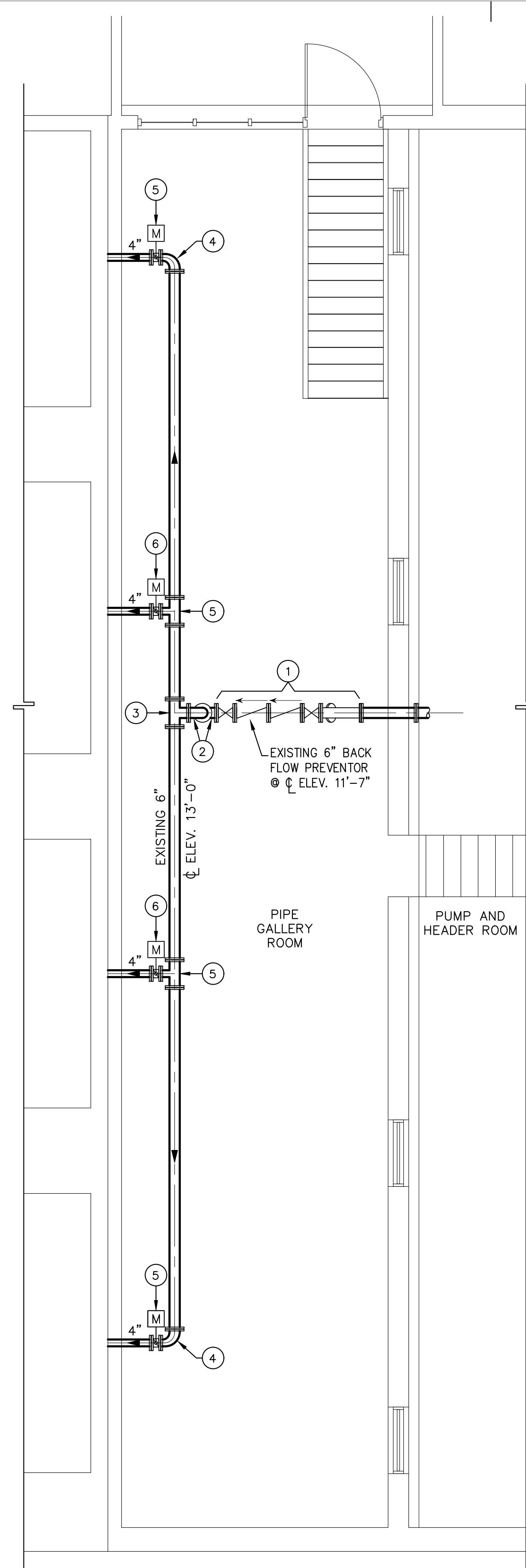
STANDARD HOOK DETAILS

STAIRS ON GROUND DETAIL

FOR THIS AREA REFER
TO DWG. WTP-PC103



EXISTING AND DEMOLITION BASEMENT FLOOR PLAN
SCALE: 1/4"=1'-0"



LEGEND DESCRIPTION:

- 6"Ø BACK FLOW PREVENTER, TO BE REMOVED.
- 6"Ø 90° LONG RADIUS ELBOW, FE, TO REMAIN.
- 6"x6"x6" TEE, FE, TO BE REMOVED.
- 6"x4" TO REDUCING ELBOW, FE, TO REMOVED.
- 6"x6"x4" TEE, FE, TO REMOVED.
- 4"Ø GATE VALVE, FE, TO BE REMOVED.
- CLEAR WELL STAND PIPE TO REMAIN.
- 12"Ø GATE VALVE, FE, TO REMOVED.
- PUMP TO BE REMOVED.
- 6"Ø GATE VALVE, FE, TO BE REMOVED.
- 6"Ø PUMP CONTROL VALVE TO BE REMOVED.
- 8"Ø GATE VALVE, FE, TO BE REMOVED.
- 8"Ø PUMP CONTROL VALVE TO BE REMOVED.
- 12"x16" INCREASER TO REMAIN.
- 16"Ø GATE VALVE, FE, TO BE REMOVED.
- 6"x8" INCREASER TO REMAIN.
- 8"Ø 45° ELBOW, FE, TO REMAIN.
- 16"x16"x8" WYE, FE, TO REMAIN.
- 6"Ø 45° ELBOW, FE, TO REMAIN.
- 8"Ø 90° LONG RADIUS BASE ELBOW, FE, TO REMAIN.
- 8"x10" INCREASER TO REMAIN.
- 12"x12"x10" TEE TO REMAIN.
- 16"x16"x6" TEE TO REMAIN.
- 6"Ø 90° LONG RADIUS BASE ELBOW, FE, TO REMAIN.
- EXISTING PROPELLER FAN TO BE REMOVED

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DGP.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

WATER TREATMENT PLANT

Drawing Title:

EXISTING + DEMOLITION BASEMENT FLOOR PLAN

Revisions

Number	Date	Description

SHEET INFO.

Project No.: 19-1637.0
Set Date: 2021/07/28
Drawn by:
Dwg. Date:

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GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

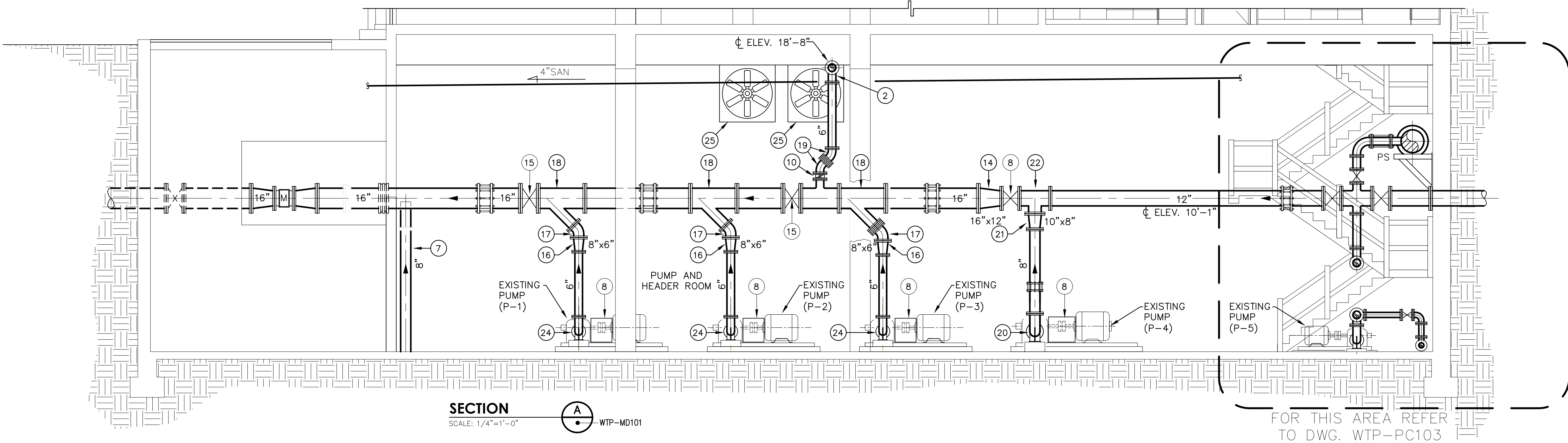
for Roosevelt Roads



WTP-MD101

LEGEND DESCRIPTION:

- 1
- 6"Ø BACK FLOW PREVENTER, TO BE REMOVED.
- 2
- 6"Ø 90° LONG RADIUS ELBOW, FE, TO REMAIN.
- 3
- 6"x6"x6" TEE, FE, TO BE REMOVED.
- 4
- 6"x4" TO REDUCING ELBOW, FE, TO REMOVED.
- 5
- 6"x6"x4" TEE, FE, TO REMOVED.
- 6
- 4"Ø GATE VALVE, FE, TO BE REMOVED.
- 7
- CLEAR WELL STAND PIPE TO REMAIN.
- 8
- 12"Ø GATE VALVE, FE, TO REMOVED.
- 9
- PUMP TO BE REMOVED.
- 10
- 6"Ø GATE VALVE, FE, TO BE REMOVED.
- 11
- 6"Ø PUMP CONTROL VALVE TO BE REMOVED.
- 12
- 8"Ø GATE VALVE, FE, TO BE REMOVED.
- 13
- 8"Ø PUMP CONTROL VALVE TO BE REMOVED.
- 14
- 12"x16" INCREASER TO REMAIN.
- 15
- 16"Ø GATE VALVE, FE, TO BE REMOVED.
- 16
- 6"x8" INCREASER TO REMAIN.
- 17
- 8"Ø 45° ELBOW, FE, TO REMAIN.
- 18
- 16"x16"x8" WYE, FE, TO REMAIN.
- 19
- 6"Ø 45° ELBOW, FE, TO REMAIN.
- 20
- 8"Ø 90° LONG RADIUS BASE ELBOW, FE, TO REMAIN.
- 21
- 8"x10" INCREASER TO REMAIN.
- 22
- 12"x12"x10" TEE TO REMAIN.
- 23
- 16"x16"x6" TEE TO REMAIN.
- 24
- 6"Ø 90° LONG RADIUS BASE ELBOW, FE, TO REMAIN.
- 25
- EXISTING PROPELLER FAN TO BE REMOVED



YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCORRER.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Drawing Title:

WATER TREATMENT PLANT
EXISTING + DEMOLITION BASEMENT SECTIONS

Sheet:

WTP-MD102

Revisions

Number	Date	Description

SHEET INFO.

Project No.: 19-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

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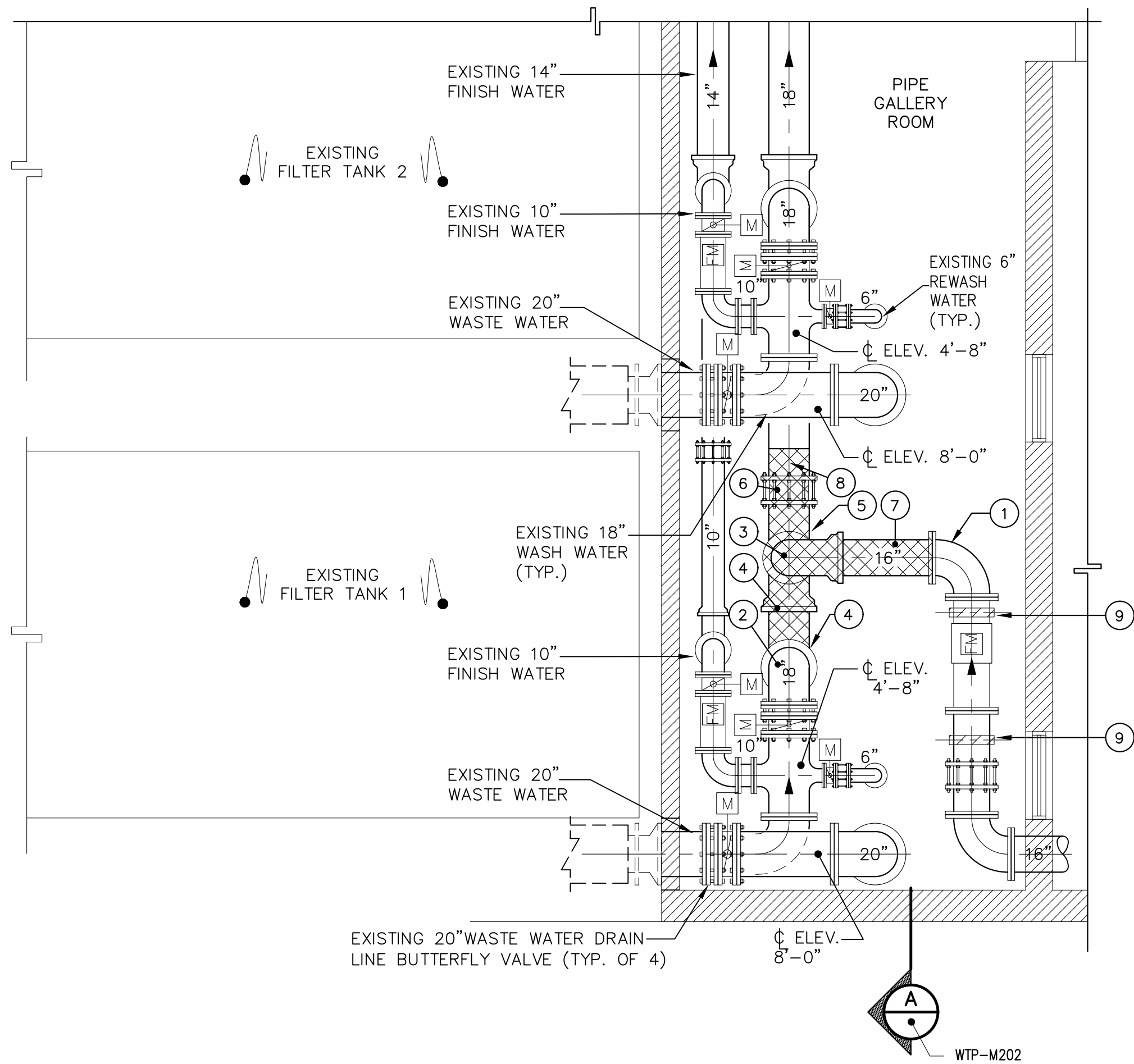
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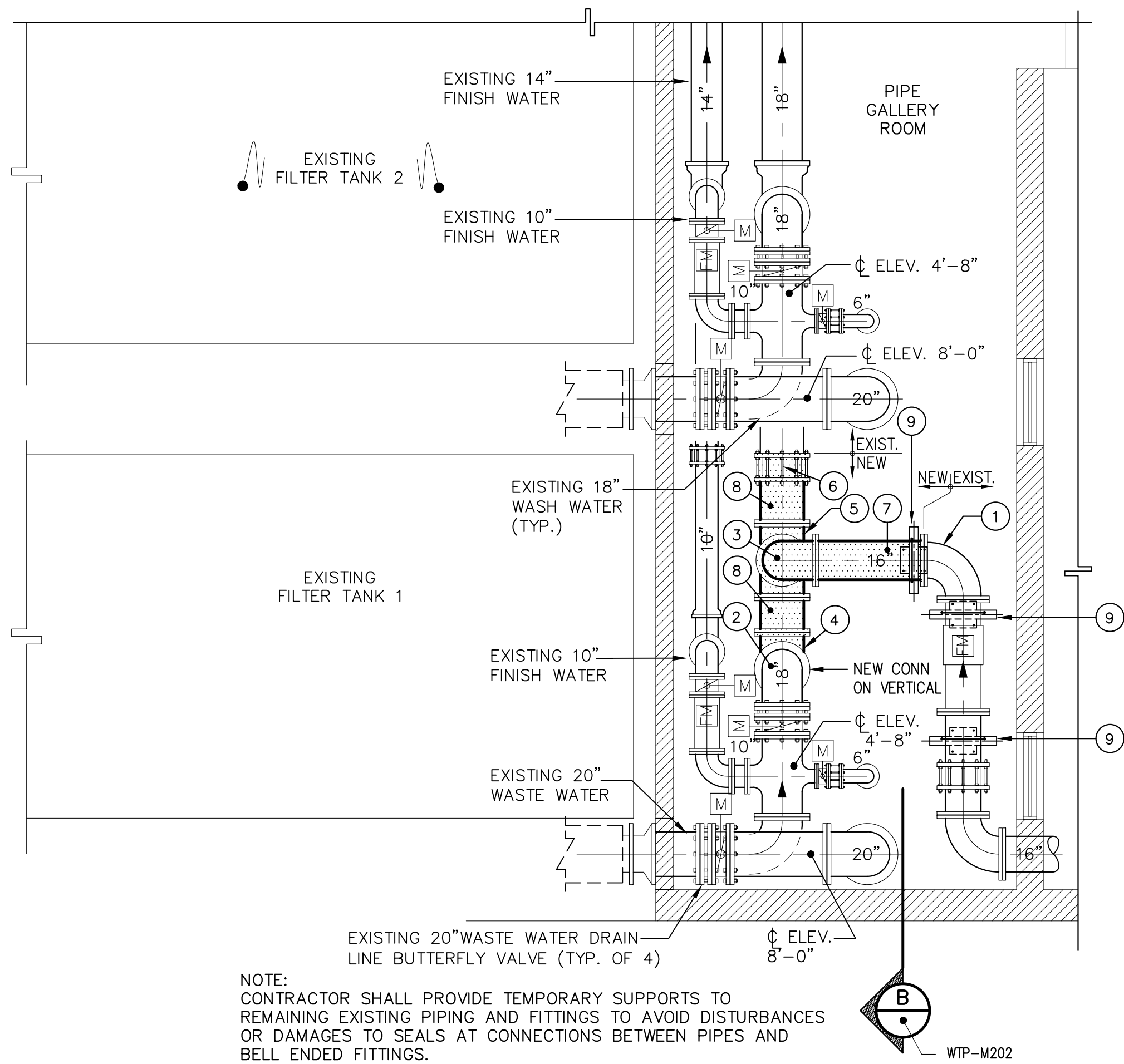


- Project Title:

WATER TREATMENT PLANT



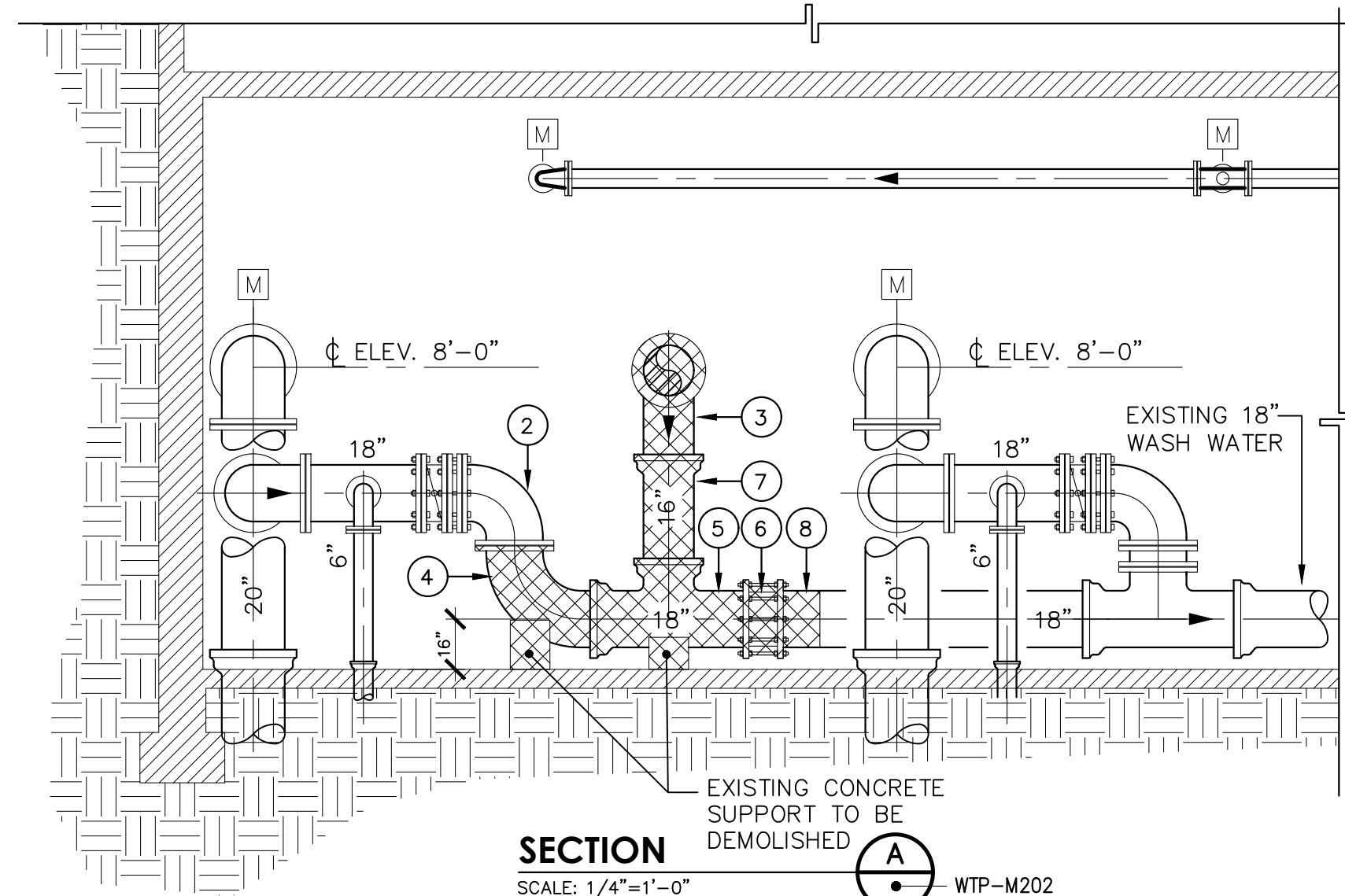
EXISTING PARTIAL FILTER'S BACKWASH PIPING BASEMENT FLOOR PLAN - DEMOLITION
SCALE: 1/4"=1'-0"



EXISTING PARTIAL FILTER'S BACKWASH PIPING BASEMENT FLOOR PLAN - NEW WORKS
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND DESCRIPTION:

- EXIST. 16"Ø, 90° ELBOW, CAST IRON, FE. TO REMAIN.
- EXIST. 18"Ø, 90° ELBOW, CAST IRON, FE. TO REMAIN.
- EXISTING 16"Ø, 90° ELBOW, CAST IRON, FE. TO BE REMOVED.
- EXISTING 18"Ø, 90° ELBOW, CAST IRON, FE. TO BE REMOVED.
- 18"Øx18"Øx16"Ø TEE, CAST IRON, FE.
- EXISTING PIPE COUPLING TO BE REMOVED.
- EXISTING 16"Ø CAST IRON PIPE, TO BE REMOVED.
- EXISTING 18"Ø CAST IRON PIPE SEGMENT, TO BE REMOVED. (SEGMENT LENGTH TO BE DETERMINED BY CONTRACTOR, ACCORDING TO NEW COUPLING TO BE INSTALLED).
- EXISTING PIPE SUPPORT TO BE REMOVED.

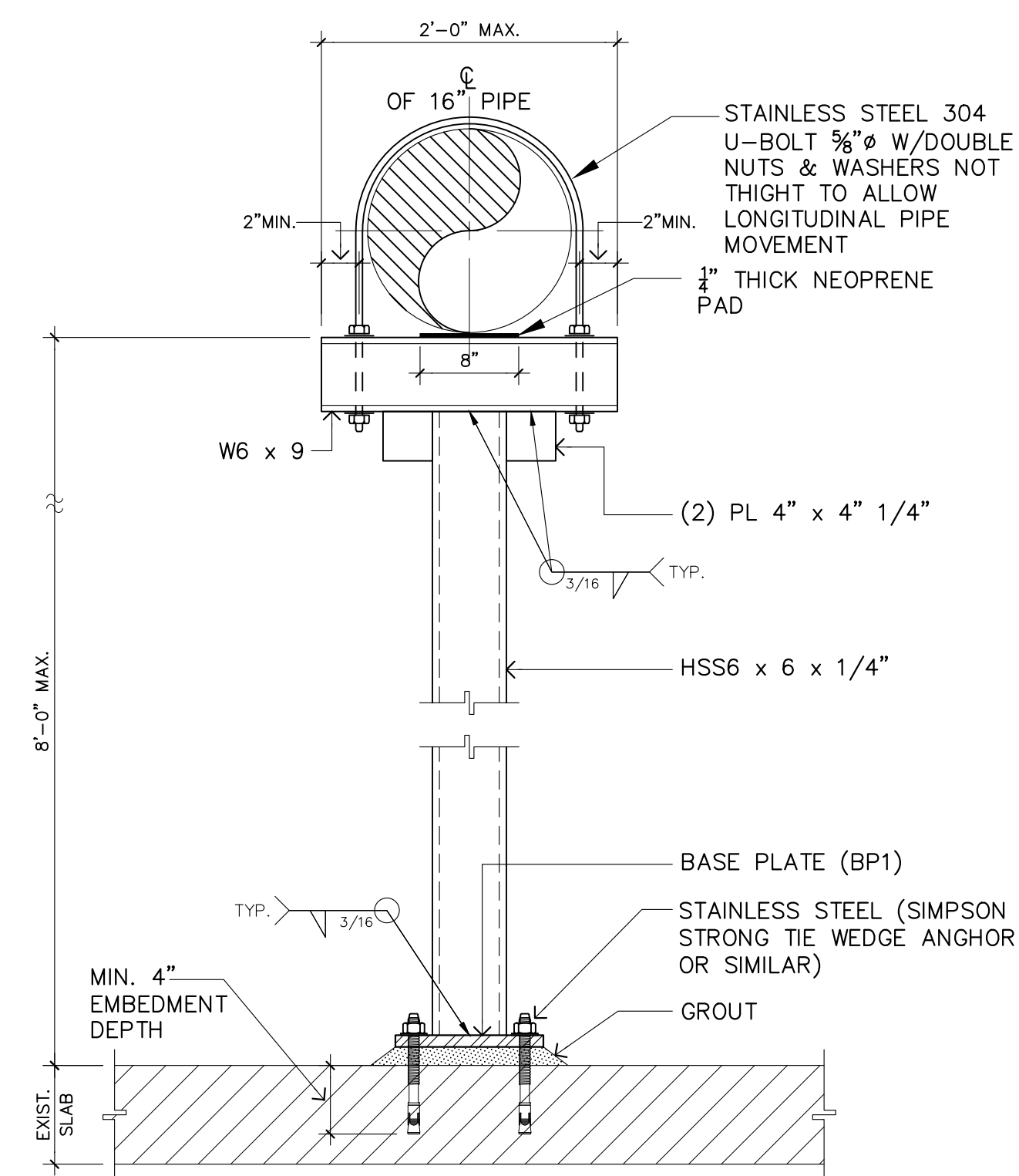
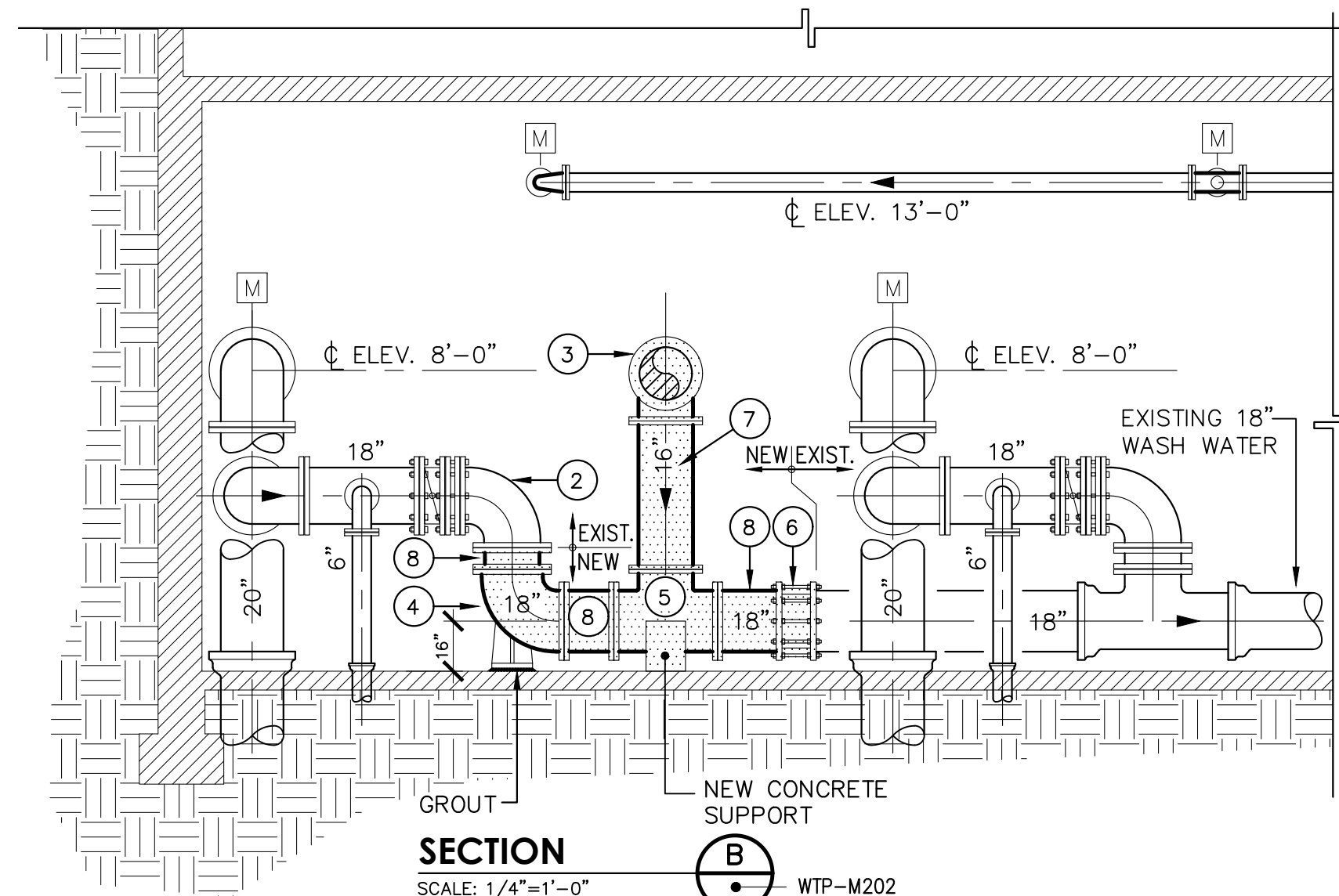


NEW LEGEND DESCRIPTION:

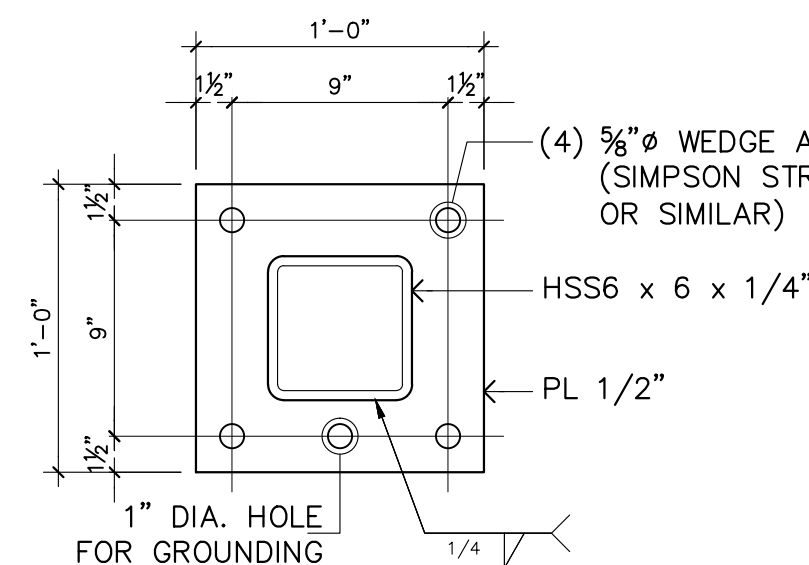
- EXIST. 16"Ø, 90° ELBOW, CAST IRON, FE. TO REMAIN.
- EXIST. 18"Ø, 90° ELBOW, CAST IRON, FE. TO REMAIN.
- NEW 16"Ø, 90° ELBOW, DUCTILE IRON, FE
- NEW 18"Ø, 90° BASE ELBOW, DUCTILE IRON, FE
- NEW 18"Øx18"Øx16"Ø TEE, DUCTILE IRON, FE.
- NEW RESTRAINED COUPLING, ROMAC MODEL 400RG
- NEW 16"Ø DUCTILE IRON PIPE, CLASS 53, FE.
- NEW 18"Ø DUCTILE IRON PIPE, CLASS 53, FE.
- NEW PIPE SUPPORT (SEE DETAIL THIS DWG.)

NOTE:

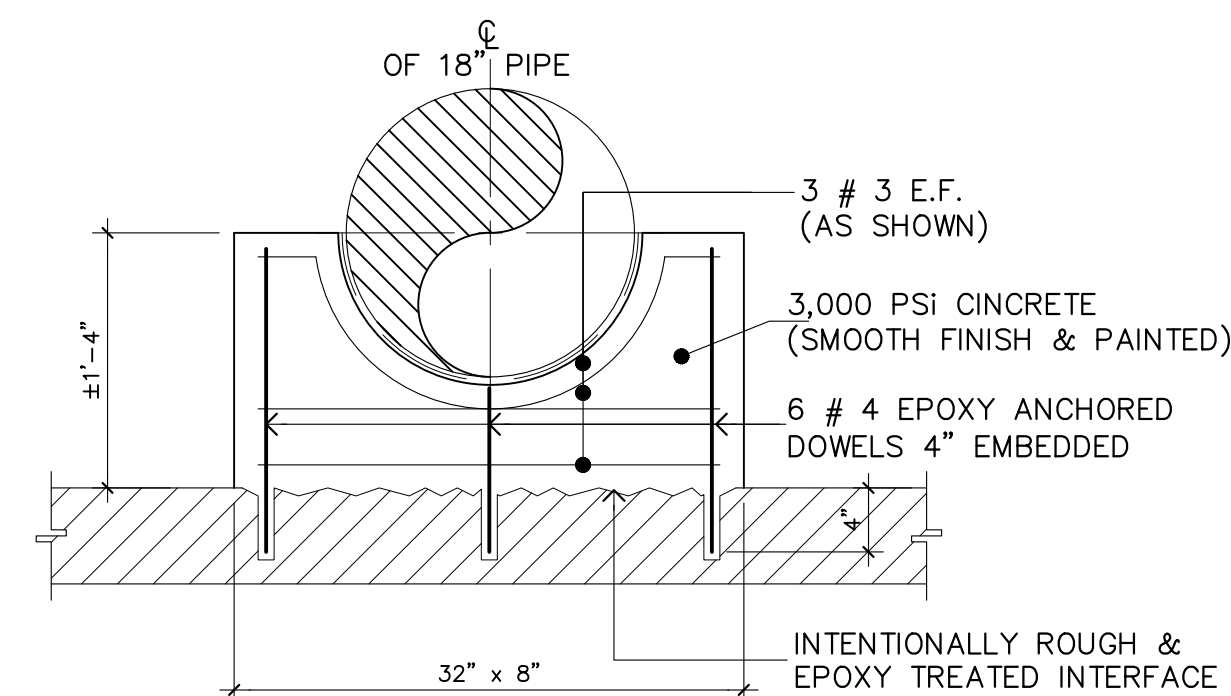
- ALL PIPES, FITTINGS, AND STEEL SUPPORT SHALL BE PRIMED WITH ALKYD METAL PRIMER & PAINTED WITH METAL WATER BORNE ENAMEL (2) COATS.



PIPE SUPPORT DETAIL
SCALE: 1"=1'-0"



BASE PLATE BP1 DETAIL
SCALE: 1 1/2"=1'-0"



CONCRETE PIPE SUPPORT
SCALE: 1"=1'-0"

LEGEND:	
	EXISTING TO BE DEMOLISHED
	NEW PIPE AND COMPONENTS
FE	FLANGED ENDS
M	MOTORIZED VALVE
FM	FLOW METER

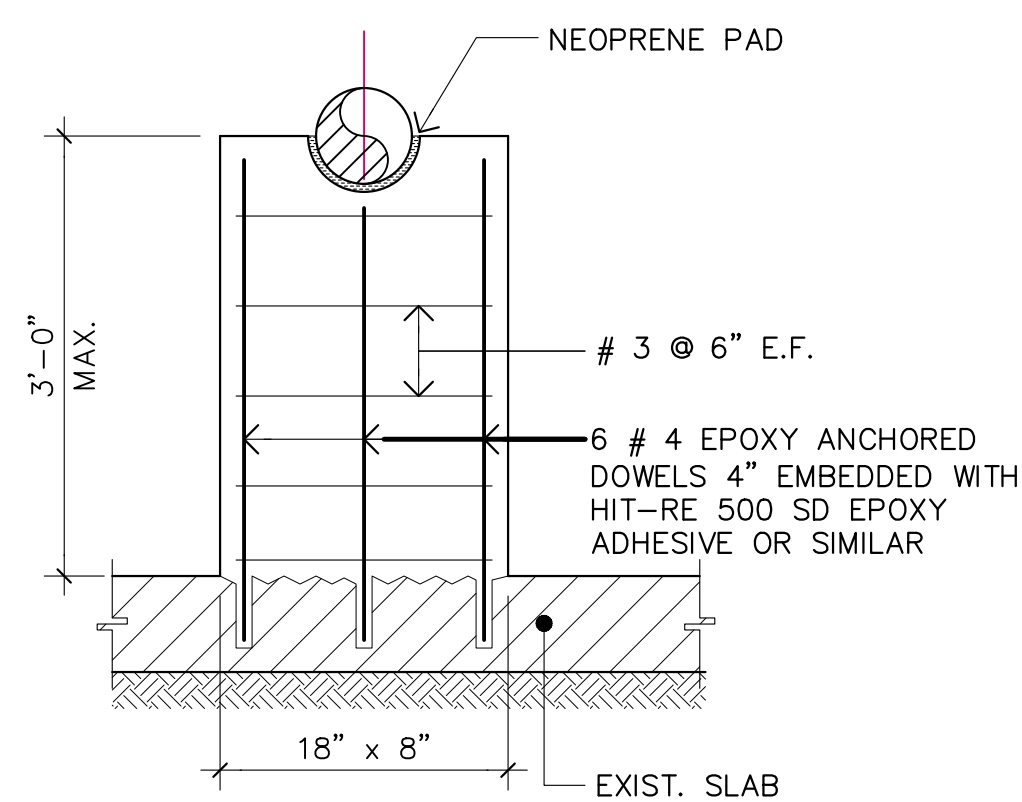
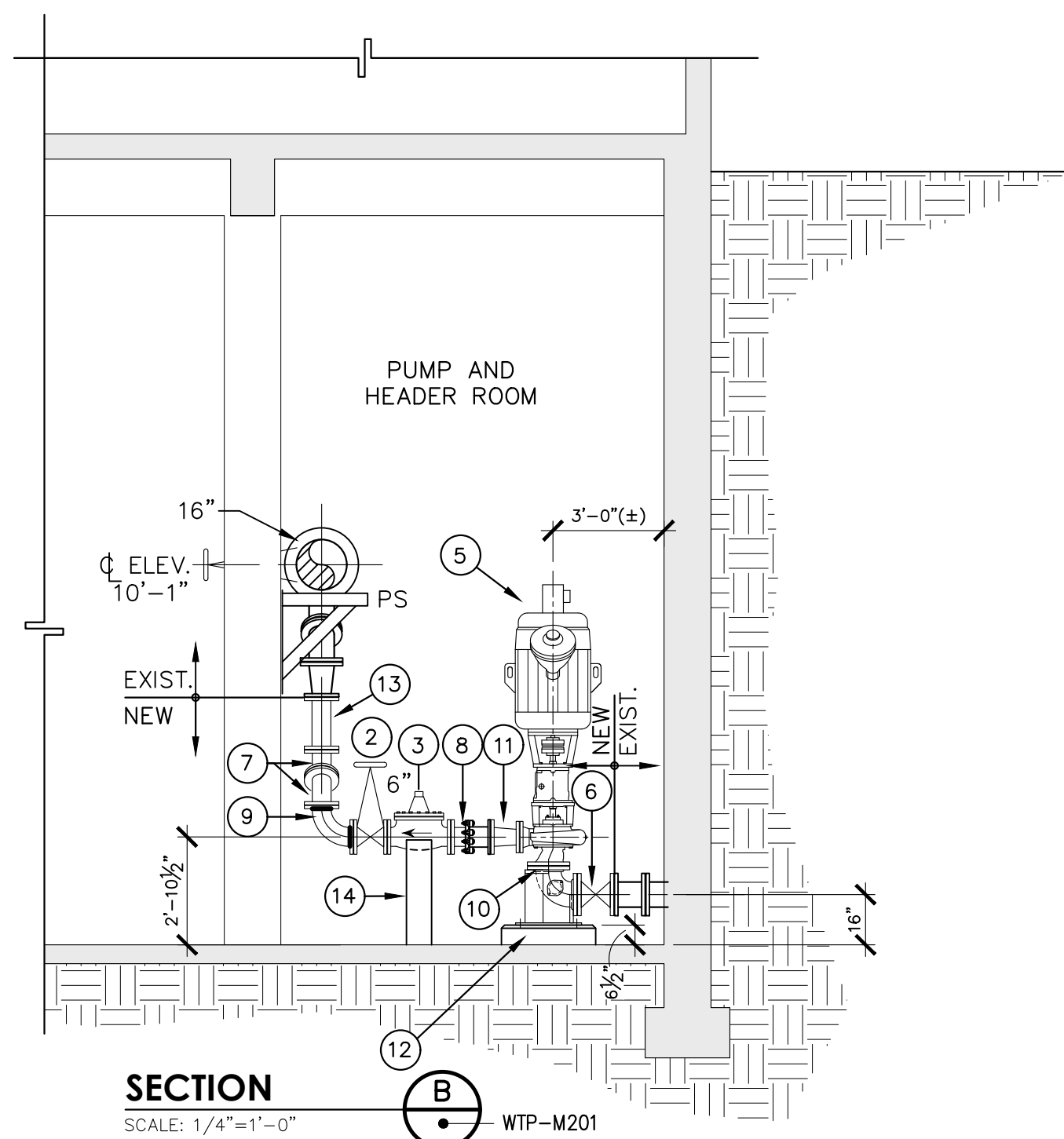
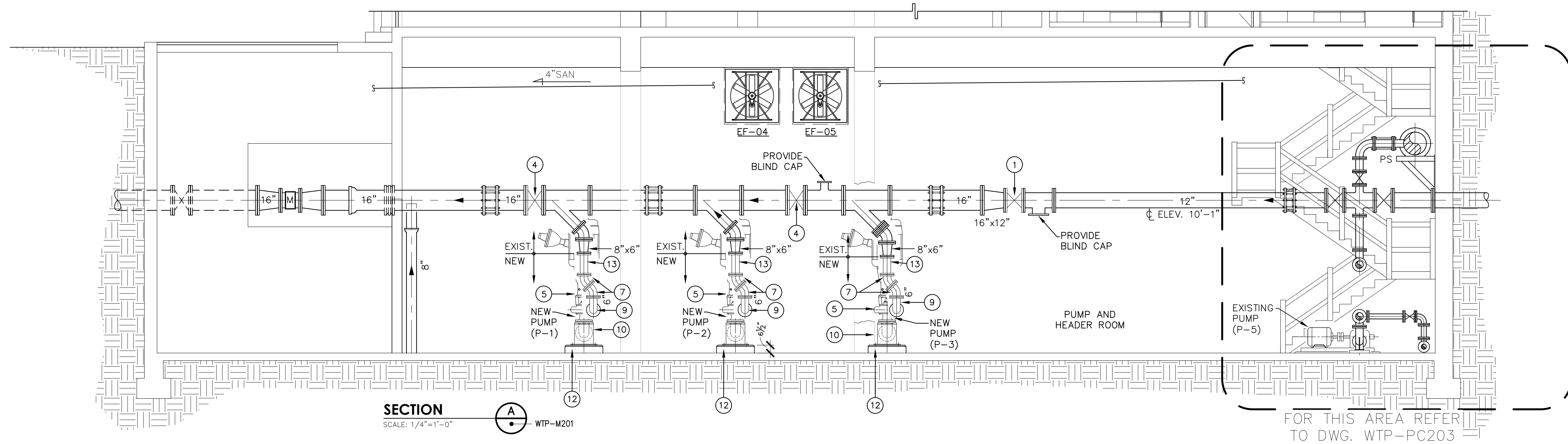
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DATE ISSUE
JULY 30, 2021
REVISED BID SET

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Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

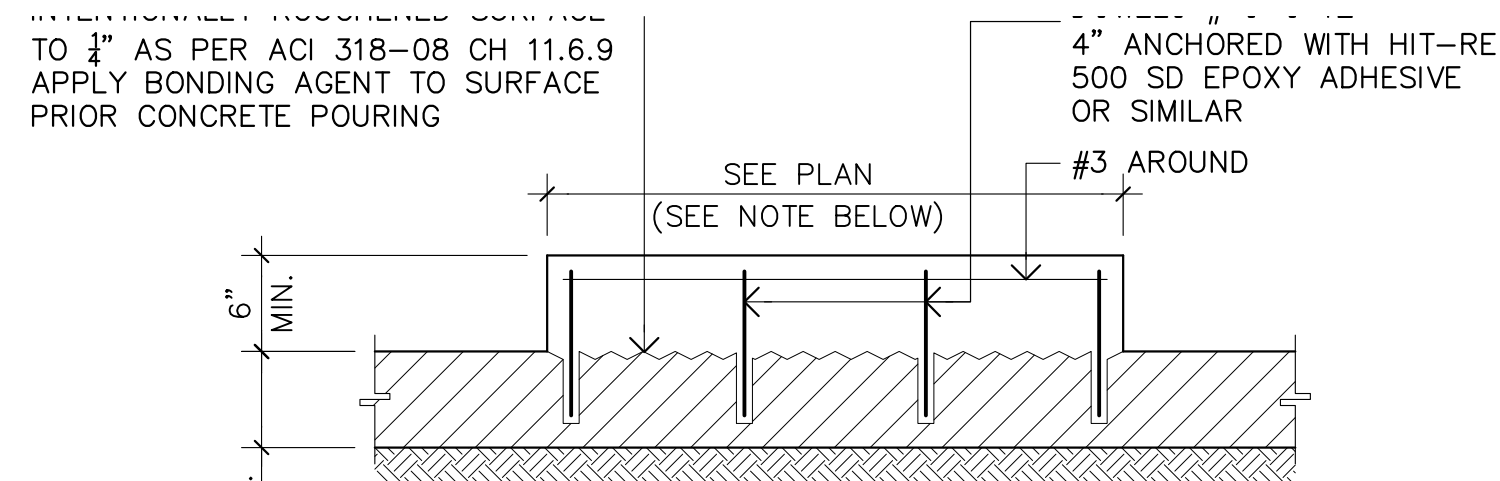


- ① NEW 12" GATE VALVE, FE. WITH CHAIN OPERATOR
- ② NEW 6" GATE VALVE, FE.
- ③ NEW 6" PUMP CONTROL VALVE. WITH BUILT IN CHECK VALVE, SIMILAR TO CLA-VAL MODEL 60-31
- ④ NEW 16" GATE VALVE, FE. WITH CHAIN OPERATOR
- ⑤ NEW PUMP (REFER TO SCHEDULE)
- ⑥ NEW 8" GATE VALVE FE.
- ⑦ NEW 6" 45° ELBOW FE.
- ⑧ NEW PIPE FLANGE ADAPTER, SIMILAR TO DRESSER STYLE 128-W.
- ⑨ NEW 6" 90° ELBOW FE.
- ⑩ NEW 8"90° ELBOW BASE PUMP
- ⑪ NEW 5"x6" REDUCER, FE.
- ⑫ NEW CONCRETE PAD (SEE DETAIL ON DWG. WTP-M201)
- ⑬ NEW CLASS 53, 6" D.I. PIPE, F.E.
- ⑭ NEW CONCRETE SUPPORT (SEE DETAIL ON DWG. WTP-M201)



NOTE:
INTENTIONALLY ROUGHENED SURFACE
TO 1/4" AS PER ACI 318-08 CH 11.6.9
APPLY BONDING AGENT TO SURFACE
PRIOR CONCRETE POURING

PIPE CONCRETE SUPPORT



TYPICAL MECHANICAL EQUIPMENT CONCRETE PAD DETAIL

SCALE: 1" = 1'-0"

NOTE:

1. ALL MECHANICAL OR ELECTRICAL EQUIPMENT SHALL BE RAISED ON A HOUSEKEEPING CONCRETE PAD. FINAL LOCATION INCLUDING ANCHOR BOLTS SIZE AND INSTALLATION LAYOUT SHALL BE AS PER FINAL VENDOR DRAWINGS SPECIFICATIONS AND/OR CERTIFIED SHOP DRAWINGS FOR SUCH EQUIPMENT.
2. NEW PADS ON EXISTING PROCESS ROOMS SHALL BE FINISHED WITH ACID RESISTANT TILES SIMILAR TO EXISTING.
3. EXISTING SLAB THICKNESS SHALL BE MEASURED PRIOR PERFORMING REBAR ANCHORING. NOTIFY DESIGNER THIS DIMENSION.

PUMPS SCHEDULE																	
GENERAL DESCRIPTION						PUMP DATA							MOTOR DATA			REMARKS	QTY.
UNIT NO.	SERVICE	LOCATION	MODEL	MANUFACTURER	REMARKS	TYPE	Q (GPM)	TDH (FT)	IMP. DIA. (IN)	CURVE NO.	WEIGHT (LBS)	BHP	MOTOR HP	MOTOR RPM	V-PH-HZ		
P-1 THRU SP-3	SUPPLY TREATED WATER	WATER TREATMENT PLANT	5YB-VC16-IMM-8X8-125-2	CORNELL	CONSTANT	CENTRIFUGAL IMMERISBLE	1,200	280	9	-	65	108	125	3,600	460-3-60	BRONZE IMPELLER, IMMERISBLE MOTOR	3

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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

Client: CEIBA & NAGUABO, PUERTO RICO
 Designer: WATER TREATMENT PLANT

PROPOSED BASEMENT SECTIONS AND DETAILS

integrated
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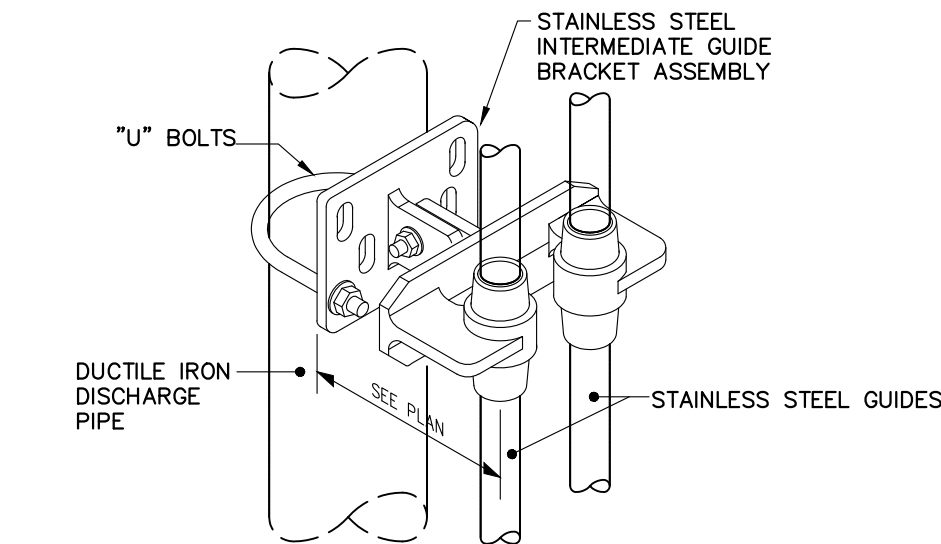
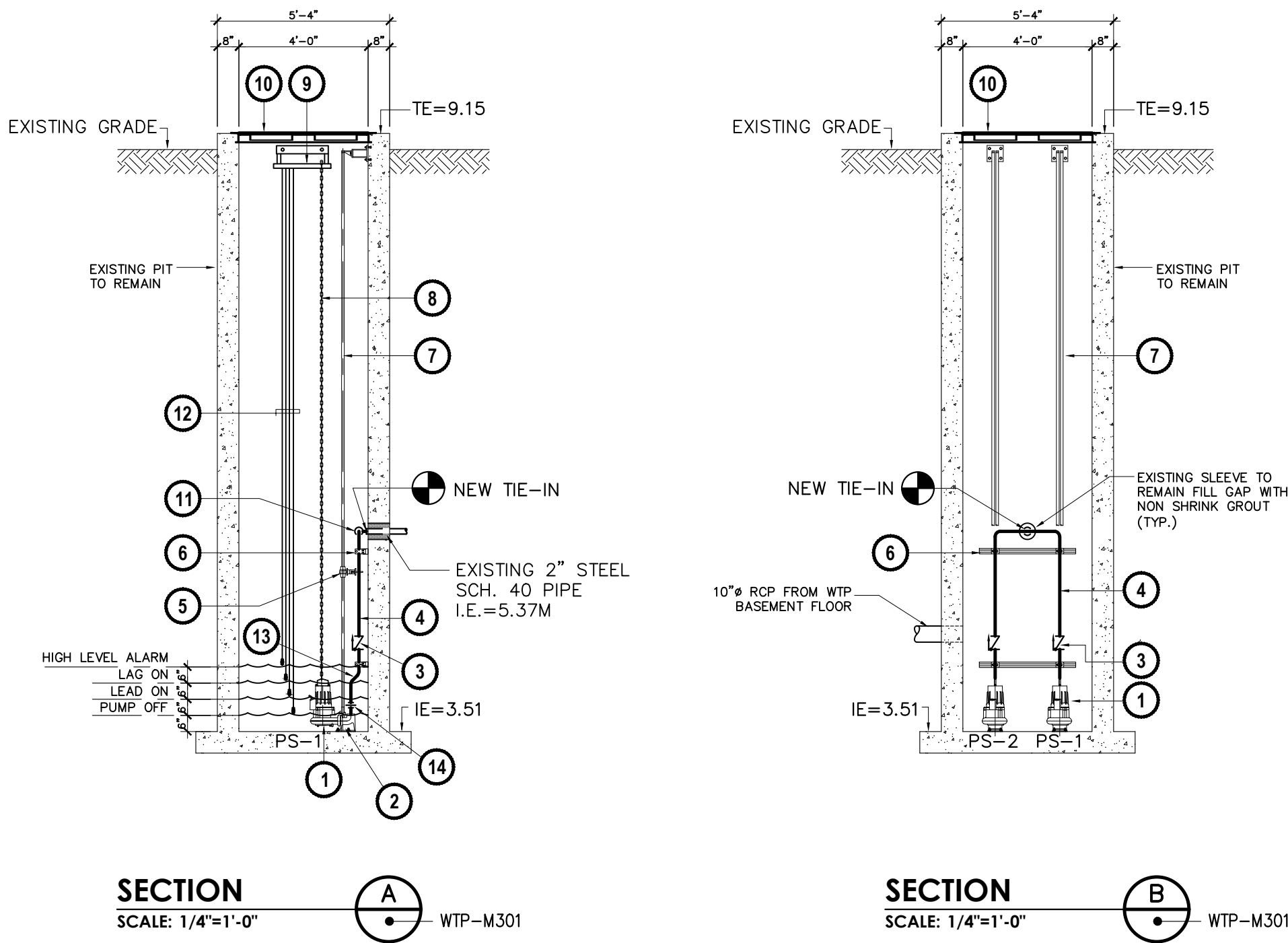
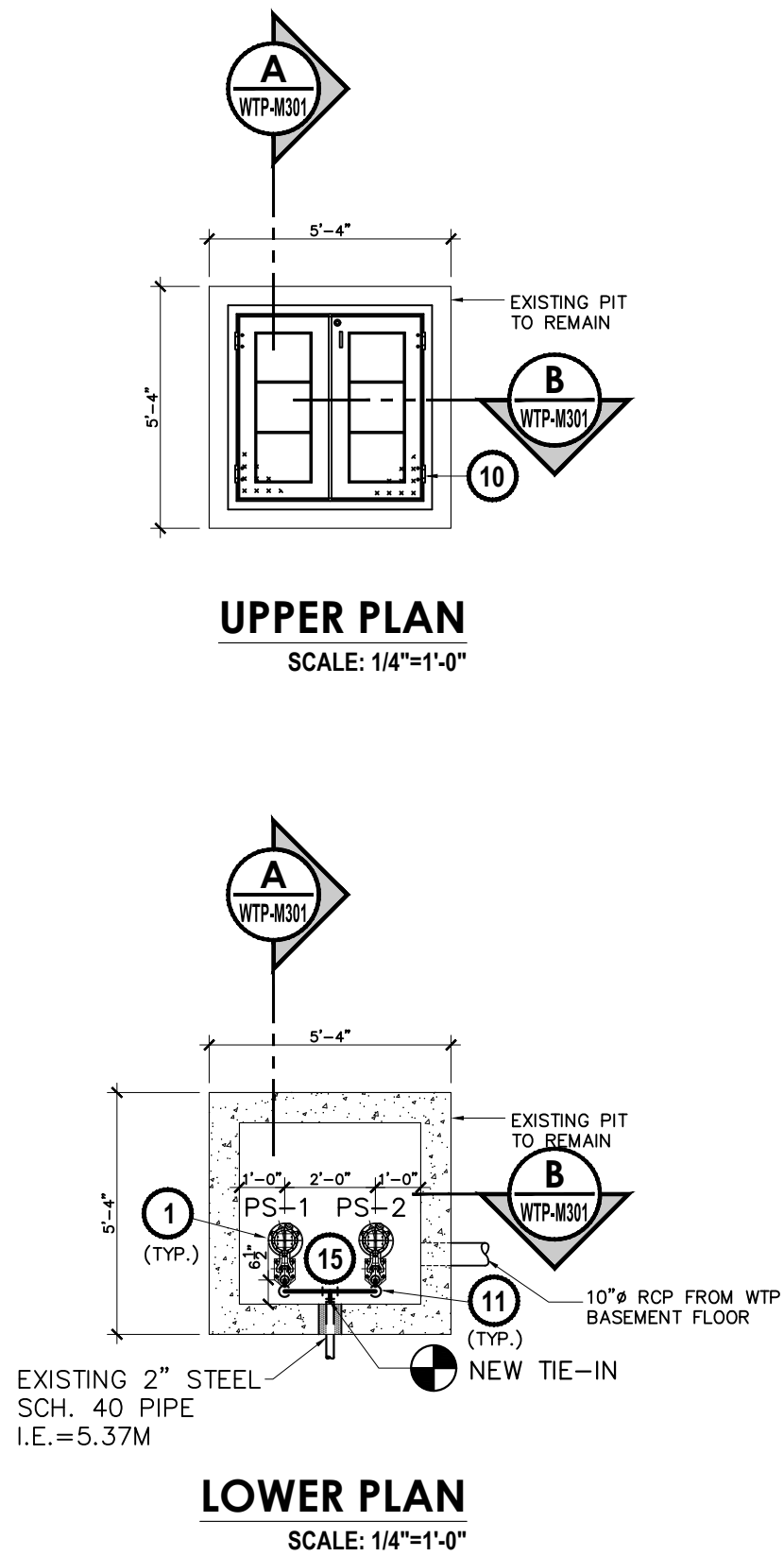
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Revisions		SHEET INFO.	
Number	Date	Description	
			Project No: 19-1837.0
			Set Date: 2021/07/28
			Drawn by:
			Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



3



GENERAL NOTES:

- THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO ORDERING MATERIALS, EQUIPMENTS AND ACCESSORIES OR BEGINNING CONSTRUCTION.
- DEMOLITION OR CONSTRUCTION SHALL NOT BE STARTED ON PIPING OR PIT TOP SLAB UNTIL ALL NEW MATERIALS, EQUIPMENTS AND ACCESSORIES ARE AT THE SITE.
- MATERIALS, EQUIPMENTS AND ACCESSORIES SHALL BE PRE ASSEMBLED AT THE SITE PRIOR TO INSTALLATION.

SCOPE OF WORKS:

- SUMP PUMPS (REFER TO SCHEDULE)
- DISCHARGE ELBOW WITH BASE & ANCHOR BOLTS.
- 2" CHECK VALVE
- NEW 2" STEEL SCH. 40 PIPE
- INTERMEDIATE GUIDE BRACKET ASSEMBLY (SEE DETAILS)
- PROVIDE UNISTRUT CHANNEL P5500 WITH PIPE CLAMP
- 3/4"Ø STAINLESS STEEL GUIDE BARS (2 PER PUMP)
- STAINLESS STEEL CHAIN WITH SHACKLES EVERY 4'-0"
- STAINLESS STEEL CABLE HOLDER.
- NEW ALUMINUM ACCESS HATCH COVER (HARLIDAY SERIES S2R4848)
- 2" 90° STEEL ELBOW
- NON MERCURY LEVEL FLOATS.
- 2" 45° STEEL ELBOW
- 2" UNIVERSAL UNION
- 2"STEEL TEE

PUMPS SCHEDULE																	
GENERAL DESCRIPTION						PUMP DATA							MOTOR DATA			REMARKS	QTY
UNIT NO.	SERVICE	LOCATION	MODEL	MANUFACTURER	REMARKS	TYPE	Q (GPM)	TDH (FT)	IMP. DIA. (MM)	CURVE NO.	WEIGHT (LBS)	BHP	MOTOR HP	MOTOR RPM	V-PH-HZ		
SP-1 & SP-2	SUMP PIT	WATER TREATMENT PLANT	CP 3045 HT	FLYGT	CONSTANT	CENTRIFUGAL	50	16	74	-	65	-	1.1	3,350	230-1-60	-	2

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DATE ISSUE
JULY 30, 2021
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YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DGPE.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER TREATMENT PLANT

Drawing Title:

BASEMENT FLOOR DRAINAGE SUMP PUMP PLANS, SECTIONS AND DETAIL

Sheet:

WTP-M301

Revisions

Number	Date	Description
1	2021/07/28	Project No. 19-1837.0
2	2021/07/28	Set Date: 2021/07/28
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4		Dwg. Date:

SHEET INFO.

Project No. 19-1837.0

Set Date: 2021/07/28

Drawn by:

Dwg. Date:

Revisions

Number	Date	Description
1	2021/07/28	Project No. 19-1837.0
2	2021/07/28	Set Date: 2021/07/28
3		Drawn by:
4		Dwg. Date:

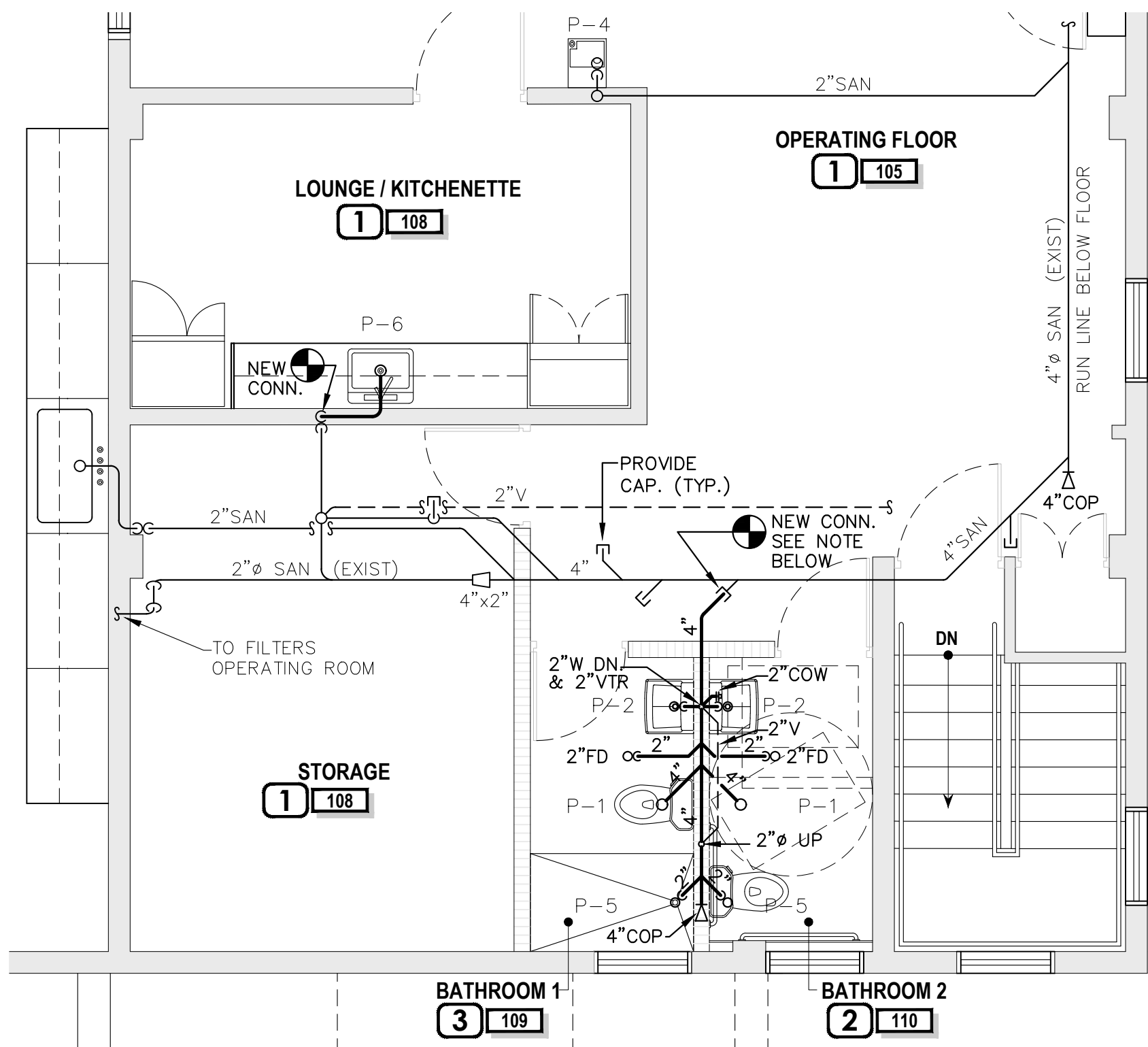
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Project No. 19-1837.0

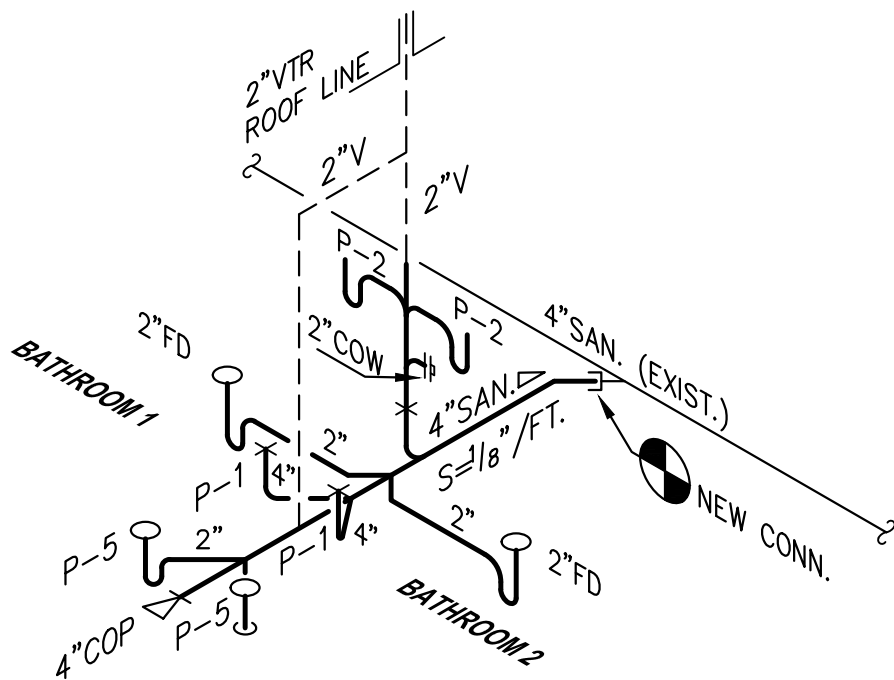
Set Date: 2021/07/28

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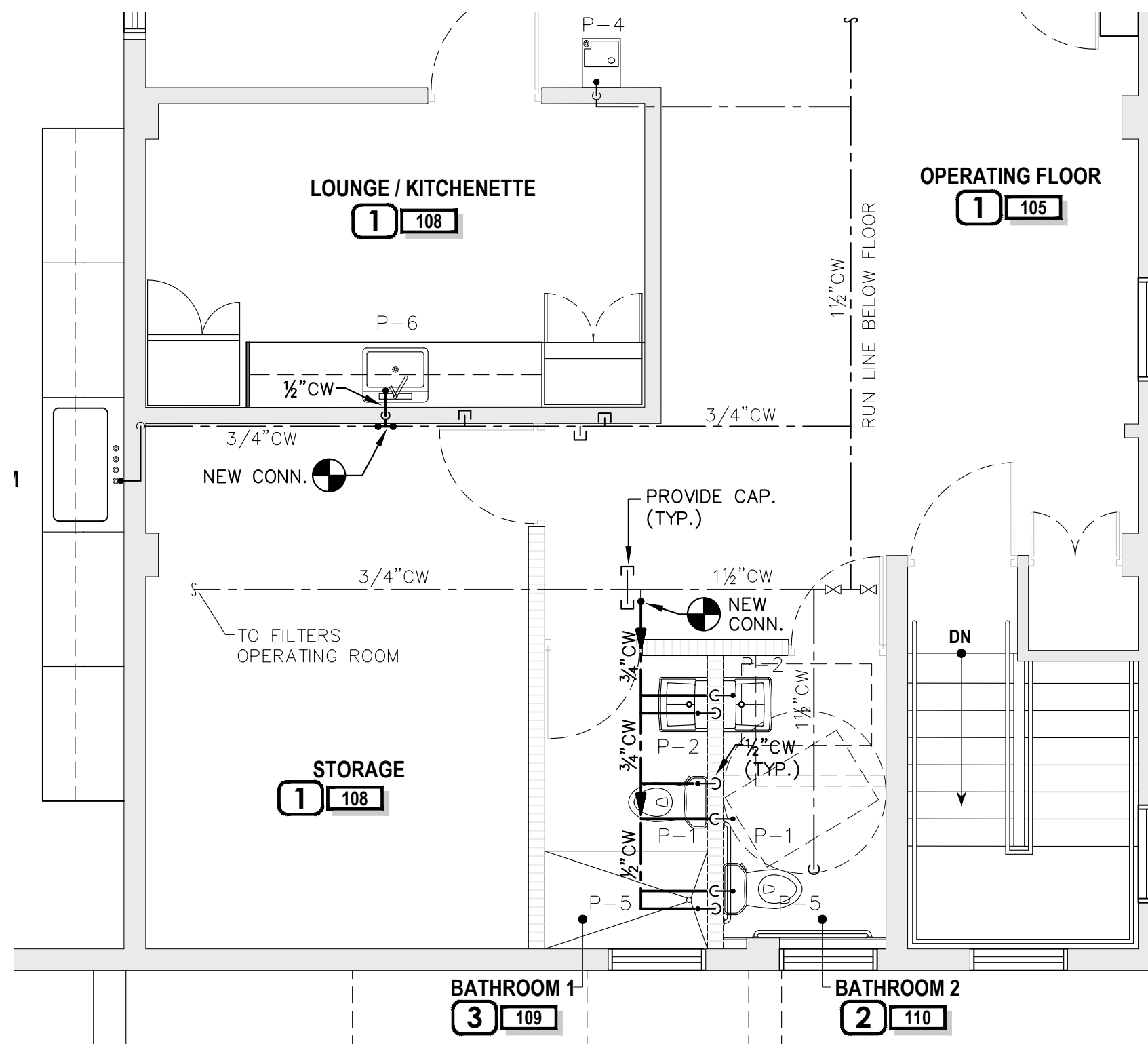
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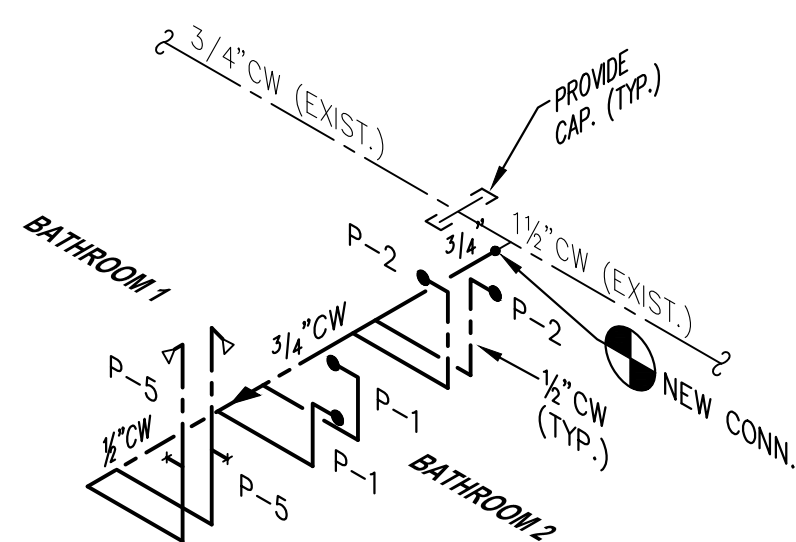
PROPOSED SANITARY PLAN
SCALE: 1/4"=1'-0"



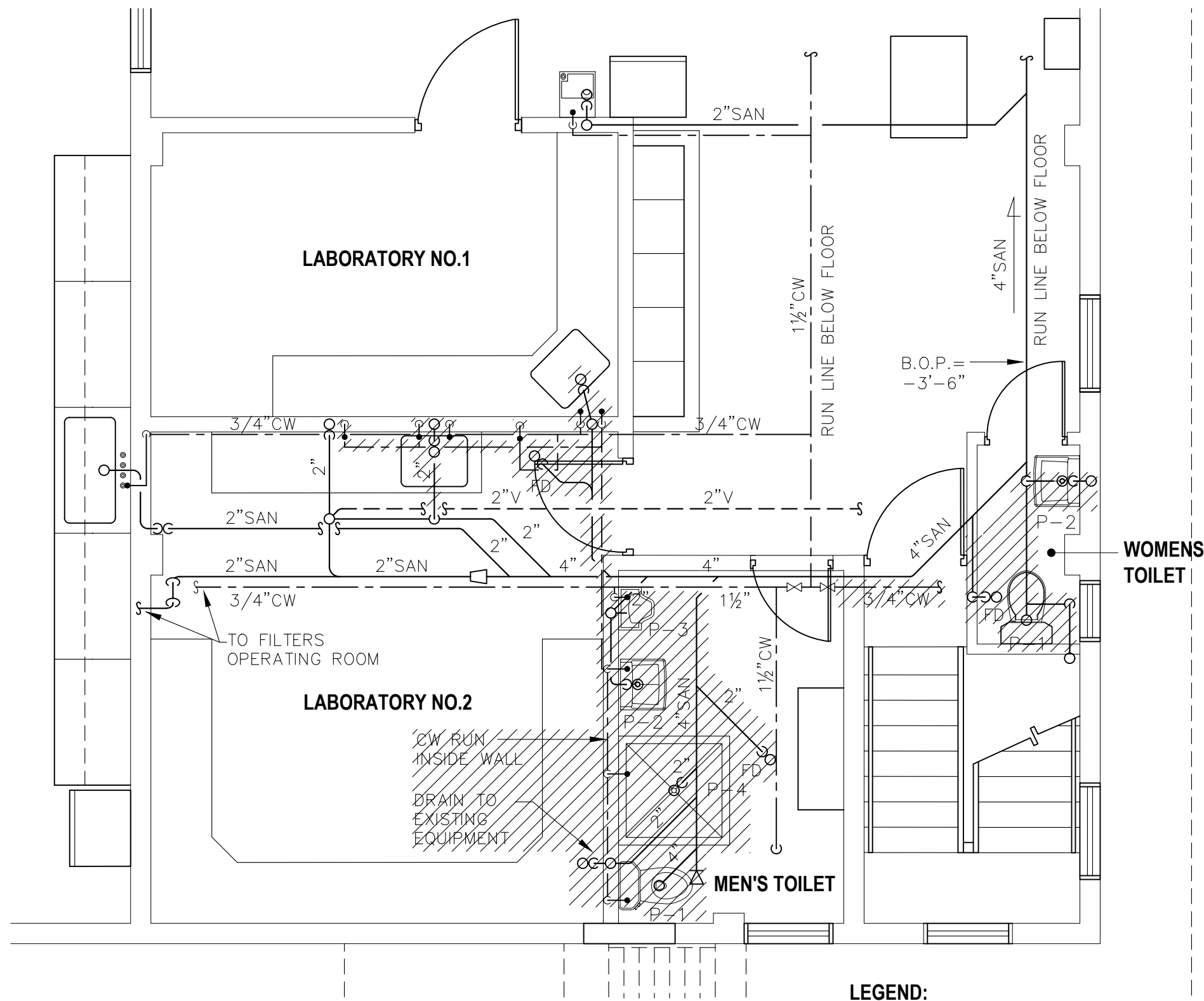
PROPOSED SANITARY ISOMETRIC
NOT TO SCALE:



PROPOSED PIPING PLAN
SCALE: 1/4"=1'-0"



PROPOSED PIPING ISOMETRIC
NOT TO SCALE:



EXISTING + DEMOLITION PLUMBING PLAN
SCALE: 1/4"=1'-0"

GENERAL NOTES:

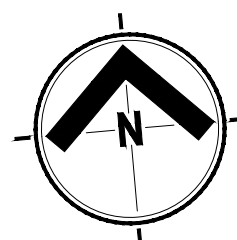
- A) CONTRACTOR SHALL REPLACE ALL NOTICEABLE LEAKING LEAD OAKUM HUB AND SPIGOT JOINT SEALS WITH TY-SEAL GASKETS AS MANUFACTURED BY TYLER CORP.
- B) CONTRACTOR SHALL ASSESS ALL POTABLE WATER LEAKING JOINTS AND REPAIR AS NECESSARY

PLUMBING LEGEND:

- COLD POTABLE WATER LINE
— SANITARY SEWER LINE
- - - SANITARY VENTILATION LINE
- P-1 INDICATES PLUMBING FIXTURE DESIGNATION SEE SCHEDULE

PLUMBING ABBREVIATIONS:

- CW COLD WATER
SAN SANITARY
(TYP.) TYPICAL
COW CLEAN OUT WALL
COP CLEAN OUT PLUG
FD FLOOR DRAIN
V VENTILATION
S=X/X" FT. SLOPE PER FEET



GRAPHIC SCALE = 1/4"=1'-0"

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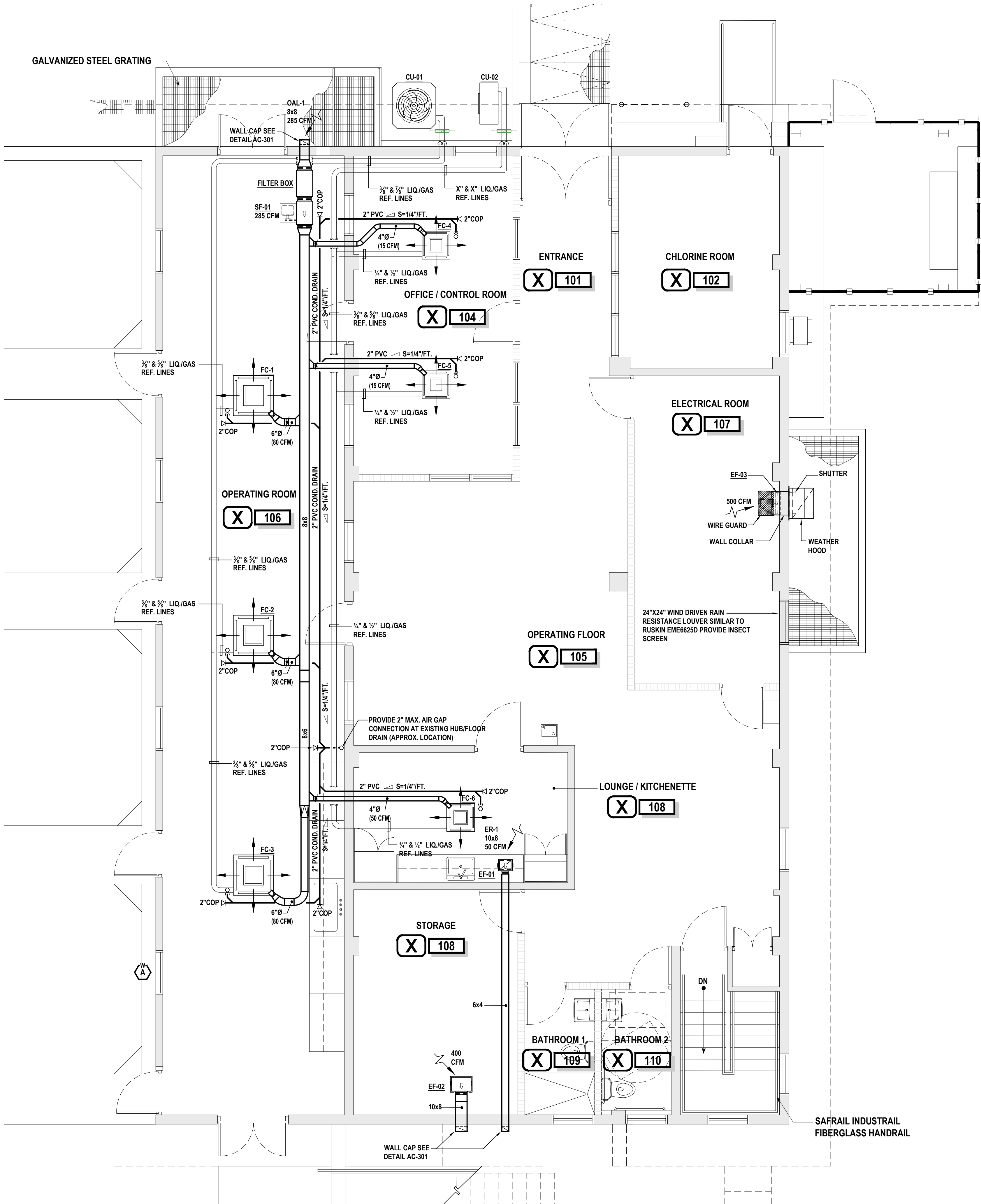
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:
CARRERA & NAGUARO, PUERTO RICO

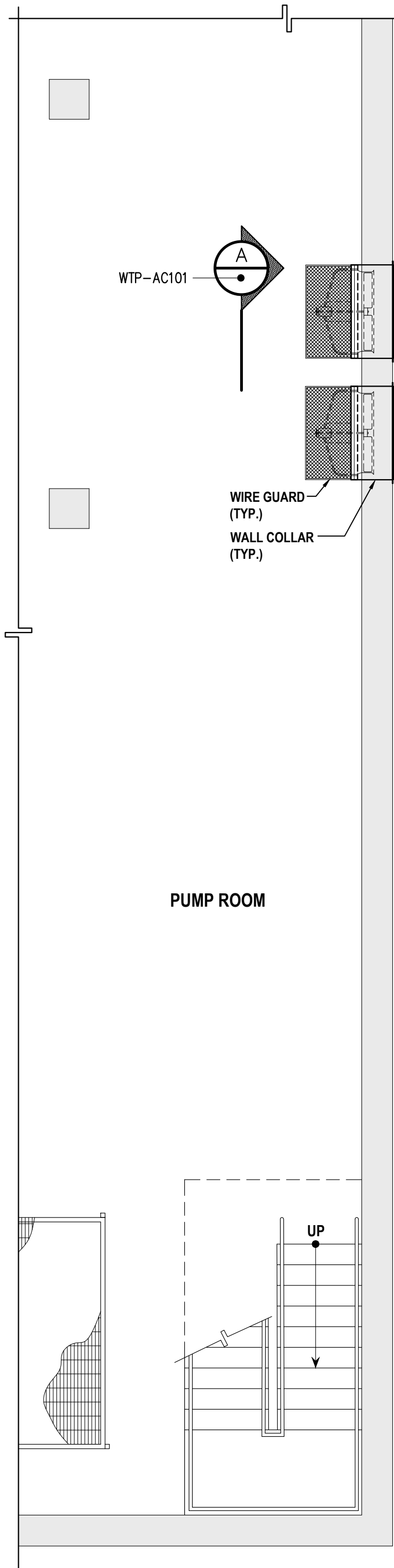
WATER TREATMENT PLANT

Drawing Title:

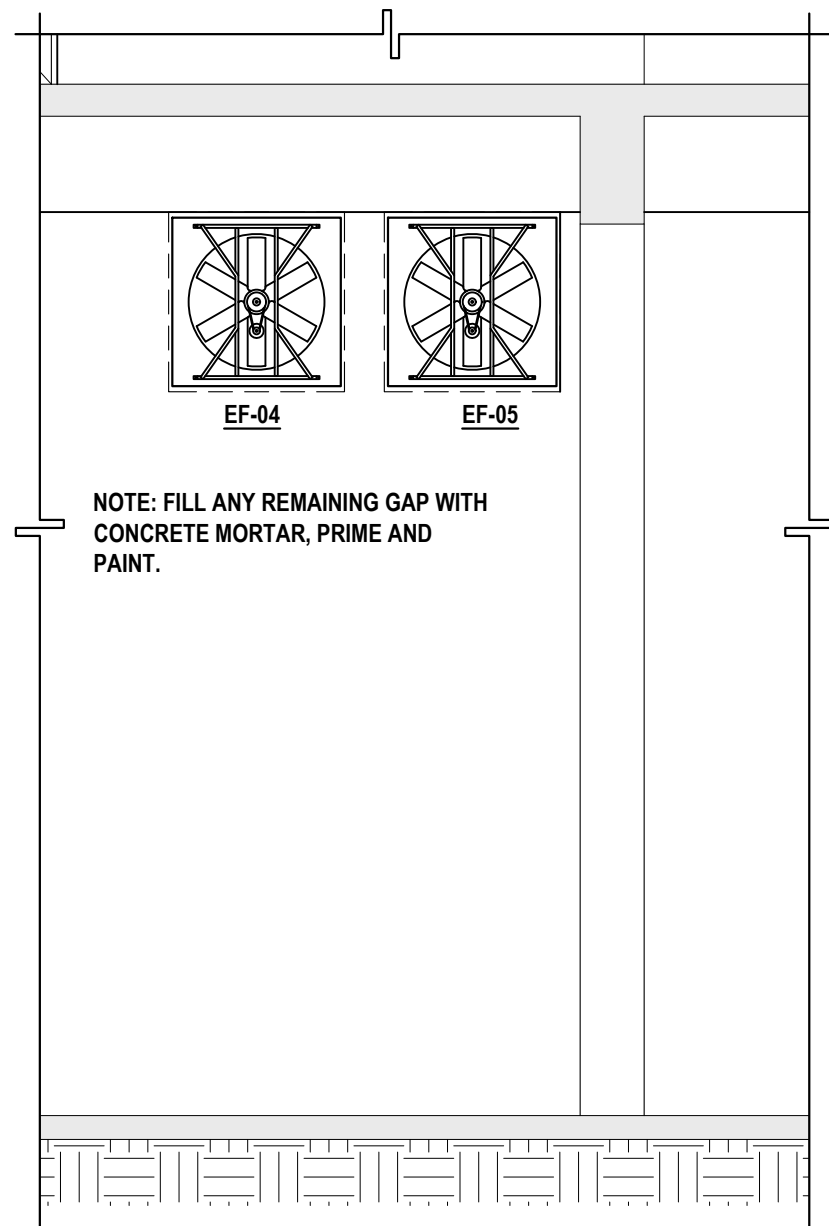
PARTIAL FIRST FLOOR PLUMBING PLANS AND ISOMETRIC



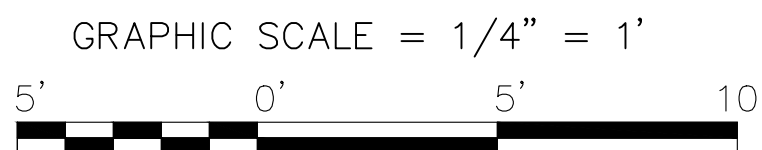
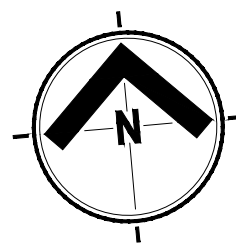
HVAC PROPOSED FIRST FLOOR PLAN
SCALE: 1/4"=1'-0"



HVAC PARTIAL BASEMENT FLOOR PLAN
SCALE: 1/4"=1'-0"



SECTION
SCALE: 1/4"=1'-0"



Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA DCPA.

Revisions			SHEET INFO.	
Number	Date	Description	Project No.	Set Date
			19-1637.0	2021/07/28
			Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER TREATMENT PLANT
Drawing Title:

WTP-AC201

FAN SCHEDULE

MARKED NO.	T Y P E	SPACE SERVED	P E R F O R M A N C E			DRIVE	MANUFACTURER AND MODEL (BASE DESIGN)	MOTOR DATA PREMIUM EFF.(TEFC)					CONTROL	ACCESSORIES OR REMARKS	ROOF OR WALL OPENNING	ROOF CURB
			C.F.M.	R.P.M.	S.P.			HP.	R.P.M.	VOLTS	AMPS	PHASE				
SF-1	CENTRIFUGAL FILTERED INLINE	OFFICE, LOUNGE, CONTROL ROOM	285	2,003	0.50	BELT	LOREN COOK 70SQN-B	.25	1,725	120	5.8	1	BY ELECT CONTRACTOR	SEE NOTE 1	-	-
EF-1	CENTRIFUGAL INLINE EXHAUSTER	LOUNGE ROOM	50	1,483	0.35	DIRECT	LOREN COOK GN242	21.6 (WATTS)	1,483	120	0.25	1	BY ELECT CONTRACTOR	SEE NOTE 2	-	YES
EF-2	CENTRIFUGAL CEILING EXHAUSTER	STORAGE ROOM	400	1,153	0.35	DIRECT	LOREN COOK GC740	193 (WATTS)	1,153	120	3.9	1	BY ELECT CONTRACTOR	SEE NOTE 3	-	YES
EF-3	WALL MOUNTED EXHAUSTER	ELECTRICAL ROOM	500	1,218	0.30	BELT	LOREN COOK 16A17D	.16	1,725	120	4.4	1	BY ELECT CONTRACTOR	SEE NOTE 4	WALL OPENING	-
EF-4 & 5	ALUMINUM PROPELLER WALL EXHAUST FAN	PUMP ROOM	8,000	773	0.375	BELT	LOREN COOK 36A9B	2.0	1,725	480	3.4	3	BY ELECT CONTRACTOR	SEE NOTE 5	WALL OPENING	-

NOTES:
1. INLINE MOUNTED, BELT DRIVEN, CENTRIFUGAL SUPPLY FAN, STANDARD PLUG DISCONNECT, ISOLATOR KIT, FILTER BOX, W/HERV 8, PERMATECTOR FAN FINISH, ACCESS DOORS, OSHA GUARD/MOTOR COVER.
2. PREWIRED FAN SPEED CONTROLLER, SPRING CEILING ISOLATOR, BACKDRAFT, STD. PREWIRED DS, STANDARD FAN FINISH.
3. PREWIRED FAN SPEED CONTROLLER, SPRING CEILING ISOLATOR, BACKDRAFT, STD. PREWIRED DS, STANDARD FAN FINISH, ANONIZED ALUMINUM GRILLE.
4. ALUMINUM CONSTRUCTION, STD-PREWIRED DS, PERMATECTOR FAN FINISH BIRD SOREEN, EXTENDED LUBE LINES, BELT TENSIONER.
5. CAST ALUMINUM PROPELLER, LORENIZED PAINT FINISH, EFF MOTOR, GRAVITY SHUTTER (HEAVY-DUTY), WIRE GUARD MOTOR SIDE, BELT TENSIONER & SHUTTER GUARD.

FAN COIL UNIT SCHEDULE (CASSETTE TYPE)

TAG	MANUFACTURER MIDEA	COOLING CAPACITY BTU/HR	AIR FLOW CAPACITY (RANGE) (CFM)	REFRIGERANT LINE SIZES		VOLTAGE	MCA	MOP
				LIQUID (IN)	GAS (IN)		AMPS	AMPS
FC-1	MODEL MDV-D27Q4/VN1-D	27,300	509-727	3/8	5/8	208-230 VOLTS/1 PHASE	.65	15
FC-2	MODEL MDV-D27Q4/VN1-D	27,300	509-727	3/8	5/8	208-230 VOLTS/1 PHASE	.65	15
FC-3	MODEL MDV-D27Q4/VN1-D	27,300	509-727	3/8	5/8	208-230 VOLTS/1 PHASE	.65	15
FC-4	MODEL MDV-D12Q4/VN1-A3	12,300	509-727	3/8	5/8	208-230 VOLTS/1 PHASE	.65	15
FC-5	MODEL MDV-D12Q4/VN1-A3	12,300	509-727	3/8	5/8	208-230 VOLTS/1 PHASE	.65	15
FC-6	MODEL MDV-D15Q4/VN1-A3	15,400	211-372	1/4	1/2	208-230 VOLTS/1 PHASE	.65	15

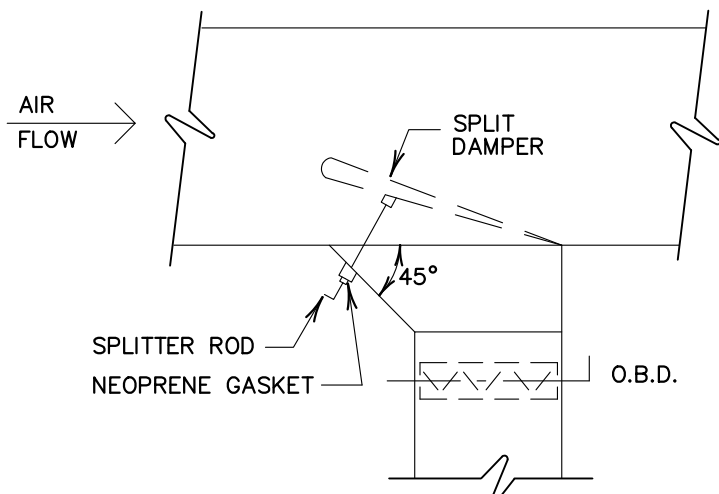
AIR COOLED CONDENSING UNITS SCHEDULE

MARKED UNIT NO.	LOCATION	UNIT SERVED	TOTAL CAPACITY BTU/HR.	DESIGN TEMPERATURE		MINIMUM CIRCUIT AMPACITY	MAXIMUM OVERCURRENT PROTECTION	VOLTS	Ø	MANUFACTURER & MODEL	REMARKS
				AIR ENTERING CONDENSER	DESIGN SAT. SUCTION TEMP. AT COMPRESSOR						
CU-1	EXTERIOR	CASSETTES UNITS	81,900	95°F	*	* AMPS	* AMPS	208	3	MIDEA MV5-X252W/V2DN1	STANDARD DISCONNECT BLACK EPOXY COATED COIL
CU-2	EXTERIOR	CASSETTES UNITS	39,900	95°F	*	* AMPS	* AMPS	208	3	MIDEA MDV-V140W/DVN1	STANDARD DISCONNECT BLACK EPOXY COATED COIL

* BY MANUFACTURER

AIR DEVICE SCHEDULE

MARKED NO.	FUNCTION	DESCRIPTION	MODEL	MANUFACTURER	C.F.M.	SIZE	ACCESSORIES	CONSTRUCTION
ER-1	EXHAUST	45° DEFLECTION REGISTER	RHD	METALAIRE	SEE DWG.	SEE DWG.	ALUMINUM OPPOSED BLADE DAMPER	ALUMINUM CONST. OFF-WHITE FINISH

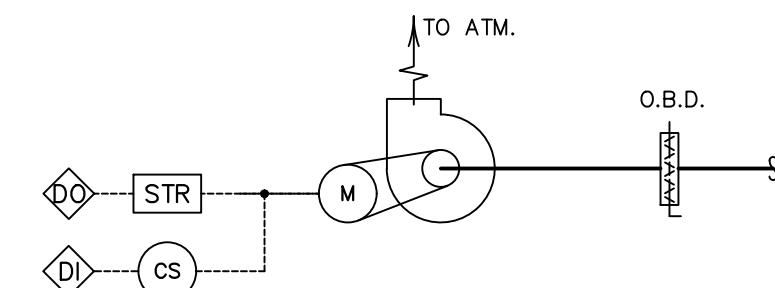


TYPICAL BRANCH TAKE-OFFS DETAIL

NOT TO SCALE

LEGEND:

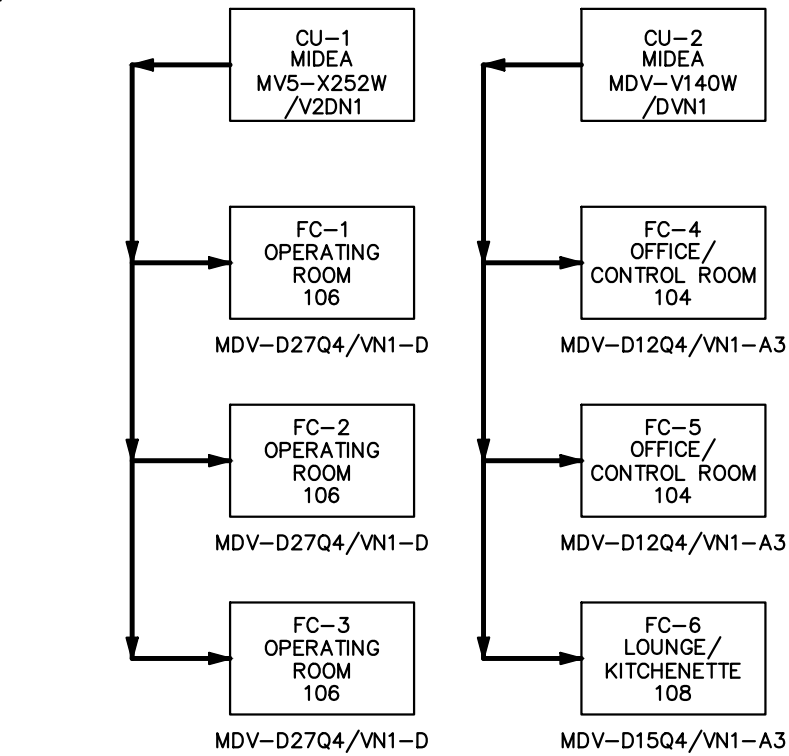
CS	CURRENT SENSING RELAY	HAWKEYE MOD. H-934
O.B.D.	OPPOSED BLADE DAMPER	RUSKING MOD. CD-50
DI	DIGITAL INPUT TO CONTROLLER	DDC SYSTEM
DO	DIGITAL OUTPUT FROM CONTROLLER	
AI	ANALOG INPUT TO CONTROLLER	
AO	ANALOG OUTPUT FROM CONTROLLER	
RLY	RELAY	ALLEN BRADLEY
-----	ELECTRICAL LINE	



EF-1 CONTROLS SCHEMATIC

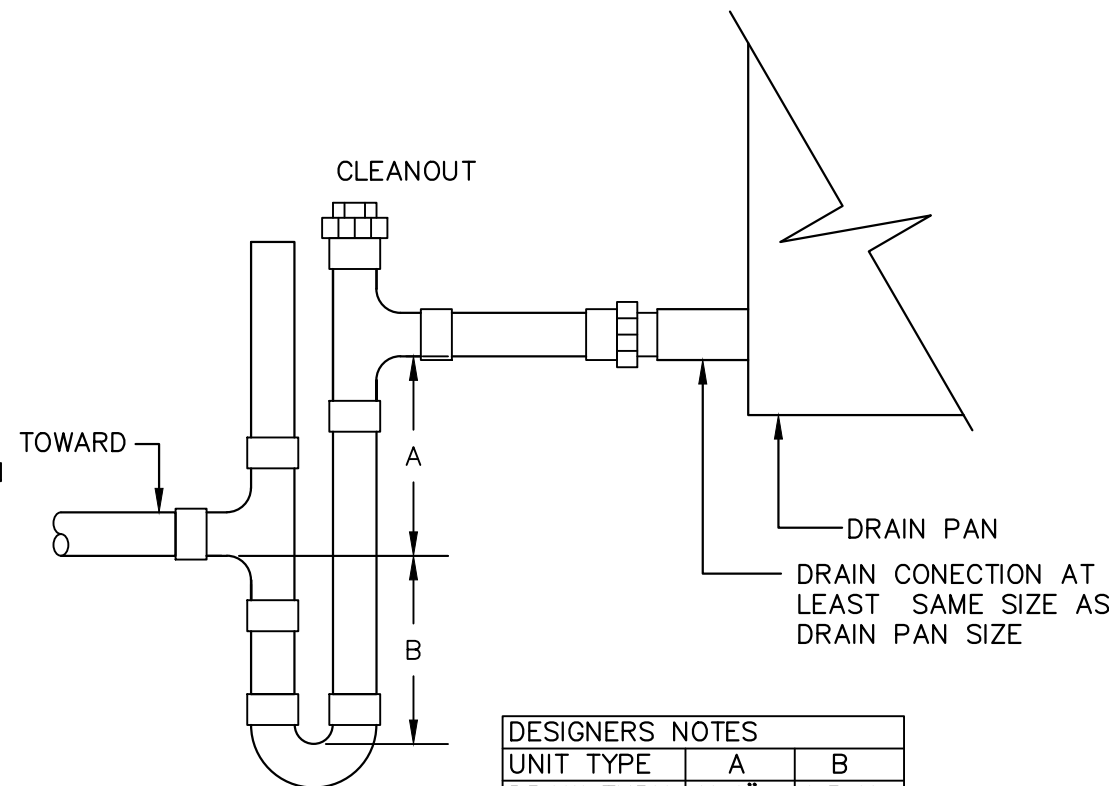
TYPICAL DUCT HANGER DETAIL ALL RECTANGULAR DUCT (FOR HORIZONTAL)

NOT TO SCALE



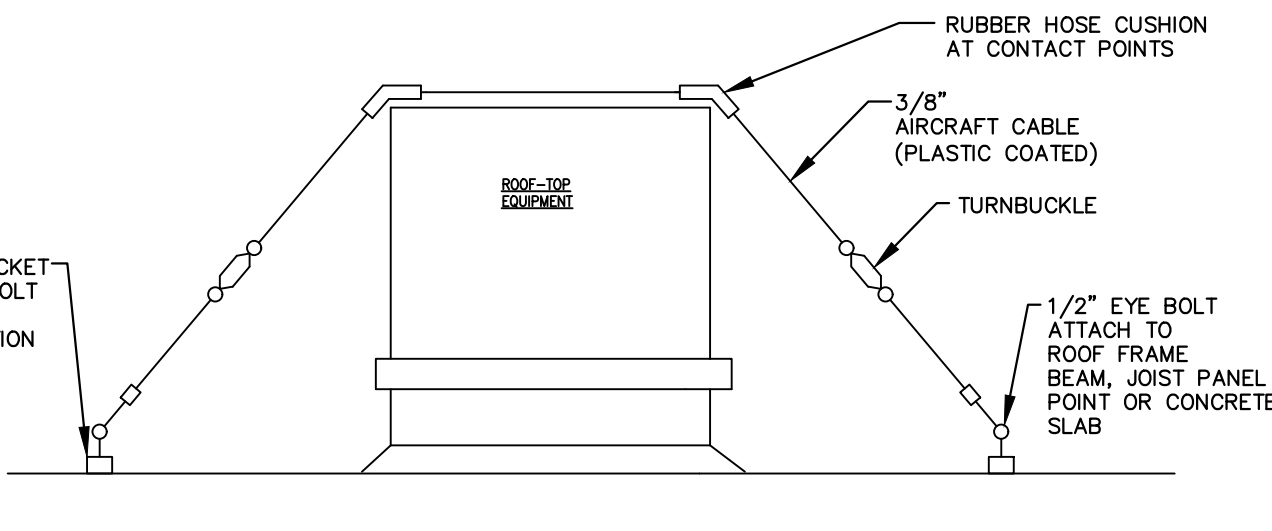
NOTES:

- 1-ALL REFRIGERANT PIPE SIZING SHALL BE FINALLY COORDINATED/ VERIFIED WITH EQUIPMENT VENDOR BASED ON FIELD CONDITIONS PRIOR TO PROCUREMENT AND INSTALLATION.
- 2-CONTROLS WIRING DIAGRAMS SHALL BE PREPARED BY EQUIPMENT VENDOR, AS LONG AS WIRING DEFINITION AND CONTROL CONDUITS.
- 3-CONTROL ARCHITECTURE INCLUDING CENTRALIZED CONTROLLER FOR INDIVIDUAL CONTROL, MONITORING AND SCHEDULING OF THE FAN COIL UNITS SIMILAR TO MD-COM09, WIRE REMOTE CONTROLLERS, SEQUENCE OF OPERATION, OPERATING SCHEDULES AND SAFETY PROVISIONS SHALL BE COORDINATED BY OWNER WITH EQUIPMENT VENDOR.
- 4-INSTALLATION OF MECHANICAL SYSTEMS SHALL BE COORDINATED WITH THE OTHER TRADES.
- 5-ALL MECHANICAL EQUIPMENT SHALL BE PROPERLY HUNG BRACED FROM CEILING STRUCTURE AND ELECTRICALLY SERVED FOLLOWING MANUFACTURER INSTALLATION RECOMMENDATIONS AND THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE.
- 6-OWNER TO COORDINATE WITH HVAC EQUIPMENT VENDOR THE REQUIRED CONTROLS AND SYSTEM AUTOMATION BASED ON SECURITY, OPERATING SCHEDULE AND ENERGY MANAGEMENT.
- 7-ALL WALL MOUNTED EQUIPMENT SHALL BE PROPERLY SUPPORTED.



CASSETTES UNIT TRAP DETAIL

NOT TO SCALE



NOTE: MINIMUM 2 CABLES PER EACH EQUIPMENT ITEM

TYPICAL EQUIPMENT AND DUCTWORK TIE-DOWN DETAIL

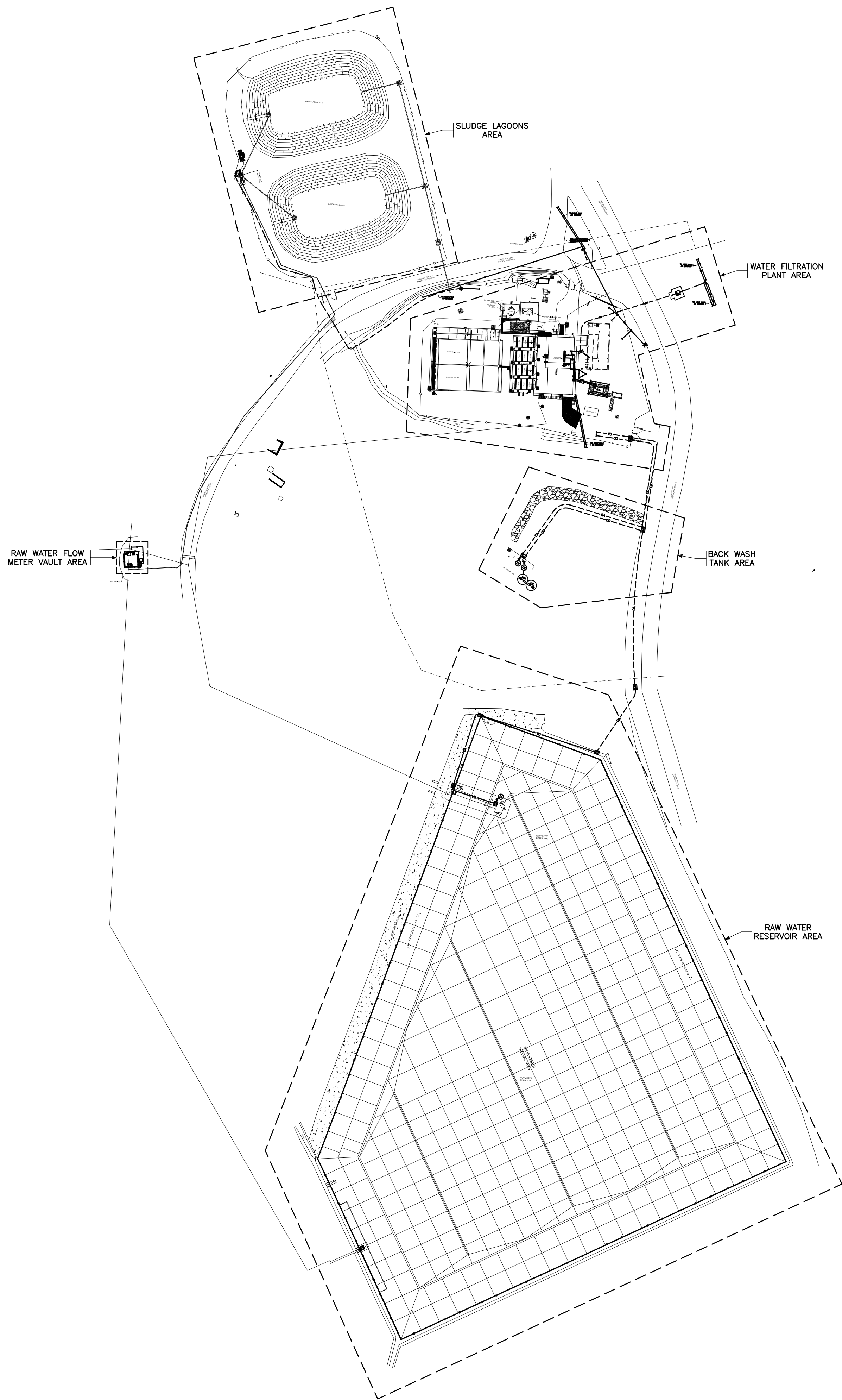
NOT TO SCALE

GENERAL NOTES:

1. ALL DUCTS AND PLENUMS SHALL BE CONSTRUCTED OF GALVANIZED SHEET METAL OF GAUGES AND REINFORCED AS PER SMACNA REQUIREMENTS IN SECTION 7 OF THE SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE - 1995* AND DUCTMATE PROPRIETARY DUCT CONNECTION SYSTEMS; THOSE CONSTRUCTED USING DUCTMATE SHALL BE IN ACCORDANCE WITH MANUFACTURER GUIDELINES. DUCTS CONSTRUCTION SHALL BE USING G-60 OR BETTER GALVANIZED STEEL (ASTM 527) LFO CHEMICAL TREATMENT. LONGITUDINAL SEAMS SHALL BE PITTSBURGH LOCK L-1 SEALED WITH DUCT SEALANT 3M #800 OR APPROVED EQUAL TRANSVERSE JOINTS SHALL BE AS PER SMACNA STANDARDS. GAUGES AND REINFORCEMENT SHALL BE FOR THE OPERATING PRESSURES OR FOR 2" W.G. NEG. OR POS. WHICHEVER IS HIGHER. CROSS BREAK ALL RECTANGULAR DUCTS LARGER THAN 12" IN. LARGER DIMENSION, FOR STIFFENING ACCESS DOORS SHALL BE PROVIDED FOR SERVICE OF DAMPERS OR OTHER EQUIPMENT.
2. WHERE SPACE CONDITIONS PERMIT, ROUND ELBOWS WITH A THROAT RADIUS NOT LESS THAN THE WIDTH OF THE DUCT IN THE PLANE OF THE TURN SHALL BE USED. WHERE SQUARE ELBOWS MIGHT BE REQUIRED SHALL BE FITTED WITH DOUBLE BLADE TURNING VANES.
3. PROVIDE ALL NECESSARY OFFSETS AND TRANSFORMATIONS REQUIRED IN THE SHEET METAL WORK TO AVOID INTERFERENCE WITH THE BUILDING CONSTRUCTION OR EQUIPMENT. NO PIPE, ELECTRICAL CONDUIT, OR STRUCTURAL MEMBER SHALL PASS THROUGH ANY DUCT.
4. INSULATION SHALL BE APPLIED TO ALL SUPPLY AND RETURN AIR CONDITIONING DUCTWORK. THE INSULATION SHALL BE FLEXIBLE FIBERGLASS, 1" THICKNESS, 3/4 PCF WITH FACTORY APPLIED ALUMINUM FOIL-REINFORCED KRAFT WITH A COMBINED RATING OF 25/50 FLAME SPREAD AND SMOKE DEVELOPMENT. INSULATION SHALL BE ADHERED TO DUCT WITH 4" STRIPS OF BONDING ADHESIVE AT 8" O.C. ON TRANSVERSAL AND LONGITUDINAL JOINTS. JOINTS SHALL BE SEALED WITH 3" WIDE STRIPS OF BENJAMIN FOSTER 30-35. ALL DUCTS SHALL BE PROPERLY SEALED TO PREVENT BALLOONING OF INSULATION. ALL DUCTS EXPOSED TO WEATHER SHALL BE INSULATED WITH FLEXIBLE FORMED PLASTICSHEET (ARMAFLEX) MATERIAL, 3/4" THICK. APPLY A THIN COAT OF ADHESIVE (ARMSTRONG #520) TO BOTH SURFACES TO BE JOINED. ALL LONGITUDINAL AND TRANSVERSE JOINTS SHALL BE JOINED WITH ADHESIVE AND ADJACENT SHEETS OF INSULATION SHALL BE COMPRESSION FIT IN PLACE. TREAT ENTIRE INSULATION SURFACE WITH TWO COATS OF ARMAFLEX FINISH TO PROTECT AGAINST WEATHER.
5. DUCTS SHALL BE SECURELY AND RIGIDLY ANCHORED AND SUPPORTED FROM THE BUILDING STRUCTURE BY MEANS OF THREADED HANGER RODS AND STEEL ANGLES HANGERS AT EVERY TRANSVERSE JOINT, BUT NOT MORE THAN 4 FEET APART. HANGER RODS SHALL BE SIZED FOR THE WEIGHT CARRIED, THREADED AT BOTH ENDS AND EQUIPPED WITH NUTS AND WASHERS. RODS SHALL PIERCE THE ANGLES USED AS BOTTOM SUPPORTS. ALL HANGERS SHALL BE CROSS-BRACED WHERE NEEDED TO PROVIDE RIGID SUPPORT.
6. PROVIDE SMOKE DETECTOR TO BE INTERLOCKED WITH AHU'S IN ORDER TO STOP THE UNIT IF SMOKE IS SENSED. SMOKE DETECTOR SHALL BE PHOTOELECTRIC UL & FM APPROVED. UNIT TO BE INSTALLED AS PER MANUFACTURER RECOMMENDATIONS AS REQUIRED BY THE FIRE MARSHALL.
7. THE AIR CONDITIONING SYSTEM SHALL BE TESTED AND BALANCED BY A CERTIFIED TEST AND BALANCE ENGINEER.
8. ALL MECHANICAL SYSTEM SHALL BE PROPERLY RESTRAINED AGAINST SEISMIC EFFECTS. CONTRACTOR SHALL COORDINATE WITH A MANUFACTURER OF VIBRATION ISOLATION AND SEISMIC RESTRAIN PRODUCTS FOR THE PROPER EQUIPMENT AND/OR ACCESSORIES TO BE USED FOR THE PROTECTION AGAINST SEISMIC EFFECTS FOR THE MECHANICAL SYSTEMS IN ACCORDANCE WITH LOCAL CODES. ALL THESE SHALL BE BASED ON THE SYSTEMS TO BE INSTALLED.
10. ALL EXTERIOR DUCTWORK SHALL BE INSULATED WITH 3/4" FLEXIBLE FORMED PLASTIC SHEET, ARMAFLEX APPLY ADHESIVE TO SURFACES TO BE JOINED; FINISH WITH A BACK COAT OF FOSTER SAFETEE MASTIC AND EMBED A WITH GLASS CLOTH AND ANOTHER COAT OF MASTIC
11. ALL DUCTS PASSING THROUGH FIRE RATED WALLS SHALL BE PROVIDED WITH DYNAMIC DAMPERS. UNITS SHALL BE 1 1/2"HR RATED, CLASSIFIED TO MEET UL 555 STANDARD LATES EDITION; GALVANIZED STEEL CONSTRUCTION RUSKIN CURTAIN SLIT 180 SINGLE OR MULTI-SECTION; USE STYLE C FOR RECTANGULAR DUCTS.
12. ALL AIR CONDITIONING WORK SHALL BE PERFORMED IN ACCORDANCE WITH NFPA 90A, PUERTO RICO CONSERVATION CODE, AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS INSTITUTE, CONTRACT DOCUMENTS AND THE REQUIREMENTS OF THE INSURANCE UNDERWRITERS.
13. CONTRACTOR SHALL FURNISH AND INSTALL PIPING VALVES, SENSORS, CONTROL SYSTEMS AND ANY OTHER ITEM NOT INDICATED NOR SPECIFIED BUT REQUIRED AND/OR RECOMMENDED FOR THE FUNCTIONING AND OPERATION OF THE SYSTEM.
14. CONTRACTOR SHALL ADJUST FANS TO THE REQUIRED CFM. CHANGE PULLEYS, BELTS AND/OR MOTORS AS REQUIRED TO MEET AIR QUANTITIES.
15. THE CONTRACTOR SHALL, WITHOUT EXTRA CHARGE, MAKE REASONABLE MODIFICATIONS IN THE DUCT AND PIPING ARRANGEMENTS AS NEEDED TO PREVENT CONFLICT WITH WORK OF OTHER TRADES OR FOR PROPER EXECUTION OF THE WORK.
16. ALL EQUIPMENT AND MATERIAL SHALL BE INSTALLED WITH THE APPROVAL OF THE OWNER IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER AND THE SPECIFICATIONS ISSUED FOR THIS PROJECT.
17. CONTRACTOR SHALL LOCATE IN FULLY ACCESSIBLE POSITIONS ALL EQUIPMENT WHICH MUST BE SERVICED, OPERATED, OR MAINTAINED.
18. ALL MATERIALS AND EQUIPMENT TO BE INSTALLED SHALL BE NEW, UNLESS OTHERWISE INDICATED.
19. IN CASE OF DISCREPANCY BETWEEN THE EQUIPMENT SPECIFIED AND THE EQUIPMENT SUPPLIED, THE CONTRACTOR SHALL ARRANGE FOR THE PROPER INSTALLATION OF THE EQUIPMENT.
21. ALL DUCT AND PIPE PENETRATION THRU WALLS OR FLOORS SHALL BE SEALED WITH SUITABLE UL LISTED SYSTEM.
22. FOAMED PLASTIC TUBING INSULATION SHALL BE COVERED WITH GLASS FABRIC EMBEDDED BETWEEN TWO 1/16" COATS OF VAPOR BARRIER MASTIC IN ORDER TO MEET NFPA REQUIREMENTS.
23. AFTER COMPLETION OF THE INSTALLATION THE CONTRACTOR SHALL MAKE ALL NECESSARY TESTS, ADJUSTMENTS, AND BALANCE THE SYSTEM TO PROVIDE UNIFORM COOLING THROUGHOUT. APPARATUS SHALL PERFORM SATISFACTORILY AND TEST NECESSARY TO SHOW IT IS CAPABLE OF MEETING SPECIFIED CONDITIONS.FURNISH ALL LABOR AND INSTRUMENTS FOR TESTS AND ADJUSTMENTS. AS PART OF THIS CONTRACT THE CONTRACTOR SHALL MAKE ANY CHANGES IN THE PULLEYS, BELT AND DAMPERS OR THE ADDITION OF DAMPERS CORRECT BALANCE AS RECOMMENDED BY BALANCING CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
24. CONTRACTORS SHALL INSTALL AN ADEQUATE FLASHING AT ALL DUCTS PENETRATIONS THRU WALLS AND ROOF TO PREVENT MOISTURE OR WATER LEAKAGE, AND SHALL INSULATE, AS REQUIRED, ANY DUCTWORK EXPOSED IN THE CONDITIONED SPACE IN ORDER TO PREVENT CONDENSATION OR SWEATING OF THE DUCT.
25. 1 INCH ACOUSTICAL LINER SHALL BE INSTALLED IN THE FIRST 15 FEET OF ALL DUCTWORK ENTERING OR LEAVING THE EQUIPMENT, AS MINIMUM.DUCT LINER MAY BE REDUCED TO 10 FEET IF TWO 90 DEG ELLS OCCUR WITHIN THE FIRST 15 FEET.
26. THE DISPOSABLE HVAC FILTERS ARE TO BE CHANGED JUST PRIOR TO THE OPENING.
27. ALL CONDENSATE DRAIN PIPE SHALL BE INSULATED WITH 1" ISOCYANURATE (POLYURETHANE) AND COVERED WITH FLAME RETARDANT FOIL - KRAFT PAPER LAMINATED JACKET WITH THE WHITE PAPER SIDE OUT WITH COMBINED RATING OF 25/50 FLAME SPREAD AND SMOKE DEVELOPMENT. ALL JOINTS IN JACKET SHALL BE VAPOR SEALED WITH WHITE VAPOR BARRIER LAP ADHESIVE FOSTER DRION CONTACT BOND CEMENT 85-75. END JOINTS SHALL BE SEALED WITH VAPOR BARRIER STRIPS OR TAPE.
28. ALL REFRIGERANT LINES SHALL BE INSULATED WITH 3/4" NOMINAL THICKNESS FOAMED PLASTIC CLOSED-CELL (K=0.27), SEALED WITH AN ADEQUATE ADHESIVE. INSULATION SHALL BE ARMSTRONG'S ARMAFLEX OR APPROVED SIMILAR, INSTALLED AS PER MANUFACTURER'S INSTRUCTIONS.
29. ALL CASSETTES AND FAN COILS UNITS SHALL BE SECURELY AND RIGIDLY ANCHORED AND SUPPORTED FROM THE BUILDING STRUCTURE BY MEANS OF THREADED HANGER RODS AND STEEL ANGLES HANGERS. HANGER RODS SHALL BE SIZED FOR THE WEIGHT CARRIED, THREADED AT BOTH ENDS AND EQUIPPED WITH NUTS AND WASHERS. RODS SHALL PIERCE THE ANGLES USED AS BOTTOM SUPPORTS. ALL HANGERS SHALL BE CROSS-BRACED WHERE NEEDED TO PROVIDE RIGID SUPPORT. ANY ADDITIONAL STRUCTURAL MEMBERS REQUIRED TO SUPPORT THE CASSETTES AND FAN COIL UNITS SHALL BE PROVIDED, FIELD COORDINATED AND SIZED BY THE CONTRACTOR AT NO ADDITIONAL COST.

Integra Design Group
DATE ISSUE
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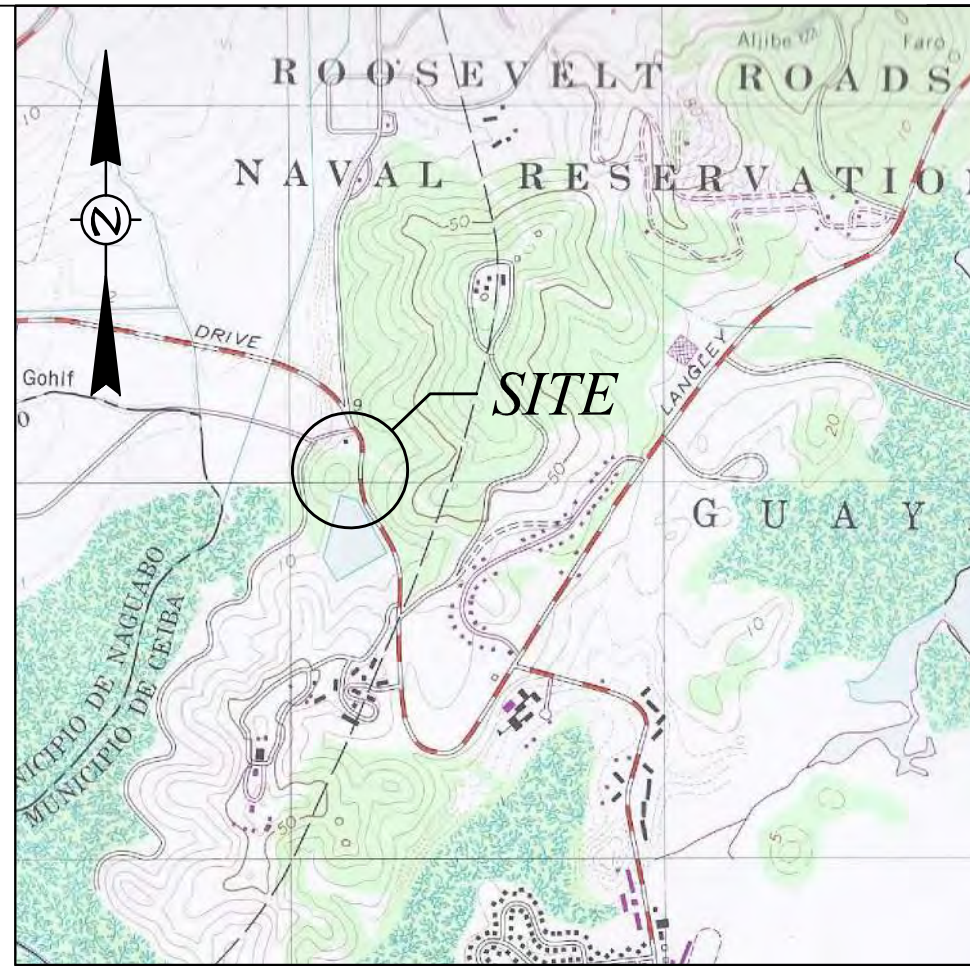
YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OPCI.



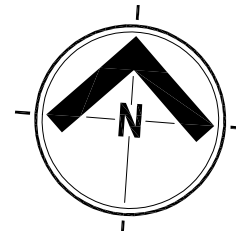
ELECTRICAL MASTER OFF-SITE PLAN
SCALE: 1:1,000

- SITE LEGEND:**
- 38 — EXISTING OVERHEAD 38 KV TRANSMISSION LINE TO REMAIN.
 - EXISTING OVERHEAD 13.2 KV PRIMARY LINE TO REMAIN.
 - T — EXISTING OVERHEAD TELEPHONE LINE TO REMAIN.
 - S — EXISTING OVERHEAD SECONDARY LINE TO REMAIN.
 - EXISTING TRIPLEX TYPE OVERHEAD SECONDARY LINE TO REMAIN.
 - C — EXISTING OVERHEAD COMMUNICATION LINE TO REMAIN.
 - EXISTING CREOSOTED WOOD TRANSMISSION POLE TO REMAIN.
 - EXISTING CREOSOTED WOOD PRIMARY POLE TO REMAIN.
 - EXISTING CREOSOTED WOOD SECONDARY POLE TO REMAIN.
 - S EXISTING POLE MOUNTED FUSED CUT-OUT FOR PRIMARY RISER CONNECTION FOR PAD MOUNTED TRANSFORMER TO REMAIN.
 - VVV EXISTING POLE MOUNTED SUBSTATION TO REMAIN.
 - EXISTING SECONDARY RISER CONNECTION TO REMAIN.
 - EXISTING PRIMARY DOWN GUY TO REMAIN.
 - EXISTING SECONDARY DOWN GUY TO REMAIN.
 - OGW — EXISTING OVERHEAD GUY WIRE TO REMAIN.
 - EXISTING POLE MOUNTED LUMINARY TO REMAIN.
 - EXISTING UNDERGROUND PRIMARY FEEDER FOR PAD MOUNTED TRANSFORMER TO REMAIN.
 - EXISTING PAD MOUNTED TRANSFORMER FOR WATER FILTRATION PLANT TO BE REPLACED AS DESCRIBED IN THE ELECTRICAL RISER DIAGRAM.
 - EMF --- EXISTING MAIN SECONDARY FEEDER FROM PAD MOUNTED TRANSFORMER TO WATER FILTER PLANT TO BE UP-GRADED AS PER ELECTRICAL RISER DIAGRAM.
 - EDP EXISTING EMERGENCY MAIN DISTRIBUTION PANELBOARD TO BE REMOVED AND REPLACED WITH NEW NORMAL SERVICE MAIN DISCONNECT AS PER ELECTRICAL RISER DIAGRAM.
 - ATS EXISTING AUTOMATIC TRANSFER SWITCH TO BE REMOVED AND REPLACED WITH NEW ONE AS PER ELECTRICAL RISER DIAGRAM AND EMERGENCY GENERATOR DESCRIPTION.
 - EXISTING MAIN DISTRIBUTION PANELBOARD TO BE REMOVED.
 - E EXISTING EMERGENCY SERVICE MAIN DISCONNECT OR PANELBOARD TO BE REMOVED.
 - ER --- EXISTING UNDERGROUND ELECTRICAL FEEDER FOR REMOTE PUMP STATION TO BE RE-WIRED AS PER ELECTRICAL RISER DIAGRAM.
 - EA --- EXISTING ELECTRICAL FEEDER TO BE ABANDONED OR REMOVED.
 - EPB EXISTING ELECTRIC PULL BOX TO REMAIN AND TO BE RE-WIRED.
 - EMB NEW EMERGENCY SERVICE MAIN DISCONNECT AS PER ELECTRICAL RISER DIAGRAM.
 - NATS NEW AUTOMATIC TRANSFER SWITCH AS PER ELECTRICAL RISER DIAGRAM AND EMERGENCY GENERATOR DESCRIPTION.
 - EXISTING MOTOR CONTROL CENTER TO BE REPLACED WITH NEW ONE AS PER ELECTRICAL RISER DIAGRAM.
 - R EXISTING ELECTRICAL FEEDER TO MOTOR CONTROL CENTER TO BE REPLACED WITH NEW ONE AS PER ELECTRICAL RISER DIAGRAM.
 - E.G. EXISTING EMERGENCY GENERATOR TO BE REPLACED WITH NEW ONE AS PER ELECTRICAL RISER DIAGRAM AND EMERGENCY GENERATOR DESCRIPTION.
 - E.D.F.T. EXISTING DIESEL FUEL TANK TO BE REPLACED WITH NEW SUB-BASE FUEL TANK INTEGRATED WITH THE GENERATOR AS PER EMERGENCY GENERATOR DESCRIPTION.
 - EXISTING DRY TYPE TRANSFORMER TO BE RE-INSTALLED AS PER ELECTRICAL RISER DIAGRAM AND ELECTRICAL DISTRIBUTION DRAWINGS.
 - ⊕ EXISTING METAL POLE WITH OUT OF SERVICE LUMINARIES, SHALL BE BE PAINTED AND RE-CONDITIONED AND EXISTING LUMINARIES SHALL BE REPLACED AS PER ELECTRICAL RISER DIAGRAM.
 - NMB NORMAL SERVICE MAIN DISCONNECT AS PER ELECTRICAL RISER DIAGRAM.
 - NEW MOTOR CONTROL CENTER AS PER ELECTRICAL RISER DIAGRAM AND MOTOR CONTROL CENTER DESCRIPTION.
 - DISTRIBUTION PANELBOARD FOR 480 V DISTRIBUTION AS PER ELECTRICAL RISER DIAGRAM AND PANELBOARD SCHEDULE.
 - DISTRIBUTION PANELBOARD FOR 208 V DISTRIBUTION AS PER ELECTRICAL RISER DIAGRAM AND PANELBOARD SCHEDULE.

- EM — EXPOSED SECTION OF ELECTRICAL FEEDER FOR EMERGENCY FACILITIES AS PER ELECTRICAL RISER DIAGRAM.
- EM --- UNDERGROUND SECTION OF ELECTRICAL FEEDER FOR EMERGENCY FACILITIES AS PER ELECTRICAL RISER DIAGRAM.
- EC — EXPOSED SECTION OF CONTROL CONNECTION FROM AUTOMATIC TRANSFER SWITCH TO EMERGENCY GENERATOR AS PER ELECTRICAL RISER DIAGRAM.
- EC --- UNDERGROUND SECTION OF CONTROL CONNECTION FROM AUTOMATIC TRANSFER SWITCH TO EMERGENCY GENERATOR AS PER ELECTRICAL RISER DIAGRAM.
- G — EXPOSED SECTION OF GROUND CONNECTION AS PER ELECTRICAL RISER DIAGRAM.
- G --- UNDERGROUND SECTION OF GROUND CONNECTION AS PER ELECTRICAL RISER DIAGRAM.
- COPPER CLAD GROUND ROD AS PER ELECTRICAL RISER DIAGRAM.
- △ DELTA GROUNDING MAT AS PER ELECTRICAL RISER DIAGRAM.
- JB JUNCTION BOX FOR TRANSITION FROM UNDERGROUND TO EXPOSED ELECTRICAL FEEDER AS PER ELECTRICAL RISER DIAGRAM AND ELECTRICAL DISTRIBUTION DRAWINGS.
- POLE MOUNTED LUMINARIE AS PER LIGHTING FIXTURE SCHEDULE.
- POLE MOUNTED PHOTOVOLTAIC LUMINARIE INCLUDING BATTERY, INVERTER AND ALL REQUIRED ACCESSORIES FOR A COMPLETE OPERATION AS PER LIGHTING FIXTURE SCHEDULE.
- CJ CONTROL JUNCTION BOX AS PER ELECTRICAL DISTRIBUTION DRAWINGS AND LEGEND.
- PJ POWER JUNCTION BOX AS PER ELECTRICAL DISTRIBUTION DRAWINGS AND LEGEND.
- NCP NEW CONTROL PANEL AS PER ELECTRICAL DISTRIBUTION DRAWINGS AND LEGEND.
- DISCONNECT SWITCH AS PER ELECTRICAL DISTRIBUTION DRAWINGS, LEGEND AND SCHEDULES.
- MAGNETIC COMBINATION STARTER AS PER ELECTRICAL DISTRIBUTION DRAWINGS, LEGEND AND SCHEDULES.
- CP-1 MAIN CONTROL PANEL AS PER INSTRUMENTATION DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- VFD ENCLOSED VARIABLE FREQUENCY DRIVE AS PER ELECTRICAL DISTRIBUTION DRAWINGS, LEGEND AND SCHEDULES.
- LCP LOCAL CONTROL PANEL AS PER ELECTRICAL DISTRIBUTION DRAWINGS, LEGEND AND SCHEDULES.
- CPB CONTROL PULL BOX AS PER ELECTRICAL DISTRIBUTION DRAWINGS AND DETAILS IN DRAWING RWR-E100.
- UPB POWER PULL BOX AS PER ELECTRICAL DISTRIBUTION DRAWINGS AND DETAILS IN DRAWING RWR-E100.
- > ELECTRICAL HOME RUN TO PANELBOARD AS PER ELECTRICAL DISTRIBUTION DRAWINGS.
- CA --- UNDERGROUND ANALOG CONTROL CONNECTION AS PER ELECTRICAL DISTRIBUTION DRAWINGS.
- CA — EXPOSED ANALOG CONTROL CONNECTION AS PER ELECTRICAL DISTRIBUTION DRAWINGS.
- CD --- UNDERGROUND DIGITAL CONTROL CONNECTION AS PER ELECTRICAL DISTRIBUTION DRAWINGS.
- CD — EXPOSED DIGITAL CONTROL CONNECTION AS PER ELECTRICAL DISTRIBUTION DRAWINGS.
- LT LEVEL TRANSMITTER SENSOR AS PER INSTRUMENTATION DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- LS LEVEL SENSOR SWITCH AS PER INSTRUMENTATION DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- SP SAMPLING PUMP AS PER MECHANICAL DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- MP METERING PUMP AS PER MECHANICAL DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- S TYPICAL PUMP AS PER MECHANICAL DRAWINGS AND ELECTRICAL DISTRIBUTION DRAWINGS.
- FILTER CONSOLE AS PER INSTRUMENTATION, MECHANICAL AND ELECTRICAL DISTRIBUTION DRAWINGS.



LOCATION
NAD 83
X= 282404.557
Y= 243176.005
SCALE: 1 : 20,000



GRAPHIC SCALE = 1:1,000



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIACION 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by:
Dwg. Date:

Revisions

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

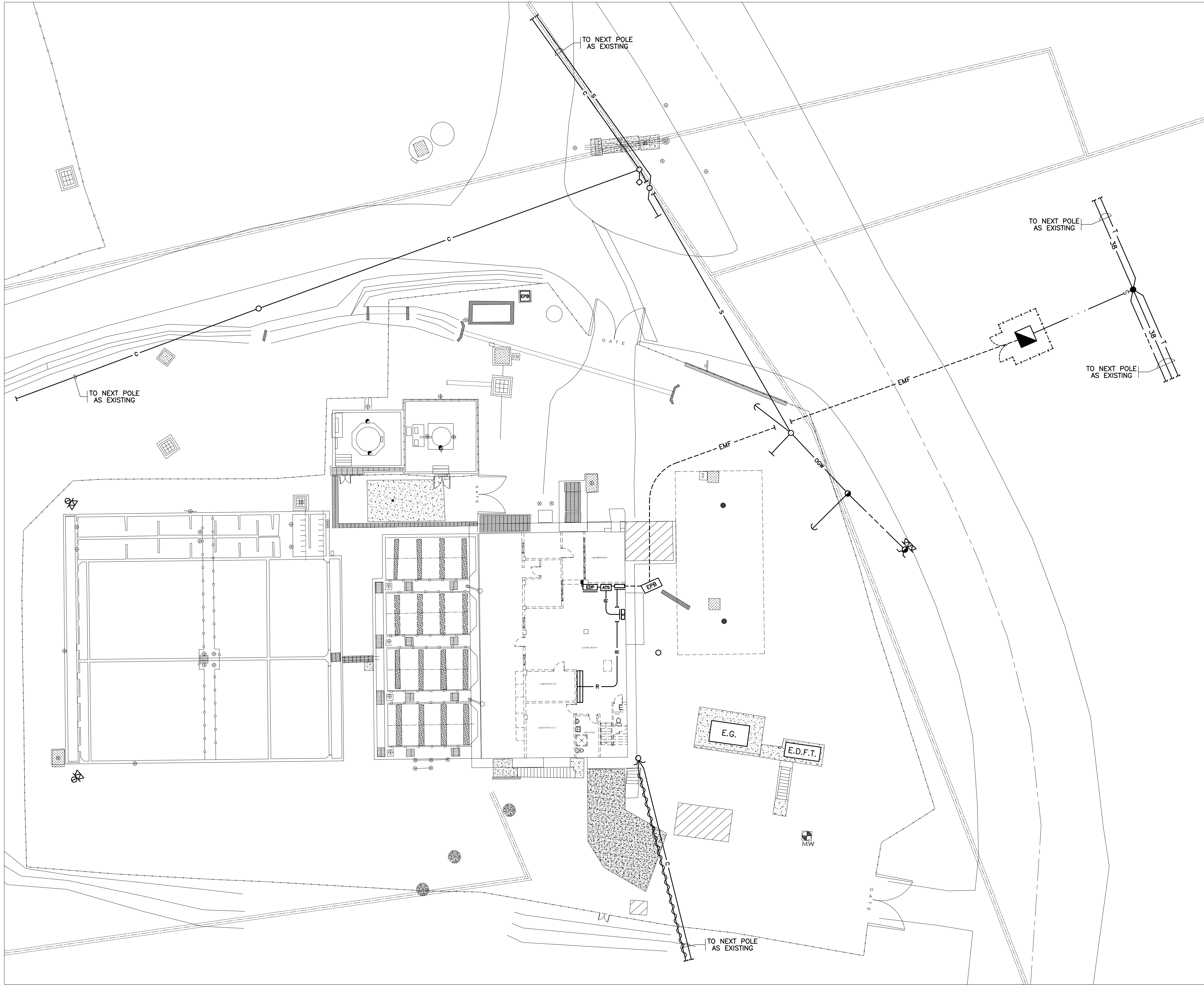


WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT
Drawing Title:
ELECTRICAL MASTER OFF-SITE PLAN

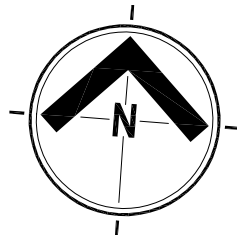
WTP-E100

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**WATER FILTRATION PLANT
EXISTING ELECTRICAL SITE PLAN**
SCALE: 1:200

NOTE:
FOR SITE SYMBOLS REFER TO DRAWING WTP-E100 AND
FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION
SYMBOLS REFER DRAWING WTP-E218.



IMPORTANT NOTE:
1. ILLUSTRATED LOCATION OF TRANSMISSION POLE,
UNDERGROUND PRIMARY FEEDER, PAD MOUNTED
TRANSFORMER AND UNDERGROUND MAIN SECONDARY
FEEDER ARE APPROXIMATES FOR REFERENCE PURPOSE
ONLY.



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DATE ISSUE
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BID SET

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PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS
ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE
DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES
DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS
REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS
REGlamentadoras O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO
QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA
PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS
AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN
RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT
Drawing Title: WATER TREATMENT PLANT
Sheet: WTP-E101

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



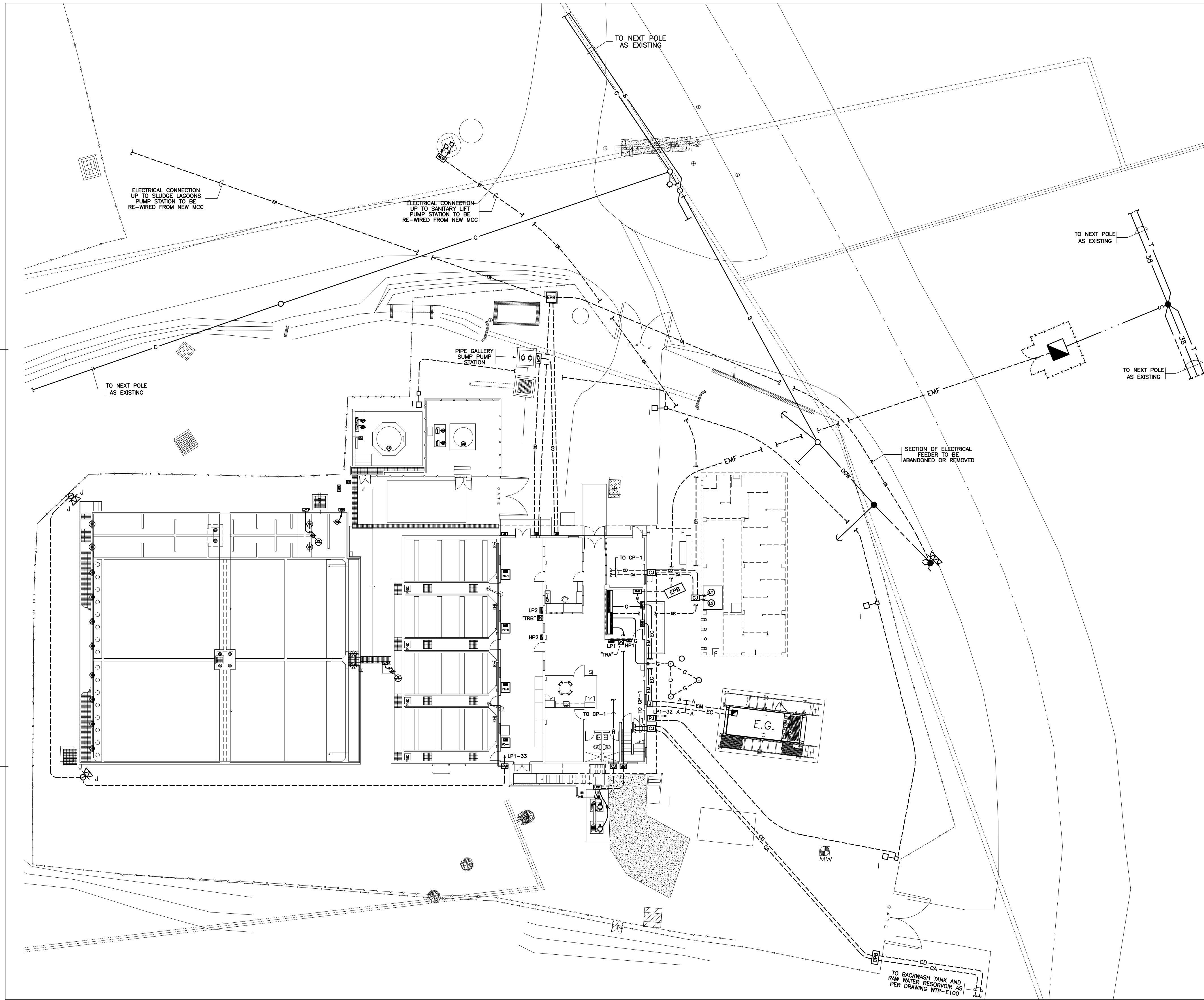
WATER TREATMENT PLANT
Drawing Title: EXISTING ELECTRICAL SITE PLAN AND LEGEND

Revisions

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by:
Dwg. Date:

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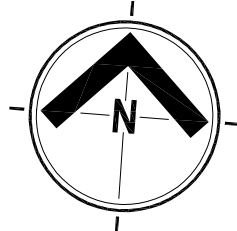


WATER FILTRATION PLANT
PROPOSED ELECTRICAL SITE PLAN

SCALE: 1:200

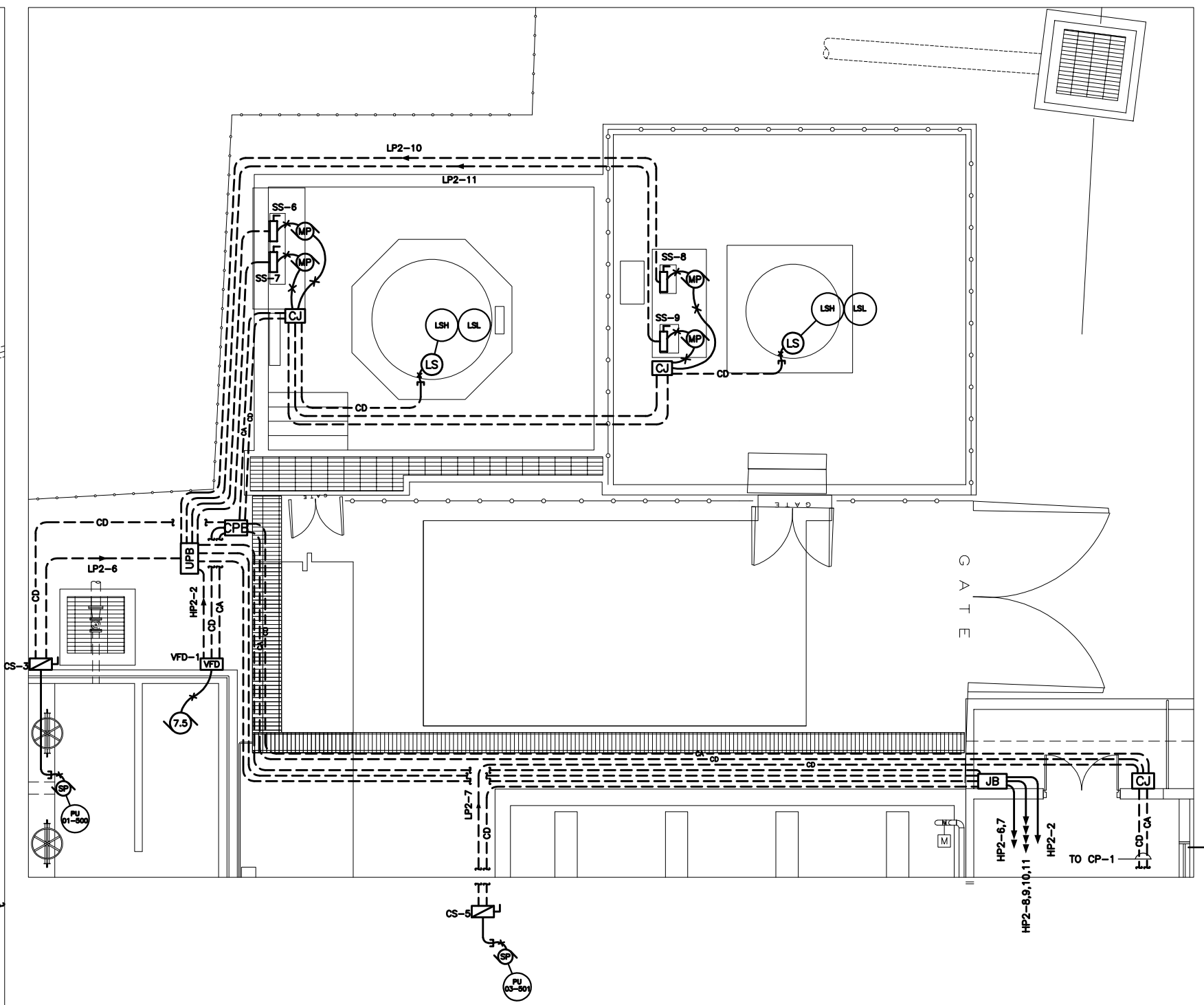
IMPORTANT NOTE:

1. ILLUSTRATED LOCATION OF TRANSMISSION POLE, UNDERGROUND PRIMARY FEEDER, PAD MOUNTED TRANSFORMER AND UNDERGROUND MAIN SECONDARY FEEDER ARE APPROXIMATES FOR REFERENCE PURPOSE ONLY.



NOTE:

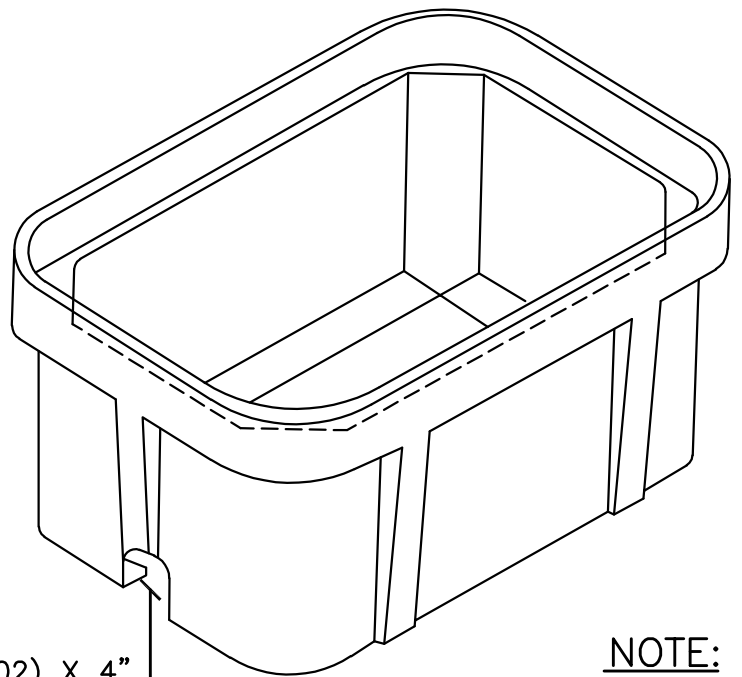
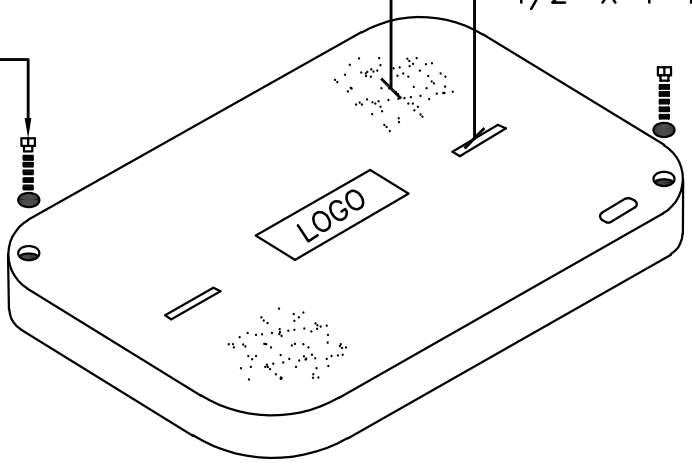
FOR SITE SYMBOLS REFER TO DRAWING WTP-E100 AND FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION SYMBOLS REFER DRAWING WTP-E218.



CHEMICAL TANKS AREA
ELECTRICAL BLOW UP

SCALE: 1:100

COVER "PG2436HH00" WITH
.5 COF SKID RESISTANT
SURFACE, FOR TRAFFIC AREA.
1/2" X 4" PULL SLOT.
3/8-16 UNC STAINLESS STEEL
HEX HEAD BOLT W/WASHER (2).



2X 4" (102) X 4" MOUSEHOLES (PG2436BB only).

NOTE:

1. POWER PULL BOX SHALL BE EQUAL OR SIMILAR TO "QUAZITE PG2436DD42" WITH 24"x36"x42" DIMENSIONS

POWER PULL BOX DETAIL
NOT TO SCALE



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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

Owner:

WATER TREATMENT PLANT

Drawing Title:

PROPOSED ELECTRICAL SITE PLAN

Revisions

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1837.0

Set Date: 2020/07/07

Drawn by:

Dwg. Date:

Ing. Ricardo Ortiz Garcia

Lic. no. 12448 P.E.

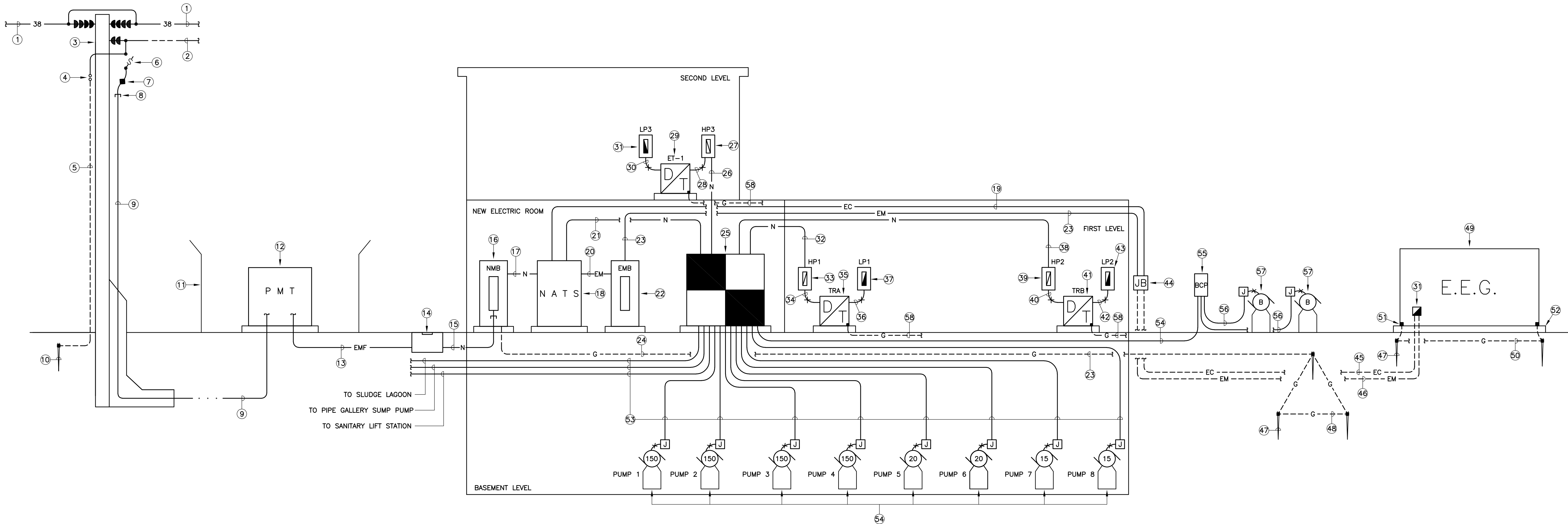
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Sheet: **WTP-E102**



ELECTRICAL RISER DIAGRAM
NOT TO SCALE

ELECTRICAL RISER DIAGRAM LEGEND:

- EXISTING OVERHEAD 38 KV TRANSMISSION LINE TO REMAIN.
- EXISTING OVERHEAD 13.2 KV PRIMARY LINE TO REMAIN.
- EXISTING CREOSOTED WOOD DAMAGED POLE TO BE REPLACED BY HURRICANES REPAIR WORKS USED FOR THE POINT OF CONNECTION FOR THE PAD MOUNTED TRANSFORMER OF WATER FILTRATION PLANT.
- EXISTING 10 KV LIGHTNING ARRESTER TO REMAIN.
- EXISTING LIGHTNING ARRESTER GROUND CONNECTION TO REMAIN.
- EXISTING POLE MOUNTED PRIMARY FUSED CUT-OUT FOR RISER CONNECTION OF PAD MOUNTED TRANSFORMER SERVICE TO REMAIN.
- EXISTING OUTDOOR PRIMARY STRESS RELIEF CONE TO REMAIN.
- EXISTING ENDBELL BUSHING WITH DUCT SEAL TO REMAIN.
- EXISTING PRIMARY FEEDER TO WATER FILTRATION PLANT PAD MOUNTED TRANSFORMER TO REMAIN.
- EXISTING PRIMARY GROUND CONNECTION ELECTRODE TO REMAIN.
- EXISTING CYCLONE FENCE FOR PAD MOUNTED TRANSFORMER YARD TO REMAIN.
- EXISTING PAD MOUNTED TRANSFORMER FOR WATER FILTRATION PLANT RATED FOR 750 KVA, 13,200 V PRIMARY VOLTAGE, 480/277 V SECONDARY VOLTAGE TO BE REPLACED WITH NEW ONE. NEW TRANSFORMER SHALL BE RATED FOR 750 KVA, 3 PHASES, 13,200 - 277/480 V, DEAD FRONT, RADIAL FEED, WITH COPPER WINDINGS, OF STAINLESS STEEL ENCLOSURE MATERIAL FOR HIGH CORROSION AREA. NEW TRANSFORMER SHALL COMPLY WITH PREPA IMPROVED LOSSES REQUIREMENTS. EXISTING TRANSFORMER SHALL BE DELIVERED TO OWNER REPRESENTATIVE.
- EXISTING SECONDARY MAIN FEEDER FROM PAD MOUNTED TRANSFORMER TO EXISTING AUTOMATIC TRANSFER SWITCH, ACTUALLY ONLY EXIST ONE SET, CONTRACTOR SHALL RE-WIRE UP TO NEW NORMAL MAIN DISCONNECT WITH THREE SETS OF 4 # 350 MCM XHHW IN EXISTING CONDUITS.
- EXISTING UNDERGROUND SECONDARY PULL BOX TO REMAIN.
- EXTENSION OF CONDUIT FOR CONNECTION OF EXISTING SECONDARY MAIN FEEDER TO NEW NORMAL SERVICE MAIN DISCONNECT CONSISTING OF 3 - 4" RGS PVC COATED CONDUITS.
- EXISTING EMERGENCY SERVICE DISTRIBUTION PANELBOARD TO BE REPLACED WITH A NEW NORMAL SERVICE MAIN DISCONNECT RATED FOR 1,000 A, 480 V, 3 PHASES, 65,000 AIC CIRCUIT BREAKER INSTALLED IN NEMA 1, GALVANIZED STEEL ENCLOSURE.
- ELECTRICAL CONNECTION FROM NEW NORMAL SERVICE MAIN DISCONNECT TO AUTOMATIC TRANSFER SWITCH CONSISTING OF THREE SETS OF 4 # 350 MCM THHN COPPER CONDUCTORS IN 4" RGS PVC COATED CONDUIT.
- EXISTING AUTOMATIC TRANSFER SWITCH TO BE REPLACED WITH NEW ONE RATED FOR 1,000 V, 480 V, 3 PHASES, PROGRAMMABLE TRANSITION WITH NEMA 1 ENCLOSURE AND 65,000 AIC, EQUAL OR BETTER TO CUMMINS OTEC.
- EXPOSED SECTION OF CONTROL CONNECTION FROM NEW AUTOMATIC TRANSFER SWITCH TO NEW EMERGENCY GENERATOR CONSISTING OF 7 # 10 AWG XHHW IN 1" RGS PVC COATED CONDUIT SUPPORTED FROM ROOF AND WALLS STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.
- ELECTRICAL CONNECTION FROM NEW AUTOMATIC TRANSFER SWITCH TO NEW EMERGENCY MAIN DISCONNECT CONSISTING OF THREE SETS OF 350 MCM THHN COPPER CONDUCTORS IN 3 - 4" RGS PVC COATED CONDUITS SUPPORTED FROM ROOF AND WALLS STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.

- ELECTRICAL CONNECTION FROM NEW AUTOMATIC TRANSFER SWITCH TO NEW MOTOR CONTROL CENTER CONSISTING OF THREE SETS OF 350 MCM THHN COPPER CONDUCTORS IN 3 - 4" RGS CONDUITS SUPPORTED FROM ROOF AND WALLS STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.
- NEW EMERGENCY SIDE MAIN DISCONNECT RATED FOR 1,000 A, 480 V, 3 PHASES, 65,000 AIC CIRCUIT BREAKER INSTALLED IN NEMA 1, GALVANIZED STEEL ENCLOSURE.
- ELECTRICAL CONNECTION FROM NEW EMERGENCY MAIN DISCONNECT TO EXTERIOR JUNCTION BOX CONSISTING OF THREE SETS OF 350 MCM THHN COPPER CONDUCTORS IN 3 - 4" RGS PVC COATED CONDUITS SUPPORTED FROM ROOF AND WALLS STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.
- GROUND CONNECTION FOR NEW NORMAL SERVICE MAIN DISCONNECT CONSISTING OF 3/0 AWG THHN COPPER CONDUCTOR IN 1.5" RGS CONDUIT SUPPORTED FROM ROOF AND WALLS STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.
- NEW MOTOR CONTROL CENTER TO REPLACE THE EXISTING ONE AS PER MOTOR CONTROL CENTER DESCRIPTION.
- ELECTRIC FEEDER FROM MOTOR CONTROL CENTER TO PANELBOARD "HP3" AS PER FEEDER SCHEDULE.
- PANELBOARD "HP3" AS PER PANELBOARD SCHEDULE.
- CONNECTION FROM PANELBOARD "HP3" TO TRANSFORMER "ET-1" AS PER PANELBOARD SCHEDULE.
- EXISTING TRANSFORMER "ET-1" TO BE RE-INSTALLED AS DESCRIBED IN DRAWINGS.
- CONNECTION FROM TRANSFORMER "ET-1" TO PANELBOARD "LP3" AS PER FEEDER SCHEDULE.
- PANELBOARD "LP3" AS PER PANELBOARD SCHEDULE.
- ELECTRIC FEEDER FROM MOTOR CONTROL CENTER TO PANELBOARD "HP1" AS PER FEEDER SCHEDULE.
- PANELBOARD "HP1" AS PER PANELBOARD SCHEDULE.
- CONNECTION FROM PANELBOARD "HP1" TO TRANSFORMER "TRA" AS PER PANELBOARD SCHEDULE.
- EXISTING TRANSFORMER "TRA" TO BE RE-INSTALLED AS DESCRIBED IN DRAWINGS.
- CONNECTION FROM TRANSFORMER "TRA" TO PANELBOARD "LP1" AS PER FEEDER SCHEDULE.
- PANELBOARD "LP1" AS PER PANELBOARD SCHEDULE.
- ELECTRIC FEEDER FROM MOTOR CONTROL CENTER TO PANELBOARD "HP2" AS PER FEEDER SCHEDULE.
- PANELBOARD "HP2" AS PER PANELBOARD SCHEDULE.
- CONNECTION FROM PANELBOARD "HP2" TO TRANSFORMER "TRB" AS PER PANELBOARD SCHEDULE.
- EXISTING TRANSFORMER "TRB" TO BE RE-INSTALLED AS DESCRIBED IN DRAWINGS.
- CONNECTION FROM TRANSFORMER "TRB" TO PANELBOARD "LP2" AS PER FEEDER SCHEDULE.

- PANELBOARD "LP2" AS PER PANELBOARD SCHEDULE.
- EXTERIOR JUNCTION BOX FOR TRANSITION FROM EXPOSED TO UNDERGROUND INSTALLATION CONSISTING OF 36" x 36" x 6" NEMA 4X STAINLESS STEEL.
- EXPOSED SECTION OF CONTROL CONNECTION FROM NEW AUTOMATIC TRANSFER SWITCH TO NEW EMERGENCY GENERATOR CONSISTING OF 7 # 10 AWG XHHW IN 1" PVC CONDUIT INSTALLED AS PER TRENCH DETAILS.
- ELECTRICAL CONNECTION FROM EXTERIOR JUNCTION BOX TO EMERGENCY GENERATOR CONSISTING OF THREE SETS OF 350 MCM XHHW COPPER CONDUCTORS IN 3 - 4" PVC CONDUITS INSTALLED AS PER TRENCH DETAILS.
- COPPER CLAD GROUND ELECTRODE FOR NEW DELTA GROUNDING MAT AND EMERGENCY GENERATOR GROUND MAT, 3/4" x 10'-0" CONNECTED WITH EXOTHERMIC CONNECTION EQUAL OR SIMILAR TO CAD WELD.
- DELTA GROUNDING MAT COPPER CONDUCTOR CONSISTING OF 1 # 3/0 AWG BARE SOFT DRAWN COPPER INSTALLED AT 12" BELOW FINISHED GRADE.
- EXISTING EMERGENCY GENERATOR TO BE REPLACED WITH NEW ONE AS PER EMERGENCY GENERATOR DESCRIPTION.
- EMERGENCY GENERATOR GROUND MAT CONDUCTOR CONSISTING OF 1 # 3/0 AWG BARE SOFT DRAWN COPPER INSTALLED AT 12" BELOW FINISHED GRADE.
- CONNECTION FROM GROUND MAT TO EMERGENCY GENERATOR ENCLOSURE CONSISTING OF 1 # 1/0 AWG BARE SOFT DRAWN COPPER AND BOLTED CONNECTION AT EMERGENCY GENERATOR.
- EMERGENCY GENERATOR CONCRETE BASE AS PER EMERGENCY GENERATOR DESCRIPTION.
- BRANCH ELECTRICAL FEEDERS FROM MOTOR CONTROL CENTER AS FEEDER SCHEDULE.
- MECHANICAL EQUIPMENTS INSTALLED AT PIPE GALLERY AS PER MECHANICAL DRAWINGS.
- BLOWER CONTROL PANEL AS SUPPLIED BY BLOWERS MANUFACTURERS.
- BRANCH ELECTRICAL FEEDERS FROM CONTROL PANEL TO BLOWERS CONSISTING OF 3 # 2 AWG THHN AND 1 # 6 AWG IN 1.5" SEALTIGHT FLEXIBLE CONDUIT.
- NEW BLOWER AS MECHANICAL DRAWINGS.



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Revisions

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Dwg. Date:



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT

WTP-E103

Sheet:

Project Title:

Drawing Title:

Owner:

Contract No.:

Scale:

Date:

Drawn by:

Checked by:

Approved by:

Signature:

Stamp:

Notes:

Comments:

Revisions:

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Drawn by:

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Project Title:

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Owner:

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Set Date:

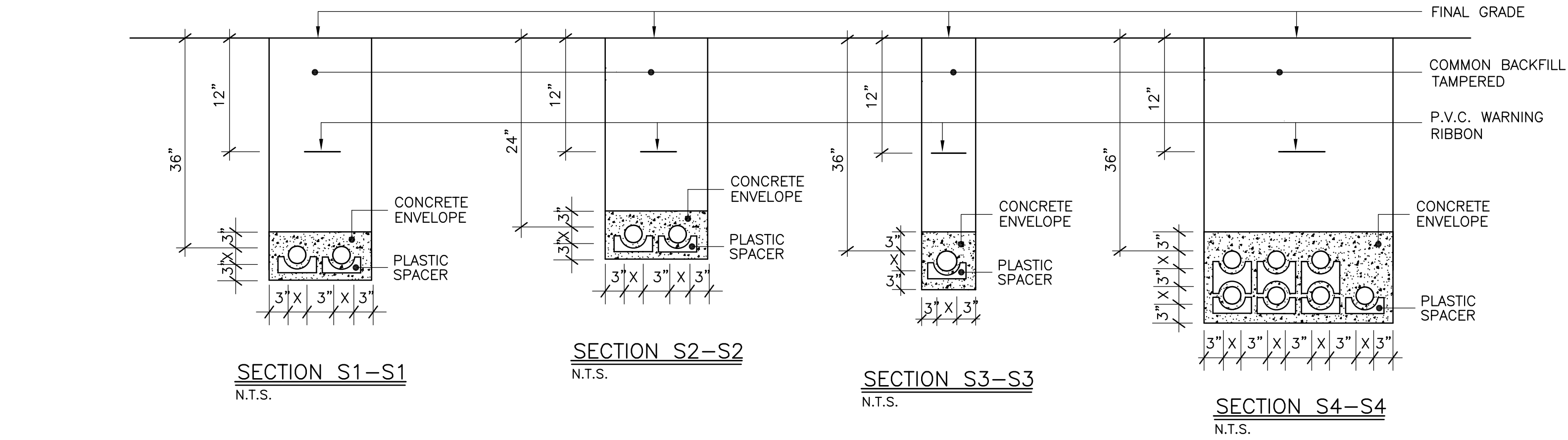
Drawn by:

Dwg. Date:

Project Title:

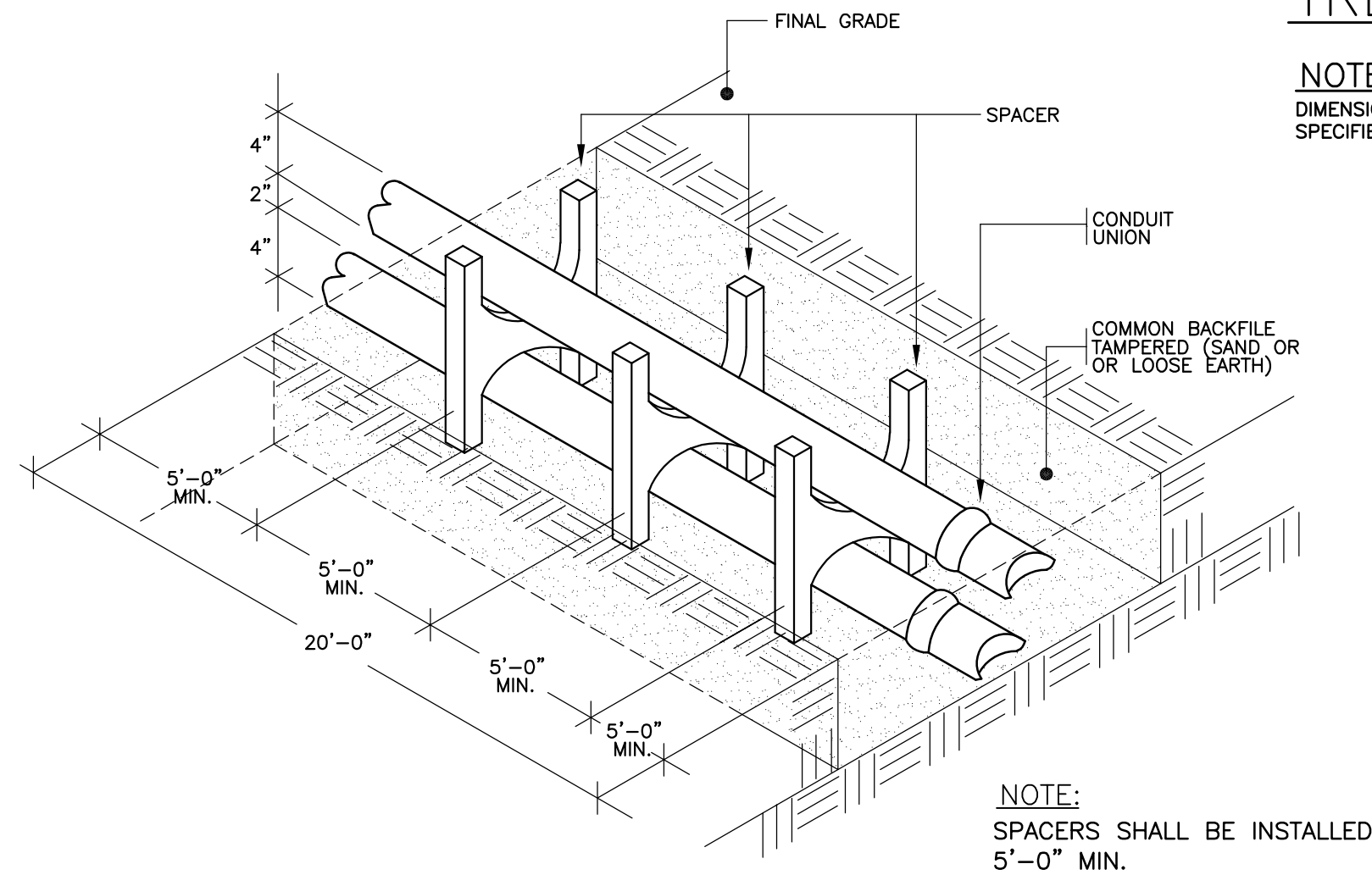
SITE NOTES:

- ALL WORK ON EXISTING ENERGIZED HIGH VOLTAGE LINES SHALL BE DONE BY P.R.E.P.A. AT CONTRACTOR EXPENSE.
- ALL CONSTRUCTION WORK SHALL BE DONE IN A THOROUGH AND WORKMANLIKE MANNER IN ACCORDANCE WITH THE PLANS, SPECS AND CONSTRUCTION DRAWINGS. THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE SHALL BE FOLLOWED EXCEPT WHERE LOCAL REGULATIONS ARE MORE STRINGENT, IN THIS CASE LOCAL REGULATIONS SHALL GOVERN.
- COORDINATE POINT OF CONNECTION AT P.R.E.P.A. LOCAL OFFICE BEFORE CONSTRUCTION BEGINS.
- WATER AND SEWAGE PIPE LINE SHALL NOT BE PLACED UNDER OR PASS THROUGH OR ABOVE THE SUBSTATION.
- ALL EQUIPMENT SHALL BE CONSTRUCTED ACCORDING TO A.N.S.I., N.E.M.A. AND P.R.E.P.A. STANDARDS.
- INSTALL APPROVED PREFABRICATED STRESS RELIEF CONES AT ALL PRIMARY CABLE TERMINATIONS.
- CONTRACTOR SHALL SUPPLY ONE SPARE FUSE FOR EACH PRIMARY FUSE HOLDER.
- BLADE OR FUSE RUNS SHALL ALWAYS CLEAR METAL PARTS BY AT LEAST SIX (6) INCHES.
- OPEN BLADE OR FUSE OF PRIMARY SWITCH SHALL BE DE-ENERGIZED.
- UP TO ONE MILE FROM SEA SHORE, ALL EQUIPMENT SHALL BE STAINLESS STEEL OR GALVANIZED STEEL WITH HEAVY DUTY FENDIX.
- CONTRACTOR SHALL COORDINATE ELECTRICAL CROSSING UNDER HIGHWAYS WITH THE PUBLIC WORKS DEPARTMENT.
- METER BANKS SHALL BE ACCESSIBLE TO P.R.E.P.A. METER READERS ALL TIMES. NO LICKING DOORS SHALL BE PERMITTED, USE CLOSET LATCH. NO STORAGE SHALL BE PERMITTED IN METER LOCKERS.
- CONCRETE BASES FOR THE INSTALLATION OF SWITCHGEAR SHALL BE COORDINATED WITH P.R.E.P.A. AND CONSTRUCTED SO AS TO PROVIDE SUFFICIENT CLEARANCE BETWEEN CONDUIT TERMINATIONS AND SWITCHGEAR CABLE TERMINALS, AND FOR MINIMUM BENDING RADIIOS BY SHIELDED CABLES AND STRESS CONES.
- ELECTRICAL CONTRACTOR SHALL NOTIFY THE P.R.E.P.A. AREA OFFICE ON BEGINNING ELECTRICAL WORK ON THE PROJECT.
- ANY CUSTOMER DEMANDING MORE THAN 50 KVA SHALL BE BILLED ACCORDING TO PRIMARY RATE GSP-1 BY APPLYING A FIXED PERCENTAGE OF TRANSFORMATION LOSSES TO THE CONSUMPTION AND DEMAND METERED IN THE SECONDARY SIDE.
- CONSTRUCTION OF NEW LINES SHALL BE DONE BY CONTRACTOR EXCEPT AS OTHERWISE NOTED.
- FOR ALL STANDARDS NUMBERS REFER TO P.R.E.P.A. DISTRIBUTION STANDARDS MANUALS.
- TRANSFORMERS SHALL BE SELF COOLED, OIL IMMersed, WITH 4-2 1/2% FULL CAPACITY VOLTAGE TAPS, BELOW NORMAL PRIMARY RATED VOLTAGE, AS REQUIRED BY P.R.E.P.A.
- GROUND SYSTEM SHALL HAVE A MAXIMUM RESISTANCE OF 10 OHMS.
- TERRAIN CONDITIONS.
- ANY LINE RELOCATIONS SHALL BE EQUAL OR BETTER THAN THE EXISTING ONE AND IN ACCORD TO THE LATEST ENFORCED STANDARDS.
- PROVIDE ELECTRICAL IDENTIFYING TAPE FOR UNDERGROUND CABLES 6" WIDE YELLOW COLOR. INSTALLED OVER ALL DIRECT BURIAL UNDERGROUND CABLES AND DUCTS AT 12" B.F.G. TAPE SHALL BE PERMANENTLY PRINTED WITH CONTINUOUS BLACK LETTERS 1 1/4" x 5/8" WITH THE WORD "PELIGRO - PELIGRO" ETC. AT THE TOP AND "LINEAS ELECTRICAS DEBAJO" AT BOTTOM.
- THE P.R.E.P.A. SHALL NOT ENERGIZE THIS PROJECT UNTIL THE OWNER HAS GRANTED THE CORRESPONDING RIGHT OF WAY AT P.R.E.P.A. LEGAL DIVISION.
- ALL ELECTRICAL CONSTRUCTION SHALL BE CERTIFICATED AND INSPECTED BY AN AUTHORIZED INSPECTOR BEFORE THE CONNECTION TO P.R.E.P.A.'S ELECTRICAL SYSTEM IN ACCORDANCE WITH CERTIFICATIONS LAW. (LAW #7 JULY 19, 1985).
- ALL TRANSFORMER INSTALLED IN THIS PROJECT MOST COMPLY WITH CIRCULAR 94-06 RELATED TO IMPROVED LOSSES CRITERIA DATED 15 NOV. 94. SEE TABLE ON THESE DRAWINGS.
- ALL PRIMARY CABLE TERMINATIONS AND ISOLATOR SHALL BE IN "SILICON RUBBER" AS PER P.R.E.P.A. CIRCULAR 00-01.
- ALL INSULATOR AND PRIMARY CABLE TERMINATIONS SHALL BE OF SILICON RUBBER AS REQUIRED IN P.R.E.P.A. COMMUNICATE 00-01.
- ALL LIGHTNING ARRESTER SHALL BE METAL OXIDE VARISTOR WITH POLYMER INSULATION AS REQUIRED IN P.R.E.P.A. COMMUNICATE 99-06.

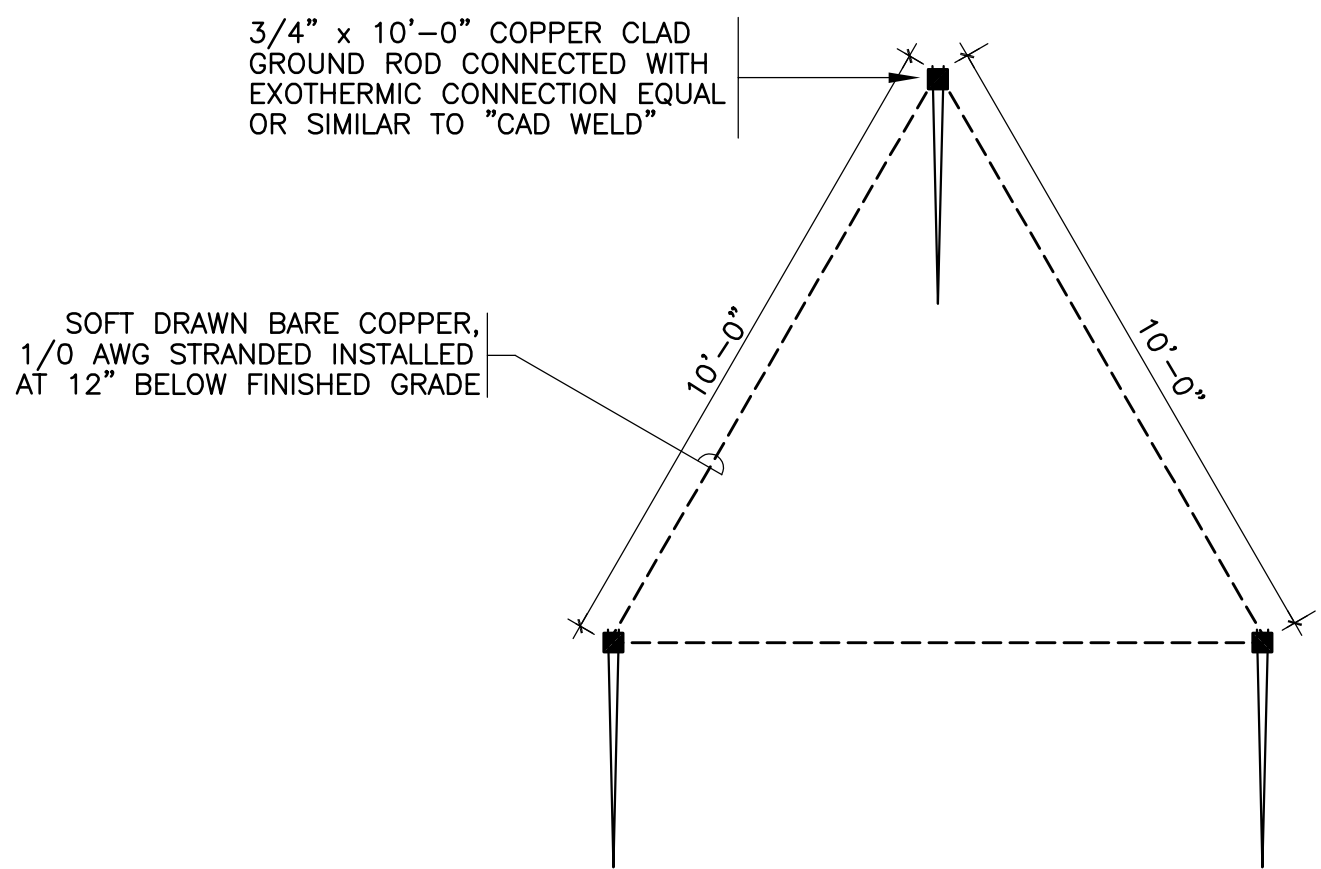


TRENCH DETAILS

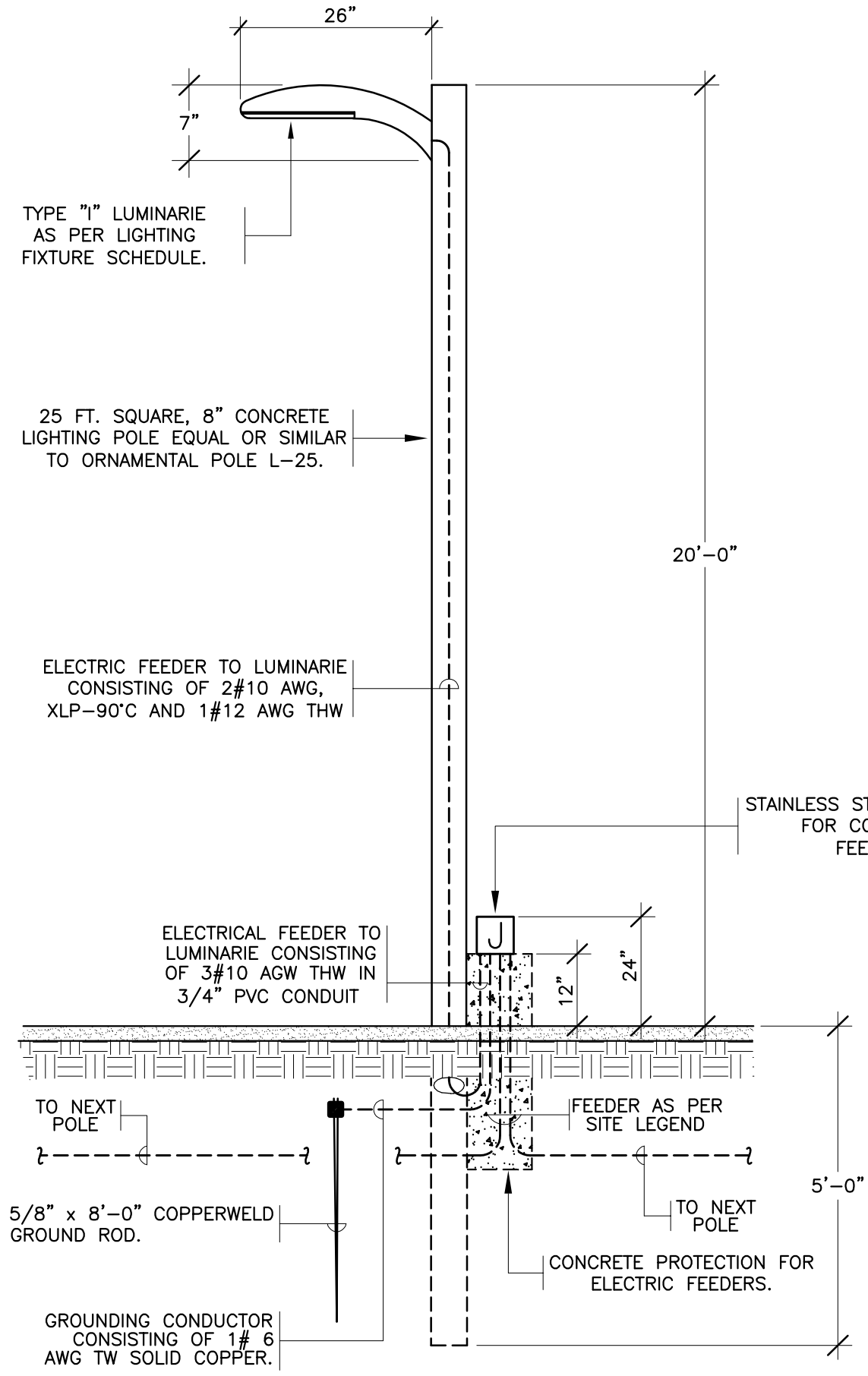
NOTE:
DIMENSION OF CONDUITS SHALL BE AS SPECIFIED ON DRAWINGS.



SPACERS INSTALLATION DETAIL



DELTA GROUNDING MAT DETAIL



LUMINARIE TYPE I INSTALLATION DETAIL

IMPORTANT NOTES:
1. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH MANUFACTURER EXACT REQUIREMENTS IN ORDER TO PROVIDE A COMPLETE INSTALLATION AS ILLUSTRATED IN THE DETAIL.



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIATURA 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHAOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGLAMENTADORAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

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Revisions	Project No.: 19-1637.0	Set Date: 2020/07/07	Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

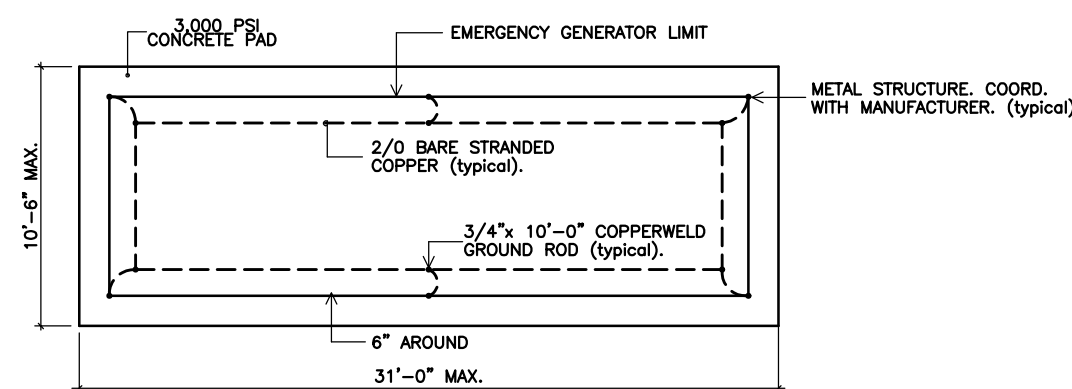


**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**
Owner: CEBEA & NAGUABO, PUERTO RICO
WATER TREATMENT PLANT
Drawing Title: SITE NOTES AND ELECTRICAL SITE DETAILS

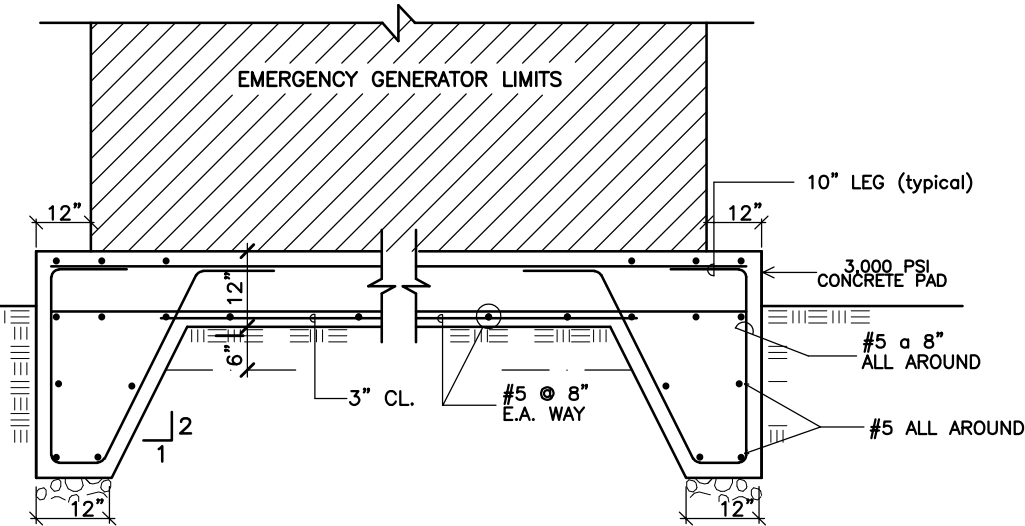
Sheet: **WTP-E104**

EMERGENCY GENERATOR DESCRIPTION:

- I. THE EMERGENCY PLANT WILL FURNISHED COMPLETE WITH A DIESEL FUEL TANK AUTOMATIC TRANSFER SWITCH, BATTERY, AUTOMATIC BATTERY CHARGER, AND ALL REQUIRED ACCESSORIES FOR NORMAL OPERATION.
- II. THE EMERGENCY GENERATOR SET SHALL BE RATED PRIME.
- A. 600 KW 750 KVA FOR 3 PHASES, 480 VOLTS, 4 WIRES, 60 CYCLES SERVICE, .8 POWER FACTOR.
- B. UNIT SHALL BE EQUAL OR SIMILAR TO CUMMINS DQPAA.
- III. THE UNIT IS TO INCLUDE THE FOLLOWING EQUIPMENT AND ACCESSORIES.
- A. AUTOMATIC TRANSFER SWITCH, RATED 1,000 AMPERES, 480 VOLTS AC 60 CYCLES, 3 PHASES, 4 WIRES, 3 POLES, PROGRAMMED TRANSITION EQUAL OR BETTER TO CUMMINS OTEC TO BE FURNISHED BY GENERATOR MANUFACTURER, ENCLOSED IN NEMA 4X ENCLOSURE WITH PILOT LIGHTS ON DOOR.
- B. INSTRUMENT CONTROL PANEL, INCLUDING THE FOLLOWING:
- VOLTMETER (0-600) AND SELECTOR SWITCH.
 - AMMETER (0-1,000) AND SELECTOR SWITCH.
 - FIELD CIRCUIT BREAKER.
 - VOLTAGE REGULATOR (AUTOMATIC).
 - WATER TEMPERATURE GAUGE.
 - OIL PRESSURE GAUGE.
 - AUTOMATIC SHUTDOWN DEVICE WITH INDICATOR LIGHTS FOR:
- a. OVER CRANKING PROTECTION AND CRANKED BUT DID NOT, START ALARM.
- b. HIGH WATER TEMPERATURE.
- c. LOW OIL PRESSURE.
- d. LOW FUEL LEVEL.
- WATER COOLED RADIATOR.
 - FREQUENCY METER.
 - RUNNING TIME METER.
 - MAIN CIRCUIT BREAKER 800 A FRAME, 1,000 TRIP UNIT.
- B. WATER COOLED RADIATOR.
- C. ONE (1) SUB-BASE DOUBLE WALL FUEL RESERVOIR TANK (1,700 GALLONS CAPACITY) WITH ALL FUEL SUPPLY LINES.
- D. HEAVY DUTY NICKEL CADMIUM BATTERIES W/RACK & CABLES.
- E. EXHAUST, CRITICAL TYPE MUFFLER WITH STAINLESS STEEL CONNECTIONS AND FITTING, INCLUDING FLEXIBLE SECTION, RAIN CAP FOR EXHAUST. ALL EXHAUST SYSTEM SHALL BE OF STAINLESS STEEL.
- F. VIBRATION ISOLATORS.
- G. INCLUDE PERMANENT MAGNETIC GENERATOR OPTION.
- H. OUTDOOR WEATHER RESISTANT ENCLOSURE CONSTRUCTED OF ALUMINUM OR STAINLESS STEEL MATERIAL RATED FOR WIND CONDITIONS OF 150 MPH, SOUND ATTENUATED FOR 68 dB AT 23 FT.
- I. INCLUDE ELECTRONIC TYPE GOVERNOR.
- IV. TRANSFER SWITCH SHALL BE PROVIDED WITH CLOCK EXERCISER TO START THE GENERATOR SET AUTOMATICALLY. IT SHALL OPERATE EVERY WEEK AND RUN GENERATOR SET FOR 1/2 (HALF) HOUR AND THEN STOP THE GENERATOR SET AUTOMATICALLY. THE GENERATOR SHALL OPERATE WITH LOAD.
- V. DIESEL FUEL TANK SHALL INCLUDE THE FOLLOWING.
- A. A LEAKAGE ALARM REPORTED TO THE EMERGENCY GENERATOR CONTROL PANEL.
- B. LOW LEVEL FUEL RELAY TO TURN OFF THE GENERATOR AT LOW LEVEL SIGNAL.
- VI. LOADS OF THE PROJECT SHALL BE STARTED IN DIFFERENT STEPS.
- VII. EMERGENCY GENERATOR SHALL COMPLY WITH FUEL / EMISSIONS REQUIREMENTS EPA TIER 2 AND LOW EMISSIONS REQUIREMENTS.
- VIII. INCLUDE ALL REQUIREMENTS ESTABLISHED IN TECHNICAL SPECIFICATIONS.



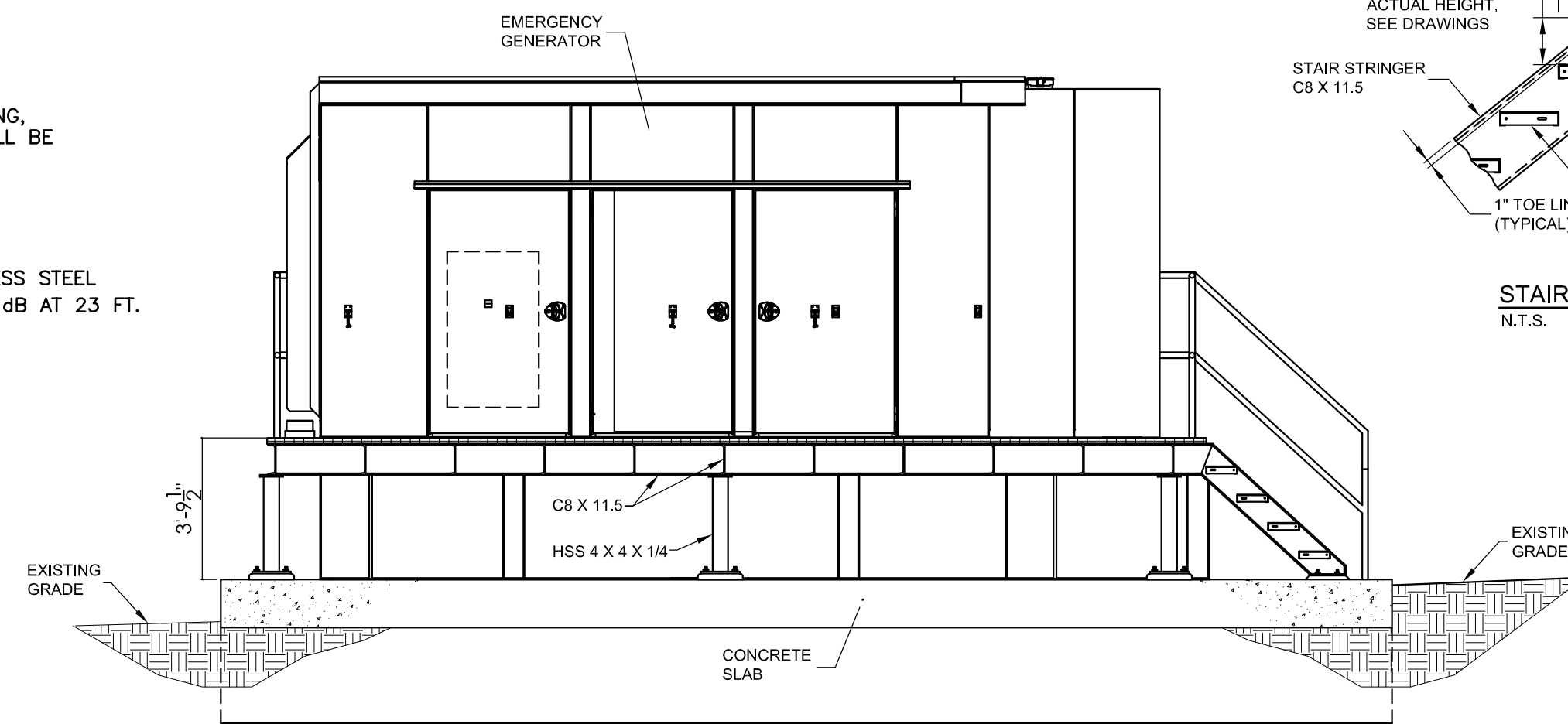
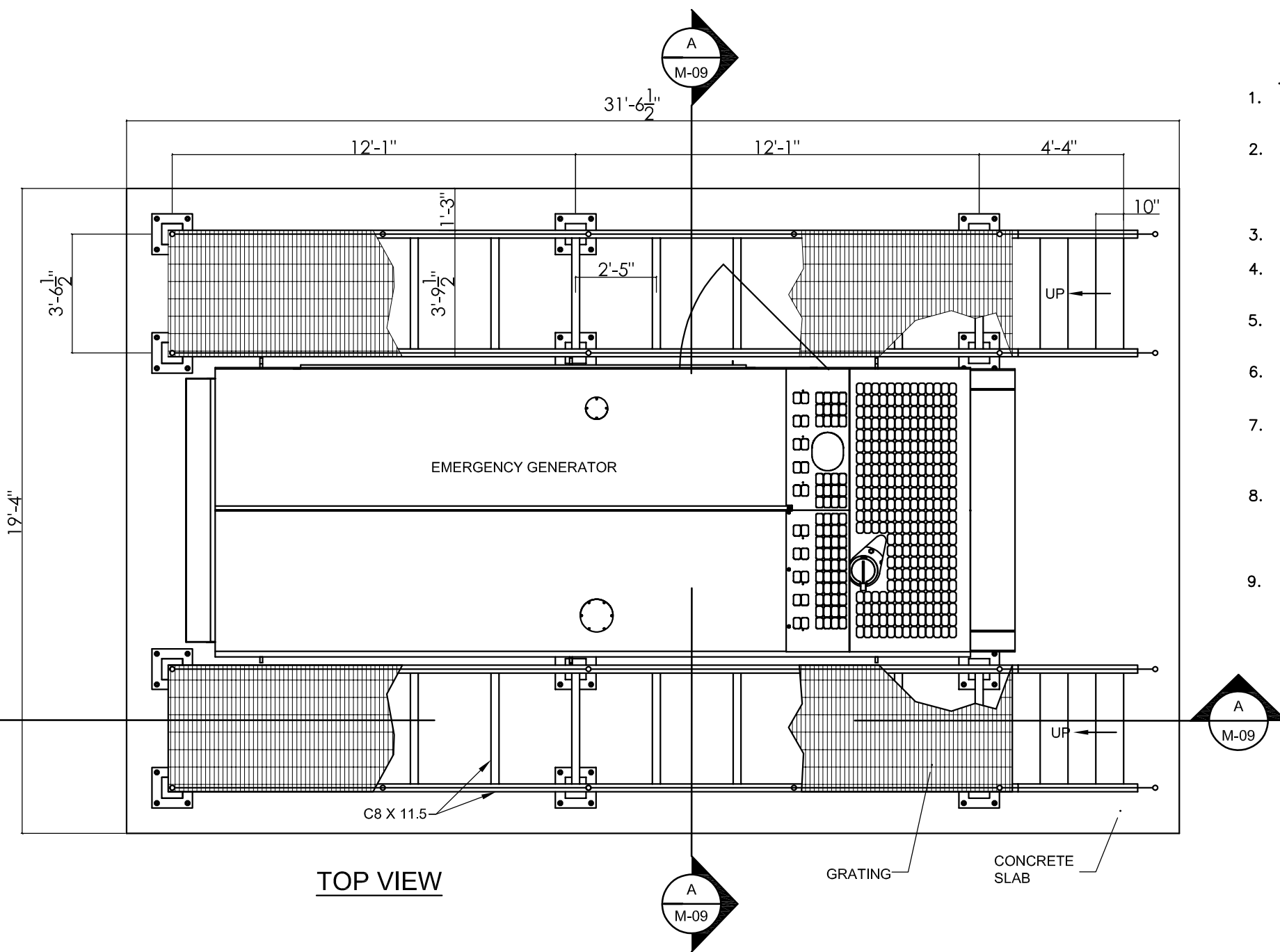
- NOTES TO EMERGENCY GENERATOR GROUNDING:**
- ALL CONNECTION SHALL BE EXOTHERMIC CADWELD OR SIMILAR.
 - GROUND SYSTEM SHALL HAVE A MAXIMUM RESISTANCE OF 10 OHMS TO TRUE GROUND REFERENCE.



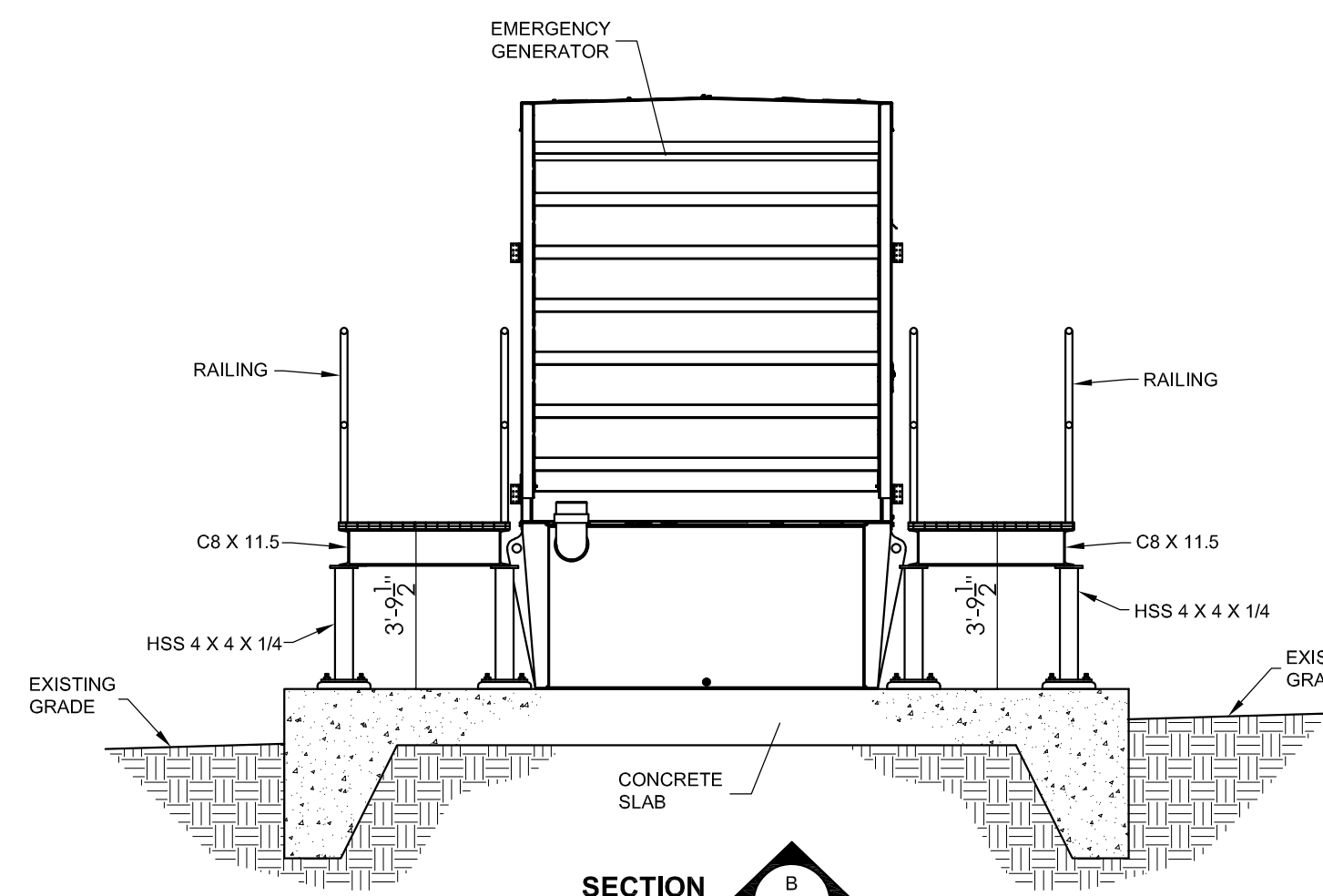
EMERGENCY GENERATOR CONCRETE PAD STRUCT. DETAIL
NOT TO SCALE

IMPORTANT NOTE:

- ELECTRICAL CONTRACTOR SHALL PROVIDE THE FUEL TANK FILLED OF DIESEL.



SECTION A-M-09
SCALE:1:33.33

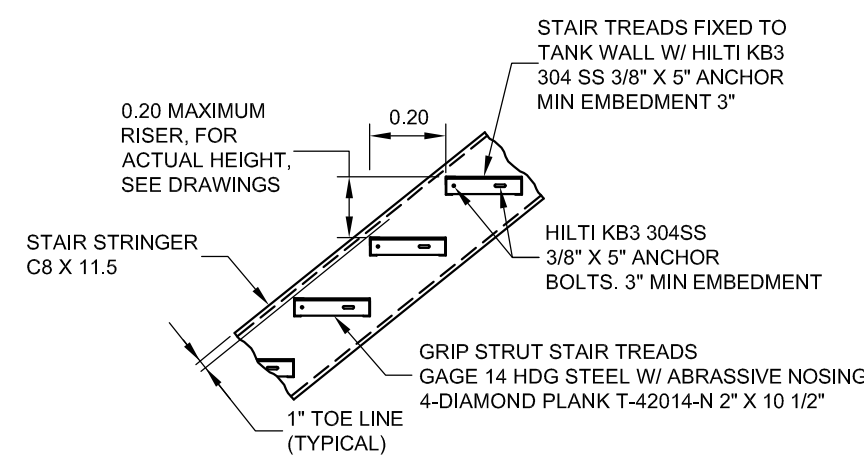


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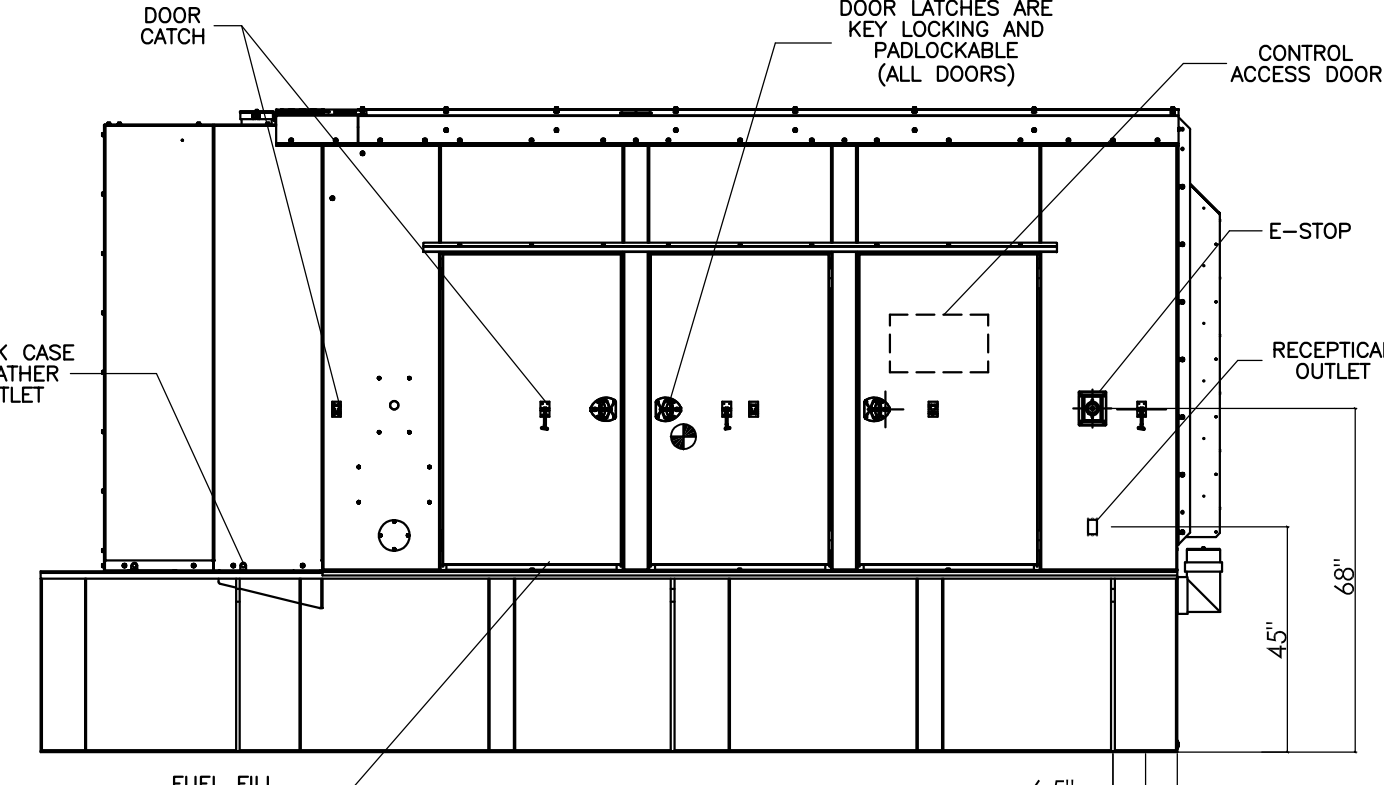
EMERGENCY GENERATOR SERVICE PLATFORM DETAILS
NOT TO SCALE

IMPORTANT NOTES:

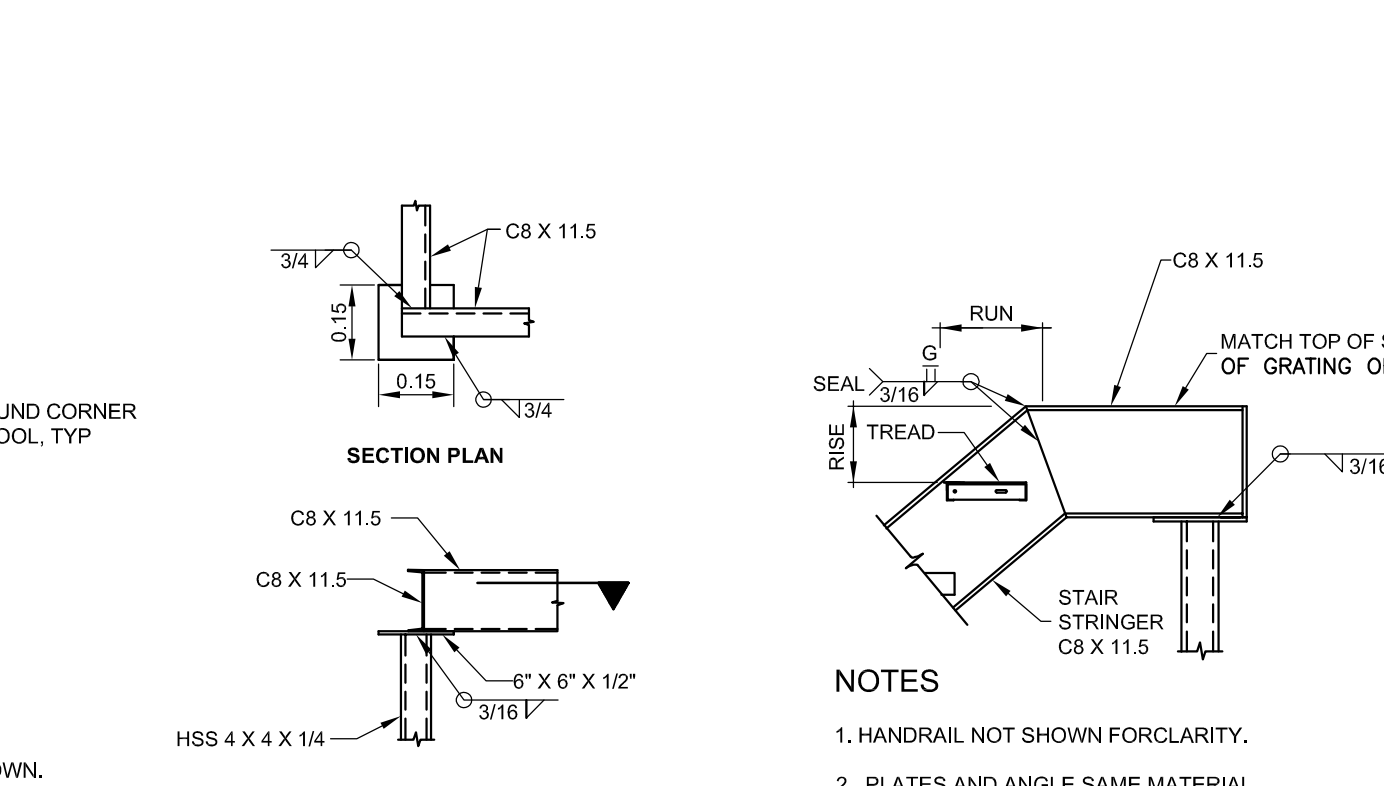
- ELECTRICAL CONTRACTOR SHALL PROVIDE THE FUEL TANK FILLED OF DIESEL.
- EMERGENCY GENERATOR AND AUTOMATIC TRANSFER SWITCH SHALL COMPLY WITH P.R.A.S.A. SPECIFICATIONS FOR EMERGENCY GENERATORS AND AUTOMATIC TRANSFER SWITCHES.
- DIESEL FUEL TANK SHALL HAS FLAME ARRESTER.
- DIESEL TANK AND PIPING MUST BE LABELED WITH MATERIAL HAZARD COMMUNICATION INFORMATION.
- CAPACITY OF TANK DOUBLE CONTAMMENT MUST BE EQUAL TO THE TANK FULL VOLUME.
- ALL TANK OPENING OTHERS THAN VENTS MUST HAVE VAPOR TIGHT CAP OR COVER.
- ALL PIPE CONNECTIONS SHALL BE LIQUID TIGHT (WELDED OR SCREWED) AND THE MATERIAL OF CONSTRUCTION MUST BE SUITABLE FOR DIESEL.
- ALL PIPING SUPPORT FOR DIESEL SUPPLY SHALL BE SUBSTANTIALLY SUPPORTED AND PROTECTED AGAINST ANY PHYSICAL DAMAGE OR EXCESSIVE STRESSES FROM SETTLEMENT, VIBRATION, EXPANSION OR CONTRACTION.
- APPLY ANTI-CORROSION PAINT OR EPOXY TO DIESEL SUPPLY PIPING TO AVOID CORROSION.



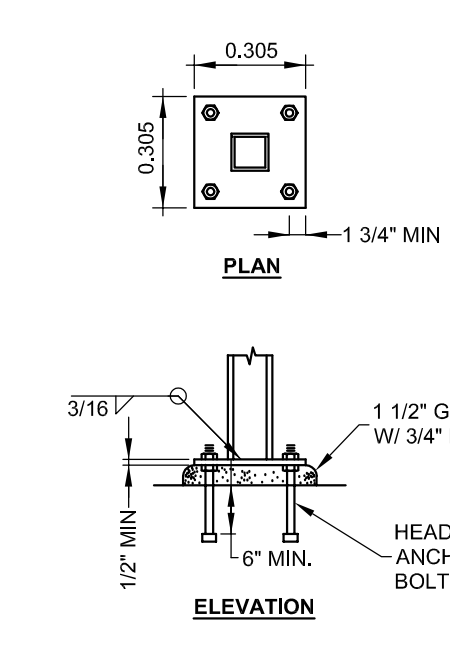
STAIR DETAIL
N.T.S.



RIGHT SIDE WALL ELEVATION WITH TANK
NOT TO SCALE

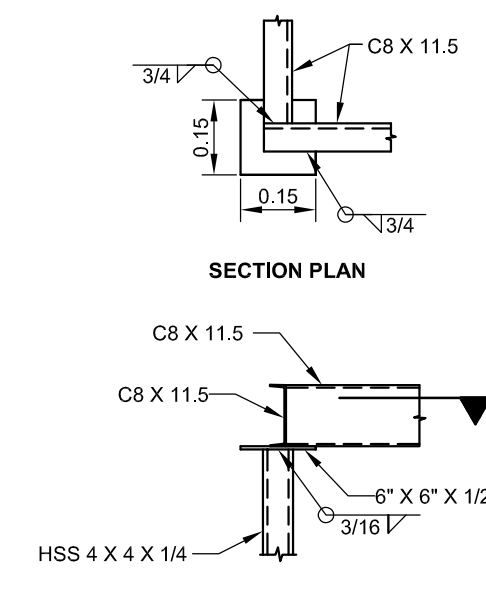


LEFT SIDE WALL ELEVATION WITH TANK
NOT TO SCALE

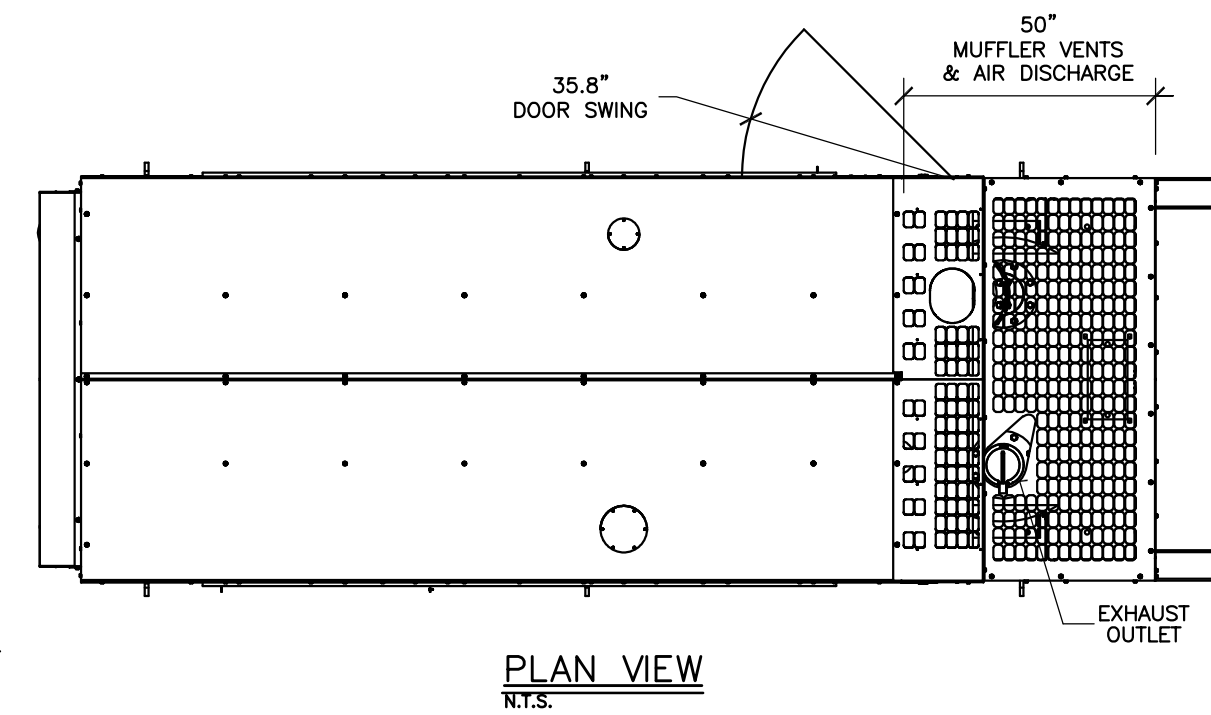


- NOTES:**
- ANCHOR BOLTS SHALL BE 3/4\"/>
 - GROUT SHALL BE NONSHRINK AS PER SPECIFICATIONS, FLOWABLE.

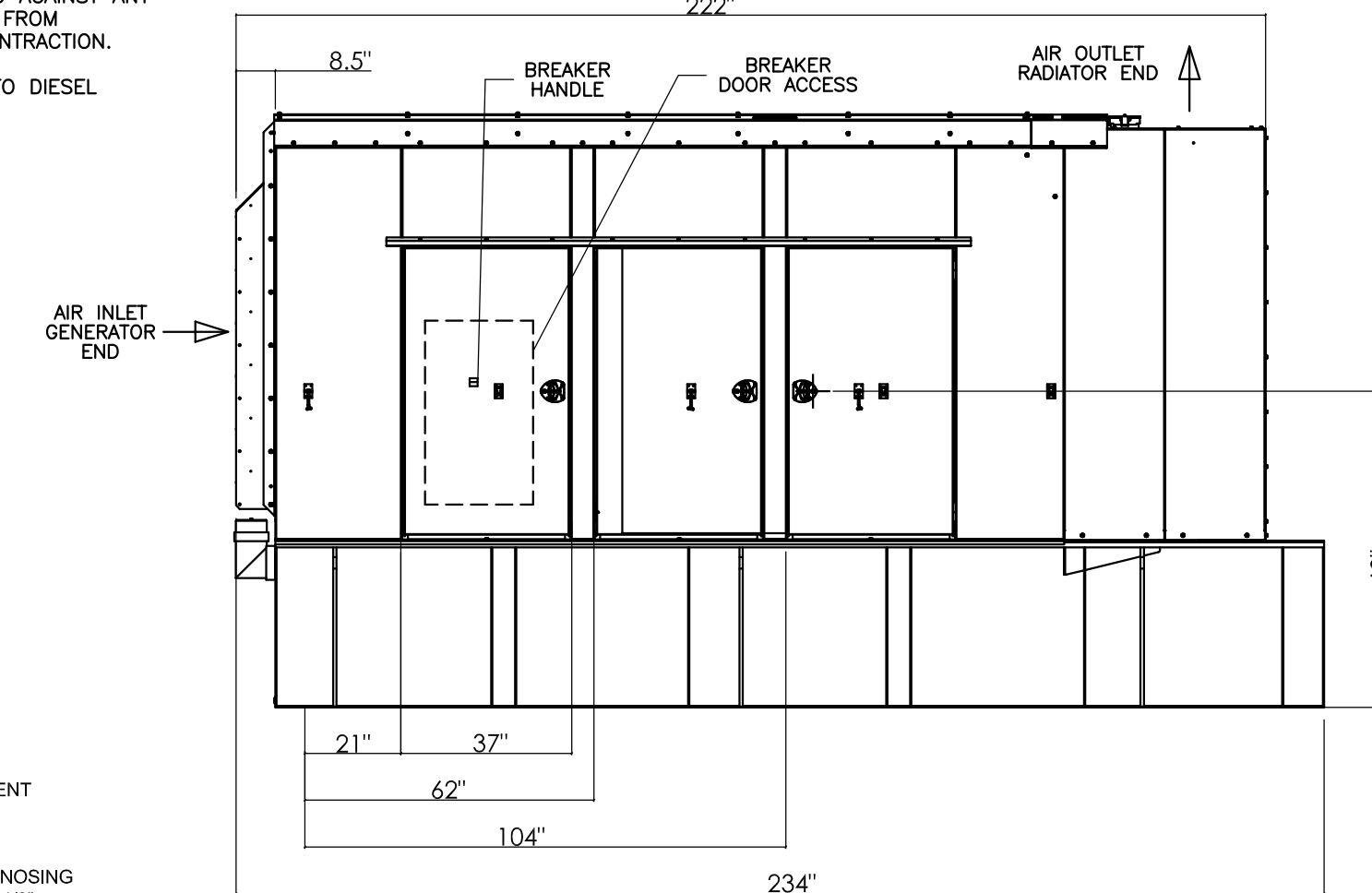
HSS COLUMN TOP
N.T.S.



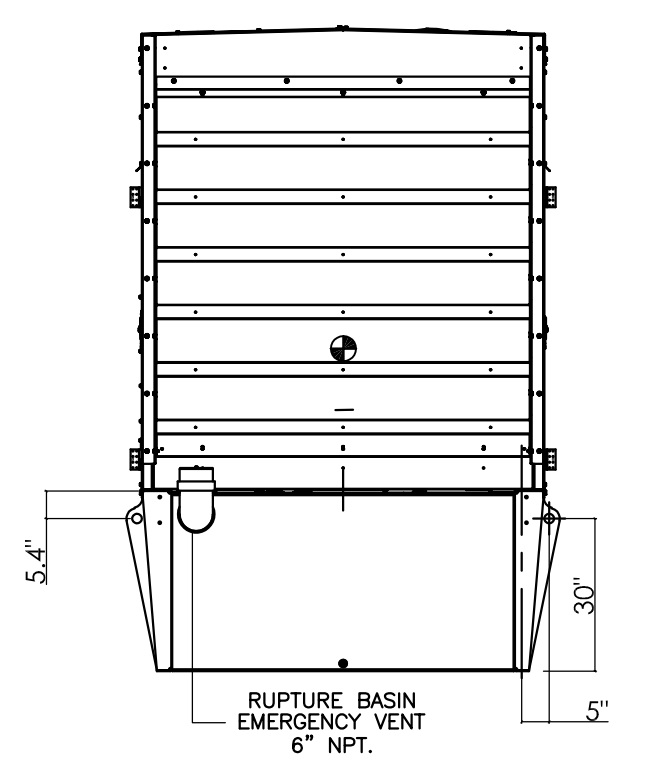
HSS COLUMN BASE
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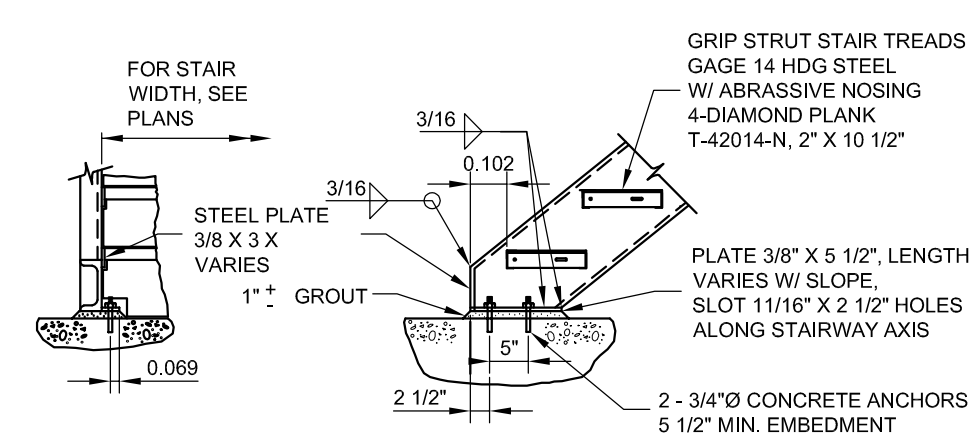
PLAN VIEW
N.T.S.



DISCHARGE ENDWALL ELEVATION
NOT TO SCALE



AIR INLET ENDWALL ELEVATION
NOT TO SCALE



- NOTES:**
- USE BASE PLATE OF SAME AS STRINGER.
 - PROVIDE PROTECTION FOR DISSIMILAR METALS AND CONCRETE.
 - STAIR HANDRAIL, NOT SHOWN.

STAIR BOTTOM CONNECTION
N.T.S.



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Revisions

No.	Description	By	Date
1	Issued for Bidding	RICARDO ORTIZ GARCIA	2020/07/07

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT

WTP-E105

Sheet:

Revisions

No.	Description	By	Date
1	Issued for Bidding	RICARDO ORTIZ GARCIA	2020/07/07

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT

WTP-E105

Sheet:

Revisions

No.	Description	By	Date
1	Issued for Bidding	RICARDO ORTIZ GARCIA	2020/07/07

Project Title:

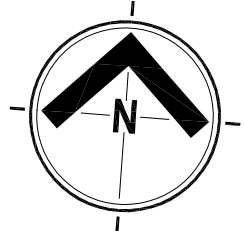
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT

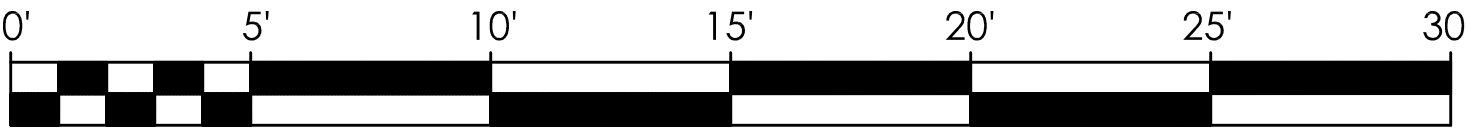
WTP-E105

Sheet:

EXISTING BASEMENT FLOOR LEVEL
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



IMPORTANT NOTES

1. EXISTING ELECTRICAL FACILITIES SHALL BE REMOVED AND DISPOSED EXCEPT INDICATED TRANSFORMERS TO BE RE-INSTALLED.



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

Project Title:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

CEIBA & NAGUABO, PUERTO RICO

Owner:

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads

Revisions

Project No.: 19-1637.0

Set Date: 2020/07/07

Drawn by:

Dwg. Date:

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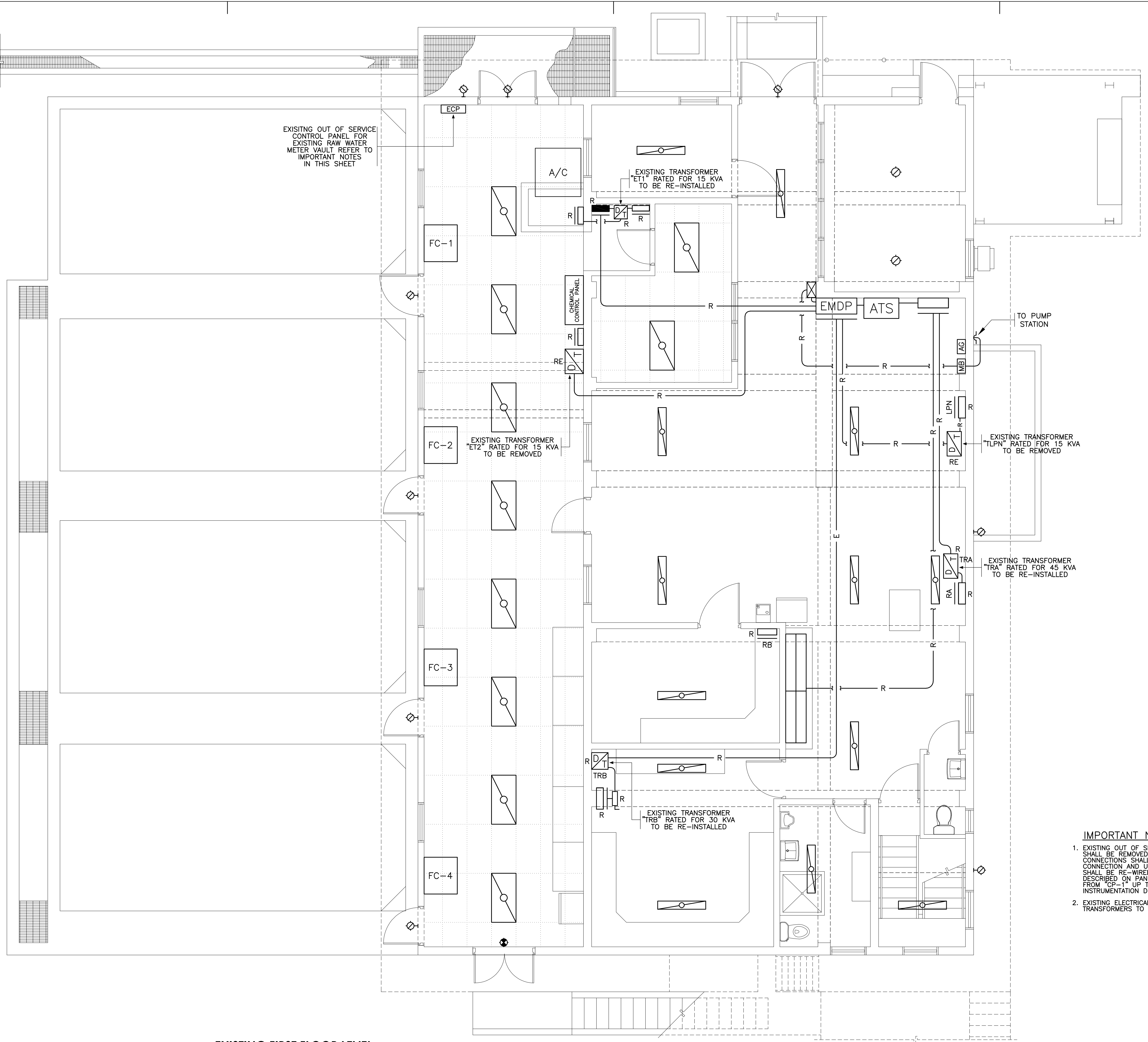
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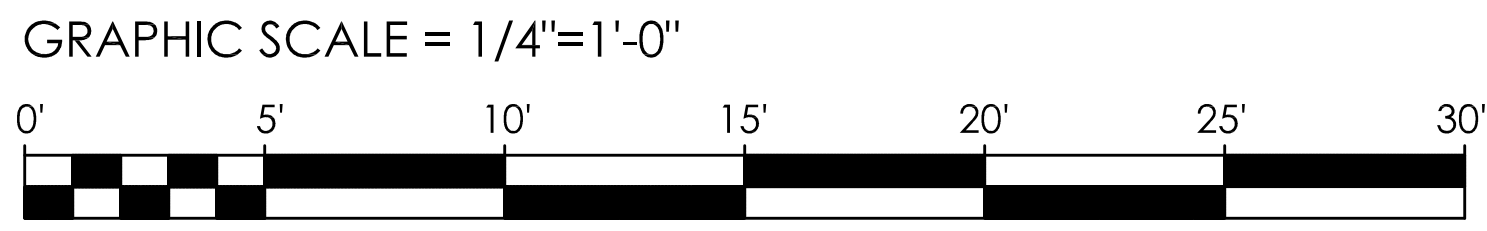
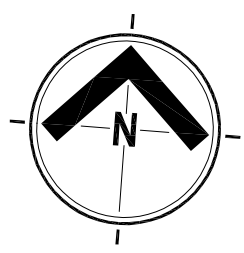
Drawing Title:

EXISTING BASEMENT FLOOR LEVEL ELECTRICAL DISTRIBUTION PLAN

Sheet: **WTP-E200**



EXISTING FIRST FLOOR LEVEL
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



IMPORTANT NOTES

- EXISTING OUT OF SERVICE CONTROL PANEL FOR EXISTING RAW WATER METER VAULT SHALL BE REMOVED. EXISTING ELECTRIC CONDUITS FOR ELECTRIC AND CONTROL CONNECTIONS SHALL BE EXTENDED UP TO PANELBOARD "HP-2" FOR ELECTRIC CONNECTION AND UP TO "CP-1" FOR CONTROL CONNECTION. ELECTRIC CONNECTION SHALL BE RE-WIRED FROM "HP-2" PANELBOARD UP TO RAW WATER METER VAULT AS DESCRIBED ON PANELBOARD SCHEDULE. CONTROL CONNECTION SHALL BE RE-WIRED FROM "CP-1" UP TO RAW WATER METER VAULT WITH OPTIC FIBER AS DESCRIBED ON INSTRUMENTATION DRAWINGS.
- EXISTING ELECTRICAL FACILITIES SHALL BE REMOVED AND DISPOSED EXCEPT INDICATED TRANSFORMERS TO BE RE-INSTALLED.



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JULY 30, 2021
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Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS DEVELOPMENT

Client: GOVERNMENT OF PUERTO RICO

Owner: WATER TREATMENT PLANT

Drawing Title: EXISTING FIRST FLOOR LEVEL ELECTRICAL DISTRIBUTION PLAN

Sheet: WTP-E201

Revisions

No.	Description	By	Date
1			
2			
3			
4			
5			

Project No.: 19-1637.0

Set Date: 2020/07/07

Drawn by:

Dwg. Date:

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

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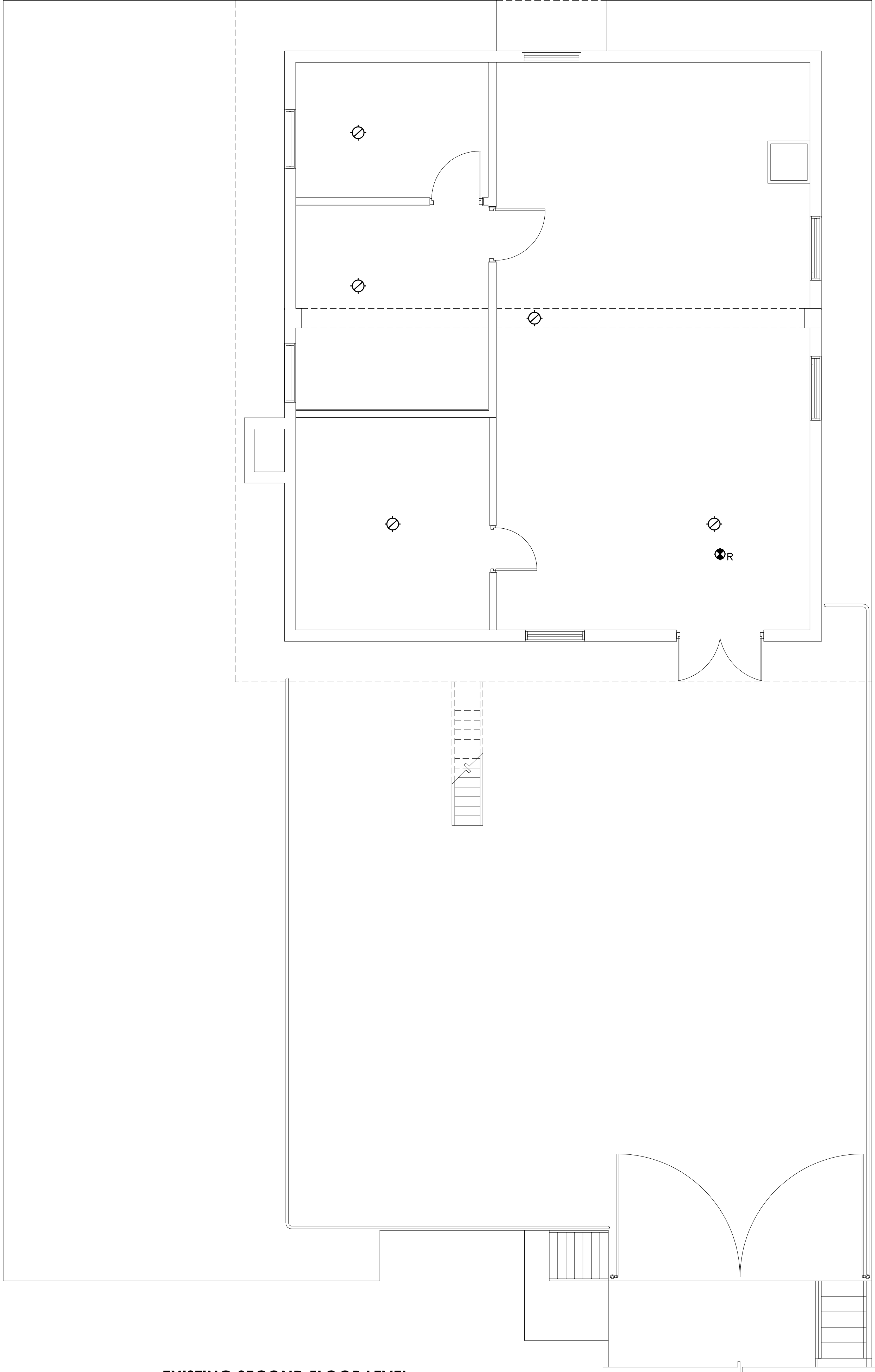
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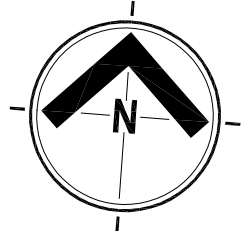
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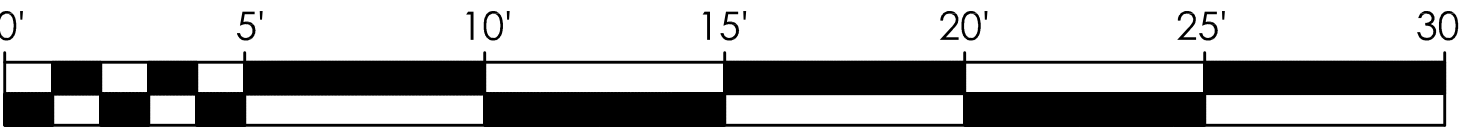
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EXISTING SECOND FLOOR LEVEL
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



IMPORTANT NOTES

1. EXISTING ELECTRICAL FACILITIES SHALL BE REMOVED AND DISPOSED EXCEPT INDICATED TRANSFORMERS TO BE RE-INSTALLED.



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Project No.: 19-1637.0
Set Date: 2020/07/07

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Revisions

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CERRA & NAGUABO, PUERTO RICO

WATER TREATMENT PLANT

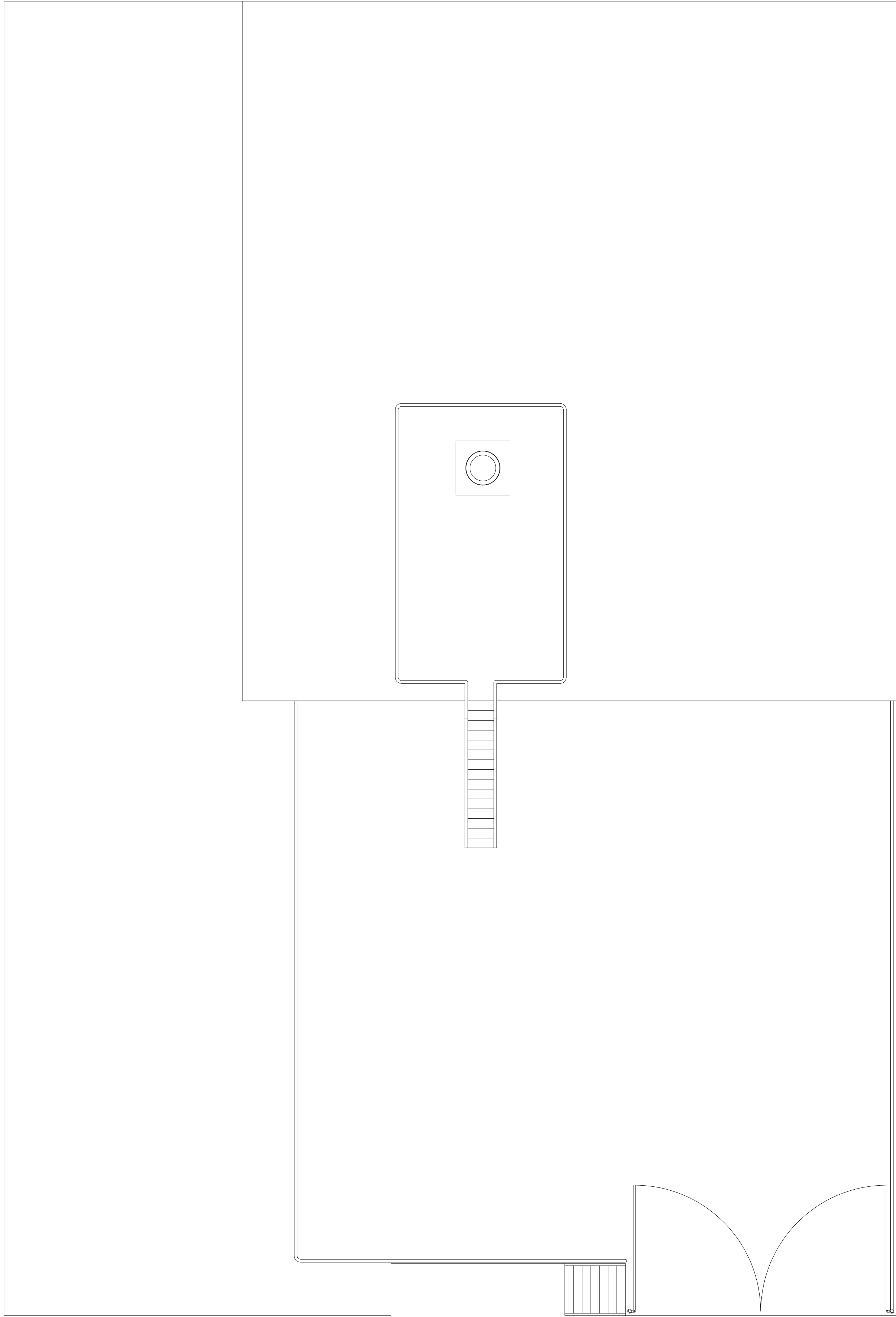
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EXISTING SECOND FLOOR LEVEL ELECTRICAL DISTRIBUTION PLAN

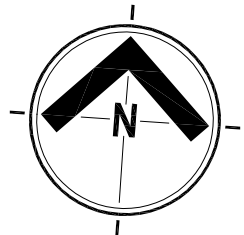
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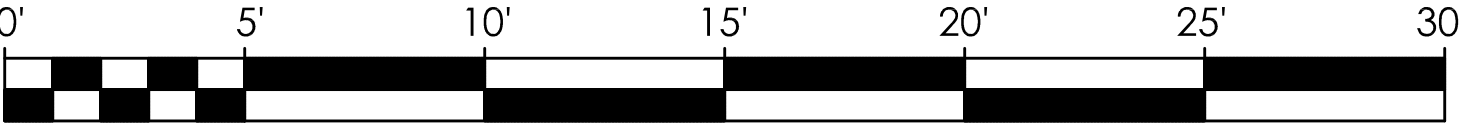
WTP-E202



EXISTING ROOF LEVEL
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



IMPORTANT NOTES

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Revisions

Project No.: 19-1637.0
Set Date: 2020/07/07
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Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT
CEIBA & NAGUABO, PUERTO RICO
Owner:

WATER TREATMENT PLANT
Drawing Title:

EXISTING ROOF LEVEL ELECTRICAL DISTRIBUTION PLAN

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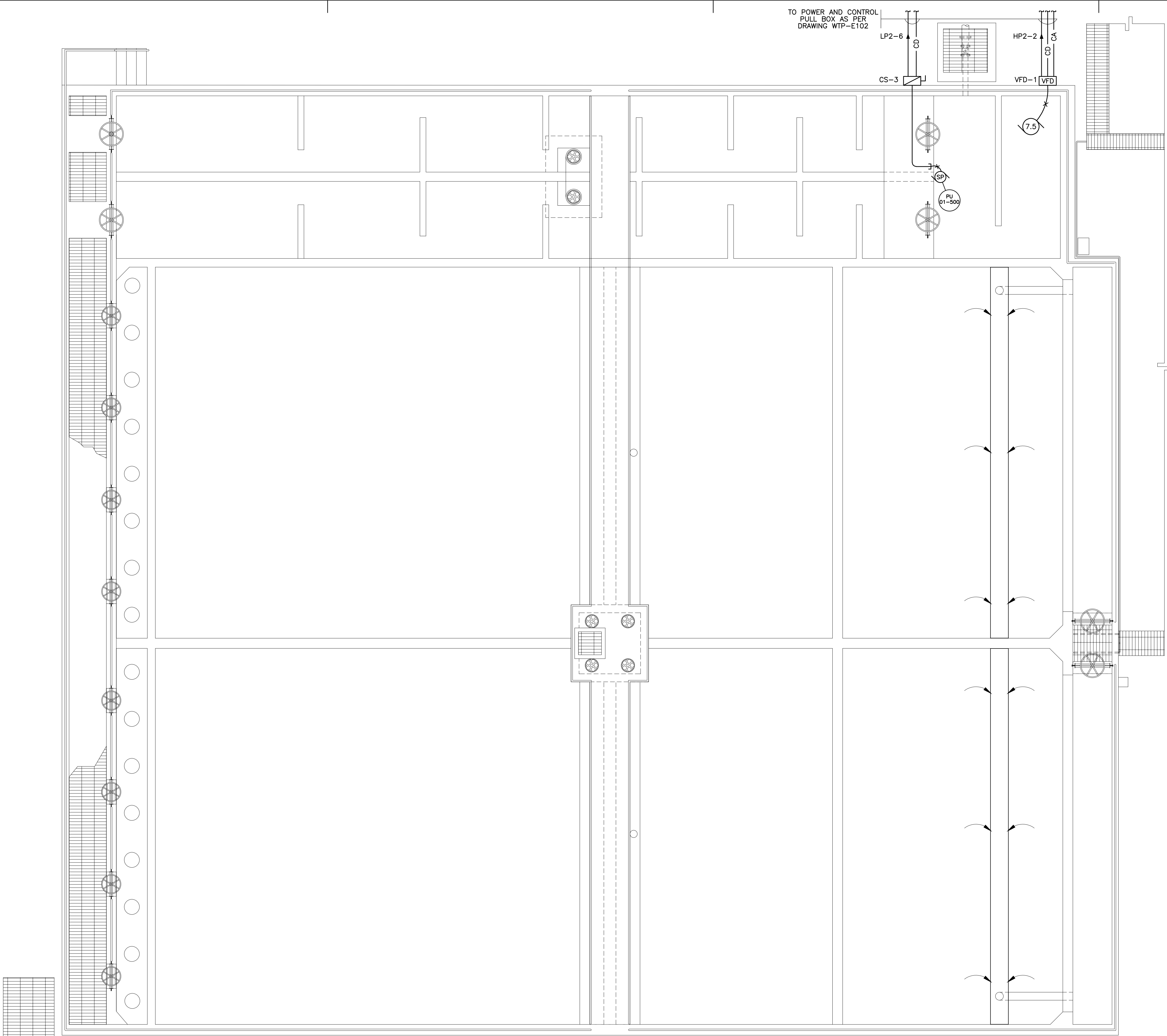
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Project Title:

Sheet:

WTP-E203



TO POWER AND CONTROL
PULL BOX AS PER
DRAWING WTP-E102

LP2-6

CS-3

HP2-2

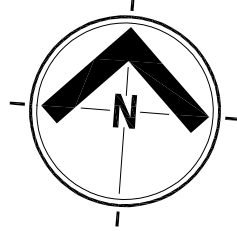
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PU 01-500

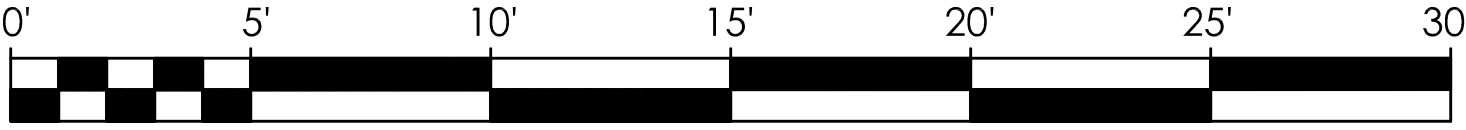
VFD

7.5

PROPOSED SEDIMENTATION BASINS AREA
ELECTRICAL DISTRIBUTION
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



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Project No.: 19-1637.0	Set Date: 2020/07/07
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for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

WATER TREATMENT PLANT

SEDIMENTATION BASINS ELECTRICAL DISTRIBUTION PLAN

Project Title:

Sheet:

WTP-E204

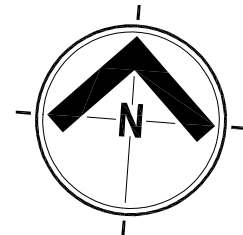
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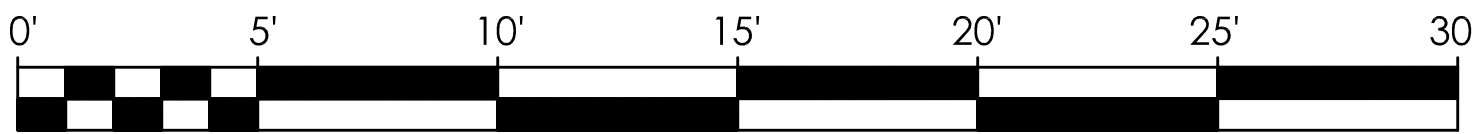
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PROPOSED BASEMENT FLOOR LEVEL
LIGHTING DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"

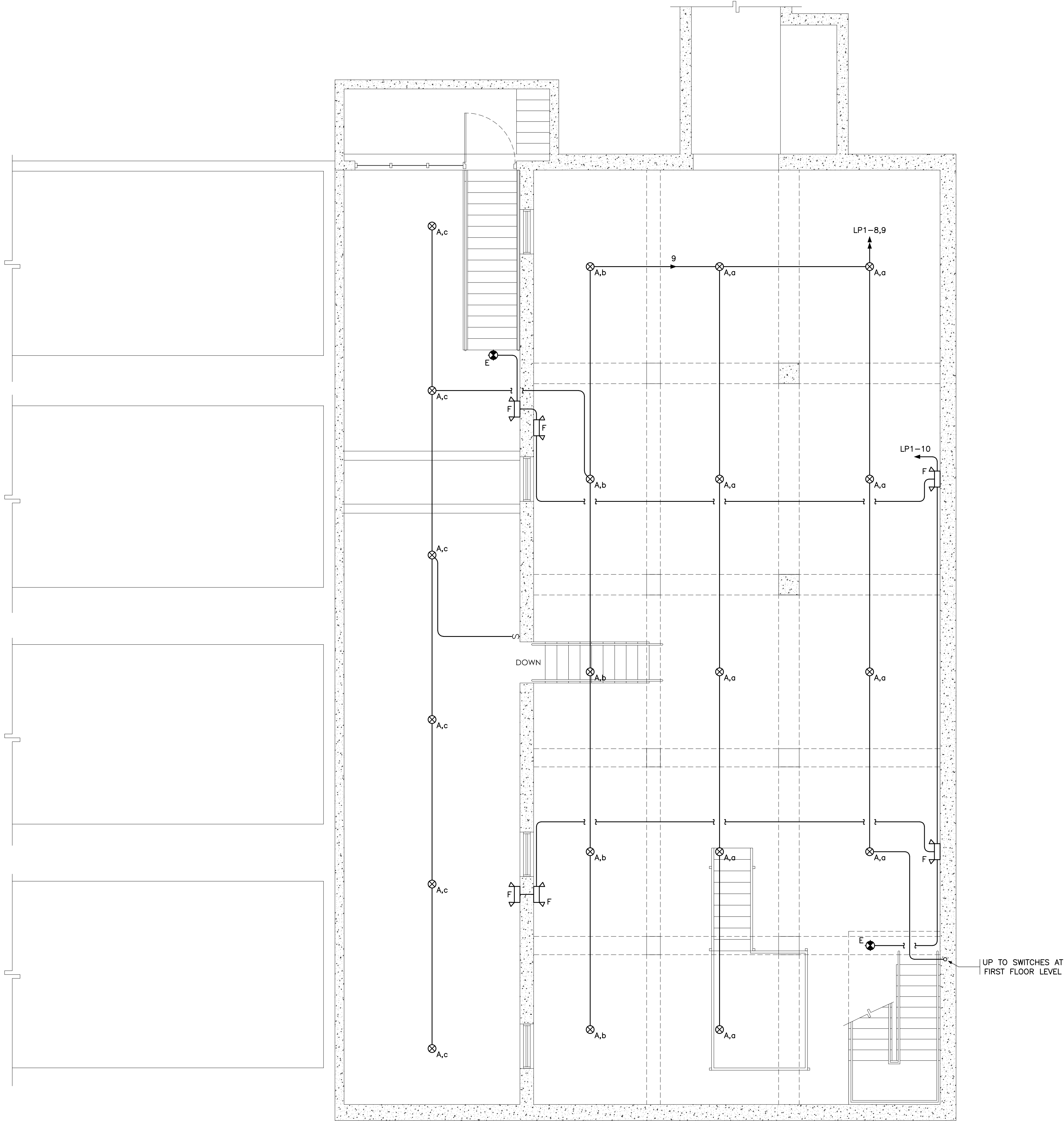


GRAPHIC SCALE = 1/4"=1'-0"



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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

Owner:

WATER TREATMENT PLANT

Drawing Title:

PROPOSED BASEMENT FLOOR LEVEL LIGHTING DISTRIBUTION PLAN

Revisions

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER TREATMENT PLANT

Drawing Title:

PROPOSED BASEMENT FLOOR LEVEL LIGHTING DISTRIBUTION PLAN

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Project No.: 19-1637.0
Set Date: 2020/07/07

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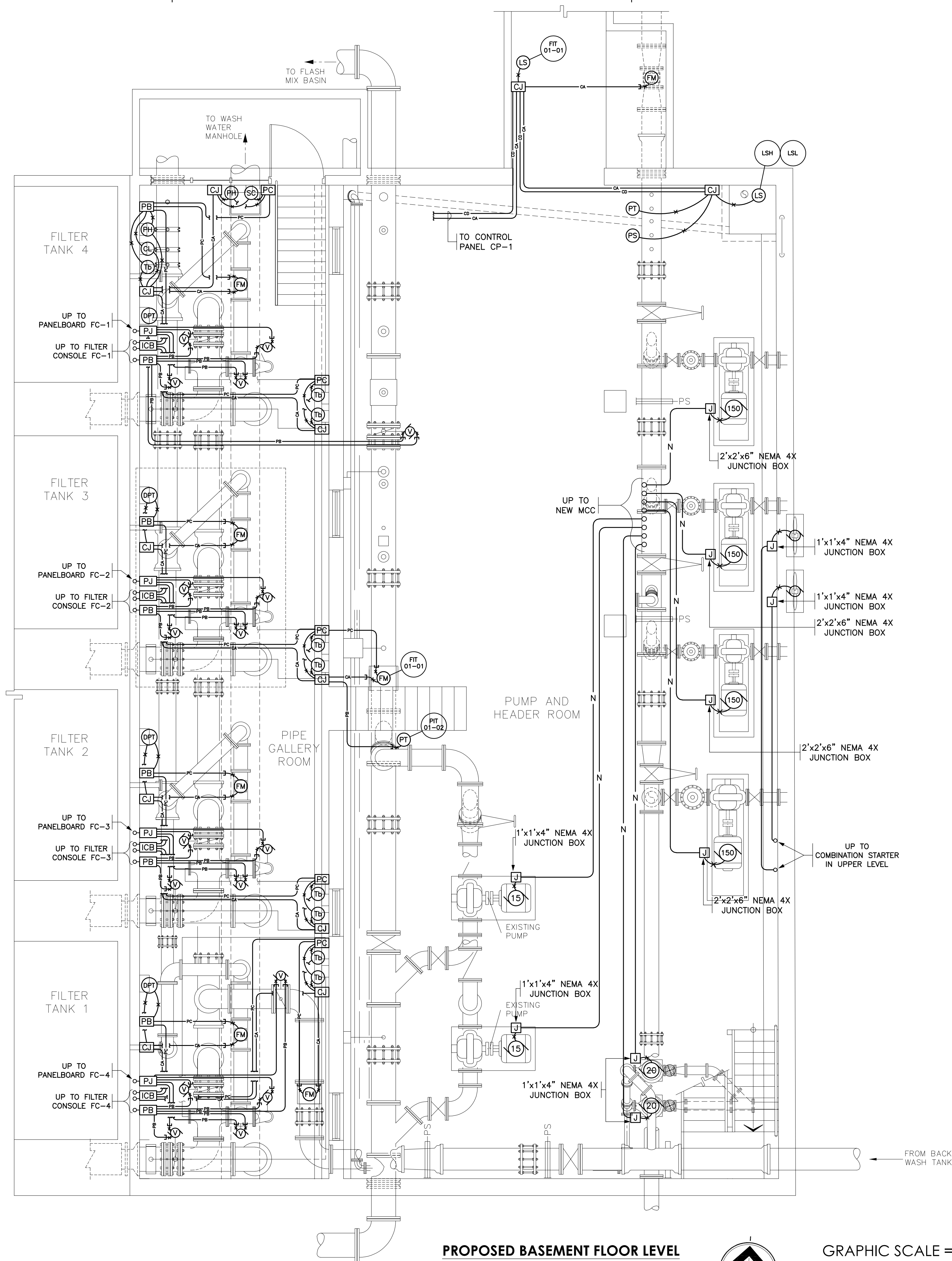
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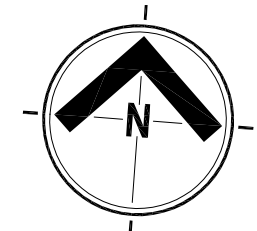
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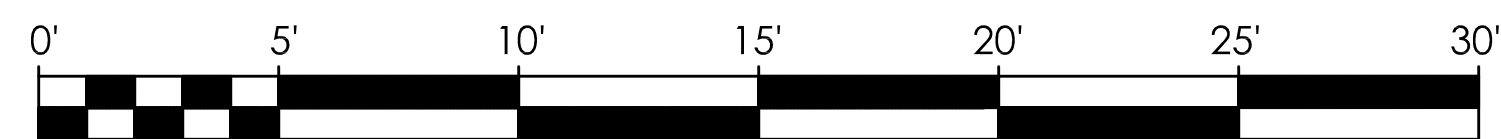
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PROPOSED BASEMENT FLOOR LEVEL
POWER AND CONTROL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



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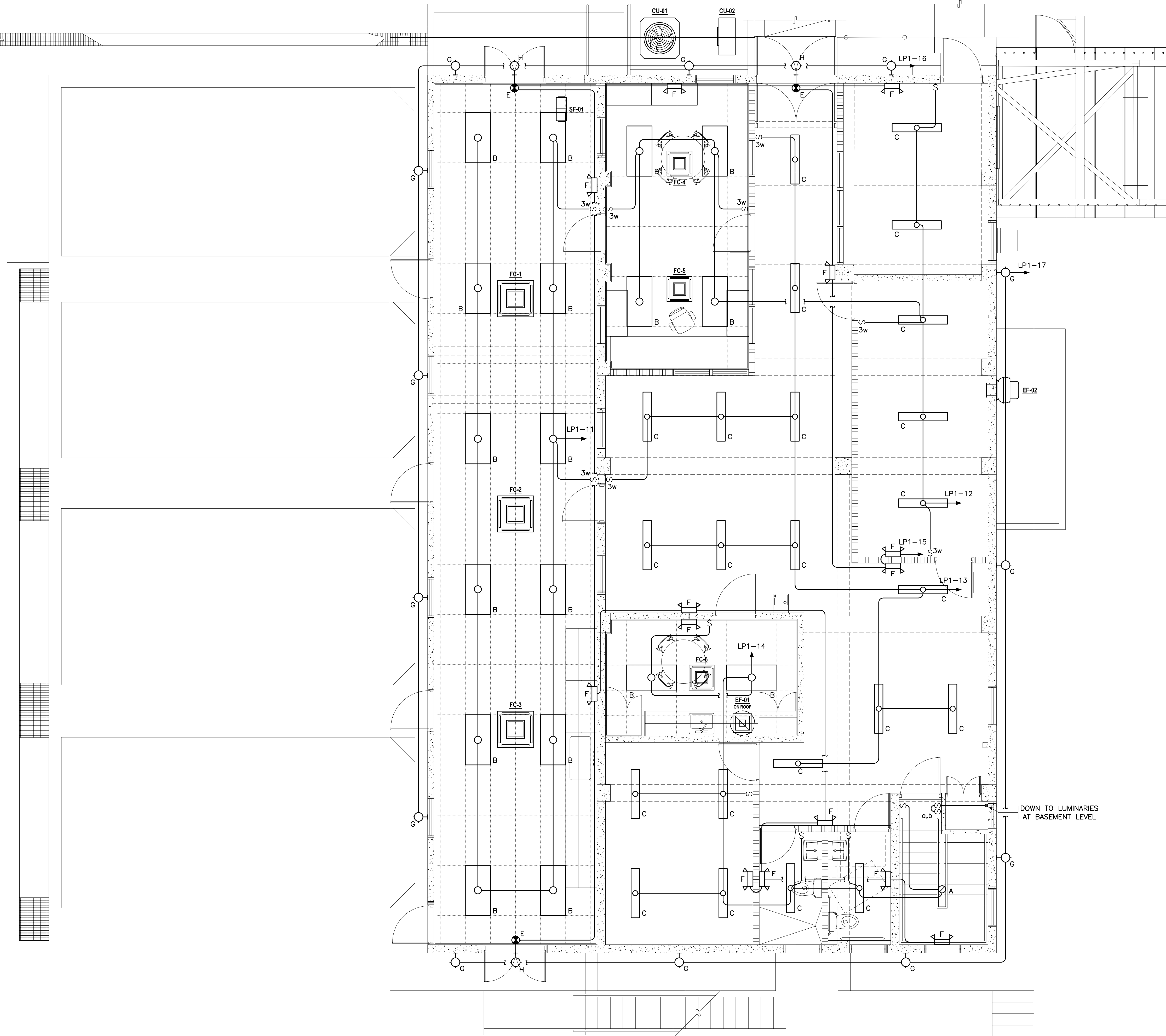


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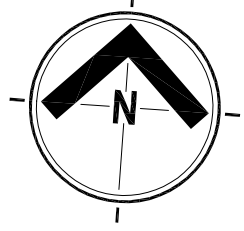
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**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads
CEIBA & NAGUABO, PUERTO RICO
Owner:
WATER TREATMENT PLANT
Drawing Title:
PROPOSED BASEMENT FLOOR LEVEL POWER & CONTROL DISTRIBUTION PLAN

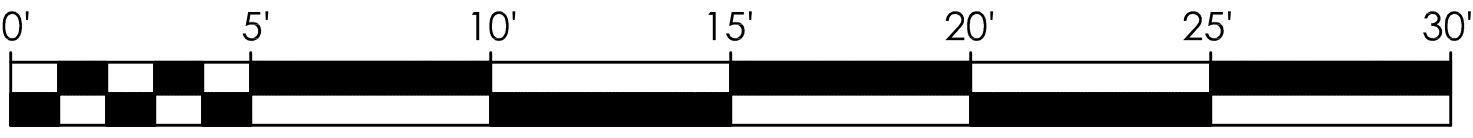
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WTP-E206



PROPOSED FIRST FLOOR LEVEL
LIGHTING DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



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Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT
Drawing Title: PROPOSED FIRST FLOOR LEVEL LIGHTING DISTRIBUTION PLAN

Revisions

Project No.: 19-1637.0	Set Date: 2020/07/07
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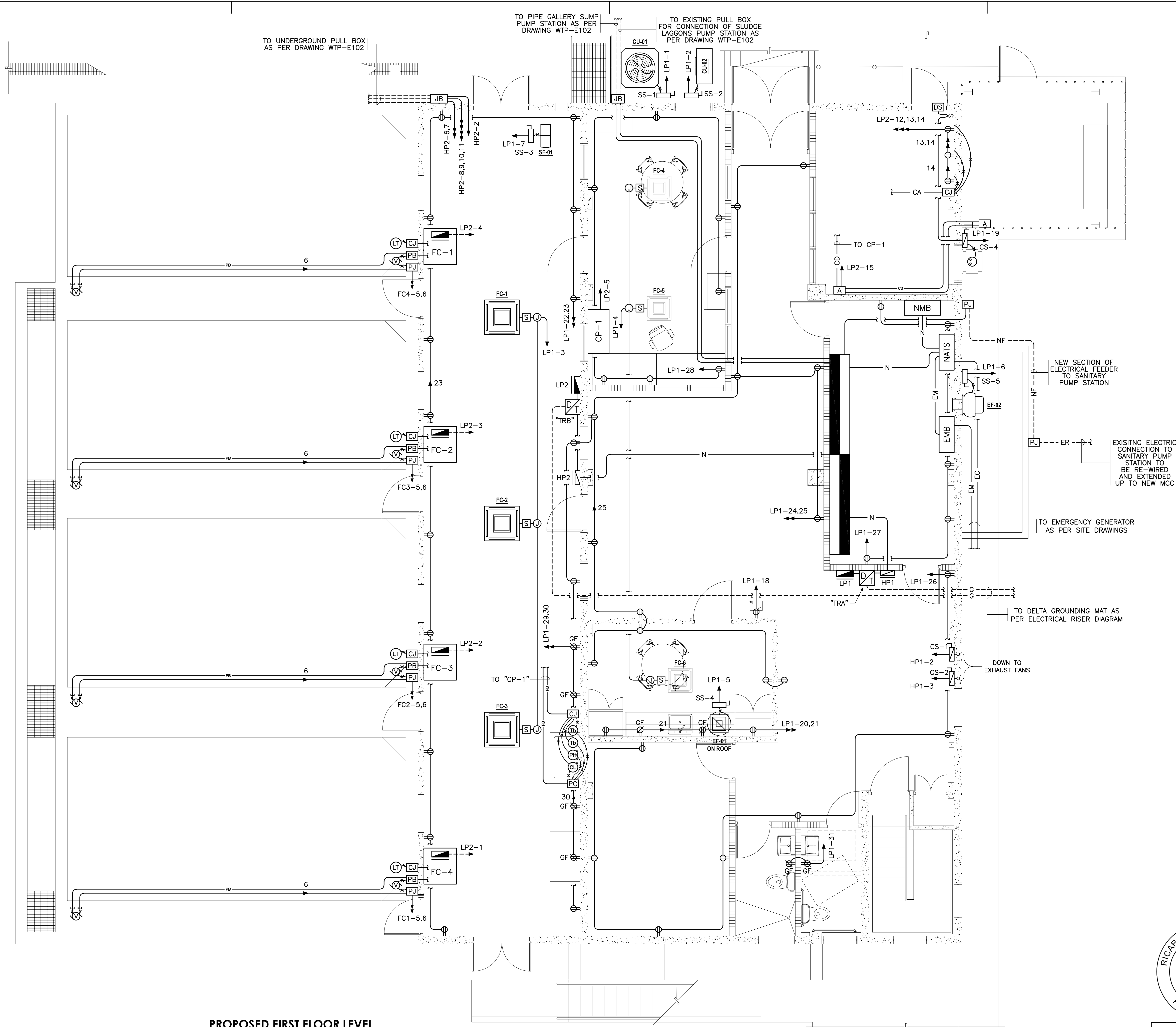
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PROPOSED FIRST FLOOR LEVEL
POWER AND CONTROL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



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Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
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Revisions

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**
CERBA & NAGUABO, PUERTO RICO
Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

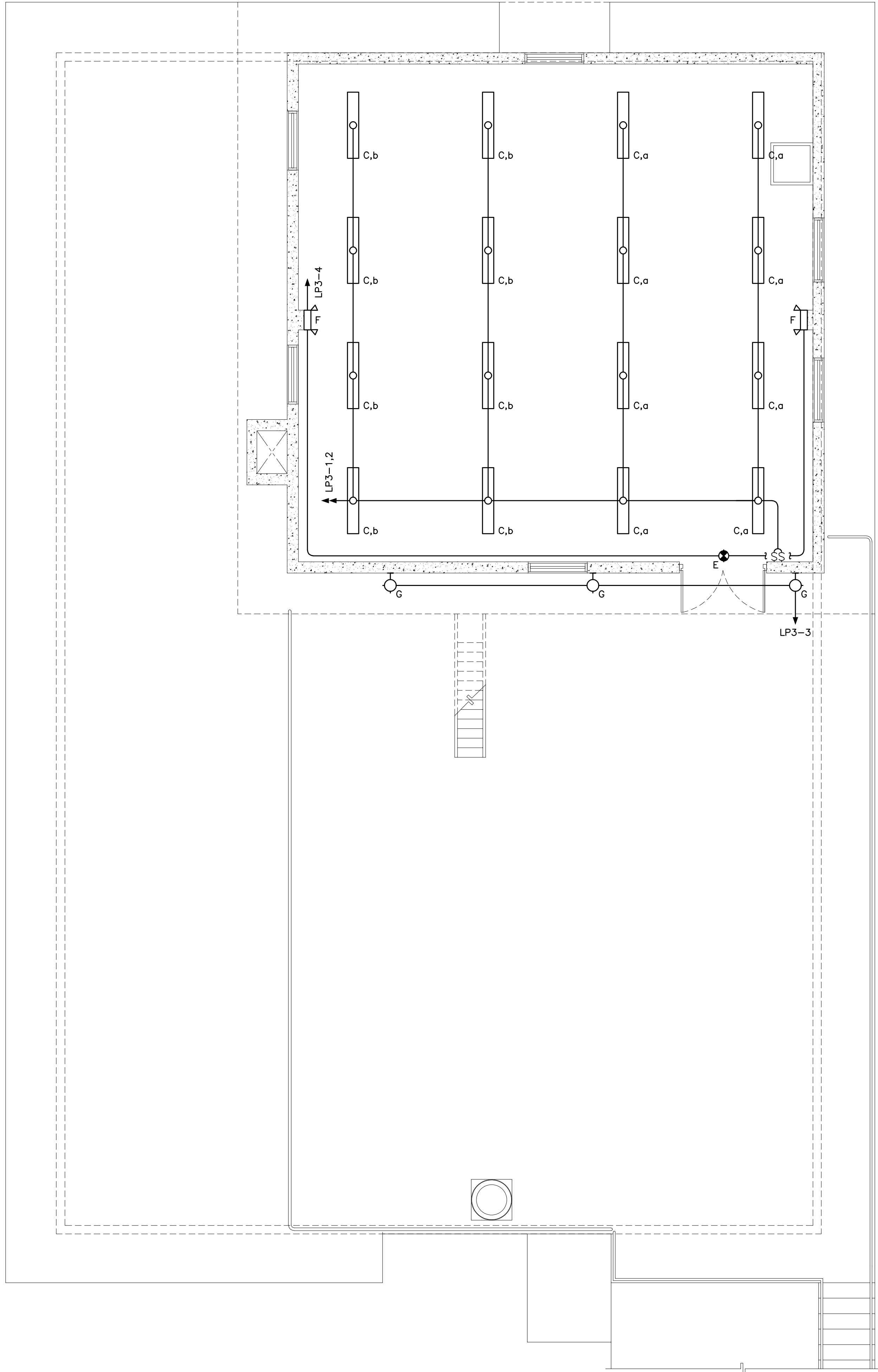
WATER TREATMENT PLANT
Drawing Title:

PROPOSED FIRST FLOOR LEVEL POWER & CONTROL DISTRIBUTION PLAN

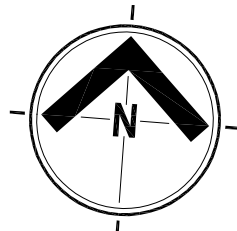
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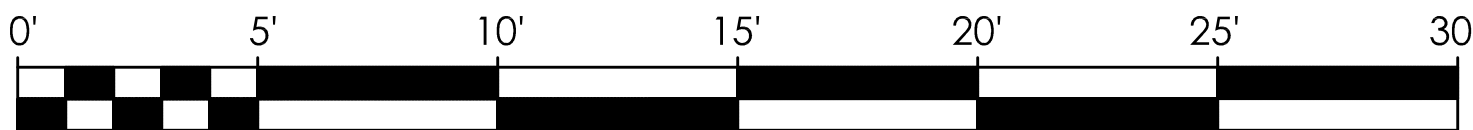
WTP-E208



PROPOSED SECOND FLOOR LEVEL
LIGHTING DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



Integra Design Group
DATE ISSUE
JULY 30, 2021
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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

Owner:

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads



WATER TREATMENT PLANT

Drawing Title:

PROPOSED SECOND FLOOR LEVEL LIGHTING DISTRIBUTION PLAN

Sheet:

WTP-E209

Revisions

Project No.: 19-1637.0

Set Date: 2020/07/07

Drawn by:

Dwg. Date:

Ricardo Ortiz Garcia & Assoc., P.S.C.

Consulting Engineers

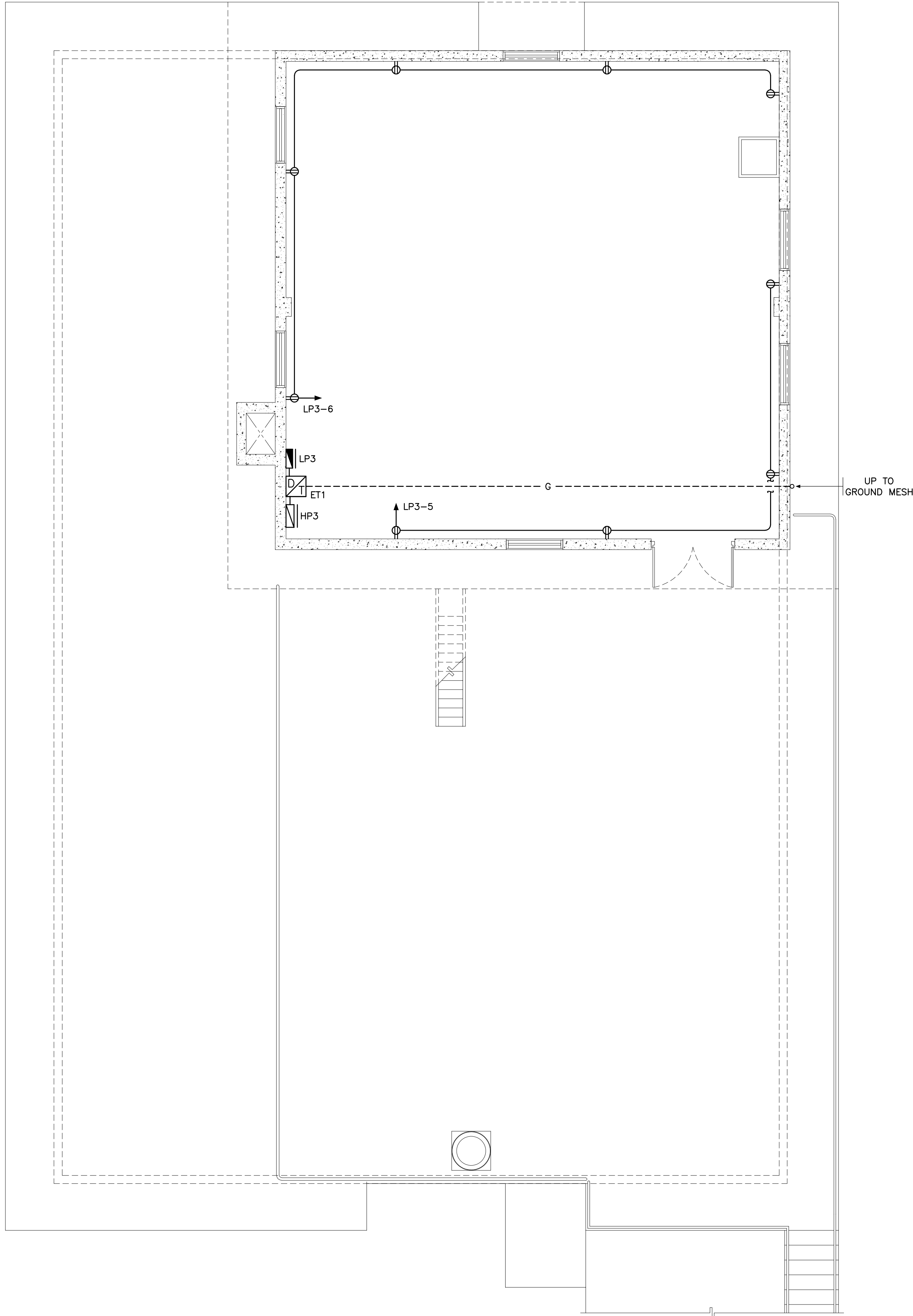
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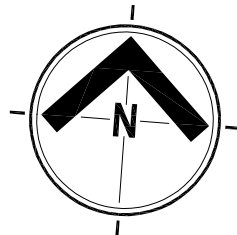
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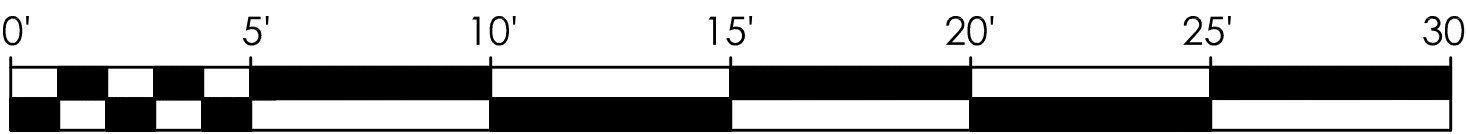
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**PROPOSED SECOND FLOOR LEVEL
POWER AND CONTROL DISTRIBUTION PLAN**
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



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Project Title:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

CEIBA & NAGUABO, PUERTO RICO

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER TREATMENT PLANT

Drawing Title:

PROPOSED SECOND FLOOR LEVEL POWER & CONTROL DISTRIBUTION PLAN

Sheet:

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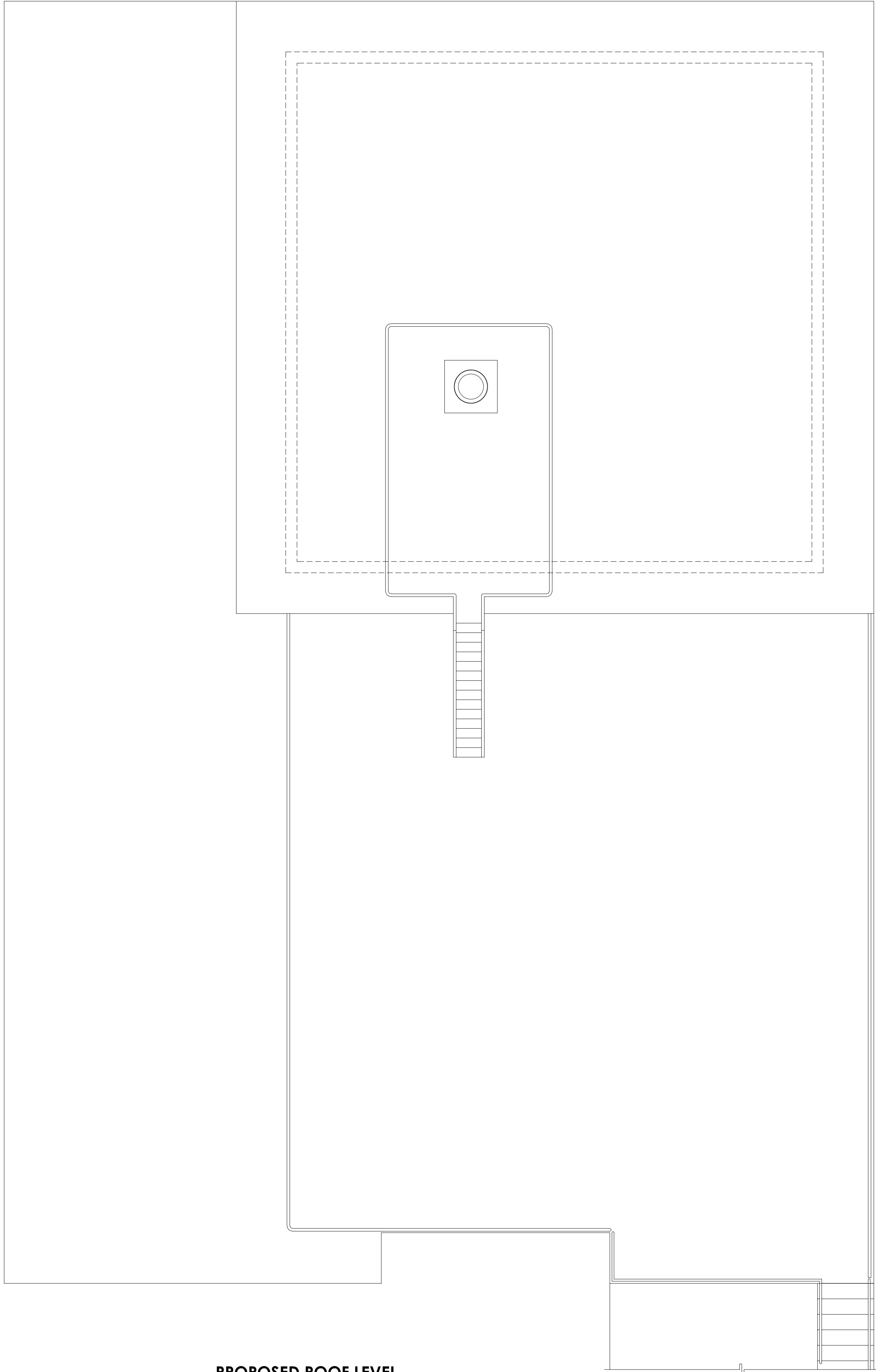
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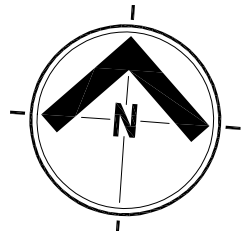
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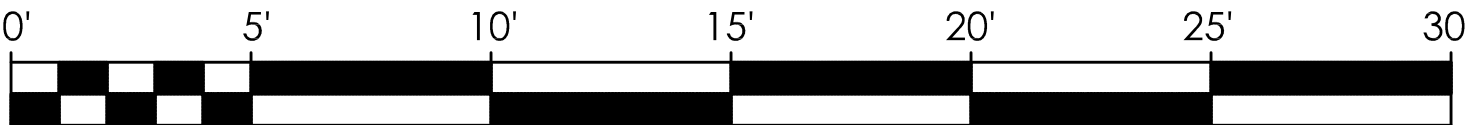
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PROPOSED ROOF LEVEL
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1/4"=1'-0"



GRAPHIC SCALE = 1/4"=1'-0"



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for Roosevelt Roads



WATER TREATMENT PLANT
Drawing Title:

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CERBA & NAGUABO, PUERTO RICO

Owner:

Sheet:

WTP-E211

PROPOSED ROOF LEVEL ELECTRICAL DISTRIBUTION PLAN

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- IMPORTANT NOTES:

RICARDO ORTIZ GARCÍA
INGENIERO
LICENCIADO
LIC. #12448
PUERTO RICO

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Revisions

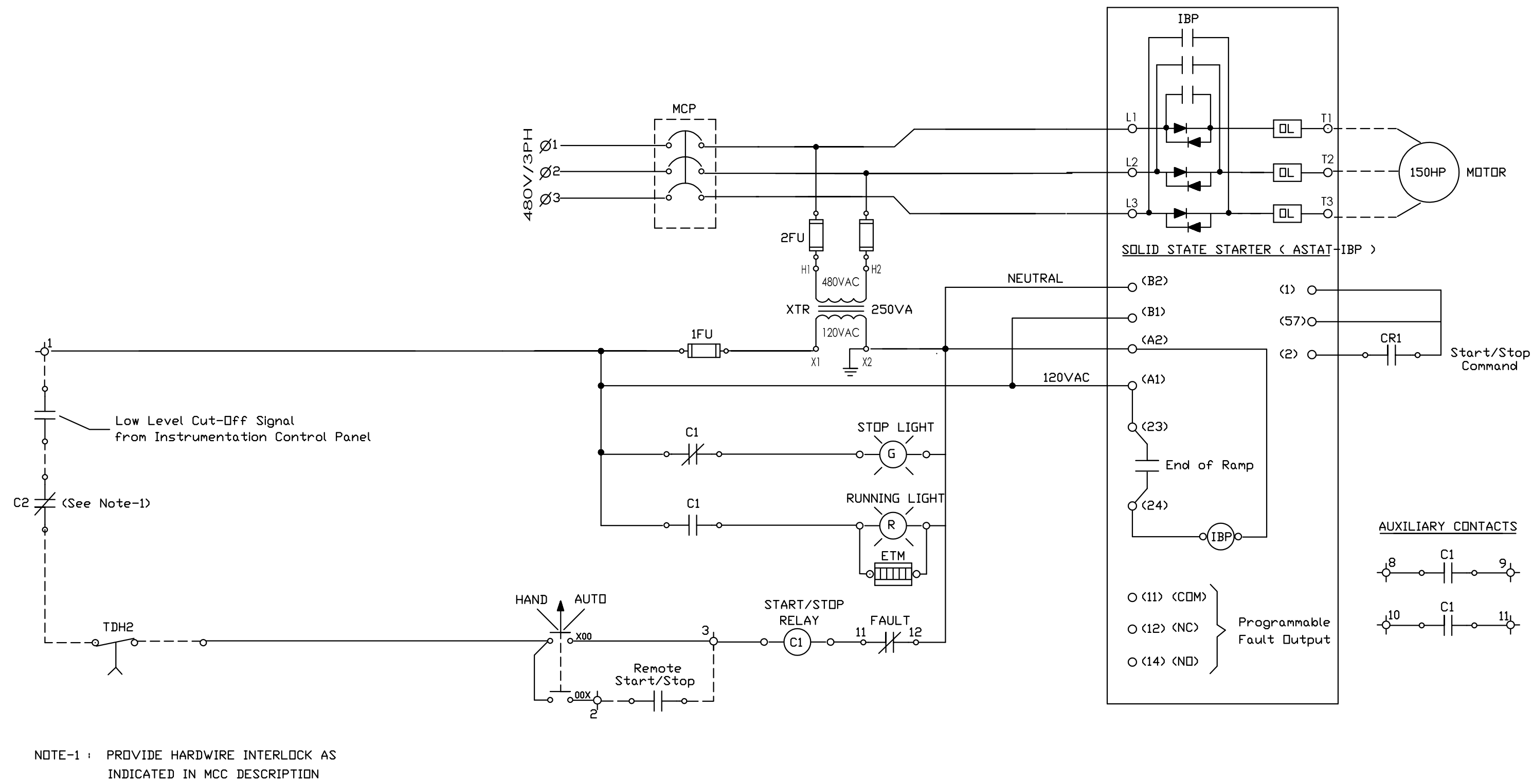
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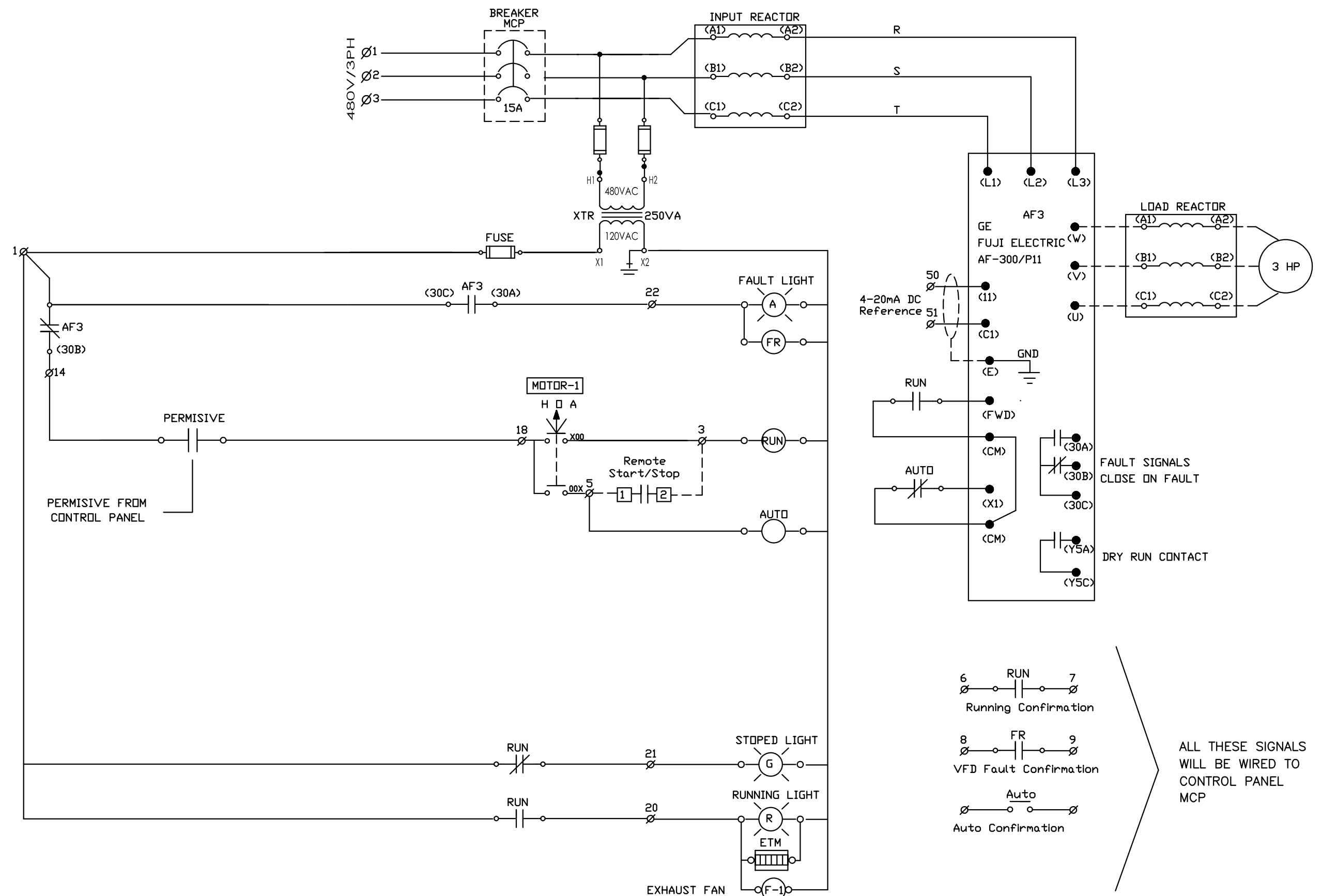
**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

WATER TREATMENT PLANT
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Client: CEIBA & NAGUABO, PUERTO RICO

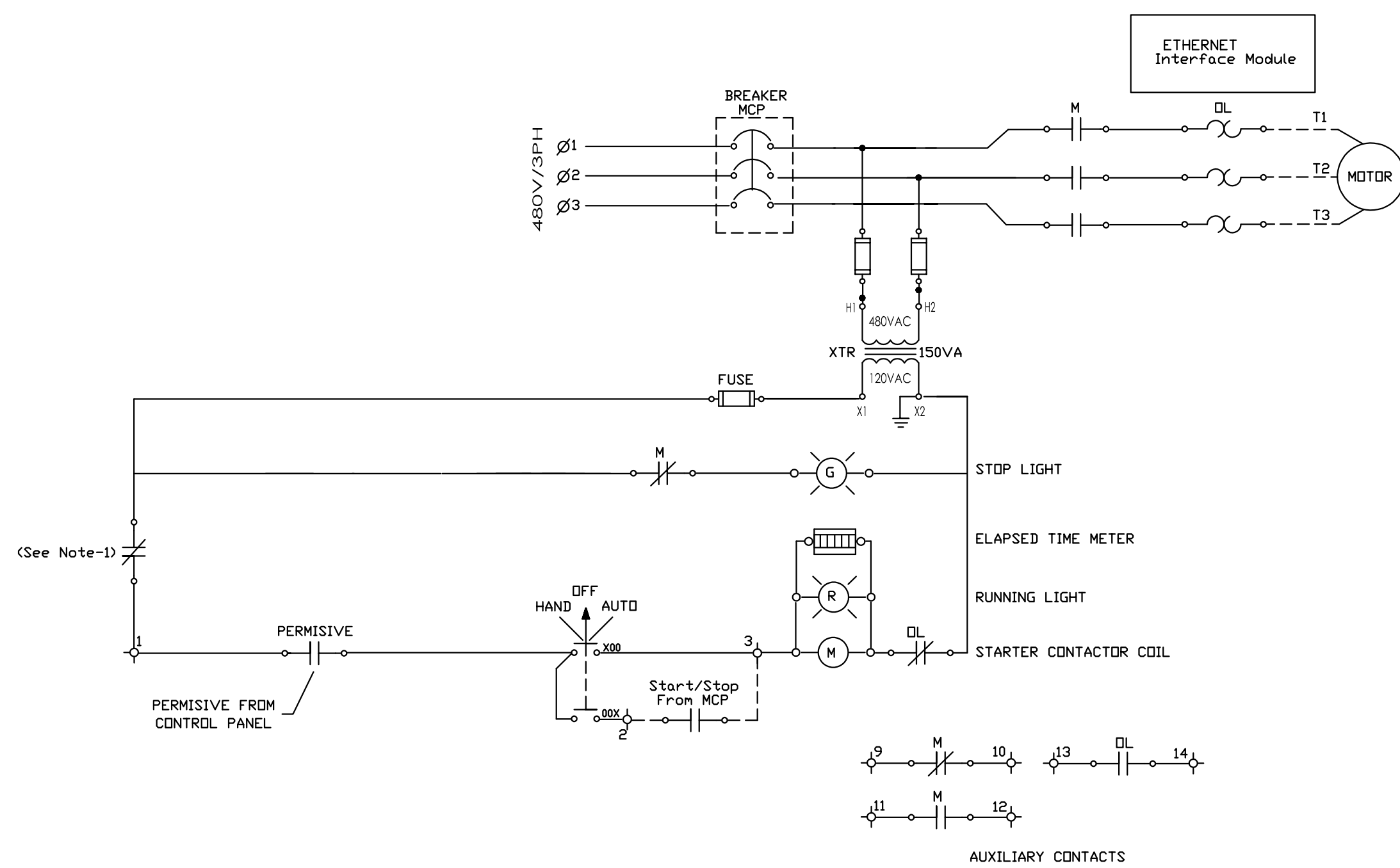
WTP-E212



TYPICAL CONTROL WIRING FOR SERVICE PUMPS WITH SOFT START DRIVES
NOT TO SCALE



TYPICAL CONTROL WIRING FOR EQUIPMENTS WITH VFD DRIVES UNITS
NOT TO SCALE



TYPICAL CONTROL WIRING FOR EQUIPMENTS WITH FVNR UNITS
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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT



GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLANT

MOTOR CONTROL CENTER DETAILS

WTP-E213

Sheet:

Project Title:

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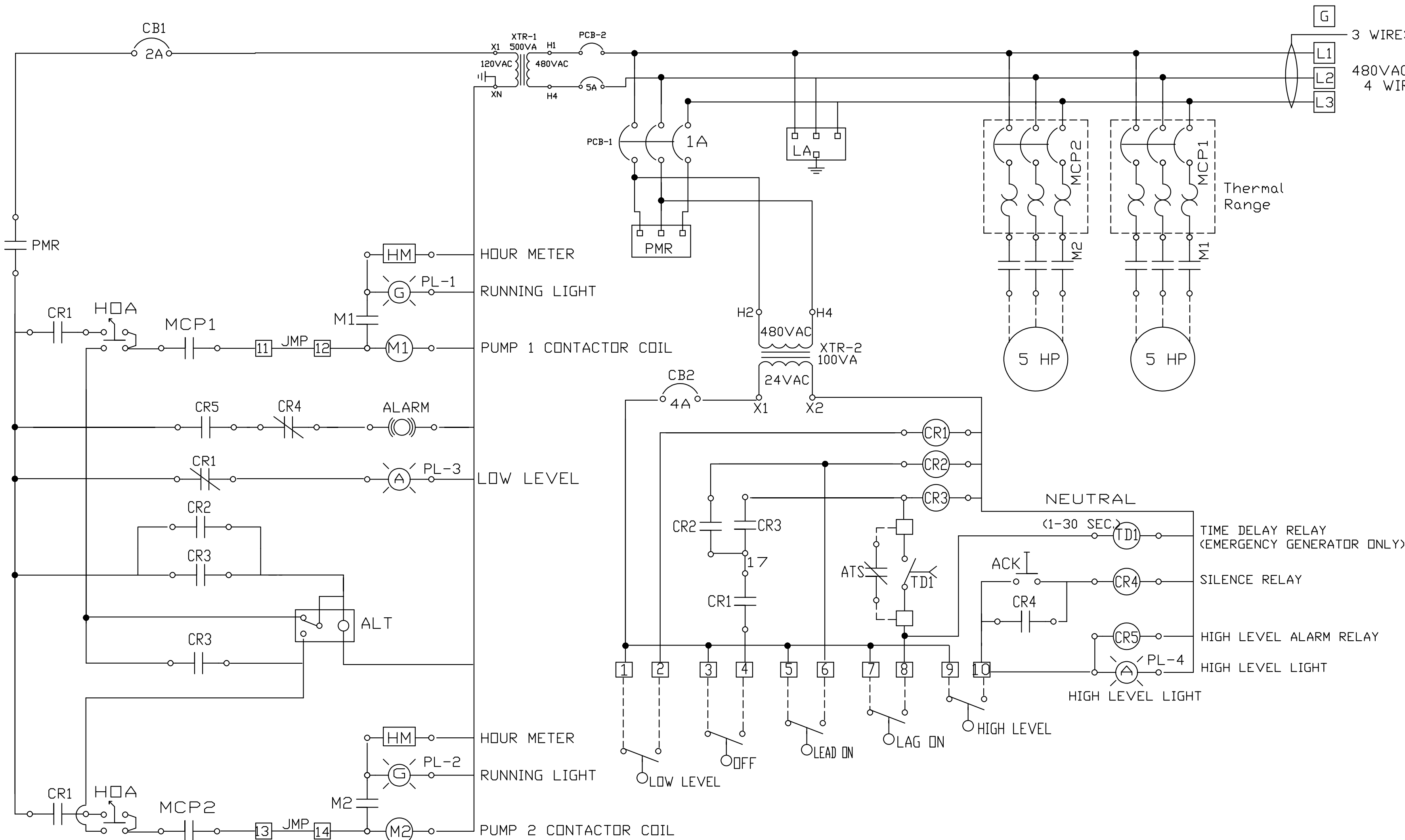
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NOTE: REMOVE JUMPER IN TERMINALS 11-12 & 13-14 TO CONNECT BIMETALLIC CONTACT FROM MOTOR PUMPS

ATS - AUTOMATIC TRANSFER SWITCH CONTACT

MOTOR CONTROL PANEL WIRING DIAGRAM

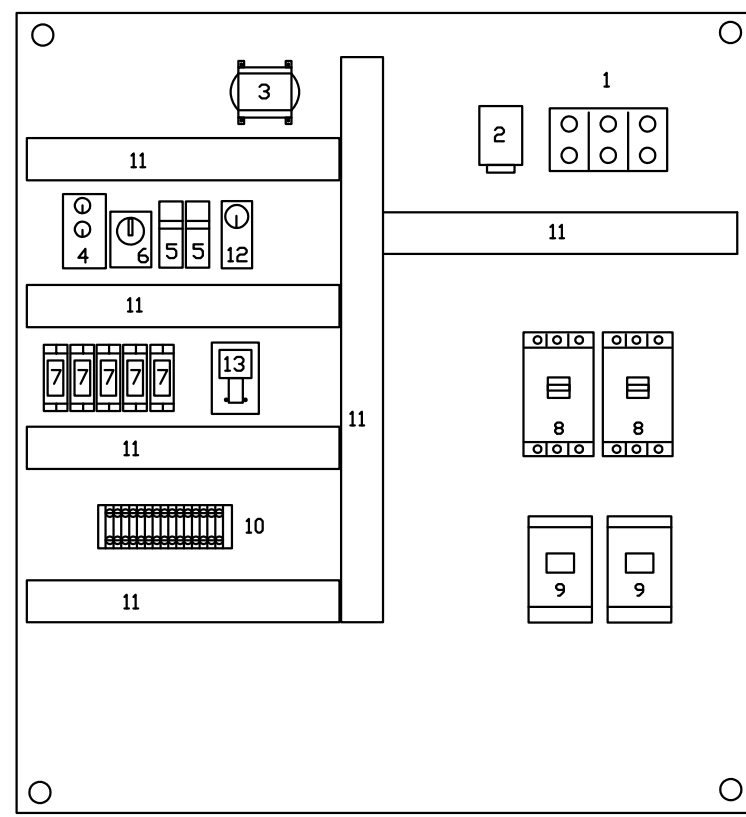
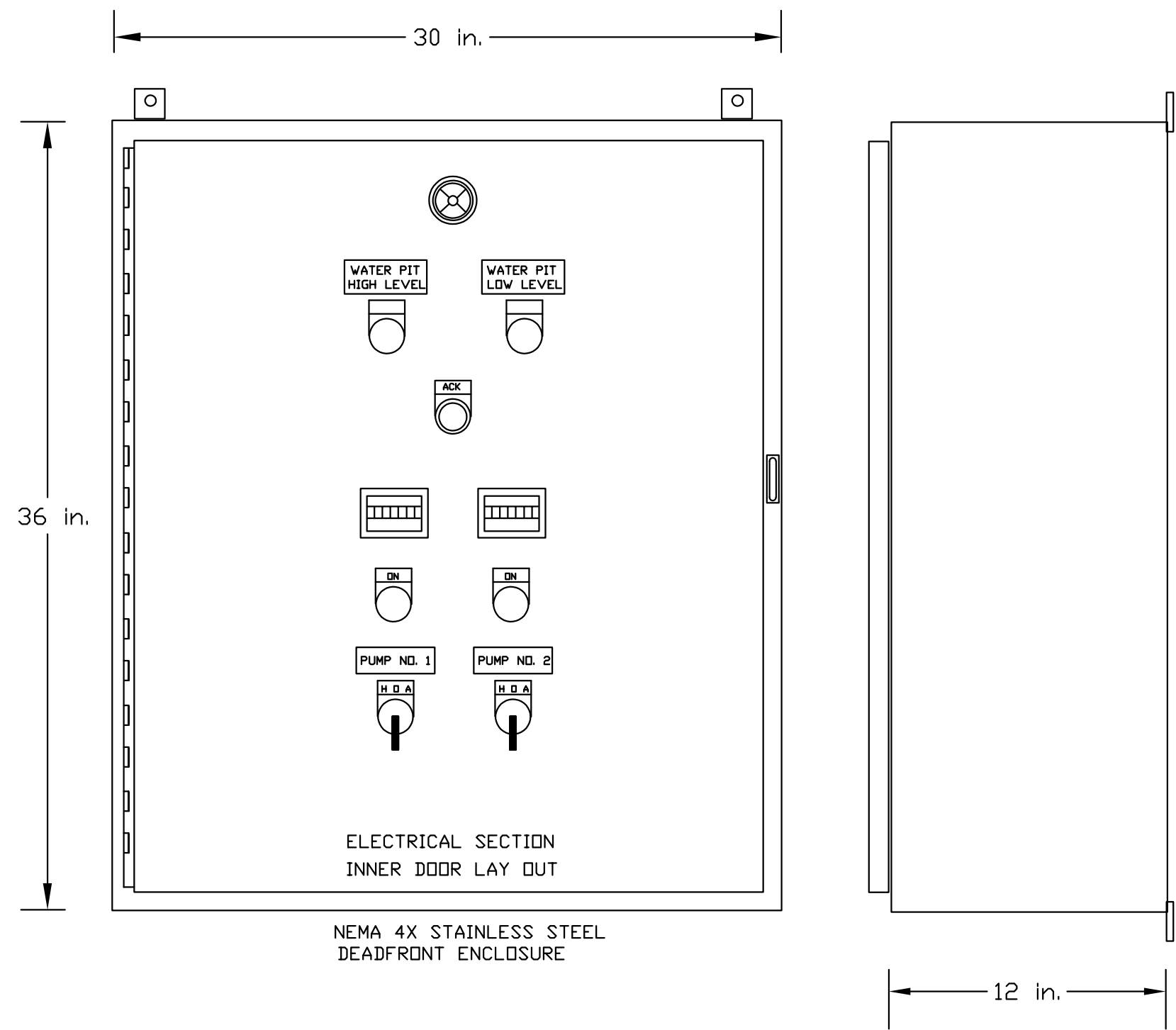
NOT TO SCALE

CONTROL PANEL IMPORTANT NOTES:

- CONTROL PANEL SHALL BE RATED FOR 100A MIN - 480 V - 3 PHASES & 20 KAIC.
- ALL BREAKERS, STARTERS, & ANY OTHER DEVICES SHALL BE RATED FOR 20 KAIC.
- MCP FOR SUBMERSIBLE PUMPS SHALL BE RATED FOR 20A-3P-480 V.
- STARTER & OVERLOAD PROTECTION FOR EACH PUMP SHALL BE RATED FOR 5 HP-3 PHASES-480 V SYSTEM, NEMA SIZE 0.
- ENCLOSURE FOR CONTROL PANEL SHALL BE NEMA 4X, STAINLESS STEEL.

ELECTRICAL CONTROL LEGEND:

MCP: MOTOR CIRCUIT PROTECTOR BREAKER
PMR: PHASE MONITOR RELAY
PCB: POWER CIRCUIT BREAKER
LA: LIGHTNING ARRESTOR
CB: CIRCUIT BREAKER
HSA: HAND SWITCH, AUTO POSITION
H O A: HAND - OFF - AUTO
CR(): CONTROL RELAY



ELECTRICAL LEGEND:

- POWER BLOCK THREE POLES
- LIGHTNING ARRESTOR
- CONTROL TRANSFORMER 480-24VAC
- PHASE MONITOR RELAY
- CIRCUIT BREAKER ONE POLE
- POWER CIRCUIT BREAKER 3 POLES
- CONTROL RELAY
- MOTOR CIRCUIT PROTECTOR BREAKER FOR X HP/480V
- MAGNETIC CONTACTOR FOR X HP/480V
- CONTROL TERMINAL BOARD
- WIRE DUCTS
- TIME DELAY RELAY
- ELECTROMECHANICAL ALTERNATOR

CONTROL PANEL LAY OUT

NOT TO SCALE

IMPORTANT NOTE:

COORDINATE WITH MECHANICAL PHASE THE ELEVATIONS OF THE DIFFERENT LEVEL SENSORS



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Revisions

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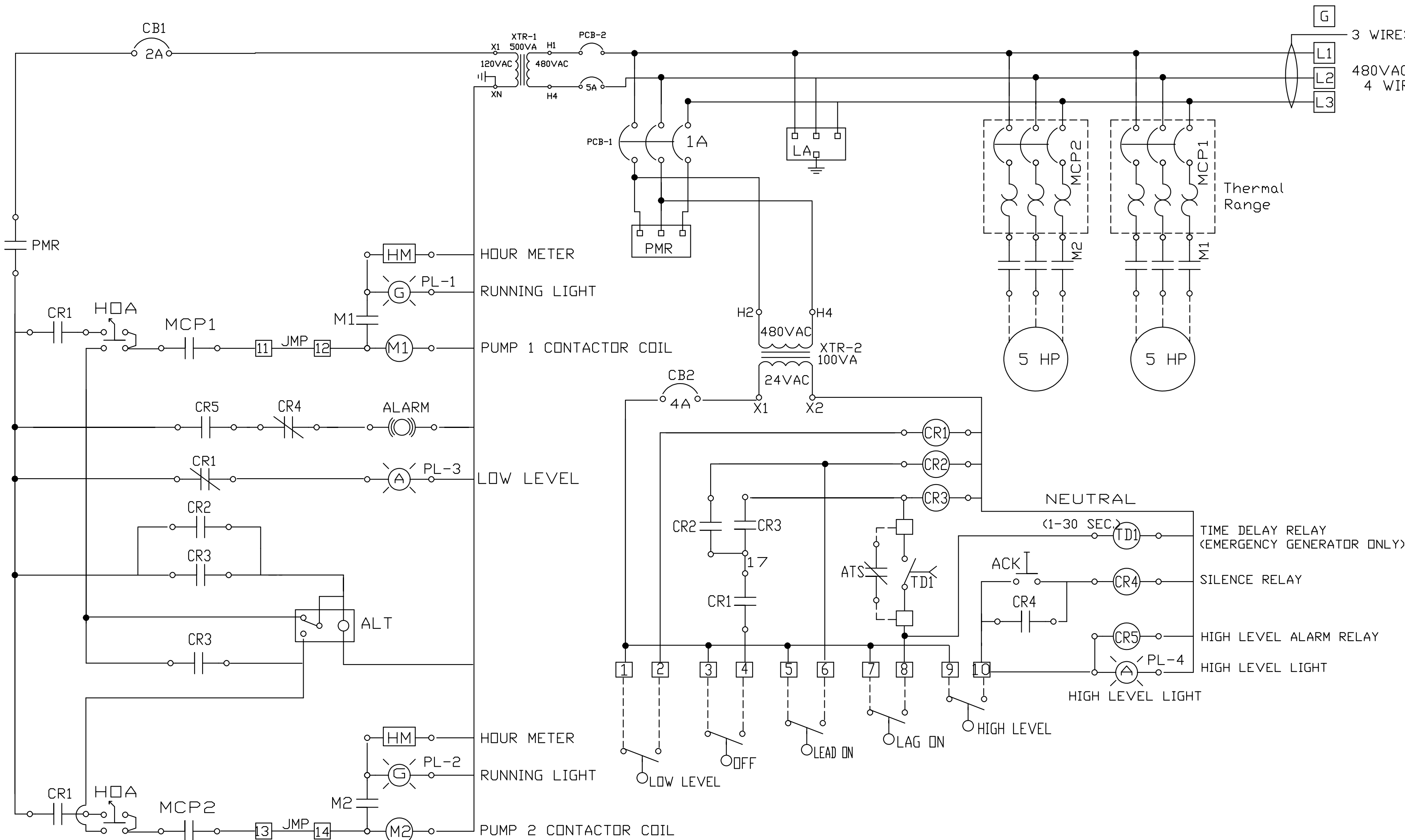
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NOTE: REMOVE JUMPER IN TERMINALS 11-12 & 13-14 TO CONNECT BIMETALLIC CONTACT FROM MOTOR PUMPS

ATS - AUTOMATIC TRANSFER SWITCH CONTACT

MOTOR CONTROL PANEL WIRING DIAGRAM

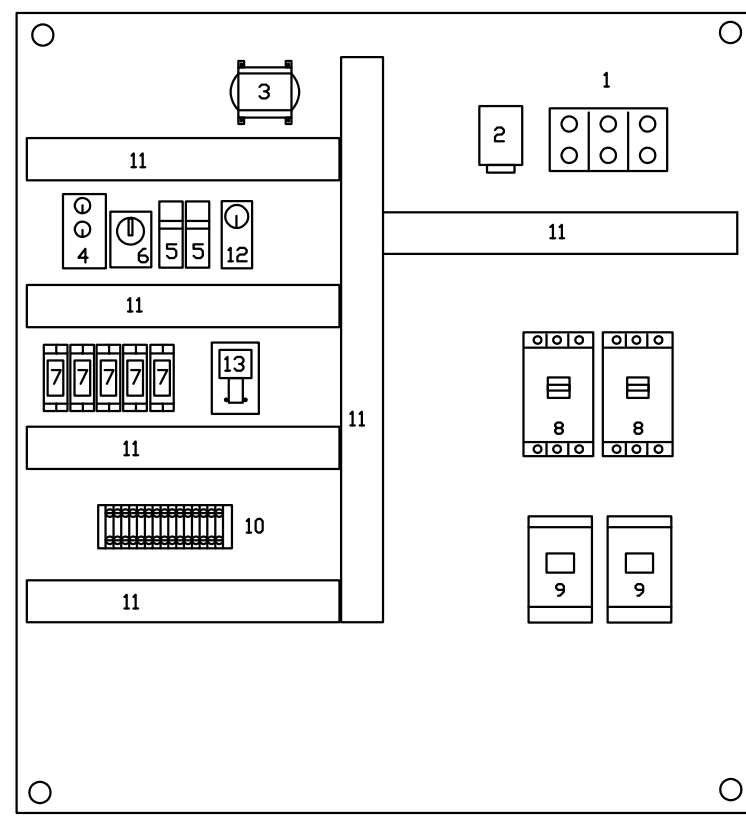
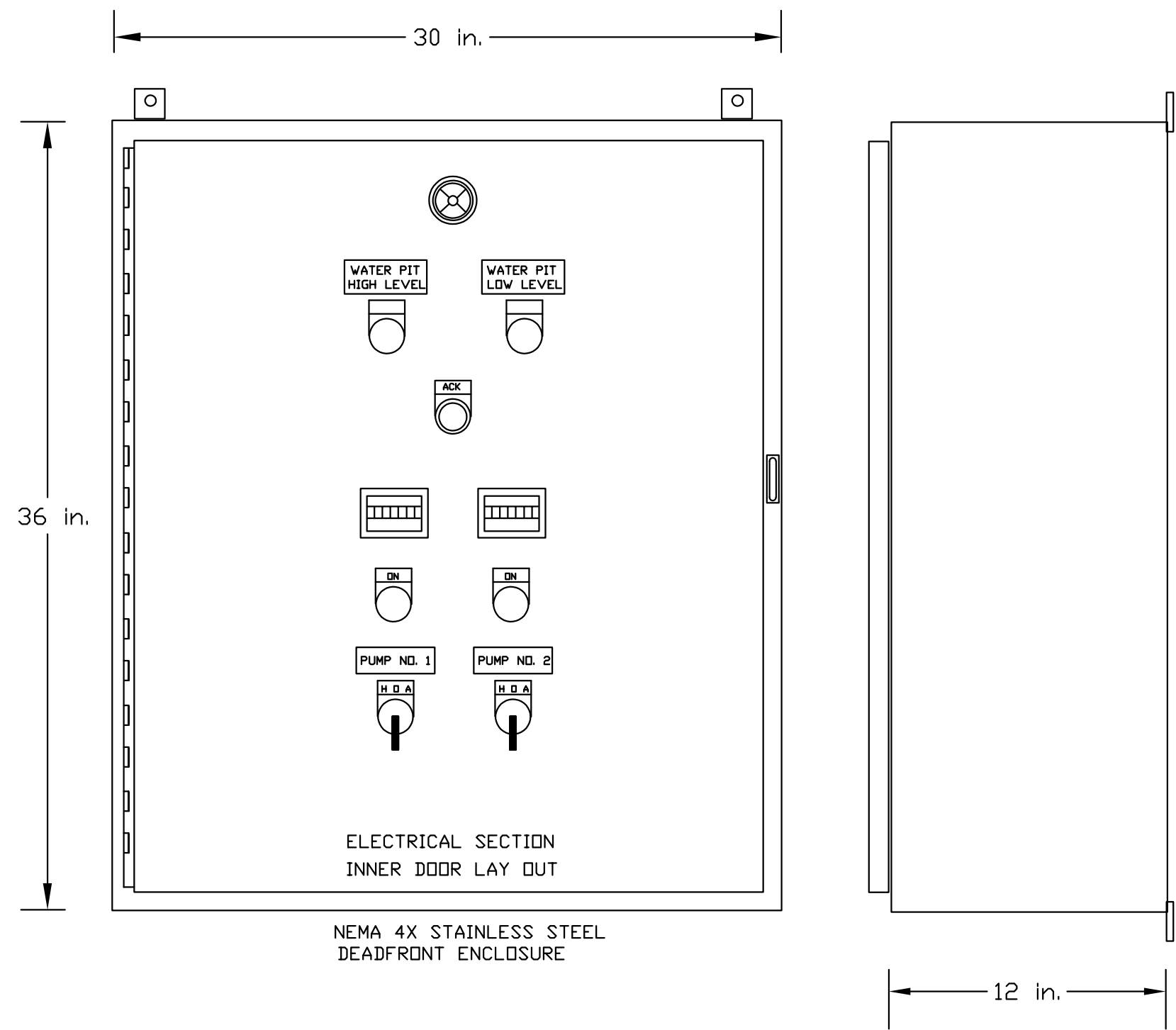
NOT TO SCALE

CONTROL PANEL IMPORTANT NOTES:

- CONTROL PANEL SHALL BE RATED FOR 100A MIN - 480 V - 3 PHASES & 20 KAIC.
- ALL BREAKERS, STARTERS, & ANY OTHER DEVICES SHALL BE RATED FOR 20 KAIC.
- MCP FOR SUBMERSIBLE PUMPS SHALL BE RATED FOR 20A-3P-480 V.
- STARTER & OVERLOAD PROTECTION FOR EACH PUMP SHALL BE RATED FOR 5 HP-3 PHASES-480 V SYSTEM, NEMA SIZE 0.
- ENCLOSURE FOR CONTROL PANEL SHALL BE NEMA 4X, STAINLESS STEEL.

ELECTRICAL CONTROL LEGEND:

MCP: MOTOR CIRCUIT PROTECTOR BREAKER
PMR: PHASE MONITOR RELAY
PCB: POWER CIRCUIT BREAKER
LA: LIGHTNING ARRESTOR
CB: CIRCUIT BREAKER
HSA: HAND SWITCH, AUTO POSITION
H O A: HAND - OFF - AUTO
CR(): CONTROL RELAY



ELECTRICAL LEGEND:

- POWER BLOCK THREE POLES
- LIGHTNING ARRESTOR
- CONTROL TRANSFORMER 480-24VAC
- PHASE MONITOR RELAY
- CIRCUIT BREAKER ONE POLE
- POWER CIRCUIT BREAKER 3 POLES
- CONTROL RELAY
- MOTOR CIRCUIT PROTECTOR BREAKER FOR X HP/480V
- MAGNETIC CONTACTOR FOR X HP/480V
- CONTROL TERMINAL BOARD
- WIRE DUCTS
- TIME DELAY RELAY
- ELECTROMECHANICAL ALTERNATOR

CONTROL PANEL LAY OUT

NOT TO SCALE

IMPORTANT NOTE:

COORDINATE WITH MECHANICAL PHASE THE ELEVATIONS OF THE DIFFERENT LEVEL SENSORS



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Revisions

Project No.: 19-1637.0

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Dwg. Date:

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT



GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

WATER TREATMENT PLANT

Drawing Title:

PIPE GALLERY SUMP PUMP STATION CONTROL PANEL DESCRIPTION

Sheet:

WTP-E215

Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0

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Project Title:

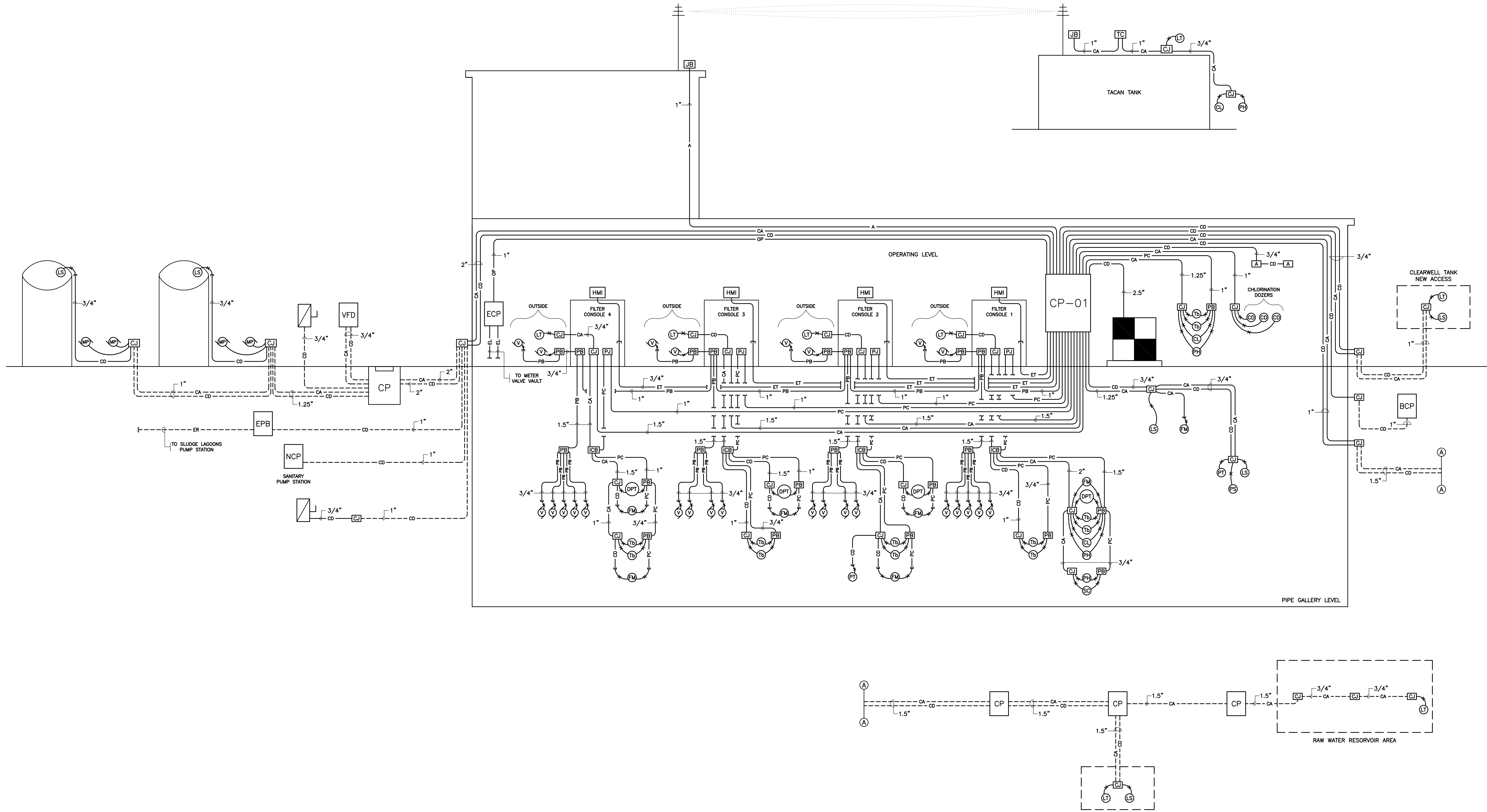
WATER TREATMENT PLANT

Drawing Title:

PIPE GALLERY SUMP PUMP STATION CONTROL PANEL DESCRIPTION

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CONTROL ROUGH-IN CONNECTION DIAGRAM
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Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
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Ing. Ricardo Ortiz Garcia
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Revisions

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

WATER TREATMENT PLANT

Drawing Title:

CONTROL ROUGH IN DIAGRAM

Project Title:

Sheet:

WTP-E216

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REMARKS:

- ① INTEGRATE REMOTE ANALOG SPEED REFERENCE FROM CONTROL PANELS.
- ② INCLUDE CONTACTS AND INTEGRATION OF PERMISSIVE FROM CONTROL PANELS.
- ③ AUTO MODE SHALL BE CONTROLLED BY REMOTE START/STOP SIGNAL FROM CONTROL PANELS.
- ④ INCLUDE ROTARY SWITCH FOR SELECTION OF AUTO—OFF—IN MODES OF OPERATION.
- ⑤ INCLUDE ONE "NO" AND ONE "NC" AUXILIARY CONTACTS.
- ⑥ INCLUDE PILOT LIGHTS FOR RUNNING, STOP, OVERLOAD CONDITIONS.
- ⑦ INCLUDE LOCAL CONTACT MOTOR THERMAL PROTECTION.

FC4 MLO FILTER CONSOLE #4 SQUARE D OR SIMILAR	SURFACE 120/208V-3PH 24 SPACES 100A LUGS
--	---

LIGHTING REMARKS:

1. INSTALLED HANG WITH STAINLESS STEEL CHAIN.
2. INCLUDE ADDITIONAL ELECTRONIC TYPE PHOTOCCELL.
3. INSTALLED ON POLE EQUAL TO "ORNAMENTAL POLE L-25", INCLUDE REQUIRED ACCESSORIES FOR A COMPLETE INSTALLATION.
4. INSTALLED ON EXISTING STEEL POLE.
5. ALL IN ONE SOLAR LUMINARIE, INSTALLED ON CONCRETE POLE EQUAL TO "ORNAMENTAL POLE L-20", INCLUDING ALL REQUIRED MATERIALS AND ACCESSORIES FOR A COMPLETE INSTALLATION AS REQUIRED BY MANUFACTURER.

SAFETY SWITCH SCHEDULE													
DESCRIPTION						FUSES			LOAD	SERVES	FROM	FEEDER	REMARKS
NO.	FRAME	POLES	VOLTS	NEMA	DUTY	TYPE	SIZE	KIND					
SS-1	60A	3	240V	4X	HD	--	--	--	--	CU-01	LP1	SEE RISER DIAGRAM	
SS-2	30A	3	240V	4X	HD	--	--	--	--	CU-02	LP1	SEE RISER DIAGRAM	
SS-3	30A	2	240V	4X	HD	--	--	--	--	SF-01	LP1	SEE RISER DIAGRAM	
SS-4	30A	2	240V	4X	HD	--	--	--	--	EF-01	LP1	SEE RISER DIAGRAM	
SS-5	30A	2	240V	4X	HD	--	--	--	--	EF-02	LP1	SEE RISER DIAGRAM	
SS-6	30A	2	240V	4X	HD	--	--	--	--	METERING PUMP	LP2	SEE PANEL SCHEDULE	
SS-7	30A	2	240V	4X	HD	--	--	--	--	METERING PUMP	LP2	SEE PANEL SCHEDULE	
SS-8	30A	2	240V	4X	HD	--	--	--	--	METERING PUMP	LP2	SEE PANEL SCHEDULE	
SS-9	30A	2	240V	4X	HD	--	--	--	--	METERING PUMP	LP2	SEE PANEL SCHEDULE	

REMARKS:
① FOR EXPOSED SECTION OF FEEDER USE RGS CONDUIT SUPPORTED FROM ROOF, WALLS AND FLOOR STRUCTURE EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS.



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TITULAR QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS
ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE
DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES
DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS
REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS
REGULATORIAS O CORRECCIONES PUBLICAS CON JURISDICCION. RECONOZCO
QUE SI ALCANZA LA ACCION DE ABUSO DE DERECHO, ME RESPONSABILIZO DE HABER
PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA VIA SEAP POR MI, MIS
AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN
RESPONSABLE DE CUALQUIER ACCION JURIDICA Y DISCIPLINARIA POR LA OGPB.

LEGEND:	
	EXISTING EMERGENCY MAIN DISTRIBUTION PANELBOARD TO BE REMOVED AS PER SITE AND ELECTRICAL RISER DIAGRAM DRAWINGS.
	EXISTING MAIN CIRCUIT BREAKER TO BE REMOVED.
	EXISTING MAIN DISTRIBUTION PANELBOARD TO BE REMOVED.
	EXISTING AUTOMATIC TRANSFER SWITCH TO BE REMOVED.
	EXISTING MAIN BREAKER TO BE REMOVED.
	EXISTING EQUIPMENT TO BE REMOVED.
	EXISTING BRANCH PANELBOARD AT 480 V TO BE REMOVED.
	EXISTING BRANCH PANELBOARD AT 120/208 V TO BE REMOVED.
	EXISTING DRY TYPE TRANSFORMER TO BE RE-INSTALLED AS PER ELECTRICAL RISER DIAGRAM.
	EXISTING DISCONNECT TO BE REMOVED.
	EXISTING CEILING MOUNTED LUMINARIE TO BE REMOVED.
	EXISTING FLUORESCENT LUMINARIE TO BE REMOVED.
	EXISTING EXIT LIGHT TO BE REMOVED.
	EXISTING MOTOR CONTROL CENTER TO BE REMOVED.
	EXISTING CONTROL PANEL TO BE REMOVED OR UP-GRADED AS PER INSTRUMENTATION AND MECHANICAL DRAWINGS.
	EXISTING ELECTRICAL FEEDER TO REMOTE PUMP STATIONS TO BE RE-WIRED AS PER ELECTRICAL DRAWINGS.
	EXISTING CONTROL CONNECTION TO BE RE-WIRED AS PER ELECTRICAL DRAWINGS AND INSTRUMENTATION DRAWINGS.
	EXISTING FILTER CONSOLES TO BE UP-GRADED AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	EXISTING STEEL POLE WITH OUT OF SERVICE LUMINARIES TO BE UP-GRADED AS PER ELECTRICAL DRAWINGS.
	EXISTING ELECTRICAL FEEDER TO BE REMOVED.
	NORMAL SERVICE MAIN DISCONNECT AS PER ELECTRICAL RISER DIAGRAM.
	AUTOMATIC TRANSFER SWITCH AS PER ELECTRICAL RISER DIAGRAM.
	EMERGENCY SERVICE MAIN DISCONNECT AS PER ELECTRICAL RISER DIAGRAM.
	MOTOR CONTROL CENTER FOR POWER DISTRIBUTION AND CONTROL OF WATER TREATMENT PLANT AS PER ELECTRICAL RISER DIAGRAM AND MOTOR CONTROL CENTER DESCRIPTION.
	UNDERGROUND POWER PULL BOX AS PER ELECTRICAL RISER DIAGRAM AND DETAILS.
	UNDERGROUND CONTROL PULL BOX FOR WIRING OF CONTROL CONNECTIONS AS PER DETAILS.
	DISTRIBUTION PANELBOARD CONNECTED AT 480 V AS PER PANELBOARD SCHEDULE AND ELECTRICAL RISER DIAGRAM.
	DISTRIBUTION PANELBOARD CONNECTED AT 208 V AS PER PANELBOARD SCHEDULE AND ELECTRICAL RISER DIAGRAM.
	DISCONNECT SWITCH AS PER ELECTRICAL RISER DIAGRAM AND SAFETY SWITCH SCHEDULE.
	COMBINATION MOTOR STARTER AS PER ELECTRICAL RISER DIAGRAM AND MAGNETIC MOTOR STARTER SCHEDULE.
	ENCLOSED VFD DRIVE AS DESCRIBED IN VFD SCHEDULE.
	CONTROL JUNCTION BOX FOR WIRING AND CONNECTION OF CONTROL CONDUCTORS AS DESCRIBED IN DRAWINGS, 12" x 12" x 4", NEMA 4X, STAINLESS STEEL.
	POWER JUNCTION BOX FOR WIRING AND CONNECTION OF POWER CONDUCTORS AS DESCRIBED IN DRAWINGS, 12" x 12" x 4", NEMA 4X, STAINLESS STEEL.
	JUNCTION BOX AS DESCRIBED IN DRAWINGS.
	JUNCTION BOX FOR CONNECTION OF EQUIPMENTS AS DESCRIBED IN DRAWINGS
	PROFIBUS CONNECTION BOX AS PER INSTRUMENTATION DRAWINGS.
	INTERMEDIATE CONNECTION BOX FOR WIRING AND CONNECTION OF CONTROL CONDUCTORS AS DESCRIBED IN DRAWINGS, 12" x 12" x 4", NEMA 4X, STAINLESS STEEL.
	MAIN CONTROL PANEL AS PER INSTRUMENTATION DRAWINGS.
	LOCAL CONTROL PANEL FOR BLOWERS TO BE INTEGRATED TO ELECTRICAL DISTRIBUTION.
	CONTROL PANEL FOR PUMPS STATION AS DESCRIBED IN DRAWINGS.
	NEW ELECTRICAL FEEDER FOR EQUIPMENTS AS ELECTRICAL RISER DIAGRAM, PANELBOARD SCHEDULES OR FEEDERS SCHEDULE.
	MAIN ELECTRIC FEEDER CONNECTED TO EMERGENCY GENERATOR AS PER ELECTRICAL RISER DIAGRAM.
	CONTROL CONNECTION FOR EMERGENCY GENERATOR AS PER ELECTRICAL RISER DIAGRAM.
	EXPOSED BRANCH ELECTRICAL CONNECTION TO MECHANICAL OR CONTROL EQUIPMENTS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER PANELBOARD SCHEDULE OR AS DESCRIBED IN DRAWINGS.
	UNDERGROUND OR WALL MOUNTED BRANCH ELECTRICAL CONNECTION TO MECHANICAL OR CONTROL EQUIPMENTS INSTALLED AS PER TRENCH DETAILS OR SUPPORTED FROM WALL STRUCTURE.
	HOME RUN TO PANELBOARD, NUMBER OF ARROWS INDICATES NUMBER OF CIRCUITS AS PER PANELBOARD SCHEDULE.
	EXPOSED CONTROL CONDUIT FOR ANALOG CONTROL CONDUCTORS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER CONTROL RISER DIAGRAM.
	SAME AS ABOVE BUT INSTALLED UNDERGROUND AS PER TRENCH DETAILS.
	EXPOSED CONTROL CONDUIT FOR DIGITAL CONTROL CONDUCTORS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER CONTROL ROUGH-IN DIAGRAM.
	SAME AS ABOVE BUT INSTALLED UNDERGROUND AS PER TRENCH DETAILS.
	EXPOSED CONTROL CONDUIT FOR ETHERNET CONTROL CONDUCTORS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER CONTROL ROUGH-IN DIAGRAM.
	SAME AS ABOVE BUT INSTALLED UNDERGROUND AS PER TRENCH DETAILS.
	EXPOSED CONTROL CONDUIT FOR POWER FOR CONTROL CONDUCTORS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER CONTROL ROUGH-IN DIAGRAM.
	SAME AS ABOVE BUT INSTALLED UNDERGROUND AS PER TRENCH DETAILS.
	EXPOSED CONTROL CONDUIT FOR PROFIBUS CONDUCTORS INSTALLED SUPPORTED FROM WALL OR ROOF STRUCTURES EVERY 5 FT. WITH CORROSION RESISTANT MATERIALS AS PER CONTROL ROUGH-IN DIAGRAM.
	SAME AS ABOVE BUT INSTALLED UNDERGROUND AS PER TRENCH DETAILS.
	POWER FLEXIBLE CONNECTION WITH LIQUID TIGHT FLEXIBLE CONDUIT SIZE AS FEEDER CONDUIT SIZE.
	CONTROL FLEXIBLE CONNECTION WITH LIQUID TIGHT FLEXIBLE CONDUIT 3/4".
	FLOW TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.

	LEVEL TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	PH AND TEMPERATURE TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	PRESSURE TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	LEVEL SENSOR SWITCH AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	RESIDUAL CHLORINE TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	DIFFERENTIAL PRESSURE TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	TURBIDITY TRANSMITTER AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS.
	GROUNDING ELECTRODE AS PER ELECTRICAL RISER DIAGRAM.
	DELTA GROUNDING MAT AS PER ELECTRICAL RISER DIAGRAM AND DETAIL.
	GROUNDING CONDUCTOR AS PER ELECTRICAL RISER DIAGRAM.
	TRANSITION TO LOWER LEVEL AS PER ELECTRICAL AND CONTROL RISER DIAGRAMS.
	TRANSITION TO UPPER LEVEL AS PER ELECTRICAL AND CONTROL RISER DIAGRAMS.
	TRANSITION FROM RGS CONDUIT TO SEALTIGHT FLEXIBLE CONDUIT.
	WATER PUMP OR MECHANICAL EQUIPMENT WITH MOTOR AS PER MECHANICAL DRAWINGS.
	MOTORIZED VALVE AS PER MECHANICAL AND INSTRUMENTATION DRAWINGS
	FRACTIONAL HORSEPOWER STARTER WITH HANDLE GUARD LOCK-OFF FOR LOCAL DISCONNECT RATED FOR 120 V, NEMA 4 DUSTTIGHT ENCLOSURE, 1 POLE WITH PILOT LIGHT EQUAL TO SQUARE D FW1P.
	DOOR SWITCH FOR CONTROL OF EXHAUST FAN AT CHLORINE BUILDING.
	FLUORESCENT LIGHTING FIXTURE, CEILING MOUNTED, CAPITAL LETTER INDICATES TYPE AS PER LIGHTING FIXTURE SCHEDULE AND SMALL LETTER INDICATES SWITCHING.
	EXIT LIGHT AS PER LIGHTING FIXTURE SCHEDULE.
	EMERGENCY LIGHT AS PER LIGHTING FIXTURE SCHEDULE.
	OCTAGONAL 4" x 4" x 1 1/2" GALVANIZED BOX, FLUSH WITH SLAB OR EXPOSED INSIDE PLENUM WITH CEILING MOUNTED LIGHTING FIXTURE, CAPITAL LETTER INDICATES FIXTURE AS PER LIGHTING FIXTURE CHEDULE, SMALL LETTER INDICATES SWITCHING.
	SAME AS ABOVE BUT FOR HIGH BAY LUMINARIES.
	SAME AS ABOVE BUT WALL MOUNTED AT 8'-0" A.F.F. OR AS INDICATED ON DRAWINGS.
	POLE MOUNTED LUMINARIE FOR SITE LIGHTING AS PER LIGHTING FIXTURE SCHEDULE AND DETAIL.
	POLE MOUNTED PHOTOVOLTAIC LUMINARIE AS PER LIGHTING FIXTURE SCHEDULE.
	JUNCTION BOX 4" x 4" x 2 1/2" CAST ALUMINUM FS TYPE BOX MOUNTED SURFACE AT HEIGHT INDICATED ON DRAWINGS OR COORDINATE WITH ARCHITECT.
	HEAVY DUTY QUIET SWITCH, WALL TYPE, 20 A, 120 V, SINGLE POLE INSTALLED SURFACE WITH WALL IN 4" x 4" x 1 1/2" CAST ALUMINUM FS TYPE BOX OR GANGED TOGETHER AT 54" A.F.F., 3W INDICATES THREE WAY, 4W INDICATES FOUR WAY, SUBLETTER INDICATES LIGHT CONTROLLED AND K INDICATES KEY OPERATED.
	DUPLEX CONVENIENCE RECEPTACLE, GROUND TYPE, 20 A, 120 V, INSTALLED IN CAST ALUMINUM FS TYPE BOX AT 18" A.F.F. UNLESS OTHERWISE INDICATED, W.P. MEANS WITH WEATHER PROOF COVER, G.F. MEANS PROTECTED WITH GROUND FAULT CIRCUIT INTERRUPTER.
	SAME AS ABOVE BUT INSTALLED 6" ABOVE COUNTER OR AS INDICATED ON DRAWINGS.
	BATTERY BANK FOR PHOTOVOLTAIC SYSTEM AT TACAN TANK AS DESCRIBED.
	PHOTOVOLTAIC EQUIPMENT CABINET AT TACAN TANK AS DESCRIBED.

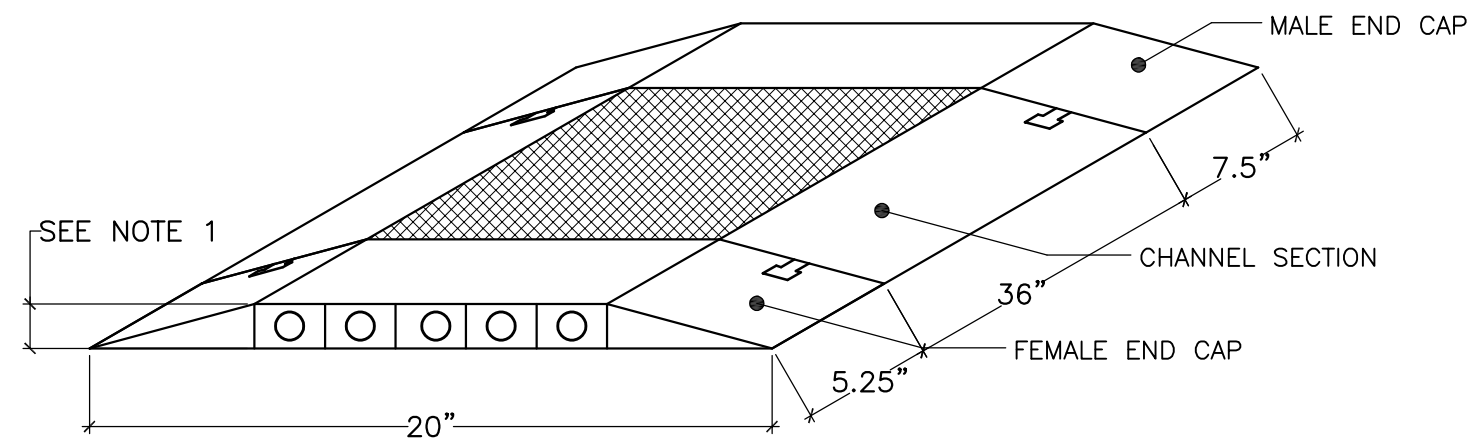
IMPORTANT NOTES:

- WIRING SHALL BE DONE IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE AND ALL APPLICABLE REGULATION OF PREPA, ANSI, AND NEMA.
- ALL UNDERGROUND PVC CONDUITS MUST BE SCHEDULE 40.
- ALL SUPPORT, BOLTS, STRAP, SCREWS, ETC, SHALL BE OF CORROSION RESISTANCE MATERIAL OR PROTECTED AGAINST CORROSION.
- NO WIRE SHALL BE SMALLER THAN NO. 12 AWG OF COPPER INSULATED 600 VOLTS TYPE INSULATION WITH HEAVY WALL NEOPRENE JACKET 90C - THHN / THWN FOR #6 AWG AND SMALLER, XHHW FOR GREATER THAN #6.
- NO CONDUIT SHALL BE SMALLER THAN 3/4" DIAMETER STANDARD HOT DIPPED GALVANIZED STEEL PVC COATED.
- CONTROL PANEL SHALL BE FACTORY WIRED, DEAD FRONT.
- ALL WIRING AND EQUIPMENT SHALL BE GROUNDED IN ACCORDANCE WITH N.E.C.
- NO CHANGE WILL BE MADE FROM THIS DESIGN DURING CONSTRUCTION UNLESS AUTHORIZED BY P.R.A.S.A.
- MOTOR CONTROLLER DISCONNECTING MEANS MUST HAVE PADLOCKING PROVISIONS.
- USE COLOR CODE WIRING FOR EACH IDENTIFICATION AND MAINTENANCE.
- PROVIDE THREE SPARES FOR EACH FUSE CAPACITY IN THE CONTROL CENTER.
- ALL EXPOSED CONDUITS MUST BE RIGID STEEL GALV, PVC COATED UNDERGROUND CONDUITS MUST BE PVC SCH. 40 .
- EMT OR ENT FLEXIBLE CONDUITS ARE NOT PERMITTED.
- ALL ELECTRICAL INSTALLATION SHALL BE EXPOSED WITH CAST IRON BOXES AND RIGID GALVANIZED PVC COATED CONDUITS.
- PROVIDE AND INSTALL DUCT SEAL TO ALL CONDUIT CONNECTIONS INCLUDING POWER AND CONTROL CONDUITS.
- FOR CONDUITS INSTALLED ON TOP OF CONCRETE WALKWAY PROVIDE A MEANS TO AVOID TIPPING HAZARD WITH MODULAR CONDUIT PROTECTION SYSTEM AS INDICATED IN DRAWINGS AND AS ILLUSTRATED IN DETAIL.

GENERAL NOTES:

- ENTIRE INSTALLATION SHALL CONFORM TO N.E.C., N.F.C. AND ALL LOCAL ORDINANCES HAVING JURISDICTION.
- MINIMUM SIZE FOR ALL PULL BOXES SHALL BE 4" TRADE.
- MINIMUM WIRE SIZE SHALL BE NO. 12 AWG.
- PROVIDE IDENTIFICATION OF ALL BRANCH CIRCUITS ON A TYPEWRITTEN DIRECTORY CARD IN THE PANEL DOOR.
- ELECTRICAL CONTRACTOR SHALL VERIFY EXACT ELECTRICAL REQUIREMENTS AND EXTENT OF WORK WITH P.R. COMMUNICATIONS AUTHORITY TELEPHONE SYSTEM INSTALLATION.
- EXCEPT WHERE NOTED OTHERWISE ALL FIXTURES & LAMPS SHALL BE FURNISHED & INSTALLED BY ELECTRICAL CONTRACTOR.
- FLUORESCENT FIXTURES SHALL HAVE ELECTRONIC TYPE BALLASTS.
- ALL MATERIALS SHALL BE NEW EXCEPT WHERE OTHERWISE NOTED & SHALL BEAR UNDERWRITER & UNION LABELS, WHERE SUCH LABELING APPLIES.
- ALL MATERIALS & INSTALLATION SHALL CONFORM TO P.R.A.S.A. GENERAL DESIGN SPECIFICATIONS & BUILDING STANDARDS.
- CONDUIT SHALL BE GALVANIZED STEEL, RIGID HEAVY WALL PVC COATED, WITH WATERTIGHT FITTINGS OR PVC.
- EXCEPT WHERE OTHERWISE INDICATED, WIRE SHALL BE COPPER WITH 600 VOLT INSULATION TYPE THHN FOR BRANCH CONDUIT WORK, TYPE THW FOR SIZES LARGER THAN #4. ALUM. WIRE NOT PERMITTED.
- OUTLET BOXES SHALL BE CAST IRON OR STAINLESS STEEL.
- ELECTRICAL CONTRACTOR SHALL VERIFY ALL EQUIPMENT REQUIREMENTS WITH EQUIPMENT SUPPLIER.
- TW COPPER PULL WIRES SHALL BE INSTALLED IN EMPTY CONDUITS (WHERE REQUIRED).
- WIRING DEVICES SHALL BE AS FOLLOW: LIGHT SWITCHES - 20 AMP HUBBELL 1221, DUPLEX RECEPTACLES - 15 AMP HUBBELL 5252, DEVICE PLATE - STAINLESS STEEL UNILINE DESIGN.
- MATERIALS AND EQUIPMENTS SHALL BE GUARANTEED FREE FROM DEFECTS FOR ONE YEAR FROM DATE OF OWNER ACCEPTANCE & REPLACED AT NO EXTRA COST.
- ENTIRE INSTALLATION SHALL BE PERFORMED BY A LICENSED ELECTRICAL CONTRACTOR IN A FIRST-CLASS WORKMANLIKE MANNER. THE COMPLETED SYSTEM SHALL BE FULLY OPERATIVE.
- CONTRACTOR SHALL GUARANTEE ALL MATERIALS AND WORKMANSHIP FREE FROM DEFECT FOR A PERIOD OF ONE (1) YEAR FROM DATE OF FINAL ACCEPTANCE.
- CORRECTION OF ANY DEFECTS SHALL BE COMPLETED WITHOUT ADDITIONAL CHARGE AND SHALL INCLUDE REPLACEMENT OR REPAIR OF ANY OTHER PHASE OF THE INSTALLATION WHICH MAY HAVE BEEN DAMAGED THEREBY.
- ALL REQUIRED INSURANCES SHALL BE PROVIDED FOR PROTECTION AGAINST PUBLIC LIABILITY & PROPERTY DAMAGE FOR THE DURATION OF THE WORK.
- ALL CIRCUIT BREAKERS USED TO SWITCH FLUORESCENT LIGHT FIXTURES SHALL BE APPROVED FOR THE PURPOSE AND MARKED "SWD".
- CONDUIT SHALL CONFORM TO THE FOLLOWING:
 - CONCEALED IN CEILING & PARTITIONS OR EXPOSED, RGS
 - CONCEALED IN CONCRETE SLAB, PVC
 - UNDERGROUND OR BELOW SLABS - PVC SCHEDULE 40.

- MAXIMUM LOAD FOR ALL BRANCH CIRCUITS IS 80%.
- ELECTRICAL CONTRACTOR SHALL VISIT THE PROJECT SITE, AND HE SHALL REVIEW STRUCTURAL , PLUMBING & H.V.A.C. PLANS AND HE SHALL ADJUST HIS WORK TO CONFORM TO ALL CONDITIONS FOUND AND/OR SHOWN ON PLANS AND AS MAY BE DIRECTED IN THE FIELD BY OWNER'S REPRESENTATIVE.
- ALL WORK TO BE IN STRICT ACCORDANCE WITH OWNER'S REQUIREMENTS AND RECOMMENDATIONS. NO WORK IS TO BE STARTED WITHOUT WRITTEN APPROVAL FROM THE OWNERS.
- COORDINATE WITH EQUIPMENT SUPPLIER MECHANICAL SUBCONTRACTOR AND GENERAL CONTRACTOR FOR ALL FINAL CONNECTION REQUIREMENTS BEFORE INSTALLATION OF CONDUIT WIRE AND STUB-UP LOCATION.
- ELECTRICAL SUB-CONTRACTOR SHALL BE RESPONSIBLE FOR BALANCING THE LOADS ON ALL PANELS.
- ALL LIGHTING FIXTURE SHALL BE WIRED AS PER ARTICLE 410 OF N.E.C..
- GROUND WIRE SHALL BE RUN IN ALL CONDUITS.
- GROUND TYPE BUSHINGS SHALL BE USED AS REQUIRED.
- TEMPERATURE CONTROL WIRING BY ELECTRICAL CONTRACTOR, H.V.A.C. CONTRACTOR WILL PROVIDE WIRING DIAGRAM. ALL DEVICES, CONTROL TRANSFORMERS ETC. FOR MOUNTING & WIRING BY ELECTRICAL CONTRACTOR.
- FOR LOCATION OF MECHANICAL EQUIPMENTS REFER TO MECHANICAL DRAWINGS.
- FUSES SHALL BE FUSETRON TYPE.
- GENERAL CONDITIONS AND SPECIAL CONDITIONS SHALL APPLY TO THIS CONTRACT . DRAWINGS ARE SCHEMATIC. THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL COST TO MAKE NECESSARY ADJUSTMENTS TO PROVIDE A COMPLETE INSTALLATION AS CONTEMPLATED BY THE DRAWINGS AND SPECIFICATIONS READY FOR USE, PRIOR TO SUBMITTING HIS BID. CONTRACTOR SHALL INSPECT THE SITE AND INCLUDE IN HIS BID ALL ADJUSTMENTS AND CHANGES REQUIRED DUE TO EXISTING CONDITIONS.
- ALL PANELBOARDS SHALL BE PROVIDED WITH A FACTORY INSTALLED GROUND BUS FOR CONNECTING TO GROUND THE GREEN WIRE IN ALL CONDUITS.
- EXPANSION AND DEFLECTION FITTINGS SHALL BE USED ON ALL CONDUITS CROSSING BUILDING EXPANSION JOINTS, SEE STRUCTURAL AND OTHER DRAWINGS.
- ALL CONDUITS IN CONTACT WITH GROUND SHALL BE ENCASED IN A 3" CONCRETE ENVELOPE.
- NO "UF" TYPE CONDUCTOR ALLOWED. ALL DROPS TO FIXTURES AND EQUIPMENT SHALL BE DONE IN FLEXIBLE METALLIC CONDUIT EXCEPT AS NOTED. WORK INSIDE DRY WALL PARTITIONS AND HUNG CEILING IS TO BE "RGS PVC COATED".
- RUN ONE GREEN GROUND WIRE TO ALL MOTORS, AND RELATED EQUIPMENT, SIZE AS INDICATED ON DRAWINGS OR IN ACCORDANCE WITH N.E.C. TABLE 250-95.
- INSTALL CORROSION RESISTANT HANGERS AND UNISTRUT CHANNELS TO PROVIDE MECHANICAL SUPPORT TO ALL EXPOSED CONDUITS.
- CIRCUIT BREAKERS SHALL BE BOLT-ON TYPE, NO PLUG-IN CIRCUIT BREAKERS ALLOWED.
- ALL PANELBOARDS SHALL BE PROVIDED WITH COPPER LUGS.



MODULAR CONDUIT PROTECTION SYSTEM DETAIL

SCALE: N.T.S.

NOTES:

- FOR 5 CHANNELS HEIGHT IS 1.25", FOR 3 CHANNELS HEIGHT IS 2.25" AND FOR 2 CHANNELS HEIGHT IS 3.25".
- PROPOSED MODULAR CONDUIT PROTECTION IS BASED IN "MODULAR CABLE PROTECTION TRUKTRAK SYSTEM" OF HUBBELL MANUFACTURER. COORDINATE COMPLETE ACCESSORIES WITH MANUFACTURER FOR A COMPLETE INSTALLATION.
- CONTRACTOR SHALL COORDINATE THE SELECTION OF 5, 3 OR 2 CHANNELS SELECTION OF "TRUKTRAK" SYSTEM BEFORE ORDERING.
- FOR EACH "TRUKTRAK" SYSTEM LOCATION INDICATED IN DRAWINGS AND IN COORDINATION WITH CONDUIT HEIGHT INCLUDE CHANNEL "TRUKTRAK", MALE END CAP AND FEMALE END CAP.



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Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by: _____
Dwg. Date: _____

Ing. Ricardo Ortiz Garcia
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Revisions

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

CERRA & NAGUABO, PUERTO RICO
Owner

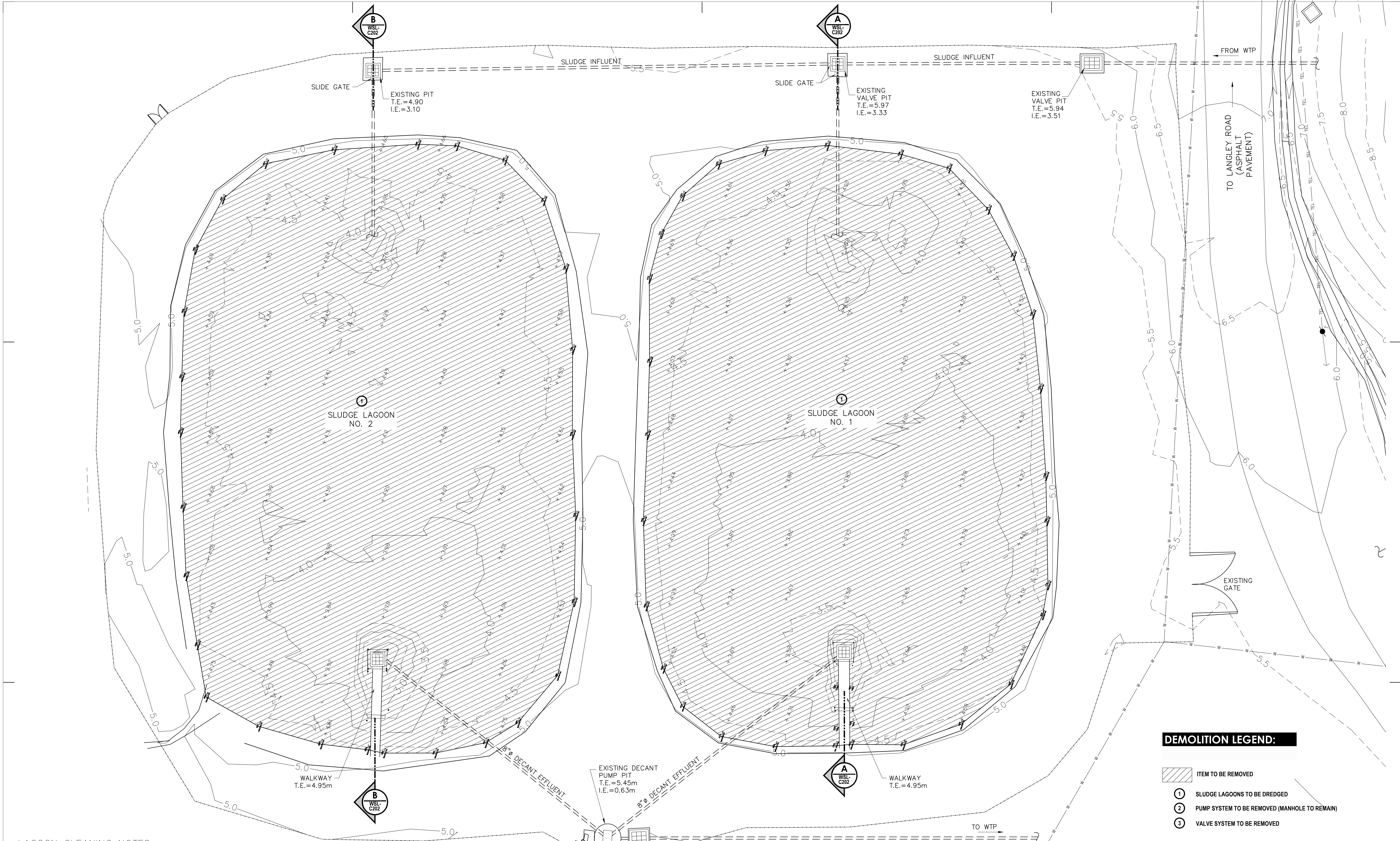
WATER TREATMENT PLANT

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Project Title: **WTP-E218**

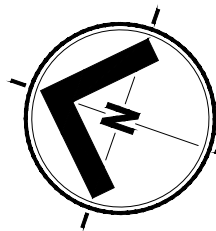
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Local Redevelopment Authority
for Roosevelt Roads

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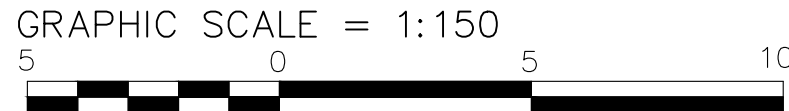


LAGOON CLEANING NOTES:

- CONTRACTOR SHALL REMOVE PARTIALLY DEWATERED NONHAZARDOUS SLUDGE FROM EACH LAGOON, DRY THE SOLIDS ON-SITE WITHIN THE LIMITS OF THE WORK AREA, SAMPLE AND ANALYZED THE DRIED SLUDGE, HAUL AND DISPOSE THE DRIED SLUDGE IN AN APPROVED LANDFILL.
- COORDINATE THE LAGOON CLEANING WITH THE OWNER'S PROJECT REPRESENTATIVE. ONLY ONE LAGOON SHALL BE OUT OF SERVICE AT ONE TIME. THE MAXIMUM TIME ONE LAGOON CAN BE OUT OF SERVICE SHALL BE 90 DAYS.
- FOR BIDDING PURPOSES, ASSUME THAT EACH LAGOON IS FILLED WITH SLUDGE UP TO ELEVATION 4.50m. ALL SLUDGE AND VEGETATION SHALL BE REMOVED FROM INSIDE THE LAGOON UP TO THE CONTOURS SHOWN ON THE SLUDGE LAGOON PLAN ON THIS SHEET. THE SOLIDS CONCENTRATION INSIDE THE LAGOON HAS NOT BEEN QUANTIFIED. CONTRACTOR SHALL PROVIDE ALL TEMPORARY PUMPING, PIPING, POWER, ETC. TO REMOVE WATER AND SLUDGE FROM THE LAGOON.
- CONTRACTOR MAY AT HIS DISCRETION USE THE BANKS AROUND THE LAGOONS UP TO THE LIMITS OF THE WORK AREA TO TEMPORARILY STOCKPILE THE SLUDGE TO ALLOW FURTHER AIR DRYING. CONTRACTOR SHALL PROVIDE TEMPORARY EROSION CONTROL MEASURES IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. OTHER DRYING METHODS MAY BE PROPOSED BY THE CONTRACTOR, SUBJECT TO APPROVAL BY THE OWNER.
- CONTRACTOR SHALL SAMPLE THE DRIED SLUDGE PRIOR TO HAULING THE SLUDGE TO AN APPROVED LANDFILL TO ENSURE NO FREE WATER IS PRESENT. THE SAMPLING TEST SHALL CONSIST OF A PAINT FILTER TEST. THE ANALYSES SHALL BE CONDUCTED BY AN INDEPENDENT LABORATORY SUBJECT TO APPROVAL BY OWNER. ALL SAMPLES SHALL INCLUDE DUPLICATE SAMPLES. THE NUMBER OF SAMPLES SHALL BE EQUIVALENT TO THE NUMBER OF TRUCKLOADS. THE SAMPLING TECHNIQUE, NUMBER OF SAMPLES, AND RESULTS SHALL BE SUBMITTED TO THE OWNER FOR APPROVAL PRIOR TO HAULING ANY SLUDGE FROM THE WATER TREATMENT PLANT SITE.
- AFTER ALL SLUDGE HAS BEEN REMOVED FROM THE LAGOON, CONTRACTOR SHALL FINE GRADE THE LAGOON BANKS AND BOTTOM TO THE ORIGINAL ELEVATIONS SHOWN ON THE PROPOSED SITE PLAN (SHEET WSL-C201)
- AFTER BOTH LAGOONS HAVE BEEN CLEANED, CONTRACTOR SHALL RETURN THE WORK AREA TO ORIGINAL CONDITIONS.



EXISTING + DEMOLITION SITE PLAN



DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- SLUDGE LAGOONS TO BE DREDGED
- PUMP SYSTEM TO BE REMOVED (MANHOLE TO REMAIN)
- VALVE SYSTEM TO BE REMOVED

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JULY 30, 2021
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YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA COSA.

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		Dwg. Date:	

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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

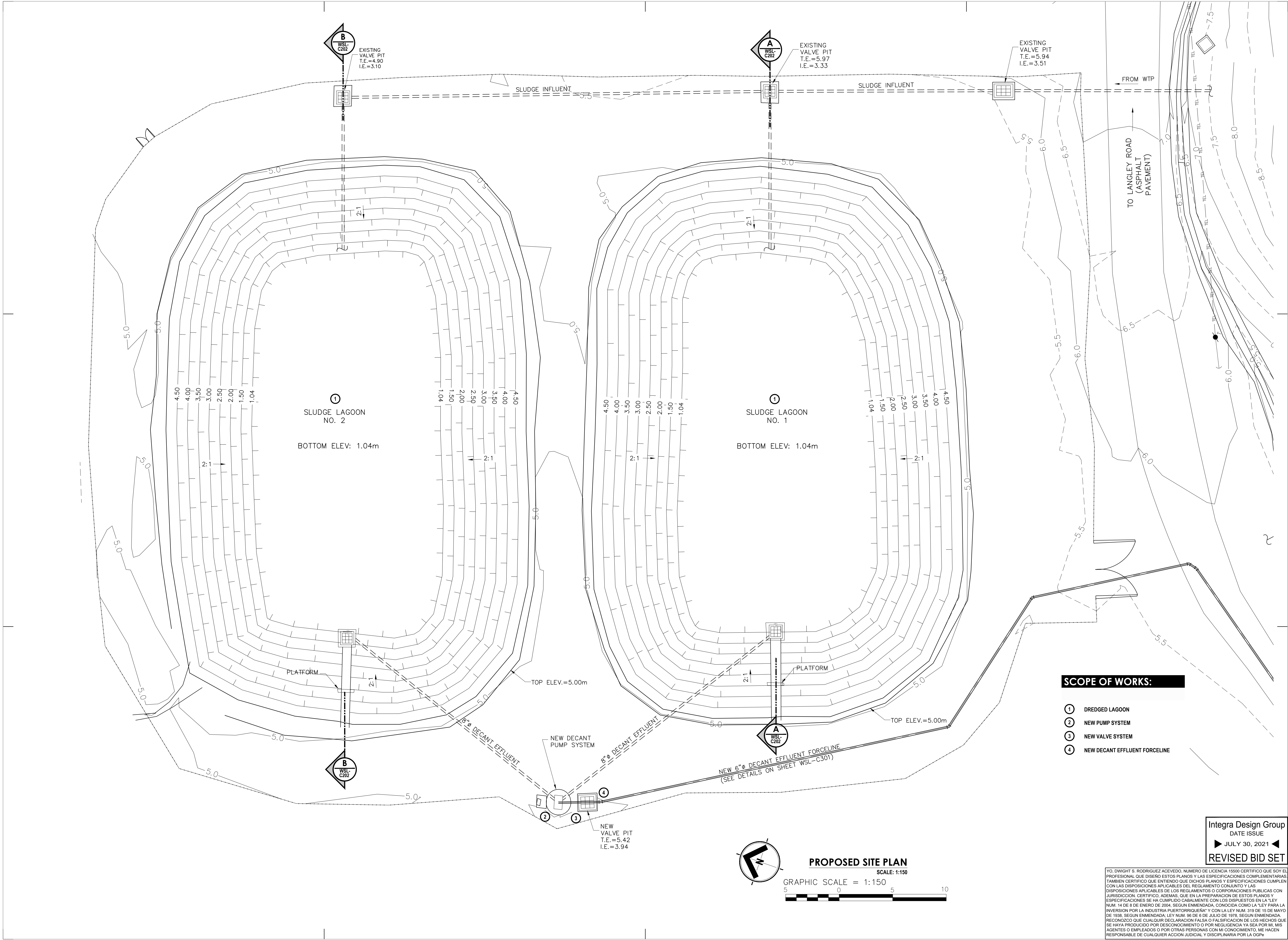
Project Title:

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SLUDGE LAGOONS
Drawing Title:

EXISTING + DEMOLITION SITE PLAN

WSL-C101



SCOPE OF WORKS:

- 1 DREDGED LAGOON
- 2 NEW PUMP SYSTEM
- 3 NEW VALVE SYSTEM
- 4 NEW DECANT EFFLUENT FORCELINE

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**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

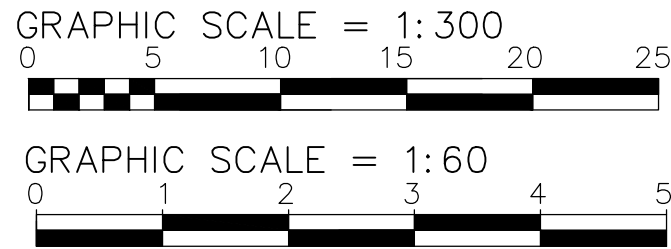
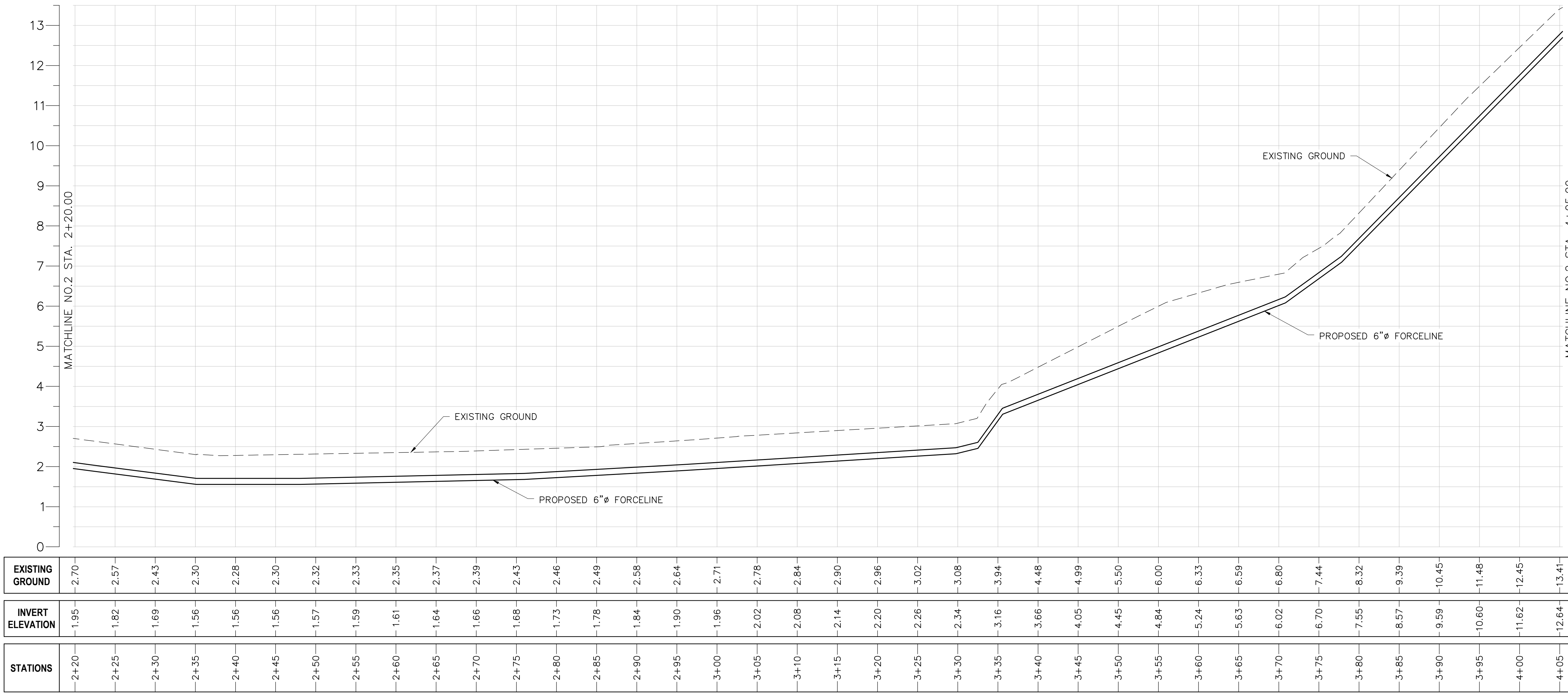
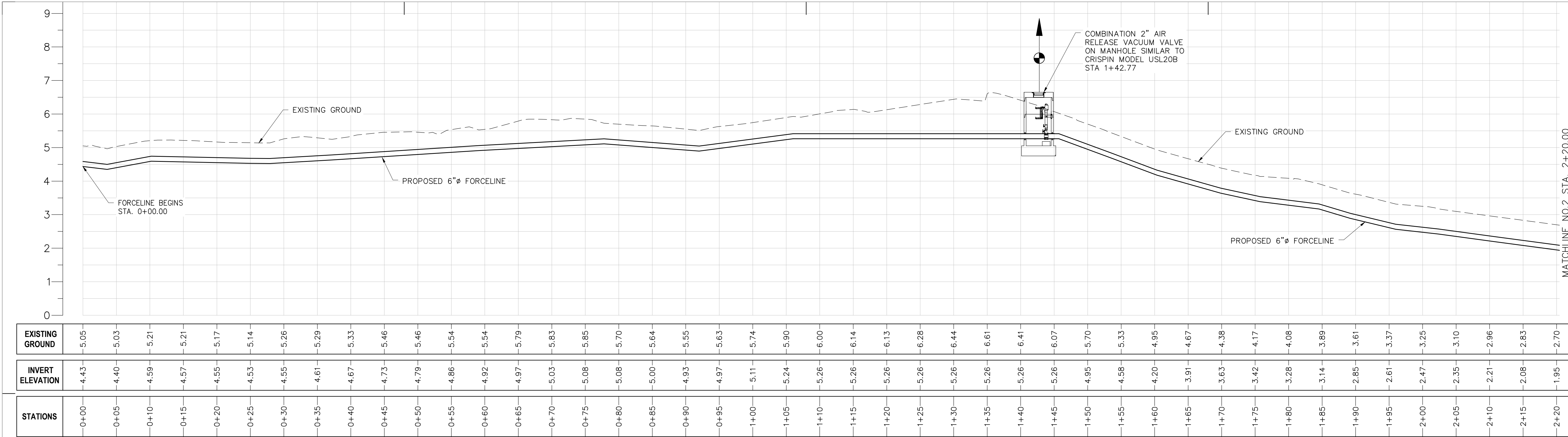
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SLUDGE LAGOONS
Drawing Title:

PROPOSED SITE PLAN

Project Title:

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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

CEBA & NAGUARO, PUERTO RICO

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Revisions

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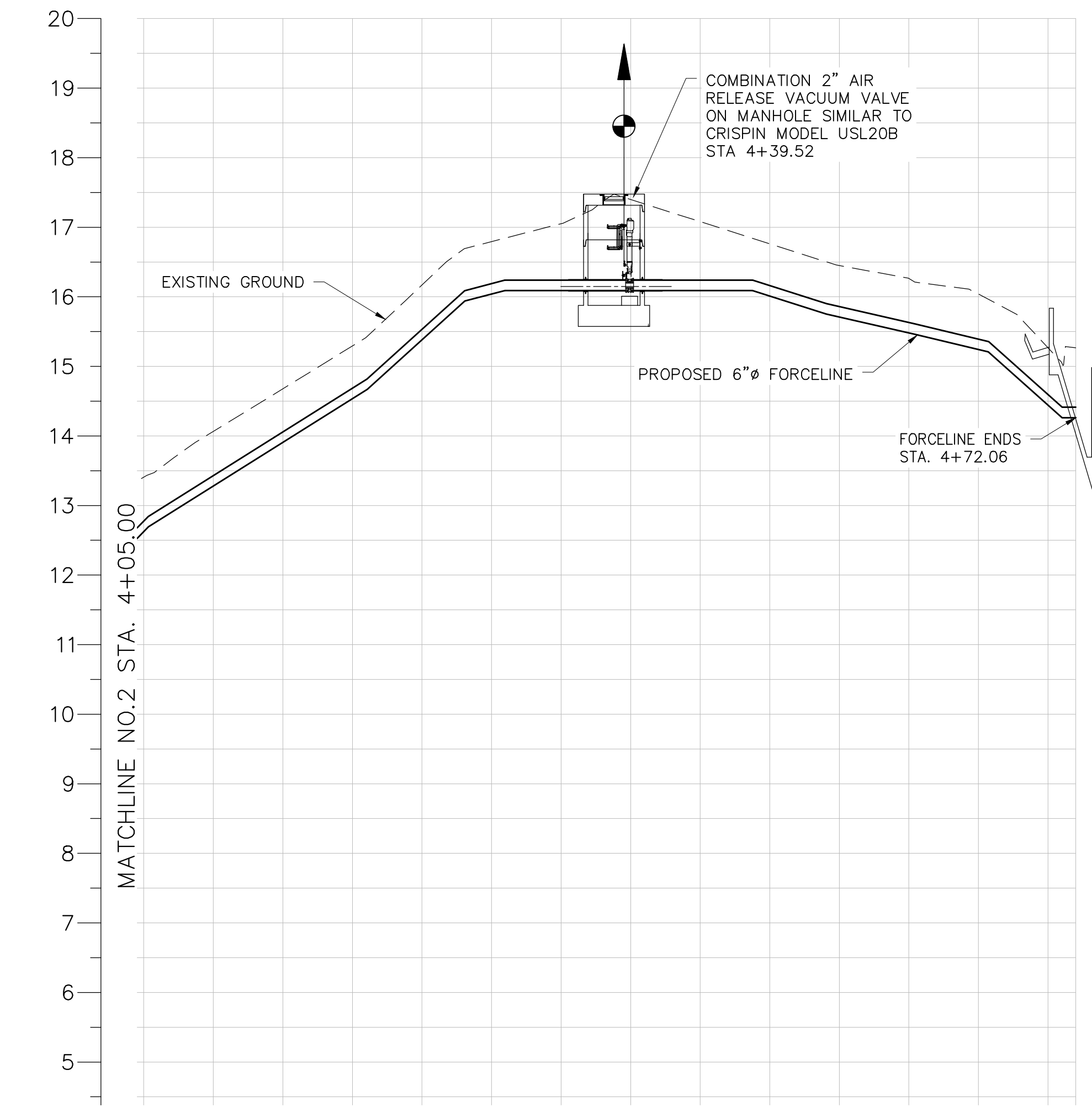
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PROPOSED FORCELINE PROFILE

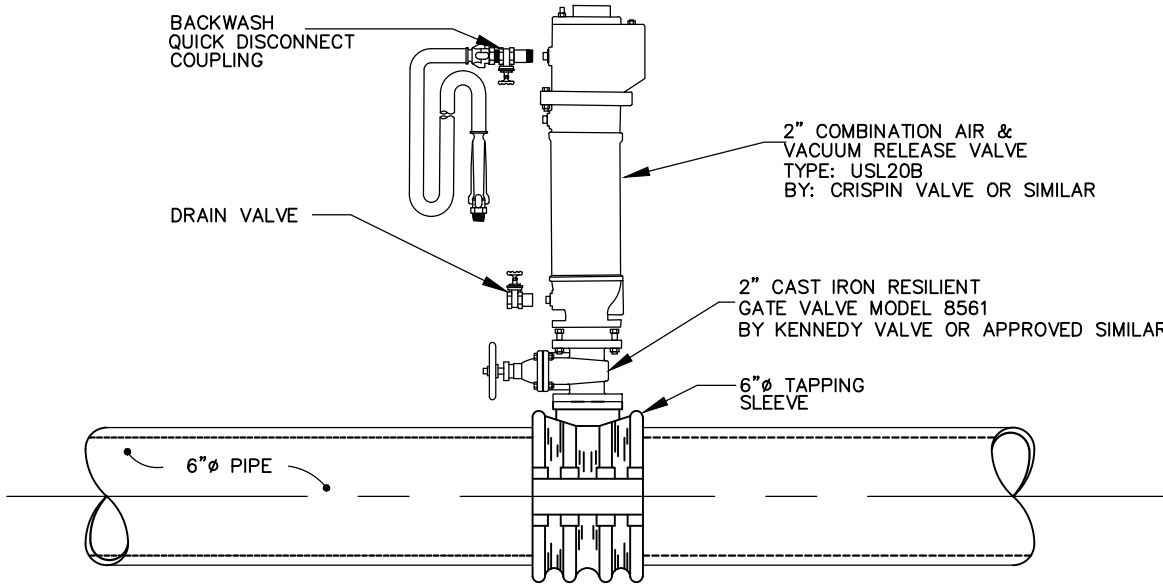
WSL-C302



EXISTING GROUND	-13.41	-14.07	-14.88	-15.29	-16.17	-16.79	-17.05	-17.40	-17.08	-16.76	-16.45	-16.26	-16.04	-15.27	-15.27
INVERT ELEVATION	-12.64	-13.29	-13.92	-14.54	-15.39	-15.05	-16.09	-16.09	-16.09	-16.01	-15.71	-15.48	-15.24	-14.43	-14.26
STATIONS	4+05	4+10	4+15	4+20	4+25	4+30	4+35	4+40	4+45	4+50	4+55	4+60	4+65	4+70	4+72.06

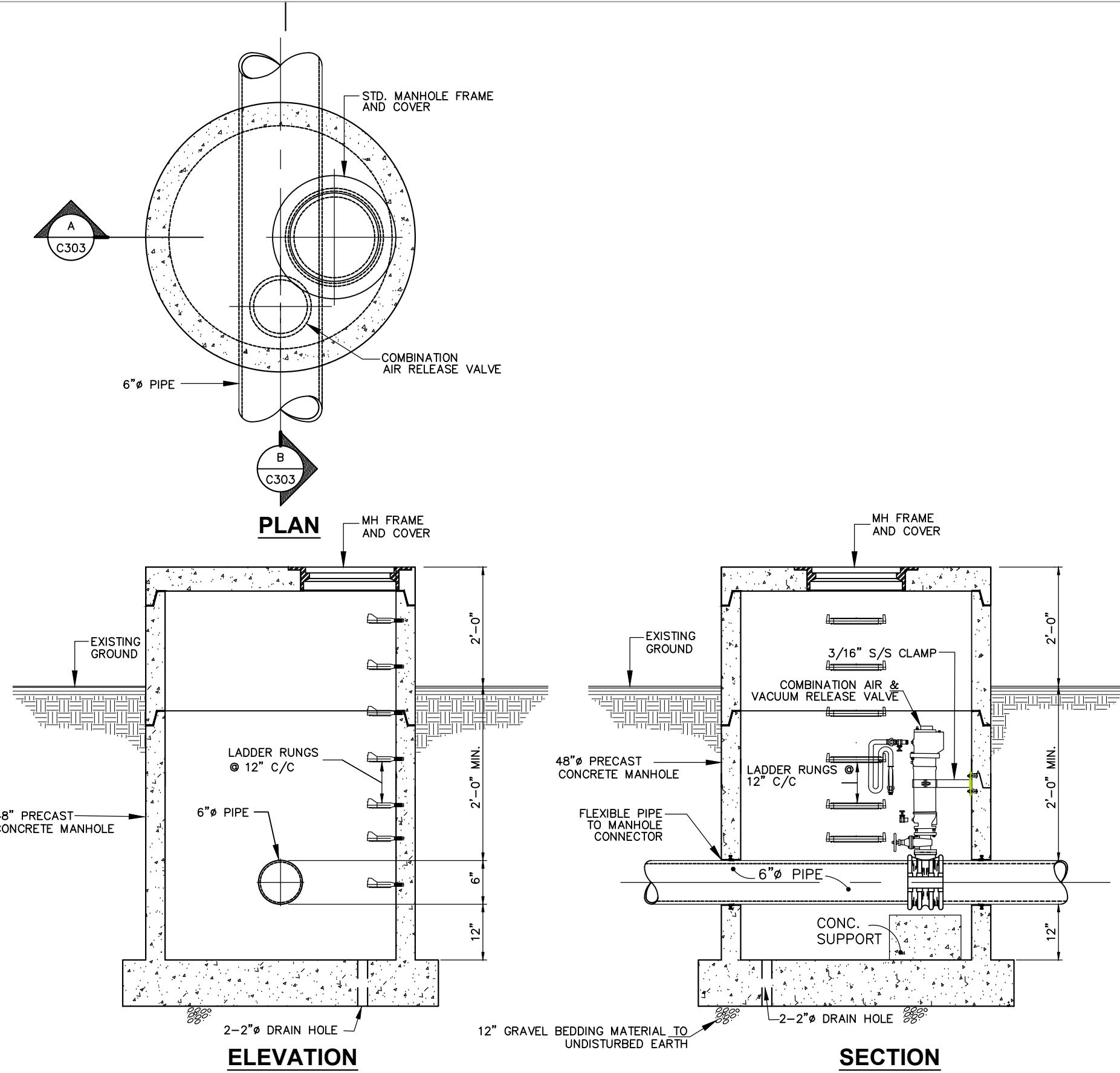
FORCELINE PROFILE
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NOTES:
1. COMBINATION AIR RELEASE VALVES SHALL BE INSTALLED AT HIGH POINTS ALONG THE PIPELINE AS INDICATED ON THIS SET OF PLANS. MINOR ADJUSTMENTS MIGHT BE REQUIRED TO ENSURE THAT VALVES ARE LOCATED AT THE HIGH POINT. CONTRACTOR SHALL COORDINATE WITH CONSTRUCTION MANAGER THE FINAL LOCATION OF COMBINATION AIR RELEASE VALVES PRIOR TO INSTALLATION, AND SHALL INDICATE THE FINAL LOCATIONS ON RECORD DRAWINGS.



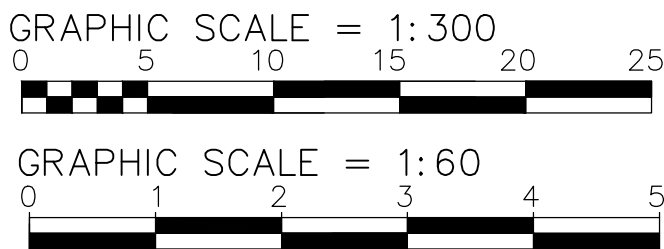
N.T.S.

AIR RELEASE VALVE DETAIL 1



N.T.S.

AIR RELEASE VALVE ON MANHOLE 2



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Revisions

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Water Infrastructure Improvements (Phase I)
At Roosevelt Roads Re-Development

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads

CEBA & NAGUABO, PUERTO RICO

Owner:

Effluent Decant Discharge Line

Drawing Title:

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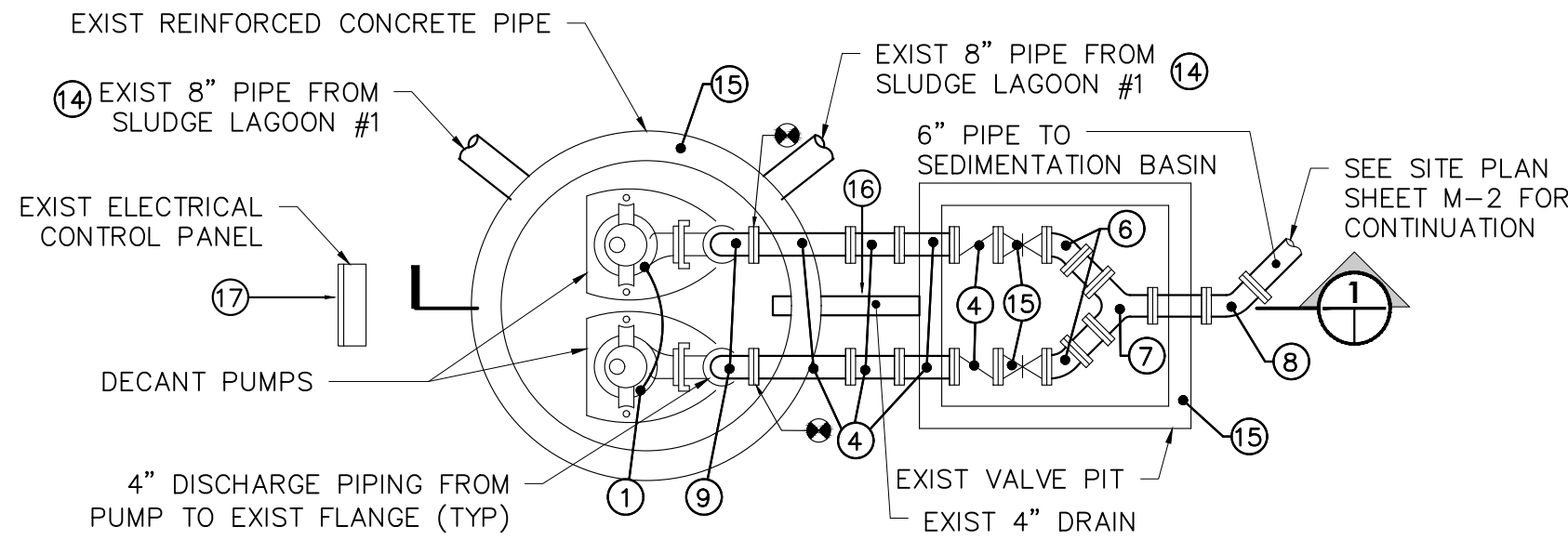
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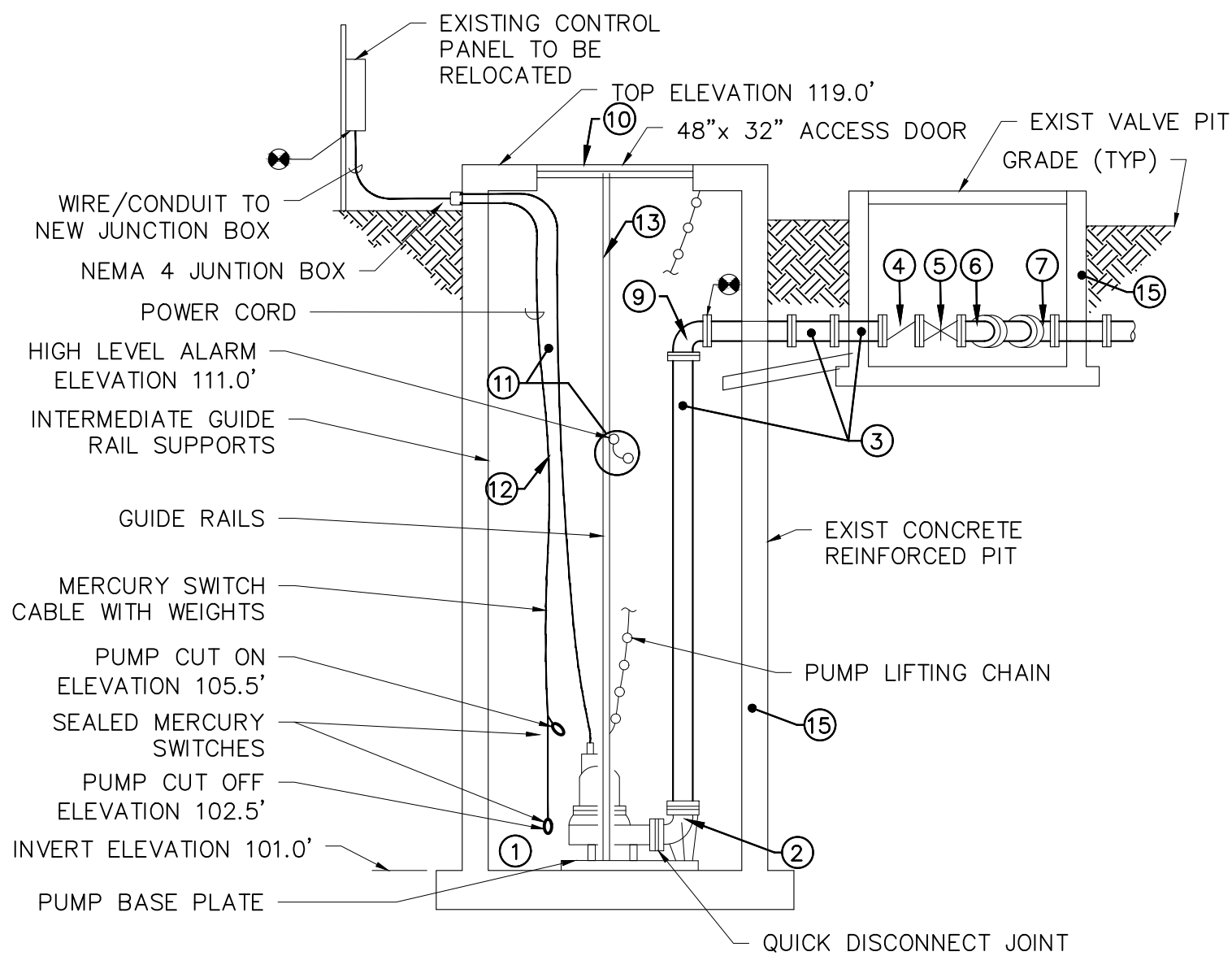
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Sheet:

WSL-C303



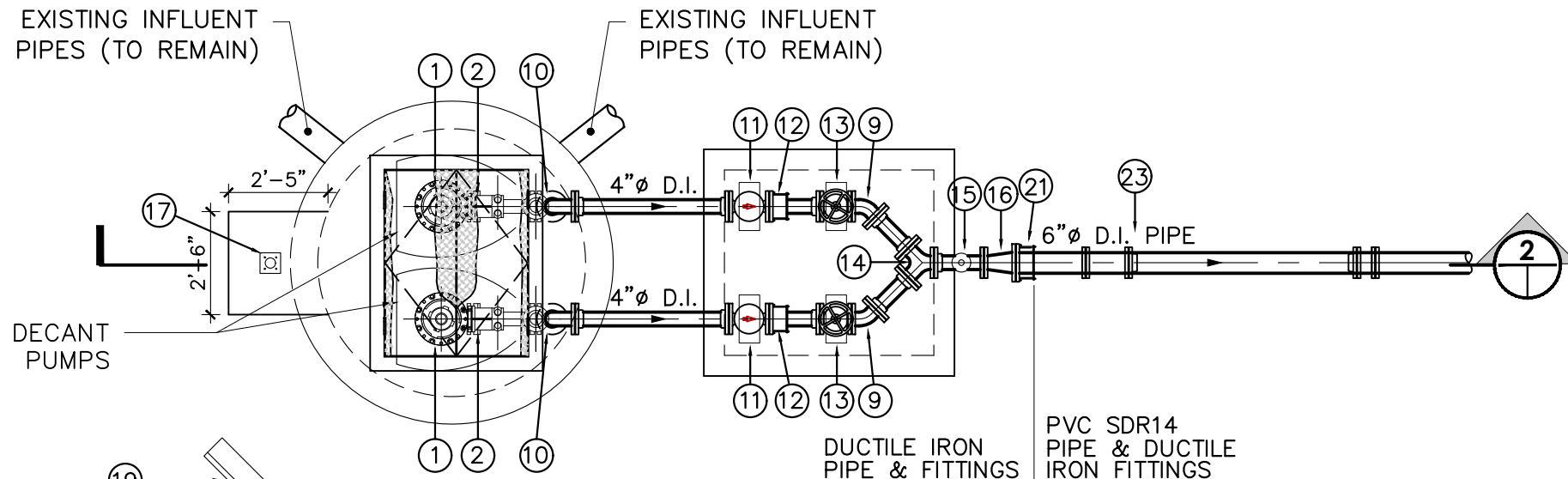
DEMOLITION PLAN - DECANT PUMP
SCALE: 1/4"=1'-0"



EXISTING - SECTION
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND DESCRIPTION:

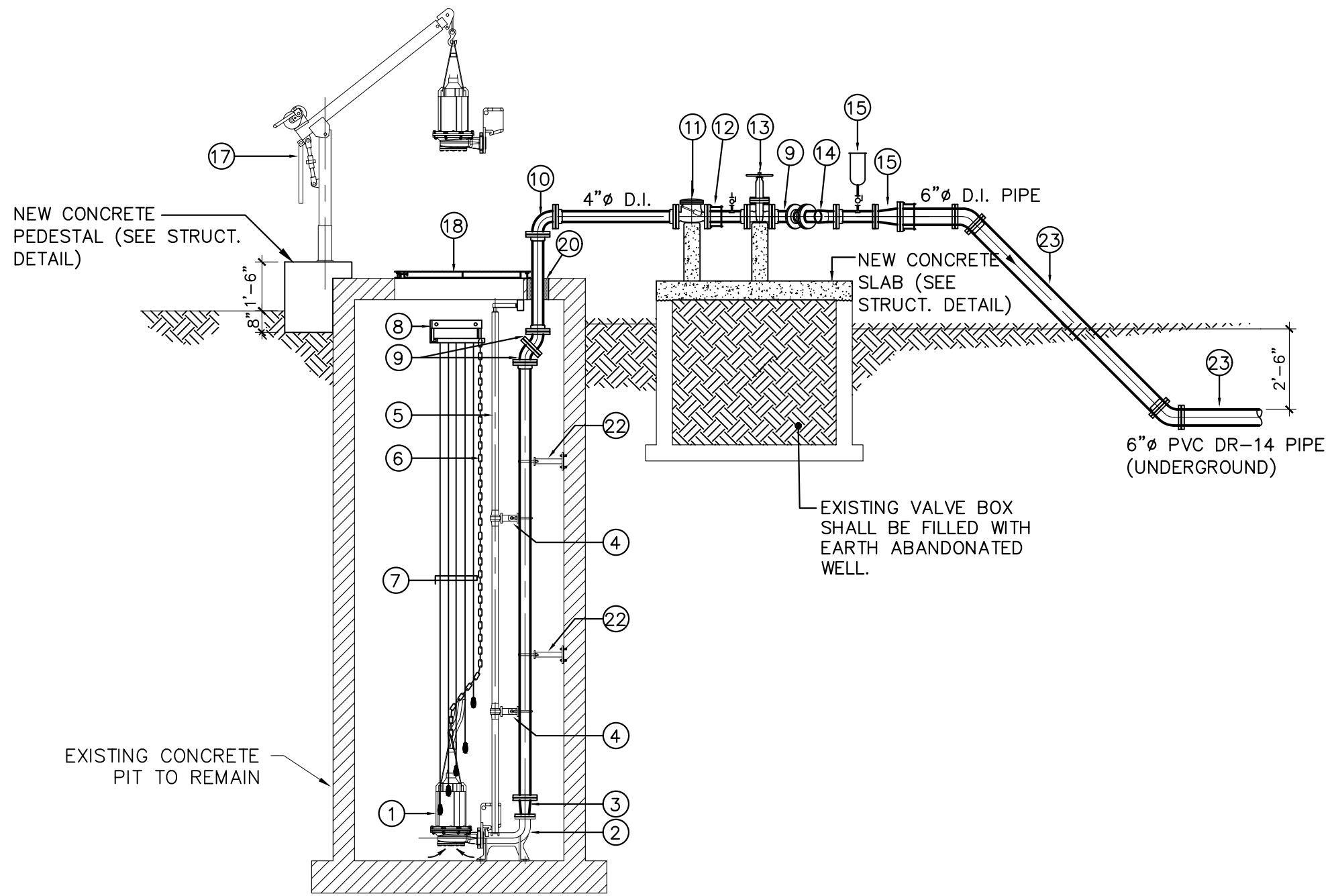
- 1 EXISTING PUMPS TO BE REMOVED
- 2 EXISTING PUMP BASE TO BE REMOVED
- 3 EXISTING 4" PIPE TO BE REMOVED
- 4 EXISTING 4" GATE VALVE TO BE REMOVED
- 5 EXISTING 4" CHECK VALVE TO BE REMOVED
- 6 EXISTING 4" 45° ELBOW TO BE REMOVED
- 7 EXISTING 4" TRUE WYE TO BE REMOVED
- 8 EXISTING 6", 45° ELBOW TO BE REMOVED
- 9 EXISTING 4" 90° ELBOW TO BE REMOVED
- 10 EXISTING ACCESS DOOR TO BE REMOVED
- 11 EXISTING LEVEL FLOAT TO BE REMOVED
- 12 EXISTING GUIDE RAIL SUPPORT TO BE REMOVED
- 13 EXISTING GUIDE RAIL TO BE SUPPORT
- 14 EXISTING INTAKE PIPE FROM EXISTING LAGOONS TO REMAIN
- 15 EXISTING CONCRETE STRUCTURE TO REMAIN
- 16 EXISTING PIPE TO ABANDONED
- 17 EXISTING CONTROL PANEL TO BE RELOCATED



REHABILITATION PLAN - DECANT PUMP
SCALE: 1/4"=1'-0"

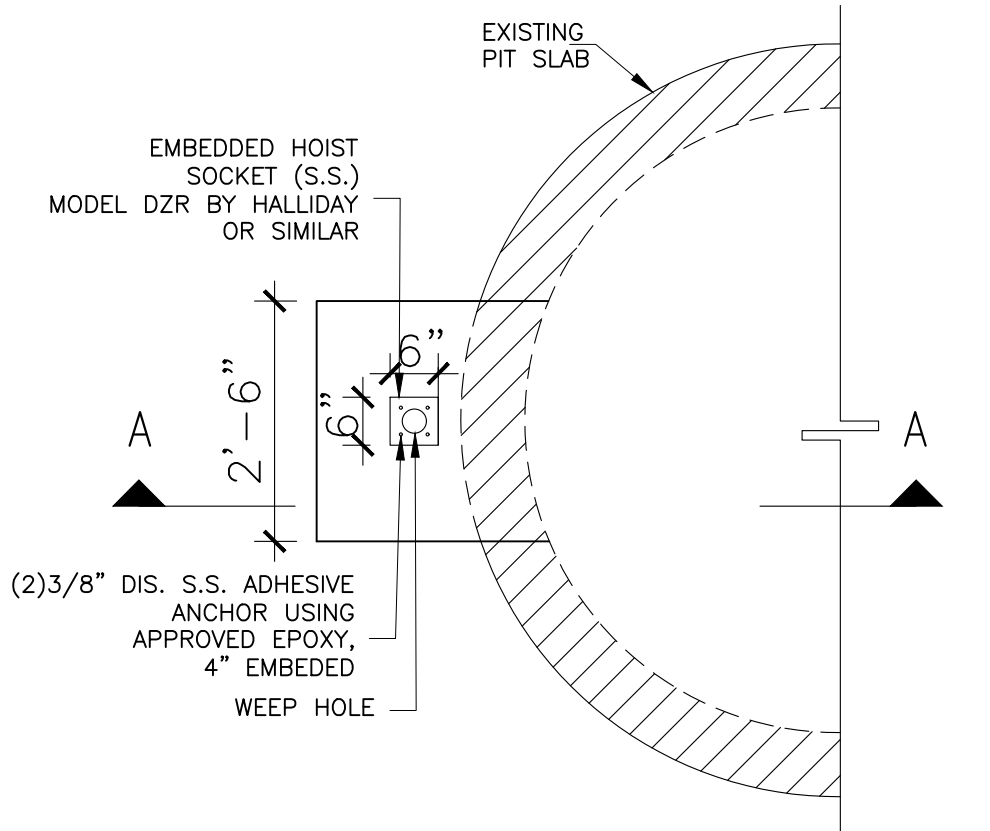
NEW LEGEND DESCRIPTION:

- 1 SUBMERSIBLE PUMPS (SEE SCHEDULE)
- 2 DISCHARGE ELBOW WITH BASE & ANCHOR BOLTS.
- 3 3"x4" INCREASER, D.I. FLANGED ENDS.
- 4 INTERMEDIATE GUIDE BRACKET ASSEMBLY (SEE DETAILS)
- 5 2" STAINLESS STEEL GUIDE BARS (2 PER PUMP)
- 6 STAINLESS STEEL CHAIN WITH SHACKLES EVERY 4'-0"
- 7 NON MERCURY LEVEL FLOATS.
- 8 STAINLESS STEEL CABLE HOLDER.
- 9 4"Ø, 45° DUCTILE IRON FLANGED ENDS
- 10 4"Ø, 90° DUCTILE IRON FLANGED ENDS
- 11 4" CHECK VALVE, FLANGED ENDS HON SLAM TYPE.
- 12 4" FLANGE COUPLING ADAPTER
- 13 4" GATE VALVE, FLANGED ENDS, RESILIENT SEATED, RISING STEM
- 14 4"x4"x4" WYE, FLANGED ENDS
- 15 2" COMBINATION SEWER AIR RELEASE AND AIR VACUUM VALVE CRISPIN MODEL US20SB
- 16 4"x6" INCREASER FLANGED ENDS
- 17 PORTABLE HOIST, SIMILAR TO HALLIDAY SERIES D2B36D
- 18 54"x42" ACCESS DOOR SIMILAR TO HALLIDAY PRODUCTS MODEL C2R
- 19 CONTROL PANEL TO BE RELOCATED
- 20 NEW OPENING SEAL WITH GROUT
- 21 6" FLANGE COUPLING ADAPTER
- 22 PIPE SUPPORT (SEE DETASIL)
- 23 6"Ø, 45° DUCTILE IRON FLANGED ENDS

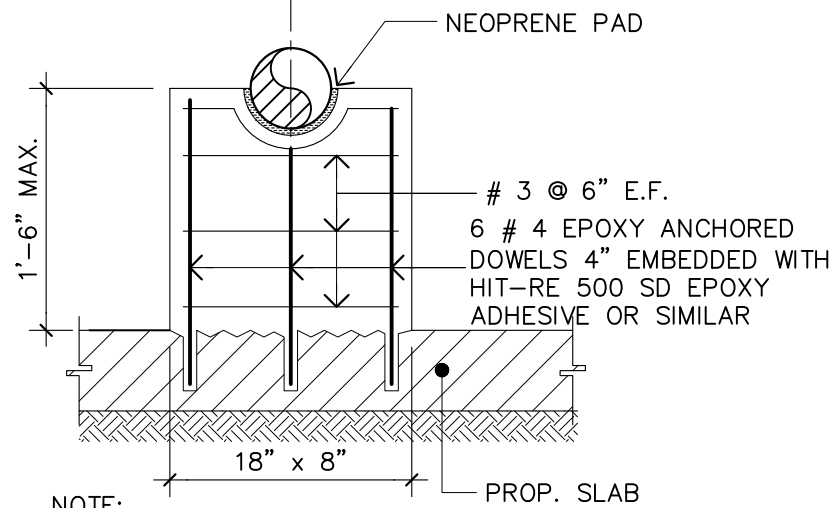


SECTION
SCALE: 1/4"=1'-0"

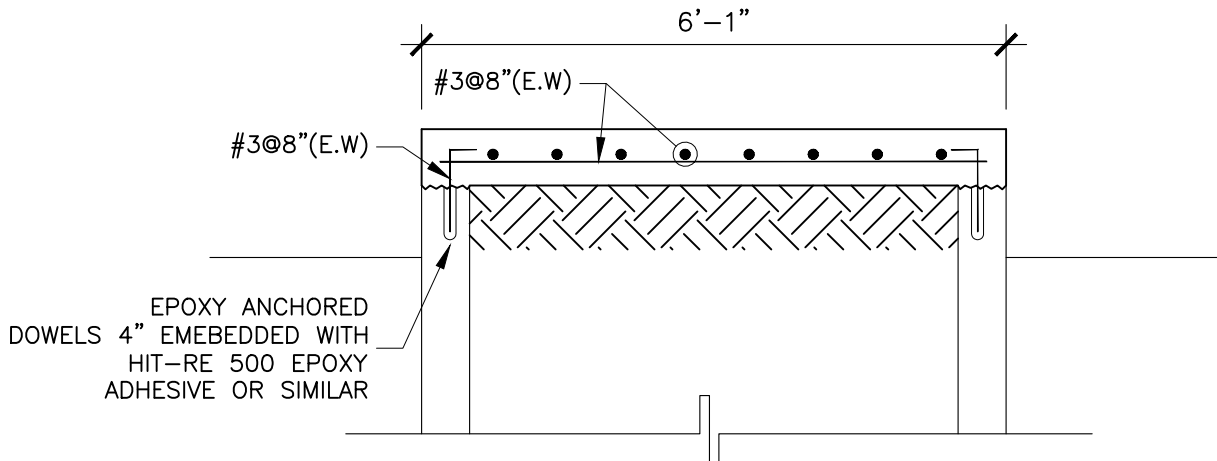
PUMPS SCHEDULE																	
GENERAL DESCRIPTION						PUMP DATA							MOTOR DATA			REMARKS	QTY.
UNIT NO.	SERVICE	LOCATION	MODEL	MANUFACTURER	REMARKS	TYPE	Q (GPM)	TDH (FT)	IMP. DIA. (IN)	CURVE NO.	WEIGHT (LBS)	BHP	MOTOR HP	MOTOR RPM	V-PH-HZ		
SP-1 & SP-2	SLUDGE LAGOON	SLUDGE LAGOONS PIT	NP 3127 HT	FLYGT	CONSTANT	CENTRIFUGAL	300	65	215 (MM)	N/A	325	8.5	10	1,720	208/3/60	N/A	2



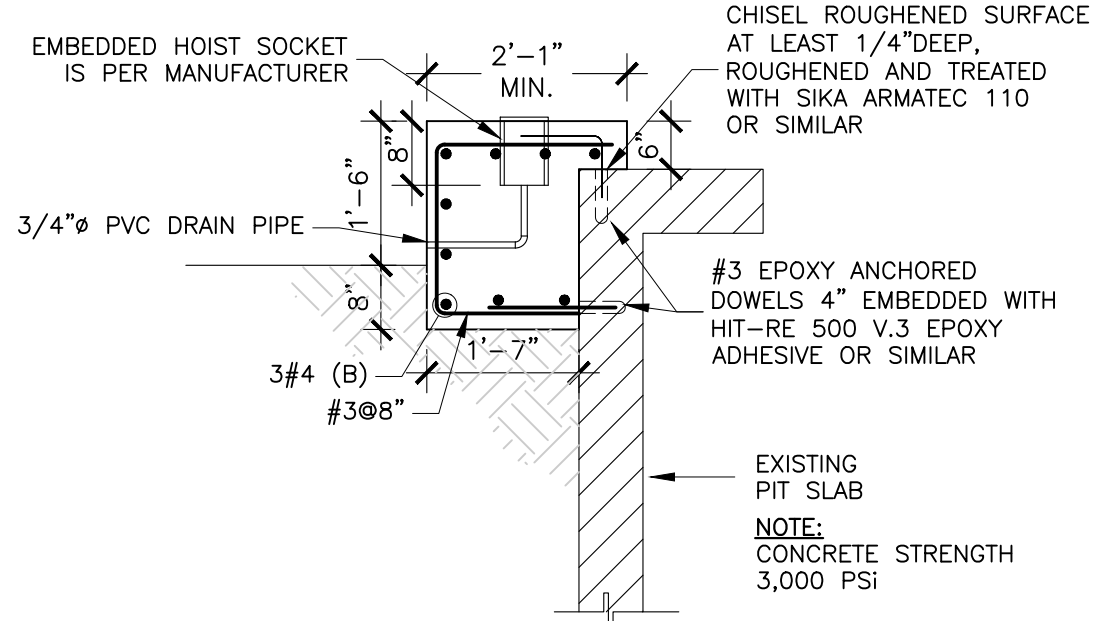
CONCRETE PEDESTAL PLAN
SCALE: 1/2"=1'-0"



PIPE CONCRETE SUPPORT DETAILS
SCALE: N.T.S.



CONCRETE SLAB SECTION
SCALE: 1/2"=1'-0"



CONCRETE PEDESTAL SECTION
SCALE: 1/2"=1'-0"

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, JOSE LUIS RODRIGUEZ MALARET, NUMERO DE LICENCIA 20349 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADO. ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCORRER.

Revisions		SHEET INFO.	
Number	Date	Description	
			Project No.: 19-1837.0
			Set Date: 20210728
			Drawn by:
			Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

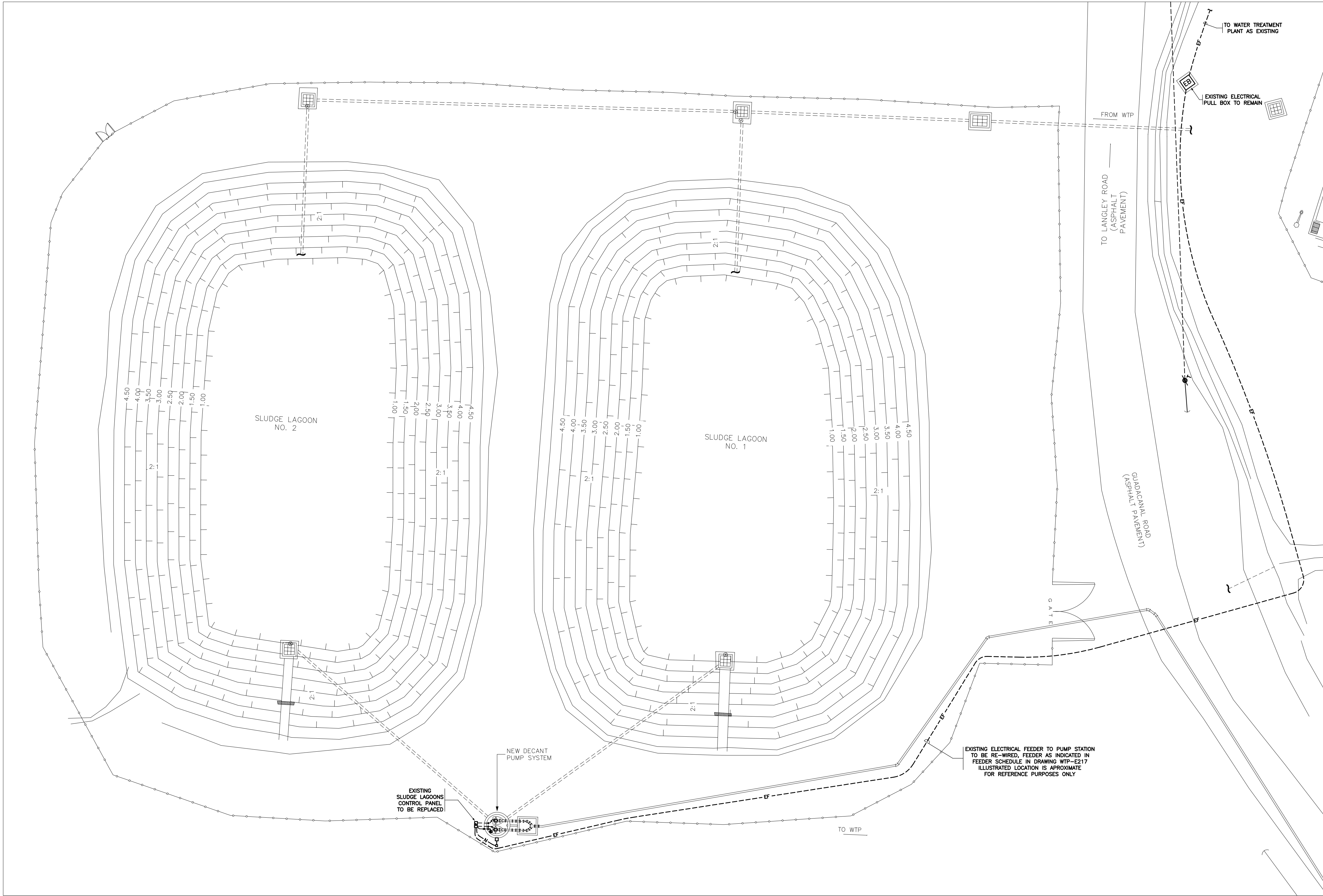


**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

SLUDGE LAGOONS
Drawing Title:

DECANT PUMPS PLAN & SECTIONS

WSL-M101



SLUDGE LAGOON
ELECTRICAL SITE PLAN
SCALE: 1:200

NOTE:
FOR SITE SYMBOLS REFER TO DRAWING WTP-E100 AND
FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION
SYMBOLS REFER DRAWING WTP-E218.



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIA 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDIENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODPE.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

Owner:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Sludge Lagoons

Drawing Title:

ELECTRICAL ELECTRICAL SITE PLAN

Revisions

Project No.:	19-1637.0
Set Date:	2020/07/07
Drawn by:	
Dwg. Date:	

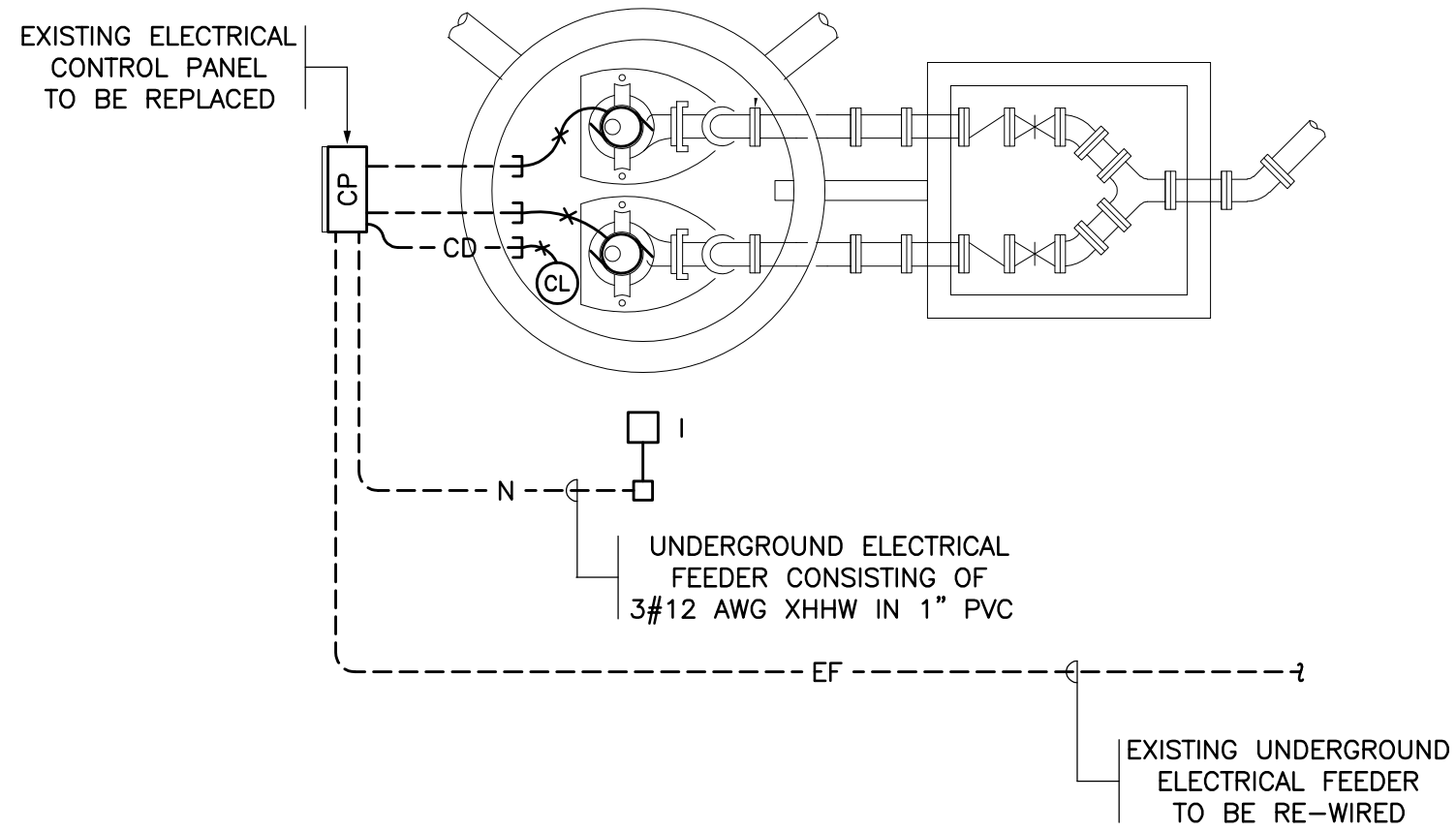
Ricardo Ortiz Garcia & Assoc., P.S.C.
Consulting Engineers

Ing. Ricardo Ortiz Garcia
Lic. no. 12448 P.R.

P.O. Box 1286-Tor Alto, P.R. 00964-Tel. (787) 810-3100 Fax. (787) 810-6060

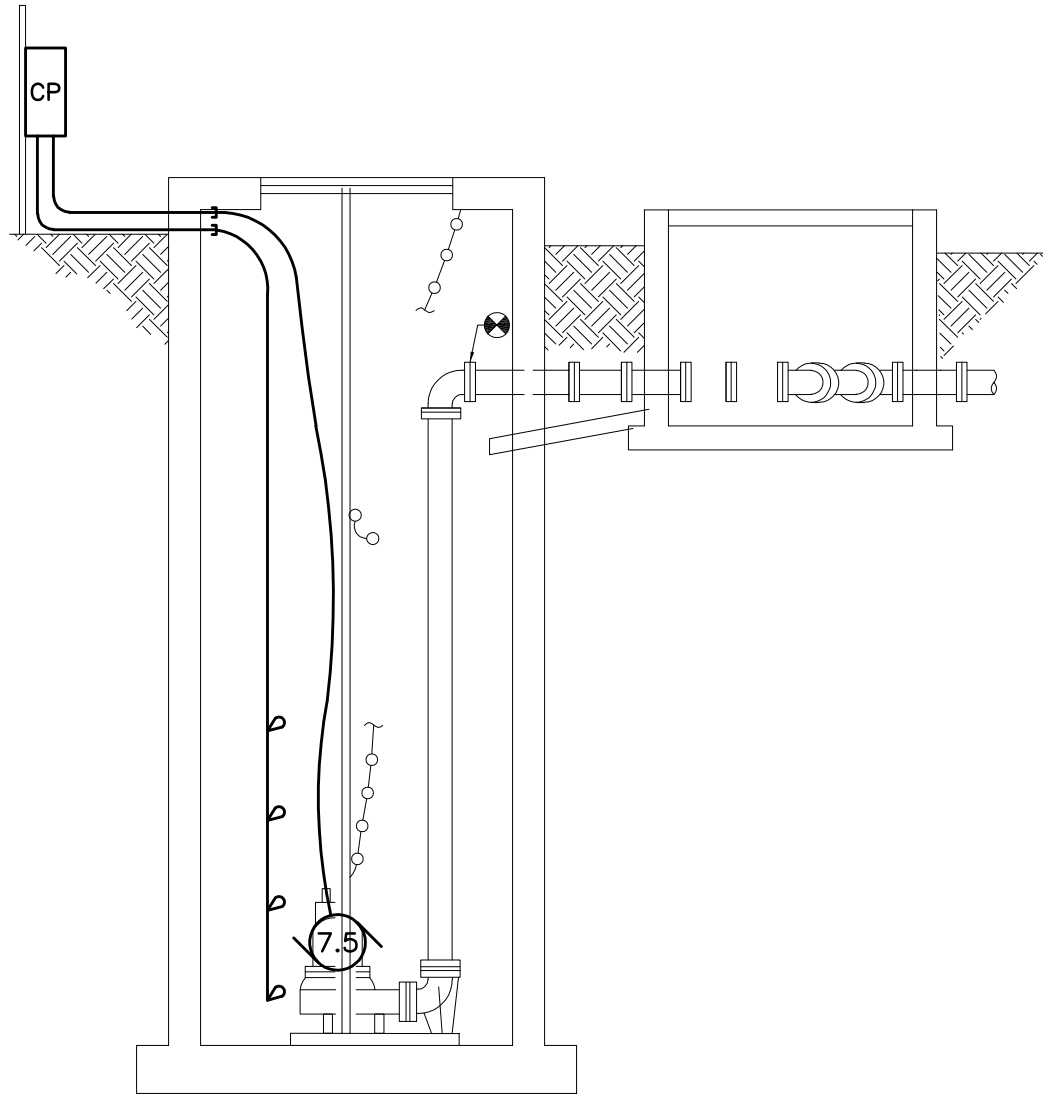
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SLUDGE LAGOON PUMP STATION
ELECTRICAL DISTRIBUTION

SCALE: 1/4"=1'-0"



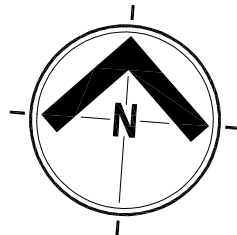
SLUDGE LAGOON PUMP STATION
ELECTRICCAL SECTION DETAIL

SCALE: 1/4"=1'-0"

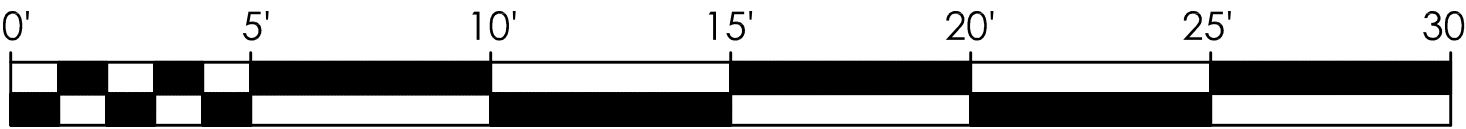
NOTE:
FOR SITE SYMBOLS REFER TO DRAWING WTP-E100 AND
FOR ELECTRICAL AND CONTROL ROUGH-IN DISTRIBUTION
SYMBOLS REFER DRAWING WTP-E218.



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DATE ISSUE
JULY 30, 2021
BID SET



GRAPHIC SCALE = 1/4"=1'-0"



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Revisions

Project No.: 19-1637.0
Set Date: 2020/07/07
Drawn by:
Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT

CERRA & NAGUABO, PUERTO RICO

Owner:

SLUDGE LAGOONS

Drawing Title:

SLUDGE LAGGONS PUMP STATIONS ELECTRICAL DISTRIBUTION AND DETAILS

Sheet:

WSL-E101

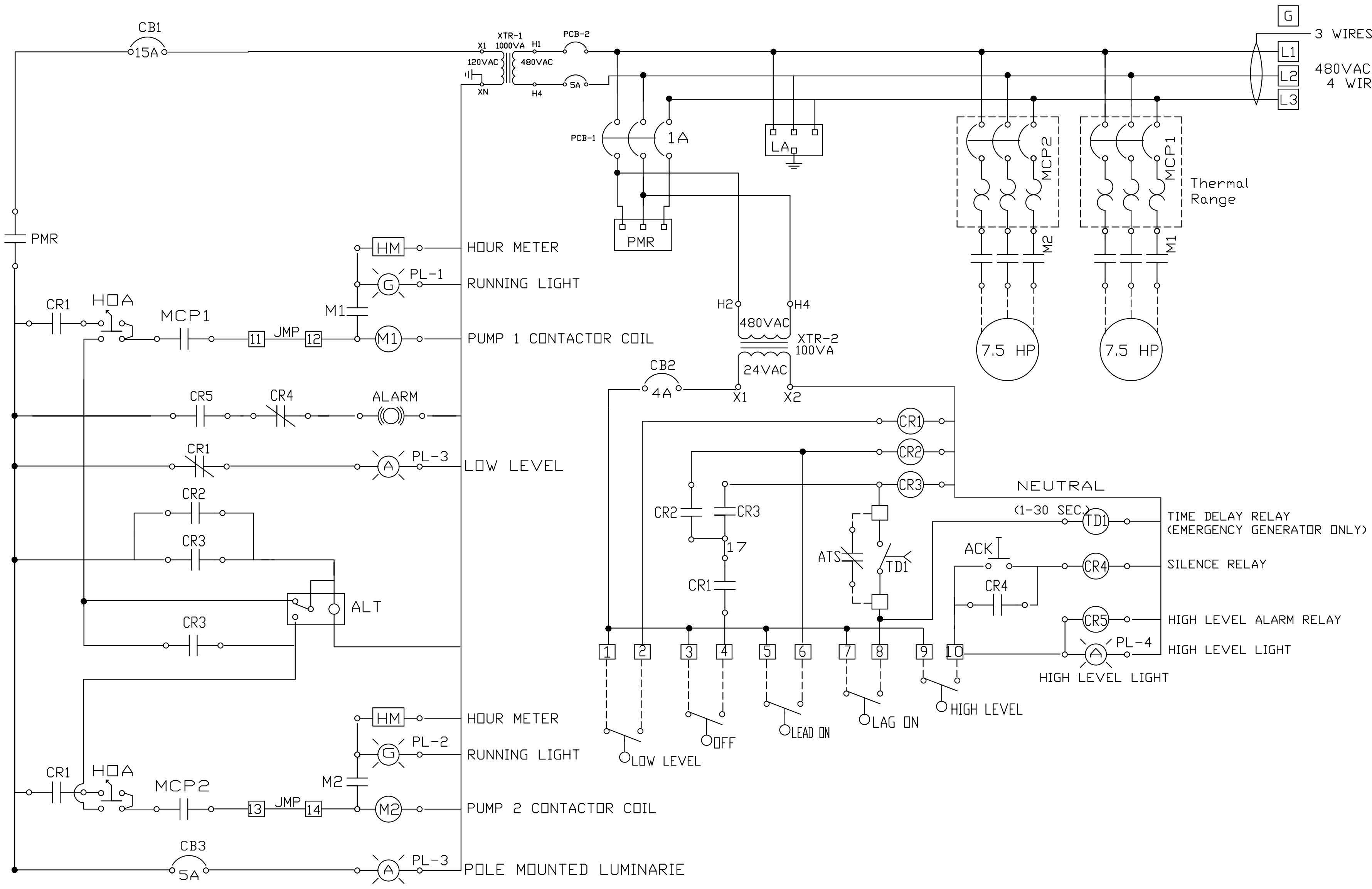
Ricardo Ortiz Garcia & Assoc., P.S.C.
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P.O. Box 1286 San Juan, P.R. 00954-1286 Tel: (787) 810-3100 Fax: (787) 810-6060

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NOTE: REMOVE JUMPER IN TERMINALS 11-12 & 13-14 TO CONNECT BIMETALLIC CONTACT FROM MOTOR PUMPS

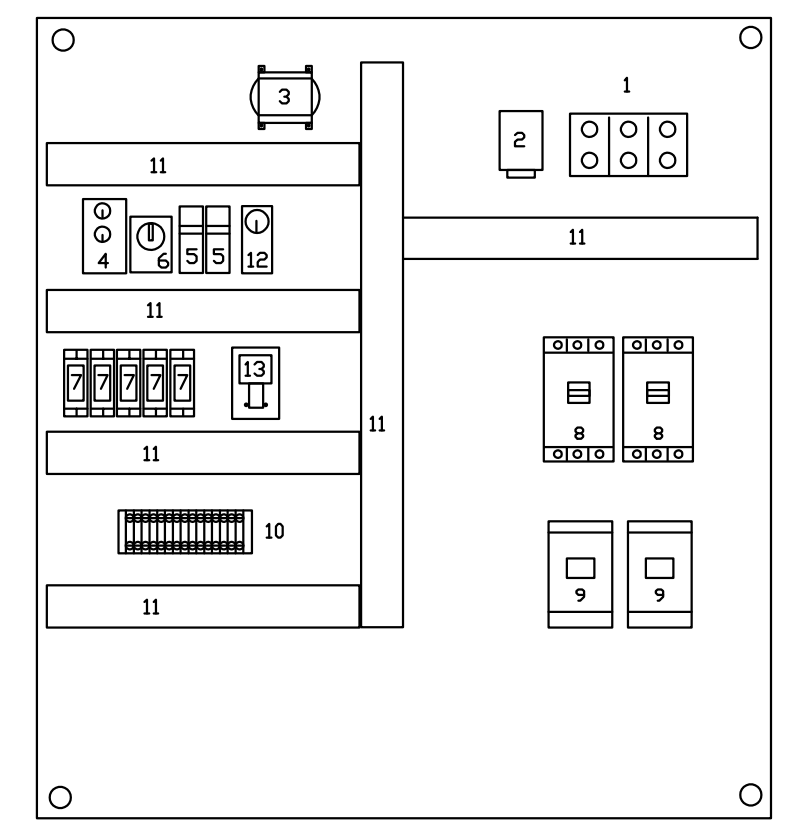
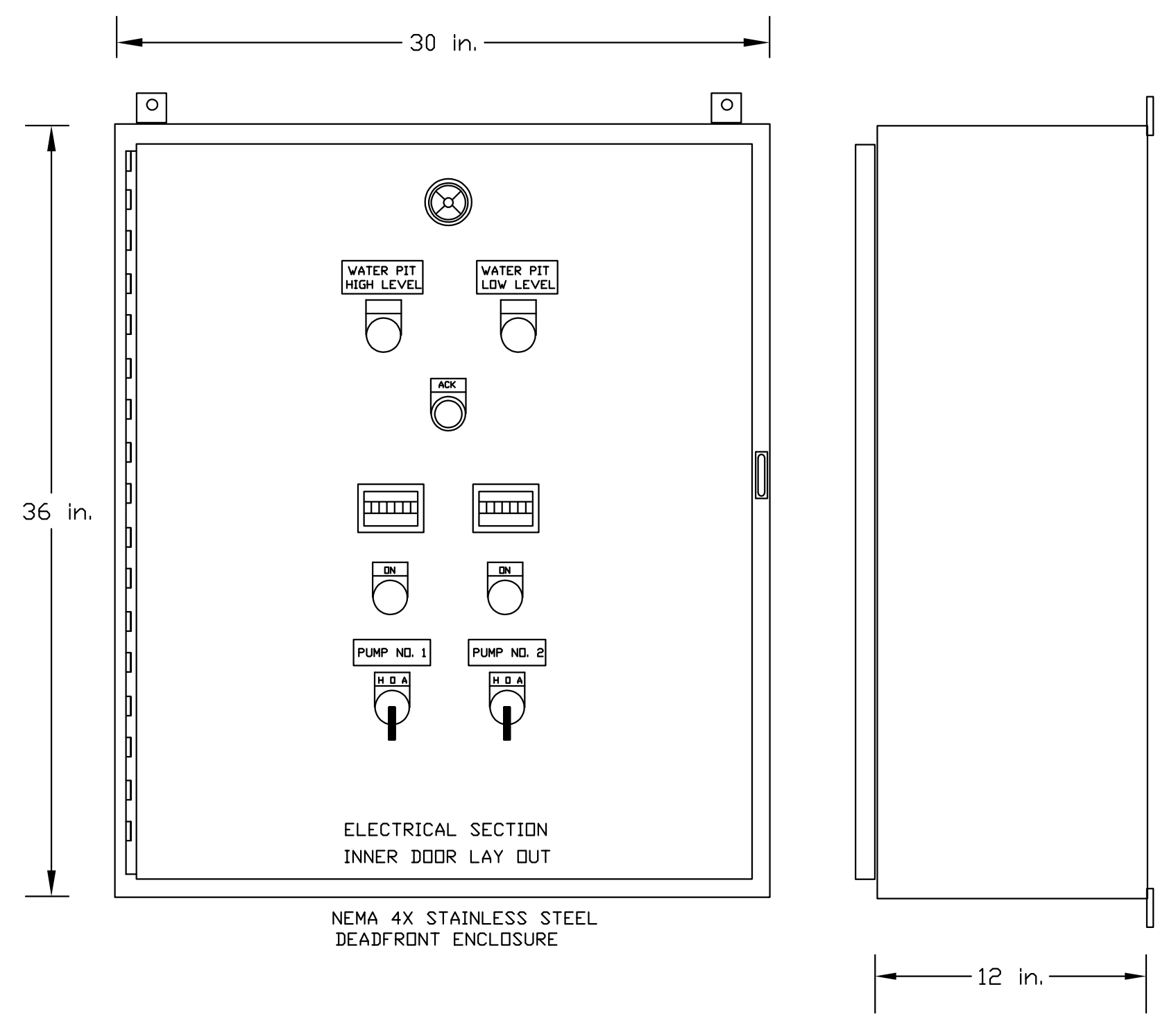
ATS - AUTOMATIC TRANSFER SWITCH CONTACT

MOTOR CONTROL PANEL WIRING DIAGRAM

NOT TO SCALE

- CONTROL PANEL IMPORTANT NOTES:**
- CONTROL PANEL SHALL BE RATED FOR 100A MIN - 480 V - 3 PHASES & 20 KAIC.
 - ALL BREAKERS, STARTERS, & ANY OTHER DEVICES SHALL BE RATED FOR 20 KAIC.
 - MCP FOR SUBMERSIBLE PUMPS SHALL BE RATED FOR 20A-3P-480 V.
 - STARTER & OVERLOAD PROTECTION FOR EACH PUMP SHALL BE RATED FOR 7.5 HP-3 PHASES-480 V SYSTEM, NEMA SIZE 1.
 - ENCLOSURE FOR CONTROL PANEL SHALL BE NEMA 4X, STAINLESS STEEL.

- ELECTRICAL CONTROL LEGEND:**
- MCP: MOTOR CIRCUIT PROTECTOR BREAKER
 - PMR: PHASE MONITOR RELAY
 - PCB: POWER CIRCUIT BREAKER
 - LA: LIGHTNING ARRESTOR
 - CB: CIRCUIT BREAKER
 - HSA: HAND SWITCH, AUTO POSITION
 - H O A: HAND - OFF - AUTO
 - CR(): CONTROL RELAY



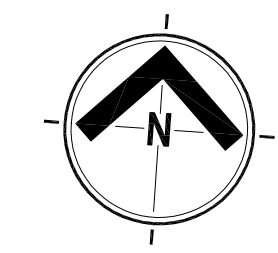
ELECTRICAL LEGEND:

- POWER BLOCK THREE POLES
- LIGHTNING ARRESTOR
- CONTROL TRANSFORMER 480-24VAC
- PHASE MONITOR RELAY
- CIRCUIT BREAKER ONE POLE
- POWER CIRCUIT BREAKER 3 POLES
- CONTROL RELAY
- MOTOR CIRCUIT PROTECTOR BREAKER FOR 7.5 HP/480V
- MAGNETIC CONTACTOR FOR 7.5 HP/480V
- CONTROL TERMINAL BOARD
- WIRE DUCTS
- TIME DELAY RELAY
- ELECTROMECHANICAL ALTERNATOR

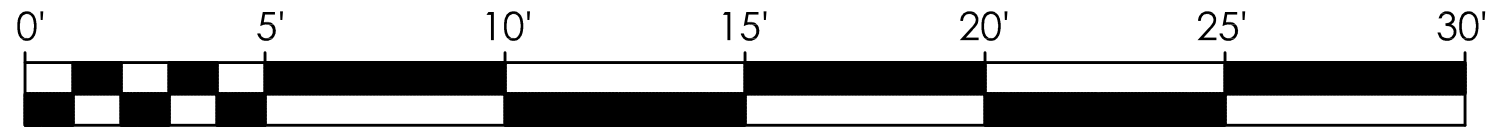
CONTROL PANEL LAY OUT

NOT TO SCALE

IMPORTANT NOTE:
COORDINATE WITH MECHANICAL PHASE THE ELEVATIONS OF THE DIFFERENT LEVEL SENSORS



GRAPHIC SCALE = 1/4"=1'-0"



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DATE ISSUE
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Revisions

Project No.:	19-1637.0
Set Date:	2020/07/07
Drawn by:	
Dwg. Date:	

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS DEVELOPMENT**

CEIBA & NAGUABO, PUERTO RICO
OWNER

SLUDGE LAGOONS
Drawing Title:

CONTROL PANEL DESCRIPTION

Sheet:

WSL-E102

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EXISTING BACKWASH TANK
IMPROVEMENTS SEE SHEET WBT-C102

ACCESS HATCH
TOP ELEV.=23.50

TANK
LEVEL
SENSOR

EXISTING 18"Ø C.I. PIPE

DIRT ROAD

EXISTING 18"Ø C.I. PIPE

BACKWASH LINE
SEE DETAIL
ON THIS SHEET

WATER
TREATMENT
PLAN

EXISTING 18"Ø C.I. PIPE

NEW 18"Ø
REPAIR CLAMP
(SEE NOTE 2)

NOTES:

1. CONTRACTOR SHALL VERIFY & COORDINATE ALL NEW AND EXISTING CONDITIONS & DIMENSIONS PRIOR TO CONSTRUCTION AND INSTALLATION
2. NEW 18"Ø REPAIR CLAMP SHALL BE FS3-2070-30 OR SIMILAR.

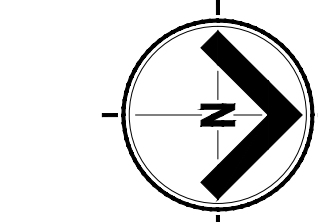
BACKWASH LINE REPAIR BLOW-UP

GRAPHIC SCALE = 1:60 SCALE: 1:20

DEMOLITION LEGEND:

ITEM TO BE REMOVED

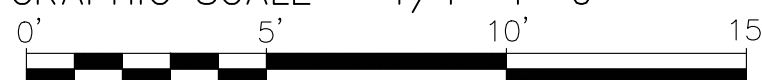
MANHOLE FRAME & COVER



EXISTING SITE PLAN

SCALE= 1:100

GRAPHIC SCALE = 1/4"=1'-0"



Integra Design Group
DATE ISSUE

► JULY 30, 2021 ◄

REVISED BID SET

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SHEET INFO:
Project No.: 19-1637.0
Set Date: 20210728
Drawn by:
Dwg. Date:

Revisions
Number Date Description

Number

Date

Description

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads

WATER TREATMENT PLAN - WASH WATER TANK

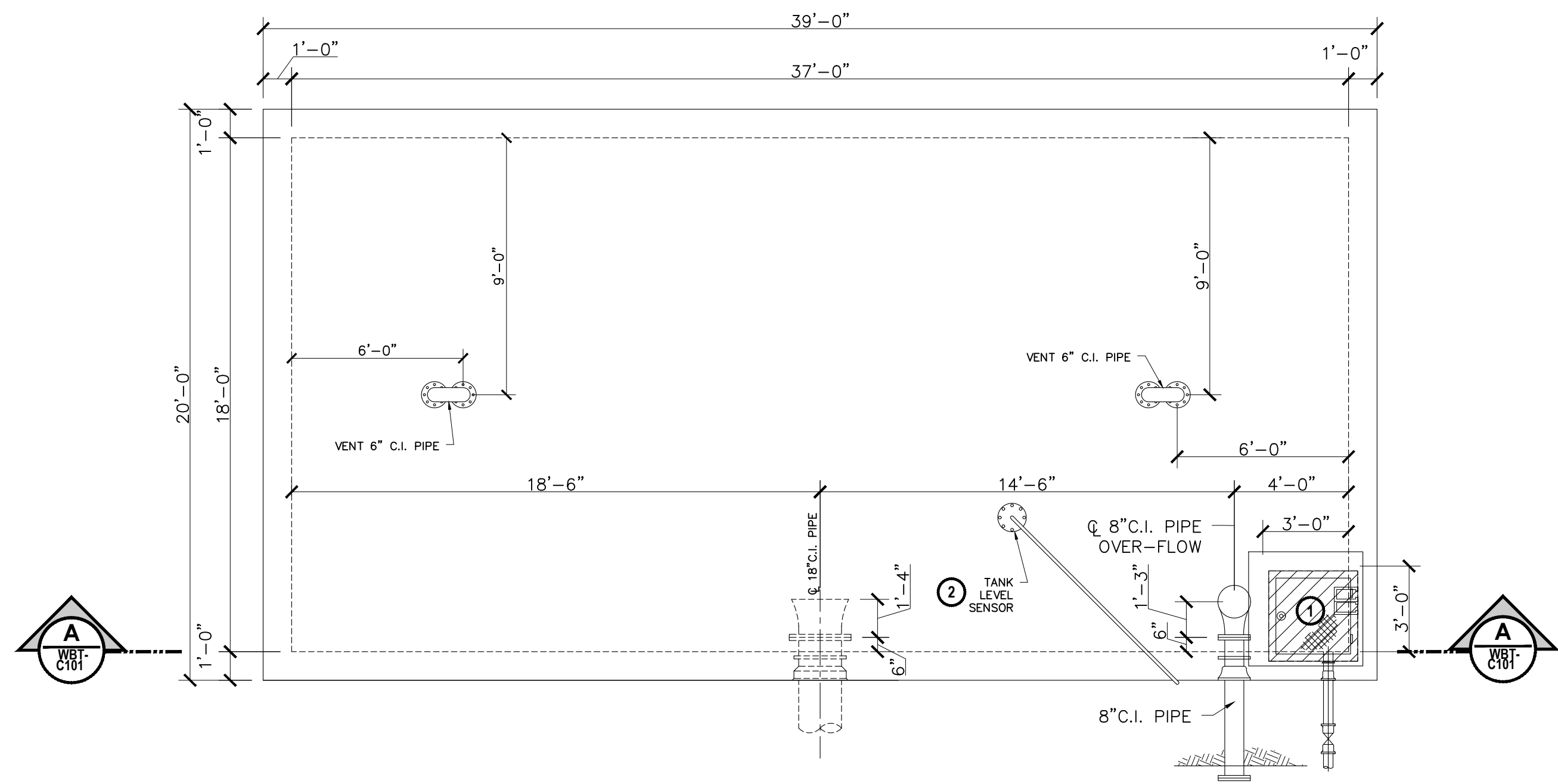
Drawing Title:

EXISTING + DEMOLITION SITE PLAN

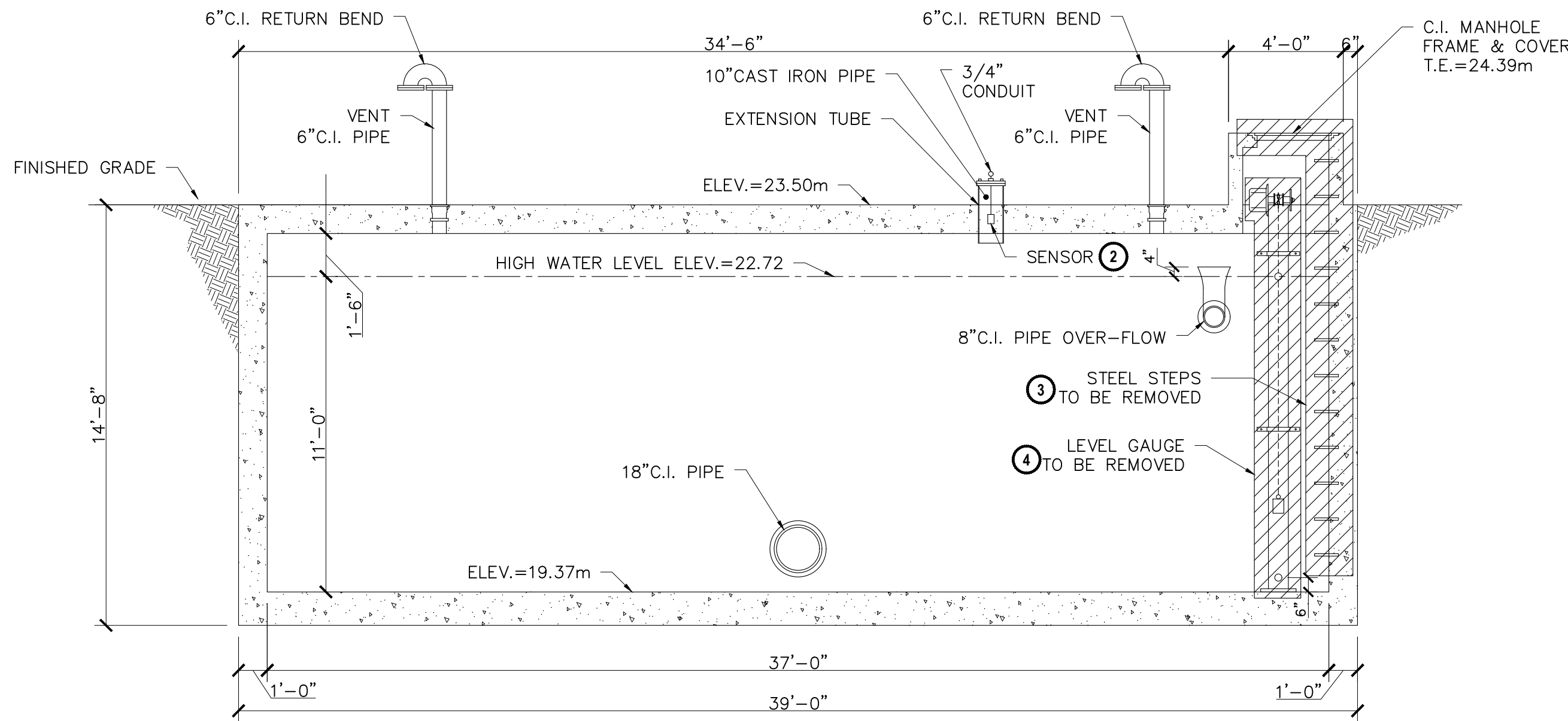
Project Title:

Sheet:

WBT-C101



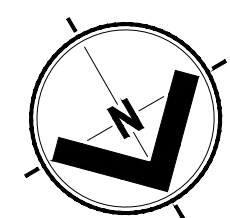
ROOF PLAN
SCALE: 1/4"=1'-0"



SECTION A-A
SCALE: 1/4"=1'-0"

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- 1 STEEL ACCESS HATCH TO BE REMOVED
 - 2 TANK LEVEL SENSOR TO BE ABANDONED
 - 3 STEEL STEPS TO BE REMOVED
 - 4 LEVEL GAUGE TO BE REMOVED



GRAPHIC SCALE = 1/4"=1'-0"

0' 5' 10' 15'

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUENA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODGP.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

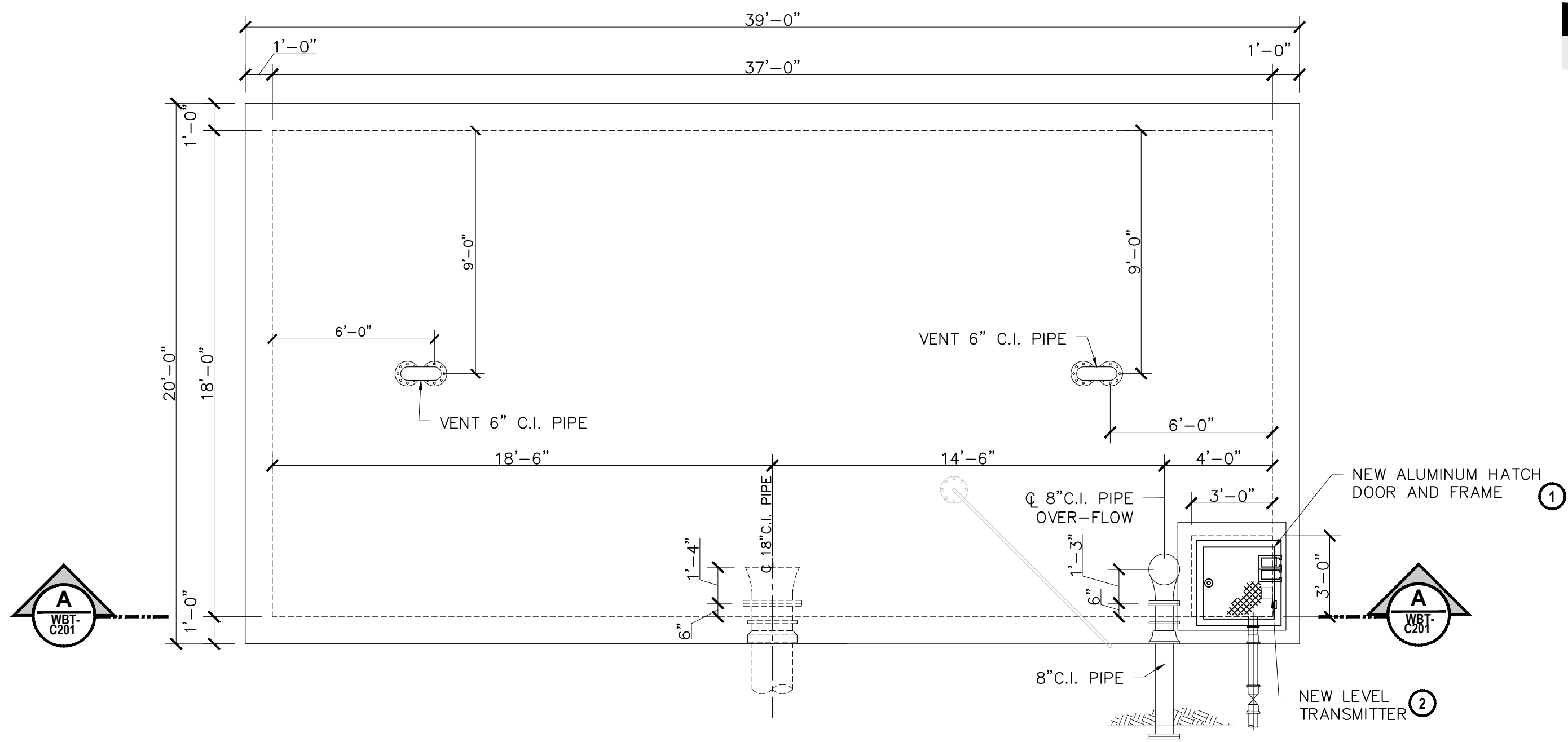
Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

WATER TREATMENT PLAN - WASH WATER TANK

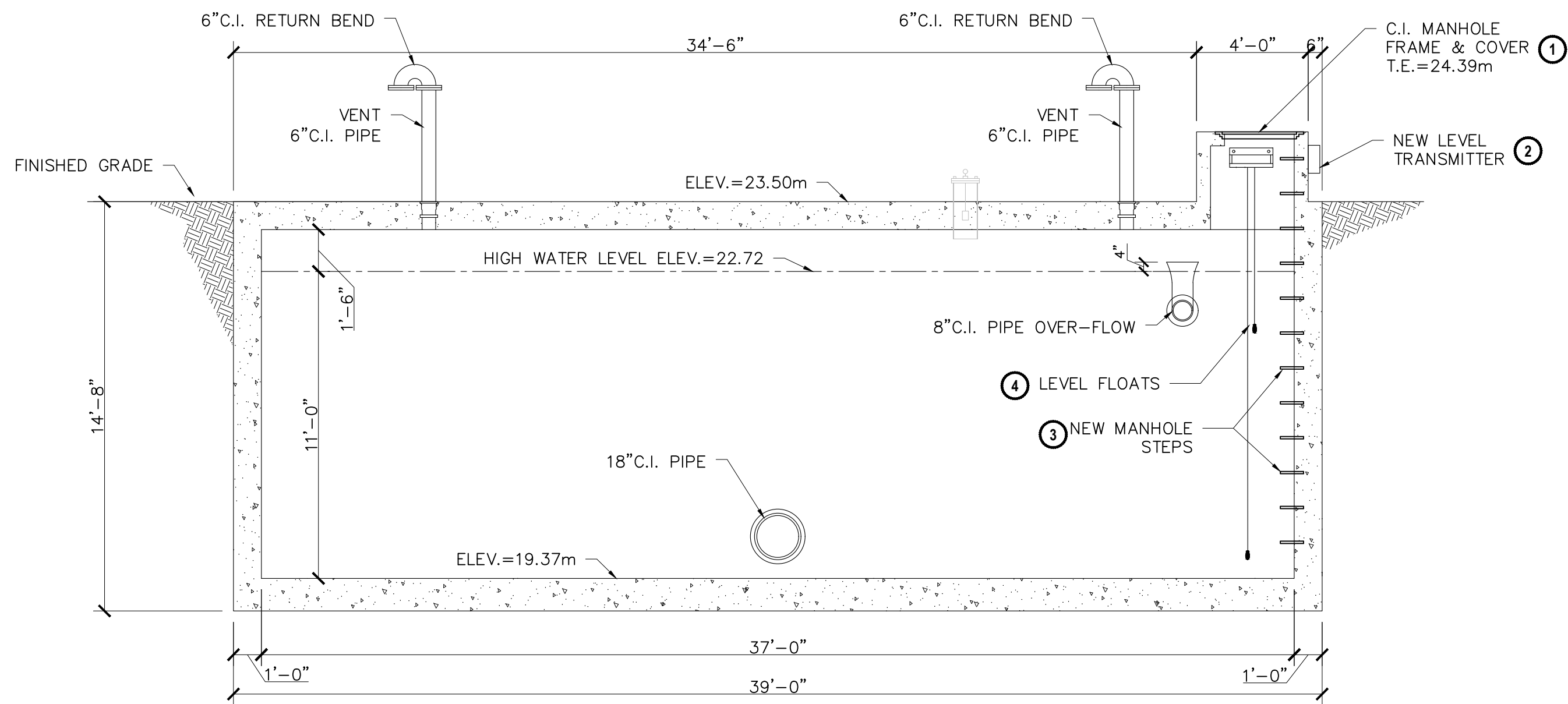
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EXISTING + DEMOLITION PLAN & SECTION

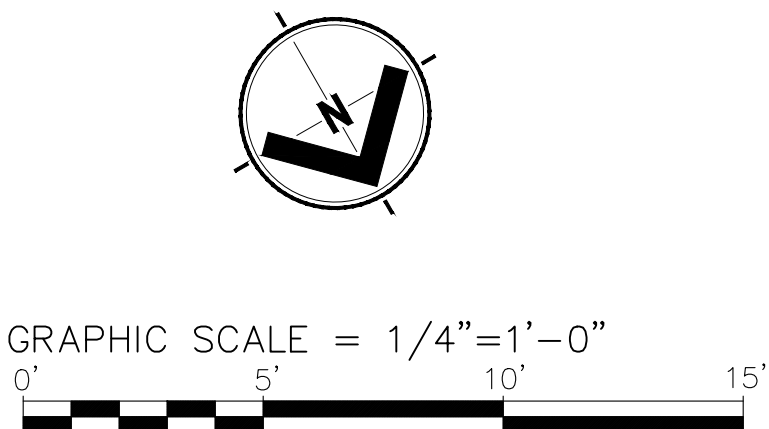
WB-T-C102



ROOF PLAN
SCALE: 1/4"=1'-0"

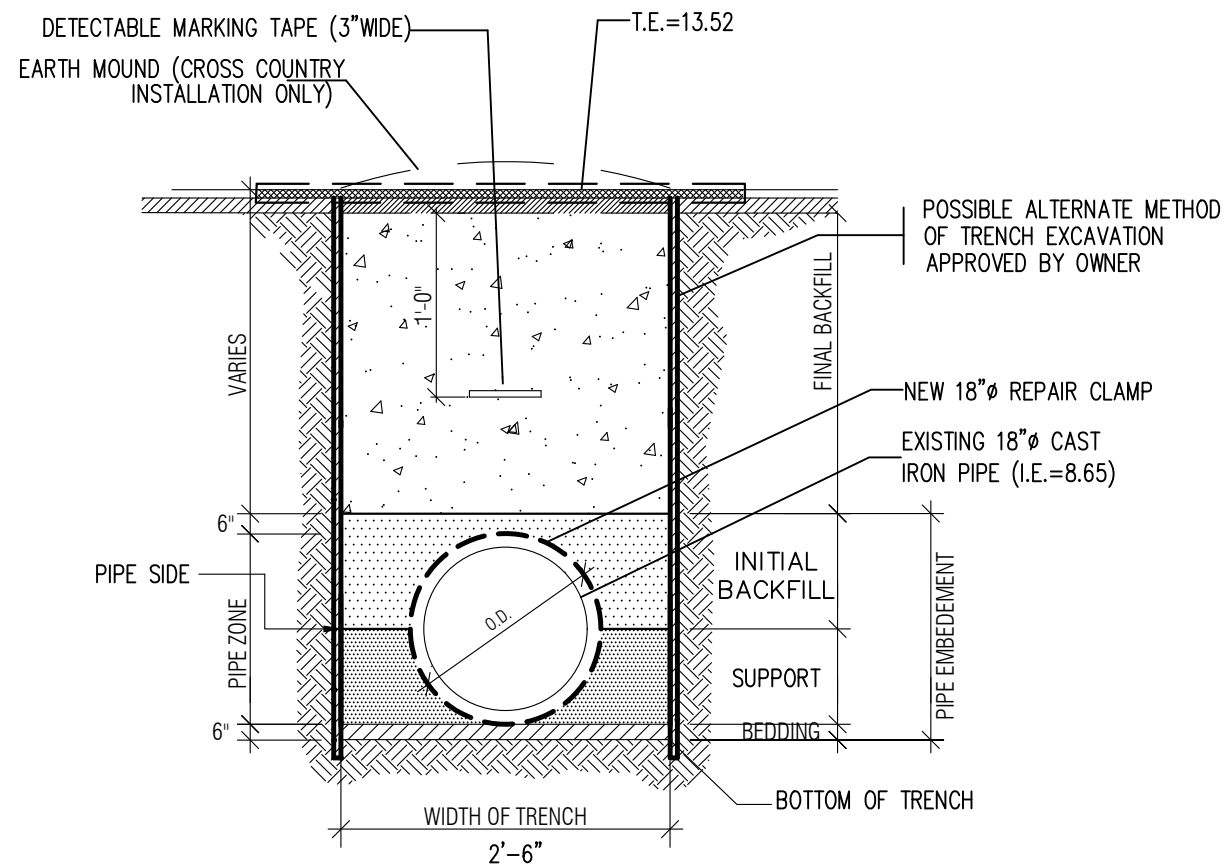


SECTION A-A
SCALE: 1/4"=1'-0"



SCOPE OF WORK:

- 1 NEW ALUMINUM HATCH DOOR AND FRAME
- 2 NEW TANK LEVEL TRANSMITTER (LIT-05-79), REFER TO SHEET WTP-PH105 AND TECHNICAL PECS 40 69 01-I
- 3 NEW MANHOLE STEPS, REFER TO DETAILS ON SHEET WTP-C400
- 4 NEW LEVEL FLOATS (LSLL-05-80 AND LSHH-05-81), REFER TO SHEET WTP-PH105 AND TECHNICAL PECS 40 69 01-I



- ADDITIONAL SPECIFICATIONS:
- 1) THE FILL MATERIAL SHALL BE PLACED IN 8" THICK LAYERS.
 - 2) THE MAXIMUM UNPAVED TRENCH LENGTH SHALL NOT EXCEED 200 LINEAR METERS.

FILL MATERIAL AND COMPACTION				
EXCAVATION ZONE	BEDDING	SUPPORT (HAND PALCED)	INITIAL BACKFILL	FINAL BACKFILL
FILL MATERIAL	SAND OR COARSE < 5% FINES		A-2-4	A-2-4
PROCTOR % DENSITY	95	75	95	95

NOT TO SCALE

BACKWASH PIPE REPAIR TRENCH DETAILS

1

Revisions

Number	Date	Description

SHEET INFO.	
Project No.:	19-1637.0
Set Date:	20210728
Drawn by:	
Dwg. Date:	

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER TREATMENT PLAN - WASH WATER TANK

Drawing Title:

PROPOSED PLAN, SECTION & DETAIL

Project Title:

Sheet:

WB1-C201

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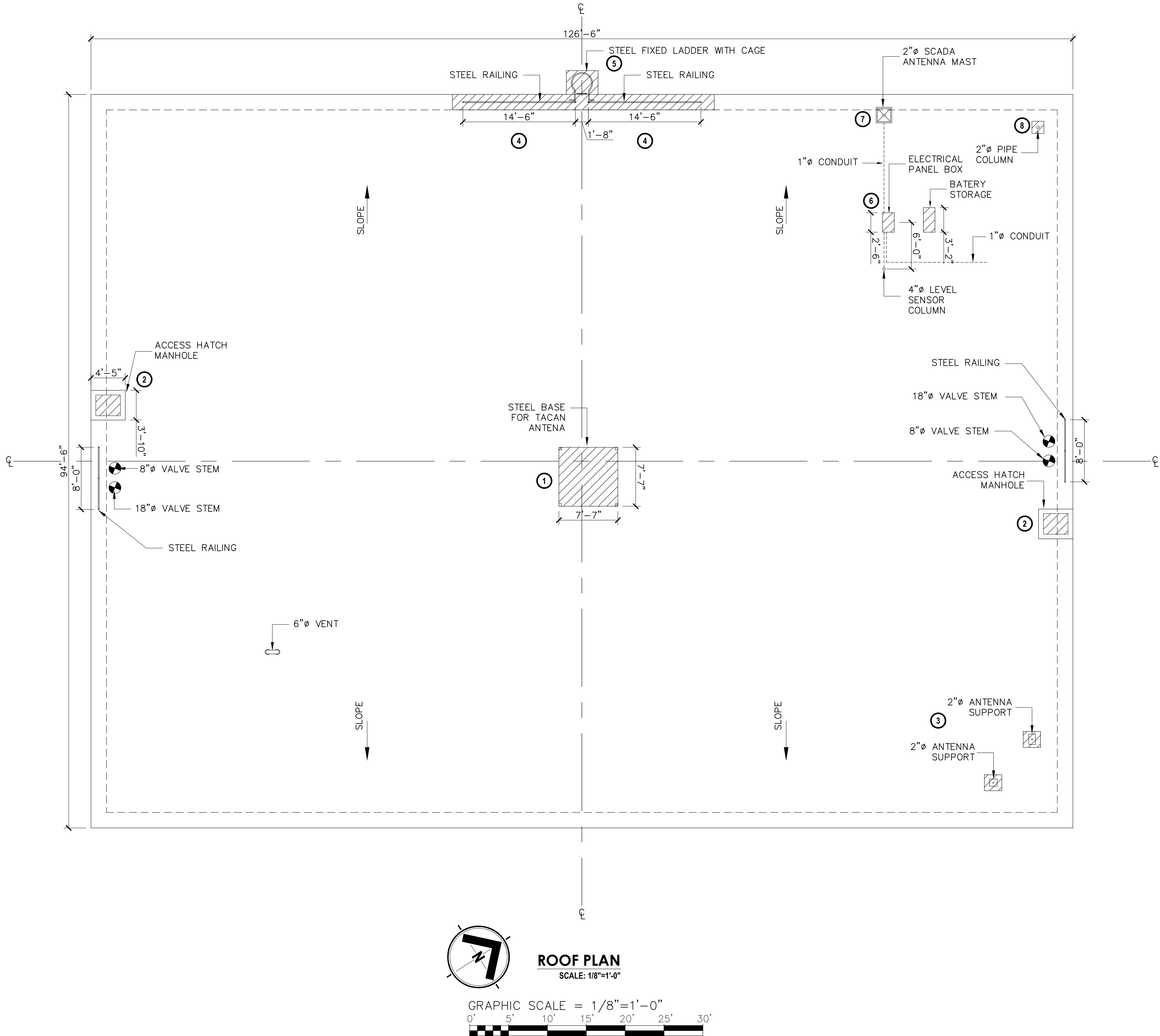
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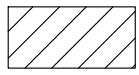
© INTEGRA DESIGN GROUP PSC

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUENA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODGP.

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DATE ISSUE
JULY 30, 2021
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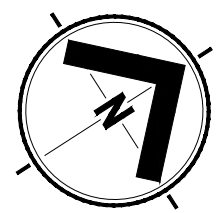


DEMOLITION LEGEND:



ITEM TO BE REMOVED

- 1 STEEL BASE AND SUPPORTS
- 2 STEEL ACCESS HATCH DOORS & FRAMES (2)
- 3 ANTENNA SUPPORTS & BASE (2)
- 4 STEEL GUARD RAILS (2)
- 5 STEEL FIXED LADDER & CAGE
- 6 ELECTRICAL PANEL BOX, BATTERY STORAGE & ELECTRICAL CONDUITS
- 7 SCADA ANTENNA MAST & BASE PLATE
- 8 PIPE COLUMN



ROOF PLAN

SCALE: 1/8"=1'-0"

GRAPHIC SCALE = 1/8"=1'-0"

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPB.

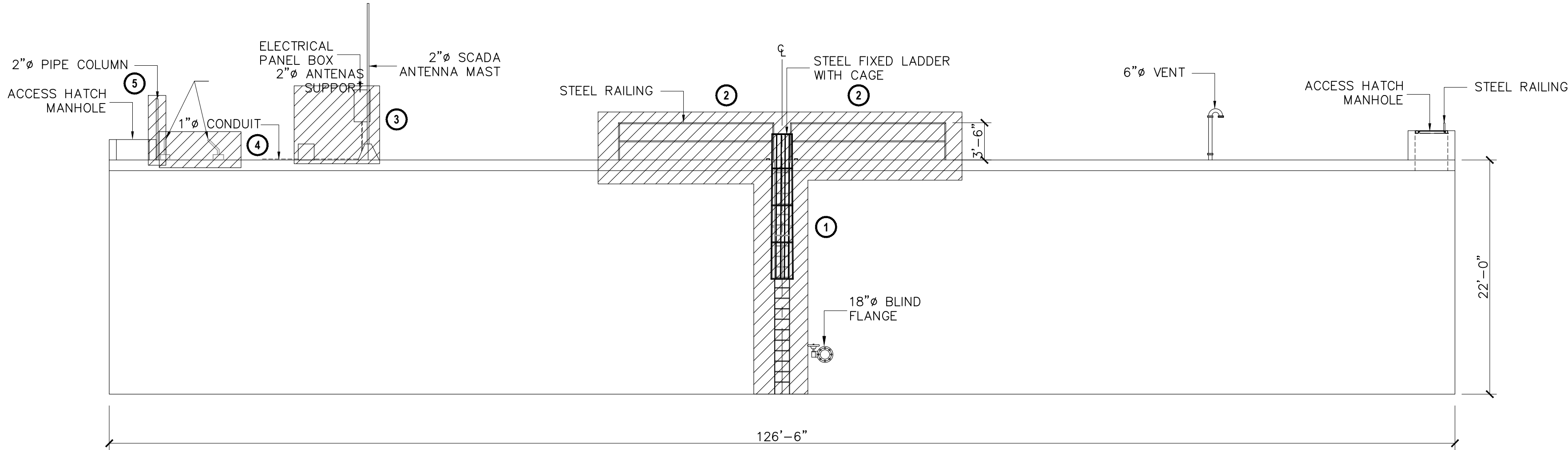
Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	Set Date: 2021/07/28
		Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

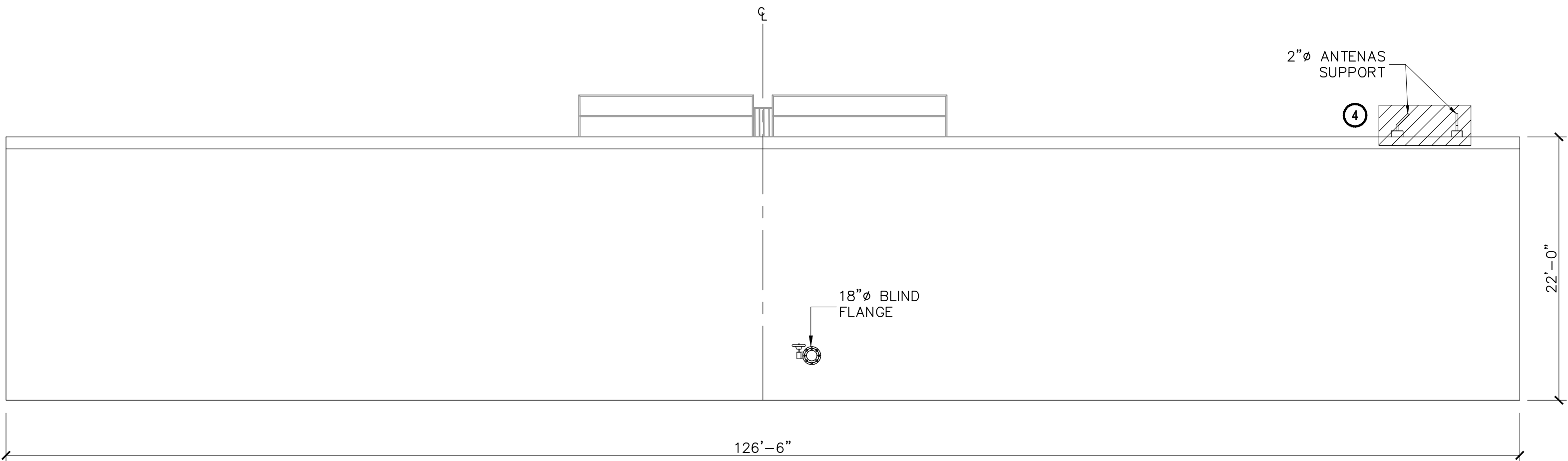


**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**
Owner: CERRA & MAGUARO, PUERTO RICO
POTABLE WATER STORAGE TANK (TACAN)
Drawing Title:
EXISTING + DEMOLITION ROOF PLAN

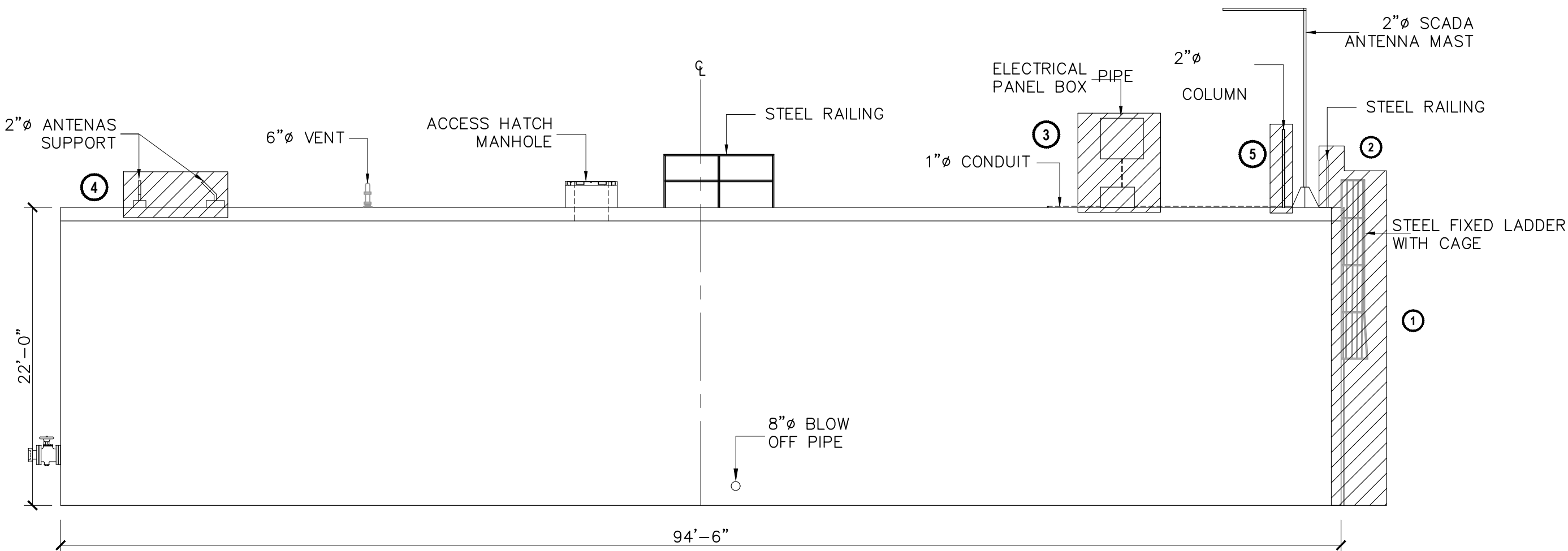
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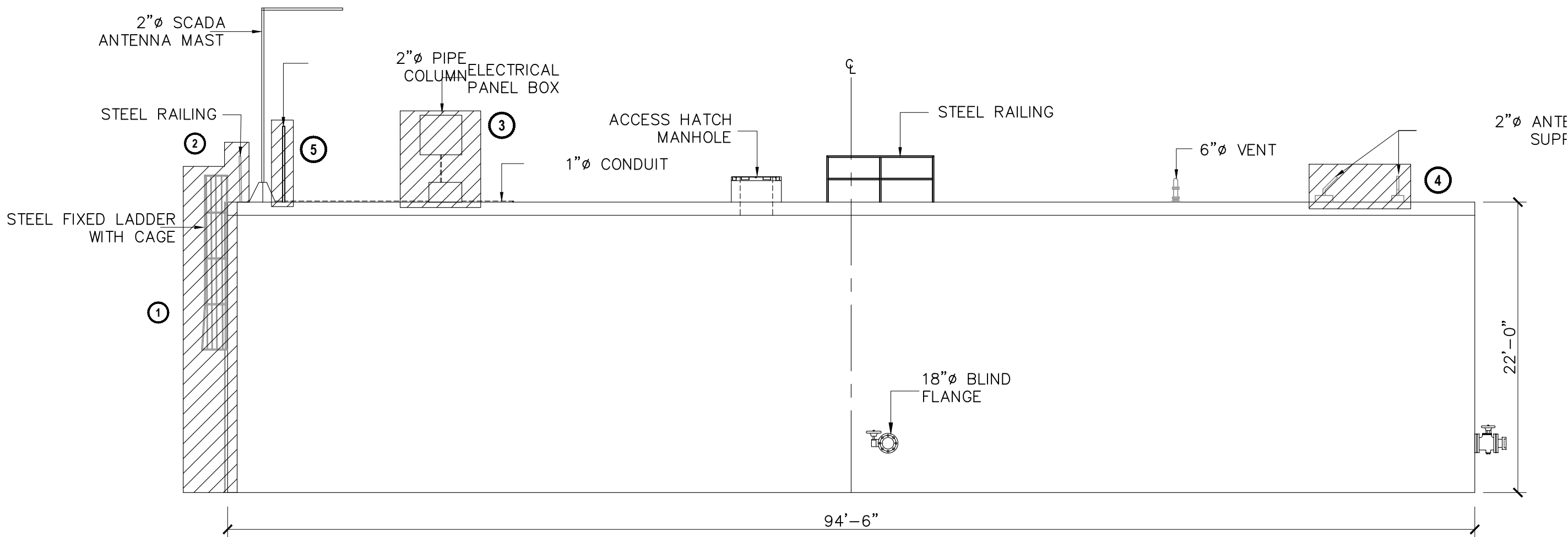
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SOUTH ELEVATION
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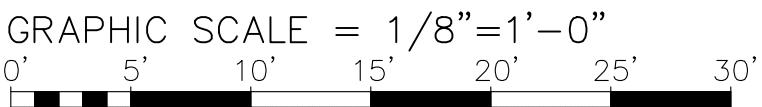
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WEST ELEVATION
SCALE: 1/8"=1'-0"

DEMOLITION LEGEND:

- ITEM TO BE REMOVED
- 1 STEEL FIXED LADDER WITH CAGE
 - 2 STEEL RAILING
 - 3 ELECTRICAL PANEL BOX, BATTERY STORAGE & ELECTRICAL CONDUITS
 - 4 ANTENNA SUPPORTS & BASE (2)
 - 5 PIPE COLUMN



YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OCPC.

Project Title:

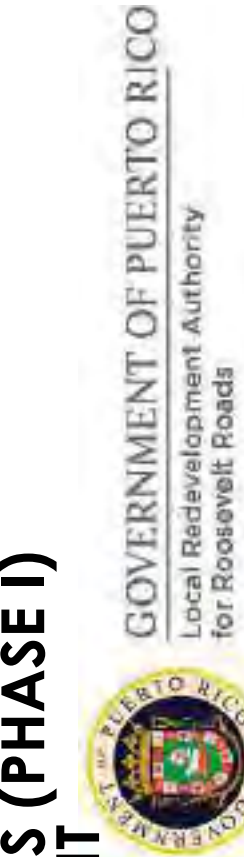
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

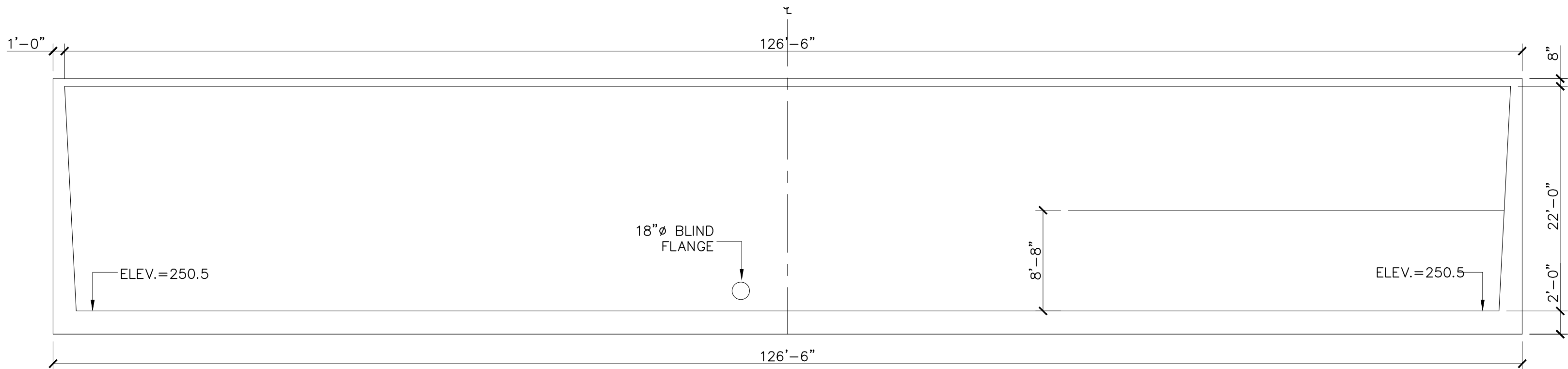
Owner:

POTABLE WATER STORAGE TANK (TACAN)
Drawing Title:

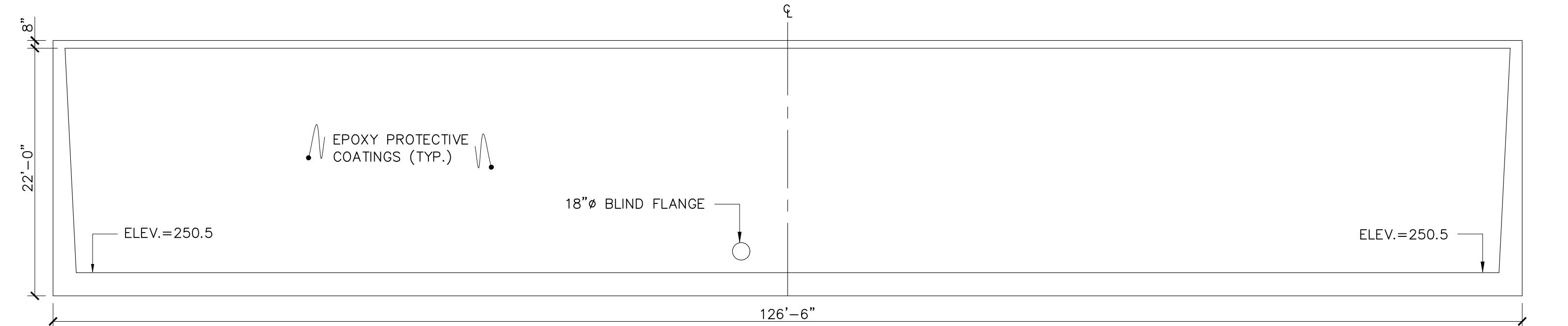
EXISTING + DEMOLITION ELEVATIONS

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

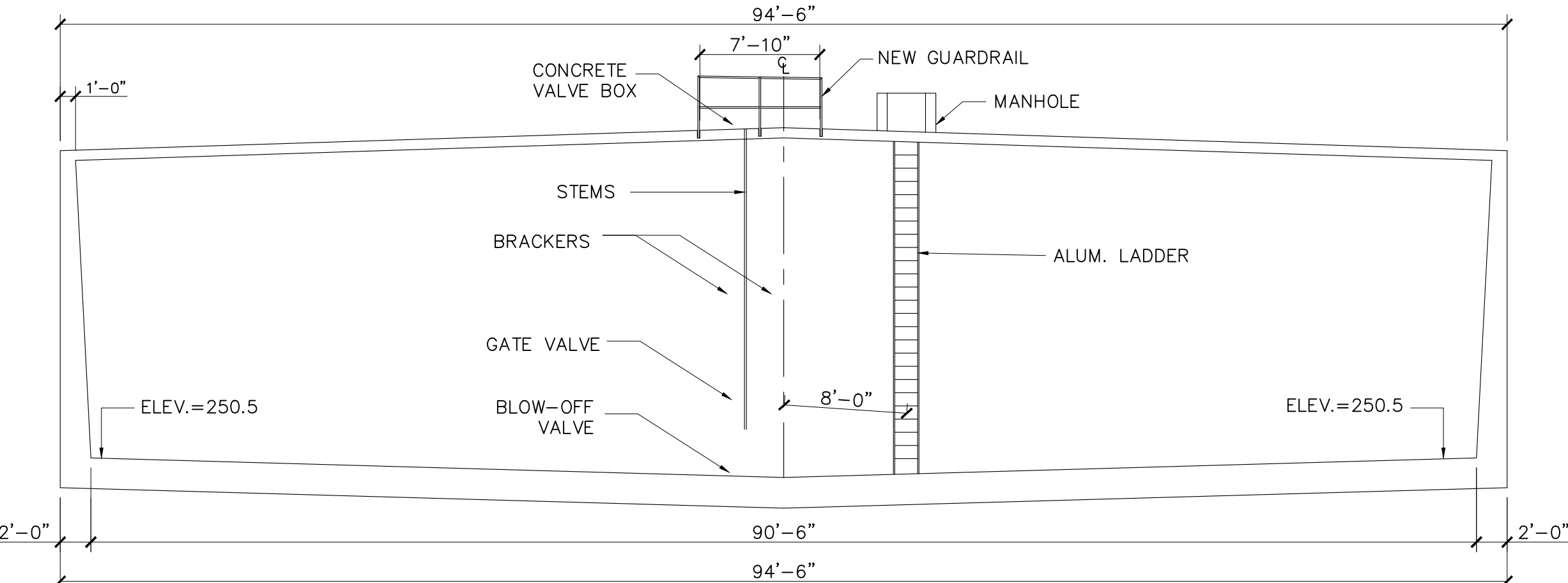




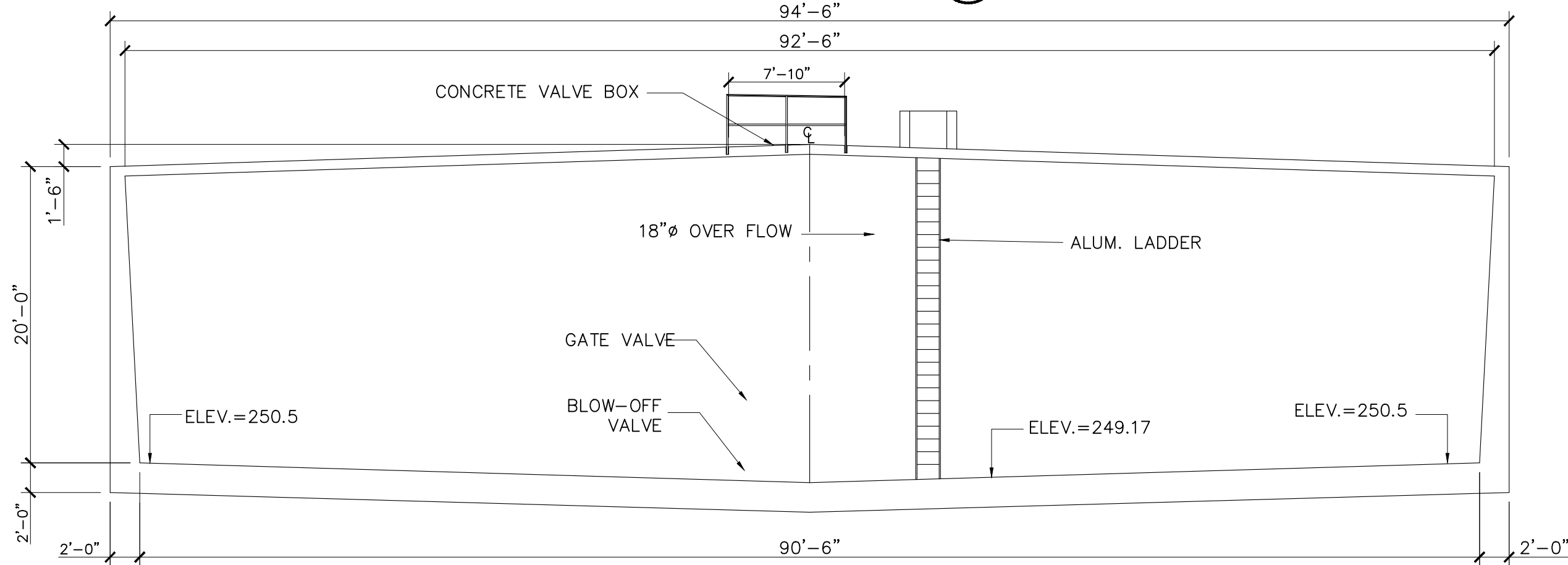
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WST-AB301



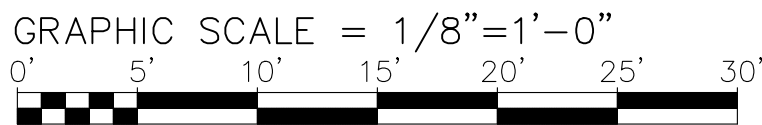
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WST-AB301



SECTION C-C
SCALE: 1/8"=1'-0"
WST-AB301



SECTION D-D
SCALE: 1/8"=1'-0"
WST-AB301



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DATE ISSUE
JULY 30, 2021
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YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPB.

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

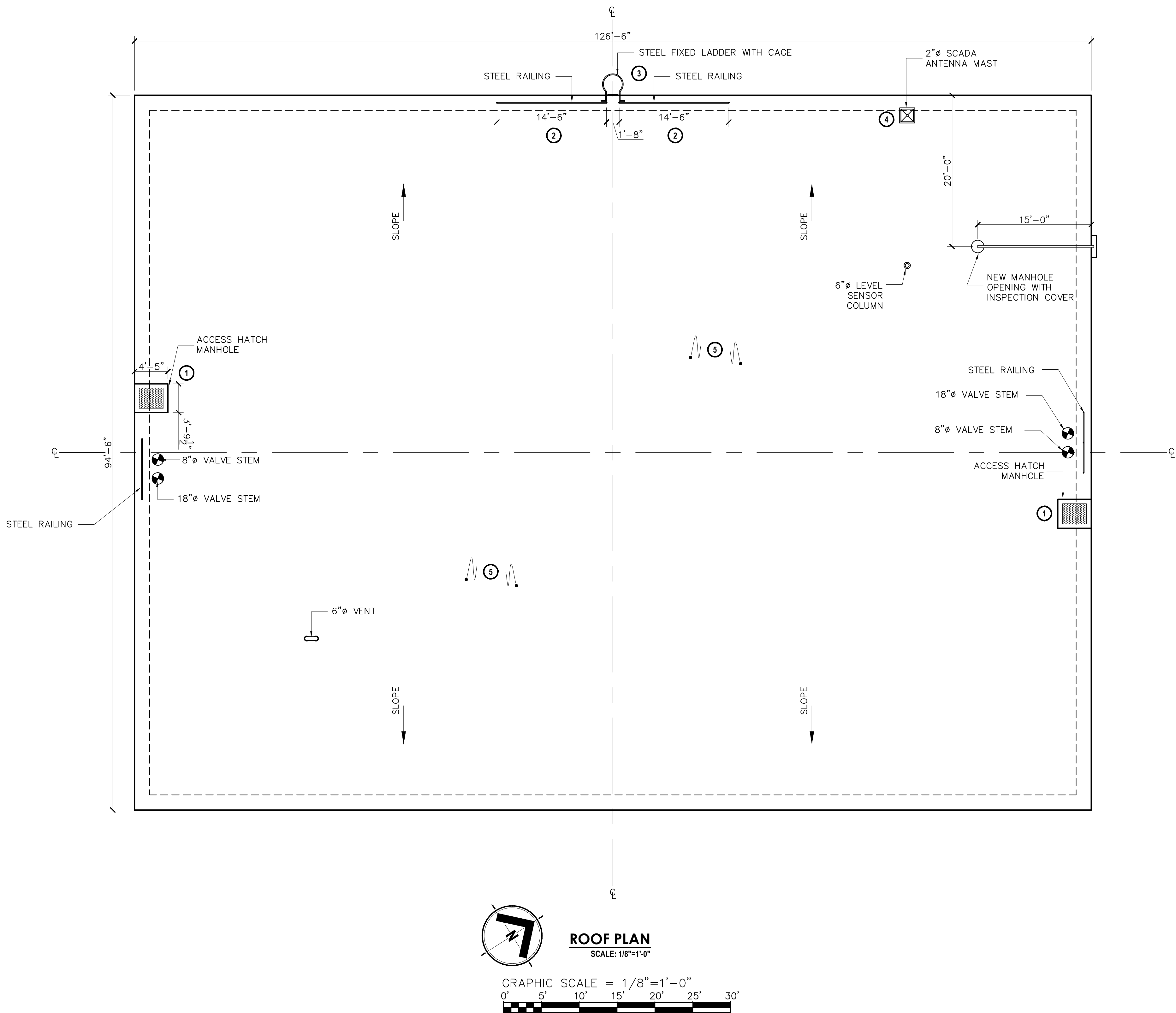
WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



POTABLE WATER STORAGE TANK (TACAN)

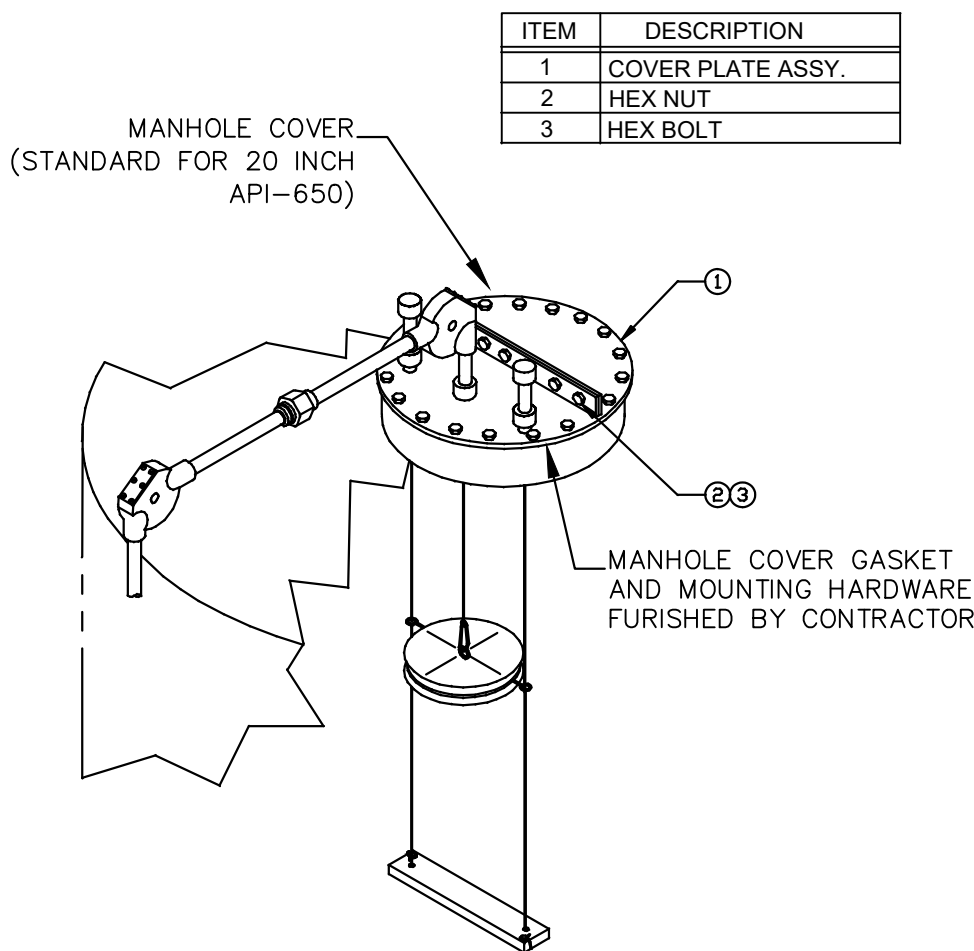
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EXISTING + DEMOLITION SECTIONS

WST-AB301



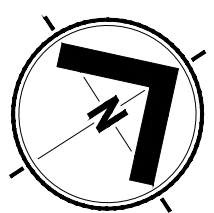
SCOPE OF WORKS:

- 1 NEW ALUMINUM 30"x30" ACCESS HATCH DOORS & FRAMES (2)
- 2 NEW STEEL GUARD RAILS (2)
- 3 NEW ALUMINUM FIXED LADDER & CAGE
- 4 NEW SCADA ANTENNA MAST & BASE PLATE
- 5 NEW ROOF ELASTOMETRIC (SILICONE) WATERPROOFING
- 6 NEW LIQUID LEVEL INDICATOR WITH 20' GAUGEBOARD VAREC 6700 OR SIMILAR (CONTRACTOR SHALL SUPPLY ALL NECESSARY PIPING, HARDWARE AND MANHOLE OPENING AND COVER)

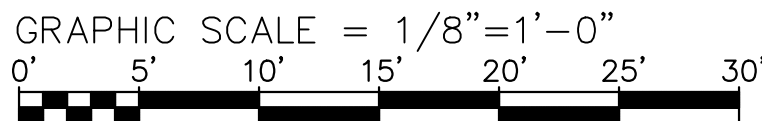


ITEM	DESCRIPTION
1	COVER PLATE ASSY.
2	HEX NUT
3	HEX BOLT

INDICATOR MANHOLE COVER DETAIL
SCALE: N.T.S.



ROOF PLAN
SCALE: 1/8"=1'-0"



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DATE ISSUE
JULY 30, 2021
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YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODGP.

Revisions			SHEET INFO.	
Number	Date	Description	Project No.	Set Date
			19-1837-0	20210728
			Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

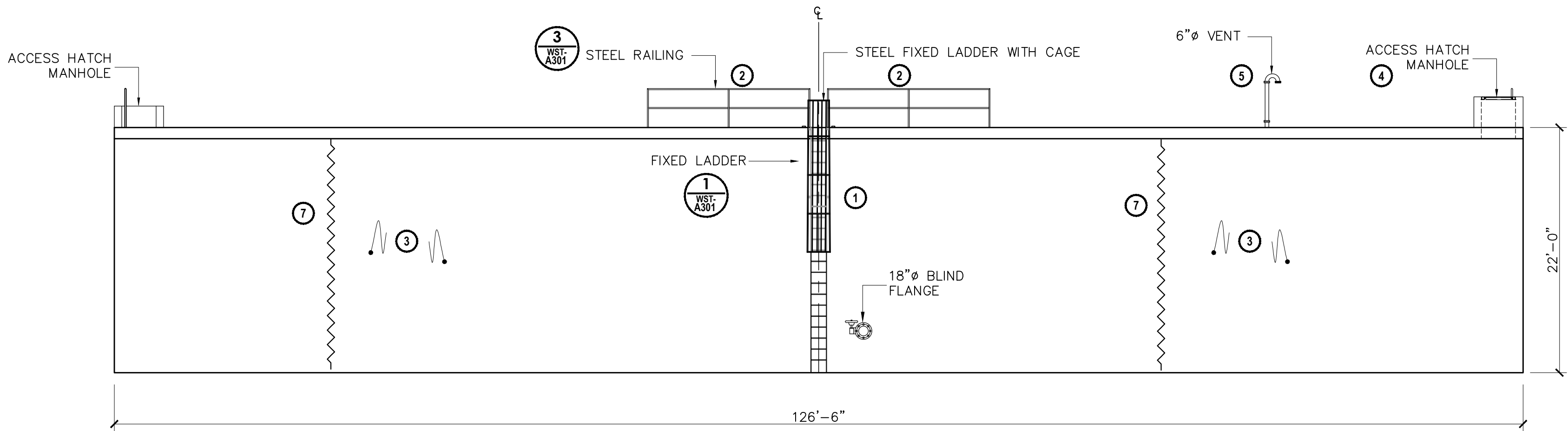
POTABLE WATER STORAGE TANK (TACAN)

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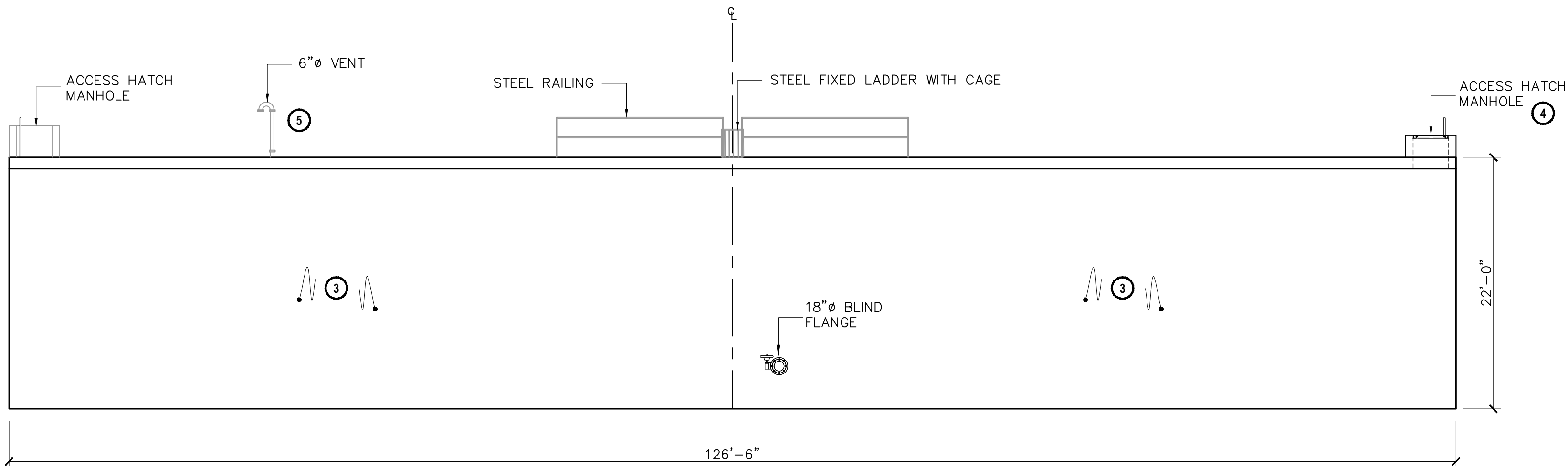
PROPOSED ROOF PLAN

WST-A102

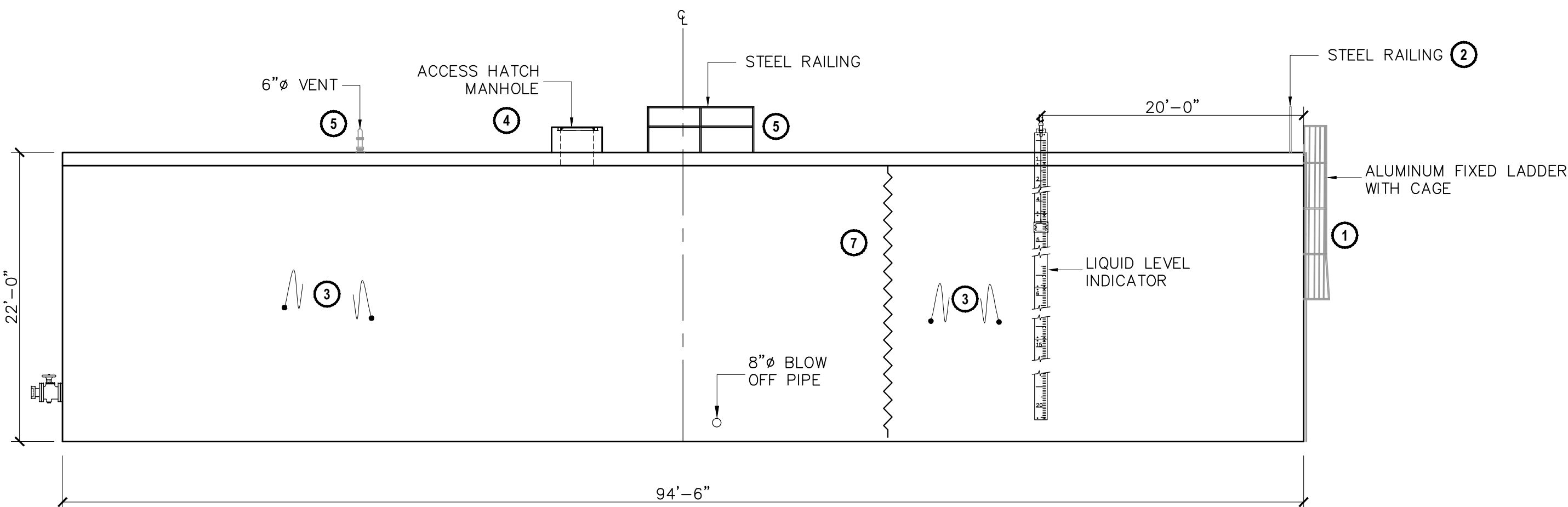
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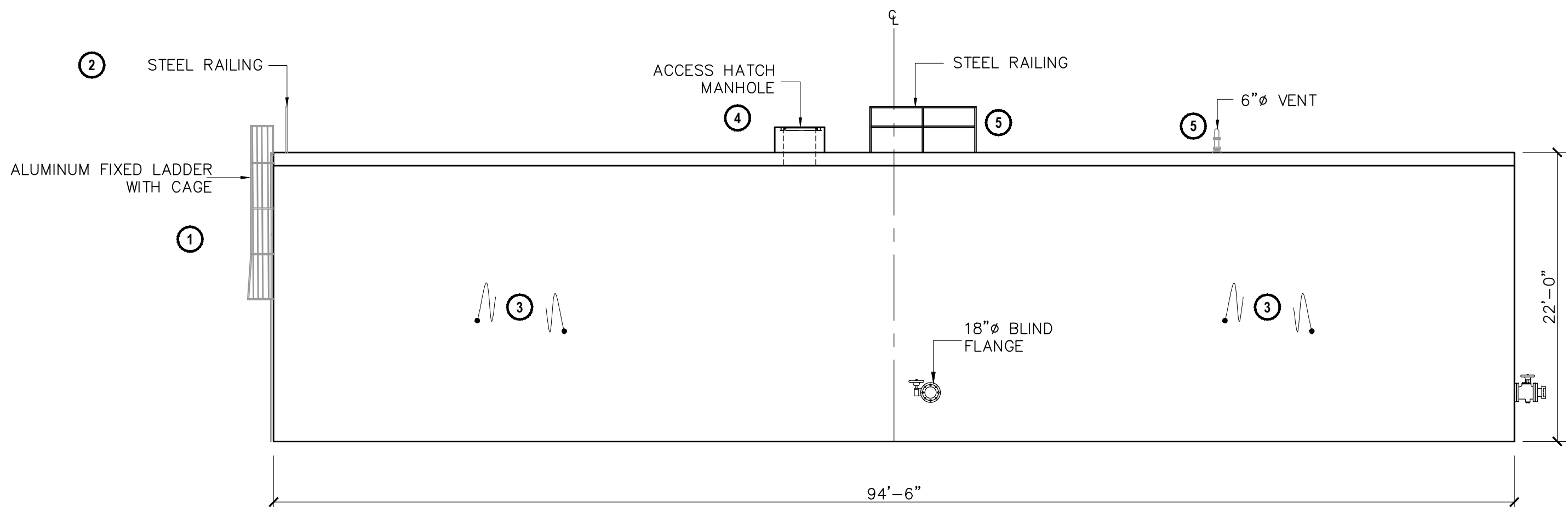
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SCALE: 1/8"=1'-0"



SOUTH ELEVATION
SCALE: 1/8"=1'-0"



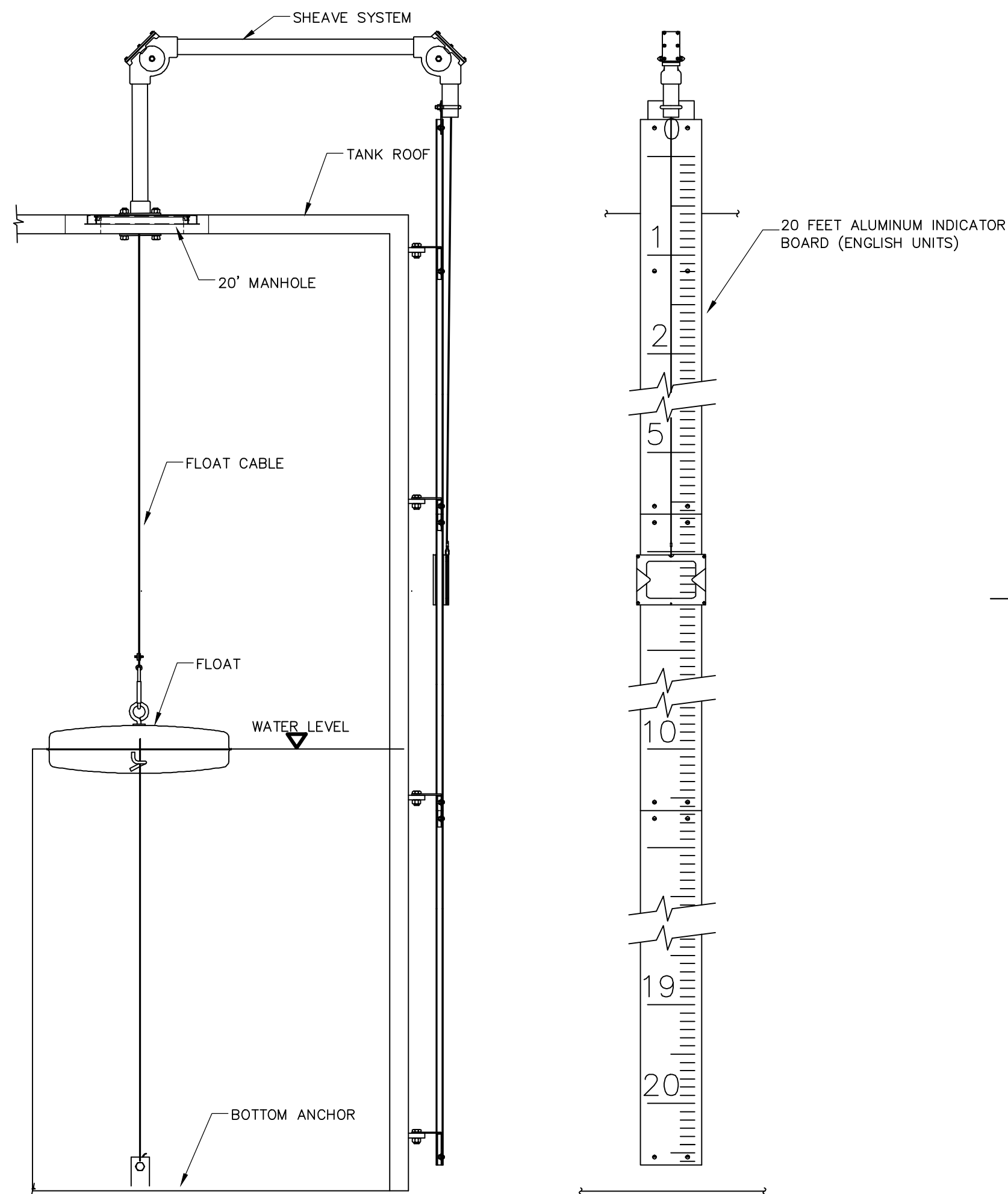
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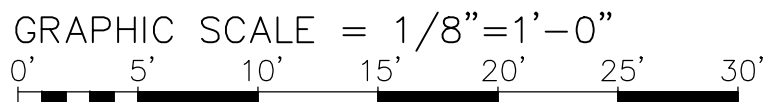
WEST ELEVATION
SCALE: 1/8"=1'-0"

SCOPE OF WORKS:

- 1 NEW ALUMINUM FIXED LADDER WITH CAGE
- 2 NEW STEEL RAILING
- 3 NEW EXTERIOR PAINTED SURFACE
- 4 NEW ACCESS HATCH MANHOLE
- 5 NEW PAINT COATING ON ALL EXPOSED VENTS, PIPES, AND RAILINGS ON ROOF. INSTALL NEW STAINLESS STEEL MESH ON VENT OPENINGS.
- 6 NEW LIQUID LEVEL INDICATOR WITH 20' GAUGEBOARD VAREC 6700 OR SIMILAR
- 7 REPAIR OF LEAKING CRACKS ON EXTERIOR & INTERIOR WALLS WITH KRYSTOL PLUG, KRYSTOL LEAK REPAIR GROUT & KRYSTOL TI LEAK REPAIR SYSTEM OR APPROVED SIMILAR, FOLLOWING MANUFACTURER'S APPLICATION INSTRUCTIONS.



TANK LIQUID LEVEL INDICATOR
SCALE: N.T.S.



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DATE ISSUE
JULY 30, 2021
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Revisions	Number	Date	Description	SHEET INFO.
	1	2021/07/28	Project No.: 18-1837.0	Project No.: 18-1837.0
	2	2021/07/28	Set Date: 2021/07/28	Set Date: 2021/07/28
	3		Drawn by:	Drawn by:
	4		Dwg. Date:	Dwg. Date:

**WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT**

POTABLE WATER STORAGE TANK (TACAN)

Drawing Title:

Project Title:

Owner: GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

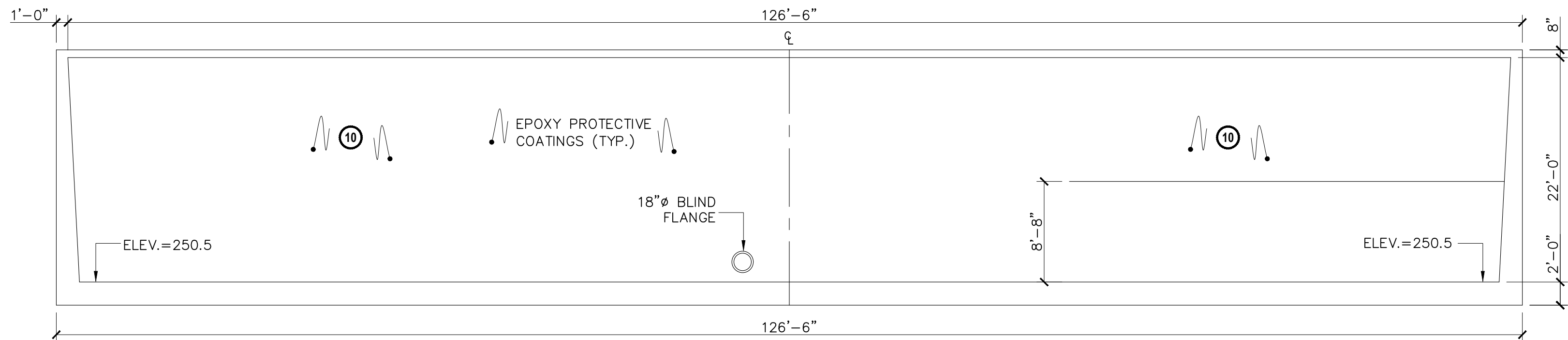
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WST-A201

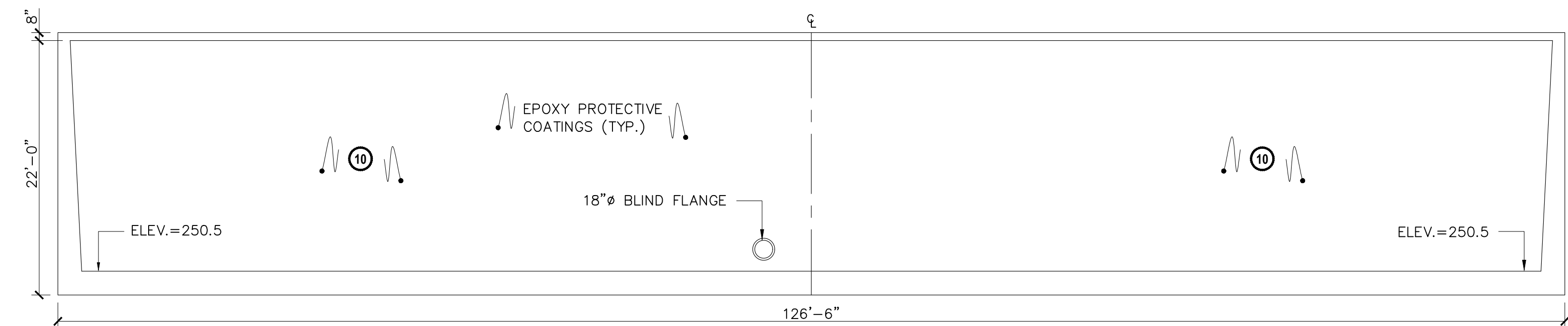
PROPOSED ELEVATIONS

INTEGRA

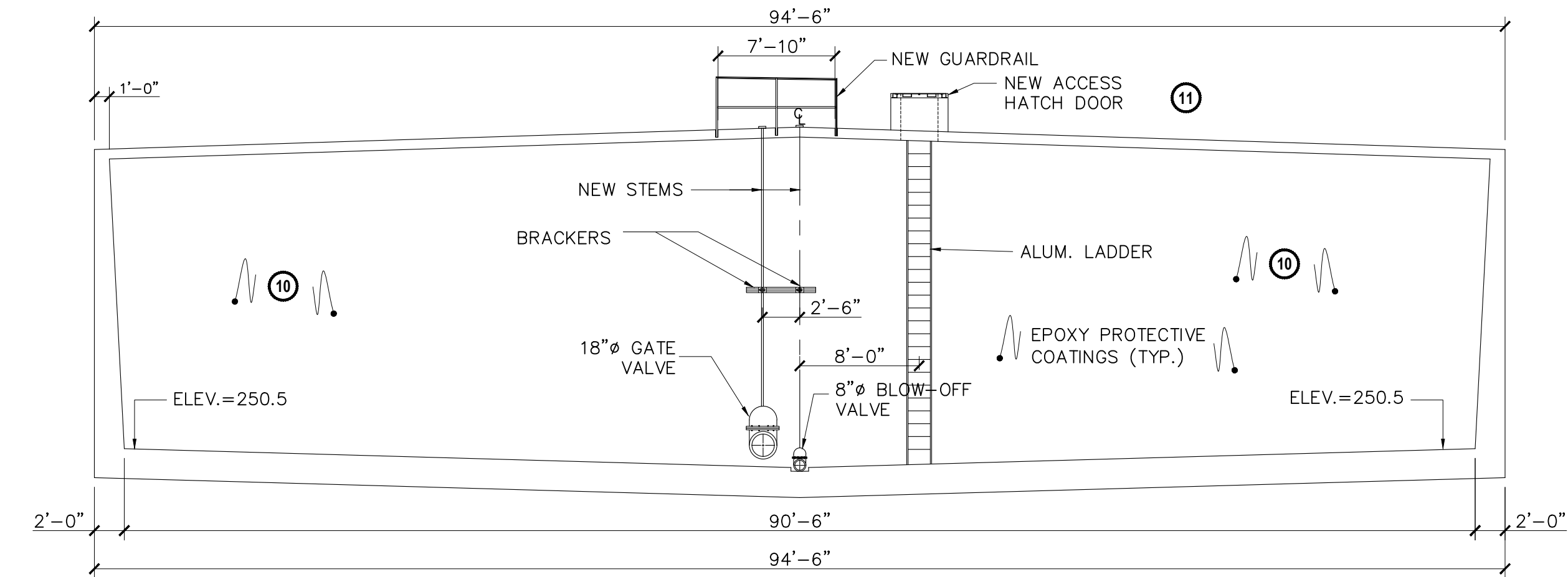
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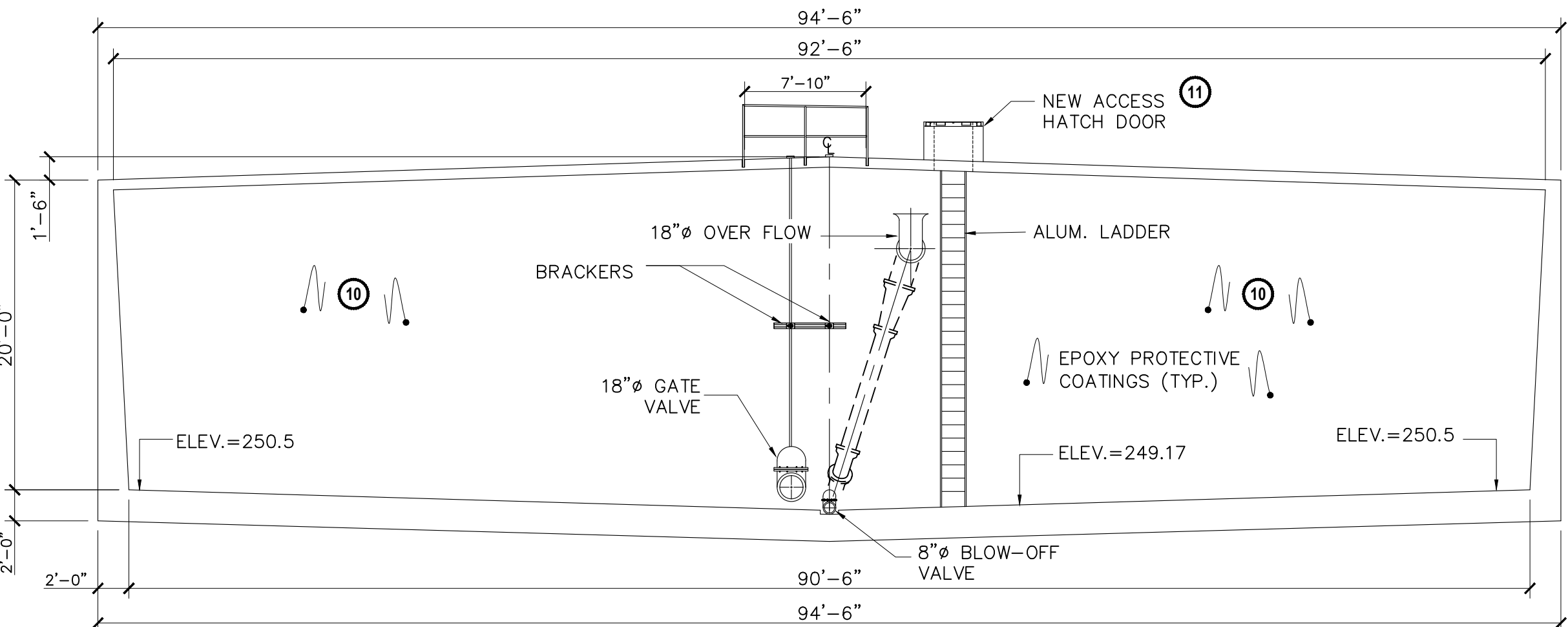
SECTION A-A
SCALE: 1/8"=1'-0"



SECTION B-B
SCALE: 1/8"=1'-0"



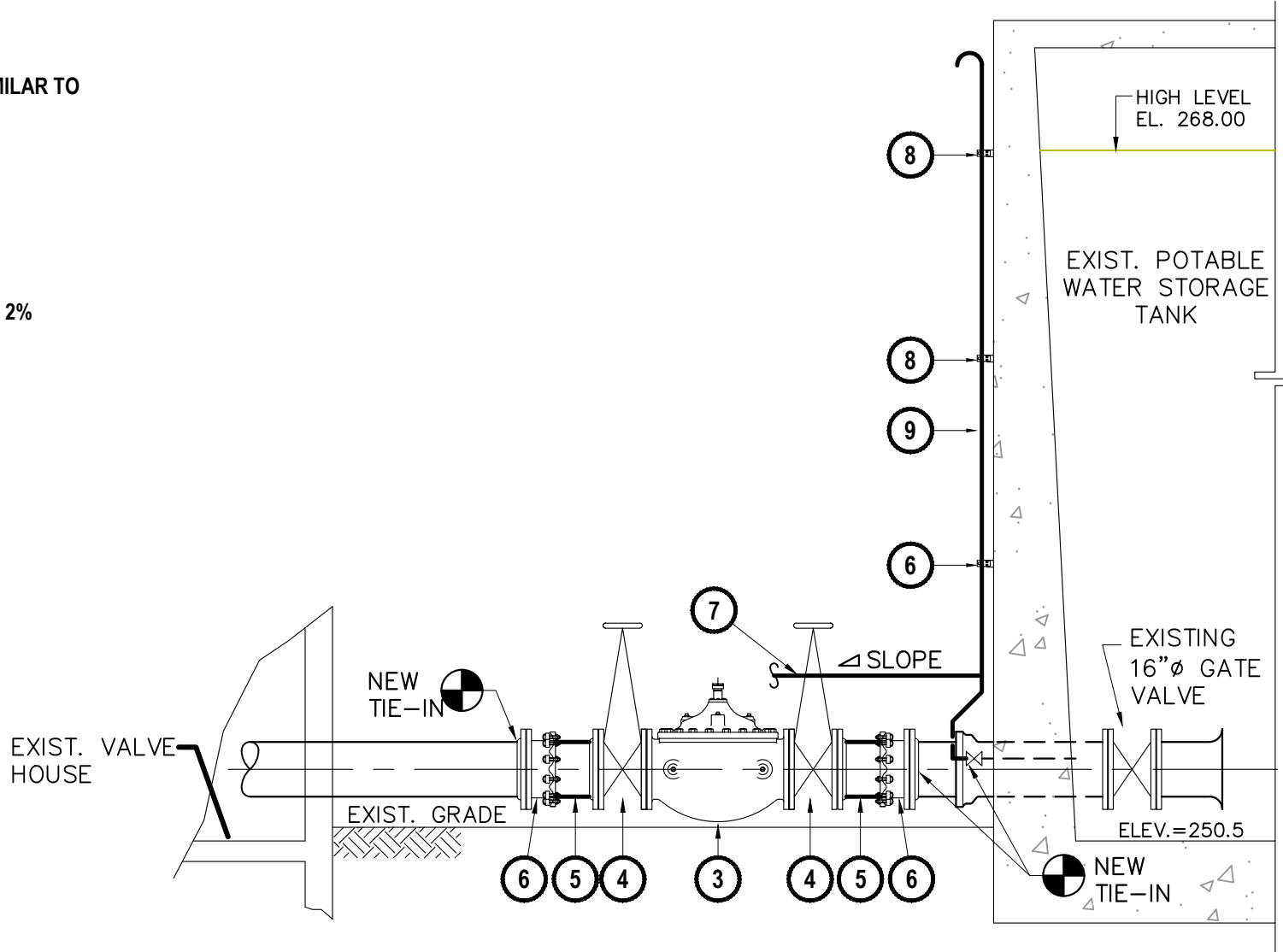
SECTION C-C
SCALE: 1/8"=1'-0"



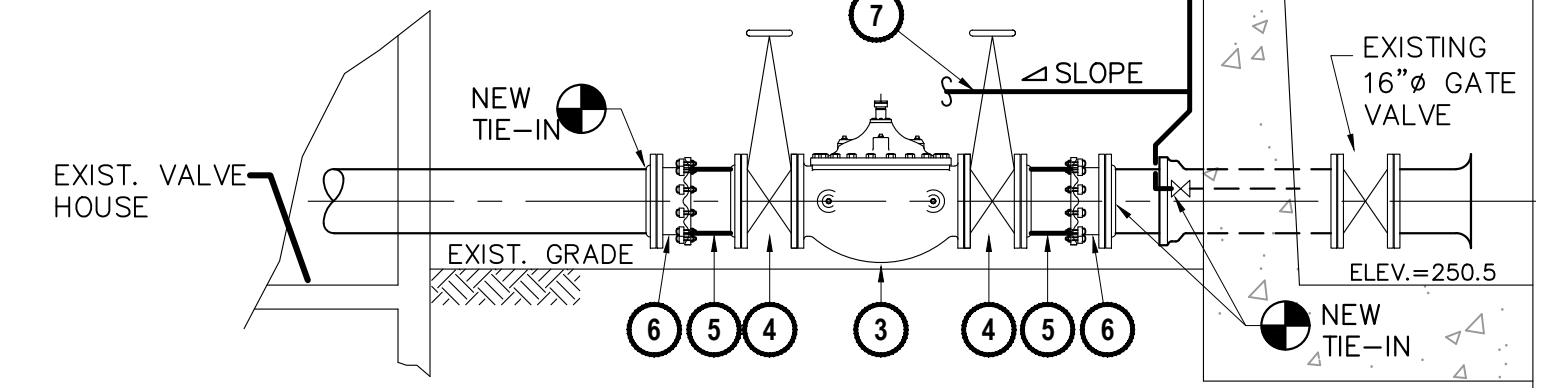
SECTION D-D
SCALE: 1/8"=1'-0"

SCOPE OF WORKS:

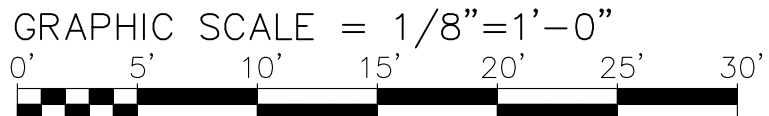
- NEW EXTERIOR PAINTED SURFACE
- NEW ACCESS HATCH MANHOLE
- ALTITUDE VALVE FOR TWO WAY FLOW, SIMILAR TO CLA-VAL MODEL 210-16
- NEW 16" GATE VALVE, FE.
- NEW 16", CLASS 53 DUCTILE IRON PIPE
- NEW 16" DRESSER STYLE 128-W FLANGE ADAPTER
- 3/4" SENSING LINE SLOPE TOWARD TANK @ 2%
- PROVIDE UNISTRUT CHANNEL P5500 WITH PIPE CLAMP
- NEW 2" PVC SCH.80 PIPE WITH 180" BEND AND STAINLESS STEEL MESH AT END
- NEW INTERIOR EPOXY COATING (SEE NOTES ON SHEET WST-A101)
- NEW ACCESS HATCH DOOR (SEE DETAILS ON SHEET WST-A401)



SECTION E-E
SCALE: 1/4"=1'-0"



SECTION F-F
SCALE: 1/4"=1'-0"



YO, LUIS GALARZA BERRIOS, NUMERO DE LICENCIA 19972 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADemas, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGPB.

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

Revisions	Number	Date	Description	SHEET INFO.
				Project No.: 19-1837.0
				Set Date: 20210728
				Drawn by:
				Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

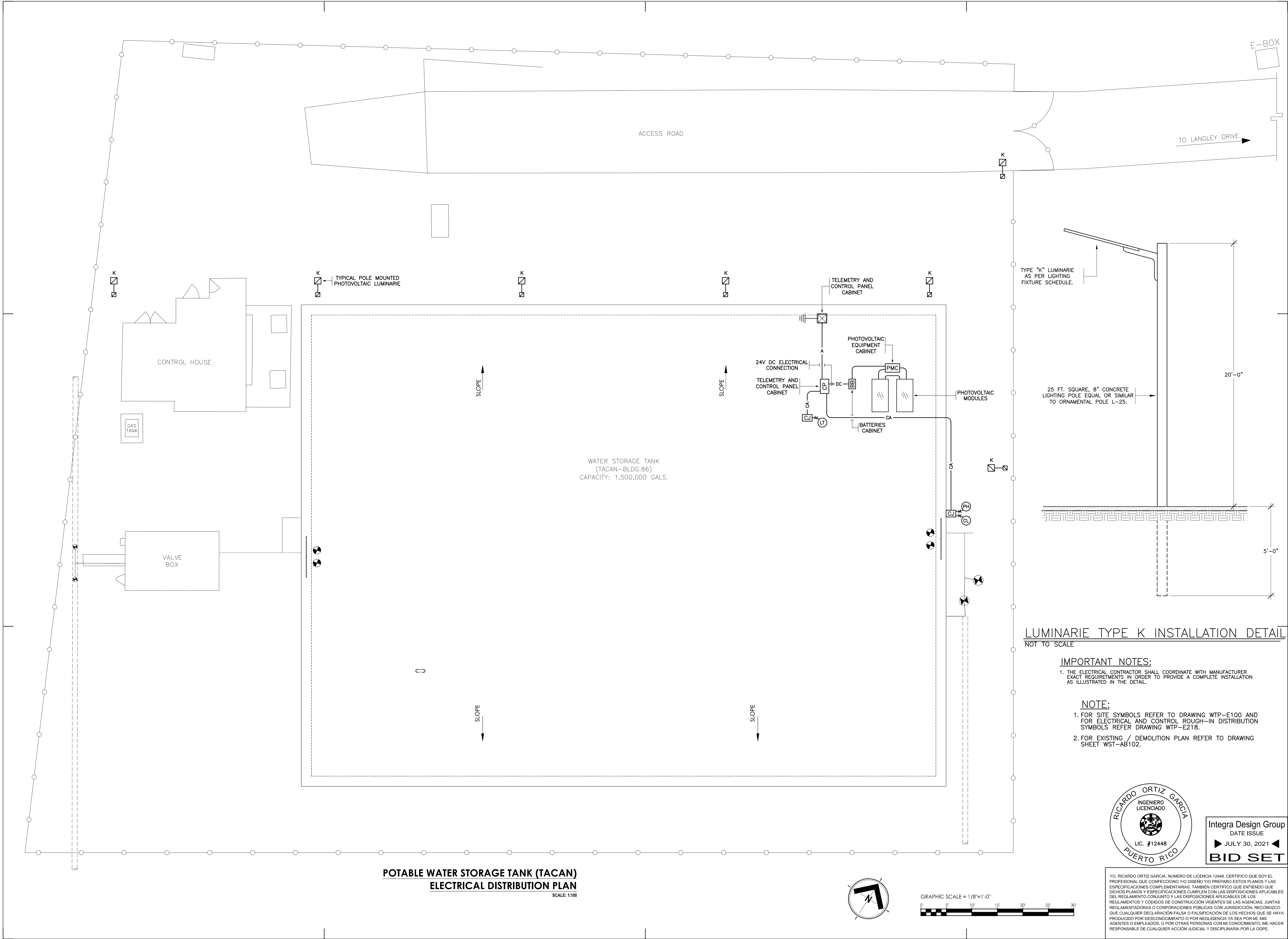
GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



POTABLE WATER STORAGE TANK (TACAN)

Drawing Title:

PROPOSED SECTIONS



POTABLE WATER STORAGE TANK (TACAN)
ELECTRICAL DISTRIBUTION PLAN
SCALE: 1:100



Integra Design Group
DATE ISSUE
JULY 30, 2021
BID SET

YO, RICARDO ORTIZ GARCIA, NUMERO DE LICENCIA 12448, CERTIFICO QUE SOY EL PROFESIONAL QUE CONFECCIONO Y/O DISEÑO Y/O PREPARO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS Y CODIGOS DE CONSTRUCCION VIGENTES DE LAS AGENCIAS, JUNTAS REGULATORIAS O CORPORACIONES PUBLICAS CON JURISDICCION. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS, O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

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architects & engineers, P.S.C.
(787) 767.2111 www.integralps.com

Revisions

Number	Date	Description
1	2020/07/07	Project No.: 19-1637.0
2	2020/07/07	Set Date: 2020/07/07
3		Drawn by: Ricardo Ortiz Garcia
4		Dwg. Date: Lic. no. 12448 P.E.

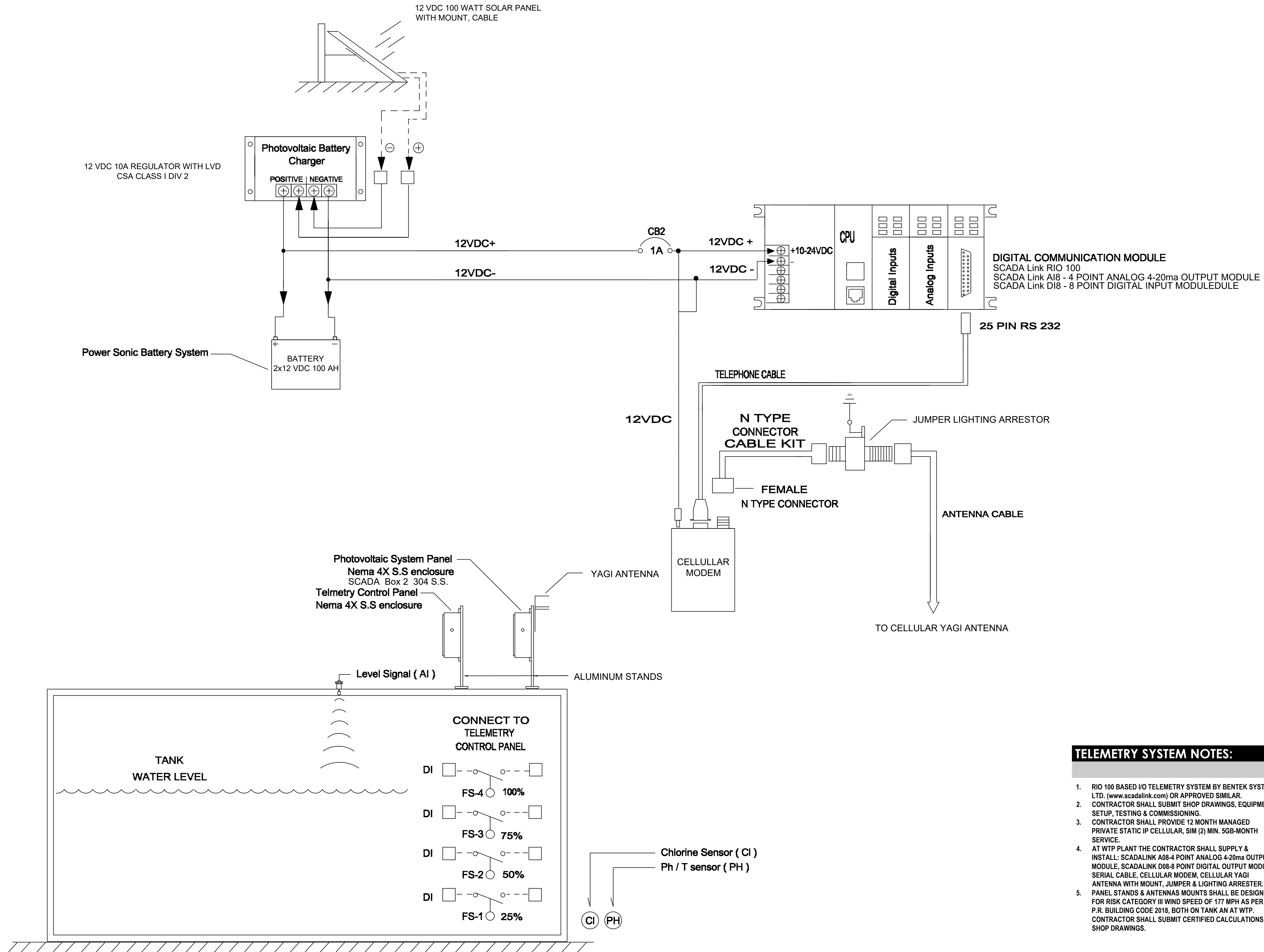
Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS DEVELOPMENT

Owner: GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

Drawing Title: POTABLE WATER STORAGE TANK (TACAN)

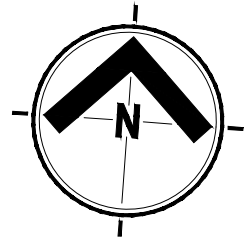
Proposed Electrical Distribution

Sheet: WST-E100



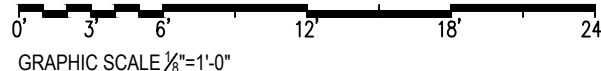
TELEMETRY SYSTEM NOTES:

1. RIO 100 BASED I/O TELEMETRY SYSTEM BY BENTEK SYSTEM LTD. (www.scdalainc.com) OR APPROVED SIMILAR.
2. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS, EQUIPMENT SETUP, TESTING & COMMISSIONING.
3. CONTRACTOR SHALL PROVIDE 12 MONTH MAINTENANCE PRIVATE STATIC IP CELLULAR, SIM (2) 1 MIN. 9GB-MONTH SERVICE PLAN.
4. AT WTP PLANT THE CONTRACTOR SHALL SUPPLY & INSTALL SCDALIN 4088 8-POINT ANALOG 4-20ma OUTPUT MODULE, SCDALIN 4088 8-POINT DIGITAL OUTPUT MODULE, SERIAL CABLE, CELLULAR DODGER, CELLULAR YAGI ANTENNA WITH MOUNT, JUMPER & LIGHTING ARRESTER.
5. PANEL STANDS & ANTENNAS MOUNTS SHALL BE DESIGNED FOR P-RISK CATEGORY III WIND SPEED OF 177 MPH AS PER P.R. BUILDING CODE 2018, BOTH ON TANK AND AT WTP.
6. CONTRACTOR SHALL SUBMIT CALIBRATED CALCULATIONS & SHOP DRAWINGS.



PHOTOVOLTAIC, TELEMETRY AND INSTRUMENTATION SYSTEMS DESCRIPTION

SCALE: 1/8"=1'-0"




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DATE ISSUE

► JULY 30, 2021 ◀
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[illegible]

Revisions		SHEET INFO.
Number	Date	Description
Project No.: 19-1837.0		
Set Date: 2021/07/28		
Drawn by:		
Dwg. Date:		


GOVERNMENT OF PUERTO RICO
 Local Redevelopment Authority
 for Roosevelt Roads


WATER TREATMENT PLANT


Owner: _____
 Client: _____
 Designing Engineer: _____

P.O. Box 1986 • San Juan, P.R. 00904 • Tel. (787) 670-7000 • Fax. (787) 670-4800
 Ing. Ricardo Ortiz García
 Lic. no. 12449 P.E.

File: P:\19-Ceiba\1837.0 PR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BidPhase\01-Site\Water Distribution\218-243-WDS-C100-WDS-C125 WATER DISTRIBUTION PLAN; Plotted: 6/1/2023 10:34 a.m. by SVAZQUEZ; Saved: 5/31/2023 2:42 p.m. by SVAZQUEZ

LEGEND:

 SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

 DRAWING SHEET

GENERAL WATER SERVICE NOTES:

- ALL NEW WATER DISTRIBUTION PIPES SHALL BE PVC AWWA C900 PRESSURE CLASS DR-14 EXCEPT WHEN PIPE SHALL BE EXPOSED OR WHEN INDICATED OTHERWISE.
- ALL CONNECTION FITTINGS SHALL BE DUCTILE IRON; CLASS 250, MECHANICAL JOINT (UNDERGROUND), AND FLANGED ENDS (EXPOSED).
- ALL PIPES SHALL BE BURIED TO A DEPTH OF 0.75 MT., PLUS PIPE DIAMETER FROM FINAL GRADE ELEVATION.
- WATER SERVICE SHALL NOT BE INTERRUPTED AT ANY TIME DURING CONSTRUCTION. IF NECESSARY, A PROVISIONAL TEMPORARY BY-PASS SHALL BE INSTALLED BY CONTRACTOR TO MAINTAIN SERVICE.
- THE CONTRACTOR SHALL TAKE EXTREME CARE SO AS NOT TO DISRUPT THE WATER SERVICE DURING EARTH WORK OPERATIONS.
- THE CONTRACTOR SHALL NOT TAKE WATER FROM THE LRA'S WATER SYSTEM FOR SPRINKLING OR CONTROLLING DUST DURING CONSTRUCTION.
- INTERCONNECTION TO EXISTING WATER LINES IN SERVICE SHALL BE PERFORMED BY CONTRACTOR PERSONNEL ONLY AFTER WRITTEN AUTHORIZATION IS GRANTED.
- THE LOCATION OF EXISTING WATER LINES IN THESE PLANS ARE APPROXIMATE IN ACCORDANCE TO OWNER INFORMATION. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THE EXACT LOCATION WITH SUBSURFACE UTILITIES DETECTION METHODS SUCH AS GROUND PENETRATING RADAR OR VACUUM EXCAVATION BEFORE THE BEGINNING OF CONSTRUCTION WORKS.
- THRUST BLOCKS SHALL BE PROVIDED TO ALL FITTING, ELBOWS, TEES , WYES, ETC.
- PRESURE TEST OF 150 PSI. MINIMUM IS REQUIRED TO ALL PIPES INSTALLED AND IT SHALL BE PERFORMED AND CERTIFIED BY CONTRACTOR.
- A DETECTABLE TAPE (SIMILAR OR EQUAL TO TERRA TAPE) 12" BELOW GROUND MUST BE INSTALLED BY THE CONTRACTOR WITH ALL PVC PIPES.
- ALL VALVES COVERS SHALL BE RE-SET TO FINAL GRADE ELEVATIONS.
- ALL METER BOX SHALL BE CONSTRUCTED ON THE SIDEWALK OR PLANTING STRIP WHEN SIDEWALK IS NARROW. THE BOX SHALL BE CONSTRUCTED WITH ITS LONGITUDINAL AXIS PERPENDICULAR TO THE SIDEWALK AXIS. IN THE EVENT THAT NOT SIDEWALK OR PLANTING STRIP EXIST, THE METER SHALL BE CONSTRUCTED NEAR THE ROW FENCE
- THE EXISTING WATER METERS SHALL BE MAINTAINED IN SERVICE AT ANY TIME. PROVISIONAL RELOCATION SHALL BE MADE IF IT'S AFFECTED AND NO DIRECT PAYMENT SHALL BE DONE FOR THIS ITEM,BUT SHALL BE CONSIDERED AS A SUBSIDIARY OBLIGATION OF THE CONTRACTOR COVERED UNDER THE PAY ITEM FOR SERVICE CONNECTION.
- THE CONTRACTOR SHALL OBTAIN OWNER'S APPROVAL OF THE PROPOSED MATERIALS PRIOR TO THE PURCHASE.
- CONTRACTOR SHALL DISPOSE OF ALL REMOVED ITEMS.
- CONTRACTOR SHALL REPAIR AFFECTED CONCRETE OR ASPHALT PAVEMENTS BY THE REMOVAL OR INSTALLATION OF VALVES, HYDRANTS PIPES AND FITTINGS.

IMPROVEMENTS SUMMARY TABLE (REPLACEMENT)																		
ITEM	QUANTITIES																	
	1"ø	2"ø	3"ø	4"ø	5"ø	6"ø	7"ø	8"ø	9"ø	10"ø	11"ø	12"ø	13"ø	14"ø	15"ø	16"ø	17"ø	18"ø
GATE VALVE (EACH)	2	4	3			9		40		15		25		12		1		5
FIRE HYDRANT & GATE VALVE (EACH)	37																	
PIPE PVC DR-14 (LN.MTS.)								340.80										

NOTE:
CONTRACTOR SHALL INSTALL PIPES, VALVES AND HYDRANTS ON LOCATIONS AND DIMENSIONS AS INDICATED ON PLAN DRAWINGS.
THIS TABLE IS A SUMMARY FOR INFORMATION ONLY. REFER TO TECHNICAL SPECIFICATION 40 05 65 "VALVES AND OPERATOR".

WATER DISTRIBUTION KEY PLAN

SCALE=1:9,000

0 50 100 200 500
GRAPHIC SCALE = 1:9,000

Integra Design Group
DATE ISSUE
JULY 30, 2021
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YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 9 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1998, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA; RECONOZZO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OSEA.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner: CEBEA & NAGUARO, PUERTO RICO

WATER DISTRIBUTION SYSTEM

Drawing Title:

WATER DISTRIBUTION KEY PLAN

Revisions

Number	Date	Description

SHEET INFO.

Project No.: 19-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority
for Roosevelt Roads

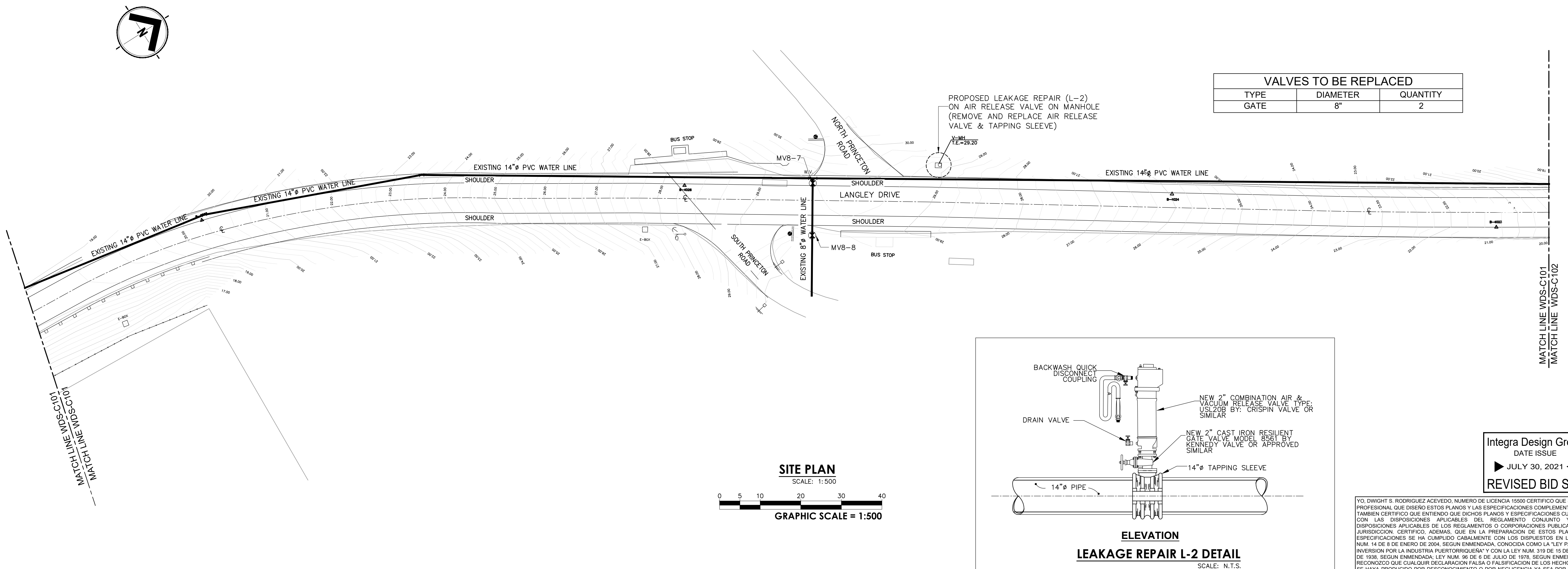
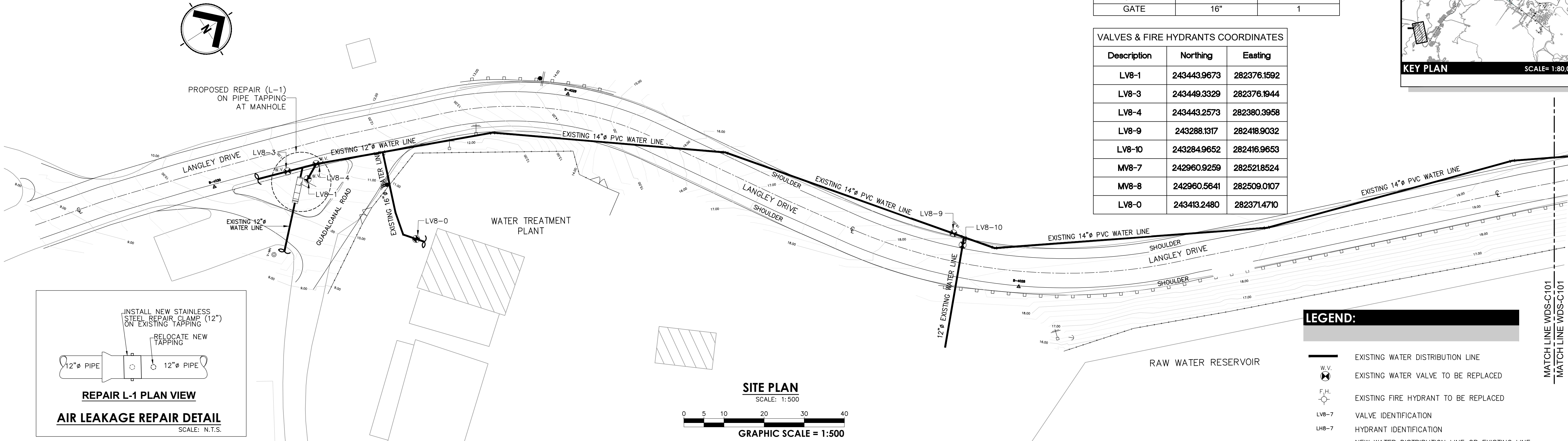


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File: P:\pr\19-Ceiba\1837.0 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BidPhase\01-Site Water Distribution\218-243-WDS-C100-WDS-C125 WATER DISTRIBUTION PLAN; Plotted: 5/31/2023 2:37 p.m. by SVAZQUEZ; Saved: 11/15/2022 9:55 a.m. by SVAZQUEZ



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Revisions

Number	Date	Description
1	2021/07/28	Project No. 18-1837.0
2	2021/07/28	Set Date: 2021/07/28
3		Drawn by: Dwg. Date:

Project Info

Project No. 18-1837.0	Set Date: 2021/07/28
Drawn by:	Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

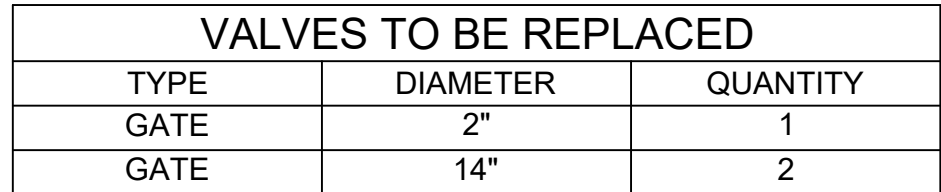
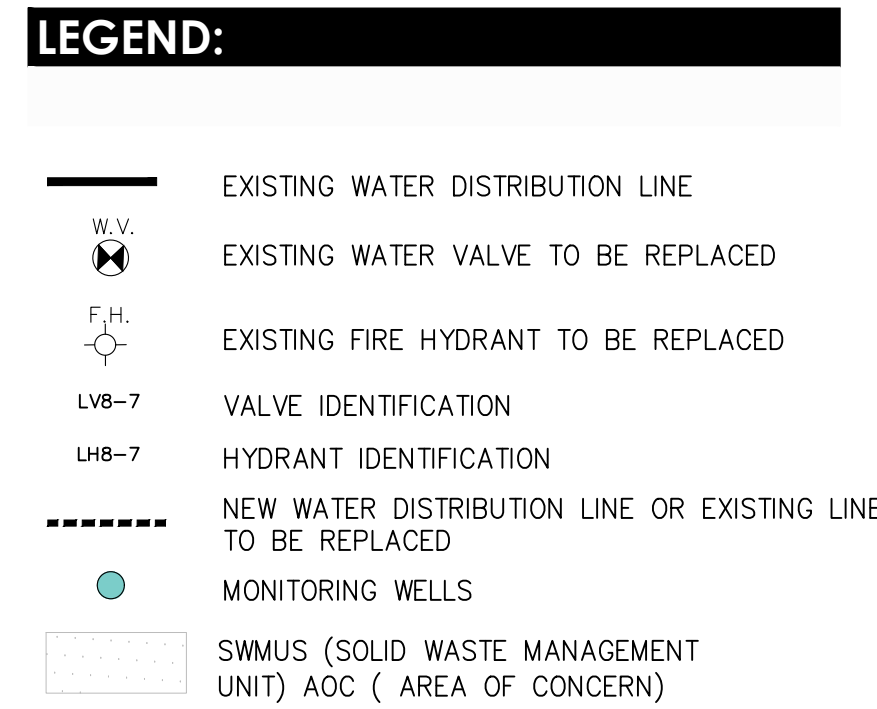
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Drawing Title:

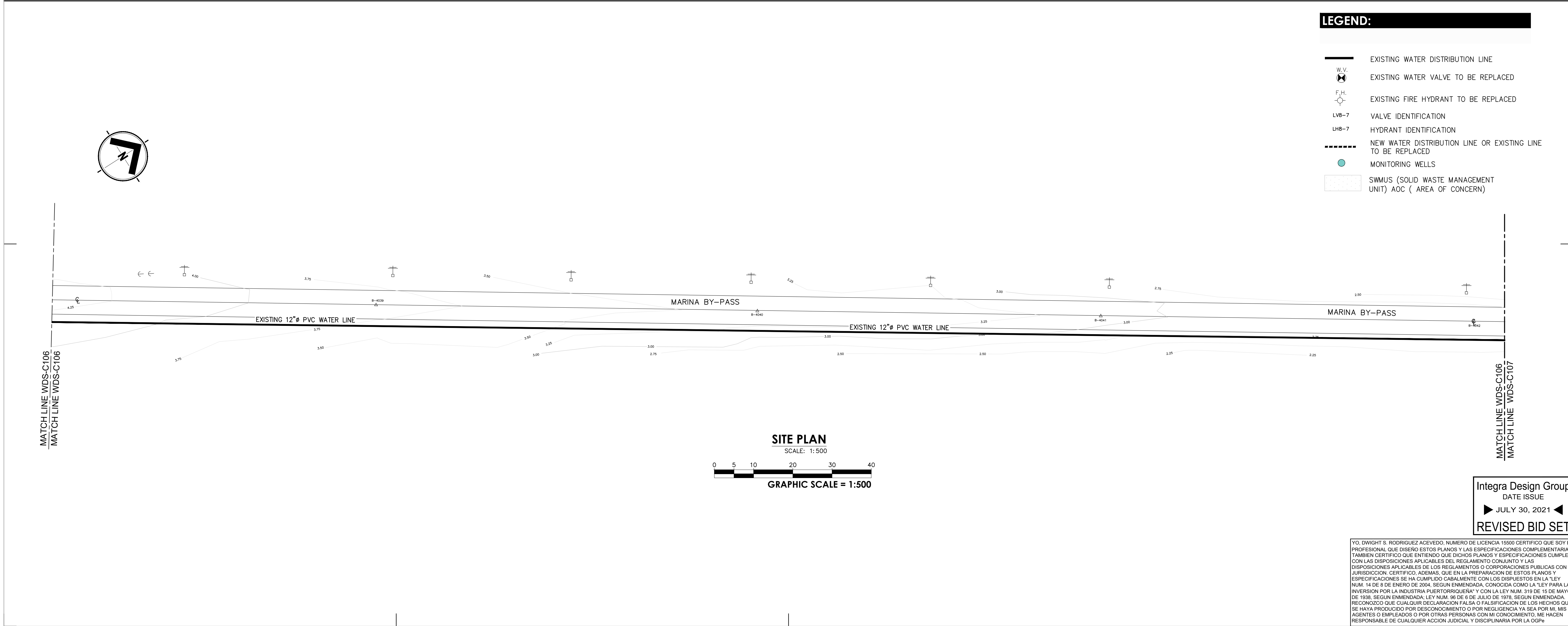
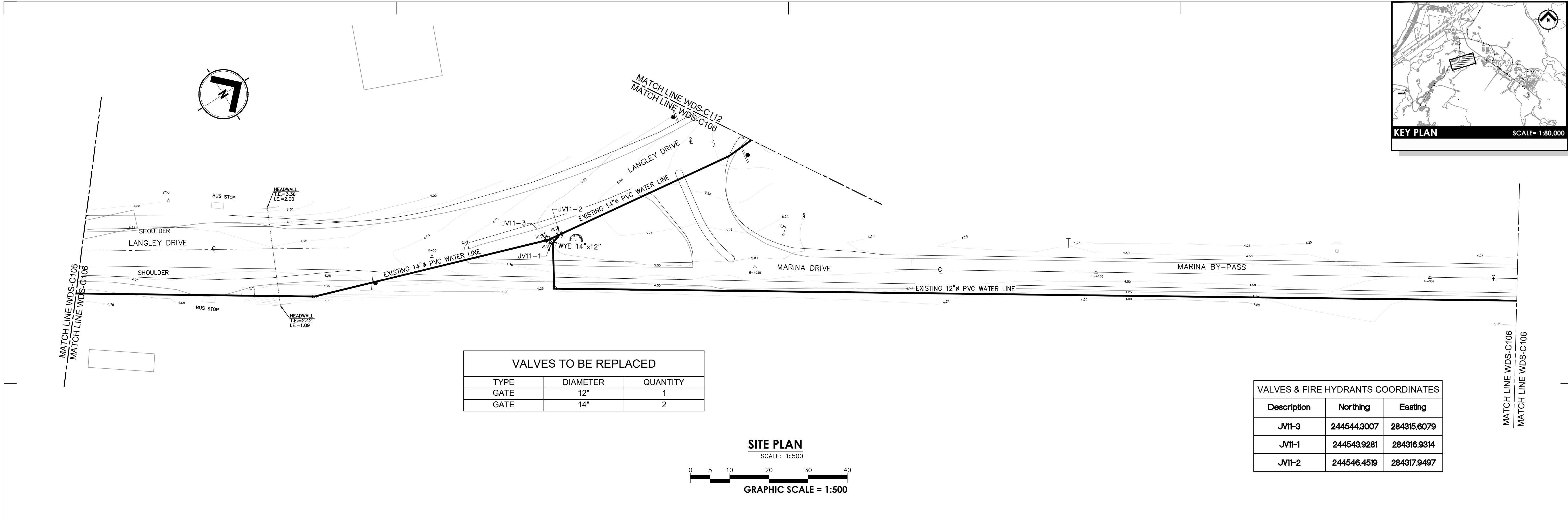
WATER DISTRIBUTION SITE PLAN

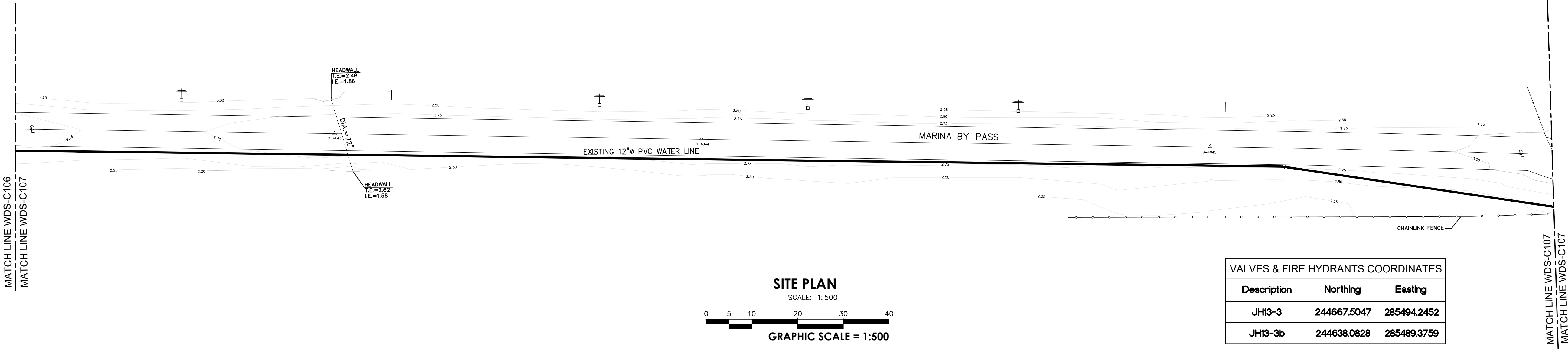
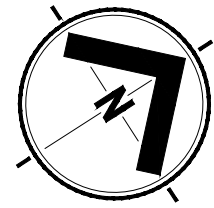
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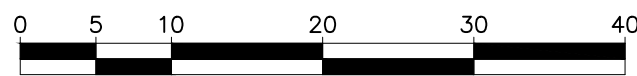
YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROPIETARIO QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS, TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES DE LA LEY DE INGENIERIA CIVIL Y LAS DISPOSICIONES APPLICABLEs DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION CERTIFICADA. ADAMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES NO HE USADO NINGUN TIPO DE INSTRUMENTO DE LA LEY NUM. 14 DE 18 DE ENERO DE 2004, SEGUN EMENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUENA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 2004, CONOCIDA COMO LA "LEY DE INCENTIVOS FISCALES PARA LA INDUSTRIA". RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE HE PAGO PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI MISMA O POR ALGUIEN QUE HE EMPLEADO, ME HARIA RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.





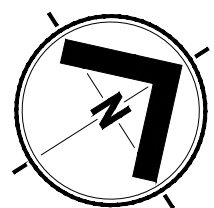
SITE PLAN

SCALE: 1:500

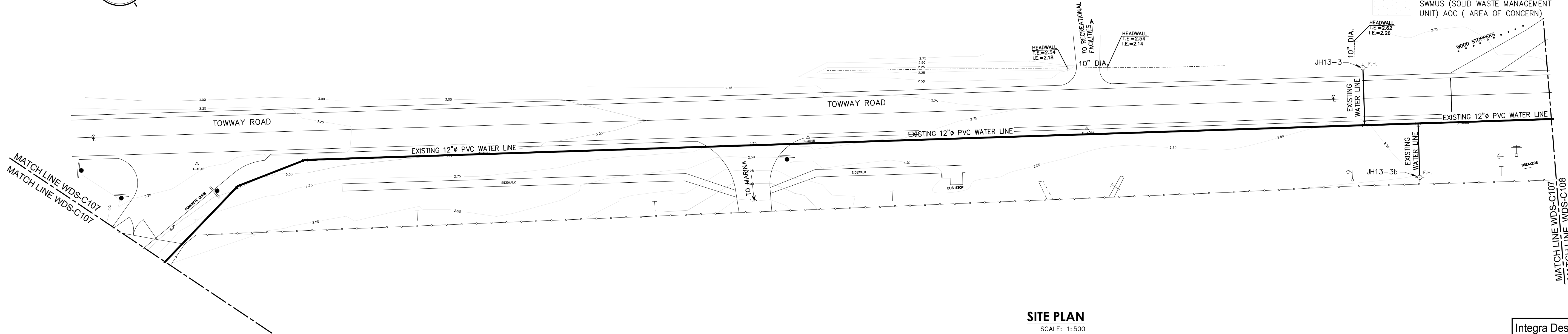


GRAPHIC SCALE = 1:500

VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
JH13-3	244667.5047	285494.2452
JH13-3b	244638.0828	285489.3759



HYDRANT TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
FIRE HYDRANT WITH VALVE		2



SITE PLAN

SCALE: 1:500



GRAPHIC SCALE = 1:500

LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER DISTRIBUTION SYSTEM

Drawing Title:
WATER DISTRIBUTION SITE PLAN

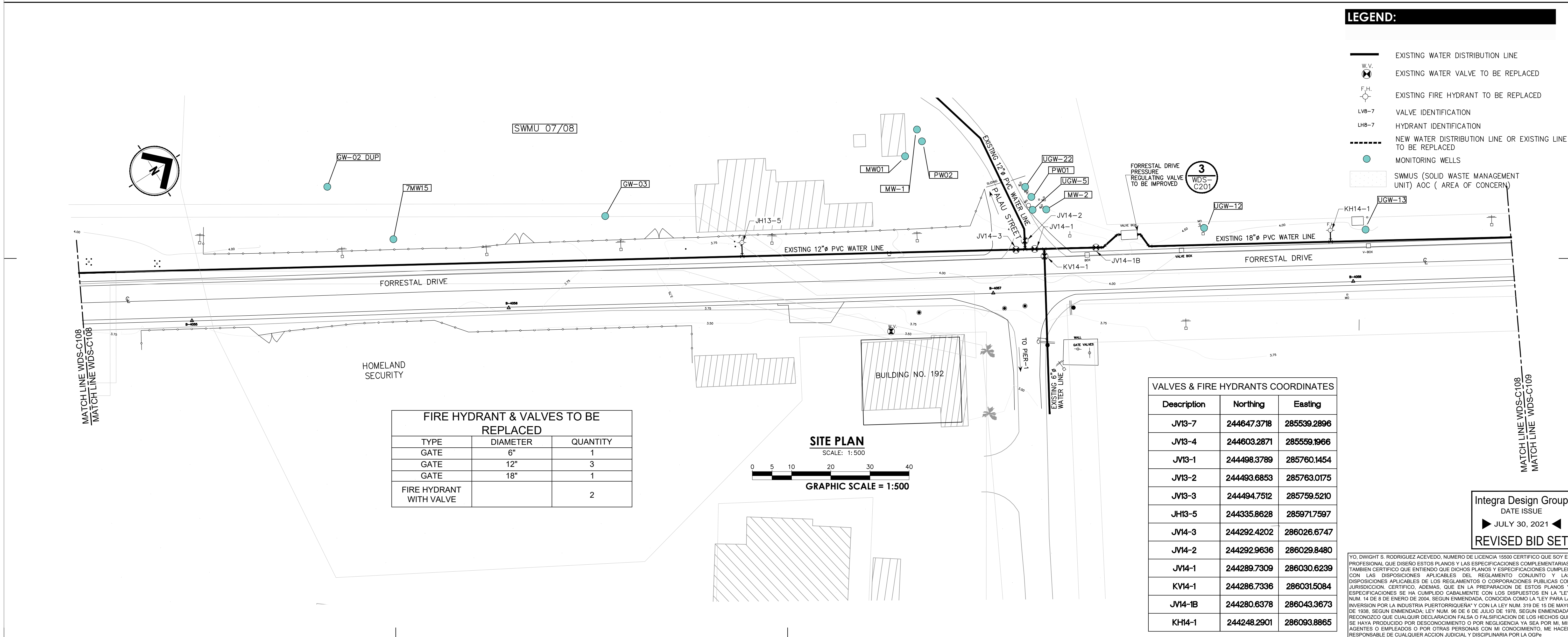
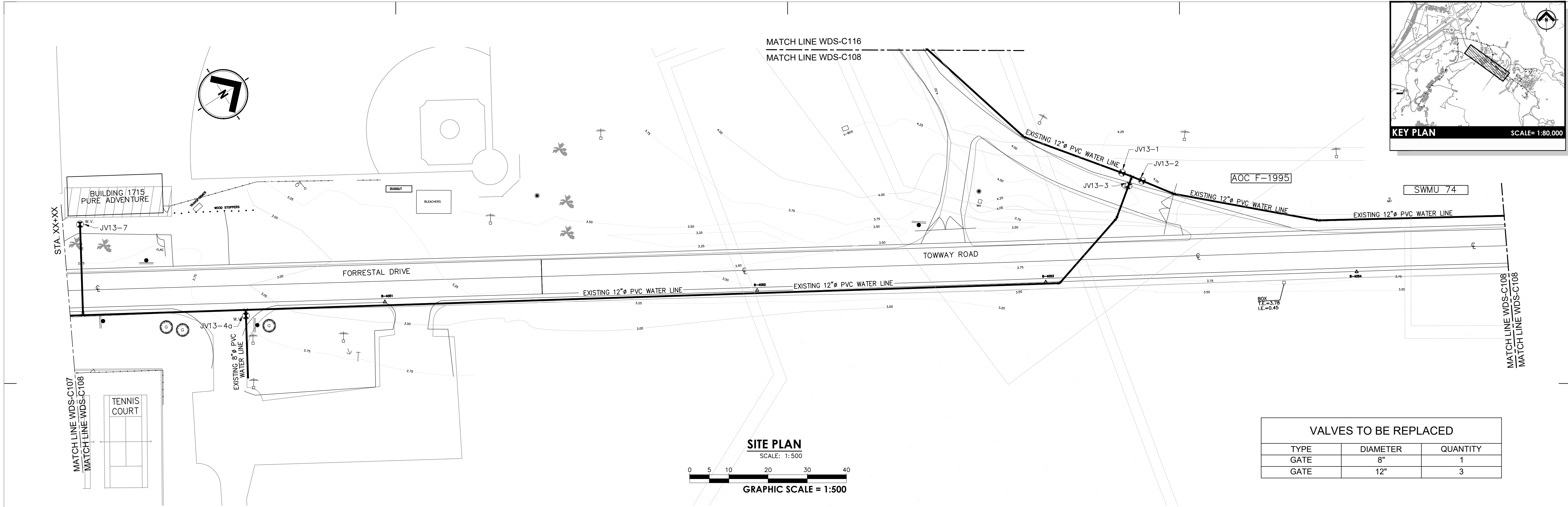
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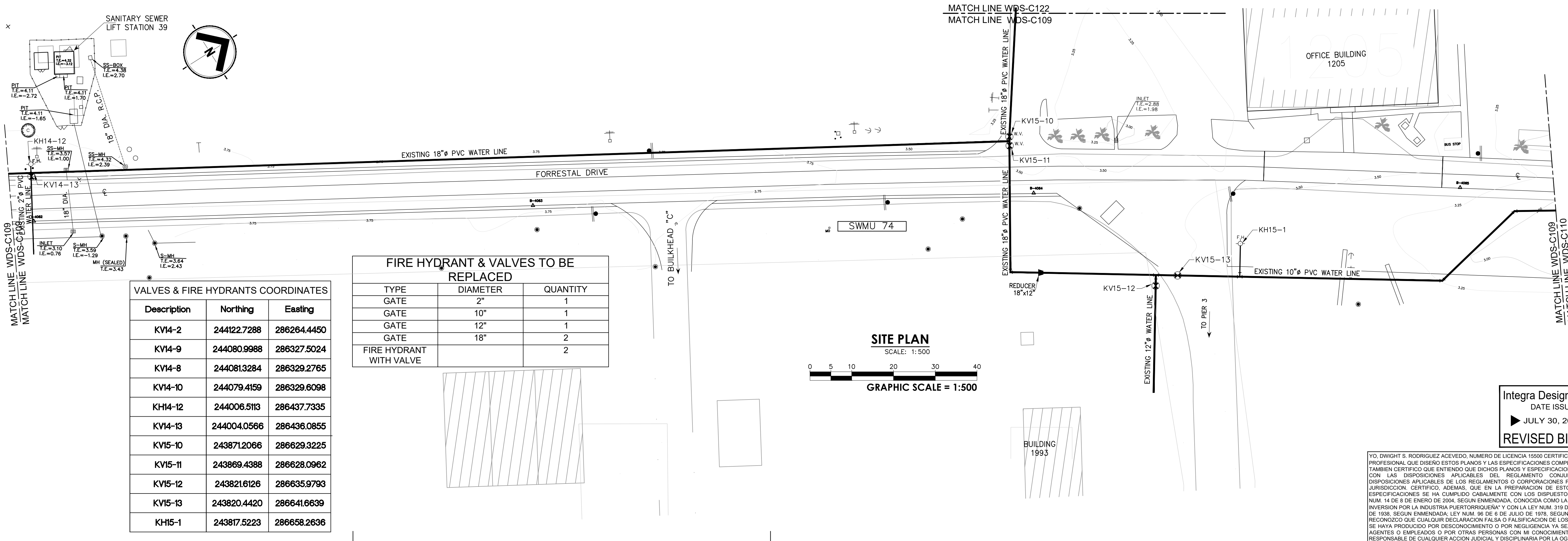
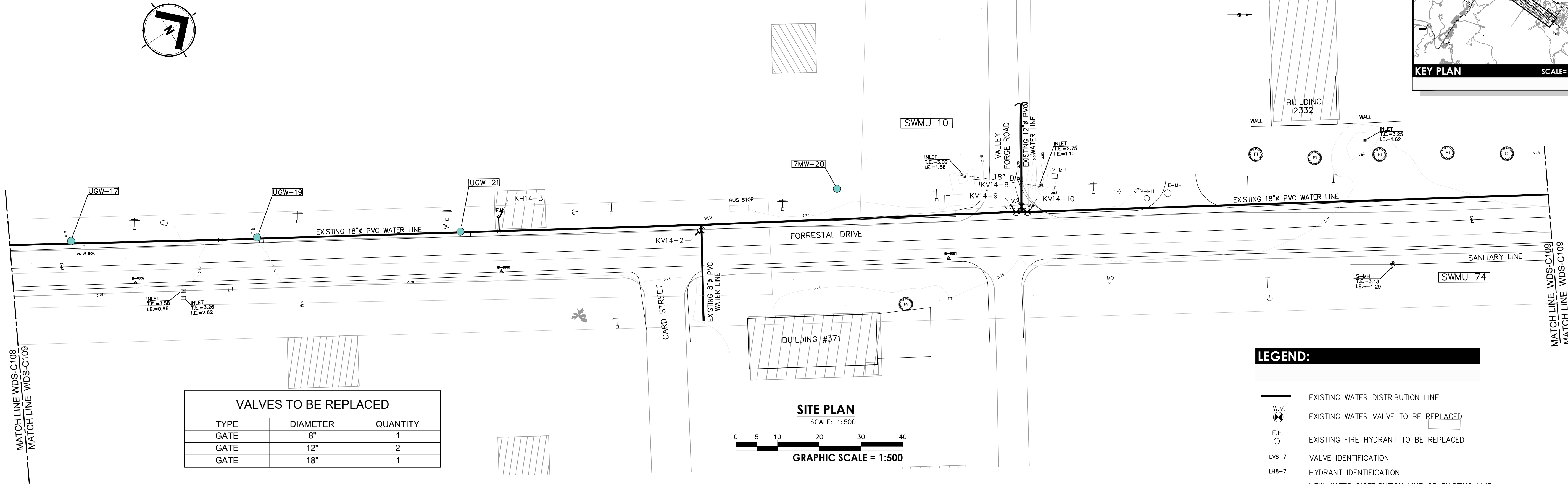
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WDS-C107

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Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

Project No.:

18-1837.0

Set Date:

20210728

Drawn by:

Dwg. Date:

Revisions

Number	Date	Description
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Integra Design Group

DATE ISSUE

▶ JULY 30, 2021 ◀

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GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

Owner:

CEREA & NAGUARO, PUERTO RICO

Water Distribution System

Drawing Title:

WATER DISTRIBUTION SITE PLAN

Sheet:

WDS-C109

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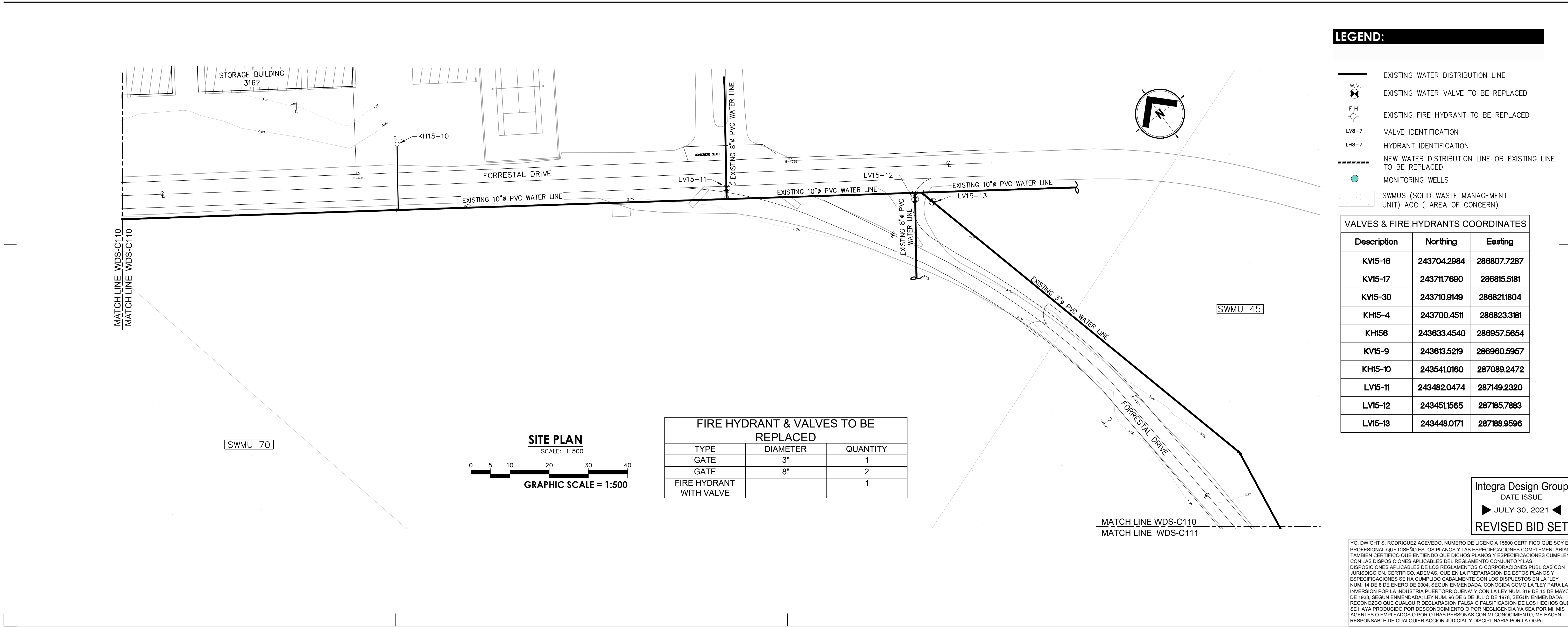
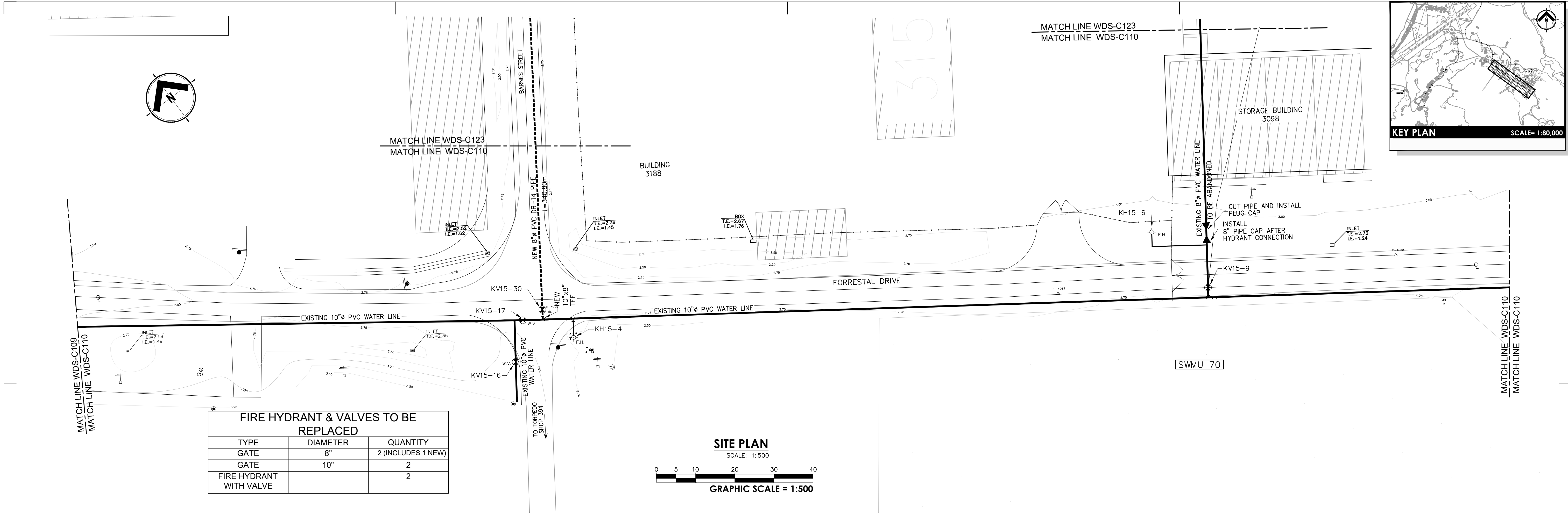
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KEY PLAN

SCALE= 1:80,000



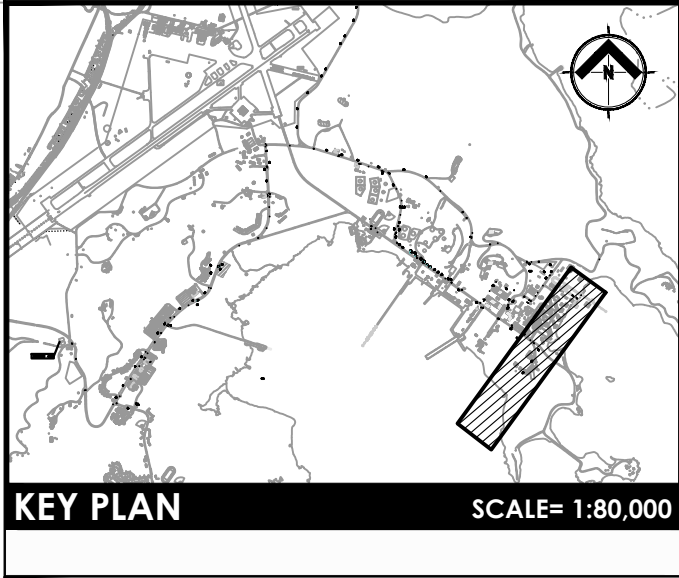
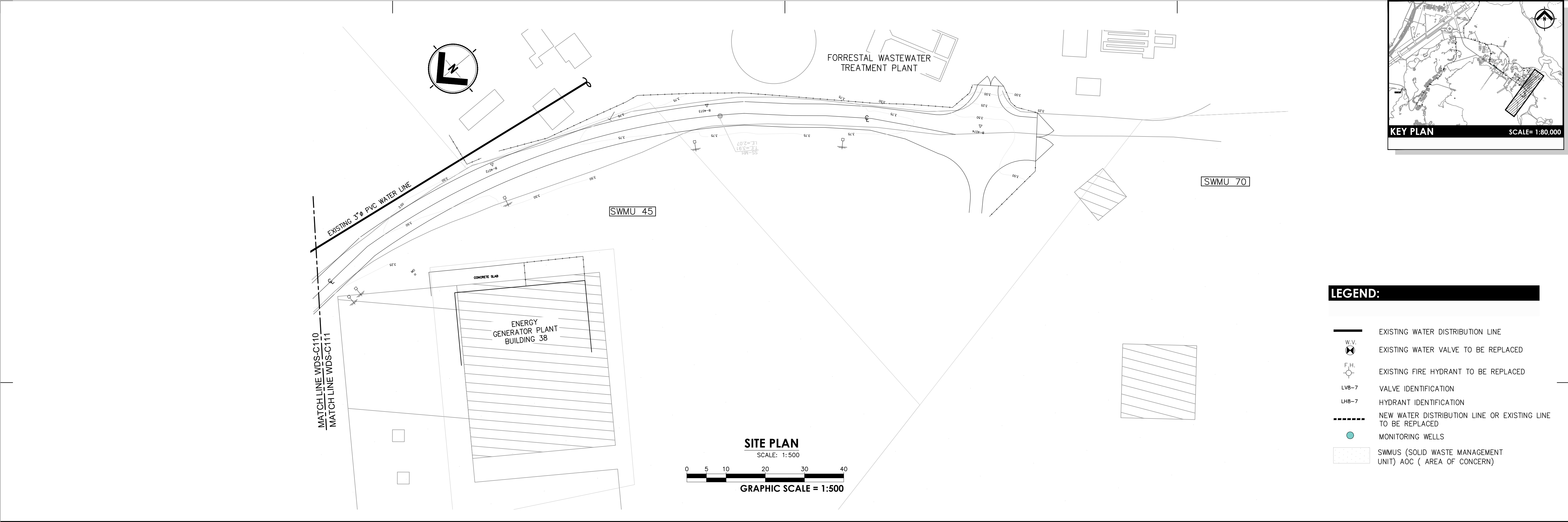
LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
KV15-16	243704.2984	286807.7287
KV15-17	243711.7690	286815.5181
KV15-30	243710.9149	286821.1804
KH15-4	243700.4511	286823.3181
KH156	243633.4540	286957.5654
KV15-9	243613.5219	286960.5957
KH15-10	243541.0160	287089.2472
LV15-11	243482.0474	287149.2320
LV15-12	243451.1565	287185.7883
LV15-13	243448.0171	287188.9596

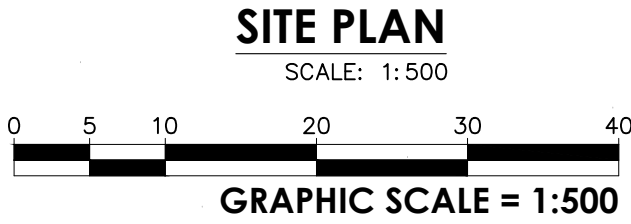
Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADemas, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA. LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.



LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)



Y.O. DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHOs PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA ODGP.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

CEIBA & NAGUABO, PUERTO RICO

Owner:

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

Project Title:

Sheet:

Revisions

Number	Date	Description

SHEET INFO.

Project No.:	18-1837.0
Set Date:	20210728
Drawn by:	
Dwg. Date:	

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

WATER DISTRIBUTION SYSTEM

Drawing Title:

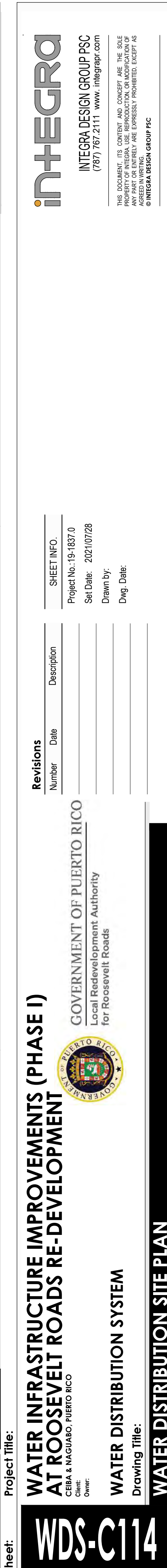
WATER DISTRIBUTION SITE PLAN

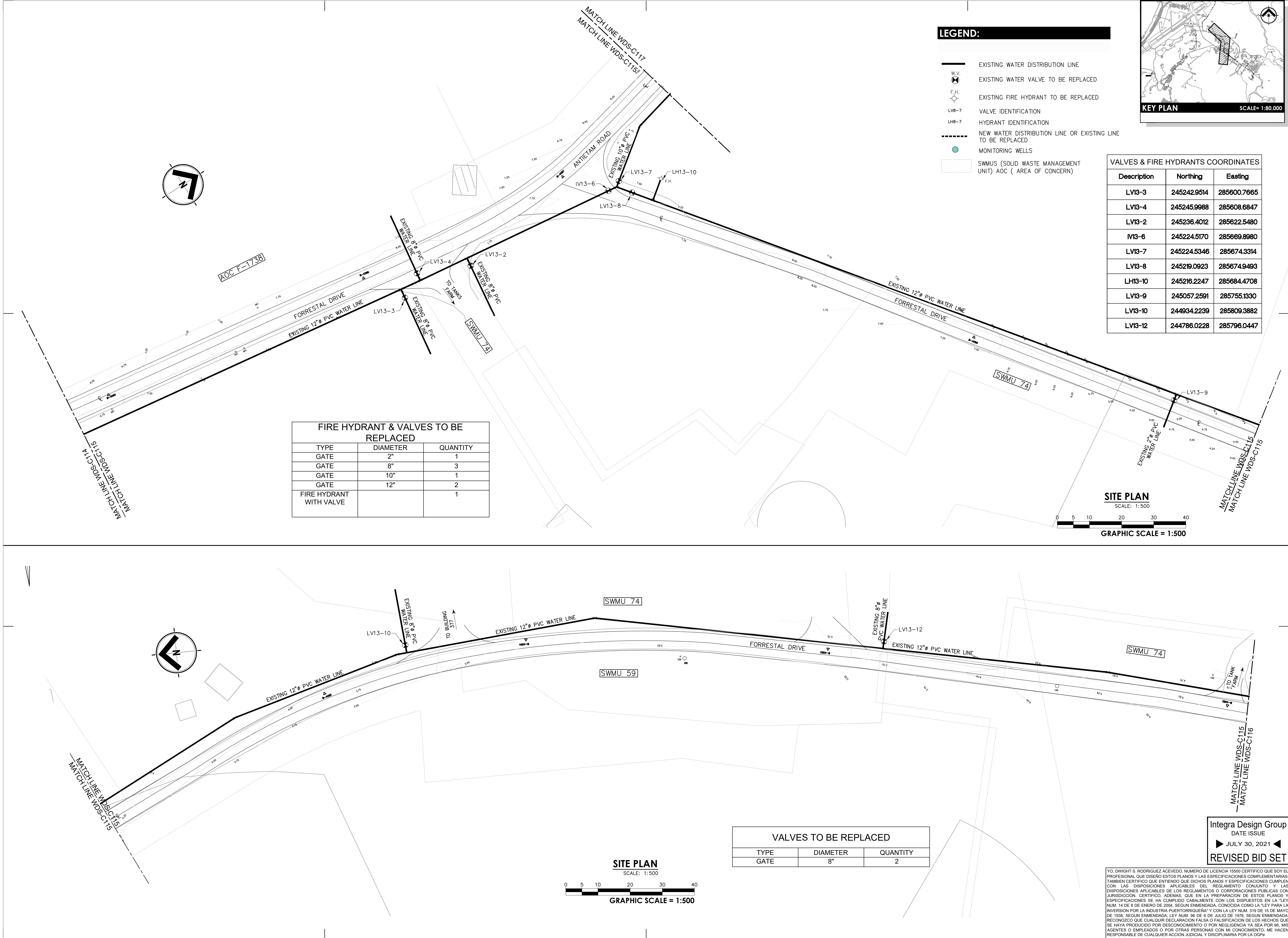
INTEGRA

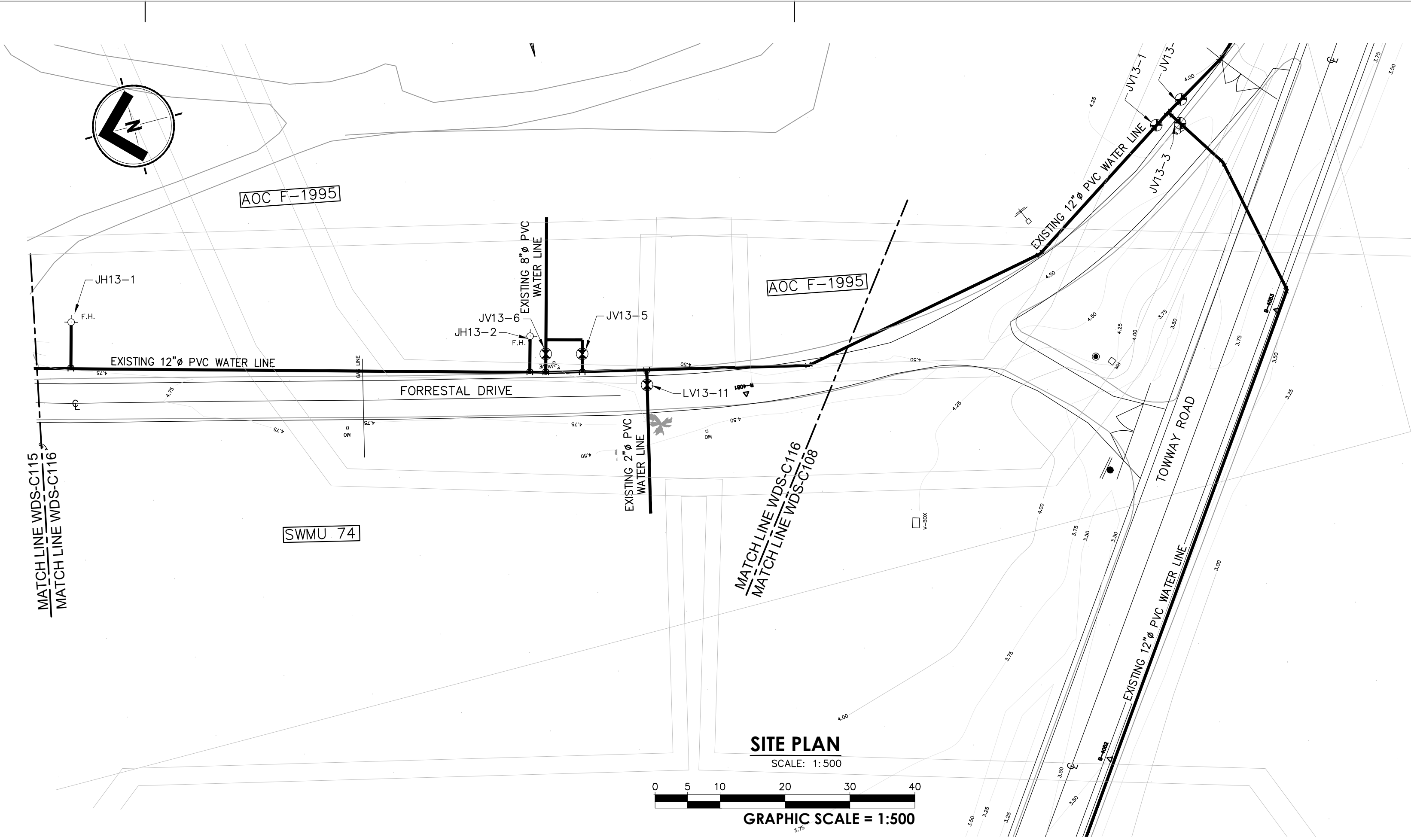
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VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
JH13-1	244667.7635	285773.5456
JH13-2	244599.9609	285753.3909
JV13-6	244598.3250	285750.1222
JV13-6	244592.8968	285748.6866
LV13-11	244584.4477	285741.5121

FIRE HYDRANT & VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	2"	1
GATE	8"	2
FIRE HYDRANT WITH VALVE		2

LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- W.V.

EXISTING WATER VALVE TO BE REPLACED
- F.H.

EXISTING FIRE HYDRANT TO BE REPLACED
- LV8-7

VALVE IDENTIFICATION
- UH8-7

HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

Integra Design Group
DATE ISSUE
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YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTENDO QUE DICHOS PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APPLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APPLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADENAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 9 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA, LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA, RECONOZZO QUE CUALQUIR DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER DISTRIBUTION SYSTEM

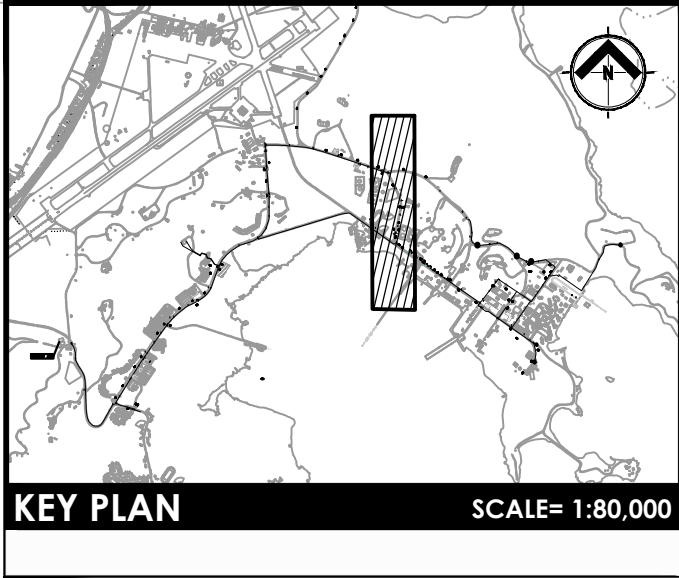
Drawing Title:

WATER DISTRIBUTION SITE PLAN

Revisions

Number	Date	Description

SHEET INFO:
Project No.: 18-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

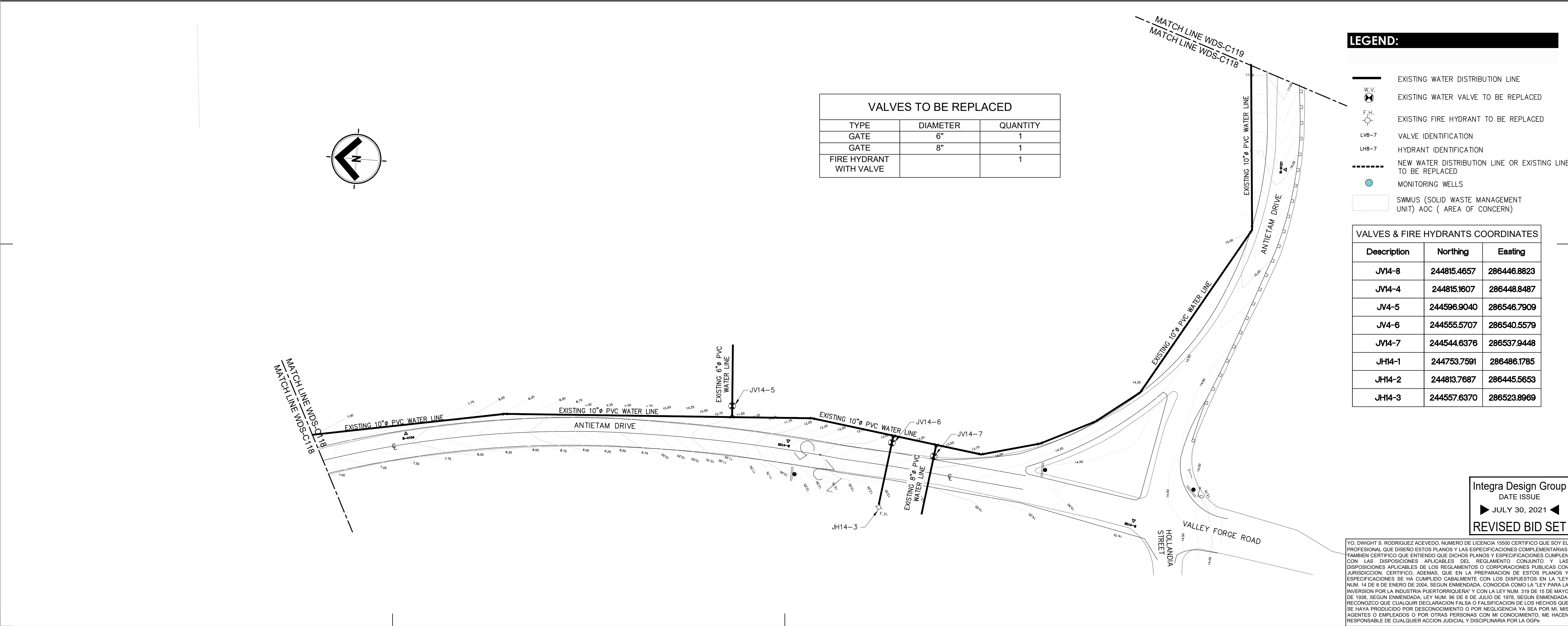
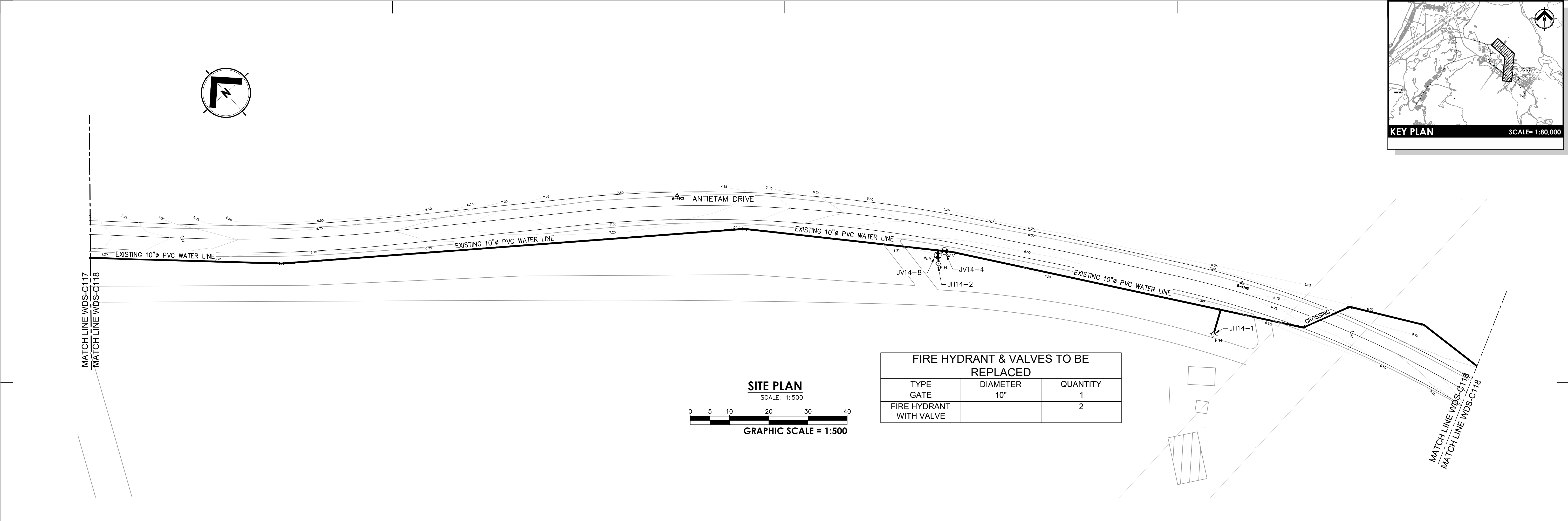


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Revisions

Number	Date	Description

SHEET INFO.

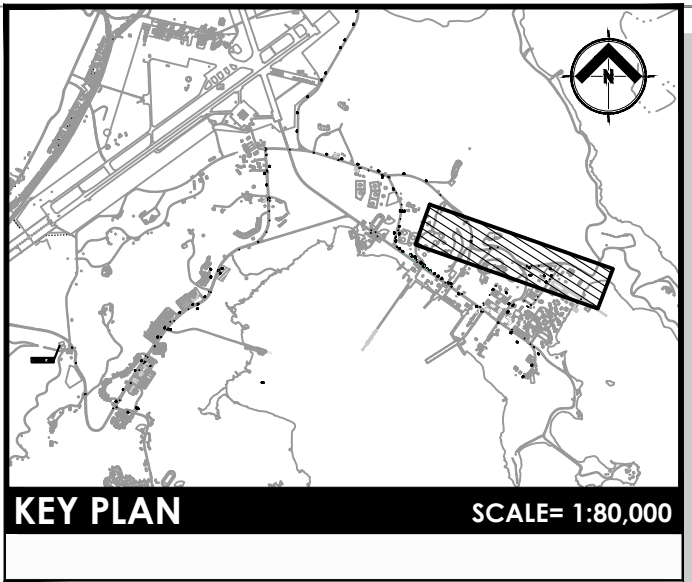
Project No.: 18-1837.0
Set Date: 20210728
Drawn by:
Dwg. Date:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads

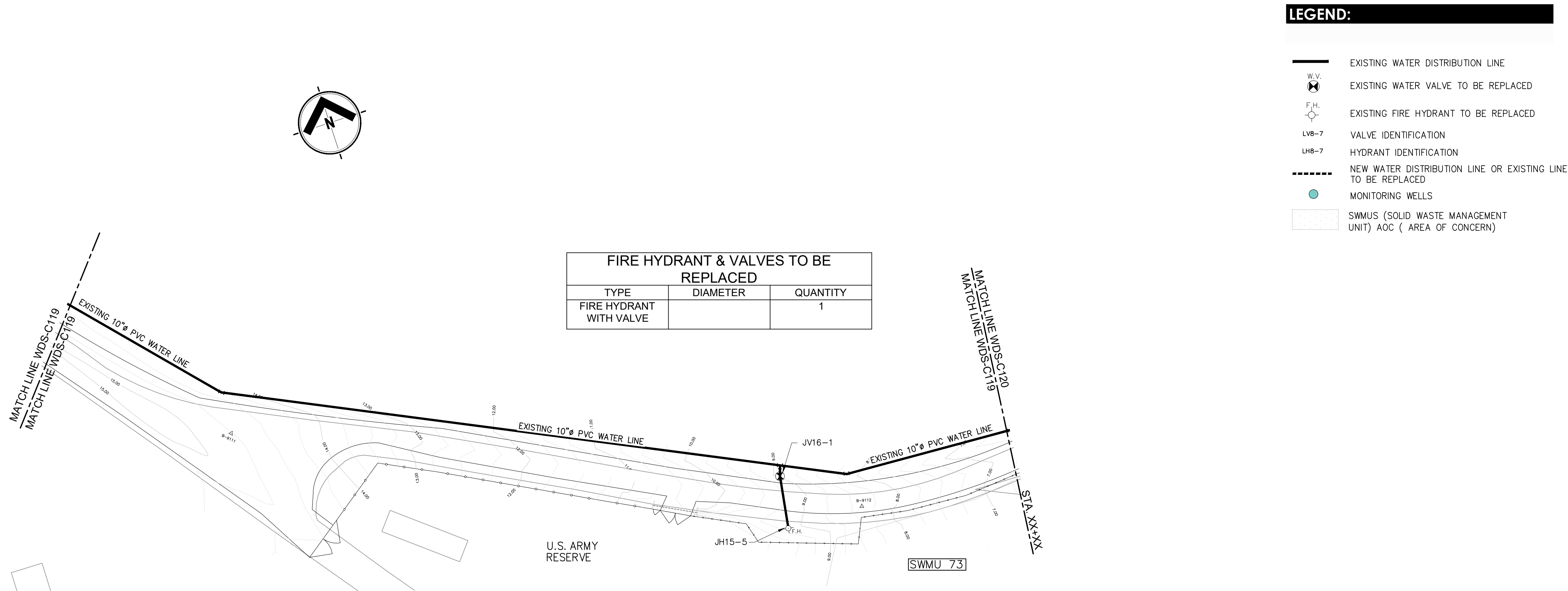
WATER DISTRIBUTION SYSTEM
Drawing Title: **WATER DISTRIBUTION SITE PLAN**

Project Title: **WDS-C118**



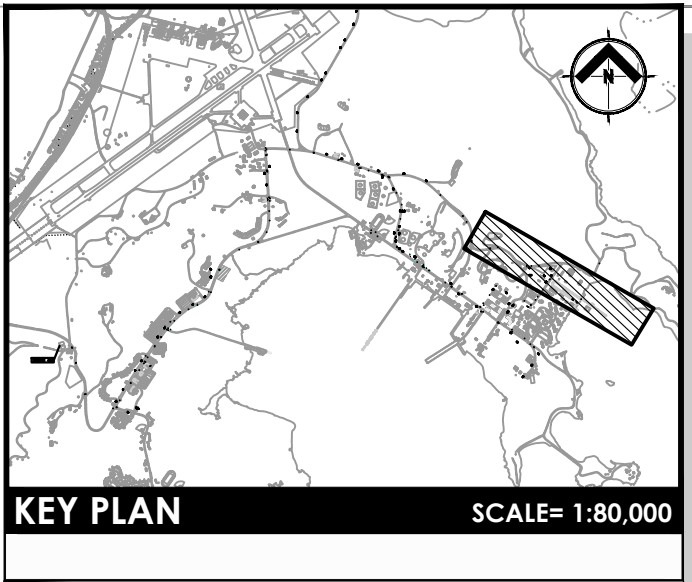
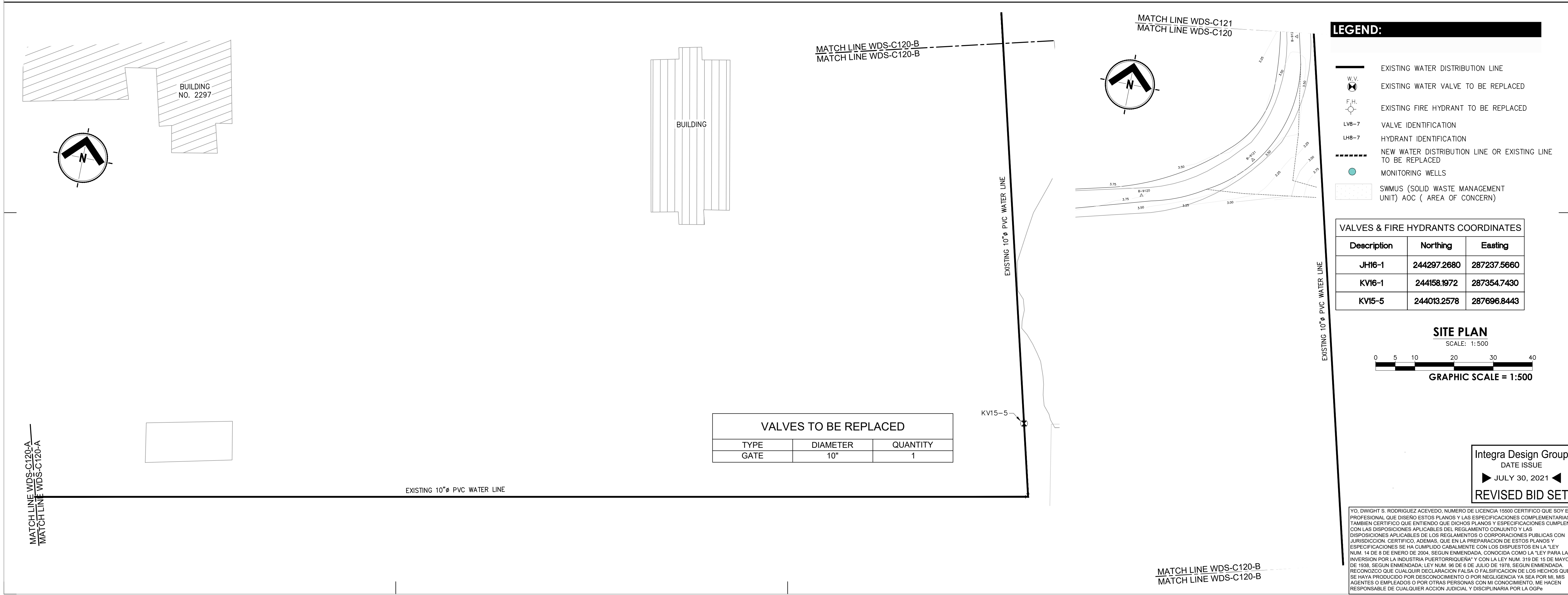
Description	Northing	Easting
JV15-5	244478.6581	286727.5831
JV15-6	244477.2862	286729.8712
JV15-7	244479.0728	286732.4386
JV15-7a	244491.1216	286810.9726
JV16-1	244301.3865	287114.6489
JH15-5	244290.9056	287112.9625

VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	8"	1
GATE	10"	3



Integra Design Group
 DATE ISSUE
 ► JULY 30, 2021 ◄
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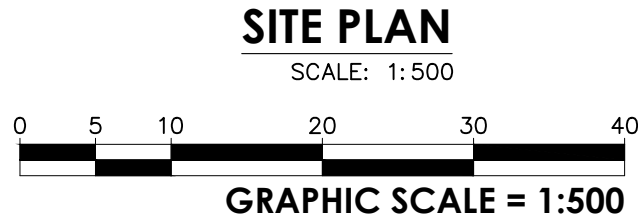


FIRE HYDRANT & VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	10"	1
FIRE HYDRANT WITH VALVE		1

LEGEND:

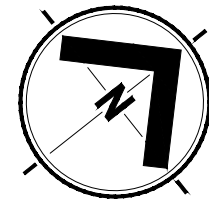
- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
JH16-1	244297.2680	287237.5660
KV16-1	244158.1972	287354.7430
KV15-5	244013.2578	287696.8443



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MATCH LINE WDS-C120
MATCH LINE WDS-C121

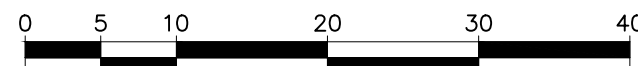
EXISTING 10" PVC WATER LINE

ANTIETAM DRIVE

EXISTING 10" PVC WATER LINE

SITE PLAN

SCALE: 1:500



GRAPHIC SCALE = 1:500

EXISTING 10" PVC WATER LINE

VALVES TO BE REPLACED

VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
JV17-1	244321.6467	287868.7340

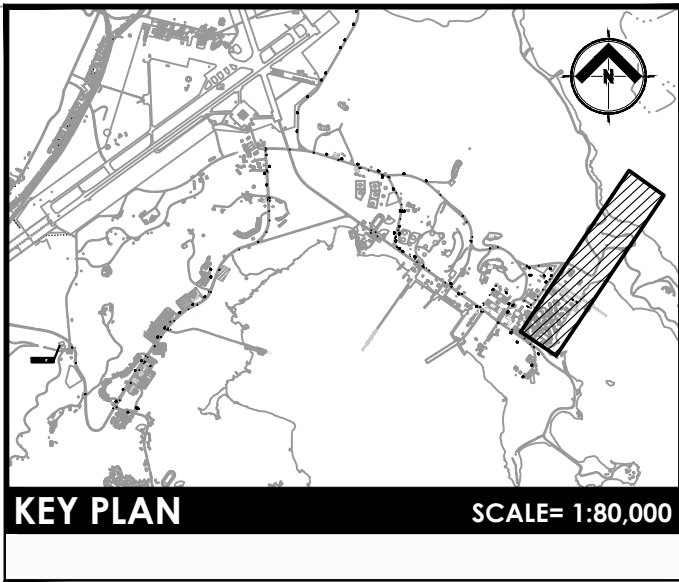
VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	10"	1

LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
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Integra Design Group
DATE ISSUE
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KEY PLAN

SCALE= 1:80,000

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER DISTRIBUTION SYSTEM

Drawing Title:

WATER DISTRIBUTION SITE PLAN

Revisions

Number	Date	Description

SHEET INFO.

Project No.: 18-1837.0

Set Date: 2021/07/28

Drawn by:

Dwg. Date:

Project Title:

Sheet:

WDS-C121

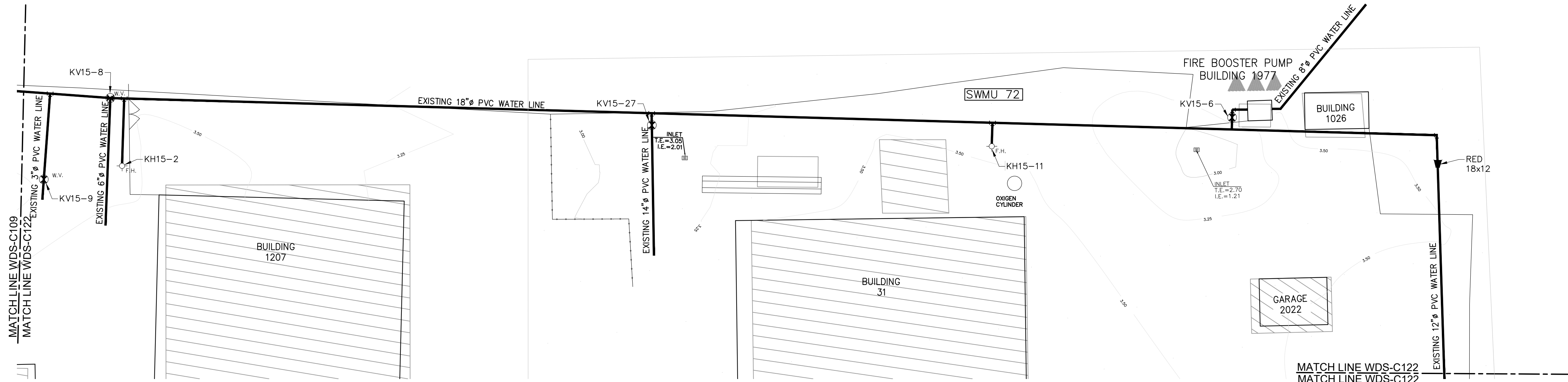
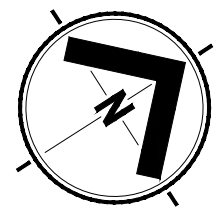
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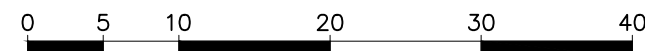
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SITE PLAN

SCALE: 1:500



GRAPHIC SCALE = 1:500

FIRE HYDRANT & VALVES TO BE REPLACED

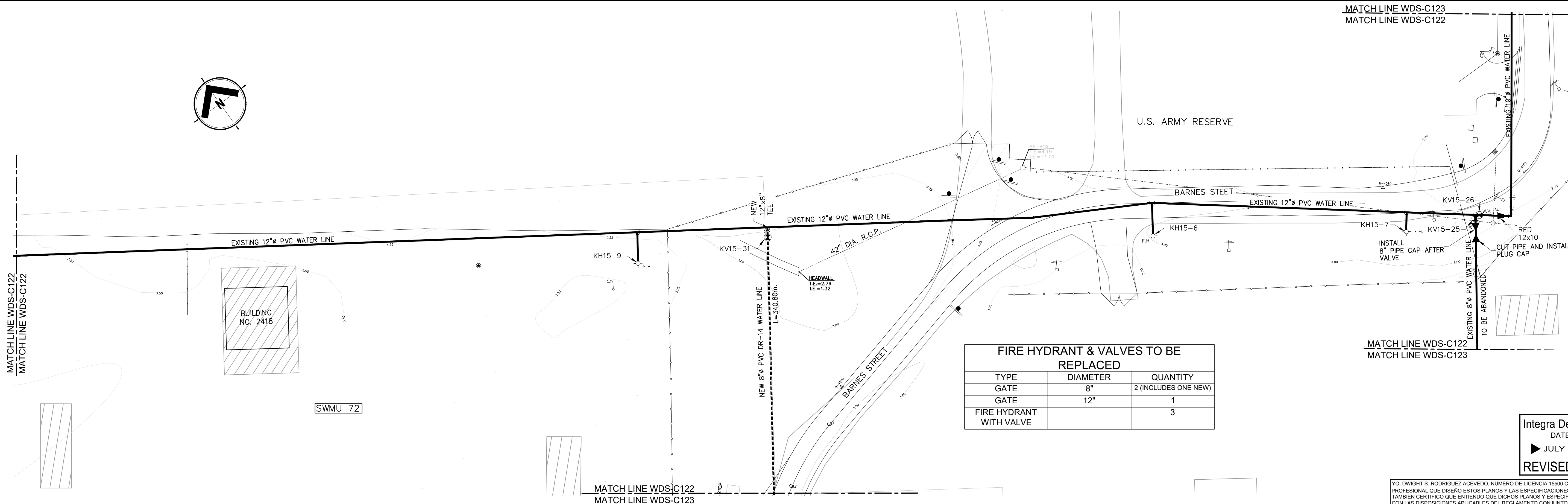
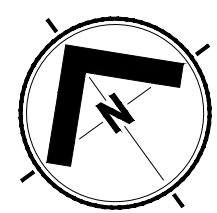
TYPE	DIAMETER	QUANTITY
GATE	3"	1
GATE	6"	1
GATE	8"	1
GATE	14"	1
FIRE HYDRANT WITH VALVE		2

VALVES & FIRE HYDRANTS COORDINATES

Description	Northing	Easting
KV15-8	243907.3220	286659.3368
KV15-9	243887.0598	286664.8446
KV15-27	243992.2497	286726.5892
KV15-6	244087.5145	286792.6803
KV15-25	243889.6530	287154.9184
KH15-6	243932.5813	287088.1360
KH15-2	243901.3628	286671.7281
KH15-9	244001.2561	286981.6317
KH15-7	243896.9384	287139.2118
KH15-11	244045.0842	286769.4737
KV15-26	243889.7316	287156.1249
KV15-31	243987.7845	287011.2036

LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMU (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)



FIRE HYDRANT & VALVES TO BE REPLACED

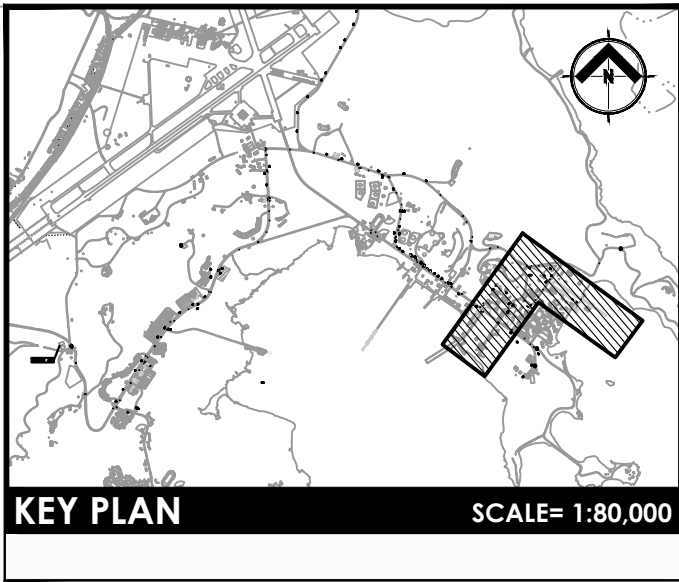
TYPE	DIAMETER	QUANTITY
GATE	8"	2 (INCLUDES ONE NEW)
GATE	12"	1
FIRE HYDRANT WITH VALVE		3

Integra Design Group
DATE ISSUE

► JULY 30, 2021 ◀

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KEY PLAN

SCALE= 1:80,000

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER DISTRIBUTION SYSTEM

Drawing Title:

WATER DISTRIBUTION SITE PLAN

Project Title:

Sheet:

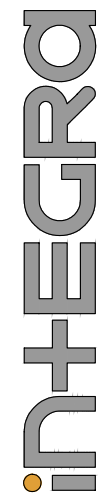
WDS-C122

Revisions

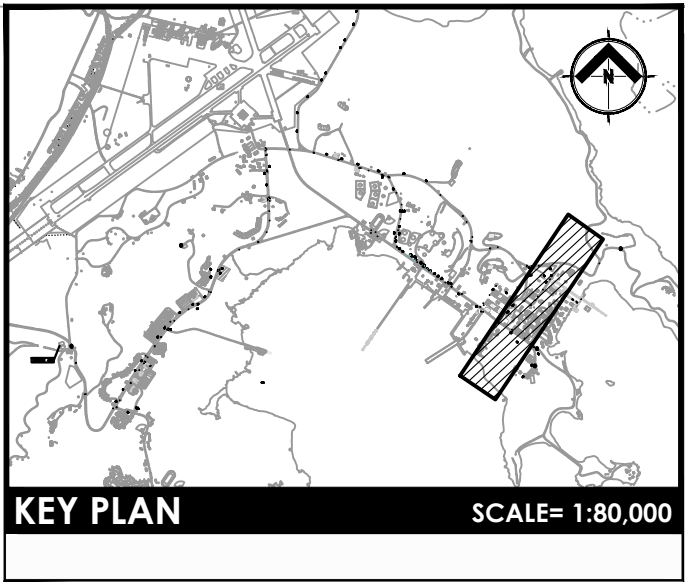
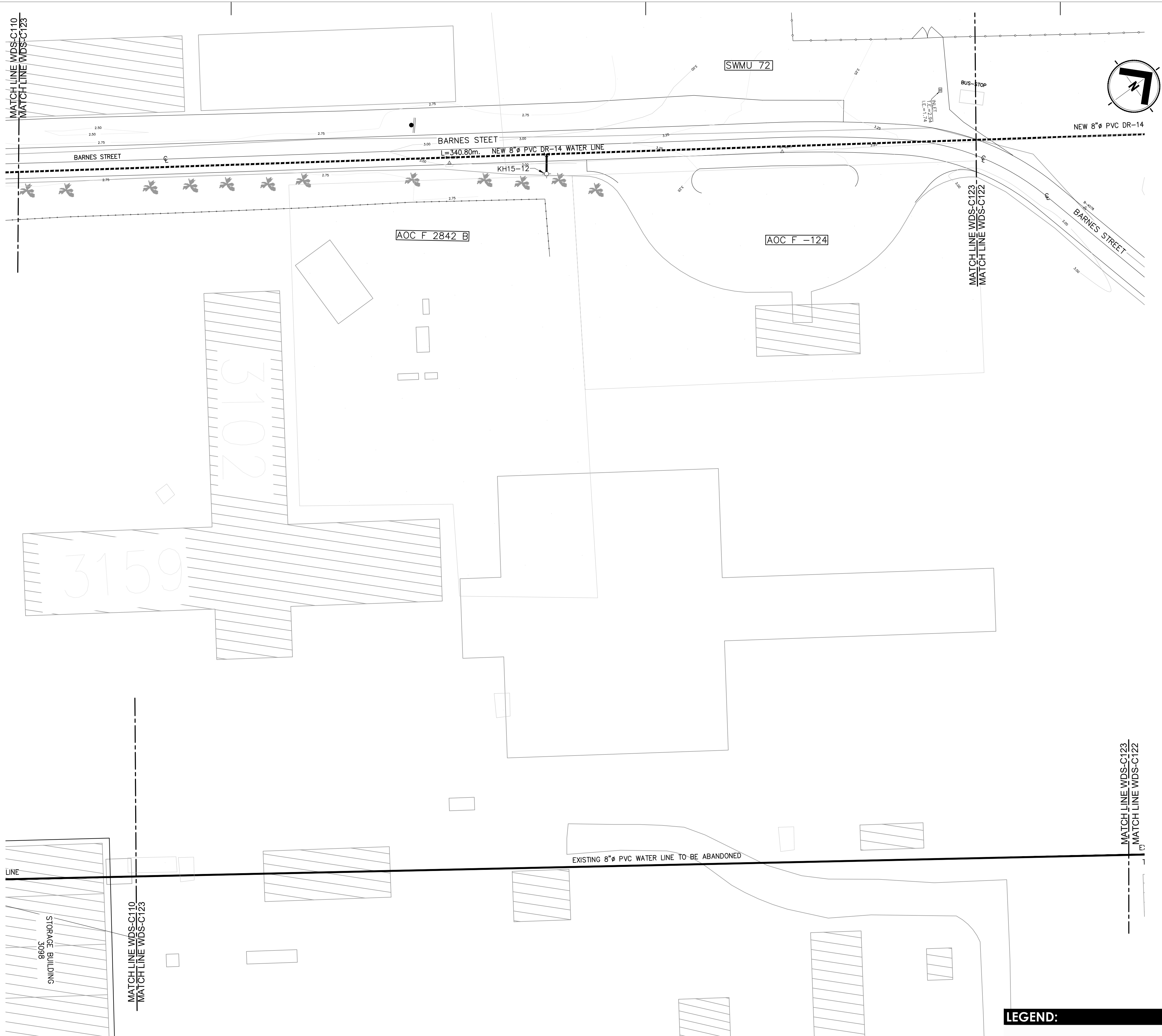
Number	Date	Description
1	2021/07/28	Project No. 18-1837-0
2	2021/07/28	Set Date: 2021/07/28
3		Drawn by:
4		Dwg. Date:

SHEET INFO.

Project No. 18-1837-0
Set Date: 2021/07/28
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LEGEND:

- EXISTING WATER DISTRIBUTION LINE
- EXISTING WATER VALVE TO BE REPLACED
- EXISTING FIRE HYDRANT TO BE REPLACED
- VALVE IDENTIFICATION
- HYDRANT IDENTIFICATION
- NEW WATER DISTRIBUTION LINE OR EXISTING LINE TO BE REPLACED
- MONITORING WELLS
- SWMUS (SOLID WASTE MANAGEMENT UNIT) AOC (AREA OF CONCERN)

VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
KH15-12	243847.6716	286920.7718

FIRE HYDRANT & VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE		
NEW FIRE HYDRANT & VALVE		1

Integra Design Group
DATE ISSUE
JULY 30, 2021
REVISED BID SET

YO, DWIGHT S. RODRIGUEZ ACEVEDO, NUMERO DE LICENCIA 15500 CERTIFICO QUE SOY EL PROFESIONAL QUE DISEÑO ESTOS PLANOS Y LAS ESPECIFICACIONES COMPLEMENTARIAS. TAMBIEN CERTIFICO QUE ENTiendo QUE DICHO PLANOS Y ESPECIFICACIONES CUMPLEN CON LAS DISPOSICIONES APLICABLES DEL REGLAMENTO CONJUNTO Y LAS DISPOSICIONES APLICABLES DE LOS REGLAMENTOS O CORPORACIONES PUBLICAS CON JURISDICCION. CERTIFICO, ADEMAS, QUE EN LA PREPARACION DE ESTOS PLANOS Y ESPECIFICACIONES SE HA CUMPLIDO CABALMENTE CON LOS DISPUESTOS EN LA "LEY NUM. 14 DE 8 DE ENERO DE 2004, SEGUN ENMIENDADA, CONOCIDA COMO LA "LEY PARA LA INVERSION POR LA INDUSTRIA PUERTORRIQUEÑA" Y CON LA LEY NUM. 319 DE 15 DE MAYO DE 1938, SEGUN ENMIENDADA; LEY NUM. 96 DE 6 DE JULIO DE 1978, SEGUN ENMIENDADA. RECONOZCO QUE CUALQUIER DECLARACION FALSA O FALSIFICACION DE LOS HECHOS QUE SE HAYA PRODUCIDO POR DESCONOCIMIENTO O POR NEGLIGENCIA YA SEA POR MI, MIS AGENTES O EMPLEADOS O POR OTRAS PERSONAS CON MI CONOCIMIENTO, ME HACEN RESPONSABLE DE CUALQUIER ACCION JUDICIAL Y DISCIPLINARIA POR LA OGP.

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER DISTRIBUTION SYSTEM

Drawing Title:

WATER DISTRIBUTION SITE PLAN

Project Title:

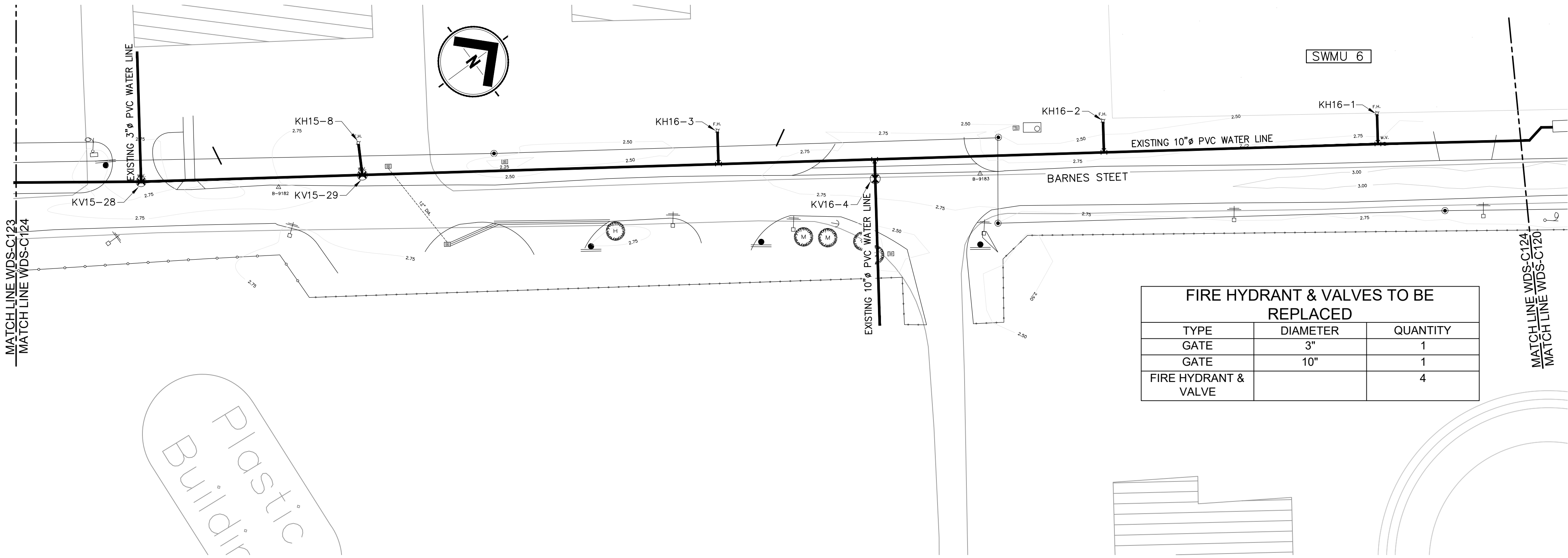
Sheet:

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 18-1837.0	
		Set Date: 2021/07/28	
		Drawn by:	
		Dwg. Date:	

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FIRE HYDRANT & VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	3"	1
GATE	10"	1
FIRE HYDRANT & VALVE		4

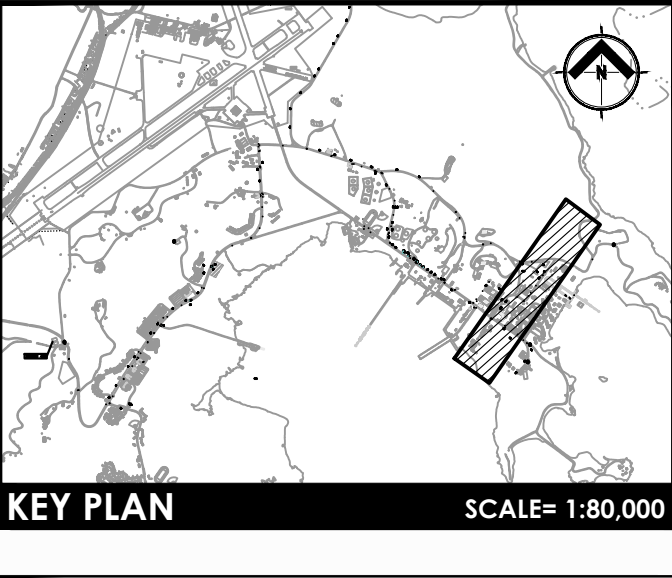
VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
KV15-28	243943.1137	287204.5985
KV15-29	243975.6553	287227.1205
KV16-4	244049.0876	287282.0381
KH15-8	243978.5004	287222.0535
KH16-3	244031.4850	287258.3664
KH16-2	244088.0202	287297.8285
KH16-1	244128.2520	287325.8034

LEGEND:

- EXISTING WATER DISTRIBUTION LINE
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Integra Design Group
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WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT



WATER DISTRIBUTION SYSTEM

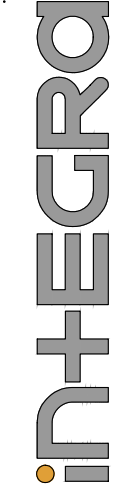
Drawing Title:
WATER DISTRIBUTION SITE PLAN

Revisions

Number	Date	Description

SHEET INFO.

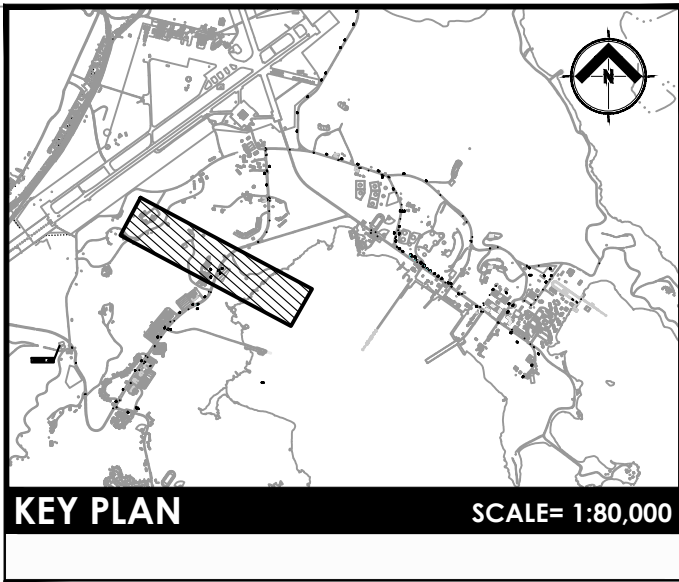
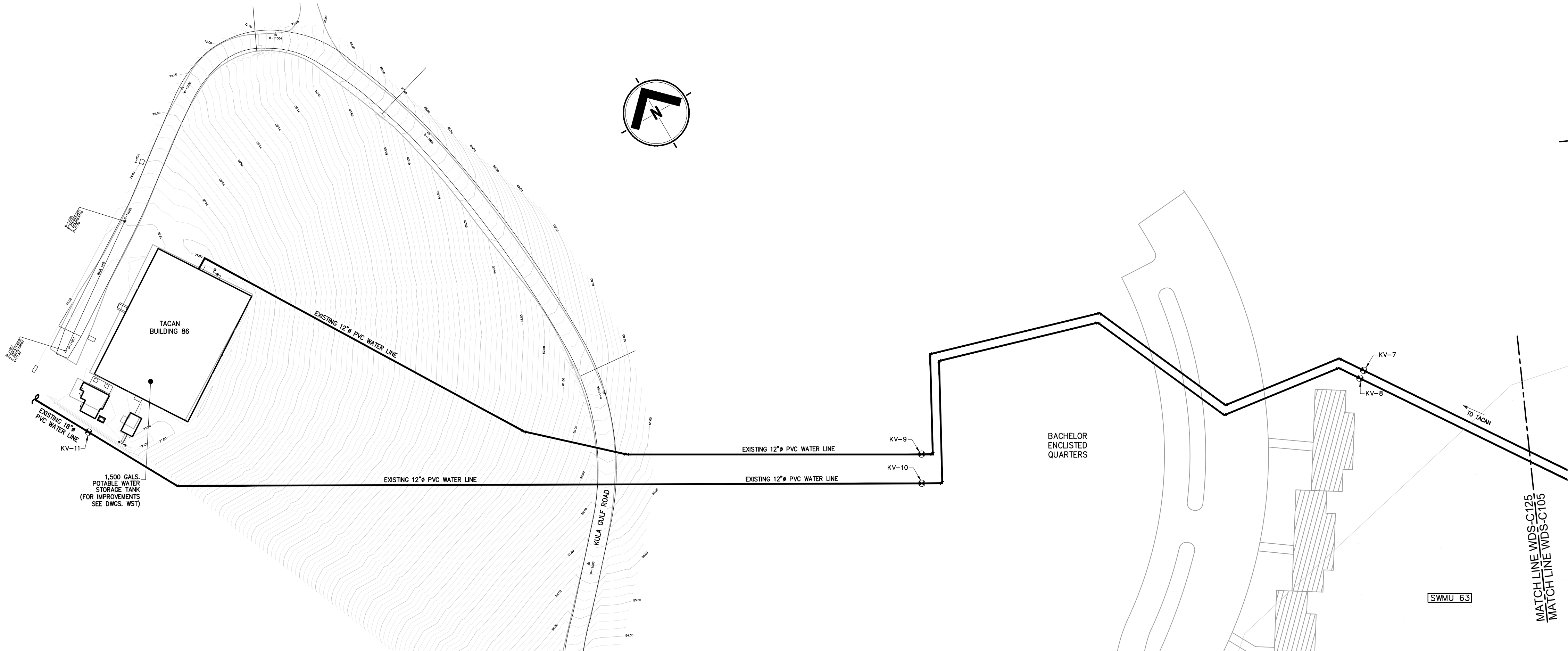
Project No.: 18-1837.0
Set Date: 20210728
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Sheet:

WDS-C124



VALVES & FIRE HYDRANTS COORDINATES		
Description	Northing	Easting
KV-11	244489.1254	283521.2934
KV-9	244368.8783	283715.2752
KV-10	244361.9465	283711.2926
KV-7	244327.6275	283831.4096
KV-8	244326.2966	283829.4114

VALVES TO BE REPLACED		
TYPE	DIAMETER	QUANTITY
GATE	12"	4
GATE	18"	1

- LEGEND:**
- EXISTING WATER DISTRIBUTION LINE
 - EXISTING WATER VALVE TO BE REPLACED
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Integra Design Group
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Project Title: WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I) AT ROOSEVELT ROADS RE-DEVELOPMENT

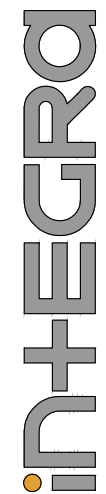
Owner: CEBRA & NAGUARO, PUERTO RICO



Drawing Title: WATER DISTRIBUTION SYSTEM

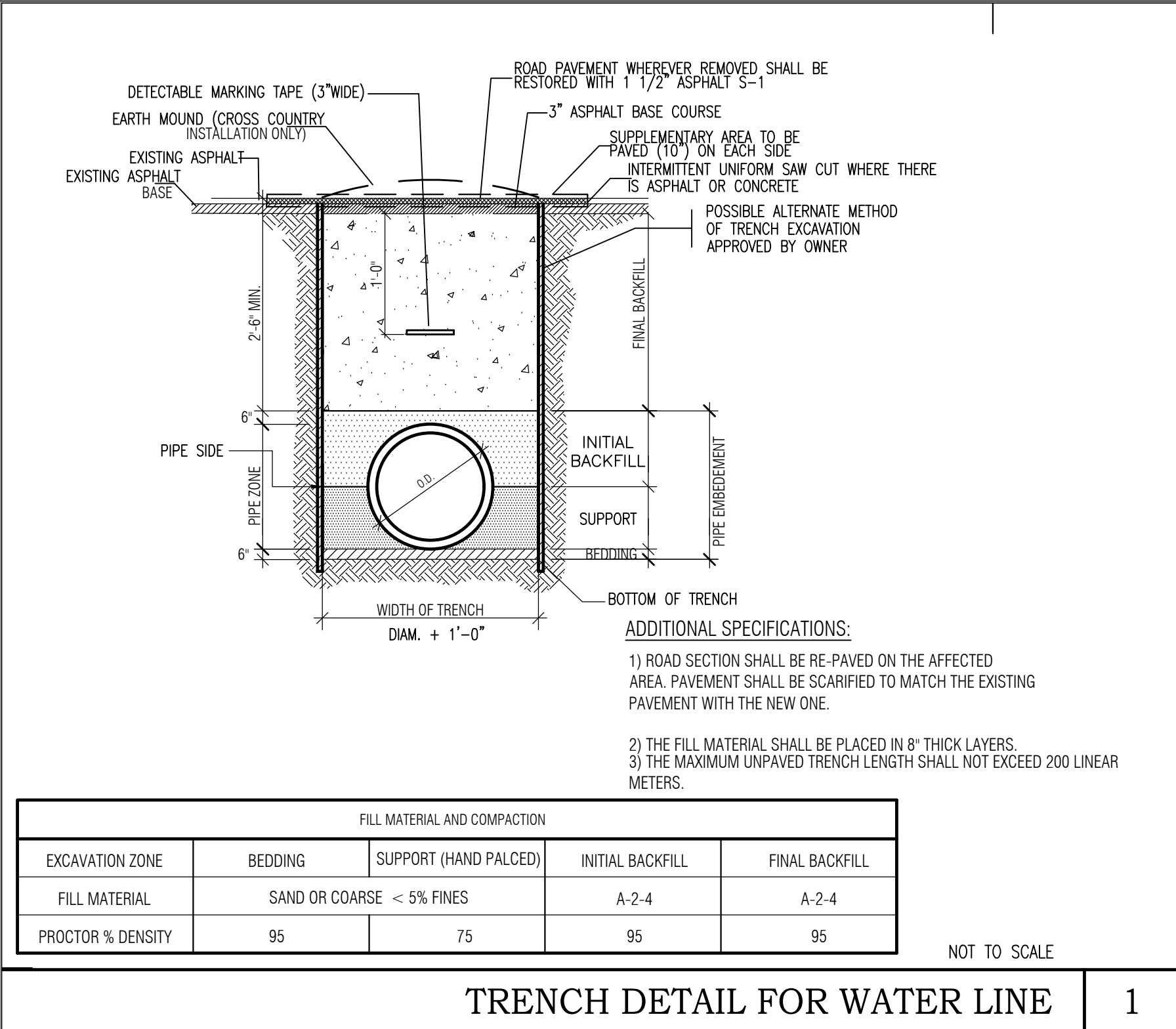
Sheet: WATER DISTRIBUTION SITE PLAN

Revisions		SHEET INFO.	
Number	Date	Description	
		Project No.: 19-1837.0	
		Set Date: 20210728	
		Drawn by:	
		Dwg. Date:	



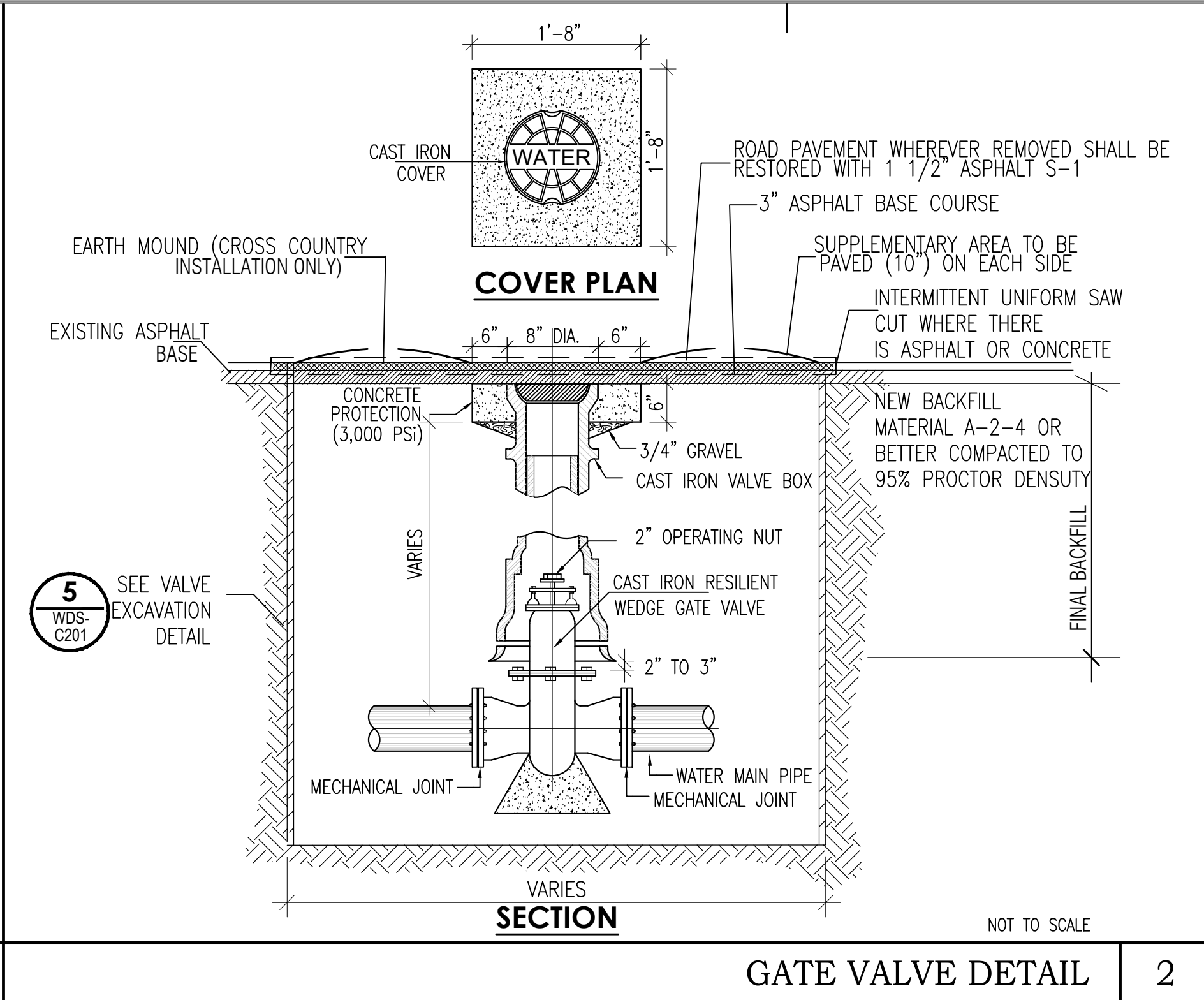
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File: P:\or19-Ceiba\1837.0 RR WATER SYSTEM IMPROVEMENTS PHASE 1\06-BldPhase\01-Site\Water Distribution\244-WDS-C201 WATER DISTRIBUTION DETAILS; Plotted: 11/15/2022 9:48 a.m. by: SVIAZQUEZ; Saved: 8/14/2021 2:10 p.m. by: SVIAZQUEZ



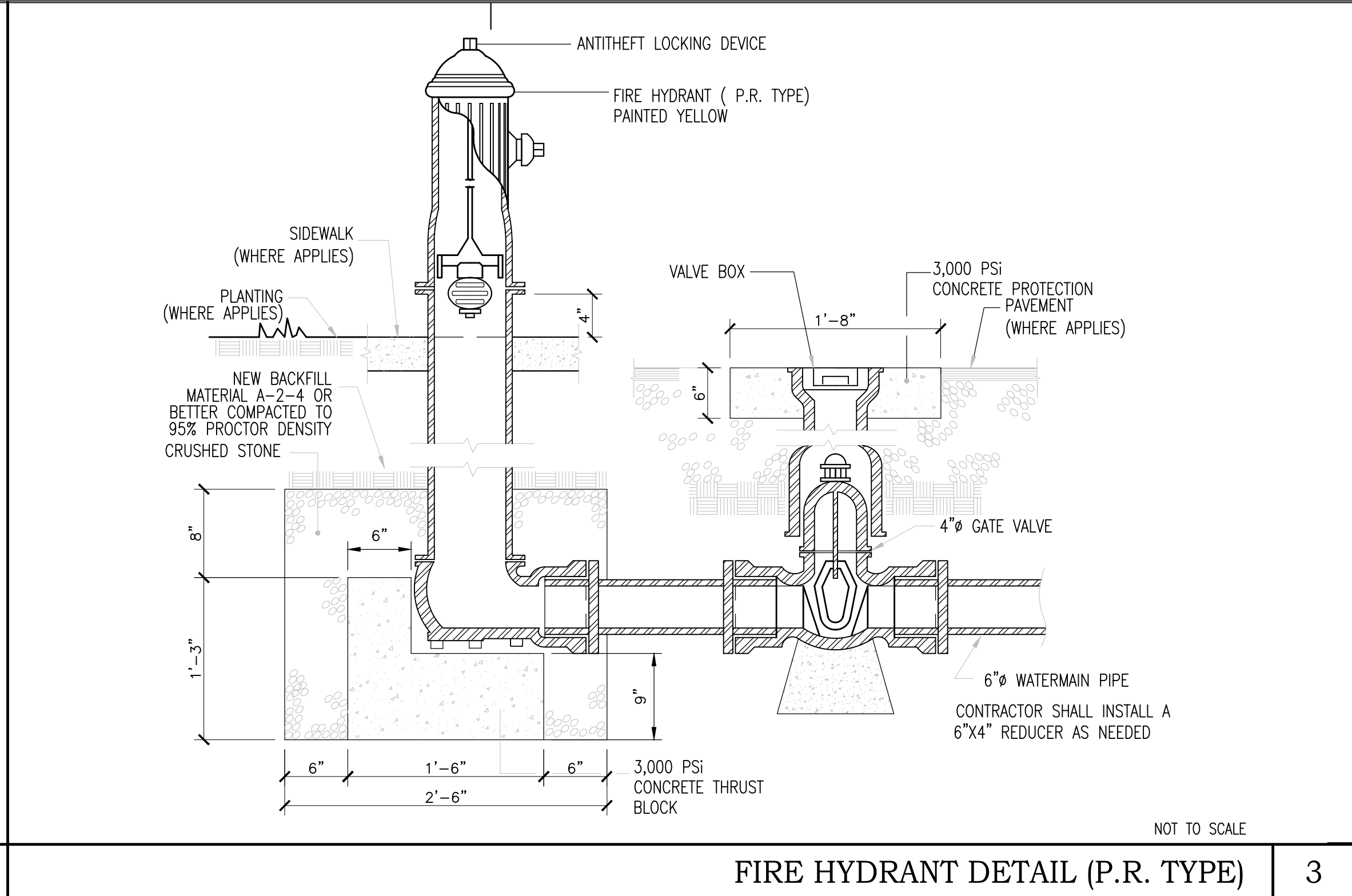
TRENCH DETAIL FOR WATER LINE

1



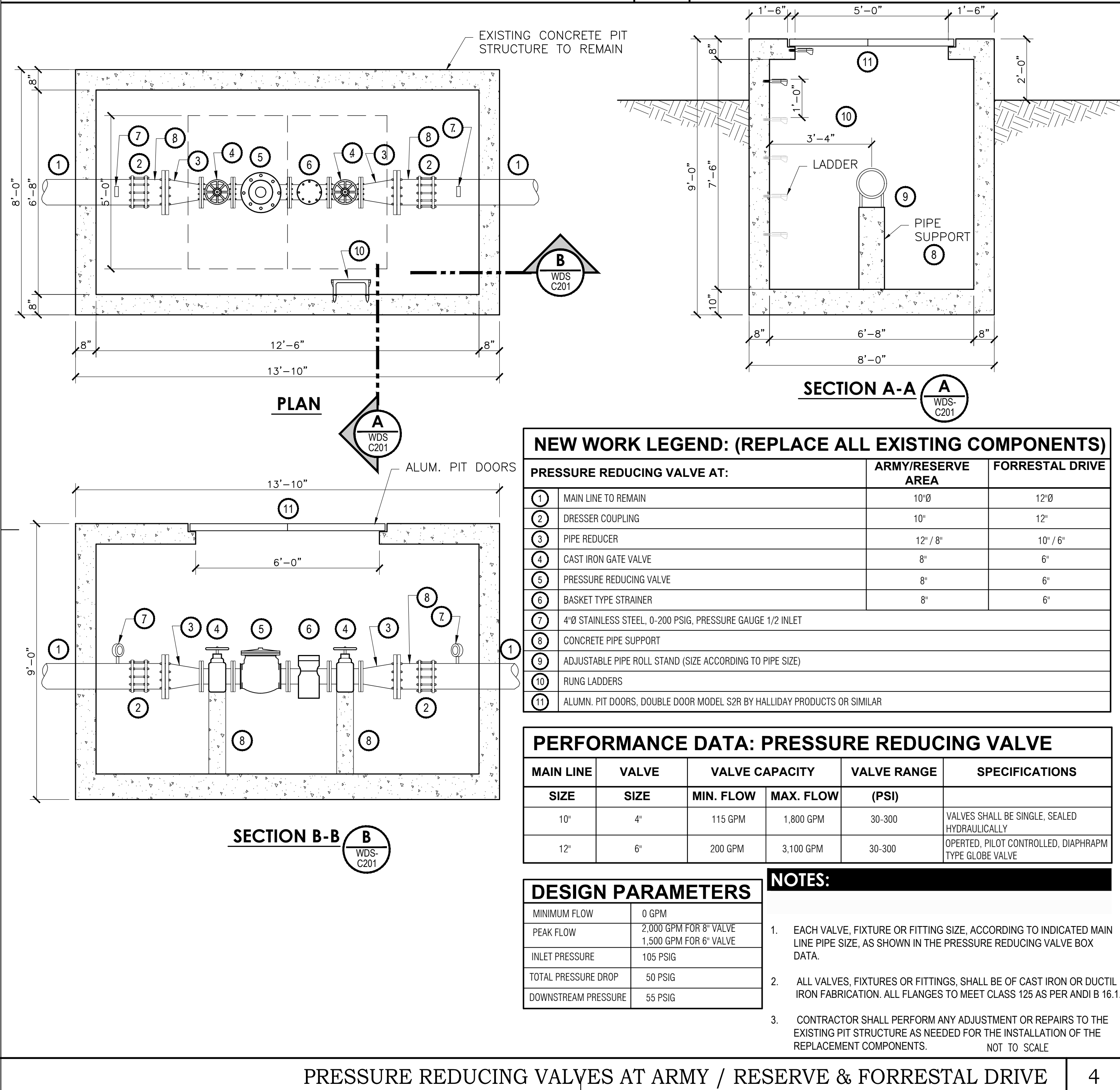
GATE VALVE DETAIL

2



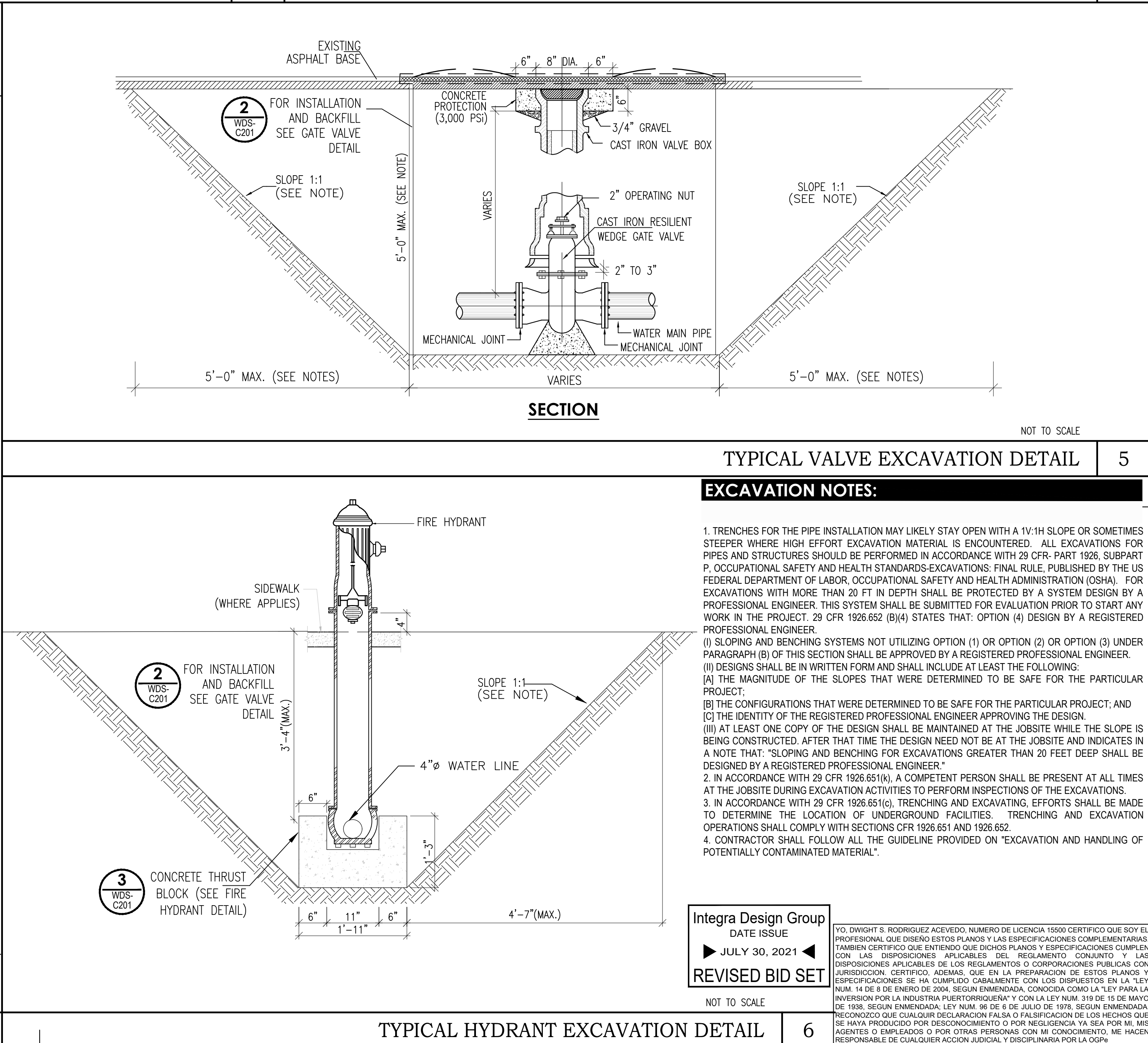
FIRE HYDRANT DETAIL (P.R. TYPE)

3



PRESSURE REDUCING VALVES AT ARMY / RESERVE & FORRESTAL DRIVE

4



TYPICAL HYDRANT EXCAVATION DETAIL

6

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SHEET INFO:

Project No.: 18-1837.0

Set Date: 2021/07/28

Drawn by:

Dwg. Date:

Revisions

Number	Date	Description

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

GOVERNMENT OF PUERTO RICO

Local Redevelopment Authority

for Roosevelt Roads

Project Title:

WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)

AT ROOSEVELT ROADS RE-DEVELOPMENT

Owner:

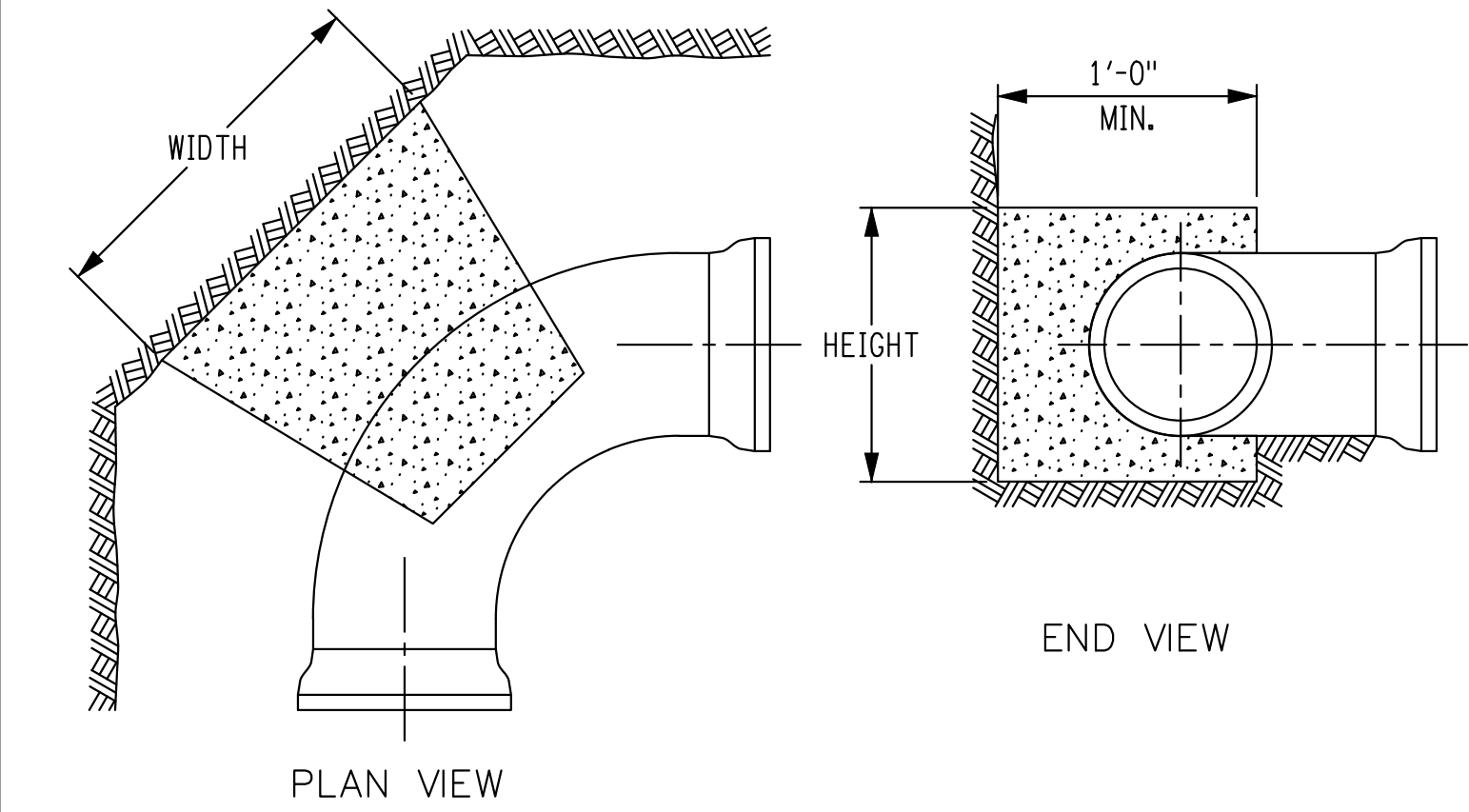
CEREA & NAGUABO, PUERTO RICO

Drawing Title:

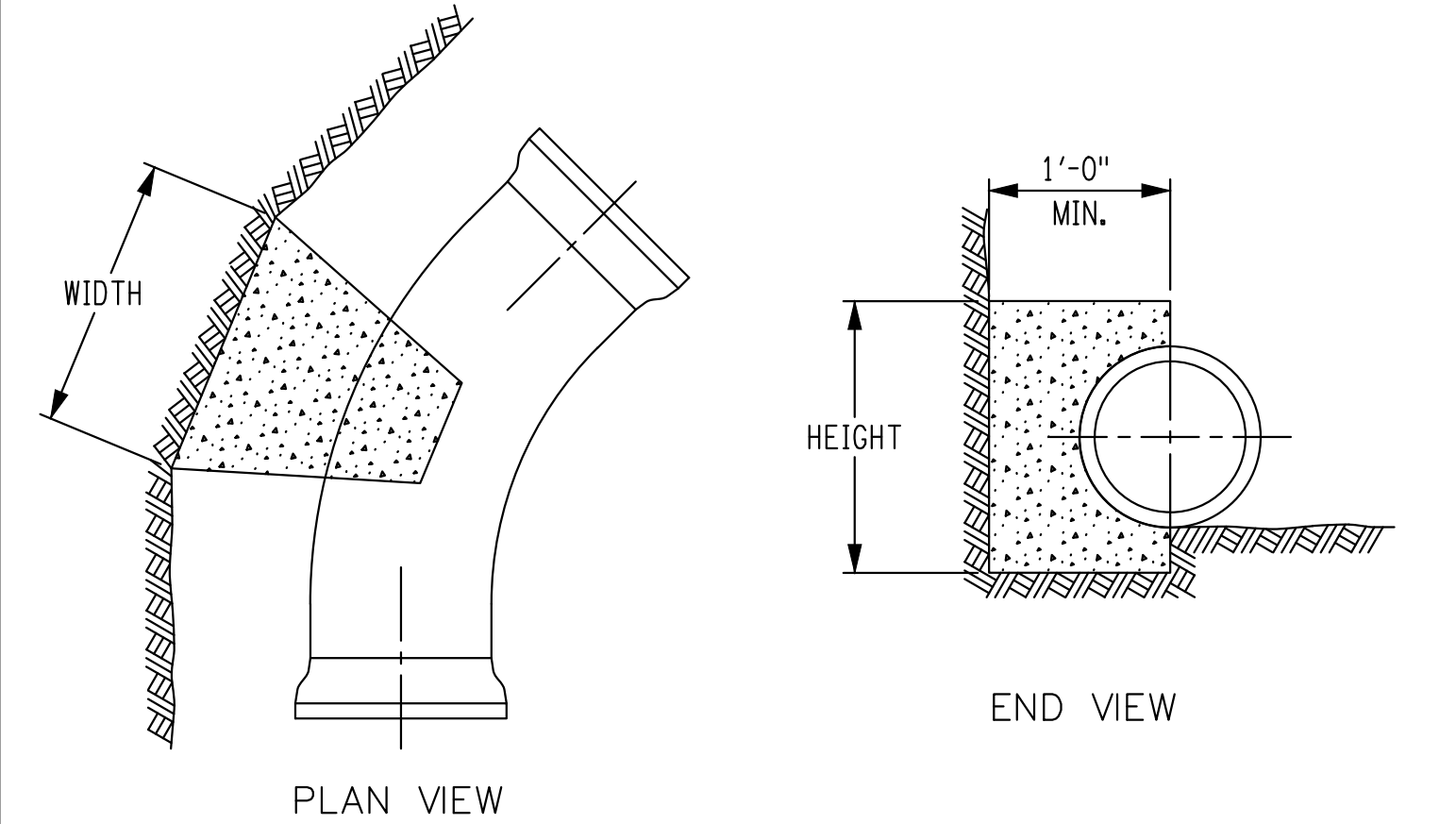
WATER DISTRIBUTION SYSTEM DETAILS

Sheet:

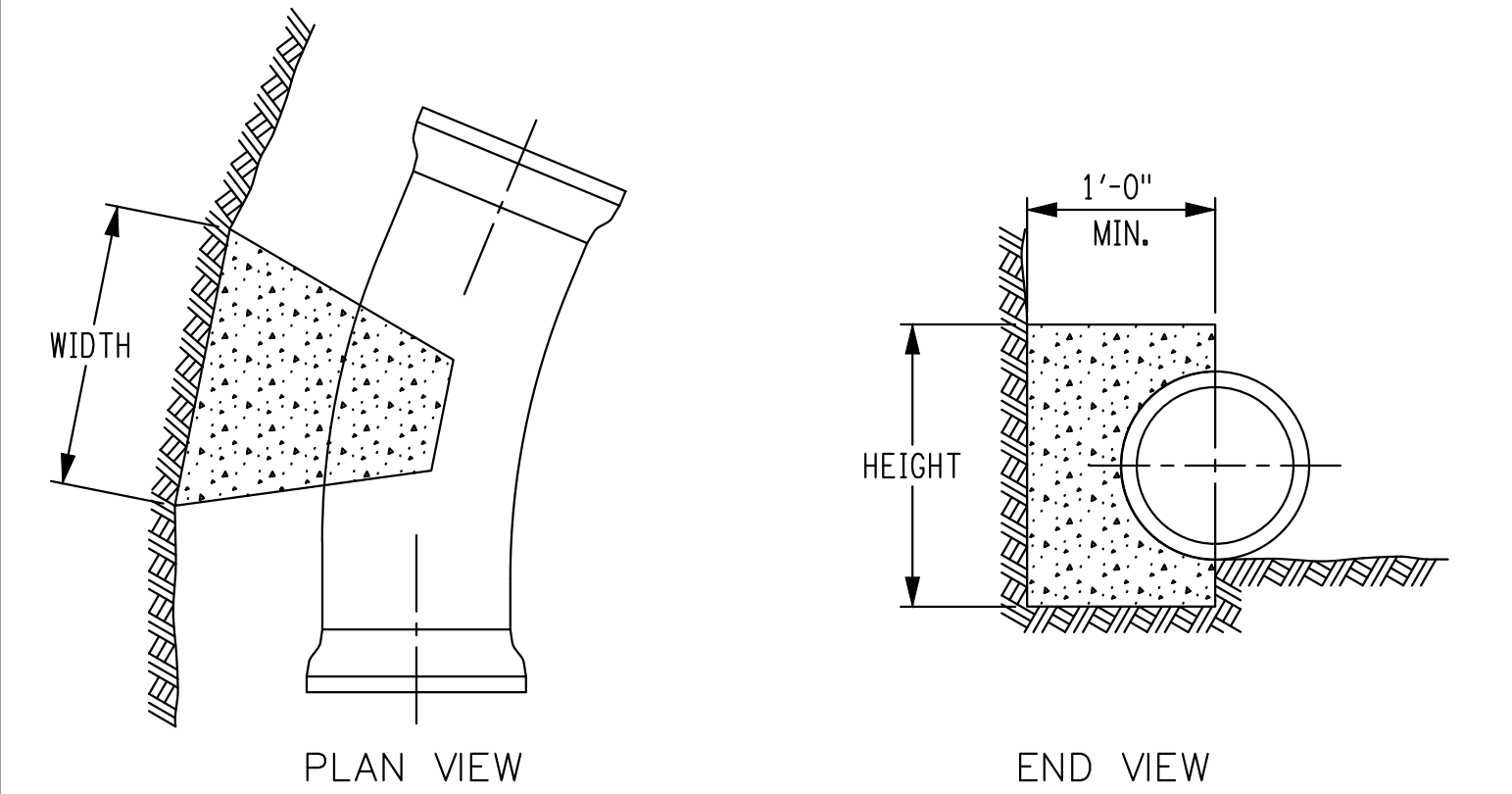
WDS-C201



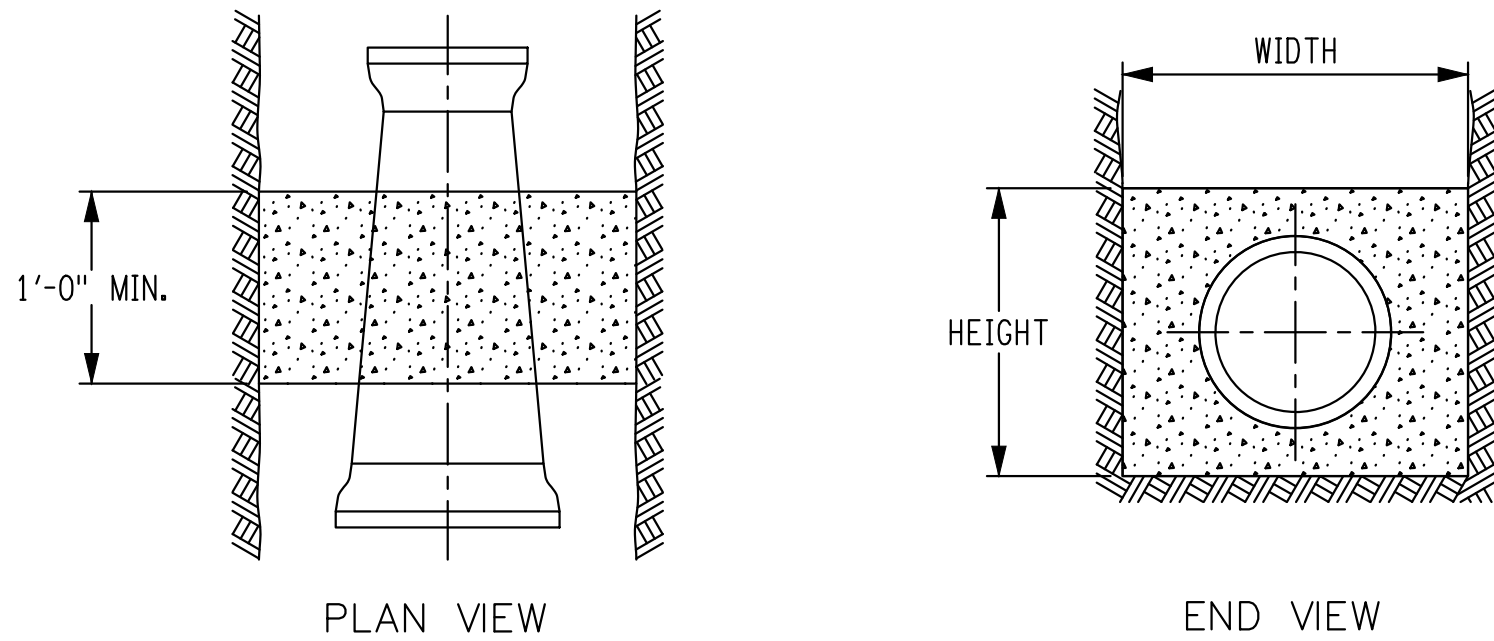
90° BEND THRUST BLOCK DIMENSIONING					
PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
4 NPS	2'-3"	1'-3"	14 NPS	7'-3"	3'-6"
6 NPS	3'-3"	1'-9"	16 NPS	8'-3"	4'-0"
8 NPS	4'-3"	2'-3"	18 NPS	9'-3"	4'-6"
10 NPS	5'-3"	2'-6"	20 NPS	10'-6"	5'-0"
12 NPS	6'-0"	3'-3"	24 NPS	12'-0"	6'-0"



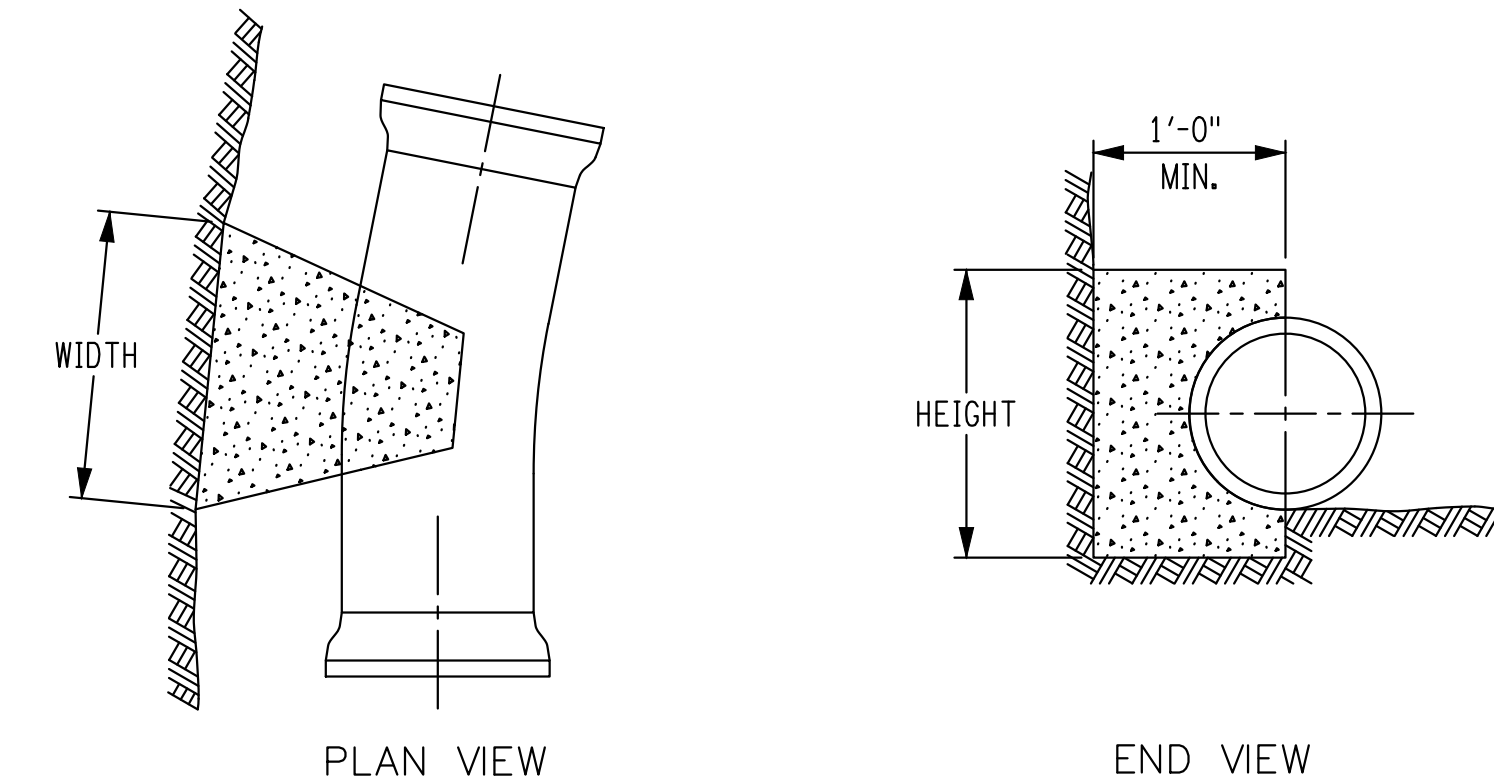
45° BEND THRUST BLOCK DIMENSIONING					
PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
4 NPS	2'-3"	0'-9"	14 NPS	5'-3"	2'-6"
6 NPS	2'-6"	1'-9"	16 NPS	5'-6"	3'-3"
8 NPS	3'-3"	1'-9"	18 NPS	7'-3"	3'-3"
10 NPS	4'-0"	2'-0"	20 NPS	7'-3"	4'-0"
12 NPS	4'-6"	2'-3"	24 NPS	18'-9"	4'-6"



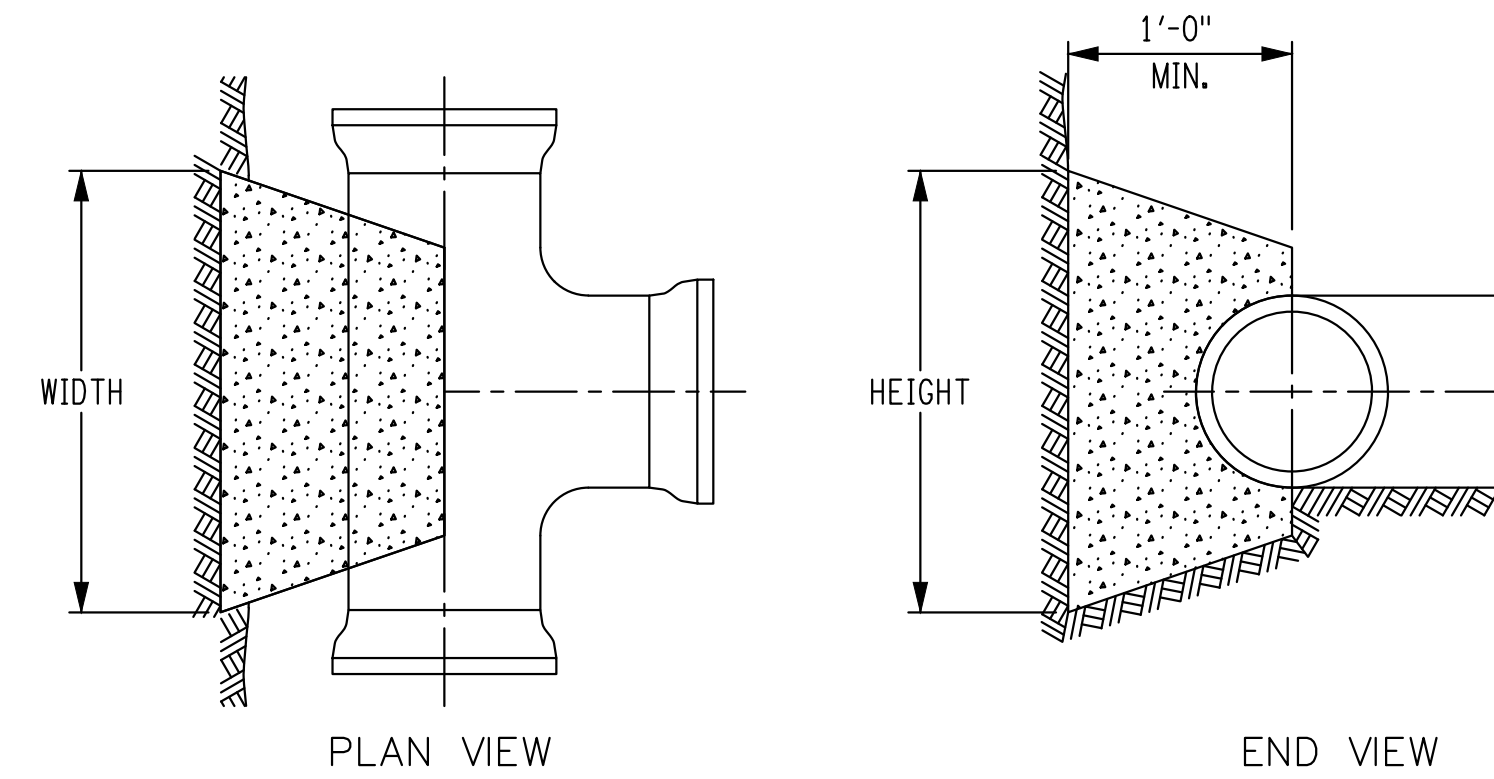
22 1/2° BEND THRUST BLOCK DIMENSIONING					
PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
4 NPS	1'-3"	0'-9"	14 NPS	3'-6"	2'-6"
6 NPS	2'-0"	0'-9"	16 NPS	4'-6"	2'-3"
8 NPS	2'-3"	1'-3"	18 NPS	5'-0"	2'-6"
10 NPS	3'-0"	1'-3"	20 NPS	5'-0"	3'-0"
12 NPS	3'-3"	1'-9"	24 NPS	6'-3"	3'-3"



REDUCER THRUST BLOCK DIMENSIONING					
SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
6x4 NPS	1'-6"	1'-3"	16x8 NPS	4'-6"	4'-6"
8x4 NPS	2'-3"	2'-3"	16x10 NPS	4'-0"	4'-0"
8x6 NPS	1'-9"	1'-9"	16x12 NPS	3'-6"	3'-6"
10x6 NPS	2'-6"	2'-6"	20x12 NPS	5'-0"	5'-0"
10x8 NPS	2'-0"	2'-0"	20x16 NPS	14'-0"	4'-0"
12x6 NPS	3'-3"	3'-3"	24x12 NPS	16'-6"	6'-6"
12x8 NPS	3'-0"	3'-0"	24x16 NPS	15'-9"	5'-9"
12x10 NPS	2'-3"	2'-3"	24x20 NPS	14'-6"	4'-6"



11 1/4° BEND THRUST BLOCK DIMENSIONING					
PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
4 NPS	1'-0"	0'-6"	14 NPS	3'-0"	1'-3"
6 NPS	1'-3"	0'-9"	16 NPS	3'-3"	1'-9"
8 NPS	1'-9"	0'-9"	18 NPS	3'-6"	1'-9"
10 NPS	2'-0"	1'-0"	20 NPS	3'-6"	2'-0"
12 NPS	2'-3"	2'-3"	24 NPS	4'-6"	2'-3"



TEE/DEAD END THRUST BLOCK DIMENSIONING					
PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)	PIPE SIZE	WIDTH (FT-IN)	HEIGHT (FT-IN)
4 NPS	2'-0"	1'-0"	14 NPS	5'-6"	3'-3"
6 NPS	3'-0"	1'-3"	16 NPS	6'-6"	3'-6"
8 NPS	3'-3"	2'-0"	18 NPS	7'-6"	4'-0"
10 NPS	4'-3"	2'-3"	20 NPS	8'-6"	4'-3"
12 NPS	5'-3"	2'-6"	24 NPS	10'-3"	5'-3"

NOTES:

- THRUST RESTRAINT USING THRUST BLOCKS OR RESTRAINED LENGTHS ARE SHOWN ON THESE SHEETS. THRUST BLOCKS, RESTRAINED JOINTS USING TIE RODS, OR RESTRAINED GLANDS ARE ALL ACCEPTABLE METHODS TO THE OWNER. HOWEVER, THE THRUST RESTRAINT METHOD SELECTED SHALL BE APPROVED BY THE SYSTEM OWNER, AND AT NO ADDITIONAL COST BY THE CONTRACTOR.
- IF THE OWNER OF THE WATER SYSTEM REQUIRES A METHOD THAT RESTRAINS INDIVIDUAL JOINTS, EACH JOINT THAT FALLS WITHIN THE MINIMUM RESTRAINED LENGTH, MEASURED FROM THE CENTER OF THE FITTING, AS SHOWN ON THESE SHEETS SHALL BE RESTRAINED, AND SHALL WITHSTAND THE MAXIMUM PRESSURE APPLIED TO THE SYSTEM.
- 3,000 PSI CONCRETE SHALL BE USED. THIS CONCRETE SHALL NOT BE PLACED UNDERWATER, THE CONTRACTOR SHALL DEWATER THE EXCAVATION OR PLACE UNDERWATER CONCRETE MIX USING APPROPRIATE UNDERWATER PLACEMENT TECHNIQUES.
- CONCRETE FOR THRUST BLOCKS SHALL NOT BE ALLOWED TO COVER OR INTERFERE WITH JOINT OR RESTRAINT HARDWARE, PLASTIC SHEETING OR BUILDING FELT MAY BE PLACED OVER PIPE OR FITTINGS TO PREVENT CONCRETE FROM ADHERING TO SURFACES. POURED AGAINST UNDISTURBED SOIL.
- FOR BENDS, BEARING AREA SHALL BE PARALLEL TO THE EDGE OF THE FITTING AT THE FITTING MIDPOINT.
- FOR TEES, BEARING AREA SHALL BE PERPENDICULAR TO THE BRANCH (SINGLE LEG) AXIS.
- FOR REDUCERS, BEARING AREA SHALL BE PERPENDICULAR TO THE FITTING AXIS, THE MINIMUM THICKNESS ALONG THE FITTING AXIS SHALL BE 1'-0" OR THE LENGTH BETWEEN THE BELLS, WHICHEVER IS SMALLER.
- THRUST BLOCK SIZES AND MINIMUM RESTRAINED LENGTHS SHOWN ON THESE SHEETS ARE BASED UPON THE FOLLOWING STANDARD CONDITIONS:
1.5 - SAFETY FACTOR
5'-0" - DEPTH OF COVER
200 PSI - WATER SYSTEM TEST PRESSURE
2,000 PSF - SOIL BEARING CAPACITY
90 LB/CF - SOIL UNIT WEIGHT
- FOR INSTALLATIONS NOT MEETING THE CONDITIONS OF NOTE 8, THE CONTRACTOR SHALL SUBMIT CALCULATIONS TO THE ENGINEER FOR APPROVAL OF RESTRAINT LENGTH CHOSEN.

MINIMUM RESTRAINED OF PIPE (FT-IN) \geq											
FITTING	4 NPS	6 NPS	8 NPS	10 NPS	12 NPS	14 NPS	16 NPS	18 NPS	20 NPS	24 NPS	
11 1/4° BEND	1'-3"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-3"	
22 1/2° BEND	1'-3"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-6"	
45° BEND	3'-3"	4'-0"	5'-3"	3'-3"	7'-6"	8'-6"	9'-6"	10'-6"	10'-6"	13'-6"	
90° BEND	7'-0"	9'-9"	12'-6"	15'-6"	18'-0"	20'-0"	23'-0"	25'-6"	28'-0"	32'-6"	
DEAD END	8'-6"	12'-6"	16'-0"	19'-3"	23'-0"	26'-0"	29'-6"	33'-0"	36'-0"	42'-0"	
NOTE: FOR PVC PIPE, MULTIPLY VALUES IN TABLE BY 1.15											
NOTE: FOR POLYETHYLENE WRAPPED PIPE, MULTIPLY VALUES IN TABLE BY 1.45											

Integra Design Group
DATE ISSUE
► JULY 30, 2021 ◀
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Revisions		SHEET INFO.	
Number	Description	Project No.	Set Date
		19-1837-0	2021/07/28
		Drawn by:	Dwg. Date:

GOVERNMENT OF PUERTO RICO
Local Redevelopment Authority
for Roosevelt Roads



WATER INFRASTRUCTURE IMPROVEMENTS (PHASE I)
AT ROOSEVELT ROADS RE-DEVELOPMENT

WATER DISTRIBUTION SYSTEM
Drawing Title:

WDS-C202

Sheet: Project Title:

WATER MAIN HORIZONTAL THRUST RESTRAINT DETAILS

2. TECHNICAL SPECIFICATIONS CONSTRUCTION DOCUMENTS



TECHNICAL SPECIFICATIONS

Construction Documents

PROJECT: Water Infrastructure Improvements
(Phase I) at Roosevelt Roads (19-1837)

LOCATION: Roosevelt Roads,
Ceiba & Naguabo, PR

OWNER: Local Redevelopment Authority for
Roosevelt Roads
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DATE: August 6, 2021(Rev. May 31, 2023)

TABLE OF CONTENTS

DIVISION 01- GENERAL REQUIREMENTS

01 10 00	SUMMARY OF WORK
01 25 00	SUBSTITUTION PROCEDURES
01 25 19	SUBSTITUTION REQUEST FORM
01 50 00	TEMPORARY FACILITIES AND CONTROLS
01 58 00	PROJECT IDENTIFICATION
01 58 00	CONSTRUCTION WASTE MANAGEMENT
01 32 19	SUBMITTALS
01 43 33	MANUFACTURER SERVICES
01 73 29	ROADWAY CROSSING BY OPEN CUT
01 75 17	EQUIPMENT TESTING AND FACILITY STARTUP
01 77 00	CLOSEOUT PROCEDURES
01 78 23	OPERATION AND MAINTENANCE DATA

DIVISION 02- EXISTING CONDITIONS

02 41 00	DEMOLITION
----------	------------

DIVISION 03- CONCRETE

03 10 00	CONCRETE FORMING
03 20 00	CONCRETE REINFORCING
03 30 00	CAST-IN-PLACE CONCRETE
03 35 00	CONCRETE FINISHING

DIVISION 04- MASONRY

04 05 13	MASORY MORTARING
04 05 16	MASONRY GROUTING
04 20 00	UNIT MANSORY

DIVISION 05- METALS

05 50 00	METAL FABRICATIONS
05 52 13	PIPES AND TUBE RAILINGS

DIVISION 06- WOOD, PLASTICS AND COMPOSITES

06 10 00	ROUGH CARPENTRY
06 41 00	ARCHITECTURAL WOOD CASEWORK

06 81 13 FIBERGLASS REINFORCED PLASTICS (FRP) RAILINGS

DIVISION 07- THERMAL AND MOISTURE PROTECTION

07 52 60 MODIFIED BITUMINOUS SHEET ROOFING

07 53 00 ELASTOMERIC MEMBRANE ROOFING

07 56 00 FLUID APPLIED ELASTOMERIC ROOFING

07 62 00 SHEET METAL FLASHING AND TRIM

07 92 00 JOINT SEALERS

DIVISION 08- OPENINGS

08 11 13 HOLLOW METAL DOORS AND FRAMES

08 14 00 WOOD DOORS

08 31 13 ACCESS DOORS AND FRAMES

08 51 13 ALUMINUM WINDOWS AND GLASS DOORS

08 71 00 DOOR HARDWARE

08 80 00 GLAZING

08 91 00 LOUVERS

DIVISION 09- FINISHES

09 24 00 PORTLAND CEMENT PLASTERING

09 51 00 ACOUSTICAL CEILINGS

09 91 00 PAINTING

DIVISION 10- SPECIALTIES

10 28 13 TOILET ACCESSORIES

10 44 13 FIRE EXTINGUISHERS AND CABINETS

DIVISION 11- EQUIPMENT

11 53 00 LABORATORY EQUIPMENT

DIVISION 22- PLUMBING

22 05 29 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

22 11 16 DOMESTIC WATER PIPING

22 13 16 SANITARY WASTE AND VENT PIPING

22 13 30 SUBMERSIBLE DRY PIT CENTRIFUGAL PUMPS

22 13 31 SUBMERSIBLE WET PIT CENTRIFUGAL PUMPS

22 13 32 IMMERSIBLE DRY PIT CENTRIFUGAL PUMPS

22 13 35 SAMPLING PUMPS

DIVISION 23- HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 05 29	HANGERS AND SUPPORTS FOR HVAC AND EQUIPMENT
23 05 48	VIBRATION AND SEISMIC CONTROL FOR HVAC PIPING AND EQUIPMENT
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	HVAC INSULATION
23 23 00	REFRIGERANT PIPING
23 31 13	DUCTWORK
23 34 16	HVAC FANS
23 37 13	DIFFUSERS, REGISTERS, AND GRILLES
23 62 00	PACKAGED COMPRESSOR AND CONDENSER UNITS

DIVISION 26- ELECTRICAL

26 05 13	MEDIUM-VOTAGE CABLES
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 23	CONTROL-VOLTAGE ELECTRICAL POWER CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 05 36	CABLE TRAYS FOR ELECTRICAL SYSTEMS
26 05 43	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
26 05 44	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAY AND CABLING
26 05 48	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
26 05 53	IDENTIFICATIONS FOR ELECTRICAL SYSTEMS
26 22 00	LOW-VOLTAGE TRANSFORMERS
26 24 16	PANELBOARDS
26 24 19	MOTOR-CONTROL CENTERS
26 27 26	WIRING DEVICES
26 28 13	FUSES
26 28 16	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 29 13	ENCLOSED CONTROLLERS
26 29 23	VARIABLE-FREQUENCY MOTOR CONTROLLERS
26 31 00	PHOTOVOLTAIC ENERGY EQUIPMENT
26 32 13	ENGINE GENERATORS
26 36 00	TRANSFER SWITCHES

26 41 13 LIGHTING PROTECTION FOR STRUCTURES

26 51 00 INTERIOR LIGHTING

26 56 00 EXTERIOR LIGHTING

DICISION 28- ELECTRONIC SAFETY AND SECURITY

28 31 11 DIGITAL ADRESSABLE FIRE-ALARM SYSTEM

DIVISION 31- EARTHWORKS

31 11 00 CLEARING AND GRUBBING

31 13 00 SELECTED TREE AND SHRUB REMOVAL

31 22 00 GRADING

31 23 00 EXCAVATION AND FILL

31 23 00 EXCAVATION AND DISPOSAL OF CONTAMINATED SOILS

31 23 16 TRENCHING FOR SITE UTILITIES

31 23 19 DEWATERING

31 25 00 EROSION AND SEDIMENTATIONS CONTROLS

DIVISION 32- EXTERIOR IMPROVEMENTS

32 11 23 AGGREGATES BASE COURSES

32 12 16 ASPHALT PAVING

32 13 13 CONCRETE PAVING

32 16 00 CURB AND GUTTERS

32 31 13 CHAIN LINK FENCES AND GATES

32 91 13 SOIL PREPARATION

32 92 19 SEEDING

32 93 00 TREES, SHRUBS, AND GROUND COVER

DIVISION 33- UTILITIES

33 01 10.60 DESINFECTION OF WATER SYSTEMS

33 05 13 MANHOLES AND STRUCTURES

33 11 00 WATER UTILITY DISTRIBUTION PIPING

33 19 26 ULTRASONIC WATER METERS

DIVISION 34- TRANSPORTATION

34 71 00 TRAFFIC REGULATION

DIVISION 35- WATERWAY AND MARINE CONSTRUCTION

35 22 26 SLUICE GATES

DIVISION 40- PROCESS INTERCONNECTIONS

40 05 57	ELECTRIC OPERATORS
40 05 65	VALVES AND OPERATORS
40 05 19	PIPING AND FITTINGS
40 69 01	PACKAGE CONTROL SYSTEMS
40 69 01-C	CONDUIT SCHEDULE
40 69 01-I	INSTRUMENT INDEX
40 69 04	FUNCTIONAL REQUIREMENTS

DIVISION 43- GAS AND LIQUID STORAGE

43 41 45	FIBERGLASS REINFORCED PLASTIC (FRP) TANKS
----------	---

DIVISION 46- WATER AND WASTEWATER EQUIPMENT

46 31 11	CHLORINE SYSTEM
46 33 43	METERING PUMPS AND APPURTENANCES
46 41 11	RAPID MIXER
46 41 80	FIBERGLASS REINFORCED PLASTIC BAFFLES AND WEIRS
46 61 10	UNDERDRAIN REHABILITATION
46 61 13	FILTER MEDIA
46 61 17	AIR SCOURING SYSTEM

End of Table of Contents

DIVISION 01 GENERAL REQUIREMENTS

SECTION 01 10 00

SUMMARY OF WORK

PART 1 – GENERAL

1.1 GENERAL INFORMATION

The Former Naval Station Roosevelt Roads (NSRR) drinking water system is composed of a raw water pipe incoming from the Río Blanco, Naguabo, a raw water reservoir and a Water Filtration Plant (WFP). The WFP system components are showing signs of deterioration. These signs are mostly noticed in metal elements and mechanical equipment of continuous use like pumps systems, instrumentation and corrosion presented in catwalks, valves leakage, pipes, and chlorine gas cylinders, among others. Also, the power and Controls & Instrumentation (C&I) components and wirings shall be replaced to include up-to-date technology that will comply with current standards, reduce power consumption and increase treatment reliability. It is also intended to provide the best available technology in order to comply with the USEPA Surface Water Treatment Rule (SWTR), Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) and if applicable Long Term 2 Enhanced Surface Water Treatment Rule (LT2). SWTR objective is to protect pathogens like viruses, Legionella, and Giardia lamblia entering the distribution system, LT1 ESWTR was established to establish additional treatment requirement to prevent pathogens, specifically the protozoan Cryptosporidium, in drinking water, and address risk trade-offs with disinfection byproducts and LT2 is the last of the requirements which requires certain systems to provide additional treatment barriers based on the risk presented by the source water body.

1.2 WORK ACTIVITIES

- A. This section is a just a general outline of some of the construction activities to be performed at the Roosevelt Roads Water Filtration Plant. However, Contractor shall refer to the construction drawings and detailed technical specs for all the work activities. There are also construction activities at the Raw Water Intake, Raw Water Meter Vault, Raw Water Reservoir, Storage Tank 86, Sludge Lagoons, Backwash Tank and the Water Distribution System.

Demolition Works:

- 1. Influent Raw Water Pipe
 - a. Remove control valves
- 2. Flash Mixing Basin
 - a. Removal of all the air piping, old mixing system and supporting elements.
 - b. Removal of all handrails.
 - c. Removal of old air mixing blowers located at the plant's basement.
- 3. Flocculation basins
 - a. Remove all slide gates.
 - b. Remove all Draining valves.
 - c. Remove all handrails.
- 4. Sedimentation basins
 - a. Remove all stop plates
 - b. Remove all draining valves
 - c. Demolish part of the existing weirs.

- d. These tasks shall be done in coordination with owner and engineer to minimize impacts to the treatment process.
 - e. Removal of all handrails.
5. Filters
- a. Removal of all filters' media: this task shall be done in coordination with owner and engineer to minimize impacts to the treatment process. Contractor shall not start work on additional filters until the impacted filter is completed, disinfected and operating. Contractor shall be responsible for the disinfection of each filter, according to DOH standards, before placing online the unit. Refer to Section 46 61 13 and drawings for specification of the new media.
 - b. Filters' bottom and shall be cleaned prior to the integrity inspection. Owner or Owner's representative will determine if the filter is clean enough to proceed with the inspection.
 - c. Removal of all instruments, actuators and valves on filters' pipes and backwash pipes, refer to construction drawings for details.
 - d. Removal of surface washer of all filters (4) and its segment in the basement of the plant.
 - e. Removal of all handrails.
 - f. Removal of all filter troughs in all filters.
 - g. All the activities outlined above shall be performed as per construction drawings and individual technical specifications.
6. Backwash Pumps
- a. Removal of existing backwash pump located at the plant's basement.
7. Clearwell
- a. Removal of existing clearwell's inside access ladders.
 - b. Removal of access hatches.
8. Chemical Storage and Injection area
- a. Removal of existing metering Pumps on both the alum and caustic soda area.
9. Chlorine Storage and Injection Area
- a. Removal of existing old 1-Ton cylinder weight scale and all existing chlorine application system.
 - b. Removal of existing chlorine injection system.

Site Work:

- 1. Install temporary erosion control and develop a CEST Plan
- 2. Install new fences
- 3.

Architectural & Structural

- 1. Replace doors and windows
- 2. New surface paint
- 3. New restrooms
- 4. Rails replacement
- 5. Structural Repairs

Electrical

- 1. Replace all electrical systems
- 2. New Electrical Room

HVAC

- 3. Replace all air conditioner and exhaust fan units

4. New Electrical Room

New Construction:

1. Construction of concrete slab for new air scouring blowers.
2. Construction of new pipe supports for the air scouring piping.

Influent Raw Water 20in Ø pipe

1. Replacement of influent control valve.
2. Installation of new instruments and injection ports.
3. Replacements of valves.
4. All the activities outlined above shall be performed as per construction drawings and individual technical specifications.

Flash Mixing Basin

1. Installation of a new Rapid Mixer.
2. Installation of a new sampling pump.

Flocculation Basins

1. Installation of new slide gates (4).
2. Installation of new draining gate valves (2).

Sedimentation Basins

1. Installation of new slide gates (10).
2. Installation of new draining gate valve (4).
3. Installation of new effluent channels and weirs.

Filters

1. Inspection of filters' bottom (4).
2. Overhaul of filters' bottom (4).
3. Installation of air scouring diffusers (4).
4. Installation of new blowers (2).
5. Installation of Ceramic Spheres
6. Installation of filter media (4).
7. Installation of all electrical actuators and valves as per construction drawings.
8. Installation of instruments as per construction drawings and individual technical specifications.

Clearwell

1. Installation of access ladder inside the clearwell, Access ladder shall be stainless steel, non-slip and shall include a grab bar from the top of the access hatch. Also, a new access cover shall be provided.
2. Installation of new baffling system inside the clearwell as per construction drawings and specifications.
3. Construction of a new concrete wall inside the clearwell as per construction drawings and individual specifications.
4. Installation of instruments as per construction drawings and individual technical specifications.

Chemical Injection Skids

1. Installation of new Alum Injection Skid.
2. Installation of new Caustic Soda Injection Skid.
3. Installation of new Chlorine Injection System.

Control System Work:

1. Installation of new Control system for the entire plant.

1.3 GENERAL CONSTRUCTION PROGRAM

This construction program is prepared to organize the construction sequence in such a way that the construction activities will cause the least impact to the treatment processes. It will be necessary for the Contractor at his own cost provide temporary bypasses between treatment processes. With the above retrofit construction criteria, the following general construction activities are presented as a guideline (the list does not pretend to mention all construction activities) for Contractor to develop his own construction program.

Approval of the Contractor Construction Program by Owner or Owner's representative is mandatory before starting construction activities. The Contractor Construction Program shall be presented to the Engineer for approval at least one week before construction startup date.

1. Units to be impacted:

- Raw water influent pipe.
- Flash mixing tank
- Flocculation Basins
- Sedimentation Basin
- Filters
- Filters' valves
- Backwash pumps
- Instrumentation
- Chemical Injection System
- Chemical Storage area
- Chlorine Injection system
- Chlorine Storage Area.
- Clearwell

2. Construction activities that can occur without impacting the present process:

- Removal and replacement of handrails.
- Installation of new blowers.
- Installation of new backwash pumps.

3. Construction activities that needs to be coordinated in advance with Plant Operator:

- Shutdown of any of the treatment units in operation.

4. Construction activities that will impact treatment plant process:

- Removal and replacement of filter media.
- Removal and replacement of filters' valves.
- Installation of the new air scouring diffuser of filters.
- Installation of a new rapid mixer.
- Replacement of valves on raw water influent pipe.
- Installation of baffle in clearwell.
- Installation of effluent channel and weirs in both sedimentation basins.
- Replacement of draining valves of:
 - i. Flash mixing tank, flocculation chambers, influent channel of sedimentation basins, sedimentation basins.
- Removal of air mixing diffusers in existing flash mixing tank.
- Installation of new slide gates.

5. Important landmarks during the retrofit:

- Startup of Filter underdrain and Backwash System.
- Instruments and Controls Integration.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Product Substitution Procedures.

1.2 GENERAL

- A. Definition: Proposal by Contractor Construction Manager to use manufacturer, product, material, or system different from one required in Contract Documents.
- B. Do not substitute Products unless a substitution request has been approved by Engineer.
- C. In case of non-availability of a specified Product notify Engineer in writing as soon as non-availability becomes apparent.

1.3 SUBSTITUTION REQUESTS

- A. Submit substitution requests on copy of form bound into Project Manual.
- B. Document specified product and proposed substitution with complete data, including:
 - 1. Product identification, including name and address of manufacturer.
 - 2. Product description, performance and test data, and reference standards.
 - 3. Sample, if requested.
 - 4. Description of any anticipated effect that acceptance of proposed substitution will have on Progress Schedule, construction methods, or other items of Work.
 - 5. Description of any differences between specified product and proposed substitution.
 - 6. Difference in cost between specified product and proposed substitution.
- C. A request constitutes a representation that the Contractor:
 - 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
 - 2. Will provide the same warranty for the substitution as for the specified Product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
- D. Substitutions will not be considered if:
 - 1. They are indicated or implied on Shop Drawings or other submittals without submittal of a substitution request.
 - 2. Approval will require substantial revision of Contract Documents without additional compensation to Engineer.
- E. Engineer will notify Contractor of approval or rejection of each Substitution Request.
- F. As a firm date of delivery, not measured from approval of drawings to date of shipping. For this purpose, the time taken by the Owner or Owner's representative to process data may be taken as not exceeding 14 calendar days. The Owner or Owner's representative does not assume responsibility for correctness or completeness of the data, however.
- G. b. The Contractor should determine that proposed delivery dates will not cause delay of result in failure to complete the project on time.
- H. c. No extension of time or waiver of liquidated damages will be granted due to failure to deliver on time.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

DOCUMENT 01 25 19
SUBSTITUTION REQUEST FORM

DATE: _____

TO: _____

ATTENTION: _____

PROJECT: _____

We submit for your consideration the following product as a substitution for the specified product:

Section No.	Paragraph	Specified Product
-------------	-----------	-------------------

_____	_____	_____
-------	-------	-------

Proposed Substitution: _____

Reason for Substitution: _____

Product Data:

Attach complete technical data for both the specified product and the proposed substitution. Include information on changes to Contract Documents that the proposed substitution will require for its proper installation.

Samples:

☐ Attached ☐ Will be furnished upon request

Does the substitution affect dimensions shown on Drawings?

☐ No ☐ Yes (explain) _____

Effects of proposed substitution on other Work:

Differences between proposed substitution and specified Product:

Manufacturer's warranties of the proposed substitution are:

☐ Same ☐ Different (explain) _____

Maintenance service and spare parts are available for proposed substitution from:

Previous installations where proposed substitution may be seen:

Project: _____	Project: _____
Owner: _____	Owner: _____
Architect: _____	Architect: _____
Date Installed: _____	Date Installed: _____

Cost savings to be realized by Owner, if proposed substitution is approved:

Change to Contract Time, if proposed substitution is approved:

☐ No Change ☐ Add _____ days ☐ Deduct _____ days

Submittal constitutes a representation that Contractor has read and agrees to the provisions of Section 01 2500.

Submitted by Contractor:

Signature

Firm

For Use by Architect:

Based on the information supplied by the Contractor, the Architect has reviewed the proposed substitution on the basis of design concept of the Work and conformance with information given in Contract Documents.

☐ Approved ☐ Approved as Noted ☐ Rejected

Submit Additional Information: _____

By: _____ Date: _____

SECTION 01 32 19 SUBMITTALS

PART 1 GENERAL

1.1 REQUIREMENTS

A. Product Submittals and Shop Drawings:

1. Submit shop drawings, product data and samples for all equipment, material and products.
2. Shop drawings, product data and samples are not considered a part of contract documents.
3. Review of shop drawings by the Engineer will not relieve the Contractor of the responsibility from meeting contract requirements as defined by the Contract Documents.

B. Operation and Maintenance Submittals: Operation and Maintenance data shall be submitted for each piece of equipment installed as specified in Section 01 78 23 - Operation and Maintenance Data.

1.2 TYPES OF PRODUCT AND SHOP DRAWING SUBMITTAL DATA

A. As applicable, the following types of data are required:

1. Fabrication and Erection (or Placement). Dimensioned drawings lists and schedules.
2. Catalog sheets.
3. Specification Sheets
4. Certifications.
5. Laboratory, shop or mill test reports.
6. Basis of design and design calculations, test procedures and related information as required per various sections of these specifications.
7. Anchor bolt layouts.
8. Lifting device drawings.
9. Experience and facilities brochures.
10. Samples
11. Parts list.
12. Recommended normal wear and tear spare parts for one year of operation.
13. Short- and long-term maintenance procedures.
14. Shipping procedures and details of ocean container.

15. Short- and long-term storage procedures.
16. Operation and Maintenance manuals.

1.3 INFORMATION TO BE INCLUDED IN PRODUCT SUBMITTALS AND SHOP DRAWINGS

A. All data needed to determine the following facts shall be submitted.

1. Conformance to specifications, including: kind, type, size, arrangement, finishes, and operation of component materials, and devices.
2. Conformance to plans, including dimensions, orientation, appearance, external connections and anchorages, installation clearances.
3. Specific purpose or design conditions, and adequacy to meet same: weights, dynamic loads, supports required, operating characteristics.
4. Coordination with other work, including items needed by this trade, but furnished by others and information needed by others to perform their part.
5. Exceptions to or deviations from specified requirements, if any, and reasons for same. Mark deviations in a separate color in submittals.
6. Delivery Date:
 - a. This should be stated as a firm date of delivery, not measured from approval of drawings to date of shipping. For this purpose, the time taken by the Owner or Owner's representative to process data may be taken as not exceeding 14 calendar days. The Owner or Owner's representative does not assume responsibility for correctness or completeness of the data, however.
 - b. The Contractor should determine that proposed delivery dates will not cause delay of result in failure to complete the project on time.
 - c. No extension of time or waiver of liquidated damages will be granted due to failure to deliver on time.
7. All submittal data shall be written in English. All dimensions and units shall be in accordance with the following table.

Linear Measures	-	Meters
Flow rates	-	U.S. Gallons per minute
Hydraulic Head -		Meters
Mechanical Power	-	Horsepower
Electrical Power-		Kilowatt
Weight	-	Pounds
Volumes	-	U.S. Gallons
Bolt Sizes	-	Inches or fractions thereof
Stresses	-	Pounds per square inch
Forces	-	Pounds, Kips

PART 2 PRODUCTS - NOT APPLICABLE

PART 3 EXECUTION

3.1 PREPARATION OF SUBMITTALS

A. Shop Drawings:

1. Preparation by a qualified detailer is required.
2. Identify details by reference to sheet, detail numbers, and specification section, schedule or room numbers as shown on the contract drawings.
3. Include on the drawing all information required for submission or submit transmittal letter containing required information.
4. Submit the number of copies which is specified in Paragraph 3.3 of this section.

B. Product Data:

1. Modify the manufacturer's standard schematic drawings to delete or supplement information as applicable.
2. For manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other descriptive data:
 - a. Clearly mark each copy to identify pertinent materials, products or models.
 - b. Show dimensions and clearances required.
 - c. Show performance characteristics and capacities.
 - d. Show wiring diagrams and controls.
3. Include on the data all information required for submission or submit transmittal letter containing required information.

C. Submission Requirements:

1. Accompany submittals with a transmittal letter in duplicate.
2. Include the following information for each submittal:
 - a. Date and revision dates.
 - b. Project title and number.
 - c. The names of:
 - 1) Engineer.
 - 2) Supplier.
 - 3) Contractor.
 - d. Identification of product or material.
 - e. Relation to adjacent structure or materials,
 - f. Field dimensions clearly identified as such.

- g. Specification section number.
 - h. Applicable standards, such as ASTM Number or Federal Specification.
 - i. A blank space on each shop drawing, approximately 5" x 5", for the Engineer's stamp.
 - j. Identification of deviations from contract documents.
 - k. Contractor's stamp with his signature signed, certifying that he has reviewed the submittal, verified field measurements and that the submittal complies with all requirements of the contract documents.
 - l. List each deviation from contract requirements and a discussion of the reason for each.
 - m. List each deviation from applicable codes and standards and a discussion of the reason for each.
3. Submit all required shop drawings, product data and samples for the following work at one time. Suitably organize and index 8-1/2" x 11", 11" x 17" and other compatibly sized materials in the 3-ring binder. Larger shop drawings may be submitted together either rolled or folded. Include an index.

3.2 ROUTING OF SUBMITTALS

- A. Submittal data and routine correspondence should be routed as follows:
- 1. Supplier (or subcontractor) to Contractor (through representative if applicable) for review process.
 - 2. Contractor to Engineer for review and approval or comment.
 - 3. Engineer to Contractor for further comment and distribution.
 - 4. Contractor to Supplier and Contract Manager (or subcontractor).

3.3 NUMBER OF COPIES REQUIRED

- A. The Supplier shall submit all of the required number of copies in the original submittal. The number of copies required is:

Contractor	2
Engineer's File	1
Contract Manager's Copies	1
Client's Engineer Copy	<u>2</u>
Total (Minimum)	6

3.4 DISPOSITION OF SUBMITTALS

- A. The Engineer will first review the submittal contents for completeness and compliance with this section. Incomplete submittals or submittals made not in accordance with the requirements of this section will be returned without any further review.

- B. After review, the Engineer shall mark each item with one of the following:
 - 1. No exceptions taken - Furnish item as submitted.
 - 2. Make corrections - Furnish item with changes as noted.
 - 3. Amend and Resubmit - Revise and resubmit to incorporate Engineer's comments.
 - 4. Rejected - Item is not acceptable, resubmit alternative item conforming to the project requirements.
- C. Contractor will distribute reviewed copies as noted in paragraph 3.3 - Number of Copies Required.

3.5 RE-SUBMISSION REQUIREMENTS

- A. Shop Drawings:
 - 1. Revise initial drawings as required and re-submit as specified for initial submittal.
 - 2. Indicate on drawings any changes which have been made, including those requested by the Engineer.
- B. Product Data and Samples: Submit new data and samples as required for initial submission.

3.6 REPETITIVE REVIEW

- A. Submittals for each item will be reviewed not more than three times at the Engineer's expense. All subsequent reviews will be performed at the Contractor's expense, based on the Engineer's then prevailing rates.
- B. The need for more than one resubmission or any other delay in obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time.

3.7 ENGINEER DUTIES

- A. The submittal schedule shall allow sufficient time for the Engineer to adequately complete his review. A minimum of 14 calendar days shall be allotted for the review of each submittal. Allow more time for large, voluminous, or complex submittals. The supplier assumes all responsibility for delays due to incomplete or incorrect submission.
- B. Affix stamp and signature, and indicate results of his review as specified in paragraph 3.4. Review of submittals shall not constitute approval of any deviation from the requirements of these specifications and plans unless those deviations are clearly noted on the submittal as specified in Paragraph 3.1.
- C. Return submittals to Contractor for distribution.

END OF SECTION

SECTION 01 43 33 MANUFACTURERS' SERVICES

PART 1 GENERAL

1.1 DEFINITIONS

- A. Person-Day: One person for a minimum of 8 hours on site within regular CONTRACTOR working hours.

1.2 SUBMITTALS

- A. Training Schedule: Submit not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
- B. Lesson Plan: Submit proposed lesson plan not less than 5 days prior to scheduled training and revise as necessary for acceptance.

1.3 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the manufacturer, factory trained and experienced in the technical applications, installation, operation and maintenance of respective equipment, subsystem or system. Additional qualifications may be specified elsewhere.
- B. Representative(s) subject to acceptance by OWNER OR ITS REPRESENTATIVE. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

- A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this Section.
- B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services or when a minimum time is not specified, the time required to perform the specified services shall be considered incidental.
- C. Schedule manufacturer's services to avoid conflicting with other onsite testing or other manufacturer's onsite services.
- D. Determine that all conditions necessary to allow successful testing have been met before scheduling services.
- E. Only those days of service approved by Owner or Owner's Representative will be credited to fulfill the specified minimum services.
- F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem or component) installation to include observation, guidance, instruction of CONTRACTOR's assembly, erection, installation or application procedures.
2. Inspection, checking and adjustment as required for product (system, subsystem or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Revisiting the site as required to correct problems until installation and operation are acceptable to Owner or Owner's Representative.
4. Resolution of assembly or installation problems attributable to or associated with, respective manufacturer's products and systems.
5. Assistance during functional and performance testing and facility startup and evaluation.
6. Training of OWNER's personnel in the operation and maintenance of respective product as required.
7. Additional requirements as may be specified.

3.2 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

- A. When specified in individual Specification sections or where products are specified to a recognized standard or code, submit prior to shipment of product or material to the site.
- B. Owner or Owner's Representative may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.
- C. Signed by product manufacturer certifying that materials, manufacture and product specified conforms to or exceeds specified requirements and intent for which product will be used. Submit supporting reference data, affidavits and certifications as appropriate.
- D. May reflect recent or previous test results on material or product, but must be acceptable to the Owner or Owner's Representative.

3.3 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

- A. Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by the equipment manufacturer's representative.
- B. Such form shall certify that the signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve and operate their equipment and is authorized to make recommendations required to assure that the equipment is complete and operational.

3.4 TRAINING

- A. General:
 1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.
 2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner or Owner's Representative and familiar with operation and maintenance manual

information specified in Section 01 78 23, OPERATION AND MAINTENANCE DATA.

3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:

1. List specified equipment and systems that require training services and show:
 - a. Respective manufacturer.
 - b. Estimated dates for installation completion.
 - c. Estimated training dates.
2. Allow for multiple sessions when several shifts are involved.
3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner or Owner's Representative, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
4. Coordinate with Sections 01 75 17, EQUIPMENT TESTING & FACILITY STARTUP.

C. Lesson Plan: When specified, prepare for each required course, containing the following minimum information:

1. Title and objectives.
2. Recommended attendees (e.g., managers, engineers, operators, maintenance).
3. Course description and outline of course content.
4. Format (e.g., lecture, self-study, demonstration, hands-on).
5. Instruction materials and equipment requirements.
6. Resumes of instructor(s) providing the training.

D. Pre-startup Training:

1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives and with submission of operation and maintenance manuals in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA.
2. Complete at least 14 days prior to beginning of facility startup.

E. Post-Startup Training: If required by Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

3.5 SUPPLEMENTS

A. The supplements listed below, following "END OF SECTION", are part of this Specification.

1. Forms: Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- ☐ Installed in accordance with Manufacturer's recommendations.
- ☐ Inspected, checked and adjusted.
- ☐ Serviced with proper initial lubricants.
- ☐ Electrical and mechanical connections meet quality and safety standards.
- ☐ All applicable safety equipment has been properly installed.
- ☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Comments: _____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve and operate their equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20____

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary utilities.
 - 2. Field offices and sheds.
 - 3. Temporary controls.
 - 4. Protection of installed Work.
 - 5. Security.
 - 6. Progress cleaning.
 - 7. Water, erosion, sediment, dust, and mold and mildew control.
 - 8. Access roads and parking areas.
 - 9. Removal.

1.2 REFERENCES

- A. Green Seal, Inc. (GS) 37 - Environmental Standard for Industrial and Institutional Cleaners.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cleaning Materials: Use only materials that:
 - 1. Comply with GS 37.
 - 2. Are not potentially hazardous to health or property.
 - 3. Do not contain hazardous ingredients.
 - 4. Are non-carcinogenic.
 - 5. Are non or mildly irritating to skin, eyes, and mucous membranes.
 - 6. Have an LD50 rating above 5 grams per kilogram.
 - 7. Are non-reactive.
 - 8. Contain minimum fragrance and dye.
 - 9. Do not require respiratory protection.

PART 3 EXECUTION

3.1 TEMPORARY ELECTRICITY

- A. Provide temporary electrical service of capacity and characteristics required for construction.
- B. Any power obtained from the owner facilities, will be charged to the Contractor by the Owner. The contractor shall install a sub-metering system for the owner to prepare a monthly bill with a rate not higher than current PR Electric Power Authority per kw/hr.
- C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

- D. Maintain distribution system and provide routine repairs.

3.2 TEMPORARY LIGHTING

- A. Provide temporary lighting for construction and security purposes.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lamps and provide routine repairs.
- D. Provide portable lights when required to provide minimum lighting levels necessary for specific work.

3.3 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.
- B. Provide temporary fan units as required to maintain clean air for construction.

3.4 TEMPORARY COMMUNICATIONS

- A. Contractor shall be accessible during normal business hours via mobile telephone with voice mail or an answering service.
- B. Provide temporary internet (Wi-Fi) service.

3.5 TEMPORARY WATER

- A. Provide temporary water required for construction.
- B. Any potable water obtained from the owner facilities, will be charged to the Contractor by the Owner. The contractor shall install a sub-metering system for the owner to prepare a monthly bill with a rate not higher than current PR Aqueduct and Sewer Authority per cubic meter.
- C. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.
- D. Maintain distribution system and provide routine repairs.

3.6 TEMPORARY SANITARY FACILITIES

- A. Provide chemical toilets for use during construction.
- B. Permanent toilets may not be used during construction.
- C. Maintain facilities in clean and sanitary condition.

3.7 FIELD OFFICES AND SHEDS

- A. Provide temporary field offices and storage sheds required for construction.
- B. Provide temporary field offices for owner resident inspection.
- C. Do not unreasonably encumber site or premises with excess materials or equipment.
- D. Temporary Structures:
 - 1. Portable or mobile buildings, structurally sound, weathertight, with floors raised above ground.
 - 2. Temperature transmission resistance: Compatible with occupancy and storage requirements.
 - 3. Provide connections for utility services when required.
 - 4. Provide steps and landings at entrances.
- E. Field Offices:
 - 1. Size required for Contractor's use and to provide space for project meetings.
 - 2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
 - 3. Provide facilities for storage of Project Record Documents.
 - 4. Provide thermometer mounted at convenient outside location, not in direct sunlight.
 - 5. Provide separate office trailer for Owner Resident Inspection equip with:
 - a. Restroom (with maintenance products)
 - b. Conference Table with 6 chairs.
 - c. Desk and chair.
 - d. 2-drawer filing cabinet.
 - e. Drawing hanging rack.
 - f. Internet Wi-Fi Connection
 - g. Air conditioning.
 - h. Mini-fridge
 - i. Microwave
 - j. Copier & Scanner machine (with paper and toner, ink jet products)
 - k. Pole mounted Weather Station (Ambient Weather WS-2902A or similar)
 - l. Provide maintenance (cleaning) of the office trailer

3.8 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas and to protect adjacent properties from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public right-of-ways and for public access to existing facilities.
- C. Fencing:
 - 1. Provide temporary fencing for construction operations.
 - 2. Construction: Contractor's option.
 - 3. Height: 6 feet.
 - 4. Locate to protect construction operations, materials, and equipment.
 - 5. Provide vehicular gates.
- D. Tree and Plant Protection:
 - 1. Protect existing trees and plants at site that are designated to remain.
 - 2. Employ qualified tree surgeon to Remove roots and branches that interfere with construction.
 - 3. Do not permit vehicular traffic, parking, storage of materials, dumping of harmful chemicals or liquids, or standing or continuously running water within root zones.
 - 4. Supervise earthwork operations to prevent damage to root zones.

5. Replace trees and plants that are damaged or destroyed due to construction operations.

3.9 EXTERIOR CLOSURES

- A. Provide temporary weathertight closures for exterior openings to provide acceptable interior working conditions, to allow for temporary heating and maintenance of ambient temperatures required in individual specification sections, to protect the Work, and to prevent entry of unauthorized persons.
- B. Provide access doors with locking hardware.

3.10 PROTECTION OF INSTALLED WORK

- A. Protect installed work from construction operations; provide special protection when required in individual specification sections.
- B. Minimize traffic, storage, and construction activities on roof surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from roofing manufacturer.
- C. Prohibit traffic from landscaped areas.

3.11 SECURITY

- A. Provide a project security program, to:
 1. Protect the Work, stored products, and construction equipment from theft and vandalism.
 2. Prevent entry by unauthorized persons.

3.12 PROGRESS CLEANING

- A. Maintain areas free from waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.
- C. Periodically clean interior areas to provide suitable conditions for finish work.

3.13 TEMPORARY CONTROLS

- A. Water Control:
 1. Grade site to drain. Prevent puddling water.
 2. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
 3. Provide water barriers to protect site from soil erosion.
- B. Erosion and Sediment Control:
 1. Plan and execute methods to control surface drainage from cuts, fills, borrow areas, and waste disposal areas. Prevent erosion and sedimentation.
 2. Minimize amount of bare soil exposed at any one time.
 3. Provide temporary measures such as silt fences, dikes, berms, settlement basins, and drainage systems to prevent water flow and sedimentation.

4. Periodically inspect earthwork to detect erosion and sedimentation; promptly employ corrective measures.
- C. Dust Control:
1. Provide dust control materials and methods to minimize dust from construction operations.
 2. Prevent dust from dispersing into atmosphere.
- D. Mold and Mildew Control:
1. Provide continuous measures to prevent formation of mold and mildew in construction.
 2. Do not install materials sensitive to mold and mildew growth until protection can be provided.
 3. Promptly remove and replace materials exhibiting mold and mildew growth.

3.14 ACCESS ROADS AND PARKING AREAS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction needs.
- B. Existing roads designated by Owner may be used for construction purposes. Do not allow heavy vehicles or construction equipment in parking areas.
- C. Provide for access by emergency vehicles.
- D. Keep fire hydrants and water control valves free from obstruction and accessible for use.
- E. Provide parking facilities for construction personnel. When parking needs exceed on site capacity, provide additional off site facilities.
- F. Maintain existing construction, and restore to original or specified condition at completion of Work.

3.15 REMOVAL

- A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.
- B. Remove foundations and underground installations; grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore permanent facilities used during construction to original or to specified condition.

END OF SECTION

SECTION 01 58 00

PROJECT IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project identification sign.
 - 2. Temporary Construction for Rural Development Sign Format document
 - 3. Maintenance and removal.

1.2 QUALITY ASSURANCE

- A. Project Sign:
 - 1. Finishes, Printing or Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.
- B. Temporary Construction Sign for Rural Development Projects:
 - 1. Finishes, Printing or Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.
 - 2. Must have the same format and components as the Temporary Construction for Rural Development Sign Format document (see attached document as part of this technical specification section).
- C. Do not erect other signs at site without Owner's approval, except those required by governing authorities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Structure and Framing: New lumber or galvanized steel, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, nominally 3/4 inch thick, standard large sizes to minimize joints. Size 16'x8'.
- C. Rough Hardware: Galvanized steel or aluminum.
- D. Paints: Alkyd or Latex type, printing tint, exterior quality, gloss, semigloss or satin sheen.

2.2 FABRICATION

- A. Provide two (2) signs.
 - 1. Bottom edge of sign: 6 feet above ground.
 - 2. Content:
 - a. Project title and logos.

- b. Owner's name.
- c. Names and titles of Architect and Consultants.
- d. Name of Contractor.
- 3. Graphic design, colors, and lettering style: As designated by Owner.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Erect at designated location.
- B. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- C. Install sign surface plumb and level, with butt joints. Anchor securely.
- D. Paint exposed surfaces of sign, supports, and framing.

3.2 MAINTENANCE

- A. Maintain signs and supports clean. Repair deterioration and damage.

3.3 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Construction waste management goals, plan, and records.

1.2 WASTE MANAGEMENT GOALS

- A. Reuse, salvage, or recycle non-hazardous waste materials.
- B. Minimize waste sent to landfills.
- C. Prioritize non-hazardous construction waste management in following order:
 - 1. Reduce amount of waste generated.
 - 2. Reuse material through on-site reuse or off-site salvaging, including sale or donation.
 - 3. Recycle material including diverting materials for secondary uses whenever economically feasible.
 - 4. Dispose of materials with no practical use or economic benefit at landfill.
- D. Divert minimum 75 percent of construction waste by weight (in tons) or volume (in cubic yards) from landfills and incinerators.
- E. Comply with Autoridad de Desperdicios Solidos (ADS) requirements for construction projects,
- F. Calculations may be performed using weight or volume but must be consistent throughout Project.

1.3 WASTE MANAGEMENT

- A. Pro-actively manage construction and demolition waste:
 - 1. Practice efficient waste management when sizing, cutting, and installing products.
 - 2. Use all reasonable means to divert construction and demolition waste from landfills, and to facilitate recycling and reuse.
 - 3. Return unused products and overages to supplier, or donate to non-profit group.
 - 4. Carefully install products; avoid removal of ill-timed and poorly installed products.
 - 5. Use centralized cutting areas to facilitate waste collection.
 - 6. Deliver, store, and handle products to prevent damage.
- B. Require subcontractors and suppliers to participate in waste management efforts.
- C. Construction waste includes:
 - 1. Products from demolition and removal, excluding excavated soil and land-clearing debris.
 - 2. Excess and unusable construction products.
 - 3. Packaging materials for construction products.
 - 4. Other materials generated during construction process but not incorporated into the Work.
- D. Give consideration to:
 - 1. Availability of viable recycling markets.
 - 2. Condition of materials.
 - 3. Ability to provide material in suitable condition and in quantities acceptable to available markets.
 - 4. Time constraints imposed by internal project completion mandates.

- E. Be responsible for implementation of special programs involving rebates and similar incentives related to recycling of waste.
- F. Revenues and other savings obtained for salvage and recycling accrue to Contractor.
- G. Ensure that firms and facilities used for recycling, reuse, and disposal have legal permits for intended uses.

1.4 SUBMITTALS

- A. Waste Management Plan:
 - 1. Submit waste management plan.
 - 2. Include:
 - a. Name of individual on Contractor's staff responsible for waste prevention and management.
 - b. Actions proposed to reduce solid waste generation and achieve waste management goal.
 - c. Description of proposed methods for recycling and reuse of materials generated, including areas and equipment for processing, sorting, and temporary storage.
 - d. Estimated types and quantities of waste to be generated.
 - e. Name of landfills and incinerators to be used.
 - f. Identification of local and regional reuse programs that will accept waste materials.
 - g. List of waste materials to be salvaged for resale, salvaged and reused, or recycled. Identify recycling facilities to be used.
 - h. Identification of materials that cannot be recycled or reused, with justification.
 - 3. If required, revise and resubmit plan within ten days after receipt of comments.
 - 4. Distribute copies of approved Waste Management Plan to concerned parties.
 - 5. Update Waste Management Plan periodically through duration of Project to reflect changed conditions.
- B. Sustainable Design Record Documents:
 - 1. Maintain records to document:
 - a. Quantities of waste generated, in tons or cubic yards.
 - b. Types and quantities of materials diverted through sale, reuse, or recycling, in tons or cubic yards, and diversion location.
 - c. Quantities of waste sent to landfill or incinerator, in tons or cubic yards.
 - 2. Submit summary of waste disposal and diversion to date along with each Application for Payment.
 - 3. Submit hauling receipts or certificates for diverted and recycled materials including material description, hauler name and location, and quantity (by weight) of diverted and recycled materials.
 - 4. Deliver final summary of solid waste disposal and diversion to Architect upon completion of project.

1.5 QUALITY ASSURANCE

- A. Review and discuss waste management plan implementation and progress at Preconstruction Conference and Progress Meetings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Designate separate areas to facilitate separation of materials for potential recycling, salvage, reuse and return.
- B. Clearly identify areas and receptacles.
- C. Keep storage areas and receptacles clean and orderly; prevent contamination of materials.

- D. Monitor storage areas; correct problems and implement preventative measures.

1.7 TRAINING

- A. Provide training of waste management methods to be used at appropriate stages of Project.
- B. Require participation of all subcontractors.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 WASTE COLLECTION

- A. Provide containers and storage areas to facilitate waste management, clearly identified.
- B. Handle recyclable materials to prevent contamination by incompatible products and materials.
- C. Separate materials by:
 - 1. Placing into marked separate containers, then transporting to recycling facility.
 - 2. Placing into single container, then transporting to recycling facility for separation.

3.2 DISPOSAL

- A. Dispose of nonhazardous waste materials that cannot be reused, recycled, or salvaged at licensed landfill or incinerator.
- B. Handle, store, and dispose of hazardous wastes in accordance with applicable codes, ordinances, rules, and regulations.

END OF SECTION

SECTION 01 75 17 EQUIPMENT TESTING & FACILITY STARTUP

PART 1 GENERAL

1.1 DEFINITIONS

- A. Reference Section 01 43 33, MANUFACTURERS' SERVICES.
- B. Facility: The entire Project, or an agreed-upon acceptable portion, including all of its unit processes.
- C. Field Quality Control: The term, as used in the individual specification sections, which refers to specified on-site functional and performance testing of equipment.
- D. Functional Test: A test or tests in the presence of the Owner or Owner's representative to demonstrate that the installed equipment meets manufacturer's installation, calibration and adjustment requirements and other requirements specified including, but not limited to, noise, vibration, alignment, speed, proper electrical and mechanical connections, thrust restraint, proper rotation and initial servicing.
- E. Owner-Furnished Equipment Contractor: The party under separate contract with Owner to furnish identified equipment or systems for incorporation into this Project.
- F. Performance Test: A test performed in the presence of the Owner and/or Owner's representative and after any required functional test, to demonstrate and confirm that individual equipment meets the performance requirements specified in individual specification sections.
- G. Source Quality Control: The term, as used in the individual specification sections, which refers to specified testing performed on specified equipment at the manufacturer's facility prior to shipment.
- H. Unit process: As used in this section, a unit process is a portion of the facility that performs a specific process function, such as chlorinating.
- I. System: The overall process or a portion thereof, that performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment. Examples of systems on this Project are as follows:
 - 1. Filters' Media, Clearwell, Filters' valves.

1.2 SUBMITTALS

- A. Administrative Submittals:
 - 1. Functional and performance test schedules, test plan, procedures and log format. Submit at least 14 days prior to start of related testing.
 - 2. Facility Startup and Performance Evaluation Plan: Submit at least 21 days prior to commencement of startup.
- B. Quality Control Submittals:

1. Completed Manufacturer's Certificate of Proper Installation as required by individual specification sections.
2. Test Reports: Functional and performance testing, in format acceptable to Owner or Owner's representative.
3. Written documentation, signed by the Owner or Owner's representative, has functional and performance test for each piece of equipment tested.
4. Certification of calibration for testing equipment, when so specified.
5. Documentation of HVAC systems balancing results, when so specified.

1.3 CONTRACTOR FACILITY STARTUP RESPONSIBILITIES

A. General:

1. Perform Work for tests specified.
2. Demonstrate proper installation, adjustment, function, performance and operation of equipment, systems, control devices and required interfaces individually and in conjunction with process instrumentation and control system.

1.4 OWNER FACILITY STARTUP RESPONSIBILITIES

A. General:

1. Review Contractor's test plan and schedule.
2. Witness each functional or performance test.
3. Coordinate other plant operations, if necessary, to facilitate Contractor's tests.
4. Provide water, power, chemicals and other items as required for testing, unless otherwise indicated.
5. Assist Contractor in developing a Facility Startup and Performance Evaluation Plan detailing step-by-step instructions for startup of each unit process and the complete facility.

B. Startup Test Period:

1. Operate process units and devices, with support of Contractor.
2. Provide sampling, labor and materials as required and provide laboratory analyses.
3. Furnish manufacturer's representative(s) for assistance during testing on Owner or Owner's representative-furnished equipment.
4. Make available spare parts and special tools and operation and maintenance information for Owner or Owner's representative -furnished equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TESTING PREPARATION

A. General:

1. Complete Work associated with the unit and related processes before testing, including related manufacturer's representative services.

2. Furnish qualified manufacturer's representatives when required to assist in testing.
3. Utilize the Manufacturer's Certificate of Proper Installation Form from Section 01 43 33, Manufacturers' Services, supplemented as necessary, to document functional and performance procedures, results, problems and conclusions.
4. Schedule and attend pretest (functional and performance) meetings related to test schedule, plan of test, materials, chemicals and liquids required, facilities' operations interface, Owner's Representative and Owner involvement.
5. Designate and furnish one or more persons to be responsible for coordinating and expediting Contractor's facility startup duties. The person or persons shall be present during facility startup meetings and shall be available at all times during the facility startup period.
6. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required to conduct testing.
7. Provide written documentation, on Contractor's form, of functional and performance test results for each piece of equipment tested. Provide space on form for Owner or Owner's representative signature that testing is complete.

B. Cleaning and Checking: Prior to starting functional testing:

1. Calibrate testing equipment in accordance with manufacturer's instructions for accurate results.
2. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.
3. Lubricate equipment in accordance with manufacturer's instructions.
4. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
5. Open and close valves by hand and operate other devices to check for binding, interference or improper functioning.
6. Check power supply to electric-powered equipment for correct voltage.
7. Adjust clearances and torques.
8. Test piping for leaks.
9. Balance HVAC systems, measuring airflow (cfm) static pressure and component pressure losses. Furnish typed report documenting results of balancing.
10. Obtain completion of applicable portions of Manufacturer's Certificate of Proper Installation in accordance with Section 01 43 33, Manufacturers' Services.

C. Ready-to-test determination will be by Owner or Owner's representative based at least on the following:

1. Notification by CONTRACTOR of equipment and system readiness for testing.
2. Acceptable testing plan.
3. Acceptable Operation and Maintenance Manuals.
4. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
5. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested, including items to be furnished by Owner or Owner's representative.
6. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment and satisfactory fulfillment of other specified manufacturers' responsibilities. Equipment and electrical tagging complete.
7. All spare parts and special tools delivered to OWNER.

3.2 FUNCTIONAL TESTING—GENERAL

- A. Conduct as specified in individual specification sections.
- B. Begin testing at a time mutually agreed upon by the Owner and Owner's representative and Contractor.
- C. Owner and Owner's representative will be present during test. Notify in writing Owner, Owner's representative and manufacturer's representative(s) at least 10 days prior to scheduled date of functional tests.
- D. Separate items of equipment demonstrated to function properly during subsystem testing might require no further functional test if documentation of subsystem testing is acceptable to Owner and Owner's representative.
- E. Conduct functional tests as specified for each equipment item or system.
- F. Demonstrate all operational features and instrumentation and control functions while in automatic mode.
- G. If, in Owner and Owner's representative's opinion, functional test results do not meet requirements specified, the systems will be considered as nonconforming.
- H. Performance testing shall not commence until the equipment or system meets the specified functional tests.
- I. Owner-Furnished Equipment Test: The contractor furnishing the equipment will perform functional testing of this equipment. Contractor shall assist by providing access to the equipment, interfacing materials and adjustments to the installation, as required to achieve a satisfactory functional test.

3.3 PERFORMANCE TEST—GENERAL

- A. Conduct as specified in individual specification sections.
- B. Begin testing at a time mutually agreed upon by the Owner, Owner's representative and Contractor.
- C. Performance testing shall not commence until the equipment is approved by the Owner or Owner's representative as having satisfied the functional test requirements specified.
- D. Owner and Owner's representative will be present during test. Notify in writing Owner, Owner's representative and manufacturer's representative(s) at least 14 days prior to scheduled date of functional tests.
- E. Conduct performance tests as specified for each equipment item or system.
- F. Source and type of fluid, gas or solid for testing shall be as specified.
- G. Unless otherwise indicated, furnish all labor, materials and supplies for conducting the test and taking all samples and performance measurements.

- H. Prepare performance test report summarizing test method. Include test logs, pertinent calculations and Contractor's written certification that the equipment or system performs as specified.
- I. If, in Owner or Owner's representative's opinion, equipment meets the performance requirements specified, such equipment will be accepted as conforming with the Contract requirements.

3.4 STARTUP TEST PERIOD

A. General:

- 1. Attend planning meetings and arrange for attendance by key major equipment manufacturer representatives as required by the Contract Documents.
- 2. Designate one or more persons on the Contractor's staff, other than the field superintendent, to be responsible for coordinating and expediting Contractor's facility startup duties.
- 3. Such person or persons shall be present during equipment testing and facility startup meetings, Project Meetings and shall be available at all times during the testing and the facility startup and performance evaluation period.
- 4. Support Owner's operations personnel throughout the Facility Startup and Performance Evaluation Period.
- 5. All equipment shall be accepted by the Owner or Owner's representative as having met the requirements of specified functional testing prior to facility startup.
- 6. Include all equipment furnished by Owner.
- 7. Sequence each unit process to the point that the complete facility is operational for evaluation of unit process and facility performance.
- 8. When facility startup has commenced, schedule remaining Work so as not to interfere with or delay the completion of facility startup.
- 9. Support facility startup activities with adequate staff to prevent delays. Such staff shall include, but not be limited to, major equipment and system manufacturer's representatives, electricians, instrumentation and control personnel, millwrights, pipe fitters and plumbers.
- 10. Furnish and coordinate specified manufacturer's facility startup services.
- 11. After the facility is operating, complete the testing of those items of equipment, systems and subsystems which could not or were not successfully tested prior to the startup test period.

B. Startup Testing:

- 1. Startup of the entire facility or any portion thereof requires the coordinated operation of the facilities by the Contractor, subcontractors, Owner's operating personnel and manufacturer's representatives.
- 2. Startup test period shall occur after all required functional tests have been completed and those performance tests deemed necessary for the safe operation of the entire facility have been completed.
- 3. Startup of the entire facility or any portion thereof shall be considered complete when, in the opinion of the Owner and Owner's representative the facility or designated portion has operated in the manner intended for 60 continuous days without significant interruption. This period is in addition to any training, functional or performance test periods specified elsewhere.
- 4. Significant interruption may include any of the following events:
 - a. Failure of Contractor to maintain qualified onsite startup personnel as schedule.

- b. Failure to meet specified performance for more than 2 consecutive hours.
 - c. Failure of any critical equipment unit, system, or subsystem that is not satisfactorily corrected within 5 hours after failure.
 - d. Failure of any non-critical unit, system or subsystem that is not satisfactorily corrected within 8 hours after failure.
 - e. As may be determined by Owner and Owner's representative.
 - 5. A significant interruption will require the startup then in progress to be stopped and restarted after corrections are made.
- C. Startup Test Reports: As applicable to the equipment furnished, certify in writing that:
 - 1. Hydraulic structures, piping systems and valves have been successfully tested.
 - 2. Equipment systems and subsystems have been checked for proper installation, started and successfully tested to indicate that they are operational.
 - 3. Systems and subsystems are capable of performing their intended functions, including fully automatic.
 - 4. Facilities are ready for intended operation.
 - 5. Calibration Curve: Contractor shall provide a calibration curve for the valve located in the Raw Water Intake. This curve must include the percent of opening of the valve and the flow as measured by the flow meter located at the influent valve box.
 - a. This curve shall have in the y-axis percentage of opening of the valve and in the x-axis flow, as measured by the flow meter in the valve box.
 - b. The data shall be submitted in a tabular and graphical format.
- D. Facility Performance Evaluation:
 - 1. During the Startup Period, conduct a performance evaluation for the purpose of evaluating the full capabilities of the facility and the performance of the computer system until all unit processes are operable and under the control of the computer system.
 - 2. Certify, on the Facility Performance Evaluation Form, that each unit process is capable of performing its intended function(s), including fully automatic and computerized operation.

3.5 SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION", are part of this Specification.
 - 1. Forms: STARTUP AND PERFORMANCE EVALUATION FORM

END OF SECTION

STARTUP AND PERFORMANCE EVALUATION FORM

STARTUP AND PERFORMANCE EVALUATION FORM:

OWNER: _____

PROJECT: _____

Unit Process Description: (Include description and equipment number of all equipment and devices):

Startup Procedure (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

Startup Requirements (Water, power, chemicals, etc.): _____

Evaluation Comments: _____

CONTRACTOR Certification that Unit Process is capable of performing its intended function(s), including fully automatic operation:

Firm Name: _____

Startup Representative: _____
(Authorized Signature)

Date: _____, 20

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Closeout procedures.
 - 2. Final cleaning.
 - 3. Adjusting.
 - 4. Project record documents.
 - 5. Operation and maintenance data.
 - 6. Warranties.
 - 7. Spare parts and maintenance materials.
 - 8. Starting of systems.
 - 9. Demonstration and instructions.
- B. Related Sections:
 - 1. Section 01 1100 - Summary of Work.

1.2 CLOSEOUT PROCEDURES

- A. Final Inspection:
 - 1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect's inspection.
- B. Closeout Submittals:
 - 1. Evidence of compliance with requirements of governing authorities.
 - 2. Project Record Documents.
 - 3. Operation and Maintenance Data.
 - 4. Warranties.
 - 5. Keys and keying schedule.
 - 6. Spare parts and maintenance materials.
 - 7. Evidence of payment of Subcontractors and suppliers.
 - 8. Final lien waiver.
 - 9. Certificate of insurance for products and completed operations.
 - 10. Consent of Surety to final payment.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean surfaces exposed to view:
 - 1. Clean glass.
 - 2. Remove temporary labels, stains and foreign substances.
 - 3. Polish transparent and glossy surfaces.
 - 4. Vacuum carpeted surfaces; damp mop hard surface flooring.
- C. Clean equipment and fixtures to a sanitary condition.
- D. Clean or replace filters of operating equipment.

- E. Clean debris from roofs and drainage systems.
- F. Clean site; sweep paved areas, rake clean landscaped surfaces.
- G. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain following record documents on site; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other Modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Material Safety Data Sheets.
- B. Store Record Documents separate from documents used for construction.
- C. Record information concurrent with construction progress.
- D. Make entries neatly and accurately.
- E. Label each set or volume with title "PROJECT RECORD DOCUMENTS", project title, and description of contents.
 - 1. Organize contents according to Project Manual table of contents.
 - 2. Provide table of contents for each volume.
- F. Drawings: Mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Drawings.
- G. Specifications: Mark each Product section description of actual Products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and Modifications.
- H. Shop Drawings: Mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Shop Drawings.
- I. PROJECT RECORD DOCUMENTS must be submitted to the Engineer for final review and approval

1.6 OPERATION AND MAINTENANCE DATA

- A. See Requirements of Section 46 61 10 Operations and Maintenance Data

1.7 WARRANTIES

- A. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.
- B. Include Table of Contents.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.
- B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.9 STARTING OF SYSTEMS

- A. Notify Owner and Architect at least seven days prior to startup of each system or piece of equipment.
- B. Prior to beginning startup verify that:
 - 1. Lubrication has been performed.
 - 2. Drive rotation, belt tension, control sequences, tests, meter readings, and electrical characteristics are within manufacturer's requirements.
 - 3. Utility connections and support components are complete and tested.
- C. Execute start-up under supervision of applicable manufacturer's representative or Contractor's personnel in accordance with manufacturers' instructions, Owner Resident Inspector.
- D. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to startup, and to supervise placing equipment or system in operation.
- E. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.10 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.
- E. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 DEFINITIONS

- A. Maintenance Operation: As used in the Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.2 QUALITY ASSURANCE

- A. Manuals for equipment and systems shall be prepared by equipment manufacturer or system Supplier.

1.3 SEQUENCING AND SCHEDULING

- A. Manual Outline: Submit detailed outline of each manual prior to preparation of Preliminary Manuals.

- B. Manuals for Equipment and Systems:
 - 1. Preliminary Manuals: Submit prior to shipment date for equipment system, subsystem, or component. Include copy of warranties, Bonds, and service agreements if specified.
 - 2. Final Manuals: Submit not less than 30 days prior to equipment or system field testing or startup.

- C. Manuals for Materials and Finishes:
 - 1. Preliminary Manuals: Submit at least 15 days prior to request for final inspection.
 - 2. Final Manuals: Submit within 10 days after final inspection.

1.4 GENERAL

- A. Furnish for each item of equipment or system as specified in the individual Specification sections.

- B. Prepare data for use by OWNER's personnel in the form of an instructional manual and on electronic media.
- C. Manual Format:
 - 1. Size: 8-1/2 inches by 11 inches.
 - 2. Paper: 20-pound minimum, white for typed pages.
 - 3. Text: Manufacturer's printed data, or neatly typewritten.
 - 4. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
 - 5. Provide fly-leaf for each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment and provide with heavy section dividers with numbered plastic index tabs.
 - 6. Provide each manual with title page, and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.
 - 7. Cover: Identify each volume with typed or printed title "OPERATION AND MAINTENANCE MANUAL, VOLUME NO. __ OF __", if applicable, and list:
 - a. Project title.
 - b. Designate the system or equipment for which it is intended.
 - c. Identity of separate structure as applicable.
 - d. Identity of equipment number and Specification section.
 - 8. Assemble and bind material in same order as specified, as much as possible.
 - 9. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.
 - 10. Binders:
 - a. Preliminary Manuals: Heavy paper covers.
 - b. Final Manuals: Commercial quality, substantial, permanent, three ring or three post binders with durable, cleanable, plastic binders
 - 11. Table of contents neatly typewritten, arranged in a systematic order:
 - a. CONTRACTOR, name of responsible principal, address, and telephone number.
 - b. List of each product required to be included, indexed to content of each volume.
 - c. List with Each Product: Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
 - 1) Identify area of responsibility of each.
 - 2) Provide local source of supply for parts and replacement.

- d. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

12. Product Data:

- a. Include only those sheets that are pertinent to specific product.
- b. Clearly annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.

13. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:

- a. Relations of component parts of equipment and systems.
- b. Control and flow diagrams.
- c. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
- d. Do not use Project record documents as maintenance manual drawings.
- e. Provide reinforced punched binder tab, bind in with text.
- f. Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
- g. Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
- h. Identify Specification section and product on Drawings and envelopes.

14. Instructions and Procedures: Within text, as required to supplement product data.

- a. Handling, storage, maintenance during storage, assembly, erection, installation, adjusting, testing, operating, shutdown in emergency, troubleshooting, maintenance, interface, and as may otherwise be required.
- b. Organize in a consistent format under separate heading for each different procedure.
- c. Provide a logical sequence of instructions for each procedure.
- d. Provide information sheet for OWNER's personnel, including:
 - 1) Proper procedures in the event of failure.
 - 2) Instances that might affect the validity of warranties or Bonds.

15. Warranties, Bonds, and Service Agreements: In accordance with Contracts Documents.

- D. Electronic Format: Microsoft Word, version 2013 or 2016.

1.5 SUBMITTAL PROCEDURE

A. Preliminary Manuals:

1. Submit three copies for ENGINEER's review.
 2. Disposition: In accordance with Section 01 32 19, SUBMITTALS.
 3. If Accepted:
 - a. One copy will be returned to CONTRACTOR.
 - b. One copy will be forwarded to Resident Project Representative.
 - c. One copy will be retained in ENGINEER's file.
 - d. Submit five copies of Final Manual.
 4. If Rejected:
 - a. Two copies will be returned to CONTRACTOR with ENGINEER's comments for revision.
 - b. One copy will be retained in ENGINEER's file.
 - c. Resubmit three copies revised Preliminary copies for ENGINEER's review.
- B. Final Manuals:
1. If different than accepted Preliminary Manuals, submit:
 - a. Two copies of any necessary supplemental material, including revised table of contents.
 - b. Instructions for insertion of supplemental material in unreturned sets.
 2. If Final Manuals are acceptable, CONTRACTOR will be so notified.
 3. If rejected, and at ENGINEER's option:
 - a. All copies will be returned to CONTRACTOR for revision, or;
 - b. All copies will be retained by ENGINEER and the necessary revision data will be requested from CONTRACTOR.

1.6 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Content for Each Unit (or Common Units) and System:
1. Description of unit and component parts, including controls, accessories, and appurtenances:
 - a. Function, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data, nameplate data. And tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 2. Operating Procedures:
 - a. Startup, break-in, routine, and normal operating instructions.
 - b. Test procedures and results of factory tests where required.
 - c. Regulation, control, stopping, and emergency instructions.
 - d. Description of operation sequence by control manufacturer.
 - e. Shutdown instructions for both short and extended durations.
 - f. Summer and winter operating instructions, as applicable.

- g. Safety precautions.
 - h. Special operating instructions.
 - i. Installation instructions.
 - 3. Maintenance and Overhaul Procedures:
 - a. Routine operations.
 - b. Guide to troubleshooting.
 - c. Disassembly, removal, repair, reinstallation, and reassembly.
 - 4. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
 - 5. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
 - 6. Spare parts ordering instructions.
 - 7. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
 - 8. Manufacturer's printed operating and maintenance instructions.
 - 9. As-installed, color-coded piping diagrams.
 - 10. Charts of valve tag numbers, with the location and function of each valve.
- B. Maintenance Summary:
- 1. Compile an individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or subunits.
 - 2. Format:
 - a. Use Maintenance Summary Form bound with this section, or an electronic facsimile of such.
 - b. Each Maintenance Summary may take as many pages as required.
 - c. Use only 8-1/2-inch by 11-inch size paper.
 - d. Complete using typewriter or electronic printing.
 - 3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
 - 4. Recommended Spare Parts:
 - a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
 - b. "Unit" is the unit of measure for ordering the part.
 - c. "Quantity" is the number of units recommended.
 - d. "Unit Cost" is the current purchase price.

C. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:

- a. Function, normal operating characteristics, and limiting conditions.
- b. Performance curves, engineering data, nameplate data, and tests.
- c. Complete nomenclature and commercial number of replaceable parts.
- a. Interconnection wiring diagrams, including all control and lighting systems.

2. Circuit Directories or Panelboards:

- a. Electrical service.
- b. Controls.
- c. Communications.

3. List of electrical relay settings, and control and alarm contact settings.

4. Electrical interconnection wiring diagram, including control and lighting systems.

5. As-installed control diagrams by control manufacturer.

6. Operating Procedures:

- a. Routine and normal operating instructions.
- b. Sequences required.
- c. Safety precautions.
- d. Special operating instructions

7. Maintenance Procedures:

- a. Routine operations.
- b. Guide to troubleshooting.
- c. Adjustment and checking.
- d. List of relay settings, control and alarm contact settings.

8. Manufacturer's printed operating and maintenance instructions.

9. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:

- a. Catalog number, size and composition.
- b. Color and texture designations.
- c. Information required for reordering special-manufactured products

2. Instructions for Care and Maintenance:

- a. Manufacturer's recommendation for types of cleaning agents and methods.

- b. Cautions against cleaning agents and methods that are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.
 - B. Content for Moisture Protection and Weather Exposed Products:
 - 1. Manufacturer's data, giving full information on products:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation
 - 2. Instructions for inspections, maintenance, and repair.

1.8 SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION", are part of this Specification.
 - 1. Forms: Maintenance Summary Form

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

MAINTENANCE SUMMARY FORM

PROJECT: _____ CONTRACT NO.: _____

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

a. Name _____ Telephone No. _____

b. Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (If Applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

8. LUBRICANT LIST

[illegible]

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost

Note: Identify parts provided by this Contract with two asterisks.				

DIVISION 02 EXISTING CONDITIONS

SECTION 02 41 00 DEMOLITION

PART 1. GENERAL

1.01 SUMMARY

1.01.1 SECTION INCLUDES

A. This section includes furnishing all labor, materials, equipment and incidentals required for demolitions, removal and disposal work shown in the Construction Drawing.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Comply with provisions of the Puerto Rico Building code and all applicable requirements for the type of demolition established by applicable regulatory Agencies.

1.03 PROJECT CONDITIONS

A. Protection

1. Contractor shall execute the demolition and removal work preventing damage or injury to structures, existing building services, electrical conduit and process piping, and other adjacent features which might result from falling debris or other causes, and so as not to interfere with the use free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadway, adjacent to the work by the placement or storage of materials with a minimum interference to traffic on these ways.
3. Contractor shall erect and maintain barriers, lights, and other required protective devices.
4. Contractor shall repair damage done to facilities to remain, or to any property belonging to the OWNER.
5. Contractor shall design, erect, install and maintain temporary enclosures to eliminate dust, noise and debris from adjacent gallery or building spaces that are in use by OWNER'S personnel.

B. Scheduling. Contractor shall carry out his operations to avoid interference with operations by the OWNER.

C. Notification: at least 48 hours prior to commencement of a demolition or removal, Contractor shall notify the Engineer in writing of his proposed schedule for demolition. Engineer will inspect the existing equipment and identify these items which are to remain the property of the OWNER. No removals shall be started without permission of the Engineer.

D. Explosives.

1. Blasting and the use of explosives shall not be used to perform any demolition work or any other work.

PART 2. PRODUCTS

Not used.

PART 3. EXECUTION

A. General

1. All material and equipment removal from existing work shall become the property of the OWNER. All materials and equipment marked by the OWNER to remain their property shall be carefully removed by the Contractor, so as not to be damaged, cleaned and stored on the site, and delivered by the Contractor at the location designated by the OWNER. The Contractor shall coordinate this delivery with the Engineer and the OWNER. All equipment and materials marked

by the OWNER to remain their property shall be cleaned and disinfected to the satisfaction of Engineer before delivery.

2. If demolition work includes a pump station, a water or sewer plant the Contractor shall prepare a list with the inventory of the equipment to be delivered to the OWNER.
3. Contractor shall dispose off the site, and in conformance with all existing applicable laws and regulations, all demolition material, equipment, debris, and all other items not marked by the OWNER to remain their property.
4. Pollution Controls: use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - a) Do not use water when it may create hazardous or objectionable conditions such as flooding, and pollution.
 - b) Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

B. Structural Removals

1. Contractor shall remove structures to the lines and grades shown unless otherwise directed by the Engineer. Where no limits are shown, the limits shall be 4 inches outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractors expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to the Contractor.
2. All concrete, concrete block, reinforcement, structural or miscellaneous metals, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill adjacent to structures or in pipe line trenches.

C. Mechanical Removals

1. Mechanical removal shall consist of dismantling and removing of existing piping, equipment and other appurtenances, including motors, pumping units, valves and fittings, as specified, shown, or required for the completion of the work. It shall include cutting, capping, and plugging as required.
2. Existing piping not required for the new work shall be removed where shown or where it will interfere with new work. Piping not indicated to be removed or which does not interfere with new work shall be removed to the nearest solid support, capped and left in place. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.
3. When underground piping is to be altered or removed, the remaining piping shall be promptly capped. Abandoned underground piping may be left in place unless it interferes with new work or is shown or specified to be removed. Any changes to potable water piping shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with local codes.

D. Electrical Removals

1. Electrical removals shall consist of the removal of existing conduits and wires, lighting fixtures, and miscellaneous electrical equipment all as shown, specified, or required to perform the work.
2. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing system in operation and to keep the integrity of the grounding system.
3. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged, and stored. Abandoned conduits concealed in floor or ceiling slabs, or in walls, shall be cut flush with the slab or wall at point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

4. Lighting fixtures shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be carefully removed from their present location and rehung where shown.
5. Wall switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed off the site as required. Care shall be taken in removing all equipment to minimize damage to architectural and structural members. Any damage incurred shall be repaired.

E. Alterations and Closures

1. Alteration shall conform to all applicable specifications, the Drawings, and the directions and approvals of the Engineer.
2. Where alterations require cutting or drilling into existing floors, walls and roofs the holes shall be repaired in an approved manner. Contractor shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the Engineer. All repairs shall be smoothly finished unless otherwise approved by the Engineer.
3. Openings existing concrete slabs, ceilings, masonry walls, floors and partitions shall be closed and sealed as shown or otherwise directed by the Engineer. In general, the same or matching materials as the existing adjacent surface shall be used. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable to the Engineer.

F. Clean-up. Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste, and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION

DIVISION 03 CONCRETE

SECTION 03 10 00

CONCRETE FORMING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Forms for cast-in-place concrete, with shoring, bracing, and anchorage.
 - 2. Form accessories.
 - 3. Stripping of forms.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 301 - Specifications for Structural Concrete for Buildings.
 - 2. 347 - Recommended Practice for Concrete Formwork.
- B. American Society of Mechanical Engineers (ASME) A17.1 - Safety Code for Elevators and Escalators.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Diagram of proposed construction joints not indicated on Drawings.
- B. Sustainable Design Submittals:
 - 1. Materials Reuse.
 - 2. Recycled Content.
 - 3. Regional Materials.

1.4 QUALITY ASSURANCE

- A. Design formwork in accordance with ACI 301 and 347

PART 2 PRODUCTS

2.1 MATERIALS

- A. Forms:
 - 1. Recycled Wood, reusable metal, reusable glass fiber, or other approved material that will not adversely affect surface of concrete and will provide or facilitate obtaining specified surface finish.
 - 2. Wood:
 - a. Concealed surfaces:
 - 1) Lumber, No. 2 Common or better, dressed to smooth contact surfaces, or:
 - 2) APA Rated Plyform Class I
 - b. Exposed surfaces: Non absorptive medium density overlay plywood.
 - 3. Metal: Minimum 16 gage steel, tight fitting, stiffened to support concrete.
- B. Architectural Form Liners:
 - 1. Type: to be selected from manufacturer's full range of patterns.
- C. Void Forms:
 - 1. Corrugated paper with wax-coated exterior and uniform cellular configuration.

2. Capable of supporting live and dead loads while maintaining full void depth indicated.
3. Designed to lose strength upon contact with soil moisture.
4. Soil retainers: [1/4 inch thick tempered hardboard] [or] [1-1/2 inch thick, minimum 40 PSI compressive strength extruded polystyrene insulation].

D. Tubular Forms:

1. Round, spirally wound laminated fiberboard, surface treated with release agent, non reusable.

2.2 ACCESSORIES

- A. Form Ties: [Snap off] [Removable] type, adjustable length, [1] inch back break dimension, free of defects that could leave holes larger than [1] inch in concrete.
- B. Form Release Agent: Nonstaining, colorless mineral oil that will not absorb moisture, stain concrete, or impair adhesion of coatings to be applied to concrete.
- C. Construction Joints Forms: Formed galvanized steel, minimum [18] gage, with keyway.
- D. Anchors and Fasteners: Size as required, sufficient strength to maintain forms in place while concrete is placed.

PART 3 EXECUTION

3.1 CONSTRUCTION

- A. Construct formwork, shoring, and bracing to produce concrete of required shape, line, and dimension.
- B. Arrange and assemble formwork with minimum joints, located to allow dismantling without damage to concrete.
- C. Make joints watertight.
- D. Provide chamfer strips in corners of forms to produce beveled external corners.
- E. Camber formwork to compensate for deflection during concrete placement.
- F. Adjust supports to take up settlement caused by concrete placement.
- G. Provide temporary openings in formwork to allow cleaning and observation; locate at bottom of forms. Close with tight fitting panels flush with face of forms.
- H. Construct forms for beams and girders so that sides may be removed without disturbing bottom of form or its support.
- I. Clean contact and screed surfaces prior to concrete placement.
- J. Install architectural form liners [at locations indicated on Drawings.]
 1. Attach liner to forms before installing form ties.
 2. Install liners square in form, with pattern aligned.
 3. Seal joints to prevent grout leaks.
 4. Dress joints and edges to match liner pattern.
- K. Construction Joints:
 1. Unless otherwise indicated on drawings, each unit of construction is a single unit; place concrete continuously to provide monolithic construction.

2. Obtain Architect's approval of construction joint locations not indicated on Drawings.
 3. Provide keys and dowels in joints.
 4. Use construction joint form for joints in floor slabs. Set screed edge at required elevation. Secure to prevent movement.
- L. Form Release Agent:
1. Apply form release agent to formwork prior to placing reinforcing, anchoring devices, and embedded items; follow manufacturer's instructions.
 2. Do not allow agent to puddle in forms or to contact hardened concrete against which fresh concrete is to be placed.
- M. Waterstops:
1. Install waterstops at [below-grade joints in concrete.]
 2. Install continuously without displacing reinforcement.
- N. Inserts and Embedded Parts:
1. Before concrete is placed, install inserts, anchor slots, anchor bolts, and embedded parts required for attachment of work.
 2. Provide formed openings where required for pipes, conduits, sleeves, and other work passing through concrete members.
 3. Maintain in position during concrete placement.
- O. Form Removal:
1. Do not remove formwork until concrete has attained sufficient strength to resist dead loads plus applied live loads.
 2. Remove formwork in manner that will not damage surfaces of concrete; patch work damaged during form removal operations.
 3. Provide shoring, reshoring, and bracing as required.
- P. Installation Tolerances:
1. Construct formwork to maintain tolerances required by ACI 301.
 2. Construct formwork for elevator hoist ways in accordance with ASME A17.1.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars, wire fabric, and accessories for cast-in-place concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI) 301 - Specifications for Structural Concrete for Buildings.
- B. ASTM International (ASTM):
 - 1. A185/A185M - Standard Specification for Welded Steel Wire Reinforcement, Plain, for Concrete.
 - 2. A615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. A767 - Standard Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
 - 4. D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel.
- C. American Welding Society (AWS) D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. Manual of Practice.
 - 2. Publication 63 - Recommended Practice for Placing Reinforcing Bars.
 - 3. Publication 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Include bar sizes, spacings, laps, locations, and quantities of reinforcing bars, wire fabric, and accessories.
 - b. Provide bending and cutting schedules.
 - c. Show complete layout plan for each layer of reinforcing.
- B. Sustainable Design Submittals:
 - 1. Recycled Content.
 - 2. Regional Materials.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcing to project site in bundles marked with tags indicating bar size, length, and mark.
- B. Store reinforcing above ground in dry, well drained area; protect from corrosion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars:
 - 1. ASTM A615/A615M, deformed billet steel, Grade 60.
 - 2. Finish: Plain
- B. Welded Wire Fabric:
 - 1. ASTM A185/A185M.
 - 2. Finish: Plain.

2.2 ACCESSORIES

- A. Spacers, Chairs, Bolsters, and Bar Supports:
 - 1. Sized and shaped for strength and support of reinforcement during concrete placement.
 - 2. Galvanized or plastic coated steel for surfaces exposed to weather.
- B. Tie Wire: Annealed steel, minimum 16 gage.

2.3 FABRICATION

- A. Fabricate in accordance with ACI 301 and CRSI Manual.
- B. Bend bars cold; do not heat or bend by makeshift methods. Discard damaged bars.
- C. Welding: AWS D1.4.
- D. Fabrication Tolerances:
 - 1. Sheared length: Plus or minus 1 inch.
 - 2. Bends in stirrups and ties: Plus or minus 1/2 inch.
 - 3. All other bends: Plus or minus 1 inch.

PART 3 EXECUTION

3.1 PREPARATION

- A. Before placing in work, thoroughly clean reinforcing of loose rust, mill scale, dirt, oil, and other materials that could reduce bonding.
- B. Inspect reinforcing left protruding for future bonding or following delay in work, and clean if necessary.

3.2 INSTALLATION

- A. Install reinforcing in accordance with ACI 301, and CRSI Manual and Publications 63 and 65.
- B. Accurately position reinforcing; securely tie at intersections.
- C. Welding: AWS D1.4.
- D. Install wire fabric reinforcing in longest practical lengths. Offset end laps in adjacent widths to prevent continuous lap.
- E. Do not displace or damage vapor retarder.
- F. Locate splices not indicated on Drawings at points of minimum stress.
- G. Clean and protect surfaces cut or damaged during installation.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete building frame members.
- B. Concrete for composite floor construction.
- C. Elevated concrete slabs.
- D. Floors and slabs on grade.
- E. Concrete shear walls, elevator shaft walls, and foundation walls.
- F. Concrete foundations for water storage tank(s).
- G. Joint devices associated with concrete work.
- H. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

1.02 RELATED REQUIREMENTS

- A. Section 03 1000 - Concrete Forming
- B. Section 03 2000 - Concrete Reinforcing.
- C. Section 07 9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2006.
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- C. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International; 1998 (Reapproved 2004).
- D. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.
- E. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).
- F. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- G. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.
- H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001.
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.
- J. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.

- K. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- L. ASTM A 497/A 497M - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete; 2007.
- M. ASTM C 33 - Standard Specification for Concrete Aggregates; 2007.
- N. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.
- O. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.
- P. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2005a.
- Q. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- R. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.
- S. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2007.
- T. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.
- U. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.
- V. ASTM C 330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 2005.
- W. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008.
- X. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2005.
- Y. ASTM C 685/C 685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2007.
- Z. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002.
- AA. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete; 2005.
- BB. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999.
- CC. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2007a.
- DD. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 1998 (Reapproved 2003).
- EE. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004.
- FF. ASTM E 1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers [Metric]; 1996 (Reapproved 2008).

- GG. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 1997 (Reapproved 2004).
- HH. COE CRD-C 48 - Method of Test for Water Permeability of Concrete; 1992.
- II. COE CRD-C 513 - COE Specifications for Rubber Waterstops; Corps of Engineers; 1974.
- JJ. NSF 61 - Drinking Water System Components - Health Effects; 2007a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- C. Samples for Pigment Color Selection: Submit manufacturer's complete sample chip set, including pigment number and required dosage rate for each color.
- D. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
- E. Samples: Submit samples of underslab vapor retarder to be used.
- F. Samples: Submit two samples of waterstops and construction joint devices.
- G. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.
- H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT

- A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C 150, Type I - Normal portland type.
 - 1. Acquire all cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C 33.
 - 1. Acquire all aggregates for entire project from same source.
- C. Lightweight Aggregate: ASTM C 330.
- D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C 979.

- E. **Waterproofing Additive:** Crystalline waterproofing intended for mixing into concrete to close concrete pores by growth of crystals, with no decrease in concrete strength or chemical resistance.
 - 1. **Permeability of Cured Concrete:** No measurable leakage when tested in accordance with COE CRD-C 48 at 350 feet of head; provide test reports.
 - 2. **Potable Water Contact Approval:** NSF certification for use on structures holding potable water, based on testing in accordance with NSF 61.
 - 3. **Manufacturers:**
 - a. Aquafin, Inc: www.aquafin.net.
 - b. Xypex Chemical Corporation: www.xypex.com.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
 - F. **Water:** Clean and not detrimental to concrete.

2.04 CHEMICAL ADMIXTURES

- A. **Air Entrainment Admixture:** ASTM C 260.
- B. **High Range Water Reducing and Retarding Admixture:** ASTM C 494/C 494M Type G.
- C. **High Range Water Reducing Admixture:** ASTM C 494/C 494M Type F.
- D. **Water Reducing and Accelerating Admixture:** ASTM C 494/C 494M Type E.
- E. **Water Reducing and Retarding Admixture:** ASTM C 494/C 494M Type D.
- F. **Accelerating Admixture:** ASTM C 494/C 494M Type C.
- G. **Retarding Admixture:** ASTM C 494/C 494M Type B.
- H. **Water Reducing Admixture:** ASTM C 494/C 494M Type A.

2.05 ACCESSORY MATERIALS

- A. **Underslab Vapor Retarder:** Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
- B. **Non-Shrink Grout:** ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. **Minimum Compressive Strength at 48 Hours:** 2,400 psi.
 - 2. **Minimum Compressive Strength at 28 Days:** 7,000 psi.
- C. **Moisture-Retaining Cover:** ASTM C 171; regular curing paper, white curing paper, clear polyethylene, white polyethylene, or white burlap-polyethylene sheet.
- D. **Liquid Curing Compound:** ASTM C 309, Type 1, clear or translucent.

2.06 BONDING AND JOINTING PRODUCTS

- A. **Latex Bonding Agent:** Non-dispersible acrylic latex, complying with ASTM C 1059 Type II.
- B. **Epoxy Bonding System:** Complying with ASTM C 881/C 881M and of Type required for specific application.

- C. **Waterproofing Admixture Slurry:** Slurry coat of portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
 - 1. **Manufacturers:**
 - a. Xypex Chemical Corporation: www.xypex.com.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- D. **Waterstops:** Rubber, complying with COE CRD-C 513.
 - 1. **Configuration:** As indicated on the drawings.
 - 2. **Size:** As indicated on the drawings.
- E. **Reglets:** Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
 - 1. **Size:** As indicated on drawings.
- F. **Joint Filler:** Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/4 inch thick and 4 inches deep; tongue and groove profile.
- G. **Joint Filler:** Compressible asphalt mastic with felt facers, complying with ASTM D 994, 1/4 inch thick and 4 inches deep.
- H. **Slab Construction Joint Devices:** Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.
 - 1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
 - 2. **Height:** To suit slab thickness.
- I. **Sealant and Primer:** As specified in Section 07 9005.

2.07 CONCRETE MIX DESIGN

- A. **Concrete Mix Design** shall be as specified in Construction Drawings and the following recommendations.
- B. **Proportioning Normal Weight Concrete:** Comply with ACI 211.1 recommendations.
- C. **Proportioning Structural Lightweight Concrete:** Comply with ACI 211.2 recommendations.
- D. **Concrete Strength:** Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Integra Architects & Engineers, PSC for preparing and reporting proposed mix designs.
- E. **Admixtures:** Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

2.08 MIXING

- A. **On Project Site:** Mix in drum type batch mixer, complying with ASTM C 685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

1. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
- B. Transit Mixers: Comply with ASTM C 94/C 94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 2. Use latex bonding agent only for non-load-bearing applications.
- B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- D. Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches and seal watertight by taping edges and ends. Cover with sand to depth shown on drawings; repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Integra Architects & Engineers, PSC not less than 24 hours prior to commencement of placement operations.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.
- F. Separate slabs on grade from vertical surfaces with joint filler.
- G. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

- H. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 9005 for finish joint sealer requirements.
- I. Install joint devices in accordance with manufacturer's instructions.
- J. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- K. Install joint device anchors for expansion joint assemblies specified in Section 07 9513. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- L. Apply sealants in joint devices in accordance with Section 07 9005.
- M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- N. Place concrete continuously between predetermined expansion, control, and construction joints.
- O. Do not interrupt successive placement; do not permit cold joints to occur.
- P. Place floor slabs in checkerboard or saw cut pattern indicated.
- Q. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into 1/4 depth of slab thickness.
- R. Screed floors level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.04 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Place concrete floor toppings to required lines and levels.
 - 1. Place topping in checkerboard panels not to exceed 20 ft in either direction.
- E. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.05 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Wood float surfaces that will receive quarry tile, ceramic tile, and terrazzo with full bed setting system.
 - 2. Steel trowel surfaces that will receive carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
 - 3. Steel trowel surfaces that will be left exposed.
- D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.06 CURING AND PROTECTION

- A. Comply with requirements of ACI 308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than 7 days.
- C. Surfaces Not in Contact with Forms:
 - 1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 - 2. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.
 - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.07 FIELD QUALITY CONTROL

- A. Contractor shall provide testing by an independent certified materials laboratory..
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- E. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C 143/C 143M.

3.08 DEFECTIVE CONCRETE

- A. Test Results: The testing laboratory shall report test results in writing to Integra Architects & Engineers, PSC and within 24 hours of test.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Integra Architects & Engineers, PSC. The cost of additional testing shall be borne by when defective concrete is identified.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Finishing concrete slabs and formed surfaces.
 - 2. Floor sealer.
 - 3. Colored, Patterned and Sandblasted concrete finish.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-In-Place Concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 301 - Structural Concrete for Buildings.
 - 2. 302.1 - Guide for Concrete Floor and Slab Construction.
- B. ASTM International (ASTM):
 - 1. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 2. E1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

1.3 DEFINITIONS

- A. Specified Overall Value (SOV): Describes the flatness or levelness value which must be achieved when all measured values of that type on a given Test Surface are combined.
- B. Minimum Local Value (MLV): Describes the flatness or levelness value below which repair or replacement is required and applies to Minimum Local Area.
- C. Minimum Local Area (MLA): An area bounded by construction or contraction joints or by column lines or half-column lines, whichever is smaller; no boundary crosses a construction joint or expansion joint.
- D. Level: Horizontal, normal to the direction of gravity. An envelope is defined by 2 level lines which are separated by stated distances.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Descriptive data for sealer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 years experience in work of this Section.
- B. Concrete Mix Design: Free from admixtures and additives not specifically approved by colorant manufacturer.

- C. Mockup:
 - 1. Size: 4 x 8 feet.
 - 2. Show: Exposed aggregate, Colored, Patterned and Sandblasted concrete joint profile. Epoxy Coatings.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Concrete Materials: Specified in Section 03 30 00.
- B. Dry-Shake Colorant: to be selected from manufacturer's standards.
- C. Concrete Stain:
 - 1. Source: to be selected from manufacturer's standards.
- D. Colored Curing Compound:
 - 1. Type recommended by colorant manufacturer, colored to match.
- E. Floor Sealer:
 - 1. Type: ASTM C309, water based, acrylic copolymer resin.
 - 2. Source: or approved substitute.

**** OR ****

- F. Floor Sealer/Hardener:
 - 1. Type: Water soluble, magnesium-fluorosilicate based, reactive with free lime in concrete, non-film forming. Or Water soluble, sodium-silicate based, free from residues. Or [Water soluble, inorganic silicate based.
 - 2. Source: to be selected from manufacturer's standards.

2.2 MIXES

- A. Patching Mortar:
 - 1. Use same proportions as concrete except omit coarse aggregate.
 - 2. Add minimum water required for handling and placing.
- B. Mortar Slurry: 1 part Portland cement and 1-1/2 part damp, loose sand, by volume.

PART 3 EXECUTION

3.1 FINISHING FORMED SURFACES

- A. Concealed Surfaces: Leave texture imparted by forms.
- B. Exposed Surfaces:
 - 1. While concrete is still green, patch voids over ½ inch in diameter or depth.
 - 2. Chip away defective concrete; form edges perpendicular to surface. Wet area to be patched with clean water.
 - 3. Apply bonding agent in accordance with manufacturer's instructions.

4. Press mortar into place; strike off slightly higher than surrounding surface. Allow initial shrinkage to occur before finishing.
5. Finish to match texture and color of adjacent surfaces.
6. Remove fins and other protrusions by rubbing with carborundum stone while concrete is still green.
7. After patching and while concrete is still green, spread mortar slurry over dampened surface.
8. Apply using burlap pads or sponge rubber floats. Remove surplus material, then rub with clean burlap.
9. Keep surfaces damp for 7 days minimum.

3.2 FINISHING INTERIOR FLOOR SURFACES

- A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

END OF SECTION

DIVISION 04 MASONRY

SECTION 04 2000

UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete unit masonry.
- B. Related Sections:
 - 1. Section 04 0513 - Masonry Mortaring.
 - 2. Section 04 0516 - Masonry Grouting.
 - 3. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. ASTM International (ASTM)
 - 1. A153/A153M - Standard Specification for Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
 - 2. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 4. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 5. A951 - Standard Specification for Masonry Joint Reinforcement.
 - 6. B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 7. C90 - Standard Specification for Hollow Loadbearing Concrete Masonry Units.
 - 8. C129 - Standard Specification for Hollow Nonloadbearing Concrete Masonry Units.
 - 9. C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
 - 10. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Concrete.
 - 11. C1019 - Standard Test Method for Sampling and Testing Grout.
 - 12. C1261 - Standard Specification for Firebox Brick for Residential Fireplaces.
 - 13. C1283 - Standard Practice for Installing Clay Flue Linings.
 - 14. C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- B. The Masonry Society (TMS):
 - 1. 402 - Building Code for Masonry Structures.
 - 2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Provide information on reinforcing and anchors including sizes, profiles, materials, and finishes.
 - 2. Samples: Concrete masonry

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 years experience in work of this Section.
- B. Perform Work in accordance with TMS 402 and 602.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store masonry off ground; prevent contact with materials that could cause staining or damage.
- B. Protect reinforcement and anchors from corrosion.

1.6 PROJECT CONDITIONS

- A. Wall Protection:
 - 1. During erection, cover tops of partially completed walls with strong waterproof membrane at end of each day or work stoppage.
 - 2. Extend cover minimum of 24 inches down both sides; hold securely in place.
- B. Load Application:
 - 1. Do not apply uniform loads for at least 12 hours after building masonry columns or walls.
- C. Environmental Requirements:
 - 1. Hot weather requirements: If ambient temperature is over 95 degrees F or relative humidity is less than 50 percent, protect from direct sun and wind exposure for minimum 48 hours after installation.
 - 2. Cold weather requirements: Do not use frozen materials or build on frozen work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Standard Concrete Masonry Units:
 - 1. ASTM C90, hollow load bearing type, normal weight, Moisture Controlled.
**** OR ****

2.2 ACCESSORIES

- A. Mortar: Specified in Section 04 0513.
- B. Grout: Specified in Section 04 0516.
- C. Single Wythe Joint Reinforcement:
 - 1. Truss type; ASTM A951, hot-dip galvanized steel wire 9 gage side rods with 9 gage cross ties.
 - 2. Width: Nominal wall thickness less 1-1/2 inches.
 - 3. Corner and tee fittings: Type to match reinforcement.
- D. Double Wythe Joint Reinforcement:
 - 1. Truss type; ASTM A951 hot-dip galvanized steel wire 9 gage side rods with 9 gage cross ties.
 - 2. Width: Nominal wall thickness less 1-1/2 inches.
 - 3. Corner and tee fittings: Type to match reinforcement.
- E. Strap Anchors: Bent steel shape, hot dip galvanized, ASTM A153/A153M.
- F. Veneer Ties: Corrugated formed sheet metal, , ASTM A153/A153M.
- G. Reinforcing Bars:
 - 1. ASTM A615/A615M, deformed billet steel, Grade 60.
- H. Flashings: Polyvinyl chloride sheet, 20 mils thick or approved substitute.

- I. Joint Sealer: Specified in Section 07 9200.
- J. Cleaner: Type recommended by masonry manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Wet brick having an absorption rate in excess of 20 g per 30 square inches per minute as determined by ASTM C67 so that absorption rate when laid does not exceed this amount.
- B. Remove dirt, loose rust, and other foreign matter from reinforcement and anchors.

3.2 INSTALLATION

- A. Establish lines, levels and courses indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimensions. Form horizontal and vertical joints of uniform thickness.
- C. Lay concrete masonry in running or stack bond.
- D. Do not butter corners or excessively furrow joints.
- E. Machine cut masonry with straight cuts and clean edges; prevent oversized or undersized joints. Discard damaged units. Do not expose cut cells.
- F. Isolate masonry from structural members with compressible filler.
- G. When joining fresh masonry to partially set masonry, remove loose masonry and mortar; clean and lightly wet exposed surface of set masonry.
- H. Stop horizontal runs by racking back normal bond unit in each course. Toothing not permitted.
- I. Horizontal Reinforcement:
 - 1. Place reinforcement at maximum 16 inches on center vertically, at topmost course, and at first two courses above and below openings.
 - 2. Extend minimum 24 inches each side of openings.
 - 3. Center reinforcing in wall.
 - 4. Lap ends 6 inches minimum; use fabricated tee and corner fittings at corners and intersections.
- J. Secure masonry to structural members with wall ties spaced maximum 16 inches on center.
- K. Veneer Ties:
 - 1. Space ties to provide one tie per 2 square feet at maximum spacing of 24 inches on center horizontally.
 - 2. Locate ties within 3 inches of ends of masonry walls and openings.
- L. Install clay flue liners in accordance with ASTM C1283.
- M. Control and Expansion Joints:
 - 1. Do not continue horizontal joint reinforcement through joints.
 - 2. Keep joints free from mortar and grout.

3. Install joint backing and joint sealer at control joints in accordance with Section 07 9200.
4. Form expansion joint as indicated on Drawings.

N. Reinforcing Bars:

1. Position reinforcing accurately and hold securely in place to prevent displacement. Maintain minimum 1 inch space between masonry and reinforcing.
2. Grout at intervals of not more than 60 inches in 6 to 8 inch lifts.
3. Vibrate grout during and after placement to ensure complete filling.
4. Stop grout 1-1/2 inch below top of masonry if grouting is stopped for 1 hour or more, except where completing grouting of finished wall.

O. Install mortar dropping control continuously in cavities above flashings.

P. Installation Tolerances; Maximum variation from:

1. Alignment of columns and pilasters: Plus or minus 1/4 inch in 10 feet.
2. Alignment face to face of adjacent units: Plus or minus 1/8 inch.
3. Vertical alignment of head joints: Plus or minus 1/2 inch in 10 feet.
4. Plumb: Plus or minus 1/4 inch in 10 feet noncumulative.
5. Level coursing: Plus or minus 1/8 inch in 3 feet;

3.3 FIELD QUALITY CONTROL

A. Testing and Inspection Services:

1. Mortar: Mold and test one set of compressive strength cubes in accordance with ASTM C780.
2. Grout: Mold and test one set of compressive strength cubes in accordance with ASTM C1019.

**** OR ****

3.4 CLEANING

- A. Protect adjacent and underlying surfaces.
- B. Apply masonry cleaner in accordance with manufacturer's instructions.
- C. Thoroughly rinse surfaces with clean water after completion of cleaning; remove all traces of cleaning solution.

END OF SECTION

SECTION 04 05 13

MASONRY MORTARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mortar for masonry.
- B. Related Sections:
 - 1. Section 04 2000 - Unit Masonry.
 - 2. Section 04 0516 – Masonry Grouting

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C91 - Standard Specification for Masonry Cement.
 - 2. C144 - Standard Specification for Aggregate for Masonry Mortar.
 - 3. C150 - Standard Specification for Portland Cement.
 - 4. C199 - Standard Test Method for Pier Test for Refractory Mortar.
 - 5. C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 - 6. C270 - Standard Specification for Mortar for Unit Masonry.
 - 7. C1329 - Standard Specification for Mortar Cement.
- B. The Masonry Society (TMS):
 - 1. 402 - Building Code for Masonry Structures.
 - 2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Samples: 1/2 x 1/2 inch x 3 inch long colored mortar samples.
- B. Quality Control Submittals:
 - 1. Test reports: Indicating mortar compliance with ASTM C270.
 - 2. Delivery tickets: If mortar is delivered to site dry and pre-blended, furnish delivery tickets indicating quantity, mortar type, and date of manufacture.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS 402 and 602.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver cement and lime in manufacturer's original, unopened packages or containers.
- B. Protect materials from moisture absorption and damage; reject damaged containers.
- C. Store aggregate to prevent inclusion of foreign matter.

1.6

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150, Type [I.]
 - 2. For exposed surfaces, provide cement from one source throughout project.

**** OR ****
- B. Masonry Cement: ASTM C91, Type M ,S or N.

**** OR ****
- C. Mortar Cement: ASTM C1329, Types M ,S or N.
- D. Firebrick Mortar: ASTM C199.
- E. Aggregate:
 - 1. ASTM C144, standard masonry type.
 - 2. For exposed surfaces, provide aggregate from one source throughout project.
- F. Lime: ASTM C207, Type S or SA.
- G. Colorant: Pure mineral oxide type manufactured by Arizona Oxides LLC or approved substitute].

**** OR ****
- H. Colorant: Carbon black.
- I. Water: Clean and free from oils, acids, alkalies, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.2 MIXES

- A. Mortar Mixes: To ASTM C270 using the Property Proportion Method.
- B. Firebrick Mortar: ASTM C199.

2.3 MIXING

- A. Mix mortar in accordance with ASTM C270.
- B. Jobsite Proportioning of Mortar:
 - 1. Mix using mechanical mixer. Hand mixing not permitted.
 - 2. Mix approximately three-quarters of required water, all of cement and lime, and one-half of aggregate for minimum of 2 minutes.
 - 3. Add remainder of water and aggregate; mix for minimum of 3 minutes.
- C. Dry Preblended Mortar:
 - 1. Mix using continuous, self-cleaning mixer mounted at apex of silo cone.
 - 2. Set water flow valve to provide workable consistency.
- D. Provide uniformity of color in exposed mortar.
- E. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect's approval.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Follow requirements specified in referenced sections.

END OF SECTION

SECTION 04 0516

MASONRY GROUTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Grout for masonry.
- B. Related Sections:
 - 1. Section 04 2000 - Unit Masonry.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C91 - Standard Specification for Masonry Cement.
 - 2. C150 - Standard Specification for Portland Cement.
 - 3. C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
 - 4. C404 - Standard Specification for Aggregates for Masonry Grout.
 - 5. C476 - Standard Specification for Mortar and Grout for Reinforced Masonry.
- B. The Masonry Society (TMS):
 - 1. 402 - Building Code for Masonry Structures.
 - 2. 602 - Specification for Masonry Structures.

1.3 SUBMITTALS

- A. Quality Control Submittals:
 - 1. Test reports: Indicating grout compliance with ASTM C476.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with TMS 402 and 602.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver cement and lime in manufacturer's original, unopened packages or containers.
- B. Protect materials from moisture absorption and damage; reject damaged containers.
- C. Store aggregate to prevent inclusion of foreign matter.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I.
- B. Aggregate: ASTM C404.
- C. Lime: ASTM C207, Type S or SA.

- D. Water: Clean and free from oils, acids, alkalies, organic matter, and other substances in amounts deleterious to mortar or metals in masonry.

2.2 MIXES

- A. Grout Mix:
 - 1. ASTM C476, fine or coarse grout.
 - 2. Compressive strength: Minimum 2500psi at 28 days.
 - 3. Slump: 7 to 8 inches.

2.3 MIXING

- A. Mix grout in accordance with ASTM C476.
- B. Thoroughly mix ingredients in quantities needed for immediate use.
- C. Mix dry ingredients mechanically until uniformly distributed; add water to achieve workable consistency.
- D. Discard lumpy, caked, frozen, and hardened mixes.
- E. Use grout within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-1/2 hours after initial mixing at ambient temperatures over 80 degrees F.
- F. Do not add accelerators, retarders, water repellents, antifreeze compounds, or other additives without Architect's approval.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Follow requirements specified in referenced sections.

END OF SECTION

DIVISION 05 METALS

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 5213 - Pipe and Tube Railings.
- D. Section 09 9000 - Painting

1.03 PRICE AND PAYMENT PROCEDURES

- A. Components:
 - 1. Basis of Measurement: By the pound.
 - 2. Basis of Payment: Includes fabrication, finishing, and installation.
- B. Components:
 - 1. Basis of Measurement: By the unit.
 - 2. Basis of Payment: Includes fabrication, finishing, and installation.

1.04 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; 1998.
- B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2002.
- C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.
- D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.
- E. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.
- F. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- G. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- H. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- I. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

J. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003 (Reapproved 2007).

K. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2007a.

L. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2007.

M. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2007.

N. ASTM B 85 - Standard Specification for Aluminum-Alloy Die Castings; 2003.

O. ASTM B 177 - Standard Guide for Engineering Chromium Electroplating; 2001 (Reapproved 2006).

P. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

Q. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

R. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2004.

S. ASTM B 210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2005.

T. ASTM B 211 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire; 2003.

U. ASTM B 211M - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric); 2003.

V. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2006.

W. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.

X. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

Y. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006 and Errata.

Z. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

AA. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

AB. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

PART 2 PRODUCTS

2.01 MATERIALS – STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.
- C. Plates: ASTM A 283.
- D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A153/A 153M where connecting galvanized components.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS – ALUMINUM

- A. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B 209 (ASTM B 209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B 210 (ASTM B 210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B 211 (ASTM B 211M), 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.

1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
2. Rungs: one inch diameter solid round bar spaced 12 inches on center.

C. Bumper Posts and Guard Rails: As detailed; prime paint finish.

D. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

E. Door Frames for Overhead Door Openings, Wall Openings, and ____: Channel sections; prime paint finish.

F. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

2.05 FINISHES - STEEL

A. Prime paint all steel items.

1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

E. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M requirements.

2.06 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I natural anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

D. Pigmented Organic Coating System: AAMA 2603 polyester or acrylic baked enamel finish; color as scheduled.

E. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as scheduled.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
65-1576 / Salvation Army Divisional HQ 05 5000 - 4 METAL FABRICATIONS
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.
- E. Section 08 8000 - Glazing: Glass baluster infill.
- G. Section 09 9000 - Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- C. ASTM E 935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).
- D. ASTM E 985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).
- E. SSPC-Paint 15 - Steel Joist Shop Paint; The Society for Protective Coatings; 1999 (Ed. 2004).
- F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings; 2002 (Ed. 2004).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two, 12 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E 985 and applicable local code.
- B. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs at any point without damage or permanent set. Test in accordance with ASTM E 935.
- C. Allow for expansion and contraction of members and building movement without damage to

connections or members.

D. Dimensions: See drawings for configurations and heights.

1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
2. Intermediate Rails: 1-1/2 inches diameter, round.
3. Posts: 1-1/2 inches diameter, round.

E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
3. For anchorage to stud walls, provide backing plates, for bolting anchors.

F. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A 123/A 123M.

1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

August 6, 2021

**Water Infrastructure Improvements (Phase I) at Roosevelt Roads
Redevelopment**

05 52 13 - 2

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Anchor railings securely to structure.
- D. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

DIVISION 06 WOOD, PLASTICS AND COMPOSITES

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking and furring.
 - 2. Telephone and electrical panel backboards.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Wood Protection Association (AWPA) U1 - Use Category System - User Specification for Treated Wood.
- B. ASTM International (ASTM):
 - 1. A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- C. Engineered Wood Association (APA) PRP-108 - Performance Standards and Qualification Policy for Structural-Use Panels.
- D. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.
- E. National Institute of Standards and Technology (NIST) - Product Standard PS 20 - American Softwood Lumber Standard.
- F. Northeastern Lumber Manufacturers Association (NELMA) - Standard Grading Rules for Northeastern Lumber.
- G. National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber.
- H. Redwood Inspection Service (RIS) - Standard Specifications for Grades of California Redwood Lumber.
- I. Southern Pine Inspection Bureau (SPIB) - Standard Grading Rules for Southern Pine Lumber.
- J. West Coast Lumber Inspection Bureau (WCLIB) - Standard Grading Rules for West Coast Lumber.
- K. Western Wood Products Association (WWPA) G-5 - Western Lumber Grading Rules.

1.3 QUALITY ASSURANCE

- A. Lumber Grading Agency: Certified to NIST PS 20.
- B. Identify lumber and panel products by official grade mark.
- C. Fire Retardant Treated Products: Bear label of recognized independent testing laboratory indicating flame spread rating of 25 or less, tested to ASTM E84.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials minimum 6 inches above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation.
- B. Do not store seasoned or treated materials in damp location.
- C. Protect edges and corners of sheet materials from damage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Lumber:
 - 1. Surfacing: Surfaced four sides (S4S) [unless otherwise indicated].
 - 2. Maximum moisture content: 19 percent.
 - 3. Certified to FSC STD-04-004.
- B. Panel Products:
 - 1. Type: APA Plywood.
 - 2. Panel grade: APA Rated Sheathing.
 - 3. Exposure:
 - a. Exterior applications: Exterior.
 - b. Interior applications: Exposure 1.

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Type and size: As required by conditions of use.
 - 2. Exterior locations and treated products: Hot-dip galvanized steel, ASTM A153/A153M, G90 coating class.
 - 3. Other interior locations: Plain steel.

2.3 FABRICATION

- A. Preservative Treatment:
 - 1. Treat lumber and panel products in accordance with AWP A U1:
 - a. Interior locations protected from moisture sources: Category UC1 - Interior/Dry.
 - b. Interior locations subject to sources of moisture: Category UC2 - Interior/Damp.
 - c. Exterior locations above ground: Category UC3A - Above Ground/Protected. UC3B - Above Ground/Exposed.
 - d. Exterior locations in contact with ground: Category UC4A - Ground Contact/General Use. UC4B - Ground Contact/Heavy Duty. UC4C - Ground Contact/Extreme Duty.
 - 2. Treatment process: Type CCA - Chromated Copper Arsenate.
- B. Fire Retardant Treatment; treat [lumber] [and] [panel products] in accordance with AWP A U1:
 - 1. Interior locations: Category UCFA - Fire Retardant/Interior.
 - 2. Exterior locations: Category UCFB - Fire Retardant/Exterior.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Provide blocking, nailers, grounds, furring, and other similar items required to receive and support work.

- B. Set members level, plumb, and rigid.
- C. Install telephone and electrical panel backboards where indicated. Oversize panel by 12 inches on all sides.

END OF SECTION

SECTION 06 41 00

ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Special fabricated cabinet units.
 - 2. Plastic laminate countertops.
 - 3. Shop finishing.
 - 4. Cabinet hardware.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. Architectural Woodwork Institute/Architectural Woodwork Manufacturers of Canada/Woodwork Institute (AWI/AWMAC/WI) - Architectural Woodwork Standards.
- B. Association of Electrical and Medical Imaging Equipment Manufacturers (NEMA) LD-3 - High Pressure Decorative Laminates.
- C. Forest Stewardship Council (FSC) STD-40-004 - Chain of Custody Standard.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Include dimensioned plan, sections, elevations, and details, including interface with adjacent work.
 - b. Designate wood species and finishes.
 - 2. Samples:
 - a. 3 x 3 inch plastic laminate samples showing available colors and finishes.
 - b. Each hardware component.
 - c. 6 inch long lumber samples.
 - d. 12 x 12 inch sheet product samples.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications:
 - 1. Minimum Experience in work of this Section.
 - 2. Certified under AWI/AWMAC/WI Quality Certification Program.
- B. Mockup:
 - 1. Size: Base and wall cabinet, minimum 48 inches wide.
 - 2. Show: Cabinets, countertops, and hardware.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.

- C. Pre-Installation Conference:
 - 1. Convene 2 weeks prior to beginning work of this Section.
 - 2. Attendance: Architect, Owner, Contractor, installer, and related trades.
 - 3. Review, discuss and resolve:
 - a. Critical dimensions.
 - b. Product delivery and storage.
 - c. Staging and sequencing.
 - d. Protection of completed work.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver materials until proper protection can be provided, and until needed for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Plastic Laminate:
 - 1. Formica Corp. (www.formica.com)
 - 2. Nevamar Co. (www.nevamar.com)
 - 3. Wilsonart International, Inc. (www.wilsonart.com)
- B. Substitutions: Equal or similar. Under provisions of Division 01.

2.2 MATERIALS

- A. Sheet Products:
 - 1. Closed grain hardwood, of quality suitable for opaque finish.
 - 2. Sheet core: Particleboard or Medium density fiberboard, fire-retardant treated.
- B. Lumber:
 - 1. Graded in accordance with AWI/AWMAC/WI Architectural Woodwork Standards, Section 3 requirements for quality grade specified, average moisture content of 6 percent.

Exposed and semi-exposed locations: quality suitable for [opaque] [transparent] finish.
- C. Hardboard: Pressed wood fiber with resin binder; standard grade, 1/8 inch thick, smooth one side.
- D. Plastic Laminate: NEMA LD-3.
 - 1. High pressure decorative laminate:
 - a. Horizontal surfaces:
 - 1) Backing sheet: Grade BGF.
 - 2) Postformed surfaces: Grade HGP.
 - 3) Acid resisting: Grade LGP.
 - 4) Other surfaces: Grade HGS.
 - b. Vertical surfaces:
 - 1) Backing sheet: Grade BLF.
 - 2) Cabinet liner: Grade CLS.
 - 3) Other surfaces: Grade VGP.
 - 2. Low pressure decorative laminate: Grade VGL.
 - 3. Colors: To be selected from manufacturer's full color range.
 - 4. Finish: To be selected.

2.3 ACCESSORIES

- A. Fasteners: Type and size as required by conditions of use.
- B. Adhesives:
 - 1. Waterproof, water based type, compatible with backing and veneer or laminate materials.
- C. Finish Hardware: As scheduled at end of Section or approved substitute.
- D. Joint Sealers: Specified in Section 07 9200.

2.4 FABRICATION

- A. Cabinets - Plastic Laminate Finish:
 - 1. Quality: AWI/AWMAC/WI Architectural Woodwork Standards, Section 10, Custom Grade.
 - 2. Construction type: Face frame.
 - 3. Interface style: Overlay.
 - 4. Semi-exposed surfaces: High pressure decorative laminate.
 - 5. Fit exposed and semi-exposed sheet edges with matching laminate edging.
 - 6. Fabricate drawer bodies to full depth of drawer fronts less 1/2 inch.
- B. Plastic Laminate Countertops:
 - 1. Quality: AWI/AWMAC/WI Architectural Woodwork Standards, Section 11, Custom Grade.
 - 2. Fabricate from sheet product with lumber fronts.
 - 3. Locate end joints centered or symmetrical. Join sections with concealed clamp fasteners. Locate plastic laminate butt joints minimum 2 feet away from sinks.
 - 4. Provide holes and cutouts for mounting of sinks, trim, and accessories.
- C. Shop assemble for delivery to project site in units easily handled.
- D. Prior to fabrication, field verify dimensions to ensure correct fit.
- E. Apply plastic laminate in full uninterrupted sheets; fit corners and joints to hairline. Slightly bevel arises. Apply laminate backing sheet to reverse side of laminate faced surfaces.
- F. Where field fitting is required, provide ample allowance for cutting. Provide trim for scribing and site conditions.
- G. Provide cutouts and reinforcement for plumbing, electrical, appliances, and accessories. Prime paint surfaces of cut edges.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prior to installation, condition cabinets to average humidity that will prevail after installation.

3.2 INSTALLATION

- A. Install in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.
- B. Set plumb, rigid and level.
- C. Scribe to adjacent construction with maximum 1/8 inch gaps.
- D. Adhere countertops, splashes, and skirts with beads of adhesive.
- E. Fill joints between tops and splashes with sealant as specified in Section 07 9200; finish flush.

END OF SECTION

SECTION 06 81 13

FIBERGLASS REINFORCED PLASTICS (FRP) RAILINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. This specification is for a pultruded fiberglass railing system in compliance with 2012 IBC, and OSHA 1910.23.

1.2 REFERENCES

- A. The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test
Methods:

ASTM D-638-Tensile Properties of Plastics

ASTM D-790-Flexural Properties of Unreinforced and Reinforced Plastics

ASTM D-2344-Apparent Interlaminar Shear Strength of Parallel Fiber Composites by
Short Beam Method

ASTM D-495-High Voltage, Low-Current, Dry Arc Resistance of Solid Electrical Insulation

ASTM D-696-Coefficient of Linear Thermal Expansion for Plastics

ASTM E-84-Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL, INC.
The International Building Code, 2012

THE OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION
Code of Federal Regulations (CFR), Title 29, Section 1910.23

1.3 CONTRACTOR SUBMITTALS

- A. The CONTRACTOR shall furnish shop drawings of all fabricated railings and accessories in accordance with the provisions of this Section.
- B. The CONTRACTOR shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.
- C. The CONTRACTOR shall submit the manufacturer's published literature including structural design data, structural properties data, corrosion resistance tables, certificates of compliance, test reports as applicable, and design calculations for systems not sized or designed in the

contract documents, sealed by a Professional Engineer.

- D. The CONTRACTOR may be requested to submit sample pieces of each item specified herein for acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the WORK.

1.4 QUALITY ASSURANCE

- A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.
- B. Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.
- C. Manufacturer shall be certified to the ISO 9001-2008 standard.
- D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (DNV, ABS, USCG, AARR).

1.5 PRODUCT DELIVERY AND STORAGE

- A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.
- B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Adhesives, resins and their catalysts are to be stored in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Guardrail and/or Handrail system to be Dynarail® as manufactured by

Fibergrate Composite Structures Inc.

5151 Belt Line Road, Suite 1212
Dallas, Texas 75254-7028 USA
(800) 527-4043 Phone (972) 250-1530 Fax

Website: www.fibergrate.com

E-mail: info@fibergrate.com

Or approved similar

2.2 GENERAL

- A. All posts and rails are to be DYNAFORM® FRP structural shapes manufactured by the pultrusion process. The structural shapes shall be composed of fiberglass reinforcement and resin in quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions specified in the Contract Documents.
- B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.
- C. Resins shall be, VEFRR, fire retardant vinyl ester, with chemical formulation necessary to provide the corrosion resistance, strength and other physical properties as required.
- D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.
- E. All pultruded structural shapes shall be further protected from ultraviolet (UV) attack with 1) integral UV inhibitors in the resin, 2) a synthetic surfacing veil to help produce a resin rich surface, and 3) an appropriate UV resistant coating for outdoor exposures.
- F. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test, (except for non-fire retardant isophthalic polyester and vinyl ester NSF Standard 61 certified shapes).
- G. Top and bottom rails for guards are to be 1.75" x 0.125" (44.4 mm x 3.2 mm) wall square tube, the posts are to be 2.125" x 0.1875" (53.9 mm x 4.8 mm) wall square tube and kick plate is to be ½" deep x 4" wide with two reinforcing ribs. Offset rail used as handrail to be 1.5" x 0.25" (38.1 mm x 6.4 mm) wall round tube.
- H. The completed railing installation shall meet the following load requirements with a minimum factor of safety of 2.0:

Concentrated Load: 200 lb (891 N) applied in any direction at any point on the rail.

Uniform Load: 50 lb/lf (730.5 N/m) applied in any direction on the rail.

Loads are assumed not to act concurrently.

- I. All rails, posts, and kick plates are to be integrally pigmented yellow.
- J. Pultruded structural shapes used in the railing systems are to have the minimum longitudinal mechanical properties listed below:

Property	ASTM Method	Value	Units
Tensile Strength	D-638	30,000 (206)	psi (MPa)
Tensile Modulus	D-638	2.5 x 10 ⁶ (17.2)	psi (GPa)
Flexural Strength	D-790	30,000 (206)	psi (MPa)

Flexural Modulus	D-790	1.8×10^6 (12.4)	psi (GPa)
Flexural Modulus (Full Section)	N/A	2.8×10^6 (19.3)	psi (GPa)
Short Beam Shear (Transverse)	D-2344	4,500 (31)	psi (MPa)
Shear Modulus (Transverse)	N/A	4.5×10^5 (3.1)	psi (GPa)
Coefficient of Thermal Expansion	D-696	8.0×10^{-6} (1.4×10^{-6})	in/in/°F (cm/cm/°C)
Flame Spread	E-84	25 or less	N/A

K. All fasteners used in the railing system are to be 316 SS. Rivets to be 18-8 SS.

PART 3 - EXECUTION

3.0 FABRICATION

- A. The post/rail connection for guards is to be fabricated such that the rails are unbroken and continuous through the post without the use of packs or splices. The bottom rail is to be installed through the post at a prepared hole made to fit the outside dimensions of the rail. The top rail is to fit into a machined, u-shaped pocket formed into top of the post such that the rail is located at the center of the post. All exposed post corners are to be radiused to eliminate sharp edges. The rails are to be joined to the post through a combination of bonding and riveting. The offset handrail is to be fabricated such that the rail is continuous with the use of connectors and splices. No sharp, protruding edges are to remain after assembly of the railing system. Spacing of the posts and offset handrail supports shall not exceed 6'-0" (1.83 m).
- B. The bases of the posts are to be attached according to the contract drawings. The bases of the posts are to be reinforced to a height of 8.5" (254 mm). The offset handrails are to be attached to guards or walls with brackets.
- C. When required, rails for guards are to be spliced using a 10" (152.4 mm) length of 1.5" x 1/8" (38.1 mm x 3.2 mm) FRP square tube bonded and riveted into place using epoxy adhesive. Rail for offset handrail to be spliced using a 5" (127 mm) length of 1" (25.4 mm) FRP round rod.
- D. To avoid embrittlement at cold temperatures and loss of strength at high temperatures, no PVC or CPVC connectors should not be used as a load carrying component of the railing system.
- E. All shop fabricated cuts are to be sealed to provide maximum corrosion resistance. Field cuts are to be similarly coated by the contractor in accordance with the manufacturer's instructions.

END OF SECTION

DIVISION 07 THERMAL AND MOISTURE PROTECTION

SECTION 07 52 60

MODIFIED BITUMEN SHEET ROOFING

PART 1 - GENERAL

1.01 SUMMARY

- A. Modified Bitumen Sheet Roofing

1.02 RELATED SECTIONS

- A. Division 7 Section Sealants: Caulks, Sealants.

1.03 REFERENCES

- A. ASTM-American Society for Testing and Material
- B. AWPB-American Wood Preservers' Bureau
- C. ASTM D41-Asphalt Primer Used in Roofing
- D. NRCA-National Roofing Contractors Association
- E. ASTM D2178-Asphalt Glass Felt Used in Roofing
- F. ASTM D312-Asphalt Used in Roofing
- G. UL-Underwriters Laboratories, Fire Classification
- H. SMACNA-Sheet Metal and Air Conditioning Contractors National Association
- I. ASTM D1227-Asphalt Emulsion as a Roof Coating
- J. ASTM D1863-Mineral Aggregate
- K. ASTM D2824-Aluminum Pigmented Asphalt Roof Coating

1.04 REGULATORY REQUIREMENTS

- A. UL Classification: Class A
- B. Factory Mutual (FM) System Classification: 1-705
- C. Additional Test Agencies & Building Code Requirements: As applies

1.05 SUBMITTALS

- A. Submit product data for: All components to be used, *i.e.*: Primer, Membranes, Coatings, *et al*

1.06 QUALITY ASSURANCE

- A. Manufacturer
 - 1. Shall provide local Technical Sales Representative to make start-up inspection and in-progress site inspections at regular intervals.
 - 2. Shall provide final inspection of completed roofing system and issuance of the warranty.
- B. Contractor
 - 1. Roofing contractor shall be a registered applicator by the Manufacturer.
 - 2. Contractor shall retain a workmanship warranty for the specified system within the manufacturer's warranty.
 - 3. Strict adherence to the manufacturer's most current published specifications are to be followed. Deviations must be approved in writing by the architect and manufacturer prior to installation.
- C. Designation of Responsible Personnel
- D. Walkover Inspection
 - 1. Attendance: Representative of Owner, General Contractor, Roofing Contractor and Manufacturer's Technical Representative.
- E. Final Inspection

1. Will be scheduled by roofing contractor upon job completion.
2. Attendance: Representative of Owner, General Contractor, Roofing Contractor and Membrane Manufacturer's Technical Representative.
3. Minimum agenda:
 - a) Walkover inspection.
 - b) Identification of problems which may impede issuance of warranty.
 - c) Creation of punch list.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials.

1. Deliver and store materials under provisions of Section 01600.
2. Deliver materials to job-site in new, dry, unopened and well marked containers showing product and manufacturer's name, production date and/or product code. All materials delivered shall be on pallets.
3. Deliver materials in sufficient quantity to allow continuity of work.

B. Storage of Materials.

1. Storage of plies to be protected from water or extreme humidity.
2. Store all roll roof materials on end to prevent their becoming deformed/damaged. Discard rolls which have flattened, creased or otherwise damaged.
3. Place materials on pallets which are at least four (4) inches above the ground. Do not stack pallets.
4. Rooftop Storage: Disperse materials to avoid concentrated loading.
5. Cover top and sides of all exterior stored materials with canvas tarpaulin (not polyethylene). Secure tarpaulin.

C. Material Handling.

1. Handle plies to avoid bending, tearing or other damage during transportation and installation.
2. Material handling equipment shall be selected and operated so as not to damage existing construction or applied roofing. Do not operate or situate material handling equipment in location(s) that will hinder smooth flow of vehicular or pedestrian traffic.

D. Safety Requirements.

1. All application, material handling and associated equipment shall conform to and be in conformance with OSHA safety requirements.
2. Comply with Federal, State, Local and Owner fire safety requirements.
3. Maintain fire extinguishers within easy access whenever power tools, kettles or torches are being used.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply roofing membrane during inclement weather.
- B. Do not apply roofing membrane to damp or frozen substrates.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during the same day.

1.09 WARRANTY

A. Manufacturer shall provide:

1. Furnish manufacturer's 10 year warranty providing coverage against water leakage through roofing system.
2. Make repairs to roofing system required due to defects in materials or workmanship resulting in water leakage into or through roofing system.
3. Include cost of labor and materials necessary to make required repairs.

4. Cover all roofing system components including roofing membrane, built-up and metal flashings, high wall waterproof flashings, roof insulation, [expansion joint covers,] and preflashed accessories.
5. Not limited to specific dollar amount.
6. Transferable to subsequent building owners during warranty period.
7. Include coverage for wind speeds up to 160 MPH.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. As approved by Project Owner.

2.02 SHEET MATERIALS

A. Modified Bitumen Base Sheet: SBS Modified Bitumen Membrane base membrane with a fiberglass mat reinforcement, protected with a burn-off film and or silica sand on either side. ASTM-D-6163-98 Type I Grade S

B. Modified Bitumen Membrane: SBS Modified Bitumen top membrane with a fiberglass mat reinforcement, finished with ceramic granule as top protection surface area and burn-off film or silica sand on the other side. ASTM-D-6163-98 Type I Grade G

2.03 BITUMINOUS MATERIAL

- A. Asphalt Primer: ASTM D41
B. Elastomeric Adhesive: ASTM D3019
C. Elastomeric Mastic: ASTM D4586
D. Aluminum Coating: ASTM D2824
E. Asphalt Emulsion: ASTM D1227

2.04 RELATED MATERIALS

- A. Sealant: One part urethane.
F. Roof Penetrations protection.

PART 3 - EXECUTION

3.01 EXAMINATION AND PROTECTION

- A. Inspection
1. Verify installation conditions as satisfactory to receive work.
 2. Do not install new roofing until all unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions.
 3. Check projections, curbs and deck for inadequate anchorage, foreign material, moisture, or unevenness that would prevent quality of execution of the new roofing system.
- B. General Workmanship
1. Substrate: Free of foreign particles prior to laying roof membrane.
 2. Phased application: Not permitted, all plies shall be completed each day.
 3. Confine equipment, storage of materials, debris and the operations and movement of workers within the limits agreed upon for the project.
 4. Where wheeled or other traffic over partially completed roofing is unavoidable, provide adequate exterior protection to the roof.
 5. Wrapper and package materials: Not to be included in roof system.
 6. All metal and masonry shall be asphalt primed before fully adhering flashing sheets.

7. Mechanical Fasteners: Seated firmly with fastener heads flush or below surface.
8. Base flashing height is not less than eight (8) inches above finished surface.

C. Protection

1. Contractor shall be responsible for protection of property during course of work. Lawn, shrubbery, paved areas and building shall be protected from damage at no extra cost.
2. Roofing and flashing shall be installed and sealed in a watertight manner on same day of installation or upon the arrival of inclement weather.
3. At the end of each work day, partial installation shall be sealed with water stops along edges to prevent water entry.
4. At the start of each work day, drains within daily work area shall be plugged. Plugs are to be removed at end of each work day or before arrival of inclement weather.
5. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day or before arrival of inclement weather.
6. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface and equipment movement. Move equipment and ground storage areas as work progresses.

D. Surface Preparation

1. Remove all existing roof membrane, insulation and flashings down to the deck and curbs.
2. Verify structural integrity of the deck. Notify the Architect of any deck or curb deficiency.
3. Remove deteriorated or damaged wood blocking and install new treated wood blocking to match existing. See detail drawings.

3.02 ROOF MEMBRANE APPLICATION

Substrate must be suitable to receive and hold roof system materials.

Prime all deck surfaces with asphalt primer at 1 gallon per 100 to 200 square feet and allow to dry.

Starting at the low point, install modified bitumen membrane by

Torch:

A. *Work Area Preparation:*

1. Adequate ventilation is required; enough ventilation such that personnel exposures to hazardous concentration of airborne contaminants are maintained at or below the allowable levels specified by OSHA or NIOSH.
 - a. Special care should be taken when torch welding is done in close or confined spaces due to possible concentration of contaminants and potential oxygen depletion. Appropriate precautions shall be observed. Use of mechanical ventilation to force air movement or use of approved respirators may be required.
2. All roof openings and edges should be protected or guarded in conformity with OSHA standards.
3. In awareness of other personnel in the torch welding area is mandatory, in tight quarters; only one (1) torch should be used.
4. The installer needs to have previously noted the locations of all pipes, curbs, or other roof top projections before working with torch welding.
5. Removal of combustible debris from the application area before the torch welding application begins is mandatory.
6. Appropriate precautions should be taken when torch welding in the proximity of gas pipe joints, HVAC coupling joints, or electrical service lines.

7. A base roofing ply shall cover all flammable materials (e.g. wood walls and wood fiber cant) before the torch welding application begins.
8. No torch welding shall be done unless the surrounding atmosphere is nonflammable and unless combustibles are moved away or properly protected from fire hazards.
9. Combustible materials which are present on a roof. Such as material wrappers, solvents, primers and roof cements shall be moved to a designated safe location.
10. Combustible materials which are present on a roof and are not movable shall be protected from fire hazards.
11. Combustible materials present on adjoining building surfaces (e.g. Shake shingles or wood siding) should be protected by covering with fire retardant blankets or a protective shield.
12. Sufficient fire extinguishing equipment shall be ready for use where torch welding roof work is being done. The fire extinguishing equipment should be portable fire extinguishers (Type ABC). In addition, buckets of sand and pails of water are advisable. Portable fire extinguishers shall be of the size and type required by local codes. A minimum of one 20 lbs. fire extinguisher per torch or torching machine should be on the roof at all times at the torching location. Special care shall be taken to check all fire extinguishers prior to and at the completion of the day's work to make sure they are full and operable.

B. Application:

1. Start at the low point of the roof and progress to the high point. The membrane shall be installed perpendicular to the slope of the roof except when the slope exceeds 3" per foot. At vertical surfaces, abutting the roof, the membrane shall extend to the cant and must be heat welded to the underlying membrane previously installed.
 - a. On slopes of more than three inches per foot, the seams should run parallel to the slope of the roof.
2. All overlaps at the membrane seam shall be installed so as to have "up" slope laps over "down" slope laps.
3. Membranes shall never be applied by any method except with a propane torch or electric heat welding devices designed for application modified bitumen.
 - a. Flammable and solvent-based material (e.g. plastic cement) should not be exposed to flame.
 - b. When re-roofing, wood and fiber cant strips are extremely flammable and should be removed or protected.
 - c. Restaurant and food service exhaust vents can contain grease (*Grease Guard* grease containment system is recommended for these areas). All intake fans should be shut off during application with special care taken to keep torches away from openings. Exhaust vents for laundromats in condominiums, apartments and other multiple tenant dwellings can contain lint and debris. Open flames should be kept clear of all vents.
4. Membranes must not be applied during adverse weather or without precautionary measures in temperatures below 40° F.
5. The coiled membrane shall be unrolled approximately 15 feet, aligned, then the propane torch flame applied to the exposed outer surface of the coiled membrane until the bitumen reaches the proper application temperature, causing to develop a slight sheen. Care should be taken to avoid overheating which may result in damage to or improper adhesion of the membrane. The flame should be moved from side to side and up the lap edge while the

membrane is slowly unrolled and adhered to the underlying surface. Subsequent shift of the roll shall be avoided after heating has begun. When complete, the remaining membrane shall be re-rolled and installed in the same manner. All end laps must be staggered so that no adjacent end laps coincide.

6. The end laps shall be lapped six inches (6"), and the side laps must be lapped four inches (4"). A bitumen bleed-out approximately 1/4" to 1/2" must be obtained at all seam areas.
 - a. To ensure the proper 1/2" flow of bitumen at the seam areas, a roller may be used. The man using roller should follow behind the torch man no more than 4 feet nor less than 3 feet to be sure that membrane will be in condition to produce proper bleed-out.
7. The seam can be rolled with a hand roller or troweled with heated trowel. When one end is complete, re-roll the opposite end not yet torched, and install in the same manner.
8. All end laps should be staggered a minimum of 15 feet.
9. All LP-Gas cylinders shall be secured in a cylinder storage area at the end of each work day.
10. All crews shall make a safety check of all equipment and LP-Gas cylinders prior to, and at the completion of the day's work
11. A fire watch shall be implemented on a daily basis after torch applications are completed. The job foreman or other designated personnel shall walk the area of application at the end of the day, checking for hot spots on the roof. A fire watch shall be conducted for a minimum of one hour after the last torch is shut off for the day.

C. Seaming:

1. The bleed out of bitumen is troweled to insure a complete seal and watertight integrity.
2. Proper troweling is achieved by using a heated trowel. The seam area and trowel should be heated simultaneously.
3. Use heated trowel to achieve a smooth and watertight seam at all overlaps.

3.03 FLASHINGS

A. Modified Bitumen Flashings:

1. Set perlite cant in elastomeric mastic or mechanically attach.
2. Install new roofing two inches minimum beyond top edge of cant.
3. Prime the wall surface with asphaltic primer.
4. Adhere flashing membrane completely to roofing membrane. Lap sheeting ends six (6) inches. Ensure complete bond without wrinkles or voids.
5. Membrane coverage - Sufficient so that after being installed, membrane will be eight (8) inches minimum up the parapet wall. It will extend at least six (6) inches beyond to edge of the cant onto the roof surface.
6. See detail drawings for individual flashing requirements.

3.04 DAILY WATERSTOP TIE-IN

A. End of day

1. Remove debris from top ply of felt along termination, width eighteen (18) inches.
2. Adhere twelve (12) and eighteen (18) inch wide ply sheets from exposed deck to applied roofing with a continuous 1/16" inch thick application of water cut-off

mastic. Extend eighteen (18) inch wide felt three (3) inches on both sides of the twelve (12) inch felt.

B. Beginning of next day's work

1. Remove temporary connection by cutting felts evenly along edge of existing roof system.

3.05 FIELD QUALITY CONTROL

A. Repair of deficiencies

1. Installations or details noted as deficient during Final Inspection must be repaired and corrected by applicator.

3.06 CLEANING

- A. Immediately upon job completion, roof membrane and flashing surfaces shall be cleaned of debris.
- B. Contractor shall be responsible for the cost of all clean-up procedures.

END OF SECTION

SECTION 07 5300

ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rigid roof insulation.
 - 2. Cover board.
 - 3. Fully adhered, Mechanically fastened or Ballasted single ply membrane roofing.
 - 4. Base flashings.
 - 5. Expansion joint covers.
 - 6. Walkway pads.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 06 10 00 - Rough Carpentry.
 - 3. Section 07 6200 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

- A. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- B. ASTM International (ASTM):
 - 1. C208 - Standard Specification for Cellulosic Fiber Insulating Board.
 - 2. C578 - Standard Specification for Preformed Cellular Polystyrene Thermal Insulation.
 - 3. C728 - Standard Specification for Perlite Thermal Insulation Board.
 - 4. C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 5. C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - 6. C1303 - Standard Test Method for Estimating the Long-Term Change in Thermal Resistance of Unfaced Rigid Closed Cell Plastic Foams by Slicing and Scaling Under Controlled Laboratory Conditions.
 - 7. C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
 - 8. D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - 9. D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 10. D4637 - Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane.
 - 11. E108 - Standard Test Methods for Fire Tests of Roof Coverings.
 - 12. E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- C. Energy Star(www.energystar.gov) - Qualified Products.
- D. Factory Mutual Insurance Co. (FM):
 - 1. 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.
 - 2. Property Loss Prevention Data Sheet 1-28 - Design Wind Loads.
 - 3. Property Loss Prevention Data Sheet 1-49 - Perimeter Flashing.

E. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

1.3 DEFINITIONS

A. Roof Areas: As defined in ANSI/SPRI RP-4.

1.4 SYSTEM DESCRIPTION

A. Design Requirements: Design roofing system to resist design wind loads in accordance with [ASCE 7.]

1.5 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Indicate:
 - a. Setting plan for insulation.
 - b. Roof slopes.
 - c. Layout of seams.
 - d. Base flashing, termination, and special details.
 - e. Fastener types and locations.
2. Product Data: Manufacturer's product specifications, installation instructions, and general recommendations for each product.
3. Samples:
 - a. [1 pint] [] of ballast aggregate.
 - b. [Fastener plate..] [Batten strip, 12 inches long.]
 - c. Walkway pad.
4. Warranty: Sample warranty form.

B. Quality Control Submittals:

1. Certificates of Compliance: Certification from an independent testing laboratory that roofing system meets fire hazard and windstorm classification requirements.

C. Sustainable Design Submittals:

1. Recycled Content.
2. Solar Reflectance Index.
3. Regional Materials.
4. Low Emitting Materials.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Minimum [] years [documented] experience in work of this Section.
2. Licensed or certified by roofing materials manufacturer.

B. Roofing System:

1. FM [1-60] [1-75] [1-90] [1-105] [1-120] [] Windstorm Resistance and [MH] [SH] Hail Resistance, tested to FM 4470.
2. Perimeter flashings: In accordance with FM 1-49.
3. Class [A] [B] [C] Fire Hazard Classification, tested to ASTM E108.
4. Energy Star qualified for project location; bear Energy Star label.
5. Solar Reflectance Index: Minimum 78, tested to ASTM C1549 and calculated in accordance with ASTM E1980.

C. Pre-Installation Conference:

1. Convene at site [2] [] weeks prior to beginning work of this Section.
2. Attendance: [Architect,] [Design/Builder,] [Contractor,] [Construction Manager,] roofing applicator, roofing manufacturer's representative, and related trades.

3. Review and discuss: Contract Documents, roofing system manufacturer's literature, project conditions, scheduling, and other matters affecting application.
4. Tour representative areas of roofing substrates; discuss substrate construction, related work, work conditions, and materials compatibility.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store materials, other than membrane, in protected, dry area, between [60 and 80] [] to [] degrees F until used; provide proper ventilation.
- B. Protect sheet goods from damage and wetting.

1.8 PROJECT CONDITIONS

- A. Do not apply roofing to damp or frozen substrate.
- B. Do not apply roofing during inclement weather or at temperatures below [40] [] degrees F, or above [100] [] degrees F or if freezing weather is anticipated within [24] [] hours after application. Do not use frozen materials.

1.9 WARRANTIES

- A. Furnish manufacturer's 10 year warranty providing coverage against water leakage through roofing system.
 1. Make repairs to roofing system required due to defects in materials or workmanship resulting in water leakage into or through roofing system.
 2. Include cost of labor and materials necessary to make required repairs.
 3. Cover all roofing system components including roofing membrane, built-up and metal flashings, high wall waterproof flashings, roof insulation, [expansion joint covers,] and preflashed accessories.
 4. Not limited to specific dollar amount.
 5. Transferable to subsequent building owners during warranty period.
 6. Include coverage for wind speeds up to 160 MPH.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Roofing System:
 1. Design Basis: Contract Documents are based on products by [].
 2. Equivalent products by following manufacturers are acceptable:
 - a. Carlisle Syntec, Inc. (www.carlisle-syntec.com)
 - b. Firestone Building Products Co. (www.firestonebpco.com)
 - c. Johns Manville. (www.jm.com)
 - d. Danosa Caribbean
 - e. [].
 - f. [].
- B. Acceptable Manufacturers - Cover Board:
 1. GP Gypsum Corporation. (www.gp.com)
 2. [].
 3. [].
 4. [].
- C. Substitutions: [Under provisions of Division 01.

2.2 MATERIALS

- A. Rigid Insulation:

1. Type: ASTM C1289, Type I, Class [1,] [2,] rigid polyisocyanurate faced both sides with aluminum foil facings.

**** OR ****

2. Type: ASTM C1289, Type II, rigid polyisocyanurate faced both sides with glass fiber mat facings.

**** OR ****

3. Type: ASTM C578, rigid expanded polystyrene, Type [I,] [IX,] minimum [0.90] [1.80] PCF density.

**** OR ****

4. Type: ASTM C728, rigid expanded perlite.

**** OR ****

5. Type: ASTM C208, rigid cellulose fiber.

**** OR ****

6. Type: ASTM C1289, Type III, composite type consisting of rigid polyisocyanurate foam with [1/2] [] inch thick [perlite] [] insulation board bonded to top surface and glass fiber mat facing on bottom surface.

7. Edges: [Square.] [].

8. Thickness: [] inches.

**** OR ****

9. Thermal resistance: Minimum R value of [] [, calculated in accordance with ASTM C1303].

10. Provide board tapered to [1/8] [1/4] [] inch per foot.

B. Cover Board:

1. Type: ASTM C1177/C1177M; 48 inches wide x [1/4] [1/2] [5/8] inch thick,] [thickness indicated,] maximum practical length, square cut ends and edges.
2. Mold resistance: 10, tested to ASTM D3273.
3. Recycled content: Minimum [90] [] percent.

C. Roof Membrane:

1. Type: EPDM (Ethylene Propylene Diene Terpolymer), [fire retardant,] [reinforced.] [non-reinforced.]
2. Physical properties: Conform to ASTM D4637.
3. Size: Maximum sheet size permitted by application and job conditions.
4. Thickness: [45] [60] [] mils.
5. Color: [Black.] [White.] [].

D. Flashing Sheet: Manufacturer's standard flashing sheet, color to match membrane.

E. Ballast: Smooth river gravel, washed, [1-1/2 inch round, Size No. 4, 3, 24, 2, or 1] [2-1/2 inch round, Size No. 2 or 1] [] in accordance with ASTM D448.

2.3 ACCESSORIES

A. Batten Strips or Fastener Plates: Manufacturer's standard, [galvanized steel.] [hard rubber.]

B. Accessories:

1. By manufacturer of roofing system, including adhesives, tapes, solvents, sealants, water cutoff mastic, and prefabricated pipe flashings.
 2. Adhesives: Maximum Volatile Organic Compound (VOC) content of [250] [] grams per liter.
- C. Walkway Pads: Precast concrete, [24 x 24] [] x [] inches x [2] [] inches thick, maximum [15] [22] [] PSF, smooth surfaced.
- **** OR ****
- D. Walkway Pads: Preformed resilient pads, recommended by roofing manufacturer, minimum [1/2] [] inch thick.
- E. Fasteners: Hot-dip galvanized or fluoropolymer coated steel, approved by roofing system manufacturer, type and length suited to project conditions.
- F. Insulation Fasteners: Hot-dip galvanized or fluoropolymer coated steel, approved by [FM and] roofing system manufacturer, type and length suited to project conditions, with [galvanized steel] [plastic] plates.
- G. Expansion Joint Covers:
1. Type: [EPDM] [Neoprene] [] cover over closed cell foam insulation, bonded to [galvanized steel] [copper] flanges, with preformed corners and intersections.
 2. Product: [] by [] or approved substitute.
- H. Nailers and Curbs:
1. Preservative treated wood, specified in Section [06 1000.] [06 1100.]
 2. Nailers: [3-1/2] [] inch face dimension x insulation thickness.
- I. Metal Flashings: Specified in Section 07 6200.
- J. Roof Coating:
1. [100 percent acrylic] [] type; [] by [] or approved substitute.
 2. Color: [White.] [].] [To be selected from manufacturer's full color range.]

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove projections that could puncture membrane from substrate.
- B. Clean substrate of loose and foreign material, oil, and grease.
- C. Complete roof penetrations and preparation for drains, flashings, and other penetrations prior to beginning roofing.
- D. Protect adjacent and underlying surfaces.

3.2 INSTALLATION - GENERAL

- A. Install roofing system in accordance with roofing system manufacturer's instructions, NRCA Manual, and approved Shop Drawings.

3.3 INSTALLATION OF INSULATION

- A. Apply [base layer] with long edges continuous [and perpendicular to deck ribs.] Stagger end joints in adjacent rows. [Locate ends over solid bearing.]
- B. Apply top layer with long edges perpendicular to those of base layer, with joints staggered in adjacent rows. Offset joints from those in base layer.

- C. Mechanically fasten to substrate in [FM] [manufacturer's recommended] fastening pattern.

**** OR ****

- D. Lay insulation loose; do not adhere or fasten to substrate.
- E. Fit insulation to other boards and at perimeter and around penetrations with maximum [3/8] [] inch voids.

3.4 INSTALLATION OF COVER BOARD

- A. Apply panels with long edges continuous [and perpendicular to [deck flutes.] [direction of insulation.] Stagger end joints in adjacent rows. [Offset joints from those in insulation.] [Locate ends over solid bearing.]
- B. Mechanically fasten to substrate in [FM] [manufacturer's recommended] fastening pattern.
- C. Fit panels to other panels and at perimeter and around penetrations with maximum [3/8] [] inch voids.

3.5 INSTALLATION OF ROOF MEMBRANE

- A. Position sheets without stretching; minimize wrinkles. Allow membrane to relax before proceeding.
- B. Provide minimum [3] [] inch lap at joints between adjacent sheets.
- C. Splice sheets by [contact adhesive] [or] [adhesive tape] method.
- D. Bond membrane to substrate with full adhesive bed.

**** OR ****

- E. Do not adhere membrane to substrate.

**** OR ****

- F. Attach membrane to decking with batten strips or fastener plates.
- G. Clean splice edges and apply bead of lap sealant completely covering edges.
- H. Fasten membrane to perimeter nailers with fasteners spaced [6] [] inches on center maximum.
- I. Daily Seal:
 - 1. Ensure that water does not flow beneath completed sections of roof.
 - 2. Temporarily seal loose edge of membrane with night seal when weather is threatening.
 - 3. When work is resumed, pull sheet free before continuing installation.

3.6 INSTALLATION OF FLASHINGS

- A. Construct in accordance with roofing system manufacturer's standard details.
- B. Juncture of Horizontal and Vertical Surfaces:
 - 1. Use longest practical length flashing to minimize joints.
 - 2. Complete splice between flashing and main roof sheet before bonding flashing to vertical surface. Extend splice [3] [] inches beyond fasteners that attach membrane to horizontal surface.
 - 3. Adhere flashing to substrate with full bed of adhesive.
 - 4. Fasten top of flashing at [12] [] inches on center maximum, under metal flashing.

- C. Penetrations through Membrane:
 - 1. Flash pipe with premolded pipe flashings wherever possible.
 - 2. Where molded pipe flashings cannot be installed, use field fabricated pipe seals.
 - 3. Seal clusters of pipes and unusually shaped penetrations with minimum [2] [] inch high flashing containing pourable sealer.
- D. Expansion Joints:
 - 1. Complete roof membrane and flashing installation prior to installing expansion joint.
 - 2. Set joint cover on top of wood nailers; secure on each side through metal flange.
 - 3. Seal joint cover flanges to membrane as for sheet splice.
- E. Roof Drains:
 - 1. Taper insulation around drain to provide smooth transition from roof surface to drain clamping ring.
 - 2. Seal between membrane and drain base with water cutoff mastic.

3.7 INSTALLATION OF BALLAST

- A. Spread ballast uniformly over completed roofing system to following coverages:
 - 1. Corners: [1000] [1300] [] pounds per square.
 - 2. Perimeter: [1000] [1300] [] pounds per square.
 - 3. Field: [1000] [1300] [] pounds per square.

3.8 APPLICATION OF ROOF COATING

- A. Clean roofing and membrane flashing surfaces; remove loose and foreign matter that could interfere with adhesion or performance of coating.
- B. Allow surfaces to dry completely before proceeding.
- C. Apply coating to roofing and membrane flashings in accordance with manufacturer's instructions, to uniform coverage.

3.9 INSTALLATION OF WALKWAY PADS

- A. Lay loose over protective mat or scrap pieces of membrane.

**** OR ****

- B. Clean underside of pad; set pads in full adhesive bed.
- C. Leave [2] [] inch space between pieces.

END OF SECTION

SECTION 07 56 00

FLUID APPLIED ELASTOMERIC ROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish and install fluid acrylic elastomeric roof coating system, including:
 - 1. Roofing manufacturer's requirements for the specified warranty (if any).
 - 2. Preparation of roofing substrates.
 - 3. Elastomeric roof coating.
 - 4. Other roofing-related items specified or indicated on drawings or otherwise necessary to provide a complete weatherproof roofing system.
- B. Disposal of demolition debris and construction waste is the responsibility of contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roof coating manufacturer.
- D. Commencement of work by the Contractor shall constitute acknowledgement by the Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing coating manufacturer.

1.02 RELATED SECTIONS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

1.03 REFERENCES

- A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.
 - 1. ASTM C 1653 - Standard Test Methods for Water Vapor Transmission of Organic Coating Films; 2008 or later.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Provide coating manufacturer's printed data sufficient to show that all components of coating system, including accessories, comply with the specified requirements and with the coating manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with coating system.
 - 2. Where UL requirements are specified, provide documentation that shows that the roof coating system to be installed is UL-Classified, as applicable; include data itemizing the components of the classified or approved system.
 - 3. Installation Instructions: Provide manufacturer's instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.
- B. Shop Drawings (if required):
 - 1. Provide standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
- C. Pre-Installation Notice (if required):

1. Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Installer shall have the following:
 1. At least 2 years experience in installing specified system.
- B. Pre-Installation Conference: Before start of metal roof coating application, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the intended result.
 1. Require attendance with all parties directly influencing the quality of the work or affected by the performance of the work.
 2. Notify Architect well in advance of meeting.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

1.07 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Warranty: Minimum 10 Year Limited Warranty covering material and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1) Master Paints
 - 2) PPG
 - 3) Lanco Paints
 - 4) Crossco
- B. Products manufactured by others may be acceptable provided the coating system is completely equivalent in materials and application conditions and the manufacturer meets the following qualifications:
 - a. Specializing in manufacturing the coating system to be provided.
 - b. ISO 9002 certified.
- C. Manufacturer of Rust Inhibitive Metal Primer: Same manufacturer as elastomeric coating.
- D. Substitution Procedures: See Instructions to Bidders.
 1. Submit evidence that the proposed substitution complies with the specified requirements.

2.02 ELASTOMERIC COATING DESCRIPTION

- A. Coating System:

1. Vehicle Base Primer & Sealer : Acrylic Resin, 100%
2. Tensile Strength (ASTM D2370) : 270 psi
3. Elongation (ASTM D 2370): 235%
4. Content:
 - a. Solids by weight: $65 \pm 2\%$
 - b. Solids by volume: $54 \pm 2\%$
5. Permeance: 4 perms according to ASTM D1653
6. Color : White
 - a. Energy Star Approved .
 - b. Initial Solar Reflectance: 0.80 (white only)
7. Low VOC < 50g/L
8. Meets ASTM D 6083
9. Apply 32 wet mils/17.3 dry mils per coat on concrete surface and 16 wet mils/ 8.6 dry mils on metal surfaces

2.03 ACCESSORY MATERIALS

Retain following elements as applicable to your project, eliminate others

- A. Rust Inhibitive Metal Primer, Red; as provided by Firestone.
- B. Acrylic Rust Inhibitive Metal Primer, White; as provided by Firestone.
- C. Elastomeric Seam Tape, a polyester fabric backed, modified butyl rubber adhesive tape [2", 4", 6" and/or 8"] as provided by Firestone.
- D. Acrylic Patching Cement reinforced with Polyester Fabric as provided by Firestone.
- E. Skylight coating [if needed]

PART 3 INSTALLATION

- A. All work associated with the installation of the specified roof coating system to be performed in accordance with the manufacturer's recommendations.

3.01 WEATHER REQUIREMENTS FOR APPLICATION

- A. Application Acrylic Roof Coating Materials, including Clear Skylight Coating, Acrylic Rust Inhibitive Metal Primer, and Acrylic Patching Cement, must be performed at 50 °F (10 °C) and rising. Temperatures must remain above 50 °F (10 °) for both application and cure time. Cure time will vary, depending on weather conditions. Low temperatures and high humidity will prolong cure time required.
- B. Do not begin work if rain is expected within twenty-four (24) hours of application. Do not apply if weather does not permit four to six (4 to 6) hours dry time prior to rain, fog or temperatures falling below 50 °F (10 °C).

3.02 SUBSTRATE PREPARATION

- A. It is the contractor's responsibility to ensure that the substrate (roof surface to be coated) is adequately prepared to receive the Elastomeric Roof Coating System
- B. Holes, splits and openings in the metal roof must be repaired prior to application of the Elastomeric Roof Coating System.

1. Holes less than or equal to (6.4 mm) in diameter can be patched using Acrylic Patching Cement and/or Elastomeric Seam Tape.
- C. New metal must be installed on all deteriorated metal panels with dents, holes or splits greater than 1/4" (6.4 mm) in any dimension.
 1. When a panel has deteriorated in the center but is still sound at the edges, it can be covered by a new panel without removing the damaged section.
 2. The new panel must be completely secured in the side laps with the screws of the proper type and size and taped at both ends.
- D. New metal must weather a minimum of six (6) months or be cleaned to remove residual oil. Residue can be removed using an environmentally safe cleaner.
- E. Replace loose or missing fasteners with oversized fasteners.
- F. Loose panels must be reattached using the appropriate fasteners to ensure panels are pulled together flush.
- G. Remove existing sealing materials (i.e., bituminous mastic, calk type sealant materials, etc.).
- H. Substrates must be clean and dry with no oils, grease, moisture or loose debris. Power washing is recommended.
- I. Treat all areas of corrosion with Rust Inhibitive Metal Primer or Acrylic Rust Inhibitive Metal Primer prior to applying repair products and coating.
- J. When Elastomeric Seam Tape is used, it is recommended that the installed tape be coated with Elastomeric Coating the same day as installation.
- K. Seal end laps with Elastomeric Seam Tape or three-coursed with Polyester Fabric and Acrylic Patching Cement.
- L. Side laps (vertical seams) must be sealed. Note: It is not necessary to seal vertical seams on standing seam roofs.
- M. Ridge vents, formed ridge caps, flat ridge caps must be sealed in accordance with Elastomeric Coating Application Guide.
- N. All penetrations, including curbs, stacks, vents, and pipes, must be sealed in accordance with Elastomeric Coating Application Guide. Do not flash penetration of hot stacks.
- O. Install Elastomeric Seam Tape on all breaks in metal at corrugations
- P. Skylights must be sealed with Elastomeric Seam Tape around the perimeter.
- Q. Rake flashing and wall flashings must be sealed in accordance with Elastomeric Coating Application Guide.
- R. On standing seam roofs, metal closures must be sealed with Acrylic Patching Cement.
- S. Caulk all reglets and termination bars.
- T. Corrective measures must be taken in areas where water ponds for more than forty-eight (48) hours. The inclusion of crickets or other remediation measures to remove low spots must be completed prior to coating application.

3.03 ELASTOMERIC ROOF COATING APPLICATION

- A. Inspect the roof to ensure that preparatory work has been properly completed and all substrate problem

areas have been corrected.

- B. **IMPORTANT:** Allow for complete coverage by multiplying the total square feet of the area to be coated by a minimum of 1.15. The extra material will compensate for the additional surface area of corrugation and irregular metal surfaces, and will insure that adequate coating is on hand to complete the job.
- C. Apply a base coat of Elastomeric Roof Coating that is a different color than the surface coating to be used (Gray base coat is recommended, any color can be used).
- D. Base coat may be applied with airless sprayer, brush, or roller. Consult application guide for specific techniques
- E. Allow base coat to dry a minimum of twenty-four (24) hours before applying top coat.
- F. Inspect base coat prior to application of top coat. Confirm proper adhesion and that surface is clean.
- G. Provide finish coat in accordance with manufacturers application guide relative to current condition.
- H. All work to secure/maintain the manufacturer's warranty must be completed using materials from that manufacturer.
- I. Inspect the completed application for uncoated areas, loose panels, gaps, holes, and joints that have been improperly taped.
- J. Correct any defects.

END OF SECTION

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Gravel stops. Edge flashings.
 - 3. Gutters, scuppers, conductor heads and downspouts.
 - 4. Flashings at roofing.
 - 5. Counterflashings over membrane roof base flashings.
 - 6. Counterflashings at roof mounted equipment and utility penetrations.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 07 9200 - Joint Sealers.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 620 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
 - 3. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
 - 4. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
 - 5. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 6. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- B. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI) ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
- C. ASTM International (ASTM):
 - 1. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 2. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 3. A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 4. B32 - Standard Specification for Solder Metal.
 - 5. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 6. B370 - Standard Specification for Copper Sheet and Strip for Building Construction.
 - 7. B506 - Specification for Copper-Clad Stainless Steel Sheet and Strip for Building Construction.
 - 8. B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- D. Copper Development Association (CDA) - Contemporary Copper, A Handbook of Sheet Copper Fundamentals, Design, Details and Specifications.

- E. Sheet Metal and Air Conditioning Manufacturer's Association International (SMACNA) - Architectural Sheet Metal Manual.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, types and thicknesses of metal, profiles, dimensions, fastening methods, provisions for expansion and contraction, and joint details.
 - 2. Samples:
 - a. Each flashing and trim profile, minimum 12 inches long. Include corners where applicable.
 - b. 3 x 3 inch prefinished metal samples in specified color.

1.4 QUALITY ASSURANCE

- A. Fabricator and Installer Qualifications: Documented experience in work of this Section.
- B. Design, fabricate, and install copings, gravel stops, edge flashings in accordance with ANSI/SPRI ES-1.
- C. Conform to SMACNA Manual for nominal sizing of gutters, scuppers, collector boxes and downspouts.
- D. Mockup:
 - 1. Locate where directed.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Sheet:
 - 1. ASTM A653/A653M, G90 2 coating class, 20 gage core steel unless noted otherwise.
 - 2. Where sheet metal is to be painted, apply phosphate film at factory.

2.2 ACCESSORIES

- A. Solder: ASTM B32.
- B. Fasteners: Hot-dip galvanized steel, Same material and finish as sheet metal, with neoprene gasketed washers where exposed.
- C. Joint Sealers: Specified in Section 07 9200.

2.3 FABRICATION

- A. Fabricate components in accordance with SMACNA Manual. CDA Handbook.
- B. Profiles:
 - 1. Fabricate end caps, downspout outlets and headers, straps, brackets, and downspout strainers in profile to suit gutters and downspouts.
- C. Pre tin edges of [copper] sheet.

- D. Solder shop formed joints except at prefinished metal. After soldering, remove flux and wash clean.
- E. Fabricate corners in single units.
- F. Form sections accurate to size and shape, square and free from distortion and defects.
- G. Provide for thermal expansion and contraction in sheet metal.
- H. Fabricate cleats and starter strips of same material as sheet metal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install flashing and sheet metal as indicated and in accordance with SMACNA Manual.
- B. Install cleats and starter strips before starting installation of sheet metal.
- C. Expansion Joints:
 - 1. Seal expansion space between ends of flashing sections.
 - 2. Apply continuous bead of joint sealer between cover plate and flashing sections at each end.
- D. Secure flashings with concealed fasteners where possible.
- E. Apply plastic cement between metal and bituminous flashings.
- F. Fit flashings tight, with square corners and surfaces true and straight.
- G. Seam and seal field joints.
- H. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.
- I. Reglets:
 - 1. Install reglets true to line and level. Seal top of surface mounted reglet with joint sealer.
 - 2. Install flashings into reglets to form tight fit. Seal remaining space with joint sealer.
- J. Gutters: Secure with straps spaced maximum 36 inches on center and within 12 inches of ends.
- K. Downspouts:
 - 1. Secure with straps spaced maximum 8 feet on center and within 2 feet of ends and elbows.
 - 2. Flash downspouts minimum 3 inches into gutters and fasten.
 - 3. Flash upper sections into lower sections minimum 2 inches at joints; fasten sections together.
- L. Apply joint sealers as specified in Section 07 9200.

3.2 CLEANING

- A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

END OF SECTION

SECTION 07 9200

JOINT SEALERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Joint backup materials.
 - 2. Joint sealers.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
 - 2. C719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - 3. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 4. C834 - Standard Specification for Latex Sealing Compounds.
 - 5. C919 - Standard Practice for Use of Sealants in Acoustical Applications.
 - 6. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 7. C1193 - Standard Guide for Use of Joint Sealants.
 - 8. C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.
 - 9. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 10. D2203 - Standard Test Method for Staining from Sealants.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use.
 - 2. Samples:
 - a. 1/2 x 1/2 x 3 inch long joint sealer samples in available colors.
 - b. 6 inch long joint backup material samples.
 - 3. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Experience in work of this Section.
- B. Maximum Volatile Organic Compound (VOC) Content; interior sealers and accessories:
 - 1. Sealants: 50 grams per liter.
- C. Laboratory Pre-Construction Testing:
 - 1. Obtain representative samples of actual substrate materials.
 - 2. Test sealers and accessories for following:

- a. Adhesion: Test to ASTM C794 and ASTM C719; determine surface preparation and required primer.
 - b. Compatibility: Test to ASTM C1087; determine that materials in contact with sealers do not adversely affect sealant materials or sealant color.
 - c. Staining: Test to ASTM D2203, ASTM C510, or ASTM C1248; determine that sealants will not stain joint substrates.
 - d. Pre-construction testing is not required when sealant manufacturer furnishes data acceptable to Architect based on previous testing for materials matching those of this Project.
- D. Field Pre-Construction Testing: Test each joint sealer and joint substrate before beginning work of this Section:
1. Install sealers in mockups using joint preparation methods and materials recommended by sealer manufacturer.
 2. Install field-test joints in inconspicuous location.
 3. Test sealers using manufacturer's standard field adhesion test; verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
 4. When test indicates sealant adhesion failure, modify joint preparation, primer, or both and retest until joint passes sealant adhesion test.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
1. BASF Building Systems. (www.buildingsystems.basf.com)
 2. Dow Corning Corp. (www.dowcorning.com)
 3. GE Silicones. (www.gesealants.com)
 4. Pecora Corp. (www.pecora.com)
 5. Sika Corp. (www.sikausa.com)
 6. Tremco, Inc. (www.tremcosealants.com)
- B. Substitutions: Equal or similar. Under provisions of Division 01.

2.2 ACCESSORIES

- A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Protect adjacent surfaces with masking tape or protective coverings.

3.2 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Install joint backing to maintain required sealer dimensions. Do not twist or stretch.
- C. Use bondbreaker tape where joint backing is not installed.
- D. Fill joints full without air pockets, embedded materials, ridges, and sags.
- E. Tool sealer to smooth profile.
- F. Apply sealer within manufacturer's recommended temperature range.

3.3 CLEANING

- A. Remove masking tape and protective coverings after sealer has cured.
- B. Clean adjacent surfaces.

END OF SECTION

DIVISION 08 OPENINGS

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hollow steel doors and frames.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 7100 - Door Hardware.
 - 3. Section 08 8000 - Glazing.

1.2 REFERENCES

- A. American National Standards Institute (ANSI)/Steel Door Institute (SDI):
 - 1. A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finished Painted Steel for Steel Doors and Frames.
 - 2. A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.
 - 3. A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 - 4. A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 - 5. A250.11 - Recommended Erection Instructions for Steel Frames.
- B. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 3. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 4. E413 - Classification for Rating Sound Insulation.
- C. National Fire Protection Association (NFPA) 80 - Standard for Fire Doors and Fire Windows.
- D. Steel Door Institute (SDI) 117 - Manufacturing Tolerances for Standard Steel Doors and Frames.
- E. Underwriters Laboratories (UL):
 - 1. 10B - Standard for Fire Tests of Door Assemblies.
 - 2. 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Show locations, elevations, dimensions, model designations, fire, thermal, and acoustical ratings, preparation for hardware, and anchoring details.
 - 2. Product Data: Show elevations, dimensions, gages of metal, hardware reinforcing gages and locations, and anchor types.

- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification that products furnished comply with ANSI/SDI A250.3, ANSI/SDI 250.4, and ANSI/SDI A250.10.

1.4 QUALITY ASSURANCE

- A. Fire Door and Frame Construction: Conform to UL.
- B. Installed Fire Rated Door and Frame Assemblies: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Ship door frames with removable angle spreader; do not remove until frame is installed.
- B. Do not cover with non vented coverings that create excessive humidity.
- C. Remove wet coverings immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Trujillo Alto Metal Corp. (www.tamcor.com)
- B. Substitutions: Equal or similar.

2.2 MATERIALS

- A. Steel Sheet:
 - 1. Commercial quality steel Zinc-Iron Alloy-Coated by hot-dip process designation to ASTM A653/A653M-95 ZF100 (A40) ASTM A755/A755M-95 ASTM A924/A924M - 95 known commercially as Galvannealed.
- B. Door Core:
 - 1. Polystyrene insulation..

2.3 ACCESSORIES

- A. Glass, Glazing Sealers, and Accessories: Specified in Section 08 80 00.
- B. Primer: Rust inhibitive touch-up.

2.4 FABRICATION

- A. Fabricate doors and frames in accordance with ANSI/SDI A250.8.
- B. Fabricate exterior doors and frames from galvanized or galvannealed steel sheet.
- C. Doors:
 - 1. Fabricate from minimum 16 to 18 gage sheets as specified in construction drawings.
- D. Frames:

1. Fabricate from minimum 14 to 18 gage sheets as specified in construction drawings.
2. Provide self-aligning tabs and slots to hold corners in alignment.

- E. Accurately form to required sizes and profiles.
- F. Grind and dress exposed welds to form smooth, flush surfaces.
- G. Do not use metallic filler to conceal manufacturing defects.
- H. Fabricate with internal reinforcement for hardware specified in Section 08 7100; weld in place.
- I. Glazing Stops:
1. Manufacturer's standard.
- J. Louvers:
1. Manufacturer's standard.

2.5 FINISHES

Apply manufacturer's standard rust-inhibiting primer paint.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with ANSI/SDI A250.11.
- B. Set plumb and level.
- C. Secure to adjacent construction using fastener type best suited to application.
- D. Install glass as specified in Section 08 8000.
- E. Install hardware in accordance with Section 08 7100.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions in primer paint to match factory finish.

END OF SECTION

SECTION 08 14 00

WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Provide wood doors.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
- C. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
 - 1. Solid-Core Exterior Doors: 5 years.
 - 2. Hollow-Core Interior Doors: 2 years.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Quality Standards: [NWWDA I.S.1-A, 'Architectural Wood Flush Doors.'] [AWI's 'Architectural Woodwork Quality Standards Illustrated.'].]
- C. Quality Standards: [NWWDA I.S.1-A, 'Architectural Wood Flush Doors.'] [WI's 'Manual of Millwork.'].]
- D. Fire Rated Wood Doors: Meet NFPA 80 requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Interior Flush Wood Doors:
 - 1. Manufacturers: As approved by Project Owner.
 - 2. Type: solid.
 - 3. Thickness: 1-3/4 inches thick.
 - 4. Wood Type: Australis.
 - 5. Frames: Wood.
 - 6. Face: Mahogany.
 - 7. Finish: Transparent.
 - 8. Finish Application: Shop primed and site finished.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Comply with NWMA I.S. 1A and specified quality standard.
- B. Prefit doors to frames. Premachine doors for hardware listed on final schedules. Factory bevel doors.
- C. Install doors with not more than 1/8 inch clearance at top and sides, 1/4 inch at bottom. Comply with NFPA 80 for rated assemblies.
- D. Adjust, clean, and protect.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL 1.1

DESCRIPTION

- A. Scope:
 - 1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified, and required to provide hinged floor access hatch doors and frames.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Manufacturer's literature, illustrations, specifications, paint certification and engineering data including dimensions, materials, size and weight.
 - 2. Shop Drawings showing dimensional plans of all floor covers, quantity schedule, details of fabrication and erection, and anchorage.

1.3 QUALITY ASSURANCE

- A. Manufacturer's qualifications:
 - 1. All access hatch covers for the project shall be the product of a single manufacturer. Covers from more than one manufacturer will not be permitted.
 - 2. Manufacturer shall have at least five years experience in producing substantially similar equipment, and shall show evidence of at least five installations in satisfactory operation for at least five years.
 - 2. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the contract drawings and operated per Manufacturer's recommendations.
- B. Reference Standards:
 - 1. ASTM A 123, Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.

1.4 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered in manufacturer's original packaging.

- B. Store all materials in a dry, protected, well-vented area. The CONTRACTOR shall thoroughly inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 GUARANTEE

- A. CONTRACTOR shall furnish a written guarantee obtained from the manufacturer. Guarantee shall state the following:
 - 1. Access hatch covers shall operate properly and be free of defects in material and workmanship for a period of five years from date of purchase.
 - 2. Should any part fail to function, or break in normal use during this period, manufacturer shall furnish a new part at no charge to PRASA.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General:
 - 1. Provide manufacturer's standard fabricated units, modified if necessary, to comply with the requirements shown and specified.
 - 2. Fabricate each unit in the shop, complete with anchors, gaskets, hardware and accessory items as required and completely assemble prior to shipping.
- B. Access Hatch Description
 - 1. Fabricated Aluminum Cover:
 - 2. Frame:
 - a. Channel Frame: 1/4-inch aluminum channel frame with continuous anchor flange and a 1-1/2-inch drainage coupling in the frame.
 - b. Angle Frame: 1/4" aluminum continuous anchor fringe.
 - 3. Mill finish aluminum frame, 1/4-inch thick.
 - 4. 1/4-inch thick aluminum diamond plate cover, reinforced to withstand at least 400 lb/sf.
 - 5. Neoprene compression gasket mounted to the under side of the cover.
 - 6. Cover shall open to 90° and automatically lock with a stainless steel hold open arm with release handle. Door cover shall have torsion bars, spring or other approved means for counter balanced operation.
 - 7. Hinges and all fastening hardware shall be 316 stainless steel.
 - 8. 316 Stainless steel slam lock with removable key.
 - 9. Manufacturer and Models:
 - a. Halliday Products, Model as indicated on Drawings
 - b. Or equal.
 - 10. Location, Size and Number: As shown on the Drawings and in the Schedule below.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors and covers in accordance with approved Shop Drawings.
- B. Set doors and covers plumb, level and true to line or grade, without warp or rack, for anchoring under other Sections of these Specifications.
- C. Protection of Aluminum from Dissimilar Materials.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS AND GLASS DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aluminum framed windows, with fixed and operable sash.
 - 2. Aluminum framed glass doors and frames.
 - 3. Shop glazing.
 - 4. Operating hardware and insect screens.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 08 8000 - Glazing.
- C. 1. Recycled Content.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 3. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.
 - 4. 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 5. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- B. American Architectural Manufacturers Association/Window and Doors Manufacturers Association (AAMA/WDMA) - 101/I.S.2 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 2. D3656 - Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
 - 3. E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
 - 4. E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference.
 - 5. E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights.
 - 6. F588 - Standard Test Method for Resistance of Window Assemblies to Forced Entry Excluding Glazing.

1.3 SYSTEM DESCRIPTION

- A. Windows and Glass Doors: AAMA/WDMA - 101/I.S.2.
 - 1. Product type:
 - a. MasterGuard 4" or 6" as specified by architect.
 - b. Gray Polyurethane Powder Coating.
 - 2. Glazing: 1/4" Annealed Solex glass.
 - 3. Glazing color: as specified by architect.
- B. Design Requirements; design windows and glass doors to withstand:
 - 1. Wind loads in accordance with Building Code.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include locations, elevations, sections, materials, finishes, and attachments.
 - 2. Two Representative Samples:
 - a. 3 x 3 inch finish samples in specified color.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Documented experience in work of this Section.
- B. Conform to applicable accessibility code for locating hardware.
- C. Mockup:
 - 1. Size: One full sized window unit.
 - 2. Locate where directed.
 - 3. Approved mockup may remain as part of the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. AirMaster Windows and Doors Company. (www.airmasterpr.com)
- B. Substitutions: Equal or similar.

2.2 MATERIALS

- A. Aluminum Extrusions:
 - 1. ASTM B221, 6063-T5 heavy commercial quality.
- B. Glass and Glazing Accessories: Specified in Section 08 8000.
- C. Operating Hardware:
 - 1. Non magnetic stainless steel.

2.3 ACCESSORIES

- A. Fasteners: Stainless steel, hot-dip galvanized steel, or fluoropolymer coated steel; type best suited to application.

- B. Weather stripping: Wool pile felt profiled for weather seal.
- C. Insect Screens: to be selected.

2.4 FABRICATION

- A. Fabricate with minimum clearances and shim spaces around perimeter, yet enabling installation and dynamic movement.
- B. Accurately fit and secure joints and intersections. Make joints flush, hairline, and weathertight.
- C. Fabricate in largest practical units.
- D. Weatherstrip operable sash.
- E. Fabricate aluminum components with integral low conductance thermal barrier located between exterior and interior exposed components that eliminates metal-to-metal contact.
- F. Conceal fasteners and attachments from view.
- G. Reinforce corners and intersections of frames and mullions.
- H. Provide internal drainage weep holes and channels to route moisture to exterior.
- I. Form glass stops, exterior sills, closures, weather stops, and flashings of same material as frame.

2.5 FINISHES

- A. Aluminum: AAMA 2605, Gray Polyurethane Powder Coating.
- B. Hardware: Matching aluminum window color.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install windows and glass doors in accordance with ASTM E2112, manufacturer's instructions, and approved Shop Drawings.
- B. Set plumb, level, and rigid, free from warpage.
- C. Anchor to supporting construction.

3.2 ADJUSTING

- A. Adjust for smooth operation.
- B. Touch up minor scratches and abrasions to match original finish.

END OF SECTION

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hardware for steel, wood, laminated plastic, aluminum doors.
 - 2. Weatherstripping and thresholds.
 - 3. Sound seals.
 - 4. Hardware for other sections referencing this section.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
 - 1. A156.1 - Butts and Hinges.
 - 2. A156.2 - Bored and Preassembled Locks and Latches.
 - 3. A156.3 - Exit Devices.
 - 4. A156.4 - Door Controls - Closers.
 - 5. A156.5 - Auxiliary Locks and Associated Products.
 - 6. A156.13 - Mortise Locks and Latches.
 - 7. A156.18 - Materials and Finishes.
 - 8. A156.26 - Continuous Hinges.
 - 9. A156.31 - Electric Strikes.
- B. National Fire Protection Association (NFPA):
 - 1. 80 - Standard for Fire Doors and Windows.
 - 2. 105 - Installation of Smoke Control Door Assemblies.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Schedule hardware by door type and location; show door size, hand, thickness, edge bevel, hardware components and quantities, keying, and finishes.
 - 2. Product Data: Manufacturer's descriptive data for each component.
 - 3. Samples: two sample of each hardware item, if requested. Samples will be returned for installation on Project.
 - 4. Warranty: Sample warranty form.
- B. Closeout Submittals:
 - 1. Copy of approved hardware schedule.
 - 2. Keying list.
 - 3. Keys; tag with mark corresponding to keying schedule.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Documented experience in work of this Section.

- B. Provide hardware labeled by recognized independent testing laboratory and meeting requirements of NFPA 80 for fire rated doors.
- C. Provide smoke gasketing at fire rated doors in accordance with NFPA 105.
- D. Conform to applicable accessibility code for locating hardware and for door opening force requirements.
- E. Follow guidelines of DHI "Recommended Locations for Builder's Hardware" and hardware manufacturers' instructions.
- F. Pre-Installation Conference:
 - 1. Convene at site prior to ordering permanent cylinders for Project.
 - 2. Attendance: Architect, Owner, Owner resident Inspector, Contractor and hardware supplier.
 - 3. Review, discuss, and finalize Owner's keying requirements.

1.2 DELIVERY, STORAGE AND HANDLING

- A. Pack hardware items separately, with fasteners, installation instructions, and templates.
- B. Mark containers with item number corresponding to hardware schedule.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Butt Hinges:
 - 1. Stanley Hardware. (www.stanleyhardware.com)
- B. Acceptable Manufacturers - Continuous Hinges:
 - 1. Stanley Hardware. (www.stanleyhardware.com)
- C. Acceptable Manufacturers - Locksets, Latchsets, Deadbolts, and Cylinders:
 - 1. PDQ Manufacturing. (www.pdqlocks.com)
- D. Acceptable Manufacturers - Exit Devices:
 - 1. American Eagle by PDQ Manufacturing. (www.pdqlocks.com)
- E. Acceptable Manufacturers - Door Seals:
 - 1. Pemko Manufacturing Co. (www.pemko.com)
- A. Acceptable Manufacturers - Door silencer:
 - 1. Trimco Architectural Hardware. (www.trimcobbw.com)
- B. Substitutions: Equal or similar.

1.2 MANUFACTURED UNITS

- A. Butt Hinges:
 - 1. Description: ANSI/BHMA A156.1, full mortise type, five knuckle, non removable pin. Stainless Steel satin finish.

2. Exterior outswinging doors: Provide set screw in barrel making hinge non-removable when door is closed.
 3. Weight: Medium weight.
 4. Bearing type: Ball bearing.
 5. Size: 4-1/2 x 4-1/2 inches.
- B. Locksets, Latchsets, Deadbolts, and Cylinders:
1. Locksets and latchsets:
 - a. Type: ANSI/BHMA A156.13, heavy duty and extra heavy duty Grade 1, mortise as specified on construction drawings.
 - b. Interchangeable core.
 - c. Mastered Kekeyed.
 - d. Satin Chrome finish.
 2. Deadbolts:
 - a. Type: Heavy Duty Grade 1, double cylinder deadbolt.
 - b. Interchangeable core.
 - c. Mastered Keyed.
 - d. Satin Chrome finish.
 - e. Functions: As scheduled.
 3. Cylinders: removable core type.
 4. Keys: Solid brass or nickel silver.
- C. Exit Devices:
1. Type 1. Description: Hex Key Dogging, Rim, Double door Strike, Heavy Duty. Sating Stainless Steel.
 2. Type 2. Description: Hex Key Dogging, Surface vertical Rod, Double door Strike, Heavy Duty. Sating Stainless Steel.
- D. Silencers: Trimco. Model 1229A. Grey rubber.
- E. Smoke Seals:
1. Type AS: Astragal Smoke Seal. Clear anodized.
 2. Type SS1; Adhesive Perimeter Gasketing, Dark Bonzed Anodized.
 3. Type SS2: Adhesive Perimeter Gasketing, Clear Anodized.

1.3 FINISHES

- A. Thresholds: Latching Panel Exit Saddle, Mill Finish Aluminum.

PART 3 EXECUTION

1.4 INSTALLATION

- A. Install hardware in accordance with approved hardware schedule and manufacturer's instructions.
- B. Install mortise items flush with adjacent surfaces.
- C. Install locksets, closers, and trim after finish painting.
- D. Set thresholds in mastic and secure.

- E. Mount closers so that closers and closer arms are not visible on corridor or public side of doors or on exterior of building.

1.5 PROTECTION

- A. Remove or protect hardware until painting is completed.

1.6 ADJUSTING

- A. Test and adjust hardware for quiet, smooth operation, free from binding and rattling.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass for other sections referencing this Section.
 - 2. Framed mirrors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) 800 - Voluntary Specifications and Test Methods for Sealants.
- B. American National Standards Institute (ANSI) Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material.
 - 2. C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
 - 3. C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
 - 4. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 5. C1036 - Standard Specification for Flat Glass.
 - 6. C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT, Coated and Uncoated Glass.
 - 7. C1115 - Standard Specification for Dense Elastomeric Silicone Rubber Gaskets and Accessories.
 - 8. C1172 - Standard Specification for Laminated Architectural Flat Glass.
 - 9. C1184 - Standard Specification for Structural Silicone Sealants.
 - 10. C1281 - Standard Specification for Preformed Tape Sealants for Glazing Applications.
 - 11. C1294 - Standard Test Method for Compatibility of Insulating Glass Edge Sealants with Liquid-Applied Glazing Materials.
 - 12. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 13. E119 - Standard Test Method for Fire Tests of Building Construction and Materials.
 - 14. E152 - Standard Test Method for Fire Test of Door Assemblies.
 - 15. E163 - Standard Test Method for Fire Tests of Window Assemblies.
 - 16. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 17. E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
 - 18. E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 19. F1233 - Standard Specification for Security Glazing Materials and Systems.
- E. Consumer Product Safety Commission (CPSC) 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

- F. Glass Association of North America (GANA):
 - 1. Engineering Standards Manual.
 - 2. Glazing Manual.
 - 3. Laminated Glass Design Guide.
- G. Insulating Glass Manufacturers Alliance (IGMA):
 - 1. IGMA TB-3001 - Sloped Glazing Guidelines.
 - 2. SIGMA TM-3000 - Glazing Guidelines for Sealed Insulating Glass Units.
- H. National Fenestration Rating Council (NFRC):
 - 1. 100 - Procedure for Determining Fenestration Product Thermal Properties.
 - 2. 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.
 - 3. 300 - Procedures for Determining Solar Optical Properties of Simple Fenestration Products.
- I. Underwriters Laboratories (UL) 752 - Standard for Safety Bullet-Resisting Equipment.

1.3 SYSTEM DESCRIPTION

- A. Glass Thicknesses:
 - 1. Indicated thicknesses are minimums; select actual glass thicknesses by analyzing loads and conditions.
 - 2. Size glass to withstand positive and negative wind pressure acting normal to plane in accordance with Building Code as measured in accordance with ASTM E330.
 - 3. Provide glass in thicknesses and strengths to meet or exceed following criteria:
 - a. Comply with ASTM E1300.
- B. Thermal and Optical Performance Properties: Provide glass meeting specified performance properties, based on manufacturer's published test data for units of thickness indicated:
 - 1. U-factor: Per NFRC 100 expressed as Btu/square foot x hour x degree F.
 - 2. Solar heat gain coefficient: Per NFRC 200.
 - 3. Solar optical properties: Per NFRC 300.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data: Descriptive data and performance attributes for insulated glass.
 - 2. Samples:
 - a. 12 x 12 inch glass samples except clear.
 - b. 1/4 x 1/4 x 3 inch long sealant and] glazing compound samples showing available colors.
 - 3. Warranty: Sample warranty form.
- B. Quality Control Submittals:
 - 1. Test Report: Preconstruction adhesion and compatibility test report from glazing sealant manufacturer, based on submitted samples or acceptable data from previous testing of current formulations with similar products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Experience in work of this Section.
- B. Regulatory Requirements:
 - 1. Provide safety glass for locations subject to human impact as required by Building Code.
 - 2. Safety glass: Tested and labeled to CPSC 16 CFR 1201.
- C. Perform Work in accordance with GANA Glazing Manual, GANA Laminated Glass Design Guide, SIGMA TM-3000 and IGMA TB-3001.

1.6 PROJECT CONDITIONS

- A. Perform glazing on dry surfaces.

1.7 WARRANTIES

- A. Laminated Glass Units: Provide manufacturer's 5 year warranty against manufacturing defects resulting in edge separation, delamination, or material obstruction of vision through glass surface.
- B. Mirrors: Provide manufacturer's 5 year warranty against silver spoilage resulting from manufacturing defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Glass:
 - 1. AirMaster Windows and Doors Company. (www.airmasterpr.com)
- B. Substitutions: Equal or similar.

2.2 ACCESSORIES

- A. Setting Blocks: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone.
- B. Spacers: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone.
- C. Glazing Gaskets:
 - 1. Dense compression gaskets: ASTM C864, neoprene or EPDM, or ASTM C1115, silicone or thermoplastic polyolefin rubber, molded or extruded shape to fit glazing channel retaining slot.
 - 2. Soft compression gaskets: ASTM C509, Type II, molded or extruded, neoprene, EPDM, silicone or thermoplastic polyolefin rubber, of profile and hardness required to maintain watertight seal.
- D. Contact Sealant:
 - 1. Type: ASTM C1184, multi component, high modulus, neutral chemical curing silicone glazing and curtain wall sealant.
 - 2. Movement capability: 12 percent in extension and compression.
 - 3. Compatible with glass unit edge seals; tested to ASTM C1294.
 - 4. Color: To be selected from manufacturer's full color range.
- E. Contact Sealant:
 - 1. Type: Single component, medium modulus, neutral moisture curing silicone sealant; ASTM C1184 and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.
 - 2. Movement capability: 50 percent in extension and compression.
 - 3. Compatible with glass unit edge seals; tested to ASTM C1294.
 - 4. Color: To be selected from manufacturer's full color range.
- F. Weather-seal Sealant:
 - 1. Type: Single component, low modulus, neutral moisture curing silicone sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G and A.

2. Movement capability: 50 percent in extension and compression.
 3. Compatible with glass unit edge seals; tested to ASTM C1294.
 4. Color: To be selected from manufacturer's full color range.
- G. Butt Joint Glazing Sealant: ASTM C920, Type S, Grade NS, Class 25; single component silicone, low modulus type, non sag, color to be selected from manufacturer's full color range.
- H. Glazing Sealant: ASTM C920, Type S, Grade NS, Class 25; single component silicone, low modulus, non sag, color to be selected from manufacturer's full color range.
- I. Sealant Backing: ASTM C1330, Type O, size and density to control glazing sealant depth and produce optimum glazing sealant performance.
- J. Primer: As recommended by glazing sealant manufacturer.
- K. Glazing Tape: ASTM C1281 and AAMA 800; butyl based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for installation.

2.3 FABRICATION

- A. Sealed Insulating Glass:
1. Comply with ASTM E2190.
 2. Fabricate spacer bar frame of tubular aluminum filled with desiccant.
 3. Bond spacer bar frame to glass panes with twin primary seals.
 4. Fill space outside frame to glass edge with elastomeric sealant.
- B. Laminated Glass:
1. Comply with ASTM C1172 and ANSI Z97.1.
 2. Laminate glass with laminating film by manufacturer's standard heat and pressure process.
 3. Cut glass to required size at factory.
 4. Discard glass with voids, delamination, or entrapped dirt or foreign matter.
- C. Low-E Coated Glass: Apply low-emissivity coating to scheduled glass surface.
- D. Mirror Glass:
1. Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
 2. Arise and polish edges.
 3. Isolate glass from frame with resilient, waterproof padding.
- E. Fabrication Tolerances: ASTM C1036 and ASTM C1048.
- F. Glass Identification:
1. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.
 2. Etch manufacturer's label on each light of tempered glass.
- G. Source Quality Control:
1. Preconstruction adhesion and compatibility testing:
 - a. Perform adhesion test including ultraviolet exposure through glass on production samples of metals and glass in accordance with ASTM C794.
 - b. Test glass units, glazing materials, and glass framing members with specified finish for sealant compatibility, priming, and preparation requirements for optimum adhesion and performance.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean glazing rabbets; remove loose and foreign matter.
- B. Remove protective coatings on metal surfaces.
- C. Clean glass just prior to installation.

3.2 INSTALLATION - GENERAL

- A. Install glass in accordance with glass manufacturer's instructions.
- B. Maintain manufacturer's recommended edge and face clearances between glass and frame members.

3.3 INSTALLATION - STRUCTURAL SILICONE GLAZING METHOD

- A. Mask aluminum and glass surfaces adjacent to sealant pockets.
- B. Install temporary glass retainers to align faces of glass.
- C. Apply contact sealant; completely fill pockets. Tool joints and remove masking tape before sealant skim cure begins.
- D. Allow sealant to cure minimum time required by manufacturer.
- E. Remove temporary glass retainers.
- F. Insert joint backing to fill void between glass unit edges and glass spacer.
- G. Mask both sides of glass for full length of joint.
- H. Apply weather-seal sealant; tool to smooth, slightly concave profile.

3.4 INSTALLATION - SILICONE GLAZING METHOD

- A. Mask both sides of joint for full length.
- B. Install temporary glass retainers to align faces of glass.
- C. Provide temporary joint backing for one side of joint.
- D. Apply sealant to completely fill spaces; tool to smooth, slightly concave surface.
- E. Allow sealant to cure minimum time required by manufacturer. Remove temporary backing and fill voids with additional sealant.

3.5 INSTALLATION - GASKET GLAZING METHOD

- A. Fabricate gaskets to fit openings; allow for stretching of gaskets during installation.

- B. Set soft compression gasket against fixed stop or frame with bonded miter cut joints at corners.
- C. Set glass centered in openings on setting blocks.
- D. Install removable stops and insert dense compression gaskets at corners, working toward centers of glass, compressing glass against soft compression gaskets to produce weathertight seal.
- E. Seal joints in gaskets.
- F. Allow gaskets to protrude past face of glazing stops.

3.6 INSTALLATION - PRESSURE GLAZING METHOD

- A. Set glass unit in opening as recommended by system manufacturer.
- B. Tighten fasteners simultaneously at rate recommended by manufacturer to avoid unequal point pressures on glass.
- C. Torque fasteners to achieve required pressure against glass. Do not over tighten.

3.7 INSTALLATION - SEALANT GLAZING METHOD

- A. Apply sealant to full depth of permanent stops.
- B. Press glass into sealant with slight lateral movement to ensure adhesion.
- C. Apply sealant to full depth of removable stops. Secure stops in position, forcing contact with sealant bead and completely filling joint.

3.8 INSTALLATION - SEALANT AND TAPE GLAZING METHOD

- A. Apply tape to permanent stops, projecting slightly above sight line.
- B. Press glass into contact with tape.
- C. Install removable stops with spacer shims between stop and glass.
- D. Fill gap between removable stop and glass with glazing sealant.
- E. Trim protruding tape edges.

3.9 INSTALLATION - TAPE GLAZING METHOD

- A. Apply tape to permanent stops, projecting slightly above sight line.
- B. Press glass into contact with tape.
- C. Place glazing tape on removable stop side of glass.
- D. Install removable stop and apply pressure to ensure contact.
- E. Trim protruding tape edges.

3.10 INSTALLATION - COMPOUND GLAZING METHOD

- A. Locate and secure glass using glazing clips.
- B. Fill voids between glass and stops with glazing compound; tool to straight line. Slope to exterior for watershed.

3.11 INSTALLATION - MIRRORS

- A. Set mirrors with stainless steel clips and apply mirror adhesive in accordance with manufacturer's instructions to cover maximum 25 percent of back of mirror. Set mirror and press against substrate to ensure adhesive bond. Anchor rigidly to wall construction.
- B. Place plumb and level without distortion.

1.2 PROTECTION

- A. After installation, mark glass with an 'X' using removable plastic tape.

END OF SECTION

SECTION 08 91 00

LOUVERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fixed and Adjustable louvers and frames.
 - 2. Insect screens.
 - 3. Blank off panels.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc. (AMCA) Standard 500 - Test Methods for Louvers, Dampers and Shutters.
- B. American Architectural Manufacturers Association (AAMA):
 - 1. 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 2. 620 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Aluminum Substrates.
 - 3. 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
 - 4. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Architectural Extrusions and Panels.
- C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.
- D. ASTM International (ASTM):
 - 1. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors under the Influence of Wind Loads.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements: Design louvers to withstand:
 - 1. Design wind pressure in accordance with Building Code.
- B. Performance Requirements: Bear AMCA Certified Ratings Seal for air performance.
- C. Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- D. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.

- E. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Include locations, elevations, sections, dimensions, materials, finishes, attachment, and relationship to adjacent construction.
 - 2. Samples:
 - a. 3 x 3 inch coating samples in specified color.
 - b. 6 inch long blade samples.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: AMCA licensed test data.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. AirMaster Windows and Doors Company. (www.airmasterpr.com)
 - 2. Airline Products Co.
 - 3. Airolite Co.
 - 4. American Warming & Ventilating Inc.
 - 5. Arrow United Industries, Inc.
 - 6. Construction Specialties, Inc.
 - 7. Dowco Corp.
 - 8. Industrial Louvers, Inc.
 - 9. Louvers & Dampers, Inc.
 - 10. Penn Ventilator Co., Inc.
 - 11. Ruskin Mfg. Co.
 - 12. Safe-Air Inc.
 - 13. Snyder (E.G.) Co., Inc.
 - 14. Vent Products Co., Inc.
- B. Substitutions: Equal or similar.

2.2 MATERIALS

- A. Aluminum wall louvers:
 - 1. Aluminum extrusions.
 - 2. ASTM B221, 6063-T5 or T6 alloy and temper.
- B. Screen: mesh aluminum.

2.3 COMPONENTS

- A. Metal Louvers:
 - 1. Type: Fixed blade.
 - 2. Blade: Horizontal storm-resistant louvers.

2.4 ACCESSORIES

- A. Anchors: Stainless steel, type best suited to application.

2.5 FABRICATION

- A. Fit components to hairline joints. Weld connections, with welds ground smooth and filled.
- B. Join vertical mullions with I-shaped slip connection.
- C. Fabricate horizontal mullions to appear as single louver.
- D. Mount screen in rewireable U-shaped frame.
- E. Provide metal sheeting of same material and finish as frame to blank out unused portions of louvers.

2.6 FINISHES

- A. Aluminum: Fluoropolymer coating, 3 coat, color to be selected from manufacturer's full color range.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
- B. Set plumb, level, and rigid, with flush hairline joints.
- C. Anchor to supporting construction.
- D. Prevent contact of aluminum and dissimilar metals by use of zinc rich paint, bituminous coating, or non absorptive gaskets.
- E. Install screen on inside face.
- F. Install blank out sheeting over unused portions of louver.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

DIVISION 09 FINISHES

SECTION 09 2400

PORTLAND CEMENT PLASTERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portland cement plaster on metal lath, concrete and masonry base.
 - 2. Trim.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C150 - Standard Specification for Portland Cement.
 - 2. C206 - Standard Specification for Finishing Hydrated Lime.
 - 3. C847 - Standard Specification for Metal Lath.
 - 4. C897 - Standard Specification for Aggregates for Job-Mixed Portland Cement-Based Plasters.
 - 5. C926 - Standard Practice for Application of Portland Cement-Based Plaster.
 - 6. C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.
 - 7. C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
 - 8. C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
- B. National Association of Architectural Metal Manufacturers (NAAMM) ML/SFA 920 - Guide Specifications for Metal Lathing and Furring.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Hot weather procedures: Description of proposed application and curing procedures.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Minimum 5 years documented experience in work of this Section.
- B. Mockup:
 - 1. Size: 100 square feet.
 - 2. Show: Plaster color and texture, horizontal and vertical control joints, and casings.
 - 3. Locate where directed.
 - 4. Approved mockup may remain as part of the Work.

1.5 PROJECT CONDITIONS

- A. Hot Weather Requirements:
 - 1. At ambient temperature above 85 degrees F, relative humidity less than 75 percent, or winds in excess of 20 MPH, fog surface with water and cover with minimum 6 mil polyethylene film weighted or taped in place.
 - 2. Leave coverings in place minimum 48 hours after application.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Metal Lath:
 - 1. ASTM C847, expanded diamond mesh, galvanized.
- B. Plaster Materials:
 - 1. Portland cement: ASTM C150, Type 1.
 - 2. Lime: ASTM C206, Type S.
 - 3. Sand: ASTM C897, natural or manufactured, uniformly graded.
 - 4. Plaster mix reinforcement: ASTM C116, glass fibers, produced specifically for integral plaster reinforcement, alkali resistant.
 - 5. Colorant: Pure mineral oxide type, color to be selected from manufacturer's standards.
 - 6. Water: Potable.

2.2 ACCESSORIES

- A. Trim Accessories:
 - 1. Material: Formed steel sheet, hot dip galvanized finish, expanded flanges. Formed zinc alloy, perforated flanges or extruded PVC, perforated flanges.
 - 2. Corner bead: Beaded edge, size and profile to suit application.
 - 3. Casing bead: Thickness governed by plaster thickness, square edge.
- B. Fasteners: Type and size suited to application, hot-dip galvanized or fluoropolymer coated steel.
- C. Tie Wire: 16 gage, galvanized steel, soft annealed.
- D. Bonding Agent: ASTM C932; type recommended for bonding plaster directly to concrete and concrete masonry surfaces.

2.3 MIXES

- A. Proportions:
 - 1. Base and brown coats: Proportion as indicated in Table 2 ASTM C926. Add glass fibers at a rate of 1-1/2 pounds per sack of cement.
 - 2. Finish coat: As indicated on Table 3 in ASTM C926.
- B. Mixing:
 - 1. Use mechanical mixer.
 - 2. Mix each batch separately; double batching with single batch discharge not acceptable.
 - 3. Accurately proportion materials for initial mixture using measuring devices of known volume. Sand may be added by shovel after mixer is calibrated with known volumes of materials, including water.
 - 4. Thoroughly mix materials dry before adding water. Continue mixing for 3 to 5 minutes after all ingredients have been added.
 - 5. Clean equipment after each batch.
 - 6. Mixtures may be retempered one time after initial mixing.
 - 7. Discard frozen, caked, and hardened mixes. Discard mixes not used within 1 hour after initial mixing.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean substrate surfaces of foreign matter.
- B. Apply bonding agent to concrete and masonry surfaces in accordance with manufacturer's instructions.
- C. Wet high suction bases with fine water spray to produce uniformly damp surface.

3.2 INSTALLATION OF METAL LATH

- A. Perform Work in accordance with ASTM C 926.
- B. Apply with long dimension perpendicular to supports, with end joints staggered and occurring over supports. Secure end laps with tie wire where they occur between supports.
- C. Lap ends minimum 1 inch and sides minimum 1-1/2 inches.
- D. Screw to framing at maximum 6 inches on center.
- E. Secure to concrete or masonry with wire hooks or loops spaced maximum 24 inches on center in both directions.
- F. Stop lath at each side of expansion and control joints and secure.
- G. Reinforce corners of openings with 6 x 12 inch lath strip installed diagonally at each corner, wire tied to lath.
- H. If lath is not continued minimum 3 inches on each side of internal corners, reinforce with 12 inch wide lath strip bent at 90 degrees and wire tied to lath.

3.3 INSTALLATION OF ACCESSORIES

- A. Install casing beads where plaster abuts dissimilar material or stops with edge exposed.
- B. Install corner beads at external corners.
- C. Install control joints:
 - 1. Locate as follows unless otherwise indicated:
 - a. As required.
 - b. Vertically above and below each side of openings.
 - c. Horizontally at each floor line.
 - 2. Run vertical joints continuous; butt horizontal joints into vertical joints.
 - 3. Apply joint sealer to form waterstop behind joints at intersections.
- D. Set level and true to line.

3.4 APPLICATION OF PLASTER

- A. Apply plaster in accordance with ASTM C926.
- B. Apply base, brown, and finish coats to minimum 1/2 inch thickness from face of lath, face of concrete or masonry.
- C. Dampen each coat prior to applying succeeding coats.

- D. Base Coat:
 - 1. Apply to nominal 3/8 inch thickness.
 - 2. Form full keys on lath. Cross rake surface to bond brown coat.
- E. Brown Coat:
 - 1. Apply to nominal 3/8 inch thickness.
 - 2. Bring out to grounds and rod level.
 - 3. Float surface to provide surface texture receptive to application of finish coat.
- F. Finish Coat:
 - 1. Apply to nominal 1/8 inch thickness.
 - 2. Work from wet edges to apply unbroken area in one continuous operation to eliminate joints.
 - 3. Finish surfaces to fine sand float texture.
 - 4. Finish surfaces true to plane, plumb and with neat, sharp corners and intersections.
 - 5. Work in panels to nearest natural break formed by intersections, corners, trim, and accessories.
 - 6. Tool plaster to V-joint at trim, grounds and accessories.
 - 7. Not acceptable: Lines caused by variations in application or finishing techniques, cold joints, and other surface defects visible when viewed from a distance of 10 feet.
- G. After application of each coat, fog spray plaster with clean water in sufficiently frequent applications to maintain plaster uniformly moist for minimum of 48 hours.
- H. Installation Tolerances:
 - 1. Plaster: Maximum 1/8 inch in 10 feet variation from true flatness.
 - 2. Trim: Maximum 1/4 inch in 10 feet variation from plumb, level, or true plane, noncumulative.

3.5 ADJUSTING

- A. Repair or replace damaged, discolored, and defective plaster. Match patched areas to surrounding plaster.

3.6 CLEANING

- A. Clean plaster from trim and accessories before it sets.

END OF SECTION

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Suspended metal ceiling grid system.
 - 2. Acoustical panels.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - 2. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 3. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
 - 4. E1264 - Standard Classification of Acoustical Ceiling Products.
- B. Ceiling and Interior Systems Construction Association (CISCA) - Ceiling Systems Handbook.
- C. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Samples:
 - a. 12 x 12 inch acoustical panel samples.
 - b. 6 inch long suspension system samples showing each profile.
- B. Quality Control Submittals:
 - 1. Certificates of Compliance: Certification from an independent testing laboratory that acoustical panels meet fire hazard classification requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 2 years experience in work of this Section.
- B. Fire Hazard Classification: Class A, UL rated, tested to ASTM E1264.

1.5 PROJECT CONDITIONS

- A. Environmental Requirements: Install in approximately same conditions of temperature and humidity as will prevail after installation.

1.6 MAINTENANCE

- A. Extra Materials: One unopened carton , 48 square feet of each acoustical panel.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Acoustical Units:
1. Design Basis: Contract Documents are based on products by Armstrong
 2. Equivalent products by following manufacturers are acceptable:
 - a. Armstrong World Industries, Inc. (www.armstrong.com)
 - b. Chicago Metallic Corporation. (www.chicago-metallic.com)
 - c. USG Corporation. (www.usg.com)
- B. Acceptable Manufacturers - Suspension System:
1. Armstrong World Industries, Inc. (www.armstrong.com)
 2. Certainteed Corporation (www.certainteed.com)
 3. USG Corporation. (www.usg.com)
- C. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Suspension Grid System:
1. ASTM C635 heavy duty, die cut, interlocking ends.
 2. Grid type: Exposed T.
 3. Material: Galvanized steel.
 4. Runners: 1-1/2 inches high, 15/16 inch exposed width, flush profile.
 5. Perimeter molding: Angle shape.
 6. Finish: Factory applied enamel paint, sprayed and baked, white color
 7. Accessories: Stabilizer bars, clips, splices.
- B. Acoustical Panels:
1. Source: Cirrus by Armstrong or approved substitute.
 2. Size: 24 x 48 inches x 3/4 inch thick.
 3. Edge configuration: Beveled.
 4. Performance requirements: Tested in accordance with ASTM E1264.
 - a. NRC: 0.70
 - b. CAC: 0.35
 - c. Light reflectance: LR-0.86

2.3 ACCESSORIES

- A. Support Channels:
1. Galvanized steel; size and type to suit application.
- B. Hanger Wire:
1. ASTM A641, minimum 12 gage galvanized steel.
- C. Hold Down Clips: Minimum 24 gage spring steel, manufacturer's standard profile.
- D. Impact Clips: Minimum 24 gage spring steel, manufacturer's standard profile.
- E. Touch-Up Paint: Color to match acoustical panels and suspension grid.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install ceilings in accordance with ASTM C636 and CISCA Handbook.
- B. Minimize panels less than one half size.
- C. Install molding around perimeters and abutting surfaces. Miter molding at exterior corners; cut flanges and bend web to form interior corners.
- D. Space hanger wires maximum 48 inches on center. Install additional hangers where required to support light fixtures and ceiling supported equipment.
- E. Do not suspend hangers directly from metal deck. Attach steel channel horizontally to adjacent framing members; place hanger at regular spacing.
- F. Hang suspension system independent of walls, columns, ducts, pipes, and conduit.
- G. Where ducts or other equipment prevent regular spacing of hangers:
 - 1. Reinforce nearest related hangers to span extra distance, or:
 - 2. Suspend steel channel horizontally beneath duct or equipment; place hanger at regular spacing.
- H. Install main tees at maximum 48 inches on center.
- I. Install cross tees to form 24 x 48 inch modules. Lock cross tees to main tees.
- J. Support ends of tees on flange of perimeter molding.
- K. Place acoustical panels with edges resting flat on suspension grid.
- L. Cutting Acoustic Units:
 - 1. Cut to fit irregular grid and perimeter edge trim and around penetrations.
 - 2. Locate cuts to be concealed.
 - 3. Cut and field paint exposed edges of reveal edge units to match factory edge.
- M. Place hold down clips over cross tees at mid point of each module.
- N. Place impact clips over cross tees at mid point of each module.
- O. Lighting Fixture Protection: Form trapezoidal, five sided box of acoustical panels cut to size over each light fixture; conform to UL requirements.
- P. Installation Tolerances: Ceilings level to 1/8 inch in 12 feet measured in any direction.

3.2 ADJUSTING

- A. Touch up minor scratches and abrasions to match factory finish.

END OF SECTION

SECTION 09 91 00 PAINTING

PART 1. GENERAL

1.01 SUMMARY

1.01.1 SECTION INCLUDES

- A.** This section includes furnishing all labor, materials and equipment necessary to perform and complete the painting and finishing required for interior and exterior of structure or elsewhere, as indicated in the Construction Drawings and/or required by the Engineer.

1.02 DEFINITIONS

Painting. The term "painting" as used herein includes the use of emulsion, enamel, paints, sealers, and other coating, organic and inorganic whether used as primer, intermediate or finish coats.

1.03 SUBMITTALS

- A.** All materials shall be subject to approval by the Engineer. The Contractor shall, if required, submit samples for approval.
- B. Color, Texture and Workmanship Submittal.** The Contractor shall prepare and fully coat a designated area or item of each kind of surface to be painted. Once a wall, space or item has been approved by the Engineer for color, texture and workmanship, the wall, space or item shall become the standard for successive work.
- C.** After final approval of all colors by the Engineer the Contractor shall submit to the authorized representative of the owner., color chips of all paint used with the manufacturer's name and his designation of the paint and color for the purpose of the future reordering of paint. Color chips shall measure at least six square inches.
- D.** The Contractor shall be responsible for the coordination of all paint materials to be supplied in the shop and field, and shall submit a complete list of all such paint materials to the engineer for approval prior to their application in either field or shop, with certification from the material suppliers that such prime and finish coat materials are compatible prime coat which is incompatible with the specified finishing material or is improper for the purpose then such prime coat shall be removed and the surface prepared for painting as specified hereinafter.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Storage.** All materials used in the work shall be stored in an approved location. Such storage space shall be kept neat and clean; all damage there to or its surroundings shall be repaired prior to completion of the work. Oily rags, waste and similar articles shall be removed from the buildings every night. Every precaution shall be taken to avoid danger of fire. Proper containers outside of the building shall be provided by the contractor and used for painting waste and no plumbing fixtures shall be used for this purpose.

1.05 QUALITY ASSURANCE

A. Workmanship:

- B.** It is intended that all painting work be first class. Materials shall be evenly spread without runs or sags. There shall be an easily perceptible difference in shades of successive coats of paint. The contractor shall notify the engineer upon completion of a particular coat. Once inspected and approved, the painter may proceed with the next coat.
- C.** The painter shall examine the specifications for the various other trades whose work is to be finished under this section. Any materials requiring painting, which are left unfinished by requirements for such other trades, shall be painted to completion under this section. Unless specifically excluded, any defects in such work, which would have an adverse effect on the finish, shall be corrected before any work of painting is started.
- D.** Painting shall be done with all possible care to protect this work and the work of other trades. All damage to this and other work caused by the operations under this section of the specifications shall be corrected or repaired as required.
- E.** Hardware and nameplates shall be removed during the painting operations. The painter shall apply clear plastic by spray can or brush to all nameplates

PART 2. PRODUCTS

2.01 MATERIALS

- A.** Paint products shall be supplied by a manufacturer experience in and specializing in the compounding of paints and coatings suitable for use in wastewater treatment plants and facilities.
- B.** The paints and paint products of the Sherwin Williams, Glidden Company, the Koppers Company, Inc., Themec Company, Inc., and the Pittsburgh (PPG) schedules are given as standards of quality. The usual "or approved equal" clause shall apply. No request for substitution will be considered which decrease the film thickness and/or the number of coats to be applied, or which offers a change from the generic type of coating specified.
- C.** All painting materials shall be delivered to the mixing room in unbroken packages, bearing the manufacturer's brand and name.
- D.** Paints containing lead surpass federal maximum levels will not be allowed. Oil shall be pure boiled linseed oil.
- E. Vinyl Paint.** Shall be first quality paint suitable for use on interior and exterior of concrete masonry surfaces. It shall prevent moisture from reaching the inner side of walls by acting as sealer.
- F.** All colors are to be selected by the Engineer.

2.02 FINISHES

- A. Paint Color.** The manufacturer shall be able to furnish all paints for exposed surfaces in a wide range of colors and lighter and darker of these colors.

The color scheme shall be in accordance with schedules provided by the engineer, and all tinting and matching shall be to satisfaction of the Engineer, where standard chart colors are not satisfactory. Two or more colors may be use in any given room or area.

All exposed piping and related equipment in the fueling facilities areas shall be color-coded in accordance with the Occupational Safety and Health Act. Where a single color is specified the pipe shall be finish painted continuously over its entire exposure. All sampling pipelines shall be color coded as indicated on the product sample.

Contractor shall follow the Standard Color Code of the Puerto Rico Aqueduct and Sewer Authority included in this section and/or as required by Engineer. The applicable safety color standards related to the Occupational Safety and Health Act of 1970, shall have priority over any other color.

- B. Compatibility of coatings.** Shop painting of materials and equipment is required under the various sections of the contract. All prime coat paint materials and/or manufacturer's standard paint system shall be compatible with the finish coat materials, to be furnished under this section. The contractor shall be responsible for the coordination of all paint materials to be supplied in the shop and field, and shall submits a complete list of all such paint materials to the engineer for approval prior to their application in either field of shop, with certification from the material suppliers that such prime and finish coat materials are compatible prime coat which is incompatible with the specified finishing material or is improper for the purpose then such prime coat shall be removed and the surface prepared for painting as specified hereinafter.

PART 3. EXECUTION

- A.** Contractor shall furnish all labor, materials and equipment necessary to do all painting and finishing as specified in the Construction Drawings, for interior and exterior of structure, or elsewhere as ordered by the Engineer. All paint shall be prepared and applied in strict accordance with the instructions furnished to the Contractor.
- B.** Skilled workmen shall do all painting, and all surfaces shall be perfectly clean, smooth, free from scratches and thoroughly dry before starting any painting. No coat shall be applied until the preceding coat has thoroughly dried. All painting shall be evenly spread, and well brushed until there are no drops, runs or sagging of materials, and when the work is finished there shall be no brush marks left on the surfaces.

Paint shall be applied in the number of coats specified in the Construction Drawings before or as directed by the Engineer. Surfaces, which cannot be satisfactorily finished in the specified number of coats, shall have such additional coats or such preparatory coats and subsequent coats as may be required to produce a satisfactory finished coat. The completed work shall be of exact shades and textures selected. Work that is not to be finished under this section shall be protected against spatter, stains, or spilling, and each type finish shall be protected against similar defacements by other finish.

1. Exterior Concrete. Treat all exterior concrete surfaces designated to be painted as follows:

a) **Step One.** Remove dust, form oil, curing compound, laitance, surface glaze, and other foreign matter. Brush blast to remove old paint and foreign matter.

b) **Step Two.** Rinse with water.

c) **Step Three.** Apply one of the following acrylic latex systems:

1) **Devroe 2.8 mils system.** One coat 13xx Tru-Vy-Kote Vinyl Acrylic Masonry. Paint with one pint 16200 Wonder Bond Mixing Liquid per gallon added, 1.4 mils. One coat 13xx Tru-Vy-Kote Vinyl Acrylic Masonry Pint, 1.4 mils.

2) **DuPont 3.0 mils system.** Two coats Lucite House Paint 1300 Series, 1.5 mils each.

3) **PPG 3.6 mils system.** Two coats 6-650 Series Speedhide Acrylic Latex House Paint, 1.8 mils each.

4) **Sherwin 2.6 mils system.** Two coats Weather Perfect Acrylic Latex Flat Exterior Finish, B-36 Series, 1.3 mils each.

2. Interior Concrete. Designated interior exposed concrete surfaces, including wall, ceiling, pilasters and columns, and like items.

a) **Step One.** Remove dust, form oil, curing and other foreign matter.

b) **Step Two.** Etch surface with a 10 to 12 percent solution of muriatic acid.

c) **Step Three.** Rinse with water to remove all acid residue.

d) **Step Four.** Apply one of the following alkyd systems:

1) **Devroe 3.7 mils system.** One coat 50501 Devroe Alkyd Primer, 1.3 mils. Two coats 23xx Velour Eggshell with final coat roller stripped 1.2 mils each.

2) **DuPont 4.5 mils system.** One coat Lucite Alkyd Interior Primer 853c, 1.5 mils. Two coats Custom Color Semi-Gloss 1911c or 1912c, 1.5 mils each.

3) **PPG 4.5 mils system.** One coat 6-3 Resistant Primer, 1.5 mils. Two coats 50-65 Snolite Alkyd Stippling Eggshell Enamel with final coat roller stippled 1.5 mils each.

4) **Sherwin 6 mils system.** One coat Wall and Wood Primer, B49 W 2, 2 mils. Two coats Eggshell Enamel, B33 W 100 with final coat roller stippled 2 mils each.

C. Shop painting is required for all of the various items of equipment and other ferrous metal items furnished under the contract. Shop painting shall conform to the applicable requirement of this section for pre-finishing, cleaning, and shop painting of the metal surfaces.

Contractor shall field paint all miscellaneous ferrous metal, structural steel, equipment including equipment previously shop painted with manufacturer's standard paint systems, piping, valves, gates, and specials. All exposed interior concrete blocks above grade, interior submerged tanks walls and pump station wet well walls abutting occupied areas, and all other work obviously required to be painted unless otherwise specified.

D. Coordination and work specified elsewhere:

The contractor shall coordinate the work specified in this section with that in other sections of this specifications in order that all necessary items shall be provided as required for satisfactory operation and that the various items of equipment will properly fit and operate in the spaces allotted to them.

The following work is specified elsewhere:

1. Concrete work
2. Masonry work
3. Mechanical Work
4. Electrical work

E. Preparation of surfaces for shop/or field painting. All metals surfaces to be shop painted or which were improperly shop painted, and all abraded or rusted shop painted metal surface which are to be field painted shall be prepared as specified herein and shall be dry and clean before painting. All non-metal surfaces shall be prepared as specified herein. No field painting shall be done until the Engineer approves the surface.

1. **Non-submerged metal surfaces.** These surfaces shall be cleaned with a commercial blast (SSPC-SP6), except that motors and like items that may be damage by blasting and cast-iron pipe and fittings may be prepared by other approved means.
2. **All submerged or intermittently submerged metal surfaces.** These surfaces shall be cleaned with near white metal blast (SSPC - SF10).
3. **Concrete and masonry surfaces.** All concrete and masonry surfaces shall be cleaned of all dust, from oil, curing compounds and other foreign matter.

Before applying coating to submerge concrete or concrete floors, these surfaces shall be etched with a 15 percent muriatic acid solution. The acid shall be washed off with water 30 minutes after it is applied. If required to obtain a clean concrete surface or if required by Engineer, the procedure shall be repeated until the desired results are obtained.

4. **Wood surfaces.** Shall be thoroughly cleaned of all extraneous matter and all cracks, nail holes, and other defects properly filled after priming and smoothed. Wood trim shall be sandpaper to a fine finish and wiped clean of dust.

5. PVC Piping. Lightly sands all surfaces to be painted.

6. Gypsum plaster. Any rough spots in plaster surfaces shall be sanded smooth and sealed before application of the priming coat.

All suction spots of the plaster (hot spots, after the application of the first coat shall be touched up before applying the second coat to produce an even result in the finish coat.

F. Application of Paint. On metal surfaces, the painter shall apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required by the manufacturer. If material has thickness or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. In other words, one gallons of paint as originally furnished by the manufacturer must not cover a greater square foot area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of additional coats of paints, on masonry, application rates will vary according to surface texture: however, in no case shall the manufacturer's rated coverage rate be exceeded. On porous surface, it shall be the painter's responsibility to achieve a protective and decorative finish either decreasing the coverage rate or by applying additional coats of painting.

G. Inaccessible metal work. Metal surfaces which are to be in permanent contact with concrete or masonry, or embedded in masonry shall be given a coat of primer and two coats of asphalt varnish in the field before being made inaccessible. Other metal surfaces which will be inaccessible for painting in the finished work shall be painted two coats of the same material as the priming coat before being made inaccessible, and other finish painting of such surfaces will not be required. This does not apply to metal work with bituminous coatings applied in the shop or factory.

H. Pre-finished items. Equipment, such as motors, pumps and other such items, which, when installed, become an integral part of a system and which may be delivered fully factory-finished, that is, having finished coatings in addition to the prime coatings, shall be patch painted where damage, sanded to a dull gloss and then painted two coats of the specified finish material with colors to suit the area of installation as directed. The Engineer may, at his option, require that certain equipment not be painted.

I. Color scheme. A complete color scheme for the work will be furnished by the Engineer from standard color charts submitted by the contractor, except for standard color-coding required by the owner.

3.02 SCHEDULE

A. The room finish schedule shown in the Construction Drawings and the painting schedule included herein are intended to supplement each other, and together constitute one complete set of painting requirement, so that any work exhibited in one and not in other shall be executed just as if it had been set forth in both, in order that the work shall be completed in every respect.

B. Standard Color Code

These colors are included for the sole purpose of identifying facilities. The paint furnished must conform to the quality requirements specified hereinafter and must also match this color code.

1. Pipes

- a. Raw water - Olive green
- b. Settled or clarified water - Light blue
- c. Filtered Water – Light Blue
- d. Treated or potable water - Dark blue
- e. Primary or Secondary Coagulant - Orange
- f. Chlorine (gas, solution or liquid) - Yellow Electrical conducts - Red
- g. Fluoride - Light yellow with red stripe Lime slurry - Light green
- h. Potassium Permanganate - Violet Polymer - Orange with green stripe
- i. Sulfur dioxide - Light green with yellow stripe Wash water - Light brown
- j. Slime ("cieno") - Dark brown Sanitary sewer - Dark gray
- k. Compressed air & Vacuum Pipe - Dark green Gas - Black
- l. Other piping - Light gray

2. Equipment

- a. Pumps, motors, belt, guards, unit drive mechanism, gear boxes ----- gray
- b. Motor control centers, control panels, bus duct and switchgear ----- gray
- c. Hydrants & Valve hand wheels ----- red
- d. Interior raw sewage pipe, valve bodies, shafting, pumps, motors, gear boxes, machinery, etc. -----
----- gray

C. Painting Schedule. The schedule of areas to be painted is as follows:

1. General

- a) Imperfections and scratches on equipment not repainted shall be touched up with matching paint provided by the equipment manufacturer.
- b) Where more than one coat of paint is required, the undercoats shall be a single lighter than succeeding coats to insure complete coverage.
- c) Colors shall be as selected by the engineer.
- d) Aluminum and stainless steel surfaces shall not be painted.
- e) Apply one coat of metal primer, of the types specified, and one coat of flat black metal enamel, to the surfaces of all ductwork behind grilles, for a distance of 18 inches.
- f) All pipes and other metals that have been dipped in tar or bituminous products shall receive two coats of copper. "Interior tar stop" or two coats of Themec "no. 707 tar bar" in place of the priming coat.

- g) Back-prime with the specific interior first coat material, all surface of finish and trim which will be concealed after installation.

2. Masonry

Interior. Contractor shall paint the interior masonry wall and ceiling surfaces listed in the room schedule included in the Construction Drawings and those walls and ceiling surfaces indicated by Engineer.

3. Metal (except as excluded above)

Contractor shall paint all interior, exterior and submerged metal surfaces, including piping, machinery, lintels, equipment, and other miscellaneous items.

4. Plaster

All exposed plaster shall be painted as required.

5. Plastic (except as excluded above)

All exposed plastic pipe and miscellaneous plastic items shall be painted.

6. Wood (except as exclude above)

All interior and exterior wood surfaces shall be painted.

D. Paint system

Contractor shall follow the indications in this sections for the different materials.

1. Masonry and Concrete

- a) **Exterior concrete and masonry.** One coat of primer and two coats exterior concrete and masonry paint, unless otherwise indicated.
- b) **Interior and exterior exposed concrete surfaces.** Two coats of silicone fortified finish, unless otherwise indicated.
- c) **Interior concrete surfaces** (except where indicated or directed to receive any other finish). Two coats interior concrete or masonry paint.
- d) **Interior hollow block masonry surface.** One coat white concrete blocks filler, one gloss enamel and one coat spatter or solid color as required by Engineer.
- e) **Interior concrete and masonry surface** (enamel finish). One coat enamel undercoated and one coat semi-gloss enamel.

- f) Toilet rooms, rest rooms, locker and dressing room, and shop areas.** Walls to be finished with ceramic tile shall be given above the tile line, a waterproofing primer and two coats of enamel paint or a polyester and Epoxy resins paint.

2. Metals

- a) Submerged or intermittently submerged ferrous metal surfaces.** Contractor shall use the following products or approved equal:

1) Manufactured by Koppers

Primer: Pug Primer (shop or field), 1 coat 1.5 dry mils. Field:
Bitumastic No. 300-M-2 coats 8-10 dry mils per coat

2) Manufactured by Themec

Primer: 77 Chem-Prime (shop or field) 1 coat 1.5 dry mils
Field Up: 413 Tnemec - Tar-2 coats 8.3 dry mils per coat

- b) Interior exposed ferrous metal surfaces.** Contractor shall use the following products or approved equal:

1) Manufactured by Koppers

Shop or field primer: Pug primer -1 coat- 1.5 dry mils
Field touch up: Pug primer-1 coat- 1.5 dry mils

2) Manufactured by Tnemec

Shop or Field primer: 77 Chem prime 1 coat 2.1 dry ,mils
Field touch up: 77 Chem prime 1 coat 2.1 dry mils
Finish: Tnemec Tufcoat (series 18) 2 coat 1.3 dry mils per coat

- c) Exterior exposed ferrous metal surfaces.** Contractor shall use the following products or approved equal:

1) Manufactured by Koppers

Shop or field primer: Torex 820 primer-2 coats 1.2 dry mils per coat
Finish: Torex 800 Enamel 2 coats 1.0 dry mils per coat

2) Manufactured by Tnemec

Shop or field Primer: 77 Chem prime 2 coat 1.9 dry mils per coat.

Finish: Chlorine (series 13) 2 coats 1.4 dry mils per coat

d) Non - ferrous and galvanized metal surfaces:

Contractor shall paint non-ferrous and galvanized metals surfaces as specified herein for ferrous metal surfaces after pre-treatment (see "Preparation of surfaces for shop/or field painting").

e) Submerged or intermittently-submerged galvanized metal surface:

Contractor shall paint as specified in this section for submerged or intermittently submerged metal surfaces.

3. Interior and exterior painted and stained wood surfaces

a) Interior mahogany. Contractor shall apply one coat of filler, one coat of stain when directed, and one coat of gloss varnish or two coats of satin varnish.

b) Other interior woodwork. Contractor shall apply one coat of enamel undercoated and two coats or semi- gloss enamel.

4. PVC Piping

a) Contractor shall apply two (2) coats of Koppers - Glamorglaze 1.75 dry mils per coat, PPG Aquapon 2 coats- 2.0 dry mils per coat, or approved equal.

E. Pipe identification markers

1. Pipe identification shall conform to the requirements of the Puerto Rico Ports Authority.

- a. Pipe markers shall consist of plastic coated fabric "all temperature" labels as manufactured by the W.H. Brady company or Seton Name Plate Corporation or approved equal. They shall indicate the pipe contents in printed, black letters on white background. Labels shall be of such length so as to completely circumscribe the pipe and overlap not less than one edge.
- b. Flow markers shall consist of labels similar to the pipe markers with a large black arrow printed on the same background color to indicate the direction of flow of the pipe.
- c. A pipe marker and a flow marker shall be placed on each pipe on each side of walls or floors through which the pipes pass. Such markers shall also be placed adjacent to valves and fittings and for exposed piping the markers shall be so located as to be clearly visible to a person standing on the floor.
- d. On pipes one inch and smaller in diameter requiring identifying marking, a metal tag of not less than one inch in diameter, with lettering etched and filled with enamel, shall be attached in lieu of labels.

- e. Concealed piping and ducts such as in shafts and over suspended ceilings shall be color-coded adjacent to valves and fittings and so to be clearly visible in the pipe shafts. Otherwise no color-coding is required for such lines.

3.03 FIELD QUALITY CONTROL

- A. Clean-up and inspection.** At the completion of the Painting work has been finished, but before its final acceptance, the Contractor shall carry out a thorough cleaning of the building, so that all paint spattering, stains, or spilling on floor (including all paint spots and oil or grease stains), walls, windows, doors, plumbing fixtures, hardware and equipment, etc., shall be removed.
- B. Final Inspection.** The contractor shall protect all painted surfaces against damage until the date of final acceptance of the work. The Engineer will conduct a final inspection of all work and the contractor will be required to repaint or retouch any areas found which do not comply with the requirements.

END OF SECTION

DIVISION 10 SPECIALTIES

SECTION 10 2813

TOILET ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Toilet bath and shower accessories.
 - 2. Framed mirrors.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. A123/A123M - Standard Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 - 2. A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 3. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 4. A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 5. B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
 - 6. C1036 - Standard Specification for Flat Glass.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Product Data:
 - a. Schedule accessories by room; show plans and elevations, and identify room name and number, type and quantity of accessories, and mounting heights.
 - b. Include manufacturer's brochures showing sizes, details of function, finishes, and attachment methods.
 - 2. Samples: One of each accessory, if requested.
 - 3. Warranty: Sample warranty form.

1.4 QUALITY ASSURANCE

- A. Conform to applicable accessibility code for locating accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. A and J Washroom Accessories. (www.ajwashroom.com)
 - 2. American Specialties, Inc. (www.americanspecialties.com)
 - 3. Bobrick Washroom Equipment, Inc. (www.bobrick.com)
 - 4. Bradley Corp. (www.bradleycorp.com)

5. GAMCO. (www.gamcousa.com)

B. Substitutions: Equal or similar. Under provisions of Division 01.

2.2 MATERIALS

A. Stainless Steel:

1. Sheet: ASTM A167, Type 304, rollable temper.
2. Tubing: ASTM A269.

B. Galvanized Steel:

1. ASTM A1008/A1008M.

C. Mirror Glass: ASTM C1036, Type I, Class 1, Quality q1, 3/16 inch thick.

2.3 ACCESSORIES

A. Fasteners: Stainless steel where exposed, hot dip galvanized where concealed; type best suited to substrate conditions.

2.4 FABRICATION

A. Use stainless steel for exposed surfaces; galvanized steel may be used in concealed locations.

B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.

C. Weld joints of fabricated components and grind smooth.

D. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.

E. Fabricate soap dispensers to operate with less than 5 pound force.

F. Provide hangers, adapters, anchor plates, and accessories required for installation.

G. Key locks alike; furnish six keys.

H. Mirrors:

1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered and welded.
2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
3. Backing: Galvanized steel sheet.
4. Isolate glass from frame and backing with resilient, waterproof padding.

I. Shop assemble units and package complete with anchors and fittings.

2.5 FINISHES

A. Stainless Steel: No. 4 satin.

B. Galvanizing: ASTM A123/A123M to 1.25 ounces per square foot.

- C. Chrome Plating: ASTM B456, Type SC 2, polished.
- D. Polyethylene: White.
- E. Enamel: White.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set plumb, level, square, and rigid.
- C. Install wiring between power supply and accessories.

3.2 SCHEDULE

NO.	DESCRIPTION	MODEL NO.	MANUFACTURER
1	Roll Towel Dispenser	B-2860	Bobrick
2	Toilet Tissue Dispenser	B-2888	Bobrick
3	Wall Mounted Liquid Soap Dispenser	B-4112	Bobrick
4	Mirror (24" x 36")	B-1652430	Bobrick
5	Curtain Rod	B-6107	Bobrick
6	Soap Holder	B-6807	Bobrick

END OF SECTION

SECTION 10 4413

FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Portable fire extinguishers.
 - 2. Cabinets and wall brackets.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM) E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops.
- B. National Fire Protection Association (NFPA) 10 - Portable Fire Extinguishers.
- C. Underwriters Laboratories (UL):
 - 1. 154 - Carbon Dioxide Fire Extinguishers.
 - 2. 299 - Dry Chemical Fire Extinguishers.
 - 3. 626 - 2-1/2 Gallon Stored Pressure, Water Type Fire Extinguishers.
 - 4. 711 - Rating and Fire Testing of Fire Extinguishers.
 - 5. 1093 - Halogenated Agent Fire Extinguishers.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings: Indicate cabinet and/or bracket locations and mounting heights.
 - 2. Product Data: Include data on extinguishers and cabinets, brackets, cabinet dimensions, operational features, materials, finishes, and anchorage.
- B. Closeout Submittals:
 - 1. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

- A. Provide fire extinguishers complying with UL 711 and applicable code.
- B. Cabinets in Fire Rated Partitions: Tested in accordance with ASTM E814 with fire resistance rating equivalent to adjacent construction.
- C. Conform to applicable accessibility code for locating extinguishers.

1.5 PROJECT CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ansul Incorporated. (www.ansul.com)
 - 2. JL Industries. (www.jlindustries.com)
 - 3. Larsen's Mfg. Co. (www.larsensmfg.com)
 - 4. Potter Roemer. (www.potterroemer.com)
- B. Substitutions: Equal or similar. Under provisions of Division 01.

2.2 COMPONENTS

- A. Extinguishers:
 - 1. Multi-purpose dry chemical type, UL 299, cast steel tank, Class 2A:10B:C, 5 pound nominal capacity.
- B. Public Area Mounting: Cabinets.
 - 1. Formed galvanized steel sheet, 18 gage minimum.
 - 2. Configuration: Recessed, sized to accommodate extinguishers.
 - 3. Trim: Flat trim.
 - 4. Door:
 - a. Hinge doors for 180 degree opening with continuous piano hinge.
 - b. Graphics: Letter FIRE EXTINGUISHER horizontally on door in red die-cut vinyl pressure sensitive letters.
- C. Service Area Mounting: Brackets: Formed galvanized steel, sized to accommodate extinguisher.

2.3 ACCESSORIES

- A. Mounting Hardware: Type best suited to application.

2.4 FINISHES

- A. Cabinet:
 - 1. Exterior and door: Baked enamel, white color.
 - 2. Interior: Baked enamel, white color.
- B. Brackets: Baked enamel, color to be selected from manufacturer's full color range.
- C. Extinguishers: Baked enamel, red color.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install cabinets and brackets in accordance with manufacturer's instructions.
- B. Set plumb, level, and rigid.
- C. Place an extinguisher in each cabinet and on each bracket.

END OF SECTION

DIVISION 11 EQUIPMENT

**SECTION 11 53 00
LABORATORY EQUIPMENT**

PART 1

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Brochures and catalogs.
 - 2. Descriptive literature.
 - 3. Manufacturer's specifications.
- B. Quality Control Submittals:
 - 1. Statements of manufacturers' and installers' qualifications.
 - 2. Installation instructions.
 - 3. Operation and maintenance data.
 - 4. Repair instructions.
 - 5. Book on specific analytical methods associated with analytical equipment.
 - 6. Manufacturer's Certificate of Proper Installation.
- C. Contract Closeout Submittals:
 - 1. Service agreements.
 - 2. List of service costs after service agreement expires.
 - 3. Information on local service, durability, and parts availability.
 - 4. List of future training topics, rates, and locations.
 - 5. Special guarantees.

1.2 QUALITY ASSURANCE

- A. Qualifications of Manufacturers: 3 years' experience specializing in manufacturing products specified.
- B. Installers: Trained representatives of manufacturers.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Ship as follows:
 - 1. Ship in factory packaging with contents of each identified.
 - 2. Attach handling and installation instructions.
- B. Delivery: Do not deliver chemicals to the site earlier than 30 days before laboratory startup. Deliver chemicals with a minimum remaining shelf life of 6 months after the time of Substantial Completion.
- C. Acceptance at Site: Coordinate delivery with ENGINEER and OWNER, who may wish to inspect items in presence of CONTRACTOR to verify condition.

- D. Handling: Provide temporary skids under products greater than 150 pounds.
- E. Storage and Protection:
 - 1. Inventory delivered products.
 - 2. Store in an area protected from deleterious elements.
 - 3. Protect in a manner that prevents damage and as recommended by product manufacturer.

1.4 SPECIAL GUARANTEE

- A. Provide manufacturer's extended guarantee or warranty, with OWNER named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the OWNER, removal and replacement of Work specified in this Specification section found *defective* during a period of **2** years after the date of Substantial Completion.
- B. Provide for each piece of equipment furnished.

1.5 MAINTENANCE

- A. Maintenance Service: 1-year maintenance agreement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Materials, equipment, and accessories specified in this section shall be products of:
 - 1. Baxter Scientific Products
 - 2. Fisher Scientific Co.
 - 3. Hach Company
 - 4. Millipore Corp.
 - 5. Perkin-Elmer Corp.
 - 6. Hewlett-Packard Corp.
 - 7. VWR Scientific
 - 8. Phipps & Birds, Inc.

2.2 LABORATORY EQUIPMENT

The CONTRACTOR shall furnish and install the laboratory equipment as specified on drawings and/or listed below.

Equipment	Reference	Qty
Multi-parameter meter	Hach DR1900 w.USB Power or Approved Equal	1
Turbidity Meter	Hach TU5200 or Approved Equal	1
pH Meter	Hach HQ440-PHC281 Lab Kit or approved equal	1

Equipment	Reference	Qty
Buffer PH 4	Hach 22834 – 49	1
Buffer PR 7	Hach 22835 – 49	1
Buffer PH 10	Hach 22836 – 49	1
6 paddle Jar Tester w. 2L beaker	Hach 26317-20 Phipps & Bird 900B Model or approved equal	1
Automatic Buret Self-Zeroing 50mL	Hach 20876-41 or approved equal	2
Buret Clamp	Hach 20878-01 or approved equal	2
Buret Stand	Hach 32900 or approved equal	1
Dipper Sample 6ft long 500mL	Hach 29293-02 or approved equal	1
Ceramic Top Stirrer 7in x7in	Hach 28813-00 or approved equal	1
Stir Magnetic Bar	Hach 2928501 or approved equal	2
Wash bottle 500mL	Hach 2613049 or approved equal	4
Chronometer	Hach 26302 – 00 or approved equal	1
Hydrometer Specific Gravity	Hach 1922-00 / 508-42 or approved equal	1

PART 3 EXECUTION

4.1 INSPECTION AND PREPARATION

- A. Examine locations for conditions that would prevent quality installation.
- B. Verify service connections are correct.
- C. Do not proceed with installation until defects are corrected.

4.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions in new and ready-to-use condition.
- B. Install with utility connections that are compatible with service and outlets provided.
- C. Furnish the necessary initial supply of lubricants and/or chemicals required by the equipment.

4.3 MANUFACTURER'S SERVICES

- A. Provide manufacturer's representative at site in accordance to Section 01 43 33 Manufacturer's Services for installation assistance, inspection and certification of proper

installation, equipment testing, startup assistance, and training of personnel for equipment provided.

B. Factory-Trained Service Engineer:

1. Test equipment prior to demonstration.
2. Ensure equipment, including specified accessories, is operational.
3. At completion of Work, provide qualified and trained applications specialist to demonstrate operation of each item of equipment and instructs OWNER in operating procedures and maintenance.

C. Demonstration:

1. Schedule demonstration minimum 2 weeks in advance and after operation and maintenance data has been submitted.
2. Demonstrate equipment to familiarize the OWNER on planned operation and maintenance, including periodic preventive maintenance measures required. Include explanation of service requirements and simple onsite service procedures, as well as information concerning name, address, and telephone number of qualified local source of service.

D. Training:

1. Train three representatives of OWNER on planned equipment operation and maintenance for one 8-hour day at OWNER's location.
2. Train three representatives of OWNER on planned equipment operation and maintenance for one 8-hour day at an offsite location at the identified cost to OWNER except per diem expenses for OWNER's representative.
3. Make written report of demonstration and training to the OWNER's representative outlining equipment used and malfunctions or deficiencies noted. Identify individuals present at demonstration. Issue certificates showing:
 - a. Installation is as specified and acceptable to the manufacturer.
 - b. Manufacturer's warranty is in full effect beginning on the date of certification with no qualifications or reservations.

4.4 ADJUSTING AND CLEANING

- A. Remove protective wrappings and clean surfaces ready for use.
- B. Test and adjust equipment and hardware and leave in perfect working order.
- C. Restore stained or discolored finishes or install new item.
- D. Protect installed Work from damage.

END OF SECTION

DIVISION 22 PLUMBING

SECTION 26 05 23

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Multimode optical-fiber cabling.
 - 2. UTP cabling.
 - 3. RS-485 cabling.
 - 4. Low-voltage control cabling.
 - 5. Control-circuit conductors.
 - 6. Identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

- A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inches (1520 mm) or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

- C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."
- B. Painting: Paint plywood on all sides and edges with **eggshell black latex** paint. Comply with requirements in Section 099123 "Interior Painting."

2.4 OPTICAL-FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on **Drawings** or comparable product by one of the following:
 - 1. Belden Inc.
 - 2. CommScope, Inc.
 - 3. Corning Incorporated.
 - 4. Emerson Connectivity Solutions.
 - 5. General Cable Technologies Corporation.
 - 6. Mohawk; a division of Belden Inc.
 - 7. Nexans; Berk-Tek Products.
 - 8. Siemon Company (The).
 - 9. Superior Essex Inc.
 - 10. SYSTIMAX Solutions; a CommScope, Inc. brand.
 - 11. 3M.
 - 12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- C. Description: Multimode, 50/125-micrometer, 24 -fiber, nonconductive, tight-buffer, optical-fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA-568-C.3 for performance specifications.
 - 3. Comply with TIA-492AAAA-B for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. Plenum Rated, Nonconductive: Type OFNP in listed plenum communications raceway installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
 - b. Riser Rated, Nonconductive: Type OFNP or Type OFNR in listed riser or plenum communications raceway.
 - c. General Purpose, Nonconductive: Type OFNG, Type OFNP, or Type OFNR in listed communications raceway.
 - d. Plenum Rated, Conductive: Type OFCP in listed plenum communications raceway.
 - e. Riser Rated, Conductive: Type OFCP or Type OFCR in listed riser or plenum communications raceway.

- f. General Purpose, Conductive: Type OFCG or Type OFCP in listed communications raceway.
 - 5. Conductive cable shall be aluminum-armored type.
 - 6. Maximum Attenuation: **3.5** dB/km at 850 nm; **1.5** dB/km at 1300 nm.
 - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- D. Jacket:
- 1. Jacket Color: Orange for 62.5/125-micrometer cable.
 - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.5 OPTICAL-FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
- 1. ADC.
 - 2. American Technology Systems Industries, Inc.
 - 3. Belden Inc.
 - 4. Corning Incorporated.
 - 5. Dynacom Inc.
 - 6. Hubbell Incorporated.
 - 7. Molex Premise Networks; a division of Molex, Inc.
 - 8. Panduit Corp.
 - 9. Siemon Company (The).
- C. Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
- 1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.
- E. Cable Connecting Hardware:
- 1. Comply with Optical-Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA-568-C.3.
 - 2. Quick-connect, simplex and duplex, **Type SC** connectors. Insertion loss of not more than 0.75 dB.
 - 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.6 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:

1. ADC.
2. Alpha Wire Company; a division of Belden Inc.
3. Belden Inc.
4. CommScope, Inc.
5. Draka Cableteq USA.
6. Genesis Cable Products; Honeywell International, Inc.
7. Mohawk; a division of Belden Inc.
8. Nexans; Berk-Tek Products.
9. Siemon Company (The).
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope, Inc. brand.
12. 3M.
13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

- C. Description: 100-ohm, four-pair UTP, 24-pair UTP, formed into four-pair binder groups with no overall jacket.

1. Comply with ICEA S-90-661 for mechanical properties of Category 5e cables.
2. Comply with ICEA S-102-700 for mechanical properties of Category 6 cables.
3. Comply with TIA-568-C.1 for performance specifications.
4. Comply with TIA-568-C.2, Category 5e.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CM or Type CMX in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
 - b. Communications, Riser Rated: Type CMP or Type CMR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."
 - c. Communications, General Purpose: Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed per NFPA 70.

2.7 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. **Basis-of-Design Product:** Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Belden Inc.
4. Dynacom Inc.
5. Hubbell Incorporated.
6. Leviton Commercial Networks Division.
7. Molex Premise Networks; a division of Molex, Inc.
8. Panduit Corp.
9. Siemon Company (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

- C. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- D. Connecting Blocks: 110-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
- F. Jacks and Jack Assemblies: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.1.
- G. Patch Cords: Factory-made, four-pair cables in **36-inch (900-mm)** lengths; terminated with eight-position modular plug at each end.
 - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 - 2. Patch cords shall have color-coded boots for circuit identification.
- H. Workstation Outlets: Two-port-connector assemblies mounted in single faceplate.
- I. Faceplates:
 - 1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
 - 2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
 - 3. For use with snap-in jacks accommodating any combination of UTP, optical-fiber, and coaxial work area cords.
 - a. Flush-mounted jacks, positioning the cord at a 45-degree angle.
- J. Legend:
 - 1. Factory labeled by silk-screening or engraving.
 - 2. Machine printed, in the field, using adhesive-tape label.
 - 3. Snap-in, clear-label covers and machine-printed paper inserts.

2.8 TWIN-AXIAL DATA HIGHWAY CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, 2 pairs, No. 20 AWG, stranded (7x28) tinned-copper conductors.
 - 2. Plastic insulation.
 - 3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - 4. Plastic jacket.
 - 5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
 - 6. Flame Resistance: Comply with NFPA 262.

2.9 RS-485 CABLE

- A. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Paired, one pair, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Flame Resistance: NFPA 262.

2.10 LOW-VOLTAGE CONTROL CABLE

- A. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - 1. *One* pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
 - 2. PVC insulation.
 - 3. Unshielded.
 - 4. PVC jacket.
 - 5. Flame Resistance: Comply with NFPA 262.

2.11 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with UL 44.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-2-THWN-2, in **raceway** complying with UL 44.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN-2-THWN-2, in raceway, complying with **UL 44**.
- D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
 - 1. Smoke control signaling and control circuits.

2.12 SOURCE QUALITY CONTROL

- A. Factory test UTP cables according to TIA-568-C.2.
- B. Factory test optical-fiber cables according to TIA-568-C.3.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Test cables on receipt at Project site.
 - 1. Test optical-fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
 - 2. Test each pair of UTP cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
 - 2. Outlet boxes for optical-fiber cables shall be no smaller than 4 inches (102 mm) square by **[1-1/2 inches (38 mm)] [2-1/8 inches (53 mm)]** deep with extension ring sized to bring edge of ring to within 1/8 inch (3.1 mm) of the finished wall surface.
 - 3. Flexible metal conduit shall not be used.
- B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.
- D. Raceway Installation in Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard if entering the room from overhead.
 - 4. Extend conduits **3 inches (75 mm)** above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- E. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems."

3. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and patch panels.
4. Cables may not be spliced.
5. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
9. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
10. Support: Do not allow cables to lie on removable ceiling tiles.
11. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. UTP Cable Installation:

1. Comply with TIA-568-C.2.
2. Install termination hardware as specified in Section 271500 "Communications Horizontal Cabling" unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) at the point of termination to maintain cable geometry.

D. Optical-Fiber Cable Installation:

1. Comply with TIA-568-C.3.
2. Terminate cable on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **30 inches (760 mm)** apart.
3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of **72 inches (1830 mm)** of cable in a coil not less than **12 inches (305 mm)** in diameter.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.

3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.5 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
 1. Class 1 remote-control and signal circuits; No 14 AWG.
 2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.6 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect UTP and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not after cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical-Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.0. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

- a. Provide auxiliary structural steel members or brackets securely attached to building framing where building structural members are not available for support of pipes and equipment, and to provide adequate bracing and hanger support. For all insulated pipes, hangers shall be outside the covering. Floor supports shall be provided as shown on the drawings or as directed by the Engineer. Proposed details on auxiliary supporting members shall be submitted to the Engineer for his approval prior to erection. All supports shall be in accordance with ANSI-MSS standards for Pipe Hangers and Supports SP-58, SP-69 and SP-89.
- b. Piping shall be supported, guided and anchored to prevent creeping, sagging, buckling, vibration or misalignment.
- c. Pipes shall not be hung from other piping or from equipment of other trades and hanger rods shall not pierce ducts or duct insulation.
- d. Wire, chain, band iron, tape or wood hangers shall not be used to support piping.
- e. Pipe supports shall be capable of vertical adjustment after installation of piping.
- f. Piping at all equipment and control valves shall be supported to prevent strains or distortions in the connected equipment and control valves. Piping shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional supports after these items are removed.
- g. All pipes shall be supported at all changes in direction, and at every joint of a horizontal run. Maximum pipe spans shall be as per table included hereinafter.

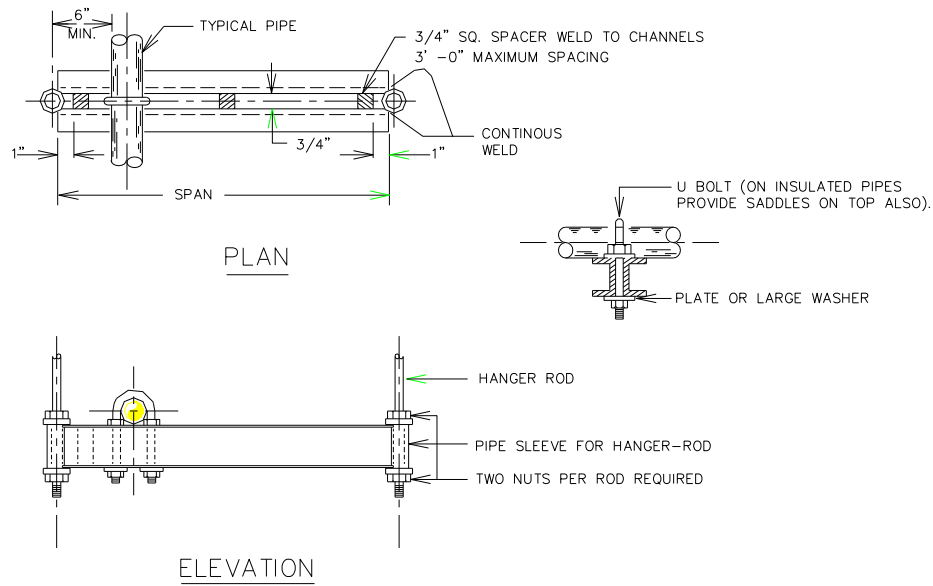
It is emphasized that the schedule is for maximum spans, and that in case of discrepancy, the first sentence of this paragraph governs. In case of pipes of different size resting on, or hanging from pipe support structures, such as steel brackets, spacing shall be for the condition producing the smallest spacing.

- h. Where pipes must be hung independently, hanger rods shall be supported from expansion shields in concrete structures and with beam clamps in steel structures.
- i. Piping at walls shall be supported on hook plates, offset clamps or wall brackets.
- j. Vertical pipes shall be supported at the bottom on base elbows of floor stands fastened to concrete piers and at each floor by riser clamps.
- k. Minimum hanger rod size for single pipe hangers shall be 3/8", for pipes up to and including 2" diameter; 1/2" for 2-1/2" and 3" diameter pipes, 5/8" for 4" up to 6" diameter pipes; 3/4" for 8" diameter pipe; 7/8" for 10" and 12" diameter pipes; and 1" for 14" up to 18" diameter pipes.
- l. Supports for piping running horizontally near the floor and not subject to thermal expansions and contractions shall be pipe stands (2" pipe) with base flange and adjustable top yoke.
- m. Independent pipe hangers shall be Grinnel, fig. 174 or 181 for insulated piping and fig 260 for uninsulated piping.

- n. Maximum pipe support spacing shall be as follows:

<u>Pipe Size</u>	<u>Maximum hanger spacing (in feet)</u>		
	<u>Copper</u>	<u>Plastic</u>	<u>Steel</u>
1/2"	5	4	7
3/4"	5	4	7
1"	6	4 1/2	7
1 1/2"	8	5	9
2"	9	5	10
3"	11	6	12
4"	12	6 1/2	14
6"		7 1/2	17
8"			19
10"			22
12"			23
14"			25
16"			27

- o. Where several pipes (two or more) are run together trapeze hangers shall be used consisting of two (2) steel channels installed back to back with hanger rods at each end; see details included herein.
- p. Insulated piping shall be provided with saddles and rigid blocking at supports. Saddles shall consist of galvanized steel sheet metal plates bent to the shape of the insulated pipe. Blocking shall consist of foam glass rigid insulation of the same thickness (this applies to soft insulations such as urethane, fiberglass, etc.).
- q. All pumps and fans shall be connected to their respective systems through the use of flexible connections.
- r. All mechanical systems shall be properly restrained (piping, equipment, etc.) against seismic effects. Angle bracing shall be used as may be required for seismic restraint to comply with Seismic Hazard Level (SHL) B as per SMACNA Standard-Seismic Restraint Manual Guidelines for Mechanical Systems. Contractor shall coordinate with a manufacturer of vibration isolation and seismic restrain products for the proper equipment and/or accessories to be used for the protection against seismic effects for the mechanical systems in accordance with local codes. This coordination shall include the sizing and location of such isolators and seismic restrain accessories. For this purposes Contractor shall submit evidence and calculations that the design of the seismic restrain systems are based on the equipment and systems to be installed; calculations shall be signed and sealed by professional structural engineer licensed in the Commonwealth of Puerto Rico.

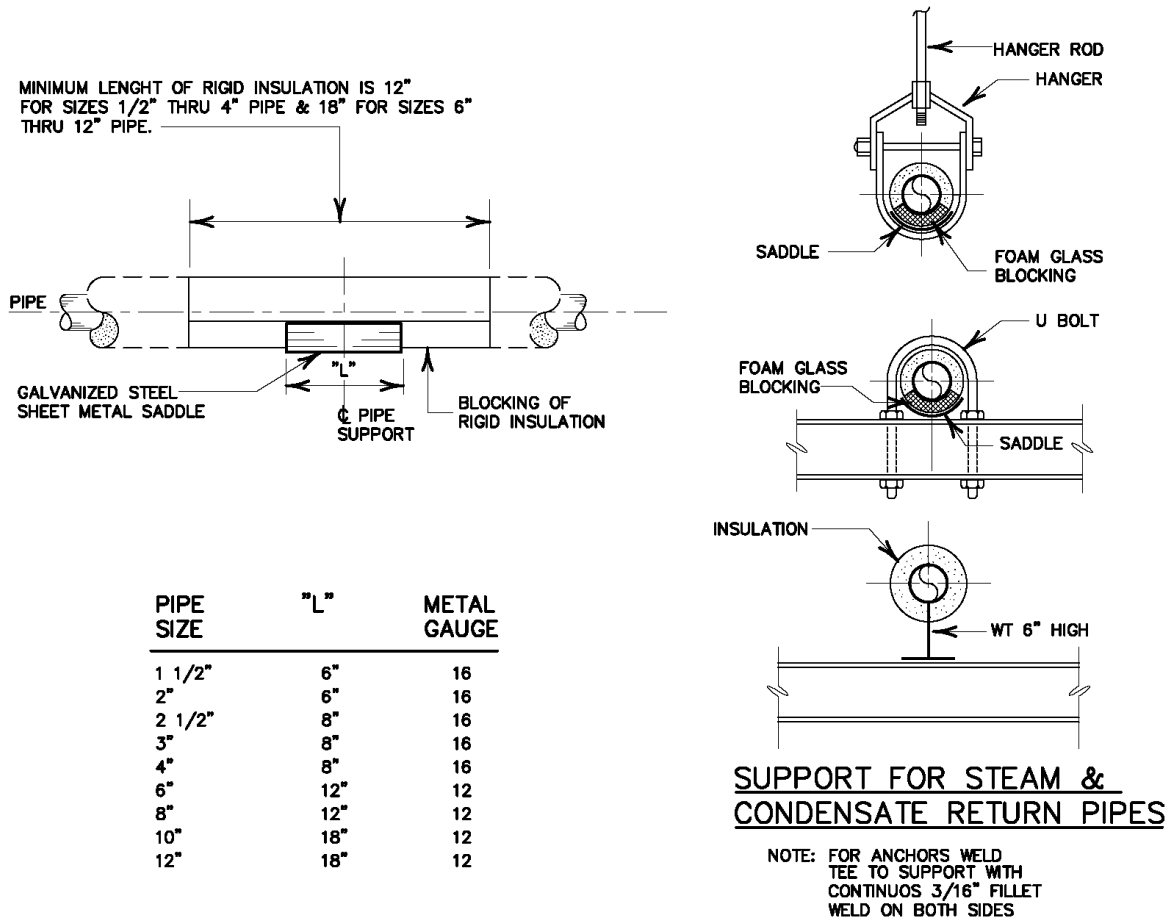


SPAN	CHANNELS SIZE	HANGER ROD SIZE	PIPE SLEEVE SIZE
2'-4'	C3 x 4.1	3/4" DIA.	3/4" PIPE
5'-8'	C4 x 7.25	3/4" DIA.	3/4" PIPE

PIPE HANGER TRAPEZE SUPPORTS

NOT TO SCALE:

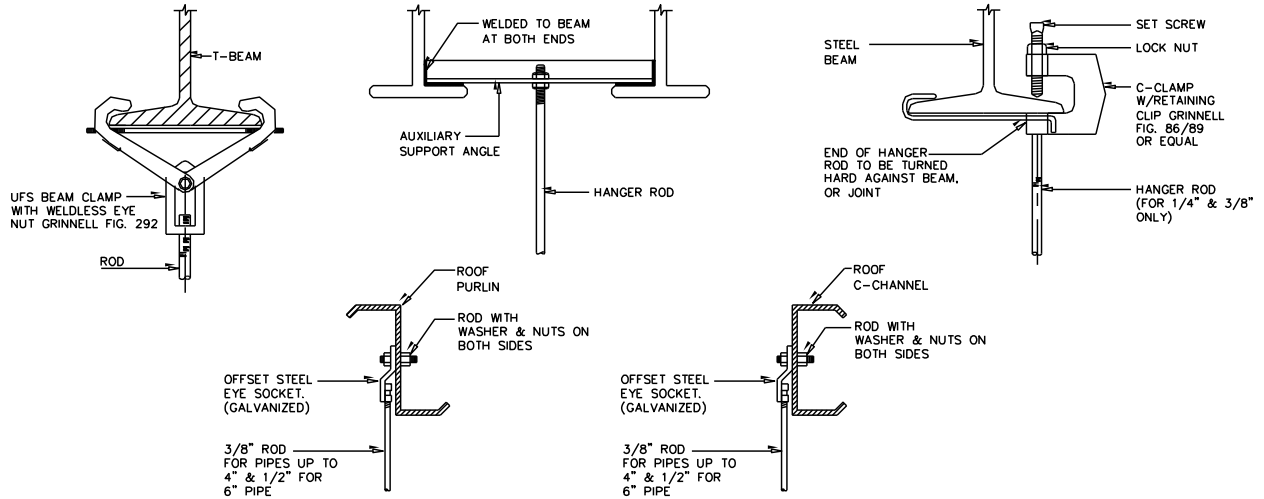
Note: For 2 to 4 feet span, supports shall be limited to not more than four (4) six (6) inch diameter pipes; and for 5 to 8 feet span, supports shall be limited to not more than four (6) six (6) inch diameter pipes.



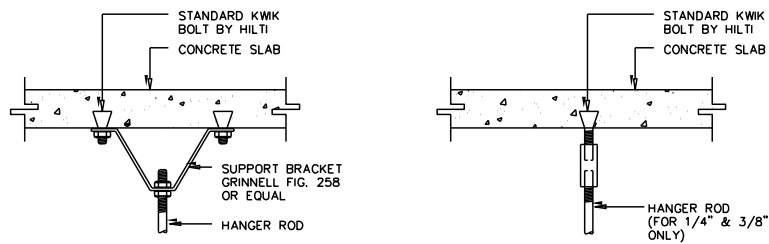
SADDLES AND BLOCKING FOR PIPE HANGERS

NOT TO SCALE:

PPNG-66



FOR STEEL STRUCTURES



FOR CONCRETE STRUCTURES

PIPE HANGERS RODS SUPPORTS

NOT TO SCALE

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

1.3 DEFINITIONS

- A. Water Service Piping: Water piping outside building that conveys water to building.
- B. Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.
- C. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.
- D. The following are industry abbreviations for plastic piping materials:
 - 1. CPVC: Chlorinated polyvinyl chloride.
 - 2. NP: Nylon.
 - 3. PB: Polybutylene.
 - 4. PE: Polyethylene.
 - 5. PP: Polypropylene.
 - 6. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Combined Fire-Protection and Domestic, Service Entrance Piping: 250 psig.
 - 2. Service Entrance Piping: 160 psig.
 - 3. Water Distribution Piping: 125 psig.
 - 4. Service Entrance Piping: 100 psig.
 - 5. Water Distribution Piping: 80 psig.

1.5 SUBMITTALS

- A. Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

1.6 QUALITY ASSURANCE

- A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.
- B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.
- D. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

- A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.
- B. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
- C. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
- D. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80.
- E. PVC Plastic Pipe: AWWA C900, Classes 150 and 200; with bell end with gasket, and spigot end.

2.2 PIPE AND TUBE FITTINGS

- A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.
- B. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.
- C. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- E. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.
- AF. Schedule 80, PVC Socket Fittings: ASTM D 2467.
- AG. Schedule 40, PVC Socket Fittings: ASTM D 2466.
- AI. PVC Gasketed Fittings: AWWA C907, Class 150; with gaskets.

2.3 JOINING MATERIALS

- A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.
- C. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.
- D. Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.
- E. Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
- F. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.4 VALVES

- A. CPVC Plastic Valves: CPVC plastic body material similar to CPVC plastic piping system with seats, seals, and other components suitable for potable-water service. Comply with the following:
 - 1. Ball Valves, 3-Inch NPS and Smaller: Union type with socket or threaded ends.
 - 2. Check Valves, 4-Inch NPS and Smaller: Ball type with socket ends.
- B. PVC Plastic Valves: PVC plastic body material with seats, seals, and other components suitable for potable-water service. Comply with the following:
 - 1. Ball Valves: Union type with socket or threaded ends.
 - 2. Check Valves, 2-Inch NPS and Smaller: Diaphragm or ball type with threaded or socket ends.
 - 3. Check Valves, 3-Inch NPS and Larger: Swing or ball type with flanged ends.
- C. PVC Plastic Valves: PVC plastic body material similar to PVC plastic piping system with seats, seals, and other components suitable for non-potable-water service. Comply with the following:
 - 1. Ball Valves: Union type with socket or threaded ends.
 - 2. Check Valves, 2-Inch NPS and Smaller: Diaphragm or ball type with threaded ends.
 - 3. Check Valves, 3-Inch NPS and Larger: Swing or ball type with flanged ends.
 - 4. Gate Valves: Nonrising-stem type with flanged ends.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.
- D. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:
 - 1. 2-Inch NPS and Smaller: Soft copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.
 - 2. 2-1/2- to 3-1/2-Inch NPS: Soft copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.
 - 3. 4- to 8-Inch NPS: Ductile-iron pipe and fittings, and mechanical or push-on joints.
 - 4. 10- and 12-Inch NPS: Ductile-iron pipe and fittings, and mechanical or push-on joints.
- E. Aboveground, Water Distribution Piping: Use the following:
 - 1. 1-1/2-Inch NPS and Smaller: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
 - 2. 2-Inch NPS: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
 - 3. 2-1/2- to 3-1/2-Inch NPS: Hard copper tube, Type L; copper, solder-joint fittings; and soldered joints.
 - 4. 4- to 6-Inch NPS: Hard copper tube, Type L with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.
 - 5. 4- to 6-Inch NPS: Flanged, ductile-iron pipe and flanged, ductile-iron fittings.
 - 6. 4- to 6-Inch NPS: Ductile-iron pipe and fittings with grooved ends and ductile-iron, keyed couplings.
 - 7. 8-Inch NPS: Flanged, ductile-iron pipe and flanged, ductile-iron fittings.
 - 8. 10- and 12-Inch NPS: Flanged, ductile-iron pipe and flanged, ductile-iron fittings.
- F. Underground, Water Distribution Piping: Do not use flanges or valves underground. Use the following:
 - 1. 2-Inch NPS and Smaller: Hard copper tube, Type L; wrought-copper, solder-joint pressure fittings; and soldered joints.
 - 2. 2-1/2- to 4-Inch NPS: Hard copper tube, Type L; wrought-copper, solder-joint pressure fittings; and soldered joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use gate, ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.
- B. Grooved-end butterfly valves may be used with grooved-end piping.
- C. Plastic gate, globe, ball, butterfly, and check valves may be used with plastic piping.

3.4 PIPING INSTALLATION, GENERAL

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

- A. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building. Refer to Division 2 Section "Water Systems" for water service piping.
- B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.
- C. Ductile-Iron, Service Entrance Piping: Comply with AWWA C600. Install buried piping between shutoff valve and connection to water service piping with restrained joints. Anchor pipe to wall or floor at entrance. Include thrust-block supports at vertical and horizontal offsets.
 - 1. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- E. Install wall penetration system at each service entrance pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

3.6 WATER DISTRIBUTION PIPING INSTALLATION

- A. Install piping with 0.25 percent slope downward toward drain.
- B. Install piping level without pitch.
- C. Fitting Option for Hard Copper Tube: Mechanically formed tee-branch outlets may be used instead of tee fittings.

3.7 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube, drill pilot hole, form collar for outlet, dimple tube forming seating stop, and braze branch tube into collar.
- C. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Solvent-Cemented, Thermoplastic Pipe and Fitting Joints: Handle cleaners, primers, and solvent cements according to ASTM F 402.

3.8 VALVE INSTALLATION

- A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS and larger.

- B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS and larger.
- C. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- D. Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Use ball valve for piping 2-inch NPS and smaller and butterfly valve for piping 2-1/2-inch NPS and larger. Refer to Division 15 Section "Plumbing Specialties" for balancing valves.
- E. Calibrated Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Install supports according to Division 15 Section "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. 3/4-Inch NPS and Smaller: Maximum horizontal spacing, 60 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 2. 1-Inch NPS: Maximum horizontal spacing, 72 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 3. 1-1/4-Inch NPS: Maximum horizontal spacing, 72 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 4. 1-1/2 and 2-Inch NPS: Maximum horizontal spacing, 96 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 5. 2-1/2-Inch NPS: Maximum horizontal spacing, 108 inches with 1/2-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 6. 3-Inch NPS: Maximum horizontal spacing, 10 feet with 1/2-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 7. 3-1/2-Inch NPS: Maximum horizontal spacing, 10 feet with 1/2-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 8. 4- and 5-Inch NPS: Maximum horizontal spacing, 10 feet with 1/2-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 9. 6-Inch NPS: Maximum horizontal spacing, 10 feet with 5/8-inch minimum rod diameter; maximum vertical spacing, 10 feet.
 - 10. 8-Inch NPS: Maximum horizontal spacing, 10 feet with 3/4-inch minimum rod diameter; maximum vertical spacing, 10 feet.
- E. Install hangers for PVC plastic piping with the following maximum spacing and minimum rod diameters:
 - 1. 2-Inch NPS and Smaller: Maximum horizontal spacing, 48 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.

2. 2-1/2- to 3-1/2-Inch NPS: Maximum horizontal spacing, 48 inches with 1/2-inch minimum rod diameter; maximum vertical spacing, 48 inches.
 3. 4- and 5-Inch NPS: Maximum horizontal spacing, 48 inches with 5/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
 4. 6-Inch NPS: Maximum horizontal spacing, 48 inches with 3/4-inch minimum rod diameter; maximum vertical spacing, 48 inches.
 5. 8-Inch NPS: Maximum horizontal spacing, 48 inches with 7/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
- F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

- A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:
1. Booster Systems: Connect cold-water suction and discharge piping.
 2. Water Heaters: Connect cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 4. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS and larger.

3.11 FIELD QUALITY CONTROL

- A. Inspect water distribution piping as follows:
- B. Inspect service entrance piping and water distribution piping as follows:
1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Test water distribution piping as follows:

D. Test service entrance piping and water distribution piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.12 CLEANING

A. Clean and disinfect potable-water distribution piping as follows:

B. Clean and disinfect potable service entrance piping and water distribution piping as follows:

C. Clean and disinfect water distribution piping as follows:

D. Clean and disinfect service entrance piping and water distribution piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for 3 hours.
 - c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

E. Prepare and submit reports for purging and disinfecting activities.

F. Clean interior of piping system. Remove dirt and debris as work progresses.

3.13 COMMISSIONING

- A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

- B. Perform the following steps before putting into operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
- C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- D. Check plumbing specialties and verify proper settings, adjustments, and operation.
 - 1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.
- E. Energize pumps and verify proper operation.

END OF SECTION

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes sanitary drainage and vent piping, and storm drainage piping inside building and to locations indicated.

1.3 DEFINITIONS

- A. Sewerage Piping: Building sewer piping outside building that conveys sanitary sewage from building.
- B. Drainage Piping: Building sewer piping outside building that conveys storm drainage from building.
- C. Service Entrance Piping: Drainage piping at entry into building between outside building sewer piping and inside drainage piping.
- D. Drainage and Vent Piping: Piping inside building that conveys waste water and vapors from fixtures and equipment throughout the building.
- E. Force-Main Piping: Drainage piping, under pressure.
- F. The following are industry abbreviations for plastic and other piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene.
 - 2. EPDM: Ethylene-propylene-diene polymer, rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Systems: 10-foot head of water.
 - 2. Storm Drainage Systems: 10-foot head of water.
 - 3. Sewage, Force-Main Piping Systems: 100 psig.

1.5 SUBMITTALS

- A. Test Results and Reports: Specified in "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.
- B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

- A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.
- B. Ductile-Iron Pipe: AWWA C151 with mechanical- or push-on-joint bell and plain spigot end, unless plain, grooved, or flanged ends are indicated.
- C. PVC Plastic Pipe: ASTM D 2665, Schedule 40.

2.2 PIPE AND TUBE FITTINGS

- A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns.

2.3 JOINING MATERIALS

- A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.
- B. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for commonly used joining materials.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use the following:
 - 1. 1-1/4- and 1-1/2-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. 2- to 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. 5- and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 6. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, Soil, Waste, and Vent Piping: Use the following:
 - 1. 1-1/2-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. 2- to 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. 5- and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 6. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- E. Aboveground, Storm Drainage Piping: Use the following:
 - 1. 2- to 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. 5- and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, Storm Drainage Piping: Use the following:
 - 1. 3- and 4-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. 5- and 6-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. 8-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 4. 10-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
 - 5. 12-Inch NPS: PVC plastic pipe, PVC socket fittings, and solvent-cemented joints.
- G. Aboveground, Sewage Force Mains: Use the following:
 - 1. 2- to 4-Inch NPS: Galvanized steel pipe and cast-iron, threaded fittings.
 - 2. 5- and 6-Inch NPS: Galvanized steel pipe and cast-iron, threaded fittings.
- H. Underground, Sewage-Force-Main, Service Entrance Piping: Use the following:
 - 1. 4- and 6-Inch NPS: Ductile-iron pipe; ductile-iron, mechanical- or push-on-joint fittings; rubber gaskets; and mechanical or push-on joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use gate, ball, or butterfly valves.

2. Throttling Duty: Use globe, ball, or butterfly valves.

B. Grooved-end butterfly valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Refer to Division 2 Section "Sewerage and Drainage" for sanitary and storm sewer piping.

B. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

C. Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

D. Extend building sanitary drain, force-main piping and connect to sanitary sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

E. Extend building storm drain, force-main piping and connect to storm sewer piping in size and location indicated for service entrance into building. Install cleanout, fitting with closure plug or equivalent, inside building.

F. Ductile-Iron, Force-Main, Service Entrance Piping: Comply with AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Encase piping with polyethylene film according to ASTM A 674 or AWWA C105.

G. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

H. Install wall penetration system at each service entrance pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.

3.6 DRAINAGE AND VENT PIPING INSTALLATION

A. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

B. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if

change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

- C. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- D. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Sanitary Building Drain: 2 percent downward in direction of flow for piping 3-inch NPS and smaller; 1 percent downward in direction of flow for piping 4-inch NPS and larger.
 - 2. Horizontal, Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Storm Building Drain: 1 percent downward in direction of flow.
 - 4. Horizontal, Storm Drainage Piping: 2 percent downward in direction of flow.
 - 5. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- E. Install force mains at elevations indicated.
- F. Install engineered, sanitary drainage and vent systems in locations indicated and as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Copper, Sovent, Single Stack: Comply with CDA 402/0, "Brass and Bronze Design Handbook, Single-Stack Plumbing System."
 - 3. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
 - 4. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- G. Install engineered, controlled-flow, storm drainage systems in locations indicated. Comply with standards of authorities having jurisdiction.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.
- I. Install ABS plastic drainage piping according to ASTM D 2661.
- J. Install PVC plastic drainage piping according to ASTM D 2665.
- K. Install underground, ABS and PVC plastic drainage piping according to ASTM D 2321.

3.7 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Compression Joints: Make with rubber gasket matching class of pipe and fittings.

- 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Grooved Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. PVC Piping Joints: Join drainage piping according to ASTM D 2665.
- E. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling during joining of plastic pipe and fittings.

3.8 VALVE INSTALLATION

- A. Shutoff Valves: Install shutoff valve on each pump discharge and where indicated. Use gate or ball valves for piping 2-inch NPS and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS and larger.
- B. Check Valves: Install swing check valve on each pump discharge, downstream from shutoff valve.

3.9 HANGER AND SUPPORT INSTALLATION

- A. Install supports according to Division 15 Section "Hangers and Supports."
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum spacing and minimum rod diameters:
 - 1. 1-1/2- and 2-Inch NPS: Maximum horizontal spacing, 60 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 2. 3-Inch NPS: Maximum horizontal spacing, 60 inches with 1/2-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 3. 4- and 5-Inch NPS: Maximum horizontal spacing, 60 inches with 5/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 4. 6-Inch NPS: Maximum horizontal spacing, 60 inches with 3/4-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 5. 8- through 12-Inch NPS: Maximum horizontal spacing, 60 inches with 7/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 6. 15-Inch NPS: Maximum horizontal spacing, 60 inches with 1-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 7. Spacing for horizontal pipe in 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- E. Install hangers for steel and ductile-iron piping with the following maximum spacing and minimum rod diameters:
 - 1. 1-1/4-Inch NPS: Maximum horizontal spacing, 84 inches; 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 2. 1-1/2-Inch NPS: Maximum horizontal spacing, 108 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
 - 3. 2-Inch NPS: Maximum horizontal spacing, 10 feet with 3/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.

4. 2-1/2-Inch NPS: Maximum horizontal spacing, 11 feet with 1/2-inch minimum rod diameter; maximum vertical spacing, 15 feet.
5. 3-Inch NPS: Maximum horizontal spacing, 12 feet with 1/2-inch minimum rod diameter; maximum vertical spacing, 15 feet.
6. 4- and 5-Inch NPS: Maximum horizontal spacing, 12 feet with 5/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
7. 6-Inch NPS: Maximum horizontal spacing, 12 feet with 3/4-inch minimum rod diameter; maximum vertical spacing, 15 feet.
8. 8- through 12-Inch NPS: Maximum horizontal spacing, 12 feet with 7/8-inch minimum rod diameter; maximum vertical spacing, 15 feet.
9. 14- through 18-Inch NPS: Maximum horizontal spacing, 12 feet with 1-inch minimum rod diameter; maximum vertical spacing, 15 feet.

F. Install hangers for ABS and PVC plastic piping with the following maximum spacing and minimum rod diameters:

1. 1-1/2- and 2-Inch NPS: Maximum horizontal spacing, 48 inches with 3/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
2. 4- and 5-Inch NPS: Maximum horizontal spacing, 48 inches with 5/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.
3. 6-Inch NPS: Maximum horizontal spacing, 48 inches with 3/4-inch minimum rod diameter; maximum vertical spacing, 48 inches.
4. 8- through 12-Inch NPS: Maximum horizontal spacing, 48 inches with 7/8-inch minimum rod diameter; maximum vertical spacing, 48 inches.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

- A. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

3.11 FIELD QUALITY CONTROL

A. Inspect drainage and vent piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- B. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head. Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.
 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.
- C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.

3.12 CLEANING AND PROTECTING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of water-based latex paint.

END OF SECTION

SECTION 22 13 30 SUBMERSIBLE-DRY PIT CENTRIFUGAL PUMP

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. National Fire Protection Association (NFPA):
 - a. 70, National Electric Code, Article 500.
 - b. 497A, Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
 - c. 497B, Classification of Class II Hazardous (Classified) Location for Electrical Installations in Chemical Process Areas.
 - d. 497M, Classification of Gases, Vapors, and Dust for Electrical Equipment in Hazardous (Classified) Locations.
 - e. 820, Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities.

1.2 DEFINITIONS

- A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Make, model, weight, and horsepower of each equipment assembly.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
 - 4. Power and control wiring diagrams, including terminals and numbers.
 - 5. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
 - 6. Factory finish system.
- B. Quality Control Submittals:
 - 1. Factory Functional and Performance Test Reports and Log.
 - 2. Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
 - 3. Special shipping, storage and protection, and handling instructions.
 - 4. Manufacturer's printed installation instructions.

5. Manufacturer's Certificate of Proper Installation.
6. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
8. Operation and maintenance manual.

1.4 EXTRA MATERIALS

- A. Furnish for each pump:
 1. Mechanical seal set.
 2. One complete set of any special tools required to dismantle pump.

PART 2 PRODUCTS

2.1 GENERAL

- A. Approved equal products may be considered.
- B. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.
- C. Pump equipment shall consist of pump(s) complete with motor(s) control system guide rail and anchoring brackets, power cable(s), and pump lifting cable(s). Pump metal parts that come into contact with guide rail or cable system shall be made of non-sparking materials.
- D. Pump shall integrate a flush valve mounted on the pump housing. The design of the valve shall be based on the ejector principle with a ball as closing device. The operation shall be completely mechanical, automatic and induced by the pump flow and pressure. Elements with electrical components will not be considered.

2.2 SUPPLEMENTS

- A. Some specific requirements are attached to this section as supplements.

2.3 ACCESSORIES

- A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.
- B. Lifting Lugs: Equipment weighing over 100 pounds.
- C. Anchor Bolts: Galvanized, Type 316 stainless steel, sized by equipment manufacturer, 1/2-inch minimum diameter.

2.4 FACTORY FINISHING

- A. Manufacturer's standard enamel finish.

2.5 SOURCE QUALITY CONTROL

- A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
- B. Factory Tests and Adjustments: Test all equipment and control panels identical to that furnished.
- C. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer.
- D. Functional Test: Perform manufacturer's standard, submerge and run for 30 minutes at pumping conditions corresponding to maximum motor load. Do motor test on equipment as necessary.
- E. Manufacturer shall offer a 2-year limited warranty against defects in materials and workmanship.
- F. Performance Test:
 - 1. Conduct on each pump.
 - 2. Perform under actual or approved simulated operating conditions.
 - 3. Test for a continuous 3-hour period without malfunction.
 - 4. Test Log: Record the following:
 - a. Total head.
 - b. Capacity.
 - c. Horsepower requirements.
 - d. Driving motor voltage and amperage measured for each phase.
 - e. Throttle discharge valve to obtain pump data points on curve at 2/3, 1/3, and shutoff conditions.
 - f.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Connect suction and discharge piping without imposing strain to pump flanges.
- C. Anchor Bolts: Accurately place using equipment templates.

3.2 FIELD QUALITY CONTROL

- A. Functional Test: Conduct on each pump.
 - 1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 2. Flow Output: Measured by plant instrumentation and storage volumes.
 - 3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.

- B. Performance Test: In accordance with ASME Power Test Codes, PTC-10. Hydraulic Institute Standards.

3.3 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:

1. [1] person-days for installation assistance and inspection.
2. [1] person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
3. [1/2] person-days for prestartup classroom or site training.
4. [1/2] person-days for facility startup.
5. [1/2] person-days for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by OWNER and ENGINEER.

3.4 SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION," are a part of this Specification.
1. Data Sheets:
 - a. Pump.
 - b. Motor.

END OF SECTION

22 13 30 - 5

PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Proposal Curve No.: _____	NPSH Required (ft water): _____	Factory Testing:
Speed (rpm): <u>1,800 / 2,400</u>	3% Head Drop _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Efficiency (%): _____		
Rated Power (BHP): <u>15</u>		

Remarks: <u>2 year warranty</u>		

Equipment Tag Number(s): _____		
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)		
<p>Pump: EQ Tank Pumps</p> <p><input type="checkbox"/> Single <input type="checkbox"/> Dual</p> <p><input checked="" type="checkbox"/> Heavy-Duty, Nonclog</p> <p>Location:</p> <p><input type="checkbox"/> Pump Station</p> <p><input type="checkbox"/> Open Concrete Sump</p> <p><input type="checkbox"/> Vented Canned Sump</p> <p><input type="checkbox"/> Manhole Sump</p> <p><input checked="" type="checkbox"/> <u>Tank Sump</u></p> <p>Double Mechanical Seal:</p> <p>API Class Code: _____</p> <p>Mfr: _____</p> <p>Model No. _____</p> <p>Bearings (Type/No.):</p> <p>Upper: ____ / ____</p> <p>Lower: ____ / ____</p> <p>AFBMA Rating Life (hours): ____</p> <p>Field Testing: <input type="checkbox"/> Not Required</p> <p><input type="checkbox"/> Required, Functional and Performance</p>	<p>Controls:</p> <p>Level Control:</p> <p>Manufacturer: _____</p> <p><input type="checkbox"/> Tilting Ball Float Mercury</p> <p>Switch (No.): _____</p> <p><input type="checkbox"/> SPST Magnet-Equipped Float</p> <p>Switch (No.): _____</p> <p>Control Features:</p> <p><input checked="" type="checkbox"/> Pumps OFF, 1st Pump ON, 2nd Pump ON, and HIGH LEVEL ALARM</p> <p><input type="checkbox"/> ON/OFF Integral Adjustable</p> <p>Differential Switch Set Point</p> <p>(inches of water): ____</p> <p><input type="checkbox"/> Pump OFF, Pump ON, and HIGH LEVEL ALARM</p>	<p>Panel Components:</p> <p><input type="checkbox"/> Motor Starters, NEMA: ____</p> <p><input type="checkbox"/> ON-OFF-AUTO Switch</p> <p><input type="checkbox"/> Running Lights</p> <p><input type="checkbox"/> Alarm Dry Contact Closure</p> <p>Rated (amps): _____</p> <p>Voltage: _____</p> <p><input type="checkbox"/> Instrumentation and Control</p> <p>System Interface</p> <p><input type="checkbox"/> Panel Enclosure: _____</p> <p><input type="checkbox"/> Terminal Strip Within Panel for All Interfacing Exterior Wiring</p> <p>Features:</p> <p><input type="checkbox"/> Alternator</p> <p><input type="checkbox"/> Vented Canned Steel or Cast</p> <p>Iron Tank and Cover</p> <p><input type="checkbox"/> High Temperature Construction (above 140 degrees F).</p> <p><input type="checkbox"/> Guide Rails:</p> <p><input type="checkbox"/> Marine Brass</p> <p><input type="checkbox"/> Type 304 SS</p> <p><input type="checkbox"/> _____</p> <p><input type="checkbox"/> Lifting Chain:</p> <p><input type="checkbox"/> Plastic-Bonded Steel</p>

<input type="checkbox"/> Type 304 SS		
MATERIALS (manufacturer to supply missing data)		
Volute: _____	Bearings: _____	Impeller: _____
Shaft Seals: _____	Upper _____	Motor Housing: _____
	Lower _____	
ADDITIONAL REQUIREMENTS		
2 year warranty		

<p>*****</p> <p>NTS TO PROCESSOR: Tab to field(s) and enter data; use the space bar to mark a box and use the space bar again to unmark a box.</p> <p>*****INDUCTION MOTOR DATA SHEET</p>	
<p>Project: <u>Roosevelt Roads WTP</u></p>	
<p>Owner: <u>Roosevelt Roads</u></p>	
<p>Equipment Name: : <u>Backwash Pumps</u></p>	
<p>Equipment Tag Number(s): <u>PU-05-18 and PU-05-19</u></p>	
<p>Type: Squirrel-cage induction meeting requirements of NEMA MG 1</p>	
<p>Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer</p>	
<p>Hazardous Location: <input type="checkbox"/> Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark</p>	
<p>Motor Horsepower: <u>20</u></p>	<p>Guaranteed Minimum Efficiency at Full Load: _____ percent</p>
<p>Voltage: <u>460</u></p>	<p>Guaranteed Minimum Power Factor at Full Load: _____ percent</p>
<p>Phase: <u>3</u></p>	<p>Service Factor (@ rated max. amb. temp.): <input type="checkbox"/> 1.0 <input type="checkbox"/> 1.15</p>
<p>Frequency: <u>60</u></p>	<p>Enclosure Type: _____</p>
<p>Synchronous Speed: <u>1800</u> rpm</p>	<p>Mounting Type: <input type="checkbox"/> Horizontal <input checked="" type="checkbox"/> Vertical</p>
<p><input checked="" type="checkbox"/> Multispeed, Two-Speed: _____ / _____ rpm</p>	<p><input type="checkbox"/> Vertical Shaft: <input type="checkbox"/> Solid <input type="checkbox"/> Hollow</p>
<p><input type="checkbox"/> Constant Horsepower</p>	<p><input type="checkbox"/> Vertical Thrust Capacity (lb): Up _____ Down _____</p>
<p><input type="checkbox"/> Variable Torque</p>	<p><input type="checkbox"/> Adjustable Speed Drive: See Section 16485, ADJUSTABLE FREQUENCY DRIVE SYSTEMS.</p>
<p><input type="checkbox"/> Constant Torque</p>	<p>Operating Speed Range: _____ to _____% of Rated Speed</p>
<p>Winding: <input type="checkbox"/> One <input type="checkbox"/> Two</p>	<p><input type="checkbox"/> Thermal Protection: _____</p>
<p><input type="checkbox"/> Space Heater: _____ volts, single phase</p>	
<p><input type="checkbox"/> Oversize main terminal (conduit) box for motors</p>	
<p><input type="checkbox"/> Terminal for connection of equipment grounding wire in each terminal box</p>	
<p>Additional Motor Requirements: <input type="checkbox"/> See DIVISION 16.</p>	
<p>Special Features:</p>	



SECTION 22 13 31
SUBMERSIBLE-WET PIT CENTRIFUGAL PUMP

1 PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. National Fire Protection Association (NFPA):
 - a. 70, National Electric Code, Article 500.
 - b. 497A, Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
 - c. 497B, Classification of Class II Hazardous (Classified) Location for Electrical Installations in Chemical Process Areas.
 - d. 497M, Classification of Gases, Vapors, and Dust for Electrical Equipment in Hazardous (Classified) Locations.
 - e. 820, Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities.

1.2 DEFINITIONS

- A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Make, model, weight, and horsepower of each equipment assembly.
 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
 4. Power and control wiring diagrams, including terminals and numbers.
 5. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
 6. Factory finish system
- B. Quality Control Submittals:
1. Factory Functional and Performance Test Reports and Log.
 2. Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
 3. Special shipping, storage and protection, and handling instructions.
 4. Manufacturer's printed installation instructions.
 5. Manufacturer's Certificate of Proper Installation.

6. Suggested spare parts list to maintain the equipment in service for a period of 1 year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
8. Operation and maintenance manual.

1.4 EXTRA MATERIALS

A. Furnish one set of:

1. Mechanical seals.
2. One impeller
3. One wear ring
4. One complete set of any special tools required to dismantle pump.

2 PART 2 PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog numbers herein is for the purpose of establishing the standard of quality and general configuration desired only. Other manufacturers' equipment will be considered in accordance with the General Conditions.
- B. The equipment shall meet all requirements of this Specification and shall be furnished by one of the following system manufacturers, or equal:
1. Flygt
 2. Flowserve
 3. Ebara
- C. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.
- D. Pump equipment shall consist of pumps complete with motors control system guide rail and anchoring brackets, power cable(s), and pump lifting cables. Pump metal parts that come into contact with guide rail or cable system shall be made of nonsparking materials.

2.2 REQUIREMENTS

- A. Furnish and install submersible non-clog wastewater pumps. Each pump shall be designed to pump solids and materials normally found in raw sewage. The minimum spherical solids passage shall be 3". Each pump shall be rated as indicated on drawings. The submersible motor shall be three-phase service with 30 feet of submersible cable included. The power and control shall be sized in accordance with NEC and ICEA standards.
- B. Each pump shall be supplied with a mating cast iron discharge connection with elbow included. The pump shall utilize a sliding bracket made of ductile iron. Cast iron sliding brackets shall not be considered equal due to their brittle characteristics. The slide bracket shall bolt directly to the pump ANSI discharge flange. The interface between the sliding bracket and the discharge base shall be achieved with metal-to-metal contact. Sealing of the pump to the discharge base by means of an O-ring, profile gasket or diaphragm shall not be acceptable. The pump shall be automatically connected to the

discharge piping when lowered into position and non-portion of the pump shall bear directly on the wet well floor. Each pump shall be fitted with 30 feet of stainless steel lifting cable.

2.3 PUMP DESIGN

- A. Pump Casing: The pump casing shall be a heavy-duty single volute design with an integrated centerline discharge flange. The volute shall be made of ASTM A48, Class 30 gray cast iron. The volute shall be a single high quality casting with smooth passages without blowholes, porosity or other irregularities. The pump casing discharge flange must meet ANSI flange thickness, dimension, and bolt pattern requirements.
- B. Impeller: The impeller shall be made of ASTM A48, Class 30 gray cast iron. The impeller shall be dynamically balanced, non-clogging, with a minimum of 2 vanes. The impeller shall be capable of handling solids, stringy materials, sludge and other debris typically found in wastewater. The impeller shall be keyed to the shaft and retained with a stainless steel bolt. Tapered shaft designs shall not be considered equal to a positively driven-keyed shaft and will not be acceptable.
- C. Wear Rings: Cast iron casing and a hardened chrome stainless steel impeller wear ring shall be provided to ensure efficient sealing between the volute and suction inlet of the impeller. The minimum Brinell hardness for the impeller wear ring shall be 250 BHN. Wear rings made of rubber or softer material shall not be considered equal.
- D. Shaft: The pump and motor shaft shall be constructed of Type 416 stainless steel and be an integral unit. Each shaft shall be sized to transmit the rated loads encountered with liberal safety factor. Each pump shaft shall be accurately machined with polished finishes to accommodate mechanical seals and bearings. Pump shafts that are not stainless steel or use a shaft sleeve shall not be considered equal.
- E. Bearings: Each rotating assembly shall rotate on two permanently lubricated bearings. The bearings shall be of sufficient size to transfer all radial and axial loads to the housing while minimizing shaft deflections and excessive heat built-up. Lower bearings shall be tapered roller bearings. A minimum bearing life of 100,000 hours is required. This calculation shall be based on a continuous operating condition of 65% BEP. Bearing life calculations shall be supplied with submittal documentation.
- F. Mechanical Seals: Each pump shall be provided with a double mechanical seal. Each seal shall operate independently of the other. The lower mechanical seal shall be located behind the impeller and have Silicon Carbide seal faces. Tungsten Carbide seal face material shall not be considered equal to Silicon Carbide. The upper mechanical seal shall operate in a reservoir and have self-lubricating Carbon/Ceramic seal faces. Each seal shall require neither maintenance nor adjustment. Cartridge type seals and seals containing a common spring between the upper and lower faces shall not be considered equal to the dual seal design.
- G. Lubrication System: Each pump shall be fitted with an oil chamber that acts as a barrier between the pumped fluid and motor. The oil chamber shall have accessibility from the exterior of the pump and shall be filled with environmentally safe oil. A moisture sensor probe must be installed in the oil chamber to detect moisture. Probes located in the motor housing are not acceptable. A corresponding relay, located in the pump control panel, shall be used in conjunction with the seal probe to detect moisture.
- H. External Hardware and Surface: Each pump shall be fitted with Type 316 stainless steel external hardware to prevent corrosion. All external surfaces coming into contact with the

pumped fluid, other than stainless steel, shall have an electrostatically applied powder coat, baked on, epoxy finish. This coating shall be extremely resistance to sewage and other chemicals normally found in wastewater. Other surfaces finishes shall not be considered equal to the baked on epoxy finish.

- I. Cooling System: Each pump shall be equipped with an adequately designed cooling system. A cast iron cooling jacket shall encircle the stator housing to provide cooling to the motor. Fabricated steel cooling jackets that are prone to corrosion and deformation shall not be acceptable. Cooling shall be accomplished by circulating clean fluid around the motor housing and dissipating the heat by means of an internal heat exchanger. The cooling system shall be independent of the installation and shall not utilize the pumped media for cooling. Each pump shall be able to operate in a snore condition, a condition which low-level shutoff is not functioning, for an extended period of time. Pumps that utilize the pumped fluid for cooling shall not be acceptable.
- J. O-Rings: Each pump shall be fitted with Buna-N or Viton O-rings where watertight sealing is required. Specific torque requirements shall not be required.
- K. Cable Entry: The cable entry seal shall be comprised of a single elastomer grommet with washer located on either side. A compression fit of the grommet seals the cable and entry from the exterior fluid. The cable entry assembly shall allow easy replacement of cable by using the same cable entry grommet. Designs that utilize epoxies or other secondary sealant shall not be acceptable.
- L. Cable: Each submersible pump shall include 30 feet of submersible cable. The pump power/control cable shall be FM approved for use in hazardous locations. The exterior jacket shall be capable of submergence in raw sewage.
- M. Discharge Assemblies: Each pump shall be equipped with a quick-disconnecting discharge base assembly. There shall be no need for personnel to enter the wet-well to install the pump. Once connected, no portion of the pump shall rest on the wet well floor. The slide bracket with attached pump unit shall be guided by 2 rails. Intermediate brackets shall be used for wet wells deeper than 20 feet. Slide brackets that do not attach to the pump discharge flange shall not be considered equal.
- N. Motor: The pump motor shall be an induction type squirrel cage design. The rotor and stator shall operate in an air-filled, watertight housing. Oil filled motors are not acceptable. The motor efficiency shall meet published EPACT efficiency ratings for standard motors to improve overall wire to water efficiencies. Motors that do not meet EPACT efficiency ratings shall not be acceptable. The motor shall have a NEMA B design rating with the stator windings and leads having a Class H insulation rating (180° C). Designs which utilize either Class B or Class F insulation systems shall not be considered equal. The motor housing shall be constructed of ASTM A48, Class 30 cast iron. The motor shall be designed for continuous duty, either submerged or unsubmerged while pumping fluids up to 40 degrees C. Motors shall be capable of handling 15 equally spaced starts per hour and to operate with variable frequency devices. All windings shall be rated for inverted duty to reduce damage caused by voltage spikes associated with variable frequency drives. Motors that do not utilize inverter spike resistance windings shall not be considered equal. Thermal switches shall be embedded in each phase of the windings and set to open at 135 degrees C. The thermal switches shall be wired in series and be connected to the motor controls to shut down the pump during a high temperature condition. The combined service factor of the motor shall be a minimum of 1.15. The motor horsepower shall be selected such that the unit is non-overloading over the entire specified performance range. The submersible motor shall be listed by Factory Mutual as explosion proof for service in Class 1, Division 1, Group C and D hazardous locations

2.4 ACCESSORIES

- A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.
- B. Lifting Lugs: Equipment weighing over 100 pounds.
- C. Anchor Bolts: Type 316 stainless steel sized by equipment manufacturer.

2.5 MAINTANENCE

- A. Furnish one set of all special tools required for proper servicing and dismantling of equipment supplied under these Specifications, packed in a suitable steel tool chest with a lock. Furnish the list and price of manufacturer's recommended normal wear and tear spare parts for one-year maintenance for each size pump furnished.

2.6 FACTORY FINISHING

- A. Manufacturer's standard enamel finish

2.7 SOURCE QUALITY CONTROL

- A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
- B. Factory Tests and Adjustments: Test all equipment actually furnished.
- C. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer.
- D. Functional Test: Perform manufacturer's standard motor test on equipment.
- E. Performance Test:
 - 1. Conduct on each pump.
 - 2. Perform under actual or approved simulated operating conditions.
 - 3. Test for a continuous 3-hour period without malfunction.
 - 4. Test Log: Record the following:
 - a. Total head.
 - b. Capacity.
 - c. Horsepower requirements.
 - d. Driving motor voltage and amperage measured for each phase.
 - e. Throttle discharge valve to obtain pump data points on curve at 2/3, 1/3, and shutoff conditions.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.

- B. Connect suction and discharge piping without imposing strain to pump flanges.
- C. Anchor Bolts: Accurately place using equipment templates.

3.2 FIELD QUALITY CONTROL

- A. Functional Test: Conduct on each pump.
 - 1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 2. Flow Output: Measured by plant instrumentation and storage volumes.
 - 3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
- B. Performance Test: In accordance with Hydraulic Institute Standards.

3.3 DELIVERY, STORAGE, AND HANDLING

- A. Pump shall be export crated and protected against moisture prior to shipment.
- B. The pump manufacturer shall provide unloading, storage, and handling instructions prior to shipment.
- C. All equipment shall be delivered in good, sound condition, and free from damage. Equipment that has been damaged will be rejected.
- D. The installing Contractor will be responsible for proper unloading, handling, and storage of equipment in accordance with the manufacturer's instructions.

3.4 MANUFACTURER'S SERVICES

- A. Provide services of pump manufacturer's factory service engineer specifically trained in the installation, operation, and maintenance of pumping units as specified herein. The services of the manufacturer's representative shall be made available during the installation period for assistance to the Contractor in adjusting and checking equipment.
- B. Man-hour requirements tabulated below are exclusive of travel time and do not relieve the Supplier of obligation to provide sufficient service to place equipment in satisfactory operation.
- C. The factory representative shall be provided for Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:
 - 1. [1] person-days for installation assistance and inspection.
 - 2. [1] person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - 3. [1/2] person-days for prestartup classroom or site training.
 - 4. [1/2] person-days for facility startup.
 - 5. [1/2] person-days for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by OWNER and ENGINEER.
- D. In the event the services of the manufacturer's representative are needed and requested by the owner for periods longer than indicated in these Contract Documents, payment for

such services shall be made by the owner. No payment shall be due for time spent by the representative due to faulty design or fabrication of the equipment.

END OF SECTION

22 13 31 - 8

PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Proposal Curve No.: _____	NPSH Required (ft water): _____	Factory Testing:
Speed (rpm): <u>1,800</u>	3% Head Drop _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Efficiency (%): _____		
Rated Power (BHP): <u>10</u>		

Remarks: _____		

Equipment Tag Number(s): _____		
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)		
<p>Pump: EQ Tank Pumps</p> <p><input type="checkbox"/> Single <input type="checkbox"/> Dual</p> <p><input checked="" type="checkbox"/> Heavy-Duty, Nonclog</p> <p>Location:</p> <p><input type="checkbox"/> Pump Station</p> <p><input type="checkbox"/> Open Concrete Sump</p> <p><input type="checkbox"/> Vented Canned Sump</p> <p><input type="checkbox"/> Manhole Sump</p> <p><input checked="" type="checkbox"/> <u> </u> Tank Sump</p> <p>Double Mechanical Seal:</p> <p>API Class Code: _____</p> <p>Mfr: _____</p> <p>Model No. _____</p> <p>Bearings (Type/No.):</p> <p>Upper: ____ / ____</p> <p>Lower: ____ / ____</p> <p>AFBMA Rating Life (hours): ____</p> <p>Field Testing: <input type="checkbox"/> Not Required</p> <p><input type="checkbox"/> Required, Functional and Performance</p>	<p>Controls:</p> <p>Level Control:</p> <p>Manufacturer: _____</p> <p><input type="checkbox"/> Tilting Ball Float Mercury</p> <p>Switch (No.): _____</p> <p><input type="checkbox"/> SPST Magnet-Equipped Float</p> <p>Switch (No.): _____</p> <p>Control Features:</p> <p><input checked="" type="checkbox"/> Pumps OFF, 1st Pump ON, 2nd</p> <p>Pump ON, and HIGH LEVEL</p> <p>ALARM</p> <p><input type="checkbox"/> ON/OFF Integral Adjustable</p> <p>Differential Switch Set Point</p> <p>(inches of water): ____</p> <p><input type="checkbox"/> Pump OFF, Pump ON, and</p> <p>HIGH LEVEL ALARM</p>	<p>Panel Components:</p> <p><input type="checkbox"/> Motor Starters, NEMA: ____</p> <p><input type="checkbox"/> ON-OFF-AUTO Switch</p> <p><input type="checkbox"/> Running Lights</p> <p><input type="checkbox"/> Alarm Dry Contact Closure</p> <p>Rated (amps): _____</p> <p>Voltage: _____</p> <p><input type="checkbox"/> Instrumentation and Control</p> <p>System Interface</p> <p><input type="checkbox"/> Panel Enclosure: _____</p> <p><input type="checkbox"/> Terminal Strip Within Panel for</p> <p>All Interfacing Exterior Wiring</p> <p>Features:</p> <p><input type="checkbox"/> Alternator</p> <p><input type="checkbox"/> Vented Canned Steel or Cast</p> <p>Iron Tank and Cover</p> <p><input type="checkbox"/> High Temperature Construction</p> <p>(above 140 degrees F).</p> <p><input type="checkbox"/> Guide Rails:</p> <p><input type="checkbox"/> Marine Brass</p> <p><input type="checkbox"/> Type 304 SS</p> <p><input type="checkbox"/> _____</p> <p><input type="checkbox"/> Lifting Chain:</p> <p><input type="checkbox"/> Plastic-Bonded Steel</p>

<input type="checkbox"/> Type 304 SS		
MATERIALS (manufacturer to supply missing data)		
Volute: _____	Bearings: _____	Impeller: _____
Shaft Seals: _____	Upper _____	Motor Housing: _____
	Lower _____	
ADDITIONAL REQUIREMENTS		

PUMP DATA SHEET CENTRIFUGAL DRY PIT PUMPS		
Project: <u>Roosevelt Roads WTP</u>	Pump Mfr.: <u>Flygt or Approved Equal</u>	
Owner: <u>Roosevelt Roads</u>	Size & Type: <u>WET PIT SUBMERSIBLE</u>	
Service: _____	Serial No.: _____	
Pump Name: <u>Draining Water Collection Manhole</u>	Model No.: <u>CP 3045 HT</u>	
Equip. Tag Number(s): <u>PU-07-21 AND PU-07-22</u>		
No. Pumps Required: <u>2</u>		
LIQUID	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: <u>Wastewater</u>	Capacity per operational point:	Temp (°F): Max _____ Min _____
Pumping Temperature (°F): 95	50 gpm @ 16 ft TDH	Rel. Hum (%): Max _____ Min _____
-	Suction Pressure (psig): _____	Altitude (ft): _____
Specific Gravity @ 68°F: <u>1</u>	Suction Pressure (psig):	<input type="checkbox"/> Indoor <input type="checkbox"/> Heated
Vapor Pressure (psia): _____	Max _____ Rated _____	<input type="checkbox"/> Outdoor <input type="checkbox"/> Unheated
Viscosity (CP) @ _____ °F: _____	Largest Solid Passing (in.): _____	Area Classification: _____
pH: 6-7		<input type="checkbox"/> Hazardous Classification (NFPA 70):
Corrosion/Erosion/Abrasion Caused by:		Class: _____ 1
		Group: _____ C and D
		Division: _____ 1
Remarks: <u>Constant</u>	Remarks; _____	Remarks: _____
PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Proposal Curve No.: _____	NPSH Required (ft water):	Factory Testing:
Speed (rpm): <u>3,350</u>	3% Head Drop _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Efficiency (%): _____		

Rated Power (BHP): 1.1

Remarks: _____

Equipment Tag Number(s): _____		
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)		
<p>Pump: EQ Tank Pumps</p> <p><input type="checkbox"/> Single <input type="checkbox"/> Dual</p> <p><input checked="" type="checkbox"/> Heavy-Duty, Nonclog</p> <p>Location:</p> <p><input type="checkbox"/> Pump Station</p> <p><input type="checkbox"/> Open Concrete Sump</p> <p><input type="checkbox"/> Vented Canned Sump</p> <p><input type="checkbox"/> Manhole Sump</p> <p><input checked="" type="checkbox"/> <u> </u> Tank Sump</p> <p>Double Mechanical Seal:</p> <p>API Class Code: _____</p> <p>Mfr: _____</p> <p>Model No. _____</p> <p>Bearings (Type/No.):</p> <p>Upper: ____ / ____</p> <p>Lower: ____ / ____</p> <p>AFBMA Rating Life (hours): ____</p> <p>Field Testing: <input type="checkbox"/> Not Required</p> <p><input type="checkbox"/> Required, Functional and Performance</p>	<p>Controls:</p> <p>Level Control:</p> <p>Manufacturer: _____</p> <p><input type="checkbox"/> Tilting Ball Float Mercury</p> <p>Switch (No.): _____</p> <p><input type="checkbox"/> SPST Magnet-Equipped Float</p> <p>Switch (No.): _____</p> <p>Control Features:</p> <p><input checked="" type="checkbox"/> Pumps OFF, 1st Pump ON, 2nd Pump ON, and HIGH LEVEL ALARM</p> <p><input type="checkbox"/> ON/OFF Integral Adjustable</p> <p>Differential Switch Set Point</p> <p>(inches of water): ____</p> <p><input type="checkbox"/> Pump OFF, Pump ON, and HIGH LEVEL ALARM</p>	<p>Panel Components:</p> <p><input type="checkbox"/> Motor Starters, NEMA: ____</p> <p><input type="checkbox"/> ON-OFF-AUTO Switch</p> <p><input type="checkbox"/> Running Lights</p> <p><input type="checkbox"/> Alarm Dry Contact Closure</p> <p>Rated (amps): _____</p> <p>Voltage: _____</p> <p><input type="checkbox"/> Instrumentation and Control</p> <p>System Interface</p> <p><input type="checkbox"/> Panel Enclosure: _____</p> <p><input type="checkbox"/> Terminal Strip Within Panel for All Interfacing Exterior Wiring</p> <p>Features:</p> <p><input type="checkbox"/> Alternator</p> <p><input type="checkbox"/> Vented Canned Steel or Cast Iron Tank and Cover</p> <p><input type="checkbox"/> High Temperature Construction (above 140 degrees F).</p> <p><input type="checkbox"/> Guide Rails:</p> <p><input type="checkbox"/> Marine Brass</p> <p><input type="checkbox"/> Type 304 SS</p> <p><input type="checkbox"/> _____</p> <p><input type="checkbox"/> Lifting Chain:</p> <p><input type="checkbox"/> Plastic-Bonded Steel</p> <p><input type="checkbox"/> Type 304 SS</p>

MATERIALS (manufacturer to supply missing data)		
Volute: _____	Bearings: _____	Impeller: _____
Shaft Seals: _____	Upper _____	Motor Housing: _____
	Lower _____	
ADDITIONAL REQUIREMENTS		

SECTION 22 13 32
IMMERSIBLE-DRY PIT CENTRIFUGAL PUMP

1 PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. National Fire Protection Association (NFPA):
 - a. 70, National Electric Code, Article 500.
 - b. 497A, Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.
 - c. 497B, Classification of Class II Hazardous (Classified) Location for Electrical Installations in Chemical Process Areas.
 - d. 497M, Classification of Gases, Vapors, and Dust for Electrical Equipment in Hazardous (Classified) Locations.
 - e. 820, Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities.

1.2 DEFINITIONS

- A. Terminology pertaining to pumping unit performance and construction shall conform to the ratings and nomenclature of the Hydraulic Institute Standards.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Make, model, weight, and horsepower of each equipment assembly.
 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
 4. Power and control wiring diagrams, including terminals and numbers.
 5. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
 6. Factory finish system
- B. Quality Control Submittals:
1. Factory Functional and Performance Test Reports and Log.
 2. Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
 3. Special shipping, storage and protection, and handling instructions.
 4. Manufacturer's printed installation instructions.
 5. Manufacturer's Certificate of Proper Installation.

6. Suggested spare parts list to maintain the equipment in service for a period of 1 year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
8. Operation and maintenance manual.

1.4 EXTRA MATERIALS

A. Furnish one set of:

1. Mechanical seals.
2. One impeller
3. One wear ring
4. One complete set of any special tools required to dismantle pump.

2 PART 2 PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog numbers herein is for the purpose of establishing the standard of quality and general configuration desired only. Other manufacturers' equipment will be considered in accordance with the General Conditions.
- B. The equipment shall meet all requirements of this Specification and shall be furnished by one of the following system manufacturers, or equal:
1. Cornell Pumps
- C. Pump and Electrical Driver: Meet requirements for class, group, and division location in accordance with NFPA 70.
- D. Pump equipment shall consist of pumps complete with motors control system guide rail and anchoring brackets, power cable(s), and pump lifting cables. Pump metal parts that come into contact with guide rail or cable system shall be made of nonsparking materials.

2.2 REQUIREMENTS

- A. Furnish and install three (3) immersible pumps. Each pump shall be rated as indicated on drawings. The immersible motor shall be three-phase service with 60 feet of submersible cable included. The power and control shall be sized in accordance with NEC and ICEA standards.

2.3 PUMP DESIGN

- A. Pump Casing: Cast iron casing, bearing frame and bracket
- B. Impeller: SAE 40 Bronze impeller
- C. Wear Rings: SAE 660 bronze wear rings and shaft sleeve
- D. Shaft: Stressproof shaft

- E. Bearings: Each rotating assembly shall rotate on two permanently lubricated bearings. The bearings shall be of sufficient size to transfer all radial and axial loads to the housing while minimizing shaft deflections and excessive heat built-up. Lower bearings shall be tapered roller bearings. A minimum bearing life of 100,000 hours is required. This calculation shall be based on a continuous operating condition of 65% BEP. Bearing life calculations shall be supplied with submittal documentation.
- F. Mechanical Seals: Single mechanical seal (Carbon vs. Ceramic), with product flush line
- G. External Hardware and Surface: Each pump shall be fitted with Type 316 stainless steel external hardware to prevent corrosion. All external surfaces coming into contact with the pumped fluid, other than stainless steel, shall have an electrostatically applied powder coat, baked on, epoxy finish. This coating shall be extremely resistance to sewage and other chemicals normally found in wastewater.
- H. Cable: Each submersible pump shall include 60 feet of submersible cable. The pump power/control cable shall be FM approved for use in hazardous locations. The exterior jacket shall be capable of submergence in raw sewage.
- I. Motor: The pump motor shall be TEBC (Totally Enclosed Blower Cooled Motor) immersible motor design. The 460V blower motor, on separate power circuit from main motor. The rotor and stator shall operate in an air-filled, watertight housing. Oil filled motors are not acceptable. The motor efficiency shall meet published EPACT efficiency ratings for standard motors to improve overall wire to water efficiencies. Motors that do not meet EPACT efficiency ratings shall not be acceptable. The motor shall have a NEMA B design rating with the stator windings and leads having a Class H insulation rating (180° C). Designs which utilize either Class B or Class F insulation systems shall not be considered equal. The motor housing shall be constructed of ASTM A48, Class 30 cast iron. The motor shall be designed for continuous duty, either submerged or unsubmerged while pumping fluids up to 40 degrees C. Thermal switches shall be embedded in each phase of the windings and set to open at 135 degrees C. The thermal switches shall be wired in series and be connected to the motor controls to shut down the pump during a high temperature condition. The combined service factor of the motor shall be a minimum of 1.15. The motor horsepower shall be selected such that the unit is non-overloading over the entire specified performance range.

2.4 ACCESSORIES

- A. Immersible bearing frame with grease cups and expellers
- B. 8"x8" cast iron base elbow with fabricated steel base
- C. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.
- D. Lifting Lugs: Equipment weighing over 100 pounds.
- E. Anchor Bolts: Type 316 stainless steel sized by equipment manufacturer.

2.5 MAINTANENCE

- A. Furnish one set of all special tools required for proper servicing and dismantling of equipment supplied under these Specifications, packed in a suitable steel tool chest with a lock. Furnish the list and price of manufacturer's recommended normal wear and tear spare parts for one-year maintenance for each size pump furnished.

2.6 FACTORY FINISHING

- A. Manufacturer's standard enamel finish

2.7 SOURCE QUALITY CONTROL

- A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
- B. Factory Tests and Adjustments: Test all equipment actually furnished.
- C. Factory Test Report: Include test data sheets, curve test results, performance test logs, certified correct by a registered professional engineer.
- D. Functional Test: Perform manufacturer's standard motor test on equipment.
- E. Performance Test:
 - 1. Conduct on each pump.
 - 2. Perform under actual or approved simulated operating conditions.
 - 3. Test for a continuous 3-hour period without malfunction.
 - 4. Test Log: Record the following:
 - a. Total head.
 - b. Capacity.
 - c. Horsepower requirements.
 - d. Driving motor voltage and amperage measured for each phase.
 - e. Throttle discharge valve to obtain pump data points on curve at 2/3, 1/3, and shutoff conditions.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Connect suction and discharge piping without imposing strain to pump flanges.
- C. Anchor Bolts: Accurately place using equipment templates.

3.2 FIELD QUALITY CONTROL

- A. Functional Test: Conduct on each pump.
 - 1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 - 2. Flow Output: Measured by plant instrumentation and storage volumes.
 - 3. Operating Temperatures: Monitor bearing areas on pump and motor for abnormally high temperatures.
- B. Performance Test: In accordance with Hydraulic Institute Standards.

3.3 DELIVERY, STORAGE, AND HANDLING

- A. Pump shall be export crated and protected against moisture prior to shipment.
- B. The pump manufacturer shall provide unloading, storage, and handling instructions prior to shipment.
- C. All equipment shall be delivered in good, sound condition, and free from damage. Equipment that has been damaged will be rejected.
- D. The installing Contractor will be responsible for proper unloading, handling, and storage of equipment in accordance with the manufacturer's instructions.

3.4 MANUFACTURER'S SERVICES

- A. Provide services of pump manufacturer's factory service engineer specifically trained in the installation, operation, and maintenance of pumping units as specified herein. The services of the manufacturer's representative shall be made available during the installation period for assistance to the Contractor in adjusting and checking equipment.
- B. Man-hour requirements tabulated below are exclusive of travel time and do not relieve the Supplier of obligation to provide sufficient service to place equipment in satisfactory operation.
- C. The factory representative shall be provided for Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:
 - 1. [1] person-days for installation assistance and inspection.
 - 2. [1] person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - 3. [1/2] person-days for prestartup classroom or site training.
 - 4. [1/2] person-days for facility startup.
 - 5. [1/2] person-days for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by OWNER and ENGINEER.
- D. In the event the services of the manufacturer's representative are needed and requested by the owner for periods longer than indicated in these Contract Documents, payment for such services shall be made by the owner. No payment shall be due for time spent by the representative due to faulty design or fabrication of the equipment.

END OF SECTION

PUMP DATA SHEET IMMERSIBLE CENTRIFUGAL DRY PIT PUMPS		
Project: <u>Roosevelt Roads WTP</u>		Pump Mfr.: <u>Cornell Pumps or Approved Equal</u>
Owner: <u>Roosevelt Roads</u>		Size & Type: <u>DRY PIT IMMERSIBLE</u>
Service: _____		Serial No.: _____
Pump Name: <u>Distribution Pumps</u>		Model No.: <u>5H-VC16-IMM- 8X8-125-2</u>
Equip. Tag Number(s): <u>PU-05-12, PU-05-13 AND PU-05-14</u>		
No. Pumps Required: <u>3</u>		
LIQUID	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: <u>Clearwater</u>	Capacity per operational point:	Temp (°F): Max _____ Min _____
Pumping Temperature (°F): <u>95</u>	1,200 gpm @ 280 ft TDH. Also the pump shall have the following operating points on the curve:	Rel. Hum (%): Max _____ Min _____
	1,000gpm @ 290 ft TDH	
	890 gpm @ 305 ft TDH	
	Suction Pressure (psig): _____	Altitude (ft): _____
Specific Gravity @ 68°F: <u>1</u>	Suction Pressure (psig):	<input type="checkbox"/> Indoor <input type="checkbox"/> Heated
Vapor Pressure (psia): _____	Max _____ Rated _____	<input type="checkbox"/> Outdoor <input type="checkbox"/> Unheated
Viscosity (CP) @ _____ °F:	Largest Solid Passing (in.): _____	Area Classification: _____
pH: <u>6-7</u>		<input type="checkbox"/> Hazardous Classification (NFPA 70):
Corrosion/Erosion/Abrasion Caused by:		Class: _____
		Group: _____
		Division: _____
Remarks: <u>Constant</u>	Remarks: _____	Remarks: _____

PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Proposal Curve No.: _____	NPSH Required (ft water): _____	Factory Testing:
Speed (rpm): <u>3,600</u>	3% Head Drop _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Efficiency (%): _____		
Rated Power (BHP): <u>125</u>		

Remarks: _____		

Equipment Tag Number(s): _____		
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)		
<p>Pump: EQ Tank Pumps</p> <p><input type="checkbox"/> Single <input type="checkbox"/> Dual</p> <p><input checked="" type="checkbox"/> Heavy-Duty, Nonclog</p> <p>Location:</p> <p><input checked="" type="checkbox"/> Pump Station</p> <p><input type="checkbox"/> Open Concrete Sump</p> <p><input type="checkbox"/> Vented Canned Sump</p> <p><input type="checkbox"/> Manhole Sump</p> <p><input type="checkbox"/> _____ Tank Sump</p> <p>Double Mechanical Seal:</p> <p>API Class Code: _____</p> <p>Mfr: _____</p> <p>Model No. _____</p> <p>Bearings (Type/No.):</p> <p>Upper: ____ / ____</p> <p>Lower: ____ / ____</p> <p>AFBMA Rating Life (hours): ____</p> <p>Field Testing: <input type="checkbox"/> Not Required</p> <p><input type="checkbox"/> Required, Functional and Performance</p>	<p>Controls:</p> <p>Level Control:</p> <p>Manufacturer: _____</p> <p><input type="checkbox"/> Tilting Ball Float Mercury</p> <p>Switch (No.): _____</p> <p><input type="checkbox"/> SPST Magnet-Equipped Float</p> <p>Switch (No.): _____</p> <p>Control Features:</p> <p><input type="checkbox"/> Pumps OFF, 1st Pump ON, 2nd Pump ON, and HIGH LEVEL ALARM</p> <p><input type="checkbox"/> ON/OFF Integral Adjustable</p> <p>Differential Switch Set Point</p> <p>(inches of water): ____</p> <p><input type="checkbox"/> Pump OFF, Pump ON, and HIGH LEVEL ALARM</p>	<p>Panel Components:</p> <p><input type="checkbox"/> Motor Starters, NEMA: ____</p> <p><input type="checkbox"/> ON-OFF-AUTO Switch</p> <p><input type="checkbox"/> Running Lights</p> <p><input type="checkbox"/> Alarm Dry Contact Closure</p> <p>Rated (amps): _____</p> <p>Voltage: _____</p> <p><input type="checkbox"/> Instrumentation and Control</p> <p>System Interface</p> <p><input type="checkbox"/> Panel Enclosure: _____</p> <p><input type="checkbox"/> Terminal Strip Within Panel for All Interfacing Exterior Wiring</p> <p>Features:</p> <p><input type="checkbox"/> Alternator</p> <p><input type="checkbox"/> Vented Canned Steel or Cast</p> <p>Iron Tank and Cover</p> <p><input type="checkbox"/> High Temperature Construction (above 140 degrees F).</p> <p><input type="checkbox"/> Guide Rails:</p> <p><input type="checkbox"/> Marine Brass</p> <p><input type="checkbox"/> Type 304 SS</p> <p><input type="checkbox"/> _____</p> <p><input type="checkbox"/> Lifting Chain:</p>

<input type="checkbox"/> Plastic-Bonded Steel		
<input type="checkbox"/> Type 304 SS		
MATERIALS (manufacturer to supply missing data)		
Volute: _____	Bearings: _____	Impeller: _____
Shaft Seals: _____	Upper _____	Motor Housing: _____
	Lower _____	
ADDITIONAL REQUIREMENTS		

SECTION 22 13 35 SAMPLING PUMPS

1 PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Manufacturer's Association (NEMA): MG-1, Motors and Generators.

1.2 SUBMITTALS

A. Shop Drawings:

1. Make, model, weight, and horsepower of each equipment assembly.
2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
4. Detailed structural, mechanical, and electrical drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
5. Power and control wiring diagrams, including terminals and numbers.
6. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
7. Factory finish system.

B. Quality Control Submittals:

1. Factory Functional and Performance Test Report and Log.
2. Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified herein.
3. Special shipping, storage and protection, and handling instructions.
4. Manufacturer's printed installation instructions.
5. Manufacturer's Certificate of Proper Installation.
6. Suggested spare parts list to maintain the equipment in service for a period of 1 year and 5 years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
7. List special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
8. Operation and maintenance manual.

1.3 EXTRA MATERIALS

A. Furnish for each pump:

1. Stator, natural rubber.
2. Stator, Buna-N, 70 durometer hardness.
3. Rotor, high carbon, high chrome tool steel, hard chrome coated.

4. Rotor, 316 stainless steel.
5. Joint assemblies to connect high carbon, high chrome rotor to drive shaft.
6. Drive belt.
7. One complete set of any special tools required to dismantle pump.

PART 2 PRODUCTS

2.1 GENERAL

- A. Approved equal products will be considered.
- B. Coordinate pump requirements with drive manufacturer and be responsible for pump and drive requirements.
- C. Where adjustable speed drives are required, furnish a coordinated operating system complete with pump, drive, and speed controller.

2.2 SUPPLEMENTS

- A. Some specific requirements are attached to this section as supplements.

2.3 ACCESSORIES

- A. Equipment Identification Plate: 16-gauge stainless steel with 1/4-inch die-stamped equipment tag number securely mounted in a readily visible location.
- B. Lifting Lugs: Equipment weighing over 100 pounds.
- C. Anchor Bolts: Galvanized, Type 316 stainless steel, sized by equipment manufacturer, 1/2-inch minimum diameter. Coat in accordance with Section 09 90 01 PAINTING, System No. 29, Fusion Bonded Coating.

2.4 FACTORY FINISHING

- A. Prepare, prime, and finish coat in accordance with Section 09 90 01 PAINTING
- B. Manufacturer's standard enamel finish.

2.5 SOURCE QUALITY CONTROL

- A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.
- B. Factory Tests and Adjustments: Test all equipment and control panels actually furnished.
- C. Factory Test Report: Include test data sheets, curve test results, certified correct by a registered professional engineer.
- D. Manufacturer shall offer a 2-year limited warranty against defects in materials and workmanship.
- E. Functional Test: Perform manufacturer's standard, motor test on equipment. Include vibration test, as follows:

1. Dynamically balance rotating parts of each pump blower and its driving unit before final assembly.
 2. Limits:
 - a. Driving Unit Alone: Less than 80 percent of NEMA MG 1 limits.
 - b. Complete Rotating Assembly Including Coupling, Drive Unit, and Motor: Less than 90 percent mils of limits established in the Hydraulic Institute Standards.
- F. Performance Test:
1. Conduct on each pump.
 2. Perform under simulated operating conditions.
 3. Test for a continuous 3-hour period without malfunction.
 4. Test Log: Record the following:
 - a. Total head.
 - b. Capacity.
 - c. Horsepower requirements.
 - d. Flow measured by factory instrumentation and storage volumes.
 - e. Average distance from suction well water surface to pump discharge centerline for duration of test.
 - f. Pump discharge pressure converted to feet of liquid pumped and corrected to pump discharge centerline.
 - g. Calculated velocity head at the discharge flange.
 - h. Field head.
 - i. Driving motor voltage and amperage measured for each phase.
 5. Adjust, realign, or modify units and retest in accordance with Hydraulic Institute Standards if necessary.
- G. Hydrostatic Tests: Pump casing(s) tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Level base by means of steel wedges (steelplates and steel shims). Wedge taper not greater than 1/4 inch per foot. Use double wedges to provide a level bearing surface for the pump and driver base. Accomplish wedging so that there is no change of level or springing of the baseplate when the anchor bolts are tightened.
- C. Adjust pump assemblies such that the driving units are properly aligned, plumb, and level with the driven units and all interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.
- D. After the pump and driver have been set in position, aligned, and shimmed to the proper elevation, grout the space between the bottom of the baseplate and the concrete foundation with a poured, nonshrinking grout of the proper category. Remove wedges after grout is set and pack void with grout.
- E. Connect suction and discharge piping without imposing strain to pump flanges.
- F. Anchor Bolts: Accurately place using equipment templates.
- G. Pipe pump drain(s) to hub drain or scupper.

3.2 FIELD FINISHING

- A. Equipment as specified in Section 09 90 01 PAINTING

3.3 FIELD QUALITY CONTROL

- A. Conduct tests on each pump.
- B. Functional Tests:
1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
 2. Vibration Test:
 - a. Test with units installed and in normal operation, and discharging to the connected piping systems at rates between the low discharge head and high discharge head conditions specified, and with the actual building structures and foundations provided shall not develop at any frequency or in any plane, peak-to-peak vibration amplitudes exceeding the limits specified.
 - b. If units exhibit vibration in excess of the limits specified, adjust or modify as necessary. Units which cannot be adjusted or modified to conform as specified shall be replaced.
- C. Performance Test: In accordance with ASME Power Test Codes, PTC-10. Hydraulic Institute Standards. AWWA E101.

3.4 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:
1. [1] person-days for installation assistance and inspection.
 2. [1] person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 3. [1/2] person-days for prestartup classroom or site training.
 4. [1/2] person-days for facility startup.
 5. [1/2] person-days for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by OWNER and ENGINEER.

3.5 SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION," are a part of this Specification.
1. Data Sheets:
 - a. Pump.
 - b. Motor.

END OF SECTION

PUMP DATA SHEET SAMPLING PUMPS		
Project: <u>Roosevelt Roads WTP</u>		Pump Mfr.: <u>Gould</u>
Owner: <u>Roosevelt Roads</u>		Size & Type: <u>Self-Priming</u>
Service: _____		Serial No.: <u>GT- Irrigator</u>
Pump Name: <u>Sampling Pump</u>		Model No.: <u>GT07</u>
Equip. Tag Number(s): <u>PU-01-500 / PU-03-501</u>		
No. Pumps Required: <u>1</u>		
Drive Type: <input type="checkbox"/> Constant <input type="checkbox"/> Adjustable		
LIQUID	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: _____	Capacity (U.S. gpm): <u>10 gpm</u>	Temp (<input type="checkbox"/> F): Max _____ Min _____
Pumping Temperature (<input type="checkbox"/> C): Normal <u>30</u> Max <u>32</u> Min <u>29</u>	Normal _____ Rated _____	Rel. Hum (%): Max _____ Min _____
Specific Gravity @ _____ <input type="checkbox"/> F: _____	Min. Continuous Flow (gpm): _____	Altitude (ft): _____
Vapor Pressure (psia): _____	Discharge Pressure (psig): <u>20</u>	<input type="checkbox"/> Indoor <input type="checkbox"/> Heated
Viscosity (CP) @ _____ <input type="checkbox"/> F: _____	Suction Pressure (psig): Max _____ Rated _____	<input type="checkbox"/> Outdoor <input type="checkbox"/> Unheated
pH: _____		Area Classification: _____
Corrosion/Erosion/Abrasion Caused by: _____ _____		Other: _____
Remarks: _____	Remarks: <u>Self-Priming</u>	Remarks: _____
_____	_____	_____
_____	_____	_____

PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)		
Proposal Curve No.: _____	Max. Head (psi): _____	Factory Testing:
Pump Speed Range (rpm): _____ / _____	Max. Power (BHP): _____	<input type="checkbox"/> Required <input type="checkbox"/> Not Required
Efficiency (%): _____		
Rated Power (BHP): _____		
Remarks: _____		

Equipment Tag Number(s): _____				
PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)				
Nozzles				
	Size	Rating	Facing	Location
Suction				
Discharge				
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> Casing Mount: <input type="checkbox"/>Foot <input type="checkbox"/>Centerline <input type="checkbox"/>Bracket <input type="checkbox"/>Near Centerline <input type="checkbox"/>Inline </div> <div style="width: 30%;"> Packing Mfr: _____ Type _____ Size/No. Rings _____ </div> <div style="width: 30%;"> Bearings (Type/No.): Radial _____ Thrust _____ AFBMA Rating Life (hrs): _____ </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 30%;"> Hydro Test Pressure (psig): _____ Pump Shaft Dia. (In.): _____ </div> <div style="width: 30%;"> Joint Assembly: _____ Manufacturer _____ Type _____ Model _____ </div> <div style="width: 30%;"> Lubrication Type: <input type="checkbox"/>Grease <input type="checkbox"/>Oil Field Testing: <input type="checkbox"/>Not Required <input type="checkbox"/>Required, functional and performance </div> </div>				
MATERIALS (manufacturer to supply missing data)				
Pump Body: _____ Cast Iron Rotor: _____ Stainless Steel Baseplate: _____ Stator: _____ Joint Assembly: _____ Type _____ Shaft: _____ Material _____ Remarks: _____ 				
ADDITIONAL REQUIREMENTS				

Project: Roosevelt Roads WTP

Owner: Roosevelt Roads

Equipment Name: Sampling Pump

Equipment Tag Number(s): PU-01-500 / PU-03-501

Special Features:

DIVISION 23

HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical systems piping and equipment.

1.3 DEFINITIONS

- A. Terminology used in this Section is defined in MSS SP-90.

1.4 PERFORMANCE REQUIREMENTS

- A. Design seismic restraint hangers and supports, for piping and equipment.
- B. Design and obtain approval from authority with jurisdiction over seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of hanger and support.
- C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.
- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- E. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.
- F. Licensed Engineer's hanger and support drawings specified in the "Quality Assurance" Article.
- G. Licensed Engineer's hanger and support installation report specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators according to AWS D1.1 "Structural Welding Code--Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
- C. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.
- D. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
 - 1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- E. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.
- F. Licensed Engineer: Prepare hanger and support design drawings, and calculations for seismic restraint of piping and equipment. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.
 - 1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
 - 2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal-Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.
- C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.
- D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.2 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36, steel plates, shapes, and bars, black and galvanized.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Grout: ASTM C 1107, Grade B, nonshrink, nonmetallic.
 - 1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Water: Potable.
 - 4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in the Section specifying the equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.2 HANGER AND SUPPORT INSTALLATION

- A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.
- C. Install supports with maximum spacings complying with MSS SP-69.
- D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
- E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert to forms. Install reinforcing bars through openings at top of inserts.
- F. Install concrete inserts in new construction prior to placing concrete.
- G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.

- H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.
- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- K. Support fire protection systems piping independent of other piping.
- L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.
- O. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
 - 2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - 3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees and have dimensions in inches not less than the following:

NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

- 4. Pipes 8 Inches and Larger: Include wood inserts.
- 5. Insert Material: Length at least as long as the protective shield.
- 6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.7 FIELD QUALITY CONTROL

- A. Licensed Engineer's Report: Prepare hanger and support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes vibration isolators, vibration isolation bases, vibration isolation roof curbs, and seismic restraints and snubbers.

1.3 SUBMITTALS

- A. Product Data: Indicate types, styles, materials, and finishes for each type of isolator specified. Include load deflection curves.
- B. Shop Drawings: Show designs and calculations, certified by a professional engineer, for the following:
 - 1. Design Calculations: Calculations for selection of vibration isolators, design of vibration isolation bases, and selection of seismic restraints.
 - 2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to the structure and to the supported equipment. Include auxiliary motor slides and rails, and base weights.
 - 3. Seismic Restraint Details: Detail fabrication and attachment of restraints and snubbers.

1.4 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of vibration isolation bases and seismic restraints that are similar to those indicated for this Project in material, design, and extent.

1.5 PROJECT CONDITIONS

- A. Project seismic zone is 4 with a zone factor of 0.40.
- B. Building Importance Factor: 1.5.

1.6 COORDINATION

- A. Coordinate layout and installation of vibration isolation and seismic-restraint devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate size and location of concrete housekeeping and vibration isolation bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. Apex Molded Products Co.
 - 4. B-Line Systems, Inc.
 - 5. Bramec Corp.
 - 6. California Dynamics Corp.
 - 7. Cannon Fabrication, Inc.
 - 8. Diversitech Corp.
 - 9. Fabreeka International, Inc.
 - 10. GMT International Corp.
 - 11. Greene Rubber Co.
 - 12. Isolation Technology, Inc.
 - 13. Karman Rubber.
 - 14. Kinetics Noise Control, Inc.
 - 15. King, H.A., Ltd.
 - 16. Lord Industrial Products.
 - 17. Mason Industries, Inc.
 - 18. Metalastik, Inc.
 - 19. Minor Rubber Co., Inc.
 - 20. Rubatex Corp.
 - 21. Service Rubber Group, Inc.
 - 22. Stock Drive Products.
 - 23. Tech Products Corp.
 - 24. Vibration Eliminator Co., Inc.
 - 25. Vibration Isolation Co., Inc.
 - 26. Wagner Products Corp.

2.2 VIBRATION ISOLATORS

- A. Isolator Pads: Oil and water resistant and factory cut to sizes that match requirements of the equipment supported.

1. Rubber Isolator Pads: Elastomer (neoprene or silicone) arranged in single or multiple layers and molded with a nonslip pattern and steel baseplates of sufficient stiffness to provide uniform loading over the pad area.
 2. Fiberglass or Cork Isolator Pads: Molded cork or glass fiber not less than 1 inch thick and precompressed through 10 compression cycles at 3 times the rated load.
 3. Load Range: From 10 to 50 psig and a deflection not less than 0.08 inch per 1 inch of thickness. Do not exceed a loading of 50 psig.
- B. Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top- and baseplates. Factory-drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.
- C. Spring Isolators: Freestanding, laterally stable, open-spring-type isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 1.2 times the rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to a 1/4-inch-thick, rubber isolator pad attached to the baseplate underside. Size baseplates to limit floor loading to 100 psig.
 6. Top Plates: Provide threaded studs for fastening and leveling equipment.
 7. Finishes: Manufacturer's standard corrosive-resistant finish.
- D. Restrained Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.
1. Housing: Welded steel with resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed. Factory-drilled baseplate for bolting to structure and bonded to a 1/4-inch-thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 0.8 times the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.
- E. Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.
- F. Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.
1. Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
5. Finishes: Baked enamel for metal components. Color-code to indicate capacity range.

2.3 SEISMIC CONTROLS

- A. Thrust Restraints: Combination spring and elastomeric restraints with coil spring and elastomeric insert in compression. Factory set for thrust.
 1. Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 5. Finishes: Baked enamel for metal components. Color-code to indicate capacity range.
- B. Manufactured Seismic Snubbers: All-directional, double-acting snubbers.
 1. Construction: Interlocking steel members restrained by a 3/4-inch-thick, replaceable, shock-absorbing neoprene insert. Maintain 1/8-inch clearance in all directions between rigid and resilient surfaces.
- C. Fabricated Seismic Snubbers: Welded structural-steel shapes designed and fabricated to restrain equipment or vibration isolation bases from excessive movement during a seismic event. Design to resist gravity forces identified by authorities having jurisdiction.
 1. Construction: Welded steel shapes conforming to ASTM A 36.
 2. Resilient Components: 3/4-inch-thick, replaceable, shock-absorbing neoprene insert.

2.4 VIBRATION ISOLATION BASES

- A. Fabricated Steel Bases: Structural-steel bases and rails designed and fabricated by the isolation equipment manufacturer. Include equipment static loadings, power transmission, component misalignment, and cantilever loadings.
 1. Fabricate bases to shapes required, with welded structural-steel shapes, plates, and bars conforming to ASTM A 36. Include support brackets to anchor base to isolation units. Include prelocated equipment anchor bolts and auxiliary motor slide bases or rails.
 2. Design and fabricate bases to result in the lowest possible mounting height with not less than 1-inch clearance above the floor.
 3. Concrete-Filled Inertia Bases: Weld reinforcing bars to the structural frame. Pour concrete into base with relocated equipment anchor bolts.
 4. Weld steel angles on frame for outrigger isolation mountings, and provide for anchor bolts and equipment support.
 5. Configure inertia bases to accommodate equipment supported.
 6. Pump Bases: Size to support pump and piping elbows.
 7. Factory Finish: Manufacturer's standard corrosive-resistant finish.

2.5 VIBRATION ISOLATION ROOF CURBS

- A. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb designed to resiliently support roof-mounted equipment and to withstand 125-mph wind impinging laterally

against the side of the equipment. Design restraints to meet seismic requirements of authorities having jurisdiction.

- B. Components: Upper support frame; lower support assembly; freestanding, unhoused, laterally stable steel springs; vertical and horizontal restraints.
 - 1. Lower Support Assembly: Provide a means of attachment to the building structure and include a wood nailer stripe for attachment of roof material and 2 inches of rigid insulation on the inside of the assembly.
 - 2. Spring Isolators: As indicated or scheduled. Include adjustment bolt to permit leveling of equipment after installation. Attach to lower assembly with a rubber isolation pad. Locate spring isolators so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - 3. Water Seal: Elastomeric seal conforming to UL Class A roofing materials, attached to the upper support frame, extending down past the wood nailer of the lower support assembly, and counterflashed over the roof materials.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and anchor vibration-, sound-, and seismic-control products according to manufacturer's written instructions and authorities having jurisdiction.
- B. Anchor interior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural floors as required by authorities having jurisdiction.
- C. Anchor exterior mounts, isolators, hangers, and snubbers to vibration isolation bases. Bolt isolator baseplates to structural supports as required by authorities having jurisdiction.
- D. Fill concrete inertia bases, after installing base frame, with 3000-psi concrete, and trowel to a smooth, hard finish. Cast-in-place concrete is specified in Division 3.
- E. Install pipe connectors at connections for equipment supported on vibration isolators.

3.2 SEISMIC CONTROL

- A. Vibration Isolation Bases: Mount equipment on structural-steel bases or concrete inertia bases.
- B. Snubbers: Install the required number of seismic snubbers on each spring-mounted piece of equipment. Locate snubbers as close as possible to the vibration isolators and bolt to supporting structure.

3.3 ADJUSTING AND CLEANING

- A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operations.
- B. Adjust thrust restraints for a maximum of 1/4 inch of movement at start and stop.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Setting quantitative performance of HVAC equipment.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Measuring sound and vibration.
 - 7. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
 - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.
- O. CTI: Cooling Tower Institute.
- P. NEBB: National Environmental Balancing Bureau.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.
- F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items: Include at least the following:
 - a. Submittal distribution requirements.
 - b. Contract Documents examination report.
 - c. Testing, adjusting, and balancing plan.
 - d. Work schedule and Project site access requirements.
 - e. Coordination and cooperation of trades and subcontractors.
 - f. Coordination of documentation and communication flow.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
 - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
- E. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- F. Testing, Adjusting, and Balancing Reports: Use standard forms from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing."
- G. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- H. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- I. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
- C. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.

- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- P. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.
- Q. Examine equipment for installation and for properly operating safety interlocks and controls.
- R. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.

2. Dampers and valves are in the position indicated by the controller.
 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 6. Sensors are located to sense only the intended conditions.
 7. Sequence of operation for control modes is according to the Contract Documents.
 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to design values.
- S. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
 2. Hydronic systems are filled, clean, and free of air.
 3. Automatic temperature-control systems are operational.
 4. Equipment and duct access doors are securely closed.
 5. Balance, smoke, and fire dampers are open.
 6. Isolating and balancing valves are open and control valves are operational.
 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section. Or
- B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

- D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, multizone, dual-duct, induction-unit supply-air systems and process exhaust-air systems. These additional procedures are specified in other articles in this Section.
- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each air-handling unit component.

- a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers under final balanced conditions.
 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 5. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- D. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type, unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 HYDRONIC SYSTEMS' BALANCING PROCEDURES

- A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.
- E. Adjust balancing stations to within specified tolerances of design flow rate as follows:
 1. Determine the balancing station with the highest percentage over design flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.8 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating if high-efficiency motor.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.9 CONDENSING UNITS

- A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

3.10 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.11 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.

- I. Verify main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.12 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.13 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.

2. Name and address of testing, adjusting, and balancing Agent.
 3. Project name.
 4. Project location.
 5. Architect's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
 10. Summary of contents, including the following:
 - a. Design versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 11. Nomenclature sheets for each item of equipment.
 12. Data for terminal units, including manufacturer, type size, and fittings.
 13. Notes to explain why certain final data in the body of reports vary from design values.
 14. Test conditions for fans and pump performance forms, including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
- F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Sheave dimensions, center-to-center and amount of adjustments in inches.
 - j. Number of belts, make, and size.
 - k. Number of filters, type, and size.
 2. Motor Data: Include the following:

- a. Make and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
3. Test Data: Include design and actual values for the following:
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat coil static-pressure differential in inches wg.
 - g. Cooling coil static-pressure differential in inches wg.
 - h. Heating coil static-pressure differential in inches wg.
 - i. Outside airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outside-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.

G. Apparatus-Coil Test Reports: For apparatus coils, include the following:

1. Coil Data: Include the following:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outside-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.

- o. Inlet steam pressure in psig.

- a. System and air-handling unit identification.

- b. Location and zone.
 - c. Test apparatus used.
 - d. Area served.
 - e. Air-terminal-device make.
 - f. Air-terminal-device number from system diagram.
 - g. Air-terminal-device type and model number.
 - h. Air-terminal-device size.
 - i. Air-terminal-device effective area in sq. ft.
 - 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.
 - d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data: Include the following:
 - a. System and air-handling unit identification.
 - b. Location and zone.
 - c. Room or riser served.
 - d. Coil make and size.
 - e. Flowmeter type.
 - 2. Test Data: Include design and actual values for the following:
 - a. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- L. Instrument Calibration Reports: For instrument calibration, include the following:
- 1. Report Data: Include the following:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.15 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

- B. **Seasonal Periods:** If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes pipe and duct insulation.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 15 Section "Metal Ductwork" for duct lining.

1.3 DEFINITIONS

- A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
- B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
- C. Cold Surfaces: Normal operating temperatures less than 75 deg F.
- D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit between the two exposed faces required to cause 1 BTU per hour to flow through 1 square foot at mean temperatures indicated.
- E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F.
- F. Density: Is expressed in pcf.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.
- C. Samples of each type of insulation and jacket. Identify each sample describing product and intended use. Submit the following sizes of sample materials:
 - 1. Board and Block Insulation: 12 inches square section.

2. Pre-Formed Pipe Insulation: 12 inches long, 2-inch NPS.

- D. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.
- E. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.5 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.
- B. Field-Constructed Mock-Up: Before installation, erect mock-up of size and at locations indicated to demonstrate workmanship quality. Include method of attachment and finishing for each.
1. Interior and exterior equipment.
 2. Interior and exterior duct systems.
 3. Interior and exterior piping systems.
 4. Retain and protect mock-ups during construction as a standard for judging completed unit of Work.
 5. Accepted mock-ups may become part of completed unit of Work.

1.6 SEQUENCING AND SCHEDULING

- A. Schedule insulation application after testing of piping and duct systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Glass Fiber:
 - a. CertainTeed Corporation.
 - b. Knauf Fiberglass GmbH.
 - c. Manville.
 - d. Owens-Corning Fiberglas Corporation.
 - e. USG Interiors, Inc. - Thermafiber Division.
 2. Flexible Elastomeric Cellular:

- a. Armstrong World Industries, Inc.
- b. Halstead Industrial Products.
- c. IMCOA.
- d. Rubatex Corporation.

2.2 GLASS FIBER

- A. Material: Inorganic glass fibers, bonded with a thermosetting resin.
- B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.
- C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.
 - 1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F average maximum, at 75 deg F mean temperature.
 - 2. Density: 12 pcf average maximum.
- D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets.
 - 1. Thermal Conductivity: 0.32 Btu x inch/h x sq. ft. x deg F average maximum, at 75 deg F mean temperature.
- E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
 - 1. Thermal Conductivity: 0.26 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F mean temperature.
 - 2. Density: 10 pcf average maximum.
- F. Adhesive: Produced under the UL Classification and Follow-up service.
 - 1. Type: Non-flammable, solvent-based.
 - 2. Service Temperature Range: Minus 20 to 180 deg F.
- G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 FLEXIBLE ELASTOMERIC CELLULAR

- A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
 - 1. Tubular Materials: ASTM C 534, Type I.
 - 2. Sheet Materials: ASTM C 534, Type II.
- B. Thermal Conductivity: 0.30 Btu x inch/h x sq. ft. x deg F average maximum at 75 deg F.
- C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.4 INSULATING CEMENTS

- A. Mineral Fiber: ASTM C 195.

1. Thermal Conductivity: 1.0 Btu x inch/h x sq. ft. x deg F average maximum at 500 deg F mean temperature.
2. Compressive Strength: 10 psi at 5 percent deformation.

B. Expanded or Exfoliated Vermiculite: ASTM C 196.

1. Thermal Conductivity: 1.10 Btu x inch/h x sq. ft. x deg F average maximum at 500 deg F mean temperature.
2. Compressive Strength: 5 psi at 5 percent deformation.

C. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.

1. Thermal Conductivity: 1.2 Btu x inch/h x sq. ft. x deg F average maximum at 400 deg F mean temperature.
2. Compressive Strength: 100 psi at 5 percent deformation.

2.5 ADHESIVES

A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.

B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.6 JACKETS

A. General: ASTM C 921, Type 1, except as otherwise indicated.

B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

2.7 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.

1. Tape Width: 4 inches.
2. Cloth Standard: MIL-C-20079H, Type I.
3. Tape Standard: MIL-C-20079H, Type II.

B. Wire: 14 gage nickel copper alloy, 16 gage, soft-annealed stainless steel, or 16 gage, soft-annealed galvanized steel.

- C. Corner Angles: 28 gage, 1 inch by 1 inch aluminum, adhered to 2 inches by 2 inches kraft paper.
- D. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.8 SEALING COMPOUNDS

- A. Vapor Barrier Compound: Water-based, fire-resistive composition.
 - 1. Water Vapor Permeance: 0.08 perm maximum.
 - 2. Temperature Range: Minus 20 to 180 deg F.
- B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.
 - 1. Water Vapor Permeance: 0.02 perm maximum.
 - 2. Temperature Range: Minus 50 to 250 deg F.
 - 3. Color: Aluminum.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.
- B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
 - 1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

- A. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.
- B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.
- C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.
- D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.
- E. Install insulation with smooth, straight, and even surfaces.
- F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.
- G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.

- H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.
- I. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.
- J. Keep insulation materials dry during application and finishing.
- K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
 - 1. Fibrous glass ducts.
 - 2. Metal ducts with duct liner.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 5. Flexible connectors for ducts and pipes.
 - 6. Vibration control devices.
 - 7. Testing laboratory labels and stamps.
 - 8. Nameplates and data plates.
 - 9. Access panels and doors in air distribution systems.
 - 10. Fire protection piping systems.
 - 11. Sanitary drainage and vent piping.
 - 12. Drainage piping located in crawl spaces, unless indicated otherwise.
 - 13. Below grade piping.
 - 14. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
 - 15. Piping specialties including air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.3 PIPE INSULATION INSTALLATION, GENERAL

- A. Tightly butt longitudinal seams and end joints. Bond with adhesive.
- B. Stagger joints on double layers of insulation.
- C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.
- D. Apply insulation with a minimum number of joints.
- E. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Cover circumferential joints with butt strips, at least 3 inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
 - 3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
 - a. Exception: Do not staple longitudinal laps on insulation applied to piping systems with surface temperatures at or below 35 deg F.
 - 4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.

5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
 6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.
- F. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.
- G. Exterior Wall Penetrations: For penetrations of below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to jacket to form a watertight seal.
- H. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."
- I. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.
- J. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.
- K. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.
1. Use same material and thickness as adjacent pipe insulation.
 2. Overlap nesting insulation by 2 inches or 1-pipe diameter, whichever is greater.
 3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
 4. Insulate elbows and tees smaller than 3 inches pipe size with premolded insulation.
 5. Insulate elbows and tees 3 inches and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
 6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.
 7. Cover insulation, except for metal jacketed insulation, with 2 layers of lagging adhesive to a minimum thickness of 1/16 inch. Install glass cloth between layers. Overlap adjacent insulation by 2 inches in both directions from joint with glass cloth and lagging adhesive.
- L. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts as specified in Division 15 Section "Supports and Anchors." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.

1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 GLASS FIBER PIPE INSULATION INSTALLATION

- A. Bond insulation to pipe with lagging adhesive.
- B. Seal exposed ends with lagging adhesive.
- C. Seal seams and joints with vapor barrier compound.

3.5 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

- A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
- B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
 1. Miter cut materials to cover soldered elbows and tees.
 2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.6 DUCT INSULATION

- A. Install block and board insulation as follows:
 1. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
 2. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.
- B. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:
 1. Smaller Than 24 Inches: Bonding adhesive applied in 6 inches wide transverse strips on 12 inches centers.
 2. 24 Inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
 3. Overlap joints 3 inches.
 4. Seal joints, breaks, and punctures with vapor barrier compound.

3.7 JACKETS

- A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2 inches laps at longitudinal joints and 3 inch wide butt strips at end joints.
 - 1. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.
- B. Interior Exposed Insulation: Install continuous glass cloth jackets.
- C. Install metal jacket with 2 inches overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches on center and at butt joints.
- D. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2 inch overlap at joints. Embed glass cloth between (2) 1/16 inch thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

3.8 FINISHES

- A. Paint finished insulation as specified in Division 9 Section "Painting."
- B. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.9 APPLICATIONS

- A. General: Materials and thicknesses are specified in schedules at the end of this Section.
- B. Interior, Exposed Piping Systems: Unless otherwise indicated, insulate the following piping systems:
 - 1. Domestic hot water.
 - 2. Recirculated hot water.
 - 3. Low-temperature hydronic (0 to 34 deg F).
 - 4. Refrigerant suction.
 - 5. Hydronic piping (35 to 99 deg F).
 - 6. Hydronic piping (100 to 250 deg F).
 - 7. High-temperature hydronic, steam, and condensate (250 to 350 deg F).
 - 8. High-temperature hydronic, steam, and condensate (350 to 450 deg F).
 - 9. Diesel engine exhaust.
- C. Interior, Concealed Piping Systems: Unless otherwise indicated, insulate the following piping systems:
 - 1. Domestic hot water.
 - 2. Low-temperature hydronic (0 to 34 deg F).
 - 3. Refrigerant suction.
 - 4. Chilled water (35 to 55 deg F).
 - 5. Hydronic piping (35 to 99 deg F).
 - 6. Hydronic piping (100 to 250 deg F).
 - 7. High-temperature hydronic, steam, and condensate (250 to 350 deg F).

8. High-temperature hydronic, steam, and condensate (350 to 450 deg F).
 9. Diesel engine exhaust.
- D. Exterior, Exposed Piping Systems: Unless otherwise indicated, insulate the following piping systems:
1. Refrigerant suction.
 2. Hydronic piping (35 to 99 deg F).
 3. Diesel engine exhaust.
- E. Exterior, Concealed Piping Systems: Unless otherwise indicated, insulate the following piping systems:
1. Refrigerant suction.
 2. Hydronic piping (35 to 99 deg F).
 3. Diesel engine exhaust.
- F. Duct Systems: Unless otherwise indicated, insulate the following duct systems:
1. Interior concealed supply, return and outside air ductwork.
 2. Interior exposed supply, return and outside air ductwork.
 3. Exterior exposed supply and return ductwork.
 4. Interior exposed and concealed supply fans, air handling unit casings and outside air plenums.

3.10 PIPE INSULATION SCHEDULES

- A. General: Abbreviations used in the following schedules include:
1. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel.
 2. Pipe Sizes: NPS - Nominal Pipe Size.
- B. Domestic Cold Water and Storm Water All Sizes (Interior): 1/2 inch thick glass fiber, cellular glass, or flexible elastomeric insulation. Field-applied jacket is not required.

INTERIOR DOMESTIC HOT WATER AND RECIRCULATED HOT WATER

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1/2	NO	NONE
	CELLULAR GLASS	1	NO	NONE
	FLEXIBLE ELASTOMERIC	1/2	NO	NONE
1-1/2 TO 4	GLASS FIBER	1/2	NO	NONE
	CELLULAR GLASS	1	NO	NONE
	FLEXIBLE ELASTOMERIC	3/4	NO	NONE
5 TO 10	GLASS FIBER	3/4	NO	NONE
	CELLULAR GLASS	1-1/2	NO	NONE
	FLEXIBLE ELASTOMERIC	3/4	NO	NONE
12 TO 36	GLASS FIBER	1	NO	NONE

CELLULAR GLASS	1-1/2	NO	NONE
FLEXIBLE ELASTOMERIC	3/4	NO	NONE

INTERIOR LOW-TEMPERATURE HYDRONIC (0 TO 34 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1	YES	NONE
	CELLULAR GLASS	1	YES	NONE
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE
1-1/2 TO 4	GLASS FIBER	1	YES	NONE
	CELLULAR GLASS	1-1/2	YES	NONE
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE
5 TO 10	GLASS FIBER	1-1/2	YES	NONE
	CELLULAR GLASS	1-1/2	YES	NONE
12 TO 36	GLASS FIBER	2	YES	NONE
	CELLULAR GLASS	2	YES	NONE

INTERIOR REFRIGERANT SUCTION AND DUAL-TEMP HYDRONIC (35 TO 100 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1	YES	NONE
	CELLULAR GLASS	1	YES	NONE
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE
1-1/2 TO 4	GLASS FIBER	1	YES	NONE
	CELLULAR GLASS	1-1/2	YES	NONE
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE
5 TO 10	GLASS FIBER	1-1/2	YES	NONE
	CELLULAR GLASS	1-1/2	YES	NONE
12 TO 36	GLASS FIBER	1-1/2	YES	NONE
	CELLULAR GLASS	2	YES	NONE

EXTERIOR REFRIGERANT SUCTION AND DUAL-TEMP HYDRONIC (35 TO 100 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	2	YES	(P)(A)(SS)
	CELLULAR GLASS	2	YES	(P)(A)(SS)
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE

1-1/2 TO 4	GLASS FIBER	2	YES	(P)(A)(SS)
	CELLULAR GLASS	2-1/2	YES	(P)(A)(SS)
	FLEXIBLE ELASTOMERIC	3/4	YES	NONE
5 TO 10	GLASS FIBER	2-1/2	YES	(P)(A)(SS)
	CELLULAR GLASS	2-1/2	YES	(P)(A)(SS)
12 TO 36	GLASS FIBER	2-1/2	YES	(P)(A)(SS)
	CELLULAR GLASS	3	YES	(P)(A)(SS)

INTERIOR HYDRONIC (100 TO 250 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 4	GLASS FIBER	1	NO	NONE
	CELLULAR GLASS	1-1/2	NO	NONE
	CALCIUM SILICATE	1-1/2	NO	(P)(K)(A)(SS)
5 TO 10	GLASS FIBER	2	NO	NONE
	CELLULAR GLASS	2-1/2	NO	NONE
	CALCIUM SILICATE	2	NO	(P)(K)(A)(SS)
12 TO 36	GLASS FIBER	2-1/2	NO	NONE
	CELLULAR GLASS	3	NO	NONE
	CALCIUM SILICATE	2-1/2	NO	(P)(K)(A)(SS)
1/2 TO 1-1/4 ONLY	FLEXIBLE ELASTOMERIC	3/4	NO	NONE

INTERIOR HYDRONIC AND L.P. STEAM (250 TO 350 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	1-1/2	NO	NONE
	CELLULAR GLASS	2	NO	NONE
	CALCIUM SILICATE	1-1/2	NO	(P)(K)(A)(SS)
1-1/2 TO 4	GLASS FIBER	2	NO	NONE
	CELLULAR GLASS	2-1/2	NO	NONE
	CALCIUM SILICATE	2	NO	(P)(K)(A)(SS)
5 TO 10	GLASS FIBER	3	NO	NONE
	CELLULAR GLASS	3-1/2	NO	NONE
	CALCIUM SILICATE	3	NO	(P)(K)(A)(SS)
12 TO 36	GLASS FIBER	3-1/2	NO	NONE
	CELLULAR GLASS	4	NO	NONE
	CALCIUM SILICATE	3-1/2	NO	(P)(K)(A)(SS)

INTERIOR HYDRONIC AND H.P. STEAM (350 TO 450 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	2	NO	NONE
	CELLULAR GLASS	2-1/2	NO	NONE
	CALCIUM SILICATE	2	NO	(K)(A)(SS)
1-1/2 TO 4	GLASS FIBER	2-1/2	NO	NONE
	CELLULAR GLASS	3	NO	NONE
	CALCIUM SILICATE	2-1/2	NO	(K)(A)(SS)
5 TO 10	GLASS FIBER	3-1/2	NO	NONE
	CELLULAR GLASS	4	NO	NONE
	CALCIUM SILICATE	3-1/2	NO	(K)(A)(SS)
12 TO 36	GLASS FIBER	4	NO	NONE
	CELLULAR GLASS	4-1/2	NO	NONE
	CALCIUM SILICATE	4	NO	(K)(A)(SS)

INTERIOR HYDRONIC AND H.P. STEAM (350 TO 450 DEG F) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1/2 TO 1-1/4	GLASS FIBER	3	NO	(A)(SS)
	CELLULAR GLASS	3-1/2	NO	(A)(SS)
	CALCIUM SILICATE	3	NO	(A)(SS)
1-1/2 TO 4	GLASS FIBER	3-1/2	NO	(A)(SS)
	CELLULAR GLASS	4	NO	(A)(SS)
	CALCIUM SILICATE	3-1/2	NO	(A)(SS)
5 TO 10	GLASS FIBER	4-1/2	NO	(A)(SS)
	CELLULAR GLASS	5	NO	(A)(SS)
	CALCIUM SILICATE	4-1/2	NO	(A)(SS)
12 TO 36	GLASS FIBER	5	NO	(A)(SS)
	CELLULAR GLASS	5-1/2	NO	(A)(SS)
	CALCIUM SILICATE	5	NO	(A)(SS)

NOTE: INSTALL OVER FREEZE PROTECTION HEAT TRACING.

INTERIOR DIESEL ENGINE EXHAUST (INCLUDING SILENCER) EXPOSED AND CONCEALED

PIPE SIZES (NPS)	MATERIALS	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
1 TO 1-1/4	CELLULAR GLASS	3	NO	(A)(SS)
1-1/2 TO 4	CELLULAR GLASS	3-1/2	NO	(A)(SS)
5 TO 10	CELLULAR GLASS	4	NO	(A)(SS)

12 TO 36 CELLULAR GLASS 5 NO (A)(SS)

3.11 DUCT SYSTEMS INSULATION SCHEDULE

INTERIOR CONCEALED HVAC SUPPLY AND RETURN DUCTS AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
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GLASS FIBER	BLANKET	1-1/2	YES	NONE
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INTERIOR EXPOSED HVAC SUPPLY AND RETURN DUCTS AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
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GLASS FIBER	BOARD - RECT.	1-1/2	YES	NONE
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GLASS FIBER	PIPE - ROUND	1-1/2	YES	NONE
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EXTERIOR CONCEALED HVAC SUPPLY AND RETURN DUCTS AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
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GLASS FIBER	BOARD - RECT.	2	YES	NONE
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GLASS FIBER	PIPE - ROUND	2	YES	NONE
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CELLULAR GLASS	BOARD - RECT.	3	YES	NONE
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GLASS FIBER	PIPE - ROUND	3	YES	NONE
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FLEXIBLE ELASTOMERIC	SHEET	2	YES	NONE
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INTERIOR EXPOSED HVAC SUPPLY FANS, AIR HANDLING UNITS, CASING, AND PLENUMS

MATERIAL	FORM	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
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GLASS FIBER	BOARD	2	YES	NONE
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END OF SECTION

SECTION 23 2300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications, including pipes, tubing, fittings, and specialties; special-duty valves; and refrigerants.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each valve type and refrigerant piping specialty specified.
- C. Shop Drawings showing layout of refrigerant piping, specialties, and fittings, including pipe and tube sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
 - 1. Refrigerant piping indicated is schematic only. Size and design the layout and installation of the piping, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and conformance with warranties of connected equipment.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.
- E. Maintenance data for refrigerant valves and piping specialties to include in the operation and maintenance manual specified in Division 1 Sections and Division 15 Section "Basic Mechanical Requirements."

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Qualify brazing and welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."
- B. Regulatory Requirements: Comply with provisions of the following codes:
 - 1. ASME B31.5, "Refrigeration Piping."
 - 2. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

- D. Listing and Labeling: Provide products specified in this Section that are UL listed and labeled.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Refrigeration Oil Test Kits: 2 each, containing everything required to conduct 1 test.
 - 2. Refrigerant: 2 containers each, with 20 lb of refrigerant.
 - 3. Filter-Dryer Cartridges: 3 of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Refrigerants:
 - a. Allied Signal Inc.; Genetron Refrigerants.
 - b. DuPont Company; Fluorochemicals Div.
 - c. Elf Atochem North America, Inc.
 - d. ICI Americas Inc.; Fluorochemicals Bus.
 - 2. Refrigerant Valves and Specialties:
 - a. Danfoss Electronics, Inc.
 - b. Eaton Corporation; Industrial Control Div.
 - c. Emerson Electric Company; Alco Controls Div.
 - d. Henry Valve Company.
 - e. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
 - f. Sporlan Valve Company.

2.2 PIPES AND TUBES

- A. Soft Copper Tube: ASTM B 88, Type L, annealed temper.

2.3 PIPE AND TUBE FITTINGS

- A. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.

2.4 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).
- B. Welding Materials: Comply with ASME Boiler and Pressure Vessel Code Section II, Part C, for welding materials appropriate for pipe being welded.

2.5 VALVES

- A. Diaphragm Packless Valves: 500-psig working pressure and 275 deg F working temperature, globe or angle pattern, forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, with solder-end connections.
- B. Packed-Angle Valves: 500-psig working pressure and 275 deg F working temperature, forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, with solder-end connections.
- C. Check Valves--Smaller than 1-Inch NPS: 500-psig operating pressure, 300 deg F operating temperature; cast-brass body, with removable piston, PTFE seat, and stainless-steel spring; straight-through globe design. Valve shall be straight-through pattern, with solder-end connections.
- D. Check Valves--Larger than 1-Inch NPS: 450-psig operating pressure, 300 deg F operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained PTFE seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.
- E. Service Valves: 500-psig pressure rating, forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, with solder-end connections.
- F. Solenoid Valves: Conform to ARI 760; 250 deg F temperature rating, 400-psig working pressure; forged brass, with PTFE valve seat, 2-way straight-through pattern, and solder-end connections; manual operator; with NEMA 250, Type 1 solenoid enclosure with 1/2-inch conduit adapter, and 24-V normally closed holding coil.
- G. Pressure Relief Valves: Straight or angle brass body and disc, neoprene seat, factory sealed and ASME labeled, for standard pressure setting.
- H. Thermal Expansion Valves: Conform to ARI 750; thermostatic-adjustable, modulating type; size as required and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

2.6 REFRIGERANT PIPING SPECIALTIES

- A. Straight- or Angle-Type Strainers: 430-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen, and screwed cleanout plug, with solder-end connections.
- B. Moisture/Liquid Indicators: 500-psig operating pressure, 200 deg F operating temperature; forged-brass body, with replaceable, polished, optical viewing window with color-coded moisture indicator, and solder-end connections.
- C. Permanent Filter-Dryer: 350-psig maximum operating pressure, 225 deg F maximum operating temperature; steel shell, and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

- D. Flexible Connectors: 500-psig operating pressure; seamless tin-bronze or stainless-steel core, high-tensile bronze-braid covering, solder-end connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inches long.

2.7 REFRIGERANT

- A. ASHRAE 34, R-22: Monochlorodifluoromethane.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for compliance with requirements for installation tolerances and other conditions affecting performance of refrigerant piping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Aboveground, within Building: Type L drawn-copper tubing.
- B. Belowground for 2-Inch NPS and Smaller: Type L annealed-copper tubing.
- C. Belowground for Larger than 2-Inch NPS: Type K annealed-copper tubing.

3.3 INSTALLATION

- A. Install refrigerant piping according to ASHRAE 15.
- B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Install piping in short and direct arrangement, with minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow normal inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- E. Install piping with adequate clearance between pipe and adjacent walls and hangers, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- F. Belowground, install copper tubing in conduit. Vent conduit outdoors.
- G. Insulate suction lines and liquid lines, but insulate them together if adjacent.
 - 1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- H. Install branch lines to parallel compressors of equal length, and pipe identically and symmetrically.

- I. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- J. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope of 0.4 percent downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope of 0.4 percent downward to compressor.
 - 3. Install traps and double risers where indicated and where required to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- K. Use fittings for changes in direction and branch connections.
- L. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- M. Reduce pipe sizes using eccentric reducer fittings installed with level side down.
- N. Provide bypass around moisture-liquid indicators in lines larger than 2-inch NPS.
- O. Install unions to allow removal of solenoid valves, pressure-regulating valves, expansion valves, and at connections to compressors and evaporators.
- P. Install flexible connectors at the inlet and discharge connection, at right angles to axial movement of compressor, parallel to crankshaft.
- Q. Install replaceable-core filter-dryers, with isolation valves and valved bypass.
- R. Install refrigerant valves according to manufacturer's written instructions.
- S. When brazing, remove solenoid-valve coils; remove sight glasses; and remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties. Do not apply heat near bulb of expansion valve.
- T. Electrical wiring for solenoid valves is specified in Division 16 Sections. Coordinate electrical requirements and connections.
- U. Mount thermostatic expansion valves in any position, close to evaporator.
 - 1. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
 - 2. Install valve so diaphragm case is warmer than bulb.
 - 3. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
 - 4. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- V. Install pressure relief valves as required by ASHRAE 15. Pipe pressure relief valves on receivers to outdoors.
- W. Charge and purge systems, after testing, and dispose of refrigerant following ASHRAE 15 procedures.
- X. Charge system as follows:

1. Install filter-dryer core after leak test, but before evacuation.
2. Evacuate refrigerant system with vacuum pump, until temperature of 35 deg F is indicated on vacuum dehydration indicator.
3. Maintain vacuum for a minimum of 5 hours.
4. Break vacuum with refrigerant gas and charge to 2 psig.

3.4 HANGERS AND SUPPORTS

- A. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- B. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
- C. Pipe rollers for multiple horizontal runs, 20 feet or longer supported by a trapeze.
- D. Spring hangers to support vertical runs.
- E. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes. Tube sizes are nominal or standard tube sizes as expressed in ASTM B 88.
 1. 1/2 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 2. 5/8 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 3. 1 Inch: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 4. 1-1/4 Inches: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 5. 1-1/2 Inches: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 6. 2 Inches: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 7. 2-1/2 Inches: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 8. 3 Inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 9. 4 Inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- F. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

- A. Basic pipe and tube joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent formation of scale.

3.6 VALVE INSTALLATIONS

- A. Install refrigerant valves according to manufacturer's written instructions.
- B. Install valves on suction and discharge of compressor, for gage taps at compressor inlet and outlet, for gage taps at hot-gas bypass regulators, on inlet and outlet, and on each side of strainers.
- C. Install check valves on compressor discharge and on condenser liquid lines on multiple condenser systems.

- D. Install refrigerant-charging (packed-angle) valve in liquid line between receiver shutoff valve and expansion valve.
- E. Install globe valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- F. Install a full-sized, 3-valve bypass around each dryer.
- G. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
 - 1. Electrical wiring for solenoid valves is specified in Division 16 Sections. Coordinate electrical requirements and connections.
- H. Mount thermostatic expansion valves in any position, close to evaporator.
 - 1. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
 - 2. Install valve so diaphragm case is warmer than bulb.
 - 3. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
 - 4. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- I. Install pressure-regulating and relief valves as required by ASHRAE 15.

3.7 SPECIALTIES APPLICATION AND INSTALLATION

- A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.
- B. Install strainers immediately upstream of each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.
- C. Install strainers on main liquid line where multiple expansion valves with integral strainers are used.
- D. Install strainers in suction line of steel pipe.
- E. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.
- F. Install pressure relief valves on ASME receivers, and pipe to outdoors.
- G. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.
- H. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.
- I. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

- J. Install receivers on systems 5 tons and larger, and on systems with long piping runs, sized to accommodate pump-down charge.
- K. Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

3.8 CONNECTIONS

- A. Electrical: Conform to applicable requirements of Division 16 Sections for electrical connections.

3.9 FIELD QUALITY CONTROL

- A. Inspect and test refrigerant piping according to ASME B31.5, Chapter VI.
 - 1. Pressure test with nitrogen to 200 psig. Perform final tests at 27-psig vacuum and 200 psig using halide torch or electronic leak detector. Test to no leakage.
- B. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- C. Repair leaks using new materials; retest.

3.10 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

3.11 CLEANING

- A. Before installation of copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.

3.12 COMMISSIONING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryer after leak test, but before evacuation.
 - 2. Evacuate refrigerant system with vacuum pump until temperature of 35 deg F is indicated on vacuum dehydration indicator.
 - 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 - 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 - 5. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 6. Complete charging of system, using new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 GENERAL

All ductwork shall be fabricated of galvanized sheet metal, unless otherwise noted, in accordance with SMACNA standards.

Ducts, casings and hangers shall be installed straight and level and shall be free of vibration and noise when fans are operated at rated capacities.

All transverse joints and longitudinal seams shall conform to SMACNA's Class A sealing as per SMACNA Manual; allowable leakage is 1% of design CFM. See ductwork leak testing hereinafter.

PART 2 ROUND DUCTWORK

- a. Round galvanized ductwork and fittings shall be fabricated spiral lock seam and machine formed as manufactured by United Sheet Metal Co. or approved equal
- b. Gauges shall be for the operating pressures of 0" to 4"WG negative as indicated hereinafter:

Duct dia. (in) Gauge Method of Manufacture

Up to 8"	28	Spiral Seam
10" thru 12"	26	Spiral Seam
14" thru 18"	24	Spiral Seam
20" thru 24"	22	Spiral Seam
26" thru 36"	20	Spiral Seam
38" thru 48"	18	Spiral Seam

- c. All girth joints shall be 2" long slip joint sealed with 3M #8000 duct sealant and riveted.
- d. The spiral duct shall have locked seams so made as to eliminate any leakage under the operating pressure.
- e. Longitudinal seam duct shall have a fusion-welded butt seam.
- f. Fittings and couplings shall be of the following minimum gauges:

<u>Diameter</u>	<u>Gauge</u>
Up to 26"	20 gauge
28" thru 34"	18 gauge
36" thru 42"	16 gauge

All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections.

- g. All 90°tees and 45° laterals (wyes) up to and including 12" diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming the entrance and shall be free of weld build-up, burrs, or irregularities.
- h. Elbows in diameters 3" through 8" shall be two section stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a center-line radius of 1.5 times of cross-section diameter. All elbows, not die-stamped, shall be fabricated according to the following schedule:

<u>Elbow Angle</u>	<u>Number of Gores</u>
Less than 35°	2
36° thru 71°	3
Over 71°	5

- i. Pipe-to pipe joints in diameters to 36" shall be of sleeve couplings, reinforced by rolled beads.

Pipe-to-fitting joints in diameters to 36" shall be slip-fit of projecting collar of the fittings into the pipe.

Insertion length of sleeve coupling, and fitting collar shall be 2" for diameters through 36".

Pipe-to-pipe and pipe-to fitting connections in diameters above 36" shall be by angle ring flanges. Connections 38" and up shall be made by the loose ring "Van Stone" flange. A 5/8" flange shall be provided for the body ends of duct sections and fittings to act as a gasket surface for sealing. The angle ring shall be rolled welded ring 2" x 2" x 3/16".

Connections to fans and equipment shall be flanged, minimum angle size shall be 2" x 2" x 3/16" attached to the duct with a continuous weld.

- j. Bolt hole spacing for angle rings shall not exceed 6".

PART 3 RECTANGULAR DUCTWORK AND PLENUMS

- a. General

All air conditioning supply, return, and exhaust ducts and plenums shall be constructed of galvanized sheet metal, unless otherwise noted, of gauges and reinforced as per SMACNA requirements of the SMACNA "HVAC Duct Construction Standards - Metal and Flexible - 1995" as amended and Ductmate proprietary duct connection systems; those constructed using Ductmate shall be in accordance with manufacturer guidelines. Where indicated on drawings ductwork shall be all stainless-steel construction as specified hereinafter.

Galvanized ducts construction shall be using G-90 or better galvanized steel (ASTM 527) LFQ chemical treatment.

Longitudinal seams shall be Pittsburgh Lock L-1 sealed with duct sealant 3M #800 or approved equal.

Transverse joints shall be as follows: for ducts 12" greatest dimension and smaller use standing drive slip T-2, for larger ducts use SMACNA standard transverse (girths) joints

or "Ductmate 25/35" flanged connections fastened with self-drilling sheet metal screws, sealed with gasket tape all around joint and corner bolted pieces.

Unless otherwise indicated hereinafter gauges and reinforcement shall be for 3" W.G. Neg. or 3" W.G. Pos.; but not less than as follows:

<u>GREATEST DIMENSION</u>	<u>GAUGE</u>	<u>REINFORCEMENT TYPE AND MAX. SPACING</u>
up to 12"	22	n/a
13" to 18"	26	C at 4' c/c
19" to 30"	24	E at 4' c/c
31" to 36"	22	F at 4' c/c
37" to 42"	22	G at 4' c/c
43" to 48"	20	H at 4' c/c
49" to 60"	18	I at 4' c/c
61" to 72"	16	J at 4' c/c
73" to 84"	18	J at 3' c/c
85" to 96"	18	K at 3' c/c
97" to 108"	18	K at 2' c/c

b. Cross Breaking

Cross break all rectangular ducts larger than 12 inches in larger dimension, for stiffening.

c. Where space conditions permit, round elbows with a throat radius not less than the width of the duct in the plane of the turn shall be used. Where square elbows might be required, these shall be fitted with double blade turning vanes.

d. Transformations

- 1) Converging: At reduction in size in the direction of flow, form the included angle between opposite sides at not over 30 degrees.
- 2) Diverging: An increase in size in the direction of the flow, form the included angle between opposite sides at not over 15 degrees.

e. Offsets

Provide all necessary offsets and transformations required in the sheet metal work to avoid interference with the building construction or equipment. Unless otherwise shown on drawings, no pipe, electrical conduit, or structural member shall pass through any duct.

f. Volume dampers

Provide dampers in the ducts where shown and wherever needed. Provide quadrants and locknuts in easily accessible locations. Provide handles to indicate damper position. Dampers are to be of the multi blade type. Blades are to be No. 16 USG with crimped or

reinforced edges. All dampers are to be located so as to be adjustable after the work is completed.

g. Duct Supports

- 1) Ducts shall be securely and rigidly anchored and supported from the building structure by means of threaded hanger rods and steel angles hangers at every transverse joint, but not more than 4 feet apart. Hanger rods shall be sized for the weight carried, threaded at both ends and equipped with nuts and washers. Rods shall pierce the angles used as bottom supports. All hangers shall be cross-braced where needed to provide rigid support. Angle supports shall be used as may be required for seismic restraint to comply with Seismic Hazard Level (SHL) B as per SMACNA Standard-Seismic Restraint Manual Guidelines for Mechanical Systems.
- 2) Ducts supports shall be installed on the outside of insulation and shall not be embedded into the insulation or mastic.
- 3) Rigidly support vertical duct risers as they pass through floors, ceilings or roofs with steel angles spanning the opening, firmly and securely attached to both the building walls and columns and to the duct riser. Thoroughly seal any remaining cracks with silicone and mastic compounds.

h. Access Doors

Provide Ventlok insulated access doors with 10 x 12 inch minimum opening in ductwork, for service of dampers, fire dampers, reheat coils or other equipment. Doors shall be gasketed for tight seal. Doors shall be installed upstream or downstream of serviced equipment indicated above.

i. Flexible Connections for Ductwork

- 1) Furnish and install sound and vibration isolating flexible fabric connections on the inlet and outlet of all air handling units and fans where ducts are to be connected to said units and fans, and wherever shown on drawings.
- 2) Connections shall have a sheet metal collar frame at each end, and shall have a minimum length of 6" where space permits. Connections shall be made of weatherproof, fire-resistant fabric, and at least 1" slack material be "Ventglass-L.A." for indoor and "Ventlon" for exposed to weather application, as manufactured by Vent Fabrics, Inc.

- j. All girth joints shall be sealed with 3M #800 duct sealant and riveted, except in the case of "Duct Mate" which shall be sealed with the gasket tape.

PART 4 FLEXIBLE DUCTWORK

Insulated flexible duct shall be a factory fabricated assembly consisting of an inner duct, insulation and an outer moisture barrier. The inner duct shall provide an air seal and shall be constructed of woven fiberglass reinforcement coated with vinyl, bonded permanently to a vinyl coated spring steel wire supporting helix. A thick insulating blanket of fiberglass, providing a thermal conductance (C Factor) of 0.23 BTU/hr./sq. ft./°F, @ 75°F, shall encase the inner duct,

and be sheathed with an outer moisture barrier of a reinforced metalized Mylar/neoprene laminate of low permeability with integral attaching devices (grommets) for a suspension system as listed by Underwriters' Laboratories, Inc. The entire flexible duct shall be rated for a maximum working velocity of 5000 FPM and shall be listed by Underwriters' Laboratories, Inc. under their UL-181 Standards as a Class 1 Air Duct and shall comply with NFPA Standard No. 90A. Working pressure shall be 6" W.G. positive and 2" W.G. negative. The flexible duct shall be Thermaflex M-KC or approved equal. Maximum length, unless otherwise noted, shall be 5 feet.

Non-insulated flexible duct shall be of a medium pressure type and factory fabricated of continuous vinyl-coated spring steel wire helix covered with woven fiber glass impregnated and coated both sides with vinyl. The coated wire and cover shall be permanently fused together to form a continuous surface with no metal exposed either internally or externally. The flexible duct shall be rated for a maximum working velocity of 5000 FPM and listed by Underwriters' Laboratories under their UL-181 Standards as a Class 1 Air Duct and shall comply with NFPA Standard No. 90A. Working pressure shall be 10" W.G. positive and 2" W.G. negative. The duct shall be Thermaflex S-LP-10 or approved equal. Maximum length, unless otherwise noted, shall be 5 feet.

PART 5 DUCTWORK LEAK TESTING

All supply return and exhaust ductwork shall be tested for leakage before the installation of insulation. Contractor shall seal-off all openings, branch take-offs, etc.; then a portable high-pressure blower shall be used to build up the pressure to 25% above the operating pressure. Under this condition the system leakage shall not exceed 1% of the total system CFM. Test procedure shall be performed following recommendations of SMACNA HVAC Air Duct Leakage Test Manual following Appendix C for leakage rate determination.

PART 6 FIRE DAMPERS

All ducts passing through fire rated walls and fire rated floor slabs shall be provided with dynamic dampers. Units shall be 1 1/2 hr. rated, classified to meet UL 555 standard latest edition; galvanized steel construction Ruskin curtain style IBD single or multi-section; use style C for rectangular and style CR for round ducts.

PART 7 SUBMITTALS

Submit 6 copies of ductwork shop drawings. Drawings shall indicate dimensions, elevations, cross section sizes, pressure classes, girth joints details, hanger construction details, required clearances, and field connection details.

END OF SECTION

23 34 00

HVAC FANS

1 PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Associated Air Balance Council.
2. Air Moving and Conditioning Association (AMCA):
 - a. 203, "Field Performance Measurements of Fan Systems.
 - b. Bulletin 300, Reverberant Room Method for Sound Testing of Fans, Setup No. 1.
 - c. Standard 99, Standards Handbook.
 - d. Standard 210, Laboratory Methods of Testing Fans for Rating.
 - e. Standard 2401, Impeller Diameters and Outlet Areas for Centrifugal Fans and Metric Equivalents.
3. American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., (ASHRAE): 90A, Energy Conservation in New Building Design.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
5. National Electrical Manufacturers Association (NEMA): MG 1-12.53a, Motors and Generators.
6. National Fire Protection Association (NFPA):
 - a. 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - b. 90B, Standard for the Installation of Warm Air Heating and Air Conditioning.
 - c. 91, Standard for Exhaust Systems for Air Conveying of Materials.
 - d. 820, Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities.
7. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA):
 - a. Guidelines for Seismic Restraints of Mechanical Systems.
 - b. HVAC Duct Construction Standards-Metal and Flexible.
 - c. HVAC Air Duct Leakage Test Manual.
8. HVAC Testing, Adjusting, and Balancing Manual.
9. International Conference of Building Officials, Uniform Fire Code (UFC):
 - a. Article 79, Flammable and Combustible Liquids.
 - b. Article 80, Hazardous Materials.

1.2 SUBMITTALS

A. Shop Drawings:

1. Complete specifications, descriptive drawings, catalog cuts, and descriptive literature that include make, model, dimensions, weight of equipment, and electrical schematics for products specified.
2. Complete performance data that indicates full compliance with the Specifications.
3. Recommended procedures for protection and handling of equipment and materials prior to installation.
4. Furnish the following information for each type of diffuser, register, and grille furnished.

- a. NC sound data.
- b. Static pressure loss data.
- c. Throw data.

B. Quality Control Submittals:

1. Manufacturer's certification of factory testing to establish conformance with specified requirements.
2. For motors specified to be energy efficient type, certified copy of test report for identical motor tested, in accordance with NEMA MG 1-12.53a and IEEE Standard 112, Test Method B, showing full load efficiency.
3. Recommended procedures for protecting and handling of equipment and materials prior to installation.
4. Detailed information on structural, mechanical, electrical, or other modifications necessary to adapt the arrangement or details shown to the equipment furnished.
5. Operation and maintenance manuals.
6. List of recommended spare parts for equipment and materials specified.
7. Qualifications and experience record of air balancing and test agency.
8. Written verification of calibration of testing and balancing equipment.
9. Balancing Log Report following completion of system adjustments including test results, adjustments, and rebalancing procedures.

1.3 QUALITY ASSURANCE

A. Air Balancing and Test Agency Qualifications:

1. Corporately and financially independent organization functioning as an unbiased testing authority.
 2. Professionally independent of manufacturers, suppliers, and installers of HVAC equipment being tested.
 3. Certified by a national balancing association.
 4. Have a proven record of at least five similar projects.
- B. Employer of engineers and technicians regularly engaged in testing and inspecting HVAC equipment and systems.

2 PART 2 PRODUCTS

2.1 GENERAL

- A. Heating Equipment: Minimum operating efficiencies as specified in Chapter 6 of ASHRAE Standard 90A.
- B. Fans shall have sound power level data (ref. 10 to -12 watts) at design operating point; ratings shall be based on AMCA Bulletin 300, Setup No. 1.

2.2 SUPPLEMENTS

- A. See supplements to this section for additional product information.

2.3 WALL MOUNTED BELT OR DIRECT DRIVEN PROPELLER FAN

- A. Construction: Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The motor, bearings and drives shall be mounted on a 14 Ga. steel power

assembly. The power assembly shall be bolted to a minimum 14 Ga. steel wall panel with continuously welded corners and an integral venturi. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

- B. Coating: All steel fan components shall be coated with an electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000-hour salt spray under ASTM B117 test method.
- C. Motor: Motor shall be Nema design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
- D. Propeller: Propeller shall be cast aluminum airfoil design with cast aluminum hub. The blade pitch shall be factory set and locked using set screws and roll pin. The hub shall be keyed and locked to the shaft utilizing two set screws or a taper lock bushing. Propeller shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
- E. Belts (Belt Driven Only) shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM
- F. Manufacturers and Products:

Loren Cook AWB or AWD

2.4 CENTRIFUGAL INLINE EXHAUSTER

- A. Construction: The fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated. Blower and motor assembly shall be mounted to a minimum 14 gauge reinforcing channel and shall be easily removable from the housing. Motor shall be mounted on vibration isolators. Unit shall be supplied with integral wiring box and disconnect receptacle shall be standard. Discharge position shall be convertible from right angle to straight through by moving interchangeable panels. The outlet duct collar shall include a reinforced aluminum damper with continuous aluminum hinge rod and brass bushings. To accommodate different ceiling thickness or mounting positions, an adjustable prepunched mounting bracket shall be provided. Gemini 100, 200 & 300 series units shall be provide have a white, non-yellowing, high impact styrene injection molded designer style grill as standard. Gemini 400 through 900 series units shall be provided with a powder painted white steel grille as standard. Unit shall be shipped in ISTA Certified Transit Tested Packaging.
- B. Wheel: Wheel shall be centrifugal forward curved type, constructed of galvanized steel. Wheel shall be balanced in accordance with AMCA Standard 204- 05, Balance Quality and Vibration Levels for Fans.
- C. Motor: Motor shall be open drip proof type with permanently lubricated bearings, built-in thermal overload protection and disconnect plug. Motor shall be furnished at the specified voltage.
- D. Manufacturers and Products:

1. Loren Cook: GN, GC

2.5 DUCT MOUNTED SQUARE INLINE SUPPLY FAN

- A. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.
- B. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
- C. Motor: Motor shall be NEMA design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
- D. Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
- E. Belts and Drives: Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.
- F. Manufacturers and Products:

1. Loren Cook: SQNB

2.6 EXHAUST AND OUTSIDE AIR INTAKE REGISTERS

- A. Exhaust Registers and outside air intake (ER-1):
 - 1. Rectangular aluminum construction.
 - 2. Extruded aluminum border and a single set of fixed deflection blades
 - 3. Border shall be 1 1/4" wide with aerodynamically shaped deflector blades on .666" centers set at 40°
 - 4. Manufacturers and Products:
 - a. Metalaire; Model RH

2.7 EQUIPMENT ACCESSORIES

- A. Equipment Identification Plates: Provide 16-gauge Type 316 stainless steel identification plate securely mounted on each separate equipment component and control panel in a readily visible location. Plate shall bear 3/8 inch high engraved block

type black enamel filled equipment identification number and letters indicated in this Specification and as shown.

- B. Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 100 pounds.

3 PART 3 EXECUTION

3.1 INSTALLATION

- A. Install equipment and systems in accordance with manufacturers' instructions.
- B. Fans and Air Handlers:
 - 1. Isolate sheet metal duct connections from noninternally spring-isolated fan units or other rotating equipment.
 - 2. Locate units approximately where shown to provide access spaces required for filter changing; motor, drive, and bearing servicing; and fan shaft and coil removal.
 - 3. Seismic Restraints:
 - a. Use lateral and vertical motion limiters described in the latest edition of SMACNA "Guidelines For Seismic Restraints of Mechanical Systems."
 - b. Restraint Snubbers: Rubber-faced, securely anchored to the floor or structure, and installed with sufficient clearance so that unit isolators are not restricted for proper free isolation but do limit movement.
- C. Install diffusers, grilles, and registers tight on their respective mounting surfaces, plumb and true with room dimensions.
- D. Provide appropriate frame to adapt to mounting surface.

3.2 AIR HANDLING

- A. Where corrosive resistance service is noted, coat interior surfaces and fan wheel in contact with the airstream with 6-mil minimum thickness of chemical-resistant epoxy coating.
- B. Where spark-proof construction requirements are noted, provide equipment in accordance with AMCA Standard 99 for Type **C** spark-proof construction.
- C. Shafts and Drive Belts:
 - 1. Provide multiple drive belts where motor horsepower is 2 hp or larger.
 - 2. Belt Guards: Meet federal and State of PR OSHA requirements for safety protection, and be easily removable by one person.
 - 3. Tachometer Access Holes: Large enough to accept standard tachometer drive shaft.
 - 4. Centerpunch fan shaft to accommodate tachometer readings.
- D. Vibration:
 - 1. Statically and dynamically balance fan equipment.
 - 2. If vibration limits are exceeded, rebalance equipment in-place, if directed by ENGINEER, until design tolerances are met.

3. Provide open spring vibration isolators (with neoprene waffle base pads top and bottom) selected for a minimum of 1.5-inch deflection (unless otherwise specified).
- E. Fan Equipment: Rated and tested in accordance with AMCA Standards 210 and 2401 for Class I service, unless otherwise specified.
- F. Ball Bearings:
 1. For Forward-Curved Fans: Size for minimum life L-10 of over 80,000 hours.
 2. For Airfoil and Backward Inclined Fans: Size for minimum life L-10 of over 40,000 hours, with an average life L-50 of over 200,000 hours.
- G. Drives for Belt-Driven Fans:
 1. Sheaves shall be capable of providing 150 percent of motor horsepower.
 2. Motors shall be mounted on adjustable motor brackets.
 3. Motors 10 hp and under shall be provided with adjustable speed sheaves that allow for 20 percent speed variation.
 4. Belt-driven fans shall be provided with cast iron or flanged steel sheaves.
- H. Air Filters, Fans, Air Handlers, and Air Conditioners: Meet requirements of NFPA No.90A or No.90B.

3.3 ADJUSTING AND BALANCING

- A. Adjust and balance air systems in accordance with standard procedures and recognized practices of the Association of Air Balance Council or the SMACNA "HVAC Testing, Adjusting, and Balancing Manual."
- B. Adjust air volumes on supply diffusers and grilles, and on return and exhaust grilles, to the quantity shown, with allowable variation of plus 10/minus 0 percent.
- C. In each system at least one air path from fan to final branch duct termination shall have dampers fully open. Achieve final air quantities by adjusting fan speed.
- D. Adjust Fan Air Volumes:
 1. Adjust fan speeds and motor drives for required equipment air volumes, with allowable variation of plus 10/minus 0 percent.
 2. After final adjustments, do not operate motor above nameplate amperage on any phase.
 3. Perform airflow test readings under simulated or actual conditions of full cooling, full heating, minimum outside air, full outside air and exhaust, and full return air.
 4. Furnish and make drive and belt changes on motors or fans as required to adjust equipment to specified conditions. Provide written notice to the air handling unit manufacturer if any drive or belt changes were made.
- E. Adjust outside air dampers, return air dampers, and exhaust air dampers, for maximum and minimum air requirements.
- F. Read and record static pressures at unit inlet and discharge, filters, coils, dampers, plenums, and mixing dual-duct or adjustable-volume boxes, on every supply, return, and exhaust fan.

- G. Adjust diffusers and grilles for proper deflection, throw, and coverage. Eliminate drafts and noise where possible.

3.4 FIELD QUALITY CONTROL

A. Leakage Testing:

1. Leak test medium pressure ductwork using a pressure blower with a calibrated orifice and manometer.
2. Blower shall maintain system static pressure during the test.
3. Maximum System Leakage: Perform testing in accordance with procedures given in the SMACNA "HVAC Air Duct Leakage Test Manual."
4. Seal audible leaks.

B. Balancing Log Report Requirements:

1. Log and record information from every test, reading, and adjustment necessary to accomplish the services described. In addition, record the following data:
 - a. Equipment identification number.
 - b. Equipment nameplate data (including manufacturer, model, size, type, and serial number).
 - c. Motor data (frame, hp, volts, FLA and rpm).
 - d. Sheave and belt size.
 - e. Starter and heater data.
2. Include a reduced set of HVAC Drawings in the balance log showing the final air readings for each system.
3. Indicate the recorded site values, and velocity and mass correction factors used to provide equivalent standard air quantities.
4. Include a separate section in the log, if necessary, that describes operating difficulties in the air or water systems that could not be eliminated by the specified procedures. Identify these problems by system and location within the building, include an outline of a summary of the condition and its effect on the building, and describe corrective actions attempted.

- C. After readjustment for vibration, measure and record the displacement only of the readjusted equipment to determine its conformance with the design.

D. Report Requirements:

1. Record information from tests, readings, and adjustments necessary to accomplish the services described. In addition, record the following data:
 - a. Equipment identification number.
 - b. Equipment nameplate data (including manufacturer, model, size, type, and serial number).
 - c. Motor data (frame, hp, volts, FLA and rpm).
 - d. Sheave and belt size.
 - e. Starter and heater data.
2. Include a reduced set of Mechanical Drawings in the balance log showing the final air and waterflow readings for each system.
3. Include a separate section in the log, if necessary, that describes any operating difficulties in the air or water systems that could not be eliminated by the specified procedures. Identify these problems by system and location within the building, include an outline of a summary of the condition and its effect on the building, and describe corrective action attempted.

- E. Quality Control Verification: After adjustments have been completed and the balance logs submitted, the balancing and testing agency shall be available to demonstrate the air and water balancing procedures and vibration tests, and verify the test results.
1. Perform spot tests on a maximum of 20 percent of the total diffusers and grilles, on two air handling fan devices per building, and on 10 percent of the total water balance fittings, with measuring equipment used in the original tests, at random points selected by the ENGINEER.
 2. Results of these spot tests shall agree with the balance logs within plus or minus 10 percent. Where this accuracy cannot be verified, rebalance portions of the system as requested by ENGINEER.
 3. At completion of the rebalance procedures, perform another spot test if required to verify those results.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
 - 3. Louvers.
- C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
 - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS:

- A. **Product Data:** Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
- B. **Samples:** 3 samples of each type of finish furnished.
- C. **Shop Drawings:** Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- D. **Maintenance Data:** Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 **PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 **CEILING AIR DIFFUSERS:**

- A. **General:** Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. **Performance:** Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. **Ceiling Compatibility:** Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. **Types:** Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule.

1. Diffuser Faces:
 - a. Round (RD): Round housing, core of concentric rings, round duct connection.
 - b. Square (SQ): Square housing, core of square concentric louvers, square or round duct connection.
 - c. Rectangular (RCT): Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
 - d. Perforated (PR): Round, square, or rectangular housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
 - e. Linear (LR): Extruded aluminum continuous slot, single or multiple.
 2. Diffuser Mountings:
 - a. Flush (FL): Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
 - b. Lay-In (L-I): Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
 3. Diffuser Patterns:
 - a. Fixed (FX): Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.
 - b. 1 Way (1-W): Fixed louver face for 1-direction air flow, direction indicated on drawings.
 - c. 2 Way (2-W): Fixed louver face for 2-direction air flow, directions indicated on drawings.
 - d. 3 Way (3-W): Fixed louver face for 3-direction air flow, directions indicated on drawings.
 - e. 4 Way (4-W): Fixed louver face for 4-direction air flow, directions indicated on drawings.
 4. Diffuser Dampers:
 - a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of diffuser.
 - b. Butterfly (BTFY): Two semicircular flaps connected to linkage adjustable from face of diffuser with key, and with straightening grid.
 5. Diffuser Accessories:
 - a. Plaster Ring (P-R): Perimeter ring designed to act as a plaster stop and diffuser anchor.
 - b. Extractor (EXTR): Curved blades mounted on adjustable frame to produce air scooping action in duct at diffuser take-off.
 6. Diffuser Finishes:
 - a. White Enamel (W-E): Semi-gloss white enamel prime finish.
 - b. Aluminum Anodize (A-A): Aluminum etched and anodized, covered with clear lacquer finish.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to, the following:
1. Anemostat Products Div.; Dymanics Corp. of America.

2. Cranes Co.; Div. of Wehr Corp.
3. Krueger Mfg. Co.
4. Titus Products Div.; Philips Industries, Inc.
5. Tuttle & Bailey; Div. of Interpace Corp.

2.2 WALL REGISTERS AND GRILLES:

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
- D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:
 1. Register and Grille Materials:
 - a. Aluminum Construction (AL): Manufacturer's standard extruded aluminum frame and adjustable blades.
 2. Register and Grille Faces:
 - a. Horizontal Straight Blades (H-S): Horizontal blades, individually adjustable, at manufacturer's standard spacing.
 - b. Vertically Straight Blades (V-S): Vertical blades, individually adjustable, at manufacturer's standard spacing.
 - c. Horizontal 45 Degree Fixed Blades (H-45 Degrees): Horizontal blades, fixed at 45 degrees, at manufacturer's standard spacing.
 3. Register and Grille Patterns:
 - a. Single Deflection (S-D): 1-set of blades in face.
 - b. Double Deflection (D-D): 2-sets of blades in face, rear set at 90 degrees to face set.
 4. Register and Grille Dampers:
 - a. Opposed Blade (O-B): Adjustable opposed blade damper assembly, key operated from face of register.
 5. Register and Grille Accessories:
 - a. Extractor (EXTR): Curved blades mounted on adjustable frame to produce air scooping action in duct at register or grille take-off.
 - b. Plaster Frame (P-F): Perimeter frame designed to act as plaster stop and register or grille anchor.

- c. Operating Keys (OP-KY): Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustable.
 - 6. Register and Grille Finishes:
 - a. White Enamel (W-E): Semi-gloss white enamel prime finish.
 - b. Aluminum Anodize (A-A): Aluminum etched and anodized, covered with clear lacquer finish.
 - E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to, the following:
 - 1. Anemostat Products Div.; Dynamics Corp. of America.
 - 2. Carnes Co.; Div. of Wehr Corp.
 - 3. Titus Products Div.; Philips Industries, Inc.
- 2.3 LOUVERS:
- A. See Technical Specs 08 91 00 Louvers.

END OF SECTION

SECTION 23 6200

PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

- A. Section includes:
 - 1. Residential air-cooled condensing units.
 - 2. Air-cooled condensing units.
- B. Related Sections:
 - 1. Section 23 23 00 - Refrigerant Piping

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, weights (shipping, installed, and operating), dimensions, required clearances, and methods of assembly of components, furnished specialties and accessories; and installation and start-up instructions.
- B. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring required for final installation of condensing units and controls. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- C. Operation and Maintenance Data: Submit maintenance data and parts list for each condensing unit, control, and accessory; including "trouble shooting" maintenance guide; plus servicing, and preventative maintenance procedures and schedule. Include this data and product data in maintenance manual; in accordance with requirements of Division 1.

1.4 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of condensing units, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. Capacity ratings for condensing units shall be in accordance with ARI Standard 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
 - 2. Refrigeration system of condensing units shall be constructed in accordance with ASHRAE Standard ASHRAE 15 "Safety Code for Mechanical Refrigeration".

3. Condensing units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A "Energy Conservation in New Building Design".
4. Construction and testing of water cooled condensing units shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII.
5. Condensing units shall be listed by UL and have UL label affixed.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Handle condensing units and components carefully to prevent damage. Follow manufacturer's written instructions for rigging. Replace damaged condensing units or components.
- B. Store condensing units and components in clean dry place off the ground. Protect from weather, water, and physical damage.

1.6 SPECIAL PROJECT WARRANTY:

- A. Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
 1. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 RESIDENTIAL AIR-COOLED CONDENSING UNITS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering residential air-cooled condensing units which may be incorporated in the work include, but are not limited to, the following:
 1. Midea Corp.
 2. Carrier Air Conditioning; Div Carrier Corp.
 3. Fedders Air Conditioning USA; Fedders Corp.
 4. Lennox Industries, Inc.
 5. Trane (The) Co; Div American Standard Inc.
 6. York; Div York International.
- B. General: factory-assembled and tested air-cooled condensing units, consisting of compressor, condenser coil, fan, motor, refrigerant reservoir, and operating controls. Capacity and electrical characteristics are scheduled (on the Drawings) (at the end of this Section).
- C. Casing: galvanized steel finished with baked enamel, complete with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Unit shall be complete with brass service valves, fittings, and gage ports on exterior of casing.
- D. Compressor: hermetically sealed with built-in overloads and vibration isolation. Compressor motor, shall have thermal and current sensitive overload devices, internal high-pressure protection, high and low pressure cutout switches, start capacitor and relay, 2-pole contactor,

crankcase heater, and temperature actuated switch and timer to prevent compressor rapid cycle.

- E. Condenser: coil shall have copper tubes and aluminum fins, or aluminum tubes and aluminum fins; complete with liquid accumulator and liquid subcooler. Aluminum propeller fan shall be direct driven, with permanently lubricated fan motor having thermal overload protection.
- F. Accessories:
 - 1. Low-voltage thermostat and subbase to control condensing unit and evaporator fan.
 - 2. Precharged and insulated suction and liquid tubing of length indicated.
 - 3. Head pressure control to modulate condenser fan motor speed for low ambient conditions.
 - 4. Heat reclaim device providing preheating of domestic hot water with hot gas from condensing unit.
 - 5. Low-voltage control transformer.
 - 6. Water-to-refrigerant heat exchanger.

2.2 AIR-COOLED CONDENSING UNITS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air-cooled condensing units which may be incorporated in the work include, but are not limited to, the following:
 - 1. Midea Corp.
 - 2. Carrier Air Conditioning; Div of Carrier Corp.
 - 3. McQuay Air Conditioning Group; McQuay Inc.
 - 4. Trane (The) Co; Div American Standard Inc.
 - 5. York; Div of York International.
- B. General: factory-assembled and tested air-cooled condensing units, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls. Capacities and electrical characteristics are scheduled (on the Drawings) (at the end of this Section).
- C. Unit Casings: designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include:
 - 1. steel, galvanized or zinc-coated, for exposed casing surfaces, treated and finished with manufacturer's standard paint coating;
 - 2. lifting lugs to facilitate rigging of units;
 - 3. factory-installed metal grilles, for protection of condenser coil during shipping, installation, and operation;
 - 4. hinged and gasketed control panel door.
- D. Compressor: reciprocating hermetic-type compressor, 1,750 RPM, designed for air-cooled condensing, complete with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports. Capacity shall be controlled through cylinder unloading. Additional features include:
 - 1. Crankcase heater in well within crankcase;
 - 2. Capacity steps as scheduled, or greater number;
 - 3. Compressor of same manufacturer as condensing unit.

- E. Controls: Operating and safety controls shall include high and low pressure cutouts, oil pressure cutout, compressor winding thermostat cutout, 3-leg compressor overload protection, and condenser fan motors with thermal and overload cutouts. Control transformer if required shall be 115-volts. Provide magnetic contactors for compressor and condenser fan motors. Additional features include:
 - 1. Reset relay circuit for manual resetting of cutouts from remote thermostat location;
 - 2. Automatic nonrecycling pumpdown, and timing device to prevent excessive compressor cycling;
 - 3. Unfused disconnect switch, factory-mounted and wired, for single external electrical power connection.
- F. Condensing Section: Condenser coil shall be seamless copper tubing mechanically bonded to heavy-duty, configured aluminum fins, with separate and independent refrigeration circuit for each compressor. Units shall include liquid accumulator and subcooling circuit, and backseating liquid line service access valve. Condenser coils shall be factory-tested at 450 psig, vacuum dehydrate, and filled with a holding charge of nitrogen.
- G. Condenser fans and drives: propeller-type condenser fans for vertical air discharge; either direct drive or belt drive. Additional features include:
 - 1. Permanent lubricated ball bearing condenser fan motors;
 - 2. Separate motor for each condenser fan;
 - 3. Constant speed condenser fan motors;
 - 4. Each fan assembly shall be dynamically and statically balanced.
- H. Low ambient control: factory-installed low ambient damper assembly, fan speed control, or fan cycling control.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify roof structure, mounting supports, and membrane installations are completed to the proper point to allow installation of roof mounted units. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install condensing units in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support:
- C. Install ground-mounted units on 4 inches thick reinforced concrete pad, 4 inches larger on each side than condensing unit. Concrete is specified in Division 3. Coordinate installation of anchoring devices.
- D. Install roof-mounted units on equipment supports specified in Division 7. Anchor unit to supports with removable fasteners.

- E. Residential Units: Connect pre-charged refrigerant tubing to unit's quick-connect fittings. Run tubing so as not to interfere with access to unit.

- 1. Install furnished accessories.

- F. Air-Cooled Condensing Units: Connect refrigerant piping to unit; maintain required access to unit.

- 1. Install furnished field-mounted accessories.

3.3 FIELD QUALITY CONTROL:

- A. Testing:

- B. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.

3.4 DEMONSTRATION:

- A. Provide services of manufacturer's authorized service representative to provide start-up service and to instruct Owner's personnel in operation and maintenance of condensing units.

- B. Start-up condensing units, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

- C. Train Owner's personnel on start-up and shut-down procedures, troubleshooting procedures, servicing, and preventative maintenance schedule and procedures. Review with the Owner's personnel, the data contained in the Operating and Maintenance Manuals specified in Division One.

- 1. Schedule training with Owner, provide at least 7-day prior notice to Architect/Engineer.

END OF SECTION

DIVISION 26 ELECTRICAL

SECTION 26 05 13

MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.
- B. Samples: 16-inch (400-mm) lengths for each type of cable specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2 and NFPA 70.

2.3 CABLES

- A. Cable Type: Type MV 105.
- B. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.
- C. Conductor: Copper.
- D. Conductor Stranding: Compact round, concentric lay, Class B.

- E. Strand Filling: Conductor interstices are filled with impermeable compound.
- F. Conductor Insulation: Crosslinked polyethylene.
 - 1. Voltage Rating: 15 kV.
 - 2. Insulation Thickness: 133 percent insulation level.
- G. Shielding: Copper tape, helically applied over semiconducting insulation shield.
- H. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.
- I. Three-Conductor Cable Assembly: Three insulated, shielded conductors cabled together with ground conductors.
- J. Cable Jacket: Sunlight-resistant PVC.

2.4 CONNECTORS

- A. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
- B. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.5 SOLID TERMINATIONS

- A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
 - 1. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
 - 2. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
- B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
 - 1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
 - 2. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include cold-shrink-rubber sleeve moisture seal for end of insulation whether or not supplied with kits.

2.6 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.

- C. Load-Break Cable Terminators: Elbow-type units with 200-A-load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- D. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
 - 1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 - 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 - 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 - 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.
- F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.7 SPLICE KITS

- A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.
- B. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.

2.8 MEDIUM-VOLTAGE TAPES

- A. Ethylene/propylene rubber-based, 30-mil (0.76-mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.
- B. Silicone rubber-based, 12-mil (0.30-mm) self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inches (38 mm) wide.
- C. Insulating-putty, 125-mil (3.175-mm) elastic filler tape. Minimum 1-1/2 inches (38 mm) wide.

2.9 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch (8 mm) thick, and compatible with cable jacket.
- C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch (25 mm) wide.

2.10 FAULT INDICATORS

- A. Indicators: Manually reset fault indicator with inrush restraint feature, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
- B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

2.11 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.
- B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches (1200 to 1800 mm) on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.
- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.

2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- F. Install direct-buried cables on leveled and tamped bed of 3-inch- (75-mm-) thick, clean sand. Separate cables crossing other cables or piping by a minimum of 2 inches (50 mm) of tamped earth, plus an additional 2 inches (50 mm) of sand. Install permanent markers at ends of cable runs, changes in direction, and buried splices.
- G. Install "buried-cable" warning tape 12 inches (305 mm) above cables.
- H. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- I. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- J. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.
- K. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.
- L. Install separable insulated-connector components as follows:
1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 3. Standoff Insulator: At each terminal junction, with one on each terminal.
- M. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
1. Clean cable sheath.
 2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
 3. Smooth surface contours with electrical insulation putty.
 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 5. Band arc-proofing tape with two layers of 1-inch- (25-mm-) wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.
- N. Seal around cables passing through fire-rated elements according to Section 078413 "Penetration Firestopping."
- O. Install fault indicators on each phase where indicated.

- P. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- Q. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.
- R. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 - 4. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- B. Prepare test and inspection reports.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.
2. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.
3. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.**

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors:** Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation:** Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-, THWN-2 and Type XHHW-2.
- C. Multiconductor Cable:** Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, metal-clad cable, Type MC, nonmetallic-sheathed cable and Type NM with ground wire.
- D. VFC Cable:**
1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.

2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.
3. Comply with UL requirements for cables in Classes I and II, Division 2 hazardous location applications.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Stranded.
- B. Branch Circuits: Copper. stranded, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

- I. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.
- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- K. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: **Copper** wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; **3/4 inch by 10 feet (19 mm by 3 m)** in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install stranded conductors unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.

6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 10. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install **[tinned]** bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 LABELING

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 5 ohms.
 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 5 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design:** Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways** capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports** capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength:** Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

- A. Product Data:** For steel slotted support systems.
- B. Shop Drawings:** Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.**

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4

inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

- J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Continuous HDPE: Comply with UL 651B.
- F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Fittings for LFNC: Comply with UL 514B.
- I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- J. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 4 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
- D. Tele-Power Poles:
 - 1. Material: Aluminum with clear anodized finish.
 - 2. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:

1. Material: Cast metal.
 2. Type: Semi-adjustable.
 3. Shape: Rectangular.
 4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).
1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: **4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).**
- M. Gangable boxes are prohibited.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 2. Nonmetallic Enclosures: Plastic.
 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- O. Cabinets:
1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.
 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete or reinforced concrete.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-40-PVC.
2. Concealed Conduit, Aboveground: RNC, Type EPC-40-PVC.
3. Underground Conduit: PVC Schedule 40 concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: RGS PVC Coated.
2. Exposed, Not Subject to Severe Physical Damage: RGS PVC Coated.
3. Exposed and Subject to Severe Physical Damage: RGS PVC Coated. Raceway locations include the following:

- a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: RGS PVC Coated.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 6. Damp or Wet Locations: RGS PVC Coated.
 - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
- 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use compression fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of **[1 inch (25 mm)] [2 inches (50 mm)] <Insert dimension>** of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 - 5. Change from ENT to RGS PVC Coated before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- O. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
 - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C)** temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C)** temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C)** temperature change.
 - d. Attics: **135 deg F (75 deg C)** temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.

- X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

- D. Install handholes with bottom below frost line.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 36

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ladder cable trays.
2. Single-rail cable trays.
3. Trough cable trays.
4. Fiberglass cable trays.

B. Related Requirements:

1. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of cable tray.

C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cable tray supports and seismic bracing.
- B. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Component Importance Factor: 1.5.

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles on individual cable tray types for specific values for uniform load distribution, concentrated load, and load and safety factor parameters.

2.3 LADDER CABLE TRAYS

- A. Description:
 - 1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
 - 2. Rung Spacing: **12 inches (300 mm)** o.c.
 - 3. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
 - 4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
 - 5. No portion of the rungs shall protrude below the bottom plane of side rails.
 - 6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
 - 7. Minimum Usable Load Depth: **4 inches (100 mm)**.
 - 8. Straight Section Lengths: **10 feet (3 m)** except where shorter lengths are required to facilitate tray assembly.
 - 9. Width: **12 inches (300 mm)** unless otherwise indicated on Drawings.
 - 10. Fitting Minimum Radius: **12 inches (300 mm)**.
 - 11. Class Designation: Comply with NEMA VE 1, Class 12B.
 - 12. Splicing Assemblies: Bolted type using serrated flange locknuts.
 - 13. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
 - 14. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.4 SINGLE-RAIL CABLE TRAYS

A. Description:

1. Configuration: Center rail with extruded-aluminum rungs arranged symmetrically about the center rail.
2. Construction: Aluminum rungs mechanically connected to aluminum center rail in at least two places, with ends finished to protect installers and cables.
3. Rung Spacing: **6 inches (150 mm)** o.c.
4. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
5. Straight Section Lengths: **10 feet (3 m)** except where shorter lengths are required to facilitate tray assembly.
6. Width: **12 inches (300 mm)** unless otherwise indicated on Drawings.
7. Support Point: Splice fittings shall be hanger support point.
8. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
9. Loading Depth: **4 inches (100 mm)**.
10. Maximum Loads: **25 lb/ft. (37 kg/m)**.
11. Unbalanced Loads: Maintain cable tray rungs within six degrees of horizontal under all loading conditions.
12. Splicing Assemblies: Bolted type using serrated flange locknuts.
13. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
14. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
15. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.

2.5 TROUGH CABLE TRAYS

A. Description:

1. Configuration: Two longitudinal members (side rails) with a solid sheet over rungs exposed on the interior of the trough, or corrugated sheet with both edges welded to the side rails.
2. Rung Spacing: Rungs or corrugations shall be spaced a maximum of 6 inches (150 mm) o.c. and have a minimum flat bearing surface of 2 inches (50 mm).
3. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
4. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
5. Minimum Usable Load Depth: **4 inches (100 mm)**.
6. Straight Section Lengths: **10 feet (3 m)** except where shorter lengths are required to facilitate tray assembly.
7. Width: **12 inches (300 mm)** unless otherwise indicated on Drawings.
8. Fitting Minimum Radius: **12 inches (300 mm)**.
9. Class Designation: Comply with NEMA VE 1, Class 12B.
10. Splicing Assemblies: Bolted type using serrated flange locknuts.
11. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

12. Hardware and Fasteners: **ASTM F 593 and ASTM F 594 stainless steel, Type 316.**

2.6 FIBERGLASS CABLE TRAYS

A. Description:

1. Configuration: Two longitudinal members with rounded edges and smooth surfaces, complying with NEMA FG 1.
2. Materials: Straight section structural elements; side rails, rungs and splice plates shall be pultruded from glass-fiber-reinforced **polyester** resin, complying with NEMA FG 1 and UL 568.
3. Fasteners: Fiberglass-encapsulated, ASTM F 593 and ASTM F 594 stainless steel, Type 316. Design fasteners so that no metal is visible when fully assembled and tightened. Fastener encapsulation shall not be damaged when torqued to manufacturer's recommended value.
4. Minimum Usable Load Depth: **3 inches (75 mm)** according to NEMA FG 1.
5. Straight Section Lengths: **10 feet (3 m)**.
6. Width: **12 inches (300 mm)** unless otherwise indicated on Drawings.
7. Class Designation: Comply with NEMA VE 1, Class 12B.
8. Temperature Rating: Reduce the load rating of tray exposed to temperatures above 75 deg F (24 deg C) according to Table 4-3, "Working Loads," in NEMA FG 1.
9. Fitting Minimum Radius: **12 inches (300 mm)**.
10. Splicing Assemblies: Minimum four nuts and bolts per plate. Splice plates shall be furnished with straight sections and fittings.
11. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.7 MATERIALS AND FINISHES

A. Steel:

1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
4. Finish: Mill galvanized before fabrication.
 - a. Hardware: Galvanized, ASTM B 633.
5. Finish: Electrogalvanized before fabrication.
6. Finish: Hot-dip galvanized after fabrication.
 - a. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
7. Finish: Epoxy-resin paint.

- a. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
- 8. Finish: Factory-standard primer, ready for field painting, with chromium-zinc-plated hardware according to ASTM F 1136.
- 9. Finish: Black oxide finish for support accessories and miscellaneous hardware according to ASTM D 769.
- B. Aluminum:
 - 1. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H35.1/H 35.1M for fabricated parts.
 - 2. Hardware: **[Chromium-zinc-plated steel, ASTM F 1136] [Stainless steel, Type 316, ASTM F 593 and ASTM F 594].**
 - 3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
- C. Stainless Steel:
 - 1. Materials: Low-carbon, passivated, stainless steel, Type 304L or Type 316L, ASTM F 593 and ASTM F 594.
 - 2. Hardware for Stainless-Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.8 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Covers: Ventilated-hat type made of same materials and with same finishes as cable tray.
- C. Barrier Strips: Same materials and finishes as for cable tray.
- D. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.9 WARNING SIGNS

- A. Lettering: **1-1/2-inch- (40-mm-)** high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA FG 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA FG 1.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Fasten cable tray supports to building structure and install seismic restraints.
- D. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems. Comply with seismic-restraint details according to Section 260548 "Vibration and Seismic Controls for Electrical Systems.
- E. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- F. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- G. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA FG 1. Space connectors and set gaps according to applicable standard.
- H. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- I. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- J. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.
- K. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.
- L. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

- B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch (1800-mm) intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."
- D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket.
- C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).
- E. Tie MI cables down every 36 inches (900 mm) where required to provide a 2-hour fire rating and every 72 inches (1800 mm) elsewhere.
- F. In existing construction, remove inactive or dead cables from cable trays.

3.4 CONNECTIONS

- A. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.

3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

- B. Prepare test and inspection reports.

3.6 PROTECTION

- A. Protect installed cable trays and cables.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for concrete-encased duct banks, and in single duct runs.
 - 2. Handholes and boxes.
 - 3. Manholes.

1.2 ACTION SUBMITTALS

- A. Product Data: For accessories for manholes, handholes, and boxes.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design and manhole frame support rings.
 - 4. Step details.
 - 5. Grounding details.
 - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT; a division of Cable Design Technologies.
 - 11. Spiraduct/AFC Cable Systems, Inc.
- C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.
- D. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
 - 3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- (50-mm-) high, 3/8-inch- (10-mm-) deep letters.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes **12 inches wide by 24 inches long (300 mm wide by 600 mm long)** and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

2.4 PRECAST MANHOLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carder Concrete Products.
 2. Christy Concrete Products.
 3. Elmhurst-Chicago Stone Co.

4. Oldcastle Precast Group.
 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
 6. Utility Concrete Products, LLC.
 7. Utility Vault Co.
 8. Wausau Tile, Inc.
- C. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.
1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
- D. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.
- E. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.5 UTILITY STRUCTURE ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Bilco Company (The).
 2. Campbell Foundry Company.
 3. Carder Concrete Products.
 4. Christy Concrete Products.
 5. East Jordan Iron Works, Inc.
 6. Elmhurst-Chicago Stone Co.
 7. McKinley Iron Works, Inc.
 8. Neenah Foundry Company.
 9. NewBasis.
 10. Oldcastle Precast Group.
 11. Osburn Associates, Inc.
 12. Pennsylvania Insert Corporation.
 13. Riverton Concrete Products; a division of Cretex Companies, Inc.
 14. Strongwell Corporation; Lenoir City Division.
 15. Underground Devices, Inc.
 16. Utility Concrete Products, LLC.
 17. Utility Vault Co.
 18. Wausau Tile, Inc.

- C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
 - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, **26 inches (660 mm)**.
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 - 2. Cover Legend: Cast in. Selected to suit system.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 - 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
- D. Manhole Sump: Depression cast in floor.
- E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.
 - 1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
- F. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- (32-mm-) diameter eye, rated **2500-lbf (11-kN)** minimum tension.
- G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
 - 1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
- H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.
 - 1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
- I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.
- J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
 2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- L. Fixed Manhole Ladders: Arranged for attachment to wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- M. Cover Hooks: Heavy duty, designed for lifts **60 lbf (270 N)** and greater. Two required.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Section 017329 "Cutting and Patching."

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of **48 inches (1220 mm)**, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 6. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.

7. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Section 312000 "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.

- b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.

3.3 INSTALLATION OF CONCRETE MANHOLES

- A. Comply with ASTM C 891, unless otherwise indicated.
- B. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
- C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- D. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
- E. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
- F. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
- G. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
- H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- J. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches (98 mm) for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- K. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.4 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 GROUNDING

- A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.7 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 3. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 4. Pressure Plates: Stainless steel.
 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Isolation pads.
2. Spring isolators.
3. Restrained spring isolators.
4. Channel support systems.
5. Restraint cables.
6. Hanger rod stiffeners.
7. Anchorage bushings and washers.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: C.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: [I] [II] [III].
 - a. Component Importance Factor: 1.5.
 - b. Component Response Modification Factor: 2.5.
 - c. Component Amplification Factor: 2.5.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
4. Design Spectral Response Acceleration at 1.0-Second Period.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
 - 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 - 3. Field-fabricated supports.
 - 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
 - c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- D. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant rubber.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- D. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- F. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- G. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
- H. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- I. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- K. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- L. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 3. Test to 90 percent of rated proof load of device.
 4. Measure isolator restraint clearance.
 5. Measure isolator deflection.
 6. Verify snubber minimum clearances.
 7. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Equipment Location.
2. Pads:
 - a. Material: Rubber.
 - b. Thickness.
 - c. Durometer.
 - d. Number of Pads.
3. Isolator Type.
4. Component Importance Factor: 1.5.
5. Component Response Modification Factor: 2.5.
6. Component Amplification Factor: 2.5.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A.** Comply with ANSI A13.1.
- B.** Comply with NFPA 70.
- C.** Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D.** Comply with ANSI Z535.4 for safety signs and labels.
- E.** Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A.** Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B.** Colors for Raceways Carrying Circuits at 600 V or Less:
1. Black letters on an orange field.
 2. Legend: Indicate voltage and system or service type.

- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Write-On Tags: Polyester tag, **0.010 inch (0.25 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Write-On Tags: Polyester tag, **0.010 inch (0.25 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write-On Tags: Polyester tag, **0.010 inch (0.25 mm)** thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

D. Tag: **Type ID:**

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be **1 inch (25 mm)**.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors,

at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

- F. **Underground-Line Warning Tape:** During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- G. **Painted Identification:** Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. **Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 50 A, and 120 V to ground:** Install labels at **10-foot (3-m)** maximum intervals.
- B. **Accessible Raceways and Cables within Buildings:** Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power.
 - 2. Power.
 - 3. UPS.
- C. **Power-Circuit Conductor Identification, 600 V or Less:** For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. **Color-Coding for Phase and Voltage Level Identification, 600 V or Less:** Use colors listed below for ungrounded service and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 6 AWG.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. **Field-Applied, Color-Coding Conductor Tape:** Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. **Install instructional sign** including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. **Conductors to Be Extended in the Future:** Attach marker tape to conductors and list source.

- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Adhesive film label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label **4 inches (100 mm)** high.

- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
 - 2. Buck-boost transformers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings: Indicate dimensions and weights.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ACME Electric Corporation; Power Distribution Products Division.
 - 2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
 - 3. Controlled Power Company.
 - 4. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
 - 6. General Electric Company.
 - 7. Hammond Co.; Matra Electric, Inc.
 - 8. Magnetek Power Electronics Group.
 - 9. Micron Industries Corp.
 - 10. Myers Power Products, Inc.
 - 11. Siemens Energy & Automation, Inc.
 - 12. Sola/Hevi-Duty.
 - 13. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 2.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- E. Enclosure: Totally enclosed, nonventilated, NEMA 250, Type 4X, stainless steel.
 - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

- F. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: ANSI 61 gray.
- G. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- H. Taps for Transformers 7.5 to 24 kVA: Two 5 percent taps below rated voltage.
- I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- J. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of **150** deg C rise above 40 deg C ambient temperature.
- K. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
 - 2. Tested according to NEMA TP 2.
- L. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
- M. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
- N. Wall Brackets: Manufacturer's standard brackets.

2.4 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.
 - 1. Finish Color: ANSI 61 gray.

2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - b. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
 - c. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

3.3 ADJUSTING

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to **SEI/ASCE 7**.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Field quality-control reports.
- C. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Surface - mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 4X.
 - c. Kitchen, Wash-Down Areas: NEMA 250, Type 4X, stainless steel material.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X type.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, power and feeder distribution type.
- D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- E. Mains: Circuit breaker.
- F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- G. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- H. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- D. Mains: Circuit breaker or lugs only.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- F. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
 - 1. External Control-Power Source: 120-V branch circuit.
- G. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- H. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I²t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **[55] [75]** percent of rated voltage.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to **NEMA PB 1.1**.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 26 24 19

MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:
 - 1. Incoming main lugs and OCPDs.
 - 2. Full-voltage magnetic controllers.
 - 3. Reduced-voltage, solid-state controllers.
 - 4. Multispeed controllers.
 - 5. Feeder-tap units.
 - 6. Instrumentation.
 - 7. Auxiliary devices.

1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. CPT: Control power transformer.
- C. LED: Light-emitting diode.
- D. MCC: Motor-control center.
- E. MCCB: Molded-case circuit breaker.
- F. MCP: Motor-circuit protector.
- G. NC: Normally closed.
- H. NO: Normally open.
- I. OCPD: Overcurrent protective device.
- J. PT: Potential transformer.
- K. SCR: Silicon-controlled rectifier.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of controller and each type of MCC.
- B. LEED Submittals:
 1. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
- C. Shop Drawings: For each MCC, manufacturer's approval drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 1. Show tabulations of installed devices, equipment features, and ratings.
 2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring for each installed controller.
 3. Nameplate legends.
 4. Vertical and horizontal bus capacities.
 5. Features, characteristics, ratings, and factory settings of each installed unit.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- B. Seismic Qualification Certificates: For MCCs, accessories, and components, from manufacturer.
- C. Product certificates.
- D. Source quality-control reports.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

- B. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.
- E. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. ABB; Control Products.
 - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 3. General Electric Company; GE Industrial Systems.
 - 4. Rockwell Automation, Inc.; Allen-Bradley Brand.
 - 5. Siemens Energy & Automation, Inc.; Power Distribution.
 - 6. Square D; a brand of Schneider Electric.
- C. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845.

2.2 FUNCTIONAL FEATURES

- A. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.
- B. Controller Units: Combination controller units.
 - 1. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 - 2. Equip units in Type B with pull-apart terminal strips for external control connections.
- C. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
- D. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.
- E. Spare Units: Installed in compartments indicated "spare."

2.3 INCOMING MAINS

- A. Incoming Mains Location: Top and bottom.
- B. Main Lugs Only: Conductor connectors suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
- C. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 3. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **[55] [75]** percent of rated voltage.
 - f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

2.4 COMBINATION CONTROLLERS

- A. Full-Voltage Controllers:
 - 1. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - 2. Magnetic Controllers: Full voltage, across the line, electrically held.
 - a. Configuration: Nonreversing.
- B. Reduced-Voltage, Solid-State Controllers:
 - 1. General Requirements for Reduced-Voltage, Solid-State Controllers: Comply with UL 508.
 - 2. Reduced-Voltage, Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass

contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium-induction motors.

- a. Configuration: Severe duty; nonreversible.
- b. Starting Mode: Voltage ramping.
- c. Stopping Mode: Adjustable braking.
- d. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
- e. Shorting and Input Isolation Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors.
- f. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
- g. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
- h. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration without external feedback from the motor or driven equipment.
- i. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
 - 1) Adjusting motor full-load amperes, as a percentage of the controller's rating.
 - 2) Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
 - 3) Adjusting linear acceleration and deceleration ramps, in seconds.
 - 4) Initial torque, as a percentage of the nominal motor torque.
 - 5) Adjusting torque limit, as a percentage of the nominal motor torque.
 - 6) Adjusting maximum start time, in seconds.
 - 7) Adjusting voltage boost, as a percentage of the nominal supply voltage.
 - 8) Selecting stopping mode, and adjusting parameters.
 - 9) Selecting motor thermal-overload protection class between 5 and 30.
 - 10) Activating and de-activating protection modes.
 - 11) Selecting or activating communications modes.
- j. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
 - 1) Controller Condition: Ready, starting, running, stopping.
 - 2) Motor Condition: Amperes, voltage, power factor, power, and thermal state.
 - 3) Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
- k. Controller Diagnostics and Protection:
 - 1) Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller overtemperature and motor overload alarm and trip; settings selectable via the keypad.
 - 2) Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
 - 3) Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component, or when the motor is stopped.

- 4) Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.

I. Remote Output Features:

- 1) All outputs prewired to terminal blocks.
- 2) Form C status contacts that change state when controller is running.
- 3) Form C alarm contacts that change state when a fault condition occurs.

m. Optional Features:

- 1) Analog output for field-selectable assignment of motor operating characteristics; 4 to 20-mA dc.
- 2) Additional field-assignable Form C contacts for alarm outputs.
- 3) Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
- 4) Full-voltage bypass contactor operating automatically. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.

C. Multispeed Magnetic Controllers:

1. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.
2. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held. Compelling relay to ensure that motor will start only at low speed.
 - a. Configuration: Nonreversing; two winding.
 - b. Compelling relays shall ensure that motor starts only at low speed.
 - c. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
 - d. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
 - e. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.

D. Disconnecting Means and OCPDs:

1. Fusible Disconnecting Means:

- a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

2. MCP Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

- c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
- d. NO alarm contact that operates only when MCP has tripped.
- e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

3. MCCB Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
- b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
- e. NO alarm contact that operates only when MCCB has tripped.

4. Molded-Case Switch Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- c. Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.
- d. NO alarm contact that operates only when molded-case switch has tripped.

E. Control Power:

- 1. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 100 VA.

2.5 FEEDER-TAP UNITS

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

- 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.

4. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
- c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
- d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at [55] [75] percent of rated voltage.
- f. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

B. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses with lockable handle.

C. Fuses are specified in Section 262813 "Fuses."

2.6 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. PTs: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. CPTs: Dry type, mounted in separate compartments for units larger than 3 kVA.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Listed or recognized by a nationally recognized testing laboratory.
2. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
3. Switch-selectable digital display of the following values with the indicated maximum accuracy tolerances:
 - a. Phase Currents, Each Phase: Plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d. Three-Phase Real Power (Megawatts): Plus or minus 2 percent.
 - e. Three-Phase Reactive Power (Megavars): Plus or minus 2 percent.
 - f. Power Factor: Plus or minus 2 percent.
 - g. Frequency: Plus or minus 0.5 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
4. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scale and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and phase-to-neutral voltages where a neutral is included.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

2.7 MCC CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from CPT.

2.8 ENCLOSURES

- A. Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, **Type 1** unless otherwise indicated to comply with environmental conditions at installed location.
- B. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
 2. Space-Heater Power Source: Transformer, factory installed in MCC.
- C. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- D. Compartments: Modular; individual lift-off doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.
- E. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.
- F. Wiring Spaces:
1. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
 2. Horizontal wireways in bottom and top of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

2.9 AUXILIARY DEVICES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - a. Push Buttons: Covered types; momentary contact unless otherwise indicated.
 - b. Pilot Lights: LED types.
 - c. Selector Switches: Rotary type.
 - 2. Elapsed Time Meters: Heavy duty with digital readout in hours nonresettable.
 - 3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy with selector switches having an off position.
- B. NO contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- E. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- F. Terminals for connecting power factor correction capacitors to the line side of overload relays.
- G. Spare-Fuse Cabinet: Identified cabinet with hinged lockable door.

2.10 CHARACTERISTICS AND RATINGS

- A. Wiring: NEMA ICS 18, Class I.
- B. Wiring: NEMA ICS 18, Class II.
- C. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
- D. Nominal System Voltage: 480Y/277 V, three phase, four wire.
- E. Short-Circuit Current Rating for Each Unit: 65 kA.
- F. Short-Circuit Current Rating of MCC: Fully rated with its main overcurrent device; 65 kA.
- G. Environmental Ratings:
 - 1. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
 - 2. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 - 3. Humidity Rating: Less than 95 percent (noncondensing).

4. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
 - H. Main-Bus Continuous Rating: 1200 A.
 - I. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating.
 - J. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends.
 - K. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.
 - L. Phase- and Neutral Bus Material: Hard-drawn copper of 98 percent conductivity, silver tin plated.
 - M. Phase-and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy.
 - N. Neutral Buses: 50 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables.
 - O. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables.
 - P. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with **mechanical** connectors for feeder and branch-circuit equipment grounding conductors.
 - Q. Front-Connected, Front-Accessible MCCs:
 1. Main Devices: Fixed mounted.
 2. Controller Units: Fixed mounted.
 3. Feeder-Tap Units: Fixed mounted.
 4. Sections front and rear aligned.
 - R. Pull Box on Top of MCC:
 1. Adequate ventilation to maintain temperature in pull box within same limits as MCC.
 2. Set back from front to clear circuit-breaker removal mechanism.
 3. Removable covers forming top, front, and sides. Top covers at rear easily removable for drilling and cutting.
 4. Insulated bottom of fire-resistive material with separate holes for cable drops into MCC.
 5. Cable supports arranged to facilitate cabling and adequate to support cables, including those for future installation.
 - S. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of unit.
- 2.11 SOURCE QUALITY CONTROL
- A. MCC Testing: Inspect and test MCCs according to requirements in **NEMA ICS 18**.
 - B. MCCs will be considered defective if they do not pass tests and inspections.

- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in each fusible switch.
- E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."
- F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- H. Install power factor correction capacitors. Connect to the line side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification of MCC, MCC components, and control wiring.
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label MCC and each cubicle with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
 - 2. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 CONNECTIONS

- A. Comply with requirements for installation of conduit in Section 260533 "Raceways and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Inspect controllers, wiring, components, connections, and equipment installation.
 - 2. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

- E. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.
- D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.
- E. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 Overcurrent Protective Device Coordination Study.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. **Products:** Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to, the following:**
 - a. Cooper; 5351 (single), CR5362 (duplex).
 - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

- A. General Description:
1. Straight blade, feed-through type.
 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; VGF20.
 - b. Hubbell; GFR5352L.
 - c. Pass & Seymour; 2095.
 - d. Leviton; 7590.

- e. <Insert manufacturer's name; catalog number(s)>.

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

- B. Switches, 120/277 V, 20 A:

1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**

- 1) Single Pole:
- 2) Cooper; AH1221.
- 3) Hubbell; HBL1221.
- 4) Leviton; 1221-2.
- 5) Pass & Seymour; CSB20AC1.
- 6) **<Insert manufacturer's name; catalog number(s)>.**
- 7) Two Pole:
- 8) Cooper; AH1222.
- 9) Hubbell; HBL1222.
- 10) Leviton; 1222-2.
- 11) Pass & Seymour; CSB20AC2.
- 12) **<Insert manufacturer's name; catalog number(s)>.**
- 13) Three Way:
- 14) Cooper; AH1223.
- 15) Hubbell; HBL1223.
- 16) Leviton; 1223-2.
- 17) Pass & Seymour; CSB20AC3.
- 18) **<Insert manufacturer's name; catalog number(s)>.**
- 19) Four Way:
- 20) Cooper; AH1224.
- 21) Hubbell; HBL1224.
- 22) Leviton; 1224-2.
- 23) Pass & Seymour; CSB20AC4.
- 24) **<Insert manufacturer's name; catalog number(s)>.**

- C. Pilot-Light Switches, 20 A:

1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. Cooper; AH1221PL for 120 and 277 V.
 - b. Hubbell; HBL1201PL for 120 and 277 V.
 - c. Leviton; 1221-LH1.
 - d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

- e. **<Insert manufacturer's name; catalog number(s)>.**
- 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."
- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; AH1221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - e. **<Insert manufacturer's name; catalog number(s)>.**
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
 - 1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; 6252.
 - b. Hubbell; DR15.
 - c. Leviton; 16252.
 - d. Pass & Seymour; 26252.
 - e. **<Insert manufacturer's name; catalog number(s)>.**
- B. GFCI, **[Feed] [Non-Feed]**-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
 - 1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; VGF15.
 - b. Hubbell; GF15LA.
 - c. Leviton; 8599.
 - d. Pass & Seymour; 1594.
 - e. **<Insert manufacturer's name; catalog number(s)>.**
- C. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
 - 1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; 7621 (single pole), 7623 (three way).

- b. Hubbell; DS115 (single pole), DS315 (three way).
- c. Leviton; 56291-2 (single pole), 5623-2 (three way).
- d. Pass & Seymour; 2621 (single pole), 2623 (three way).
- e. **<Insert manufacturer's name; catalog number(s)>.**

D. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.

- 1. **Products:** Subject to compliance with requirements, **[provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. Cooper; 7631 (single pole), 7633 (three way).
 - b. Hubbell; DS120IL (single pole), DS320 (three way).
 - c. Leviton; 5631-2 (single pole), 5633-2 (three way).
 - d. Pass & Seymour; 2625 (single pole), 2626 (three way).
 - e. **<Insert manufacturer's name; catalog number(s)>.**
- 2. Description: With neon-lighted handle, illuminated when switch is "off."

2.7 RESIDENTIAL DEVICES

A. Fan Speed Controls:

- 1. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters.
- 2. Comply with UL 1917.
- 3. Continuously adjustable **[slider] [toggle switch] [rotary knob]**, **[5 A] [1.5 A]**.
- 4. Three-speed adjustable **[slider] [rotary knob]**, 1.5 A.

B. Telephone Outlet:

- 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3560-6.
 - b. Leviton; 40649.
- 2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

C. Combination TV and Telephone Outlet:

- 1. **Products:** Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 3562.
 - b. Leviton; 40159.
- 2. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "off."
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Type 302 stainless steel 0.04-inch- (1-mm-) thick, brushed brass with factory polymer finish..
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: **Red**.
 - 3. TVSS Devices: Blue.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay.
- B. Feeders: Class L, time delay.
- C. Motor Branch Circuits: Class RK1, time delay.
- D. Other Branch Circuits: Class RK1, time delay.
- E. Control Circuits: Class CC, time delay.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- G. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- G. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Lugs: Suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

- C. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 600-V ac; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 600-V ac; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- F. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Ferraz Shawmut, Inc.
 - 3. Littelfuse, Inc.
- C. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- D. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- F. Accessories:
 - 1. Oiltight key switch for key-to-test function.
 - 2. Oiltight ON pilot light.
 - 3. Isolated neutral lug.
 - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 - 5. Form C alarm contacts that change state when switch is tripped.
 - 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
 - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I²t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 - 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 7. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 4X.
 - 2. Outdoor Locations: NEMA 250, Type 4X.

3. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 26 29 23

VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.
- B. See Section 262419 "Motor-Control Centers" for VFCs installed in motor-control centers.

1.2 DEFINITIONS

- A. BAS: Building automation system.
- B. CE: Conformance Europeene (European Compliance).
- C. CPT: Control power transformer.
- D. EMI: Electromagnetic interference.
- E. IGBT: Insulated-gate bipolar transistor.
- F. LAN: Local area network.
- G. LED: Light-emitting diode.
- H. MCP: Motor-circuit protector.
- I. NC: Normally closed.
- J. NO: Normally open.
- K. OCPD: Overcurrent protective device.
- L. PID: Control action, proportional plus integral plus derivative.
- M. PWM: Pulse-width modulated.
- N. RFI: Radio-frequency interference.
- O. VFC: Variable-frequency motor controller.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and rating of VFC indicated.
- B. LEED Submittals:
 1. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
- C. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 1. Show tabulations of installed devices, equipment features, and ratings.
 2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- B. Seismic Qualification Certificates: For VFCs, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.
- C. Product certificates.
- D. Source quality-control reports.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. ABB.
 - 2. Baldor Electric Company.
 - 3. Danfoss Inc.; Danfoss Drives Div.
 - 4. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 5. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 6. Rockwell Automation, Inc.; Allen-Bradley Brand.
 - 7. Siemens Energy & Automation, Inc.
 - 8. Square D; a brand of Schneider Electric.
 - 9. Toshiba International Corporation.
 - 10. Yaskawa Electric America, Inc; Drives Division.
- C. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
- D. Application: Constant torque and variable torque.
- E. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - 1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."

2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- F. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- G. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- H. Unit Operating Requirements:
1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
 2. Input AC Voltage Unbalance: Not exceeding 5 percent.
 3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 4. Minimum Efficiency: 97 percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
 6. Minimum Short-Circuit Current (Withstand) Rating: 22 kA.
 7. Ambient Temperature Rating: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).
 8. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 9. Humidity Rating: Less than 95 percent (noncondensing).
 10. Altitude Rating: Not exceeding 3300 feet (1005 m).
 11. Vibration Withstand: Comply with IEC 60068-2-6.
 12. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 14. Speed Regulation: Plus or minus **10** percent.
 15. Output Carrier Frequency: Selectable; 0.5 to **15** kHz.
 16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- I. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.
- J. Isolated Control Interface: Allows VFCs to follow remote-control electrical signal over a minimum 40:1 speed range.
- K. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: 0.1 to 999.9 seconds.
 4. Deceleration: 0.1 to 999.9 seconds.
 5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- L. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 3. Under- and overvoltage trips.

4. Inverter overcurrent trips.
 5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 6. Critical frequency rejection, with three selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Loss-of-phase protection.
 9. Reverse-phase protection.
 10. Short-circuit protection.
 11. Motor overtemperature fault.
- M. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- N. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- O. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- P. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- Q. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- R. Integral Input Disconnecting Means and OCPD: NEMA AB 1, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
 2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.

2.2 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.
 2. Run.
 3. Overvoltage.
 4. Line fault.
 5. Overcurrent.
 6. External fault.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
1. Running log of total power versus time.
 2. Total run time.
 3. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
 2. Motor speed (rpm).
 3. Motor status (running, stop, fault).
 4. Motor current (amperes).
 5. Motor torque (percent).
 6. Fault or alarming status (code).
 7. PID feedback signal (percent).
 8. DC-link voltage (V dc).
 9. Set point frequency (Hz).
 10. Motor output voltage (V ac).
- E. Control Signal Interfaces:
1. Electric Input Signal Interface:
 - a. A minimum of two programmable analog inputs: 4- to 20-mA dc.
 - b. A minimum of six multifunction programmable digital inputs.
 2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:
 - a. 0- to 10-V dc.
 - b. 4- to 20-mA dc.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 3. Output Signal Interface: A minimum of one programmable analog output signal(s) **4- to 20-mA dc**, which can be configured for any of the following:
 - a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (V dc).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set point frequency (Hz).

4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Set point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.
- F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
 1. Number of Loops: One.
- G. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
 1. Network Communications Ports: Ethernet and RS-422/485.
 2. Embedded BAS Protocols for Network Communications: Modbus/Memobus; protocols accessible via the communications ports.

2.3 LINE CONDITIONING AND FILTERING

- A. Input Line Conditioning.
- B. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 BYPASS SYSTEMS

- A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
- B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.
- C. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.
- D. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
 1. Bypass Contactor: Load-break, NEMA-rated contactor.
 2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.
 3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-

energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

- E. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

- F. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 100 VA.
6. Overload Relays: NEMA ICS 2.

2.5 OPTIONAL FEATURES

- A. Damper control circuit with end of travel feedback capability.
- B. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station, this password-protected input:
1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
 2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
 3. Forces VFC to transfer to Bypass Mode and operate motor at full speed.
 4. Causes display of Override Mode on the VFC display.
 5. Reset VFC to normal operation on removal of override signal automatically.
- C. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.6 ENCLOSURES

- A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: Type 4X.
 - 2. Outdoor Locations: Type 4X.
 - 3. Wash-Down Areas: Type 4X, stainless steel.
 - 4. Other Wet or Damp Indoor Locations: Type 4X.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
- B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.7 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
 - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
 - a. Push Buttons: Covered types; momentary.
 - b. Pilot Lights: LED types; push to test.
 - c. Selector Switches: Rotary type.
- B. NC bypass contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
 - 1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.
- E. Supplemental Digital Meters:
 - 1. Elapsed time meter.
 - 2. Kilowatt meter.
 - 3. Kilowatt-hour meter.
- F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- H. Cooling Fan and Exhaust System: For NEMA 250, Type 12; UL 508 component recognized: Supply fan, with stainless steel intake and exhaust grills and filters; 120 -V ac; obtained from integral CPT.

2.8 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
 - 1. Test each VFC while connected to a motor that is comparable to that for which the VFC is rated.
 - 2. Verification of Performance: Rate VFCs according to operation of functions and features specified.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
 - 1. Curbs and roof penetrations are specified in Section 077200 "Roof Accessories."
 - 2. Structural-steel channels are specified in Section 260529 "Hangers and Supports for Electrical Systems."
- C. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in each fusible-switch VFC.
- F. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."
- G. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- H. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each VFC with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic control devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
 - 2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 - 2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

- E. VFCs will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.5 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.
- D. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION

SECTION 26 31 00

PHOTOVOLTAIC ENERGY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PV laminates (cells laminated into rigid sheets, with connecting cables).
2. PV modules (laminates in mounting frames).
3. Charge controllers.
4. Inverters.
5. Mounting structures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For PV modules.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly.
4. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special materials and workmanship warranty and minimum power output warranty.

1.4 WARRANTY

A. Manufacturer's Special Materials and Workmanship Warranty: Manufacturer agrees to repair or replace components of PV modules that fail in materials or workmanship within specified warranty period.

1. Manufacturer's materials and workmanship warranties include, but are not limited to, the following:
 - a. Faulty operation of PV modules.

2. Warranty Period: Two years from date of Substantial Completion.
- B. Manufacturer's Special Minimum Power Output Warranty: Manufacturer agrees to repair or replace components of PV modules that fail to exhibit the minimum power output within specified warranty period. Special warranty, applying to modules only, applies to materials only, on a prorated basis, for period specified.
 1. Manufacturer's minimum power output warranties include, but are not limited to, the following warranty periods, from date of Substantial Completion:
 - a. Specified minimum power output to 80 percent or more, for a period of 25 years.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. Aleo Solar.
 2. BP Solar USA.
 3. Canadian Solar.
 4. ET Solar.
 5. Evergreen Solar, Inc.
 6. GE Energy; General Electric Company.
 7. Kaneka Corporation.
 8. Kyocera International, Inc.
 9. Mitsubishi Electric Corporation.
 10. REC Solar US LLC.
 11. Sanyo North America Corporation.
 12. Schott Solar.
 13. Sharp Electronics Corporation.
 14. SunPower Corporation.
 15. Suntech Power.
 16. Trina Solar Limited.
 17. United Solar Ovonic LLC.
 18. Yingli Green Energy Holding Co., Ltd.

2.2 SYSTEM DESCRIPTION

- A. Grid-Tied PV System:
 1. An array of six modules to generate a total nominal 1000 rated W.
 2. System Components:
 - a. Cell materials.
 - b. PV modules.
 - c. Array frame.
 - d. Charge controller.

- e. Inverter.
- f. Overcurrent protection/combiner box.
- g. Mounting structure.
- h. Utility meter.

B. Battery-Storage PV System:

- 1. Connected to a battery bank to provide electricity to Project.
- 2. An array of six modules to generate a total nominal 1000 rated W.
- 3. System Components:
 - a. Cell materials.
 - b. PV modules.
 - c. Array frame.
 - d. Charge controller.
 - e. Inverter.
 - f. Overcurrent protection/combiner box.
 - g. Mounting structure.
 - h. Battery charge controller(s).
 - i. Batteries.
 - j. Battery-storage structure.

2.3 MANUFACTURED UNITS

- A. Cell Materials: Amorphous silicon (a-Si).
- B. Cell Materials: Copper indium (di)selenide (CIS).
- C. Cell Materials: Copper indium gallium (di)selenide (CIGS).
- D. Cell Materials: Cadmium telluride (CdTe).
- E. Cell Materials: Cadmium sulfide.
- F. Cell Materials: Polycrystalline.
 - 1. c-Si.
 - 2. Gallium arsenide (GaAs).
- G. Module Construction:
 - 1. Nominal Size: 32 inches (800 mm) wide by 64 inches (1600 mm) long.
 - 2. Weight: 42.8 lb (19.4 kg).
- H. Encapsulant: Ethyl vinyl acetate.
- I. Front Panel: Fully tempered glass.
- J. Front Panel: 0.125-inch- (3.2-mm-) thick glass.
- K. Front Panel: Laminating film.
- L. Backing Material: Tempered glass.

M. Backing Material: Polyester film.

N. Backing Material: PVC film.

O. Junction Box:

1. IP Code: IP67.

P. Series Fuse Rating: 10A.

2.4 CAPACITIES AND CHARACTERISTICS

A. Minimum Electrical Characteristics:

1. Rated Open Circuit Voltage (V_{oc}): As indicated on drawings.
2. Maximum System Voltage: As indicated on drawings.
3. Maximum Power at Voltage (V_{pm}): As indicated on drawings.
4. Short-Circuit Temperature Coefficient: As indicated on drawings.
5. Rated Short-Circuit Current (I_{sc}): As indicated on drawings.
6. Maximum System: As indicated on drawings.
7. Rated Operation Current (I_{mp}): As indicated on drawings.
8. Maximum Power at STC (P_{max}): As indicated on drawings.
9. Nominal Operating Cell Temperature: As indicated on drawings.

2.5 MODULE FRAMING

A. PV laminates mounted in anodized extruded-aluminum frames.

1. Entire assembly UL listed for electrical and fire safety, Class A, according to UL 1703, complying with IEC 61215.
2. Frame strength exceeding requirements of certifying agencies in subparagraph above.
3. Finish: Anodized aluminum.
 - a. Alloy and temper recommended by framing manufacturer for strength, corrosion resistance, and application of required finish.
 - b. Color: As indicated by manufacturer's designations.
4. Finish: High-performance organic finish.
 - a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVC resin by weight.
 - b. Color: As indicated by manufacturer's designations.
5. Finish: Baked-enamel finish.
 - a. Color: As indicated by manufacturer's designations.

2.6 ARRAY CONSTRUCTION

A. Framing:

1. Material: Extruded aluminum.

2.7 CHARGE CONTROLLER

A. Charge Controller Electrical Characteristics:

1. Output Current Rating: As indicated on drawings.
2. Nominal Battery Voltage: As indicated on drawings.
3. PV Maximum Open Circuit Voltage: As indicated on drawings.
4. Equalization Voltage: As indicated on drawings.
5. Voltage Step-Down Capability: As indicated on drawings.
6. Power Conversion Efficiency: As indicated on drawings.

2.8 INVERTER

A. Control Type: Pulse width modulation control.

B. Control Type: Maximum power point tracker control.

C. Inverter Electrical Characteristics:

1. Maximum Recommended PV Input Power: As indicated on drawings.
2. Maximum Voc: As indicated on drawings.
3. PV Start Voltage: As indicated on drawings.
4. MPPT Voltage Range: As indicated on drawings.
5. Maximum Input Current: As indicated on drawings.
6. Number of String Inputs: As indicated on drawings.
7. Number of Independent MPPT Circuits: As indicated on drawings.
8. Nominal Output Voltage: As indicated on drawings.
9. CEC Rated Power: As indicated on drawings.
10. Nominal Output Voltage: As indicated on drawings.
11. Maximum Output Current: As indicated on drawings.
12. Peak Efficiency: As indicated on drawings.
13. CEC Weighted Efficiency: As indicated on drawings.
14. CEC Night Tare Loss: As indicated on drawings.
15. DC/AC Terminal Range (AWG): As indicated on drawings.
16. NEMA 250 Enclosure Rating: As indicated on drawings.

D. Disconnects:

1. Low-voltage disconnect.
2. Low-voltage reconnect.
3. High-temperature disconnect.
4. High-temperature reconnect.

E. Regulatory Approvals:

1. IEEE 1547.1.
2. IEEE 1547.3.
3. UL 1741.

F. Characteristics:

1. Inverter Dimensions: As indicated on drawings.
2. Inverter Weight: As indicated on drawings.

2.9 SYSTEM OVERCURRENT PROTECTION

A. Combiner Box:

1. Fuses: As indicated on drawings.
2. Circuit Breakers: As indicated on drawings.

2.10 MOUNTING STRUCTURES

- A. Roof Mount: Extruded aluminum, two rails, tilt legs, and roof standoffs.
- B. Pole Mount: Top.
- C. Tracking Mounts: One axis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. PV module will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 32 13

ENGINE GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged engine-generator sets for emergency power supply with the following features:
 - 1. Diesel engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted control and monitoring.
 - 4. Outdoor enclosure.
- B. See Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator and accessory indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Source quality-control test reports.
- C. Field quality-control test reports.

- D. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within **100 miles (321 km)** of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1.
- E. Comply with NFPA 37.
- F. Comply with NFPA 70.
- G. Comply with NFPA 99.
- H. Comply with NFPA 110 requirements for Level [1] [2] emergency power supply system.
- I. Comply with UL 2200.
- J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- K. Noise Emission: Comply with applicable state and local government **requirements** for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 5 to 40 deg C.
 - 2. Relative Humidity: 0 to 95 percent.
 - 3. Altitude: Sea level to **1000 feet (300 m)**.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Caterpillar; Engine Div.
 2. Generac Power Systems, Inc.
 3. Kohler Co.; Generator Division.
 4. Magnetek, Inc.
 5. Onan/Cummins Power Generation; Industrial Business Group.
 6. Spectrum Detroit Diesel.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- C. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
 2. Output Connections: Three-phase, four wire.
 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance:
1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. **Steady-State Frequency Stability:** When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. **Transient Frequency Performance:** Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. **Output Waveform:** At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. **Sustained Short-Circuit Current:** For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. **Start Time:** Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

- A. **Fuel: Fuel oil, Grade DF-2.**
- B. **Rated Engine Speed:** 1800 rpm.
- C. **Maximum Piston Speed for Four-Cycle Engines:** 2250 fpm (11.4 m/s).
- D. **Lubrication System:** The following items are mounted on engine or skid:
 1. **Filter and Strainer:** Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 2. **Thermostatic Control Valve:** Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 3. **Crankcase Drain:** Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- E. **Engine Fuel System:**
 1. **Main Fuel Pump:** Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 2. **Relief-Bypass Valve:** Automatically regulates pressure in fuel line and returns excess fuel to source.
 3. **Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:**
 - a. **Carburetor.**
 - b. **Secondary Gas Regulators:** One for each fuel type.
 - c. **Fuel-Shutoff Solenoid Valves:** One for each fuel source.
 - d. **Flexible Fuel Connectors:** One for each fuel source.
- F. **Coolant Jacket Heater:** Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.
- G. **Governor:** Adjustable isochronous, with speed sensing.
- H. **Cooling System:** Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 2. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 25 dB at 500 Hz.
 2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be [85] <Insert number> dBA or less.
- J. Muffler/Silencer: Residential type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 18 dB at 500 Hz.
 2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 95 dBA or less.
- K. Muffler/Silencer: Industrial type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 12 dB at 500 Hz.
 2. Sound level measured at a distance of 25 feet (8 m) from exhaust discharge after installation is complete shall be 87 dBA or less.
- L. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- M. Starting System: 24-V electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.
 5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 - a. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236.

2.4 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
2. Capacity: Fuel for 48 hours' continuous operation at 100 percent rated power output.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction.

2.5 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.
- D. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 2 system, and the following:
 1. AC voltmeter.
 2. AC ammeter.
 3. AC frequency meter.
 4. DC voltmeter (alternator battery charging).
 5. Engine-coolant temperature gage.
 6. Engine lubricating-oil pressure gage.
 7. Running-time meter.
 8. Ammeter-voltmeter, phase-selector switch(es).
 9. Generator-voltage adjusting rheostat.
 10. Fuel tank derangement alarm.
 11. Fuel tank high-level shutdown of fuel supply alarm.
 12. Generator overload.
- E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
 1. Overcrank shutdown.
 2. Coolant low-temperature alarm.
 3. Control switch not in auto position.
 4. Battery-charger malfunction alarm.
 5. Battery low-voltage alarm.

- G. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with NEMA AB 1 and UL 489.
 - 1. Tripping Characteristic: Designed specifically for generator protection.
 - 2. Trip Rating: Matched to generator rating.
 - 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 - 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
 - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
 - 2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- C. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.
 - 1. AC lighting system and connection point for operation when remote source is available.
 - 2. DC lighting system for operation when remote source and generator are both unavailable.
- D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.9 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
 - 1. Material: Natural rubber.
 - 2. Durometer Rating: 50.
 - 3. Number of Layers: Two.
- B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
 - 2. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install packaged engine generator with restrained spring having a minimum deflection of **1 inch (25 mm)** on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
 - 1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Section 232113 "Hydronic Piping."
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- F. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- G. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- H. Connect engine exhaust pipe to engine with flexible connector.
- I. Connect fuel piping to engines with a gate valve and union and flexible connector.
 - 1. Natural-gas piping, valves, and specialties for gas distribution are specified in Section 231123 "Facility Natural-Gas Piping."
 - 2. LP-gas piping, valves, and specialties for gas piping are specified in Section 231126 "Facility Liquefied-Petroleum Gas Piping."
- J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- L. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 - 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
 - 7. Exhaust Emissions Test: Comply with applicable government test criteria.
 - 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
 - 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 - 10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- C. Coordinate tests with tests for transfer switches and run them concurrently.

- D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- E. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- F. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- G. Remove and replace malfunctioning units and retest as specified above.
- H. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- I. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes automatic transfer switches rated 600 V and less.

1.2 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based.
- B. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 70.
- D. Comply with NFPA 99.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Contactor Transfer Switches:
 - b. AC Data Systems, Inc.
 - c. Caterpillar; Engine Div.
 - d. Emerson; ASCO Power Technologies, LP.
 - e. Generac Power Systems, Inc.
 - f. GE Zenith Controls.
 - g. Kohler Power Systems; Generator Division.
 - h. Onan/Cummins Power Generation; Industrial Business Group.
 - i. Russelectric, Inc.
 - j. Spectrum Detroit Diesel.
 - k. Transfer Switches Using Molded-Case Switches or Circuit Breakers:
 - l. AC Data Systems, Inc.
 - m. Eaton Electrical Inc.; Cutler-Hammer.
 - n. GE Zenith Controls.
 - o. Hubbell Industrial Controls, Inc.
 - p. Lake Shore Electric Corporation.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated, provide overlapping neutral contacts.
- H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- J. Battery Charger: For generator starting batteries.
 - 1. Float type rated 10 A.
 - 2. Ammeter to display charging current.
 - 3. Fused ac inputs and dc outputs.
- K. Enclosures: General-purpose NEMA 250, Type 4X, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.

- F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
- G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.
- H. Automatic Transfer-Switch Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 - 2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
 - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 - 4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - 5. Test Switch: Simulate normal-source failure.
 - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 - 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
 - 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
 - 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
 - 11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
 - 12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 - 13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
 - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.

- b. Push-button programming control with digital display of settings.
- c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Floor-Mounting Switch: Anchor to floor by bolting.
 - 1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- C. Identify components according to Section 260553 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
 6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION

SECTION 26 41 13

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes lightning protection for structure elements and building site components.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For air terminals and mounting accessories.
 - 1. Layout of the lightning protection system, along with details of the components to be used in the installation.
 - 2. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Certified by UL, trained and approved for installation of units required for this Project.
- B. System Certificate:
 - 1. UL Master Label.
 - 2. LPI System Certificate.
 - 3. UL Master Label Recertification.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96 and NFPA 780.
- B. Roof-Mounted Air Terminals: NFPA 780, Class I, copper unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. East Coast Lightning Equipment Inc.
 - b. ERICO International Corporation.
 - c. Harger.
 - d. Heary Bros. Lightning Protection Co. Inc.
 - e. Independent Protection Co.
 - f. Preferred Lightning Protection.
 - g. Robbins Lightning, Inc.
 - h. Thompson Lightning Protection, Inc.
 3. Air Terminals More than 24 Inches (600 mm) Long: With brace attached to the terminal at not less than half the height of the terminal.
 4. Single-Membrane, Roof-Mounted Air Terminals: Designed specifically for single-membrane roof system materials. Comply with requirements in roofing Sections.
- C. Main and Bonding Conductors: Copper.
- D. Ground Loop Conductor: The same size and type as the main conductor except tinned.
- E. Ground Rods: **Copper-clad steel, sectional type; 3/4 inch (19 mm) in diameter by 10 feet (3 m) long.**

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Conceal the following conductors:
1. System conductors.
 2. Down conductors.
 3. Interior conductors.
 4. Conductors within normal view of exterior locations at grade within 200 feet (60 m) of building.
- C. Cable Connections: Use crimped or bolted connections for all conductor splices and connections between conductors and other components. Use exothermic-welded connections in underground portions of the system.
- D. Cable Connections: Use exothermic-welded connections for all conductor splices and connections between conductors and other components.
1. Exception: In single-ply membrane roofing, exothermic-welded connections may be used only below the roof level.
- E. Air Terminals on Single-Ply Membrane Roofing: Comply with roofing membrane and adhesive manufacturer's written instructions.

- F. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.
- G. Ground Loop: Install ground-level, potential equalization conductor and extend around the perimeter of **area or item indicated**.
 - 1. Bury ground ring not less than **24 inches (600 mm)** from building foundation.
 - 2. Bond ground terminals to the ground loop.
 - 3. Bond grounded building systems to the ground loop conductor within 12 feet (3.6 m) of grade level.
- H. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

3.2 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.3 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

- A. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- B. UL Inspection: Meet requirements to obtain a UL Master Label for system.
- C. LPI System Inspection: Meet requirements to obtain an LPI System Certificate.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.
5. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.
3. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
4. Section 265561 "Theatrical Lighting" for theatrical lighting fixtures and their controls.

1.2 ACTION SUBMITTALS

- A. Product Data:** For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.
- B. Shop Drawings:** Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. **Product Certificates:** For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.**

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Diffusers and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least **0.125 inch (3.175 mm)** minimum unless otherwise indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
- I. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Section 233713 "Diffusers, Registers, and Grilles."
 - 1. Air-Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
 - 2. Heat-Removal Units: Air path leads through lamp cavity.
 - 3. Combination Heat-Removal and Air-Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air-supply units.
 - 4. Dampers: Operable from outside fixture for control of return-air volume.
 - 5. Static Fixture: Air-supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 or higher.
10. Power Factor: 0.95 or higher.

B. luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

D. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

E. Ballasts for Low-Temperature Environments: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

F. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.

G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

I. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 30 and 50 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.95 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Nightlight Connection: Operate one fluorescent lamp continuously.
 3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
 3. Lamp end-of-life detection and shutdown circuit.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 20 percent.
 6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: 0.90 or higher.
 9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 10. Protection: Class P thermal cutout.
- C. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

2.7 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
 2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.

- c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.8 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
 - 7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.9 FLUORESCENT LAMPS

- A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.
- B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.
- C. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
 - 7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

2.10 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80 , and color temperature 4000 K.
- E. Low-Pressure Sodium Lamps: ANSI 78.41, CRI 0, and color temperature 1800 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, **12 gage (2.68 mm)**.
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

- A. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.
- B. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
- C. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
 1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is **145 mph**.
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 50 years.
 - c. Velocity Conversion Factors: 1.0.
 2. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is **145 mph**.
 - a. Wind Importance Factor: 1.0.
 - b. Minimum Design Life: 25 years.
 - c. Velocity Conversion Factors: 1.0.

1.3 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - 2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
 - 3. LED Fixtures: ANSI C78.62612-2018 American National Standard for Electric Lamps—Self-Ballasted LED Lamps
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
 2. Specular Surfaces: 83 percent.
 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: Dark bronze.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
 - a. "USES ONLY" and include specific lamp type.
 - b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.

- c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
- d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
- e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
- f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 FLUORESCENT BALLASTS AND LAMPS

- A. Ballasts for Low-Temperature Environments:
 - 1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - 2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
- B. Ballast Characteristics:
 - 1. Power Factor: 90 percent, minimum.
 - 2. Sound Rating: Class A.
 - 3. Total Harmonic Distortion Rating: Less than 10 percent.
 - 4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
 - 5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
 - 6. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
- C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures **0 deg F (minus 18 deg C)** and higher.

2.5 BALLASTS FOR HID LAMPS

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
 - 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 - 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
 - 3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 - 4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

- B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

2.6 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), CCT color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 - 1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Low-Pressure Sodium Lamps: ANSI C78.43.
- C. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.
- D. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.
- E. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.7 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.8 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: Square, straight.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if

- present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: **As indicated by manufacturer's designations.**

2.9 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
 1. Shape: Square, straight.
 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
 2. Finish: Same as pole.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: Dark bronze.

2.10 WOOD POLES

- A. Poles: Southern yellow pine complying with ANSI O5.1 and with AWPA C4 for wood species used; and bored, roofed, and gabled before treatment.
 - 1. Mounting Provisions: Embedded.
- B. Preservative Treatment: Pressure treat poles with creosote according to AWPA C1 and AWPA C4.
- C. Luminaire Brackets: Comply with ANSI C136.13.

2.11 POLE ACCESSORIES

- A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Section 262726 "Wiring Devices" for ground-fault circuit-interrupter type.
 - 1. Recessed, **12 inches (300 mm)** above finished grade.
 - 2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, Insert color to match pole, that when mounted results in NEMA 250, Type 4X enclosure.
 - 3. With cord opening.
 - 4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.
- B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.
- C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast(s) indicated accessories.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: **60 inches (1520 mm)**.
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: **10 feet (3 m)**.
 - 3. Trees: **15 feet (5 m)** from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Dig holes large enough to permit use of tampers in the full depth of hole.
 - 2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 - 3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 - 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top **4 inches (100 mm)** above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top **4 inches (100 mm)** above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

END OF SECTION

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

- A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.**

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance:** Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data:** For each type of product indicated.
- B. Shop Drawings:** For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.

5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data, deliver copies to authorities having jurisdiction and include the following:
 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.

- d. Manufacturer's user training manuals.
 - 5. Manufacturer's required maintenance related to system warranty requirements.
 - 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
- 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. AMSECO - a Potter brand; Potter Electric Signal Company.
2. Bosch Security Systems.
3. Commercial Products Group/CPG Life Safety Signals.
4. Faraday; Siemens Building Technologies, Inc.
5. Federal Signal Corporation.
6. Fire Control Instruments, Inc.; a Honeywell company.
7. Fire Lite Alarms; a Honeywell company.
8. GAMEWELL; a Honeywell company.
9. GE Infrastructure; a unit of General Electric Company.
10. Gentex Corporation.
11. Harrington Signal, Inc.
12. NOTIFIER; a Honeywell company.
13. Siemens Building Technologies, Inc.; Fire Safety Division.
14. Silent Knight; a Honeywell company.
15. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Heat detectors in elevator shaft and pit.
7. Fire-extinguishing system operation.
8. Fire standpipe system.

- B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm-notification appliances.
2. Identify alarm at the fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Recall elevators to primary or alternate recall floors.
8. Activate emergency lighting control.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

- C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 2 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
 2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Initiating Device Circuits: Style A.
 - b. Notification Appliance Circuits: Style W.
 - c. Signaling Line Circuits: Style 4.
 - d. Install no more than 50 addressable devices on each signaling line circuit.

- D. Notification Appliance Circuit: Operation shall sound.
- E. Elevator Recall:
 - 1. Smoke detectors at the following locations shall initiate automatic elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 - 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, plastic-rod type. With integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Station Reset: Key- or wrench-operated switch.

4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.6 NONSYSTEM SMOKE DETECTORS

A. Single-Station Smoke Detectors:

1. Comply with UL 217; suitable for NFPA 101, residential occupancies; operating at 120-V ac with 9-V dc battery as the secondary power source. Provide with "low" or "missing" battery chirping-sound device.
2. Auxiliary Relays: One Form A and one Form C, both rated at 0.5 A.
3. Audible Notification Appliance: Piezoelectric sounder rated at 90 dBA at 10 feet (3 m) according to UL 464.
4. Visible Notification Appliance: 177-cd strobe.
5. Heat sensor, 135 deg F (57 deg C) combination rate-of-rise and fixed temperature.
6. Test Switch: Push to test; simulates smoke at rated obscuration.
7. Tandem Connection: Allow tandem connection of number of indicated detectors; alarm on one detector shall actuate notification on all connected detectors.
8. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
9. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
10. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Single-Station Duct Smoke Detectors:

1. Comply with UL 268A; operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.
 - a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of **135 deg F (57 deg C)** or a rate of rise that exceeds **15 deg F (8 deg C)** per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of **190 deg F (88 deg C)**.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, red.

2.9 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - 1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 - 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - 3. Rating: 24-V ac or dc.
 - 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.10 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.

- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Comply with requirements for concrete base specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."
 - 1. Install seismic bracing. Comply with requirements in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- E. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of the building.
 - 2. Connect new equipment to existing monitoring equipment at the supervising station.
 - 3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- F. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - 3. Smooth ceiling spacing shall not exceed **30 feet (9 m)**.

4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 5. HVAC: Locate detectors not closer than **5 feet (1.5 m)** from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- H. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- I. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- J. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- K. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- L. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
- M. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- N. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- O. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 2. Alarm-initiating connection to elevator recall system and components.
 3. Alarm-initiating connection to activate emergency lighting control.

4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
5. Supervisory connections at valve supervisory switches.
6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
7. Supervisory connections at elevator shunt trip breaker.
8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
9. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

END OF SECTION

DIVISION 31 EARTHWORKS

SECTION 31 1100
CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removal of surface debris, paving and curbs.
 - 2. Removal of plant life and grass.
 - 3. Grubbing roots.
 - 4. Topsoil excavation.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 31 2200 - Grading.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 SITE CLEARING

- A. Remove vegetation, debris, and obstructions from areas of structures, walks, paving and planting beds.
- B. Apply herbicide to remaining stumps and plant life to inhibit growth.
- C. Strip existing topsoil from areas of structures, walks, and paving. Stockpile on site for reuse as needed as specified in Section 31 2200 or remove from site.
- D. Grub out roots and underground obstructions to minimum depth of 12 inches.
- E. Remove waste material from site as it accumulates. Comply with applicable codes and ordinances regarding waste transportation and disposal.

END OF SECTION

SECTION 31 13 00

SELECTED TREE AND SHRUB REMOVAL AND TRIMMING

PART 1 - GENERAL

1.1 SCOPE

- A. Work includes the felling or removal by tree spade of trees or larger shrubs designated in the contract to be removed from the project site, and related work as indicated in the drawings.

1.2 RELATED WORK

- A. Applicable provisions of Division 1 shall govern all work under this section.
- B. Dimensions: Tree caliper measurements shall be taken 54" (1.4 m) above ground level.
- C. Related Work Specified Elsewhere:
 - 1. Section 32 93 00 – Trees, Shrubs, And Ground Cover

1.3 REFERENCES

- A. Tree limbs shall be pruned according to current American National Standards for Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance-Standard Practices.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. As specified on drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Mechanical diggers shall be in good operating condition, with properly aligned, sharpened and damage-free blades. Hydraulic systems shall be free of leaks.
- B. For trees up to 10" (25.4 cm) caliper, the tree spade size used should allow a minimum root area equivalent of 9-10" (22.9-25.4 cm) of soil per inch of trunk diameter. (Example: A 4" caliper tree should be dug with a 40" tree spade.)

3.2 FELLING

- A. Fell trees to prevent damage to adjacent structures and to those trees and shrubs designated to remain. Remove stumps and roots to a clear depth of 36" (0.9 m) below existing grades in areas of lawn, and to full depth in areas of paving, building footings, or utility structures.

3.3 PRUNING

- A. Only those branches of existing trees that interfere in some way with the Contractor's operations, or with the spading operation are to be pruned.
- B. Pruning shall be performed by a certified arborist or tree surgeon.
- C. Where necessary, repairs to damaged wood shall be performed under the direction of the Owner, or a certified arborist.
- D. Evergreens shall only be pruned to remove dead, broken or damaged branches.
- E. Perform pruning using scissors-style cutting devices, and not anvil-style handpruners, pole pruners or loppers.

3.4 DIGGING

- A. To minimize soil compaction, damage from tires, etc., the Contractor shall lay down wood planking as surface protection during tree spade operations.
- B. In preparing a tree for removal by tree spade, branches are to be tied up or down to allow access by spade. Presoaking the area around the tree for 24-48 hours prior to removal is advisable. Two to three hours prior to transplanting spray tree to run-off with an approved anti-transpirant at a 1:10 dilution rate.
- C. Remove weeds and excess topsoil from the rootball prior to removal. Match the size of the rootball with the hole dug for transplanting.
- D. Spade blades are to be dropped one at a time, alternating one side with the other to ensure even penetration. After lifting tree, cut any roots protruding from spades with sharp hand tools.

3.5 TRANSPORT

- A. Prior to transporting, wrap tarp around both the upper portion of tree to prevent moisture loss from leaves and stems and around the bottom of the rootball.

3.6 CLEANING

- A. All trimmed branches and other debris shall be removed from the site by the Contractor at the end of each work day.

END OF SECTION

SECTION 31 2200

GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cutting and grading of site.
 - 2. Topsoil placement.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 31 1100 - Clearing and Grubbing.

1.2 SUBMITTALS

- A. Submittals:
 - 1. Fill Material classification and origin.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Stockpiled on site material, specified in Section 31 1100 [supplemented by off site material if required].
 - 2. Off site materials: Natural friable loam of region, free of clay, toxic substances, large or matted roots, debris, excess weeds, and rocks over 1 inch in any dimension.

PART 3 EXECUTION

3.1 CUTTING AND GRADING

- A. Excavate subsoil to permit placement of structures, paving, and site improvements, and from areas to be regraded.
- B. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level areas.
- C. Leave areas to receive topsoil 4 inches below final required grade.
- D. Tolerances: Within plus or minus 1 inch of required subgrade elevation.

3.2 TOPSOIL PLACEMENT

- A. Place topsoil to 4 inch depth over areas modified by work of this Contract that are not covered by planting beds, structures or paving.
- B. Uniformly distribute to required grades; feather back to where grades remain unchanged.

- C. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level areas.
- D. Remove rubbish, debris, vegetation, and concentrations of rocks. Rake areas smooth; leave suitable for seeding or sodding.

3.3 CLEANING

- A. Remove surplus materials and those not suitable for reuse from site.

3.4 PROTECTION

- A. Protect graded areas from traffic and erosion; keep free of trash and debris.
- B. Repair settled, eroded, or rutted areas.

END OF SECTION

SECTION 31 2300

EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating for structures and site components.
 - 2. Filling.
 - 3. Trenching.
 - 4. Backfilling.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - 3. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - 4. D2487 - Standard Classification of Soils for Engineering Purposes.
 - 5. D2922 - Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. D4254 - Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
 - 7. D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SYSTEM DESCRIPTION

- A. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on Drawings or reasonably necessary for performance of Work.
- B. Contractor is responsible for design of temporary earth retention systems.

1.4 SUBMITTALS

- A. Submittals:
 - 1. Fill Material classification and origin.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Engineered Fill:
 - 1. Type: Granular Material
 - 2. Tested to ASTM D4318, classified as Type GC in accordance with ASTM D2487 and Type A-2-4 in accordance with AASHTO.
 - 3. Free from trash, debris, roots over 1 inch in diameter, matted roots, rocks over 3 inches in diameter, topsoil, and other deleterious matter.

2.2 SOURCE QUALITY CONTROL

- A. Testing and Inspection Services: Test Engineered Fill prior to placement:
 - 1. Liquid limit, plastic limit, and plasticity index: Test to ASTM D4318.
 - 2. Moisture/density relationship: Test to ASTM D698.
 - 3. Provide soil description; determine compliance with gradation and quality requirements.

PART 3 EXECUTION

3.1 EXCAVATING

- A. Excavate to grades and subgrades indicated. Make excavations large enough to permit placing and inspection of work.
- B. Stockpile excavated materials that are suitable for reuse separately from subgrade material.
- C. Remove and dispose of excavated material that is unsuitable or not required for backfilling. Remove underground obstructions.
- D. Brace sides of excavations where necessary; maintain until permanent construction is in place. Remove temporary shoring and bracing as backfill is placed.
- E. Excavation for Structures:
 - 1. Form bottoms of excavations reasonably level.
 - 2. Maintain moisture level in excavations as near their natural level as possible.
- F. Correct over-excavation under footings by use of lean concrete. Correct other over-excavation by use of Engineered Fill, compacted to density of existing subgrade.
- G. Keep excavations free of water.

3.2 FILLING

- A. Prior to placing fill on existing subsoils:
 - 1. Proof roll to detect soft and weak zones. Remove soft and spongy soils down to firm subsoil.
 - 2. Replace undercut areas with Engineered Fill placed in maximum 12 inch deep loose, even, horizontal lifts. Compact each lift to 95 percent of ASTM D1557 modified Proctor maximum dry density.
- B. Fill low areas outside of structures and under paving with Engineered Fill to achieve required grades and elevations.
 - 1. Place fill in maximum 12 inch deep loose, even, horizontal lifts.
 - 2. Compact each lift to 95 percent of ASTM D1557 modified Proctor maximum dry density.
- C. Fill under structures with Engineered Fill.
 - 1. Place fill in maximum 12 inch deep loose, even, horizontal lifts.
 - 2. Compact each lift to 95 percent of ASTM D1557 modified Proctor maximum dry density.
- D. Do not fill over porous, wet, frozen, or soft subgrades.
- E. Bench fill into slopes.
- F. When moisture must be added to aid in compaction, uniformly apply water to surface, but do not flood. Free water shall not appear on surface during or after compaction operations.

- G. Scarify soil too wet for proper compaction and allow to dry. Replace and recompact.
- H. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level grades.
- I. Tolerances: Within plus or minus 1 inch of required subgrade elevation.

3.3 TRENCHING

- A. Cut trenches sufficiently wide to allow for installation of utilities and for inspection of work.
- B. Hand trim excavations; remove loose matter.
- C. Remove rocks and obstructions.
- D. Correct over-excavation by use of lean concrete or pipe bedding material.
- E. Keep trenches free of water.

3.4 BACKFILLING

- A. Backfill under structures with Fill material AASHTO A-2-4.
 - 1. Place backfill in loose, even, horizontal lifts maximum 12 inches deep.
 - 2. Compact each lift to 95 percent of ASTM D1557 modified Proctor maximum dry density.
- B. Backfill outside of structures and under paving with Fill material AASHTO A-2-4.
 - 1. Place backfill in loose, even, horizontal lifts maximum 12 inches deep.
 - 2. Compact each lift to 95 percent of ASTM D1557 modified Proctor maximum dry density. .

3.5 FIELD QUALITY CONTROL

- A. Testing and Inspection Services: Perform field in place density tests, ASTM D2922, at following rates; minimum of three tests for each lift or area:
 - 1. Under structures: One test for each 270 square feet, per lift.
 - 2. Under paving: Minimum two tests for each paved area, or every 10,000 square feet.
 - 3. Trenches, below grade walls, retaining walls, grade beam backfill: One test for the first 100 linear feet, per lift, then one test every 250 linear feet, per lift.

3.6 CLEANING

- A. Remove surplus materials and those not suitable for reuse from site.

3.7 PROTECTION

- A. Protect graded areas from traffic and erosion; keep free of trash and debris.

END OF SECTION

SECTION 31 2316

TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

- A. Section 31 22 00 - Grading: Site grading.
- B. Section 31 23 00 – Excavation and Fill: Building and foundation excavating and backfilling at building and foundations

1.03 REFERENCES

- A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2000a.
- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2002.
- F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994(R 2001).
- G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
- I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: Indicated on drawings.

1.05 SUBMITTALS

- A. Materials Sources: Submit name of imported materials source.
- B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- C. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

- A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
- C. Verify that survey bench marks and intended elevations for the Work are as indicated.
- D. Protect plants, lawns, rock outcroppings, and other features to remain.
- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill - Fill Type A-2-4: Imported borrow.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
- B. Granular Fill - Gravel - Fill Type A-1: Pit run washed stone; free of shale, clay, friable material and debris.
- C. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- D. Topsoil: See Section 32 91 13.
- E. Topsoil: Topsoil excavated on-site.
 - 1. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.

2.02 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage.

3.02 TRENCHING

- A. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- C. Do not interfere with 45 degree bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.
- F. Remove large stones and other hard matter which could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Stockpile excavated material to be re-used in area designated on site.
- I. Remove excess excavated material from site.
- J. If water is encountered during trenching dewatering procedure must be performed. Refer to specs 32 23 19.

3.03 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.

- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 12 inches compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 12 inches compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 ft (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 95 percent of maximum dry density.
 - 2. At other locations: 95 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use general fill unless otherwise specified or indicated.
- B. Utility Piping, Conduits, Duct Bank:
 - 1. Bedding: Use sand.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.
- C. At Pipe Culverts:
 - 1. Bedding: Use sand.
 - 2. Place filter fabric if specified over compacted bedding.
 - 3. Cover with general fill.
 - 4. Fill up to subgrade elevation.
 - 5. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

3.06 TOLERANCES

- A. Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (25 mm) from required elevations.

3.07 FIELD QUALITY CONTROL

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.
- B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.08 CLEAN-UP

- A. Leave unused materials in a neat, compact stockpile.
- B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 23 17

EXCAVATION AND DISPOSAL OF CONTAMINATED SOILS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Drawings apply to this Section.
 - 2. Excavating for site components inside SWMU's areas.
 - 3. Filling.
 - 4. Trenching.
 - 5. Backfilling.
 - 6. Reference Document; "Measures to be implemented on Affected SWMUs and AOCs" (Additional information regarding each SWMU's)
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Division 02: Removal and Disposal of Contaminated Soil
 - 3. Division 31: Earthworks

1.2 DEFINITIONS

- A. Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.
- B. Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).
- C. Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

1.3 SYSTEM DESCRIPTION

- A. This section includes specifications for excavating, handling, stockpiling, temporarily storing, and/or disposing of existing contaminated material (e.g., soil, water, debris) either known or unknown to exist that may be encountered during the work. This section includes preparation of a Site Specific Health and Safety Plan (HASP). Hazardous materials include those defined in the General Conditions. This section also includes procedures applicable to Contractor's generation, use, and/or release of hazardous or contaminated substances in the course of Contractor's operation, for which Contractor is responsible under the General Conditions.
- B. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on Drawings or reasonably necessary for performance of Work.
- C. Potentially hazardous materials, contaminated soils and/or water, will be encountered during the work that may require excavation, handling, stockpiling, temporary storing, and disposal. The Contractor shall manage these materials in compliance with applicable statutes and regulations.
- D. Potential contaminants that may be encountered include Vanadium, Arsenic, Chromium, Zinc, PAHs (dibenzo(a,h)anthracene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, in-deno(1,2,3-cd)pyrene)), Cobalt, PCB, TPH-DRO & TPH-GRO and volatile organic compounds (VOCs).
- E. The extent of known contaminated materials and the types of known contaminants are provided in reference information. Notify the Engineer immediately if contaminated substances are discovered that were not previously

identified or assumed, or if other discrepancies between data provided and actual field conditions are discovered.

- F. Conduct work in accordance with direction received from the Engineer; with the accepted HASP; and with applicable federal, state, and local statutes, regulations, and guidance.
- G. Contractor shall be responsible for the collection, sampling (for permit compliance or disposal facility requirements), treatment (if necessary), and disposal of water (sump water and dewatering effluent). Water disposal may be permitted for sewer discharge or taken offsite for disposal at licensed facility.
- H. Samples. Physical examples that illustrate materials, equipment, or workmanship and establish standards by which the work will be judged.
- I. Environmental data provided as reference information.

1.4 SUBMITTALS

- A. Site Specific Health and Safety Plan (HASP):
 - 1. Submit three copies of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1910.120 at least 14 days prior to mobilization FOR EACH AFFECTED SWMUs, see reference information regarding "Measures to be implemented on Affected SWMUs and AOCs". Do not commence excavation work until this plan is received, reviewed, and approved by the U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:
 - a. Introduction
 - b. Workplan and Scope of Work
 - c. Subcontractor Project and Field Team Management
 - d. Sampling and analysis
 - e. Detailed Site and Task Hazard Analyses addressing
 - 1) Physical Hazards
 - 2) Chemical Hazards
 - f. Hazard Control
 - g. Site Control
 - h. Contaminated Material Handling Plan
 - i. Personal Protective Equipment and Respiratory Protection
 - j. Emergency Plan
 - k. Training
 - l. Medical Surveillance
- B. Quality Assurance Submittals:
 - 1. Submit three copies of the following:
 - a. Submit qualifications of the task supervisor and the person conducting environmental water sampling for discharge to sanitary sewer.
 - b. Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
 - c. Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.
 - d. Personnel working with hazardous material and substances shall have received training and have experience for the work to be performed.
 - e. Contractor and subcontractor personnel assigned for the purpose of performing or supervising hazardous materials work in accordance with the provisions of the Health and Safety Plan (HASP), above Level D protection, shall have received appropriate safety training in compliance with 29 CFR 1910.120, 29 CFR 1910.134, and WAC 296-62. Minimum of 40 hours health and safety training, 24 hours of "on the job" training, 8 hours annual refresher training, and annual medical monitoring by an occupational physician is required. Minimum of 8 hours additional specialized training in managing hazardous waste operations is required for supervisory personnel. Workers without current certification will not be allowed to enter the Exclusion Zone.
 - f. Comply with the medical surveillance program requirements of OSHA standards 29 CFR 1910.120, 29 CFR 190.134, and WAC 296-62-300. Provide documentation that personnel have received medical examinations and are certified for respirator use (if necessary) within the last 12 months, and are cleared to work on hazardous sites before entering an Exclusion Zone or contacting hazardous materials.

- C. Responsibilities:
1. Site Safety and Health Officer:
 - a. Required to be on site and present during hazardous and/or contaminated substance Work to be completed by Contractor
 - b. Responsible for the development, implementation, enforcement, and monitoring of the work in accordance with the HASP
 - c. Responsible for conducting the pre-construction training, pre-entry briefings, and other periodic training of onsite personnel with regard to contents of the HASP and other safety requirements to be observed during construction.
 - d. Responsible for performing air monitoring as required by the HASP.

1.5 GENERAL REQUIREMENTS

- A. Potentially hazardous materials, contaminated soils and/or water, will be encountered during the work that may require excavation, handling, stockpiling, temporary storing, and disposal. The Contractor shall manage these materials according to reference information regarding to "Measures to be implemented on Affected SWMUs and AOCs" and in compliance with applicable statutes and regulations.
- B. Potential contaminants that may be encountered includes Vanadium, Arsenic, Chromium, Zinc, PAHs (dibenzo(a,h) anthracene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, in-deno(1,2,3-cd)pyrene)), Cobalt, PCB, TPH-DRO & TPH-GRO and volatile organic compounds (VOCs).
- C. The extent of known contaminated materials and the types of known contaminants are provided in reference information (Measures to be implemented on Affected SWMUs and AOCs). Notify the Engineer immediately if contaminated substances are discovered that were not previously identified or assumed, or if other discrepancies between data provided and actual field conditions are discovered.
- D. Instruments such as a photoionization detector (PID), flame ionization detector (FID), or other air monitoring equipment should be used in conjunction with health and safety monitoring for determining potential impacts to media.
- E. Conduct work in accordance with direction received from the Engineer; with the accepted HASP; and with applicable federal, state, and local statutes, regulations, and guidance.
- F. Obtain all required permits and notifications for removal (excavation/dewatering), storage, transportation, and disposal of contaminated material, including sanitary sewer discharge.
- G. Contractor shall be responsible for the collection, sampling (for permit compliance or disposal facility requirements), treatment (if necessary), and disposal of water (sump water and dewatering effluent) if encounter during excavation procedures. Water disposal may be permitted for sewer discharge or taken offsite for disposal at licensed facility.
- H. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
- I. When fill materials need to be stored on site, locate stockpiles where indicated.
 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 2. Prevent contamination.
 3. Protect stockpiles from erosion and deterioration of materials.
- J. Verify that survey bench marks and intended elevations for the Work are as indicated.
- K. Protect plants, lawns, rock outcroppings, and other features to remain.
- L. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 - PRODUCTS

2.1 DECONTAMINATION MATERIAL

- A. Contractor shall provide facilities for equipment, tool, and personnel decontamination for the duration of the work.

2.2 STAGING MATERIAL

- A. Geomembranes to be used as liner or material cover shall be chemical resistant, reinforced, and leak proof, with minimum thickness of 10 mils.

PART 3 - EXECUTION

3.1 GENERAL

- A. The workers' health and safety is the Contractors sole responsibility.
- B. If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor suspects or encounters apparent soil or groundwater contamination at the site based on visual discoloration observations, sheen or presence of chemical smell, the Contractor shall immediately take the necessary steps to ensure worker health and safety. The Contractor shall stop work activity, safely secure work area, and immediately notify the LRA & U.S. Navy Project Manager or designated representative.
- C. Upon notification by Contractor, the LRA Project Manager will investigate to confirm the nature and extent of the apparent contamination and will notify the Subcontractor of the results.
- D. If contamination levels are confirmed above "Screening Levels" (see reference documents, Measures to be implemented on Affected SWMUs and AOCs) , the Contractor shall proceed pursuant to 29CFR1910.120, Hazardous Waste Operations and Emergency Response. For purposes of this requirement, Screening Levels means risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. Screening Levels are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. When target or suspected contaminants are detected to be present but at levels less than Screening Levels, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- E. If suspected contaminated soils or groundwater are encountered the Contractor shall rearrange the schedule as necessary, proceed to the next designated work location and continue overall job progress without delay.

3.2 CONTAMINATED SOILS REMOVAL, HANDLING AND STORAGE

- A. Conduct all work according to approved HASP as described in reference document; Measures to be implemented on Affected SWMUs and AOCs.
- B. Strip and stockpile overburden and cut soil separately from contaminated material, in areas of contamination considered to be below action levels based on contamination screening or testing. Contractor shall be responsible for protecting this material from becoming contaminated. This may include covering the soil with plastic sheeting. Such soil that becomes contaminated as a result of Contractor activities shall be disposed of at Contractor's expense.
- C. In areas where contamination is suspected, Contractor shall place soil in staging areas for disposal characterization by the Engineer.
- D. Excavation shall be performed in a manner to limit the potential for contaminated material to mix with uncontaminated material. The Contractor shall maintain an excavation of sufficient size to allow workers ample room to complete the work. Additional screening, excavation, and sampling may be required based on analytical results. The Contractor shall assist the Engineer with soil sample collection (e.g., sample collection from the excavator bucket). If required, additional soil sample collection and chemical analyses will be performed by the Engineer.
- E. Construction debris (man-made materials such as metal, plastic, glass, concrete, asphalt, bricks, and wood products larger than 2 inches) encountered below grade during excavation (overburden or cut material) shall be separated from soil by use of a physical screen or rough brushing, and stored in a separate stockpile. The stockpiled and separated overburden and cut material may be reused as backfill based on chemical testing results and geotechnical suitability, as determined by the Engineer.
- F. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests, and associated disposal notices and notifications necessary for accomplishment of the work.

- G. Provide documentation of proper disposal or treatment to the Engineer.
- H. Place contaminated soils in properly labeled drums or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location assigned by the LRA.
 - 1. Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
 - 2. Secure drum closures and cover and tarp soil containers;
 - 3. Label containers as specified by University at the time of accumulation.
 - 4. Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.). Contractor shall maintain, and operators of motorized equipment shall possess, validation of proper training unique to equipment used.

3.3 CONTAMINATED SOILS REUSE

- A. Site-Contaminated Soils: Contaminated soils excavated from the Project site shall not be reused as backfill. Backfill material must be the ones shown on drawings and Technical specs 31 23 00 "Excavation and Fill".

3.4 CONTAMINATED MATERIALS DISPOSAL

- A. Site-Contaminated Materials: Contaminated soils or other site-materials excavated from the Project site will be classified and disposed of by the Project Contractor.
- B. Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements. Provide materials for handling waste.

3.5 SAMPLING AND ANALYSIS

- A. Contractor Requirements
 - 1. Provide the Engineer with 24 hours advance notice prior to excavation and stockpiling activities and provide the Engineer with access to perform verification sampling.
 - 2. Sump water and dewatering shall be sampled and analyzed by the Contractor in accordance with disposal facility requirements, the CMMP, and Section 31 23 19 Site Water Control and Treatment. Notify the Engineer prior to water sampling and allow observation.
 - 3. The Contractor shall be aware and anticipate that up to 7 business days may be required between the collection of soil samples and completion of chemical laboratory analyses.
- B. Engineer Requirements
 - 1. The Engineer will inspect removal of existing contaminated material from each location. After suspected contaminated material is removed, confirmation samples from the excavation will be collected and analyzed by the Engineer. Based on test results, additional excavation may be required to remove material contaminated above action levels, as directed by the Engineer. Locations of samples shall be marked in the field and documented on the surveys and the as-built Drawings.
 - 2. Perform the required stockpile (contaminated, overburden, and cut) soil sampling and chemical analyses for determining onsite reuse or offsite disposal.

3.6 OFFSITE DISPOSAL OF HAZARDOUS MATERIAL

- A. Load contaminated material for offsite disposal.
- B. Provide transportation in accordance with Hazardous Material Regulations and federal, state, and local requirements, including obtaining necessary permits, licenses, and approvals. Evidence that a state-licensed transporter is being used shall be included in the submittals.
- C. Treatment, Disposal, and Recycling
 - 1. The treatment, disposal, and recycling of contaminated materials shall be in accordance with all applicable laws and regulations, and conditions specified herein. This work shall include all necessary personnel, labor, transportation, packaging, equipment, and reports.
 - 2. Contaminated soil can be treated or landfilled, with preference given to treatment.
 - 3. If soil is to be treated, transport contaminated soil to an approved licensed facility in accordance with applicable requirements:
 - a. The treatment facility must be approved by the Engineer. The Contractor shall make arrangements for transportation and treatment of the contaminated soil with the

- facility operator.
4. If landfilled, dispose of contaminated soil in a licensed landfill in accordance with applicable requirements:
 - a. The Subtitle D landfill must be approved by the Engineer. The Contractor shall make arrangements for transportation of the contaminated soil with the facility operator.
 5. If required, dispose of hazardous material classified as Dangerous Waste, in a Landfill approved by the Engineer.

Reference Document – Measures To be Implemented On Affected SWMUs and AOCs

MEASURES TO BE IMPLEMENTED ON AFFECTED SWMUs AND AOCs

Design Sheet ID (WDS)	VAIVES ID & PIPES	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C101	LV8-1	NO	51.12	SWMU 42			Do not perform construction staging on SWMU 42. No additional measures needed.	N/A
	LV8-3	NO	52.4	SWMU 42				
	LV8-4	NO	55.2	SWMU 42				
	PROPOSED REPAIR (L-1) ON PIPE TAPPING AT MANHOLE	NO	44.7	SWMU 42				
	LV8-9	NO	173.7	SWMU 42				
	LV8-10	NO	175.4	SWMU 42				
	MV8-7	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed.	N/A
	PROPOSED LEAKAGE REPAIR (L-2) ON AIR RELEASE VALVE AT MANHOLE	NO	FURTHER THAN 250 METERS	N/A				
	MV8-8	NO	FURTHER THAN 250 METERS	N/A				
C102	MV8-5	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed.	N/A
	MV8-3	NO	FURTHER THAN 250 METERS	N/A				
	MV8-2	NO	FURTHER THAN 250 METERS	N/A				
C103	MV86	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed.	N/A
	LV9-2	NO	FURTHER THAN 250 METERS	N/A				
	LH9-1	NO	FURTHER THAN 250 METERS	N/A				
	LV9-9	NO	FURTHER THAN 250 METERS	N/A				
	LH9-6	NO	247.8	SWMU 1			Do not perform construction staging on SWMU 1. No additional measures needed.	N/A
	REPLACEMENT OF 4" PVC LINE (LEAKAGE REPAIR L-3)	NO	234.5	SWMU 1				
	LV-XX	NO	229.5	SWMU 1				
	LV-XX	NO	233.7	SWMU 1				
	LH9-5	NO	183.4	SWMU 1				
	LV9-11	NO	174.7	SWMU 1				
	LH9-7	NO	226.9	SWMU 1				
	LV9-15	NO	227.1	SWMU 1				
	LV9-2	NO	93.21	SWMU 1				
	LV9-16	NO	86.8	SWMU 1				

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C104	LV9-17	NO	5	SWMU 1			Do not perform construction staging on SWMUs 1 & 71. No additional measures needed.	N/A
	LV9-18	NO	5	SWMU 1				
	LV9-19	NO	9.8	SWMU 1				
	LV9-22	NO	6.7	SWMU 1				
	LV9-23	NO	20	SWMU 1				
	LV9-24	NO	2.9	SWMU 1				
	KV9-2	NO	119/124	SWMU 1/ SWMU 71				
	KV10-1	YES	INSIDE	SWMU 71	Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	Vanadium, Arsenic, PAHs (dibenzo(a,h)anthracene, benzo(a)pyrene)	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 71".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 71".
	KV10-2	YES	INSIDE	SWMU 71	Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	Vanadium, Arsenic, PAHs (dibenzo(a,h)anthracene, benzo(a)pyrene)	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 71". Do not perform construction staging at and around well 71MW08 location area.	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 71".
C105	KV10-3	NO	100.7	SWMU 2			Do not perform construction staging on SWMUs 2 and 71. No additional measures needed.	N/A
	KH10-1	NO	68.6	SWMU 71				
	KV10-4	YES	INSIDE	SWMU 2	Ongoing investigation / Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	Cobalt	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 2".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 2".
	KV10-5	YES	INSIDE	SWMU 2				
	KV10-6	YES	INSIDE	SWMU 2				
	JV10-1	NO	247	SWMU 2			Do not perform construction staging on SWMU 2. No additional measures needed.	N/A
C106	JV11-1	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed.	N/A
	JV11-2	NO	FURTHER THAN 250 METERS	N/A				
	JV11-3	NO	FURTHER THAN 250 METERS	N/A				

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C112	JV-XX	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed.	N/A
	JV11-6	NO	FURTHER THAN 250 METERS	N/A				
	JV-XX	NO	FURTHER THAN 250 METERS	N/A				
	LV11-1	NO	FURTHER THAN 250 METERS	N/A				
	LH-XX	NO	234.9	SWMU 67			Do not perform construction staging on SWMU 67. No additional measures needed.	N/A
	LV11-2	NO	225.1	SWMU 67				
	LV-XX	YES	INSIDE	SWMU 67	None/CAC without Controls		No additional measures needed.	N/A
C113	LV11-7 & Replacement of 6" PVC Line	NO	62.8	SWMU 67			No additional measures needed.	N/A
	LH11-6 & Replacement of connecting line	NO	65.2	SWMU 67				
	LV11-9 & Replacement of 12" PVC Line	NO	110.9	SWMU 67				
	LV11-14	NO	125.6	SWMU 67				
	HV11-13	NO	138.2	SWMU 67				
	HV11-15	NO	179.1	SWMU 67				
	LV12-4	YES	INSIDE	SWMU 74	Ongoing investigation / Non-residential use	TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".
C114	LV12-3 & Replacement of 8" PVC Line	YES	INSIDE	SWMU 74				
	LV12-5	YES	INSIDE	SWMU 74				
	LV12-2 & Replacement of 6" PVC Line	YES	INSIDE	SWMU 74				
	LH12-4 & Replacement of 6" PVC Line	YES	INSIDE	SWMU 74				
	LH12-5 & Connecting Pipe Line	YES	INSIDE	SWMU 74				
	LV12-1 & Replacement of 8" PVC Line	YES	INSIDE	SWMU 74				
	LV13-5 & Replacement of 8" PVC Line	NO	8.3	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C115	LV13-3	NO	5.1	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	LV13-4	YES	INSIDE	SWMU 74/AOC F-1738	Ongoing investigation / Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	TPH-DRO & TPH-GRO / Total TPH & MtBE	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 & AOC F-1738".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 & AOC F-1738".
	LV13-2	YES	INSIDE	SWMU 74	Ongoing investigation / Non-residential use	TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".
	LV13-8	NO	12.3	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	LV13-8	NO	18.1	SWMU 74				
	LV13-7	NO	12.6	SWMU 74				
	LH13-10	NO	21.4	SWMU 74				
	LH13-9	YES	INSIDE	SWMU 74	Ongoing investigation / Non-residential use	TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".
	LV13-10	NO	5.5	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	Replacement of 8" PVC Line	YES	INSIDE	SWMU 74	Ongoing investigation / Non-residential use	TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".
	Replacement of 8" PVC Line	YES	INSIDE	SWMU 59	Corrective measures implementation	Copper, Lead & Zinc	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 59".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 59".
	LV13-7	YES	INSIDE	SWMU 59				

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C116	FH-XX & Connecting Line	YES	INSIDE	SWMU 74/AOC F-1995	Ongoing investigation / Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	TPH-DRO & TPH-GRO / Total TPH	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 / AOC F1995".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 / AOC F1995".
	JV13-6	YES	INSIDE	SWMU 74/AOC F-1995				
	Replacement of 8" PVC Line	YES	INSIDE	SWMU 74/AOC F-1995				
	JV13-5	YES	INSIDE	SWMU 74/AOC F-1995				
	Replacement of 8" PVC Line	YES	INSIDE	SWMU 74/AOC F-1995				
	FH-XX & Connecting Line	YES	INSIDE	SWMU 74/AOC F-1995				
	LV-XX	YES	INSIDE	SWMU 74/AOC F-1995				
C107	JH13-3	NO	166.2	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	JH13-3B	NO	186.5	SWMU 74				
C108	JV-XX	NO	144.8	SWMU 74				
	JV13-4	NO	123.7	SWMU 74	Ongoing investigation / Non-residential use; restriction on subsurface soil activities; restriction on groundwater use and well installation	TPH-DRO & TPH-GRO / Total TPH	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 / AOC F1995".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74 / AOC F1995".
	JV13-1	YES	INSIDE	SWMU 74/AOC F-1995				
	JV13-2	YES	INSIDE	SWMU 74/AOC F-1995				
	JV13-1	YES	INSIDE	SWMU 74/AOC F-1995				
	JH13-5	YES	INSIDE	SWMU 7/8 / SWMU 74	Non-residential use; restriction on surface and subsurface soil activities; restriction on groundwater use and well installation / Ongoing investigation	Arsenic, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, in-deno(1,2,3-cd)pyrene) / TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications for SWMU 7/8 and SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications for SWMU 7/8 and SWMU 74".
	JV14-1	YES	INSIDE	SWMU 7/8	Non-residential use; restriction on surface and subsurface soil activities; restriction on groundwater use and well installation	Arsenic, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene , in-deno(1,2,3-cd)pyrene)	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 7/8". Do not perform construction staging on adjacent monitoring wells.	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 7/8".
	JV14-2	YES	INSIDE	SWMU 7/8				
	JV14-3	YES	INSIDE	SWMU 7/8				
	KV14-1	YES	INSIDE	SWMU 7/8				
	JV14-1B	YES	INSIDE	SWMU 7/8				
	PRESSURE REGULATING VALVE	YES	INSIDE	SWMU 7/8				

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C109	KH14-1	YES	INSIDE	SWMU 7/8	Non-residential use; restriction on surface and subsurface soil activities; restriction on groundwater use and well installation	Arsenic, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, in-deno(1,2,3-cd)pyrene)	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 7/8". Do not perform construction staging on adjacent monitoring wells.	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 7/8".
	KH14-3	YES	INSIDE	SWMU 7/8				
	KH14-2	YES	INSIDE	SWMU 7/8				
	KH14-8	YES	INSIDE	SWMU 10	Non-residential use; restriction on surface and subsurface soil activities	PCB	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 10".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 10".
	KH14-9	YES	INSIDE	SWMU 10				
	KH14-10	YES	INSIDE	SWMU 10				
	KH14-12	NO	11.3	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	KH14-13	NO	9	SWMU 74				
	KV15-10	NO	11.4	SWMU 74				
	KV15-11	NO	9.2	SWMU 74				
	KV15-12	YES	INSIDE	SWMU 74	Ongoing investigation / Non-residential use	TPH-DRO & TPH-GRO	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 74".
	KV15-13	YES	INSIDE	SWMU 74				
	KH15-1	YES	INSIDE	SWMU 74				
C110	KV15-16	NO	92.7	SWMU 70			Do not perform construction staging on SWMU 70. No additional measures needed.	N/A
	KV15-17	NO	91	SWMU 70				
	KH15-4	NO	78	SWMU 70				
	NEW VALVE 8"	NO	86	SWMU 70				
	NEW 8" PVC Line L=340.80m	NO	86	SWMU 70				
	NEW TEE 10X10X8	NO	86	SWMU 70				
	KH15-6	NO	18.9	SWMU 70				
	KV15-9	YES	INSIDE	SWMU 70	Non-residential use; restriction on subsurface soil activities, groundwater use and well installation	Arsenic, chromium and zinc	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 70".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 70".
	CUT PIPE AND INSTALL 8" PLUG CAP	NO	18.9	SWMU 70			Do not perform construction staging on SWMU 70. No additional measures needed.	N/A
	LH-XX	NO	71.8	SWMU 70				
	LV15-11	NO	90.8	SWMU 45			Do not perform construction staging on SWMU 45. No additional measures needed.	N/A
	LV15-12	NO	49.4	SWMU 45				
	LV-XX	NO	45.4	SWMU 45				

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C122	KH15-25	NO	117.8	SWMU 73			Do not perform construction staging on SWMU 73. No additional measures needed.	N/A
	KH15-26	NO	117.8	SWMU 73				
	KH15-7	NO	104.6	SWMU 73				
	CUT PIPE AND INSTALL 8" PLUG CAP	NO	119.3	SWMU 73				
	KH15-6	NO	64.3	SWMU 73	Corrective Action Complete without Controls	N/A	No additional measures needed	N/A
	NEW VALVE 8"	YES	INSIDE	SWMU 72				
	NEW 8" PVC Line L=340.80m	YES	INSIDE	SWMU 72				
	NEW TEE 12X12X8	YES	INSIDE	SWMU 72				
	KH15-9	YES	INSIDE	SWMU 72				
	KV15-6	YES	INSIDE	SWMU 72				
	FH-XX	YES	INSIDE	SWMU 72				
	KV15-27	YES	INSIDE	SWMU 72			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
	KV15-8	NO	58.4	SWMU 74				
	KH15-2	NO	60.7	SWMU 74				
	KV15-9	NO	45	SWMU 74				
C123	NEW FIRE HYDRANT	YES	INSIDE	AOC F 2842 B	Non-residential use; restriction on surface and subsurface soil activities; restriction on groundwater use and well installation	TPH & VOC (Benzene)	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications AOC F2842B".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications AOC F2842B".
	NEW 8" LINE (340 M)	YES	INSIDE	SWMU 72	Corrective Action Complete without Controls	N/A	No additional measures needed	N/A
C124	KH16-3	NO	70.9	SWMU 6			Do not perform construction staging on SWMU 6. No additional measures needed.	N/A
	KH16-4	NO	43.8	SWMU 6				
	KH16-2	YES	INSIDE	SWMU 6	Corrective Action Complete without Controls	N/A	No additional measures needed.	N/A
	KH16-1	YES	INSIDE	SWMU 6				
	KV-XX	NO		N/A			No additional measures needed	N/A
C120	JH16-1	YES	INSIDE	SWMU 73	Corrective Measures Study	Chromium	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 73".	Follow the "Excavation and Handling of Potentially Contaminated Material Specifications SWMU 73".
	JH15-5	NO	10	SWMU 73			Do not perform construction staging on SWMU 73. No additional measures needed.	N/A

Design Sheet ID (WDS)	VAIVES ID	AFFECTING SWMU (YES/NO)	DISTANCE FROM NEAREST SWMU (METERS)	SWMU ID	Restrictions / Status	Contaminants of Concern	Construction Contractor's Measures During Excavation	Construction Contractor's Excavation Disposal Procedures
C119	JV-XX	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed	N/A
	JV15-7	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed	N/A
	JV15-5	NO	FURTHER THAN 250 METERS	N/A				
	JV15-6	NO	FURTHER THAN 250 METERS	N/A				
	JV15-7	NO	FURTHER THAN 250 METERS	N/A				
C118	JV14-5	NO	FURTHER THAN 250 METERS	N/A				
	JV14-6	NO	FURTHER THAN 250 METERS	N/A				
	JV14-7	NO	FURTHER THAN 250 METERS	N/A				
	FH-XX	NO					No additional measures needed	N/A
	JH14-1	NO	199.2	SWMU 7/8			Do not perform construction staging on SWMU 7/8. No additional measures needed.	N/A
	JH14-4	NO	206	SWMU 7/8				
	JH14-2	NO	206	SWMU 7/8				
	JH-XX	NO					No additional measures needed	N/A
C117	LV14-1	NO	145.3	SWMU 74			Do not perform construction staging on SWMU 74. No additional measures needed.	N/A
C121	JV17-1	NO	FURTHER THAN 250 METERS	N/A			No additional measures needed	N/A

**EXCAVATION AND HANDLING OF POTENTIALLY
CONTAMINATED MATERIAL SPECIFICATIONS
AT APPLICABLE SWMUs AND AOCs**

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 2

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C115 applies to this Section.
- (b) Review WDS C115 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU.

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1** Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 2

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) The maximum detected concentrations of three metals (arsenic, chromium and lead) exceeded industrial Regional Screening Levels (RSLs) and were identified as contaminants of potential concern (COPCs) for a soil screening (0 – 6 bgs) in the “Final Technical Memorandum for SWMU 2” prepared on behalf of US Navy in 2016². Nevertheless, these COPCs were not identified near the work site area.
- (b) A Supplemental Investigation performed in 1992 indicated that Cobalt exceeded cancer risk (CR) of 1E-05 and hazard quotient (HQ) > 1 in a sampling location near work site.³

² Final Technical Memorandum SWMU 2. CH2M Hill, Inc. July 7, 2016. Page 7.

³ Sampling and Analysis Plan SWMU 2 Corrective Measures Study Supplemental Data Investigation. CH2M Hill, Inc. August 2018. Figure 4.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 2

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for Cobalt parameter to determine if soil contamination level is above Screening Levels (SLs) for industrial soil of 350 ppm.
- (c) If cobalt concentration is confirmed above SLs of 350 ppm, the soil shall be handled as contaminated soil. When cobalt is detected to be present but at levels less than SLs, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for cobalt to verify OSHA TWA of 0.1 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*⁴.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

⁴ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 2

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) Chemical analysis for Cobalt shall be performed on all samples as per EPA SW-846⁵ Test Method for Cobalt.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

⁵ The Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium, also known as SW-846 or the Compendium, is EPA's official collection of methods for use in complying with the Resource Conservation and Recovery Act (RCRA) regulations. <https://www.epa.gov/hw-sw846/basic-information-about-how-use-sw-846>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 7/8

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawings C108 and C109 apply to this Section.
- (b) Review WDS-C108 and WDS-C109 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1** Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 7/8

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) Surface Soil: arsenic, PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene)
- (b) Subsurface Soil: benzo(a)pyrene.
- (c) Corrective action objectives (CAOs) for industrial use were developed for the aforementioned contaminants in SWMU 7/8. A Statement of Basis (SoB)² indicated that PAHs were not detected; however, the detected arsenic levels at SWMU 7/8 are considered naturally occurring within the surface soil and are also below the revised CAO for industrial land use.
- (d) Arsenic and PAHs were not identified near the work site area.

² Statement of Basis for SWMUs 7 & 8, Naval Activity Puerto Rico. June 2015

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 7/8

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels (CAOs, in this case) for industrial soil:

Chemical of Concern (Contaminant)	Corrective Action Objective (CAO) (ppm)
Arsenic	3.81
Benzo(a)anthracene	7.8
Benzo(a)pyrene	7.3
Benzo(b)fluoranthene	7.8
Indeno(1,2,3- cd)pyrene	7.8

- (c) If any of these chemicals of concern concentration is confirmed above CAO, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than CAO, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for PAHs to verify OSHA TWA of 0.2 mg/m³; and for Arsenic to verify OSHA TWA of 0.01 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*³.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

³ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 7/8

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 10

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C109 applies to this Section.
- (b) Review WDS-C109 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- #### **2.1.1**
- Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 10

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) SWMU 10 was subjected to a soil removal action for PCBs in 1995. All confirmatory soil sample results were below the PCB cleanup level of 10 ppm, as determined in the 1993 Interim Remedial Action Decision Document.²
- (b) No chemicals of concern (COCs) were identified or evaluated, and corrective action objectives were not determined for SWMU 10 in July 2001.²

² Corrective Measures Study Final Report SWMU 10 Draft Naval Station Roosevelt Roads. CH2M Hill. July 6, 2001

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 10

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for PCB to determine if soil contamination level is above Screening Levels (adopted Corrective Action Objective (CAO) screening criteria in this case) of 10 ppm for PCB:
- (c) If any of these chemicals of concern concentration is confirmed above CAO, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than CAO, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for PCBs to verify OSHA PEL of 0.5 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above PEL.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*³.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

³ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 10

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) PCBs analysis will be performed to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that exceed 10 ppm PCB shall be considered hazardous waste and will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL

SWMU 59

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C115 applies to this Section.
- (b) Review WDS-C115 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1 Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 59

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) Copper, lead, and zinc were identified as ecological chemicals of concern (COCs) in surface soil.²

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels (CAOs, in this case):

² Statement of Basis for SWMU 59 Naval Activity Puerto Rico. August 2016.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL

SWMU 59

Chemical of Concern (Contaminant)	Corrective Action Objective (CAO) (ppm)
Copper	192
Lead	96
Zinc	132

- (c) If any of these chemicals of concern concentration is confirmed above CAO, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than CAO, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for the aforementioned contaminants to verify OSHA PELs. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above PELs:

Chemical of Concern (Contaminant)	OSHA PEL (mg/m ³)
Copper	1
Lead	0.05
Zinc	5

- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the "*Permiso General Consolidado*"³.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
- (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

³ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 59

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL

SWMU 70

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C110 applies to this Section.
- (b) Review WDS-C110 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1 Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 70

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²³:

- (a) Arsenic, chromium and zinc were identified as key contaminants in surface soil.

² Finding of Suitability to Lease (FOSL) Carved-outs within Sale Parcel I-Bundy, Naval Activity Ceiba, Puerto Rico. February 2008

³ Revised Final Full RCRA Facility Investigation Work Plan SWMU 70, Naval Activity Ceiba, Puerto Rico. April 7, 2011

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 70

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm) ⁴
Arsenic	2
Chromium	150,000
Zinc	31,000

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for Chromium to verify OSHA TWA of 0.5 mg/m³; for Arsenic to verify OSHA TWA of 0.01 mg/m³; and for Zinc to verify OSHA TWA of 10 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*⁵.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

⁴ Revised Final Full RCRA Facility Investigation Work Plan SWMU 70, Naval Activity Ceiba, Puerto Rico. Table 4-4. April 7, 2011

⁵ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 70

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 71

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C104 applies to this Section.
- (b) Review WDS-C104 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1** Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 71

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²³:

- (a) The following constituents were detected above residential and/or industrial Screening Levels (SLs) for soil:
 - Surface soil – vanadium
 - Subsurface soil – PAHs (dibenzo(a,h)anthracene, benzo(a)pyrene), arsenic, vanadium

² Finding of Suitability to Lease (FOSL) Carved-outs within Sale Parcel I-Bundy, Naval Activity Ceiba, Puerto Rico. February 2008

³ Revised Final Full RCRA Facility Investigation Work Plan SWMU 71, Naval Activity Ceiba, Puerto Rico. May 26, 2011

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 71

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm) ⁴
Arsenic	2
Vanadium	7
Benzo(a)pyrene	0.21
Dibenzo(a,h)anthracene	0.21

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for PAHs to verify OSHA TWA of 0.2 mg/m³; for Arsenic to verify OSHA TWA of 0.01 mg/m³; and for Vanadium to verify OSHA TWA of 0.05 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*⁶.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

⁴ Revised Final Full RCRA Facility Investigation Work Plan SWMU 71, Naval Activity Ceiba, Puerto Rico. Table 4-3. May 26, 2011

⁵ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 71

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL

SWMU 73

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C120 applies to this Section.
- (b) Review WDS-C120 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1 Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 73

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²:

- (a) Chromium was detected at surface soil above Regional Screening Level (RSL) for industrial soil at SWMU 73 work site area.

² Corrective Measures Study Investigation Report SWMU 73, Naval Activity Ceiba, Puerto Rico. Table 1 (19E-SS04). 2011

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 73

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm) ³
Chromium	5.6

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for Chromium to verify OSHA TWA of 0.5 mg/m³. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the "*Permiso General Consolidado*"⁴.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

³ Corrective Measures Study Investigation Report SWMU 73, Naval Activity Ceiba, Puerto Rico. Table 1 (19E-SS04). 2011

⁴ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 73

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 74

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawings C108, C109, C114 and C115 apply to this Section.
- (b) Review WDS-C108, WDS-C109, WDS-114 and WDS-115 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1 Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 74

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DRO) and Total Petroleum Hydrocarbons – Gasoline Range Organics (TPH-GRO) were detected in soil and retained as contaminants of potential concern (COPCs)

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels (adopted Corrective Action Objective (CAO) screening criteria in this case) of 100 ppm for TPH.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 74

- (c) If any of these chemicals of concern concentration is confirmed above CAO, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than CAO, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for Petroleum mixtures (distillates) to verify OSHA PEL of 2,000 mg/m³ (500 ppm). The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above PEL.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*².
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) TPH Diesel and TPH Gasoline analysis will be performed to all samples.
- (d) A TCLP VOC analysis will be performed for each associated contaminant to all samples.

² Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL SWMU 74

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL

AOC F-1738

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C115 applies to this Section.
- (b) Review WDS-C115 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- ##### **2.1.1**
- Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1738

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²³:

- (a) No contaminants of concern were identified above Regional Screening Levels (RSL) for industrial soils in surface and subsurface soils. Total TPH and MtBE were identified in groundwater only.

² Finding of Suitability to Lease (FOSL) Carved-outs within Sale Parcel I-Bundy, Naval Activity Ceiba, Puerto Rico. February 2008

³ Revised Final Methyl Tertiary Butyl Ether Investigation Report AOC F 1738, Naval Activity Ceiba, Puerto Rico. June 28, 2013

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1738

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm) ⁴
Total TPH	100 (local PREQB)
MtBE	220,000

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for TPH to verify OSHA PEL TWA of 500 ppm (2,000 mg/m³); and for MtBE to verify OSHA PEL-TWA of 40 ppm (144 mg/m³). The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the *"Permiso General Consolidado"*⁵.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw waddles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

⁴ Revised Final Methyl Tertiary Butyl Ether Investigation Report AOC F 1738, Naval Activity Ceiba, Puerto Rico. Table 6-1. June 28, 2013

⁵ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1738

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excavated soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1995

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawings C108 and C116 apply to this Section.
- (b) Review WDS-C108 and WDS-C116 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1** Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1995

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²:

- (a) No contaminants of concern were identified above Regional Screening Levels (RSL) for industrial soils in surface and subsurface soils. Total TPH was identified in groundwater only.

² Finding of Suitability to Transfer (FOST) Port Parcel, Naval Activity Ceiba, Puerto Rico. December 2008

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1995

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm)
Total TPH	100 (local PREQB target level)

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for TPH to verify OSHA PEL TWA of 500 ppm (2,000 mg/m³). The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the "*Permiso General Consolidado*"³.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

³ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-1995

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-2842B

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

- (a) Water Distribution System (WDS) Drawing C123 applies to this Section.
- (b) Review WDS-C123 for coordination with additional requirements and information that apply to work under this Specification.

1.1.2 Section Includes:

Excavation, handling and temporary storage of potentially contaminated soils that may be encountered during the course of the Work.

1.1.3 Definitions:

Screening Levels (SLs)¹ - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- #### **2.1.1**
- Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-2842B

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION²³:

- (a) No contaminants of concern were identified as exceeding RSLs in surface soil and subsurface soil. Total TPH and VOC (Benzene) were identified in groundwater only.

² Finding of Suitability to Lease (FOSL) Carved-outs within Sale Parcel I-Bundy, Naval Activity Ceiba, Puerto Rico. February 2008

³ Final Sampling and Analysis Plan Data Gap Investigation AOC F, Naval Activity Ceiba, Puerto Rico. December 19, 2016

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-2842B

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Soil screening shall be performed for the aforementioned contaminants to determine if soil contamination level is above Screening Levels for industrial soil (RSL):

Chemical of Concern (Contaminant)	Industrial Soil Regional Screening Level RSL (ppm) ⁴
Total TPH	100 (local PREQB)
Benzene	5.1 (local PREQB)

- (c) If any of these chemicals of concern concentration is confirmed above RSL, the soil shall be handled as contaminated soil. When any chemical of concern is detected to be present but at levels less than RSL, Subcontractor shall provide and document worker Hazard Communication and awareness level training.
- (d) Air monitoring shall be performed for TPH to verify OSHA PEL TWA of 500 ppm (2,000 mg/m³); and for Benzene to verify OSHA TWA of 1 ppm. The Contractor shall proceed pursuant to 29 CFR 1910.0120 if air monitoring values are above TWA.
- (e) If, during the course of excavation, or other facet of Contractor's scope of work, the Contractor encounters groundwater at the site, the Contractor shall pump and containerized it for disposal. Removed groundwater shall be characterized with a Full RCRA analysis prior disposal (see Sections 5.4 and 5.5).

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sedimentation controls shall be implemented as specified in the "*Permiso General Consolidado*"⁵.
- (b) Erosion and sedimentation controls shall be implemented during excavation activities to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Excavated soil shall be placed (stockpiled) over a double layer of 6-mil polyethylene sheet. Also, straw wattles, silt fencing or any other erosion and sedimentation control shall be used.
 - (2) If excavated soil is temporarily stockpiled, the stockpiles must be covered with 6-mil plastic sheeting at all times and protected from stormwater runoff. Construction best management practices for temporary erosion and sediment control must be implemented during stockpiling activities.

⁴ Final Sampling and Analysis Plan Data Gap Investigation AOC F, Naval Activity Ceiba, Puerto Rico. December 19, 2016

⁵ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

EXCAVATION AND HANDLING OF POTENTIALLY CONTAMINATED MATERIAL AOC F-2842B

4.3 EXCAVATED SOIL

Excavated soil will not be reused as backfill of the original excavation area and/or for other excavation areas. Excavated soil shall be disposed as described in the following sections. Backfilling activities shall be performed with A-2-4 soil, as per project specifications.

4.4 SOILS SAMPLING AND ANALYSIS

Excavated soil shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the excess soil that will be disposed.
- (b) A swap sample will be performed to any other excavated materials (e.g. valves, pipes, not soils) that were in direct contact with contaminated soil.
- (c) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 SOILS HANDLING AND STORAGE

Soils characterized as hazardous waste will be handled and temporarily stored as follows:

- (a) Place contaminated soils in properly labeled drums as per required regulations or lined hazardous waste storage/transportation conveyance units (i.e., roll-off waste boxes, etc.) in a location designated by the Contractor and approved by LRA.
- (b) Line containers other than drums with a double layer of 6 mil polyethylene sheet; seal seams with duct tape (all provided by Subcontractor);
- (c) Place any other excavated site materials (e.g. valves, pipes) identified as hazardous waste into 6-mil plastic bags and place into drums;
- (d) Secure drum closures and cover with 6 mil plastic sheeting;
- (e) Label containers as per required regulations at the time of accumulation.
- (f) Provide and use proper drum or container handling equipment for movement of containers (drum dolly, fork truck, etc.).

4.6 WASTE DISPOSAL

Hazardous waste: soil or other materials excavated from the site that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

CHARACTERIZATION, HANDLING AND DISPOSAL OF SLUDGE MATERIAL SWMU 42

1.0 GENERAL

1.1 SUMMARY

1.1.1 Related Documents:

(a) Raw Water Reservoir and WTP Sludge Lagoon Sediments Survey Report¹.

1.1.2 Section Includes:

Removal, handling temporary storage, characterization and disposal of Sludge sediments.

1.1.3 Definitions:

Screening Levels (SLs)² - Risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. SLs are considered by the EPA to be protective for humans (including sensitive groups) over a lifetime. They are used for site "screening" and as initial cleanup goals, if applicable.

Contaminated Soil – for the purposes of this document, soil is considered contaminated when any contaminant of concern concentration is above SLs or above the US Navy/US EPA defined level for the specific SWMU (e.g. corrective action objectives, CAOs).

Hazardous Waste - A solid waste is a hazardous waste if it is specifically listed as a known hazardous waste or meets the characteristics of a hazardous waste. Listed wastes are wastes from common manufacturing and industrial processes, specific industries and can be generated from discarded commercial products. Characteristic wastes are wastes that exhibit any one or more of the following characteristic properties: ignitability, corrosivity, reactivity or toxicity.

2.0 SUBMITTALS

2.1 SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP)

- 2.1.1** Submit a copy of Site Specific Health and Safety Plan (HASP) pursuant to the requirements set forth in 29 CFR 1926.53 and 29 CFR 1910.120 at least 14 days prior to mobilization. Do not commence excavation work until this plan is submitted, reviewed, and approved by the LRA and U.S. Navy. HASP shall detail site specific requirements for identification, evaluation, control, and mitigation of hazards associated with work scope as pertaining to protection of workers, personnel or employees, the public, and environment. The HASP shall address, at a minimum, the following:

¹ Integra Design Group, PSC; Raw Water Reservoir and WTP Sludge Lagoon Sediments Survey Report for: potable Water Infrastructure improvements (Phase I) at Roosevelt Roads Re-development, Ceiba-Naguabo, Puerto Rico. February 8, 2020.

² US Environmental Protection Agency. Risk Assessment Regional Screening Levels. November 2020. <https://www.epa.gov/risk/regional-screening-levels-frequent-questions>

CHARACTERIZATION, HANDLING AND DISPOSAL OF SLUDGE MATERIAL SWMU 42

- a) Introduction
- b) Workplan and Scope of Work
- c) Subcontractor Project and Field Team Management
- d) Detailed Site and Task Hazard Analyses addressing
 - (1) Physical Hazards
 - (2) Chemical Hazards
- e) Hazard Control
- f) Site Control
- g) Contaminated Material Handling Plan
- h) Personal Protective Equipment and Respiratory Protection
- i) Emergency Plan
- j) Training
- k) Medical Surveillance

2.2 QUALITY ASSURANCE SUBMITTALS:

2.2.1 Submit a copy of the following:

In case that Hazardous Waste Operations are required:

- (a) A HASP pursuant to the requirements set forth 29 CFR 1910.120 shall be submitted in case that a Hazardous Waste Operation is involved.
- (b) Evidence that personnel directly involved with on-site excavation activities have received initial OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and initial 24-hour supervised field work, and current under 29CFR 1910.120 refresher training requirements.
- (c) Evidence that personnel who supervise hazardous waste handling have additionally completed the 8 hour HAZWOPER Supervisor training requirements.

3.0 SITE CONDITIONS

3.1 SITE CHARACTERIZATION:

- (a) Sludge lagoon sediments and leachate/supernatant sludge did not exhibit hazardous waste characteristics.

4.0 EXECUTION

4.1 GENERAL

- (a) The HASP development and implementation is the Contractors sole responsibility.
- (b) Sludge lagoon sediments and leachate/supernatant sludge screening shall be performed to determine if air monitoring needs to be performed to in accordance with OSHA standards.

CHARACTERIZATION, HANDLING AND DISPOSAL OF SLUDGE MATERIAL SWMU 42

4.2 EROSION AND SEDIMENTATION CONTROLS

- (a) Erosion and sediment control during dredging and dewatering of sludge lagoon sediments and leachate/supernatant sludge, activities shall be performed as specified in the *"Permiso General Consolidado"*³ for the project.
- (b) Dredging technique must minimize turbidity of the lagoon and turbidity shall not exceed the Puerto Rico Water Quality Standard⁴ for Class SD waters of 50 nephelometric turbidity units (NTU).
- (c) Erosion and sedimentation controls shall be implemented during all phases of the project to ensure no human exposure or potential migration of potentially contaminated material onto the ground surface.
 - (1) Sludge lagoon sediments and leachate/supernatant sludge shall be placed on existing drying beds, filter pressed or dewatering bags. Erosion and sedimentation control shall be implemented.
 - (2) Sludge lagoon sediments and leachate/supernatant sludge when dried shall be covered with 6-mil plastic sheeting at all times and protected from storm-water runoff. Erosion and sediment control must be implemented during stockpiling activities.
 - (3) Leachate/supernatant run-off will be diverted to the sludge lagoons.

4.3 DRIED SLUDGE LAGOON SEDIMENTS AND LEACHATE/SUPERNATANT SLUDGE

Dried sludge lagoon sediments and leachate/supernatant sludge will not be reused as backfill at any excavation area.

4.4 SAMPLING AND ANALYSIS

Dried sludge lagoon sediments and leachate/supernatant sludge shall be sampled and analyzed prior disposal to determine if it is a hazardous waste.

- (a) A composite sample will be collected from the dried sludge lagoon sediments and leachate/supernatant sludge.
- (b) A TCLP analysis will be performed for each associated contaminant to all samples.

4.5 WASTE DISPOSAL

Hazardous waste: sludge lagoon sediments and leachate/supernatant sludge that is identified as hazardous waste will be disposed of by Contractor in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

³ Reglamento Conjunto 2020. Junta de Planificación Puerto Rico.

⁴ Department of Natural Resources and Environment Regulation 9079, Puerto Rico Water Quality Standards Regulation. 2019

**CHARACTERIZATION, HANDLING AND DISPOSAL OF SLUDGE MATERIAL
SWMU 42**

Non-hazardous Waste and Contractor-Generated Waste: Properly containerize, label and remove waste in accordance with federal, state, and local requirements in an approved disposal facility. Provide materials disposal manifests to LRA.

END OF SECTION

SECTION 31 23 19

DEWATERING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Clearing and Grubbing
 - 2. Excavation and Embankment
 - 3. Removal of Structures and Obstructions
 - 4. Devices for Embankment Construction Control and Ground Water Observations
 - 5. Soil Erosion and Water Pollution Control

1.2 SYSTEM DESCRIPTION

- A. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on Drawings or reasonably necessary for performance of Work. Dewatering of existing ponding area shall consist of the installation of a dewatering system to remove and adequate disposal of the accumulated water on the designated location. The removal of water and disposal shall comply with the local and federal environmental permits. Also includes the removal and adequate disposal of debris, roots, vegetation and other material within the ponding area.

1.3 SUBMITTALS

- A. Action Submittals
 - 1. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
 - 1.1 Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 - 1.2 Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
 - 2. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Informational Submittals
 - 1. Qualification Data: for qualified land surveyor and professional engineer.
 - 2. Field quality-control reports.
 - 3. Other Informational Submittals: Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

- B. **Regulatory Requirements:** Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. **Pre-installation Conference:** Conduct conference at the Project site to be specified on contract and coordinated by the Engineer.

Review methods and procedures related to dewatering including, but not limited to, the following:

- 1. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
- 2. Geotechnical report.
- 3. Proposed site clearing and excavations.
- 4. Existing utilities and subsurface conditions.
- 5. Coordination for interruption, shutoff, capping, and continuation of utility services.
- 6. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 PROJECT CONDITIONS

- A. **Interruption of Existing Utilities:** Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two weeks in advance of proposed interruption of utility.
 - 2. Do not proceed with interruption of utility without Construction Manager's and Owner's written permission.
- B. **Project-Site Information:** Contractor is responsible to conduct a geotechnical report for this Project. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 - 2. The geotechnical report shall be submit to the Engineer for revision and record for the Project documents.
- C. **Survey Work:** Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

- A. **General:**
 - 1. Such materials as are required for dewatering and that are not to be a part of the completed contract shall be as determined by the Contractor but they shall conform to all applicable Federal, Commonwealth and local laws, codes and regulations.

PART 3 EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Spec. 210 - Soil Erosion and Water Pollution during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level depth below surface excavation as recommended on Geotechnical Report.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum depth below overlying construction as recommended on Geotechnical Report.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 DEWATERING SYSTEM

- A. Payment shall cover the design, furnish, installation, required materials and equipment, removal and disposal of water, sediments and debris within the ponding area identify on project contract, all related repairs and materials of the storm sewer system and any other materials and labor required to perform the work

3.4 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.
- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Society for Testing and Materials (ASTM):
 - a. D1682, Breaking Load and Elongation of Textile Fabrics.
 - b. D3776, Mass Per Unit Area (Weight) of Woven Fabric.
 - c. D3786, Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics-Diaphragm Bursting Strength Tester Method.
 - d. D4355, Deterioration of Geotextiles from Exposure to Ultraviolet LightC and Water (Xenon-Arc Type Apparatus).
 - e. D4632, Grab Breaking Load and Elongation of Geotextiles.

1.2 DEFINITIONS

- A. N/A

1.3 SUBMITTALS

- A. Administrative Submittal: Sub-schedule of drainage, erosion, and sedimentation control.
- B. Shop Drawings:
 - 1. Product Data: Commercial products.
- C. Quality Control Submittals:
 - 1. Construction Period Drainage and Erosion/Sedimentation Control Plan and Procedures.
 - 2. Manufacturer's Installation Instructions: Commercial products.

1.4 DELIVERY, STORAGE, AND PROTECTION

1.5 SEQUENCING AND SCHEDULING

- A. ENGINEER's acceptance of Construction Period Erosion/Sedimentation Control Plan required prior to starting earth disturbing activities.
- B. Notify ENGINEER at least 3 days in advance of:
 - 1. Materials delivery.
 - 2. Start of control activities.

1.6 MAINTENANCE

- A. Operations:
 - 1. Inspect, repair, and replace as necessary all erosion control measures during the time period from start of construction to completion of construction.

PART 2 PRODUCTS

2.1 EROSION CONTROL MATTING

2.2 REINFORCED PLASTIC COVERING

- A. Co-extruded, copolymer laminate reinforced with a nonwoven grid of high strength nylon cord submersed in a permanently flexible adhesive media allowing for equal tear resistance in all directions.
- B. Black in color and ultraviolet stabilized.
- C. Physical Requirement (Minimum Average Roll Values):
 - 1. Tear Strength: 130 pounds.
 - 2. Elongation: 620 percent.
- D. Manufacturers:
 - 1. Reef Industries, Inc., Houston, TX.
 - 2. Griffolyn Co., Houston, TX.

2.3 CLEARING LIMIT FENCE

- A. Ultraviolet stabilized polyethylene or polypropylene safety fence, 3 feet in height, and yellow or orange in color.
- B. Pervious Sheet: Polyester, polypropylene, or nylon filaments, woven into a uniform pattern, distinct and measurable openings.
 - 1. Filaments: Resistant to damage from exposure to ultraviolet rays and heat.
 - 2. Material Edges: Finish so that filaments retain their relative positions under stress.
- C. In accordance with requirements of Table No. 1:

Table No. 1 - Filter Fence		
Physical Property	Required Value	Test Method
Weight, pz/sq yd, min.	4	ASTM D3776
Equivalent Opening Size, max.	50-70	U.S. Standard Sieve
Grab Tensile Strength, lb, min.	160	ASTM D4632
Elongation, % max.	25	ASTM D1682
Mullen Burst Strength, psi, min.	350	ASTM D3786
Ultraviolet Radiation Resistance, % Strength Retention	70	ASTM D4355

- D. Manufacturers:
 - 1. Polyfelt, Evergreen, AL.
 - 2. Dupont Co., Wilmington, DE.

3. Mirafi, Inc., Charlotte, NC.

2.4 SUPPORT FENCE

- A. Wire Mesh Material: As recommended by manufacturer of geotextile; strong enough to support applied loads.
- B. Support Posts: As recommended by manufacturer of geotextile.
- C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.5 STRAW BALES

- A. Machine baled clean salt hay or straw of oats, wheat, barley, or rye, free from seed of noxious weeds, using standard baling wire or string.

2.6 POSTS FOR STRAW BALES

- A. 2-inch by 2-inch untreated wood or commercially manufactured metal posts.

PART 3 EXECUTION

3.1 CLEARING LIMIT FENCE

- A. Install in accordance with manufacturer's standard instructions and before beginning clearing and grubbing operations.

3.2 SUPPORT FENCE AND GEOTEXTILE

- A. Install prior to starting earth disturbing activities upslope of fence.
- B. One-piece geotextile or continuously sewn to make one-piece geotextile for full height of the fence, including portion buried in the toe trench.
- C. When joints are necessary, splice geotextile together only at a support post, with a minimum 6-inch overlap, and securely fasten both ends to support post.
- D. Geotextile shall not extend more than 24 inches above the ground surface. Securely fasten to upslope side of each support post using ties. Geotextile shall not be stapled to existing trees.
- E. Fasten wire mesh material support fence securely to upslope side of post fasteners. Extend wire into the trench a minimum of 4 inches, and not more than 36 inches above the ground surface.
- F. Take precaution not to puncture geotextile during installation. Repair or replace damaged area.
- G. Remove support fence for geotextile after upslope area has been permanently stabilized. Immediately dress sediment deposits remaining after the geotextile fence has been removed to conform to existing grade. Prepare and seed graded area.

3.3 SOIL STOCKPILES

- A. Protect from erosion with geotextile and support fence.

3.4 STRAW BALES

- A. Embed minimum of 4 inches in flat-bottomed trench.
- B. Place with ends tightly abutting or overlapped. Corner abutment is not acceptable.
- C. Install so that bale bindings are oriented around the sides and not over the top and bottom of the bale.
- D. Use two posts for each bale. Drive posts through the bale until top of post is flush with top of bale.
- E. Wedge loose straws in any gaps between bales.

3.5 FIELD QUALITY CONTROL

- A. Upon completion of maintenance period and on written notice from CONTRACTOR, ENGINEER will, within 15 days of receipt, determine if a satisfactory stand has been established.

END OF SECTION

DIVISION 32 EXTERIOR IMPROVEMENTS

SECTION 32 11 23 AGGREGATES BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course. B. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 31 2200 - Grading: Preparation of site for base course.
- B. Section 31 2300 – Excavation and Fill: Compacted fill under base course.
- C. Section 32 1216 - Asphalt Paving: Binder and finish asphalt courses.
- D. Section 32 1313 - Concrete Paving: Finish concrete surface course.
- E. Section 33 0513 - Manholes and Structures: Manholes including frames.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (2004).
- B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
- C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2007.
- D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.
- E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2007.
- F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.
- G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.
- H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When aggregate materials need to be stored on site, locate stockpiles where indicated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Coarse Aggregate Type: Gravel: Coarse aggregate, conforming to State of PR Highway Department standard.
- B. Fine Aggregate : Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

2.02 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Under Portland Cement Concrete Paving:
 - 1. Compact to 95 percent of maximum dry density.
- B. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.
- C. Variation From Design Elevation: Within 1/2 inch.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate base course.
 - 2. Asphalt concrete binder and surface course.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. Asphalt Institute (AI):
 - 1. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
 - 2. MS-3 - Asphalt Plant Manual.
 - 3. MS-8 - Asphalt Paving Manual.
 - 4. MS-19 - Basic Asphalt Emulsion Manual.
- B. ASTM International (ASTM):
 - 1. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
 - 2. D946 - Standard Test Method for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
 - 3. D1188 - Standard Test Method for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
 - 4. D2172 - Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.
 - 5. D2922 - Standard Test Methods for Determining the Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Mix Designs: Indicate composition of each type asphaltic concrete.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum 1 year experience in work of this Section.
- B. Perform work in accordance with AI MS-8.
- C. Mixing Plant: AI MS-3.
- D. Obtain materials from same source throughout work.

1.5 PROJECT CONDITIONS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Base Course: Crushed stone or pit run gravel, free of shale, clay, friable material, and debris, graded in accordance with ASTM C136 type AASHTO A-1- a.
- B. Asphalt Cement:
 - 1. ASTM D946.
- C. Aggregate: Crushed stone or Washed gravel and sand, graded in accordance with AI MS-2 type AASHTO A-1- a..
- D. Primer: AI MS-19, homogenous, medium curing, cut back liquid asphalt.
- E. Tack Coat: AI MS-19, homogenous, rapid curing, cut back liquid asphalt.

2.2 MIXES

- A. Asphaltic Concrete:
 - 1. Uniform mixture of coarse and fine aggregate, mineral filler, and asphalt cement, accurately proportioned by weight in accordance with AI MS-2.
 - 2. Binder or Base course: Coarse Type B-1 graded aggregate, 4.5 to 6.0 percent asphalt cement by weight.
 - 3. Surface course: Fine Type S-1 graded aggregate, 5.0 to 7.0 percent asphalt cement by weight.

PART 3 EXECUTION

3.1 CONSTRUCTION

- A. Aggregate Base Course:
 - 1. Place to 6 inch depth after compaction.
 - 2. Roller compact to minimum 95 percent. Add small quantities of fine aggregate if necessary to aid compaction.
 - 3. Uniformly grade areas to smooth surface at required grades and elevations. Make grade changes gradually. Blend slopes into level grades.
 - 4. Tolerances: Within plus or minus 1 inch of required elevation.
- B. Primer: Apply to base course and contact surfaces of curbs and abutments at minimum rate of 1/2 gallon per square yard.
- C. Asphaltic Concrete:
 - 1. Place within 24 hours after applying primer.
 - 2. Minimum compacted thicknesses:
 - a. Binder course: 4 inches.
 - b. Surface course: 1 inches.
 - 3. Apply tack coat to binder course at minimum rate of 1/2 gallon per square yard.
 - 4. Compact with pneumatic roller, then with steel roller. Do not displace or extrude asphaltic concrete from position. Hand compact in areas inaccessible to rolling equipment.
 - 5. Roll with consecutive passes to achieve uniform, smooth surface, free from roller marks.
 - 6. Construction joints:

- a. Place mixture as nearly continuous as possible. Roll unprotected edge of freshly laid mixture only when laying is discontinued for such length of time as will allow cooling of mixture.
- b. When resuming work, cut back previously laid material to produce slightly beveled edge for full depth of course; place fresh mixture against fresh cut.
- c. Hot smoothing irons may be used for sealing joints; use care to avoid burning surface.
- d. Construct joints either parallel to or at right angles to longitudinal axis of work.

D. Installation Tolerances:

1. Maximum surface deviation: Plus or minus 1/4 inch in 10 feet, measured parallel to line of drainage.
2. Maximum deviation from specified thickness: Plus or minus 1/4 inch.

3.2 FIELD QUALITY CONTROL

A. Testing and Inspection Services:

1. Aggregate base course: Perform field in place density tests, ASTM D1557 or D2922, one test for each 1000 square feet.
2. Asphaltic concrete:
 - a. Perform one laboratory density and stability test for each day's operation.
 - b. Perform one field in place density test, ASTM D1188, on each type of asphaltic concrete for each day's operation.
 - c. Perform one extraction and gradation test, ASTM D2172, on each type of asphaltic concrete for each day's operation.
 - d. Examine pavement to determine whether specified total thickness of asphaltic concrete has been placed, minimum of one core test for each 2000 square feet of paving.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete curbs, gutters, walks, and paving.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 03 10 00 - Concrete Forming.
 - 3. Section 03 20 00 - Concrete Reinforcement.
 - 4. Section 03 30 00 - Cast-In-Place Concrete.
 - 5. Section 03 35 00 - Concrete Finishing.
 - 6. Section 07 92 00 - Joint Sealers.

1.2 REFERENCES

- A. ASTM International (ASTM) D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

- A. Concrete mix design.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Formwork:
 - 1. Specified in Section 03 1000.
 - 2. Metal Forms: Free of deformities, furnished in maximum practical lengths.
 - 3. Wood Forms: Good grade lumber, sound and free of warp, minimum 2 inch nominal thickness except where extremely short radii of curves require thinner forms.
- B. Reinforcement:
 - 1. Specified in Section 03 2000.
 - 2. Dowels: Plain round bar dowels, conforming to reinforcing steel requirements.
- C. Concrete Materials: Specified in Section 03 3000.

2.2 ACCESSORIES

- A. Joint Filler: Non asphaltic type, ASTM D1752, Asphaltic type, ASTM D1752 with removable strip providing recess for joint sealer.
- B. Joint Sealers: Specified in Section 07 9200.

PART 3 EXECUTION

3.1 CONSTRUCTION OF FORMS

- A. Construct formwork in accordance with Section 03 1000.
- B. Set forms accurately to required grades and alignment.
- C. Brace forms to withstand loads applied during concrete placement.
- D. Install flexible or curved forms of wood or metal for curves with radius of 300 feet or less.
- E. Leave forms in place for minimum 12 hours after completion of finishing operation.
- F. Provide expansion joints where paving abuts other construction, and at maximum 5 feet on center. [or spacings as indicated on Drawings.]
 - 1. Shape joint filler to concrete cross section and fasten in place.
 - 2. Provide holes for dowel bars maximum 1/8 inch larger than bar diameter.
 - 3. Use removable strips to provide recess for sealant.

3.2 PLACING REINFORCING

- A. Install reinforcement in accordance with Section 03 2000.
- B. Place reinforcing in middle third of flatwork.
- C. Stop alternate bars of reinforcing steel at control joints.
- D. Provide dowels at maximum 12 inches on center at expansion joints. Wrap one end of dowel in building paper or felt. Stop reinforcement on both sides of joint.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with Section 03 3000.
- B. Place concrete continuously between predetermined expansion and control joints. Do not interrupt successive placement such that cold joints occur.
- C. Shape curbs and gutters to cross section indicated on Drawings.
- D. Strike off flatwork with screed, then float to uniform surface.
- E. Provide broom finish in accordance with Section 03 3500.
- F. Tool expansion joint edges and other exposed edges to smooth, dense surface with 1/8 inch radius.
- G. Provide sawn or tooled control joints at maximum 5 feet on center or spacings as indicated on Drawings.
- H. Installation Tolerances: Surfaces true to plane, in longitudinal direction to required grade, within plus or minus 1/4 inch in 10 feet, noncumulative.
- I. Seal control and expansion joints as specified in Section 07 9200.

END OF SECTION

SECTION 32 16 00

CURBS AND GUTTERS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The WORK under this Section includes providing all labor, materials, tools, and equipment necessary for furnishing and installing curb, and gutter as shown on the Drawings and Standard Details.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Materials shall conform to the requirements of Section 03 3000 – Concrete Structures, except "Concrete International Corporation" Ashford Formula, or approved equal, shall be used instead of the specified curing materials.
- B. Synthetic fibers may be substituted for rebar or wire mesh upon approval of the ENGINEER.

PART 3 – EXECUTION

3.1 METHODS OF CONSTRUCTION

- A. Curb and gutter, and valley gutter shall conform to the applicable requirements of Section 03 3000 - Concrete Structures, and as shown on the Drawings, except "Concrete International Corporation" Ashford formula, or approved equal, shall be used as a curing compound.
 - 1. The curing compound shall be sprayed on the surface with a low-pressure sprayer immediately following the finishing operation.
 - 2. The entire surface shall be kept wet for 30 minutes by brooming excess material onto the dry spots or by re-spraying them immediately. No areas on the concrete surface shall be allowed to dry during the initial 30 minute period.
 - 3. As the curing compound begins to dry into the surface and becomes slippery, lightly sprinkle the surface with water to aid the penetration of the curing compound and to bring any alkali to the surface.
 - 4. After 30 to 40 minutes, squeegee or broom the surface to remove any excess curing compound and alkali or other impurities brought to the surface. All WORK required for the application of the curing compound shall conform to the manufacturer's recommendations.
- B. Concrete curb and gutter, curb, and valley gutter shall be integral, one course

construction, and molded in place on a gravel subgrade. The face forms of the integral curb and gutter shall be removed as soon as practicable. The top and inclined surface shall then be worked with floa or steel trowels to a gritty finish. Glazing, sprinkling of sand or cement, or blotting will not be permitted. Both front and back edges shall be tooled to a radius of one-half inch.

- C. Use of monolithic curb and gutter machines will be permitted only on the written approval of the ENGINEER. Mortar may be added to the curb machine in a quantity approved by the ENGINEER.
- D. Expansion joints shall be placed at 30-foot, maximum, intervals along all structures and about all features that project into, through, or against the concrete. An expansion joint shall be constructed at the intersection of sidewalks, between sidewalk crossings and sidewalks and at the beginning and end of curb returns. Expansion joints shall not be placed between the sidewalk and the curb.
- E. Expansion joint material shall conform to the requirements of AASHTO M 213. This material shall extend the full width of the structure and shall be cut to such dimensions that the base of the expansion joint shall extend to the subgrade and the top shall be depressed not less than one-quarter inch nor more than one-half inch below the finished surface of the concrete. The material shall be one piece in the vertical dimension and shall be securely fastened to the existing concrete face against which fresh concrete is to be poured.
- F. Transverse contraction joints, cut to a depth of one inch prior to the final set of the concrete, shall be tooled in the sidewalk at intervals approximately equal to the width of the sidewalk, and at ten foot intervals in the curb and gutter. Where the sidewalk adjoins the curb (parallel to it), contraction joints in the sidewalk and curb shall be made to match where practicable.
- G. The top and face of the finished curb shall be true and straight and the top surface of curbs shall be of uniform width, free from lumps, sags, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb, or on the surface of gutters, the surface shall not vary more than 0.02 foot from the edge of the straightedge except at grade changes or curves. All discolored concrete shall be cleaned at the CONTRACTOR's expense. The concrete may be cleaned by abrasive blast cleaning or other methods approved by the ENGINEER. Repairs shall be made by removing and replacing the entire unit between scoring lines or joints.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fence framework, fabric, and accessories.
 - 2. Excavation for posts.
 - 3. Concrete post foundations.
 - 4. Gates and hardware.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 03 3000 - Cast-In-Place Concrete.

1.2 REFERENCES

- A. ASTM International (ASTM) C94 - Standard Specification for Ready-Mixed Concrete.
- B. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.
- C. ASTM A 121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire; 2007
- D. ASTM A 123/A 123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002
- E. ASTM A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2007
- F. ASTM F 567 - Standard Practice for Installation of Chain-Link Fence; 2007.
- G. ASTM F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2008.
- H. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.

1.3 SYSTEM DESCRIPTION

- A. Fence Height: As indicated on Drawings.

1.4 SUBMITTALS

- A. Submittals for Review:
 - 1. Hardware, and schedule of components.

1.5 QUALITY ASSURANCE

- A. N/A

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Ameristar. (www.ameristarfencing.com)
 - 2. Master-Halco, Inc. (www.fenceonline.com)
 - 3. Merchants Metals. (www.merchantsmetals.com)
 - 4. Perfection Fence Corp. (www.perfectionfence.com)
 - 5. Southwestern Wire, Inc. (www.southwesternwire.com)
 - 6. Anchor Die Cast.
 - 7. Protecto Fence Mfg..

- B. Substitutions: Under provisions of Division 01.

2.2 MATERIALS

- A. Materials and Components: Conform to CLFMI Product Manual.
- B. Framing:
1. Intermediate posts: Type I - round.section.
 2. Terminal, corner, rail, brace, and gate posts: Type I round.]
 3. Framing sizes: Per CLFMI Product Manual.
 4. Finish: Galvanized, to CLFMI Product Manual.
- C. Materials:
1. Posts, Rails, and Frames: ASTM F 1083 Schedule 40 hot-dipped galvanized steel pipe,welded construction, minimum yield strength of 30 ksi.
 2. Wire Fabric: ASTM A 392 zinc coated steel chain link fabric.
 3. Barbed Wire: Zinc-coated steel, complying with ASTM A 121 Type Z Coating Class 1; 3 strands of 0.099 inch diameter wire, with 2-pointed barbs at 4 inches on center.
 4. Concrete: Type specified in Section 03 3000. minimum 3000 PSI compressive strength at 28 days, 3 to 5 inch slump
- D. Components:
1. Line Posts: 2.0 inch diameter.
 2. Corner and Terminal Posts: 3.0 inch.
 3. Gate Posts: 3.5 inch diameter.
 4. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
 5. Gate Frame: 1.66 inch diameter for welded fabrication.
 6. Fabric: 2 inch diamond mesh interwoven wire, 9 gage thick, top selvage knuckle end closed, bottom selvage twisted tight.
 7. Tension Wire: 6 gage thick steel, single strand.

2.3 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Extension Arms: Cast steel galvanized, sloped at 45 degrees, to accommodate 3 strands of barbed wire, single arm, vertical.
- D. Hinged Gate Hardware:
1. Two hinges per gate leaf, sized to gate weight and conditions.
 2. Fork latch with gravity drop and padlock provisions].
 3. Center gate stop and drop rod for double gates.

2.4 FABRICATION OF GATES

- A. Fabricate to CLFMI Product Manual.
- B. Fitting and truss rod frame construction.

2.5 FINISHES

- A. Framing: Galvanized.
- B. Fabric: Galvanized.
- C. Hardware and Fittings: Color to match framing.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install fencing in accordance with CLFMI Product Manual.
- B. Space posts maximum 10 feet on center.
- C. Drill post holes into undisturbed or compacted soil, with diameter equal to 12 inches minimum.
- D. Set posts minimum 30 inches below grade, with bottom of hole 3 inches below bottom of post. Excavate deeper in soft or loose soils and for posts with heavy lateral loads.
- E. Place concrete around posts in continuous pour, tamp and dome top away from post. Check for vertical and top alignment; brace posts until concrete has set.
- F. Pour top of footings flush with finished grade.
- G. Stretch panels taut and secure to posts with wire post brackets.
- H. Install gates plumb and level. Adjust for smooth operation.
- I. Install extension arms sloped inward and attach barbed wire; stretch taut and secure to arms.

3.2 INSTALLATION TOLERANCES

- A. Maximum Variation from Plumb: 1/4 inch in 10 feet.
- B. Maximum Offset from True Position: 1 inch.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 - GENERAL

1.1 SCOPE

- A. The work under this section shall consist of providing all work, materials, labor, equipment and supervision necessary to complete seeding, mulching and maintenance as indicated on the drawings. Included are the following topics:

1.2 RELATED WORK

- A. Applicable provisions of Division 1 govern work under this Section.
 - 1. 32 91 13 – Soil Preparation
 - 2. 32 93 00 – Trees, Shrubs and Ground Cover

1.3 SUBMITTALS

- A. Provide seed samples and data showing seed mix composition and a guarantee of germination.
- B. Provide seed mixture.
- C. Provide information on method of sowing seed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Seed shall be delivered to the site in its original, unopened container, labeled as to weight, analysis, and manufacturer. Store any seed delivered prior to use in a manner safe from damage from heat, moisture, rodents, or other causes. Any seed damaged after acceptance shall be replaced by the Contractor.

1.5 PLANTING SEASON

- A. The regular seeding season is considered April 1-June 15 and September 1-October 15.

1.6 GUARANTEE

- A. The Contractor shall guarantee the germination of seed installed during the regular seeding season.

PART 2 - PRODUCTS

2.1 Grass Seed

- A. Grass seed shall be Zoysia Grass.

2.2 Water

- A. Water free of wastewater effluent or other hazardous chemicals.

2.3 Mulch

- A. Clean straw or hay that is well-seasoned, and free of rot, mildew and the seeds of noxious weeds.

PART 3 - EXECUTION

3.1. PREPARATION

- A. Prepare area in accordance with Section 32 91 19 – Soil Preparation.
- B. No seeding shall occur on frozen ground or at temperatures lower than 32° F (0° C).

3.2. SOWING

- A. Unless otherwise noted, sow seed at a rate of 2# (dry seed weight)/1000 square feet.

3.3. MULCHING

- A. Uniformly spread the mulching material over the designated areas to a loose depth of 1/2 to 1 1/2 inches. Loosen or make fluffy the mulch material from compacted bales before spreading in place. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.

3.4. CLEANING AND REPAIR

- A. Waste and excess material from the seeding operation shall be promptly removed. Adjacent paved areas are to be cleaned, and any damage to existing adjacent turf areas shall be repaired.

3.5. MAINTENANCE WATERING

- A. Seeded areas are to be watered daily to maintain adequate surface soil moisture for proper seed germination. Watering shall continue for not less than 30 days following seeding. Thereafter, apply 1/2" (1.3 cm) of water twice weekly until final acceptance.

3.6. MOWING

- A. Cool season grasses, such as bluegrass, tall fescue, perennial ryegrass, etc. shall be mown to a height of 2-1/2" (6.4 cm) in spring and fall, and no less than 3" (7.6 cm) from June through September. These heights are to be maintained through repeat mowings as needed until final acceptance.
- B. No more than 40% of grass leaf shall be removed during any single mowing operation.
- C. The mowing operation is to include trimming around obstacles and the raking of excess grass clippings. Weed eaters shall not be used around trees.

END OF SECTION

SECTION 32 93 00

TREES, SHRUBS AND GROUND COVER

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bed preparation.
 - 2. Plant materials.
- B. Related Sections:
 - 1. Division 01 - Administrative, procedural, and temporary work requirements.
 - 2. Section 31 22 00 - Grading.

1.2 REFERENCES

- A. American National Standards Institute (ANSI) Z60.1 - Nursery Stock.

1.3 SUBMITTALS

- 1. List of trees, shrubs and grasses to be planted.

1.4 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating plants specified in this Section with minimum two [2] years experience.
- B. Installer Qualifications: Company specializing in installing plants specified in this Section with minimum two [2] years experience.
- C. Maintenance Services: Performed by installer.
- D. Regulatory Requirements: Comply with requirements of authorities having jurisdiction for fertilizer and plant materials.
- E. Plant Materials: Described by ANSI Z60.1.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and manufacturer.
- B. Deliver plant materials immediately prior to installation; keep moist and protect from damage until planted.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install plant materials at ambient temperatures below 35 degrees F or above 95 degrees F.
 - 2. Do not install plants when wind velocity exceeds 30 MPH.

1.7 MAINTENANCE

- A. Maintenance Service:
 - 1. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition. Include fertilization, weeding, pruning, and insect and disease control.

2. Replace dead or dying plants with plants of same size and species specified; plant in next growing season.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Trees, Shrubs, and Ground Cover:
 1. Species and size as indicated in plant schedule; grown in climatic conditions similar to those at site.
 2. Free of disease, hazardous insects, and defects including weak or broken limbs, crotches, and damaged trunks, roots, or leaves
- B. Backfill: Topsoil as specified in Section 31 2200.
- C. Mulch: Shredded Cypress, Cedar or Hardwood, free from growth or germination inhibiting ingredients.
- D. Fertilizer: General purpose type.
- E. Herbicides:
 1. Translocating type.
 2. Pre-emergent type.
- F. Bracing Materials:
 1. Stakes: Softwood lumber.
 2. Wires: Non-corrosive material.
 3. Protectors: Rubber or other suitable material.

2.2 MIXES

- A. Prepared Topsoil Mixture: Mix fertilizer with topsoil at rate of 2 pounds per inch of caliper for trees, and 1/2 pound per container plant.

PART 3 EXECUTION

3.1 PREPARATION

- A. Bed Preparation:
 1. Apply translocating herbicide to grass in areas to be planted.
 2. Remove foreign materials, large rocks, and lumps.
 3. Mix in 10 pounds of fertilizer per 1000 square feet. Apply pre-emergent herbicide.
 4. Till to 6 inch depth, then fine grade to lines and levels indicated.
 5. Request approval of bed preparation and location by Architect.
- B. Plant Materials:
 1. Remove synthetic and treated cloths, twines, and pots.
 2. Untreated organic cloths may be left in place; loosen from root collar to prevent girdling.
 3. Locate plants and request approval of location by Architect.

3.2 INSTALLATION

- A. Dig pits and beds 6 inches larger than plant root system.

- B. Set plants vertically; place for best appearance.
- C. Set plants in pits or beds, on prepared topsoil mixture. Lay bare-rooted plants so roots lie in natural position.
- D. Place prepared topsoil mix around plant; settle with water when hole is half full and again when full; remove air pockets.
- E. Brace plants against wind damage:
- F. Install guy wires with protectors where wires contact trees. Stake in position.
- G. Position to prevent hazards to pedestrians where possible.
- H. Do not restrict plant movement under light wind loads or damage bark.
- I. Cover bare soil with minimum 4 inch layer of mulch.

END OF SECTION

DIVISION 33 EXTERIOR IMPROVEMENTS

**SECTION 33 01 10.60
DISINFECTION OF WATER SYSTEMS**

PART 1 - GENERAL

1.1 SCOPE

- A. This section specifies the general procedures to be followed in cleaning piping and fluid handling equipment.
- B. The following is a list of standards which may be referenced in this section:
 - 1. American Water Works Association (AWWA):
 - a. B300, Hypochlorites.
 - b. B301, Liquid Chlorine.
 - c. B303, Sodium Chlorite.
 - d. C651, Disinfecting Water Mains.
 - e. C652, Disinfection of Water-Storage Facilities.
 - f. C653, Disinfection of Water Treatment Plants.

1.2 QUALITY CONTROL SUBMITTALS

- A. Procedures and plans for disinfection and testing. Proposed locations within system where Samples will be taken.
- B. Type of disinfecting solution, method of preparation, methods/equipment to accomplish controlled dosing.
- C. Training records for employees working with concentrated chlorine solutions or gas.
- D. Qualifications: Independent testing agency.
- E. Testing Agency:
 - 1. Equipment: Certified calibrations, manufacturer's product data, and test procedures.
 - a. Independent Testing Agency: Certification that testing agency is qualified to perform chlorine concentration testing bacteriological testing in accordance with AWWA standards, agency requirements and this specification.
 - 2. Sample Collection and Analysis Procedures for:
 - a. Bacteriological Samples.
 - b. Chlorine Samples.
- F. Certified Bacteriological Test Results:
 - 1. Facility(ies) tested is free from coliform bacteria contamination.
 - 2. Forward results directly to Owner.
- G. Method to be used for disposal of heavily chlorinated water utilized in disinfection.

1.3 QUALIFICATIONS

- A. Independent Testing Agency: Certified in PR, with 10 years experience in the field of water sampling and testing required for this Project. Calibrated testing instruments and equipment, and documented standard procedures for performing specified testing.

1.4 SEQUENCING AND SCHEDULING

- A. Commence initial disinfection after completion of the following:
 - 1. Completion and acceptance of internal painting of system(s).
 - 2. Completion and acceptance of hydrostatic and pneumatic testing, pressure and leakage testing, functional and performance testing of pipelines, pumping systems, structures, and equipment.
 - 3. Disinfection of:
 - a. Pumps and associated system piping.
 - b. Treatment plant basins and processes used to supply water to system including but not limited to Backwash tank, piping, and clearwell.

1.5 PERFORMANCE REQUIREMENTS

- A. Isolate systems to be disinfected from equipment.
- B. Install temporary connections, strainers, temporary screens and other equipment as necessary to provide full circulation through all parts of the system to be disinfected and to protect equipment and control valves where permanent strainers are not provided.
- C. Take all necessary precautions and provide all necessary materials to protect the work from damage from exposure to cleaning chemicals.

PART 2 - PRODUCTS

2.1 WATER FOR DISINFECTION AND TESTING

- A. Clean, uncontaminated, and potable.
- B. Owner will supply potable quality water, Contractor shall convey in disinfected pipelines or containers.

2.2 CONTRACTOR'S EQUIPMENT

- A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
- B. Water used to fill pipeline may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connection as required by AWWA C651. Contractor shall be responsible for providing a temporary connection and a meter at this connection.

2.3 WELL CAPPING PLATE

- A. Minimum 1/4-inch thick steel plate with threaded plug installed in approximate center of plate.

2.4 MIXING DISINFECTANT

- A. Prepare “stock” solution by mixing any of following as described below. The purpose of the stock solution is to facilitate mixing and dilution to ensure a uniform disinfecting solution. The Contractor will not be required to mix a stock solution if a liquid chlorine gas feed system that can accurately feed a desired amount of chlorine to mix a final (dilute) disinfecting solution is used.
 - 1. Liquid chlorine gas conforming to AWWA B301 and water mixture.
 - 2. Dry chlorine gas conforming to AWWA B301.
 - 3. Calcium hypochlorite conforming to AWWA B300 or sodium hypochlorite conforming to AWWA B303 powder or liquid and water mixture.
- B. Feed dry chlorine gas through devices to regulate the rate of flow and ensure uniform diffusion of gas into water within the pipe or vessel being treated. Chlorinating devices for feeding chlorine gas solution or the gas itself shall prevent backflow of water into chlorine cylinder.
- C. Use following proportions of hypochlorite or chlorine to water:
 - 1. Chlorine Gas or Liquid (100 Percent Cl): 1 pound per 11.75 gallons water.
 - a. Apply liquid chlorine gas-water solution by means of a solution feed chlorinating device.
 - 2. Calcium Hypochlorite (65 to 70 Percent Cl): 1 pound per 7.5 gallons water.
 - a. If calcium hypochlorite is used, first mix dry powder with water to make a thick paste, then thin to a 1 percent solution (10,000 ppm chlorine).
 - 3. Sodium Hypochlorite (5.25 Percent Cl): 1 gallon per 4.25 gallons water.
 - a. If sodium hypochlorite procedure is used, dilute the liquid with water to obtain a 1 percent solution.

PART 3 - EXECUTION

3.1 GENERAL

- A. Disinfect the following pumps, tanks, wells, filters, and pipelines, installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
 - 1. Disinfect new pipelines that connect to existing pipelines up to the point of connection.
 - 2. Disinfect surfaces of materials that will contact finished water, both during and following construction using spray method described below. Disinfect prior to contact with finished water. Take care to avoid recontamination following disinfection.
- B. Prior to application of disinfectants, clean tanks, equipment and pipelines of loose and suspended material. Flush pipelines until clear of suspended solids and color. Use water suitable for flushing and disinfecting.
- C. Conform to AWWA C651 for pipes and pipelines, C652 for tanks and reservoirs, and AWWA C654 for wells, AWWA C6543 for water treatment plants and filters, except as modified in these Specifications.
- D. Allow freshwater and stock disinfectant solution to flow into the pipe or vessel at a measured rate so that the chlorine-water solution is at the specified strength. Do not place concentrated commercial disinfectant in the pipeline or vessel before it is filled with water.

3.2 PIPING AND PIPELINES

- A. Flushing:
 - 1. Before disinfecting, flush all foreign matter from pipeline. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties. Flushing velocities shall be at least 2.5 fps. For large diameter pipe, where it is impractical or impossible to flush the pipe at specified velocity, clean the pipeline in-place from the inside by brushing and sweeping, then flush the line.
 - 2. Flush pipelines through flushing branches and remove branches after flushing is completed. Operate valves during flushing process at least twice during each flush.
 - 3. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections.
- B. Disinfecting Solution: Chlorine-water solution having a free chlorine concentration of not less than 50 ppm.
- C. Disinfecting Procedure In accordance with AWWA C651, unless herein modified.
- D. Point of Application:
 - 1. Inject chlorine mixture into pipeline to be treated at beginning of line through corporation stop or suitable tap in top of pipeline.
 - 2. Control water from existing system or to flow slowly into pipeline during application of chlorine.
 - 3. Control rate of chlorine solution flow in proportion to rate of water entering pipe so that combined mixture shall contain not less than 50 ppm of free available chlorine.
 - 4. Prevent backflow of chlorine solution into line supplying water.
- E. Retention Period
 - 1. Retain treated water in pipeline for at least 24 hours to destroy all nonspore-forming bacteria. At end of 24 hour period, disinfecting solution shall contain at least 10 ppm of free chlorine or the pipeline shall be cleaned once again, disinfecting solution shall be reapplied, and specified procedure repeated.
 - 2. Operate valves, hydrants, and appurtenances during disinfection to ensure that disinfecting solution is dispersed into all parts of pipeline, including dead-ends and areas that otherwise may not be treated.
 - 3. After disinfection, flush water from the permanent source until water through the pipeline is equal chemically and bacteriologically to permanent source of supply. Flushing of service connections after chlorination is not required.

3.3 PUMPS

- A. Disinfecting Solutions: Minimum free chlorine concentration of 200 ppm.
- B. Disinfecting Procedure In accordance with AWWA C653, unless herein modified.
- C. Application:
 - 1. Inject the disinfecting solution into the pump and associated piping and circulate for a minimum 3 hour period of time. At the end of the 3 hour period, the solution shall have strength of at least 50 ppm free chlorine.

2. Operate valves and/or pump appurtenances during disinfection to ensure that the disinfecting solution is dispersed into all parts of the pumps and lines.
3. If the disinfecting solution contained in the pumps has a residual free chlorine concentration less than 50 ppm after the 3 hour retention period, pump shall be cleaned once again, reapply disinfecting solution, and retest until a satisfactory test result is obtained.
4. After chlorination, flush the water from the pumps until the water through the units is chemically and bacteriologically equal to the permanent source of supply.

3.4 TANKS AND RESERVOIRS

A. Cleaning

1. Clean interior surfaces using water under pressure before sterilizing. Isolate tank and reservoir from system to prevent contaminating materials from entering the distribution system. Cleaning shall
 - a. Remove all deposits of foreign nature.
 - b. Remove all biological growths.
 - c. Clean the slopes, walls, top, and bottom.
 - d. Avoid damage to the structure.
 - e. Avoid pollution or oil deposits by workers and equipment.
2. Dispose of water used in cleaning in accordance with applicable regulations before adding disinfecting solution to the reservoir.

B. Alternatively, the clear well, reservoir, and other structures, excluding the, may be cleaned by scrubbing the walls and floor with solution containing at least 200 ppm of free chlorine, rinsing the walls and floor with a stream of water, and disposing of the rinse water. The structures shall then be filled with water containing at least 2 ppm of chlorine until 1 ppm of free chlorine remains after 24 hours' contact.

C. Disinfecting Procedure In accordance with AWWA C652, unless herein modified.

1. Disinfect interior surfaces of tank and reservoir and inlet and outlet pipelines by the application of chlorine. Wash and disinfect surfaces even though there may be no visible evidence of contamination.
2. Adapt procedure in Article MIXING DISINFECTANT to obtain residual chlorine concentrations required.
3. Disinfect in accordance with one of the following methods:
 - a. Spray or brush a solution containing 200 ppm of free chlorine onto the interior surfaces of tank and reservoir. Apply solution from the bottom up and to the entire structure. Allow to remain 3 hours or until dry before being rinsed off.
 - b. Fill tank and reservoir with water containing at least 50 ppm of free chlorine. Hold solution for at least 3 hours, drain the structure, and fill with potable water.
 - c. Parts of structures, such as ceilings or overflows, that cannot be immersed by the second method above shall be spray or brush disinfected.
4. Drain previous chlorine solution and fill tank and reservoir with chlorinated water to produce a free chlorine residual of 5 ppm after a retention period of 24 hours. After holding for 24 hours, drain the reservoir and fill with potable water.

3.5 FILTERS

- A. Disinfection Procedure In accordance with AWWA C653, unless herein modified.
- B. Disinfect the filter influent gullet, filter structure, filter media and under drains, filter effluent piping, backwash supply piping, finished water piping, and potable water piping. Clean other new facilities designed to hold or transport process water prior to disinfection of these facilities including raw water piping, flocculation and sedimentation basins, filter influent piping, and channels.
- C. Prior to disinfection, remove foreign material from filtration structures. Clean using fire hoses and tools suitable for adequate scrubbing and cleaning. Pump or drain scrub water from structures. Fill structures with water containing not less than 50 ppm free chlorine and hold for 24 hours. Drain or pump solution to waste in accordance with applicable regulations and as described in this section.

3.6 WELLS

- A. Disinfection Procedures: In accordance with AWWA C654, unless herein modified.
 - 1. After well has been completed and tested, it shall be cleaned of all foreign substances. Swab the inner lining using alkalies if necessary to remove oil, grease, or other extraneous matter.
 - 2. Use chlorine solution of a volume and strength so that a concentration of at least 50 ppm of free chlorine is contained in the well.
 - 3. Prepare and apply chlorine solution in accordance with manufacturer's directions.
 - 4. Chlorine solution shall be poured into the well and the well surged for at least 5 minutes. After 4 hours, the well shall be pumped or bailed until the chlorine concentration is less than 5 ppm.
 - 5. Take care to prevent the entrance into well(s) of dirt or other contamination while installing pump(s).
 - 6. Pump bowls, column, and air-line shall be thoroughly washed, first with clear water and then with a 50 ppm free chlorine solution immediately before being placed into the well.
 - 7. Thoroughly wash the inside of the well casing above the water surface with 50 ppm free chlorine solution before installing the pump into the well.
 - 8. Pour additional chlorine solution into the well in such volume and strength to result in a concentration of at least 50 ppm of free chlorine in all parts of the well.
 - 9. Allow chlorine solution to stay in the well for 24 hours after the pump has been installed. Then pump solution out of the well and dispose in accordance with applicable regulations and as described in this section.
- B. Capping Tack weld capping plate to casing after well has been disinfected and pumped out.

3.7 DISPOSAL OF DISINFECTING WASTEWATER

- A. Do not allow flow into a waterway without neutralizing disinfectant residual.
 - 1. See AWWA C652 for acceptable neutralization methods.

3.8 TESTING

- A. Test Equipment:

1. Clean containers and equipment used in sampling and assure they are free of contamination.
 2. Obtain sampling bottles with instructions for handling from OWNER's for an independent testing laboratory.
- B. Chlorine Concentration Sampling and Analysis:
1. Sampling Frequency for Disinfecting Solution: as determined by ENGINEER/OWNER.
 2. Residual Free Chlorine Samples: as determined by ENGINEER/OWNER.
 3. Dechlorinated Disinfecting Wastewater Residual Samples: as determined by ENGINEER/OWNER.
 4. Sampling Locations: as determined by ENGINEER/OWNER.
 5. Analysis to be performed by the OWNER's laboratory, by an independent test laboratory. Samples will be analyzed using the amperometric titration or method for free chlorine as described in the latest edition of Standard Methods for Examination of Water and Wastewater.
 6. Collection of Samples: Coordinate activities to allow Samples to be taken in accordance with this Specification. Provide valves at sampling points. Provide access to sampling points. Samples should be collected in accordance with AWWA Standard.
- C. After tanks, reservoirs, filters, and pipelines have been cleaned, disinfected, and refilled with potable water, an independent laboratory will take water Samples and have them analyzed for conformance to bacterial limitations for public drinking water supplies. Samples shall be analyzed for coliform concentrations in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater.
1. A minimum of two Samples on each of 2 consecutive days from each separable structure and every 2,000 feet of pipeline will be obtained and analyzed by standard procedures outlined by local regulatory agencies.
 2. Sampling points will be representative as accepted by the Owner or Owner's representative.
 3. Independent laboratory will be selected and retained by Owner or Owner representative, but services shall be purchased by the Contractor.
- D. If the minimum Samples required above are not bacterially negative, the disinfecting procedures and bacteriological testing shall be repeated on the respective facilities until bacterial limits are met.
- E. After initial disinfection process has been completed, fill tank reservoir with water containing at least 2 ppm of free available chlorine residual; after 24 hours' contact, 1 ppm of free available chlorine must remain.

END OF SECTION

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

1.01 SECTION INCLUDES

- A. Monolithic concrete manholes with transition to lid frame, covers, anchorage, and accessories.
- B. Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- C. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2007.
- D. ASTM C 478M - Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2007.
- E. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2007.
- F. ASTM C 923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).
- B. Concrete: As specified in Section 03 3000.
- C. Concrete Reinforcement: As specified in Section 03 3000.

2.02 COMPONENTS

- A. Lid and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; live load rating of 100 psf;.
- B. Manhole Steps: Formed plastic covered steel rungs; 1/2 inch diameter. Formed integral with

manhole sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

- A. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
- B. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.
- C. Cut and fit for pipe.
- D. Set cover frames and covers level without tipping, to correct elevations.
- E. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings for site water lines including domestic water lines and fire water lines.
- B. Valves, Fire hydrants, and Domestic water hydrants.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 00- Excavation: Excavating and Fill.

1.03 REFERENCES

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
- C. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.
- D. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.
- E. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2005.
- F. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.
- G. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water; American Water Works Association; 2003 (ANSI/AWWA C104/A21.4).
- H. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002, and Errata 2002 (ANSI/AWWA C151/A21.51).
- I. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association; 2002.
- J. AWWA C502 - Dry Barrel Fire Hydrants; American Water Works Association; 2005 (ANSI/AWWA C502/C502a).
- K. AWWA C504 - Rubber Seated Butterfly Valves; American Water Works Association; 2006.
- L. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS; American Water Works Association; 2001 (ANSI/AWWA C508).
- M. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances; American Water Works Association; 2005 (ANSI/AWWA C600).
- N. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution; American Water Works Association; 2007 (ANSI/AWWA C900/C900a).
- O. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; 1993.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company requirements.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Copper Tubing: ASTM B 88, Type K, annealed:
- B. PVC Pipe: ASTM D 1785, Schedule 40.
- C. PVC Pipe: AWWA C900 Class 100:
- D. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.

2.02 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

2.03 HYDRANTS

- A. Hydrants: Puerto Rico Type as required by Puerto Rico Aqueduct and Sewer Authority.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles, one pumper nozzle.
- D. Finish: Primer and two coats of enamel in color required by utility company.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 2316.
- B. Cover: As specified in Section 31 2316.

2.05 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.
- B. Meter: N/A

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See Section 31 2316 for additional requirements.
- B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Establish elevations of buried piping to ensure not less than 2 ft of cover.
- B. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- C. Install piping and fittings
- D. Route pipe in straight line.
- E. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- F. Slope water pipe and position drains at low points.
- G. Install trace wire 6 inches above top of pipe; coordinate with Section 31 2316.13.

3.05 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished

3.06 SERVICE CONNECTIONS

- A. N/A.

3.07 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.

END OF SECTION

SECTION 33 19 26 ULTRASONIC WATER METERS

PART 1 - GENERAL

1.1 SCOPE

- A. Section specifies the minimum requirements for ultrasonic water meters. This element will measure continuous level of a process fluid and transmit the signal.

1.2 QUALITY ASSURANCE

- A. All instruments shall be made in compliance with all the regulatory agencies and suitable for industrial and harsh environments.
- B. Factory Testing:
 - 1. All instruments shall be factory tested for performance and accuracy. A factory calibration test shall be performed at a minimum of five points evenly space throughout the instrument range to ensure linearity.

1.3 SUBMITTALS

- A. The submittals shall be as defined in Section 01 32 19, Submittals.

1.4 OPERATING REQUIREMENTS

- A. The equipment shall operate in an ambient temperature of -4 to 158 °F and relative humidity of 85% at 104°F.
- B. The equipment enclosure shall comply with code regulations and shall be suitable for the application. The enclosure shall comply with NEMA standard and the National Electrical Code.
- C. When using the transmitter in hazardous areas, the installation shall comply with the proper area classification.

1.5 IDENTIFICATION TAGS

- A. The identification tags shall be as defined in Section 01 75 17 Equipment Testing

1.6 RELATED SECTIONS

- A. Section 01 75 17, Equipment Testing

PART 2 – PRODUCT PERFORMANCE REQUIREMENTS


2.1 REQUIREMENTS

- A. Flow Computer
 - 1. Display: Alphanumeric
 - 2. Keyboard: 4x4 Keypad
 - 3. Mounting: Wall Mount or optional Panel Mount.
 - 4. Output: 4-20mA or 0-20mA analog output, frequency output (12- 9999Hz), relay, serial output
 - 5. Power: Wall Mount: 120VAC
- B. Performance
 - 1. Accuracy: $\pm 1.0\%$ of reading above ± 1 ft/s
 - 2. Repeatability: $\pm 0.2\%$ at 1 to 53 ft/s
 - 3. Linearity: 0.5%
- C. Identification Tag: Tag as required

PART 3 - EXECUTION

3.1 INSTRUMENT SPECIFICATION SHEET

- A. Fill out an Instrument Specification Sheet for every level transmitter following the previous minimum requirements and adding specific information regarding the project.

		Project Number: _____ Project Name: _____	
GENERAL	1	Tag Number	
	2	Service	
	3	Location	
	4	Area Classification	
	5	Mounting	
	6	Certification	
	7	Barrier - Manufacturer / Model	
PROCESS CONDITIONS	9	Fluid	
	10	Pressure Max.	Oper.
	11	Temperature Max.	Oper.
	12	Lower Oper. S.G.	Lower Oper. Visc.
	13	Vacuum	Over Pressure
TRANSMITTER	15	Application	
	16	Type	
	17	Enclosure	
	18	Housing	Paint
	19	Power Supply	Load Resist
	20	Process Connection	Electrical Connection
	21	Accuracy	Response Time
	22	Max. Static Pressure	
	23	Element Material	
	24	Wetted O - Ring Material	
	25		
	26	Instrument Range Min.	Max.
	27	Calibration Range Min.	Max.
ELEMENT	28	Elevation	Suppression
	29	Allow Oper. Pressure	Allow Oper. Temp.
	30	Overpressure Limits	
	31	Process Connection & Rating	
	32	Antenna Material	
COMMUNICATION AND SOFTWARE	33	Antenna Lining Material	
	34	Antenna Length	
	35	Inactive Length (dead band)	
	36	Antenna OD	
	37	Beam Angle	
	38		
	39	Communication Type	
OPTIONS	40	Baud - Rate	
	41	Communication with:	
	42	Configuration from:	
	43	Internal Diagnostics	
	44	Held Terminal	
PURCHASE	45		
	46	Integral Meter	Scale
	47	Lightning Protection	
	48	Hydrostatic Testing	
	49	Mounting Brackets	
NOTES:	50		
	51	Manufacturer	
	52	Model	
	53	Purchase Order Number	
	54	Price	Item Number
55		Serial Number	
INSTRUMENT SPECIFICATION Level Transmitter Ultrasonic			
No. By Date Revision App'd Code		Spec. No.: _____ Rev.: _____	

Standard Instrument Specification Sheet

3.2 INSTALLATION

A. General:

1. All installations shall be in accordance with Manufacturer's recommendation and instructions.
2. All necessary mounting accessories shall be provided.
3. All instruments shall be installed in their respective field or panel location as shown on the drawings.

3.3 ACCEPTANCE TESTING AND CALIBRATION

A. General: The acceptance testing and calibration shall be as describe in Section 01 75 17 – Equipment Testing.

1. All documentation; including but not limited to calibration records, revised instrument specification sheet, wiring check-out sheet, spare part list, and configuration values sheet; shall be provided to the system owner.

3.4 APPROVED MANUFACTURERS

- A. Endress + Hauser
- B. Siemens
- C. Emerson – Mobrey
- D. Flowmotion
- E. GE Panametrics
- F. Or Equal

END OF SECTION

DIVISION 35 WATERWAY AND MARINE CONSTRUCTION

SECTION 35 22 26

SLUICE GATES

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Society for Testing and Materials (ASTM):
 - a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. A193, Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature Service.
 - c. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
 - d. B21, Standard Specifications for Naval Brass Rod, Bar, and Shapes.
 - e. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
 2. American Water Works Association (AWWA):
 - a. C501, Cast-Iron Sluice Gates.
 - b. C540, Power-Actuating Devices for Valves and Sluice Gates.
 3. Joint Industry Conference (JIC): Standards for Hydraulic Cylinders.
 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. MG 1, Motors and Generators.

1.2 DEFINITIONS

- A. Submersible: The ability to exclude water when submerged under a 20-foot head of freshwater for 24 hours and still maintain electrical integrity.
- B. Slenderness Ratio: The ratio of maximum unsupported stem length to stem cross-section radius of gyration.
- C. Self-Contained: The arrangement of gate operator, supported by gate frame, such that operating thrust loads are not applied external to gate assembly.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Equipment Assembly: Make, model, weight, horsepower of each.
 2. Manufacturer's catalog information, descriptive literature, specifications, dimensional layouts, and identification of materials of construction.
 3. Detailed mechanical, and electrical drawings showing equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.

4. Gate opening and closing thrust forces that will be transmitted to support structure with operator at extreme positions and load.
5. Gate operator and stem calculations for each gate and service condition.
6. Power and control wiring diagrams, including terminals and numbers.
7. Field performance test procedures.

B. Quality Control Submittals:

1. Manufacturer's Certificate of Compliance for materials.
2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer's installation instructions.
4. Routine maintenance requirements prior to plant startup.
5. Manufacturer's Certificate of Proper Installation.
6. Operation and maintenance manual.

1.4 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage following spare parts and special tools.

<u>Item</u>	<u>Quantity</u>
Stem collars for gate stems	1 of each different size
Bronze lift nuts	1 of each different size
Indicator lights	1 dozen
Special tools required to maintain or dismantle	1 complete set

2.1 SLUICE GATES

A. General:

1. Conform to AWWA C501, rising stem type.
2. Minimum Acceptable Casting Thickness for Cast Iron Components: 3/4 inch.

B. Wall Thimbles:

1. Cast iron, one-piece construction, in accordance with ASTM A276.
2. Cast center ring or water stop around periphery.
3. Front Flange: Machined, with tapped holes for sluice gate frame attaching studs.
4. Stamp vertical center lines of metal with word "top."
5. Furnish permanent gasket of uniform thickness or mastic suitable for contact with potable water between sluice gate frame and thimble.
6. For large rectangular thimbles, furnish holes in invert to allow concrete placement under thimble. Space holes so that unvented invert length does not exceed 24 inches.
7. Coordinate sluice gate manufacturer and the fabricator for required

bolt hole size and pattern for connection to sluice gate thimbles.

C. Frames:

1. Stainless Steel 316, in accordance with ASTM 276.
2. Machine contact surfaces.
 - a. Machine dovetailed grooves on front face, into which seat facings shall be driven and machined.
 - b. Machine back flange to bolt directly to machined face of wall thimble cast in concrete.
3. For frames with top and bottom wedges, furnish integrally cast pads machined with keyways to receive wedge seats.
4. Where side clearance is limited, flanged frames may require mounting holes to be drilled through to front face of frame.

D. Discs:

1. Stainless Steel 316 in accordance with ASTM A276.
2. Machine dovetailed grooves on seating face, into which seat facings shall be driven and machined.
3. Wedge Pads: Integrally cast on disc and machined to receive adjustable wedges.
4. Cast a heavily reinforced nut pocket integrally on vertical centerline above horizontal centerline to receive thrust nut.

E. Guides:

1. Stainless Steel 316, in accordance with ASTM A276 designed to withstand total thrust from water pressure and wedging action.
2. Machine contact surfaces.
3. Length: Sufficient to retain and support at least half disc in fully OPEN position. Attach to frame with ASTM A276 or ASTM A193, Type 316 stainless steel studs; dowel to prevent relative motion between guides and frame or cast guides integrally with frame.
4. Securely attach wedge seats to machined pads on guides.

F. Wedges and Seat Facings:

1. Side wedges for all conditions. Top and bottom wedges for unseating heads as necessary to meet leakage requirements.
2. Solid cast ASTM B584, Alloy 865 manganese bronze.
3. Machine contact surfaces. Key to cast iron pads to prevent rotation or lateral motion.
4. Attach wedges to disc with ASTM A276 or ASTM A193, Type 304 stainless steel studs and nuts.
5. Seat Facings: ASTM B21, Alloy B, shaped to fill and permanently lock in machined dovetail grooves when pneumatically impacted into place. Attaching pins and screws not permitted.

G. Stems:

1. 1-inch minimum diameter, ASTM A276, Type 316 stainless steel.
2. Threads: Acme type with RMS surface roughness of

63 micro-inches or less on flanks for manually operated gates and 32 micro-inches or less on flanks for electrically operated gates. Extend threaded portion of stem 2 inches above operator when gate is in CLOSED position.

3. Couplings:
 - a. Use when stems have more than one section.
 - b. Same material as stem.
 - c. Furnish with internal threads that transmit full thrust of stem.
 - d. Hold in place on stem with bolts or keys and keyways.
 - e. Same size and interchangeable.
4. Size so that ratio of unsupported stem length (L) to radius of gyration (r), both in inches, does not exceed 200
5. Withstand in compression, without damage, thrust equal to at least 2-1/2 times rated output of hoisting mechanism, with a 40-pound effort applied to handwheel or crank.
6. Electric motor-driven floor stands to withstand at least 1.25 times output thrust of motor in stalled condition.
7. Actuated by hydraulic cylinders to withstand at least 1.25 times output of hydraulic cylinder with pressure at pressure relief valve setting.
8. Cast iron, bushed stem guides, mounted on cast iron brackets, adjustable in two directions and spaced so that L/r ratio does not exceed 200 Adjustable stop collar for CLOSED position.

H. Stem Covers:

1. Transparent plastic, vented pipe stem cover and cap.
2. OPEN/CLOSED designators on clear mylar pressure sensitive, adhesive tape, suitable for outdoor application.

I. Flush-Bottom Closure Seals:

1. Compressible Resilient Seal:
 - a. Attached to bottom of disc with a bronze or stainless steel bar and bronze or stainless steel fasteners.
 - b. Specially molded shape designed to fit a lip machined on bottom rib of disc.
 - c. Shaped to produce a wide sealing area on a machined cast iron stop bar, bolted and keyed to gate frame to form a flush invert.
 - d. Differential sealing pressure of resilient seal on stop bar shall be variable by adjustment of side wedges on gate.
2. Alternative Closures:
 - a. Solid, square-cornered, resilient rubber seal in place of bottom dovetail facing and wedging devices.
 - b. Securely fastened to bottom cross member of frame on a stop plate, with a retainer bar and stainless steel fasteners.
 - c. Make top surface of seal flush with invert of gate opening.
 - d. Machine full length of bottom edge of disc accurately to make contact with seal when disc is closed.

J. Manufacturers:

1. Whipps Inc.

2. HydroGate Corp.
3. Rodney Hunt Co.
4. Waterman Industries, Inc.
5. Craft Machine Works, Inc.
6. Approve Equal

2.2 OPERATORS

A. General:

1. Components: Withstand a minimum of 250 percent of design torque or thrust at extreme operator positions without damage.
2. Sizing: Include hydraulic down-pull load for heads greater than 30 feet and for nominal gate widths greater than 5 feet.
3. Gear train and gate stem sections shall produce a self-locking drive train.
4. Lift Nuts: Internally threaded with cut or cold-rolled Acme threads corresponding to stem threading.
5. Roller Bearings: Ball-thrust or tapered above and below lift nut to support both opening and closing thrusts.
 - a. Grease lubrication fittings for bearings. Input pinions with needle or ball bearings.
6. Lubrication: Furnish rising stem gates with an insert lubricator flange in lift, with a grease fitting for greasing stem threads below stem nut.
7. Manual Operator Limit Switches:
 - a. Mounted on an angle adjacent to stem and actuated through limit switch wands by stop collar.
 - b. Single-pole, double-throw type, with contacts rated 5 amps at 120V ac.

B. Type 1, Manual, Handwheel-Operated Floor Stands:

1. Manual Effort: Not to exceed 40 pounds.
2. Handwheel: Directly drive a replaceable bronze stem nut for a rising gate stem, bearing mounted on a cast iron pedestal and base.

C. Type 2, Manual, Geared Floor Stands and Offset Stands:

1. Crank-operated, with weatherproof housings and solid bronze lift nut mounted on high-strength cast iron pedestal or base.
2. Manual Effort: Not to exceed 40 pounds.
3. Suitable for portable electric drill operation after removal of hand crank. Furnish one adapting chuck to fit sluice gate operators and to fit electric drill operators.

D. Type 3, Electric Motor Operators:

1. Description: 28-inch high steel pedestal, totally enclosed weatherproof electric drive unit, and a totally enclosed gear box that operates a two-piece, bronze stem nut, which lifts gate stem.
2. Gears:
 - a. Heat treated alloy steel, supported throughout by antifriction

- ball or roller bearings and grease lubricated.
- b. Operate on hammer-blow principle for starting of operation.
- 3. Limit and Torque Switches:
 - a. Automatic double-acting, geared directly to operating gear train and "in step" at all times, whether in motor or manual operation.
 - b. Wire limit switches internally to stop motor at fully OPEN and fully CLOSED positions.
 - c. Wire torque switches internally so that, in event of a mechanical overload in either direction, motor will be stopped.
- 4. Handwheel:
 - a. Side mounted.
 - b. Include an automatic clutch to positively disengage handwheel when drive motor control is energized.
 - c. Design handwheel operator so that failure of motorized gearing will not prevent hand operation of gate.
- 5. Drive Unit: Electric motor as specified on Induction Motor Data Sheet with integral OPEN/STOP/CLOSE weatherproof pushbuttons, reversing controller, 480/120-volt control power transformer, space heaters in motor, space heaters in limit switches and in control compartments, mechanical dial type position indicator, and transparent plastic pipe stem cover and cap.
 - a. Furnish motor enclosure with drainage and breathing holes.
 - b. Self-locking, with 12 inches per minute gate travel speed, and a rated running torque equal to 20 percent of motor starting torque at a rated running time of 15 minutes, without exceeding allowable NEMA temperature rise for insulation class used.
- 6. Operation: Drive gate to its fully OPEN or CLOSED position when OPEN or CLOSED pushbutton is depressed momentarily. Motor shall stop in mid-travel when STOP button is depressed.
- 7. Remote Position Indication: Integral position transmitter producing a 4 to 20 mA dc output in direct proportion to gate position for connection to an external instrument loop. Fully CLOSED position shall correspond to 4 mA dc. Transmitter shall be capable of driving an external load impedance of 350 ohms minimum.
- 8. Manufacturers and Products:
 - a. Limitorque; L120 Series.
 - b. EIM Valve Controls; 2000 Series.

E. Electric Controls:

- 1. Feature A: Local OPEN/STOP/CLOSE pushbutton station.
- 2. Feature B: End position limit switches; OPEN and CLOSED position switches shall be normally open contacts that close at end position; contacts shall be dry and rated for 5 amps at 120V ac.
- 3. Feature C: Continuous position output; furnish a signal converter to generate a 4 to 20 mA dc signal to an external loop in direct proportion to gate position; signal converter shall be factory mounted in a NEMA 250, Type 4X enclosure.
- 4. Feature D: LOCAL/REMOTE weatherproof selector switch and provisions for remote OPEN/STOP/CLOSE operation; remote commands will be by way of a four-wire circuit, as shown; motor operator shall impress voltage required to read these contacts and shall go to commanded position or stop when in REMOTE mode.

5. Styles:

- a. Style 1: Includes control Feature A only.
- b. Style 2: Includes control Features A and B.
- c. Style 3: Includes control Features A, B, C, and D.

F. Type 4: Hydraulic Cylinder Operators:

- 1. Conform to JIC Standards. Include rod end and square plate floor mounts. Cylinder Rods: ASTM A276, Type 316 stainless steel with hard chrome plating.
 - a. Furnish stop tubes to prevent excessive bearing side loads with extended rod.
 - b. Size rods for a Slenderness Ratio not greater than 160.
- 2. Cushion cylinders at both ends and have a rubber boot completely covering that part of rod which enters cylinder.
- 3. Removable plugs at top of cylinders for venting air during filling.
- 4. Operating Pressure Rating: 3,000 psi. At a pressure of 1,750 psi, cylinders shall have a minimum safety factor of 4, based on yield strength of materials.
- 5. Internal Leak Rate at Required Load and Pressure: Not to exceed 1 inch per 24 hours.
- 6. Factory installed gate position linear displacement transducers and proximity switches.
- 7. Linear Displacement Transducer Sensor:
 - a. Sealed waterproof stainless steel unit threaded into cylinder; leakproof to 3,000 psi.
 - b. Torroidal magnet mounted on piston to determine position of piston.
 - c. Frictionless operation and no data loss on power interruption.
 - d. High linearity (0.05 percent), analog output of 4 to 20 mA dc, zero-trim fine adjustment.
 - e. Electronics operate continuously at 35 to 180 degrees F.
 - f. Factory Mutual approved safety barriers for explosion-proof operation and water-submersible service.
 - g. Power Supply: 120V ac, single-phase, 60-Hz.
 - h. Sensor Manufacturer: Temposonics, Inc.
- 8. Manufacturer: Parker Hannifin; Miller Fluid Power.

G. Identification Tagging Requirements:

- 1. For each gate operator, 1-1/2-inch minimum diameter heavy brass tag, bearing gate tag number shown in schedule.
- 2. Attach tags to operator by soldered split key rings so that ring and tag cannot be removed. Use block type numbers and letters with 1/4-inch minimum high numbers and letters stamped on and filled with black enamel.

H. Portable Electric Drill Gate Operators:

- 1. Furnish 115-volt, single-phase, 60-Hz, heavy-duty universal electric drills, complete with overload release clutch and lightweight, adjustable tripod, support assemblies.

2. Suitable for operating sluice gates specified in this section.
3. Complete with adapting chuck to fit gate operator shafts, a 20-foot electrical cord and grounding plug with a weatherproofing cover, and reversing switch.
 - a. Plug: Conform to Twist-Lock NEMA Configuration L5-30P.
4. Capable of delivering a minimum of 50 foot-pounds of torque and shall maintain a minimum speed of 60 rpm under full load conditions.
5. Motors: Suitable for 15-minute operation under full load when rested for same period of time between operations.
6. Manufacturers: Milwaukee Power Tool; Black & Decker.

2.3 APPURTENANCES

- A. Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 100 pounds.
- B. Anchor Bolts: ASTM A193, Type 316 stainless steel sized by equipment manufacturer at least 1/2 inch in diameter, or as shown in construction drawings.

2.4 SHOP/FACTORY FINISHING

- A. Factory prepare, prime, and finish coat exposed metal surfaces with manufacturer's standard coating in accordance with Section 09 90 00, PAINTING, Coat embedded surfaces of thimble with System No. 2 as specified.

2.5 SOURCE QUALITY CONTROL

- A. Factory Tests and Adjustments: Fully assemble, including motor, and test sluice gates and control panels actually furnished.
 1. Functional Test: Perform manufacturer's standard, motor test on equipment.
 2. Performance Test: In accordance with AWWA C540.

PART 3 EXECUTION

3.1 INSTALLATION

- A. In accordance with manufacturer's written instructions.
- B. Accurately place anchor bolts using templates furnished by manufacturer.
- C. Wall Thimbles:
 1. Brace internally during concrete placement.
 2. Provide for installing sluice gates. Direct bolting to concrete walls is not acceptable.
 3. Where sluice gate thimbles and prestressed concrete cylinder pipe (PCCP) are embedded in a common wall, bolt thimbles to flange ring of PCCP wall pipe section. Bolting shall be adequate to prevent wall pipe-thimble assembly from separating or shifting during concrete

placement.

- D. Grease threads above stem nut prior to placing gate in operation.

3.2 FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on each sluice gate.
- B. Performance Test:
 - 1. Conduct on each sluice gate.
 - 2. Perform under actual or approved simulated operating conditions.
 - 3. Test for a continuous 3-hour period without malfunction.
 - 4. Adjust, realign, or modify units and retest if necessary.
 - 5. Leakage shall not exceed 0.1 gallon per minute per foot of gate periphery under either seating or unseating head conditions.

3.3 MANUFACTURER'S SERVICES

- A. Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:
 - 1. 1 person-days for installation assistance and inspection.
 - 2. 1 person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - 3. 1 person-days for prestartup classroom or site training.
 - 4. 1 person-days for facility startup.
 - 5. 1 person-days for post-startup training of OWNER's personnel.

END OF SECTION

DIVISION 40 PROCESS INTERCONNECTIONS

SECTION 40 05 19

PIPING AND FITTINGS

PART 1 - SCOPE

1.01 SCOPE:

- A. The work included in this section consist of furnishing all material, equipment, labor and performing all operations necessary for the supply of all piping, fittings and accessories within the limits of work, as shown on the drawings and specified herein.
- B. Where references are made to other standards or codes, unless specific date references are indicated the latest edition of said standard or code shall govern.

1.02 WORK NOT INCLUDED UNDER THIS SECTION:

- A. Piping installation for various types of piping systems is specified various other sections herein. Installations specified in this section are supplementary to those sections and in the case of conflict the more stringent condition shall prevail.

1.03 PIPING LAYOUT:

Field verifies dimensions prior to preparation of layout and shop drawings. Obtain shop drawing approval prior to fabrication of piping. All items not specifically mentioned in the Specifications or noted on the approved Plans, but which are obviously necessary to make a complete working installation shall be included.

1.04 DELIVERY, STORAGE AND HANDLING

- A. During shipping, delivery and installation of pipe and accessories, handle in a manner as to ensure a sound undamaged condition.
- B. Exercise particular care not to injure pipe coatings.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS: DUCTILE IRON AND CAST RON

A. GENERAL

As used herein, "ANSI" denotes the American National Standards Institute, "AWWA" denotes the American Water Works Association, and "ASTM" denotes the American Society for Testing and Materials.

All pipe and fittings to be furnished hereunder shall conform to the referenced ANSI and/or AWWA Standard as modified herein, as appearing in the following sections.

All markings required on pipe and fittings, shall be clearly legible and located such that they will not be hidden or destroyed when assembled into the intended system.

B. PIPE

All pipe shall be ductile iron pipe conforming to ANSI/AWWA Standard C151/A21.51-02, "Ductile-Iron Pipe, Centrifugally Cast, for Water". All pipe and fittings for water applications shall be in full compliance with ANSI/NSF 61, "Drinking Water System Components-Health Effects". Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.

The pipe thickness and outside diameter of pipe for sanitary sewer and water usage shall conform to Tables 1 and 2 (for push-on and mechanical joint pipe, respectively) of ANSI/AWWA Standard C151/A21.51-02 for the following sizes (The pressure class specified is the minimum permitted):

Size	Pressure Class
4-inch through 12-inch	350
14-inch through 20-inch	250
24-inch	200
30-inch through 54-inch	150

For restrained joint pipe, the thickness of the pipe barrel remaining after grooves are cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained joint pipe as shown above.

Each piece of pipe shall be marked as required in Subsection 4.6 of AWWA C151-02. Letters and numerals on pipe sizes 12-inch and smaller shall be not less than 3/8-inch.

The Water and Sewer Department absolutely reserves the right to require the use of "thickness" class pipe or higher pressure class pipe in applications where in the opinion of the Engineer (ie the Chief, Engineering Division, M-D WASD or his representative) such use is in the best interest of the Department. The Engineer's decision in this regard shall be final.

A sufficient quantity of non-toxic vegetable soap lubricant shall be supplied with each shipment of pipe. The soap lubricant shall be suitable for use in subaqueous trench conditions.

For flanged ductile-iron pipe with integrally cast flanges or threaded flanges, the nominal wall thickness of the pipe barrel shall be as specified in Section 3.3, "Joints and Accessories" under "Flanged Joints", hereinbelow.

The single gasket push-on pipe shall be shipped in standard 18-foot or 20-foot lengths, but not both. The restrained single-gasket push-on joint pipe shall be shipped in standard 18 or 20-foot lengths as specified above or fabricated lengths as noted in each order. At least two lengths of each size of single gasket push-on pipe furnished under each order shall be tested with circumferential gauges to insure that the pipe may be cut at any point along its length and have an outside diameter which will be within the manufacturer's standard design dimensions and tolerances for plain pipe. These lengths shall be identified with an easily distinguished, painted marking, longitudinally along the full length of the pipe.

C. FITTINGS

Fittings Conforming with ANSI/AWWA C110/A21.11-98 (Water & Sewer Use)

Restrained push-on joint fittings shall be cast ductile iron for use with ductile-iron pipe as specified above. Standard mechanical joint, push-on joint and flanged joint fittings shall also be ductile iron for use with ductile-iron pipe as specified above. Cast ductile-iron fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi, minimum; (except flange-joint fittings shall be rated at 250 psi, minimum); and in the 30-inch through 48-inch size range shall be pressure rated at 250 psi, minimum. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C110/A21.10-98, "Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".

The weight of fittings shall be as given in ANSI/AWWA C110/A21.11-98 for ductile-iron fittings. The weight of mechanical joint fittings shall be as established in Tables 3 through 12. The weight of flanged joint fittings shall be as established in Tables 13 through 20.

Fittings Conforming with ANSI/AWWA C153/A21.53-00 (Water & Sewer Use)

All fittings shall be cast ductile-iron for use with ductile-iron pipe as specified above. Fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi, minimum; 30-inch through 48-inch size range shall be pressure rated at 250 psi, minimum; and in the 54-inch through 64-inch size range shall be pressure rated at 150 psi, minimum (except for those fittings such as plugs, caps, and sleeves which are normally rated at a higher pressure). No flanged fittings or mixtures of flanged with other end type fittings will be allowed in the range of 3-inch through 48-inch since they are not covered in the AWWA Standard. Flanged fittings conforming with and covered by this standard are allowed in sizes, 54, 60 and 64-inch. In conformance with the standard, 54, 60 and 64-inch flanged tees, crosses and reducers with outlets of smaller dimension as listed in ANSI/AWWA C153/A21.53-00 are permitted. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C153/A21.53-00, "Ductile-Iron Compact Fittings for Water Service". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings" except as otherwise allowed in C153. Mechanical joint glands shall be ductile-iron only.

Since the C153 Standard provides only minimum dimensions, fully detailed drawings of all fittings proposed shall be supplied by the manufacturer with his bid. The tabulated nominal weight of each size and type of fitting shall also be supplied by the manufacturer for all items proposed. This weight shall be that of the bare casting prior to application of any lining or coating. The weight of a fitting supplied under the contract shall not be less than ninety-five (95) percent of the tabulated nominal weight supplied by the manufacturer's catalog literature for that fitting. Further, the weight of fittings supplied shall not be more than five (5) percent above the same tabulated nominal weight.

D. JOINTS AND ACCESSORIES

Push-On Type Joints (Single Gasket and Single Gasket with Gasket Restraint)

Push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-00, except that the gaskets for pipe and fittings shall be neoprene where so specified.

The required number of gaskets for each push-on joint pipe plus one extra for every 50 joints or fraction thereof, shall be furnished with each order. The gaskets shall be shipped in suitable protective containers. All single gasket pipe shall be as manufactured by United States Pipe and Foundry Company (Tyton), by the American Cast Iron Pipe Company (Fastite), by McWane, Inc. (Mix of Tyton and Fastite), Tyler/Union (Tyton) or approved equal.

Push-on joints together with both their regular and gasket-restraint gaskets shall be of the design, dimensions and tolerances of either those provided by American Cast Iron Pipe Company (Fastite/Fast-Grip) or those provided by United States Pipe and Foundry Company (Tyton/Field Lok). No other designs shall be acceptable. If required by the Miami-Dade Water and Sewer Department, the Vendor shall supply complete design drawings, with dimensions, tolerances and materials of the joint and gasket being supplied within fourteen (14) calendar days of the date of receipt of the letter, fax or E-mail requiring said submission. If so required by the Water and Sewer Department, this submission shall be signed, sealed and dated by an Engineer registered to practice in the State where the manufacturer is located. If the pipe is of non-domestic origin, signing, sealing and dating of the submission, when required, shall be performed by an Engineer registered in the state where the Vendor's main office is located or the State of Florida, at the discretion of the Chief, Engineering Division, Miami-Dade Water and Sewer Department or his designee.

Mechanical Joints

Mechanical joints for fittings shall conform to ANSI/AWWA Standard C111/A21.11-00, except that the gaskets for each fitting under Groups D and D1 shall be neoprene. Bolt holes for mechanical joints shall be equally spaced, and shall straddle the vertical centerline. Tee head bolts and hexagonal nuts for all mechanical joints in fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11-00. Glands shall be of ductile-iron construction for ductile iron fittings, and cast gray iron or ductile iron for cast gray-iron fittings.

The proper number of gaskets, glands, bolts and nuts, all conforming to ANSI/AWWA Standard C111/A21.11-00, plus one extra gasket for every 10 joints or fraction thereof, shall be furnished with each order. The gaskets and joint accessories shall be shipped in suitable protective containers. Follow-on glands held in place with set screws will not be acceptable. Segmented glands will not be acceptable.

Mechanical Joint and Push On Joint Megalug-Type Restraining Systems

Use of this type of restraint is restricted to underground mechanical joint or push on joint applications and in general may not be used above grade or as a substitute for flanged joints. Any above grade applications will require submission of shop drawings of the piping system where they are utilized and may require design by a Florida registered Professional Engineer.

In any mechanical joint or push on joint underground piping system of 30-inch nominal diameter and below this type of restraint may be utilized as design or field conditions dictate.

In sizes 36, 42 and 48-inch the prior written permission of the Engineer is required. In instances where written permission cannot be immediately obtained, verbal permission will be allowed but is to be confirmed in writing on the first business day following the substitution. If this type of restraint is used without permission or if permission is denied, the Contractor making the substitution shall be solely responsible for all costs, both direct and indirect, of immediately correcting the restraint system to the satisfaction of the Engineer.

It is recognized that flange adapters of this type form a useful tool for adjusting lengths of flanged pipe runs in instances such as runs with a large number of deflections where it is almost impossible to predict all lengths correctly. Therefore, a very restricted number of these joints will be allowed in instances where it can be clearly shown to the satisfaction of the Engineer that they are necessary. This application is restricted to 20-inch nominal diameter and below. Further, this use shall be designed in and shall not be made as a field substitution. In all instances flange adapters shall be rated for a minimum working pressure of 250 psi with a minimum safety factor of 2:1. In no case will these flange adapters be used as

a general substitute for standard flanged joints.

The Department absolutely reserves the right to require other forms of restraint where in the opinion of the Engineer the use of this form of restraint is not in the best interest of the Department and his decision shall be final.

The Megalug restraint systems manufactured by EBAA Iron Sales, Eastland Texas, will be considered the standard of quality for comparison purposes and if the Department has any doubts as to the durability, quality or ability to restrain of a proffered substitute, the entity offering the substitute shall bear the entire burden of proving this equality to the complete satisfaction of the Engineer. Other manufacturers producing this type of restraint system shall submit data with their shop drawings showing that their restraint system has been in the marketplace for a minimum of three years in this country.

Each thrust-resistant mechanical joint or push on joint made up with this type of restraint and the pipe and fitting of which it is a part, shall be designed to withstand an axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

This type of joint restraint shall not be used above grade except as previously specified nor shall it be used as a carrier pipe within a casing. This type of restraint shall not be used with tape wrapped pipe or with too great a coating thickness on the exterior of the pipe.

Restrained Push-on Joints (Single Gasket Non-Gasket Restrained)

Restrained joints in pipe and fittings shall be of the single gasket push-on type, and shall conform to all applicable provisions of ANSI/AWWA Standard C111/A21.11-00, except that gaskets for pipe and fittings shall be neoprene, where so specified, and the following requirements:

Thickness of the pipe barrel remaining at grooves cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained pipe as

specified in Section 3.1 above.

Restrained joints using field welding, set screws, or gaskets with expanding metal inserts will not be acceptable.

The restraining components, when not cast integrally with the pipe and fittings, shall be ductile iron or a high strength non-corrosive alloy steel.

Tee head bolts and hexagonal nuts for all restrained joints in pipe and fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11-00, except that the length of the bolts shall meet the requirements for the restrained joint design.

The proper number of gaskets, bolts, nuts and all necessary joint material, plus one extra gasket for every 10 joints or fraction thereof, shall be furnished with each order. The gaskets and joint accessories shall be shipped in suitable protection containers.

Each thrust-resistant joint and the pipe and fitting of which it is a part, shall be designed to withstand the axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly. During deflection, all components in the restrained system shall be in contact to provide an equal force on all contact areas.

When restrained spigot ends are ordered for items of Group A, the corresponding bell ends of the pipe to be restrained (also within Group A), shall be furnished with the required matching restraining features at no additional cost other than the price bid per foot of pipe.

Flanged Joints

Connecting pieces with one end flanged and the other end either plain-end or mechanical joint, shall conform to ANSI/AWWA Standard C110/A21.10-98. Joint material for both the flanged end and the mechanical joint accessories for connecting pieces with a mechanical joint end shall be furnished as specified.

Flange adapters shall be used only on a restricted basis and shall not be used as a general substitute for regular flanged joints. Further, the Department absolutely reserves the right to require regular flanged or other types of joint when it is considered in the Department's best interest. The decision of the Engineer shall be final in such situation. Flanges shall be made of ductile iron conforming with ASTM 536. Flange shall be restrained by a number of individual gripping wedges operated by torque-limiting actuating screws. Each flange adapter shall have a permanently cast in identification number allowing tracing of the date, foundry and pour that fabricated the unit together with all test data for the material of the pour. Records for this purpose shall be retained by the foundry for a minimum of two years after the pour date and shall be supplied to the Department within no more than two weeks after request. Factor of safety shall be a minimum of 2 to 1.

Other types of flanged fittings, and flanged pipe, shall conform to the following requirements unless otherwise stated in the order:

Flanged fittings shall conform to ANSI/AWWA Standard C110/A21.10-98, as specified hereinabove. Flanged ductile-iron pipe with integrally cast flanges shall be manufactured in accordance with ANSI/AWWA Standard C151/A21.51-02, and with provisions contained hereinabove for centrifugally cast ductile iron pipe, and shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, "Cast Iron Pipe Flanges and Flanged Fittings", latest revision. Hollow back flanges are not acceptable.

Flanged ductile-iron pipe with threaded flanges shall be manufactured in accordance with ANSI/AWWA Standard C115/A21.15-99, "Flanged Ductile-Iron Pipe With Ductile-Iron or Grey-Iron Threaded Flanges", and shall be rated for a working pressure of 250 psi, minimum. The nominal thickness of flanged ductile-iron pipe, 6-inch and larger, shall not be less than those shown in Table 1 of ANSI/AWWA Standard C115/A21.15-99. The nominal thickness of 4-inch flanged ductile-iron pipe shall be Class 54 (min.) conforming to Tables 3 and 4 of ANSI/AWWA Standard C151/A21.51-02. The pipe shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, latest revision. Hollow back flanges and grey-iron flanges shall not be acceptable for use as threaded flanges. Threaded flanges shall be individually fitted and machine tightened on the threaded pipe by the manufacturer, and shall not be interchangeable in the field. Pipe lengths shall be as ordered. Removal of flanges, cutting and re-threading the pipe, and re-installing the flanges will not be permitted in any case.

All flanges on ductile-iron pipe and fittings shall be of ductile iron. All joint materials for flanged pipe and fittings, shall be supplied with all pipe or fittings ordered. Bolts and nuts shall comply with all requirements of Appendix Section A.1 of ANSI/AWWA Standard C115/A21.15-99 except that both shall be stainless steel. Unless ring gaskets are specifically called for in the order, gaskets shall be full-faced, and gaskets shall be of 1/8-inch thickness. Gaskets shall fully conform with the requirements of ANSI/AWWA Standard C115/A21.15-99 Appendix Section A.2 except that gaskets shall be SBR for water and neoprene for sewer usages.

D. LININGS AND COATINGS

Asphaltic Coating

All pipe and fittings shall be outside-coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall meet AWWA Specifications for this type of coating, shall be smooth without pinholes, thin, bare or overly thick areas. Smoothness shall be such that when hand rubbed, no "sand paper" feeling will be experienced and such that the spigot area will readily slide through the gasket without pulling, tearing, rolling or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to painting and to an extent that will permit ready insertion of the spigot through the gasket area.

Cement-Mortar Lining

Pipe and fittings where so specified shall be cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4-95, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water".

Ceramic Epoxy Lining and Polyethylene Lining

Pipe and fittings where so specified shall be lined with either ceramic epoxy or virgin polyethylene. A Vendor may supply one or the other material but not both in the same order.

All sewer pipe and fittings of 4-inch nominal diameter and above, except for riser pipe for valves, shall be lined with either ceramic epoxy lining or virgin polyethylene. Polyethylene shall be compounded with carbon black to resist exposure to the ultraviolet rays during open-air storage, and comply with ASTM Standard D1248-00a, "Polyethylene Plastics Molding and Extrusion Materials". Ceramic epoxy shall contain pigmentation to resist ultraviolet exposure under the same conditions.

Ceramic Epoxy

All ductile iron pipe and fittings shall be delivered to the application facility without asphalt, cement lining or other lining on the interior surface or the first 6 inches on the spigot end of the pipe exterior. The only ceramic epoxy material approved by the Department at this time is a high-build multi-component Amine cured Novalac epoxy, Protecto 401, by Vulcan Painters, Inc. of Bessemer, AL 35021.

Material must meet the following criteria and be accompanied by certification of the following test results:

- A. A permeability rating of 0.00 when tested according to Method A of ASTM E96-00 "Test Method for Water Vapor Transmission of Materials", Procedure A with a test duration of 30 days.
- B. The following test must be run on coupons from factory lined ductile iron pipe:
 - 1. ASTM B117 Salt Spray (scribed panel) - Results to equal no more than 0.5mm undercutting after one year.
 - 2. ASTM G95 Cathodic Disbondment 1.5 volts @ 77 degrees F. Results to equal no more than 0.5mm undercutting after 30 days.
 - 3. Immersion Testing rating using ASTM D714-87 (1994).
 - a. 20% Sulfuric Acid - No effect after one year.
 - b. 25% Sodium Hydroxide - No effect after one year.
 - c. 160 degree F. Distilled Water - No effect after one year.
 - d. 120 degree F. Tap Water (scribed panel) - 0.0 undercutting after one year with no effect.
- C. A statement from the manufacturer attesting to the fact that at least 20% of the volume of the lining contains ceramic quartz pigment.

D. A statement concerning recoatability and repair to the lining.

Application

A. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

B. Surface Preparation

Prior to abrasive blasting, the entire area which will receive the protective compound shall be inspected for oil, grease, etc., Any areas where oil, grease or any substance which can be removed by solvent is present shall be solvent cleaned using the guidelines outlined in SSPC-1 Solvent Cleaning. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before coating must be reblasted to remove all rust.

C. Lining

After the surface preparation and within 8 hours of surface preparation, the interior of pipe and fittings shall receive a minimum forty (40) mils dry film thickness of the protective lining. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flange ends are included in the Project, the linings must not be used on the face of the flange; however, full face gaskets must be used to protect the ends of the pipe. The 40-mil system shall not be applied in the gasket grooves.

D. Coating of Gasket and Spigot Ends

Due to the tolerances involved, the gasket area and exterior of the spigot end for 6 inches back from the end of the spigot must be coated with six (6) mils minimum, ten (10) mils maximum of Protecto Joint Compound. This coating shall be applied by brush to ensure coverage. Care should be taken that the coating is smooth without excess buildup in the gasket groove or on the spigot end. All material for the gasket groove and spigot end shall be applied after the application of the lining as specified in the preceding paragraph.

E. Number of Coats

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The time between coats shall never exceed that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoatable with itself without roughening the surface.

F. Touch-Up and Repair

Protecto Joint Compound shall be used for touch-up or repair. Procedures shall be in accordance with manufacturer's recommendations.

Inspection and Certification

A. Inspection

1. All ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PC-2 Film Thickness Rating.
2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500 volt test.
3. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on the date.

B. Certification

The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified, and that the material was applied as required by the specification.

Procedures for Sealing Cut Ends and Repairing Field Damaged Areas

1. Remove burrs caused by field cutting of ends or handling damage and smooth out the edge of the lining if rough.
2. Remove all traces of oil, grease, asphalt, dust, dirt, etc.
3. Areas of loose or damaged lining associated with field cutting the pipe shall be repaired, if approved by the Engineer, as recommended by the pipe manufacturer. The damaged area shall be stripped back by chiseling or scraping about 1 to 2 inches into the well-adhered lining before patching.

The exposed metal and the 1 to 2-inch lining overlap shall be roughened with a coarse grade of emery cloth (#40 grit), rasp or small chisel. Avoid wire brushing or similar buffing since these tend to make the surface too smooth for good adhesion.

4. With the area to be sealed or repaired absolutely, clean and suitably roughened, apply a coat of Protecto Joint Compound by brush in accordance with the manufacturer's recommendations.

Polyethylene Lining

The polyethylene shall be fused to the pipe and fittings with heat to form a tightly bonded uniform lining 40 mils thick, minimum, extending from the spigot end to the gasket seat in the bell of push-on, restrained push-on and mechanical type joints.

Prior to preheating the pipe, 75% or more of the high-temperature oxide film shall be removed through proper preparation of pipe interior surface. Fittings shall be sand blasted. Pipe and fittings shall be uniformly preheated to a temperature adequate to provide uniform fusing of the polyethylene powders and proper bonding to the interior of the pipe and fittings.

The lining at the ends (spigot and bell) shall be hermetically sealed with a coal-tar epoxy. This epoxy shall coat the inside of the bell of both pipe and fitting as well as the last six inches on the inside of the spigot end of the pipe and two to three inches on the outside of the spigot end.

The lining of all pipe and fittings shall be subjected to and pass a test for pinholes, bare spots, metal particles, insufficient lining thickness and other defects by a method conforming to ASTM Standard G62-87 (1998), "Holiday Detection in Pipeline Coatings", Method B (high voltage). Other test methods may be submitted to the Department for approval, but no approval will be granted unless it is clearly shown to the satisfaction of the Department that the method is equivalent to the specified tests insofar as detecting defects and insufficient lining thickness.

The manufacturer shall provide certifications on the holiday test as well as certifications on a

uniform (spigot end to gasket seat in bell) minimum 40-mils-thick lining.

C. QUALITY ASSURANCE

All pipe, fittings and other materials supplied under this contract shall be subject to inspection while still on the delivery truck. It is the sole responsibility of the vendor and supplier to make prior contact with the Storekeeper or the Construction Management section and provide a minimum of 48-hours prior notice of delivery. When so notified, the Department will make arrangements for inspection of the material upon arrival or within a reasonable time thereafter. Material will not be unloaded without inspection taking place either prior to or, if necessary for examination, during the unloading procedure. The Department will not be responsible for any delays or additional costs created by non-compliance with the requirement for prior notification or the requirement for thorough inspection.

Materials shall be delivered in complete compliance with the AWWA Standards as modified herein, without damage, and shall match or exceed the quality of any samples supplied. The Department absolutely reserves the right to require samples of any material supplied and to perform whatever tests considered by the Engineer, whose decision shall be final, to be in the Department's best interest on said samples. Where such tests are of a destructive nature, the sample, if it passes the test will be paid for (at cost as shown by invoice) by the Department. Samples failing will be immediately replaced with suitable material at the supplier's/contractor's expense. Samples required prior to order as a condition for purchase or as a materials submittal for approval will be at the supplier's/contractor's expense but, if approved and not used for destructive tests, may be used in the work with permission from the Engineer.

Materials found to be defective, not in strict compliance with the quality standards of samples supplied or these specifications shall be immediately returned to the vendor at his expense. If defects are discovered at a later time, the vendor shall be required to remove said items and shall bear all costs for so doing together with any replacement costs. Rejection of items may subject the vendor to liquidated and/or actual damages as specified elsewhere herein.

Foundries supplying materials shall maintain their metallurgical records for a minimum period of two years after fabrication and firms not doing so may be found in default.

Flaws which provide cause for rejection include but are not limited to; incorrect metallurgy or metallurgy which cannot be verified to the complete satisfaction of the Engineer; foundry identification/location, size, pressure and material identification information lost, removed, non-existent, or not visible when assembled; not in complete compliance with all applicable AWWA Standards as modified herein and/or these specifications; not in compliance with NSF; not in compliance with approved shop drawings; out of roundness in excess of AWWA requirements; dimensional differences in excess of AWWA requirements; rough exterior coating; chipped, cracked, scratched or otherwise damaged interior or exterior coatings or linings; interior or exterior coatings which are too thin; coatings too thick to allow proper assembly; coatings too thick to allow proper grip by restraining gaskets or other restraining elements; pin holes or honey combing of pipe; weld spatter or excess metal in gasket grooves or the whole of the bell area; bell areas which are distorted or otherwise improperly cast; spigots which are out of round, not of proper dimension, or not beveled to an extent that will allow easy assembly of the pipe joint; gaskets which are defective or of the wrong material; lack of joint materials; improper or defective joint materials; bolting of the wrong material or size; electro galvanizing or other exterior plating when hot-dip galvanizing is required; incorrect, flawed or damaged interior coating or lining; lack or non-submittal of all required certifications; non-timely submission of certifications; incorrect/incomplete certifications or certifications lacking the signature, date and seal of a professional engineer when so required; flanges which are too thin, not a right angles to the pipe centerline, or otherwise distorted; together with all other flaws or defects which in the opinion of the Engineer, who's decision shall be final, adversely affect the assembly and/or function of the piping system as intended.

2.02 PIPE AND FITTINGS: CAST IRON SOIL

- A. Cast iron soil pipe and fittings shall be cast gray iron, extra heavy, conforming to the requirements of ASTM Standard A74 "Cast Iron Soil, Pipe and Fittings".
- B. Joints in soil pipe and fittings shall be made with neoprene rubber, compression type gaskets conforming to ASTM Standard C564, "Rubber Gaskets for Cast Iron Soil Pipe and Fittings".
- C. Hubless EHCl with stainless steel and neoprene "Band-Aid" connections is only approved for use in size 2-inches. All EHCl of larger diameter shall be hub pipe.

2.03 PIPE AND FITTINGS: POLY VINYL CHLORIDE (PVC)

A. **TYPE PSM SDR-35 PVC, AWWA C900 PVC AND C905 PVC SEWER PIPE AND FITTINGS**

1. TYPE PSM SDR-35 PVC SEWER PIPE

Type PSM SDR-35 PVC Sewer Pipe for sewer mains and laterals shall conform to ASTM Standard D 3034, "Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings", except as modified herein.

- a. Pipe shall be made of PVC thermoplastic having a cell classification of 12454-B, 12364-B, 12364-C or 13364-B as defined in ASTM Standard D 1784-90, "Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds".
- b. The PVC compounds used in the manufacture of the gravity sewer pipe shall be as listed in the Plastic Pipe Institute (PPI) Technical Report TR-4.
- c. The PVC pipe shall be push-on type, with bells, spigots and elastomeric gaskets, in accordance with ASTM Standard D 3034, and in accordance with ASTM Standard D 3212, "Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals", except as otherwise modified herein. The gaskets shall be the sole element depended upon to make the joint flexible and watertight. Joints using solvent cement will not be permitted. The pipe bells shall have an annular recess or race to seat and retain the gasket, and the gaskets may be either prepositioned by the manufacturer, or shipped separately in suitable protective containers. Pipe spigots shall be beveled. Pipe bells shall be extruded integral with the pipe barrel with a thickness equal to or greater than that of the barrel.
- d. The gaskets shall be fabricated from a high-grade elastomer compound in accordance with ASTM Standard F 477, "Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe", except as otherwise modified herein. The basic polymer for the gaskets shall be synthetic rubber. Natural rubber gaskets, or gaskets with both natural and synthetic rubbers will not be permitted. Gaskets shall be continuous, elastomeric, rubber ring type.
- e. Nominal laid length of Type PSM SDR-35 PVC sewer pipe shall be 13 feet.
- f. Type PSM SDR-35 PVC sewer pipe shall be double labeled (180 degrees apart) as follows at intervals of five (5) feet or less:

Date of manufacture - Manufacturer's name & Code - Nominal size - Cell classification - "Type PSM SDR-35 PVC Sewer Pipe" - "Specification D 3034"

2. Type PSM SDR-35 PVC Sewer Fittings

- a. Type PSM SDR-35 PVC Sewer Fittings shall conform to ASTM Standard D 3034

and to the specifications for Type PSM SDR-35 PVC sewer pipe herein, except as modified below.

b. The waterway and bell wall thickness shall be equal to or greater than that specified for pipe, except that for reducing fittings or those with smaller inlets, the wall thickness of each inlet shall be no less than the minimum wall thickness for that size pipe.

B. AWWA C900 AND C905 PVC (CI) PIPE AND FITTINGS

1. TYPE C900 and C905 PVC PIPE

AWWA C900 and C905 PVC (CI) Pipe for sewer mains and laterals shall conform respectively to ANSI/AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution", and ANSI/AWWA C905, "Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14 In. Through 48 In." except as otherwise modified herein.

- a. The dimensions and pressure classes shall be for Dimension Ratios 14, 18 and 25 (DR's 14, 18 and 25) for C900 PVC pipe and DR's of 14,18, 21,25, 26, 32.5, 41 and 51 for C905 PVC Pipe with equivalent cast iron pipe outside diameters.
- b. AWWA C900 and C905 pipe shall be made from PVC thermoplastic having physical and chemical properties which meet or exceed a cell classification of 12454-A or 12454-B virgin compounds as defined in ASTM Standard D 1784.
- c. The AWWA C900 and C905 pipe shall be push-on type, with bells, spigots and elastomeric gaskets in accordance with ASTM Standard D 3139, "Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals". The gaskets shall conform to ASTM Standard F477 and shall be synthetic rubber. One gasket shall be furnished with each length of elastomeric-gasket bell-end pipe. Pipe spigots shall be beveled. Pipe bells shall be extruded integral with the pipe barrel with a thickness equal to or greater than that of the barrel.
- d. Nominal laid length of AWWA C900 and C905 PVC (CI) pipe shall be 20 feet.
- e. The C900 and C905 pipe shall be labeled with the following at intervals of not more than five (5) feet:

Date of manufacture - Manufacturer's Name & Code

- Nominal size - "(CI)" - DR number - Pressure Class - Test Pressure for Hydro Tested or "NOT HYDROSTATIC PROOF TESTED" - AWWA designation number - Manufacturer's name or trade mark and production run or lot code - Seal (Mark) of the testing agency verifying suitability of material for potable water service (must be NSF).

Couplings and fabricated fittings shall be marked with:

Nominal Size - "(CI)" - Deflection angle, if applicable - "PVC" - AWWA Pressure Class - AWWA designation number of the applicable standard (C900 or C905) - Manufacturer's name or trademark - Seal (Mark) of the testing agency verifying suitability of material for potable water service (must be NSF).

2. TYPE C900 and C905 PVC FITTINGS

Fittings for AWWA C900 and C905, PVC (CI) shall conform to the requirements of ASTM Standard D 1784 and the specifications for AWWA C900 and C905, PVC (CI) pipe herein, except as modified below.

- a. All fittings for C900 pipe shall be manufactured from PVC compound conforming to ASTM Standard D 1784-11. Fittings shall conform to the thickness requirements of DR18. All fittings, except wye branches, shall be Class 235 and shall be manufactured to withstand 755 psi quick burst pressure tested in accordance with ASTM Standard D 1599-99(2005), "Test Method for Short-Time Hydraulic Failure of Plastic Pipe, Tubing, and Fittings" and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM Standard D 1598-02(2009), "Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure".
 - b. All fittings for C905 pipe shall be manufactured from PVC compound conforming to ASTM Standard D 1784-11. Fittings shall conform to the thickness requirements of DR18 for sizes 14 through 30-inch and DR25 for 36 through 48-inch. All fittings, except wye branches, shall be Class 235 for sizes 14 through 30-inch and Class 165 for 36 through 48-inch. Fittings 14 through 30-inch shall be manufactured to withstand 755 psi quick burst pressure tested in accordance with ASTM Standard D 1599-99(2005), "Test Method for Short-Time Hydraulic Failure of Plastic Pipe, Tubing, and Fittings" and withstand 500 psi for a minimum of 1,000 hours tested in accordance with ASTM Standard D 1598-02(2009), "Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure". . Fittings 36 through 48-inch shall be manufactured to with-stand 535 psi quick burst pressure tested in accordance with ASTM Standard D 1599-99(2005), "Test Method for Short-Time Hydraulic Failure of Plastic Pipe, Tubing, and Fittings" and withstand 350 psi for a minimum of 1,000 hours tested in accordance with ASTM Standard D 1598-02(2009), "Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure".
3. Fittings shall be as manufactured by The Harrington Corporation, Lynchburg, VA, Head Manufacturing Company, Preston, ID, or approved equal.
- C. MANHOLE COUPLINGS FOR TYPE PSM SDR-35 PVC SEWER PIPE shall conform to the requirements specified hereinbefore for Type PSM SDR-35 PVC Sewer Fittings and shall be completely coated on the exterior with fine aggregate bonded into/to the PVC surface. Man-hole couplings for Type PSM SDR-35 PVC sewer pipe shall be as manufactured by Johns-Manville, Harrington Corporation, or approved equal.
- D. MANHOLE COUPLINGS FOR AWWA C900 and C905, PVC (CI) PIPE shall conform to the requirements specified hereinbefore for AWWA C900 AND C905, PVC (CI) fittings and shall be completely coated on the exterior with fine aggregate bonded into/to the PVC surface. Man-hole couplings for AWWA C900 and C905, PVC (CI) pipe shall be as manufactured by Harrington Corporation, or approved equal.
- E. ADAPTER COUPLINGS shall have adjustable stainless steel shear rings. Insert shall be pro-vided with coupling. Clamps shall be all stainless steel. Adapter couplings shall be as manufactured by The Logan Clay Products Company, Logan, Ohio, or approved equal.
- F. SMALL DIAMETER PVC PIPE AND FITTINGS (SCHEDULES 40 AND 80)
1. Poly (vinyl chloride (PVC) pipe and fittings specified herein are small diameter PVC with threaded, flanged and solvent cemented joints. All poly (vinyl chloride) (PVC) pipe and fittings shall be made from high impact, rigid poly (vinyl chloride) compounds. Pipe and fittings shall be marked indicating size, type and schedule, ASTM Designation, manufacturer or trade mark, and shall bear the NSF (National Sanitation Foundation) seal of approval. Wherever the abbreviation PVC is used in these Specifications in relation to pipe and fittings, it shall mean poly (vinyl chloride) plastic pipe and fittings as specified herein.
 2. PVC pipe shall be Schedule 80 as called for on the Plans or by the Engineer, Type I, Grade I, or Class 12454B with socket ends, and shall comply with ASTM Standard D1785, "Poly

(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120".

3. Schedule 80 socket-type fittings shall comply with ASTM Standard D2467, "Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80" and D2464 "Specification for Threaded Poly Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, for threaded fittings.
4. Joining cement for PVC pipe and fittings shall comply with ASTM Standard D2564, "Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings". Cemented joints shall be made in accordance with ASTM Standard D2855, "Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings".
5. Flanges: One piece molded hub type flat face flanges, 125 pound standard as specified under fittings hereinbefore.
6. Gaskets: Full faced, 1/8-inch thick, neoprene (for sewer) or SBR (for water).
7. AISI Type 316 stainless steel, ASTM A193, Grade B8M hex bolts and ASTM A194 Grade E8 hex head nuts. Bolts shall be fabricated in accordance with ANSI B 1812 and provided with washers of the same materials as the bolts.

2.04 CERTIFICATION

- A. The Contractor shall provide the Department with notarized Certifications, signed by an authorized agent of the manufacturer, that the material was manufactured, sampled, tested, and inspected in accordance with these specifications, and has been found to meet the requirements. A report of said test results shall be furnished.
- B. No pipe or fitting will be accepted for use in the project until the Certifications have been submitted to and approved by the Department.

2.05 HANDLING AND STORING PVC PIPE AND FITTINGS

- A. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading or unloading operations, the manufacturer's unitized package of pipe and/or fittings shall be lifted with a forklift or other suitable equipment in such a manner as to prevent damage. Pipe may be unloaded by individual lengths; however, each length shall be slid or rolled on skidways in such a manner that the pipe is not dropped, and to avoid any shock. Under no circumstances shall pipe and/or fittings be dropped or allowed to roll or slide against obstructions.
- B. Pipe and/or fittings having ultraviolet degradation, warpage, impact damage, abrasion damage, or gouges or cuts will not be accepted. Bell ends showing compression set, damage or deformation will not be acceptable.
- C. Gaskets, if not prepositioned in the bell ends, shall be stored and shipped in suitable protective containers. Gaskets shall not be exposed to excessive heat, direct sunlight, oil or grease.
- D. Pipe and fittings shall be stored in a manner that will prevent warpage or other damage as previously specified.
- E. If the pipe and/or fittings are to be stored for any period in excess of six months in direct sunlight the items shall be covered with an opaque material. The cover shall be placed in

such a manner that will permit air circulation above and around the items being covered to prevent excessive heat accumulation.

- F. Pipe and fittings shall be manually or mechanically lowered into the trench for installation, and shall not be thrown, dropped or pushed in the trench.

2.06 PIPE AND FITTINGS: COPPER

- A. Pipe: Copper pipe shall be Type K for interior piping and Type K Soft Temper for exterior piping, both conforming to ASTM B88, seamless, round, drawn tubing.
- B. Fittings: Solder joint fittings shall be wrought copper and bronze fittings conforming to ANSI B16.22 or cast brass fittings conforming to ANSI Standard B16.18. Fittings for use with copper tubing shall be one of the following:
 - 1. Cast Bronze Solder-Joint Fittings: Solder joint fittings of this type shall be cast bronze fittings conforming to ANSI B16.18, "Cast Brass Solder-Joint Fittings", and ASTM Standard B62, "Composition Bronze or Ounce Metal Castings", as manufactured by Chase Brass and Copper Co., Stanley G. Flagg & Co., Inc., or approved equal.
 - 2. Wrought Copper Solder-Joint Fittings: Solder joint fittings of this type shall be wrought copper fittings in accordance with ANSI B16.22, "Wrought Copper and Bronze Solder Joint Pressure Fittings".
- C. Solder: Solder shall consist of 95 percent tin and 5 percent antimony. Soldering shall be in conformance with Section 3 of the Copper and Brass Research Association Copper Tube Handbook.
- D. Connection of copper pipe or fittings with galvanized pipe or fittings shall be made with dielectric fittings.

2.07 PIPE AND FITTINGS: GALVANIZED STEEL

- A. Steel pipe, except as otherwise specified below, shall be Schedule 40, galvanized, seam-less steel pipe, conforming to ASTM Standard A53, "Pipe, Steel Black and Hot-Dipped, Zinc-Coated Welded and Seamless", Type S, Grade A or B. Black steel pipe may be used in fabricating items which are to be hot-dip galvanized after fabrication.
- B. Screwed fittings, except as otherwise specified, shall be 150 psi galvanized malleable iron. Screwed unions shall be galvanized malleable iron with ground brass seats. Pipe threads shall be American Standard B2.1 NPT. Joint compound shall be used on all threaded joints, applied to the male threads only.
- C. Furnish data certified by the manufacturer that the pipe and fittings are of the material specified. No piping will be accepted or used in construction until certificates have been submitted to and approved by the Engineer of Record.

2.08 PIPE AND FITTINGS: VITRIFIED CLAY

- A. Vitrified clay pipe and fittings for gravity sewers shall be extra-strength, non-perforated. Pipe and fittings shall conform to the latest edition of ASTM Standard C700, "Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated", and the following requirements.
- B. A single fracture or crack passing through socket of the pipe bell and exceeding a length of one-

half (½) inch in any direction shall be cause for rejection of the pipe. This requirement supersedes the portion of the ASTM Specifications cited above in conflict herewith.

- C. The Contractor shall furnish certification from the manufacturer that the pipe and fittings used meet the requirements of ASTM Specifications C700.
- D. The manufacturer shall furnish certification that the pipe and fittings supplied meet the requirements of ASTM Standard C700, latest edition. The Contractor shall be prepared to produce said certification when requested by the Department.
- E. Only factory bonded joints will be permitted for all vitrified clay pipe. The joints shall have rubber "O" ring type compression seals conforming to "Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings", ASTM C425, latest edition.
- F. Department approved pipe joints are Polyester Ring-Type joints as manufactured by Logan Clay Products Company under the trade name of "Logan-O-Ring", Can-Tex Industries under the trade name of "Can-O-Lock," or approved equal.
- G. Where cast iron soil pipe or ductile iron pipe laterals are used with vitrified clay mains, the wye or tee shall be vitrified clay. For the joint between the vitrified clay wye or tee and the lateral pipe use FERNCO "Donut" No. 6-10-601 with E.H.C.I. soil pipe and "Donut" No. 6-08-607 with ductile iron laterals, or approved equals. When using E.H.C.I. soil pipe with ductile iron tees or wyes, use transition gasket by Romac or approved equal.

2.09 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. Smooth wall high density polyethylene pipe shall be a Type III, Class C, Category 5, Grade P34; PE 3408; as defined in ASTM D1248. Minimum classification, as given by ASTM D3350, shall be PE 335434C. Pipe shall meet the standards of ASTM F714, as modified herein, including the "Government/Military Procurement" sections. Minimum hydrostatic design basis shall be 1600 psi. In all cases, hydrostatic design basis and pres-sure rating shall be as determined using the methods of ASTM F714. Pipe of this type shall be butt-fusion welded at joints. All welding of joints shall be in strict conformity with the recommendations of the pipe manufacturer and by a firm or individual recommended to the Engineer of Record in writing by the manufacturer.
- B. As a part of the shop drawing submittals, the Contractor shall furnish the following signed by a Florida Registered Engineer, all calculations to determine, the pipe thickness, SDR rating, allowable stresses, in accordance with ASME B31.8 -1992, Table A842.22 and recommended coating, as required by the pipe manufacturer.

2.10 HIGH DENSITY POLYETHYLENE (HDPE) FOR USE IN POTABLE WATER SERVICES 2-INCH NOMINAL DIAMETER AND LESS

All mechanical fittings utilized with HDPE pipe and tubing services, shall conform with ANSI/AWWA C800-01 "Underground Service Line Valves and Fittings" as modified here-in, shall utilize AWWA Standard (Mueller) threads on tapped pipe and tapping saddles; shall be; designed and manufactured to withstand a sustained working pressure of 150 psi and to restrain the pipe against pull out under loading beyond that causing tensile yield in the HDPE pipe or tubing connected. The manufacturer shall supply certification of these capabilities and fittings shall not be accepted or installed without said certification. If fittings are being supplied to the Department the certification shall ship with the fittings and payment will not be made without this certification. At the discretion of the Engineer, this certification may be required to be signed and sealed by a professional engineer licensed to practice in the state where the supplying firm is located or in the State of Florida. His decision in this regard shall be final.

In all cases, fittings shall be installed in strict accordance with the manufacturer's instructions.

A. HDPE PIPE FOR WATER SERVICES:

All 2-inch high density polyethylene pipe used for services shall be IPS-O.D. Controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi, nominal outside diameter of 2.375-inches, minimum wall thickness of 0.264-inches, PE 3408, all in conformance with ASTM D3035-95 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter". Pipe shall conform with ANSI/AWWA C901-96 "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service" as modified herein. Pipe shall have a (natural) inner core with a blue colored outer shell. Pipe shall have footage marks at a maximum interval of every two feet. Polyethylene material shall have a minimum cell classification in accordance with ASTM D3350-00 "Polyethylene Plastics Pipe and Fitting Materials" of 345444D for the core, which shall be 100% virgin material, and 345444E for the outer shell. Note that both of these materials are UV stabilized as signified by the "D" for natural colored and "E" for the colored shell. Pipe shall conform with NSF 61 or 14. Manufacturer shall supply certification of compliance with all of the above requirements. Certification shall ship with the pipe on material sold to the Department and shall always be submitted with shop drawings and catalogue cuts. When required by the Chief, Engineering Division, Miami-Dade Water and Sewer Department or his designee, certification shall be signed and sealed by a professional engineer licensed to practice in the state in which the manufacturer is located or in the State of Florida.

B. HDPE TUBING FOR WATER SERVICES:

All 1-inch high density polyethylene tubing used for services shall be CTS-O.D. Controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi, nominal outside diameter of 1.125-inches, minimum wall thickness of 0.125-inches, PE 3408, all in conformance with ASTM D2737-99 "Polyethylene (PE) Plastic Tubing". Tubing shall conform with ANSI/AWWA C901-96 "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service" as modified herein. Tubing shall have a (natural) inner core with a blue colored outer shell. Tubing shall have footage marks at a maximum interval of every two feet. Polyethylene material shall have a minimum cell classification in accordance with ASTM D3350-00 "Polyethylene Plastics Pipe and Fitting Materials" of 345444D for the core, which shall be 100% virgin material, and 345444E for the outer shell. Note that both of these materials are UV stabilized as signified by the "D" for natural colored and "E" for the colored shell. Tubing shall conform with NSF 61 or 14. Manufacturer shall supply certification of compliance with all of the above requirements. Certification shall ship with the tubing on material sold to the Department and shall always be submitted with shop drawings and catalogue cuts. When required by the Chief, Engineering Division, Miami-Dade Water and Sewer Department or his designee, certification shall be signed and sealed by a professional engineer licensed to practice in the state in which the manufacturer is located or in the State of Florida.

2.11 WALL SLEEVES, PIPES AND CASTINGS

- A. Wall Sleeves: Wall sleeves shall be of cast iron, ductile iron or carbon steel with steel galvanized after fabrication as specified in plans, under wall pipe. Sleeves shall be provided with seals and shall be oversized as required for the installation of seals. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2-inches above the finished floor. Escutcheons shall be provided at walls and floor to completely conceal the sleeves smaller than 3-inches. Escutcheons shall be brass or cast iron, nickel plated split-type.
- B. Interior: Wall sleeves shall be installed for all piping passing through interior walls and floors, except where noted on the Drawings. Sleeves shall be of sufficient size to pass the pipe without binding.

- C. Wall Sleeve Seals: Wall sleeve seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. The synthetic rubber shall be suitable for exposure to treated sewage effluent and groundwater. Bolts, nuts and hardware shall be 18-8 stainless steel. The seals shall be Link Seal as manufactured by Thunderline Corporation or equal, and the wall sleeve and seal shall be sized as recommended by the seal manufacturer.
- D. All piping passing through exterior walls and base slabs shall be provided with wall pipes. All wall pipes shall be of ductile iron and shall have an intermediate flange or waterstop located in the center of the wall. Each wall pipe shall be of the same grade, thickness and interior coating as the piping to which it is joined. Those portions of the wall pipes that are buried shall have a coal tar outside coating.

PART 3 - EXECUTION

3.01 General:

- A. The Contractor shall provide all barricades and/or flashing warning lights necessary to warn of the construction throughout the Project.
- B. Pipe and fittings shall at all times be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions.
- C. All work shall be performed by skilled workmen experienced in similar installations. All pipe and fittings shall be adequately supported by clamps, brackets, straps, concrete supports, rollers or other devices as shown and/or specified. Supports or hangers shall be spaced so that maximum deflection between supports or hangers shall not exceed 0.050 inch for pipe filled with liquid, but shall not be further than 6 feet apart, whichever is closer, unless otherwise shown. All pipe supports shall be secured to structures by approved inserts or expansion shields and bolts.
- D. All pipe shall be thoroughly cleaned internally before being installed. All pipes, except oxygen service, air and gas, shall be flushed with water and swabbed to assure removal of all foreign matter before installation. Air and gas piping shall be tapped with a hammer to loosen scale or other foreign matter that might be within the pipe, then thoroughly blown with a high pressure air hose. Air shall be from the Contractor's air compressor.
- E. Whenever possible, the pipe will be installed with minimum 48-inches of cover, however, due to the numerous utilities in the area, this burial could change substantially.
- F. At all horizontal or vertical pipe deviation, the Contractor shall install both restrained pipe and thrust blocks. Joints may only be opened to adjust alignment by half of the AWWA or manufacturer's recommended opening (which is smaller).
- G. Pipe Sleeves and Wall Castings: Pipe sleeves and wall castings shall be provided at the locations called for on the Drawings and/or specified herein. These units shall be as de-tailed and of the material as noted on the Drawings and/or specified herein. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the walls are poured. Ends of all wall castings and wall sleeves shall be of a

type consistent with the piping to be connected to them.

- H. Tie Rods: Unless otherwise indicated on the Drawings, the size and number of tie rods for a joint or installation shall be as recommended by the manufacturer's design chart for a working pressure of 150 psi. Tie rods shall be installed as recommended by the manufacturer.

3.02 EXCAVATION FOR PIPING

- A. The Contractor shall make all excavation necessary for the construction of the pipelines, connections, valves and appurtenances, to the lines and grades shown on the Plans.
- B. The trench shall be excavated at least 6 inches below pipe laying grade as shown on the Plans. All sheeting and shoring shall be installed at the Contractor's expense where it is necessary for pipe installation and property protection or required by the Trench Safety Act. The cost of dewatering any excavation shall be at the Contractor's expense. The disposal of water removed from an excavation shall be in a manner which will not create a hazard, or be detrimental to the public health or to public or private property.
- C. The Contractor shall obtain all necessary permits approving the location and proposed method of disposal before discharging water from any excavation into any portion of the public right-of-way or into any existing drainage structure or facility. All construction signs required shall be provided by the Contractor.

3.03 INSTALLATION OF PIPE, FITTINGS AND VALVES

A. General:

- 1. The design Drawings are in some cases diagrammatic. They may not show every bend, offset, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work of this Section with that of Division 2 and 16 is necessary to avoid conflicts. Install gravity lines at uniform grade to low point after field verification of low point invert.
- 2. The centerline of the pipe shall not vary by more than 2 inches from the location shown on the Plans and the top of the pipe shall not vary by more than 2 inches from the established grade, except at points where this tolerance must be changed to clear obstructions, or make connections. Deviation from this location will be permitted only upon written instructions from the Engineer.
- 3. Sandbags may be used to support the pipe in the ditch but no pipe shall be laid on blocks, except by the written permission of the Engineer of Record. The trench shall be dewatered to the extent that all poured lead joints in cast iron pipe and fittings may be made perfectly dry. Flanged joints, mechanical joints and push-on joints in cast iron pipe and fittings may be made under water.

B. Installation of Ductile Iron Pipe

- 1. All bends, tees, and plugs, unless otherwise specified, shall be backed with concrete to undisturbed ground. Provision shall be made to prevent concrete from adhering to plugs or bolts.
- 2. Bolts, nuts and rubber gaskets for use in flanged and mechanical joints shall be stored under cover. Gaskets shall not be exposed to heat, light or any petroleum products, shall be kept clean and shall not be handled with greasy or dirty hands.
- 3. Before making up flanged joints in cast iron pipe and fittings, the back of each flange under the bolt heads, and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry.

4. Before laying the ductile iron pipe, all lumps, blisters and excess coal-tar coating shall be removed from the bell and spigot ends of each pipe and the outside of the spigot and the inside of the bell wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe manufacturer's recommendations, to aid in making the joint. The workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall be made only after the joint has been assembled.
5. Cutting of ductile iron pipe for inserting valves, fittings, etc., shall be done by the Contractor with a mechanical pipe saw in a neat and workmanlike manner without damage to the pipe, the lining, or the coating.
6. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing in the direction of laying; and for lines on an appreciable slope, the bells shall, at the discretion of the Engineer, face upgrade.
7. Push-on and mechanical joints in ductile iron pipe and fittings shall be made in accordance with the manufacturer's standards except as otherwise specified herein. Joints between push-on and mechanical joint pipe and/or fittings shall be made in accordance with AWWA Standard Specifications, "Installation of Ductile Iron Water Mains and Appurtenances," C600-87, except that deflection at joints shall not exceed one-half of the manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600-87, whichever is the lesser amount.
8. Flanged joints shall be used only where indicated on the Plans. Before making up flanged joints in the pipeline, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to insure that bolt stresses are evenly distributed.
9. Bolts and nuts in flanged and mechanical joints shall be tightened in accordance with the recommendations of the pipe manufacturer for a leak-free joint. The workmen shall exercise caution to prevent overstress. Torque wrenches shall be used until, in the opinion of the Engineer, the workmen have become accustomed to the proper amount of pressure to apply on standard wrenches.

C. Installation of PVC Pipe:

1. In the installation of glue joint PVC pipe, the pipe shall first be cut square and smooth. Wipe all surfaces to be connected with a cloth moistened with an appropriate solvent and remove any foreign matter from socket of fitting. Using an ordinary paint brush of width about equal to the nominal pipe size, apply a generous coat of cement to inside and shoulder of socket, flowing on but not brushing out. A similar coat shall then be applied to the end of the pipe for at least the same distance on the pipe as the depth of socket, and to the cut end. Pipe and fittings shall then be pressed firmly together and the pipe turned a quarter to a half turn to evenly distribute the cement. The cementing and joining operation must not exceed one minute. Allow 24 hours setup time before applying pressure. Sand shall be used as backfill material around pipe installed underground.
2. Thread Sealant: Teflon tape.

3. All rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations. Plastic pipe shall be laid by snaking the pipe from one side of the trench to the other. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of solvent welding and during operation.
4. Schedule 80 pipe shall not be threaded. Use Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
5. Only strap wrenches shall be used for tightening threaded plastic joints, and care shall be taken not to over tighten these fittings.
6. Provide adequate ventilation when working with pipe joint solvent cement.
7. Testing: All lines shall be hydrostatically tested at the pressures specified elsewhere herein or at the design pressures.
8. Supports And Hangers: In accordance with the manufacturer's recommendations.

D. Installation of Copper Pipe:

1. Tubing above ground shall, whenever possible, be run in full lengths between fittings, valves and connections and joints shall be kept to a minimum. All connections shall be made without sharp bends or kinks in the tubing. Above ground tubing shall be supported at short intervals to prevent sagging and vibration.
2. All copper pipe shall be reamed to full diameter before joining. The ends of pipe and the inside of fittings shall be cleaned and flux applied to the entire area of pipe to be soldered.

E. Joint Pipe:

1. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound "Tite-Seal" or approved equal, on male threads only.
2. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of nipple is less than 1-1/2".
3. Provide reducing fittings rather than bushings where changes in pipe sizes occur.
4. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.

F. Unions: Provide unions or flanges in all domestic water service lines at each piece of equipment, specialty valves or at other locations required for ready disconnect.

G. Pipe Protection:

1. Paint all uninsulated metal (ductile iron or steel) piping underground with two coats of asphaltic paint.
2. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene.
3. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.
4. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc

chromate.

H. Cleaning and Testing: All of the piping installed under this project shall be tested as follows and as directed by the Engineer.

1. With exceptions as noted below, all ductile iron piping installed under this Contract shall be cleaned and tested according to Paragraph I hereinbelow in this Section:
 - a) Only potable water piping shall be disinfected.
 - b) No leakage shall be permitted for flanged piping.
 - c) No leakage shall be permitted for any type of above ground piping.
2. Unless otherwise specified elsewhere herein, all PVC pressure system bushings and galvanized steel piping shall be tested at 100 psig. No leakage will be permitted.

I. Installation of Aboveground and Exposed Piping

1. Aboveground and exposed pipe fittings, valves and accessories shall be installed as shown or indicated on the Drawings.
2. Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings rather than bushings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipe lines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated and as required to insure adequate support of the piping.
3. Welded connections shall be made in conformity with the requirements of AWWA Standard C 206 and shall be done only by qualified welders. The Engineer may, at his option, require certificates that welders employed on the work are qualified in conformity with the requirements of this standard and/or sample welds to verify the qualifications of the welders. Before testing, field welded joints shall be coated with the same material as used for coating its pipe in accordance with the requirements of AWWA.
4. Flanged joints shall be made up by installing the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with a suitable lubricant immediately before installation.
5. Joints using Dresser couplings shall be made up as recommended by the manufacturer.
6. Use of perforated band iron (plumber's strap), wire or chain as pipe hangers will not be acceptable. Supports for pipe less than 1-1/2 inches nominal size shall not be more than 8-feet on centers and pipe 2-inches nominal size and larger shall be supported at not more than 10-feet on centers, unless otherwise indicated. Supports for PVC pipe shall be spaced one-half the distance specified above unless otherwise indicated. Any noticeable sagging shall be corrected by the addition of extra supports at the Contractor's expense.

J. INSTALLATION OF HDPE SERVICES

All HDPE services require the use of a 10 gauge stranded copper blue tracer wire.

2.010 FIELD QUALITY CONTROL

A. All water mains shall be flushed to remove all sand, debris, rock and other foreign matter. Dispose

of the flushing water without causing a nuisance or property damage.

- B. Pressure and Leakage Testing: All pumps, piping and gauges shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer. Pump shall be of a non-pulsating type suit-able for this application and gauge accuracy certification may be required at the Engineer of Record's discretion. All pressure and leakage testing shall be done in the presence of a representative of the Department as a condition precedent to the approval and acceptance of the system.

END OF SECTION

SECTION 40 05 57

ELECTRIC OPERATORS

PART 1

GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Water Works Association - AWWA C540, Power-Actuating Devices for Valves and Sluice Gates.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for make and model.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Power and control wiring diagrams, including terminals and numbers.
 - 4. Complete motor nameplate data.
 - 5. Open/close and throttle actuators sizing calculations.
- B. Quality Control Submittals:
 - 1. Certificate of Compliance for Electric Operators; full compliance with AWWA C540.
 - 2. Tests and inspection data.
 - 3. Manufacturer's Certificate of Proper Installation.
 - 4. Operation and maintenance manual.

PART 2 PRODUCTS

2.1 GENERAL

- A. Valve to include operator, actuator, and accessories for a complete operation.
- B. Valve and operator to be suitable for intended service. Renewable parts not to be of a lower quality than specified.
- C. Size operator to operate valve for the full range of pressures and velocities.
- D. Valve to open by turning counterclockwise.
- E. Factory mount operator, actuator, and accessories unless otherwise noted.

2.2 SCHEDULE

Tag. Number	P&ID	Description	Type	Signal Type	Control Panel	Function	Actuator Mount	Actuator Voltage
FV-01-20	PI103	Raw Water Inflow	Butterfly 20"	Profibus DP	CP-05	Modulate	Direct	208 VAC
XV-01-79	PI103	Raw Water Control Valve Box	Butterfly 24"	LOCAL	LOCAL	Open Close	Direct	120 VAC
XV-01-80	PI103	Raw Water Control Valve Box	Butterfly 24"	LOCAL	LOCAL	Open Close	Direct	120 VAC
XV-04-103	PI104	Filter 1 Inlet Valve	Butterfly 12"	Profibus DP	CP-05	Open Close	Pedestal	120 VAC
XV-04-106	PI104	Filter 1 Waste Valve	Butterfly 20"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-107	PI104	Filter 1 Air Scouring Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
FV-04-109	PI104	Filter 1 Filtrate Valve	Butterfly 10"	Profibus DP	CP-05	Modulate	Direct	208 VAC
XV-04-110	PI104	Filter 1 Filter to Waste Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-111	PI104	Filter 1 Back Wash Valve	Butterfly 18"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-203	PI104	Filter 2 Inlet Valve	Butterfly 12"	Profibus DP	CP-05	Open Close	Pedestal	120 VAC
XV-04-206	PI104	Filter 2 Waste Valve	Butterfly 20"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-207	PI104	Filter 2 Air Scouring Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
FV-04-209	PI104	Filter 2 Filtrate Valve	Butterfly 10"	Profibus DP	CP-05	Modulate	Direct	208 VAC
XV-04-210	PI104	Filter 2 Filter to Waste Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC

Tag. Number	P&ID	Description	Type	Signal Type	Control Panel	Function	Actuator Mount	Actuator Voltage
XV-04-211	PI104	Filter 2 Back Wash Valve	Butterfly 18"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-303	PI104	Filter 3 Inlet Valve	Butterfly 12"	Profibus DP	CP-05	Open Close	Pedestal	120 VAC
XV-04-306	PI104	Filter 3 Waste Valve	Butterfly 20"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-307	PI104	Filter 3 Air Scouring Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
FV-04-309	PI104	Filter 3 Filtrate Valve	Butterfly 10"	Profibus DP	CP-05	Modulate	Direct	208 VAC
XV-04-310	PI104	Filter 3 Filter to Waste Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-311	PI104	Filter 3 Back Wash Valve	Butterfly 18"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-403	PI104	Filter 4 Inlet Valve	Butterfly 12"	Profibus DP	CP-05	Open Close	Pedestal	120 VAC
XV-04-406	PI104	Filter 4 Waste Valve	Butterfly 20"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-407	PI104	Filter 4 Air Scouring Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
FV-04-409	PI104	Filter 4 Filtrate Valve	Butterfly 10"	Profibus DP	CP-05	Modulate	Direct	208 VAC
XV-04-410	PI104	Filter 4 Filter to Waste Valve	Butterfly 6"	Profibus DP	CP-05	Open Close	Direct	120 VAC
XV-04-411	PI104	Filter 4 Back Wash Valve	Butterfly 18"	Profibus DP	CP-05	Open Close	Direct	120 VAC
FV-04-701	PI104	Back Wash Header Valve	Butterfly 16"	Profibus DP	CP-05	Modulate	Direct	208 VAC

2.3 OPERATORS

A. Electric Operator:

1. General:
 - a. Comply with AWWA C540.
 - b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of valve.
 - c. Controls integral with the actuator and fully equipped as specified in AWWA 540.
 - d. Non rising stem valves.
2. Actuator Operation-General:
 - a. Suitable for full 90-degree rotation of quarter-turn valves or for use on multiturn valves.
 - b. Manually override handwheel.
 - c. Integral valve position indication.
 - d. Operate from FULL CLOSED to FULL OPEN positions or the reverse in the number of seconds given in the Instrument Index.
3. Open-Close or Throttling Service:
 - a. Size motors for one complete OPEN-CLOSE-OPEN cycle no less than once every 10 minutes.
 - b. Actuator suitable for throttling operation of valve at intermediate positions.
 - c. Integral OPEN-STOP-CLOSE pushbutton controls or wiring terminal for the controls to be provided by others as noted in the Instrument Index.
 - d. Integral OPEN and CLOSED indicating lights or wiring terminals for the lights to be provided by others as noted in the Instrument Index.
 - e. Reversing motor starter with built-in overload protection.
 - f. Accept maintained (valve stops when contacts open) OPEN and CLOSE contacts to control valve.
4. Modulating Service:
 - a. Size motors for continuous duty.
 - b. Feedback potentiometer producing a 0-100% output via Profibus.
 - c. Integral HAND-OFF-AUTO (Local-Off-Remote) Selector Switch unless otherwise noted in the Instrument Index.
 - d. Integral OPEN-STOP-CLOSE pushbuttons to control valve in HAND (Local) position unless otherwise noted in the Instrument Index.
 - e. Accept maintained (valve stops when contacts open) OPEN and CLOSE contacts to control valve.
 - f. Integral OPEN and CLOSED indicating lights or wiring terminals for the lights to be provided by others as noted in the Instrument Index.
 - g. Ac motor with reversing starter and built-in overload protection.
 - h. Duty cycle limit timer and adjustable band width to prevent actuator hunting.
5. Actuator Power Supply:
 - a. 208V or 120 V ac, as indicated in valve schedule.
 - b. For Modulating Service continuous duty 480 V ac or 208 Vac may be required.
 - c. Control power transformer, 120-volt secondary.
 - d. Externally operable power disconnect switch.

6. Enclosure:
 - a. IP66/IP68 (7 m, 72 Hr.)
 - b. NEMA 4, 4X, & NEMA 6 Double Sealed.
 - c. Actuators shall be 'O' ring sealed, watertight to NEMA 6, and shall at the same time have an inner watertight and dustproof 'O' ring seal between the terminal compartment and the internal electrical elements of the actuator fully protecting the motor and all other internal electrical elements of the actuator from ingress of moisture and dust when the terminal cover is removed on site for cabling.
7. Limit Switch:
 - a. Single-pole, double-throw (SPDT) type, field adjustable cam-operated, with contacts rated for 5 amps at 120 volts ac.
 - b. Each valve actuator to have a minimum of two transfer contacts at end position, one for valve FULL OPEN and one for valve FULL CLOSED.
 - c. Housed in actuator control enclosure.
8. Terminal compartment:
 - a. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal.
9. Control Features: Furnish electric actuators with features noted in the Electric Operator Schedule.
10. Manufacturers and Products:
 - a. Rotork;
 - b. Limitorque
 - c. Tyco Biffi

2.4 ACCESSORIES

- A. Tagging: 1-1/2-inch diameter heavy brass or stainless-steel tag for each valve operator, bearing the valve tag number shown on the Electric Operator Schedule.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Electric Operators shall be factory installed on new valves.
- B. Electric Operators to be installed on existing valves shall be installed at the field in accordance with manufacturer's instructions. Provide mounting hardware to adapt operator to valve.

3.2 TESTS AND INSPECTION

- A. Automatic valve to be tested in conjunction with control system testing.
- B. Test that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, in both directions for two-way valve and applications.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Manufacturer's Representative: Present at site for minimum person-days listed below, travel time excluded:
 - 1. 1 person-days for installation assistance and inspection.
 - 2. 1 person-days for functional and performance testing.

3.4 SUPPLEMENTS

- A. The Supplement following "END OF SECTION," is a part of this Specification.
 - 1. Instrument Index (13390-I)

END OF SECTION

SECTION 40 05 65 VALVES AND OPERATORS

PART 1 GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for make and model.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Bill of material, catalog information, descriptive literature, wiring diagrams, and shop drawings for components of control system.
 - 4. Catalog information on electrical devices furnished with system.
 - 5. Shop drawings, catalog material, and dimensional layout drawings for control panels and enclosures.
 - 6. Manufacturer's list of proposed spares, expendables, and test equipment.
- B. Quality Control Submittals:
 - 1. Tests and inspection data.
 - 2. Manufacturer's Certificate of Proper Installation.
 - 3. Operation and maintenance manual.

PART 2 PRODUCTS

1.2 GENERAL

- A. Valve to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and accessories for a complete operation.
- B. Valve to be suitable for intended service.
- C. Size valve to provide a minimum 50 to 1 turndown ratio for a modulating service.
- D. Valve ends to suit adjacent piping.
- E. Size operator to operate valve for the full range of pressures and velocities.
- F. Valve to open by turning counterclockwise.
- G. Factory mount operator, actuator, and accessories.
- H. Where noted or shown provide valves integrally mounted with flow elements.

1.3 VALVES

- A. Gate Valves
 - 1. Resilient Seated Gate Valve 3-Inch to 12-Inch:
 - a. Iron body, resilient seat, bronze mounted, flanged ends, nonrising stem in accordance with AWWA C509, rated 200 psi cold water, full port, epoxy-coated inside.
 - b. Manufacturers and Products:
 - 1) American Series 2500
 - 2) Kennedy Style KS FW

2. Resilient Seated Gate Valve 3-Inch to 12-Inch for Buried Service:
 - a. Iron body, resilient seat, bronze mounted, mechanical joint ends, nonrising stem in accordance with AWWA C509, rated 200 psi cold water, full port, epoxy-coated inside.
 - b. Manufacturers and Products:
 - 1) American Series 2500
 - 2) Kennedy Style KS FW
 3. Resilient Seated Gate Valve Gate Valve 12 Inches and Larger:
 - a. Iron body, bronze mounted, flanged ends, solid wedge gate, outside screw and yoke in accordance with AWWA C509, rated 125-pound SWP, 200-pound WOG.
 - b. Manufacturers and Products:
 - 1) American Series 2500
 - 2) Kennedy Style KS RW
- B. Check Valves
1. Check Valve 2-1/2 Inches Through 12 Inches: Flanged end, cast iron body, bronze mounted swing type, solid bronze hinges, stainless steel hinge shaft, outside lever and spring rated 125-pound SWP, 200-pound WOG.
 2. Manufacturers and Products:
 - a. Stockham; G-931.
 - b. Crane Co.; Cat. No. 383.
- C. Butterfly Valves:
1. General: Butterfly valve specified as AWWA C504 to be in compliance with AWWA C504 and following requirements:
 - a. Suitable for throttling operations and infrequent operation after periods of inactivity.
 - b. Elastomer seats bonded or vulcanized to body shall have adhesive integrity of bond between seat and body assured by testing with minimum 75-pound pull in accordance with ASTM D429, Method B.
 - c. Bubble-tight with rated pressure applied from either side.
 - d. No travel stops for the disc on interior of the body.
 - e. Self-adjusting V-type or O-ring shaft seals.
 - f. Isolate metal-to-metal thrust bearing surfaces from flowstream.
 2. Butterfly Valve:
 - a. Flanged end, short body type.
 - b. AWWA C504, Class 150B.
 3. Manufacturers and Products:
 - a. Bray 3A
 - b. Kennedy Style 4500
- D. Altitude Type Level Control Valves
1. Hydraulically operated, diaphragm actuated, pilot controlled globe valve with cast iron, ductile iron, or steel body, ANSI B16.1 flanged ends, rated 175 psi,

bronze or stainless steel trim, stainless steel stem, externally mounted strainer with cock. Designed to control the high-water level in reservoirs without the need for floats or other devices. It shall be a non-throttling type valve and remain fully open until the "shut-off" point in the reservoir is reached. The valve is designed for two-way flow.

Manufacturers and Products:

Cla-Val; Model 210-16.

Flomatic C205

- E. Pump Control Valve: Hydraulically operated, diaphragm actuated, pilot controlled globe valve with cast iron, ductile iron, or steel body, ANSI B16.1 flanged ends, rated 175 psi, bronze or stainless steel trim, stainless steel stem, externally mounted strainer with cock. Designed to eliminate pipeline surge caused by pump startup and shutdown with an automatic check feature.

Manufacturers and Products:

Cla-Val; Model 60-31.

Flomatic C611

- F. Self-Contained Automatic Valves:

1. Air Release Valve:

- a. Suitable for water service, automatically exhaust small amounts of entrained air that accumulates in a system, in CLOSED position, seat against resilient seat to prevent water leakage.
- b. Rated 300 psi working pressure, cast iron or ductile iron body and cover with stainless steel float and trim.
- c. Manufacturers and Products:
 - 1) APCO Valve and Primer Corp.; Model No. 50
 - 2) Val-Matic Valve;
 - 3) Cla-Val, Model 34; or equal

2. Combination Air Release Valve:

- a. Suitable for water service, combines the operating features of both an air and vacuum valve and air release valve. Air and vacuum portion to automatically exhaust air during filling of system and allow air to re-enter during draining or when vacuum occurs. The air release portion to automatically exhaust entrained air that accumulates in system.
- b. Rated 300 psi working pressure, cast iron, ductile iron, or semi-steel body and cover with stainless steel float and trim.
- c. Valve single body or dual body, air release valve mounted on air and vacuum valve, isolation valve mounted between the dual valves.
- d. Manufacturers and Products:
 - 1) APCO Valve and Primer Corp.,
 - 2) Val-Matic Valve;
 - 3) Cla-Val, Model 36; or equal

- G. Pressure Reducing Valves: The Pressure Reducing Control Valve shall automatically throttle to reduce a higher incoming pressure and maintain an accurate and constant lower downstream pressure regardless of changing flow rate and/or inlet pressure. If downstream pressure increases above the pilot spring setting, the valve shall close.

The main valve shall be hydraulically operated, single diaphragm actuated, globe pattern. The valve shall consist of three major components; the body with seat installed, the cover with bearing installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating the operating pressure from line pressure. Packing glands, stuffing boxes and/or rolling diaphragm technology will not be permitted and there shall be no pistons operating the main valve or pilot controls. No fabrication or welding shall be used in the manufacturing process. Y-pattern valves shall not be permitted. Main valve shall comply with NSF/ANSI Standard 61 and certified lead free to NSF/ANSI 372 as a safe drinking water system component.

Manufacturers and Products:

Cla-Val; Model 90-01.

Flomatic C103

1.4 FACTORY FINISHING

A. Epoxy Lining and Coating:

1. In accordance with AWWA C550 unless otherwise specified.
2. Two-part liquid epoxy material or heat-activated fusion bonded epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

1.5 OPERATORS

A. Electric Operator: In accordance with Section 15101, Electric Valve Operators.

B. Manual Operator:

1. General:
 - a. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
 - b. Operator self-locking type or equipped with self-locking device.
 - c. Position indicator on quarter-turn valves.
 - d. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threader steel reach rods with internally threaded bronze or ductile iron nut.
2. Exposed Operator:
 - a. Galvanized and painted handwheels.
 - b. Lever operators allowed on quarter-turn valves 8 inches and smaller.
 - c. Cranks on gear type operators.
 - d. Buried Operator: Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Enclose moving parts of valve and operator in housing to prevent contact with the soil.

- e. Buried valves shall have extension stems, bonnets, and valve boxes.

PART 3 EXECUTION

2.1 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Valve Orientation:

1. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
2. Install operating stem horizontal in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above finish floor, unless otherwise shown.

2.2 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

- ##### **B. Test that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, in both directions for two-way valve and applications.**

END OF SECTION

**SECTION 40 69 01
PACKAGE CONTROL SYSTEMS**

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Instruments, Systems, and Automation (ISA): S50.1, Compatibility of Analog Signals for Electronic Process Instruments.
 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
 - c. ICS 2, Industrial Control Devices, Controllers and Assemblies.
 3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).

1.2 SYSTEM DESCRIPTION

- A. Contractor shall furnish, install, calibrate and place in satisfactory operation the process control systems and related equipment required, complete with appurtenances and accessories, ready for operation, as shown on the drawings, specified herein or required by the engineer.

1.3 SUMMARY

- A. Work Includes: Engineering, furnishing, installing, configuring, calibrating, adjusting, testing, documenting, starting up, and OWNER training for a complete Control System for the system. Major parts are:
1. Components including primary elements, transmitters, control devices, control panel, network interface components, coaxial cables, fiber optic cables and devices, connectors, control panel, programmable logic controllers (PLC), and an operator interface units (OIU).
 2. Detailed design, configuration, testing, and documenting the PLC system (including the OIU).
 3. Contractor to modify existing SCADA system programming to provide monitoring of all equipments and instruments. Programming must comply with PRASA guidelines and/or specifications. Also all the required alarms for compliance must be provided.
 4. Monitor normal power source status in the control panel (i.e., loss of 120-volt ac power to the panel) and incorporate into system controls.
- B. Detailed Design: The control system design as shown and specified includes functional and performance requirements. The Contractor shall complete detailed control system design. The detail design shall include as a minimum:

- Control Panels Lay Out and Bill of Material Drawings.

- Control Panel Power Distribution Drawings (120 Vac, 24 Vdc)
 - PLC Cards Wiring.
 - Networks Drawings (Profibus , Ethernet, etc..)
 - Detail Design Software and Integration Specification. This will be based on the functional Specification and will require approval from client before the system integration and will detail:
 - a) Network Description
 - b) Control System Description
 - c) I/O inputs list with address, description, range and calibration.
 - d) The Screens Layout.
 - e) Process functionality
 - f) Modes of Operation
 - g) Control Loops function and Description
 - h) PID controllers
 - i) Process interlocks
 - j) Security
 - k) Power consumption
- C. Control wiring and conduit demolition: Where they are available, reuse the existing wiring and conduits unless otherwise stated. If they are not reused, demolish the existing wiring and conduits unless otherwise stated. The Contractor shall include the wiring and conduits demolition plan in his detailed control system design.
- D. Any omission of details in this specification or its attachment shall not relieve the Contractor of his obligation to furnish a system which is complete and operable in a satisfactory manner per the contractor's standard practice and as explicitly stated in this specification and the construction drawings.
- E. In the event of conflict between requirements, the Contractor shall request the Engineer for clarification in writing.
- F. If any departures from this specification are deemed necessary by the Contractor, details of such departure and reasons therefor shall be submitted for approval as soon as practicable to the Engineer. No such departure shall be made without the prior written approval of the contract manager.

1.4 SUBMITTALS

A. Shop Drawings:

1. Bill of material, catalog information, descriptive literature, wiring diagrams, and shop drawings for components of control system.
2. Catalog information on electrical devices furnished with system.
3. Shop drawings, catalog material, and dimensional layout drawings for control panels and enclosures.
4. Panel elementary diagrams of prewired panels. Include in diagrams control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.
5. Plumbing diagrams of preplumbed panels and interconnecting plumbing diagrams.
6. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.
7. Complete PLC configuration information including ladder logic listing and I/O lists. On I/O lists, show source or designation, tag number, functional description, engineering units range, transfer register location, and OIU/SCADA database reference number for each point.

B. Complete configuration information and developed graphics for OIU.

C. Quality Control Submittals:

1. Manufacturer's Certificate of Proper Installation.
2. Programmable Controller Submittals:
 - a. Complete set of user manuals.
 - b. I/O listing.
 - c. Fully documented ladder logic listings with rung and coil/contact usage description.
 - d. Function listing for function blocks not fully documented by ladder logic listing.
 - e. Cross-reference listing.
3. Manufacturer's list of proposed spares, expandables, and test equipment.
4. PLC program shall not be copyrighted.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers and related equipment as recommended by capsule manufacturer.

1.6 SPARES, EXPENDABLES, AND TEST EQUIPMENT

- A. Lamp for Selector Switch, Pushbutton, and Indicating Light: 100 percent, min. two(2) of each type used
- B. Light Bulb: 100 percent, two minimum, of each type used.
- C. Fuse: 100 percent, two minimum, of each type used.

- D. Surge Suppressors: 50 percent, five minimum, of each type used.
- E. 20 percent uninstalled (loose) spare I/O modules for each type of module used including processor modules and power supplier (chassis mount or external).

PART 2 PRODUCTS

2.1 SIGNAL CHARACTERISTICS

- A. Analog Signals:
 - 1. 4 to 20 mA dc, in accordance with compatibility requirements of ISA S50.1.
 - 2. Unless otherwise specified or shown, use Type 2, two-wire circuits.
 - 3. Transmitters: Load resistance capability conforming to Class L.
 - 4. Fully isolate input and output signals of transmitters and receivers.
- B. Pulse Frequency Signals: dc pulses whose repetition rate is linearly proportional to process variable over 10:1 range. Generate pulses by contact closures or solid state switches.
 - 1. Power source: Less than 30V dc.
- C. Discrete Signals:
 - 1. Two-state logic signals.
 - 2. Utilize 24V dc sources for control and alarm signals.
 - 3. Alarm signals shall be normally open, close to alarm isolated contacts rated for 5-ampere at 120V ac and 2-ampere at 30V dc.
 - 4. Use for Motors Starters, VFD and Soft starts.
 - 5. Use for Motorized Valves.

2.2 CORROSION PROTECTION

- A. Corrosion-Inhibiting Vapor Capsule Manufacturers:
 - 1. Northern Instruments; Model Zerust VC.
 - 2. Hoffmann Engineering; Model A-HCI.

2.3 CONTROL PANEL

- A. Conform to NEMA ratings as specified in individual equipment sections.
- B. Minimum Metal Thickness: 14 gauge.
- C. NEMA 250, Type 4X Panels: Type 316 stainless steel construction.
- D. Doors:
 - 1. Three-point latching mechanisms in accordance with NEMA 250, Type 1 and 12 panels with doors higher than 18 inches.
 - 2. For other doors, stainless steel quick release clamps.

- E. Cutouts shall be cut, punched, or drilled and finished smoothly with rounded edges.
- F. Access: Front, suitable for installation with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.
- G. Temperature Control:
 - 1. Size panels to adequately dissipate heat generated by equipment mounted on or in the panel.
 - 2. Furnish cooling fans with air filters if required to dissipate heat.
 - 3. For panels outdoors, furnish sunshields to protect exposed south, east, and west facing surfaces.
- H. Lighting: Minimum of one hand switch controlled internal 100-watt incandescent light for panels 12 cubic feet and larger.
- I. Minimum of one 120-volt duplex receptacle for panels 12 cubic feet and larger.
- J. Finish:
 - 1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Manufacturer's standard gray unless otherwise specified.
 - 2. Internal Surfaces: White enamel.
- K. Panel Manufacturers:
 - 1. Hoffman.
 - 2. Rittal.
 - 3. Sanginaw
- L. Breather and Drains: Furnish with NEMA 250, Type 4X panels.
 - 1. Manufacturer and Product: Crouse-Hinds; Model ECD18.

2.4 CONTROL PANEL ELECTRICAL

- A. Control Panels Without Motor Starters:
 - 1. Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
 - 2. Locate to provide clear view of and access to breakers when door is open. Group on single subpanel. Provide typed directory.
 - 3. Circuit Breakers:
 - a. Coordinate for fault in branch circuit trips, branch breaker, and not main breaker.
 - b. Branch Circuit Breakers: 15 amps at 250V ac.
 - c. Breaker Manufacturers and Products:
 - 1) Allen Bradley
 - 2) Phoenix.
 - 3) Weidmuller
- B. Control Panels with Three-Phase Power Supplies and Motor Starters:

1. Interlock main circuit breaker with panel door.
 - a. Mount logic controls, branch circuit breakers, overload reset switches, and other control circuit devices.
 - b. Mount operator controls and indications on front access door.
2. Circuit Breakers:
 - a. In accordance with NEMA AB 1.
 - b. 18,000-ampere RMS symmetrical rating, minimum at 480 volts, unless otherwise specified.
 - c. Breakers except Motor Branch Breakers: Molded case thermal magnetic.
 - d. Motor Branch Circuit Breakers:
 - 1) 50 hp and Less: Magnetic.
 - 2) Larger than 50 hp: Thermal magnetic with adjustable magnetic trip units.
 - 3) Ratings: Recommended by manufacturer for maximum motor protection.
 - 4) Padlock Provisions: OFF position.
 - e. Tripping: Indicate with operator handle position.
3. Magnetic Motor Starters:
 - a. Full voltage, NEMA ICS 2, Class A, Size O minimum.
 - b. Include three-pole bimetallic or eutectic alloy thermal overload relays sized for each motor.
 - c. Manual reset type with reset button mounted on panel door.
4. Motor Control: 120V ac (except intrinsically safe circuits where applicable).
 - a. Power Control Transformer:
 - 1) Sufficient capacity to serve connected load, including 200VA for duplex outlet plus 100VA (minimum).
 - 2) Limit voltage variation to 15 percent during contact pickup.
 - 3) Fuse one side of secondary winding and ground the other.
 - 4) Furnish primary winding fuses in underground conductors.
5. Power Monitoring Relay:
 - a. Protect three-phase equipment from single phasing, phase imbalance, or phase reversal.
 - b. Separate, isolated contact outputs to stop motors and activate alarm light during abnormal conditions.
 - c. Transient Voltage Protection: 10,000 volts.
 - d. Manufacturer and Product: Furnace; Class 47.
6. Power Distribution Blocks: Furnish to parallel feed top on branch circuit protective devices. Do not "leap frog" power conductors.
7. Terminations for Power Conductors: Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

C. Wiring:

1. ac Circuits:
 - a. Type: 600-volt, Type MTW stranded copper.
 - b. Size: For current to be carried, but not less than No. 14 AWG.
2. Analog Signal Circuits:
 - a. Type: 300-volt, Type 2 stranded copper, twisted shielded pairs.
 - b. Size: No. 18 AWG, minimum.
3. Other dc Circuits.
 - a. Type: 600-volt, Type MTW stranded copper.
 - b. Size: No. 18 AWG, minimum.

4. Separate analog and other dc circuits at least 6 inches from any ac power and control wiring.
5. Enclose wiring in sheet metal raceways or plastic wiring ducts.
6. Wire Identification:
 - a. Numbered and tagged at each termination.
 - b. Wire Tags: Snap-on or slip-on PVC wire markers with legible machine printed markings and numbers. Do not use adhesive or taped-on tags.

D. Wiring Interface:

1. For analog and discrete signal, terminate at numbered terminal blocks.
2. For special signals, terminate power (240 volts or greater) at manufacturer's standard connectors.
3. For panel, terminate at equipment on/with which it is mounted.

E. Terminal Blocks:

1. Quantity:
 - a. For external connections.
 - b. Wire spare or unused panel mounted elements to their panels' terminal blocks.
 - c. Spare Terminals: 20 percent of connected terminals, but not less than 10.
2. General: Group to keep 120V ac circuits separate from 24V dc circuits.
 - a. Connection Type: Screw connection clamp.
 - b. Compression Clamp:
 - 1) Hardened steel clamp with transversal grooves penetrating wire strands providing a vibration-proof connection.
 - 2) Guides strands of wire into terminal.
 - c. Screws: Hardened steel, captive and self-locking.
 - d. Current Bar: Copper or treated brass.
 - e. Insulation:
 - 1) Thermoplastic rated for minus 55 to plus 110 degrees C.
 - 2) Two funnel shaped inputs to facilitate wire entry.
 - f. Mounting:
 - 1) Rail.
 - 2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
 - 3) End Stops: One at each end of rail, minimum.
 - g. Wire Preparation: Stripping only.
 - h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
 - i. Marking System:
 - 1) Terminal number shown on both sides of terminal block
 - 2) Allow use of preprinted and field marked tags.
 - 3) Terminal strip numbers shown on end stops.
 - 4) Mark terminal block and terminal strip numbers as shown.
3. Terminal Block, 120-Volt Power:
 - a. Rated Voltage: 600V ac.
 - b. Rated Current: 30 amps.
 - c. Wire Size: P22-10 AWG.
 - d. Rated Wire Size: 10 AWG.
 - e. Color: Gray body.
 - f. Spacing: 0.25 inch, maximum.

- g. Manufacturer and Product: Phoenix, Weidmuller
4. Terminal Block, Ground:
 - a. Wire Size: 22-12 AWG.
 - b. Rated Wire Size: 12 AWG.
 - c. Color: Green and yellow body.
 - d. Spacing: 0.25 inch, maximum.
 - e. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
 - f. Manufacturer and Product: Phoenix, Entelec; Type M4/6.P.
5. Terminal Block, Blade Disconnect Switch:
 - a. Use: Provide one for each discrete input and output field interface wire.
 - b. Rated Voltage: 600V ac.
 - c. Rated Current: 10 amps.
 - d. Wire Size: 22-12 AWG.
 - e. Rated Wire Size: 12 AWG.
 - f. Color: Gray body, orange switch.
 - g. Spacing: 0.25 inch, maximum
 - h. Manufacturer and Product: Phoenix, Weidmuller; Type M4/6.SN.
6. Terminal Block, Fused, 24V dc:
 - a. Rated Voltage: 600V dc.
 - b. Rated Current: 6.3 amp.
 - c. Wire Size: 22-12 AWG.
 - d. Rated Wire Size: 12 AWG.
 - e. Color: Gray body.
 - f. Fuse: 5 by 20 GMA fuses.
 - g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 - h. Indication: LED diode 24V dc.
 - i. Leakage Current: 5.2 mA, maximum.
 - j. Spacing: 0.32 inch, maximum
 - k. Manufacturer and Product: Phoenix, Weidmuller; Type M4/6.SFD.
7. Terminal Block, Fused, 120V ac:
 - a. Rated Voltage: 600 V ac.
 - b. Rated Current: 6.3 amp.
 - c. Wire Size: 22-12 AWG
 - d. Rated Wire Size: 12 AWG.
 - e. Color: Gray body.
 - f. Fuse: 5 by 20 GMA fuses.
 - g. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 - h. Indication: Neon lamp 110V ac.
 - i. Leakage Current: 1.8 mA, maximum.
 - j. Spacing: 0.32 inch, maximum
 - k. Manufacturer and Product: Phoenix, Weidmuller; Type M4/6.SFL.
- F. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.
- G. Relays:
 1. General:
 - a. Relay Mounting: Plug-in type socket.
 - b. Relay Enclosure: Provide dust cover.

- c. Socket Type: Screw terminal interface with wiring.
- d. Socket Mounting: Rail.
- e. Furnish holddown clips.
- 2. Control Circuit Switching Relay, Nonlatching:
 - a. Type: Compact general purpose plug-in.
 - b. Contact Arrangement: 3 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 240V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
 - g. Expected Mechanical Life: 10,000,000 operations.
 - h. Expected Electrical Life at Rated Load: 100,000 operations.
 - i. Indication Type: Neon or LED indicator lamp.
 - j. Push-to-test button.
 - k. Manufacturer and Product: IDEC, Potter and Brumfield; Series KUP.
- 3. Control Circuit Switching Relay, Latching:
 - a. Type: Dual coil mechanical latching relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 28V dc or 120V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As noted or shown.
 - f. Coil Power: 2.7 watts (dc), 5.3VA (ac).
 - g. Expected Mechanical Life: 500,000 operations.
 - h. Expected Electrical Life at Rated Load: 50,000 operations.
 - i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.
- 4. Control Circuit Switching Relay, Time Delay:
 - a. Type: Adjustable time delay relay.
 - b. Contact Arrangement: 2 Form C contacts.
 - c. Contact Rating: 10A at 240V ac.
 - d. Contact Material: Silver cadmium oxide alloy.
 - e. Coil Voltage: As specified or shown.
 - f. Operating Temperature: Minus 10 to 55 degrees C.
 - g. Repeatability: Plus or minus 2 percent.
 - h. Delay Time Range: Select range such that time delay set point fall between 20 to 80 percent or range.
 - i. Time Delay Set Point: As specified or shown.
 - j. Mode of Operation: As specified or shown.
 - k. Adjustment Type: Integral potentiometer with knob external to dust cover.
 - l. Manufacturer and Products: Potter and Brumfield.
 - 1) Series CB for 0.1-second to 100-minute delay time ranges.
 - 2) Series CK for 0.1- to 120-second delay time ranges.

H. Intrinsic Safety Barriers:

- 1. Intrinsically Safe Relays: Monitor discrete signals that originate in hazardous area and are used in a safe area.
 - a. Manufacturer and Product: MTL, Inc.; Series MTL 2000.
- 2. Intrinsically Safe Barriers: Interface analog signals as they pass from hazardous area to safe area.
 - a. Manufacturer and Product: MTL, Inc.; Series MTL 3000.

I. Programmable Logic Controller:

1. PLC shall meet the functional requirements of Section 13390F Automation Functional Requirements. PLC shall also meet the functional requirements of Component Y69, Y70, Programmable Logic Controller found later in this section.
2. Provide data interface tables in the PLC for exchange of information on a plantwide fiber optic network. Use contiguous blocks of memory to facilitate transfer of information between individual equipment PLC and other nodes that may exist on a plantwide network.
 - a. Discrete inputs sent to the package shall be packed into contiguous memory registers. These registers shall be contiguous and contain only discrete inputs. Setting the corresponding bit shall represent true condition for a state.
 - b. Discrete outputs provided by the equipment package shall be packed into contiguous memory registers. These registers shall be contiguous and contain only discrete outputs. Setting the corresponding bit shall represent true condition for a state.
 - c. Analog inputs sent back to the package shall be in memory registers. Values shall be scaled in a manner consistent with the existing plantwide control and computer based OIU.
 - d. Analog outputs from the package shall be in memory registers. Values shall be scaled in a manner consistent with the existing plantwide control and computer based OIU.

J. Louver Plates:

1. Where noted or shown, install louver plates on panel to provide panel ventilation.
2. Louvers per Plate: 3 minimum.
3. Plate Material: Steel or Type 316 stainless steel, as noted.
4. Louver Plates per Panel: Two minimum, unless otherwise noted.
5. Minimum Dimensions: 3.25 x 3.25 inches.
6. Minimum Open Area per Plate: 0.86 square inches.

2.5 COMPONENT SPECIFICATIONS

A. Control Valves:

Refer to specification Section 15100 – Valves and operators
and Section 15100-01 – Electric Operators.

B. A16 Turbidity Element and Transmitter (Low Range):

1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to turbidity of a sample stream of process fluid.
 - b. Type: Light scatter detection measurement using a 90-degree scatter photocell detector.
 - c. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
2. Performance:
 - a. Operation Range: 0-10 NTU.
 - b. Resolution: .002 NTU or better.

- c. Repeatability: Plus or minus 1.0 percent or plus or minus 0.002 NTU, whichever is greater.
 - d. Response Time: For a full scale step change, 90 percent response in 5 minutes at 500 ml/min flow.
 - e. Required Flow: 250-750 ml/min.
 - f. Sample Fluid Temperature: 0-50 degrees C.
 - g. Operating Temperature: 0-40 degrees C.
- 3. Element:
 - a. General: Flow-through body using focused light and a photodetector cell to measure 90-degree scattered light within the fluid.
 - b. Internal bubble trap and vent.
- 4. Transmitter:
 - a. Features:
 - 1) Indication Range: 0-10 NTU.
 - 2) Four-digit display.
 - b. Signal Interface:
 - 1) Output: 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - 2) Alarm Contacts: Two independent alarm set points, each SPDT and rated 5A continuous at 115V ac, minimum. Each set point adjustable over the full range.
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - d. Power: Selectable 115V ac or 230V ac.
- 5. Cable: 20 feet.
- 6. Expendables:
 - a. Lamp Units: One for each unit provided.
 - b. Formazin Calibration Kit: One for each unit provided.
- 7. Manufacturers and Products:
 - a. Hach Company; Turbidimeter, Model 1720E.

C. A17 Turbidity Element and Transmitter (High Range):

- 1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to turbidity of a sample stream of process fluid.
 - b. Type: Surface scatter detection noncontact.
 - c. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
- 2. Performance:
 - a. Range: 0-9999 NTU.
 - b. Resolution: .1 NTU or better.
 - c. Required Flow: 250-750 ml/min.
 - d. Sample Fluid Temperature: 0-50 degrees C.
 - e. Operating Temperature: 0-40 degrees C.
- 3. Element:
 - a. General: Non contact
 - b. Internal bubble trap and vent.
- 4. Transmitter:
 - a. Features:
 - 1) Indication Range: 0-9999 NTU.
 - 2) Four-digit display.
 - b. Signal Interface:

- 1) Output: 4 to 20 mA dc Hart for a load impedance of 500 Ohms minimum.
 - 2) Alarm Contacts: Two independent alarm set points, each SPDT and rated 5A continuous at 115V ac, minimum. Each set point adjustable over the full range.
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - d. Power: Selectable 115V ac or 230V ac.
 5. Cable: 20 feet.
 6. Expendables:
 - a. Lamp Units: One for each unit provided.
 - b. Formazin Calibration Kit: One for each unit provided.
 7. Manufacturers and Products:
Hach Company; Turbidimeter, Model Surface Scatter 7.
- D. A18 Turbidity Element and Transmitter (Immersion Style):
 1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to turbidity of a sample stream of process fluid.
 - b. Type Dual infrared light beams
 - c. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
 2. Performance:
 - a. Operation Range: 0.001-4000 NTU.
 - b. Accuracy: .001 NTU or better.
 - c. Repeatability: Less than 1% reading
 - d. Response Time: 1s<T90<30s
 - e. Required Flow: 3 m/s max.
 - f. Sample Fluid Temperature: 0-40 degrees C.
 - g. Operating Temperature: 0-40 degrees C.
 3. Element:
 - a. Dual infrared light beams. LED light source transmits light at 45° to sensor face. Nephelometric photoreceptors detect light at 90° to the transmitted light beam.
 - b. Self-cleaning wiper.
 - c. Material PVC
 4. Transmitter:
 - a. Features:
 - 1) Universal Controller
 - 2) Digital and analog sensors
 - b. Signal Interface:
 - 1) Output: 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - d. Power: 24Vdc
 5. Cable: 10 meters
 6. Expendables:
 - a. Handrail Mounting Kit MH236B00Z
 - b. Sun Shield for sc200 controller 9220600
 - c. Wiper Blades, LZX050

Calibration Kit, includes calibration cylinder, two 500-mL 800 NTU StablCal®, and a sensor bracket 5733000

7. Manufacturers and Products:
 - a. Solitrax; LXV423.99.10000 Turbidity, t-line sc, PVC with wiper (0.001 to 4000 NTU)

E. A20 pH Element and Transmitter:

1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to pH of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
2. Performance:
 - a. Range: 0-14 pH.
 - b. Accuracy shall be better than 0.05 pH units with 24 hour zero stability of 0.01 pH units.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
3. Element:
 - a. General: Electromechanically measure pH without requiring electrolyte flow.
4. Transmitter:
 - a. Features:
 - 1) Indication Range: 0-14 pH
 - b. Signal Interface:
 - 1) Probe Digital Communication to sc1000.
 - 2) Output 1 pH
 - 3) Output 2 Temperature
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - d. Power: Selectable 115V ac.
5. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
6. Manufacturers and Products:

Hatch, DPD2P1

F. A21 Residual Chlorine Analyzer and Transmitter:

1. General:
 - a. Unit shall measure continuously the chlorine residual of the sample process stream.
 - b. Unit shall measure either free or total chlorine residual, field selectable.
 - c. Principle of operation shall be amperometric with pH buffering.
2. Parts:
 - Analyzer/transmitter unit
 - Mounting hardware
 - Sample tubing connectors
 - Reagent
 - Expendables
 - Sample conditioning system

3. Performance:
 - a. Sensitivity shall be better than 0.001 mg/l with a 4-second maximum response time.
 - b. Unit shall have integral temperature compensation.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
4. Transmitter:
 - a. Features:
 - b. Indication either free or total chlorine residual, field selectable.
 - c. Signal Interface:
 - 1) Output: Hart, 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - d. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - e. Power: Selectable 115V ac.
5. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
6. Manufacturers and Products:

Hach CL-17

G. A22 Redox (ORP) Element and Transmitter:

1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to ORP of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
2. Performance:
 - a. Range: (100-2000mV)
 - b. Accuracy shall be better than 0.1mV.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
3. Element:
 - a. General: Electromechanically measure ORP without requiring electrolyte flow.
4. Transmitter:
 - a. Features:
 - 1) Indication Range: 100-2000mV
 - b. Signal Interface:
 - 1) Output: Hart, 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - d. Power: Selectable 115V ac.
5. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.

6. Manufacturers and Products:
 - a. Yokogawa PH402G
- H. A23 Dissolved Oxygen Element and Transmitter:
1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to dissolve oxygen in water of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
 2. Performance:
 - a. Range: (0-50 ppm)
 - b. Accuracy shall be better than 0.05 ppm
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
 3. Element:
 - a. General: Electromechanically measure Dissolved Oxygen without requiring electrolyte flow.
 4. Transmitter:
 - a. Features:
 - 1) Indication Range: 1-50 mg/l (ppm)
 - b. Signal Interface:
 - 1) Output: Probe Digital Communication to sc1000.
 - c. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - d. Power: From sc1000.
 5. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
 6. Manufacturers and Products:
 - a. HACH LDO MODEL 2
- I. A24 Alkalinity Element and Transmitter:
1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to Alkalinity of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
 2. Performance:
 - a. Range: 0-1000 mg/l.
 - b. Accuracy +0 .5%.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-25 degrees C.
 3. Element:
 - a. General: The analyzer combines titrimetric and colorimetric methods of detection to determine concentration.
 - b. Transmitter:

- c. Features:
 - 1) Indication Range: 0-1000 mg/l
 - 2) Automatic self-cleaning, self-calibrating and self-priming.
 - d. Signal Interface:
 - 1) Two Output: Hart, 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - 2) Selectable readout in total, phenolphthalein, bicarbonate, carbonate or hydroxide alkalinity.
 - e. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - f. Power: Selectable 115V ac.
- 4. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
 - 5. Manufacturers and Products:
 - a. Hatch APA 6000 Alkalinity Analyzer

J. A25 Streaming Current Analyzer and Transmitter:

- 1. General:
 - a. Unit shall measure continuously the net ionic and particle surface charge in a chemically treated water.
- 2. Parts:
 - Analyzer/transmitter unit
 - Mounting hardware
 - Sample tubing connectors
 - Reagent
 - Expendables
 - Sample conditioning system
- 3. Performance:
 - a. Accuracy shall be better than 1% full scale
 - b. 5 second maximum response time.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
- 4. Transmitter:
 - a. Features:
 - b. Indication Streaming Current Signal.
 - c. Signal Interface:
 - 1) Output: 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - d. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - e. Power: Selectable 115V ac.
- 5. Options:
 - a. Jet wash sample cell cleaning.
- 6. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.

7. Manufacturers and Products: Chemtrak 3500 or approved equal.

K. A21 Residual Chlorine Analyzer and Transmitter:

1. General:
 - a. Unit shall measure continuously the chlorine residual of the sample process stream.
 - b. Unit shall measure either free or total chlorine residual, field selectable.
 - c. Principle of operation shall be amperometric with pH buffering.
2. Parts:
 - Analyzer/transmitter unit
 - Mounting hardware
 - Sample tubing connectors
 - Reagent
 - Expendables
 - Sample conditioning system
3. Performance:
 - a. Sensitivity shall be better than 0.001 mg/l with a 4-second maximum response time.
 - b. Unit shall have integral temperature compensation.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-40 degrees C.
4. Transmitter:
 - a. Features:
 - b. Indication either free or total chlorine residual, field selectable.
 - c. Signal Interface:
 - 1) Output: 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - d. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - e. Power: Selectable 115V ac.
5. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
6. Manufacturers and Products: Wallace and Tieman, Hach and Capitol Controls.

L. A27 Particle Count Analyzer and Transmitter:

1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to [article count of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
2. Performance:
 - a. Range: 2-750 microns.
 - b. Resolution (10% preferred) at 10 microns
 - c. Sample Fluid Temperature: 0-50 degrees C.

- d. Operating Temperature: 0-25 degrees C.
- 3. Element:
 - a. Sensor :
 - 1) Laser-illumination, light-blocking type.
 - 2) Volumetric, the sensing area shall be the entire cross-section of the sample flow path.
 - b. Features:
 - c. Indication Range 2-750 microns.
 - d. Signal Interface:
 - 1) Output: 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - 2) Selectable readout in Cumulative/differential
 - 3) Enclosure:
 - a) Type: NEMA 4X.
 - b) Mounting: Wall-mounted.
 - e. Power: Selectable 115V ac.
- 4. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
- 5. Manufacturers and Products:
 - a. Hatch 57050-00 2200 PCX Particle Counter w/ Analog and Water Weir 57050-00

M. A28 TOC Element and Transmitter:

- 1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to Total Organic Carbon of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
- 2. Performance:
 - a. Range: 0-1000 mg/l.
 - b. Accuracy $\pm 0.5\%$.
 - c. Sample Fluid Temperature: 0-50 degrees C.
 - d. Operating Temperature: 0-25 degrees C.
- 3. Element:
 - a. General: The TOC analyzer uses a multi-staged UV oxidation reactor and a chemically impervious non-dispersive infrared (NDIR) CO₂ detector system assuring full compliance with Standard Methods 5310 C and EPA method 415.1.
 - b. Transmitter:
 - c. Features:
 - 1) Indication Range: 0-5 / 10 / 25 mg/l TOC
 - 2) Automatic self-cleaning, self-calibrating and self-validation.
 - d. Signal Interface:
 - 1) Two Output: Hart, 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - e. Two 4-20 mA with an output span based on the selected measurement range and the TOC removal percentage process control range

- f. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - g. Power: Selectable 115V ac.
- 4. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
- 5. Manufacturers and Products:
 - a. Hatch 1950plus TOC
 - b. 1950plus, Stainless Steel,
 - c. 4P95-1311-00 1950 plus, Stainless Steel, 115V, View Window / Additional UV Lamp /Level Detection Kit
 - d. 1950plus, 2 Yr. Spare Parts Kit

N. A29 Permanganate Analyzer Element and Transmitter:

- 1. General:
 - a. Function: Continuously measure, indicate and transmit a signal proportional to Permanganate of a sample stream of process fluid.
 - b. Parts: Element, transmitter, interconnecting cable, mounting hardware and expendables.
- 2. Performance:
 - a. Range: 0.020 – 2.00 ppm
 - b. Accuracy +-2%.
 - c. Sample Fluid Temperature: 5-50 degrees C.
 - d. Operating Temperature: 0-30 degrees C.
- 3. Element:
 - a. General: The Permanganate analyzer provide In line monitoring..
 - b. Transmitter:
 - c. Features:
 - 1) Indication Range: 0.020 – 2.00 ppm
 - d. Signal Interface:
 - 1) One Output: Hart, 4 to 20 mA dc for a load impedance of 500 Ohms minimum.
 - e. Enclosure:
 - 1) Type: NEMA 4X.
 - 2) Mounting: Wall-mounted.
 - f. Power: Selectable 115V ac.
- 4. Expendables:
 - a. Spare sensor: One for each unit provided.
 - b. Calibration Kit: One for each unit provided.
- 5. Manufacturers and Products:
 - a. ChemScan mini
 - b. Equivalent approve equal

O. F4, Flow Element and Transmitter, Electromagnetic:

- 1. General:
 - a. Function: Measure, indicate, and transmit the flow of a process liquid in a full pipe.

- b. Type: Electromagnetic flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.
 - c. Parts: Flow element, transmitter, interconnecting cables, mounting hardware, and calibrator.
- 2. Service:
 - a. Stream Fluid: As noted in Instrument Index.
 - b. Flow Stream Descriptions: As noted in Instrument Index.
- 3. Performance:
 - a. Flow Range: As noted in Instrument Index.
 - b. Accuracy: Plus or minus 1 percent of rate for all flows resulting from pipe velocities of 1 to 33 feet per second.
 - c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.
- 4. Features:
 - a. Zero stability feature to eliminate the need to stop flow to check zero alignment.
 - b. No obstructions to flow.
 - c. Very low pressure loss.
- 5. Process Connection:
 - a. Meter Size: As noted.
 - b. Connection Type: 150-pound ANSI raised-face flanges or wafer style depending on meter size, unless otherwise noted.
 - c. Flange Material: Carbon steel, unless otherwise noted.
- 6. Signal Interface:
 - a. Ethernet.
- 7. Power: 120V ac, 60-Hz, unless otherwise noted.
- 8. Element:
 - a. Meter Tube Material: 304 stainless steel, unless otherwise noted.
 - b. Liner Material: Teflon, unless otherwise noted.
 - c. Liner Protectors: Covers on each end to protect liner during shipment.
 - d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.
 - e. Electrode Material: 316 stainless steel, unless otherwise noted.
 - f. Enclosure: NEMA 4X, unless otherwise noted.
 - g. Grounding Ring/Electrode Material: 316 stainless steel, unless otherwise noted.
- 9. Transmitter:
 - a. Display: Blind or indicating and/or totalizing as noted.
 - b. Mounting: Pipe stand, wall, panel, or integral as noted.
 - c. Enclosure: NEMA 4X.
 - d. Zero and Span: Field adjustable.
 - e. Indicator: Digital 16-character display, with scale range as noted.
 - f. Totalizer: Digital 16-character display, with totalizer unit digit value as noted.
- 10. Cables:
 - a. Types: As recommended by manufacturer.
 - b. Lengths: As required to accommodate device locations.

11. Calibration System:

- a. Features:
 - 1) Field programmable electronics.
 - 2) Self-diagnostics with troubleshooting codes.
 - 3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
 - 4) Initial flow tube calibration and subsequent calibration checks.
- b. Equipment:
 - 1) Built-in electronics with each unit provided.
 - 2) Alternatively, one portable calibrator of each type required for the various electromagnetic flowmeters provided on the project.

12. Manufacturers:

- a. Endress+Hausser, Promag 5053

P. F5, Insertable Average Flowmeter, Electromagnetic:

- 1. General:
 - a. Function: Measure, indicate, and transmit the flow of a process liquid in pipe close to elbows/bends.
 - b. Type: Electromagnetic Average flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.
 - c. Parts: Flow element, transmitter, interconnecting cables, mounting hardware, and calibrator.
- 2. Service:
 - a. Stream Fluid: As noted.
 - b. Flow Stream Descriptions: As noted.
- 3. Performance:
 - a. Flow Range: As noted.
 - b. Accuracy: Plus or minus 1 percent of rate for all flows resulting from pipe velocities of 1 to 20 feet per second.
 - c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.
- 4. Features:
 - a. Zero stability feature to eliminate the need to stop flow to check zero alignment.
 - b. No obstructions to flow.
 - c. Very low pressure loss.
- 5. Process Connection:
 - a. Meter Size: As noted.
 - b. Connection Type: 2" NPT.
- 6. Signal Interface:
 - a. 4 to 20 mA dc for load impedance 0 to 800 ohms minimum for 24V dc supply.
- 7. Power: 120V ac, 60-Hz, unless otherwise noted.

8. Element:
 - a. Average Sensor.
 - b. Electrode Material: 316 stainless steel, unless otherwise noted.
 - c. Enclosure: NEMA 4, unless otherwise noted.
 9. Transmitter:
 - a. Display: Blind or indicating and/or totalizing as noted.
 - b. Mounting: Pipe stand, wall, panel, or integral as noted.
 - c. Enclosure: NEMA 4X.
 - d. Zero and Span: Field adjustable.
 - e. Indicator: Digital 16-character display, with scale range as noted.
 - f. Totalizer: Digital 16-character display, with totalizer unit digit value as noted.
 10. Cables:
 - a. Types: As recommended by manufacturer.
 - b. Lengths: As required to accommodate device locations.
 11. Calibration System:
 - a. Features:
 - 1) Field programmable electronics.
 - 2) Self-diagnostics with troubleshooting codes.
 - 3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
 - 4) Initial flow tube calibration and subsequent calibration checks.
 - b. Equipment:
 - 1) Built-in electronics with each unit provided.
 12. Manufacturers:
 - a. McCrometer FPI Mag
 - b. ABB AquaProbe FEA200
- Q. F6, Flume & Weir Flow Element and Transmitter, Ultrasonic Level:
1. General:
 - a. Function: Continuous, noncontacting level measurement..
 - b. Type: Open Channel Ultrasonic.
 - c. Parts: Element, transmitter, and interconnecting cable between element and transmitter.
 2. Service:
 - a. Atmospheric, unless otherwise noted..
 - b. Operating Temperature Range:
 - 1) Element: Minus 40 to plus 200 degrees F.
 - 2) Transmitter: Minus 5 to 140 degrees F.
 3. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Accuracy: Plus or minus 0.25 percent.
 - c. Resolution: 2 mm or 0.1 percent of range, whichever is greater.
 - d. Blanking Distance: 1-foot or less.
 4. Element:
 - a. Waterproof/weatherproof.
 - b. Housing and Face: Kynar, unless otherwise noted.
 - c. Process Connection: 1-inch NPT, unless otherwise noted.

- d. Rating: Factory Mutual (FM) approval for use in the following hazardous environments : Class I, Division I, Groups A, B, C, D, and Class II, Division I, Groups E, F, and G.
 - e. Beam Angle: 12 degrees or less.
 - 5. Transmitter:
 - a. Microprocessor based with keyboard operator interface.
 - b. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.
 - c. Power Supply: 115-volt, 50/60-Hz, unless otherwise noted.
 - d. Isolated Analog Output:
 - 4-20 mA current loop for load impedance of 0 to 750 ohms.
 - e. Display:
 - 1) Four digit high contrast LCD.
 - 2) In standard engineering units (gpm); volumetric conversion.
 - 3) Alarm Messages: Loss of echo and cable circuit open or shorted.
 - f. Provide Characterizations for flumes and weirs:
 - 1) Parshall
 - 2) Rectangular
 - 3) V Notch weir
 - 4) Etc..
 - 6. Interconnecting Cable: Weatherproof, length as required.
 - 7. Manufacturers/Models:
 - a. Drexelbrook USonic-R or approved equal.
- R. F7, Open Channel Flow Element and Transmitter:
 - 1. General:
 - a. Function: Continuous, submersible level measurement with presence of foam.
 - b. Type: Open Channel. RF Admittance
 - c. Parts: Element, transmitter, and interconnecting cable between element and transmitter.
 - 2. Service:
 - a. Atmospheric, unless otherwise noted..
 - b. Operating Temperature Range:
 - 1) Element: Minus 40 to plus 200 degrees F.
 - 2) Transmitter: Minus 5 to 140 degrees F.
 - 3. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Accuracy: Plus or minus 0.25 percent.
 - c. Resolution: 2 mm or 0.1 percent of range, whichever is greater.
 - 4. Element:
 - a. Waterproof Submersible.
 - b. Housing and Face: fluorocarbon.
 - c. Process Connection: Channel wall mount.
 - d. Rating: Factory Mutual (FM) approval for use in the following hazardous environments : Class I, Division I, Groups A, B, C, D, and Class II, Division I, Groups E, F, and G.
 - 5. Transmitter:
 - a. Microprocessor based with keyboard operator interface.
 - b. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.
 - c. Power Supply: 115-volt, 50/60-Hz, unless otherwise noted.
 - d. Isolated Analog Output:

- 4-20 mA current loop for load impedance of 0 to 750 ohms.
 - e. Display:
 - 1) Four digit high contrast LCD.
 - 2) In standard engineering units (gpm); volumetric conversion.
 - f. Provide Characterizations for flumes and weirs:
 - 1) V Notch weir
6. Interconnecting Cable: Weatherproof, length as required.
7. Manufacturers/Models:
 - a. Drexelbrook 305-0300 or approved equal.

S. F8 Flow Switch Fork Type:

- 1. General:
 - a. Function: Indicate presence of flow.
 - b. Type: Vibration Limit Switch.
- 2. Performance:
 - a. Range: Detect Presence of Liquid in Pipe.
 - b. Temperature: 150 degrees F, minimum.
- 3. Features:
 - a. Type: Vibration Limit Flow Switch.
 - b. Switch: SPDT dry contact.
 - c. Materials: Wetted parts stainless steel.
- 4. Process Connections:
 - a. Line Size: 16 inch.
 - b. Connection Type: 3" Flange 150#.
- 5. Enclosure:
 - a. Type: Nema 4X Aluminum.
- 6. Extension:
 - a. Type: 20" 316SS.
- 7. Electronic:
 - a. Power: 120Vac.
 - b. Contacts: Relay Type DPDT
- 8. Manufacturers:
 - 1) E&H FTL51-A-AL2-SB20-4-E5
 - 2) Or approved equal.

T. F9, Ultrasonic Flowmeter,:

- 1. General:
 - a. Function: Measure, indicate, and transmit the flow of a process liquid in pipe.
 - b. Type: Ultrasonic flowmeter, with pipe external transducers.
 - c. Parts: Flow Transducers, submersible, transmitter, interconnecting cables, mounting hardware, and calibrator.
- 2. Service:
 - a. Stream Fluid: As noted.
 - b. Flow Stream Descriptions: As noted.
- 3. Performance:
 - a. Flow Range: 0.3 to 82 feet per second.
 - b. Accuracy: ± 2 % of reading ± 0.03 ft/s
 - c. Repeatability: 0.25 % of reading ± 0.03 ft/s.

4. Features:
 - a. Non-intrusive flow measurement with high measuring.
 - b. Precise bi-directional, highly dynamic flow measurement.
 - c. Water-tight transducers (IP67) .
5. Process Connection:
 - a. Pipe Size: 8" to 95"Connection Type: Stainless steel strap kit
6. Signal Interface:
 - a. 4 to 20 mA dc for load impedance 0 to 500 ohms minimum for 24V dc supply.
7. Power: 120V ac, 60-Hz, unless otherwise noted.
8. Element:
 - a. Set of ultrasonic flow transducers.
 - b. Integrated transducer cable length 32.8'
 - c. 2x Permarails made of stainless steel SS316
 - d. Transducer Water Proofing Kit
9. Transmitter:
 - a. Display: Blind or indicating and/or totalizing as noted.
 - b. Mounting: Pipe stand, wall, panel, or integral as noted.
 - c. Enclosure: IP68.
 - d. Zero and Span: Field adjustable.
 - e. Indicator: Digital 16-character display, with scale range as noted.
 - f. Totalizer: Digital 16-character display, with totalizer unit digit value as noted.
10. Cables:
 - a. Types: As recommended by manufacturer.
 - b. Lengths: As required to accommodate device locations.
11. Calibration System:
 - a. Features:
 - 1) Field programmable electronics.
 - 2) Self-diagnostics with troubleshooting codes.
 - 3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
 - 4) Initial flow tube calibration and subsequent calibration checks.
 - b. Equipment:
 - 1) Built-in electronics with each unit provided.
12. Manufacturers:
 - a. FLEXIM Fluxus F501IP Single Channel Water Flowmeter
 - 1) F501IPNN01NNNN-K
 - RF-FSK-NNNTS-000/IP68/AC
 - MOU-VLK-DS-S092/IP68

U. L3 Level Element and Switch, Float:

1. General:
 - a. Function: Activate contact(s) at preset liquid level(s).
 - b. Type: Reed Switch; Dry Contact.
 - c. Parts: Floats(s), holder, enclosure (if specified), cabling.
2. Performance:
 - a. Set Point(s): As Noted in Mechanical Drawings.
3. Service:
 - a. Process Liquid: Sludge.
 - b. Operating Temperature: 50 to 100 degrees F.
 - c. Operating Pressure: Ambient.
4. Contacts:
 - a. Type: Non Mercury.
 - b. Number: One per noted set point.
 - c. Power: 120V ac, 60-Hz, or 240V ac, 60-Hz.
 - d. Contacts: DPDT, rated at 10 amps continuous at 120V ac.
 - e. Enclosure: NEMA 4X .
5. Cabling:
 - a. Provide interconnecting conductors between electrode holder and relays.
 - b. Type: As recommended by manufacturer.
 - c. Quantity and Length: As required.
6. Ancillaries:
 - a. Furnish all ancillaries for a complete and operating system.
 - b. Include such items as wire connectors for wire suspension electrodes.
7. Manufacturers:
 - a. MJK 7030

V. L4 Non-contact limit detection in liquids and solids:

1. General:
 - a. Function: Activate contact(s) at preset solid or slurry level(s).
 - b. Type: Ultrasonic.
 - c. Parts: Proximity Sensor, holder, enclosure (if specified), cabling.
2. Performance:
 - a. Set Point(s): As noted in Instrument Index.
3. Service:
 - a. Process Liquid: Sludge.
 - b. Operating Temperature: 50 to 100 degrees F.
 - c. Operating Pressure: Ambient.
4. Contacts:
 - a. Type: Dry Contact.
 - b. Number: One per noted set point.
 - c. Power: 120V ac, 60-Hz, or 240V ac, 60-Hz.
 - d. Contacts: DPDT, rated at 5 amps continuous at 120V ac.
 - e. Enclosure: NEMA 4X .
5. Ancillaries:
 - a. Furnish all ancillaries for a complete and operating system.
6. Manufacturers:
 - a. E&H FTU230A or approved equal.

W. L5 Level Element and Transmitter, Ultrasonic:

1. General:
 - a. Function: Continuous, noncontacting level measurement..
 - b. Type: Ultrasonic.
 - c. Parts: Element, transmitter, and interconnecting cable between element and transmitter.
2. Service:
 - a. Vapor Space Pressure: Atmospheric, unless otherwise noted..
 - b. Operating Temperature Range:
 - 1) Element: Minus 40 to plus 200 degrees F.
 - 2) Transmitter: Minus 5 to 140 degrees F.
3. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Zero Reference: Tank Bottom.
 - c. Accuracy: Plus or minus 0.25 percent.
 - d. Resolution: 2 mm or 0.1 percent of range, whichever is greater.
 - e. Blanking Distance: 1-foot or less.
4. Element:
 - a. Waterproof/weatherproof.
 - b. Housing and Face: Kynar, unless otherwise noted.
 - c. Process Connection: 1-inch NPT, unless otherwise noted.
 - d. Rating: Factory Mutual (FM) approval for use in the following hazardous environments : Class I, Division I, Groups A, B, C, D, and Class II, Division I, Groups E, F, and G.
 - e. Beam Angle: 12 degrees or less.
 - f. Integral temperature compensation.
5. Transmitter:
 - a. Microprocessor based with removable keyboard operator interface.
 - b. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.
 - c. Power Supply: 115-volt, 50/60-Hz, unless otherwise noted.
 - d. Isolated Analog Output:
Hart, 4-20 mA current loop for load impedance of 0 to 750 ohms.
 - e. Discrete Outputs: Five SPDT contacts, rated at 5 amps, continuous, at 115VAC.
 - f. Display:
 - 1) Four digit high contrast LCD.
 - 2) In standard engineering units (feet, inches, or centimeters); volumetric conversion.
 - 3) Alarm Messages: Loss of echo and cable circuit open or shorted.
 - g. Filters, Electronic:
 - 1) For agitator blade echoes.
 - 2) To remove small variations from surface waves.
6. Interconnecting Cable: Weatherproof, length as required.
7. Manufacturers/Models:
 - a. Endress & Hauser, FMU-860.
 - b. Ohmart Vega

X. L6 Level Element and Transmitter, Ultrasonic Low Power

1. General:
 - a. Function: Continuous, noncontacting level measurement..
 - b. Type: Ultrasonic.

- c. Parts: Element, transmitter, and interconnecting cable between element and transmitter.
- 2. Service:
 - a. Vapor Space Pressure: Atmospheric, unless otherwise noted..
 - b. Operating Temperature Range:
 - 1) Element: Minus 40 to plus 200 degrees F.
 - 2) Transmitter: Minus 5 to 140 degrees F.
- 3. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Zero Reference: Tank Bottom.
 - c. Accuracy: Plus or minus 0.25 percent.
 - d. Resolution: 2 mm or 0.1 percent of range, whichever is greater.
 - e. Blanking Distance: 1-foot or less.
- 4. Element:
 - a. Waterproof/weatherproof.
 - b. Housing and Face: Kynar, unless otherwise noted.
 - c. Process Connection: 1-inch NPT, unless otherwise noted.
 - d. Rating: Factory Mutual (FM) approval for use in the following hazardous environments : Class I, Division I, Groups A, B, C, D, and Class II, Division I, Groups E, F, and G.
 - e. Beam Angle: 12 degrees or less.
 - f. Integral temperature compensation.
- 5. Transmitter:
 - a. Microprocessor based with removable keyboard operator interface.
 - b. Enclosure: NEMA 4X polycarbonate, unless otherwise noted.
 - c. Power Supply: 115-volt, 50/60-Hz, unless otherwise noted.
 - d. Isolated Analog Output:
 - Hart, 4-20 mA current loop for load impedance of 0 to 750 ohms.
 - e. Discrete Outputs: Five SPDT contacts, rated at 5 amps, continuous, at 115VAC.
 - f. Display:
 - 1) Four digit high contrast LCD.
 - 2) In standard engineering units (feet, inches, or centimeters); volumetric conversion.
 - 3) Alarm Messages: Loss of echo and cable circuit open or shorted.
 - g. Filters, Electronic:
 - 1) For agitator blade echoes.
 - 2) To remove small variations from surface waves.
- 6. Interconnecting Cable: Weatherproof, length as required.
- 7. Manufacturers/Models:
 - a. Micro Flex LR Integral, MI2-B-10-T-6-SN-02-X-XX-X-X-A.

Y. L8 Level Switch Fork Type:

- 1. General:
 - a. Function: Indicate presence of flow.
 - b. Type: Vibration Limit Switch.
- 2. Performance:
 - a. Range: Detect Presence of Liquid in Pipe.
 - b. Temperature: 150 degrees F, minimum.
- 3. Features:
 - a. Type: Vibration Limit Flow Switch.
 - b. Switch: SPDT dry contact.

- c. Materials: Wetted parts stainless steel.
- 4. Process Connections:
 - a. Line Size: 1 inch.
 - b. Connection: Screw
- 5. Enclosure:
 - a. Type: Nema 4X Aluminum.
- 6. Extension:
 - a. Type: Pressure tight feed through 6"
- 7. Electronic:
 - a. Power: 120Vac.
 - b. Contacts: Relay Type DPDT
- 8. Manufacturers:
 - 1) E&H FTL51-A-GM2-SB6-4-E4
 - 2) Or approved equal.

Z. M26 Hand Switch and Light, Corrosion, Round:

- 1. General:
 - a. Function: Select, initiate, and display discrete control functions.
 - b. Type: Heavy-duty, corrosion-resistant, industrial.
- 2. General Features:
 - a. Mounting: 30.5 mm single round hole. Panel thickness 1/16 inch to 1/4 inch.
 - b. Legend Plate: Standard size square style laminate with white field and black markings, unless otherwise noted. Markings as shown.
 - c. Configuration: Light, pushbutton, or switch as noted or shown.
- 3. Light Features:
 - a. Lights: 6V ac lamps and integral transformer for operation from 120V ac, unless otherwise noted.
 - b. Lens Color: Color as specified under PANEL, STANDARD LIGHT COLOR AND INSCRIPTIONS, or as noted.
- 4. Pushbutton and Switch Features:
 - a. Guard: Full guard with flush button, unless otherwise noted.
 - b. Operator: Black pushbutton, black nonilluminated knob on switch, unless otherwise noted.
 - c. Boot: None, unless otherwise noted.
- 5. Signal Interface:
 - a. Contact Block:
 - 1) Type: Silver-coated butting, unless otherwise noted.
 - 2) Rating: 10 amps continuous at 120V ac or as noted.
 - 3) Sequence: Break-before-make, unless otherwise shown.
 - 4) Arrangement: Normally open or normally closed as shown, or to perform the functions noted.
 - 5) Terminals: Screw with strap clamp, unless otherwise noted.
- 6. NEMA Rating: NEMA 4, watertight, dusttight, and NEMA 4X, corrosion-resistant.
- 7. Manufacturers:
 - a. Allen-Bradley; Bulletin 800H.
 - b. Eaton Corp.; Cutler-Hammer, Type E34.
 - c. Square D Co.; Class 9001, Type SK.
 - d. or Approved equal

AA. P3 Pressure Differential Transmitter, Electronic:

1. General:
 - a. Function: Measure differential pressure and transmit signal proportional to differential pressure, flow, or level.
 - b. Type: Electronic variable capacitance, two-wire transmitter.
 - c. Parts: Transmitter and three-valve manifold.
2. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Maximum Adjustable Range: Such that the noted range shall be between 40 percent and 80 percent of the maximum adjustable range.
 - c. Accuracy: Plus or minus 0.25 percent of calibrated span between 4 and 100 percent of input differential pressure.
 - d. Temperature: Operating range minus 20 degrees F to plus 150 degrees F, minimum.
3. Features:
 - a. Square Root Extraction: When noted.
 - b. Damping: Fluid or electronic type with adjustment.
 - c. Indicator: As noted.
 - d. Suppressed or Elevated Zero: When noted.
 - e. Materials: Wetted parts including process flanges and drain/vent valves, Type 316 stainless steel, unless otherwise noted.
 - f. Wetted O-Rings: Viton, unless otherwise noted.
 - g. Housing: Modular with separate compartments for electronics and field connections.
 - h. Fill Fluid: Silicone, unless otherwise noted.
4. Signal Interface: Hart, 4 to 20 mA dc output for load impedance of 0 to 500 ohms minimum without load adjustment with 24V dc supply.
5. Enclosure:
 - a. Type: NEMA 4X, unless otherwise noted.
 - b. Mounting: Pipe or wall as noted. Provide brackets with Series 300 stainless steel bolts.
6. Three-Valve Manifold:
 - a. Provide unless otherwise noted.
 - b. Materials: Type 316 stainless steel.
7. Manufacturers:
 - a. Yokogawa: EJA
 - b. Rosemount; Alphaline, Model 3051DP.
 - c. Foxboro; Series 823DP.
 - d. or Approved equal

BB. P5 Pressure Transmitter, Submersible:

1. General:
 - a. Function: Measure and transmit a signal proportional to pressure or level.
 - b. Type: Totally submersible, two-wire transmitter.
 - c. Parts: Transmitter and cable.
2. Service:
 - a. Fluid: As noted in Instrument Index.
3. Performance:
 - a. Range: As noted.
 - b. Accuracy: 0.5 percent of full scale.

- c. Sensitivity: Plus or minus 0.5 percent of reading.
 - d. Temperature, Operating: Minus 5 to plus 140 degrees F.
- 4. Sensor:
 - a. Dimensions: Able to pass the 1-1/2 " NPT Transmitter mounting connection.
 - b. Materials: 316 SS or Hastelloy C. Viton seals.
- 5. Signal Interface: 2-wire system, 4 to 20 mA dc Hart output for load impedance of 0 to 750 ohms minimum for 24V dc supply without load adjustment.
- 6. Cable: Length as required to measure vessel level.
- 7. Transmitter Enclosure : NEMA 4X, Aluminum
- 8. Manufacturer:
 - a. Druck; Type PTX 161/D.
 - b. Endress+Hauser : Model DB 52A
 - c. MJK 1100, 2100, 3100
 - d. or Approved equal

CC. P9 Pressure Transmitter, Electronic:

- 1. General:
 - a. Function: Measure pressure and transmit signal proportional to pressure.
 - b. Type: Electronic variable capacitance, two-wire transmitter.
- 2. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Maximum Adjustable Range: Such that the noted range shall lie between 4 percent and 100 percent of the maximum adjustable range.
 - c. Accuracy: Plus or minus 0.25 percent of calibrated span.
 - d. Temperature: Minus 20 degrees F to plus 150 degrees F, minimum.
- 3. Features:
 - a. Type: Gauge pressure, unless otherwise noted.
 - b. Damping: Fluid or electronic type with adjustment.
 - c. Indicator: When scale range is noted.
 - d. Suppressed or Elevated Zero: When noted.
 - e. Materials: Wetted parts including process flanges and drain/vent valves, 316 stainless steel, unless otherwise noted.
 - f. Wetted O-Rings: Viton, unless otherwise noted.
 - g. Housing: Modular with separate compartments for electronics and field connections.
 - h. Fill Fluid: Silicone, unless otherwise noted.
- 4. Process Connections:
 - a. Line Size: 1/2 inch or 1/4 inch, selectable.
 - b. Connection Type: FNPT.
- 5. Signal Interface: Hart, 4 to 20 mA dc output for load impedance of 0 to 500 ohms minimum without load adjustment with 24V dc supply.
- 6. Enclosure:
 - a. Type: NEMA 4X, unless otherwise noted.
 - b. Mounting: Pipe or wall as noted. Provide brackets with Series 300 stainless steel bolts.
- 7. Manufacturers:
 - a. Gauge Pressure Units:
 - 1) Foxboro; Model 821G.
 - 2) Yokogawa; EJA 430A
 - 3) Rosemount; Alphaline, Model 3051GP.

- b. Absolute Pressure Units:
 - 1) Foxboro; Model 821A.
 - 2) Yokogawa; EJA 310A
 - 3) Rosemount; Alphaline, Model 3051AP.
 - 4) or Approved equal

DD. P10 Pressure Gauge:

- 1. General:
 - a. Function: Measure pressure.
 - b. Type: Bourdon Tube..
- 2. Performance:
 - a. Range: Range: As noted in Instrument Index.
 - b. Accuracy: Plus or minus 1.0 percent of calibrated span.
 - c. Temperature: Minus 20 degrees F to plus 150 degrees F, minimum.
- 3. Features:
 - a. Type: Gauge pressure, unless otherwise noted.
 - b. Damping: Fluid and snubber. At any Pumps Discharge.
 - c. Pigtail Siphons: For steam applications.
 - d. Indicator: 4 ½" Dial.
 - e. Materials: Wetted parts stainless steel.
 - f. Diagphagm: Provide for chemicals additions and slurry fluids.
 - g. Fill Fluid: Silicone, unless otherwise noted.
- 4. Process Connections:
 - a. Line Size: 1/2 inch.
 - b. Connection Type: NPT.
- 5. Enclosure:
 - a. Type: Phenolic with acrylic.
 - b. Mounting: Pipe mount..
- 6. Manufacturers:
 - 1) US gauge.
 - 2) Ashcroft.
 - 3) Wika

EE. P11 Pressure Switch:

- 1. General:
 - a. Function: Trip at measure pressure.
 - b. Type: Piston.
- 2. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Accuracy: Plus or minus 1.0 percent of calibrated span.
 - c. Temperature: Minus 20 degrees F to plus 150 degrees F, minimum.
- 3. Features:
 - a. Type: Reed Switch, Non Mercury.
 - b. Adjustable Deadband.
 - c. Damping: Fluid and snubber. At any Pumps Discharge.
 - d. Pigtail Siphons: For steam applications.
 - e. Indicator: N/A.
 - f. Materials: Wetted parts stainless steel.
 - g. Diagphagm: Provide for chemicals additions and slurry fluids.
 - h. Fill Fluid: Silicone, unless otherwise noted.

4. Process Connections:
 - a. Line Size: 1/2 inch.
 - b. Connection Type: NPT.
5. Enclosure:
 - a. Type: NEMA 4X minimum.
6. Manufacturers:
 - 1) Ashcroft. LPA-N4-J-GG-B-07-XHN-200#

FF. T2 Temperature Transmitter, Electronic:

1. General:
 - a. Function: Measure temperature and transmit signal proportional to temperature.
 - b. Type: Electronic variable capacitance, two-wire transmitter.
2. Performance:
 - a. Range: As noted in Instrument Index.
 - b. Maximum Adjustable Range: Such that the noted range shall lie between 4 percent and 100 percent of the maximum adjustable range.
 - c. Accuracy: Plus or minus 0.25 percent of calibrated span.
 - d. Temperature: Minus 20 degrees F to plus 150 degrees F, minimum.
3. Features:
 - a. Type: Electronic.
 - b. Sensor: RTD 100 ohms.
 - c. Indicator: Local.
 - d. Suppressed or Elevated Zero: When noted.
 - e. Materials: Wetted parts including process flanges and drain/vent valves, 316 stainless steel, unless otherwise noted.
 - f. Thermowell: 316 stainless steel.
4. Process Connections:
 - a. Connection Type: Threaded NPT.
5. Signal Interface: Hart, 4 to 20 mA dc output for load impedance of 0 to 500 ohms minimum without load adjustment with 24V dc supply.
6. Enclosure:
 - a. Type: NEMA 4X, unless otherwise noted.
 - b. Mounting: Pipe or wall as noted. Provide brackets with Series 300 stainless steel bolts.
7. Manufacturers:
 - a. Temperature Units:
 - 1) Yokogawa;
 - 2) Foxboro;
 - 3) Honeywell

GG. Y63 Operator Interface Unit:

1. General:
 - a. Function: Operator interface for an Allen-Bradley PLC or remote I/O.
 - b. Type: Thin Film Transistor (TFT) Display, 6 colors minimum.
2. Performance:
 - a. Operating Temperature: 32 to 131 degrees F.
 - b. Humidity Rating: 5 to 95 percent (without condensation).

3. Features:
 - a. Screen: 15"
 - b. Field replaceable backlight.
 - c. Communication Port: Ethernet I/P and RS-232
 - d. Enclosure Rating: NEMA 12, 13, 4X (indoor only).
 - e. Interface: Touch screen.
 - f. Application Memory: 1 M byte minimum
 - g. ATA Flash; IDE; PCMCIA Type II, Memory Card for application files: 6 M byte minimum. Easily removable without tool.
 - h. Power: 120 V ac
4. Accessories:
 - a. Configuration software, suitable for windows operating system.
 - b. One copy per lot of operator interface units furnished.
5. Manufacturer/Model:
 - a. Allen-Bradley PanelView Plus 1500 Color Operator Terminal.

HH. Y64 Operator Interface Unit:

1. Acceptable RTMC Software Packages. Wonderware – InTouch (Archestra Platform).
2. RTMC Applications Programming
 - a. Wonderware Software's shall be purchase thru the AAA IT department.
 - b. General. Do RTMC application programming work in collaboration with CLIENT and OPERATOR. The general standards in this article are intended to provide a consistent approach for all projects. Complete application programming in compliance with these standards.
 - c. System integration shall be designed to meet the AAA requirements using the Orchestra Platform for Remote Telemetric Monitoring from Barbosa Building. All objects shall be designed and approved by AAA IT department then deployed to the plant using Register Templates. A Wide Area Network (WAN) communication line (512 kb min.) shall be provided for communication with the Barbosa Server.
 - d. PLC I/O. Organize PLC I/O by data type [floating point, integer, bits, etc.]. Use PLC data structures and RTMC I/O capabilities to organize data transfer operations for ease of modification and expansion.
 - e. Control Functions and Calculations. Perform all control functions and calculations in the PLC. This includes calculations like runtime and flow totalizers. Provide for easy operator viewing and entry of operator adjustable parameters in human sensible units. Where operations procedures require it, include security protection to only accept changes from those authorized to do so.
 - f. General Graphics Characteristics. Present text in Spanish. Effectively use RTMC software features to provide pleasing appearance and user-friendly interaction were used. Use graphic representations of equipment and piping. Use symbols from symbol libraries where practical. Select or develop graphic symbols to clearly differentiate similar equipment types. Only use "3d" presentation where a "2d" approach cannot adequately present process operation, equipment status and function. Minimize depiction of extraneous static objects not associated with the process. Only include equipment identification number or names to distinguish between a number of parallel

- equipment items. Use only the instrument index tag number to identify each item.
- g. **Analog Values.** Depict analog values graphically wherever appropriate; for example, a tank level. However, avoid the use of gauges where graphic space is limited; text is the preferred method of representation in these cases. Always supplement graphical depictions with text values. Include units adjacent to text indications. An alarm shall be configured for each analog value. Where several related analog variables are located on a single display, display them as a vertically aligned set; for example, process value and setpoint on a PID controller.
 - h. **Alarm Summary Windows.** On most graphics, include an alarm summary window listing recent system or plantwide alarm occurrences. Display alarm points relevant to each graphic are continuously, even when out of alarm. Group these points into a block which looks like an annunciator box. Use dynamic coloring for individual point blocks to indicate status. Where the number of annunciator points for a display is too large for inclusion on the display, provide a target for accessing a separate annunciator box graphic. Dynamically color the target to indicate the presence of alarms.
 - i. **Real Time Trends.** Provide real time trends for all PID control loops and chemical composition measurements. Link values displayed on the real time trends to trend blocks so that real time trends are immediately displayed when the graphic is opened.
 - j. **Graphics Resolution.** Develop graphics using 1280 by 1024 pixel resolution and 256 colors.
 - k. **Targets.** Targets will serve as the primary operator interaction with the RTMC system. On each graphic screen, provide selectable targets to invoke all operator actions. Selectable means that the area can be pointed to with the mouse and "picked" by pressing the left mouse button. By selecting a target, the operator will be telling the RTMC system to perform the associated [selected] action. All required target actions fall into one of the two following categories:
 - 1) **Display branching (vector) target.** When selected, a display branching target causes another display to appear. The display which appears is related to the target's graphical representation (text, equipment symbol, etc.).
 - 2) **Equipment control target.** When selected, an equipment control target causes a pop up control screen to appear that enables the operator to place the equipment in manual or auto, start or stop equipment, change a setpoint, or otherwise change the equipment status.
 - l. **Graphics Hierarchy.** Arrange graphic displays in a hierarchy. Levels in the hierarchy are systemwide, plantwide, unit process or pop up (equipment control) graphics.
 - m. **Navigation Between Graphics.** Navigation between graphics will be achieved by selecting display branching targets on graphics. Provide for LAST screen relative navigation. Provide the following three types of display branching targets: pushbuttons, equipment symbols and flowstream connectors. Place flowstream connectors on graphics where a flow "enters" or "leaves" a graphic and the source or destination is depicted on another graphic. Use pushbutton targets to provide quick access to related graphics. These pushbuttons should be included in the graphic template.

- n. Equipment Control. Equipment control will be a two step process. A pushbutton serves as the target. Selection of the target will cause a control pop up window to appear. The equipment control pop up window will contain control targets (start/stop buttons, setpoint adjustment targets, etc.) which can be selected to perform the desired action. After selection of the control target, the operator will be prompted to confirm that the requested control action is to be executed. Displays, Files, Disk Locations and Naming
- o. Graphic Display File Names. Use process graphic file names composed of a facility code followed by an underscore character followed by the process code and the standard graphic display extension. Use file names consistent with the Instrumentation and Control Loop Tagging System article of these criteria.
- p. Specific Graphic Displays. Provide the following graphic displays for each project: Water or Wastewater System Geographic Overview, Alarm Summary, Communications Status/Diagnostic Summary, Historical Display Overview, Distribution or Collection System Overview, and Phone List. For each plant provide the following additional displays: Plant Overview, Plant Status, Process Overview, Alarm Summary, Electrical Distribution, Network Status (Device Net show each component node status) and Unit Process displays for each unit process and remote facility.
- q. Geographic Overview Display. On the geographic overview include major highways and streets and provide dynamic links [targets] for monitored facilities. Selecting a link will bring up the facility overview graphic.
- r. Fonts and Colors. Work with the CLIENT and OPERATOR during design to develop a standard set of fonts and colors. Object colors and features for all strategic projects will be standardized to provide uniform appearance. Pipeline colors will be static and coded to represent the process fluid normally contained within. Symbols for equipment which is monitored or controlled will be animated to change appearance to illustrate process conditions. Text messages adjacent to animated symbols will be used as necessary to further clarify process conditions.
- s. Rapid Application Development Tools. Fully utilize rapid application development tools [Wizards and scripting for example] to ease application development and maintenance. Utilize object already develop by AAA .
- t. Database Conventions. Work with the Client during design to develop database record [point] and function naming conventions and standards. Variable [record], facility, instrument and equipment names shall be consistent with the Instrumentation and Control Loop Tagging System article of these criteria shown also in the P&ID's and Instrument Index.
- u. Alarming and Messaging. Log all alarms and events to alarm and event summary files and to the alarm printer. Events are normal [expected] status changes such as operator log on, setpoint change and automatic equipment cycling. Annunciate alarms visually and audibly. For selected alarms initiate the automated operator paging system. Work with the Client during design to develop operator paging conventions and standards.
- v. Trending. Provide historical trending in accordance with the RTMC Software Monitoring and Control Functions article.

- w. Manual Data Entry and Reporting. Work with the Client during design to develop manual data entry and reporting conventions and standards. In general, provide graphic displays for manual entry of operator conducted analysis. Move manually entered data to the data warehouse. Provide forms developed in a database application like Microsoft's ACCESS for editing and approving manually entered data from Admin Workstations.
 - x. Security. Work with the Client during design to develop a security matrix and assignments in accordance with article RTMC Security.
 - y. Reports. Use Historian to log all analog values, alarms and events.
3. Operator workstation (total of 1) shall be Intel's. Features shall include:
- a. Processor: Intel Core 4th Gen. i7-4790 3.6GHz (Up to 4.0GHz Turbo Boost)
 - b. Memory: 16GB DDR3 Ram
 - c. Hard Drive: 240GB SSD (Solid State Drive)
 - d. Video: Intel HD Graphics 4600
 - e. **Operating System:** Genuine Windows 10 Pro 64-Bit
 - f. Optical Drive Type: DVD±RW
 - g. Ports:
 - 1) USB
 - 2) HDMI
 - 3) Display Ports
 - 4) RJ-45
 - 5) Serial
 - 6) PS/2
 - 7) UAJ
 - 8) Line-out
 - h. Monitor: Flat Monitors 1280 x 1024 pixels, 19 inches diagonal

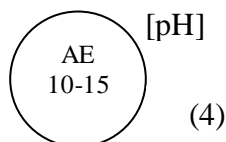
II. Y70 Programmable Logic Controller, Type 5:

- 1. General:
 - a. Function: Main Control Processor
 - b. Expandable communication ports.
 - c. Type: Capable of initiating communication.
 - d. Parts, processor, power supply, battery, I/O chassis, I/O modules, and cabling.
- 2. Processor Features:
 - a. Memory: 1.5 Mbyte.
 - b. Communication Ports: Expandable.
 - 1) Ethernet
 - 2) RS-232-C.
 - 3) Control Net Redundant (If Required)
 - 4) Device Net (If Required)
 - c. Memory Type: Battery-back RAM, EPROM, or EE PROM.
- 3. Local I/O System:
 - a. Chassis with at least two spare slots.

- b. I/O Modules: Quantity shall provide minimum 20 % of installed spare points for each type of the I/O.
 - c. Series 1756 I/O System with the following features:
 - 1) 4 to 20 mA dc differential analog inputs.
 - 2) 4 to 20 mA dc isolated analog outputs.
 - 3) 120V ac discrete inputs.
 - 4) Relay contact discrete outputs, individually isolated, rated for 1.2A continuous at 24V dc. All discrete outputs shall be provided with interposing relays with contact rating 5 A continuous at 120 V ac.
- 4. Remote I/O System:
 - a. Din Rail Mount Flex I/O.
 - b. Network (Ethernet, Control Net or Device Net) communication adapter with Main PLC.
 - c. I/O Modules: Quantity shall provide minimum 20 % of installed spare points for each type of the I/O.
 - d. Series 1794 I/O System with the following features:
 - 1) 4 to 20 mA dc differential analog inputs.
 - 2) 4 to 20 mA dc isolated analog outputs.
 - 3) 120V ac discrete inputs.
 - 4) Relay contact discrete outputs, individually isolated, rated for 1.2A continuous at 24V dc. All discrete outputs shall be provided with interposing relays with contact rating 5 A continuous at 120 V ac.
- 5. Accessories:
 - a. Power supply.
 - b. Battery.
 - c. Cabling.
- 6. Power Supply: 24V dc.
- 7. Manufacturer/Model:
 - a. Allen-Bradley ControlLogix Processor, Model 1756-L62, with Series 1756 I/O System and required specialty I/O and Flex I/O.

2.6 INSTRUMENT TAG NUMBERS

- A. An ISA tag number notation is used. For example:



<u>Notation</u>	<u>Explanation</u>
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AE	Type of instrument per the ISA designation : Analysis Element
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10 – [1st Digit]

Unit process number indicating a group of instruments associated with the same process unit as per the following table:

15 – [2nd and 3rd Digits]

Process control loop number. Sequential numbers are assigned for each individual control loop for each similar piece of equipment. Loop number start with the number "01" and proceed sequentially.

(4) Instrument quantity. Where a unit process is typical for multiple unit processes, only the instrument tag numbers for the first unit process are shown on P&ID. The same instruments are required in quantity indicated.

[pH] Same notation shown at 2 o'clock position on ISA circle symbol on Process and Instrument Diagram

- B. Instrument tags shall be used for unique instrumentation and control loop identification. The tagging scheme shall be based on ANSI/ISA S5.1 Instrumentation Symbols and Identification system.

The convention for instrumentation and control loop tags shall be as follows:

AA TAG –W-X-Y-Z

-
- AA** Facility Code: As defined under "Facility Code" heading above.
- TAG** Instrument Tag/Descriptor: Defines function of instrument or component. Based on ANSI/ISA S5.1.
- W** Area Process Designator: Identifies an area or a process. Below is an example Area Process Designation scheme for a typical water treatment plant.

See Area Process Designator Table

2.7 NAMEPLATES, NAMETAGS, AND SERVICE LEGENDS

- A. Nametags: Permanently mounted bearing the ISA tag number (e.g. AE-015).
1. Panel Mounted: Plastic, mounted to instrument behind panel face.
 2. Field Mounted: Engraved Type 316 stainless steel, 22-gauge minimum thickness, attach with stainless steel.
- B. Service Legends (Integrally Mounted with Instrument) and Nameplates:
1. Engraved, rigid, laminated plastic type with adhesive back. Furnish service legends and nameplates to adequately describe functions of panel face mounted instruments.
 2. Color: White with black letters. Letter height 3/16 inch.

3. For each panel, face mounted laminated nameplate inscribed with the panel name and tag number. Color shall be white with black letters 1/2-inch high.

- C. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Gray
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	Green
MANUAL	MANUAL	Red
LOCAL	LOCAL	Yellow
REMOTE	REMOTE	White
FORWARD	FORWARD	Red
REVERSE	REVERSE	Blue

1. Lettering: Black on white and amber lenses; white on red and green lenses.

2. Standard Pushbutton Colors and Inscriptions:
 - a. Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
OO	ON OFF	Red Green
OC	OPEN CLOSE	Red Green
SS	START STOP	Red Green
FR	FORWARD REVERSE	Red Blue
RESET	RESET	Black
OCA	OPEN CLOSE AUTO	Red Green White

Tag	Inscription(s)	Color
OOA	ON OFF AUTO	Red Green White
OOR	ON OFF REMOTE	Red Green White
LR	LOCAL REMOTE	Yellow White
MA	MANUAL AUTO	Yellow White
EMERGENCY STOP	EMERGENCY STOP	Red

- b. Unused or noninscribed buttons shall be black. Lettering: Black on white and yellow buttons; white on black, red and green buttons.

2.8 ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General: Equip control panels with surge-arresting devices to protect equipment from damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.
- B. Suppressor Locations:
1. At point of connection between each equipment item, including ac powered transmitters and its power supply conductors (direct wired equipment).
 2. On all analog and digital signals at each end when the signal travels outside of building.
 3. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to design of equipment.
- C. Power Supply Suppressor Assemblies:
1. Suitable for connection to 120-volt, single-phase power supplies
 2. Suitable for connection to 480-volt, three-phase power supplies; Square D J9200-9A.
- D. Analog Signal Cable Suppressor Assemblies:
1. Epoxy encapsulated within a phenolic enclosure.
 2. Flame retardant.
 3. Four lead devices; include a threaded mounting/grounding stud.
 4. Manufacturers and Products:
 - a. Phoenix

- b. EDCO; SRA-64 Series.
- c. MTL SD 32, 32X Hart
- d. Joslyn; Series 1800 and 1669.

E. Digital Signal Cable Suppressor Assemblies:

- 1. Epoxy encapsulated within a phenolic enclosure.
- 2. Flame retardant.
- 3. Four lead devices; include a threaded mounting/grounding stud.
- 4. Manufacturers and Products:
 - a. Phoenix
 - b. MTL SD 150

F. Grounding: Provide surge suppressor grounding in field panels and field instrumentation in accordance with suppressor manufacturer's requirements. Furnish control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation.

2.9 NETWORKS

- A. General: Provide network of type as shown on the Block Diagram. Provide all cabling and ancillaries (connectors, etc.) to support a fully functioning network.

PART 3 EXECUTION

3.1 ELECTRICAL POWER AND SIGNAL WIRING

- A. Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.
- B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.
- C. Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.
- D. Do not splice or tap wiring except at device terminals or terminal blocks.

3.2 PROTECTION

- A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.

- B. During Work, periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules at Substantial Completion.

3.3 TRAINING

- A. Provide onsite training for operators and engineers. The class must be offered for at least 2 different shifts for 10 students and last not less than 1 full day. The training class should include at least the following:
 - 1. Analog and discrete I/O points
 - 2. Field adjustments/ calibration
 - 3. PLC program
 - 4. OIU program
 - 5. Chart recorder program
 - 6. Setpoint adjustment
 - 7. Alarm response
 - 8. Troubleshooting
 - 9. Maintenance

3.4 SUPPORT

- A. Provide follow up support for fully commissioned systems as follows;
- B. Schedule a weekly visit to review system operation once a week for the first month after commissioning is complete. Note any operating problems and take corrective action. If reprogramming or further training is required, schedule as required.
- C. Schedule a monthly visit as described above, once a month for the following six months.
- D. Provide technical support via telephone as needed.

END OF SECTION

**SECTION 40 69 04
AUTOMATION FUNCTIONAL REQUIREMENTS**

1 PART 1 GENERAL

1.1 WORK INCLUDES

A. General:

1. See Section 40 69 01, PACKAGE CONTROL SYSTEMS, for general instrumentation and control requirements, including submittal and testing requirements. All instrumentation, control, and electrical components provided under this section shall comply with the requirements of Section 40 69 01, PACKAGE CONTROL SYSTEMS and the INSTRUMENTATION GENERAL SPECIFICATION. The CONTRACTOR and selected System Integrator shall be responsible for furnishing a complete and functional central monitoring and control system for the facility described in the Task Order.
2. The monitoring and control system, as specified herein, includes the following:
 - a. Provide and install the instrumentation listed on the Instrument Index.
 - b. Provide and install wiring and conduits listed on the Instrument Index and the Conduit Schedule list
 - c. Provide Detail Drawings in ACAD including Panel Layout, Bill of Material, Power Distribution, PLC Cards Wiring and Control Architecture Drawings.
 - d. Prepare a Detail Design System Specification to be use as a basis of design for the system integration. This spec shall be approved by the client and final user before the integration. The Detail Design System Specification shall describe in detail:
 - Network Description
 - Control System Description
 - I/O inputs list with address, description, range and calibration.
 - The Screens Layout.
 - Process functionality
 - Modes of Operation
 - Control Loops function and Description
 - PID controllers
 - Process interlocks
 - Security
 - Power consumption

3. Panels and PLC:

Tag Number	Scope	Description	Supply By	Power Supply
CP-05	New	Main PLC Control Panel	I&C Contractor	120 VAC
LCP-09	New	New Remote I/O in Raw Water Box Area	I&C Contractor	120 VAC
LCP-F1	Refurbish	Filter 1 Local Control Panel	I&C Contractor	120 VAC
LCP-F2	Refurbish	Filter 2 Local Control Panel	I&C Contractor	120 VAC

Tag Number	Scope	Description	Supply By	Power Supply
LCP-F3	Refurbish	Filter 3 Local Control Panel	I&C Contractor	120 VAC
LCP-F4	Refurbish	Filter 4Local Control Panel	I&C Contractor	120 VAC
LCP-100	New	Caustic Injection System	Package Vendor	120 VAC
LCP-102	New	Coagulant Injection System	Package Vendor	120 VAC
LCP-201	New	Chlorine Injection System	Package Vendor	120 VAC
LIT-05-72	New	Takan Tank Level RTU	I&C Contractor	Solar Power

4. Control Architecture
Roosevelt Road Water Filtration Plant Control Architecture include a new Main Control PLC (CP-05) located in the Control Room with Distributed I/O and Profibus communication to monitor and control all plants equipment's and instruments.
5. **CP-05 Main PLC Control Panel :**
 - a. The panel include a four slot rack Control Logix family type with PLC, Ethenet card and two Profibus communication cards.
 - b. The panel includes a Flex I/O type to interphase with plat signals and instruments.
 - c. The panel will include a Ethernet subnet to connect the Flex I/O and HMI stations..
 - d. The panel will include two Profibus subnet to connect the new motorized valves.
 - e. The panel will communicate to the LCP-09 Remote I/O using Ethernet fiber Optic media.
 - f. The panel will communicate via radio with the Takan tank to monitor the tank level.
 - g. The MCC signal will be hardwired to the CP-05 panel.
 - h. The panel will distribute 120 Vac for the Filters panels and Instruments that require 120 Vac,
 - i. The panel will also communicate to the package controls panels of:
 - 1) Caustic Injection System
 - 2) Coagulant Injection System
 - 3) Chlorine Injection System
 - j. Provide external UPS power for the chassis, analog measurements, analog outputs, discrete inputs, discrete output interposing relays and other panel mounted devices except for motor driven valves.
6. **LCP-09 Control Panel:**
 - a. The panel will monitor and control the Raw Water Box Area.
 - b. The panel includes a Flex I/O type to interphase with the new signals in the Raw Water Box Area.
 - c. The panel will communicate to the main PLC using Ethernet fiber Optic media.
7. **LCP-F1, F2, F3, F4 Local Control Panel Filters 1,2,3,4:**
 - a. The existing Filters panels will be refurbish to be reused. All internals components will be removed. A new Top Plate and Back Panel will be installed.
 - b. A new HMI will be installed in the new To Plate.
 - c. New terminals and power supply will be installed in the new Back Panel.
 - d. A new Circuit Breaker Box provided by the electrical contractor will be installed in the side panel for power distribution of the electric valve actuator.
 - e. Power for filter FIT and AIT will be wired from the Filter Panel.
 - f. All signal wiring of the filter will be wired thru the new filter terminal blocks. In the back panel.

- g. An Ethernet connection to the Main Panel CP-05 will be required for the HMI communication.

8. **LCP-100 Caustic Injection System Local Control Panel**

- a. The Caustic Injection System will have a Control Panel to Monitor and control the package.
- b. The communication to the CP-05 will be hardwired.
- c. Analyzer signals and flow will be used to control the dosification pumps.

9. **LCP-102 Coagulan Injection System Local Control Panel**

- a. The Coagulant Injection System will have a Control Panel to Monitor and control the package.
- b. The communication to the CP-05 will be hardwired.
- c. Analyzer signals and flow will be used to control the dosification pumps.

10. **LCP-201 Chlorine Injection System Local Control Panel**

- a. The Chlorine Injection System will have a Control Panel to Monitor and control the package.
- b. The communication to the CP-05 will be hardwired.
- c. Analyser signals and flow will be send to LCP-201 to control each Chlorinator. Two signals will be wired to each Chlorinator. The operator will select in the HMI the Chlorinator outflow direction and the PLC will communicate the required flow and Residual Chlorine signals to the respective Chlorinator.

11. **LIT-05-72 Takan Tank Level RTU Control Panel**

- a. The Takan Tank Level RTU will have a Control Panel with radio telemetry and solar power battery package to Monitor the level of the Takan Tank.
- b. The communication to the main plc panel CP-05 will be by radio telemetry. Radio telemetry router with antenna are required on both panel.
- c. Furnish a Remote Wireless Panel to be located in the Takan Tank area with the followings equipment's for Communication.
 - 1) Remote Wireless Panel for Transceiver
 - a) 16 x 12 x 8 - N4X Continuous Hinge Clamped Cover. Model: N4X-161208 M10127
 - 2) COMMON WIRELESS RAIL - NO PS
 - a) Phoenix Contact, Inc. P/N: 5607321-NO PS
 - 3) Common rail assembly used with wireless radios includes ,TMC Breaker, and DC surge protection.
 - a) Radioline 2.0 - RAD-900-IFS Phoenix Contact, Inc.P/N: 2901540
 - 4) Bidirectional, Radioline 900 MHz transceiver for wireless transmission of serial and I/O data I/O extension module –
 - a) RAD-DI4-IFS Phoenix Contact, Inc.P/N: 2901535
 - 5) RAD-ISM-900-ANT-YAGI-3-N
 - a) Phoenix Contact, Inc.P/N 2867801
 - 6) Panel antenna, IP65 protection, gain 5 dBi, cable length 1.5m,connection N (female)
 - a) RAD-CAB-LMR500-25 Phoenix Contact, Inc.P/N: 5606126
 - 7) LMR500 Cable - 25ft cable Low loss cable
 - 8) Surge protection device - CN-UB-70DC-6-BB

- Phoenix Contact, Inc.
P/N: 2803166
- 9) Attachment plug with surge protection for coaxial signal interfaces.
Connection: N connector, female/female
Antenna cable - RAD-PIG-RSMA/N-1
Phoenix Contact, Inc.
P/N: 2903264
- 10) Antenna cable, 1 m in length; N (male) -> RSMA (male), impedance 50ohms. Phoenix Contact Antenna - PSI-GSM/UMTS-ANT-OMNI-2-5 – 2900982
- d. Furnish a Solar Power System Panel to be located in the Takan Tank area with the followings equipment's:
- 1) Power Ready 1 module 160Wp Array, pole mounted on 26.5 in SOP UNIVERSAL mount, 24Vdc, 108AH GEL bat. pole mounted in F2 enclosure.
Manufacturer: Sunwize
Model: PRE-160-24-108-FPWA-101
Operating temperature -30°C to +50°C
- Batteries rated for 500+ cycles at 80% DoD*
 - NEC compliant pre-wired control panel
 - Installation manual and wiring diagram
 - QC testing performed on all control panels
 - Systems sized to IEEE 1562 specifications
- Manufacturer shall offer a 2-year limited warranty against defects in materials and workmanship.
- e. Furnish a Master Enclosure for Wireless Transceiver Panel to be located in the Control Room area near CP-05 area with the followings equipment's for Communication.
1. Master Enclosure for Wireless Transceiver
16 x 12 x 8 - N4X Continuous Hinge Clamped Cover 304SS
Model: N4X-161208 M10127
2. COMMON WIRELESS RAIL - 1.3 Amp Power Supply
Phoenix Contact, Inc.
P/N: 5607321-1.3A
3. Common rail assembly used with wireless radios includes 1.3 Amp Power supply, TMC Breaker, and 120VAC surge protection.
4. Radioline 2.0 - RAD-900-IFS
Phoenix Contact, Inc.
P/N: 2901540
5. Bidirectional, Radioline 900 MHz transceiver for wireless transmission o serial and I/O data I/O extension module - RAD-AO4-IFS
Phoenix Contact, Inc.
P/N: 2901538
6. Customer Enclosure,
RAD-ISM-900-ANT-OMNI-5
Phoenix Contact, Inc.
P/N: 2867199
7. 5 db Omni Base Station Antenna, Larsen FB35 T900, full ground plain with type N (F) connector
8. RAD-CAB-LMR500-25
Phoenix Contact, Inc.

- P/N: 5606126
- 9. LMR500 Cable - 25ft cable
Low loss cable
- 10. Surge protection device - CN-UB-70DC-6-BB
Phoenix Contact, Inc.
P/N: 2803166
Attachment plug with surge protection for coaxial signal interfaces.
Connection: N connector, female/female
- 11. Antenna cable - RAD-PIG-RSMA/N-1
Phoenix Contact, Inc.
P/N: 2903264
Antenna cable, 1 m in length; N (male) -> RSMA (male), impedance 50 ohms.

B. Raw Water Influent P&ID-PI103

- 1. Raw Water Control Box Station will be monitored by LCP-09. Influent Flow FIT-01-08, Valve status and sump pump station pumps and level alarms will be monitored. Valves will be operated local manually.
- 2. Raw water Reservoir level will be monitored (LIT-01-51)
- 3. Raw Water Influent quality will be monitored AIT-02-91 (Tu,).
Generate alarms if water quality is out of normal range.
- 4. Flow FIT-01-01 will be controlled by modulating the FV-01-20.
- 5. Influent pressure will be monitored PIT-01-01. The pressure will be proportional to the water level in the reservoir.
- 6. Back Pumps will be protected against low level in the reservoir.
- 7. Flash Mixing Tank Water will be monitored AIT-02-83 (Tu,), AIT-02-50 (SCM).
Generate alarms if water quality is out of normal range.
- 8. The Rapid Mix Mixer speed will be controlled locally. Mixer shall operate at different speeds.
- 9. Settling Tanks Water quality will be monitored AIT-03-94 (Tu).
Generate alarms if water quality is out of normal range.

C. Filters System Functional Requirements P&ID- PI104:

- 1. The Backwash flow will be controlled by a new automatic flow control valve and the existing Magnetic flow meter.
- 2. The Backwash Tank level will be monitored by a new Level transmitter. The level will allow for backwash if the tank has enough water level for one backwash.
- 3. All valves will be replaced by valves and actuators using Profibus communication protocol.
- 4. New Effluent Magnetic Flow transmitters will be installed.
- 5. New Head Differential Pressure Transmitters will be installed.
- 6. New ultrasonic level transmitters will be installed.
- 7. Effluent Water quality to clear well will be monitored AIT-04-601 (Tu), AIT-04-602 (CHL-R), and AIT-04-603 (pH, Temp).
Generate alarms if water quality is out of normal range.
- 8. The filters can be monitored and controlled from the HMI terminal in each Filter Local Panel or from the control room HMI.
- 9. For the filters, program PLC to provide the following functions:
 - a. Full manual operation of all valves associated with the filter.
 - b. Automatic backwash of each filter.
 - c. Inhibit filter backwash initiation if the other filter is in backwash.

10. Configure the HMI to provide an appropriate number of color screens, allowing the operator to both monitor and control the plant including filter backwash and influent meters.
11. Provide an overview filters screen to display the following:
 - a. Display filters status.
 - b. Display filters mode of operation.
 - c. Display filters level.
 - d. Display filters loss of head.
 - e. Display filters individual and combined turbidity.
 - f. Display blower's system status and control.
 - g. Display back wash pumps' system status and control.
12. As a minimum, provide one screens per filter. As a minimum, display the following:
 - a. Open/Close status of all associated non-modulating filter valves.
 - b. Open/Close manual selection of all associated non-modulating filter valves.
 - c. Elapsed time between filter backwashes.
 - d. Auto status of the air scour blower.
 - e. Elapsed runtime of air scour blower.
 - f. On/Off status of air scour blower.
 - g. Backwash sequence inhibited (other filters in backwash).
 - h. No response checking alarm (for all filter valves, all backwash pumps, and all air scour blowers).
 - i. Equipment alarms.
 - j. Process variable alarms, including, but not limited to:
 - 1) Loss of Head, one per filter.
 - 2) Low Filter Level, one per filter.
 - 3) High Filter Level, one per filter.
 - k. Auto Backwash Sequence Alarms:
 - 1) At least one alarm per step, indicating:
 - a) Valves not in proper position.
 - b) Air scour blowers called to run, but not proven on.
 - c) For applicable steps, backwash flow rates exceed or fall short of set point by a preset percentage.
 - l. Indication of all process variables associated with the filters, including but not limited to:
 - 1) Backwash water flow rate (in GPM units).
 - 2) Backwash water totalized flow (in GAL units).
 - 3) Filtered water turbidity (in NTU units).
 - 4) Filter level (in FEETS Water units).
 - 5) Pressure drop, headloss (in INCHES Water units).
 - 6) Time since last backwash (in MIN and HOURS units).
 - m. For each filter, Filtration/Backwash status.
 - n. Automatic backwash controls, including but not limited to:
 - 1) Manual initiation to start automatic backwash sequence.
 - 2) Enable/Disable control of process initiated automatic backwash sequence as follows:
 - a) Requiring supervision password to change modes.
 - b) If enabled, start the backwash sequence on:
 - (1) Pressure drop (Head Loss) exceeds the design set point for a preset period.
 - (2) Turbidity exceeds the design set point for a preset period.

- (3) Elapsed runtime since last backwash exceeds design set point. (Filter must be online for time to be accumulated.)
 - 3) Manual/Auto/Semi-Auto Selection:
 - a) Manual:
 - (1) Open/Close manual selector switches control the non-modulating filter valves.
 - (2) Manual positioning of modulating filter valves.
 - b) Auto: Upon initiation, backwash sequence executes automatically. Auto status of the air scour blowers shall be included in the permissive for this mode.
 - c) Semi-Auto: Backwash advances only one step at a time when operator activate the advance step.
 - 4) Process graphics indicating the step in the backwash sequence and also displaying positions of all valves throughout the sequence. Include time remaining for appropriate steps.
 - 5) All set points related to the automatic backwash, including:
 - a) Time set point of timed steps (such as air scour step).
 - b) Flow rate set points of low and high rate backwashes.
 - c) Supervisor access for modification of time and flow rate set points.
 - o. Steady-State Filtration Controls:
 - a) Auto Mode 1/Auto Mode 2 selection.
 - b) Auto Mode 1: Flow rate set point of filter effluent valve.
 - c) Auto Mode 2: Filter level set point control adjusts effluent flow rate set points.
- 13. Steady-State Filtration Controls, including but not limited to:
 - a. Two automatic control modes of each filter effluent valve:
 - 1) Auto Mode 1: Provide flow rate set point control of each filter effluent valve. Process variable is filter effluent flow. Provide Proportional-Integral control with Auto/Manual selection. Limit filter effluent flow to a configurable preset value.
 - 2) Auto Mode 2: Same as Mode 1 except flow rate set point is a proportional function of filter level. As level rises, increase the flow rate set point. Limit filter effluent flow to a configurable preset value.
- 14. System Response After a Power Outage:
 - a. If at steady-state filtration (not in backwash) and a power outage occurs, resume steady-state filtration on power recovery.
 - b. If in backwash and a power outage occurs take filter offline on power recovery by:
 - 1) Closing all associated valves.
 - 2) Stopping backwash pump and air scour blower.
- 15. Automatic Backwash Control System Functions:
 - a. System Startup:
 - 1) Wash cycle shall start on:
 - a) Manual initiation
 - b) See Backwash Sequence Chart for sequence.
 - b. Define conditions that indicate whether each filter is in Steady-State Filtration, In Backwash, or Out-of-Service. Conditions shall be similar to:
 - 1) Steady-State Filtration: Influent valve is proved open and effluent valve is modulating.
 - 2) In Backwash: Effluent valve is closed.
 - 3) Out-of-Service: All filter valves are closed.

16. Backwash Control Sequence:

Action	Filter on line	Close Influent	Close filter effluent valve	Air Purge	Start Air Scouring	Stop Air Scouring	Low Rate Wash	High Rate Wash	Low Rate Wash	Filter to Waste	Filter on line
Step Description	0	1	2	4	5	7	6	8	9	10	0
Influent Valve	o	c	c	c	c	c	c	c	c	o	o
Effluent Valve	o	o	c	c	c	c	c	c	c	c	o
Air Purge Valve	c	c	c	o	c	o	c	c	c	c	c
Air Scouring Valve	c	c	c	c	o	c	c	c	c	c	c
Backwash Valve	c	c	c	c	c	c	o	o	o	c	c
Filter to Waste Valve	c	c	c	c	c	c	c	c	c	o	c
Main Backwash Valve	off	off	off	off	off	M	M	M	M	off	off
Main Blower	off	off	off	run	run	off	off	off	off	off	off

Abbreviations

o = Open
c = Closed
m = Modulating
O = Change in state to open
C = Change in state to close
M = Change in state to modulate
H = Hold last position at previous step
off = Stopped, not running
run = Motor running
OFF = Change in state to stopped
RUN = Change in state to running
S = Standby

Notes:

D. Clear Well and Distribution Tank P&ID-PI105

1. Distribution Water quality will be monitor. AIT-04-74 (Tu), AIT-04-75 (CHL-R), AIT-04-76 (pH, Temp) Generate alarms if water quality is out of normal range.
2. Clear well Water level of back wash suction will be monitored LIT-05-82, LSHH-05-83, LSLL-05-90.
3. Back wash pumps will operate to fill backwash tank. They will start automatically at low level and stop at high level. Pumps shall alternate every 24 hrs. Low level alarms of clear well will be used to protect pumps.
4. Clear well Water level of distribution suction will be monitored LIT-05-94, LSHH-05-95, LSLL-05-92.
5. Distribution pumps will operate to fill Takan tank and distribution line. Discharge flow FIT-05-77 and pressure PIT-05-409 will be monitored. They will start automatically at low pressure and stop at high pressure using pressure transmitter and pressure switch signals. Pumps shall alternate every 24 hrs. Low level alarms of clear well will be used to protect pumps.

E. Sludge Lagoon Lift Station P&ID-PI106

1. Sludge Lagoon will be monitored LSHH-06-85, LSH-06-87, LSL-06-86, LSLL-06-84. Pumps will be controlled from a local control panel using the level float signals.
2. Pumps Status, Alarm and Hi Hi level alarms will be monitored from the main control panel. Local Horn and Strobe will be activated at Hi Hi level.

F. Chlorine Contact Well and Distribution Tank P&ID-07

1. Distribution Water quality will be monitor (CHL-R,CHL Dioxide) . Generate alarms if water quality is out of normal range.
2. The Chlorine Dioxide signal will be used to control the dosification of Chlorine Dioxide Package by the Chlorine Dioxide Generator pumps.
3. The Distribution flow transmitter will be replaced.
4. The AIT-04-75 (CHL-R) signal will be used to control the dosification of Chlorine Dioxide Package by the Chlorine Dioxide Generator pumps.
- 5.

G. Chlorine Dioxide Generator P&ID-09:

1. The Chlorine Dioxide Generator will be controlled by a local PLC with communication to the compliance PLC.
2. The generator shall be able to start remotely and monitor all its signals from the compliance PLC.
3. All chemical additions will monitor the plant influent flow. In case of no flow all chemicals additions shall be close.
4. The pumps control shall be configured to be characterized with:
 - a. Stroke %
 - b. Max Flow range
 - c. PPM range
 - d. K factor
5. The pumps control shall be configured to work in function of the process variable (Flow) or by a fix PPM setpoint.

Chemicals addition will be monitored and controlled with PID control loops.

H. Standard Functions:

1. Critical Interlocks:
 - a. Include the Following:
 - 1) Conditions that present personnel safety risks, will cause major equipment damage, or otherwise produce critical malfunctions.
 - b. Implement critical interlocks in hard-wired control panel logic, not PLC logic.
2. Startup Delays: To prevent nuisance alarms and trips, provide preset startup, shutdown, or power failure delays overriding monitoring devices until process conditions or power supply to the system has stabilized.
3. Debounce Delays: To prevent nuisance alarms and trips, provide preset debounce delays for all process interlocks.

I. Standard SCADA Functions:

1. Typical package control system interface requirements communicated up to/down from the future network include, but are not limited to, the following:
 - a. Equipment Status Information: ON, OFF, etc.
 - b. Equipment Alarms: Include automated report generation software for SCADA System (FAIL, TROUBLE, etc.)
 - c. Equipment Supervisory Control Functions:
 - 1) Pump CALL.
 - 2) Pump control switch in HAND, etc.
 - d. Process variable value (in engineering units).
 - e. Process Variable Alarms:
 - 1) HIGH-HIGH, HIGH, LOW, LOW-LOW, HIGH CONCENTRATION, LEAK, etc.
 - 2) OUT-OF-RANGE, OUT-OF-SERVICE, etc.
 - f. System Controls, Operating Parameters, and Functions:
 - 1) PID controller mode (AUTO/MAN/REMOTE/CASCADE).
 - 2) PID controller control functions (set point, 0 – 100 percent output).
 - 3) System or sequence READY.
 - 4) System or sequence RESET, START, STOP, or HOLD (locally or remotely).
 - 5) Panel power (ON/OFF).
 - 6) Sequence status (READY, SEQUENCE STEP, COMPLETE, HALTED, etc.).
2. Input Processing;
 - a. Analog Inputs:
 - 1) Scale Range and Engineering Units: Refer to Section 13390, PACKAGE CONTROL SYSTEMS, for requirements.
 - 2) HIGH/LOW Alarm Limits: Select to annunciate conditions requiring attention. Disable alarms for equipment not in operation.
 - 3) Instrument failure detection. Log alarm message when detected. If detection is not handled by PLC, then set High-High/Low-Low limits to high scale range minus 2 percent, respectively.
 - 4) Alarm Dead Band: 2 percent of instrument range.
 - 5) Rate of change alarm limit set for no alarm.
 - 6) Totalize all flow, power, and other rate type variables.
 - 7) Averaging Filter : Provide averaging filter with adjustable samples range (0 to 20 samples minimum) for each analog input.
 - b. Discrete Inputs:
 - 1) Alarms: For all abnormal operation inputs.
 - 2) Status Change Logging:

- a) Available, but deactivated for all points.
- b) Normally used only for troubleshooting and activated on fewer than 5 percent of points.
- 3) Elapsed Runtime Monitoring: For equipment units with ON status.

3. Control:

- a. No Response Checking (Logic done in PLC): If a control device fails to respond within a preset time to a control output, log an alarm message that identifies a nonresponsive device and requested control output.
- b. Disagree Alarm (Logic done in PLC): Each time a PLC is polled, check status inputs associated with control inputs. Log a "DISAGREE" message where conflicts persist between inputs and outputs after a suitable startup delay.
- c. Not in REMOTE (Logic done in PLC): Before a control output is executed, verify that the control device is in REMOTE mode. If not, suspend control and issue a "NOT IN REMOTE" message.
- d. Standby Unit Assignment (Logic in PLC): Where standby unit assignment selectors are provided (1/OFF/2 for example), provide logic to assign control and monitoring of associated units based on standby unit assignment selection.

J. Supplements:

- 1. Supplements listed below and following "END OF SECTION" are part of this Specification.
 - 1) Instrument Index.
 - 2) Conduit Schedule
 - 3) Instrument Data Sheets
 - 4) P&ID's drawings. (Refer to Construction Drawings)

END OF SECTION

DIVISION 43 GAS AND LIQUID STORAGE

SECTION 43 41 45

FIBERGLASS REINFORCED PLASTIC (FRP) TANKS

1. APPLICABLE STANDARDS:

the design, fabrication, testing, and installation of FRP storage tanks will meet or exceed the following industry standards:

A.S.T.M. D-3299 – Filament Wound Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.

A.S.T.M. D-4097 – Contact Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks.

Where applicable, provision from A.N.S.I./A.W.W.A. D120-84 – Thermoset Fiberglass Reinforced Plastic Tanks and A.S.M.E./A.N.S.I. RTP-1 – Reinforced Thermoset Plastic Corrosion Resistant Equipment will be used.

Due to variations between the above specifications, many possibilities of design parameters are available. Design characteristics may be modified to suit. Consult with the factory for more specific details.

1.1 DESCRIPTION OF TERMS:

1.1.1 Definitions for most terms used within this standard are in accordance with A.S.T.M. D-883 Definitions of terms relating to plastics.

1.1.2 FILAMENT WOUND – The process in which the principle circumferential load bearing reinforcement is applied by continuous filament winding.

1.1.3 CONTACT MOLDED – A molding process that includes spray-up, hand lay-up, or a combination of those manufacturing processes.

1.1.4 HEAD – The end closure of cylindrical tanks (top or bottom).

1.2 TANK CLASSIFICATION – Tanks to be installed will be classified in the following manner:

Type 1: Atmospheric pressure tanks vented directly to the atmosphere, designed for pressure no greater or lower than atmospheric.

GRADE 1: (Premium) Tanks manufactured using a vinyl ester resin throughout.

2. MATERIALS:

2.1 RESIN – The resins used shall be a corrosion resistant vinyl ester or isophthalic polyester thermo set resin that has been determined by previous documented service to be acceptable for the particular service conditions.

2.1.1 The resin shall contain no pigments, colorants, or fillers unless specified by the customer.

2.1.2 Ultraviolet absorber will be added to exterior resin layer.

2.1.3 3-5% Antimony Trioxide may be added to halogenated resin in the structural laminate only, to increase the ignition resistance of the resin.

2.2 REINFORCEMENTS:

- 2.2.1 SURFACING VEIL – The inner surface reinforcement shall consist of either a synthetic fiber veil or a chemical resistant glass veil. The surfacing veil shall contain a coupling agent or binder that is compatible with the corrosion barrier resin. Veil thickness shall be 10 mil. minimum.
- 2.2.2 CHOPPED STRAND MAT OR GUN APPLIED CHOPPED STRANDS – Shall be constructed from single-end type E-glass strands 1/2" minimum to 2" maximum length. The coupling agent or binder shall be compatible with the resin used.
- 2.2.3 CONTINUOUS ROVING – Filament winding requires a single-end type E-glass reinforcement with 250 yards/pound yield. The coupling agent or binder shall be compatible with the resin used.
- 2.2.4 WOVEN ROVING – Shall be minimum 24 ounces/square yard and compatible with the resin used.

3. LAMINATE CONSTRUCTION:

- 3.1 STRUCTURAL TANK – The laminate comprising the structural tank (bottom head, sidewall, and top head) shall consist of four separate layers. These are the inner surface and the interior layer which make up the corrosion barrier, the structural layer, and exterior surface.
 - 3.1.1 INNER SURFACE – The inner surface exposed to the chemical environment shall be a resin rich layer 0.010 to 0.020 inch thick, reinforced with a surfacing veil. The glass content shall be 10% by weight maximum in this layer.
 - 3.1.2 INTERIOR LAYER – The interior layer shall consist of a resin rich laminate reinforced with chopped strands.
 - 3.1.2.1 CORROSION BARRIER – The glass content of the inner surface and the interior layer combined shall be 27% +/- 5% by weight. The combined thickness of the inner surface and the interior layer shall not be less than 0.100 inch.
 - 3.1.3 STRUCTURAL LAYER:
 - 4.1.3.2 CONTACT MOLDED STRUCTURAL LAYER – Subsequent reinforcement shall be comprised of alternating layers of chopped strands and such additional number of plies of woven roving to a thickness as required to meet the physical properties that are used for the design. Each successive ply or pass of reinforcement shall be well rolled prior to the application of additional reinforcement. All woven shall be overlapped 1". Laps in subsequent layers shall be staggered at least 3" from laps in the preceding layer. All woven roving shall be followed by chopped strands without exception.

3.1.3.1 **FILAMENT WOUND STRUCTURAL LAYER** – Subsequent reinforcement shall be continuous strand roving. Glass content of the filament wound structural layer shall be 50% to 80% by weight. The thickness of the filament wound portion of the tank shell will vary with tank height (tapered wall construction). If additional axial strength is required, the use of chopped strands or unidirectional glass strands interspersed between wind layers is acceptable.

3.1.4 **EXTERIOR SURFACE** – The outer surface shall be coated with a resin rich layer for spill protection. Where air inhibited resin is exposed to air during cure, a full surface cure shall be obtained by coating the surface with a coat of resin containing 0.2% to 0.6% paraffin wax surfacing agent and ultraviolet absorbers. This layer may contain pigments, or fire-retardant additives if specified by the customer.

3.2 JOINTS:

3.2.1 The cured resin surfaces of parts to be joined shall be ground to expose the glass fiber reinforcement. The ground area shall extend beyond the lay-up areas so that no reinforcement is applied to an unprepared surface. The surface shall be clean and dry before lay-up. The entire ground area shall be coated with paraffinated resin after joint overlay is made.

3.2.2 The gap between bell and spigot joints shall be filled with a resin pour to eliminate any air pockets between the two pieces to be joined.

3.2.3 Highly filled resin putty shall be spread over the crevices and irregular shapes between joined pieces, leaving a smooth surface for lay-up.

3.2.4 The width of the first layer of joint overlay shall be 6" minimum. Successive layers shall increase 1" width minimum, to form a smooth contour laminate that is centered on the joint +/- 1/2 inch.

3.3 FITTINGS AND ACCESSORIES

3.3.1 The surfaces of fittings and accessories exposed to product shall have the same corrosion barrier laminate as outlined in section 4.1.1 and 4.1.2.

3.3.2 The cut edges of all laminates exposed to the product shall be sealed with the corrosion barrier laminate as outlined in 4.1.1 and 4.1.2. Where shape, thickness, or other restrictions preclude covering the edges with the corrosion barrier laminate, the edges shall be coated with paraffinated resin.

3.3.3 **NOZZLE AND MANWAY INSTALLATION** – follow the requirements of ASTM D-3299 or D-4097 for minimum installation standards.

3.3.4 **NOZZLE AND MAYWAY CUTOUT REINFORCEMENT** – Where a tank sidewall or head is cut in an area bearing hydrostatic pressure, the cutout reinforcing laminate shall not be less than two times the nominal nozzle diameter. For nozzles less than 6" diameter, the reinforcement diameter shall be the nozzle size plus 6".

- 3.3.4.1 CUTOUT REINFORCEMENT LAMINATE THICKNESS – The thickness of the cutout reinforcement laminate shall be determined using the following formula, but shall not be less than 1/4 inch.

$$Tr = 0.036 \times \square \times H \times D \times K / 2 Sr$$

WHERE:

Tr = Cutout reinforcement laminate thickness (in inches) \square = Specific gravity of product.
H = Height of liquid above nozzle. D = Tank nominal inside diameter (in inches).
K = 1.0 for nozzles 6 inch diameter and larger. K = (d/dr-d) for nozzles less than 6 inch diameter.
d = Nominal nozzle diameter (in inches). dr = Cutout reinforcement diameter (greater of 2 times d or d+6) (in inches). Sr = Allowable tensile stress (not to exceed 10% of reinforcement laminate tensile strength).

This thickness (Tr), may be applied to the outer or inner surfaces, or be divided between them.

4. LAMINATE DESIGN PHYSICAL PROPERTIES:

- 4.1 Standard laminate design physical properties meet or exceed ASTM D-3299, ASTM D-4097 and ASME RTP-1 standards.

5. DESIGN REQUIREMENTS:

- 5.1 SIDEWALL – The minimum required wall thickness of the cylindrical straight shell at any fluid level shall be determined by using the following formula, but shall not be less than 1/4".

$$t = .036 \times \square \times H \times D / 2 \times Sh$$

WHERE:

t = Wall thickness in inches. \square = Product specific gravity.
H = Fluid head in inches. D = Tank nominal diameter in inches.
Sh = Allowable hoop stress in P.S.I. (see 6.1.1).

- 5.1.1 Allowable stress shall be determined using the following formula:

$$Sh = Et \times Z$$

WHERE:

ET = Tensile Modulus of laminate in hoop direction.
Z = Allowable strain (maximum allowable strain of the tank shall not exceed 0.001 inch/inch).

5.1.1.1 Allowable hoop stress (Sh) shall not exceed 1/10 of hoop tensile strength.

- 5.2 TOP HEAD – The minimum allowable head thickness shall be 1/4". The top head must be able to support a 250 pound load on a 16 square inch area without damage.
- 5.3 OPEN TOP TANKS – Open top tanks shall incorporate a stiffening ring or flange. Additional stiffening may be incorporated into the design depending upon the intended use. Customer must advise fabricator of any equipment such as agitation, pumps, etc. causing external forces.
- 5.4 FLAT BOTTOM HEAD – Flat bottom heads shall be molded integrally with the straight shell portion of the tank, unless otherwise agreed upon. The perimeter of the tank bottom shall not have any variations from a flat plane that would prevent uniform contact with a properly prepared flat tank support pad when filled with liquid. The sidewall to bottom knuckle radius shall be not less than 1" for tanks 4' diameter & smaller and not less than 1 1/2" for tanks larger than 4' diameter.

- Tb = Thickness (in inches) □ = Product specific gravity.
H = Fluid head at deepest point (in inches). D = Inside tank diameter (in
inches). S = Allowable stress – (not to exceed 1/10 of laminate tensile
strength) in pounds/square inch.
 α = 1/2 the included (apex) angle of the cone at the centerline of the head.

5.9 FITTINGS:

The corrosion barrier of tank nozzles shall be equivalent to the inner corrosion barrier of the tank they are installed in. Construction shall be as follows:

5.9.1 **FLANGED NOZZLES** – Dimensions for flanged nozzles shall be per chart. The nozzle shall be of hand lay-up construction. Press molded flanges attached to pipe with adhesive are not acceptable.

Flange Size	Flange Face O.D. (Max.)	Bolt Circle	Bolt Hole Size	Flange Face Thickness	PSI Rating	Bolts (Qty) - Size
1"	4-3/4"	3-1/8"	5/8"	11/16"	150	(4) - 1/2
1-1/2"	5-1/2"	3-7/8"	5/8"	11/16"	150	(4) - 1/2
2"	6-1/2"	4-3/4"	3/4"	3/4"	150	(4) - 5/8
2-1/2"	7-1/2"	5-1/2"	3/4"	3/4"	150	(4) - 5/8
3"	8"	6"	3/4"	7/8"	150	(4) - 5/8
4"	9-1/2"	7-1/2"	3/4"	1"	150	(8) - 5/8
6"	11-1/2"	9-1/2"	7/8"	1"	100	(8) - 3/4
8"	14"	11-3/4"	7/8"	13/16"	50	(8) - 3/4
10"	16-1/2"	14-1/4"	1"	15/16"	50	(12) - 7/8
12"	19-1/2"	17"	1"	1-1/16"	50	(12) - 7/8

5.9.2 **COUPLINGS, NIPPLES, PIPE STUBS** – Shall be of filament wound or contact molded construction. Press molded fittings are not acceptable.

5.9.3 **TOP AND SIDE MANWAYS** – Shall be constructed per manufacturer's standards using hand lay-up construction and of the same materials as the tank they are installed in. Prefabricated press molded flat plate side manhole covers are not acceptable.

5.9.4 **VENTS** – All tanks shall be vented to prevent an internal pressure or vacuum. The vent must be of sufficient size to handle the flow displacement of all combined inlet or outlet nozzles.

5.9.5 **HOLD DOWN LUGS** – Hold down lugs or plates shall be installed on all tanks. The size and number of hold down lugs shall depend on wind, seismic, and other loads the tank will be subjected to during normal operation.

5.9.6 **LIFTING LUGS** – Shall be installed on tanks over 200 pounds weight unless otherwise specified.

6. INSULATED TANKS:

- 6.1 SIDEWALL INSULATION – 2-pound density foam insulation shall be used on tank sidewalls. Either prefabricated foam board or sprayed-on insulation is acceptable.
- 6.2 TOP OR BOTTOM HEAD INSULATION – Must conform to 7.1.
- 6.3 INSULATION CASING – The protective exterior casing over insulation shall be either contact molded or filament wound. The minimum allowable thickness for insulation casing shall be 1/8". The insulation casing resin shall contain a pigment to protect insulation from ultraviolet rays. *Note: For minor cracks in the insulation case, an exterior expandable caulk may be used.*
- 6.4 EXPANSION JOINT – To allow for differences in expansion between the tank and the insulation casing, one or more expansion joints must be installed in insulation casing. The expansion joint must allow free movement of tank and insulation casing and be sealed off from water infiltration.

7. NAMEPLATE:

Tank nameplate shall be constructed of laminated paper encapsulated in FRP materials and located approximately 5' up from tank bottom when possible. The nameplate shall include the following information:

- | | |
|------------------------------------|------------------------------|
| 1. Order Number. | 8. Service Temperature. |
| 2. Customer. | 9. Product. |
| 3. Customer purchase order number. | 10. Corrosion barrier veil. |
| 4. Tank model. | 11. Corrosion barrier resin. |
| 5. Tank capacity. | 12. Structural layer resin. |
| 6. Design Pressure. | 13. Date of fabrication. |
| 7. Specific Gravity. | 14. Tank tag. |

8. WORKMANSHIP AND LAMINATE QUALITY:

8.1 GENERAL APPEARANCE – Tank should be uniform in color. Joints and matting ground fittings shall not be whited out from over catalyzation. On pigmented tanks color of matting on joints and fittings shall be matched as close as possible to the color of the tank exterior. There shall be no burrs or sharp edges on tank. No knots in filament winding. All cut or ground edges shall be coated with paraffinated resin.

8.2 VISUAL INSPECTION CRITERIA (Ref. ASTM C-582, Section 9, Table 5):

DEFECT	SURFACE INSPECTED	
	CORROSION BARRIER	STRUCTURAL LAMINATE
Cracks	None	None
Crazing (fine surface cracks)	None	Maximum dimension 1". Maximum density 5/ft ² . ^A
Blisters (rounded elevations of the laminate surface over bubbles)	None	Maximum 1/4" diameter x 1/8" high, maximum 2/ft ² . ^A
Wrinkles & solid blisters	Maximum deviation, 20% of wall thickness, but not exceeding 1/8". ^A	Maximum deviation, 20% of wall thickness, but not exceeding 3/16". ^A
Pits (craters in the laminate surface)	Maximum dimensions, 1/8" dia. x 1/32" deep. Maximum number, 10/ft ² . ^A	Maximum dimension 1/8" diameter x 1/16" deep. Maximum density 10/ft ² . ^A
Surface porosity (pinholes or pores in the laminate)	Maximum dimensions, 1/16" diameter x 1/32" deep. Maximum number 20/ft ² by 1/16 in. Must be resin-rich. ^A	Maximum dimension 1/16" diameter x 1/16" deep. Maximum number 20/ft ² . Must be resin-rich. ^A
Chips (small piece broken from edge or surface)	Maximum dimensions, 1/8" diameter x 1/32" deep. Maximum number 1/ft ² . ^A	Maximum dimension 1/4" diameter by 1/16" deep. Maximum number 5/ft ² . ^A
Dry Spot (non-wetted reinforcing)	None	Maximum dimension, 2 in. ² . ^A
Entrapped air (bubbles, voids or delaminations in laminate)	Maximum diameter 1/16", 10/in. ² maximum density. Maximum diameter 1/8", 2/in. ² maximum density. Maximum depth of 1/32 in. ^{A,B}	Maximum diameter 1/16" 10/in. ² maximum density. Maximum diameter 1/8", 2/in. ² maximum density. Maximum diameter 3/16", 2/ft ² maximum density. ^{A,B}
Exposed glass	None	None
Burned areas	None	None
Exposure of cut edges	None ^C	None ^C
Scratches	None over 0.005 in. deep and 4 in. long	Maximum length 12". Maximum depth 0.010" 2/ft ² , maximum density. ^A
Foreign matter	None	1/8" diameter, maximum density 1/ft ² . 3/16" diameter, maximum density 1/ft ² . ^{A,D}

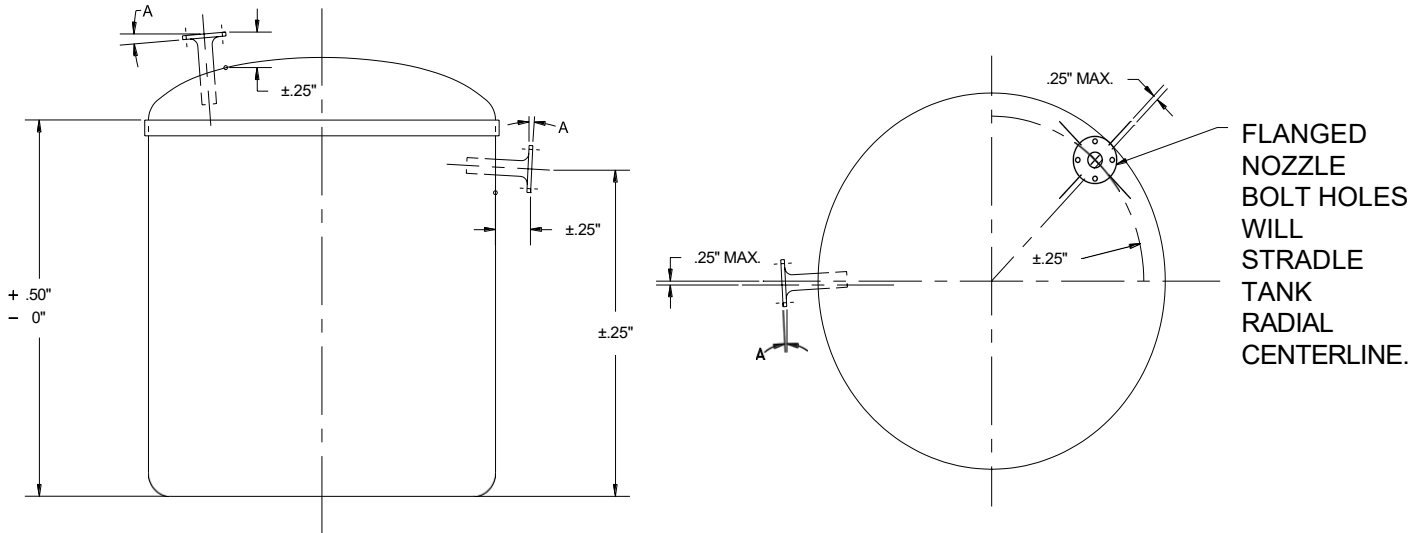
^A Maximum 5% of total surface area affected.

^B Entrapped air or bubbles described are allowed, provided the surface cannot easily be broken with a pointed object, such as a knife blade.

^C Maximum 5% of total surface area affected.

^D Maximum 5% of total surface area affected.

9. DIMENSIONS AND TOLERANCES:



A = 1° for Nozzles 1" to 8" and 1/2° for Nozzles 10" and Up.

10. HEAT CURE:

10.1 FOOD GRADE TANKS – Tanks should be heated on the interior to a temperature of 180° to 200° F. and maintained for (4) hours. After tank installation and before putting the tank into service, attention to the following procedures is important to help achieve FDA compliance.

- (1) Steam-treat or steep it with hot water for 8 – 16 hours at 160° to 180° F. This should remove residual styrene from the interior surface.
- (2) Wash the tank with a mild detergent and rinse thoroughly.
- (3) Check state or local requirements in addition to the above recommendations.

10.2 POST CURE – When recommended by the resin manufacturer's corrosion guide, the tank be should be heated on the interior to a temperature of 180° F. to 200° F. and maintained for (4) hours to more completely cure the resin. See resin corrosion guide for specific environments requiring a heat cure.

11. SURFACE CURE:

11.1 BARCOL HARDNESS TEST – All tanks should have Barcol hardness readings taken and recorded on Quality Control report. Ten readings will be taken on the clean, resin rich surface of the tank. The (2) high and the (2) low readings will be eliminated. The average of the remaining readings will be reported as the Barcol hardness of the tank. (Barcol hardness reading of 90% or better of resin manufacturer's specified Barcol hardness for resin used is considered satisfactory).
Note: Synthetic veil will lower Barcol readings 5 to 10 points.

11.2 ACETONE TEST – Tanks requiring acetone test to check for proper cure should be tested as follows: Remove all mold release or paraffin wax and all dust from surface, rub a small amount of clean Acetone on the laminate surface until the Acetone evaporates. If the surface stays dry and hard, it is properly cured.

12. WATER FILL TEST:

Tanks requiring Water Fill testing should be filled to rated capacity. All water spilled or splashed on tank and surrounding area should be dried off. Tank should then be left standing for a minimum of 2 hours and checked for leaks.

13. GENERAL:

Specifications requiring independent laboratory tests shall be as outlined in ASTM D-3299 and ASTM D-4097.

14. FINAL INSPECTION:

Tanks shall be inspected for compliance with all applicable standards before being released for shipment. Detailed records of final inspection shall be kept in the job master file for future reference and certification of compliance with standard.

15. SHIPPING:

After final inspection, tanks are to be loaded on tank trailers or skids in such a manner as to prevent damage to flange faces and other fittings. Handling and installation instructions shall be provided to Contractor. Contractor shall follow the instructions to insure proper handling and installation of tanks during and after delivery.

END OF SECTION

DIVISION 46 WATER AND WASTEWATER EQUIPMENT

SECTION 46 31 11 CHLORINE SYSTEM

PART 1 GENERAL

1.1. DESCRIPTION OF THE WORK

- A. The design is based in a complete vacuum system, includes a shut off system as a primary security option and consider redundancy to avoid unwanted dosing interruptions. The dosing be controlling by a smart panel capable of work in mode manual, automatic residual, automatic channel; in automatic mode the system can have 3 configurations or modes that will be residual, flow or both. The signal will be transmitted by a 4-20 mA each.
- B. Work Includes:
1. Supplying all the necessary components for a new 100 PPD capacity chlorine gas vacuum system.
 2. The system components to be supplied as described herein.
- C. Acceptable Manufacturers:
1. As shown on components descriptions or approved equal.
 2. Consideration will be given to alternates provided to the specifications clearly stated in the vendor's proposal, and may be approved, if the owner and owner's representative considers such alternates equal or superior to those specified.
 3. Vendor proposal shall clearly state all rates and charges associated with installation or start-up supervision.
 4. As a separate item, include all applicable taxes and duties.
 5. State the time required for delivery of equipment after approval of Shop Drawings. Special considerations and exceptions will be given to any action by the vendor directed to improve the equipment delivery time.
 6. A proposed start-up plan and schedule shall be submitted with the proposal showing estimated requirements (number and type of craft, people and timing) for installation, commissioning, and start-up.
 7. All quotations shall be F.O.B. job site:
 8. The vendor shall submit the following data, drawings and information with the proposal:
 - i. Proof of successful service at various installations for the design conditions. The evidence shall include pictures, catalog data, or other information and reference to satisfactory service of identical equipment in similar service.
 - ii. Complete descriptions of all supplied components
 - iii. Description of equipment operation.
 - iv. Typical cross section of major parts.
 - v. Equipment delivery time.
 - vi. Any other pertinent data for complete technical and economical evaluation including utility consumption.
 - vii. List of recommended spare parts.
- D. Quality Assurance- Codes and Standards
1. All materials and workmanship described herein shall be in accordance with the latest editions and addenda of the codes and standards listed below and all applicable Federal, State and local codes. Should there be any conflict between any code, standard, and/or specification, the more stringent shall govern.
 - i. ASTM American Society for Testing and Materials
 - ii. NEMA National Electrical Manufacturers Association

- iii. NFPA National Fire Protection Association
- iv. UL Underwriters Laboratories, Inc.

E. System Requirements:

Pre-Chlorination:	4.4 PPD
Post-Chlorination:	2.6 PPD
Total dosage capacity:	7 PPD
Initial Water Treated Flow:	0.3 MGD
Projected Water Treated Rate:	2 MGD Projected dosage: 70 PPD
Type:	Vacuum with Redundancy
Accessories:	weight system
Safety:	Gas Chlorine Monitor & Shut Off System
Containers Type:	150 pounds cylinders

PART 2 PRODUCTS

2.1. WEIGH SCALES

- A. The scale shall be an Eagle Microsystems Model DCS302 Dual Cylinder Electronic Scale or approved equal suitable for individually weighing two (2) compressed gas cylinders having a maximum diameter of 12 inches / 30 cm, furnished complete with Model EI-2000 Dual Channel Electronic Indicator. Scale shall have a maximum capacity of 360 lbs. / 162 kg. per cylinder, providing an accuracy of 0.25 % of rated capacity. The scale base shall be anchored to the floor by the contractor with 3/8" diameter mounting hardware
- B. Start up / operation -Installation shall be accomplished without the need for special tools or lifting devices. Start up, calibration and operation of the scale shall not require the services of the manufacturer, however, assistance shall be available from a factory trained, local representative if required.
- C. The scale shall be comprised of a floor mount dual cylinder weighing base and a remote mount dual channel electronic indicator furnished complete with 15 ft. / 3 m. interconnection cable. The entire weighing system shall weigh less than 35 lbs. / 16 kg for ease of installation.
- D. Scale base - The weighing platform shall be a non-corrosive, high impact base, protected by 5 year warranty, suitable for weighing two (2) compressed gas cylinders having a maximum diameter of 12 inches / 30 cm.. Scale base shall incorporate two independent reliable lever systems to convey each cylinder's weight to its dedicated environmentally sealed strain gauge load cell. Load cells shall be temperature compensated 0 to 150o F / 0 to 65o C. Systems incorporating hydraulic load cells shall not be acceptable. All scale electronics, including the load cells, shall be enclosed in a NEMA 4X enclosure. Maximum height of scale base (excluding electronics enclosure) shall not exceed 1.6 in. / 4.1 cm.
- E. Electronic indicator - The electronic indicator shall be a two (2) channel device, with each channel providing an operating display of 0 to 360 lbs (or 0 to 162 kg.) and individual electronic tare weight adjustments of 0 to 100 %. Display resolution shall be user selectable in 0.2, 0.5 or 1 lb. (0.1 or 0.5 kg.) increments. The electronic indicator shall provide dual LED digital displays of "Gross", "Tare", "Remaining", and "Total" weights. Vertical light arrays shall clearly indicate status of each channel's weight display. A "Low Level" visual indicator shall be furnished as standard with the capability of an associated alarm contact. (see options). 15 ft. / 5m of interconnection cable shall be furnished as standard, however, the indicator shall be capable of remote mounting to a distance of 1000 ft. /300 m.
- F. Analog output - The electronic indicator shall provide two (2) isolated 4-20 mADC outputs, user selectable and proportional to either the Gross", "Remaining" or "Total" weight.

- G. **Warranty** - The entire scale shall be covered by the manufacturers Standard Warranty, which shall include the entire assembly for one (1) year from date of startup. The scale base shall be protected by an extended warranty for a minimum of five (5) years, which will provide warranty repair or replacement if the scale base is damaged through corrosive exposure.
- H. **POWER SUPPLY** - The scale shall operate from a 120 VAC, 60 Hz (other) power supply.
- I. **Outputs / Relays**
1. **Low weight alarm contact (low weight alarm)** - The electronic indicator shall provide a total of two (2) low weight alarm contacts. Each contact shall be rated at 1 amp @ 120 VAC and dedicated to the channel measured.
 2. **Serial output** - The electronic indicator shall provide one (1) RS-485 serial output or one (1) RS-232 serial output capable of transmitting weight values and scale status.
 3. **Wall bracket** - dual cylinder wall mount bracket shall be furnished, including safety chains and clips for securing two vertical compressed gas cylinders.

2.2. VACUUM REGULATOR

- A. The vacuum regulators shall mount directly on the chlorine valves of cylinders by means of a positive yoke type clamp having an integral tightening screw with slide bar handle. No wrenches or other tools shall be required to mount or dismount the vacuum regulator from the chlorine valve. The chlorine valve/chlorinator inlet adaptor shall be constructed of corrosion-proof fluoroplastic material which shall be inert to the effects of wet, dry or liquid chlorine. The inlet safety shut-off/vacuum regulating valve shall be of capsulated design, easily removable as a unit from the outlet side of the yoke. A fluoroplastic filter shall be installed in the vacuum regulator inlet and shall be capable of removing impurities greater than 25 microns. A pressure relief valve shall be incorporated into the vacuum regulator to prevent pressure from building up in the system. All external screws and nuts shall be made of Titanium to prevent corrosion.

	Part Description	Material of Construction
Vacuum Regulator	Body assembly - molded	ABS – GLASS REINFORCED
	Diaphragm plates	ABS – GLASS REINFORCED
	Gaskets & o-rings	Viton – ((LITHARGE CURED))
	Screws and nuts	Titanium
	Main regulating spring	Tantallum Alloy
	Diaphragm	HALAR (ECTFE)
	Inlet valve plug	Alloy K
	Inlet valve seat	Teflón
	Inlet adapter	KYNAR (PVDF)
	Inlet capsule housing	KYNAR (PVDF)
	Inlet filter	25 micron
	Yoke assembly	0.020" HALAR Over Steel

2.3. SWITCHOVER

- A. The switchover module shall be vacuum operated and shall be factory pre-set, not requiring field adjustment. The module shall automatically change chlorine feed from an empty chlorine source to a full source, with no manual resetting required after switchover has been made and the empty supply replaced.
- B. The Switchover (SO) must include a bypass that could be used in case the SO be out of service during its maintenance or repair.

	Part Description	Material of Construction
Switchover	Body	PVC
	Internal Body Parts	PVDF
	Shafts	PVDF
	Springs	Tantallum Alloy
	Gaskets & O'rings	Viton
	Plugs	PVDF
	Screws	Titanium

2.4. THE AUTO VALVE

- A. The Automatic Chlorine Gas control valve shall be the SUPERIOR™ AutoValve Model AV-1 or approved equal, manufactured by Chemical Injection Technologies, Inc., and shall have a maximum capacity of 100 pounds per day (1000 gr/hr) of Chlorine Gas feed, and shall be equipped with a variable area gas flow meter of 100 pounds per day (gr/hr).
- B. The auto valve shall be a micro-processor-based device for automatically controlling the feed rate of chlorine gas, based on process water flow rate, residual set point, or a combination of these parameters to achieve: Flow Proportioning Control, Residual Control, or Compound Loop Control. The auto valve shall incorporate all three (3) control modes as standard, without the need for added programming, PC boards, or any other upgrades.
- C. The valve shall consist of three (3) component assemblies, mounted on a sturdy, corrosion-proof plastic panel suitable for wall mounting. The valve components shall include an electronic controller, a motorized valve, and a variable area flow meter with integral manual gas feed rate valve. All components shall be constructed of materials resistant to the corrosive effects of the gas being fed, and all electronics shall be housed in NEMA-4, gas tight housings.
- D. Electronic Controller:
 1. The controller shall be capable of either 110 VAC or 220 Vac, 60/50 Hz operation by use of an internally mounted toggle switch. No jumpers or separate "add-on's" shall be required to change the operating voltage. Operating voltage to the PC board and the motorized valve shall be reduced to 12 Volts DC by a high-grade transformer immediately upon entering the controller. All functions, settings and options, shall be accessible through the operator interface panel for ease of operation and for operator safety, and no internal jumpers or dipswitches shall be used for operator control.
 2. Operator interface shall be through a 2-line, alphanumeric 16 character, back lighted LCD display, with integral 4-button keypad. All keypad buttons shall be assigned to menu variables. All menus and variables shall be displayed in easily understood English words. No codes or references requiring external lookups shall be permitted. A terminal compartment, separate from the PC boards, shall be provided in the electronics enclosure to allow convenient external wiring connections without opening or disturbing the electronics boards. The electronics enclosure shall have a minimum rating of NEMA 4X.
 3. The controller shall incorporate two levels of password protection to allow separate, authorized personnel access to programming functions and/or parameter set points, if desired. Nonauthorized personnel shall be restricted to setting manual or automatic control modes. In operating (run) mode, the display shall indicate both the input signal level and the valve plug position. Any alarm condition or input/output error shall cause the display backlight to flash on/off as a visual alert.
 4. Controller software shall incorporate operator selectable 4, 5, or 11 point linearization calibration to allow for individual installation requirements.
- E. Inputs and Outputs - Input signal(s) shall be 4-20 mA standard (1-5 Volt DC option with jumper setting). Terminals shall be provided for input signals from both a water flow meter and residual analyzer. A 4-20 mA output signal, proportional to gas feed rate, shall be provided as standard, for interfacing with other process monitoring equipment or control systems. The controller shall allow setting of two independent alarm conditions for Low Flow Signal and for Residual Deviation. An alarm condition shall

energize a relay, the polarity of which shall be user selected as normally open or normally closed, for a set of contacts on the terminal board. The contacts shall be of the "dry" type (non-energized), up to 240 VAC.

F. Motorized Valve:

1. The automatic motorized valve assembly shall have all electrical components housed in a NEMA-4X enclosure. All materials of the valve assembly exposed to the process gas or to atmosphere surrounding the valve shall be constructed of materials resistant to any corrosion by the gas. All exterior metal parts shall be constructed of Titanium. The valve sub-assembly shall be separated from the motor/electrical enclosure by a at least a 3" (76mm) air gap.
2. The valve shall use a bi-directional rotary hybrid stepping motor with a step angle of 1.8N and step accuracy of $\pm 3\%$. The valve plug shall be of linearized design and shall have a minimum travel of 1.0 inches (25mm) for 0% to 100% of maximum gas feed rate to allow for maximum accuracy and adjustability. Minimum feed rate turndown shall be 10:1 or better for any valve feed range. Feed rate accuracy shall be $\pm 4\%$ or better. A feedback potentiometer shall be connected to the valve shaft by direct gear drive for precise valve positioning. An operator accessible thumbwheel shall be attached the valve shaft for emergency valve positioning in the event of power failure.

- G. Gas Flow Meter** - The Automatic Valve system shall incorporate a variable area gas flow meter attached directly to the auto valve mounting board. The flow meter shall be visible to operating personnel when calibrating procedures are being performed, allowing "one-man" calibration. The flow meter panel shall incorporate a manual feed rate control valve to allow for manual bypass control in the event of power failure or valve maintenance and repair. Minimum calibrated feed rate of the auto valve system shall be 1/20th of maximum flow meter scale (20:1 turndown ratio).

	Part Description	Material of Construction
Rotameter	Body Assemble - Molded	ABS – GLASS REINFORCED
	Flow Tube	Borosilicate Glass
	Gaskets & O-Rings	Viton – (litharged Cured)
	Rate valve seat, knob & plug shaft	KYNAR (PVDF)
	Rate valve metering tip	Alloy K

2.5.EJECTOR

- A.** Contractor shall furnish and install two ejectors and required appurtenances as per construction drawings and this Section.
- B.** Vacuum shall be created by a fixed-throat venturi/ejector system connected directly to the chlorine solution diffuser. A dual high pressure/ low-pressure check valve system shall prevent water from entering the gas system. The ejector assembly shall be capable of withstanding water pressure up to 300 PSIG (20.7 Bars). A universal type chlorine solution diffuser shall be provided which shall allow close-coupling of the ejector to a water main, use of flexible solution hose or rigid solution pipe without the use of special adaptors.

	Part Description	Material of Construction
Ejector	Check valve & ejector body - molded	ABS – GLASS REINFORCED
	Nozzle (venturi)	ABS – GLASS REINFORCED
	Spring	Tantallum Alloy
	Diaphragm	Teflon
	High pressure check valve	Viton – (litharged Cured)
	O-rings	Viton – (litharged Cured)
	Diffuser	ABS – GLASS REINFORCED

- C. The ejector must be mounted with an arrangement that includes a Pressure gauge for the inlet pressure and a Pressure gauge diaphragm protected at the outlet that will be used to test the hydraulic conditions when required.

D. Ejector Inlet gauges

Dial: 2 ½"
Range: 0-200 PSI
Case: SS 316
Window: Polycarbonate
Fill: Glycerin Filled
Connection: ¼" MNPT

E. Ejector Outlet gauges

Dial: 2 ½"
Range: 0-200 PSI
Case: SS 316
Window: Polycarbonate
Fill: Glycerin Filled
Diaphragm: PTFE sealed
Connection: ½" FNPT

2.6. PIPES, VALVES AND TUBING

- A. Tubing for Chlorine under vacuum: High Density Polyethylene
- B. Solid Pipe for Chlorine under Vacuum: PVC SCH 80 no less than ½" of diameter.
- C. Valves for Chlorine under Vacuum: All Type-21/21A ball valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. PVC conforming to ASTM D1784 Cell Classification 12454A. The ball valves shall have a pressure rating of 230psi for sizes 1/2" to 3" and 150psi for 4" at 70° F.

2.7. CYLINDERS

- A. Contractor shall furnish four (4) chlorine gas cylinders as described herein.
- B. Chlorine cylinders are constructed of seamless steel AISI 4130X (Chromium-molybdenum Steel) and must comply with DOT 3AA480 specifications such as in 49 CFR 173.304a. The cylinders will be coated with 1175 Metallic Aluminum paint. Chlorine cylinders may have convex or concave- style base (bottom) constructions.
- C. All cylinders must have a valve protective cap in place over the valve except when the cylinder is in use or during cylinder maintenance requiring access to the valve. The valve will be made of bronze 1.030"- 14 NGO.
- D. The fusible will be according to what is indicated on the section 5.1.1 on Pamphlet 17 of The Chlorine Institute.
- E. The 150 lb. chlorine cylinders must be compatible with Chlorine Institute Emergency Kit A Cylinders must be steel-die stamped in the cylinder shoulder (area near the neck-ring) with the following information:

1. DOT specification number or DOT exemption number Material specification
 2. Symbol and serial number (of owner or builder)
 3. Inspector's official mark
 4. Date of test (month and year)
 5. Water capacity
 6. Tare (this is recommended by the Institute)
- F. The capacity of chlorine in a cylinder to 1.25 times the weight of water that the cylinder would hold (i.e., water capacity in weight units) at 60°F (15.6°C). 150 lb. (68 kg) of chlorine.

2.8. HAZARDOUS GAS DETECTOR

- A. The chlorine gas detector shall be the Premier Series Gas Detector Model GD-1000 as manufactured by Eagle Microsystems, Inc or approved equal. The unit shall consist of a microprocessor-based Alarm Indicator Unit with one or two remotely mounted Gas Sensor(s) and interconnecting cable.
- B. Gas Sensor - Each Gas Sensor shall be a three-electrode, micro fuel cell-type device mounted in a NEMA 4X enclosure. Each sensor shall be capable of responding to levels of the target gas from 0.1 to 30.0 PPM. Each sensor shall provide an 80% response to a 10 PPM leak of gas in air within 30 seconds. Recovery time shall be 30 seconds for an 80% recovery from a 10 PPM peak. An LED shall be mounted on the Gas Sensor enclosure to indicate when the sensor is powered.
- C. Alarm Indicator Unit - The Alarm Indicator Unit shall be housed in an NEMA 4X (IP65) -rated, weather resistant enclosure. A clear, hinged, gasketed door shall provide access to the pushbutton controls. The unit shall be equipped with a two-line by 16-character back lit LCD display. The first line of the operational display shall register gas concentration or, when in alarm, the words "Critical" or "Danger" are displayed and the display flashes. The second line shall show the measured gas concentration as a percent of full scale bar graph, or the charge level of the backup battery. The unit shall provide an isolated 4-20 mAdc output signal proportional to the full-scale calibrated range. The Alarm Indicator Unit shall be capable of single or dual channel operation.
- D. Alarms - Three programmable relays shall be provided to permit actuation of alarms for Danger and Critical alarm conditions and to alert the operator to a sensor fault condition. When the battery backup function is provided, the third relay shall also alert the operator to a low battery condition. All alarms shall be displayed on the alphanumeric display and annunciated via the 103 dB integral audible alarm horn. All alarm contacts shall be gold plated and be rated 1.2 A at 120 Vac. The alarm set point values shall be entered via the instrument keypad and stored in non-volatile EEPROM memory. All programming, including alarm set-point values shall be retained regardless of main power or backup battery condition. Each Gas Sensor shall be furnished with a 15 foot cable for interconnection to the Alarm Indicator Unit. The Gas Detector shall operate on (120) (240) Vac, (50) (60) Hz, single phase power.
- E. Backup Battery - A battery backup system shall be built into the Alarm Indicator Unit to provide power in the event of loss of AC power. The battery backup shall be capable of maintaining operation of the unit for approximately 45 minutes. The battery shall be continuously charged by a trickle charging circuit.

2.9. HEAVY DUTY EXTRACTOR

- A. Fan diameter as per construction drawings, one phase, 120 V 60 hz, 1 HP, CFM HIGH 1,420 for air extraction in industrial environment, vertical wall mounted. The fans shall be speed-controllable and engineered for continuous operation in highly corrosive environments, outdoor use and wet applications. Glass-filled, high impact polypropylene fan blades are powered by a wash down, severe duty ball bearing motor. Sealed motor is Class F insulated and features automatic thermal protection for low maintenance. Motor is housed in die cast aluminum and offers a labyrinth seal between housing and

impeller guard to keep out moisture. Fan supports absorb sound and vibration for low noise operation. Vacuum formed, heavy duty fiberglass frame features corrosion resistant wire guards on motor side for safety. UL507 certified for outdoor use. C-UL recognized

2.10. SELF- CONTAINED BREATHING APPARATUS (SCBA)

- A. The SCBA shall be an open circuit, positive pressure, compressed air approved by **NIOSH/ MSHA** and designed for non-firefighting applications. Designed to provide respiratory protection for hazardous environments, including those deemed Immediately Dangerous to Life and Health (IDLH).
- B. It must include; compact demand valve (CDV) with minimum 500 liters per minute of capacity, pressure reducer, full face mask, 4 points harness, low pressure alarm, Aluminum Cylinder, rated at 2,216 psi with a service life of 30 minutes and Yellow Storage Wall Case made of plastic. Reference model ISI Frontier Industrial or approved equal.

2.11. SUIT

- A. For being used with the SCBA, level A, Large Size, yellow, made of Tychem ® TK or approved equal, mask with three layers (PVC 40 mil /Teflon 5 mil/ PVC 20 mil), external gloves made of butyl, back space for the SCBA, front enter, tight zipper, knees pads, double exhausting valves and internal tight belt ASTM F1052 approved. TK554T style or its equivalent

2.12. FULLFACE MASK

- A. The mask will be design for removing the gas chlorine, with full rubber silicon cover, one only cartridge located at chin, NIOSH approved, light weight, for environments with more than 19.5% oxygen concentration, includes storage and carry case. Size L and rubber harness. Reference model MSA 3100/ cartridge 10059903 or approved equal.

2.13. EMERGENCY SHOWER

- A. The emergency shower shall be a combination Drench Shower/Eyewash Unit capable to fit easily into any work environment. Shower valve shall operate quickly by a pull rod with a triangular handle. Shower shall provide a superior washdown with a more even spray pattern. Eyewash shall be operated by a large, highly visible push handle. The unit must assure safe, steady water flow under varying water supply conditions from 30–90 PSI. NOTE: The ANSI Z358.1 standard requires an uninterruptible supply of flushing fluid at a minimum 30 PSI flowing pressure.
- A. Shower Valve - Chrome-plated brass 1" NPT stay-open ball valve. Operated by a stainless steel rod with triangular handle.
- B. Eye Wash Bowl - 10" (254mm) diameter yellow impact-resistant plastic.
- C. Standard Sprayhead Assembly - Chrome-plated brass sprayhead with twin soft-flow eyewash heads and protective sprayhead covers. Safe, steady water flow under varying water supply conditions from 30–90 PSI is assured by integral flow control in the sprayhead assembly.
- D. Eyewash Valve - Chrome-plated brass ½" NPT stay-open ball valve. Hand operated by highly visible safety yellow PVC push handle. Pipe and Fittings - ¼" galvanized steel with BradTect® safety yellow coating.
- E. Water Supply = 1¼" NPT.

2.14. WARNING SIGNALS

- A. The proposal must include a warning bilingual signals (Spanish and English) set made of plastic or fiberglass according with the standard 29 CFR 1910.145. The set consists in three warning signals of 10" width – 14"height with the following legends:
1. Danger Bilingual Sign, "Chlorine" and "Cloro", 14"H x 10"W
 2. Caution Bilingual Sign, "Chemical Storage Area" and "Almacenamiento de Químicos", 10"H x 14" W.
 3. Notice Bilingual Sign, "Authorized Personnel Only" and "Solo Personal Autorizado", 7" H x 10"W.
 4. Emergency Bilingual Sign, "Eye Wash Station" and "Estación de Lavado de Ojos", 7"H x 10"W.

PART 2 WARRANTY

All the parts and components of the system must be covered by a warranty of two years or more except the Vacuum Regulators, Auto Valve, Switchover and ejector which warranty is described below.

A. Standard Warranty

Three (3) Year Standard Warranty on all the components and parts:

- i. Vacuum Regulators
- ii. Auto Valve
- iii. Switchover
- iv. Ejector

B. Lifetime Warranty

- i. Vacuum Regulators
- ii. Remote Meter/Feed Rate Control Panels
- iii. Ejectors
- iv. Switchover Modules
- v. Complete Check Valve Assemblies

END OF SECTION

SECTION 46 33 43 METERING PUMPS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Contractor shall provide all labor, materials, services, equipment and incidentals required to furnish, install, test and place in satisfactory operation, hydraulically balanced diaphragm metering pumps as shown and as specified herein. All pumps in this Section shall be supplied by a single manufacturer. This Section includes, but is not limited to the following:
 - a. Caustic Soda Metering Pumps.
 - b. Alum Metering Pump
- B. Coordination:
 - 1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before the metering pumps and appurtenances Work.
- C. Related Sections:
 - 1. Section 09 91 00, Painting.
 - 2. Division 13, Applicable Sections on Instrumentation and Controls
 - 3. Division 26, Electrical.

1.2 REFERENCES

- A. Standards referenced in this Section are listed below:
 - 1. American Bearing Manufacturers Association, (ABMA).
 - 2. American Gear Manufacturers' Association, (AGMA).
 - 3. American National Standards Institute, (ANSI).
 - 4. American Petroleum Institute, (API).
 - a. API 675, Positive Displacement Pumps Controlled Volume.
 - 5. American Society for Testing and Materials, (ASTM).
 - 6. American Water Works Association, (AWWA).
 - 7. Hydraulics Institute, (HI).
 - 8. Institute of Electrical and Electronics Engineers, (IEEE).
 - 9. National Electrical Code, (NEC).
 - 10. National Electrical Manufacturers' Association, (NEMA).
 - 11. National Sanitation Foundation, (NSF).

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer shall have a minimum of five years experience producing substantially similar equipment and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
- B. Component Supply and Compatibility:
 - 1. Obtain all equipment included in this Section regardless of the component manufacturer

- from a single metering pumps and appurtenances manufacturer.
2. The metering pumps and appurtenances equipment manufacturer to review and approve or to prepare all Shop Drawings and other submittals for all components furnished under this Section.
 3. All components shall be specifically constructed for the specified service conditions and shall be integrated into the overall assembly by the metering pumps and appurtenances equipment manufacturer.

1.4 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 1. Complete layout and installation drawings for each feed pump showing mounting details, dimensions, fitting locations, paint certification, materials of construction, including manufacturer's literature, catalog cuts and specifications for feed pumps and accessories, showing performance data, turndown and capacity.
 2. Shop Drawings Showing: Fabrication, assembly, installation and wiring diagrams.
 3. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorage devices.
 4. Drawings of control panels shall be furnished in accordance with the requirements of Division 13.
- B. Operation and Maintenance Manuals:
 1. Submit complete installation, Operation and Maintenance Manuals, including, test reports, maintenance data and schedules, description of operation, and spare parts information.
 2. Furnish Operation and Maintenance Manuals in conformance with the requirements of Section 017800, Operation and Maintenance Manual.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 1. Deliver materials to the Site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices which are to be embedded in cast-in-place concrete in ample time to prevent delay of that Work.
- B. Storage and Protection:
 1. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- C. Acceptance at Site:
 1. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the Site. CONTRACTOR shall notify ENGINEER, in writing, if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition in accordance with manufacturer's instructions.

1.6 GUARANTEE AND WARRANTY

- A. Guarantee: In addition to the manufacturer's standard guarantee, CONTRACTOR shall include the services of a factory-trained serviceman to provide repair service for the equipment for the period of one year commencing with substantial completion of the project. This service shall include the cost of all replacement parts required during the interval.

- B. **Warranty:** The equipment shall also be warranted by the manufacturer for a two-year period commencing with substantial completion of the project. Wear items may be prorated during the two-year period.

PART 2 - PRODUCTS

2.1 EQUIPMENT PERFORMANCE

- A. **General:**
1. All wetted surfaces of the feed pumps and all sealing gaskets shall be suitable for continuous exposure to Caustic Soda, Primary Coagulant and Secondary Coagulant.
 2. All wetted surfaces shall be of materials suitable for contact with potable water and shall not leach out any organic or inorganic constituent that is not permitted by local or federal regulations.

- B. **Design Criteria:**

Design Conditions	PU-07-402 and PU-07-403	PU-07-400 and PU-07-401
Service (Chemical):	Alum	Sodium Hydroxide
Location:	Chemical Area	Chemical Area
Number of Pump / skid:	2	2
Number of Skids	1	1
Feed Rate, (gph):	4.3– 6.4 gph	0.5 – 1.1 gph
Design Head, (psi):	100 psig max.	100 psig max.
Pump Head Material:	Polypropilene	Polypropilene
Speed Control:	Auto/Manual	Auto/Manual
Stroke Adjustment:	0-100%	0-100%
Input Voltage:	120-208	120-208

2.2 MANUFACTURERS

- A. **Manufacturers:** Provide equipment of one of the following:
1. Grundfos.
 2. Prominent.
 3. Milton Roy
 4. Jesco
 5. Or approved equal.

2.3 DETAILS OF CONSTRUCTION

- A. Pumps shall be hydraulically balanced diaphragm type, where a measuring piston reciprocates within a cylinder and causes hydraulic oil to deflect a flat diaphragm. The flat diaphragm in turn should deflect a tubular process diaphragm through an intermediate fluid

completely isolated from the primary hydraulic oil. The flat primary diaphragm shall operate within restricting dish cavities to prevent excessive stretching and stress to the diaphragm material. The tubular diaphragm shall provide a straight-through internal flow path of the process fluid with no restriction other than the valve system. The hydraulic oil system shall include a means to automatically relieve excess hydraulic pressure and make up oil and bleed off vapors. They shall be specially designed, constructed and installed for the service intended and shall comply with the conditions as shown on the Feed Pump Schedule, above.

B. Pump Construction:

1. Pumps shall be provided with the following:
 - a. External 0 to 100 percent calibrated stroke scheduled for each pumping head.
 - b. SCR controlled variable speed motors.
 - c. Check Valves: Single or double check for suction and discharge ports. Valves shall be either ball type, poppet type or spring loaded valves as required and suitable for the service, capacity, viscosity and pressure.
 - d. Internal pressure relief valve set at factory for 200 psig on oil system, or as recommended by the manufacturer.
 - e. Vacuum compensating valve, if required.
 - f. Positive venting of hydraulic fluid.
2. Gears and bearings shall be oil lubricated.
3. Wetted parts shall be constructed of the following materials:
 - a. Diaphragm: PTFE.
 - b. Pump Head: Polypropylene.
 - c. Valve Body: PVC.
4. Stroke Adjustment:
 - a. Manual micrometer dial type 0 to 100 percent, digital scale indication for manual stroke adjustment of the pumps.
 - b. Maximum stroke rate for all feed pumps shall not exceed 180 strokes per minute (spm).
5. Pump motor shall be mounted on a common steel base or cast floor stand. Each pump and motor shall have stainless steel nameplate with raised letters providing the manufacturer's model, serial number, rating, range, speed and other pertinent data.
6. Pump Accessories:
 - a. Each feed pump pumping head shall be equipped with a device to indicate a pump diaphragm malfunction. Acceptable means to detect a diaphragm malfunction shall include either a positive pressure-actuated hermetically sealed switch or a conductivity probe to measure any change in conductivity of the intermediate fluid as a result of a diaphragm rupture. Relays and amplifiers for each feed pump shall be located in the control panel.
 - b. Diaphragm malfunction device(s) for each pump shall provide circuitry within the feed pump control panel to indicate an alarm at the Operator Workstation, remotely located.
 - c. Pump shall include discharge flow measuring capabilities.

C. Motors:

1. Motors for each feed pump shall be of the permanent magnet type rated for continuous duty DC, and shall have a base speed of 1,750 rpm. Motors shall be totally enclosed, suitable for chemical duty, and shall operate without excessive heating at ten percent base speed. Controllable speed range shall be over a minimum 10:1 range. Motors shall have winding insulation suitable for operation in ambient temperatures of 10 to 50°C. Motors shall be furnished with either a Standard NEMA C face or be foot mounted for installation on the pump base. Motors shall have prelubricated shielded ball bearings and top or side mounted oversized, gasketed conduit box.
2. Each DC motor shall be furnished with epoxy treated armature and a temperature sensing thermostat with automatic reset.

3. Each DC motor shall be equipped with a tachometer generator suitable for use in providing a feedback signal for SCR controllers. Feedback signal shall provide speed regulation of ± 1 percent.

2.4 CALIBRATION COLUMNS

- A. Features:
 1. Construction: Transparent, clear tube with base and top heads and acrylic scales. Construction material to be determined by the CONTRACTOR.
 2. All calibration columns shall be calibrated in millimeters.
 3. Each calibration column shall be equipped with a 1-inch ball type isolation valve with a screwed end. Valve material to be determined by the CONTRACTOR.
 4. Volume of calibration columns shall be 2000 mL.
 5. Columns shall have tops with drain pipes that lead to an approved location, as shown.
- B. Schedule:
 1. Chemical: Coagulant / Polymer
 2. Number of Units: 2
 3. Nominal Capacity: 2000 mL
 4. Connection: PVC
- C. Products and Manufacturers: Provide one of the following:
 1. Milton Roy.
 2. Koflo.
 3. Grundfos.
 4. Or approved equal.

2.5 PRESSURE RELIEF VALVES

- A. General: Each pump shall be equipped with an external diaphragm type pressure relief valve to protect piping systems from over-pressures.
- B. Materials of Construction:
 1. Valve Body: PVC.
 2. Seals: EPDM.
 3. Diaphragm: Stainless Steel.
- C. Features:
 1. Valves shall be factory set, as recommended by metering pump manufacturer.
 2. Valve pressure setting shall be field adjustable without disconnecting the valve from the line.
 3. Size: As shown.
 4. Capacity at Set Pressure: Equal to or greater than pumping head capacity.
- D. Manufacturers: Provide products of one of the following:
 1. Prominent.
 2. Or approved equal.

2.6 BACKPRESSURE REGULATOR VALVES

- A. General: Each feed pump shall include an external backpressure valve, as shown. The backpressure valve shall prevent backflow or siphoning of chemicals and provide sufficient backpressure to accurately operate the pumps.
- B. Materials of Construction:

1. Valve Body: PVC.
 2. Diaphragm: Stainless Steel.
- C. Features:
1. Valve pressure setting shall be factory set and field adjustable without disconnecting the valve from the line.
 2. Size: As shown.
 3. Capacity: Equal to or greater than pumping head capacity at set pressure.
- D. Manufacturers: Provide equipment of one of the following:
1. Milton Roy
 2. Prominent.
 3. Or approved equal.

2.7 PUMP CONTROL PANEL

- A. General:
1. Furnish a common control panel for all pumps
 2. Panel construction shall be NEMA 4X and shall conform to the requirements of DIVISION 26.
 3. Factory test control panel prior to shipment.
 4. Furnish a 120 volt, 3 phase, 60 Hz power feeder to the control panel. Include a main disconnect, transformer(s), and circuit breaker load center for all 120 volt panel power requirements.
 5. The feed pump control panel shall be constructed as shown and as specified herein and in DIVISION 26. Panel logic and power distribution shall comply with the general intent of the ladder logic and electrical layout as shown. Panel elevations shall be as shown. The feed pump control panel shall provide local pump speed control via a manual speed adjusting potentiometer.
 6. The feed pump control panel shall be constructed with speed controllers of open-chassis design which shall be mounted in the panel. All pilot devices for status and control, as shown and as specified in DIVISION 26, shall be mounted on the hinged front doors of the control panel. The nameplate legend for the pilot devices shall be as shown and as specified in DIVISION 26.
- B. SCR Speed Controllers:
1. Each feed pump shall be furnished with a non-reversing SCR speed controller for purposes of varying the pump speed, which in turn shall vary the output capacity of the pump.
 2. Each SCR controller shall accept the DC input power specified in the Feed Pump Schedule. A 120/240V, 60 Hz, single phase panelboard shall include individual circuit breakers for each pump motor and shall provide voltage for the ancillary pilot devices and control devices.
 - a. Suitably sized and number of circuit breakers for all branch circuits within enclosure.
 - b. Each SCR speed controller shall have adjustments for maximum and minimum speed, IR drop (load) compensation, torque control and torque slope control (current limit).
 - c. Each SCR speed controller shall be furnished with a tachometer/armature switch. Tachometer generator mounted on the DC motor shall be wired to the SCR speed controller for feedback purposes. Tachometer feedback signal shall provide for one percent speed regulation with 96 percent load change.
 - d. SCR speed controllers shall provide a minimum of 10:1 speed range.
 - e. Speed shall be controlled locally via a manual speed adjusting potentiometer or remotely. In "REMOTE" mode, speed will be controlled from the Distributed

Control System via a 4 to 20 mADC input signal. The setting of selector switches at the Feed Pump Control Panel shall determine the point of speed control.

- f. The Feed Pump Control Panel shall be equipped with speed indicating meters. Meters shall receive signals from its respective chemical metering pumps DC drive tachometer generators. Speed indicating meters shall be as specified in Division 13 and Division 16.
 - g. Manufacturers: Provide DC Motors and SCR Speed Controllers of one of the following:
 - 1) Reliance Electric, Inc.
 - 2) Or equal.
- C. Panel Accessories:
- 1. Provide two spare fuses for each SCR chassis.
 - 2. Furnish two spare SCR units to match those installed.

2.8 TOOLS, SPARE PARTS AND MAINTENANCE MATERIALS

- A. Pumps shall be furnished with one set spare parts for each size of the following additional materials:
 - 1. One spare diaphragm.
 - 2. Complete set of gaskets for all gasketed covers and connections.
 - 3. Two complete sets of special tools required for normal maintenance or operation.
 - 4. One quarter of touch-up paint.
- B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project.

2.9 SURFACE PREPARATION AND PAINTING

- A. Pumps, motors, drives, frames, baseplates, appurtenances, etc., shall receive shop primer coating conforming to the requirements of Section 09 91 00, Painting.
- B. Surface preparation and painting shall conform to the requirements of Section 09 91 00, Painting.
- C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.
- D. CONTRACTOR shall certify, in writing, that the shop primer and finish coating system conform to the requirements of Section 09 91 00, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall verify that structures, pipes and equipment are compatible.
- B. Make adjustments required to place system in proper operating condition.

3.2 INSTALLATION

- A. Manufacturer's representative shall check and approve the installation prior to operation. Manufacturer's representative shall field test and calibrate the equipment to assure that the system operates to the OWNER'S satisfaction.

3.3 FIELD QUALITY CONTROL

- A. All equipment will be given running tests by CONTRACTOR at the job Site following installation of the equipment and controls. Should the tests indicate any malfunction, CONTRACTOR shall make any necessary repairs and adjustments. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete, and the equipment is functioning properly and accurately, and is ready for permanent operation.
- B. A factory trained representative shall be provided for installation supervision, start-up and test services. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the equipment conforms to the requirements. Representative shall revisit the Site as often as necessary until all trouble is corrected and the installation is entirely satisfactory. Refer to Section, 01 75 17 for Facility start-up.
- C. All costs, including travel, lodging, meals and incidentals, for additional visits shall be at no additional cost to the OWNER.

3.4 SUPPLEMENTS

- a. None.

END OF SECTION

SECTION 46 41 11 RAPID MIXER

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gear Manufacturers Association (AGMA):
 - a. Standard Practice 420.04.
2. National Electrical Manufacturer's Association (NEMA):
 - a. MG 1, Motors and Generators.

1.2 WORK INCLUDED

A. This section covers the work necessary for furnishing and installing, complete, the mixer specified herein.

1.3 DESIGN REQUIREMENTS

A. The mixer shall be capable of rapid mix primary coagulants with the influent stream providing velocity gradients between 800 s^{-1} and $1,000 \text{ s}^{-1}$ as per construction drawings.

1.4 DESCRIPTION OF THE WORK

- A. Like items of equipment provided hereunder shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.
- B. See Conditions of the Contract and Division 1, which contain information and requirements that apply to the work specified herein and are mandatory for this project.
- C. The CONTRACTOR shall furnish one rapid mixer in one the tank as shown and specified in project drawings. Mixer unit shall be approved according to UL standards.
- D. Mixers shall be manufactured according to ISO 900 regulations.
- E. All parts shall be designed and proportioned for ample strength, stability, and stiffness for their intended purposes.
- F. Mixers shall be designed for continuous-duty operation capable to rapid mix primary coagulants and pH stabilization chemicals in the rapid mixing chamber over a short period of time.
- G. Mixer installation appurtenances shall permit safe and easy handling of the mixer.
- H. Mixer selection shall be based on the manufacturer's recommendation, to provide the best possible, most economical performance and mechanical solutions that meet or exceed specified application data.

- I. Operator shall be able to locally control the mixer velocity.

1.5 SUBMITTALS

- A. Submittals shall be made in accordance with Division 1. In addition, the following specific information shall be provided:
 - 1. Drawings showing complete dimensional data.
 - 2. Complete literature on the mechanical mixers.
 - 3. Substantiation of motor horsepower selection.
 - 4. Exceptions to these Specifications.
 - 5. Curves indicating line current, input power, mixing capacity in terms of velocity gradients as a function of rated speed for motor under rated load.
- B. All information shall be furnished in duplicate.

PART 2 PRODUCTS

2.1 GENERAL

- A. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.
- B. Mixers shall be furnished complete with speed reducer locally controlled, electric motor drive connected through a fully-enclosed flexible coupling, baseplate, agitator shaft, and impellers.

2.2 MIXER DESCRIPTION

- A. Brawn Top Entry Mixer Model 4BTO7.5-140. 1750rpm/230/460v 60Hz / 3ph/ TEFC with 316SS wetted parts, as manufactured by Brawn Mixer or approved equal.

2.3 OPERATING CONDITIONS FOR THE RAPID MIXER:

- A. Total Number of Mixers: 1
- B. Tank I.D.: TK-02-80
- C. No. of tanks: 1
- D. Mixing Zone Dimensions: 1.5m (W) x 1.5m (L) x 3.5 m (H)
- E. Minimum Velocity Gradient (G): 800 to 1,000

2.4 PERFORMANCE REQUIREMENTS:

- A. Homogenization +/- 10%.

2.5 ACCESSORIES

- A. Identification Plates: A 16-gauge stainless steel identification plate shall be securely mounted on the equipment in a readily visible location. The plate shall bear the 1/4-inch equipment die-stamped, engraved, or laser etched identification number.
- B. Lifting Lugs: Equipment weighing over 100 pounds shall be provided with lifting lugs.

2.6 ASSEMBLY AND DELIVERY

- A. Drive unit, including motor, shall be completely factory assembled, aligned, and securely crated for shipment. Accessory equipment which cannot be shipped assembled to the unit, such as shafts, baseplates, impellers, spare parts, and anchorage materials, shall be separately crated, clearly marked as to the contents, and shipped on the same shipment as the drives.
- B. Manufacturer shall coat, with a rust-preventative compound such as System No. 5, all exposed surfaces subject to rust, such as mounting flange faces, etc.

2.7 SPARE PARTS AND SPECIAL TOOLS

- A. According to manufacturer specification and recommendations.

PART 3 EXECUTION

3.1. EQUIPMENT INSTALLATION

- B. The Contractor shall locate and install the equipment specified herein in conformance with the manufacturer's suggested method.

3.2. PAINTING

- C. Unless special painting is required by the Detail Specifications, equipment and accessories shall be shop prepared and primed. The Contractor shall field topcoat in accordance with Section 09 90 01, System Nos. 4 and 2 for exposed and submerged surfaces, respectively.

3.3. FACTORY TESTS

- A. The mixer manufacturer shall perform the following inspections and tests on each mixer before shipment:
 - 1. An insulation test of the windings,
 - 2. A balancing of the motor (rotor),
 - 3. A test of the mixer motor to verify electrical data measurements. All electrical data shall be registered as part of documentation,
 - 4. A motor and cable insulation test for moisture content and insulation defects,
 - 5. Run mixer test to verify correct rotation and mechanical integrity. The entire unit is checked for vibrations,
 - 6. A final inspection of propeller, motor rating, and electrical connections for compliance with purchase order.

3.4. FIELD TEST

- D. Prior to acceptance of each mixer, the Contractor shall inspect all equipment for proper alignment, quiet operation, proper connection, and satisfactory performance while mixing the liquid specified in the Detail Specifications.
- E. Where specified in the Detail Specifications, the Contractor shall conduct detailed performance test.

3.5. PREPARATION

- A. Field measurements:
 - 1. Field-verify all dimensions affecting installation.
 - 2. Layout all work prior to installation.
- B. Protection:
 - 1. Protect adjacent surfaces, piping and other items.

3.6. INSTALLATION

- A. Approval for installation or incorporation in this project will be made only after submittal of shop drawings, or other data as specified herein.

3.7. FIELD SERVICE

- A. Start-up: Following completion of the installation the Mixer Manufacturer shall provide a qualified representative to verify proper installation and assist in mixer start-up.
- B. Mixer Manufacturer shall provide qualified training and maintenance instruction to the Owner's maintenance personnel.
- C. Manufacturer's Representative: Present at site or classroom designated by OWNER, for minimum person-days listed below, travel time excluded:
 - 1. [1] person-days for installation assistance and inspection.
 - 2. [1] person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - 3. [½] person-days for prestartup classroom or site training.
 - 4. [½] person-days for facility startup.
 - 5. [½] person-days for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by OWNER and/or ENGINEER.

3.8. CERTIFICATE OF PROPER INSTALLATION

- A. Manufacturer shall provide a Certificate of Proper Installation, Refer to Section 01 43 33 Manufacturers' Services.

3.9. WARRANTY

- A. Equipment shall be guaranteed to be free from defects in material for a period of 1 year from date of Substantial Completion by Owner.

END OF SECTION

SECTION 46 41 80 FIBERGLASS REINFORCED PLASTIC BAFFLES AND WEIRS

PART 1 – GENERAL

1.1 SCOPE

- A. This specification shall govern all work necessary to furnish fiberglass baffle walls including all anchorage hardware required for proper installation of the system components, Launderers and required anchorage, and fiberglass weir plates, scum baffles, mounting brackets, lap plates and cover washers. Fabrication shall be in strict compliance with the American Water Works Association procedures set forth in standard ANSI/AWWA F102-96.
- B. The contractor will furnish and install baffle walls as specified below and as per construction drawings. The work to be done includes labor, materials, equipment, and services required for the construction of proposed baffle walls and all other items necessary, including columns, for the construction of the baffle wall. Contractor shall coordinate required access to locate all required materials for the installation of the baffle walls inside the clear well.
- C. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install fiberglass-reinforced plastic (FRP) launders and troughs, and appurtenances complete and operational as shown and specified. All anchor bolts, fasteners and accessories shall be included. Standard design calculations for both round and flat bottom trough configurations shall incorporate load evaluations, displacement, and stress calculations. Calculations will comply with the American Water Works Association procedures set forth in specification ANSI/AWWA F101-96. Furthermore, this standard includes additional requirements for enhanced performance and lifetime over and above AWWA spec F101-96.
- D. The contractor shall furnish and install fiberglass weir plates, scum baffle plates, and scum baffle supports as shown on the plans. Included shall be necessary butt and splice plates at each weir and baffle plate joint to prevent short circuiting. Necessary fiberglass washers and stainless-steel mounting hardware shall also be included. All hardware shall be type 316 stainless steel unless otherwise specified by the engineers.

1.2 DESIGN CRITERIA

- A. Baffle Walls shall be designed to sustain the following load combinations in accordance with ANSI/ASCE 7-10:
 - 1. Panel Loading: The panels shall be designed to support the following loading:
 - i. Lateral load: Panels shall be designed to withstand 4 to 6 inches differential head of water between both sides of the panel with a minimum safety factor of 2.5:1 and an L/D ratio of ≥ 100 . Certified calculations must be submitted for review and approval prior to manufacture of the baffle walls.
 - ii. Vertical Load: The panels shall be designed to carry up to 50 pounds per foot load along the length of the baffle with a safety factor of 2.5:1 and an L/D ratio of ≥ 100 . The baffles shall not bow, crush, or deflect to a point that causes permanent deformation or failure. Stiffener plates may be installed to increase strength as required.
 - iii. Wind Loading – The baffle system shall be designed to withstand a wind load that is area specific per ANSI/ASCE 7-10 and have a minimum safety factor of 2.5:1 and an L/D ratio

≥ 100 for the baffle panels.

2. Column loading: Columns shall be designed to support all the loading transferred to it by the baffle assembly within allowable stress and deflection limitations. The column shall have a minimum L/D ratio of 180.
- B. Troughs and Launderers shall be fabricated using a general-purpose polyester resin with 24-oz. woven roving inter-layered with glass mat reinforcement. The interior of the trough shall be smooth, while the exterior of the trough is finished with one ply of surfacing mat to give a smooth and uniform appearance.
- C. Drawings are to be taken as standard for troughs. Thicknesses of layers shall be as specified for each combination of diameter, depth, and span as determined by computerized calculations using classical lamination theory. Factors of safety shall be reported for all critical areas.
- D. **Troughs and Launderers Loadings:** The troughs shall be designed to supply, within stress and deflection limitations, the following loadings.
 1. Gravity Load - Downward vertical loads shall include the weight of the trough and appurtenant attachments, such as weir plates and the spreader bars, together with the weight of water to fill the trough. Any additional loads, such as piping, and so forth, shall also be considered.
 2. Buoyant Load - Upward vertical loads shall include the weight of the displaced water (trough weight neglected). The line of action passes through the centroid of the submerged cross-sectional area.
 3. Lateral Load - Loads acting against the trough sidewalls by differential water levels on either side of the trough walls. The maximum possible differential, existing when the trough is empty, and the tank is full, or, when the trough is full, and the tank is empty, shall be used when calculating deflection, fiber stress, etc.
- E. **Troughs and Launderers Thermal Stresses** - The troughs shall be designed to accommodate temperature induced stresses resulting from differences in coefficients of thermal expansion and contraction between the trough and tank material or support members.
- F. **Troughs and Launderers Torsional Stability** - The trough system shall be designed to resist torsional oscillations induced by the flow of water over trough edges. Any or all of the following trough stabilization techniques shall be considered:
 1. Trough-to-Trough Stabilization
 2. Torsional Stiffeners
 3. Support Spacing and/or Shell Stiffening Methods
 4. Internal Baffles and/or Flow straighteners
- G. **Troughs and Launderers Deflections Under Load:**
 1. Maximum vertical deflection under full buoyant or gravity load shall be less than or equal to $L/1000$, where L is defined as the unsupported trough length in inches. Under no circumstances shall the maximum vertical deflection, measured at the midpoint between trough supports, exceed 3/16 inch.
 2. Maximum trough sidewall horizontal deflection under full lateral load shall be less than or equal to $D/100$, where D is defined as the trough depth, in inches. Under no circumstances shall the maximum sidewall deflection exceed 3/16 inch.
 3. Trough bottom deflection under full buoyant or gravity load shall be less than or equal to $W/100$, where W is defined as the trough width in inches. Under no circumstances shall

the maximum bottom deflection exceed 3/16 inch.

- H. **Troughs and Launderers Fiber Stress Limitations** - Supplemental to the deflection criteria established in the previous section 1.2.G, the troughs shall be designed such that the maximum wall stress under the most severe loading condition is less than or equal to 1500 psi. This stress criterion is approximately equivalent to an 8:1 factor of safety as applied to the tensile and flexural properties of contact-molded troughs and launderers.
- I. **Troughs and Launderers Thermal Expansion/Contraction** - The troughs shall be designed to accommodate thermally induced expansion and contraction of 1/8 inch per 20 foot length of trough over a temperature range of -100F to 1000F, without exceeding the deflection or strain limitations set forth in Sections 1.2.G and 1.2.H Governing Criteria.
- J. **Troughs and Launderers Additional Requirements** - The following presents additional design requirements that should be incorporated over and above the AWWA standard to yield a trough design with enhanced performance and endurance characteristics.
1. **Buckling of Cross Braces** - In addition to AWWA F101-96, the design should include critical buckling load calculations for the trough cross braces or spreaders. This calculation is required to ensure that the cross braces do not approach the critical Euler column buckling load when the trough is empty, and the tank is being filled, thereby placing the braces in compression.
 2. **Blind End Stress** - The blind or closed end of the trough is anchored to the wall with 3/8-inch-thick FRP spacer washers to allow for thermal expansion along the length of the trough. Using the thermal excursion as specified in AWWA F101-96, maximum thermal displacements will be calculated and applied to the mounting area on the blind end to determine plate bending stresses. The plate thickness will then be calculated so that stresses do not exceed the level set forth in the AWWA spec.
 3. The inner surface of the trough shall be smooth and resin-rich, reinforced with a surfacing veil as described in Section 2.8.
 4. Each ply of reinforcement shall be thoroughly wetted with resin and rolled out to exclude all air pockets and bubbles prior to the application of the next ply.
 5. The exterior or outer surface shall consist of a layer of paraffinated resin not less than 0.020-inch-thick to prevent air inhibition. This layer is applied after the cure of the structural layer to embed all reinforcing fibers.
 6. When it is necessary to cut the laminate, drill holes, and/or machine slots, all cut edges shall be sanded smooth and sealed with paraffinated resin solution to prevent water from penetrating or wicking into the laminate.
 7. The top edges of the trough shall be level and parallel within a tolerance of +/- 1/8 inch as measured when the trough is not loaded. The length of a trough section shall have a tolerance of +/-1/8 inch per 10-foot length.
 8. Laminate thickness shall be in accordance with the design requirements set forth in this Section, but not less than 3/16 inch. The thickness tolerance shall be plus 1/16 inch, minus 0 inch.
 9. Thickness at locations of supports such as saddles shall be a least 1-1/2 times the nominal thickness of the trough and shall conform to the fiber stress limitations set forth in Section 1.2.H.
 10. End flanges and blind ends shall be a minimum of 1-1/2 times the nominal thickness of the trough and shall conform to the fiber stress limitations set forth in Section 1.2.H.
 11. An integrally molded water stop shall be provided on the trough wherever the trough is grouted into and/or passes through a wall.
 12. Cross braces or spreaders shall be bolted between the trough walls on approximate 3

foot centers to enhance the structural rigidity of the trough system.

K. Weirs and Baffle Plates Dimensions

1. Weir plates shall be a nominal 1/4-inch-thick and shall have 90-degree V-notches, rectangular notches, or shall be flat crested (straight edge). For 2-inch-deep V-notches, the weir plate shall be 9 inches wide. For 3-inch-deep V-notches, the weir plate shall be 10 inches wide. Flat crested weir plates shall be straight, varying not more than +/- 1/32 inch in 12 feet of length. Other sizes may be produced with agreement between the Engineer and manufacturer.
2. Weir plates shall be provided with 2-5/8-inch diameter holes (or slots) for mounting hardware. For curved walls, these holes shall be located a maximum of 24 inches on center. For straight walls, holes shall be located a maximum of 12 inches on center. The holes shall provide a minimum of two inches vertical and horizontal adjustment. Weir plate slots for mounting to troughs shall be 1/16 inch wider than the bolts and shall provide for a minimum adjustment of ±1 inch after allowing for the diameter of the attachment bolt.
3. Weir plates shall be secured to the walls by anchor bolts and 5-inch diameter fiberglass washers over holes in weir to prevent short circuiting. The ends of the weir plates shall be covered by 6-inch-wide butt plates, arranged to allow for horizontal expansion.
4. Scum baffle plates shall be a nominal 1/4-inch-thick by 12 inches wide. Mounting holes shall be counter-sunk to a depth that allows the flat head bolts to be flush or below the surface. Spacing of holes for mounting brackets shall be a maximum of 48 inches for curved walls, and a maximum of 24 inches for straight walls.
5. Scum baffle mounting brackets shall have a width of not less than 3 inches, a base length of not less than 6 inches, and a depth of not less than 6 inches. Brackets shall be fabricated from fiberglass-reinforced material with a nominal thickness of 1/4 inch.
6. All weir plates and baffle plates shall be of standard length not to exceed 12 feet with closure plates made to length at the factory. Final laminate thickness shall be +/- 10% of the nominal specified thickness.

- L. Weirs and Baffle Plates Finish and Appearance** - All weir plates and baffle plates shall have uniform, smooth, resin rich surfaces and shall be free of voids and porosity, without dry spots, crazes or un-reinforced areas. All plates shall have a glass content of 30%, +/- 2%.

PART 2 – MATERIALS

- A. All materials shall be new and shall be specifically designed or selected for the function and service specified and shall be NSF 61 approved. No material may be used in the project that has not been approved by the engineer.

2.1 CLEARWELL BAFFLE PANEL REQUIREMENTS

- A. Corrugated baffle panels are 23-1/2 inches high by 3 inches wide with a 3/16" laminate thickness.

2.2 CLEARWELL BAFFLE PANEL RESIN REQUIREMENTS

- A. Resin shall be as required for the use intended. Panels shall be NSF 61 approved.
B. Color shall be olive-green.

2.3 CLEARWELL BAFFLE PANEL HARDWARE

A. All fasteners shall be 316 SS and NSF 61 approved.

2.4 CLEARWELL BAFFLE PANEL ULTRAVIOLET RESISTANCE

A. Ultraviolet protection is required through a stabilizer in the resin system and a polyester veil on the exterior surface of the part.

2.5 CLEARWELL BAFFLE PANEL LAMINATE MINIMUM PHYSICAL PROPERTIES

A. Baffle panels shall be produced from continuous pultrusion process. Minimum physical properties for the product shall conform to those presented in Table 1:

Table 1 Laminate Minimum Physical Properties – Pultruded Baffle Panel

Property @ 70°F	Value	Test Method
Tensile Strength, psi	42,000	ASTM D638
Flexural Strength, psi	32,000	ASTM D790
Flexural Modulus, psi	1.5 x 10 ⁶	ASTM D790
Water Absorption	0.25%	ASTM D570
Izod Impact, ft-lbs/in	25	ASTM D256
Compressive Strength, psi	50,000	ASTM D695
Modulus of Elasticity	2.5 x 10 ⁶	ASTM D 696
Coefficient of Linear Thermal Expansion, in/in/°F	4.4 x 10 ⁻⁶	

2.6 TROUGHS AND LAUNDERS RESIN REQUIREMENTS

- A. The resin shall be a commercial-grade polyester thermosetting resin which has been determined to be acceptable for the service conditions. The resin shall contain no fillers or additives except as follows:
- A thixotropic agent may be added for viscosity control.
 - Pigments shall be light stable, not soluble in water, and compatible with the resin.
 - Typical color shall be blue-green.

2.7 TROUGHS AND LAUNDERS ULTRAVIOLET RESISTANCE

- A. Ultraviolet stabilizers are required in all laminates exposed to ultraviolet light whether it be in the form of pigmentation or ultraviolet absorbers.

2.8 TROUGHS AND LAUNDERS GLASS REINFORCEMENT

- A. The reinforcing materials used shall be 24/15 oz woven roving mat combination Type E glass with a chrome or silane finish, and a binder compatible with the resin. Surfacing veil shall be Type C veil with a binder containing silane and compatible with the lay-up resin.

2.9 TROUGHS AND LAUNDERS FASTENERS

- A. All trough mounting brackets and hardware shall be NSF Std 61 approved and type 316 stainless steel and shall be supplied by the trough manufacturer.

2.10 TROUGHS AND LAUNDERS METAL REINFORCEMENT

- A. When metal reinforcements are used, they shall be free of rust, oil, and any foreign matter. They shall be completely encapsulated with a minimum of 1/8 inch thick laminate.

2.11 TROUGHS AND LAUNDERS COMPOSITE REINFORCEMENT

- A. When composite sandwich structures are used as reinforcements, liquid resistant materials such as end-grain balsa wood or structural PVC core may only be used as core materials.

2.12 TROUGHS AND LAUNDERS LAMINATE MINIMUM PHYSICAL PROPERTIES

- A. Minimum physical properties for the product shall conform to those presented in Table 2.

Table 2 Laminate Minimum Physical Properties –Troughs FRP and Launderers FRP

Property @ 70°F	Value	Test Method
Tensile Strength Trough, psi	26,500	ASTM D 638
Tensile Strength Weir, psi	14,000	ASTM D 638
Compressive Strength Trough, psi	30,000	ASTM D 695
Compressive Modulus Trough, psi	2,500,000	ASTM D 695
Flexural Strength Trough, psi	39,400	ASTM D 790
Flexural Strength Weir, psi	25,000	ASTM D 790
Flexural Modulus Trough, psi	1,550,000	ASTM D 790
Barcol Hardness Trough	50	ASTM D 2583
Glass Content Trough	45%	ASTM D 2584
Water Absorption	0.09% Max	ASTM D 570
Coefficient of Linear Thermal Expansion (in/in/°F) - Molded	3.6×10^{-6}	ASTM D 696

2.13 WEIRS RESIN REQUIREMENTS

- A. The resin shall be a commercial-grade polyester thermosetting resin which has been determined to be acceptable for the service conditions. The resin shall contain no fillers or additives except as follows:
- A thixotropic agent may be added for viscosity control.
 - Pigments shall be light stable, not soluble in water, and compatible with the resin.

2.14 WEIRS GLASS REINFORCEMENT

- A. The reinforcing materials used shall be Type E glass mat, with chrome or silane finish and a styrene-soluble binder compatible with the resin. Surfacing veil shall be Type C veil, with styrene-soluble binder compatible with the resin.

2.15 WEIRS ULTRAVIOLET RESISTANCE

- A. Ultraviolet stabilizers are required in all laminates exposed to ultraviolet light whether it be in the form of pigmentation or ultraviolet absorbers.

2.16 WEIRS LAMINATE MINIMUM PHYSICAL PROPERTIES

- A. Minimum physical properties for the product shall conform to those presented in Table 3.

Table 3 Laminate Minimum Physical Properties – Weirs

Property @ 70°F	Value	Test Method
Tensile Strength, psi	14,000	ASTM D 638
Flexural Strength, psi	25,000	ASTM D 790
Flexural Modulus, psi	900,000	ASTM D 790
Barcol Hardness	35 Min	ASTM D 2583
Izod Notch Impact	13	ASTM D 256
Glass Content	30%	ASTM D 2584
Water Absorption	0.2% Max	ASTM D 570
Coefficient of Linear Thermal Expansion (in/in/°F) - Molded	3.6×10^{-6}	ASTM D 696

PART 3 – SUBMITTALS

- 3.1 Final approval for incorporation into the project will be made only after the review of shop drawings, specifications, and data as follows:

- a. Shop drawings complete with all dimensions, details of connecting piping, and the size and location of any required openings.
- b. Shop drawings shall complete with all details such as, but not limited to;
 - i. Connection details between baffles panels.
 - ii. Connection details between baffles
 - iii. Connection detail between baffles and columns.
 - iv. Support Details
 - v. Anchorage Details
- c. Specifications for all components.
- d. Details of the major fabricated components showing the arrangement of components and labeled with member sizes and materials of construction.
- e. Structural calculations for all components.
- f. Manufacturer's recommended procedures for jobsite storage of equipment, handling, and erection.

3.2 Design Calculations

- A. Classical or advanced numerical techniques should be used to determine optimum design for the specified operating conditions. As a standard, strength of materials approaches coupled with computerized classical lamination theory should be used to determine displacements, stresses, and factors of safety. Factors of safety for each lamina used in high stress areas will include values using the Tsai-Hill or equivalent approach to determine the minimum factor of safety for each ply.
- B. A written narrative that clearly states all the basic design assumptions and parameters that were used in the computerized calculations shall accompany the calculations. Approval by the engineer shall not relieve the manufacturer of responsibility for providing material and designs conforming to the intent of this specification.

- C. As part of the shop drawings for all components, the fabricator must supply all analyses pertinent to the composite design.
- D. A complete analysis of stresses and deflection due to differential pressure loading will be submitted.
- E. Engineering calculations must be signed and sealed by a registered professional engineer in Puerto Rico.

PART 4 - QUALITY ASSURANCE

4.1 QUALIFICATIONS

- A. Manufacturer shall have a minimum of five (5) years of history of successful installations of similar design. Past job list with customer contact information may be requested.

4.2 MANUFACTURER'S QUALITY CONTROL

- A. All fabrication shall be carefully inspected at the factory by inspectors who shall use whatever means necessary to assure the proper fit of all field connections and compliance with all material and fabrication requirements of the specifications.

4.3 WARRANTY

- A. Manufacturer shall warrant the Launderers, Weirs and Baffle Walls to be free of defects in materials and workmanship for a minimum of one (1) year after installation.
- B. Materials, equipment, and components in this section shall be as manufactured by Fiberglass Fabricators, Inc. or approved equal.

4.4 FIELD

- A. The contractor shall be responsible for verifying all field dimensions to develop and approve shop drawings.

4.5 MANUFACTURING PROCEDURES

- A. The matched-die molding process shall be used to produce fiberglass-reinforced plastic molded parts with smooth resin-rich surfaces and edges, dimensional accuracy, and consistency. Weir plate notches shall be molded within dies to ensure resin-rich edges and notches for increased corrosion and weather resistance. Weir plates and scum baffle plates produced from fabricated plate stock with cut edges and notches will not be acceptable. All cut edges shall be sanded and sealed with non-air-inhibited resin to ensure edges are completely sealed and to prevent water and chemicals from penetrating the laminate.

PART 5 - INSTALLATION, STORAGE, HANDLING, AND MAINTENANCE

- 5.1 The contractor shall follow instructions provided by the manufacturer for the installation, long-term storage, handling, and maintenance for the products provided.

END OF SECTION

SECTION 46 61 10 UNDERDRAIN REHABILITATION

PART 1 - GENERAL

1.1 GENERAL INFORMATION

- A. This section of the specifications covers all labor, materials and equipment required for the rehabilitation of the existing four (4) gravity filters at Roosevelt Roads. Each filter structure consists of a monolithic Wheeler bottom underdrain, and each filter measures 13'-0" x 28'-0" for a total surface area of 1,456 square feet.
- B. Project work shall be performed in strict accordance with this specification and construction drawings. The project work specified herein shall include the following:
 - a. Removal and disposal of filter media, support gravel and porcelain spheres from each filter.
 - b. Inspection, cleaning, and rehabilitation of existing underdrains.
 - c. Installation of new porcelain spheres in all filters.
- C. The equipment covered by this specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry, and shall operate satisfactorily when installed in accordance with manufacturer's recommendations and contract documents.

1.3 QUALIFICATIONS

- A. All project work shall be performed in accordance with these specifications without exception or substitutions. Due to the criticality of this project and the need to maintain plant operation during the project, all equipment specified herein shall be represented and furnished by one (1) filter manufacturer who is regularly engaged in the rehabilitation of large gravity filtration plants.
- B. The manufacturer shall be responsible for the detailed design of the equipment and materials to be furnished, the preparation of the required submittal data including operation and maintenance manuals, and technical supervision for installation and startup of the equipment.

1.4 QUALITY CRITERIA

- A. All equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be constructed and installed in accordance with the best practice of the trade. Products and construction shall be in accordance with the below standards and specifications unless otherwise noted in this document. In case of conflict, the standard with more stringent requirements shall apply.
 - 1. American National Standard Institute (ANSI).
 - 2. American Society of Mechanical Engineers (ASME).
 - 3. American Society of Testing and Materials (ASTM).
 - 4. American Water Works Association (AWWA).
 - 5. National Sanitary Foundation (NSF).

1.5 SUBMITTALS

- A. The manufacturer of the water treatment equipment shall submit the following data:

1. Shop drawings.
 2. Certification of NSF 61 Listing for specified underdrain restoration system. The system in its entire shall be NSF 61 Listed including but not limited to hydraulic cement, porcelain thimbles and spheres, and hopper inserts.
 3. No material furnished under this Specification shall be shipped to the jobsite until all submittals have been approved by the Engineer.
 4. Certification of compliance with the Buy-American Act.
 5. Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed treatment system's compliance with the Contract Documents. Partial or incomplete submissions shall be returned disapproved without review.
- B. Data to be submitted shall include, but not be limited to:
1. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various system components and accessories.
 2. Six (6) complete Operation and Maintenance Manuals shall be furnished.
 3. The Construction Plans provide a general outline of the required water treatment system construction. The supplying equipment manufacturer shall furnish detailed shop drawings and installation instructions to the Engineer. This information shall be in sufficient detail to facilitate direct field construction and erection by the Contractor.

PART 2 – PRODUCT

2.1 GENERAL

- A. The existing filter media, support gravel and porcelain spheres shall be removed from each of the filters and properly disposed. Following media removal, the filter walls, underdrains and plenum chambers shall be thoroughly cleaned to remove all deposits, paint chips, etc. Sandblasting and/or acid treatments shall not be permitted. Only one (1) filter shall be removed from service at a time for reworking.

2.2 FILTER UNDERDRAIN REHABILITATION

- A. Each of the monolithic Wheeler bottom underdrains shall be inspected following the removal of the existing filter materials and after the filter basins and plenum chambers have been cleaned. Any imperfections which would necessitate repairs to the support piers or pyramidal hoppers shall be performed using CM-120 hydraulic cement mix or approved equal. The inspection and direction of the repair work shall be done by the filtration system manufacturer.
- B. Any pyramidal hoppers with loose or missing porcelain thimbles shall be reformed using CM-120 hydraulic cement mix or approved equal and new porcelain thimbles. Reforming of the pyramidal hoppers shall be done using precision machined, magnesium Wheeler hopper forms as shown in construction drawings.
- C. Following any underdrain repairs, each Wheeler bottom hopper shall receive a protective liner, as manufactured by Roberts' Filters Retroliner or approved equal, insert to restore the original contours of the hoppers and complete the restoration of the underdrain.
- D. Each liner insert shall be manufactured from virgin polystyrene and be true in form and dimension, and with smooth, hard, rigid surfaces. Each liner shall be formed with an integrally molded top flange and with an integrally molded nozzle to ensure proper engagement of the liner into the porcelain thimble. Liner types shall be furnished with

different headloss orifices to balance the backwash flow across the filter underdrain, according to manufacturer's recommendations. Placement of the liner types shall be as recommended by the manufacturer to optimize backwash distribution. Liner systems which do not allow for balancing the backwash flow shall not be permitted.

- E. New porcelain spheres shall be furnished and installed in each of the monolithic Wheeler bottom hoppers. Porcelain spheres shall be dry process poured and fired at 2,410°F with less than 0.05 percent water adsorption. Flexural strength shall be 10,000 psi and compressive strength shall be 50,000 psi.
- F. The entire rehabilitation system including hopper inserts, hydraulic cement, porcelain thimbles and porcelain spheres furnished and installed shall be NSF 61 Certified.
- G. All monolithic Wheeler Bottom repairs including placement of porcelain spheres shall be performed by the filter manufacturer. Additionally, the Contractor shall retain the services of the filter manufacturer to supervise the placement of the first three grades of gravel.
- H. The underdrain restoration system shall be the Retroliner® System as manufactured by Roberts Services, Incorporated, Darby, Pennsylvania or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. All equipment installation shall be completed in accordance with supplying manufacturer's instructions and recommendations.
- B. The Contractor shall not be permitted, without expressed written consent of the Owner, to remove more than on (1) filter unit from service at any given time.
- C. The proper storage of all filter materials shall be the responsibility of the Contractor and the Owner assumes no responsibility for materials which are not properly protected from the weather by the Contractor. Any material which, in the opinion of the Engineer, becomes contaminated with dirt or other unsanitary materials shall be rejected and replaced by the Contractor at no additional cost to the Owner. The Owner shall provide the Contractor with adequate storage area within a convenient location to the filter units.

3.2 UNDERDRAIN RENOVATIONS

- A. Following the removal of the existing filter media, support gravel, porcelain spheres and cleaning of the filter basins by the Contractor, the filter underdrains shall be inspected and repaired as required.
- B. All monolithic Wheeler Bottom repairs including placement of porcelain spheres shall be performed by the filter manufacturer. Additionally, the Contractor shall retain the services of the filter manufacturer to supervise the placement of the first three grades of gravel.

3.3 MANUFACTURER'S SERVICES

- A. The manufacturer shall maintain a qualified staff of factory trained field service personnel during the rehabilitation of all filters' underdrain. This staff shall be permanent, full-time employees of the manufacturer with at least ten years of experience with installation and operation of the type of equipment being supplied.
- B. Supervisory services of a factory trained field service engineer shall be provided for supervision of Contractor's placement of first three grades of gravel in each filter.

- C. The services of the above field service engineer shall be provided for a period of one day per filter for supervision of backwashing and skimming of filter beds.
- D. The services of such designated manufacturer representative shall be included in the contract price. The service times specified above shall be considered as full eight (8) hour working days.

3.4 WARRANTY

- A. Manufacturer shall provide a warranty for the filter rehabilitation including but not limited to the protective liner, repaired thimbles and porcelain spheres.
 - 1. The warranty shall commence on the date of Substantial Completion.
 - 2. The warranty shall continue for a period of three (3) years from substantial completion.

END OF SECTION

SECTION 46 61 13 FILTER MEDIA

PART 1 GENERAL

1.1 ALTERNATES

- A. Refer to Section 01 10 00, SUMMARY OF WORK for description of Work under this section affected by alternates.

1.2 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Water Works Association (AWWA): AWWA B100, Granular Filter Material, latest edition.

1.3 SUBMITTALS

- A. Shop Drawings: Submit not less than 30 days prior to shipment manufacturer's product information, including grain size ranges for each gravel and fine media layer specified. Gravel sizes shall be in inches or U.S. sieve sizes. Fine media sizes shall be in millimeters.
- B. Samples: Submit Sample of gravel and fine media material following delivery of shipment.
- C. Quality Control Submittals: Submit gradation test results of fine media, including sieve analysis prior to loading and shipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fine Media:
 - 1. Unifilt Corp.
 - 2. F.B. Leopold Co.
 - 3. Ricci Bros Sand and Gravel
 - 4. Northwest Filter Co.
 - 5. MicroFLOC Products.
 - 6. Robert Filters
 - 7. Approved Equal

2.2 SILICA GRAVEL

- A. Meet the requirements of AWWA B100, modified as follows:
 - 1. Hard, rounded stones with average specific gravity not less than 2.5.
 - 2. Not more than 1 percent by weight shall have a specific gravity of 2.25 or less.
 - 3. Not more than 2 percent by weight of thin, flat, or elongated pieces (pieces in which largest dimension exceeds three times smallest dimension), as determined by hand picking.

4. Free from shale, mica, clay, sand, loam, and organic impurities of any kind.
5. Screened to proper size.
6. Screen gravel over 1/4 inch in diameter through wire screens with square openings or plates with round openings.
7. Use wire screens for sizes smaller than 1/4 inch.

2.3 FINE MEDIA-DUAL MEDIA FILTERS

- A. Dual Media of Anthracite Coal and Silica Sand for Water Filters: Clean, hard, durable particles in conformance with AWWA B100, modified as follows:
1. Anthracite coal of specific gravity 1.55, effective size 0.9 to 1 millimeter, and uniformity coefficient not more than 1.40.
 2. Filter sand shall be composed of hard, durable clean siliceous particles, free of all mica with an average specific gravity of 2.6 (".05) and shall be in strict accordance with AWWA B100, and have an effective size of 0.45-0.55mm, and a uniformity coefficient of 1.40 or less, for a finished depth after backwashing and scraping and removal of fines and debris of 9 inches. For depths up to 12 inches, a 1 inch skimming allowance shall be provided.

2.4 MIXED MEDIA FILTERS

- A. Supporting High Density Gravel:
1. Provide high density gravel furnished by filter media supplier.
 2. Size to match bottom layer of filter media with top layer of silica gravel.
 3. Match the physical characteristics of silica gravel, except the specific gravity shall be not less than 3.8.
- B. Fine Media:
1. Media shall meet the following criteria:
 - a. Relative size of particles shall be such that hydraulic grading of material during backwash will result in a filter bed graded progressively from coarse to fine in the direction of filtration (downward).
 - b. Anthracite coal of specific gravity greater than or equal to 1.55.
 - c. Silica sand of specific gravity greater than or equal to 2.6.

2.5 SOURCE QUALITY CONTROL

- A. **Manufacturer** will test Samples in accordance with procedures specified in AWWA B100 and will provide data to support compliance.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:
1. Do not permit workers to walk or stand directly on gravel or other materials that are less than 1/2 inch in diameter. Use boards that will sustain workers' weight without displacing gravel.
 2. Before gravel or fine media is placed, mark top of all layers on side of filter.

B. Media:

1. Clean filter tanks before media is placed and keep tanks clean throughout placement operation.
2. Place media in layers as specified below:

SIZE AND LAYER THICKNESS		
Gravel Layer	Layer Thickness (In.)	Size Limits
Silica Sand	9	.45 to .55 mm
Anthracite	20	0.9 to 1 mm
*U.S. standard sieve series number.		

3. Transport and place fine media carefully to prevent contamination of any sort.
4. Replace contaminated media with clean media.
5. Level fine media by hand to within plus or minus 6 inches of the appropriate mark prior to backwashing.
6. Install in following sequence:
 - a. Place 9 inches of silica sand and level.
 - b. Backwash bed a minimum of three times, and remove surface fines by scraping after each washing.
 - c. Replace scrapings with new material after each washing to obtain the required depth.
 - d. Place 20 inches (Considering 1 in for skimming) of anthracite coal and finish off smooth to proper elevation.
 - e. Backwash bed three times, and remove minimum of 1/2 inch of surface fines by scraping after each washing.
 - f. Replace scraping with new material after each washing to obtain the required depth.
 - g. Backwash and remove surface fines until gradation is in accordance with specified bed design.
7. Final depth of fine media after washing and scraping shall be 29 inches.

3.2 DISINFECTION

- A. After installation of media is completed, disinfect media in accordance with the requirements of Section 33 01 10.60, Disinfection of Water Systems.

END OF SECTION

SECTION 46 61 17

AIR SCOURING SYSTEM

PART 1.1 - GENERAL

1.1.1. DESCRIPTION

- A. This section of the specifications covers all labor, materials and equipment required for the installation of an air scour system in four (4) gravity filters. Project work shall be performed in strict accordance with these specifications, construction plans, and manufacturer's recommendations.
- B. The equipment covered by this specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practice of the industry, and shall operate satisfactorily when installed in accordance with manufacturer's recommendations and the contract documents.

1.1.2. QUALIFICATIONS

- A. The manufacturer shall be responsible for the detailed design of the equipment and materials to be furnished, the preparation of the required submittal data including operation and maintenance manuals, and technical supervision for installation and startup of the equipment.
- B. Special conditions are included in appropriate specification sections and shall be adhered to without exception.
- C. Manufacturer shall present at least 5 years of experience in similar projects.

1.1.3. QUALITY CRITERIA

- A. All equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be constructed and installed in accordance with the best practice of the trade. Products and construction shall be in accordance with the below standards and specifications unless otherwise noted in this document. In case of conflict, the standard with more stringent requirements shall apply.
 - 1. American National Standard Institute (ANSI).
 - 2. American Society of Mechanical Engineers (ASME).
 - 3. American Society of Testing and Materials (ASTM).
 - 4. American Water Works Association (AWWA).
 - 5. National Sanitary Foundation (NSF).

1.1.4. SUBMITTALS

- A. The manufacturer of the water treatment equipment shall submit shop drawings for Engineer's review and approval.
- B. No material furnished under this Specification shall be shipped to the jobsite until all submittals have been approved by the Engineer.
- C. Each submittal shall be complete in all aspects incorporating all information and data listed herein and all additional information required to evaluate the proposed treatment

system's compliance with the Contract Documents. Partial or incomplete submissions shall be returned disapproved without review.

- D. Data to be submitted shall include, but not be limited to:
 - 1. Catalog Data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various system components and accessories.
 - 2. The Construction Plans provide a general outline of the required water treatment system construction. The supplying equipment manufacturer shall furnish detailed shop drawings and installation instructions to the Engineer. This information shall be in sufficient detail to facilitate direct field construction and erection by the Contractor.

PART 1.2 – PRODUCT

1.2.1. FILTER AIR SCOUR SYSTEM

- A. Filter Air Scour System shall be installed for optimization of filter performance, conservation of backwash water and to maintain the condition of the filter media. No systems shall be reviewed which introduce air beneath the underdrain or from within the underdrain.
- B. Each filter shall be equipped with an air scouring system. The air scour system shall be removable without removal of the filter media. Air supply piping to the individual units shall be fabricated of Schedule 10S Type 304L stainless steel.
- C. The filter air scour system shall provide for proper cleansing of the filter media at air flow rates of 2.5 SCFM/SF or less. The filter air scour system shall be capable of being installed and removed within a fluidized bed. No modification to the filter underdrains shall be allowed. The air system shall consist of an air header, lateral pipes and air diffusers. All individual components shall be interlocking to form a complete and independent operating system.
- D. The air scour system shall be designed to accommodate installation without the need for lower support and securement hardware for air scour modules located within the filter bed. Systems requiring lower support and securement hardware shall not be allowed.
- E. The air supply piping to each filter shall be Schedule 10S Type 304L stainless steel. The air scour distribution system within each filter shall consist of Schedule 10S Type 304L stainless steel header drilled to accommodate 18 gauge stainless steel laterals by means of transition pieces. Each lateral shall be drilled to accommodate unitized air diffusers.
- F. The air distribution system shall consist of Type 304 stainless steel header, fittings and laterals. Each lateral shall be drilled and tapped to accommodate air diffusion nozzles. Air distribution systems fabricated of PVC or plastic type materials shall not be allowed.
- G. The support and securement hardware for this assembly shall be constructed of Type 304 stainless steel.
- H. Each air diffusion nozzle shall be of one piece Type 304 stainless steel construction. Each nozzle shall contain an internal metering orifice. The metering orifice shall open into a larger chamber in the body of the nozzle with Type 304 stainless steel screen at the discharge. Screen and chamber shall be sized as required to prevent clogging by media or extraneous material. Plastic air diffusion nozzles with detachable caps shall not be acceptable.
- I. The filter air scour system shall be the Aries® Managed Air System as manufactured by Roberts Water Technologies, Inc., or approved equal.

PART 1.3 – EXECUTION

1.3.1. SYSTEM

- A. All necessary precautions recommended by the manufacturer and as specified herein shall be followed to ensure that the air distribution system and piping connected thereto is completely clean and free of any debris, dirt, or other foreign materials which could clog the system or interfere with flow. Piping shall be flushed with air only.
- B. Air distribution system shall be installed as shown on the Contract Drawings and per the written instructions of the manufacturer.
- C. Following installation of air supply piping within the filter units, the individual modules shall be assembled on top of the filter bed. Once assembled, the individual modules shall be positioned, and the backwash flow started and maintained until the filter bed is fluidized and the modules lower into place. The modules are then connected to the air supply piping using fittings furnished by manufacturer.
- D. The air scour system shall be tested in the air only mode at 2.5 SCFM/SF with 6 inches of water over the filter bed. Test flow rates shall be sustained for approximately two minutes while visual observations are made. Tests shall be extended or repeated if required or as indicated by the Engineer.
- E. During each test, the water surface shall present a uniformly turbulent appearance, without dead spots or boils. The Contractor shall take such measures as are necessary to correct any deficiencies revealed by these tests, and shall repeat the specified tests until such deficiencies are corrected, as determined by the Engineer.

1.3.2. WARRANTY

- A. Manufacturer shall provide a warranty for the filter rehabilitation including but not limited to the protective liner, repaired thimbles and porcelain spheres.
 - 1. The warranty shall commence on the date of Substantial Completion.
 - 2. The warranty shall continue for a period of three (3) years from substantial completion.

PART 1.4 –MANUFACTURER'S SERVICES

The Contractor shall obtain the services of the filtration system manufacturer to furnish the services of a competent representative at the plant for supervisory service. Provide the services of a qualified factory certified representative for the required man-days as specified hereunder.

Installation Supervision:	Two (2) Days Service
Startup Assistance:	One (1) Days Service
Operator Training:	One (1) Days Service

The services of such designated manufacturer representative shall be included in the contract price. The service times specified above shall be considered as full eight (8) hour working days and does not include travel time.

PART 2.1 – GENERAL -POSITIVE DISPLACEMENT BLOWER

2.1.1. REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. Acoustical Society of America (ASA):47, Specification for Sound Level Meters.
 - 2. American National Standards Institute (ANSI):B16.5, Pipe Flanges and Flanged Fittings.
 - 3. American Society of Mechanical Engineers (ASME):Power Test Codes, PTC 10.
 - 4. American Society for Testing and Materials (ASTM):A48, Standard Specification for Gray Iron Castings.

2.1.2. DEFINITIONS

- A. BHP:(Shaft) Brake horsepower is the standard curve horsepower required corrected for pressure and temperature at inlet conditions.
- B. icfm: Inlet volume in cubic feet per minute is the volume of air in CFM entering the blower at inlet conditions.
- C. scfm: Standard volume in cubic feet of air per minute is the volume of air in CFM at 68 degrees F, 14.70 psia and 36 percent relative humidity.
- D. Discharge Pressure: The pressure in pounds per square inch gauge (psig) at the blower discharge flange at rated capacity.
- E. Overall Efficiency: The total efficiency for motor, drive, and blower from the motor terminals to the pumped air.

2.1.3. DESCRIPTION

- A. Scope: The contractor shall provide all labor, materials, equipment and services necessary for furnishing two (2) Positive Displacement Blowers. Blowers shall be the Sutorbilt 7MR "Legend" Series or approved equal. The blower shall be furnished completely packaged with all accessories, tested and ready for operation.

2.1.4. QUALITY ASSURANCE

- A. Manufacturer or Packager Qualifications: Supplier shall have experience in providing similar equipment and shall show evidence of satisfactorily operating installations in projects of similar magnitude.
- B. Blower Packagers must be an Authorized Distributor or Representative of the blower being supplied and must be authorized to perform warranty service.

2.1.5. SUBMITTALS

- A. Submittal sheets are to be 8½ x 11 inches, or if larger, to be folded to 8½ x 11 inches so that the title block is clearly visible without unfolding. Drawings are to be similarly folded and inserted in pockets as appropriate. Bind each copy in a soft cover binder.
- B. Shop Drawings: Submit ten (10) copies of an integrated shop drawing for the blower system. All mechanical and electrical equipment and components specified herein must be included to be considered a complete shop drawing.

1. Make, model, weight, and horsepower of each equipment assembly.
 2. Manufacturer's catalog information, descriptive literature, dimensional layouts, specifications, and identification of materials of construction.
 3. Performance data showing compliance with specification requirements. Include:
 - a. Sample blower curves showing pressure, capacity, horsepower demand and efficiency over the entire operating range from shutoff to maximum capacity.
 - b. Furnish for each different size or type of equipment to be supplied.
 4. Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.
 5. External utility requirements such as air, water, power, drain, etc., for each component.
 6. Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, or alarmed.
 7. Control panel elevation drawings showing construction and placement of operator interface devices and other elements.
 8. Power and control wiring diagrams
- B. Quality Control Submittals:
1. Manufacturer's Certificate of Compliance: Commercial products, including specific reference to meeting maximum noise level requirements, and painting/coating system(s).
 2. Test results of control panels for proper operation, construction, electrical connection and function.
 3. Test results, reports, and certifications.
 4. Special shipping, storage and protection, and handling instructions.
 5. Manufacturer's Certificate of Proper Installation.
 6. Installation, Operation, and Maintenance Manuals: Submit five (5) copies of the manuals within four (4) weeks of receiving approved shop drawings.
- C. Contract Closeout Submittals:
1. Service records for maintenance performed during construction.
 2. Special guarantee.

2.1.6. MANUFACTURER'S REPRESENTATIVE

- A. General: Provide the services of a qualified factory certified representative for the required days as specified hereunder. A person-day is defined as eight (8), on-site, working hours.
1. Manufacturer's Representative: Present at site or classroom designated by OWNER for minimum person-days listed below, travel time excluded:
 - a. One person-day for installation assistance: and inspection.
 - b. One person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
 - c. One person-day for pre-startup classroom or site training.
 - d. One person-day for facility startup.
 - e. One person-day for post-startup training of OWNER's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by ENGINEER.
 - f. Initial Operation / Training: Upon notification of completion of aeration system by the contractor, provide a minimum of one (1) day for blower equipment installation inspection, certification, start-up, and corrective adjustments.
- B. See Section 01 43 33 MANUFACTURERS' SERVICES and Section 01 75 17 EQUIPMENT TESTING

AND FACILITY STARTUP.

2.1.7. TESTING

- A. A factory slip test report from the actual blower manufacturer shall be supplied for each blower.
- B. Each blower shall be tested in accordance with ASME PTC-9 testing procedures for positive displacement blowers. The results of this test shall be and submitted to the engineer prior to shipment of the blowers.

PART 2.2 - PRODUCTS

2.2.1. DESIGN CRITERIA

- A. The air blowers shall be fabricated, assembled and located as shown on the drawings.
- B. Operating Conditions:

1. Name	Filters' Air Scouring Blowers
2. Quantity	2
3. Discharge Pressure	6.0 PSIG
4. Minimum Motor Horsepower	50 HP
5. Max. Brake Horsepower	32.4 BHP
6. Motor RPM	1800 RPM
7. Inlet Volume - SCFM	910 SCFM
8. Inlet Volume - ACFM	981 ACFM
9. Elevation	45 ft.
10. Inlet Air Temperature	90°F
11. Blower RPM	1553 RPM
12. Maximum Allowable RPM	1650 RPM
13. Blower Model Number	Sutorbilt 7MR or Approved Equal
14. Noise	<75dbA

2.2.2. ROTARY POSITIVE DISPLACEMENT BLOWERS

- A. General: Each blower shall be of the horizontal, rotary, positive displacement type. Each assembly shall be rugged in construction and of such design that it may be disassembled and inspected without disturbing the inlet or discharge piping.
- B. Casing: Casing shall be of one piece with separate head plates, and shall be made of close grained gray cast iron suitably ribbed to prevent distortion under service conditions.
- C. Head Plates: Fabricate drive end and gear end head plates of close grained cast iron which are precision machined for exact bearings housing fit.
- D. Impeller and Shaft: Impeller and shaft shall be made from common cast iron. Impeller shall be of the straight, two lobe type and shall operate without rubbing and shall be positively timed by a pair of accurately machined heat-treated alloy steel, spur tooth, timing gears. Impeller must be 11" in length. Impellers less than 11" will not be acceptable.

- E. Bearings: Each impeller/shaft shall be supported by double row ball or spherical roller bearings sized for a minimum of 100,000 hours of B-10 life.
- F. Bearing Seals: Provide a lip type oil seal at each bearing, designed to prevent lubricant from leaking into the air stream. Provisions shall be made to vent the lubrication system to prevent any possible carryover of lubricant into air stream.
- G. Lubrication: The timing gears and the bearings shall be splash oil lubricated from oil slingers mounted on the drive shaft and dipping in the oil. Sight glasses for oil level observation shall be provided.

2.2.3. ELECTRIC MOTORS

- A. Motors: Provide a single speed, constant torque, TEFC 1800 RPM motor, 1.15 S.F., Premium efficiency suitable for connecting to the blower by a V- belt and sheave drive assembly. Motor shall have a cast iron frame and brackets. Motors with rolled steel frames are acceptable. Motors shall be as manufactured by Marathon, Baldor, WEG Electric, World Wide Electric or approved equal.

2.2.4. BLOWER PACKAGE ACCESSORIES

- A. General: The blower packages shall be fabricated and assembled with the following accessories and shipped complete as a unit. Packages knocked down for shipment are not acceptable. Contractor assembly of component parts is also not acceptable. Shipment must be made on open top flatbed type trailer. Van shipments via common carrier will be returned to shipper.
- B. Equipment Base: The base shall be built so that the blower and the motor are mounted to provide for horizontal tensioning of the v-belt drive. The base shall be a minimum of 3/8" plate steel with angle legs and gussets. These items shall also have a minimum thickness of 3/8". The blower package base must weigh at least 80% of the blower weight. Bases constructed of all angle iron will not be acceptable.
- C. Drive: Provide V-belt drive assembly consisting of Sheaves, quick detachable bushings, V-belts, and sliding motor base. Provide drive assembly with a 1.4 service factor based on motor nameplate horsepower.
- D. Guard: Provide OSHA Style steel belt guard to enclose drive and belts. Design guard for easy removal. The guard shall be constructed to allow visual inspection of the drive system without removing the guard.
- E. Intake Filter: Provide each blower with a suitably sized air filter. Filters to be Model CCF-6" as manufactured by Universal Silencer, or approved equal.
- F. Intake Silencer: Provide a heavy duty, all welded, noise attenuation unit constructed of carbon steel sheet and plate and featuring an acoustically treated outlet for pulse control. Provide silencer equal to Model RISY on silencers larger than 4" and RIS type on sizes 4" and smaller. Silencers to be Model RISY-6" manufactured by Universal Silencer or approved equal.
- G. Discharge Silencer: Provide a heavy duty, all welded, noise attenuation unit constructed of carbon steel sheet and plate and featuring an acoustically treated outlet for pulse control. Provide silencer equal to Model SDY on sizes larger than 4" and SD type on 3" and smaller. Silencers to be Model SDY-6" manufactured by Universal Silencer or approved equal.

- H. Expansion Joints: Provide threaded sleeved cylindrical type, three ply bias fiberglass reinforced silicone rubber connectors for blower inlet and discharge connections. Furnish units which are capable of withstanding 25 psi and handle operating temperatures of 250°F. Expansion joints to be equivalent to XL-Fab Series 500, General Rubber Corp., Metra Flex Co or approved equal.
- I. Pressure Relief Valve: Provide weight type relief valve with proper sizing and weights for set point pressure. Provide valves equal to Sutorbilt PL or approved equal. Spring type or Kunkle valves are not acceptable.
- J. Check Valves: Provide threaded type, cast iron body, aluminum internals for mounting on blower discharge piping. Provide valve equivalent to Flexi-Hinge Model 518-6" or approved equal. Threaded valves are not acceptable.
- K. Discharge Butterfly Valve: Provide wafer type, resilient seated, lever operated, tight closing butterfly valve for positively isolating the blower from the manifold system. Furnish valve with cast iron body and disc of nodular iron; Stainless steel stem; Acetal Bushing; Buna-N seat; and 316 SS Torque plug. Valve shall be Deltech Model 50-6", DeZurik, Crane, Pratt or approved equal.
- L. Discharge Pressure Gauge: Provide a stem mounted discharge pressure gauge on the blower package to be equivalent to U.S. Gauge, McDaniel Instruments or approved equal.
 - 1. Range: 0-15 psig.
 - 2. Accuracy: 2 percent of full scale.
 - 3. Dial: 2.5", 270 degree scale.
- M. Inlet Restriction Gauge: Provide each blower with a Dwyer Model 2020 inlet gauge to measure loss through the inlet filter or approved equal.
- N. Controls: In accordance with general control requirements and component qualities specified in Section: PACKAGE CONTROL SYSTEMS.

2.2.5. FABRICATION

- A. Factory prepare, prime, and finish coat exposed metal surfaces of equipment in accordance with Section 09 91 00, PAINTING.

2.2.6. SPARE PARTS

- A. The contractor shall deliver the following spare parts for each size blower:
 - 1. One (1) Set of V-belts.
 - 2. Four (4) Filter Elements.
 - 3. One Case of Blower Oil

2.2.7. SOUND REDUCTION ENCLOSURE

- A. Each blower assembly shall be furnished with a weather tight, sound attenuating enclosure. The enclosure shall be manufactured of 16 gage aluminum, and shall be lined with 2" of acoustical foam, and 22 ga. Galvanized perforated steel; sufficient to meet the 75 dba attenuation requirement at one

- meter from any exterior surface of the enclosure. The enclosure shall have removable side panels which will allow full access to the assembly for maintenance or repair.
- B. An air ventilation fan shall be mounted on the enclosure and sized as necessary to keep the assembly at a temperature needed to maintain proper operation as recommended by the assembly manufacturer. The ventilation fan motor will be 115v/1 ph/60 hz; provide approx. 10 CFM/motor HP.
 - C. The two side panels shall provide for a minimum of 50% of each side to be removed for access. The panels shall include 2 locking latch assemblies and a minimum of two lifting handles.
 - D. Any pipe penetration holes in the enclosure shall be sized to allow for passage of pipe flanges. All penetration holes shall have flash rings installed around the pipe.
 - E. The enclosure will be free standing and not attached or mounted onto the blower package frame in any way. The enclosure will require field assembly and shall be supplied with installation instructions as well as all special tools and fasteners required for assembly.

2.2.8. BLOWER CONTROL PANEL

- A. Control Panel: Provide a NEMA 4X Stainless Steel control panel for the blowers. The panel shall house the components for both blowers and contain the following:
 - 1. NEMA 4X Combination Circuit Breaker
 - 2. Soft Starter with Thermal Overload Protection
 - 3. Power Contactor
 - 4. 1 Main Circuit Breaker and Two (2) Normally Open and Two (2) Normally Closed Auxiliary Contacts
 - 5. Fused Disconnects
 - 6. 120Volt Control Transformer
 - 7. H-O-A Switches
 - 8. Run Time / Hour Meter
 - 9. Timer / Alternator
 - 10. Field Wiring Terminals for Pressure and Temperature Switches
 - 11. Green - Run Light
 - 12. Red – Red Pilot Light
 - 13. Thermal and Condensation Strips
 - 14. Alarm Light on Panel
 - 15. Engraved laminated phenolic identification plates
- B. In the automatic position, each blower shall alternate run cycles. Should blower overload or fail, controls shall start alternate blower.

PART 2.3 EXECUTION

2.3.1. INSTALLATION

- A. In accordance with the manufacturer's written instructions.
- B. Anchor Bolts: Place using templates furnished by manufacturer.

2.3.2. FIELD QUALITY CONTROL

- A. Functional Tests: Conduct on each unit.

1. Vibration Test:
 - a. Conduct on assembly, consisting of blower and drive unit, connected and in normal operation.
 - b. Assembly shall not exceed vibration specified.
- B. Performance Test:
 1. Conduct on each blower unit.
 2. Perform under actual or approved simulated operating conditions.
 3. Test for a continuous 3 hour period without malfunction.
 4. Perform with the ENGINEER present.
 5. Test Log: Upon completion of test, record the following:
 - a. Flow measured by plant instrumentation and storage volumes.
 - b. Blower inlet and Discharge Pressure.
 - c. Driving motor voltage and amperage measured for each phase.
 6. Adjust, realign, or modify units and retest in accordance with ASME Power Test Code if necessary.

2.3.3. SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION," are a part of this Specification.
 1. Data Sheet: Induction Motor.

END OF SECTION

INDUCTION MOTOR DATA SHEET

Project: Roosevelt Roads Water Filtration Plant

Owner: Local Redevelopment Authority

Equipment Name: SCOURING SYSTEM BLOWER

Equipment Tag Number(s): BL-04-30 and BL-04-31

Type: Squirrel-cage induction meeting requirements of NEMA MG 1

Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark

Motor Horsepower: 50

Guaranteed Minimum Efficiency at Full Load: _____ percent

Voltage: 480

Guaranteed Minimum Power Factor at Full Load: _____ percent

Phase: 3

Service Factor (@ rated max. amb. temp.): ☐ 1.0 ☐ 1.15

Frequency: 60 Hz

Enclosure Type: _____

Synchronous Speed: _____ rpm

Mounting Type: ☐ Horizontal ☐ Vertical

☐ Multispeed, Two-Speed:

☐ Vertical Shaft: ☐ Solid ☐ Hollow

_____ / _____ rpm

☐ Vertical Thrust Capacity (lb): Up _____ Down _____

☐ Constant Horsepower

☐ Adjustable Speed Drive: See Section 16485, ADJUSTABLE FREQUENCY DRIVE SYSTEMS.

☐ Variable Torque

☐ Constant Torque

Winding: ☐ One ☐ Two

☐ Thermal Protection: _____

☐ Space Heater: _____ volts, single phase

☐ Oversize main terminal (conduit) box for motors

☐ Terminal for connection of equipment grounding wire in each terminal box

Additional Motor Requirements: ☐ See DIVISION 16.

3. PERMITS AND ENDORSEMENTS





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

July 21, 2021

Alfonso Nieves Velez
Director of Development and Operation
Local Redevelopment Authority for Naval Station Roosevelt Roads
Edificio de Fomento Industrial
#355 Roosevelt Ave., Suite 106
Hato Rey, PR 00918

Re: EPA Response to Comments on Request for Authorization Letter and the Excavation
Specifications for Work on SWMUs 1, 2, 6, 7/8, 10, 42, 45, 59, 63, 67, 71, 72, 73, 74, AOC
1738, AOC F F1995 and AOC
F2842B at the Former Naval Station Roosevelt Roads

Dear Mr. Nieves-Velez:

The EPA has reviewed the response to comment letter and revised documents associated with the proposed improvements to the potable treatment plant and distribution system in Roosevelt Roads, Ceiba. The response letter and revised documents were received via e-mail on June 23, 2021.

The EPA accepts the responses within the comment letter and changes made within the Water Distribution Plans drawings and revised Technical Specification, Section 31 23 17. The response letter and revised documents addresses most concerns raised in the EPA's comment letter dated November 13, 2020. However, there are two aspects of the project which the EPA would like to remind LRA of its responsibilities throughout the duration of the project. They include:

1. General Comment 2 – additional information has been added to the Technical Specification document regarding the process for sampling, handling and disposal of soils in SWMUs of known contamination. This process should also be used in areas where contamination, though not originally suspected, is encountered during the project.
2. General Comment 3 - though the response letter ensures that potential damage inflicted to project areas (such as roadways, sidewalks, utilities) will be corrected, the comment requested information on site restoration. This would include information such as final gradings and processes including seeding, maintenance of erosion and sediment controls, and inspections until such time that vegetation has been established and no erosion is identified.

If you have any questions or would like to discuss further, please contact me at mollin.jessica@epa.gov or by phone at 212-637-3921.

A handwritten signature in cursive script that reads "Jessica Mollin".

Jessica Mollin
Remedial Project Manager
Federal Facilities Section

cc (via e-mail):

Juan Baba Peebles – PRDNER

Thuane Fielding – NAVFAC PMOE

Kevin Cloe - NAVFAC Atlantic

Jamie Butler – NAVFA Atlantic



Notificación de Requisitos para Aprobación de Permiso de Construcción

Water Infrastructure Improvements (Phase I) al Roosevelt Roads

Datos de Localización

Dirección Física

TERRENOS DE LA BASE NAVAL ROOSEVELT ROADS
EN .
, Ceiba, Puerto Rico

Número(s) de Catastro

232-000-001-04

Materiales de Construcción

Acero Estructural
PVC, ductil iron,
Hormigón Armado y Bloques

Área

Cabida de los desarrollos: 5.499 m²

Área Bruta de Construcción: 31.709 p²

Dueño

Autoridad para el Redesarrollo Local de RR

Proyectista

Ingeniero Carlos Baez Lic. No. 17371

Tipo de Solicitud

Nueva

Estimado de Costo de la Obra (\$USD)

Costo Estimado (Original) \$7,590,276.66

Asunto

Fase I Rehabilitación de Planta de Filtración de la Antigua Base Naval de Roosevelt Roads. Se expide la presente Notificación de Requerimientos para Aprobación de permiso certificado al amparo de lo dispuesto en la Ley Núm. 135 de 15 de junio de 1967, según enmendada, la Ley Núm. 7 de 19 de julio de 1985, según enmendada, conocida como "Ley de Certificación de Planos" y la Ley 161-2009, según enmendada, conocida como "Ley para la Reforma del Proceso de Permiso de Puerto Rico", según aplique.

Requerimientos

Estimado(a) :Ingeniero Carlos Baez Lic. No. 17371





Notificación de Requisitos para Aprobación de Permiso de Construcción

Costo Estimado (Original)

Estimado(a) :

Por medio de esta notificación se le informa que para que se le otorgue una aprobación final a su solicitud, tendrá que cumplir con las condiciones señaladas a continuación:

1. Someter la Certificación para el Trámite de Permiso de Construcción o Urbanización (Póliza Eventual), según formalizado en la Oficina correspondiente de la Corporación del Fondo del Seguro del Estado.
2. Someter evidencia de que se han satisfecho los arbitrios municipales correspondientes a esta obra, de conformidad con la Ley Núm. 88 del 24 de junio de 1971, copia del decreto de exención como evidencia de que le es de aplicación al Artículo 2, Sección C de la Ley de Incentivos Contributivos de 1987, Ley Número 8 del 24 de enero de 1987, según enmendada, o certificación al efecto de la Oficina de Exención Contributiva Industrial del Departamento de Estado.
3. Someter una foto del rótulo que identificará la construcción (debidamente instalado) a tenor con lo dispuesto en el Reglamento Conjunto vigente. Será responsabilidad del desarrollador la instalación de un rótulo con tamaño mínimo de 2' x 4' en la entrada principal de la propiedad que incluya lo siguiente: número de solicitud, tipo de solicitud presentada, nombre del dueño y proponente de la obra, dirección postal y electrónica de la OGPE para comentarios sobre la solicitud.
4. Someter copia firmada de la siguiente información de la obra:
 - a. Fecha de comienzo de la obra.
 - b. Tiempo de construcción
 - c. Número de empleos directos a crear.

Condiciones Especiales

Se condiciona el levante del permiso a que la parte proponente someta copia del Contrato de Designación del Inspector de Proyecto, y las credenciales vigentes del inspector designado.

Aviso

Es de entenderse que esta notificación no es autorización ni permiso para iniciar las obras de construcción y que la vigencia de esta notificación está limitada por el Reglamento Conjunto vigente, según facultado por la Ley Núm. 161 de 1 de diciembre de 2009 para la Reforma del Proceso de Permisos de Puerto Rico, según enmendada. Esta notificación quedará sin efecto a los dos años, a partir de la fecha de expedición.





Notificación de Requisitos para Aprobación de Permiso de Construcción

Firma / Sellos

Fecha de Expedición:

13/05/2020



Departamento de Desarrollo Económico y Comercio de Puerto Rico
Oficina de Gerencia de Permisos





Resolución Sobre Solicitud de Prórroga o Reapertura

DESCRIPCIÓN Y LOCALIZACIÓN

La Autoridad para el Redesarrollo Local de Roosevelt Roads por conducto del Ing. Carlos I. Báez Dotel, amparándose en las disposiciones legales y reglamentarias vigentes, radicó ante la consideración de la Oficina de Gerencia de Permisos (OGPe), una solicitud de prórroga al Caso Núm. 2018-242952-PCOC-002288, en una finca localizada en:

Dirección Física: Terrenos de la Base Naval Ceiba	Dueño: Autoridad para el Redesarrollo Local de Roosevelt Roads
Municipio: Ceiba y Naguabo	Proponente: Ing. Carlos I. Báez Dotel, Lic. 17371
Calificación: E1 (49%), E2 (15%), E4 (15%), M1 (6%), M3 (3%), NC (3%), E5 (3%), E6 (2%), PF (1%), S1 (1%), DE (1%)	Número de Catastro: 232-000-001-04
Clasificación PUT: No disponible [N/A]: Datos del Catastro.	Referencia Número: 2018-242952-PCOC-002288 2015-094812-DEC-146060 2015-094812-DEC-146457 2015-094812-DEC-146464 2015-094812-DEC-150720

DETERMINACIONES DE HECHO

- La parte proponente recurrió ante la Oficina de Gerencia de Permisos (OGPe) el 4 de mayo de 2022, solicitando una prórroga relacionada con la Notificación de Requisitos para Aprobación de Permiso de Construcción del caso Núm. 2018-242952-PCOC-002288 con Fecha de Expedición: [13/05/2020], Fecha de Expiración [13/05/2022]. **Asunto: Fase I Rehabilitación de Planta de Filtración de la Antigua Base Naval de Roosevelt Roads.** [Condiciones Especiales]: Se condiciona el levante del permiso a que la parte proponente someta copia del Contrato de Designación del Inspector de Proyecto, y las credenciales vigentes del inspector designado. [Costo Estimado (Original) \$7,590,276.66].
- Según el caso Núm. del expediente del caso Núm. 2018-242952-PCOC-002288, objeto de prórroga, para la Determinación de Cumplimiento Ambiental se consideraron los casos que más adelante se relacionan, a saber: **Toma Aguas Usadas**, Ref. Núm. 2015-094812-DEC-146060 [Fecha de Exp.: 20/DEC/2015]; **Toma Aguas Crudas Río Blanco**, Ref. Núm. 2015-094812-DEC-146457, Ref. Núm. [Fecha de Exp.:20/DEC/2015] **Planta Tratamiento Agua Potable**, Ref. Núm. 2015-094812-DEC-146457 [Fecha de Exp.: 25/DEC/2015]; **Planta Tratamiento Aguas Usadas**, Ref. Núm. 2015-094812-DEC-146464 [Fecha de Exp.: 25/DEC/2015]; **Líneas de Agua Potable y Sanitario**, Ref. Núm. 2015-094812-DEC-150720 [Fecha de Exp.: 17/JAN/2016].
- Mediante memorial explicativo con fecha del 21 de abril de 2022, que obra en el expediente administrativo digital la parte proponente expone los argumentos que más adelante se consignan en apoyo a la solicitud, a saber:
[...] Resumen: La Autoridad para el Redesarrollo Local de Roosevelt Roads adscrita al Departamento de Desarrollo Económico y Comercio de PR, propuso una etapa inicial para el desarrollo de las mejoras de infraestructura existente del sistema de agua potable localizado en los terrenos de la Antigua Base Naval Roosevelt Roads en el Municipio de Ceiba, y en la toma existente de aguas crudas en el Río Blanco en la Planta Hidroeléctrica en el Municipio de Naguabo, esto bajo el trámite número 2018-242952-PCOC-002288. Para este se obtuvo la Notificación de Requisitos para Aprobación de Permiso de Construcción el pasado 13/5/2020. No se ha podido completar los documentos para el levante ya que no se ha completado el proceso de subasta y/o adjudicación del proyecto.



Resolución Sobre Solicitud de Prórroga o Reapertura

El estimado de la obra es de aproximadamente \$7,520,276.66 a ser financiados con fondos federales. Y se espera la obra genere 232 empleos divididos en 104 empleos directos, 80 empleos indirectos y 48 empleos inducidos. Las mejoras al sistema de agua potable incluirán lo siguiente:

I. Mejoras y Rehabilitación de Toma de Agua, Medidor de flujo y Reserva de Aguas Crudas El sistema de agua potable utiliza la toma existente de aguas crudas en el Río Blanco en Naguabo y luego es transportada por una tubería hasta una reserva de aguas crudas dentro de la base. Se propone una serie de mejoras que incluye: En la toma existente en Río Blanco (Naguabo), • Reemplazo de tapas metálicas • Reemplazo de parrillas de limpieza • Reemplazo de compuertas • Remoción de sedimentos en reserva de aguas crudas Dentro de la base se contemplan, • Mejoras estructurales a reserva de aguas crudas • Reemplazo de medidor de flujo de aguas crudas

II. Mejoras y Rehabilitación de Planta de Tratamiento de Agua Potable. Actualmente Roosevelt Roads cuenta con una planta de tratamiento de agua potable, establecida en el en los años 1940's. Esta planta se diseñó con una capacidad de aproximadamente 4.0 millones de galones al día, pero actualmente, debido a su condición actual, podría producir solamente hasta 1.0 millones de galones de forma eficiente y segura. Debido a las condiciones existentes, la planta no cuenta con la tecnología y equipos para producir la capacidad máxima de agua potable para la que fue diseñada. Se propone una serie de mejoras que incluye: • Rehabilitación del edificio de control • Reemplazo y mejoras del sistema eléctrico de distribución • Nuevo generador de emergencia • Reemplazo de controles y sensores • Reemplazo de válvulas y tuberías • Nuevos equipos de laboratorio • Nuevo equipo de desinfección • Reparación de sistema de filtración • Mejoras a sistema de lagunas de cieno

III. Mejoras a Sistema de Almacenaje y Distribución El sistema de almacenaje y distribución está compuesto por un tanque de almacenaje con capacidad de 1.5 millones de galones. El sistema de distribuciones está compuesto por tuberías con diámetros variables desde 4" hasta 14", en diferentes materiales (PVC, concreto, hierro dúctil, etc.). Algunos tramos de tubería no cuentan con la capacidad necesaria para el redesarrollo, y otros segmentos no están en condiciones óptimas para la operación. Las mejoras propuestas incluyen lo siguiente: • Reemplazo de múltiples segmentos de tuberías existentes ubicadas a lo largo de las calles y carreteras principales. • Rehabilitación de tanque de almacenamiento (reemplazo de válvulas, pintura y sistema de control y comunicación). • Reemplazo de válvulas e hidrantes.

Se solicita por este medio tiempo adicional en la vigencia de la Notificación de Requisitos para Aprobación de Permiso de Construcción. [...]

CONCLUSIONES DE DERECHO

1. La pertenencia ubica en un Área Calificada E1 (49%), E2 (15%), E4 (15%), M1 (6%), M3 (3%), NC (3%), E5 (3%), E6 (2%), PF (1%), S1 (1%), DE (1%), Clasificación, No disponible [N/A], según Datos del Catastro.



Resolución Sobre Solicitud de Prórroga o Reapertura

2. De un análisis de las disposiciones legales y reglamentarias pertinentes, concluimos que la Ley Núm. 81 del 31 de agosto de 1991, según enmendada, conocida como la "Ley de Municipios Autónomos del Estado Libre Asociado de Puerto Rico" [Ley 107-2020 del Código Municipal de Puerto Rico], el Plan de Uso de Terreno vigente, el Reglamento Conjunto para la Evaluación y Expedición de Permisos Relacionados al Desarrollo, Uso de Terrenos y Operación de Negocios (en adelante "Reglamento Conjunto 2020"), Reglamento de Ordenación de los Terrenos y la Forma Urbana de la Antigua Base Naval de Roosevelt Roads de los Municipios de Ceiba y Naguabo con fecha de vigencia del 3 de octubre de 2014 y el Reglamento de Planificación Núm. 13, Reglamento sobre Áreas Especiales de Peligro a Inundación, Octava Revisión (Reglamento Núm. 9238 del 9 de diciembre de 2020), son los cuerpos reglamentarios de aplicación a la solicitud presentada.
3. REGLA 2.2.5 TÉRMINOS DE VIGENCIA DE LAS DETERMINACIONES FINALES: a. Toda determinación final sobre cualquier consulta o recomendación relacionada a un proyecto de construcción, quedará sin efecto si:
 1. Dentro del término de dos (2) años, contado a partir de haberse notificado la misma, no se obtuviera el correspondiente permiso de construcción; o
 2. Luego de haberse obtenido el correspondiente permiso de construcción, las obras autorizadas en éste no se comenzarán dentro del término de dos (2) años a partir de la fecha de su notificación.[...]
 4. Proyectos a ser realizado en etapas (fases) de construcción:
 - a) Una vez completada una fase, la siguiente fase deberá iniciarse conforme se establezca en la Consulta, pero dentro del término de cinco (5) años de completada la fase anterior.
 - b) De no iniciarse la siguiente fase dentro del término dispuesto, podrá presentar una reapertura de la Consulta y actualizar las recomendaciones aplicables.[...]
 - d. La expedición de un permiso de construcción tendrá un término de dos (2) años para comenzar las mismas y se mantendrá vigente durante el tiempo necesario para concluir dichas obras, lo cual incluye las casetas de construcción u oficinas para la venta de un proyecto.
 - e. A menos que un Tribunal con jurisdicción determine lo contrario, la presentación de una revisión, impugnación de una determinación final, no tendrá el efecto de paralizar los efectos de dicha determinación. No obstante, en el caso de una paralización emitida por el Tribunal o que el Proponente de la acción decida paralizar las obras hasta tanto haya una determinación final o firme, el término de vigencia de dicha determinación se considerará interrumpido desde la paralización emitida por el Tribunal o desde la radicación de la revisión judicial.
 - f. Todas las recomendaciones y autorizaciones de obras incidentales que se emitan como parte de una solicitud de permiso ante la OGPe, tendrán la misma vigencia que el permiso para la cual fue emitido.
 - g. Cualquier enmienda a una determinación final, excepto en el caso de las Consultas, no tendrá los efectos de extender los términos de vigencia.
4. REGLA 2.2.6 PRÓRROGA A LA VIGENCIA DE PERMISO DE CONSTRUCCIÓN
 - a. Los términos de vigencia indicados se considerarán definitivos para todos los efectos legales. Sin embargo, los mismos podrán ser prorrogados a petición de la parte interesada cuando no se considere tal extensión contraria al interés público siempre que la petición de prórroga se someta con anticipación a la fecha de expiración del permiso de construcción expedido.



Resolución Sobre Solicitud de Prórroga o Reapertura

- b. Se deberá señalar los motivos en que se basa la petición y será acompañada de una certificación del proyectista y especialistas, si algunos, a los efectos de que el proyecto de construcción aún continúa conforme con las leyes y reglamentos aplicables.
- c. Solamente se concederá un máximo de dos (2) prórrogas de un (1) año.

5. REGLA 2.2.7 PRESUNCIÓN DE CORRECCIÓN Y LEGALIDAD

- a. Existe una presunción de corrección y legalidad para las determinaciones finales y los permisos expedidos por OGPe, los PA o los Municipios Autónomos con Jerarquías de la I a la III.
- b. Las determinaciones finales y permisos podrán ser revocados por el Tribunal de Primera Instancia, solamente cuando luego de la investigación administrativa correspondiente advenga en conocimiento de que dicha determinación final fue obtenida en violación a las leyes o reglamentos aplicables; o cuando la determinación final fue obtenida legalmente, pero existe evidencia de un incumplimiento a leyes y reglamentos durante su ejecución u operación.

ACUERDO

Por la presente, tomando en consideración lo anteriormente expuesto, y en virtud de las facultades conferidas mediante las leyes, los reglamentos y las normas y órdenes administrativas vigentes, la Secretaria Auxiliar OGPe tomó el siguiente **ACUERDO: Favorable**.

Disponiéndose lo siguiente: (1) de ninguna manera se entiende que esta autorización implica la otorgación de variaciones que no fueran adjudicadas en la radicación original, ni ha conllevado un nuevo proceso de revisión; (2) la parte proponente tendrá que actualizar las recomendaciones de la agencias concernidas; (3) las demás condiciones y requerimientos indicados en informes o resoluciones anteriores de este Desarrollo, no alterados por la presente resolución, se mantienen en todo su vigor y efecto. La vigencia de la presente determinación será de un (1) año a partir de su notificación.

Una parte adversamente afectada por una actuación, determinación final o resolución de la OGPe, podrá presentar una solicitud de revisión administrativa ante la División de Revisiones Administrativas, dentro del término jurisdiccional de veinte (20) día contados a partir de la fecha de archivo en autos, de copia de la notificación de la actuación, determinación final o resolución. Presentada la solicitud de revisión administrativa, la división correspondiente de la Oficina de Gerencia de Permisos, el Profesional Autorizado, o el Municipio Autónomo con Jerarquía de la I a la V, elevará a la División de Revisiones Administrativas de la OGPe copia certificada del expediente del caso, dentro de los diez (10) días naturales siguientes a la radicación de la moción.

La parte recurrente utilizará el mecanismo que proveerá el "Single Business Portal" al presentar el recurso electrónicamente ante la División de Revisiones Administrativas para notificar simultáneamente a la Oficina de Gerencia de Permisos, a la Junta Adjudicativa, los Municipios Autónomos con la Jerarquía de la I a la V, o al Profesional Autorizado, según aplique.

Además, la parte recurrente notificará copia de la solicitud de revisión administrativa, por correo certificado con acuse de recibo u mediante otro mecanismo dispuesto por reglamento, a las partes, incluyendo a la OGPe, y a los interventores, dentro del término de cuarenta y ocho (48) horas desde la presentación de la solicitud. La oportuna notificación es un requisito de carácter jurisdiccional y su cumplimiento deberá ser certificado y evidenciado oportunamente ante la División de Revisiones Administrativas.

El Juez Administrativo de la División de Revisiones Administrativas tendrá un término de quince (15) días para determinar si acoge la misma. Si en este término se denegase o no se emitiese una determinación a esos fines, en cuyo caso se entenderá rechazada de plano, perderá jurisdicción sobre la misma y comenzará a decursar el término de treinta (30) días para recurrir al Tribunal de Apelaciones desde que se notifique la denegatoria o desde que expiren esos quince (15) días, según sea el caso.



Resolución Sobre Solicitud de Prórroga o Reapertura

La División de Revisiones Administrativas dispondrá de las solicitudes acogidas ante su consideración dentro de un periodo de noventa (90) días naturales desde su presentación. Dicho término podrá ser prorrogado por treinta (30) días adicionales contados a partir de la fecha de vencimiento, en casos excepcionales. Si la División de Revisiones Administrativas no adjudicara la solicitud dentro del término aquí dispuesto, dicho foro perderá jurisdicción sobre la misma y comenzará a decursar el término de treinta (30) días para recurrir al Tribunal de Apelaciones. Las resoluciones de la División de Revisiones Administrativas serán consideradas determinaciones finales de la Oficina de Gerencia de Permisos.

La presentación de una solicitud de revisión administrativa no es un requisito jurisdiccional previo a la presentación de una solicitud de revisión de decisión administrativa ante el Tribunal de Apelaciones. No obstante, su oportuna presentación paralizará los términos para recurrir ante dicho Tribunal.

Cualquier parte adversamente afectada por una determinación final, permiso o resolución de la Oficina de Gerencia de Permisos podrá presentar una solicitud de revisión ante el Tribunal de Apelaciones, dentro de un término de treinta (30) días contados a partir de la fecha del archivo en autos de la copia de la notificación de la determinación final, permiso o resolución de la agencia o a partir de la fecha aplicable cuando el término para solicitar la revisión judicial haya sido interrumpido mediante la presentación oportuna de una solicitud de revisión administrativa. La parte notificará la presentación de la solicitud de revisión a la agencia y a todas las partes dentro del término para solicitar dicha revisión. La notificación podrá hacerse por correo.

FIRMAS Y SELLOS

NOTIFÍQUESE: A las partes cuyos nombres se mencionan a continuación: **Autoridad para el Redesarrollo Local de Roosevelt Roads, Avenida F.D. Roosevelt #355 Ceiba, PR 00918** [executivedirector@lra.pr.gov] por conducto del Ing. Carlos I. Báez Dotel, PO Box 195488 San Juan, PR 00919-5488.

CERTIFICO: Que la Secretaria Auxiliar de la OGPe, en Sesión celebrada el 31 de agosto de 2022, acordó lo aquí expuesto.

En San Juan, Puerto Rico hoy 6 de septiembre de 2022.


Arq. María Cintrón Flores
Secretaria Auxiliar OGPe/DDEC

CERTIFICO: Que he notificado copia fiel y exacta de la presente Resolución a las partes mencionadas en el Notifíquese, bajo mi firma:

En San Juan, Puerto Rico hoy 12 de septiembre de 2022


Idta Ríos Rodríguez
Secretaria





GOVERNMENT OF PUERTO RICO
STATE HISTORIC PRESERVATION OFFICE

Executive Director | Carlos A. Rubio-Cancela | carubio@prshpo.pr.gov

June 23, 2022

Nilda Marchán

Executive Director
LRA for Roosevelt Roads
Edificio de Comercio & Exportación
159 Ave. Carlos Chardón, Piso 3
Hato Rey, PR 00918

SHPO 05-25-22-01 CONSULTATION REGARDING NHPA SECTION 106
FOR ROOSEVELT ROADS, POTABLE WATER INFRASTRUCTURE
IMPROVEMENTS PROJECT, PHASE 1, ISLANDWIDE, PUERTO RICO /
LRA-22-107

Dear Ms. Marchán,

Our Office has received and reviewed the above referenced project in accordance with 54 U.S.C. 306108 (commonly known as Section 106 of the *National Historic Preservation Act*) and 36 CFR Part 800: *Protection of Historic Properties*.

We believe that a finding of **no historic properties affected** would be appropriate for this undertaking.

Please note that should you discover other historic properties at any point during project implementation, you should notify the SHPO immediately. If you have any questions regarding our comments, please do not hesitate to contact our Office.

Sincerely,

Carlos A. Rubio-Cancela
State Historic Preservation Officer

CARC/GMO/MB





GOBIERNO DE PUERTO RICO

Departamento de Salud
Secretaría Auxiliar para Salud Ambiental
División de Agua Potable

25 de abril de 2023

LRA-Roosevelt Rd 15MAY'23PM4:46

Nilda Marchand
Directora
Autoridad para el Redesarrollo Local de Roosevelt Roads
Ave. Roosevelt 355, Suite 106
San Juan, Puerto Rico 00918

**Re: Ceiba – Mejoras de Infraestructura (Fase I) en la
Antigua Base Roosevelt Roads.**

Estimada señora Marchand:

Me permito informarle que se otorga un re-endorso de construcción del proyecto en referencia, asignándole el permiso núm. 23-19-501.

Cualquier cambio que desee hacer al proyecto, deberá ser sometido con antelación a la consideración de este Departamento, con el propósito de asegurarnos que dicho cambio o modificación, no represente un riesgo a la salud pública.

La persona natural o jurídica encargada de la administración y mantenimiento del proyecto, será responsable ante el Departamento de Salud del funcionamiento del mismo. Además, será responsable de cumplir con las disposiciones de los reglamentos vigentes en Puerto Rico y demás **condiciones adicionales que se anexan**.

El Departamento de Salud se reserva el derecho de requerir las mejoras o alteraciones pertinentes adecuadas que por omisión involuntaria no se hayan incluido en el proyecto original y que a su juicio, sean necesarias para el buen funcionamiento y operación del sistema.

De tener algún comentario sobre el particular, puede comunicarse con nuestra División de Agua Potable adscrito a la Secretaría Auxiliar para Salud Ambiental en el Departamento de Salud. Nuestras Oficinas están ubicadas en el piso núm. 9, Edificio Nacional Plaza, Ave. Ponce de León #431, Hato Rey, Puerto Rico.

Cordialmente,

Javier O. Torres, P.E.
Director Interino
División de Agua Potable

JMS

cf

Integra Design Group, PSC.; Sr. Javier Melendez, Coordinador Región Este, Departamento de Salud

CONDICIONES ADICIONALES

1. El endoso tendrá validez de un (1) año. Luego de este período de no haber iniciado la construcción del proyecto, deberá solicitar el endoso nuevamente, sometiendo los planos de construcción y documentos necesarios.
2. Proveer “check valve” en el punto de aplicación de cloro pre (en sedimentadores).
3. Notificar a este Departamento sobre las reuniones pre-construcción e inspecciones pre y finales del proyecto.
4. Se realizará una inspección una vez terminada las obras para otorgar un permiso de operación. Notificar cuándo estas mejoras serán puestas en operación para uso público.
5. Notificar el comienzo de la desinfección de líneas instaladas, tanques u otra facilidad antes de comenzar a operar. La misma estará sujeta a corroboración por nuestro Departamento.
6. Incluir dichas mejoras al sistema en la forma utilizada "Record Creation & Maintenance".

4. ENVIRONMENTAL REPORT





Preliminary Engineering Report (PER) for:

Potable Water Infrastructure Improvements (Phase I) at Roosevelt Roads Re-development Ceiba-Naguabo, Puerto Rico

March 1, 2016

Submitted to:



LOCAL REDEVELOPMENT AUTHORITY FOR ROOSEVELT ROADS

Fomento Industrial Building
#355 Roosevelt Ave. Suite 106
Hato Rey, PR 00918
T (787) 274-6088
www.rooseveltroads.pr.gov

Submitted by:



Integra Design Group,
Architects & Engineers, PSC
576 Arterial B Avenue, Suite 102
San Juan, PR 00918

Contact: Carlos I. Báez, MSCE, PE
Principal in Charge | Lead Engineer
T. 787-767-2111 F. 787-758-7757
cbaez@integrapr.com
<http://integrapr.com/>

Contents

LIST OF APPENDIXES	5
LIST OF FIGURES	6
LIST OF TABLES	7
1) EXECUTIVE SUMMARY & INTRODUCTION	8
2) PROJECT PLANNING	10
a) Location	10
b) Environmental Resources	14
i) Flood Areas	14
ii) Soils	15
iii) Geology	15
iv) Preservations Areas and Archaeology	16
v) Surface Waters and Groundwater	16
vi) Land Use	18
vii) Environmental Concern Areas	19
viii) Vegetation	22
ix) Wildlife	23
c) Service Areas and Population Trends	25
i) Service Area	25
ii) Population Trends	26
x) Population Projection	28
d) Community Engagement	30
3) EXISTING FACILITIES	31
a) History	31
i) Raw Water Line & Reservoir	31
ii) Water Treatment Plant	32

iii)	Water Distribution System	32
iv)	System Administration and Operation	32
b)	Condition of Existing Facilities	32
i)	Raw Water Intakes and Extraction Capacity	32
ii)	Raw Water Pipeline.....	34
iii)	Raw Water Reservoir	35
iv)	Water Treatment Plant (WTP)	36
v)	Storage Tank 86 (Tacan).....	39
vi)	Distribution System	40
d)	Financial Status of any Existing Facilities	42
e)	Water/Energy/Waste Audits	42
4)	NEED FOR PROJECT	43
a)	Health, Sanitation and Security	43
b)	Aging Infrastructure	43
c)	Reasonable Growth	43
5)	ALTERNATIVES CONSIDERED	45
a)	Introduction	45
b)	Design Criteria & Flows	45
i)	Demand Flows.....	46
vii)	Distribution System Design Criteria	47
c)	Alternative 1	48
i)	General Description	48
ii)	Raw Water Intake Improvements	48
iii)	Raw Water Reservoir	48
iv)	Raw Water Pipeline	48
v)	Water Treatment Plant Upgrade and Rehabilitation	48
vi)	Storage Tank 86 (Tacan)	50

vii)	Distribution System	50
xi)	Environmental Impacts.....	51
xii)	Land requirements	52
xiii)	Potential Construction Problems.....	52
xiv)	Sustainability Considerations.....	52
xv)	Permits.....	54
xvi)	Expansion Capacity	55
xvii)	Social and Community Impacts	55
xviii)	Cost Estimate	56
d)	Alternative 2	57
i)	General Description	57
ii)	Raw Water Intake Improvements	57
iii)	Raw Water Reservoir	57
iv)	Raw Water Pipeline	57
v)	Water Treatment Plant Substitution.....	57
vi)	Storage Tank 86 (Tacan)	58
vii)	Distribution System	58
viii)	Environmental Impacts.....	59
ix)	Land requirements	60
x)	Potential Construction Problems	60
xi)	Sustainability Considerations.....	60
xii)	Permits.....	62
xiii)	Expansion Capacity	63
xiv)	Social and Community Impacts	63
xv)	Cost Estimate	64
e)	Alternative 3	65
i)	General Description	65

ii)	Raw Water Intake Improvements	65
iii)	Raw Water Reservoir	65
iv)	Raw Water Pipeline	65
v)	Water Treatment Plant Closure	65
vi)	PRASA Water Source Connection	66
vii)	Storage Tank 86 (Tacan)	66
viii)	Distribution System	66
ix)	Environmental Impacts.....	67
x)	Land requirements.....	68
xi)	Potential Construction Problems.....	68
xii)	Sustainability Considerations.....	68
xiii)	Permits.....	70
xiv)	Expansion Capacity	71
xv)	Social and Community Impacts	71
xvi)	Cost Estimate	72
6)	SELECTION OF AN ALTERNATIVE	73
a)	Life Cycle Cost Analysis	73
i)	Initial Capital Cost	73
ii)	Investment cost	73
iii)	Land	73
iv)	Operational Costs	73
v)	Design Lives and Replacement Schedule	76
vi)	Total Equivalent Present Cost Analysis.....	77
b)	Non- monetary Factors	77
c)	Evaluation matrix for the Assessment of Alternatives	79
7)	PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)	81
a)	Introduction.....	81

b) Project Design	81
i. Drinking Water:.....	81
ii. Wastewater/Reuse	81
iii. Solid Waste	81
iv. Stormwater	82
c) Project Schedule	82
d) Permit Requirements	83
e) Sustainability Consideration	83
i. Water Efficiency	83
ii. Energy Efficiency	84
iii. Green Infrastructure	84
f) Total Project Cost Estimate (Engineers Opinion of Probable Cost)	84
g) Annual Operating Budget	85
i. Annual O &M Costs	85
ii. Initial Interests Repayment.....	86
iii. Debt Repayment	87
iv. Reserves.....	88
v. Income	89
h) Project Budget	93
8) CONCLUSIONS AND RECOMMENDATIONS	95
REFERENCES	97

LIST OF APPENDIXES

Appendix I Alternative 1 Location Plan & Preliminary Cost Estimate
Appendix II Alternative 2 Location Plan & Preliminary Cost Estimate
Appendix III Alternative 3 Location Plan & Preliminary Cost Estimate
Appendix IV Census Data
Appendix V OMB Circular A-94

LIST OF FIGURES

Figure 1 Geographic Location	10
Figure 2 Location Map- USGS Topographic Map	11
Figure 3 Aerial Photo	12
Figure 4 Re-development zones (2014 Master Plan)	13
Figure 5 FEMA Flood Maps	14
Figure 6 Soil Survey	15
Figure 7 Geological Map	16
Figure 8 Groundwater Resources Map	17
Figure 9 Surface Water Resources Map	18
Figure 10 Land Use Map (ROTFU-PR Planning Board Zoning)	19
Figure 11 Environmental Concern Areas	21
Figure 12 Vegetation Areas	22
Figure 13 Threatened Wildlife Habitat Locations	24
Figure 14 Project Service Areas	26
Figure 15 Population History Graph	27
Figure 16 Population Projection Graph for Phase I	29
Figure 17 Former Naval Base Map	31
Figure 18 Rio Blanco Raw Water Intakes (top: at tail race, bottom: at upstream)	33
Figure 19 Rio Blanco Raw Water Intakes Grit Chamber	33
Figure 20 Raw Water Intake and Pipeline Location	34
Figure 21 Raw Water Reservoir	35
Figure 22 Raw Water Reservoir	36
Figure 23 Water Treatment Plant	37
Figure 24 Water Treatment Plant	38
Figure 25 Water Treatment Plant control building deteriorated roof slabs	38
Figure 26 Sludge Lagoons	39
Figure 27 Distribution Storage Tank 86 (Tacan)	40
Figure 28 Existing Water Distribution System	41
Figure 29 Existing and Proposed Water Distribution System (Alternative 1)	51
Figure 30 Existing and Proposed Water Distribution System (Alternative 2)	59
Figure 31 Existing and Proposed Water Distribution System (Alternative 3)	67
Figure 32 Loan Disbursement S-Curve	86

Figure 33 Net Present Value Graph.....	94
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LIST OF TABLES

Table 1 Population for Ceiba and Naguabo Communities, Years 2000-2010	28
Table 2 Projected Population Calculation for Phase I	29
Table 3 Existing Facilities Operation & Maintenance Annual Costs	42
Table 4 Service Area (Phase I) Client's Growth	44
Table 5 Design Flowrates Criteria for Proposed Uses	46
Table 6 Calculated Water Demands	46
Table 7 Water Demands Summary	47
Table 8 Distribution System Design Criteria	47
Table 9 Cost Breakdown for Alternative 1	56
Table 10 Cost Breakdown for Alternative 2	64
Table 11 Cost Breakdown for Alternative 3	72
Table 12 Summary of Investment Cost	73
Table 13. Water Annual Operation and Maintenance Cost (O&M) - Alternative 1	74
Table 14. Water Annual Operation and Maintenance Cost (O&M) - Alternative 2	74
Table 15. Water Annual Operation and Maintenance Cost (O&M) - Alternative 3	74
Table 16 Summary of Annual Operation and Maintenance Costs (O&M)	75
Table 17 Total Present Cost Value for Each Alternative	77
Table 18: Alternatives Advantages & Disadvantages	78
Table 19: Alternative Evaluation Matrix	80
Table 20 Schedule Summary	82
Table 21 Estimated Operational Costs for the Project	85
Table 22 Interest Debt Service Repayment Schedule	87
Table 23 Loan Repayment Details	88
Table 24 Proposed Billing Fees & Rates	89
Table 25 Phase I Customer Class Summary	90
Tables 26 Monthly Customer Billing per Development Period	91
Table 27 Project Budget Cash Flow	93

1) EXECUTIVE SUMMARY & INTRODUCTION

The “Local Redevelopment Authority for Roosevelt Roads” (LRA), proposes major water infrastructure improvements for the initial re-development at a group of land parcels conforming the former “Naval Station Roosevelt Roads”. This group of parcels is located on the Machos, Guayacán, Quebrada Seca and Daguao Wards, in the municipalities of Ceiba and Naguabo, PR. After the United States Navy ceased military operations in Roosevelt Roads in 2004, the Government of Puerto Rico created the “Local Redevelopment Authority – Roosevelt Roads” (LRA) as the government agency authorized to promote the re-development at the former base.

The re-development of the former “Naval Station Roosevelt Roads” (NSRR or Roosevelt Roads) in Ceiba and Naguabo, requires the planning for a proper infrastructure support. Because of its age and prior uses, the existing facilities at former NSRR won’t—at mid and long term- optimally satisfy the predicted demands as defined by a Reuse Plan prepared by the LRA.

The 2014 Development Zones Master Plan was prepared by the LRA and the 2014 “Plan Especial y Reglamento para el Redesarrollo de los Terrenos y Facilidades de la Antigua Base Naval de Roosevelt Roads, (ROTFU)” was prepared by the PR Planning Board as Reuse Plans to supplement and redirect the focus of the development to better leverage site opportunities, current market potentials and strategic economic development opportunities in order to temperate new economic and social conditions. After full build-up (in about 25 years), it is expected to create 21,000 jobs and bring \$280 million from the construction and \$600 million from the operation during the first 20-25 years. It will then support a mixed development of residential units, hotel rooms, combined lodging, retail, office and light industrial space.

In addition the “2012 Roosevelt Roads Infrastructure Master Plan” was developed as a fundamental complement to re-use plans. It provided the guidelines and cost projections for the entire shared infrastructure and major utility components. It also included an assessment of the existing conditions based on data supplied by the former occupants as well as from technical reports prepared by numerous professionals since 2004.

Based on current redevelopment conditions, the LRA has the intention to provide initial infrastructure improvements (Phase I) for a portion of the re-development zones as established in the 2014 Development Zones Master Plan. The developing zones are the following: A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, D1. While some portions of the proposed infrastructure improvements will provide the capacity for servicing the 25 years (years 2016 to 2041) re-development period, other components such as the raw water intake will have a limited capacity until the year 2028.

The infrastructure improvements must be developed during the first 5 years (years 2016 to 2021) of the re-development in order to be effective and in operation for the current and initial clients.

This report incorporates current data as well as the data contained in the “2012 Infrastructure Master Plan” and compares the assessed water infrastructure components against the proposed projects (as per the 2014 Development Zones Master Plan and the 2014 Reuse and the Land Use Plan (ROTFU)) and determines the capacity and adequacy of each system. It provides a list of recommendations for improvements or changes within all primary, shared utility corridors. It also incorporates development phases into its recommendations.

In order provide a feasible alternative for the project, a Preliminary Engineering Report (PER) is presented here. The Preliminary Engineering Report (PER) evaluates the project’s scope feasibility, by considering and evaluating different alternatives. The analysis and evaluation will consider different parameters and factors

such as; project development cost, environmental & social impacts, operation & maintenance, sustainability and constructability among others.

Being of a strategic nature, the alternatives presented on this PER, impact the principal water infrastructure services. Different assessments were performed, but the secondary infrastructure requirements located within future public or private developments inside the zones parcels are not included as part of the assessments. Nonetheless, capacities and demands assume the development goals proposed within the 2014 Development Zones Master Plan and the 2014 Reuse and the Land Use Plan (ROTFU) for the whole redevelopment period.

In essence, the assessments concluded that given the age, most of the existing utility systems are obsolete and inefficient which will require major reinvestment to update/modernize.

Three alternatives are being considered for the improvements:

- **Maintaining and upgrading the existing water filtration treatment plant and upgrading portions of the pipe distribution network and related systems.**
- **Elimination of the existing water filtration treatment plant, developing a new WTP and upgrading portions of the pipe distribution network and related systems.**
- **Elimination of the existing water filtration treatment plant and connecting to the existing Puerto Rico Aqueduct and Sewer Authority (PRASA) system in the Municipality of Fajardo and upgrading portions of the pipe distribution network and related systems.**

The considered alternatives are presented on this PER, along with their corresponding conceptual design parameters, total development costs and lifecycle financial cost analysis for USDA Rural Development loan assistance program.

2) PROJECT PLANNING

a) Location

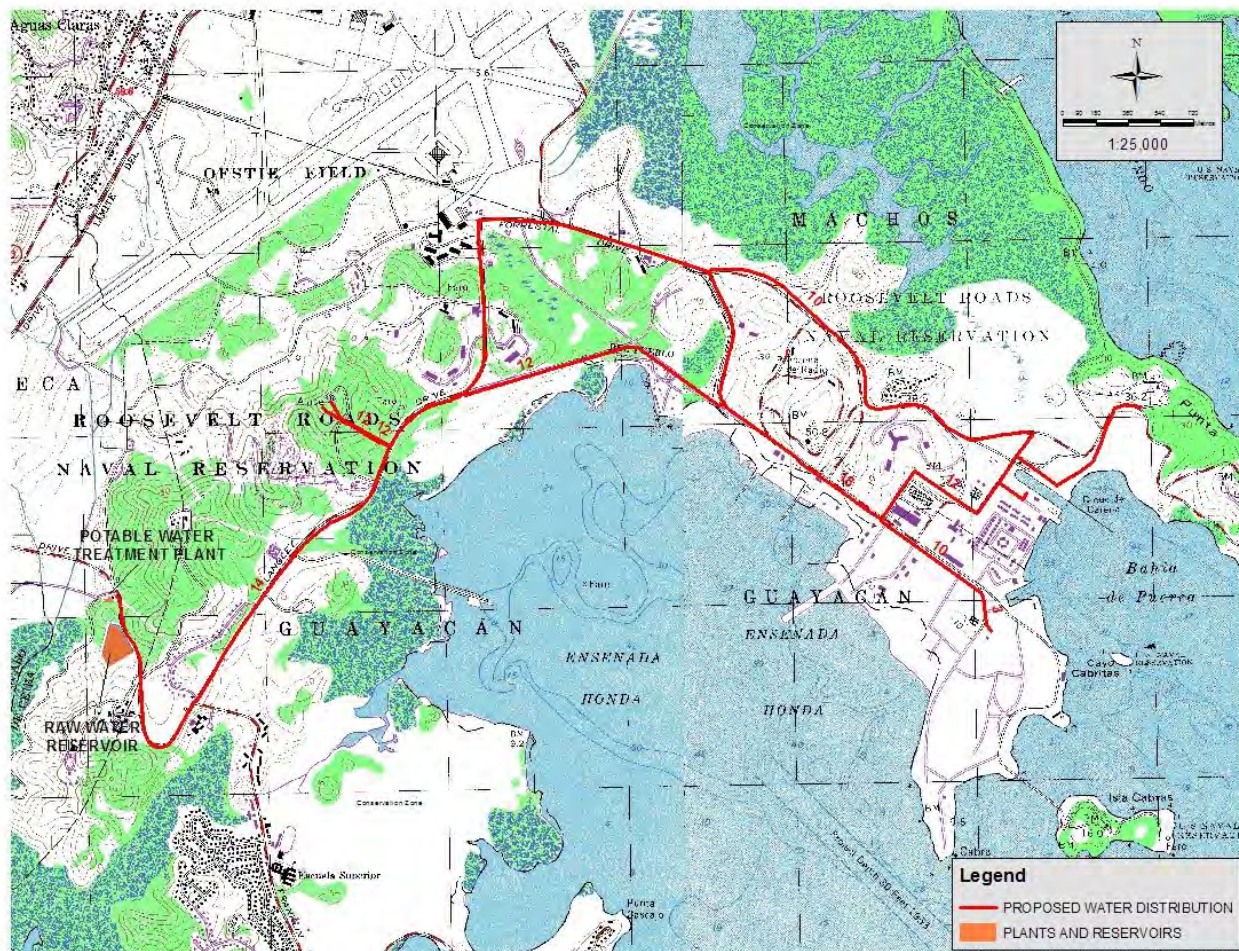
The former Naval Station (NSRR) is located in the municipalities of Ceiba and Naguabo. To the North is bounded by the municipality of Fajardo, to the East is bounded by Vieques Passage, to the South is bounded by the municipality of Humacao and to the West is bounded the municipalities of Luquillo, Rio Grande and Las Piedras.



Figure 1 Geographic Location

The former NSRR is bounded on the North by the various public lands and the access road from State Road PR-3; on the South by various conservation zones on public lands; on the East by Medio Mundo Passage, Bahia Ensenada Honda and Bahia de Puerca; and on the West by State Road PR-53 and Jose Aponte de la Torre Airport.

The area under consideration for this project is located inside the NSRR premises at the Municipality of Ceiba portion, and based on the 2014 Development Zones Master Plan, includes zones: A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, D1. A Location Map and an Aerial Photo are shown on Figure 2 and Figure 3, respectively. The zones location according to the 2014 Master Plan is shown in Figure 4.



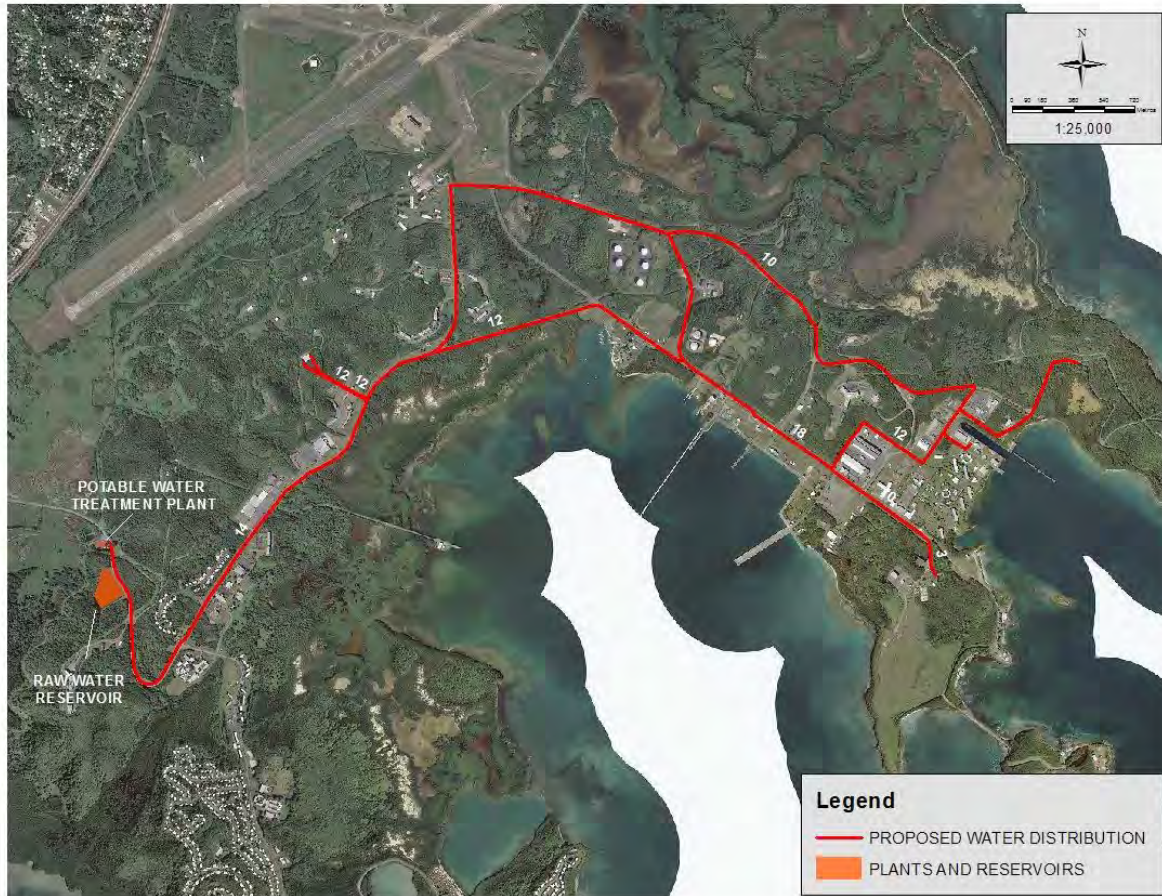


Figure 3 Aerial Photo

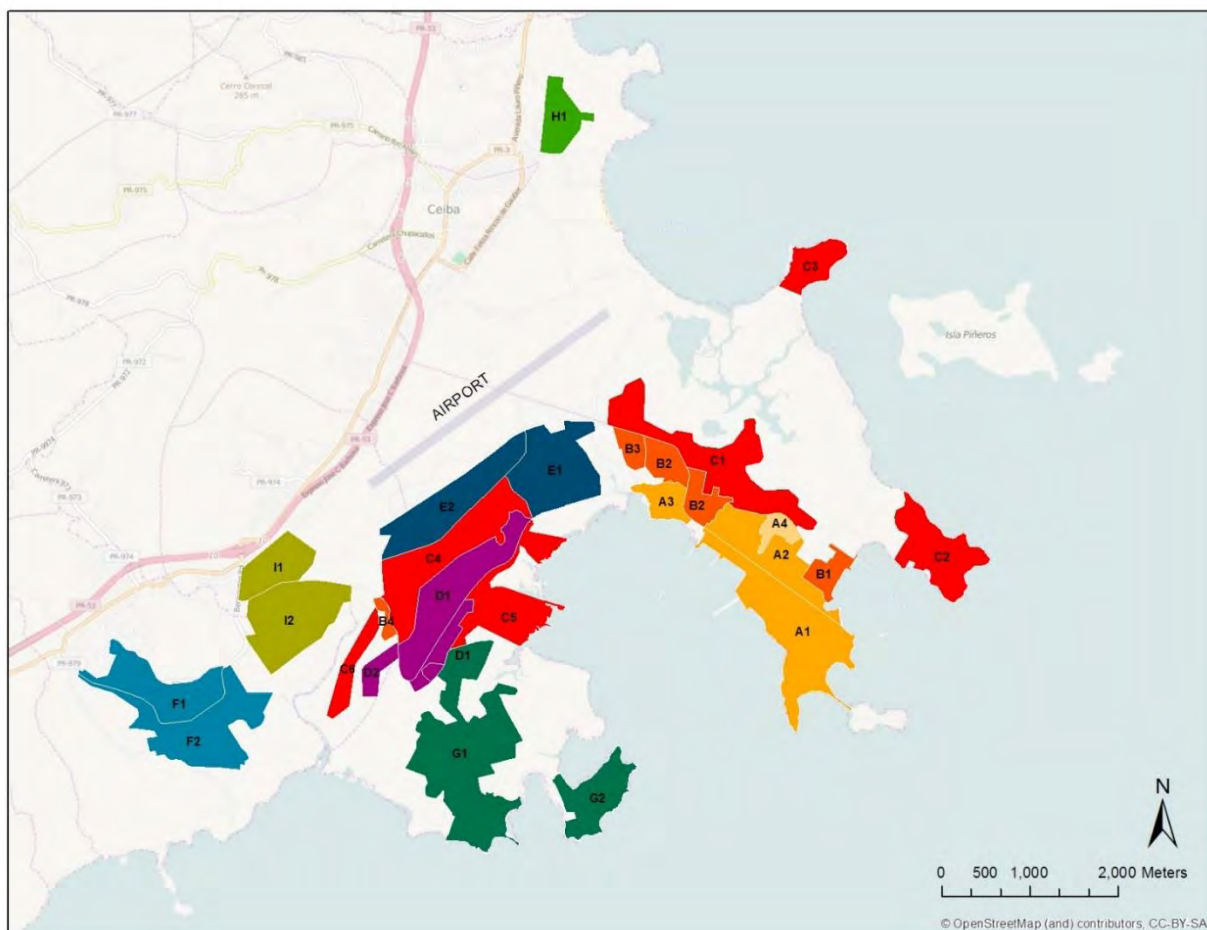


Figure 4 Re-development zones (2014 Master Plan)

b) Environmental Resources

The proposed project will be located within a suburban improved area, which is mainly comprised of existing roads and developed commercial /industrial areas. The environmental resources that are located within the area to be impacted are described as follows:

i) Flood Areas

Figure 5 (FEMA Flood Map) shows the susceptibility areas of flooding for the proposed project. Due to the location of the site, the current maps with effective date November 18, 2009, applied to this project are the 72000C1285J, 72000C1305J, 72000C840J and 72000C0820J. There are multiple flooding risk areas defined as Zones: A, AE, VE and X. Zones AE and VE shows the Base Flood Elevations or depths within those zones¹. The proposed distribution pipes improvements locations will be underground and at existing roads corridors. The existing distribution tanks and water treatment plant are located outside flood zones. Flooding does not represent a significant issue to the proposed water treatment and distribution systems improvements.

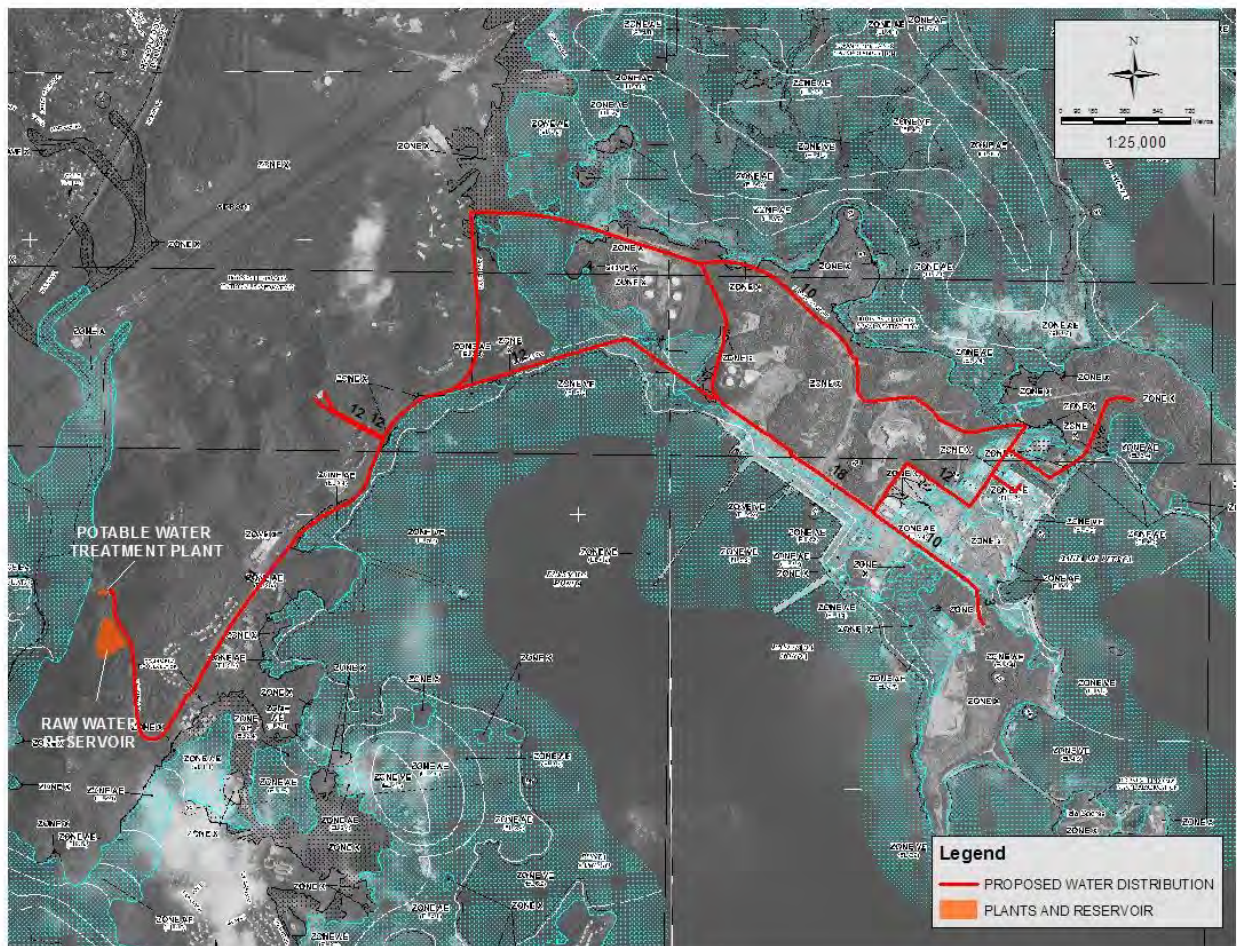


Figure 5 FEMA Flood Maps
Maps Numbers: 72000C1285J, 72000C1305J, 72000C840J and 72000C0820J

¹ For more information about flood rate zones, please refer to <https://msc.fema.gov/portal>.

ii) Soils

As shown in Figure 6, according to the soil survey, prepared by the USDA Natural Resources Soil Conservation Service, the primary types of soils within the project area consist of: Descalabrado and Guayama Soils (DgF2), Jacana Clay (JaC2), Made land (Md), Descalabrado Clay Loam (DeE2), Mabi Clay (MaB) and Coloso Silty Clay Loam (Co).

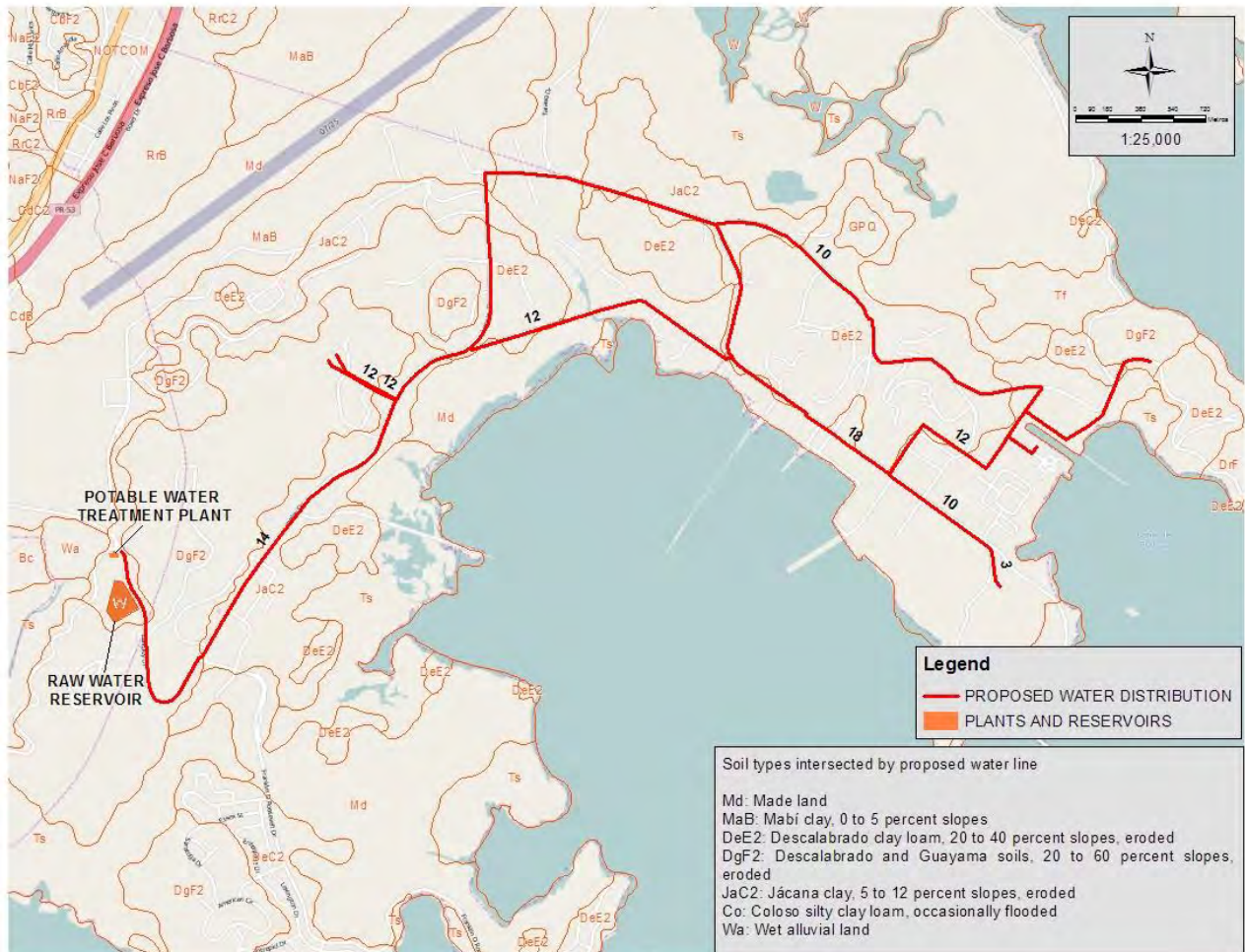


Figure 6 Soil Survey

iii) Geology

As shown in Figure 7, the formations within the proposed project as reported by United States Geological Survey (USGS) consist of: Artificial fill and manmade land (af), Hornblende quartz diorite (Tkdd), Dagua Intrusive breccia (Kdi), Diorite (Tkd), Beach deposits (Qb), Dagua formation (breccia) (Kd-ts), Swamp Deposits (Qs), and Alluvium and fanglomerate (Qaf).

Minor geological faults were identified on the project area near the raw water reservoir and on some portions of the existing pipelines. Those faults are inactive and do not represent any hazard to the water treatment and distribution system.

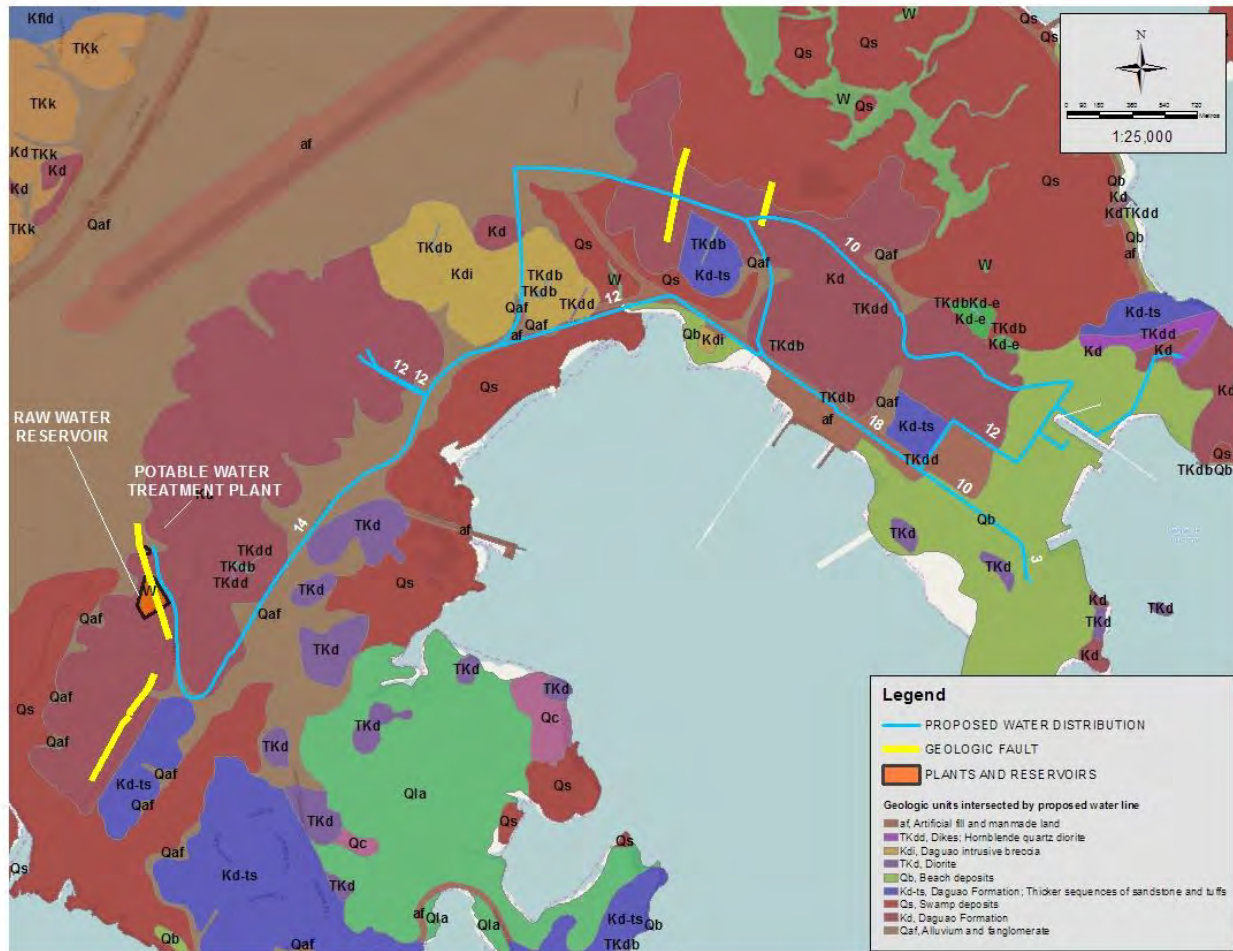


Figure 7 Geological Map

iv) Preservations Areas and Archaeology

The Navy conducted station-wide archaeological surveys in three phases from 1994 through 1996. More than 25% of the Naval Station was surveyed as part of this initiative, resulting in the identification of 27 archaeological sites. An additional four sites were identified during a survey conducted in the summer of 2004. Of the 31 sites identified to date that lie within the former base, 19 sites have been determined to be eligible and three sites are classified as potentially eligible for listing in the NRHP. The remaining sites have been determined to be ineligible for listing. The remaining acres at the installation, which were identified as being relatively undisturbed and having a moderate to high potential for the presence of archaeological resources, were surveyed in mid-2005. The survey effort identified three additional sites as eligible for the NRHP.

The proposed project will not impact any identified preserved historic or archeological areas.

v) Surface Waters and Groundwater

Several streams that originate in the foothills northwest of NSRR flow through the premises and drain the lands that make up NSRR. These streams include the Rio Daguao and various named and unnamed creeks, and they are an important source of freshwater flow and nutrients to large marshes and the Daguao and

Demajagua mangrove forests. In addition to freshwater drainages, estuarine open water lagoons exist in association with the Los Machos mangrove forest. Multiple culvert crossings that discharge surface waters into the Ensenada Bay and mangrove areas are located along roads where improvements are expected.

The principal aquifer in the NSRR area is an alluvial valley aquifer, consisting of beds of clay, sand and gravel, and rock fragments to a depth of 98 feet or less (Gomez Gomez and Heisel 1980). Yield of wells in the alluvium are commonly 50 to 150 gallons per minute (gpm) (U.S. Geological Survey 2002).

Volcaniclastic, igneous, and sedimentary aquifers of Cretaceous and Tertiary age are also present in the area. Compared to the alluvial aquifers, these are of minor importance and yield because water is stored and transmitted in fractures in the rock. Wells completed in these aquifers typically yield less than 10 gpm (U.S. Geological Survey 2002).

Construction and operation of new facilities have the potential to result in impacts on groundwater recharge and discharge and on water quality. The water infrastructure improvements are within areas that were previously developed, thereby minimizing impacts on these undeveloped buffer areas. With implementation of best management practices during construction and storm water treatment measures, construction and operation of the facilities are not expected to result in significant adverse impacts on surface water. Figures 8 & 9, shows the area of the proposed project and the surface and groundwater resources.



Figure 8 Groundwater Resources Map

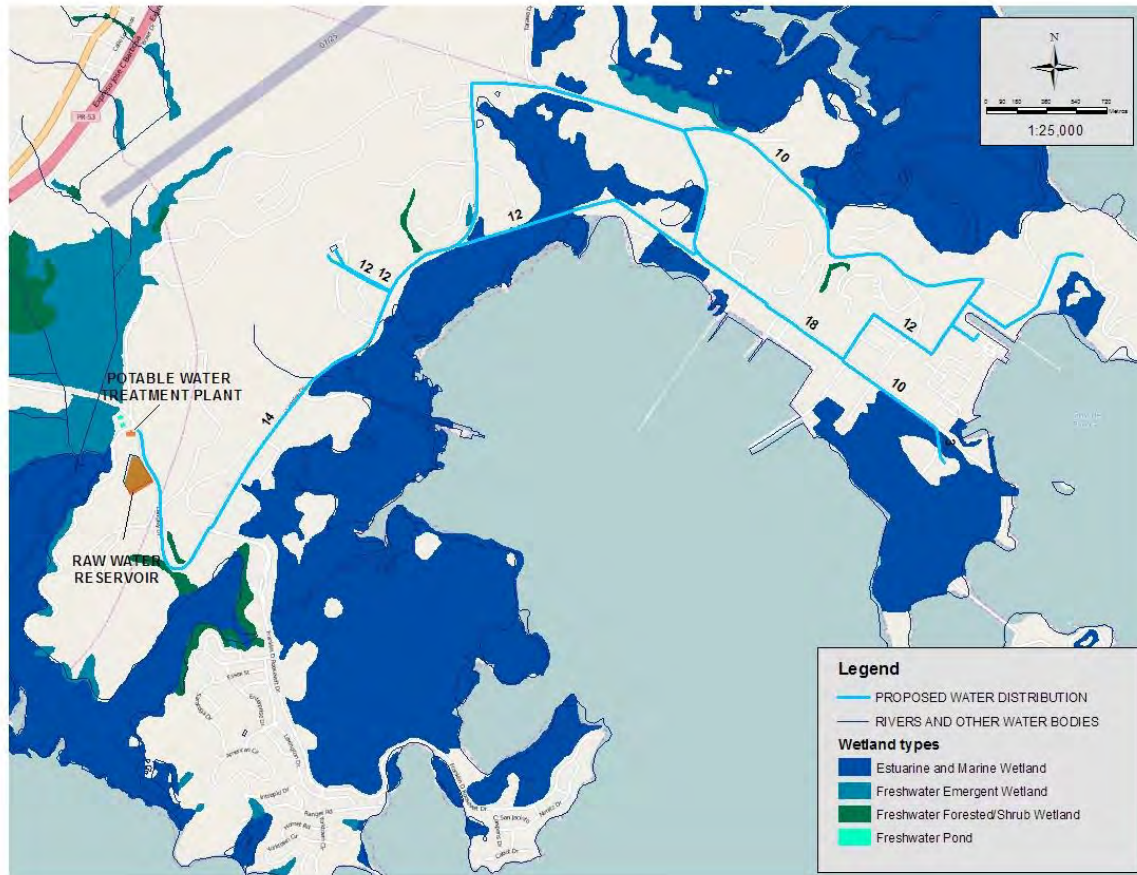


Figure 9 Surface Water Resources Map

vi) Land Use

As shown in the Land Use Map Figure 10, the land uses defined in the “Mapa del Reglamento de Ordenacion de los Terrenos y la Forma Urbana de la Antigua Base Naval de Roosevelt Roads (ROTFU)” published by the PR Planning Board, the locations of the proposed water infrastructure improvements comprise multiple land uses. The proposed land uses defined by the PR Planning Board are similar to the current existing land use in terms of developed and undeveloped zones. The infrastructure located on the West portion on the NSRR interconnects a conservation zone with a proposed commercial-residential zone (thru Langley Drive). The South central portion connects another conservation zone with an urban maritime front zone (thru Langley Drive, Marina By-Pass Road and Forrestal Drive). Some of the land use zones are the following:

- M1: Urban-General (high density residential & commercial)
- M2: Urban-Central (high density residential & commercial)
- M3: Maritime Front (high density residential & commercial)
- DE: Educational
- E1: Conservation District (recreational, agricultural and natural resources conservation)
- E2: Rural District (natural resources conservation)

The project will only have a direct impact during construction works and during operation of the public use areas and the Residential urban areas. The portions located within conservation zones will be installed on existing road corridors.

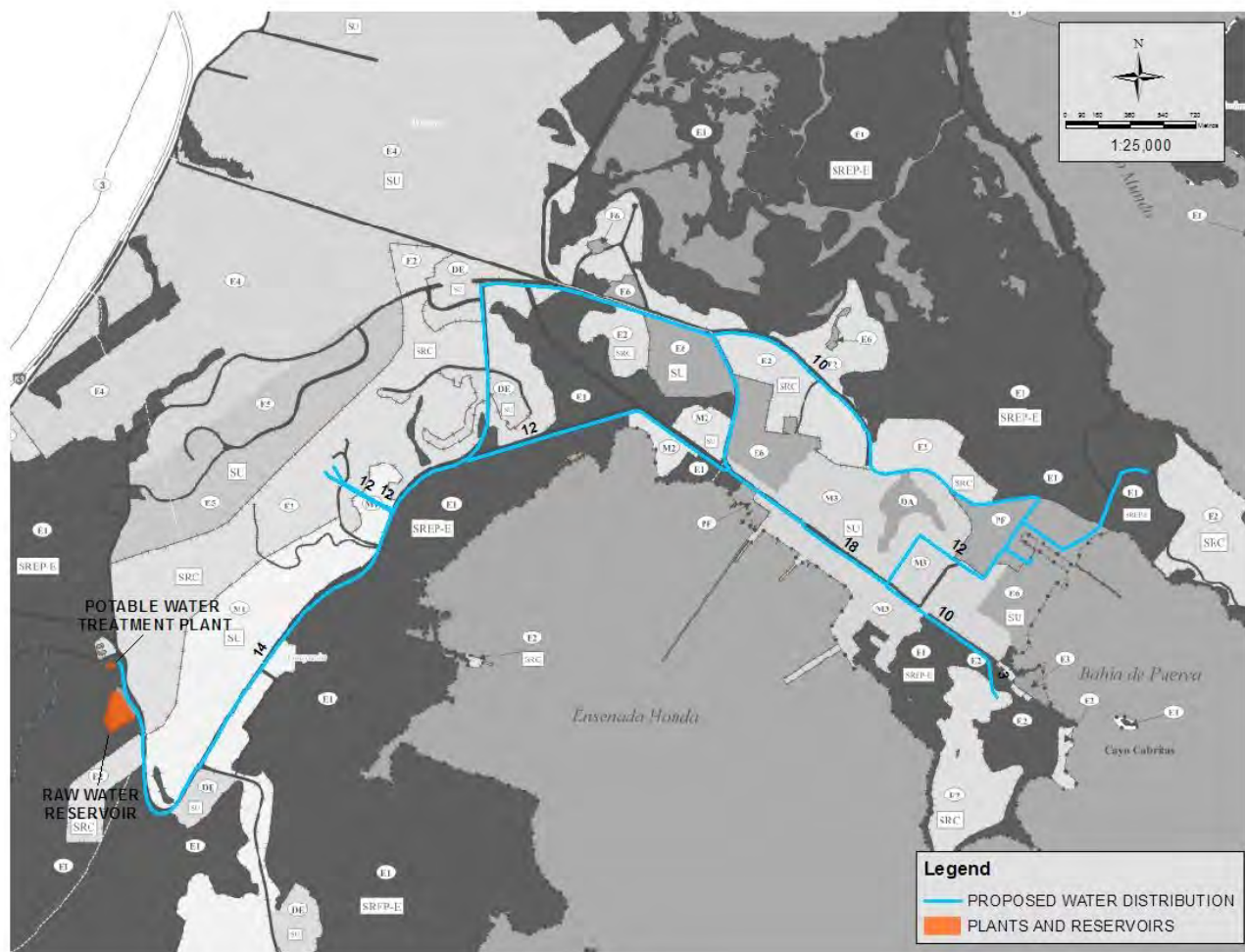


Figure 10 Land Use Map (ROTFU-PR Planning Board Zoning)

vii) Environmental Concern Areas

The Navy has conducted a series of Environmental Condition of Property (ECP) Assessments. The effort focused on all available information pertaining to current and past uses of the property, specifically focusing on activities that might pertain to the use, storage, release, or disposal of hazardous substances and petroleum products or their derivatives. The ECP report identified a mature installation restoration program (IRP) at the facility administered under a Resource Conservation and Recovery Act (RCRA) Part B permit specifying corrective action. The current permit was issued by EPA on October 20, 1994 and addresses 55 solid waste management units (SWMUs), four areas of concern (AOCs), and an additional unclassified site for a total of 60 sites. A permit renewal application was submitted in 2004 that proposes updated actions based on progress to date. The sites are in various stages of study and cleanup, ranging from preliminary investigation to remedial action complete. These sites are identified as SWMU and AOC sites on. The current status of the 60 sites is as follows:

- 30 sites – corrective action complete;
- 9 sites – proposed for no further action;
- 7 sites – proposed for no further action with land use controls; and
- 14 sites – various stages of ongoing study and remediation.

Following the base closure, installation operations that required a RCRA Part B Permit have ceased, and the regulated units are now undergoing closure according to the permit requirements. Upon completion of closure, only the corrective action portions of the permit need to remain in force.

Most of the project proposed improvements and pipelines are located outside the environmental concern sites, but are aligned adjacent to some of those sites.

The adjacent sites are the following:

- | | | |
|-----------|-----------|-----------|
| • SWMU 1 | • SWMU 60 | • SWMU 30 |
| • SWMU 2 | • SWMU 10 | • SWMU 3 |
| • SWMU 17 | • SWMU 70 | • SWMU 32 |
| • SWMU 25 | • SWMU 11 | |

Some portions of the existing main water pipelines are located within environmental concern sites. Those pipelines will remain installed and will have no impact or disturbance of the concern areas. The identified sites are the following:

- | | | |
|-------------------|-------------------|-------------|
| • SWMU 29 | • SWMU 74 Hill S2 | • SWMU 7/8 |
| • SWMU 30 | • SWMU 74 Hill S3 | • AOC F1995 |
| • SWMU 71 | • SWMU 74 Hill S4 | • SWMU 55 |
| • SWMU 42 | • SWMU 74 Port SC | • SWMU 45A |
| • SWMU 67 | • SWMU 74 Port SD | • SWMU 13 |
| • SWMU 74 Hill S1 | • SWMU 74 Port SE | • AOC F1738 |

Only a minor portion of pipelines replacements are located within environmental concern sites. The impacted areas are the following:

- SWMU 42: Improvements on water treatment plant sludge lagoons
- SWMU 45-A: Pipelines replacement

Those parcels have the following land use controls:

- SWMU 42 Water Treatment Plant Filter Backwash Lagoons designed as Corrective Action with Controls until the sediment in the lagoons is removed and disposed of properly when the plant ceases operation. While the WTP and lagoons are operational, either the Navy (pre-transfer) or the new property owner (post transfer) will perform annual inspections to ensure non-residential land use is maintained and lagoon sediments are not disturbed (Baker, 2008a).
- SWMU 45-A is the exterior of Building 38 where transformer oils containing PCBs were routinely discarded directly onto the ground, and includes the path of the cooling water intake tunnel from Puerca Bay. There are two closed in place 50,000-gallon underground storage tanks (USTs) associated with SWMUs 11/45. To prevent unacceptable risks to human health and the environment, the Navy included the following land use controls on some of the properties:

To prevent unacceptable risks to human health and the environment, the Navy included the following land use controls on some of the properties:

- A restriction on land use to non-residential uses only.
- A restriction on certain invasive activities in areas where surface soil, subsurface soil and or sediments are contaminated.
- A restriction on use of groundwater and installation of new wells in or near areas of known groundwater contamination.

- A requirement to protect the integrity of any existing and all future groundwater monitoring or extraction wells, remedial action equipment and associated utilities.
- A requirement that all ongoing and future environmental investigations and remedial activities at or adjacent to the Subject Property not be disrupted.

The pipeline installation or improvements adjacent environmental concern sites will be kept at a safe buffer distance in order to prevent any disturbance on those sites. This measure will be strictly enforced during the construction phase.

For the SWMU 42, the Navy has a cleanup process finishing on March 2016. In case that the cleanup process is not performed, the WTP rehabilitation project contemplates the removal and disposal of the sludge sediment. In addition, environmental monitoring will be implemented during the removal phase in order to prevent any environmental risk.

For the SWMU 45-A, the Navy has a cleanup process finishing on October 2017. Pipeline replacements inside that area, will be scheduled to be performed after that date. In addition, environmental monitoring will be implemented during the construction phase in order to prevent any environmental risk. The concern areas are shown on Figure 11.

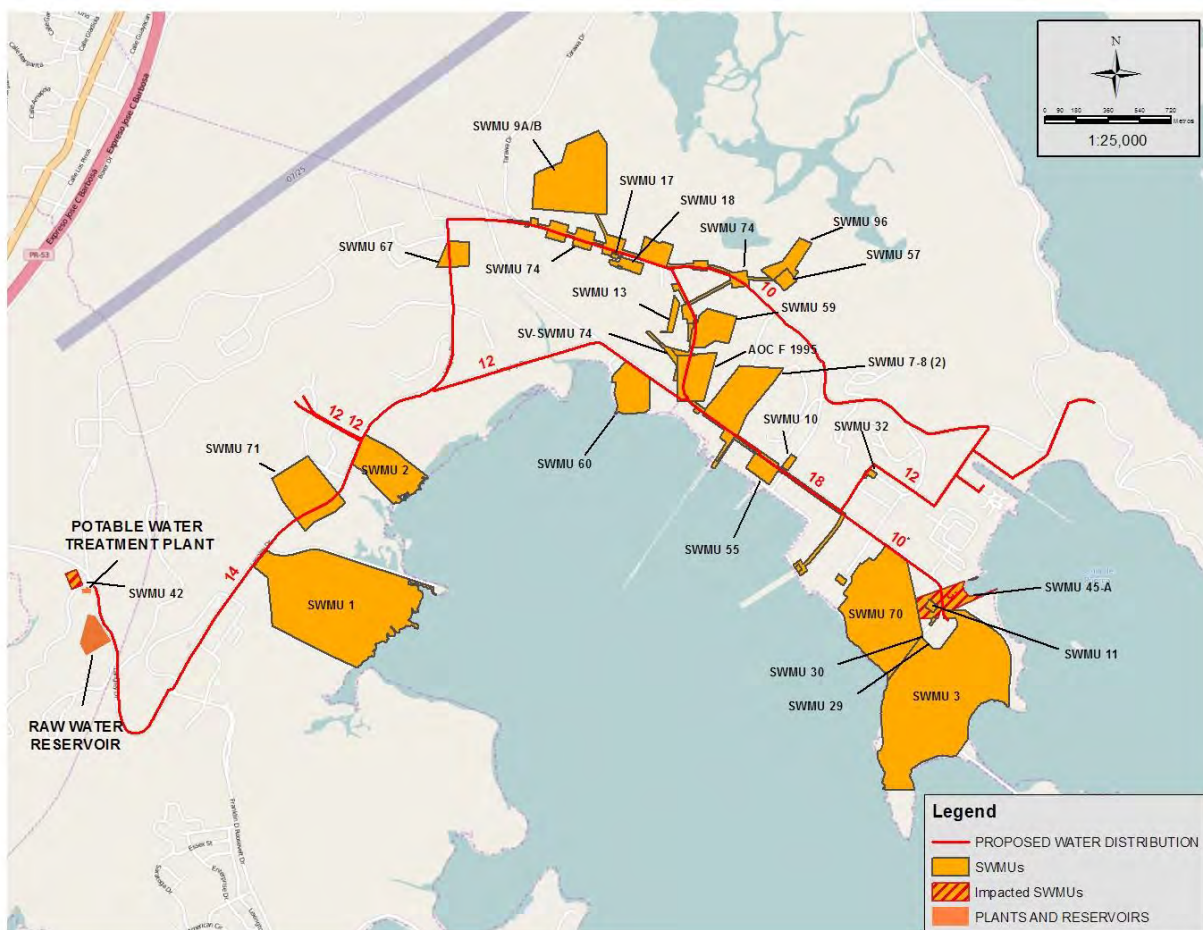


Figure 11 Environmental Concern Areas

viii) Vegetation

The coastal area of Puerto Rico near Ceiba, including NSRR, is classified as a subtropical dry forest ecological life zone (Ewel and Whitmore 1973). Historical land use of the property, which has included grazing and development associated with NSRR, has lead to the replacement of the historic climax upland community with scrub/forest communities. Approximately 2,500 acres of land at NAPR have been developed. The remainder of the base comprises unimproved (4,500 acres) and semi-improved (1,400 acres) areas with various terrestrial, marine, and transitional communities (U.S. Navy 2004).

Terrestrial communities at NAPR include coastal scrub forest, upland coastal forest, grassland, and freshwater wetlands (wet coastal scrub forest and wet meadow). Wetland communities—transitional areas between marine and terrestrial environments—have been divided into freshwater and tidal wetland communities. Mangrove forests comprise about 2,100 acres of NAPR (U.S. Navy 1996), approximately 25% of NSRR.

The majority of the undeveloped terrestrial areas at NSRR are characterized as coastal scrub forest communities. One plant has been identified as threatened species, the “Cobana Negra”.

The proposed improvements will be located on the existing road corridors and right of ways. Some road corridors can be located thru natural zones such as heavily vegetated areas and wetlands, thus construction activities shall be performed with restrictions in order to prevent, the intrusion of heavy equipment and personnel into those sensitive areas. In addition effective erosion control measures are needed to prevent sedimentation and contamination. No temporary or permanent effect on sensitive vegetation areas is expected due to the proposed improvements. The concern areas are shown on Figure 12.



Figure 12 Vegetation Areas

ix) **Wildlife**

Wildlife at NSRR comprises multiple native reptile, amphibian, and avian species as well as a host of introduced mammal species. Approximately six species of snakes are known to occur at NSRR. Known snake species include the Puerto Rican boa (*Epicrates inornatus*), Virgin Island tree boa (*Epicrates monesis granti*), Puerto Rican racer (*Alsophis portoricensis*), Puerto Rican garden snake (*Arrhyton exiguuum*), Virgin Island blindsnake (*Typhlops richardi*), and Puerto Rican wetland blindsnake (*Typhlops rostellatus*) (U.S. Navy 1998). A large mongoose population has reduced the reptile population.

Multiple terrestrial and seabird species use the beach strand, grassland, upland forest, and mangrove forest habitats at the station. Numerous species of frogs and toads occur, including the coqui, a small tree frog. The mammal population is predominantly made up of introduced species that include mongoose, dogs, cats, Norway and grey-bellied rats, and mice (U.S. Navy 2004).

Threatened and endangered species are typically found primarily in less disturbed and more unique communities. Federally listed and Commonwealth-listed plant and animal species found at NAPR includes one Mammal specie (west Indian Manatee), 6 Reptiles species (Pr Boa, Turtles, etc.), and 10 Bird species (Yellow-shouldered blackbird, etc.).

Threatened and endangered species location areas and conservation measures are defined in the report "Parcel Map for the Disposal of Naval Activity Puerto Rico" (U.S. navy 2005). The conservation measures require the consultation with the U.S. Fish and Wildlife Service regarding all development plans on the identified areas. Also it requires that some development, construction and maintenance activities be restricted on a seasonal basis and to maintain a buffer distance from sensitive areas. For developments near sea turtle nesting beach areas, it requires to implement precautionary measures before, during, and after development activities. For Yellow-shouldered blackbird nesting areas, visual inspections must be performed in order to identify any nesting on buildings, structures and trees.

The proposed improvements will be located on the existing road corridors and right of ways. Some road corridors can be located thru natural zones where endangered species can be found, such as the Yellow-shouldered Blackbird nesting areas, thus construction activities shall be performed with restrictions in order to prevent the intrusion of heavy equipment and personnel into those sensitive areas. In addition effective erosion control measures are needed to prevent sedimentation and contamination adjacent to turtle nesting areas.

Minor temporary disruption can be caused on existing structures (buildings) where the Yellow shouldered-blackbird can be encountered, for that reason, qualified personnel shall be present at all times during construction activities to identify and prevent any adverse effect on that specie. No permanent effect on threatened or endangered wildlife is expected due to the proposed improvements. The concern areas are shown on Figure 13.

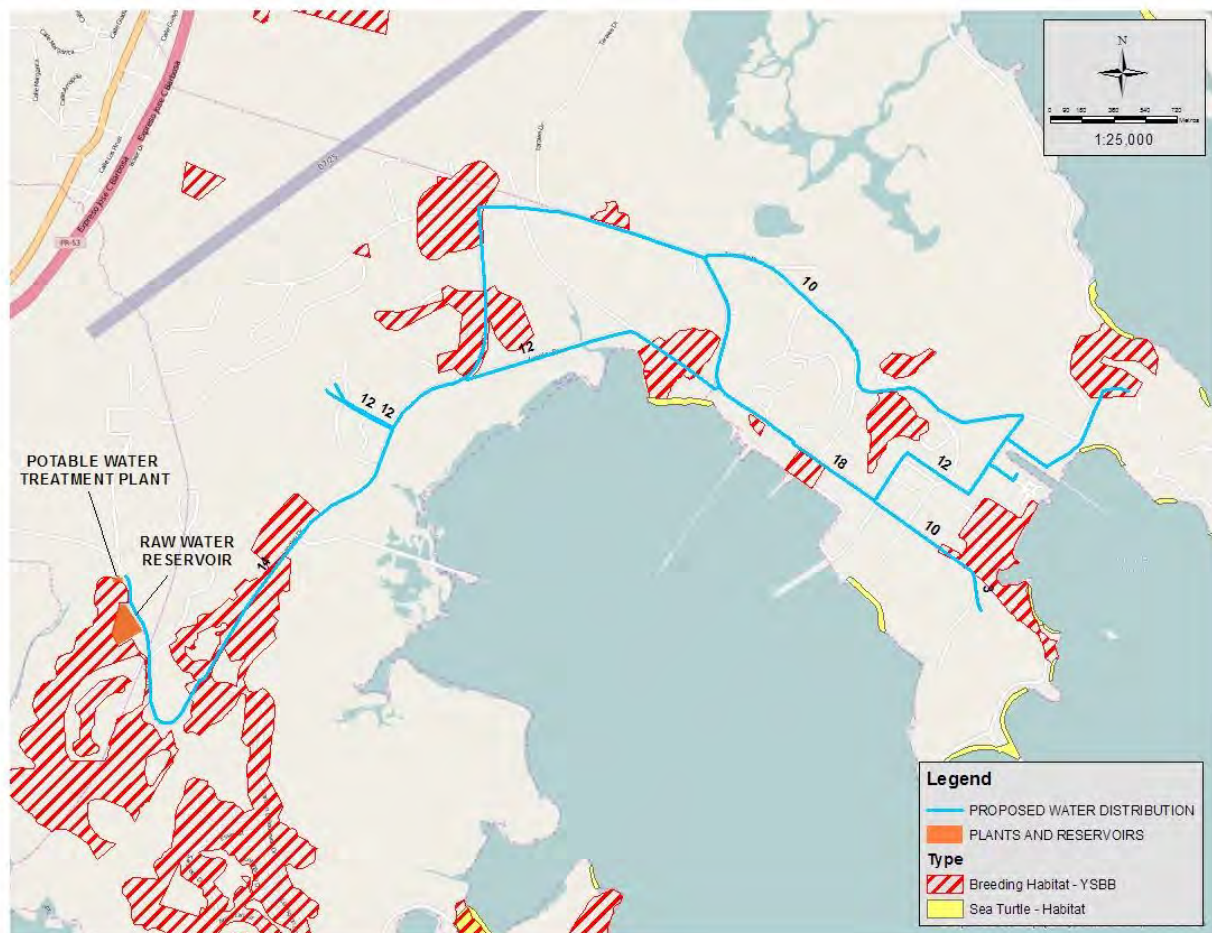


Figure 13 Threatened Wildlife Habitat Locations

c) Service Areas and Population Trends

i) Service Area

The Roosevelt Roads Redevelopment encompass a series of zones as defined in the 2014 Development Zones Master Plan and the “Plan Especial y Reglamento para el Redesarrollo de los Terrenos y Facilidades de la Antigua Base Naval de Roosevelt Roads, (ROTFU)”.

A brief description of each zone is presented here:

Zone	Uses Description
A1 Waterfront District	Mixed use development (residential-commercial)
A2 Forrestal Bayview Hills	Mixed use; hotels, retail, health related
A3 Commercial Marina	Small vessel marina, nautical tourism, commercial
A4 Hospital	Hospital or health related facility
B1 Waterfront Industrial	Dry dock for boat repairs, office space
B2 Fuel Terminal	Fuel storage terminal and support
B3 Light Industrial Support	Light industrial, offices
B4 Water Treatment Plant	Existing water treatment plant
C1 Marsh Vista	Golf course, eco housing, retail
C2 Punta Puerca	Eco-lodge, visitors center, research
C3Punta Medio Mundo	Environmental research, eco-lodging
C4 Las Delicias Hill	Golf course and housing
C5 Ensenada Honda Lowlands	Trails, parkland, pier
C6 Guadalcanal	Trails, boardwalks, parkland
D1 Langley Urban Strip	Retail, institutional, multifamily housing, lodge
D2 South Princeton Hill	R&D center or museum facility
E1 Airside Industrial Park	Aviation oriented industries, offices
E2 Airside Institutional Cluster	Institutional, colleges, technical institutes
F1 Bundy Campus	R&D facilities, corporate retreats, small retail
F2 Ocean Hills	Lodging, sustainable residential
G1 Inland Capehart	School, office park, small retail
G2 Cascajo Peninsula	Waterfront residential
H Ceiba Ensanche	Small retails, welcome center
I1 Highway Portal	Recreational, PV farm, agriculture
I2 Langley Lowlands	Trails, boardwalks, parkland

Based on current redevelopment conditions, the LRA has the intention to provide initial infrastructure improvements (Phase I) for a portion of the re-development zones. The Phase I developing zones are the following: A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, D1.

In addition to serving those zones, the proposed infrastructure improvements will provide the capacity for servicing other future interconnected re-development zones, in the 25 years (years 2016 to 2041) development period. Due to the fact that the proposed infrastructure improvements will provide service to future re-development areas outside the project area, the service area covers the entire Roosevelt Roads parcels as defined in the 2014 Master Plan and the 2014 ROTFU.

The infrastructure improvements must be developed during the first 5 years (years 2016 to 2021) of the re-development in order to be effective and in operation for the current and initial clients.

The area coverage for the flow calculations is presented in Figure 14.

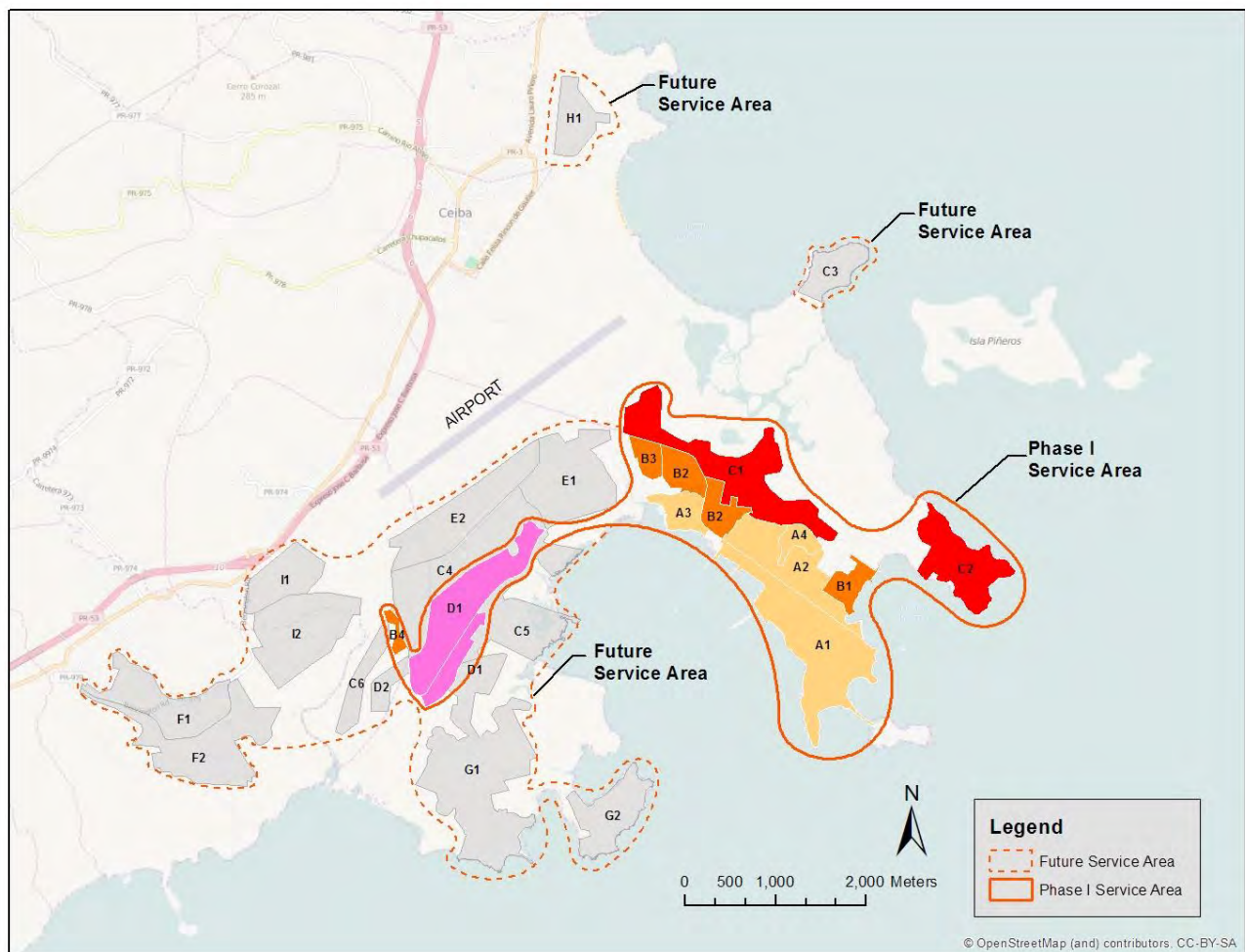


Figure 14 Project Service Areas

ii) Population Trends

In the last demographic data reported by The US Census Bureau, the municipality of Ceiba reported a total population of 13,631 people and for the municipality of Naguabo a total of 26,720. Comparing the Population History bar graphs shown in Figure 15 for both municipalities, Naguabo reported a positive population trend growth since 1960 versus Ceiba, which in the last decade reported a loss of 4,373 people.

The Municipality of Naguabo reported data has shown a constant 0.5% increase. The only decade that reported a negative trend was in the 50's decade. That decrease in population of 3,824 can be attributed to the migration reported to the United States mainland in those years, but otherwise there hasn't been any other population reduction in the municipality of Naguabo.

The Municipality of Ceiba reported three (3) trends, the first trend reported was considered from 1920 to 1970 with a 1.15% increase. The Second trend was reported from 1970 to 2000 with a 0.4% increase. The last trend occurred in the last decade in which was reported a decrease in population with a trend of 0.3%. This decrease in population can be attributed with the closure of the Roosevelt Roads Naval Station. A graph depicting the total population from the years 1920 to the year 2010 for both municipalities is shown on Figure 15.

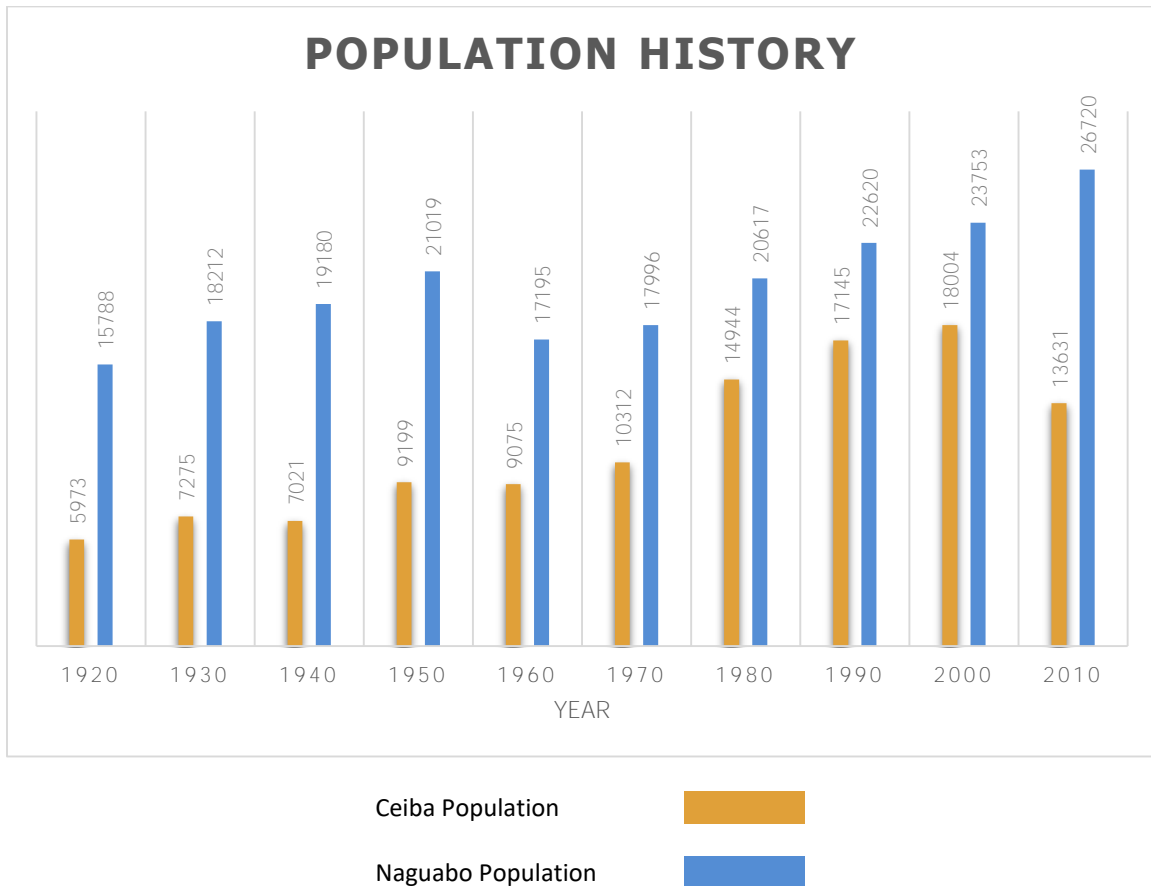


Figure 15 Population History Graph

The NSRR area is located in the Municipality of Ceiba between Guayacán, Machos, Quebrada Seca and Dagua Ward and in the Dagua Ward in the Municipality of Naguabo. Table 1 shows the population distribution along the mentioned wards including the Roosevelt Road community with a reported total population of 3,975 people in the year 2010. As stated before, due to the Naval Station closure in 2004, all operations ceased and the permanent residents were relocated. For this reason the population reported in year 2010, was of 2 residents.

Table 1 Population for Ceiba and Naguabo Communities, Years 2000-2010

	Ward		Year	2000	2010
Ceiba	Guayacán			3242	2
	Roosevelt Road Community			3242	2
	Machos			4186	3567
	Aguas Claras			203	175
	Ceiba zona urbana			2404	1910
	Roosevelt Road Community			719	0
	Remainder of Machos			860	1482
	Quebrada Seca			1568	1415
	Aguas Claras			1494	1273
	Roosevelt Roads Community			14	0
	Remainder of Quebrada Seca			60	142
	Daguao			237	235
Naguabo	Daguao			237	235
	Daguao			2186	2273
	Daguao Community			1488	1604
	Roosevelt Roads			0	0
	Remainder of Daguo			698	669

x) Population Projection

Typically, the population projection for the design period of 25 years will involve the extrapolation of the census trends of the service area and surrounding communities. In this case, as indicated above, the Ceiba municipality shows a negative population trend and the Naguabo municipality shows a positive population trend, according to PR Planning Board census data, (See Appendix IV).

Due to the nature of the project, those trends will not effectively represent the population projection for this redevelopment.

The residential components of the proposed redevelopment (Phase I) in the 25 years period were distributed in various phases according to the 2014 master plan and the 2012 Infrastructure Master Plan. Based on the redevelopment phasing schedule, and the total number of dwelling units contemplated (2,536), a population projection was obtained from the year 2016 up to the year 2041.

As obtained from the 2010 Census data for the municipality of Ceiba, an average of 2.61 persons per dwelling unit was used for the population calculations. The calculated population for the entire redevelopment period is shown on Table 2 and the population trend graph is shown on Figure 16.

Table 2 Projected Population Calculation for Phase I

Redevelopment Period (years)	Cumulative Dwelling Units	Persons per Unit	Population
2016 to 2017	0	2.61	0
2018 to 2022	530	2.61	1378
2023 to 2027	1015	2.61	2639
2028 to 2032	1522	2.61	3957
2033 to 2037	2029	2.61	5275
2038 to 2041	2536	2.61	6594

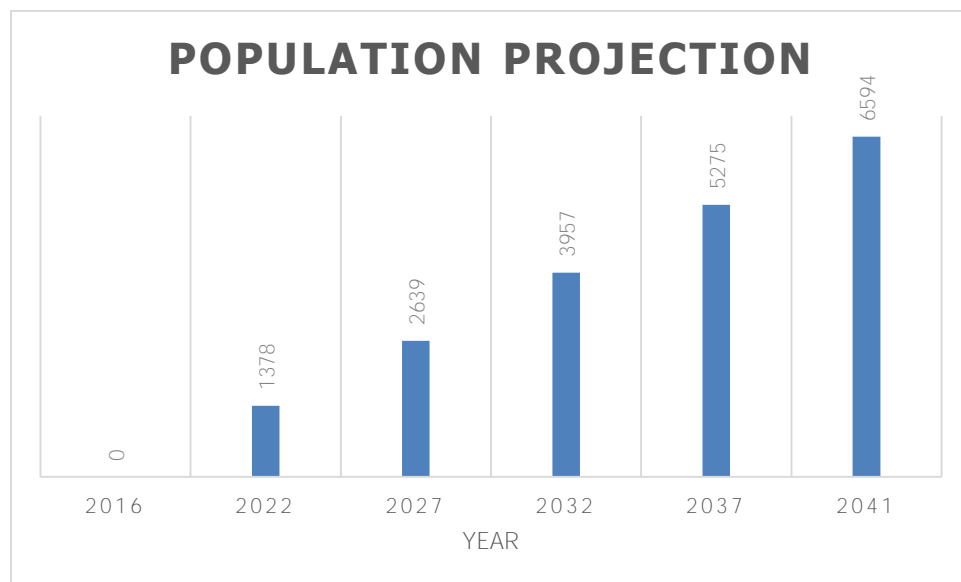


Figure 16 Population Projection Graph for Phase I

d) Community Engagement

As part of the re-development efforts since the base closure in 2004, the surrounding communities in Ceiba and Naguabo have been informed of the re-development plans. The LRA has engaged the communities through a series of public hearings, meetings, educational workshops, presentations and participative committees.

In order to ensure community representation in the planning and redevelopment of the property, and pursuant to an executive order by the Governor of PR, the LRA Board of Directors includes the appointment of two residents of Ceiba, and one of Naguabo to the Board of Directors, the entity tasked with working with the LRA in developing a reuse plan.

In addition, the Mayors of Naguabo and Ceiba are also members of the Board. In order to address community concerns and to ensure local participation, the Board created subcommittees that were to be principally composed of residents of Ceiba and Naguabo. The subcommittees created included: Planning and Property Uses, Environment, Housing and Homeless, Human Resources, Economic Development, Infrastructure, Health and Education

Multiple citizens from the Eastern region of Puerto Rico actively participated in the sub-committees, providing insightful and enthusiastic policy recommendations and suggestions related to the future of the former base. In order to understand the communities existing needs, since 2004 and continuously, the LRA also made numerous trips and visits to the area to meet with community leaders, community organizations, displaced workers, industry leaders, local stakeholders and other affected parties.

3) EXISTING FACILITIES

a) History

President Franklin Roosevelt ordered the construction of the facility in 1940. It was completed in 1943 and Roosevelt Roads was commissioned as a U.S. Naval Operations Base. The water supply system was constructed between 1942 and 1943 and still is in use today. It obtained water from the tail race of the Insular Power plant (currently Puerto Rico Electric Power Authority- Rio Blanco Hydroelectric Plant) on the Rio Blanco in Naguabo. The raw water is delivered through 11 miles of 27 inch concrete pipe by gravity to a 43,600,000 gallon raw water reservoir on the base. The raw water is then treated at the Water Treatment Plant by coagulation, filtration, and chlorination and delivered to fresh water reservoirs by pump, for gravity distribution to the entire base. The treatment plant was designed for a daily capacity of 4,000,000 gallons per day (4.0 MGD)¹.

1. "Building the Navy's Bases in World War II" History of the Bureau of Yards and Docks and the Civil Engineering Corps 1940-1946 Volume II.

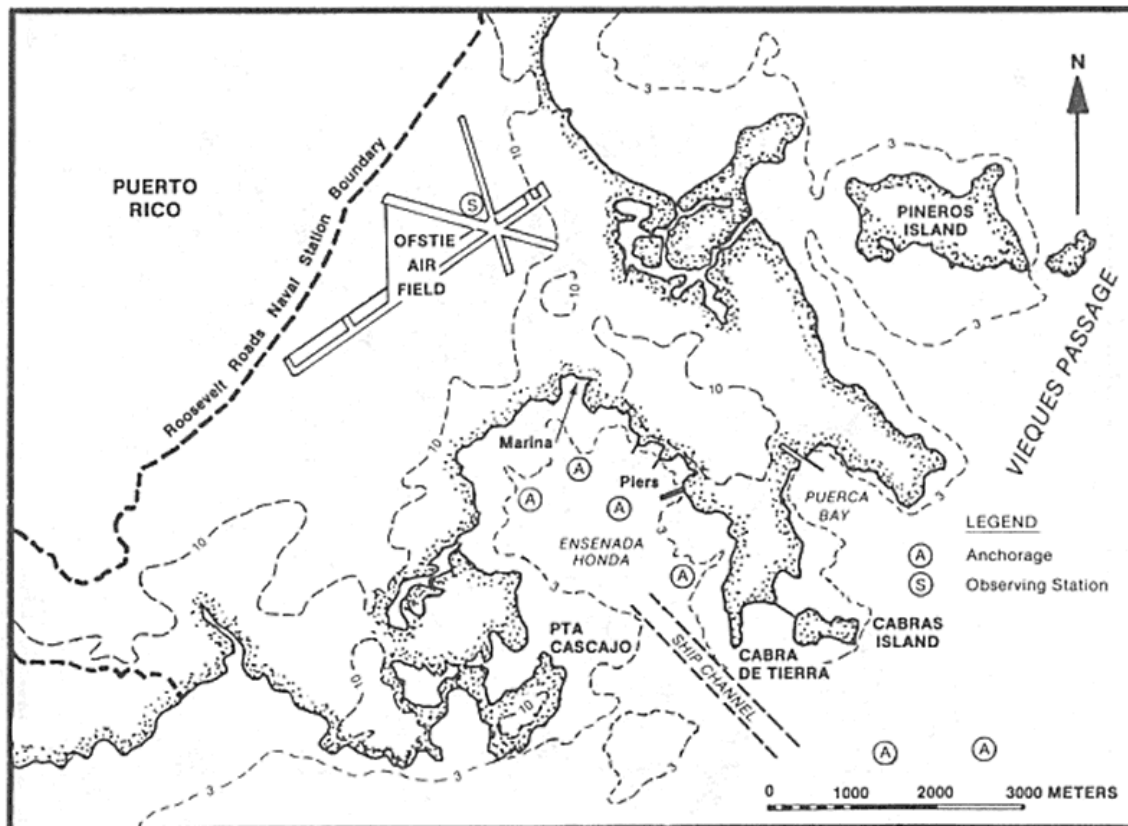


Figure 17 Former Naval Base Map

i) Raw Water Line & Reservoir

The raw water supply line continues to operate without major improvements since its installation in 1943. The raw water transmission main and intake underwent some upgrades during 1991. Work included a new intake screen, removal of accumulated sediment in the grit tank, replacement of access hatches and goosenecks at the grit tank, and provision of air and vacuum relief valve on certain high points along the

raw water transmission main profile between the intakes and the treatment plant. In addition improvements to the raw water reservoir perimeter fence and valve pits were performed.²

ii) **Water Treatment Plant**

A major repair project was undertaken in 1976. This project included the complete replacement of the sand media, filter underdrains, filter control console and valves. Surface washers also were added at this time. During 1977 and 1978, two sludge lagoons were constructed for the purpose of capturing and thickening solids greeted during the treatment process.

Another major repair program was developed in 1986. Included in this project were improvements to the chemical feed facilities and laboratory as well as replacement of the flash mix basin aeration piping and blowers, and a new emergency generator was also included².

In 1998 other improvements were performed that included sludge lagoons sediment removal, major upgrades to valves, sensors and controls, major electrical improvements and the installation of a caustic soda system.

2. Report 1 Potable Water System Evaluation Study Prepared by Baker Environmental and Roy F. Weston, Inc. March 1993,

iii) **Water Distribution System**

Major water distribution system repairs and upgrade were performed in 1990 for the project "Hurricane Hugo Repairs to Water Distribution System". It included replacement of major water lines with new PVC pipes, new valves and new pressure reducing systems on all he base premises.

Another major improvements were performed in 1995 that included the replacement of some portions of the main distribution pipelines, new hydrants, improvements to controls an telemetry to existing booster pump stations and the construction of an additional booster pump station.

iv) **System Administration and Operation**

The US Navy owned the water treatment and distribution system facilities but the operation of all the systems was performed by a private sub-contractor.

Currently the water treatment and distribution system facilities are owned by the LRA, but the operation of the WTP is performed by a private sub-contractor. The LRA provides maintenance to the water distribution system. The water service is billed to some of the current tenants, depending on use of the facilities and on various fee agreements.

b) **Condition of Existing Facilities**

i) **Raw Water Intakes and Extraction Capacity**

There are two intakes on the Rio Blanco for the raw water line, one located upstream of the Hydroelectric Power Plant and another at the Plant tail race. The flow capacity of the Intake # 2 is dependent of the power plant operation. The intakes grit chamber is cleaned on a yearly basis by an LRA contractor. The grit chamber is in fair condition, but minor improvements can be performed to the access hatches.

Although the intakes maximum capacity is over 4.0 MGD, currently the maximum allowable extraction rate is about 1.5 MGD, in order to prevent any detrimental impact on the Puerto Rico Aqueduct and Sewer Authority (PRASA's) Rio Blanco Reservoir intake. The diversion of 1.5 MGD from the Rio Blanco, is

considered on the report: *"Firm Yield Analysis and Impact on Minimum Instream Flows: Rio Blanco Offstream Reservoir"*, prepared for PRASA by Gregory L. Morris & Assoc. on August 22, 2000. The Ro Blanco Offstream Reservoir is in operation since the October 2008.



Figure 18 Rio Blanco Raw Water Intakes (top: at tail race, bottom: at upstream)



Figure 19 Rio Blanco Raw Water Intakes Grit Chamber

ii) Raw Water Pipeline

The raw water pipeline is composed of an 11 mile 27 inch concrete pipe. Although no assessment or improvements have been performed on the raw water pipelines since the last upgrades during 1991, the system is in operation and provide the necessary water delivery for storage and treatment.

There are not known any major issue affecting its capacity. Based on previous reports and information provided by the current operator, the precise location of the complete pipe alignment is unknown.² There are multiple air release valve pits (45 per records) along the route. During field surveys performed on 1993, multiple small diameter connections without backflow preventers were found outside the base premises. By examination of existing legal documents and right of way plans, there is an easement for the complete alignment. Approximately 9 miles of the pipeline is located outside the base premises on a dedicated easement. Currently, large portions of the pipeline easements have been developed with residential and commercial structures. The condition of the pipe below those structures has not been assessed.

The raw water delivery piping has control valves on the pipe entering the raw water reservoir to divert water from the reservoir into the surrounding wetland, if necessary. These have automatic control as well as manual. The valves are in working condition but the Auto servo-motors do not work. The valves are operated manually. The control valves box needs cleaning.³

3. Naval Station Roosevelt Roads Potable Water System Assessment Report May 2011 prepared by ERM

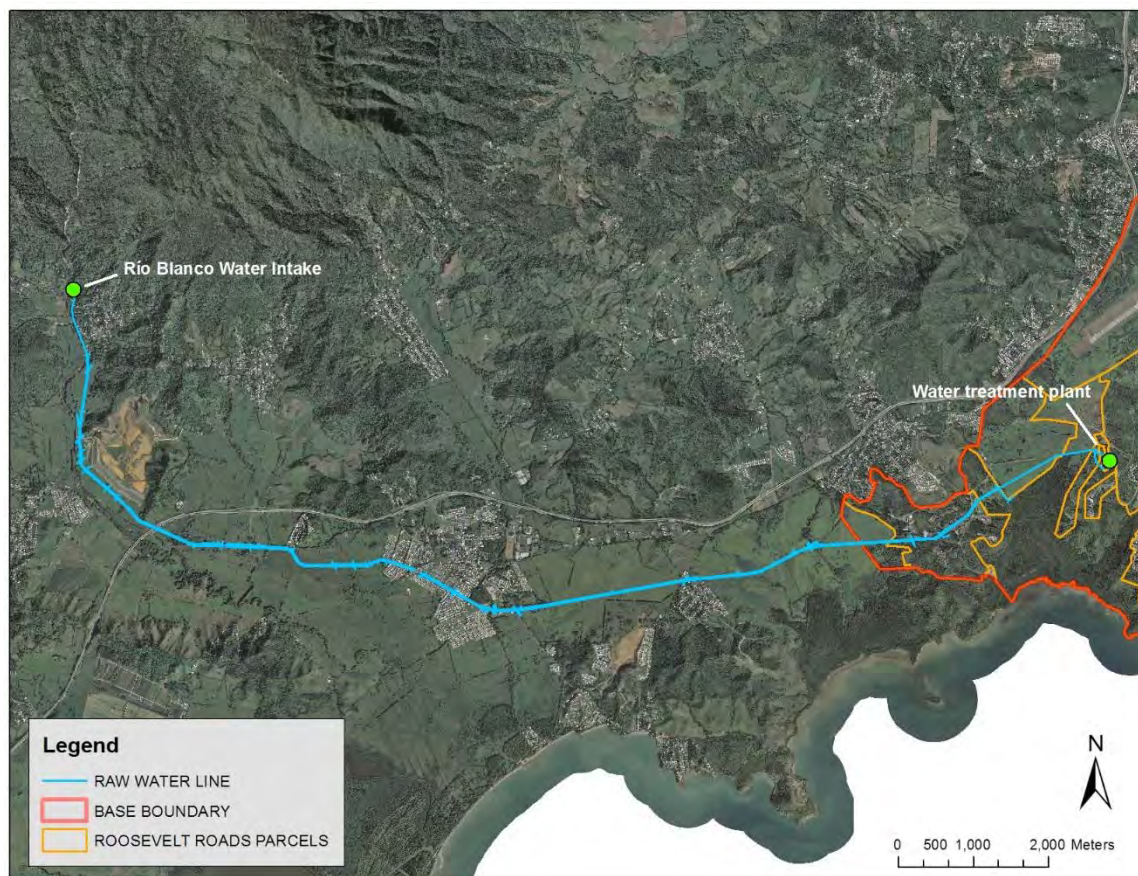


Figure 20 Raw Water Intake and Pipeline Location

iii) Raw Water Reservoir

The raw water reservoir has a design capacity of 43.6 million gallons. It serves as a buffer to dampen out fluctuations in raw water flow, turbidity, and color and to provide a 10 day emergency reserve. The reservoir is a reinforced concrete-lined basin with a distribution inlet, an overflow, and a discharge structure incorporating two discharge pipes. It has a 5.6 acre surface area, with a 30-foot design depth. The reservoir inlet is a 24-inch diameter cast-iron pipe. The discharge pipe is a 24-inch diameter main extending to the plant building. Another reservoir discharge is a 16 inch diameter pipe that may be used to drain the reservoir and allow sediment to discharge into a concrete paved ditch surrounding the reservoir. Three drainage valves control the drain lines that serve the discharge pipe. They are currently inoperable; this has allowed sediment to build up in the reservoir.

The reservoir overflow is a broad-crested concrete weir that drains to the paved concrete ditch.

Water flows either by gravity or is discharged by the booster pumps into the flash mixing basin.

The

It also has displaced concrete slabs that are visible from the sides of the reservoir. In addition to the concrete slabs displacement, it was found that some soil surrounding the reservoir has caved in.



Figure 21 Raw Water Reservoir



Figure 22 Raw Water Reservoir

iv) **Water Treatment Plant (WTP)**

The existing WTP provides treatment by means of flocculation chamber, settling tanks, dual media filtration and disinfection. This is a conventional treatment system, which is compatible with current treatment trends even though every unit will require replacement of mechanical equipment and installation/construction of new units.

The design flow is of 4.0 MGD but the current production rate is approximately 0.5 MGD. Major improvements are needed in order to maintain and increase the flow rate, without affecting the water quality.

WTP facilities and process units include:

- 3-stories concrete building with houses the laboratory, control room, distribution pumps and chemical storage
- Raw water reservoir
- Flocculation Chambers
- Settling Tanks (2)
- Media Filters (4)
- Clear Well
- Sludge Lagoon (2)
- Distribution Tank

Although the main structural components is considered sound, the WTP system components are showing signs of deterioration. These signs are noticed in metal elements and continuous use mechanical equipment like pumps systems, instrumentation and corrosion presented in catwalks, valves, pipes, and chlorine gas cylinders, between others.

Also, the power and controls & Instrumentation (C&I) components and wirings shall be replaced to include up to date technology that will reduce power consumption and will increase treatment reliability.

In addition, it is also intended to provide the best available technology in order to comply with the USEPA Surface Water Treatment Rule (SWTR) , Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) and if applicable Long Term 2 Enhanced Surface Water Treatment Rule (LT2). SWTR objective is to protect pathogens like viruses, Legionella, and Giardia lamblia entering the distribution system, LT1 ESWTR was established to establish additional treatment requirement to prevent pathogens, specifically the protozoan Cryptosporidium, in drinking water, and address risk trade-offs with disinfection byproducts and LT2 is the last of the requirements which requires certain systems to provide additional treatment barriers based on the risk presented by the source water body.

The control room building shows deteriorated floor/roof concrete slabs that present a hazard to the working personnel. In addition, general repairs are needed to replace doors, windows, restroom fixtures and laboratory equipment, to provide surface coatings (painting) and to replace lighting fixtures, with more efficient systems.



Figure 23 Water Treatment Plant



Figure 24 Water Treatment Plant



Figure 25 Water Treatment Plant control building deteriorated roof slabs



Figure 26 Sludge Lagoons

v) **Storage Tank 86 (Tacan)**

The main water storage, Tank 86 (Tacan) is located on top of a hill on Gulf Road. This is an aboveground concrete tank with a 1,500,000 gallons capacity. The tank is approximately 128 feet long by 94 feet width and 20 feet high.

The tank needs interior and exterior re-coating. The remote control system (SCADA) is not operating. Also there is a need to replace exposed valves and fittings due to leakage and corrosion problems.



Figure 27 Distribution Storage Tank 86 (Tacan)

vi) **Distribution System**

After completing the raw water treatment, water is chlorinated and stored in a 120,000 gallons capacity “clearwell” and delivered to the distribution system by means of four centrifugal pumps located at the WTP’s control building. The pumps capacities are as follows:

- 3 pumps Q (discharge)=1,000 gpm @ 275 ft, 125 HP, 1,780 rpm each
- 1 pump Q(discharge)=1,400 gpm @ 275 ft, 150 HP, 1,780 rpm (out of service)

The pumps work in parallel feeding the system through a common 16” Ø ductile iron pipeline. According to information provided by the plant’s operator, the three pumps with a capacity of 1,000 gallons per minute (gpm) each, are activated one or two at a time, alternating between the three. In the past, the pump with a Q=1,400 gpm (currently out of service) was only used if necessary to fill the main distribution tank, (Tank 86 or Tacan) at a faster rate.

The distribution system is composed of approximately 64.4 miles (103.6 kilometers) of distribution piping ranging in various sizes up to 18 inches in diameter. The composition of piping materials is distributed approximately of 76% PVC, 6% Cast Iron, 1% Galvanized iron, 1% Ductile Iron and 17% of unknown materials. The distribution system piping services virtually all the developed areas inside the Base and with interconnections (currently valves are closed) to the Jose Aponte de la Torre Airport.

The existing raw water pipeline is mostly located on cross country land, while the water distribution network is mostly located along the existing road corridors. The conditions of the existing piping’s cannot be easily addressed, although based on collected data, major repairs and improvements were performed by the U.S. Navy under project “Hurricane Hugo Repairs to Water Distribution System” in 1990.

The pipeline network is interconnected to two domestic water storage tanks, three fire suppression tanks, three domestic and three fire suppression water booster pumping stations to maintain water pressure at areas with high elevations and farther away from distribution storage tanks. There are 179 hydrants distributed within the system. Currently only Tank 86, known as Tacan, with a capacity of 1,500,000 gallons is in use.

The current pressure along the water distribution system ranges between 65 and 110 psi. Pressure to industrial areas is limited to 65 psi and pressure to all housing is controlled at 85 psi.



Figure 28 Existing Water Distribution System

d) Financial Status of any Existing Facilities

The management of the water treatment and distribution systems is conducted by the LRA through their Engineering Officer, Field Operations Manager and field employees. The LRA performs the operation, maintenance and repairs of the distribution system. They also perform the metering and billing of the current customers.

The water treatment plant is operated by a private entity under contract with the LRA. The LRA provides the chemicals for the treatment and is responsible for the electric energy consumption, and any equipment repairs or replacement.

The average annual operation costs and energy consumption of the WTP is included in Table 3 (based on the years 2014 and 2015 data). There are no additional expenses associated with any outstanding loans or financing charges related with the operation and maintenance of the water treatment and distribution facilities.

Table 3 Existing Facilities Operation & Maintenance Annual Costs

Task	Amount
Water Filtration Plant Operation	\$ 240,000.00
Systems Upgrades, Lines Repairs & Sludge Lagoons Maintenance	\$ 60,000.00
Total	\$ 300,000.00

e) Water/Energy/Waste Audits

The LRA Operations Personnel and the WTP operator sub-contractor perform periodic inspection of the water treatment and distribution systems. The inspection includes: WTP operation, and leakage detection of pipelines.

Inspection reports are logged for records but no water/energy/waste audits were obtained for this facility.

4) NEED FOR PROJECT

a) Health, Sanitation and Security

The need to satisfy regulatory water quality requirements is essential for the re-development plans at Roosevelt Roads.

As demand of potable water increases, new technologies shall be implemented in the water treatment process in order to comply with the USEPA Surface Water Treatment Rule (SWTR) , Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) and if applicable Long Term 2 Enhanced Surface Water Treatment Rule (LT2). SWTR objective is to protect pathogens like viruses, Legionella, and Giardia lamblia entering the distribution system.

It is known that most distribution system-related outbreaks are linked to cross-connections and backsiphonage and the rest is attributed to main breaks or repair and contamination of municipal water storage tanks. The magnitude and severity of outbreaks associated with distribution systems vary, with an average of about 200 illnesses per outbreak (Craun and Calderon, 2001)⁴ and a total of 13 deaths. These outbreaks have been associated with chemical (copper, chlordane, ethylene glycol and others) and microbial contaminants, including enteric protozoa (Giardia, Cyclospora), enteric bacteria (Salmonella, Shigella, Campylobacter, and E. coli O157:H7) and enteric viruses (noroviruses and Hepatitis A virus).

4. Waterborne Disease Outbreaks Caused by Distribution System Deficiencies, Journal AWWA, 93(9)

b) Aging Infrastructure

As indicated, in the existing facilities description, the water treatment and distribution systems were established in the 1940's. Major upgrades have been performed in multiple occasions. The last recorded major upgrade was in 1994 (over 20 years ago). This represents a major challenge since the Post-World War II pipes tend to have an average life of 75 years (AWWA, 2001; AWWSC, 2002).

Although there has been upgrades to the many systems components such as pumps and control systems thru the years, the buildings structures, mechanical and piping systems will continue to deteriorate after exceeding the design lifespan. In addition, problems such as infiltration and leaks can arise in the piping system if not properly monitored and maintained.

The need for a more efficient and reliable water treatment and distribution system, is essential for the re-development plans at Roosevelt Roads.

c) Reasonable Growth

The need to provide the capacity to satisfy future demands of the Roosevelt Roads redevelopment, is one of the main reasons essential for the water infrastructure improvements.

Currently the service area is composed of only commercial and institutional clients, there are no residential clients. As part of the project development, additional clients will be added to the distribution system. Those additional clients will be located along the proposed project service area (full redevelopment on Phase I and Future phases). There will be a 25 years redevelopment period. The proposed improvements will be designed to satisfy the demands on the clients growth expected in the whole redevelopment period. For service area detailed definition see section 5 b).

The following tables summarize the service area client's growth in the redevelopment period.

Table 4 Service Area (Phase I) Client's Growth

Customer Classes	YEARS PERIOD									
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2023-2027	2028-2032	2033-2037	2038-2041
	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients	Cumulative Clients
Residential	0	50	150	270	390	530	1015	1522	2029	2536
Commercial	14	28	57	85	104	121	227	350	471	592
Industrial	2	3	3	3	4	4	7	12	16	20
Institutional	8	8	8	8	8	8	8	8	8	8
Parks and Recreational	1	1	3	6	8	9	9	10	10	10
Total Clientes per Period	25	89	221	372	513	672	1266	1901	2534	3165

5) ALTERNATIVES CONSIDERED

a) Introduction

Three different alternatives are being considered for the water infrastructure improvements. Two of the alternatives consider the use of the existing raw water source and in-site treatment facilities. A third alternative considers the use of Puerto Rico Aqueduct and Sewer Authority (PRASA) water source outside the premises.

All the three alternatives considers the replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as tanks, pressure regulating valves and fire hydrants.

The general description of each alternative is presented here. A more detailed description is included afterwards.

- **Alternative 1**
 - **Major upgrade to existing Water Treatment Filtration Plant (WTP), replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.**
- **Alternative 2**
 - **Construction of a new modular Water Treatment Filtration Plant (WTP), replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.**
- **Alternative 3**
 - **Connection to PRASA water source outside the base premises, replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.**

b) Design Criteria & Flows

The Design Criteria considered for the all the alternatives, will follow the recommended guidelines and standards for water distribution systems design from the PRASA and other applicable local, state and federal regulations and guides. The design water demands rates are calculated according to the values required in “Reglamento de Normas de Diseño” from the Puerto Rico Aqueducts and Sewer Authority (PRASA). Other more specific design flow rates not available on the PRASA Regulations, were obtained from actual water consumption data provided by clients and by the water flow rates from “Water Distribution Systems Handbook” by McGraw-Hill, “Wastewater Engineering; Treatment, Disposal, Reuse” by Metcalf & Eddy and other sources. The typical design flowrates are presented on Table 5.

The existing water demands on the current service area were determined according to field inspections and from data provided by the LRA. The existing demands are composed of a combination of institutional and commercial clients. The demands for the proposed 25 years re-development period will also include residential, industrial, educational, hospitality, health related and recreational facilities.

Table 5 Design Flowrates Criteria for Proposed Uses

Source	Flowrate (gallons per day)
Residential	400 GPD/dwelling unit
Office	300 GPD/1,000 s.f.
School or Educational	30 GPD/student
Boarding School	100 GPD/student
Boat Marina	30 GPD/boat slip
Hospitality (Hotel)	200 GPD/room
Hospitality (Eco-Lodge)	100 GPD/room
Golf/ Parks	14,000 GPD
Light Industrial	1,620 GPD/acre
Recreational	200 GPD/acre
Hospital	350 GPD/bed
Other uses	350 GPD/plumbing fixture

i) Demand Flows

Because the redevelopment will be phased according to the Master Plan and the infrastructure availability, the water demand calculations were divided into three main periods:

- Current and immediate tenants from years 2015 to 2016
- Phase I between years 2016 to 2041

The water demand calculation for each period, and the zones included on each one are shown on Table 6.

Table 6 Calculated Water Demands

Customer Classes	Total Clients	Total Demand (GPD)	YEARS PERIOD									
			2016-2017		2017-2018		2018-2019		2019-2020		2020-2021	
			Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)
Residential	2,536	1,014,200	-	-	50	20,000	150	60,000	270	108,000	390	156,000
Commercial	592	943,870	14	25,820	28	42,020	57	111,020	85	144,020	104	168,620
Industrial	20	256,632	2	7,000	3	17,010	3	27,020	3	31,024	4	39,032
Institutional	8	72,450	8	72,450	8	72,450	8	72,450	8	72,450	8	72,450
Parks and Recreational	10	82,400	1	1,400	1	1,400	3	20,400	6	44,400	8	63,400
Totals	3,165	2,369,552	25	106,670	89	152,880	221	290,890	372	399,894	513	499,502

Customer Classes	Total Clients	Total Demand (GPD)	YEARS PERIOD							
			2023-2027		2028-2032		2033-2037		2038-2041	
			Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)	Cumulative Clients	Cumulative Demand (GPD)
Residential	2,536	1,014,200	1,015	405,800	1,522	608,600	2,029	811,400	2,536	1,014,200
Commercial	592	943,870	227	329,620	350	594,370	471	799,120	592	943,870
Industrial	20	256,632	7	91,682	12	151,332	16	203,982	20	256,632
Institutional	8	72,450	8	72,450	8	72,450	8	72,450	8	72,450
Parks and Recreational	10	82,400	9	68,400	10	82,400	10	82,400	10	82,400
Totals	3,165	2,369,552	1,266	967,952	1,901	1,509,152	2,534	1,969,352	3,165	2,369,552

The calculated water demands summary is presented here

Table 7 Water Demands Summary

Development Phase	Calendar Year Period	Water Demand (GPD)
Current	2016-2017	106,670
Phase I	2018-2041	2,262,882
Total		2,369,552

vii) **Distribution System Design Criteria**

For the design of the water distribution system the following design criteria is established:

Table 8 Distribution System Design Criteria

Parameter	Value
Distribution pipe minimum size	4" Ø
Minimum pressure	30 psi
Main pipes minimum capacity	2.25 x average flow
Minimum flow velocity (gravity)	4.0 ft/s
Maximum flow velocity (pumping)	8.0 ft/s
Pipe material (for diameters up to 14" Ø)	PVC AWWA C900 Pressure Class 305 (DR-14)
Pipe material (for diameters larger than 14" Ø)	D.I. AWWA C111 Pressure Class 250
Fittings and accessories	Gray Iron, Ductile Iron AWWA C100, C110, C111

A hydraulic model of the proposed flows was prepared to analyze the existing diameters and proposed demands in the 2012 Infrastructure Master Plan.

A new model shall be prepared in order to update the information accordingly to the 2014 Master Plan and before any design phases begin. This model shall take in consideration the distribution system design criteria presented here.

c) Alternative 1

i) General Description

This alternative proposes the major upgrade and rehabilitation of the existing treatment system including the raw water intake and reservoir. In addition it involves the replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.

A description of the improvements is presented here:

ii) Raw Water Intake Improvements

The improvements at the Río Blanco intake will include:

1. Río Blanco Grit Chamber Valve Repair and Maintenance – Replace all metal elements and valves.
2. Raw Water Intake and Bar Screen – Rehabilitation and installation of a new mechanical bar screen.
3. Intake Valve Repair – Replacement of the valve and provide remote monitoring and operation.

iii) Raw Water Reservoir

The improvements at the Raw Water Reservoir will include:

1. Raw Water Screen Channel & Reservoir – Rehabilitate the concrete structure and provide adequate mechanical screening.
2. Raw Water Reservoir Dredging – Dredge the existing tank to provide full storage capacity and reduce solids carry over to the WFP. Also, dredging of the uncovered tank will reduce treatment costs.
3. Raw Water Reservoir Manhole Cover – Replace all metal elements.
4. Raw Water Reservoir Bridge Repair – Replace the Raw Water Bridge.
5. Raw Water Reservoir Spillway Gate Repair – Replace the sluice gate and rehabilitate the concrete structure.
6. Raw water Reservoir Concrete Lining- Repair damaged concrete liner portions.

iv) Raw Water Pipeline

No improvements of the raw water pipeline are contemplated on this alternative.

v) Water Treatment Plant Upgrade and Rehabilitation

The upgrade and rehabilitation project will retrofit the existing treatment units, improve several components and construct new treatment units to have a fully automatically and efficient operation while complying with current federal and state regulatory limits. Although the plant has a 4.0 MGD design capacity, the improvements will performed in order to have a maximum production of 1.5 MGD. Flows greater than 1.5 MGD can decrease the treated water quality. In the future, if it is necessary to increase the maximum treatment capacity, other treatment process improvements shall be performed.

The proposed project shall consider improvements to the following elements:

1. New Process Control Instrumentation & Automation – The plant shall be provided with a SCADA (supervisory control and data acquisition) system, which is central control system operating with coded signals over communication channels so as to provide control of remote equipment. Although the SCADA do not eliminate the need of operators onsite, it reduces the need for manpower and increases the reliability of the treatment process by providing a continuous monitoring of process control parameters, equipment status and recording events (online record keeping).
2. Rapid Mixing and Flocculation Units – New rapid mixing system to be constructed including 2 flocculation units, mechanical elements and treatment components. The sedimentation units shall be provided with automatic scrapping systems, tube settlers and effluent troughs. Also flow distribution control capability shall be provided to minimize water short-circuiting and solids carry over.
3. Filters Repair – The 4 Filtration units shall be provided with new underdrains, filter media, backwash pumps, air blowers and filter to waste valves. Also, the plant's SCADA system shall provide a fully automated backwash process that will signal an alarm anytime the turbidity value exceeds the pre-established set point, the head loss increases or the period for backwashing has been exceeded.
4. Disinfection System – The disinfection system will be upgraded by replacing the existing chlorine system. Also, it is possible to add an additional inactivation barrier like Ultra Violet (UV) Disinfection. The addition a UV system will secure compliance with the disinfection by product rule.
5. Clear well improvements – Structural repairs, new coating and control valves.
6. Settling tank improvements- Structural repairs, new coating and control valves for the 2 settling tanks.
7. Laboratory Equipment – New laboratory equipment will be provided to adequately control daily process operations.
8. Pumping Systems – Every pump system will be replaced according to water treatment demand and to provide high efficiency electric motors.
9. Sludge Lagoons – The sludge lagoons will be dredged and conditioned according to the development conditions. Also the existing decant pumping system will be replaced and a new forceline will be installed in order to discharge the decant in to the existing raw water line, for re-circulation into the raw water reservoir.
10. Distribution Pumps Replacement – The distribution pumps will be replaced to install new high efficiency units.
11. Water Meters – All water meters will be replaced.
12. Flushing Valves Replacement – All valves will be replaced
13. Fencing Repair – In order to improve security, a new fence and monitoring equipment will be installed.
14. Chemical Metering System (coagulation - flocculation neutralization) – The system will be totally replaced.
15. Main building architectural repairs- Replacement of doors, windows, bathroom fixtures, painting and roofing waterproofing.
16. Main building structural repairs- Repair of spalled concrete slabs
17. Main building electrical repairs- Repair of electrical distribution system, electrical site connection and new emergency generator.
18. Site improvements - new exterior fencing repairs and new landscaping.
19. Commissioning and Start Up- Commissioning and startup of all new mechanical and controls equipment.

vi) **Storage Tank 86 (Tacan)**

The existing treated water storage tank (TACAN), will be also rehabilitated as follows:

1. New interior and exterior coatings.
2. Replacement of valves and fittings.
3. Installation of remote control system (SCADA).

vii) **Distribution System**

The existing distribution system is composed of multiple pipelines of different materials and diameters with different lifespans. Most of the existing pipelines are PVC pipes that were installed in the 1990's, according to various construction drawings and reports provided by the US Navy. Those PVC pipe portions shall be in good condition, as PVC pipe can have a longevity in excess of 100 years. Only portions, not identified as PVC pipes will be replaced. The assessment of the pipe segments that need replacement is based on the following:

- a) Assessment included in *"Report 1- Potable Water System Evaluation Study"*, prepared for the Atlantic Division Naval Facilities Engineering Command, by Baker Environmental and Roy F. Weston, Inc. on March 1993
- b) Assessment included in *"Roosevelt Roads Infrastructure Master Plan"*, prepared for the Local Redevelopment Authority for Roosevelt Roads, by Integra Design Group on June 2012
- c) Assessment included in *"Naval Station Roosevelt Roads Potable Water System Assessment Report"*, E prepared for the Local Redevelopment Authority for Roosevelt Roads, by Environmental Resources Management (ERM) on May 2011
- d) Construction plans: *"Hurricane Hugo Repairs to Water Distribution System"* prepared for the U.S. Naval Station Roosevelt Roads, PR, by Villate & Associates on June 1990
- e) Plans: *"Potable Water Distribution System Maps"* prepared for the Atlantic Division Naval Facilities Engineering Command, by Patton, Harris, Rust & Associates on February 1995
- f) Interviews with LRA utilities management personnel

It should be noticed that additional field studies must be performed during the planning phases in order to confirm the location, materials and condition on the pipe segments to be repaired or replaced.

Also, a hydraulic modeling was performed in the 2012 Infrastructure, Master Plan, which identified all the water distribution pipes in the base premises. The modeling determined the capacity and node pressures for the proposed re-development water demand and concluded that the existing pipe diameters are adequate. The peak demands can be achieved without producing low pressures. The current system will be able to provide the capacity and pressures for the future development with only minor upgrades.

In addition, due to poor maintenance and corrosion problems, the existing fire hydrants shall be replaced. New fire hydrants are considered in order to provide more area coverage for fire protection.

The improvements will include the following:

1. Replacement of two 12" Ø lines, with new 12" Ø PVC lines from Langley Drive up to the Tacan distribution tank connection, one for tank filling and another for distribution. The approximate total length of pipe lines is of 865 meters.
2. Replacement of a 10" Ø line, with a new 10" Ø PVC line on Forrestal Drive from the intersection of Barnes Street up to the entrance to the Forrestal WWTP. The approximate total length of pipe line is of 670 meters.

3. Replacement of a 3" Ø line, with a new 4" Ø PVC line from Forrestal Drive up to the connection point of Forrestal WWTP. The approximate total length of pipe line is of 228 meters.
4. Replacement of 37 fire hydrants and valves, and installation of 105 additional hydrants along existing main distribution pipelines on the existing road corridors from the Water Treatment Plant on Langley Drive and continuing on to Marina By-Pass, Tow Way Road, Forrestal Drive, Antietam Road and Barnes Street.
5. Replacement of two pressure regulating valves
6. All the existing secondary or service branches that serve the existing or proposed facilities shall remain connected to the water mains.

The location of the existing WTP and distribution pipes with proposed replacement segments are shown on Figure 29 and on Appendix I.

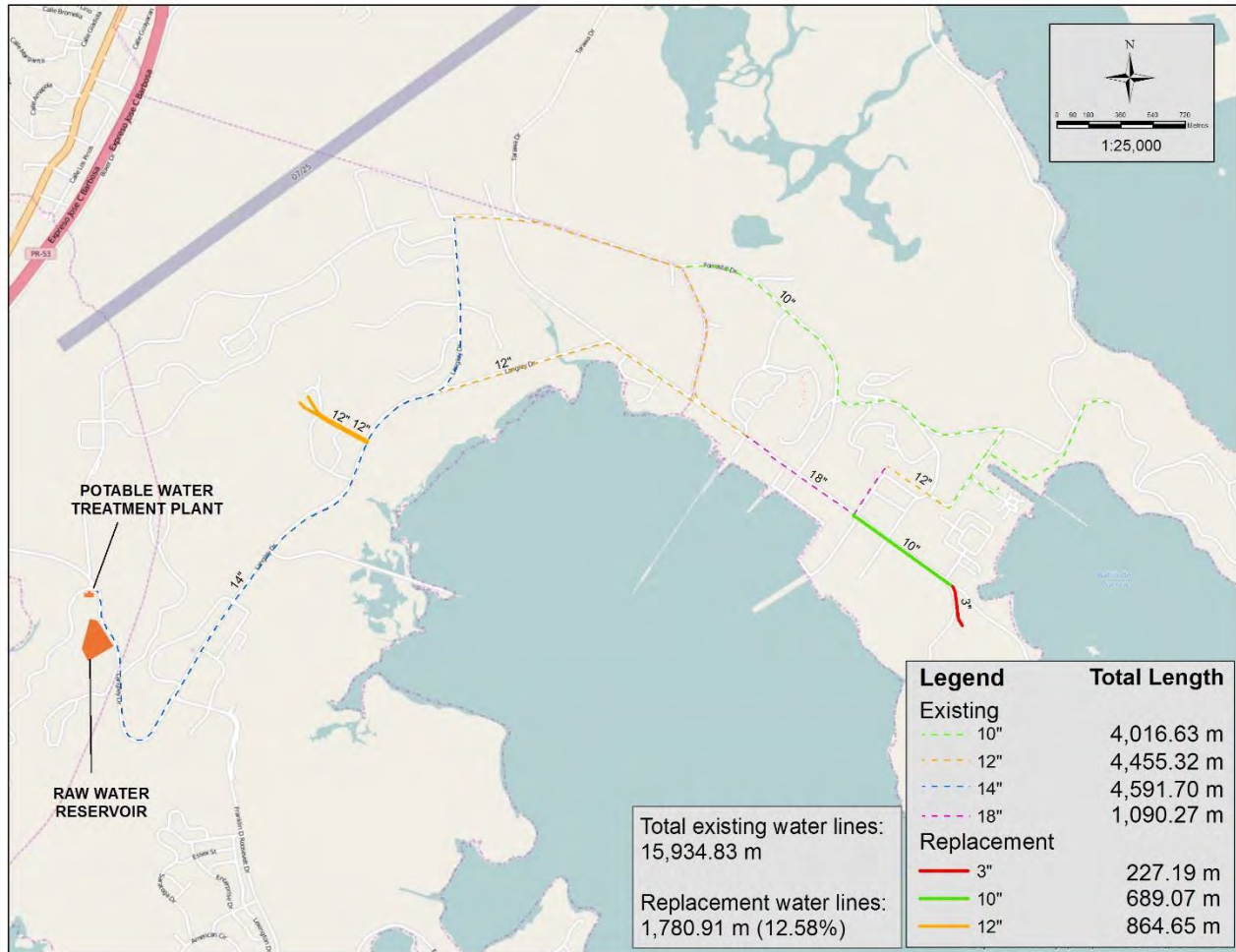


Figure 29 Existing and Proposed Water Distribution System (Alternative 1)

xi) Environmental Impacts

This alternative is considered to not have significant environmental impacts on undeveloped areas. The total of the pipe line repairs and new pipe alignment installation will be along existing roads, streets, avenues and right of ways. The improvements on the raw water intake, raw water reservoir, water

treatment plant, sludge lagoons, pump stations and distribution tanks will be performed on the existing parcels and footprints. No installations and repairs are expected outside the developed areas.

Due to the existence of multiple solid waste management units or areas of concern related to previous environmental contamination, it is necessary to avoid work along or near those areas.

In order to minimize temporary construction environmental impacts caused by excavations and earthwork, an erosion and sedimentation control plan shall be implemented.

xii) **Land requirements**

All works will be performed on public lands, existing right of ways, easements and roads

For the above mentioned conditions, no new easements or land acquisitions are expected on this alternative. If additional land is needed, in order to develop the new treatment plant equipment, available adjacent public land can be used.

xiii) **Potential Construction Problems**

This alternative involves some construction tasks, which may arise some difficult situations during the installation and construction phase. The following are the expected situations:

- Due to the location near the seashore, ground water table can be encountered during pipelines and excavation operations. Dewatering procedures shall be contemplated in order to provide a safe and dry work area.
- There are also possible location of underground utilities such as sanitary, storm sewer and telecommunications fiber optic lines along the roads, which shall be completely identified during the design and construction phases, in order to minimize or avoid any conflicts or services interruptions.
- Another potential construction problem that shall be taken into consideration is the location of solid waste management units or environmentally sensitive areas adjacent to the pipe alignments locations. Construction protection measures, shall be included in order to not disturb those sensitive areas and to avoid the location of any temporary storage of equipment or materials near those areas.
- In order to maintain continuous operation, during the installation of the systems replacements, temporary piping by-passes shall be installed between the existing systems and the new ones. The existing treatment system shall be maintained in operation until the refurbishing is completely operational.

xiv) **Sustainability Considerations**

Sustainable engineering, which is sometimes called green engineering, is the design and construction of products that conserve natural resources and exert the smallest possible impact on the environment. Conventional engineering designs strive to minimize cost and maximize performance. Green engineering often results in products that are neither the most cost-effective nor the longest lived, but engineers and consumers across the globe are realizing that sustainability is a critical feature.

a) **Water Efficiency**

The temporary potable water use will be for domestic consumption of construction and inspection personnel, and this is a temporary condition. Measures will be implemented on contract documents to prevent the use of potable water for sediment control, and cleansing after demolition works.

New water consumption is expected during operation, due to the nature of the project, which involves a new re-development. It is expected that the re-development guidelines and government regulations will establish the use of water efficient plumbing fixtures and other equipment. In addition, water efficient plumbing equipment will be installed at the Water Treatment Plant.

b) Energy Efficiency

The temporary electric energy use will be for minor hand tools of construction personnel and for the temporary construction and inspection offices. Any other major electrical demand during construction can be attained thru the use of portable power generators.

The only electric energy consumption expected during operation, due to the nature of the project, will be for the Water Treatment Plant operation. New mechanical, control electrical and lighting equipment will be installed. The new control systems will provide automatization with programmable logic controls that will result in efficiencies in electrical consumption. In addition, the replacement of conventional lighting with fluorescent and LED lighting fixtures, will provide energy efficiency and savings.

c) Green Infrastructure

This alternative does not involves any permanent management of stormwater. Although some portions of the project are located on flood zones as indicated by the Federal Emergency Management Agency (FEMA), flood maps, there will be no direct impact on existing stormwater features or facilities.

There are various drainage structures for surface runoff, such as culvert crossings along the road corridors where the pipelines are located. Pipelines cross above or below the drainage culverts depending on available clearance. Pipelines replacement will be located at the same locations as the existing ones.

Only temporary management of stormwater runoff will be needed. Measures shall be implemented in order to manage the surface flows and to prevent erosion, and contamination. After the pipes installations are completed, the affected stream bed and banks will be restored to their original condition including the restoration of the vegetative cover.

No permanent impacts to the stormwater systems will be made for his alternative. The project area is mostly a developed sub-urban area. There are no other natural systems on the project area.

d) Operational & Maintenance Simplicity

Water Treatment Plant

This alternative provides for the upgrade and rehabilitation of the water treatment plant. This rehabilitation will provide partial automation of many treatment processes. Industry data indicate that highest O&M costs at a water treatment plant are for labor, energy and chemicals. Therefore automation in these areas has the greatest potential for producing savings. An investigation of typical savings produced by applying advanced automation showed the following range of values:

- Chemical savings: Topically 15 to 40 percent
- Labor savings: typically 5 to 30 percent, some higher values reported with unattended operation

- Energy savings: Typically 5 to 35 percent

Some of these savings may be attributable to applying a greater level of automation.

Plant automation must be used and must be maintained in good working order. Effective automation reduces operating costs by eliminating the need for human involvement in process operations, and by improving the efficiency of the process through regulating chemicals and electric power. Such cost reductions are balanced by the maintenance costs of the automation systems and equipment. Maintenance of automation systems involves both routine servicing and corrective maintenance of repairs. Routine maintenance includes activities such as cleaning, calibration, setting up new systems and making archive data images.

Water Distribution Pipelines

Conventional PVC pressure pipe, due to its proven technology, simplicity, and ease of operation and maintenance, is the accepted method of approach for providing water distribution service for communities in Puerto Rico and new developments.

Distribution system operation involves several activities:

- Major operations required to convey safe drinking water to the users, e.g. starting and stopping a motorized pump, the supply of fuel and the control of valves.
- The correct handling of facilities by users to ensure long component life, e.g. the flushing of lines and hydrants, valves operation, etc.

The proper operation of a supply results in its optimum use and contributes to a reduction in breakdowns and maintenance needs.

Distribution System Maintenance involves several activities:

- Preventive maintenance - regular inspection and servicing to preserve assets and minimize breakdowns.
- Corrective maintenance - minor repair and replacement of broken and worn out parts to sustain reliable facilities.
- Crisis maintenance - unplanned responses to emergency breakdowns and user complaints to restore a failed supply.

xv) **Permits**

Due to the nature of the project, on which the majority of it will be performed on a developed area and on existing roads, no major issues regarding the permits or endorsements needed for the project are expected. The only endorsement that can affect the overall project schedule or modify the project scope is the US Fish and Wildlife Service, due to the location near the seashore and environmentally sensitive areas.

The following permits or endorsements shall be considered:

- OGPE (Oficina de Gerencia de Permisos):
 - Environmental Evaluation or Categorical Exclusion
 - Consolidated General Permit
 - Earth Movement Incidental Permit
- Comisión de Servicio Público (CSP)
 - Excavation Notification (during the construction phase)
- Environmental Protection Agency (EPA)

- Stormwater Pollution Prevention Plan (NPDES) ,Notice of Intent (NOI) and Notice of Termination (NOT), (during the construction phase)
- Municipality of Ceiba: endorsement
- Autoridad de Desperdicios Solidos (ADS)
 - Waste Recycling Program: (during the construction phase)
- State Historic Preservation Office (SHPO): endorsement
- PR Institute of Culture: endorsement
- US Fish and Wildlife Service: endorsement

xvi) **Expansion Capacity**

The proposed WTP improvements shall have the adequate capacity for the Phase I future demand growth until the year 2032 due to the limitation of the Rio Blanco raw water source maximum output of 1.5 MGD. The WTP can be improved to a maximum capacity of 4.0 MGD afterwards, but it will be necessary to obtain an alternate raw water source.

The proposed distribution system improvements shall have the adequate capacity for current and future flows (until year 2041). In addition, connection valves will be installed on critical points along the project route, which will be accessible for future connections either for local service connections or for distribution lines for other development areas.

As stated above, due to the limitations on the maximum output of the raw water source, an additional alternative for potable water shall be considered for future demands. The two possible alternatives that can be considered are:

1. A connection from PRASA's existing potable water systems in Ceiba and Fajardo.
2. The installation of deep wells on the premises. This alternative have some limitations due to high total dissolved solids concentrations found on previous studies and due to the low yield of the alluvial valley aquifer, typically 50 to 150 gallons per minute. This information is discussed thoroughly on the "Environmental Assessment for the Disposal of Naval Activity Puerto Rico" dated April 2007.

xvii) **Social and Community Impacts**

This alternative provides multiple positive social benefits to the community re-development by providing adequate and needed potable water service for clients which currently are operating with insufficient or inadequate water supply.

Inefficient water supply is very often associated with an unsustainable exploitation of natural resources. Improved water management, including industrial pollution control and water conservation is a key factor for maintaining ecosystem integrity.

Furthermore, water, sanitation and hygiene is important for improving living and working conditions, by reducing the risks of contracting water-related illnesses, and opening opportunities for large scale enterprises.

Another benefit of providing a reliable and adequate water supply is related to the availability of water for emergency fire service. All built-upon areas of a community should be served by a water distribution system that not only provides taps for consumer consumption, but also provides approved fire hydrants for installation at locations and with spacing considerations for convenient use by fire department pumping equipment and to meet needed fire flows in the proximity of the buildings to be protected.

xviii) **Cost Estimate**

For this alternative, the estimated project capital cost is of **\$7,218,180.01**. The detailed cost estimate is included on Appendix I.

A summary of the cost breakdown is included on Table 9.

Table 9 Cost Breakdown for Alternative 1

Cost Item	Cost
Net Construction Cost	\$5,233,010.00
Contingencies	\$784,952.00
Survey and Design	\$575,631.10
Engineering Services During Construction	\$101,284.91
Construction Management and Inspection	\$261,651.00
Land and/or ROW Acquisition	N/A
General and Administration Expenses	\$261,651.00
Estimated Total Project Cost (Cost eligible for Rural Development (RD) Participation)	\$7,218,180.01

d) Alternative 2

i) General Description

This alternative proposes the substitution of the existing conventional treatment system with a new 1.5 MGD modular package treatment system. In addition it involves the improvements of the raw water intake and reservoir, replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.

A description of the improvements is presented here:

ii) Raw Water Intake Improvements

Same improvements as alternative no.1

iii) Raw Water Reservoir

Same improvements as alternative no.1

iv) Raw Water Pipeline

No improvements of the raw water pipeline are contemplated on this alternative.

v) Water Treatment Plant Substitution

The project will eliminate and replace the existing treatment plant. The proposed treatment system will be a 1.5 MGD compact conventional process package potable treatment plant. This type of modular, system, is a complete and autonomous drinking water treatment plant with a short delivery time and very simple works on site allow to bring quickly drinking water production. It can also be expanded according to demands increments

The proposed project shall consider improvements to the following elements:

Treatment System

1. New standardized compact unit with conventional treatment process
 - Coagulation-Flocculation
 - Settling
 - Pressurized Sand Filtration
 - Disinfection (Chlorine)
 - 1.5 MGD capacity

Control Building

1. Main building architectural repairs- Replacement of doors, windows, bathroom fixtures, painting and roofing waterproofing

2. Main building structural repairs- Repair of spalled concrete slabs
3. Main building electrical repairs- Repair of electrical distribution system, electrical site connection and new emergency generator.
4. Laboratory Equipment – New laboratory equipment will be provided to adequately control daily process operations.
5. Chemical Metering System (coagulation - flocculation neutralization) – The system will be totally replaced.

Other improvements

1. Distribution Pumps Replacement – The distribution pumps will be replaced to install new high efficiency units.
2. Sludge Lagoons – The sludge lagoons will be dredged and conditioned according to the development conditions. Also the existing decant pumping system will be replaced and a new forceline will be installed in order to discharge the decant in to the existing raw water line, for re-circulation into the raw water reservoir.
3. Fencing Repair – In order to improve security, a new fence and monitoring equipment will be installed.
4. Site improvements – fence repairs and new exterior landscaping.
5. Commissioning and Start Up- Commissioning and startup of all new mechanical and controls equipment.

vi) **Storage Tank 86 (Tacan)**

Same improvements as alternative no.1

vii) **Distribution System**

Same improvements as alternative no.1

The location of the existing WTP and distribution pipes with proposed replacement segments are shown on Figure 30 and on Appendix II.

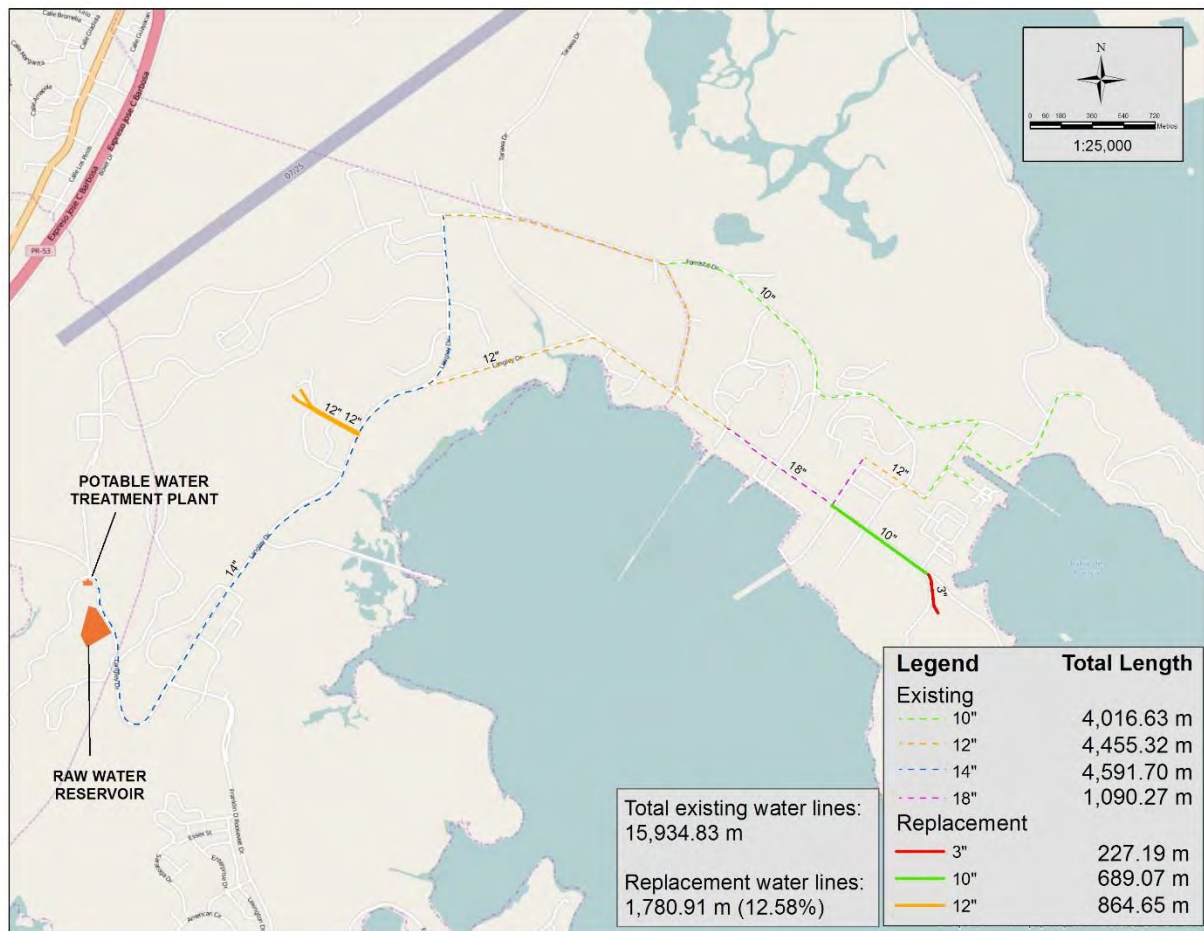


Figure 30 Existing and Proposed Water Distribution System (Alternative 2)

viii) Environmental Impacts

This alternative is considered to not have significant environmental impacts on undeveloped areas. The total of the pipe line repairs and new pipe alignment installation will be along existing roads, streets, avenues and right of ways. The improvements on the raw water intake, raw water reservoir, sludge lagoons, pump stations and distribution tanks will be performed on the existing parcels and footprints. The new water treatment plant modules will be installed on the same parcel as the existing plant. No installations and repairs are expected outside the developed areas.

Due to the existence of multiple solid waste management units or areas of concern related to previous environmental contamination, it is necessary to avoid work along or near those areas.

In order to minimize temporary construction environmental impacts caused by excavations and earthwork, an erosion and sedimentation control plan shall be implemented.

ix) **Land requirements**

All works will be performed on public lands, existing right of ways, easements and roads
For the above mentioned conditions, no new easements or land acquisitions are expected on this alternative.

x) **Potential Construction Problems**

This alternative involves some construction tasks, which may arise some difficult situations during the installation and construction phase. The following are the expected situations:

- Due to the location near the seashore, ground water table can be encountered during pipelines and excavation operations. Dewatering procedures shall be contemplated in order to provide a safe and dry work area.
- There are also possible location of underground utilities such as sanitary, storm sewer and telecommunications fiber optic lines along the roads, which shall be completely identified during the design and construction phases, in order to minimize or avoid any conflicts or services interruptions.
- Another potential construction problem that shall be taken into consideration is the location of solid waste management units or environmentally sensitive areas adjacent to the pipe alignments locations. Construction protection measures, shall be included in order to not disturb those sensitive areas and to avoid the location of any temporary storage of equipment or materials near those areas.
- In order to maintain continuous operation, during the construction of the new treatment facilities, temporary piping by-passes shall be installed between the existing systems and the new ones. The existing treatment system shall be maintained in operation until the new system is completely operational.

xi) **Sustainability Considerations**

Sustainable engineering, which is sometimes called green engineering, is the design and construction of products that conserve natural resources and exert the smallest possible impact on the environment. Conventional engineering designs strive to minimize cost and maximize performance. Green engineering often results in products that are neither the most cost-effective nor the longest lived, but engineers and consumers across the globe are realizing that sustainability is a critical feature.

e) **Water Efficiency**

The temporary potable water use will be for domestic consumption of construction and inspection personnel, and this is a temporary condition. Measures will be implemented on contract documents to prevent the use of potable water for sediment control, and cleansing after demolition works.

New water consumption is expected during operation, due to the nature of the project, which involves a new re-development. It is expected that the re-development guidelines and government regulations will establish the use of water efficient plumbing fixtures and other equipment. In addition, water efficient plumbing equipment will be installed at the Water Treatment Plant.

f) Energy Efficiency

The temporary electric energy use will be for minor hand tools of construction personnel and for the temporary construction and inspection offices. Any other major electrical demand during construction can be attained thru the use of portable power generators.

The only electric energy consumption expected during operation, due to the nature of the project, will be for the Water Treatment Plant operation. New mechanical, control electrical and lighting equipment will be installed. The new control systems will provide automatization with programmable logic controls that will result in efficiencies in electrical consumption. In addition, the replacement of conventional lighting with fluorescent and LED lighting fixtures, will provide energy efficiency and savings.

g) Green Infrastructure

This alternative does not involves any permanent management of stormwater. Although some portions of the project are located on flood zones as indicated by the Federal Emergency Management Agency (FEMA), flood maps, there will be no direct impact on existing stormwater features or facilities.

There are various drainage structures for surface runoff, such as culvert crossings along the road corridors where the pipelines are located. Pipelines cross above or below the drainage culverts depending on available clearance. Pipelines replacement will be located at the same locations as the existing ones.

Only temporary management of stormwater runoff will be needed. Measures shall be implemented in order to manage the surface flows and to prevent erosion, and contamination. After the pipes installations are completed, the affected stream bed and banks will be restored to their original condition including the restoration of the vegetative cover.

No permanent impacts to the stormwater systems will be made for his alternative. The project area is mostly a developed sub-urban area. There are no other natural systems on the project area.

h) Operational & Maintenance Simplicity

Water Treatment Plant

This alternative provides for the substitution of the water treatment plant. This substitution will provide full automation of many treatment processes. Industry data indicate that highest O&M costs at a water treatment plant are for labor, energy and chemicals. Therefore automation in these areas has the greatest potential for producing savings. An investigation of typical savings produced by applying advanced automation showed the following range of values:

- Chemical savings: Typically 15 to 40 percent
- Labor savings: typically 5 to 30 percent, some higher values reported with unattended operation
- Energy savings: Typically 5 to 35 percent

Some of these savings may be attributable to applying a greater level of automation.

Plant automation must be used and must be maintained in good working order. Effective automation reduces operating costs by eliminating the need for human involvement in process operations, and by improving the efficiency of the process through regulating chemicals and electric power. Such cost reductions are balanced by the maintenance costs of

the automation systems and equipment. Maintenance of automation systems involves both routine servicing and corrective maintenance of repairs. Routine maintenance includes activities such as cleaning, calibration, setting up new systems and making archive data images.

Water Distribution Pipelines

Conventional PVC pressure pipe, due to its proven technology, simplicity, and ease of operation and maintenance, is the accepted method of approach for providing water distribution service for communities in Puerto Rico and new developments.

Distribution system operation involves several activities:

- Major operations required to convey safe drinking water to the users, e.g. starting and stopping a motorized pump, the supply of fuel and the control of valves.
- The correct handling of facilities by users to ensure long component life, e.g. the flushing of lines and hydrants, valves operation, etc.

The proper operation of a supply results in its optimum use and contributes to a reduction in breakdowns and maintenance needs.

Distribution System Maintenance involves several activities:

- Preventive maintenance - regular inspection and servicing to preserve assets and minimize breakdowns.
- Corrective maintenance - minor repair and replacement of broken and worn out parts to sustain reliable facilities.
- Crisis maintenance - unplanned responses to emergency breakdowns and user complaints to restore a failed supply.

xii) **Permits**

Due to the nature of the project, on which the majority of it will be performed on a developed area and on existing roads, no major issues regarding the permits or endorsements needed for the project are expected. The only endorsement that can affect the overall project schedule or modify the project scope is the US Fish and Wildlife Service, due to the location near the seashore and environmentally sensitive areas.

The following permits or endorsements shall be considered:

- OGPE (Oficina de Gerencia de Permisos):
 - Environmental Evaluation or Categorical Exclusion
 - Consolidated General Permit
 - Earth Movement Incidental Permit
- Comisión de Servicio Público (CSP)
 - Excavation Notification (during the construction phase)
- Environmental Protection Agency (EPA)
 - Stormwater Pollution Prevention Plan (NPDES) ,Notice of Intent (NOI) and Notice of Termination (NOT), (during the construction phase)
- Municipality of Ceiba: endorsement
- Autoridad de Desperdicios Solidos (ADS)
 - Waste Recycling Program: (during the construction phase)
- State Historic Preservation Office (SHPO): endorsement
- PR Institute of Culture: endorsement
- US Fish and Wildlife Service: endorsement

xiii) **Expansion Capacity**

The proposed WTP improvements shall have the adequate capacity for the Phase I future demand growth until the year 2032 due to the limitation of the Rio Blanco raw water source maximum output of 1.5 MGD. The WTP can be improved to a maximum capacity of 4.0 MGD afterwards, but it will be necessary to obtain an alternate raw water source.

The proposed distribution system improvements shall have the adequate capacity for current and future flows (until year 2041). In addition, connection valves will be installed on critical points along the project route, which will be accessible for future connections either for local service connections or for distribution lines for other development areas.

As stated above, due to the limitations on the maximum output of the raw water source, an additional alternative for potable water shall be considered for future demands. The two possible alternatives that can be considered are:

3. A connection from PRASA's existing potable water systems in Ceiba and Fajardo.
4. The installation of deep wells on the premises. This alternative have some limitations due to high total dissolved solids concentrations found on previous studies and due to the low yield of the alluvial valley aquifer, typically 50 to 150 gallons per minute. This information is discussed thoroughly on the "Environmental Assessment for the Disposal of Naval Activity Puerto Rico" dated April 2007.

xiv) **Social and Community Impacts**

This alternative provides multiple positive social benefits to the community re-development by providing adequate and needed potable water service for clients which currently are operating with insufficient or inadequate water supply.

Inefficient water supply is very often associated with an unsustainable exploitation of natural resources. Improved water management, including industrial pollution control and water conservation is a key factor for maintaining ecosystem integrity.

Furthermore, water, sanitation and hygiene is important for improving living and working conditions, by reducing the risks of contracting water-related illnesses, and opening opportunities for large scale enterprises.

Another benefit of providing a reliable and adequate water supply is related to the availability of water for emergency fire service. All built-upon areas of a community should be served by a water distribution system that not only provides taps for consumer consumption, but also provides approved fire hydrants for installation at locations and with spacing considerations for convenient use by fire department pumping equipment and to meet needed fire flows in the proximity of the buildings to be protected.

xv) **Cost Estimate**

For this alternative, the estimated project capital cost is of **\$8,350,967.16**. The detailed cost estimate is included on Appendix II.

A summary of the cost breakdown is included on Table 10.

Table 10 Cost Breakdown for Alternative 2

Cost Item	Cost
Net Construction Cost	\$6,054,255.00
Contingencies	\$908,138.00
Survey and Design	\$665,968.05
Engineering Services During Construction	\$117,180.11
Construction Management and Inspection	\$302,713.00
Land and/or ROW Acquisition	N/A
General and Administration Expenses	\$302,713.00
Estimated Total Project Cost (Cost eligible for Rural Development (RD) Participation)	\$8,350,967.16

e) Alternative 3

i) General Description

This alternative proposes the closure of the existing Water Treatment Plant. It is proposed to obtain potable water from the Puerto Rico Aqueduct and Sewer Authority (PRASA) through a new connection to an existing transmission system outside the base premises.

In addition it involves replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.

A description of the improvements is presented here:

ii) Raw Water Intake Improvements

The raw water intake valves will be closed. Any accumulated sediments will be removed and disposed properly.

iii) Raw Water Reservoir

The reservoir will be emptied, and the sediments will be removed and disposed properly.

iv) Raw Water Pipeline

No improvements of the raw water pipeline are contemplated on this alternative.

v) Water Treatment Plant Closure

The project will eliminate the existing treatment plant. A planned shutdown process will begin after the system is interconnected to the PRASA system. The process will include the mothballing of the buildings, equipment and related facilities. Machinery can be idle from intermittent use, stand-by (redundancy), storage for spare parts, or for temporary decommissioning.

Any existing product must be drained from the main circuits as well as any hazardous materials that might be in any secondary circuits. Flush these circuits with water and collect the flushings for treatment before disposal. Low points in piping and buried pipe that cannot be drained may be flushed with water or a solvent to displace/remove remaining product.

Internal equipment atmospheres may need to be tested for explosion or toxic hazard, and, depending on the test result, purged to a flare or vapor recovery system. Once a safe internal atmosphere has been established, the equipment can be opened for inspection. Start with inspections that can be done without entry as vessel entries can be complicated by safety considerations, e.g., whether fugitive sludges or deposits in the vessel contain hazardous material that should be removed by lancing, by mechanical, or by chemical methods. If the equipment is to be saved, it may be prudent to remove deposits and scale.

Also, in order to improve security on the “mothballed” facilities, a new fence and monitoring equipment will be installed.

vi) **PRASA Water Source Connection**

It is proposed to install a new 14" ϕ pipeline from a water main at the Fajardo Regional WTP, located north of Roosevelt Roads. The Fajardo WTP has a design capacity of 12 MGD, and is currently producing 8.0 MGD. PRASA shall provide the water to supply Phase I of the Roosevelt Roads Re-development for a total of 1.5 MGD.

The alternative includes:

- A new main 8,856 meters, 14" ϕ pipe feeder from PRASA connection point at the Fajardo WTP to the interconnection with the existing distribution system in the intersection between Tarawa Drive and Forrestal Drive.
- This scenario assumes that the minimum pressure that PRASA will provide at the connection point with the Roosevelt Roads Redevelopment shall be 30 psi.
- A new 1.5 MGD booster pump station is proposed at an intermediate point on Tarawa Drive, adjacent to the Airport, to supply water to the system and Tank 86.
- Tank 86 will be operating in floating mode in the system.

With this alternative, the LRA will be billed by PRASA for the water consumption at the water main interconnection at the Roosevelt Roads property limit. The LRA will manage, maintain and operate the internal distribution and pumping systems operations as well as the billing of the current and future base tenants.

vii) **Storage Tank 86 (Tacan)**

Same improvements as alternatives no.1 & no.2

viii) **Distribution System**

Same improvements as alternatives no.1 & no.2

The location of the PRASA connection point, new booster pump station and distribution pipes with proposed replacement segments are shown on Figure 31 and on Appendix III.



Figure 31 Existing and Proposed Water Distribution System (Alternative 3)

ix) Environmental Impacts

This alternative is considered to not have significant environmental impacts on undeveloped areas. The total of the pipe line repairs and new pipe alignment installation will be along existing roads, streets, avenues and right of ways. No improvements on the raw water intake, raw water reservoir, water treatment plant and sludge lagoons will be performed.

The new 14" water main will be installed along existing roads right of ways up to the Fajardo WTP. The new booster pump station will be also located at existing right of way on Tarawa Road near the Airport.

Additional improvements on the distribution tank and pipelines will be located on the existing parcels and footprints. No installations and repairs are expected outside the developed areas.

Due to the existence of multiple solid waste management units or areas of concern related to previous environmental contamination, it is necessary to avoid work along or near those areas.

In order to minimize temporary construction environmental impacts caused by excavations and earthwork, an erosion and sedimentation control plan shall be implemented.

x) **Land requirements**

All works will be performed on public lands, existing right of ways, easements and roads

For the above mentioned conditions, no new easements or land acquisitions are expected on this alternative.

xi) **Potential Construction Problems**

This alternative involves some construction tasks, which may arise some difficult situations during the installation and construction phase. The following are the expected situations:

- Due to the location near the seashore, ground water table can be encountered during pipelines and excavation operations. Dewatering procedures shall be contemplated in order to provide a safe and dry work area.
- There are also possible location of underground utilities such as sanitary, storm sewer and telecommunications fiber optic lines along the roads, which shall be completely identified during the design and construction phases, in order to minimize or avoid any conflicts or services interruptions.
- Another potential construction problem that shall be taken into consideration is the location of solid waste management units or environmentally sensitive areas adjacent to the pipe alignments locations. Construction protection measures, shall be included in order to not disturb those sensitive areas and to avoid the location of any temporary storage of equipment or materials near those areas.
- The existing treatment system shall be maintained in operation until the new PRASA connection is completely operational.
- Installation of proposed water main for PRASA connection along state roads outside the base premises, can create temporary traffic disruptions along the pipe route.

xii) **Sustainability Considerations**

Sustainable engineering, which is sometimes called green engineering, is the design and construction of products that conserve natural resources and exert the smallest possible impact on the environment. Conventional engineering designs strive to minimize cost and maximize performance. Green engineering often results in products that are neither the most cost-effective nor the longest lived, but engineers and consumers across the globe are realizing that sustainability is a critical feature.

i) **Water Efficiency**

The temporary potable water use will be for domestic consumption of construction and inspection personnel, and this is a temporary condition. Measures will be implemented on contract documents to prevent the use of potable water for sediment control, and cleansing after demolition works.

New water consumption is expected during operation, due to the nature of the project, which involves a new re-development. It is expected that the re-development guidelines and government regulations will establish the use of water efficient plumbing fixtures and other equipment.

j) Energy Efficiency

The temporary electric energy use will be for minor hand tools of construction personnel and for the temporary construction and inspection offices. Any other major electrical demand during construction can be attained thru the use of portable power generators.

The only electric energy consumption expected during operation, due to the nature of the project, will be for the new booster pump station operation. Energy efficient mechanical, control electrical and lighting equipment will be installed. Control systems will provide automatization with programmable logic controls that will result in efficiencies in electrical consumption.

k) Green Infrastructure

This alternative does not involves any permanent management of stormwater. Although some portions of the project are located on flood zones as indicated by the Federal Emergency Management Agency (FEMA), flood maps, there will be no direct impact on existing stormwater features or facilities.

There are various drainage structures for surface runoff, such as culvert crossings along the road corridors where the pipelines are located. Pipelines cross above or below the drainage culverts depending on available clearance. Pipelines replacement will be located at the same locations as the existing ones.

Only temporary management of stormwater runoff will be needed. Measures shall be implemented in order to manage the surface flows and to prevent erosion, and contamination. After the pipes installations are completed, the affected stream bed and banks will be restored to their original condition including the restoration of the vegetative cover.

No permanent impacts to the stormwater systems will be made for his alternative. The project area is mostly a developed sub-urban area. There are no other natural systems on the project area.

l) Operational & Maintenance Simplicity

Water Treatment Plant

This alternative provides for closure of the water treatment plant. This will eliminate the need for day to day operation and maintenance.

The mothballing of the existing equipment will need minor periodic maintenance in order to prevent deterioration of equipment, building and facilities. In addition, site surveillance shall be included.

Booster Pump Station

The proposed booster pump station will include full automation in the pumping system. Station automation must be used and must be maintained in good working order. Effective automation reduces operating costs by eliminating the need for human involvement in process operations, and by improving the efficiency of the process through regulating electric power. Such cost reductions are balanced by the maintenance costs of the automation systems and equipment. Maintenance of automation systems involves both routine servicing and corrective maintenance of repairs. Routine maintenance includes activities such as cleaning, calibration, setting up new systems and making archive data images. Savings may be attributable to applying a greater level of automation.

The proposed booster pump station will require routine and periodic maintenance. The following activities shall be considered:

- General building and grounds maintenance.
- Electrical repair and maintenance.
- Exercise, flushing and inspection of equipment.
- Scheduling of equipment maintenance.
- General maintenance, repair or replacement of parts or equipment.
- Telemetry alarm checks, repairs, loading programs, re-calibration, upgrades.

Water Distribution Pipelines

Conventional PVC pressure pipe, due to its proven technology, simplicity, and ease of operation and maintenance, is the accepted method of approach for providing water distribution service for communities in Puerto Rico and new developments.

Distribution system operation involves several activities:

- Major operations required to convey safe drinking water to the users, e.g. starting and stopping a motorized pump, the supply of fuel and the control of valves.
- The correct handling of facilities by users to ensure long component life, e.g. the flushing of lines and hydrants, valves operation, etc.

The proper operation of a supply results in its optimum use and contributes to a reduction in breakdowns and maintenance needs.

Distribution System Maintenance involves several activities:

- Preventive maintenance - regular inspection and servicing to preserve assets and minimize breakdowns.
- Corrective maintenance - minor repair and replacement of broken and worn out parts to sustain reliable facilities.
- Crisis maintenance - unplanned responses to emergency breakdowns and user complaints to restore a failed supply.

xiii) **Permits**

Due to the nature of the project, on which the majority of it will be performed on a developed area and on existing roads, no major issues regarding the permits or endorsements needed for the project are expected. The only endorsement that can affect the overall project schedule or modify the project scope is the US Fish and Wildlife Service, due to the location near the seashore and environmentally sensitive areas.

The following permits or endorsements shall be considered:

- Puerto Rico Aqueduct and Sewer Authority (PRASA): endorsement and approval
- OGPE (Oficina de Gerencia de Permisos):
 - Environmental Evaluation or Categorical Exclusion
 - Consolidated General Permit
 - Earth Movement Incidental Permit
- Comisión de Servicio Público (CSP)
 - Excavation Notification (during the construction phase)
- Environmental Protection Agency (EPA)
 - Stormwater Pollution Prevention Plan (NPDES) ,Notice of Intent (NOI) and Notice of Termination (NOT), (during the construction phase)

- Municipality of Ceiba: endorsement
- Autoridad de Desperdicios Solidos (ADS)
 - Waste Recycling Program: (during the construction phase)
- State Historic Preservation Office (SHPO): endorsement
- PR Institute of Culture: endorsement
- US Fish and Wildlife Service: endorsement
- PR Department of Transportation and Public Works (DTOP): endorsement
- PR Highway and Transportation Authority (PRHTA): endorsement
- Municipality of Fajardo: endorsement

xiv) **Expansion Capacity**

The proposed PRASA connection and the distribution system improvements shall have the adequate capacity for future demand growth. The design shall consider the flow contribution from residential, commercial, institutional and industrial clients' future growth in the project area for a 25 years development period.

The Fajardo WTP have a design capacity of 12.0 MGD and a current production of 8.0 MGD. The available 4.0 MGD can satisfy the future redevelopment water demand of approximately 2.4 MGD.

The new booster station will also have a design capacity of 1.5 MGD but can be expanded in the future for a maximum capacity of 4.0 MGD.

The diameters of the pressure distribution system shall have the adequate capacity for current and future flows. In addition, connection valves will be installed on critical points along the project route, which will be accessible for future connections either for local service connections or for distribution lines for other development areas.

xv) **Social and Community Impacts**

This alternative provides multiple positive social benefits to the community re-development by providing adequate and needed potable water service for clients which currently are operating with insufficient or inadequate water supply.

Inefficient water supply is very often associated with an unsustainable exploitation of natural resources. Improved water management, including industrial pollution control and water conservation is a key factor for maintaining ecosystem integrity.

Furthermore, water, sanitation and hygiene is important for improving living and working conditions, by reducing the risks of contracting water-related illnesses, and opening opportunities for large scale enterprises.

Another benefit of providing a reliable and adequate water supply is related to the availability of water for emergency fire service. All built-upon areas of a community should be served by a water distribution system that not only provides taps for consumer consumption, but also provides approved fire hydrants for installation at locations and with spacing considerations for convenient use by fire department pumping equipment and to meet needed fire flows in the proximity of the buildings to be protected.

xvi) **Cost Estimate**

For this alternative, the estimated project capital cost is of **\$11,355,319.34**. The detailed cost estimate is included on Appendix III.

A summary of the cost breakdown is included on Table 11.

Table 11 Cost Breakdown for Alternative 3

Cost Item	Cost
Net Construction Cost	\$8,232,340.00
Contingencies	\$1,234,821.00
Survey and Design	\$905,557.40
Engineering Services During Construction	\$159,336.94
Construction Management and Inspection	\$411,617.00
Land and/or ROW Acquisition	N/A
General and Administration Expenses	\$411,617.00
Estimated Total Project Cost (Cost eligible for Rural Development (RD) Participation)	\$11,355,319.34

6) SELECTION OF AN ALTERNATIVE

The best alternative will be selected considering both, Life Cycle Cost Analysis and Non-monetary factors. Below is the description and the analysis to determine the best alternative. Alternatives description and considerations were indicated in previous sections.

a) Life Cycle Cost Analysis

i) Initial Capital Cost

For this analysis the initial capital cost was determined as the Calculated Estimated Total Project Cost, which includes the amount to be financed by the participant agency (if applies) plus the matching contribution by the LRA.

As previous described, three (3) alternatives were considered, of these alternatives, two correspond to using the water source at Rio Blanco and, one corresponds to a connection to the PRASA system in Fajardo.

ii) Investment cost

Investment costs are based on preliminary cost estimates presented in Appendixes I, II and III for the corresponding alternatives 1 thru 3; refer to such appendixes for details on the items included on the estimates. Investment costs are summarized in Table 12.

Table 12 Summary of Investment Cost

Alternative	Development Cost			
	Net Construction Cost	Estimated Total Project Cost	RD Grant Participation (30%)	LRA Participation (70% As Loan)
Alternative 1	\$ 5,223,010.00	\$ 7,218,180.00	\$ 2,165,454.00	\$ 5,052,726.00
Alternative 2	\$ 6,054,255.00	\$ 8,350,967.16	\$ 2,505,290.15	\$ 5,845,677.01
Alternative 3	\$ 8,232,340.00	\$ 11,355,319.34	\$ 3,406,595.80	\$ 7,948,723.54

iii) Land

Beside the LRA is the owner of property, for the purposes of this analysis; it was assumed all water lines and treatment plant are located within the existing right-of-way. Therefore, no easement acquisition property purchase has been included.

iv) Operational Costs

A typical operational cost budget for this type of system includes the human resources cost (inspection and maintenance staff), preventive maintenance costs, equipment replacement costs, energy consumption, and other consumables such as chemicals for a pretreatment and treatment processes.

Table 13, Table 14 and Table 15 resume operation and maintenance estimated expenses associated with each alternative, the costs expressed in those tables are separated for all class of expenses and each system components.

Table 13. Water Annual Operation and Maintenance Cost (O&M) - Alternative 1

	Annual Cost	%	Source of Supply	Water Treatment	Distribution System	Admin. & General
Salaries and Wages (Employees and Officers)	175,000	44%	17500	43750	61250	52500
Electric Power Cost	80,000	20%		60400	12000	8000
Fuel for Emergency Generators	3,000	1%		1350	1350	300
Sludge Removal Expense	8,000	2%		6400		1600
Chemicals	15,000	4%		11250	3750	
Materials and Supplies	6,000	2%	600	1500	2100	1800
Contractual Services (Legal, accounting, Eng, etc.)	20,000	5%				20000
Testing	18,000	5%	2700	10800	4500	
Equipment Rental	8,000	2%	1200	2400	3200	1200
Transportation Expenses	25,000	6%	6250	2500	8750	7500
Insurance (Gral. Liability, Workers Comp., Vehicles, etc.)	20,000	5%	3000	5000	5000	7000
Regulatory and Compliance Expense	6,000	2%	900	1500	1500	2100
Other Costs/Misc.	10,000	3%	2500	2500	2500	2500
Totals	\$ 394,000.00	100%	\$ 34,650.00	\$149,350.00	\$ 105,900.00	\$ 104,500.00

Table 14. Water Annual Operation and Maintenance Cost (O&M) - Alternative 2

	Annual Cost	%	Source of Supply	Water Treatment	Distribution System	Admin. & General
Salaries and Wages (Employees and Officers)	175000	45%	17500	43750	61250	52500
Electric Power Cost	70000	18%		49000	14000	7000
Fuel for Emergency Generators	3000	1%		1350	1350	300
Sludge Removal Expense	7000	2%		5600		1400
Chemicals	12000	3%		9000	3000	
Materials and Supplies	10000	3%	1000	2500	3500	3000
Contractual Services (Legal, accounting, Eng, etc.)	20000	5%				20000
Testing	18000	5%	2700	10800	4500	
Equipment Rental	12000	3%	1800	3600	4800	1800
Transportation Expenses	25000	6%	6250	2500	8750	7500
Insurance (Gral. Liability, Workers Comp., Vehicles, etc.)	20000	5%	3000	5000	5000	7000
Regulatory and Compliance Expense	6000	2%	900	1500	1500	2100
Other Costs/Misc.	10000	3%	2500	2500	2500	2500
Totals	\$ 388,000.00	100%	\$ 35,650.00	\$ 137,100.00	\$ 110,150.00	\$ 105,100.00

Table 15. Water Annual Operation and Maintenance Cost (O&M) - Alternative 3

	Annual Cost	%	Source of Supply	Water Treatment	Distribution System	Admin. & General
Salaries and Wages (Employees and Officers)	105,000	12%			63,000	42,000
Electric Power Cost	60,000	7%			42,000	18,000
Fuel for Emergency Generators	2,500	0%			1,500	1,000
Sludge Removal Expense	-	0%				-
Chemicals	-	0%			-	
Materials and Supplies	6,000	1%			3,600	2,400
Contractual Services (Legal, accounting, Eng, etc.)	20,000	2%				20,000
Testing	12,000	1%			12,000	
Equipment Rental	9,000	1%			6,300	2,700
Transportation Expenses	20,000	2%			12,000	8,000
Insurance (Gral. Liability, Workers Comp., Vehicles, etc.)	18,000	2%			7,200	10,800
Regulatory and Compliance Expense	8,000	1%			5,600	2,400
PRASA wholesale water cost*	564,670		564669.78			
Other Costs/Misc.	20,000	2%			10,000	10,000
Totals	\$ 845,169.78	33%	\$ 564,669.78	\$ -	\$ 163,200.00	\$ 117,300.00

The following considerations has been made for the O&M calculations above:

- Salaries and Wages: Considers one operator per 8 hr working shift in the WTP, with three working shifts per day. One crew (two persons) was assumed to be shared with the sanitary sewer system maintenance per working shift, with three working shifts per day. Administrative and support staff is considered to be shared with the sanitary sewer system and just one shift per day.
- Electric Power Cost: Considers the cost of energy for the operation of the WTP, the booster pump stations where applies and, the offices and other related energy consumption.
- Contractual Services: Are services required to support and maintain the technical and administrative operation of the system. Include engineers, accountants, lawyers, etc.
- Transportation Expenses: Includes the vehicular transportation for working crews and administrative personnel for job related tasks.
- Regulatory and compliance: Includes expenses related to records maintenance, standards of safety, quality control and assurance, and other associated costs.
- On Alternative 3, the wholesale cost of PRASA water service is included.
- Other items are self-explained.

A summary of the operational cost for the four alternatives is presented in the following table.

Table 16 Summary of Annual Operation and Maintenance Costs (O&M)

	Alternative 1	Alternative 2	Alternative 3
Salaries and Wages (Employees and Officers)	175,000	175,000	105,000
Electric Power Cost	80,000	70,000	60,000
Fuel for Emergency Generators	3,000	3,000	2,500
Sludge Removal Expense	8,000	7,000	-
Chemicals	15,000	12,000	-
Materials and Supplies	6,000	10,000	6,000
Contractual Services (Legal, accounting, Eng, etc.)	20,000	20,000	20,000
Testing	18,000	18,000	12,000
Equipment Rental	8,000	12,000	9,000
Transportation Expenses	25,000	25,000	20,000
Insurance (Gral. Liability, Workers Comp., Vehicles, et	20,000	20,000	18,000
Regulatory and Compliance Expense	6,000	6,000	8,000
PRASA wholesale water cost*			564,670
Other Costs/Misc.	10,000	10,000	20,000
Total	\$ 394,000.00	\$ 388,000.00	\$ 845,169.78

* the cost of PRASA wholesale water only considers the "Base Charge" plus "Environmental Charge" for a 12" pipe connection plus a 20% of base rate for a consumption of 0.75MGD of water.

v) **Design Lives and Replacement Schedule**

For the purpose of this evaluation, Water and Raw Water Lines, and WTP components listed below are assumed to have the following design lives and replacement schedules.

Design Lives:

- Existing PVC Lines: 40+ Years
- New PVC Lines: 50+
- Pumps and Controls: 20 years
- Tanks: 40+ Years
- Motors: 20 years
- Valves and fittings: 20-25 years
- Raw Main Water line: 40+ years

Replacement Schedule

- Pressure Lines: Do not require major repair/replacements; will not include a residual/salvage value at the end of 40 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance).
- Water Treatment Plant: Will require improvements at 20, 30 and 40 years of use; will include a residual/salvage value at the end of 40 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance).
- Raw Water Line: Does not require major repair/replacements; will include a residual/salvage value at the end of 40 years (Note: Evaluation includes costs associated with Preventative Maintenance and Routine Maintenance).
- Motors: Require repair/replacements at Year 10 in the evaluation; this cost is included in the Yearly Maintenance Cost (because it is not a capital cost. The residual/salvage value at the end of 40 years is included in the overall WTP residual/salvage value).
- Tanks: Require repairs every 10 Years; this cost is included in the Yearly Maintenance Cost because it is not a capital cost. No residual/salvage value at the end of 40 years is considered.

Salvage Value

For the purpose of this evaluation, the design lives of water and raw water lines, pumps, and tank structures are 40 years. While each alternative may have a residual value at the end of 40 years, all may be functionally obsolete by hydraulic capacity or service area needs. Therefore, the salvage value of water lines, tanks, and raw water line, are considered zero at the end of the 40-year design life. Only the Water Treatment Plant is considered to have a Salvage Value at year 40. However, since this evaluation is for a 20-year life cycle, each of these items will include a salvage value at year 20. The salvage value will be the remaining value at the end of the 30 years period, assuming 40-year straight-line depreciation.

vi) Total Equivalent Present Cost Analysis

To perform the economic evaluation, it was assumed a lifespan of 20 years for all considered alternatives. The operation costs for that period were converted into an equivalent present cost, presuming a discount rate of 3.1%, as state in the more recent OMB circular A-94 (revised, See Appendix V). The total equivalent present cost (TEPC) for each alternative was determined by adding the operational total equivalent present cost to the capital cost. The equation to calculate the TEPC (Revelle, Whitch, & Wright, 1997) is the following:

$$TEPC_i = I_i + C_i \times \frac{(1+r)^T - 1}{r \times (1+r)^T} \times SPPW$$

Where:

TEPC_i = total equivalent present cost for alternative i

T = analysis period in years

r = inflation or interest discount rate (assumed 3.4%)

C_i = annual operation cost for alternative i

I_i = initial or capital investment for alternative i

SPPW = single payment worth of the salvage value at present value

The results for the compared alternatives are presented in the following table.

Table 17 Total Present Cost Value for Each Alternative

Alternative	Estimated Total Project Cost (USD)	Operational Costs		Salvage Value at Present Value	Total Equivalent Present Cost
		Total Annual Cost	Total Cost O&M at Present Value		
			20 Years (3.1%)		20 Years
Alternative 1	\$ 7,218,180.00	\$ 394,000.00	\$5,807,895.66	\$1,418,134.94	\$ 11,607,940.73
Alternative 2	\$ 8,350,967.16	\$ 388,000.00	\$5,719,450.55	\$1,643,831.91	\$ 12,426,585.80
Alternative 3	\$ 11,355,319.34	\$ 845,169.78	\$12,458,522.58	\$2,235,218.57	\$ 21,578,623.35

b) Non- monetary Factors

In order to consider non-monetary factors the advantages of each alternative are disclosed. Then, such factors, together with monetary considerations, are evaluated for a final determination of the best alternative. A summary of the findings are as follows:

- With Alternative 1, the project will address the need for the water supply for Phase I development on the former Roosevelt Roads Naval Station. On this alternative, the existing Raw Water Intake and WTP are rehabilitated. Existing tanks and water lines will be maintained, rehabilitated and replaced as need.
- With Alternative 2, the project will address the need for the water supply for Phase I development on the former Roosevelt Roads Naval Station. On this alternative, the existing Raw Water Intake is rehabilitated but a New Water Treatment Plant is considered. Existing tanks and water lines will be will be maintained, rehabilitated and replaced as need.
- With Alternative 3, the project will address the need for the water supply for Phase I development on the former Roosevelt Roads Naval Station by connecting the project to the PRASA system, specifically

to Fajardo WTP. On this alternative, the existing Raw Water Intake and WTP are abandoned. Existing tanks and water lines will be maintained, rehabilitated and replaced as need.

Below is a summary of the main advantages and disadvantages of each alternative:

Table 18: Alternatives Advantages & Disadvantages

Alternative	Advantages	Disadvantages
Alternative 1	<ul style="list-style-type: none"> • Maintains a dedicated water intake and reservoir • Lower initial development cost • No land acquisition requirement • Very low environmental impact • WTP capacity can be improved up to 4.0 MGD 	<ul style="list-style-type: none"> • Higher O&M costs • Requires more intensive pre-construction assessment • Raw water intake limited capacity for expansion greater than 1.5 MGD • Temporary systems required to maintain continuous operation during construction
Alternative 2	<ul style="list-style-type: none"> • Maintains a dedicated water intake and reservoir • WTP could be designed to permit future capacity expansion greater than 1.5 MGD • No land acquisition requirement • Relatively low environmental impact 	<ul style="list-style-type: none"> • High O&M costs • High initial investment cost • Raw water intake limited capacity for expansion greater than 1.5 MGD • Temporary systems required to maintain continuous operation during construction
Alternative 3	<ul style="list-style-type: none"> • Lower O&M costs (excluding PRASA wholesale water fee) • No land acquisition requirement • Lower environmental impact • Good sustainability 	<ul style="list-style-type: none"> • High initial development cost • Low reliability due to loss of “self supplied source” water intake and water treatment process • Limited capacity for expansion greater than 4.0 MGD • LRA must pay water service fee to PRASA

c) Evaluation matrix for the Assessment of Alternatives

In order to evaluate and select the best alternative, a weight matrix was developed. This matrix comprises a set of technical indicators to evaluate how does each alternative focuses on the solution of problems and the way it adjust to the environment within the existing and proposed community.

Weights were assigned based on a relative comparison between the three alternatives for each one of the indicators. The used scale varies from a minimum of zero (0) for the less adequate alternative up to a maximum of ten (10), which was awarded to the better alternative.

The technical indicators are briefly described here:

Initial Development Cost: It is the estimated total project cost as indicated on the calculated preliminary cost estimates including the net construction cost plus additional general and administrative expenses. A value of zero (0) denotes a very high cost (and a value of ten (10) denotes a very low cost.

Present Value Total Cost: It is the estimated future amount of the project cost (20 years lifespan) that has been discounted to reflect its current value, as if it existed today. A value of zero (0) denotes a very high cost and a value of ten (10) denotes a very low cost. This cost includes construction and O&M costs.

Environmental Impact: It considers the impacts of the project on undeveloped areas. Also it takes in consideration any temporary or permanent modifications to any natural resource along the project route or location. A value of zero (0) denotes a very high environmental impact and a value of ten (10) denotes minimum or no impact at all.

Permits: It considers the quantity and complexity of the permits and endorsements needed for the project completion. A value of zero (0) denotes a large amount of very complex permits involved and a value of ten (10) denotes a minimum amount or simple permits to be obtained.

Land Acquisition: It considers the quantity and size of parcels or right of ways that need to be acquired or established in order to install the project components. A value of zero (0) denotes a large quantity of very large parcels required for the project and a value of ten (10) denotes no land acquisitions needed.

Construction Complexity: It considers the grade of difficulty involved during the construction and installation phase of the project components. A value of zero (0) denotes a very complex and difficult construction tasks and a value of ten (10) denotes typical non- complex construction tasks.

Social Impact: It considers the social benefits for the surrounding communities arising from the project development, such as less air, water and sound pollution during the project operation, new sewer connections, and jobs created during construction. A value of zero (0) denotes a minimum of social benefits after the project completion and a value of ten (10) denotes a high social benefit after the project completion.

Sustainability: It considers the benefits of using a resource (water and electric energy) so that the resource is not depleted or permanently damaged during the project construction and operation. A value of zero (0) denotes a high usage of potable water and electric energy during the project construction and operation and a value of ten (10) denotes no usage of potable water and electric energy during the project construction and operation.

O&M: It considers the simplicity and costs associated for the project components maintenance and operation. A value of zero (0) denotes a very complex and costly maintenance & operation for the project and a value of ten (10) denotes very simple and a minimum cost for maintenance & operation for the project.

Capacity for Expansion: It considers the ability of the facility to handle future flow contributions from population growth in the immediate project area, or from other areas to be connected. A value of zero (0) denotes a no expansion capacity considered and a value of ten (10) denotes the largest expansion capacity considered.

Project Objective Compliance: It considers the achievement of the clients' goals and objectives for the project scope as requested for the PER preparation. A value of zero (0) denotes no achievement of the project's goals and objectives and a value of ten (10) denotes the full achievement of the project's goals and objectives.

To reflect what in our judgment is the weight of each technical indicator, a column including the percentage of the possible 100% weight was included the matrix. Resulting matrix is showed in Table 19.

Table 19: Alternative Evaluation Matrix

Item	Description	Weight	Alternative 1	Alternative 2	Alternative 3
			WTP Rehab.	New WTP	Conn. To PRASA
1	Initial Development Cost	100%	10	9	7
2	Present Value Total Cost	100%	10	9	5
3	Environmental Impact	80%	10	8	8
4	Permits	80%	9	7	9
5	Land Acquisition	50%	10	10	8
6	Construction Complexity	80%	8	8	8
7	Social Impact	80%	10	10	10
8	Sustainability	60%	8	10	10
9	O&M	80%	9	10	6
10	Capacity for Expansion	75%	10	8	8
11	Project Objective Compliance	75%	10	10	8
TOTAL			81.6	76.9	66.8

Note that the best resulting alternative was Alternative 1 that obtained 81.6 points from a maximum of 86 (note that if every technical indicator has a 100% weight a maximum 110 points would be possible) in the evaluation. This alternative will address the water supply needs for Phase I and subsequent development phases on the former Roosevelt Roads Naval Station.

7) PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

a) Introduction

Based on the analysis and results of the Evaluation Matrix, Alternative 1 is the best resulting alternative.

This alternative considers the major upgrade and rehabilitation of the existing treatment system including the raw water intake and reservoir. In addition it involves the replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.

b) Project Design

The project design involves the selection of a qualified engineering design firm with the capabilities to deliver construction plans, documents, cost estimates, land surveying, permitting process and preparation of technical studies. Additional studies that must be considered shall include: Existing Facilities Technical Assessment, Geotechnical Exploration, Lead and Asbestos Assessment and Archeological Resources Evaluation. All the design and studies phases shall be in compliance with PRASA Design Guidelines and current building codes and regulations.

The components that must be considered during the design phase shall include the following aspects:

i. Drinking Water:

The project goal is to produce and deliver potable water with the highest quality standards and according to current environmental, operational and health regulations. The main use will be for current and future tenants of the redevelopment. Currently, water production and distribution must be maintained in operation at all times during the improvements and construction phase. The other potable water use will be for domestic consumption of construction and inspection personnel, and this is a temporary condition. A temporary service tapping shall be installed on the construction area premises. Measures will be implemented on contract documents to prevent the use of potable water for sediment control, and cleansing after any demolition works.

ii. Wastewater/Reuse

There are no wastewater requirements for the selected alternative. During construction, the contractor shall install portable toilet facilities and /or temporary washroom facilities connected to an existing sewer service connection. No reuse is considered either during construction nor operation.

iii. Solid Waste

There are no solid waste management requirements for the selected alternative. The solid waste management requirements for the project are limited for waste generated during the temporary construction phase.

A temporary waste collection area shall be established by the contractor on an adequate location accessible for the construction crews and at a reasonable distance from residential units and food serving business or schools.

Closed containers shall be installed for separate waste components. Waste shall be separated into recyclable and non-recyclable components as required by local regulations. A recycling program shall be implemented by the Contractor.

A private authorized hauler shall collect and dispose the waste generated during construction and transport it to an approved waste disposal facility.

It is expected that the waste will be mostly composed of the following: PVC pipe remnants, plastic wrapping, corrugated cardboard, concrete and asphalt residues and domestic waste from construction tasks.

iv. Stormwater

This alternative does not involve any permanent management of stormwater. Although some portions of the project are located within flood zones as indicated by the Federal Emergency Management Agency (FEMA), flood maps 72000C1285J, 72000C1305J, 72000C840J and 72000C0820J 72000C1560J (effective date November 18, 2009).

There are no stormwater management requirements for the selected alternative nor are permanent impacts expected. There are several culvert crossings along the project route. All culvert systems discharge either into the existing wetlands, conservation zones or directly into the sea. Replacement water pipelines will be installed at the same location as existing ones, mostly by crossing below those culvert structures.

Only temporary management of stormwater runoff during construction will be needed. Measures shall be implemented in order to manage the stream flow and to prevent erosion, and contamination. After the pipes installations are completed, the affected excavated areas will be restored to their original condition including the restoration of the pavement or vegetative cover.

No green infrastructures components are expected or required for the selected alternative.

c) Project Schedule

The project schedule is as follows:

Table 20 Schedule Summary

Task	Duration (days)	Year Period
Survey , Design Phase, Permits	240	2016-2017
Land and/or ROW Acquisition	N/A	N/A
Bid Process	60	2017
Contract Award	60	2017
Construction	615	2017-2019
Commissioning	120	2019
Total	1,095 days (36 months approx.)	

d) Permit Requirements

The following permits or endorsements shall be considered and obtained:

- OGPE (Oficina de Gerencia de Permisos):
 - Environmental Evaluation or Categorical Exclusion
 - Consolidated General Permit
 - Earth Movement Incidental Permit
- Comisión de Servicio Público (CSP)
 - Excavation Notification (during the construction phase)
- Environmental Protection Agency (EPA)
 - Stormwater Pollution Prevention Plan (NPDES) ,Notice of Intent (NOI) and Notice of Termination (NOT), (during the construction phase)
- Municipality of Ceiba: endorsement
- Autoridad de Desperdicios Solidos (ADS)
 - Waste Recycling Program: (during the construction phase)
- State Historic Preservation Office (SHPO): endorsement
- PR Institute of Culture: endorsement
- US Fish and Wildlife Service: endorsement

Some of the indicated permits shall be obtained in coordination with the selected Construction Contractor.

e) Sustainability Consideration

The selected alternative shall take in consideration the objectives and actions contained in the *“Memorandum of Agreement Between the United States Environmental Protection Agency and the United States Department of Agriculture – Rural Development Rural Utilities Service”* signed in 2011, which promotes sustainable rural water and wastewater systems.

The design and construction of the selected alternative must conserve natural resources and exert the smallest possible impact on the environment. Sustainable engineering often results in projects that are neither the most cost-effective nor the longest lived, but engineers and consumers across the globe are realizing that sustainability is a critical feature.

The main factors that must be addressed for sustainability shall consider the following:

Sustainable engineering, which is sometimes called green engineering, is the design and construction of products that conserve natural resources and exert the smallest possible impact on the environment. Conventional engineering designs strive to minimize cost and maximize performance. Green engineering often results in products that are neither the most cost-effective nor the longest lived, but engineers and consumers across the globe are realizing that sustainability is a critical feature.

i. Water Efficiency

The temporary potable water use will be for domestic consumption of construction and inspection personnel, and this is a temporary condition. Measures will be implemented on contract documents to prevent the use of potable water for sediment control, and cleansing after demolition works.

New water consumption is expected during operation, due to the nature of the project, which involves a new re-development. It is expected that the re-development guidelines and government regulations will establish the use of water efficient plumbing fixtures and other equipment. In addition, water efficient plumbing equipment will be installed at the Water Treatment Plant.

ii. Energy Efficiency

The temporary electric energy use will be for minor hand tools of construction personnel and for the temporary construction and inspection offices. Any other major electrical demand during construction can be attained thru the use of portable power generators.

The only electric energy consumption expected during operation, due to the nature of the project, will be for the Water Treatment Plant operation. New mechanical, control electrical and lighting equipment will be installed. The new control systems will provide automatization with programmable logic controls that will result in efficiencies in electrical consumption. In addition, the replacement of conventional lighting with fluorescent and LED lighting fixtures, will provide energy efficiency and savings.

iii. Green Infrastructure

This alternative does not involves any permanent management of stormwater. Although some portions of the project are located on flood zones as indicated by the Federal Emergency Management Agency (FEMA), flood maps, there will be no direct impact on existing stormwater features or facilities.

There are various drainage structures for surface runoff, such as culvert crossings along the road corridors where the pipelines are located. Pipelines cross above or below the drainage culverts depending on available clearance. Pipelines replacement will be located at the same locations as the existing ones.

Only temporary management of stormwater runoff will be needed. Measures shall be implemented in order to manage the surface flows and to prevent erosion, and contamination. After the pipes installations are completed, the affected stream bed and banks will be restored to their original condition including the restoration of the vegetative cover.

No permanent impacts to the stormwater systems will be made for his alternative. The project area is mostly a developed sub-urban area. There are no other natural systems on the project area.

f) Total Project Cost Estimate (Engineers Opinion of Probable Cost)

An itemized estimate of the alternative based on the stated period of construction, including all the engineering, construction, administrative, land right of way, contingency and other costs associated with the proposed project construction has been determined. The total project cost is of **\$7,218,180.01**. (See Appendix I, for a detailed cost estimate)

g) Annual Operating Budget

An itemized annual operating budget has been calculated. The annual operating budget analysis will consider the revenue income and operations & maintenance (O & M) costs. This information will be used to evaluate the financial capacity of the system. This analysis only considers the O&M cost and revenues of the phase I Re-development of the Former Naval Base.

i. Annual O & M Costs

The operation and maintenance budget for the selected alternative includes the payroll cost of the maintenance and supervision staff assigned for the project area, cost related to the electric energy consumption, and any other cost related to the O&M as described in previous section. Total annual O&M budget for selected alternative is **\$394,00.00/year**

The summary of the Operation & Maintenance Costs are presented here:

Table 21 Estimated Operational Costs for the Project

	Annual Cost	%
Salaries and Wages (Employees and Officers)	175,000	44%
Electric Power Cost	80,000	20%
Fuel for Emergency Generators	3,000	1%
Sludge Removal Expense	8,000	2%
Chemicals	15,000	4%
Materials and Supplies	6,000	2%
Contractual Services (Legal, accounting, Eng, etc.)	20,000	5%
Testing	18,000	5%
Equipment Rental	8,000	2%
Transportation Expenses	25,000	6%
Insurance (Gral. Liability, Workers Comp., Vehicles, etc.)	20,000	5%
Regulatory and Compliance Expense	6,000	2%
Other Costs/Misc.	10,000	3%
Totals	\$ 394,000.00	100%

ii. Initial Interests Repayment

The initial 3 years’ period (years 2016 to 2019) of the project development will include the planning, studies, design, construction and commissioning. In addition, during that period, the customer base will have a limited growth, that will produce a limited service billing.

An analysis has been performed to have the interest repayment based on a loan disbursement during the 3 years initial period. The loan disbursement is based on a semester (bi-annual) distribution. The S-Curve for the total disbursement of **\$5,052,726** is shown here:

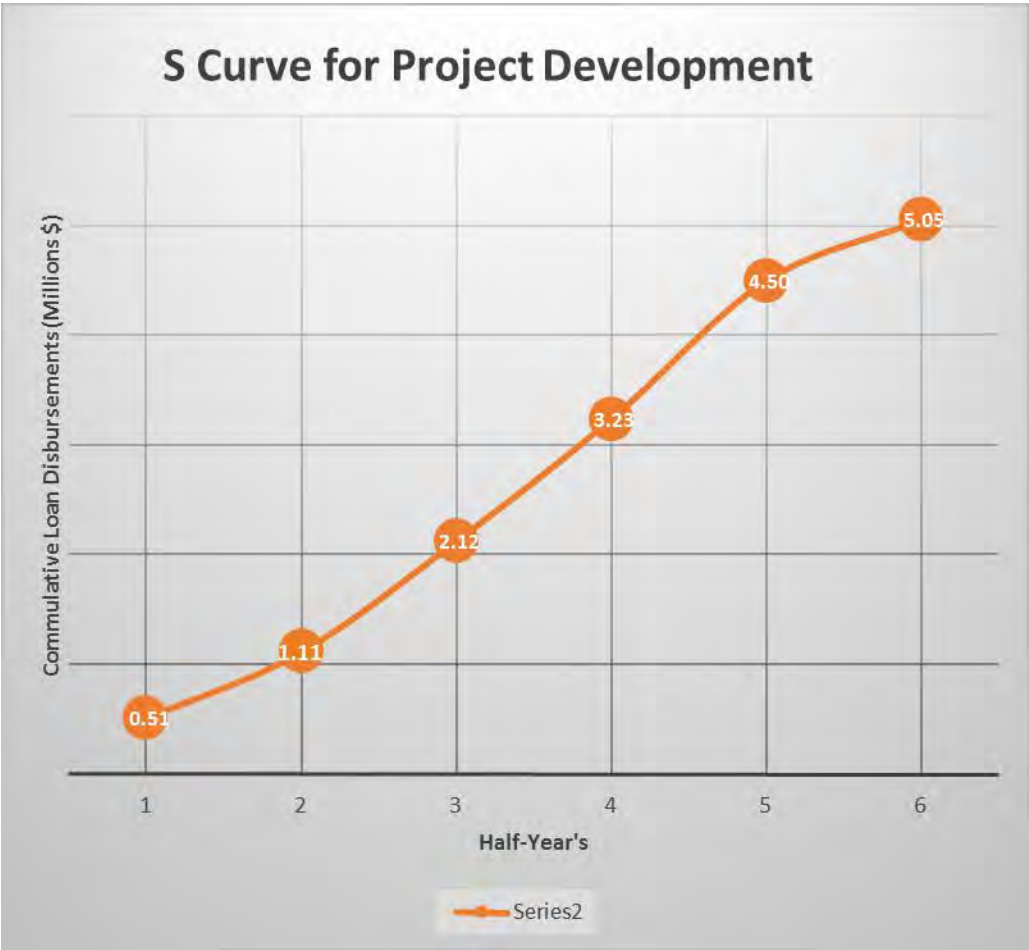


Figure 32 Loan Disbursement S-Curve

Based on those disbursements, the debt service payment schedule for the three proposed disbursements at an interest rate of 3.0% are shown on the following table:

Table 22 Interest Debt Service Repayment Schedule

	Year 1		Year 2		Year 3		Year 4		Year 5	
	Jul-16	Jan-17	Jul-17	Jan-18	Jul-18	Jan-19	Jul-19	Jan-20	Jul-20	Jan-21
Issue Amount (\$)	505,273	606,327	1,010,545	1,111,600	1,263,182	555,800				
.5 Yr Debt Service	6,316	7,579	12,632	13,895	15,790	6,947				
Debt Service Schedule (Years) Interest Rate of 3.0%	1	6,316	6,316	6,316	6,316	6,316				
			7,579	7,579	7,579	7,579				
	2		12,632	12,632	12,632	12,632	12,632	12,632		
				13,895	13,895	13,895	13,895	13,895		
	3				15,790	15,790	15,790	15,790	15,790	15,790
						6,947	6,947	6,947	6,947	6,947
Totals (\$)	6,316	13,895	26,527	40,422	56,212	63,159	49,264	49,264	22,737	22,737

The accumulated interest for the total loan will be **\$350,533**. That amount is included in the loan amount presented in Table 22.

iii. Debt Repayment

The estimated total investment of **\$7,218,180.01** is required for the proposed alternative. The eligible cost for a USDA Rural Development funding loan is assumed on this report to be a **70%** of the investment which equals to **\$5,052,726.00** plus interest of the first 3 years. Total loan including interest only years in the loan is **\$5,403,258.87**.

Because of the extent of planning and construction process (3 years in total) we suggest to make one loan for the total amount but distribute the funds availability in three separate disbursements during those 3 years. In that way, considering the three years of “interest only” payment, the principal + interest payment for each one would be on years 4, 5 and 6 respectively.

Using the statement above, and for a 40 years’ loan term, which includes the “interest only” years, repayment schedules for the three disbursements and interest rates of 3%, 3.5% and 4.0% are presented here:

Table 23 Loan Repayment Details

Total Loan Amount \$ 5,403,258.87					
		Year 1 Disb.	Year 1+2 Disb.	Year 1+2+3 Disb.	
		\$ 1,187,390.61	\$ 3,454,801.40	\$ 5,403,258.87	
Loan Interest Rate	3%	\$ 4,101.78	\$ 11,934.44	\$ 18,665.29	Monthly Payment
		\$ 49,221.38	\$ 143,213.26	\$ 223,983.45	Accumulated Annual Payment
		\$ 1,821,190.94	\$ 5,298,890.67	\$ 8,287,387.51	Total Payments
		\$ 633,800.33	\$ 1,844,089.27	\$ 2,884,128.65	Total Interest Paid
	3.5%	\$ 4,773.00	\$ 13,887.41	\$ 21,719.71	Monthly Payment
		\$ 57,276.06	\$ 166,648.96	\$ 260,636.53	Accumulated Annual Payment
		\$ 2,119,214.18	\$ 6,166,011.48	\$ 9,643,551.78	Total Payments
		\$ 931,823.57	\$ 2,711,210.08	\$ 4,240,292.92	Total Interest Paid
	4.0%	\$ 5,128.22	\$ 14,920.94	\$ 23,336.14	Monthly Payment
		\$ 61,538.66	\$ 179,051.32	\$ 280,033.65	Accumulated Annual Payment
		\$ 2,276,930.56	\$ 6,624,899.02	\$ 10,361,245.18	Total Payments
		\$ 1,089,539.95	\$ 3,170,097.62	\$ 4,957,986.32	Total Interest Paid

Using the 3% interest on Table 22 and Table 23, the approximate loan repayment schedule will be as follow:

- Year 1: Interest Only of **\$20,211/year** (included in loan)
- Year 2: Interest Only of **\$66,949/year** (included in loan)
- Year 3: Interest Only of **\$119,371/year** (included in loan)
- Year 4:
 - Interest Only of **\$98,528/year** (included in loan)
 - Principal + Interest of **\$49,221/year**
- Year 5:
 - Interest Only of **\$45,475/year** (included in loan)
 - Principal + Interest of **\$143,213/year**
- Year 6 and beyond: Principal + Interest of **\$223,983/year**

iv. Reserves

a. Debt Service Reserve

The estimated debt service reserve is calculated to be the amount necessary to accumulate at least one year of the estimated payment in a period of 10 years or a 10% of the annual payment.

With a 3% interest rate, and a 40 years loan repayment term, the approximate annual reserve should be as follow:

- Year 4: **\$4,922/year** (10% of total annual payment of \$49,221).
- Year 5: **\$14,321/year** (10% of total annual payment of \$143,213).
- Year 6 to 13: **\$22,398/year** (10% of total annual payment of \$223,983).
- Year 14: **\$17,476/year** (Same as year 6 to 13 minus reserve of year 4 which will has accumulated 10 years by that date)
- Year 15: **\$3,155/year** (Same as year 6 to 13 minus reserve of year 4 and 5 which will has accumulated 10 years by that date)

b. Short-Lived Asset Reserve or Capital Improvements

The short lived assets include the infrastructure and equipment in the system with an estimated lifespan up to 20 years from installation. The repair or replacement of these assets is generally funded by the Operations and Maintenance annual budget. However a reserve for the capital improvement is considered as a prudent measure. For this analysis a 5% of the annual O&M budget will be considered as CIP fund. This amount equals **\$19,700.00/year** (5% of total O&M annual payment of \$394,000).

v. Income

Currently, the LRA operational budget plus a monthly service billing to the existing customers, compose the available funding to cover the water treatment and distribution systems maintenance and operation costs.

A new billing system that accomplishes the needs to cover debt services expenses, O&M expenses, and other reserves should be established to assure a self-sufficient project. For this analysis, a simple service charge based on two components is proposed:

- a fixed monthly fee based on customer class
- a fixed per gallon fee to cover expenses related to the Rio Blanco water extraction franchise fee required by the PR Department of Natural and Environmental Resources
- a variable rate per monthly consumed gallons, and that is based on customer class

The summary of the fixed and variable rates is shown on the following table:

Table 24 Proposed Billing Fees & Rates

Customer Class	Fixed monthly fee per client	Franchise Fee Rate per Gallon	Rate per Gallon
Residential	\$13.00	\$0.0002	\$0.0015
Commercial	\$75.00	\$0.0002	\$0.003
Industrial	\$300.00	\$0.0002	\$0.010
institutional	\$300.00	\$0.0002	\$0.005
Parks and Recreational	\$25.00	\$0.0002	\$0.005

In order to determine the annual income for the current and future connections, the estimated water consumption is calculated from the water demands flows included in Section 5b) of this report as part of the analysis of the alternatives for the project. A non-billed volume of water of 50% of the calculated demands is considered to account for water loses or any other non-billed or accounted volume of water.

The income has been determined for redevelopment areas within Phase I, in various stages from the year 2016 up to the year 2041. The customer's classes are based on the different redevelopment components as defined in Sections 5 of this report. One residential client is assumed per dwelling unit. In order to obtain the number of commercial clients, it was assumed that one client is expected per each 4,000 sq. ft. of commercial areas and one client per lodging or hotel use. For the industrial client's calculations, it was assumed one client per each 50,000 sq. ft. of industrial areas.

For Institutional and Parks and recreational uses, one client was assumed per indicated area.

The total number of clients are:

Table 25 Phase I Customer Class Summary

Customer Class (Phase I)	Total Number of Clients
Residential	2,536
Commercial	592
Industrial	20
institutional	8
Parks and Recreational	10
Total	3,165

Based on the billing fees and rates, and the total number of clients, the monthly customer billing per development period were calculated and are shown on the following tables:

Tables 26 Monthly Customer Billing per Development Period

Customer Classes	Development Phase Existing - Years 2016-2017									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Billable Cumulative Demand (Gals/Month)	Franchise Fee Rate per Gallon (dollars)	Consumption Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	0	0	0	0.0002	0.0015	-	-	13.00	-	\$ -
Commercial	14	12,910	387,306	0.0002	0.0030	77.4612	1,161.92	75.00	1,050.00	\$ 2,289.38
Industrial	2	3,500	105,000	0.0002	0.0100	21.0000	1,050.00	300.00	600.00	\$ 1,671.00
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	1	700	21,000	0.0002	0.0050	4.2000	105.00	25.00	25.00	\$ 134.20
Total										\$ 12,145.68

Customer Classes	Development Phase Years 2017-2018									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	50	10,000	300,000	0.0002	0.0015	60.0000	450.00	13.00	650.00	\$ 1,160.00
Commercial	28	21,010	630,306	0.0002	0.0030	126.0612	1,890.92	75.00	2,062.50	\$ 4,079.48
Industrial	3	8,505	255,148	0.0002	0.0100	51.0297	2,551.48	300.00	750.00	\$ 3,352.51
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	1	700	21,000	0.0002	0.0050	4.2000	105.00	25.00	25.00	\$ 134.20
Total										\$ 16,777.29

Customer Classes	Development Phase Years 2018-2019									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	150	30,000	900,000	0.0002	0.0015	180.0000	1,350.00	13.00	1,950.00	\$ 3,480.00
Commercial	57	55,510	1,665,306	0.0002	0.0030	333.0612	4,995.92	75.00	4,275.00	\$ 9,603.98
Industrial	3	13,510	405,297	0.0002	0.0100	81.0593	4,052.97	300.00	900.00	\$ 5,034.03
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	3	10,200	306,000	0.0002	0.0050	61.2000	1,530.00	25.00	75.00	\$ 1,666.20
Total										\$ 27,835.30

Customer Classes	Development Phase Years 2019-2020									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	270	54,000	1,620,000	0.0002	0.0015	324.0000	2,430.00	13.00	3,510.00	\$ 6,264.00
Commercial	85	72,010	2,160,306	0.0002	0.0030	432.0612	6,480.92	75.00	6,337.50	\$ 13,250.48
Industrial	3	15,512	465,356	0.0002	0.0100	93.0712	4,653.56	300.00	960.00	\$ 5,706.63
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	6	22,200	666,000	0.0002	0.0050	133.2000	3,330.00	25.00	150.00	\$ 3,613.20
Total										\$ 36,885.41

Customer Classes	Development Phase Years 2020-2021									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	390	78,000	2,340,000	0.0002	0.0015	468.0000	3,510.00	13.00	5,070.00	\$ 9,048.00
Commercial	104	84,310	2,529,306	0.0002	0.0030	505.8612	7,587.92	75.00	7,762.50	\$ 15,856.28
Industrial	4	19,516	585,475	0.0002	0.0100	117.0949	5,854.75	300.00	1,080.00	\$ 7,051.84
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	8	31,700	951,000	0.0002	0.0050	190.2000	4,755.00	25.00	200.00	\$ 5,145.20
Total										\$ 45,152.42

Customer Classes	Development Phase Years 2021-2022									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	530	106,000	3,180,000	0.0002	0.0015	636.0000	4,770.00	13.00	6,890.00	\$ 12,296.00
Commercial	121	94,810	2,844,306	0.0002	0.0030	568.8612	8,532.92	75.00	9,075.00	\$ 18,176.78
Industrial	4	19,516	585,475	0.0002	0.0100	117.0949	5,854.75	300.00	1,080.00	\$ 7,051.84
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	9	34,200	1,026,000	0.0002	0.0050	205.2000	5,130.00	25.00	225.00	\$ 5,560.20
									Total	\$ 51,135.92

Customer Classes	Development Phase Years 2023-2027									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	1,015	202,900	6,087,000	0.0002	0.0015	1,217.4000	9,130.50	13.00	13,188.50	\$ 23,536.40
Commercial	227	164,810	4,944,306	0.0002	0.0030	988.8612	14,832.92	75.00	17,025.00	\$ 32,846.78
Industrial	7	45,841	1,375,225	0.0002	0.0100	275.0449	13,752.25	300.00	2,242.50	\$ 16,269.79
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	9	34,200	1,026,000	0.0002	0.0050	205.2000	5,130.00	25.00	225.00	\$ 5,560.20
									Total	\$ 86,264.27

Customer Classes	Development Phase Years 2028-2032									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	1,522	304,300	9,129,000	0.0002	0.0015	1,825.8000	13,693.50	13.00	19,779.50	\$ 35,298.80
Commercial	350	297,185	8,915,556	0.0002	0.0030	1,783.1112	26,746.67	75.00	26,221.88	\$ 54,751.65
Industrial	12	75,666	2,269,975	0.0002	0.0100	453.9949	22,699.75	300.00	2,242.50	\$ 26,858.74
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	10	41,200	1,236,000	0.0002	0.0050	247.2000	6,180.00	25.00	250.00	\$ 6,677.20
									Total	\$ 131,637.49

Customer Classes	Development Phase Years 2033-2037									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	2,029	405,700	12,171,000	0.0002	0.0015	2,434.2000	18,256.50	13.00	26,370.50	\$ 47,061.20
Commercial	471	399,560	11,986,806	0.0002	0.0030	2,397.3612	35,960.42	75.00	35,343.75	\$ 73,701.53
Industrial	16	101,991	3,059,725	0.0002	0.0100	611.9449	30,597.25	300.00	4,867.50	\$ 36,076.69
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	10	41,200	1,236,000	0.0002	0.0050	247.2000	6,180.00	25.00	250.00	\$ 6,677.20
									Total	\$ 171,567.72

Customer Classes	Development Phase Years 2038-2041									
	Cumulative Number of Clients	Billable Cumulative Demand (GPD)	Cumulative Demand (Gals/ Month)	Franchise Fee Rate per Gallon (dollars)	Rate per Gallon (dollars)	Franchise Fee / Month (dollars)	Consumption Fee / Month (dollars)	Fixed Fee/ Per Client/ Month (dollars)	Fixed Fee / Month (dollars)	Total Billed/ Month
Residential	2,536	507,100	15,213,000	0.0002	0.0015	3,042.6000	22,819.50	13.00	32,961.50	\$ 58,823.60
Commercial	592	471,935	14,158,056	0.0002	0.0030	2,831.6112	42,474.17	75.00	44,390.63	\$ 89,696.40
Industrial	20	128,316	3,849,475	0.0002	0.0100	769.8949	38,494.75	300.00	6,030.00	\$ 45,294.64
Institutional	8	36,225	1,086,750	0.0002	0.0050	217.3500	5,433.75	300.00	2,400.00	\$ 8,051.10
Parks and Recreational	10	41,200	1,236,000	0.0002	0.0050	247.2000	6,180.00	25.00	250.00	\$ 6,677.20
									Total	\$ 208,542.94

As can be seen from the billing analysis, the current development period from 2016 to 2017 produces a relatively small income. After the year 2018 period, it is expected a continuous growth of clients and subsequently of income.

h) Project Budget

Based on this billing projections determined in the previous section, the project budget can be determined.

The project budget includes the all the costs involved in the project development, improvements, operation and maintenance:

- RD Loan Re-payment
- O&M costs
- Loan Reserve
- Capital Improvements Costs

After deducting the costs from the billing income, the remaining balance (positive or negative) is determined. In addition the cumulative cost-revenues balance is calculated.

The project includes the initial 3 years of the development were only interests are considered in the RD loan repayment. Afterwards, the full loan repayment is contemplated for the remaining loan term time period. For this analysis, a loan rate of 3% and a loan term of 40 years is considered.

A fifteen years project budget cash flow is shown on the following table:

Table 27 Project Budget Cash Flow

Yearly Accounting (US Dollars)								
No.	Year	RD Loan Re-payment	O&M cost	Loan Reserve	Capital Improvements	Billing Income	Balance	Cumulative Cost-Revenues Balance
1	2016		(300,000)			145,748	(154,252)	(154,252)
2	2017		(300,000)			201,328	(98,672)	(252,924)
3	2018		(300,000)			334,024	34,024	(218,901)
4	2019	(49,221)	(300,000)	(4,922)	(19,700)	428,229	54,385	(164,515)
5	2020	(143,213)	(394,000)	(14,321)	(19,700)	523,847	(47,388)	(211,903)
6	2021	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(279,288)
7	2022	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(346,673)
8	2023	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(414,058)
9	2024	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(481,442)
10	2025	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(548,827)
11	2026	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(616,212)
12	2027	(223,983)	(394,000)	(22,398)	(19,700)	592,697	(67,385)	(683,597)
13	2028	(223,983)	(394,000)	(22,398)	(19,700)	1,000,325	340,243	(343,354)
14	2029	(223,983)	(394,000)	(17,476)	(19,700)	1,000,325	345,165	1,812
15	2030	(223,983)	(394,000)	(3,155)	(19,700)	1,000,325	359,487	361,298

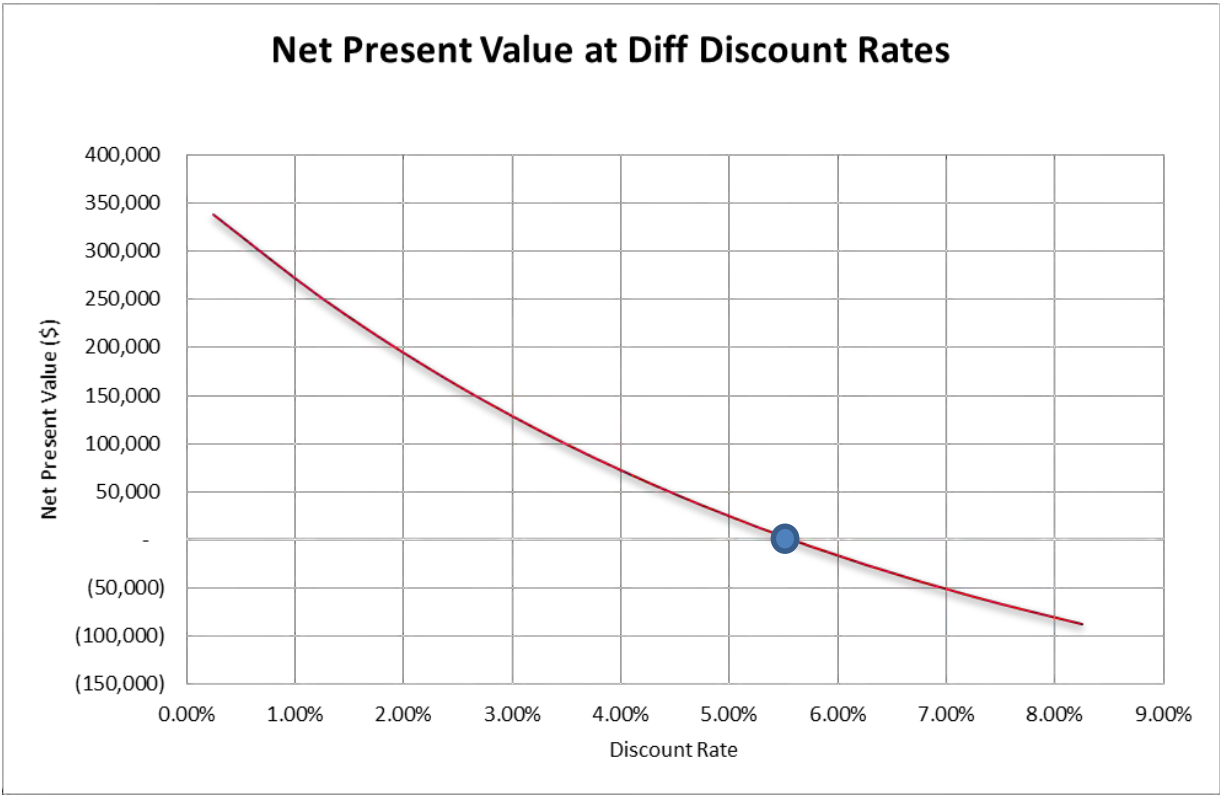
The project budget cash flow shows on the Balance column, that until the year 2028, the water service billing income will not be sufficient to cover all the project expenses.

In addition, the cumulative costs-revenue balances shows a deficit until the year 2028, but afterwards it will maintain a substantial positive balance that can be used for major future capital improvements.

Doing a discounted cash flow analysis from the “Balance” column on Table 27, the Internal Rate of Return (IRR) of the projected cash flow over a holding period of 15 years is 5.57%. This is the “discount rate” at which the Net Present Value (NPV) of the cash inflows and outflows equals to zero. This analysis assumes that the salvage value of the project is Zero by the end of year 15 which is very conservative.

Figure 33 graph below shows how NPV varies with the applicable discount rate.

Figure 33 Net Present Value Graph



8) CONCLUSIONS AND RECOMMENDATIONS

- a) The solution to water infrastructure upgrade at Roosevelt Roads, as needed for the future redevelopment, is addressed with the selected alternative (Alternative 1). The alternative proposes the major upgrade and rehabilitation of the existing treatment system including the raw water intake, reservoir and the Water Treatment Plant. In addition, it involves the replacement or rehabilitation of some portions of the main water lines and rehabilitation of supporting systems such as reservoir, tanks, pressure regulating valves and fire hydrants.
- b) The proposed Water Treatment Plant (WTP) improvements will provide the adequate processing capacity (1.5 MGD) in order to supply the current and future demands of Phase I. The proposed replacement of non-PVC distribution piping will provide the system reliability to satisfy the operational requirements. Also the replacements will provide reduced operation costs, due to the reduction in maintenance and repairs.
- c) Currently the water treatment and distribution systems serves approximately 25 clients. Additional connections from future developments that will benefit from this project, can increase the customer base to 3,165 clients. Although the proposed project will have the treatment capacity for the future service demand up to 1.5 MGD, it is important to acknowledge that additional water distribution infrastructure improvements will be needed in order, to provide service to future developments outside the Phase I limits.
- d) Regarding project constraints, the proposed Water Treatment Plant improvements will require temporary systems and by-passes in order to maintain the current potable water production. The proposed water mains installation along the existing roads will encompass a series of construction constraints on some heavy traffic area. Those two situations will be only temporary issues that will not affect the operational phase.
- e) One of the main benefits of the selected alternative is the immediate reduction of operation & maintenance costs per treated gallon, related to the existing Water Treatment Plant under operation. In addition another major benefit, is the low environmental impact either temporary or permanent, caused by the improvements work, especially near environmental sensitive areas.
- f) Regarding the project financing, it was assumed for the repayment analysis, that the eligible cost for a USDA Rural Development funding loan is a 70% of the investment + initial interests which equals to \$5,403,258.87 with a 40 years loan term at 3.0% interest rate, beginning in the year 2016.
- g) From the project budget cash flow it can be seen until the year 2028, the water billing will not cover the total costs the loan repayment as well for the operation and maintenance. Afterwards, the customer base growth will provide the necessary billing income to cover all the expenses. In addition, from the net present value (NPV) analysis, the internal rate of return (IRR) of 5.57% was calculated. The internal rate or return is used to evaluate the attractiveness of a project or investment or to measure the profitability of potential investments. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project.
- h) It shall be that this report is based on the re-development zones, uses and development schedules as defined in the “2014 Roosevelt Roads Development Zones Master Plan” and in the “Plan Especial y Reglamento para el Redesarrollo de los Terrenos y Facilidades de la Antigua Base Naval de Roosevelt Roads, (ROTFU)”. Assumptions regarding technical and financial aspects on this report has been made according to the best engineering and economic principles. Any changes in the scope of the project as

well as the re-development uses and schedules, can change the water demands as well as the water service billing income.

- i) Additional studies (expanded topographic survey, geotechnical, archeological resources, pipes surveys, etc.) must be performed in order to develop the selected alternative construction plans and documents.

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APPENDIX I

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Project:
ROOSEVELT ROADS WATER LINES IMPROVEMENTS
CEIBA, PUERTO RICO



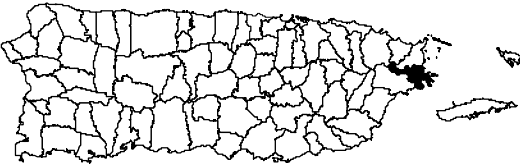
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ALTERNATIVE 1



SHEET INFORMATION

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SCALE: 1:25,000	DESCRIPTION





Cost Estimate Alternative 1

Water System

Project : **Preliminary Engineering Report for Water Infrastructure
Improvements (Phase I)-Roosevelt Roads
Ceiba, Puerto Rico**

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
A. Raw Water Intake Improvements					
1	1	LS	Río Blanco Grit Chamber Valve Repair and Maintenance	25,000.00	25,000.00
2	1	LS	Intake valve repair	18,000.00	18,000.00
Sub - Total A					\$ 43,000.00
B. Raw Water Reservoir					
3	1	LS	Raw Water Screen Channel repair	8,000.00	8,000.00
4	1	LS	Raw Water Reservoir Dredging and concrete repair	350,000.00	350,000.00
5	1	LS	Raw Water Reservoir Manhole Cover and bridge handrail	5,000.00	5,000.00
6	1	LS	Raw Water Bridge Repair	25,000.00	25,000.00
7	1	LS	Raw Water Spillway Gate Repair	7,000.00	7,000.00
Sub - Total B					\$ 395,000.00
C. Water Treatment Plant Upgrade and Rehabilitation					
8	1	LS	Process Control Instrumentation & Automation	400,000.00	400,000.00
9	1	LS	Rapid Mixing and Flocculation Units (2 units)	150,000.00	150,000.00
10	1	LS	Filters Repair (2 filters)	200,000.00	200,000.00
11	1	LS	Disinfection System	200,000.00	200,000.00

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
12	1	LS	Clear Well Improvements	50,000.00	50,000.00
13	1	LS	Settling Tanks Improvements (2 tanks)	300,000.00	300,000.00
14	1	LS	Laboratory Equipment	50,000.00	50,000.00
15	1	LS	Sludge Lagoons Rehabilitation and New decant system	150,000.00	150,000.00
16	1	LS	Pumps Replacement or Improvement	150,000.00	150,000.00
17	1	LS	Flushing Valves Replacement	10,000.00	10,000.00
18	1	LS	Fencing Repair	30,000.00	30,000.00
19	1	LS	Chemical Metering System	75,000.00	75,000.00
20	1	LS	Electrical repairs	250,000.00	250,000.00
21	1	LS	Commissioning	40,000.00	40,000.00
22	1	LS	Painting & Landscaping	25,000.00	25,000.00
Sub - Total C					\$ 2,080,000.00
D. Control Room					
23	1	LS	Main building architectural repairs	50,000.00	50,000.00
24	1	LS	Main building structural repairs	35,000.00	35,000.00
25	1	LS	Main building electrical repairs	25,000.00	25,000.00
Sub - Total D					\$ 110,000.00
E. Storage Tank 86 (Tacan)					
26	52,800.00	SF	New interior and exterior coating	2.00	105,600.00
27	6	LS	Replacement of valves and fittings	3,075.00	18,450.00
28	1	LS	Installation of remote control system	26,000.00	26,000.00
Sub - Total E					\$ 150,050.00

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
F. Distribution System					
29	865	LM	12" Ø pipe removal	121.44	105,046.00
30	865	LM	12" Ø pvc pipe installation	368.00	318,320.00
31	670	LM	10" Ø pvc pipe removal	87.12	58,370.00
32	670	LM	10" Ø pvc pipe installation	264.00	176,880.00
33	228	LM	3" Ø pvc pipe removal	38.94	8,878.00
34	228	LM	4" Ø pvc pipe installation	118.00	26,904.00
35	37	EA	Fire hydrant replacement	2,200.00	81,400.00
36	105	EA	Fire hydrant installation	1,800.00	189,000.00
37	2	EA	Pressure regulating valve	8,330.00	16,660.00
Sub - Total F					\$ 981,458.00
SUB- TOTAL WATER IMPROVEMENTS					\$ 3,759,508.00

SUB- TOTAL WATER IMPROVEMENTS		\$3,759,508.00
General Administrative Project Costs	10.0%	375,951.00
Sub total		4,135,459.00
Overhead	12.0%	496,255.00
Profit	8.0%	330,837.00
Sub total		4,962,551.00
Construction Tax	5.5%	270,459.00
Sub total		5,233,010.00
TOTAL WATER IMPROVEMENTS		\$5,233,010.00

CONSTRUCTION COST FOR RD PARTICIPATION

\$5,233,010.00

NET CONSTRUCTION COST

\$5,233,010.00

Cost Estimate

Net Construction Cost	\$5,233,010.00
Construction Cost for R.D. - Fm.H.A. Participation	\$5,233,010.00
Contingencies	\$ 784,952.00
Studies, Survey and Design	\$ 575,631.10
Architect or Engineering Services During Construction	\$ 101,284.91
Construction Management and Inspection	\$ 261,651.00
Land and /or Right of Way Acquisition	\$ -
General and Adm. Expenses	\$ 261,651.00
Estimated Project Cost Eligible For R.D. - Fm.H.A. Participation	\$ 7,218,180.01
Item Not Eligible for R.D. - Fm.H.A. Participation	
Additional General and Adm. Expenses	\$ -
Estimated Total Project Cost for Alternative 2	\$ 7,218,180.01

APPENDIX II

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Loc tionΩ I Ω & rj limiΩ ry Cost Estim tı



Project:
ROOSEVELT ROADS WATER LINES IMPROVEMENTS
CEIBA, PUERTO RICO

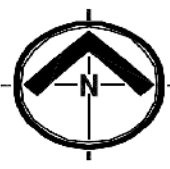
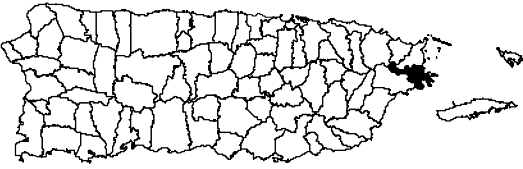


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ALTERNATIVE 2



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SCALE:	DESCRIPTION
1:25,000	





Cost Estimate Alternative 2

Water System

Project : **Preliminary Engineering Report for Water Infrastructure
Improvements (Phase I)-Roosevelt Roads
Ceiba, Puerto Rico**

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
A. Raw Water Intake Improvements					
1	1	LS	Río Blanco Grit Chamber Valve Repair and Maintenance	25,000.00	25,000.00
2	1	LS	Dredging near Water Intake	35,000.00	35,000.00
3	1	LS	Intake valve repair	18,000.00	18,000.00
Sub - Total A					\$ 78,000.00
B. Raw Water Reservoir					
4	1	LS	Raw Water Screen Channel & Reservoir	75,000.00	75,000.00
5	1	LS	Raw Water Reservoir Dredging and concrete repair	350,000.00	350,000.00
6	1	LS	Raw Water Reservoir Manhole Cover	8,000.00	8,000.00
7	1	LS	Raw Water Bridge Repair	32,000.00	32,000.00
8	1	LS	Raw Water Spillway Gate Repair	10,000.00	10,000.00
Sub - Total B					\$ 475,000.00
C. Water Treatment Plant Substitution (1.5 MGD)					
<u>C1. Treatment System</u>					
9	1	LS	Demolition of existing Treatment Plant	450,000.00	450,000.00
10	1	LS	Standardized compact treatment plant	1,700,000.00	1,700,000.00
11	1	LS	Laboratory Equipment	50,000.00	50,000.00
12	1	LS	Commissioning	25,000.00	25,000.00
Sub - Total C1					\$ 2,225,000.00

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
<u>C2. Control Building</u>					
12	1	LS	Main building architectural repairs	50,000.00	50,000.00
13	1	LS	Main building structural repairs	35,000.00	35,000.00
14	1	LS	Main building electrical repairs	25,000.00	25,000.00
Sub - Total C2					\$ 110,000.00
<u>C3. Other Improvements</u>					
14	1	LS	Distribution Pumps Replacement	150,000.00	150,000.00
15	1	LS	Sludge Lagoons Rehabilitation and New Decant System	150,000.00	150,000.00
16	1	LS	Fencing Repair	30,000.00	30,000.00
Sub - Total C3					\$ 330,000.00
Sub - Total C					\$ 2,665,000.00
D. Storage Tank 86 (Tacan)					
17	52,800.00	SF	New interior and exterior coating	2.00	105,600.00
18	6	LS	Replacement of valves and fittings	3,075.00	18,450.00
19	1	LS	Installation of remote control system	26,000.00	26,000.00
Sub - Total D					\$ 150,050.00
E. Distribution System					
20	865	LM	12" Ø pipe removal	121.44	105,046.00
21	865	LM	12" Ø pvc pipe installation	368.00	318,320.00
22	670	LM	10" Ø pvc pipe removal	87.12	58,370.00
23	670	LM	10" Ø pvc pipe installation	264.00	176,880.00
24	228	LM	3" Ø pvc pipe removal	38.94	8,878.00

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
25	228	LM	4" Ø pvc pipe installation	118.00	26,904.00
26	37	EA	Fire hydrant replacement	2,200.00	81,400.00
27	105	EA	Fire hydrant installation	1,800.00	189,000.00
28	2	EA	Pressure regulating valve	8,330.00	16,660.00
Sub - Total E					\$ 981,458.00
Sub-Total Improvements					\$ 4,349,508.00

Sub-Total Improvements			\$4,349,508.00
General Administrative Project Costs	10.0%		434,951.00
Sub total			4,784,459.00
Overhead	12.0%		574,135.00
Profit	8.0%		382,757.00
Sub total			5,741,351.00
Construction Tax	5.5%		312,904.00
Sub total			6,054,255.00
TOTAL WATER IMPROVEMENTS			\$6,054,255.00

CONSTRUCTION COST FOR RD PARTICIPATION

\$6,054,255.00

NET CONSTRUCTION COST

\$6,054,255.00

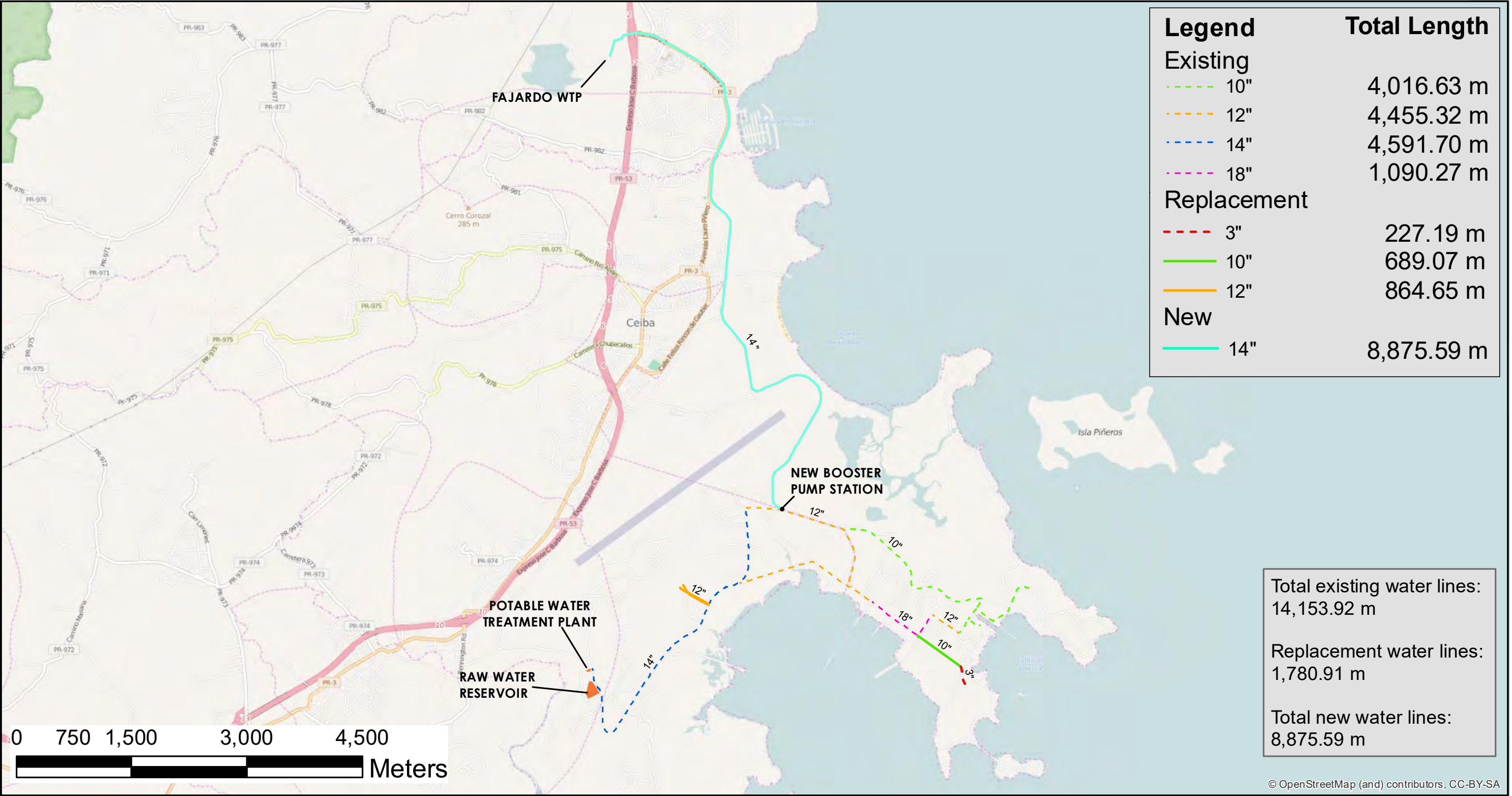
Cost Estimate

Net Construction Cost	\$6,054,255.00
Construction Cost for R.D. - Fm.H.A. Participation	\$6,054,255.00
Contingencies	\$ 908,138.00
Studies, Survey and Design	\$ 665,968.05
Architect or Engineering Services During Construction	\$ 117,180.11
Construction Management and Inspection	\$ 302,713.00
Land and /or Right of Way Acquisition	\$ -
General and Adm. Expenses	\$ 302,713.00
Estimated Project Cost Eligible For R.D. - Fm.H.A. Participation	\$ 8,350,967.16
Item Not Eligible for R.D. - Fm.H.A. Participation	
Additional General and Adm. Expenses	\$ -
Estimated Total Project Cost for Alternative 1	\$ 8,350,967.16

APPENDIX III

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Project:

ROOSEVELT ROADS WATER LINES IMPROVEMENTS

CEIBA, PUERTO RICO

INTEGRA
architects & engineers, PSC
(787) 757-2111 www.integrapr.com

ALTERNATIVE 3

OFFICE OF THE GOVERNOR
DEPARTMENT OF
ECONOMIC DEVELOPMENT
& COMMERCE

ROOSEVELT
ROADS

SHEET INFORMATION	
DATE SUBMITTED:	PROJECT NO.
SCALE: 1:50,000	DESCRIPTION

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Cost Estimate Alternative 3

Water System

Project : **Preliminary Engineering Report for Water Infrastructure
Improvements (Phase I)-Roosevelt Roads
Ceiba, Puerto Rico**

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
A. Raw Water Intake Improvements					
1	1	LS	Sedimentation removal and disposal	35,000.00	35,000.00
Sub - Total A					\$ 35,000.00
B. Raw Water Reservoir					
2	1	LS	Reservoir emptying and sedimentation removal and disposal	85,000.00	85,000.00
Sub - Total B					\$ 85,000.00
C. Water Treatment Plant Closure					
3	1	LS	Shutdown process and facilities closure (Mothballing)	350,000.00	350,000.00
Sub - Total C					\$ 350,000.00
D. PRASA Water Source Connection (1.5 MGD)					
4	8,856	LM	14" Ø pipe installation	439.00	3,887,784.00
5	1	LS	Booster pump station	425,000.00	425,000.00
Sub - Total D					\$ 4,312,784.00
E. Storage Tank 86 (Tacan)					
6	52,800	SF	New interior and exterior coating	2.00	105,600.00
7	6	LS	Replacement of valves and fittings	3,075.00	18,450.00
8	1	LS	Installation of remote control system	26,000.00	26,000.00
Sub - Total E					\$ 150,050.00

Cost Estimate

Item	Quantity	Unit	Description	Unit Price	\$ Total
F. Distribution System					
9	865	LM	12" Ø pipe removal	121.44	105,046.00
10	865	LM	12" Ø pvc pipe installation	368.00	318,320.00
11	670	LM	10" Ø pvc pipe removal	87.12	58,370.00
12	670	LM	10" Ø pvc pipe installation	264.00	176,880.00
13	228	LM	3" Ø pvc pipe removal	38.94	8,878.00
14	228	LM	4" Ø pvc pipe installation	118.00	26,904.00
15	37	EA	Fire hydrant replacement	2,200.00	81,400.00
16	105	EA	Fire hydrant installation	1,800.00	189,000.00
17	2	EA	Pressure regulating valve	8,330.00	16,660.00
Sub - Total F					\$ 981,458.00
SUB- TOTAL WATER IMPROVEMENTS					\$ 5,914,292.00

SUB- TOTAL WATER IMPROVEMENTS			\$5,914,292.00
General Administrative Project Costs	10.0%		591,429.00
Sub total			6,505,721.00
Overhead	12.0%		780,687.00
Profit	8.0%		520,458.00
Sub total			7,806,866.00
Construction Tax	5.5%		425,474.00
Sub total			8,232,340.00
TOTAL WATER IMPROVEMENTS			\$8,232,340.00

CONSTRUCTION COST FOR RD PARTICIPATION

\$8,232,340.00

NET CONSTRUCTION COST

\$8,232,340.00

Cost Estimate

Net Construction Cost	\$8,232,340.00
Construction Cost for R.D. - Fm.H.A. Participation	\$8,232,340.00
Contingencies	\$ 1,234,851.00
Studies, Survey and Design	\$ 905,557.40
Architect or Engineering Services During Construction	\$ 159,336.94
Construction Management and Inspection	\$ 411,617.00
Land and /or Right of Way Acquisition	\$ -
General and Adm. Expenses	\$ 411,617.00
Estimated Project Cost Eligible For R.D. - Fm.H.A. Participation	\$11,355,319.34
<u>Item Not Eligible for R.D. - Fm.H.A. Participation</u>	
Additional General and Adm. Expenses	\$ -
Estimated Total Project Cost for Alternative 3	\$11,355,319.34

APPENDIX IV

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Proyección de población por municipios Puerto Rico: años 2013 a 2020

Municipios	2013	2014	2015	2016	2017	2018	2019	2020
Adjuntas	19,098	18,936	18,751	18,545	18,316	18,065	17,792	17,496
Aguada	41,331	41,010	40,631	40,196	39,706	39,161	38,562	37,912
Aguadilla	60,422	59,860	59,251	58,594	57,890	57,139	56,340	55,494
Aguas Buenas	28,940	28,863	28,767	28,653	28,522	28,372	28,205	28,020
Aibonito	25,617	25,440	25,245	25,033	24,804	24,558	24,295	24,015
Añasco	29,076	28,952	28,800	28,618	28,406	28,166	27,897	27,600
Arecibo	93,010	91,572	89,983	88,240	86,339	84,281	82,061	79,679
Arroyo	19,525	19,501	19,473	19,439	19,401	19,357	19,309	19,255
Barceloneta	25,346	25,530	25,715	25,899	26,083	26,267	26,451	26,634
Barranquitas	30,490	30,497	30,480	30,442	30,382	30,302	30,202	30,082
Bayamón	199,189	195,693	192,179	188,553	184,708	180,599	176,242	171,675
Cabo Rojo	51,179	51,169	51,108	50,994	50,828	50,609	50,337	50,013
Caguas	142,270	141,919	141,498	141,010	140,455	139,833	139,146	138,393
Camuy	34,746	34,532	34,270	33,957	33,591	33,174	32,707	32,191
Canóvanas	47,933	47,899	47,796	47,622	47,374	47,052	46,651	46,172
Carolina	171,089	168,873	166,494	163,954	161,250	158,385	155,357	152,167
Cataño	27,699	27,512	27,321	27,128	26,934	26,739	26,544	26,349
Cayey	47,887	47,757	47,593	47,396	47,170	46,918	46,645	46,353
Ceiba	12,272	11,826	11,380	10,933	10,487	10,040	9,594	9,148
Ciales	18,252	18,018	17,597	17,471	17,162	16,830	16,477	16,102
Cidra	42,821	42,460	42,033	41,542	40,988	40,372	39,694	38,954
Coamo	40,667	40,627	40,540	40,403	40,216	39,976	39,682	39,332
Comerio	20,847	20,852	20,847	20,832	20,807	20,773	20,728	20,674
Corozal	37,327	37,222	37,094	36,942	36,766	36,567	36,345	36,098
Culebra	1,780	1,762	1,740	1,715	1,687	1,655	1,621	1,583
Dorado	39,700	40,113	40,526	40,940	41,354	41,769	42,184	42,600
Fajardo	36,068	35,492	34,873	34,210	33,504	32,753	31,959	31,122
Florida	12,633	12,581	12,503	12,398	12,265	12,105	11,918	11,706
Guánica	18,553	18,187	17,776	17,323	16,828	16,295	15,728	15,131
Guayama	44,929	44,692	44,406	44,070	43,682	43,240	42,744	42,193
Guayanilla	20,722	20,370	19,985	19,572	19,130	18,660	18,163	17,638
Guaynabo	96,914	96,226	95,466	94,635	93,733	92,759	91,714	90,597
Gurabo	47,887	48,704	49,510	50,304	51,086	51,857	52,616	53,364
Hatillo	41,753	41,534	41,234	40,850	40,380	39,820	39,170	38,426
Hormigueros	17,157	17,090	17,004	16,898	16,772	16,625	16,456	16,266
Humacao	57,591	57,137	56,642	56,109	55,537	54,920	54,257	53,546
Isabela	45,171	44,896	44,564	44,175	43,732	43,234	42,683	42,078
Jayuya	16,842	16,771	16,691	16,602	16,503	16,395	16,277	16,151
Juana Díaz	49,475	48,877	48,192	47,421	46,563	45,618	44,586	43,466
Juncos	40,624	40,631	40,582	40,476	40,311	40,086	39,799	39,448
Lajas	24,782	24,348	23,855	23,303	22,691	22,016	21,279	20,477
Lares	30,667	30,246	29,788	29,294	28,762	28,194	27,588	26,946
Las Marías	9,527	9,383	9,220	9,034	8,823	8,589	8,330	8,050
Las Piedras	39,084	39,110	39,076	38,983	38,828	38,611	38,328	37,981
Loíza	28,456	27,796	27,090	26,339	25,538	24,686	23,780	22,822
Luquillo	20,059	19,991	19,910	19,816	19,709	19,588	19,454	19,307
Manatí	43,552	43,344	43,103	42,817	42,477	42,079	41,618	41,094
Maricao	6,114	6,046	5,971	5,888	5,798	5,701	5,596	5,484
Maunabo	12,146	12,069	11,988	11,901	11,809	11,711	11,608	11,500
Mayaguez	85,436	83,846	82,126	80,373	78,630	76,915	75,193	73,418
Moca	39,972	39,917	39,836	39,719	39,555	39,339	39,067	38,738
Morovis	32,676	32,605	32,486	32,318	32,098	31,826	31,500	31,120
Naguabo	27,737	28,053	28,377	28,708	29,047	29,392	29,745	30,105
Naranjito	30,389	30,332	30,252	30,157	30,047	29,924	29,788	29,637
Orocovis	23,224	23,175	23,125	23,067	22,996	22,904	22,787	22,641
Patillas	18,959	18,803	18,612	18,391	18,151	17,902	17,650	17,396
Peñuelas	23,937	23,568	23,164	22,726	22,255	21,750	21,212	20,640
Ponce	157,629	154,421	151,058	147,542	143,872	140,048	136,072	131,942
Quebradillas	25,123	24,724	24,254	23,711	23,094	22,400	21,627	20,774
Rincón	15,148	15,109	15,056	14,989	14,906	14,808	14,695	14,565
Río Grande	54,625	54,526	54,384	54,198	53,970	53,699	53,386	53,029
Sabana Grande	25,500	25,390	25,263	25,118	24,955	24,775	24,578	24,362
Salinas	30,579	30,337	30,059	29,748	29,402	29,024	28,614	28,171
San Germán	35,110	34,828	34,524	34,197	33,848	33,477	33,084	32,668
San Juan	378,169	371,309	364,289	357,130	349,763	342,105	334,109	325,766
San Lorenzo	40,762	40,621	40,444	40,223	39,954	39,635	39,266	38,848
San Sebastián	42,821	42,600	42,350	42,070	41,760	41,421	41,052	40,654
Santa Isabel	23,704	23,824	23,933	24,032	24,120	24,198	24,266	24,324
Toa Alta	75,064	75,120	75,035	74,807	74,437	73,922	73,261	72,455
Toa Baja	86,764	85,655	84,464	83,190	81,833	80,393	78,871	77,265
Trujillo Alto	73,868	73,381	72,782	72,059	71,211	70,237	69,141	67,929
Utuado	32,314	31,965	31,582	31,174	30,744	30,295	29,829	29,346
Vega Alta	40,340	40,423	40,487	40,532	40,558	40,567	40,559	40,534
Vega Baja	57,763	56,972	56,105	55,163	54,146	53,054	51,888	50,647
Vieques	9,326	9,325	9,317	9,301	9,281	9,257	9,231	9,202
Villalba	25,441	25,179	24,875	24,522	24,115	23,655	23,143	22,582
Yabucoa	37,292	36,946	36,569	36,160	35,719	35,247	34,743	34,208
Yauco	40,474	39,810	39,063	38,233	37,322	36,337	35,282	34,164
Puerto Rico	3,659,364	3,626,677	3,590,408	3,551,023	3,507,876	3,461,008	3,410,358	3,355,911

Nota: Los datos del Censo tienen fecha de referencia del 1ero de abril de 2013

Fuente: Junta de Planificación, Programa de Planificación Económica y Social, Oficina del Censo.

Preparado: noviembre de 2013.

APPENDIX V

OM+ CÚcç a k A 94



BRIEFING ROOM

ISSUES

THE ADMINISTRATION

PARTICIPATE

1600 PENN

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Circular A-94 Appendix C

Revised December 2014

OMB Circular No. A-94

Click [here](#) for PDF assistance **DISCOUNT RATES FOR COST-EFFECTIVENESS, LEASE PURCHASE,
AND RELATED ANALYSES**

Effective Dates. This appendix is updated annually. This version of the appendix is valid for calendar year 2015. A copy of the updated appendix can be obtained in electronic form through the OMB home page at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/. The text of the main body of the Circular is found at http://whitehouse.gov/omb/circulars_a094/, and a table of past years' rates is located at <http://whitehouse.gov/sites/default/files/omb/assets/a94/dischist.pdf>. Updates of the appendix are also available upon request from OMB's Office of Economic Policy (202-395-3316).

Nominal Discount Rates. A forecast of nominal or market interest rates for calendar year 2015 based on the economic assumptions for the 2016 Budget is presented below. These nominal rates are to be used for discounting nominal flows, which are often encountered in lease-purchase analysis.

**Nominal Interest Rates on Treasury Notes and Bonds
of Specified Maturities (in percent)**

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
1.7	2.2	2.5	2.8	3.1	3.4

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2016 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

**Real Interest Rates on Treasury Notes and Bonds
of Specified Maturities (in percent)**

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
0.1	0.4	0.7	0.9	1.2	1.4

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

Other DocumentsText of OMB Circular No. A-94 in [HTML](#) or [PDF](#) (22 pages, 78 kb)

5. GEOTECHNICAL REPORT

Geotechnical Engineers

Geologists

Testing Laboratory

Environmental Drilling



**Geotechnical Investigation Report for
Proposed Phase I Water Improvements
at Roosevelt Roads, Ceiba, PR**



Job No. 1963

December 3rd, 2019



Prepared for:

**Eng. Carlos I. Baez Dotel
Integra Design Group, Architects & Engineers, PSC**



**US Army Corps
of Engineers,
Validated
Laboratory**

Prepared by:

**MGV GEOTECHNICAL GROUP, PSC
PO Box 2636
Vega Baja, PR 00694-2636**





**Geotechnical Investigation Report for
Proposed Phase I Water Improvements at Roosevelt Roads
Ceiba, Puerto Rico**

Job No. 1963

December 3rd, 2019

Prepared by:

A handwritten signature in blue ink, appearing to read "MGV", is written over a light blue grid background.

Marcus García Vincenty, M.E.C.E., P.E., Lic. #15928
Geotechnical Engineer

12/3/19
Date

This report consists of 31 Pages

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 SITE LOCATION AND PROJECT DESCRIPTION	1
3.0 FIELD WORK PERFORMED	2
3.1 Subsoil Exploration	2
3.2 Laboratory Work	3
4.0 USGS GEOLOGY	3
5.0 GENERAL SUBSOIL CONDITIONS	4
6.0 ENGINEERING RECOMMENDATIONS	6
6.1 Rippability Characteristics	6
6.2 Discussion	7
6.3 Trench Excavations	7
6.4 Pipe Foundation and Backfill	9
6.5 External Loads on Pipes	10
6.6 Concrete Pad Foundations	11
7.0 COMMENTS	12
8.0 REFERENCES	15
9.0 STANDARDS	15

APPENDIX A: Figures

APPENDIX B: Boring Logs

1.0 INTRODUCTION

This report details the results of a subsoil exploration program and outlines geotechnical engineering recommendations for design of the Phase I Water Improvements proposed in Roosevelt Roads in the Municipality of Ceiba, Puerto Rico. The investigation was conducted at the request of Eng. Carlos Baez, from Integra Design Group, pursuant to the terms and conditions of our proposal No. 2727A with date of May 9, 2019.

The report discusses the field exploration accomplished, laboratory testing of samples, geologic and subsoil conditions encountered. The engineering recommendations outlined in the report deal with foundation recommendations, methods, types and support of excavations, dewatering requirements, loads and bedding conditions of pipe conduits, and excavations and backfill. The second objective of the exploration was directed to provide with an approximate guideline of the rippability characteristics at tested locations along the pipeline route in order to submit general information with regard to the excavation techniques that might be necessary for the pipeline installation.

2.0 SITE LOCATION AND PROJECT DESCRIPTION

The Roosevelt Roads old Navy Base is located at the east of Puerto Rico in the Municipality of Ceiba, PR. **Figure 1** shows a a satellite picture from Google Earth with the approximate alignment of the sanitary line depicted on it.

The project consists in the following construction works:

- Installation of approximately 300 lineal meters of 8 in. diameter PVC water pipe. Excavation depths will not exceed some 4 feet.
- Improvements to the existing water treatment plant by means of installing two blowers over a proposed concrete pad.

3.0 FIELD WORK PERFORMED

Four test boreholes along the proposed pipe alignment and one for the proposed concrete pad were requested to be drilled. Borings locations are approximately shown in **Figures 2A and 2B** and were marked at the site by using existing reference, boundary points and topographic features to stake them out. Boreholes B-1 to B-4 were executed for the proposed pipe alignment and B-5 at the proposed concrete pad.

Subsurface exploration was preceded by a review of the available information concerning the geological and subsurface conditions at or near the area and of a physical examination of the site. This information was supplemented by more direct investigations which consisted of: the geologic reconnaissance; the subsoil exploration program; routine laboratory tests on soil samples; engineering interpretation of the data and all results obtained.

3.1 SUBSOIL EXPLORATION

3.1.1 Soil Sampling - Soil samples were obtained by driving into the undisturbed soil at the bottom of the hole a 1.375" ID/ 2" OD split barrel sampler for a distance of 24 inches. The sampler is driven with a 140 pounds hammer falling freely from 30 inches. The blows of the hammer are recorded every 6 inches. The SPT value (N) or penetration resistance is the sum of the blows over the middle two 6 inches intervals; and gives an indication of the consistency of fine grained soils or density of coarser materials. This method corresponds to ASTM Standard Designation: 1586, Penetration Test and Split Barrel Sampling of Soils Methods.

Measurements of depth to the probable phreatic level were made within the borings during and after drilling. These observations, if applicable, are included in the boring

logs.

3.2 LABORATORY WORK

The laboratory work consisted in the determination of natural moisture contents and compressive strength of some of the cohesive samples. Results are presented as part of the detailed information shown on boring logs in Appendix B of this report.

4.0 USGS GEOLOGY

The study area has been mapped in the Geologic Map of the Naguabo and Part of the Punta Puerca Quadrangles. As seen from this map, the proposed gravity line alignment is underlain by two possible geologic formations or deposits. These are artificial fill (af) and Beach Deposits (Qb). The location of the proposed concrete pad is most probably underlain by either Alluvium and Flangomerate (Qaf) or Dagua Formation (Kd). The following paragraphs provide the geologic descriptions of the encountered units cited in the Geologic Map.

Artificial fill is not described in the Map. Nevertheless, it is considered to be derived from uplands parts of the Base where probable quarrying was performed during the construction of the Base facilities.

The Beach Deposits (Qb) consists of unconsolidated fine- to coarse-grained sand and pebble deposits. South of Ensenada Honda composed of quartz and feldspar grains and plutonic and volcanic rock fragments, with considerable amounts of sand {shell, algal, and coral fragments} locally. From Ensenada Honda northward quartz grains are rare and plutonic rock fragments uncommon; deposits are principally of calcium carbonate grains with local admixtures of volcanic rock fragments and pebble clasts. Gradational into, and

partly overlain by, alluvial and swamp deposits. Thickness probably more than 10 m locally.

The Alluvium and Flangomerate (Qaf) consists of unconsolidated to weakly consolidated, poorly to well sorted clay to boulder sized material in fans and in stratified alluvial valley fill deposits. Locally terraced; includes slope wash, small landslides and channel fill deposits. Gradational into units mapped as predominantly alluvium, alluvial plain, and terraced deposits. Thickness locally more than 25 meters.

The Dagua Formation consist of interbedded volcanic breccia, lava, and subordinate volcanic sandstone and crystal tuff. The volcanic breccia is medium gray, massive, and is composed of clasts of dark-gray irregularly shaped subangular to subrounded granule- to cobble-size porphyritic andesite lava in a medium gray coarse-grained plagioclase and clinopyroxene crystal tuff matrix.

Figure 3 depicts the extent of these (geologic) units as mapped in the Geologic Map quadrangle and overlapped on the Google Earth satellite picture with boreholes locations depicted on it.

5.0 GENERAL SUBSOIL CONDITIONS

Based on the exploration depths of the borings drilled for this report, the subsurface profile along the site is consistent with the information provided in the USGS Geologic Maps.

Water Pipe

Silty sand, sand, clay, clayey sand and clayed sandy gravel are among the descriptions assigned to samples. Olive brown, grayish green, black and white are some of the colors

observed within samples. The Standard Penetration Test registered "N" values ranging from 10 to 79 blows per foot (bpf). In regards to the water content levels for these materials, the recorded values ranged between 3 to 36 percent. Its variance will be in function of the existing groundwater conditions and the amount of fines for a particular location. The lower results are associated with the more granular samples while the higher values are associated with fine materials (clay/silt) or organics.

Concrete Pad

Silty sand and silty clay were the descriptions assigned to samples. Olive gray, olive and olive brown, grayish green, black and white are some of the colors observed within samples. The Standard Penetration Test registered "N" values ranging from 8 to 34 blows per foot (bpf). Water content ranged between 18 to 37 percent.

The groundwater was not detected in any of the boreholes but saturated conditions in samples could be observed which ultimately will seep groundwater into excavations. However, these levels shall not be considered invariant and accurate. Sometimes these correspond to perched water conditions and sometimes they are not. Monitoring wells are necessary in order to provide accurate groundwater levels with time. These were beyond the scope of work of this study. In addition, it should be noted that the groundwater table is always being affected by natural factors such as the distance from water sources, the permeability of the subsoil, the topography of the area, and the amount of precipitation. Moreover, it should be taken into account that whenever changes in the topography of a site are made, changes in the groundwater characteristics of the region frequently occur. Such conditions are difficult to detect within the normal scope of time of the exploration. The groundwater levels in the project are considered to be directly related to the adjacent wetlands.

The above information corresponds to a general description of the subsoil conditions prevailing at the area but, as previously stated, the reader should refer to the enclosed boring logs for detailed information on the soil characteristics at the test holes locations.

6.0 ENGINEERING RECOMMENDATIONS

6.1 RIPPABILITY CHARACTERISTICS

Where the Standard Penetration Tests performed on the subsoil material obtained more than 50 blows per foot, the estimated degree of ripping effort for this material ranges from medium to difficult. This material may require hard ripping (pneumatic punchers) and even some drilling and blasting. Nevertheless, the need of blasting shall not be used due to the proximity of structures. Blasting will adversely affect nearby structures with vibrations. The relatively high "N" values measured within samples are believed to correspond to gravel and cobbles content of artificial fill or to compacted fill. This condition, "N" values higher than 50 bpf, also might be expected at locations between boreholes. It should be mentioned that there always exists the possibility of encountering large boulders, or nucleus of more consolidated materials along the selected route, especially at areas not investigated.

It is strongly recommended that the contractor make visits and tests in the field, particularly with equipment he considers suitable for the cut and/or excavation operations, in order to establish actual rippability characteristics of the ground mass and the other requirements necessary to perform the cuts.

The given information should be used only as a guide to estimate the costs of the excavation works and shall not be used as the only source of information to base contract bids. To accurately establish and evaluate rippability characteristics, seismic refraction

surveys shall be made. These specific studies are very valuable for actual prediction of cutting effort procedures.

This information regarding to excavation efforts should be used only as a guide to estimate costs and should not be used by contractors to base their contract bids. We shall not be held responsible if the contractor uses this information without limitation to base such contract bids.

6.2 Discussion

All earthwork activities to be performed should be performed under the supervision of a Geotechnical Engineer Firm. These observations should include, but not limited to, clearing and grubbing, identification and removal of unsuitable materials which may appear, laboratory testing and review of any proposed fill and backfill materials, in situ testing of compacted materials for quality control, inspection of ditches or trenches and excavations, and evaluation of any unexpected subsoil or groundwater conditions found during construction.

6.3 Trench Excavations

6.3.1 – Excavation Efforts

Conventional equipment may be used to excavate trenches along most of the alignment, except for those locations as previously mentioned where "N" values higher than 50 bpf were obtained. Furthermore, methods beyond ripping (e.g., blasting) shall not be used close to existing structures as previously discussed.

6.3.2 – Excavation Safety

Trenches for the pipe installation may likely stay open with a 1V:1H slope. Nevertheless, all excavations should be performed in accordance with 29 CFR Part 1926, Occupational Safety and Health Standards-Excavations: Final Rule, published by the US Federal Department of Labor, Occupational Safety and Health

Administration.

Any excavation for the pipe installation, in which there is a potential hazard of cave in or moving ground will require a protective ground retaining system. Due mainly to the extent of the work and to the variability of the subsoil conditions, it is impossible to predict or locate zones where localized shear failure may occur. For this reason, it is recommended that excavations exceeding 5 ft in height where recommended slope is not possible must be shored or braced. A trench box can also be used at some sectors if properly designed and if its use proves to be satisfactory. The effect of a particular system on the load over the conduit as well as the consequences of removing the sheeting, bracing, or any used temporary retaining system shall be evaluated.

Excavated materials should be stockpiled away from the border of the trenches and excavations at a minimum distance of half the bottom depths to be excavated, in order to minimize cave-in that may otherwise occur as a result of the surcharge. The application of any additional load between the edge of the excavation and the intersection of the ground surface with the possible failure surface plane must be considered in the stability analyses for the excavation. If required, a temporary earth retaining system shall be designed by a qualified Geotechnical Engineer based on the particular conditions encountered.

6.3.3 – Trench Width

The trench width shall be such as to provide enough working room for construction. In general, an allowance of 6 inches from each side of the pipe is a workable minimum width for small and medium sized trenches. The trench width greatly influences the amount of load to act on pipes. At any given depth and for any given conduit size there is a certain limiting value to the width of the trench beyond which no additional load is imposed to the conduit.

6.3.4 – Construction Dewatering

The site drainage should be designed to divert water away from trenches and excavations. Though no groundwater was detected at boreholes up to maximum explored depth, natural springs are commonly encountered during construction. The presence of saturated material, as previously mentioned, will require the need a dewatering system to keep trenches in dry conditions. Therefore sump pumps shall be used to keep excavations in dry conditions. In addition, run-off waters shall be diverted away from trenches and excavations.

The contractor shall be informed about the need for designing and installing a comprehensive dewatering system for such purpose, if groundwater is encountered during construction, given that the pipeline shall be always installed under dry conditions. The actual design of the dewatering system is beyond the scope of this study.

6.4 Pipe Foundation and Backfill

6.4.1 Haunching and Bedding - The proposed pipe may be placed on Class C haunching and bedding; i.e., that method provides with a stiffer foundation for the pipes that will try to deform when subjected to the proposed vertical backfill loads. Refer to **Figure 4**. The bedding shall consist of granular material, sand and/or crushed gravel, whose average size shall not exceed 0.5 inch and its gradation spans from 0.75 inch to Sieve No. 4. This mixture shall not have more than 10 percent of fine material passing Sieve No. 200. Poorly-graded small size crushed stone meeting the above requirements is suitable for bedding material. The bedding material must be compacted to a degree not less than 90 percent based on results of Modified Proctor Tests. The granular bedding material shall be placed at least, up to half diameter of the pipe. Haunching and bedding material shall be placed in six 6 inches layers and compacted with light compaction equipment. Detrimental settlements or

heave of the proposed pipe lines are not expected provided that the beddings are well constructed and in situ soils are not disturbed. Joints should be watertight to prevent leakage of sewage from the line or infiltration of groundwater into.

6.4.2 Backfill – Above the bedding material, a general earth fill may be used to backfill the trench excavation. The general fill shall consist of non-organic material of the excavated soils, however, because of the clayey nature of most of insitu soils, it is expected that significant re-working and moisture conditioning will be required in the field to attain required compaction levels at some portions of the alignment if the insitu cohesive soils, especially from the Alluvial, are used as backfill. Artificial fill, as disclosed by the boreholes, might be used as backfill provided that requirement compaction is achieved. Alternatively, better quality fill material may be used. The fill material should be properly compacted according to standard PRASA specifications. In order that pipe lines are not damaged, the initial backfill shall be placed and compacted only with light compaction equipment up to 0.30 meters on top of conduit. Above this elevation backfill shall be placed in twelve (12) inches layers and compacted to no less than 90% of maximum dry density as per Modified Proctor Test, PRASA, Municipal Department of Public Works or Project's Engineer. Flexible pipes under earthfill derives their ability to support the load from their inherent strength and the passive resistance pressure of the soil as they deflect and the sides of the pipe move outward against the soil. On account of this mechanism, the placement of the fill or backfill around the pipe is of great importance, since if not properly placed, most of the load will only be resisted by the pipe inducing excessive pipe deflection or even rupture. The trench condition shall not be overlooked. Experience indicates that proper placement of the backfill is seldom performed on account of improper inspection and testing.

6.5 External Loads on Pipes

External loads on pipes should be calculated using Marston's Method:

$$W_c = C_d \gamma B^2$$

where:

W_c = total dead load on the conduit per unit length

C_d = load factor

γ = unit weight of backfill

B = trench width

The recommended load factor as per Figure 4 is 1.5. Unit weights of 125 pcf may be assumed, provided that inorganic excavated soils will be used as backfill. A unit weight of about 135 pcf shall be used for granular fill material, such as A-2-4 as per AASHTO Soil Classification System.

6.6 Concrete Pad Foundations

In view of the results of the exploration, the developer may construct the proposed structures over conventional spread footings with an allowable bearing pressure not exceeding 2,000 psf. The minimum depth of foundation shall be 48 inches below existing elevation. Footings shall always have minimum size according to pertinent code.

A coefficient of friction (μ) of about 0.30 is recommended to compute friction at footing base.

Footings shall be designed to sustain a maximum vertical movement of about one (1) inch and differential settlements of about 0.75 inch between maximum and minimum loaded columns.

The bottom of the excavations of the foundations shall be dry, clean, without

saturated soils, any loose material and / or construction waste and supported on a tested competent material.

Expansion joints shall be incorporated at construction joints since relative movements between existing and new slab are expected.

We strongly recommend that our services are retained, or any other qualified geotechnical engineer, during the earthwork and excavation procedures in order to observe footing excavations, and approve them as adequate for concrete casting. This approval shall be done prior to steel reinforcement installation. Footings shall be always cast under dry conditions and bottom of excavation shall be always free of loose sediments prior to reinforcement placement. Bottom of excavations might require to be compacted with the aid of hand tampers.

7.0 COMMENTS

The information given by the borings can be used as a guide for estimating, in the design phase, the project budget. However, this information should not be used alone by the contractor to base his bid for the project. This office shall not be held responsible if the contractor uses this information without limitations to base his contract bid.

It is recommended to make mandatory that **the contractor bidding for the project perform visits to the site** to become acquainted with the actual conditions of the project area. Field test should be performed by these contractors, particularly with the actual equipment he considers suitable for such trenching operations, to establish the cutting requirements necessary for the construction and installation of the pipeline on those areas with difficult excavation conditions.

In accordance with the generally accepted construction practice, the contractor will be solely and completely responsible for the working conditions at the job site, including the safety of all persons during the performance of the work (including any excavation in soil and/or rock). These requirements will apply continuously and not be limited to normal working hours.

Any construction review of the contractor performance by the Geotechnical Engineer is not intended to include the review of the adequacy of the contractor safety measures, in or near the construction site.

It is recommended that **the contractors bidding for this project must conduct a careful evaluation of the geotechnical data and comments given in this report, and the borings. The project designer shall provide this information to the contractor to make him aware of the limitations of this report and the difficulties to be found during the excavation phase of this project.**

Specialty contractors shall be involved in the design of the excavation and dewatering process. They will need to perform additional field tests. This issue shall not be overseen. In accordance with generally accepted construction practices, the contractor will be solely and completely responsible for working conditions at the job site, including the safety of all persons and property during the performance of the work. These requirements will apply continuously and not be limited to normal working hours.

Any construction review of the contractor's performance, conducted by the Soils Engineer, is not intended to include a review of the adequacy of the contractor's safety measures, in or near the job site. The above conclusions and recommendations are being based on a number of representative tests which we consider appropriate to enable us to form a judgment in accordance with the best standards of engineering practice. But the testing of every square meter of land to be occupied by the proposed pipeline would

be economically unfeasible and variations might be encountered in the soil profile, especially, at intermediate areas between boreholes. These variations shall be evaluated by us during construction to provide the corresponding solution.

The inspection or supervision of earthworks, once excavation processes are, in general, a very delicate and specialized matter. In some cases, this service is not rendered by the Geotechnical Engineer who conducted the subsoil investigation and recommended the specific foundation alternatives for a given project. In a large number of projects, these operations are successfully completed due to a prevalence of ideal and uniform subsoil conditions and the execution of the work by a competent and responsible contractor. But, there are cases where the lack of proper construction techniques and the lack of adequate supervision have given rise to the occurrence of foundation problems and failures.

It is a common practice to assign almost all the responsibility for these failures, both professionally and legally, to the Geotechnical Engineer, who is sometimes unable to disclose and gather all necessary evidence and information to prove that the failure or problem was not his responsibility and that his recommendations were correct.

Aware of the above-mentioned problem, we wish to state that the validity of our recommendations given for this project is subordinated to the inspection of the pile driving operations by us or a competent and experienced Geotechnical Engineer. If the supervision contract is not awarded to this office, the selected supervising Geotechnical Engineer shall receive a copy of this report, evaluate the same and adopt it as his own or request additional soil data to verify our recommendations or modify them according to his personal knowledge and judgment.

This report has been prepared taking into consideration the design factors presently known to us. The project designers shall be alerted to any item that might have been

overlooked, that could require clarification or that may need additional recommendations to those discussed herein.

8.0 REFERENCES

- M'Gonigle, J.W., 1979 Geologic Map of the Naguabo and Part of the Punta Puerca Quadrangles: U.S. Geol. Survey Map I-1099
- Coduto, Donald P., 1994. *Foundation Design-Principles and Practices*, Prentice Hall, Inc., New Jersey.
- Duncan, J. Michael and Wright, Stephen G., 2005. *Soil Strength and Slope Stability*, John Wiley & Sons, New Jersey.
- Spangler, Merlin G. and Handy, Richard L. (Iowa State University), Chapter 25 "Loads on Underground Conduits" *Soil Engineering*, 3rd Edition Intext Educational Publishers, New York and London
- USGS, 1967 Naguabo Quadrangle, Puerto Rico 7.5-Minute Series (Topographic). (Photorevised 1982): U.S. Geological Survey.

9.0 STANDARDS

- ASTM D 1557 "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³)"
- ASTM D 1586 "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils."
- ASTM D 2216 "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass."

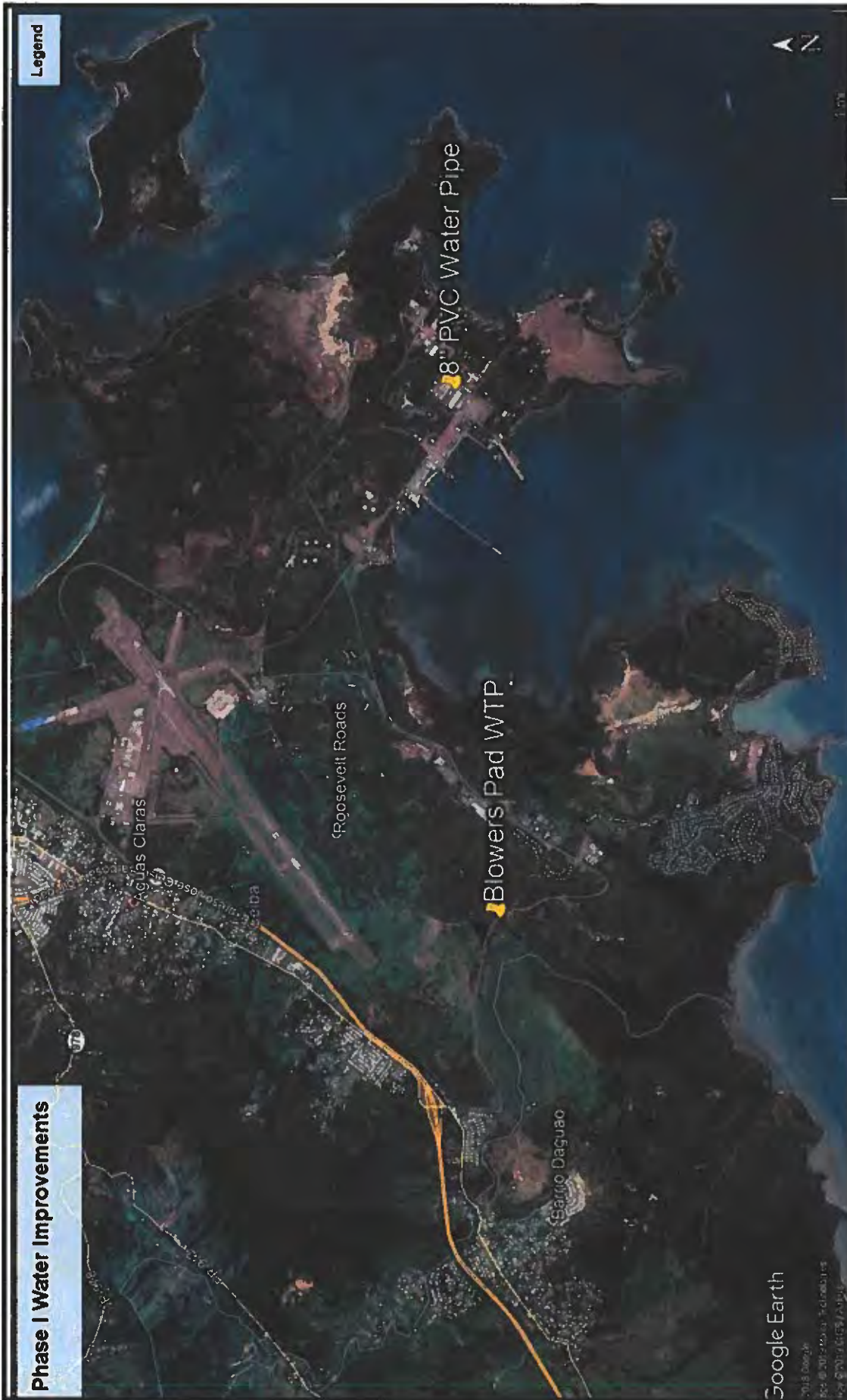
ASTM D 2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)."

ASTM D 3282 "Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes."

ASTM D 4220 "Standard Practices for Preserving and Transporting Soil Samples."

APPENDIX A

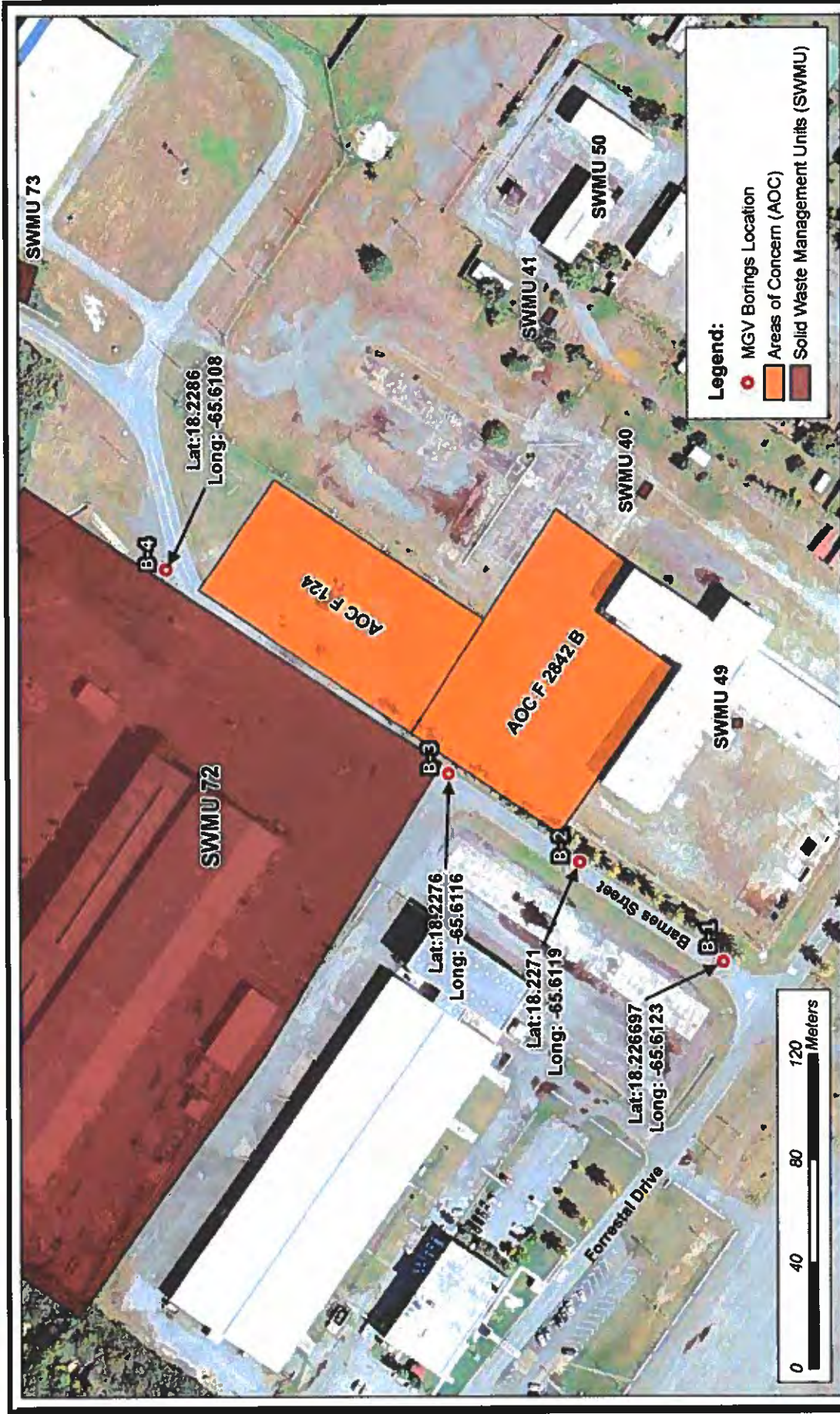
FIGURES.



Phase I Water Improvements

Legend

<p>MGV GEOTECHNICAL GROUP, PSC. PO BOX 2636 VEGA BAJA, PR 00694-2636</p>	 <p>NTS</p>	<p>Geotechnical Investigation Report For Proposed Phase I Water Improvements at Roosevelt Roads, Celiba, PR <i>Fig. 1 Satellite Picture From Google Earth</i></p> <p>Project No.: 1963</p>
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Geotechnical Investigation Report For Proposed
Phase I Water Improvements at Roosevelt Roads,
Celba, PR

Fig. 2A Approximate Borings Location

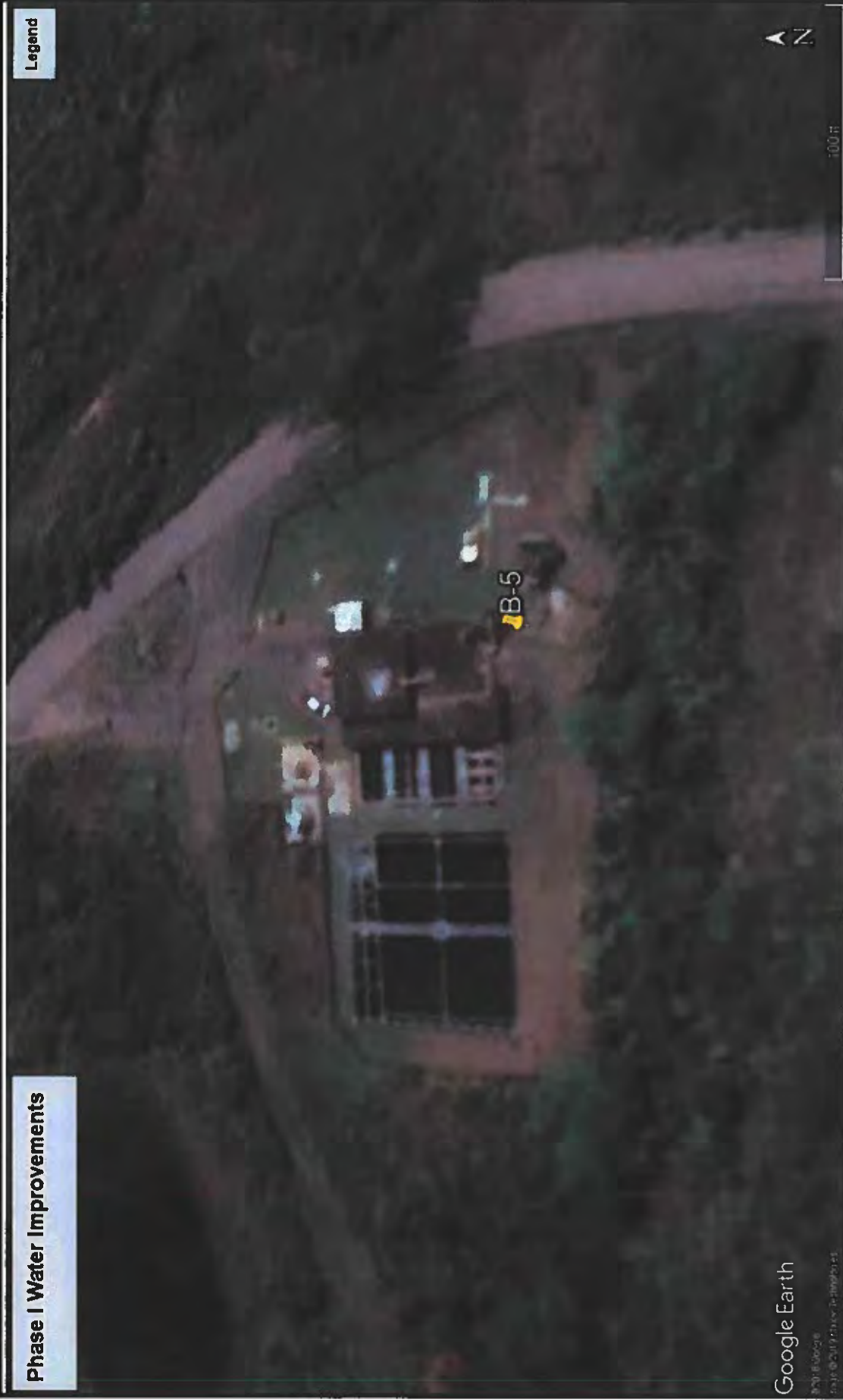
Project No.: 1963

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NTS

Phase I Water Improvements

Legend



Google Earth

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**Geotechnical Investigation Report For Proposed
Phase I Water Improvements at Roosevelt Roads,
Celba, PR**
Fig. 2B Approximate Borings Location

Project No.: 1963



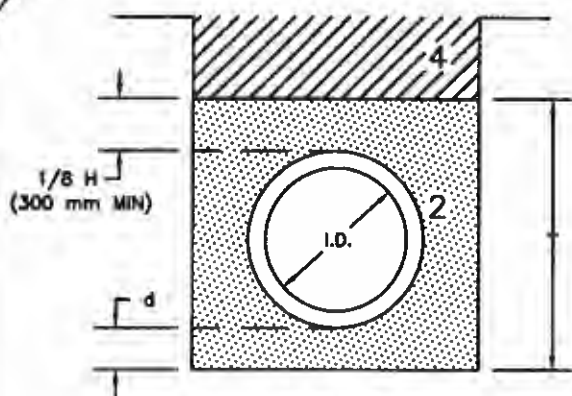
Geotechnical Investigation Report For Proposed
Phase I Water Improvements at Roosevelt Roads,
Celba, PR
Fig. 3 USGS Geologic Map Of The Naguabo and Part of the Punta Puerca Quadrangles

Project No.: 1963

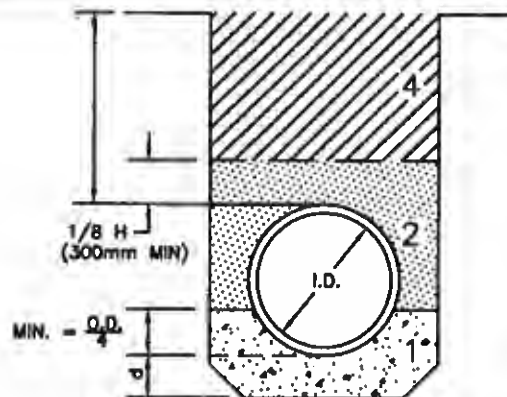


NTS

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PSC.
PO BOX 2636
VEGA BAJA, PR 00694-2636



CLASS B
FIRST CLASS BEDDING
LOAD FACTOR 1.9

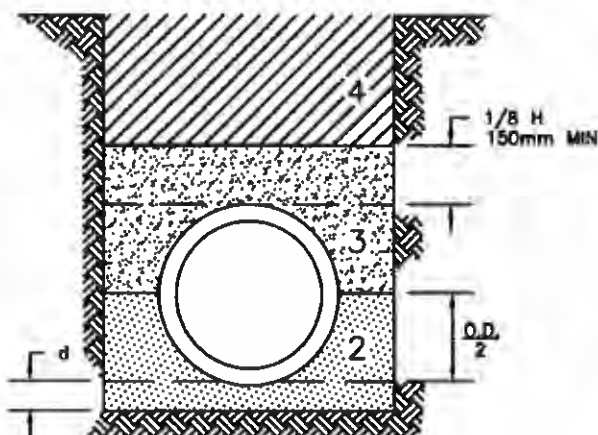


CLASS A
CONCRETE CRADLE
LOAD FACTOR 2.8

DEPTH OF BEDDING MATERIAL BELOW PIPE

I.D.	d (MIN)
≤ 675mm	75mm
750mm - 1500mm	100mm
> 1500mm	150mm

MINIMUM COVER OVER TOP
OF PIPE - 1.0m



CLASS C
ORDINARY BEDDING
LOAD FACTOR 1.5

- 1** CONCRETE
28 DAY STRENGTH TO BE 20MPa OR MORE
- 2** 20mm MINUS GRAVEL OR SAND
HAND PLACED IN LAYERS NOT OVER 150mm
AND COMPACTED TO 95% STANDARD PROCTOR
DENSITY.
- 3** HAND PLACED BACKFILL
FINELY DIVIDED GRANULAR MATERIAL
FREE FROM DEBRIS, STONES AND LARGE LUMPS
- 4** MACHINE PLACED BACKFILL
FREE FROM DEBRIS, LARGE LUMPS OR
STONES OVER 150mm SIZE.
- O.D. - OUTSIDE DIAMETER
- I.D. - INSIDE DIAMETER
- H - DISTANCE FROM GROUND TO TOP OF PIPE

NOTES:

- FOR ROCK OR OTHER INCOMPRESSIBLE MATERIALS, THE TRENCH SHALL BE OVER-EXCAVATED A MIN. OF 150mm FROM THE OUTSIDE COUPLINGS OR BELLS OF THE PIPES & REFILLED WITH GRANULAR MATERIAL. (MAX. AGGREGATE SIZE - 25mm)
- FOR PVC PIPE; BEDDING TO BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY.
- THIS DRAWING INDICATES MINIMUM SPECIFICATIONS. MANUFACTURERS RECOMMENDED BEDDING AND BACKFILLING SHALL GOVERN WHERE THEY EXCEED THIS SPECIFICATION.

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**Geotechnical Investigation Report For
Proposed Phase I Water Improvements at
Roosevelt Roads,
Ceiba, PR**
Fig. 4 Bedding Details
Project No.: 1963

APPENDIX B

BORING LOGS.

BORING NO. B-1
SHEET 1 **OF** 1
JOB NO. 1963

PROJECT Phase I Water Improvements at Roosevelt Roads

LOCATION Ceiba, PR

SAMPLER:

TYPE _____ **SPT** _____

SIZE 1.375" ID

HAMMER: WT 140 lbs

DROP _____ **30 inches**

DESCRIPTION: FM

APPROVED: MG

FINAL WATER DEPTH: _____ **ft.** **INITIAL WATER DEPTH:** _____ **ft.**

DATE STARTED 11/14/19

COMPLETED 11/14/19

DRILL MACHINE BK - 51

DRILLER E. Garcia

GROUND ELEV.

DEPTH OF HOLE 6

WATER TABLE	N.D.
--------------------	-------------

[illegible]

U.S.C.S. - UNIFIED SOIL CLASSIFICATION SYSTEM DESIGNATION.
 NF, WATER TABLE NOT FOUND.
 W_N, W_p, W_L AND I_p - NATURAL WATER CONTENT, PLASTIC LIMIT,
 LIQUID LIMIT AND PLASTICITY INDEX (I_p
 $W_L - W_p$) RESPECTIVELY.

UNLESS OTHERWISE SPECIFIED, ARBITRARY COORDINATES USED.
* q_u - UNCONFINED COMPRESSION STRENGTH; REPORTED VALUES
OBTAINED FROM:
A. POCKET PENETROMETER
B. SPRING TEST

BORING NO. B-2
SHEET 1 **OF** 1
JOB NO. 1963

DATE STARTED	11/14/19
--------------	----------

COMPLETED 11/14/19

DRILL MACHINE BK - 51

DRILLER E. Garcia

GROUND ELEV.

DEPTH OF HOLE 6

WATER TABLE	N.D.
-------------	------

UNLESS OTHERWISE SPECIFIED, ARBITRARY COORDINATES USED.
 *q_u - UNCONFINED COMPRESSION STRENGTH; REPORTED VALUES
 OBTAINED FROM:
 A. POCKET PENETROMETER
 B. SPRING TEST

MGV Geotechnical Group, PSC

BORING NO. B-3
SHEET 1 OF 1
JOB NO. 1963

PROJECT Phase I Water Improvements at Roosevelt Roads
LOCATION Ceiba, PR

DATE STARTED 11/14/19
COMPLETED 11/14/19
DRILL MACHINE BK - 51
DRILLER E. Garcia
GROUND ELEV. _____
DEPTH OF HOLE 6
WATER TABLE N.D.

SAMPLER: _____
TYPE SPT SIZE 1.375" ID
HAMMER: WT 140 lbs DROP 30 inches
DESCRIPTION: FM APPROVED: MG
FINAL WATER DEPTH: _____ ft. INITIAL WATER DEPTH: _____ ft.

DEPTH (ft)	ELEV. (m)	SAMPLE NO.	Blows per 6 in. incr.	SPT N VALUE (BLOWS/FT)	SAMPLER	MATERIAL DESCRIPTION	SYMBOL	% RECOVERY	MOISTURE CONTENT				STRENGTH																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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0	0.0	1	130	41		Asphalt with silty SAND, some fine to coarse gravel, subrounded, no plasticity, dry, black.		83	3.6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												</

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UNLESS OTHERWISE SPECIFIED, ARBITRARY COORDINATES USED.
 q_u^* - UNCONFINED COMPRESSION STRENGTH; REPORTED VALUES OBTAINED FROM:
A. POCKET PENETROMETER
B. SPRING TEST

MGV Geotechnical Group, PSC

BORING NO. B-4
SHEET 1 OF 1
JOB NO. 1963

PROJECT Phase I Water Improvements at Roosevelt Roads
LOCATION Ceiba, PR

DATE STARTED 11/14/19
COMPLETED 11/14/19
DRILL MACHINE BK - 51
DRILLER E. Garcia
GROUND ELEV.
DEPTH OF HOLE 6
WATER TABLE N.D.

SAMPLER:
TYPE SPT SIZE 1.375" ID
HAMMER: WT 140 lbs DROP 30 inches
DESCRIPTION: FM APPROVED: MG
FINAL WATER DEPTH: ft. INITIAL WATER DEPTH: ft.

DEPTH (ft)	ELEV. (m)	SAMPLE NO.	Blows per 6 in. incr.	SPT N VALUE (BLOWS/FT)	SAMPLER	MATERIAL DESCRIPTION	SYMBOL	% RECOVERY	MOISTURE CONTENT					STRENGTH		PROPERTIES VS. DEPTH
									W _n	W _p	W _L	I _p	q _u *	(TSF)		
0	0.0	1	61	35		Asphalt with silty SAND, little fine to coarse gravel, subrounded, no plasticity, dry, black and white.		92	12.0							<p> LL PL Wn N value 102030405060708090 </p>
-0.6		2	6	10		CLAY, high plasticity, little fine to coarse sand, little fine to coarse gravel, subrounded, moist, olive brown.		33	25.5							
-1.2		3	5	15		As above, no sand, no gravel.		100	35.8							
-1.8						END OF BORING										
-2.4																
-3.0																
-3.6																
-4.2																
-4.8																
-5.4																
-6.0																
-6.6																
-7.2																
-7.8																
-8.4																
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-25.2																
-25.8																
-26.4																
-27.0																
-27.6																
-28.2																
-28.8																
-29.4																
-30.0																

U.S.C.S. - UNIFIED SOIL CLASSIFICATION SYSTEM DESIGNATION.
NF, WATER TABLE NOT FOUND.
W_n, W_p, W_L AND I_p - NATURAL WATER CONTENT, PLASTIC LIMIT,
LIQUID LIMIT AND PLASTICITY INDEX (I_p)
W_L - W_p RESPECTIVELY.

UNLESS OTHERWISE SPECIFIED, ARBITRARY COORDINATES USED.
*q_u - UNCONFINED COMPRESSION STRENGTH; REPORTED VALUES
OBTAINED FROM:
A. POCKET PENETROMETER
B. SPRING TEST

MGV Geotechnical Group, PSC

BORING NO. B-5
SHEET 1 OF 1
JOB NO. 1963

PROJECT Phase I Water Improvements at Roosevelt Roads
LOCATION Ceiba, PR

DATE STARTED 11/15/19
COMPLETED 11/15/19

SAMPLER:

TYPE SPT SIZE 1.375" ID
HAMMER: WT 140 lbs DROP 30 inches
DESCRIPTION: FM APPROVED: MG
FINAL WATER DEPTH: _____ ft. INITIAL WATER DEPTH: _____ ft.

DRILL MACHINE BK - 51
DRILLER E. Garcia
GROUND ELEV. _____
DEPTH OF HOLE 20
WATER TABLE N.D.

DEPTH (ft)	ELEV. (m)	SAMPLE NO.	Blows per 6 in. incr.	SPT N VALUE (BLOWS/FT)	SAMPLER	MATERIAL DESCRIPTION	SYMBOL	% RECOVERY	MOISTURE CONTENT					STRENGTH	
									W _n	W _p	W _L	I _p	q _u [*]	(TSF)	
														PROPERTIES VS. DEPTH ● LL ■ PL ▲ W _n ● N value 102030406060708090	
0	0.0	1	9	19		Silty gravel SAND, subangular, clay pockets, no plasticity, roots, dry, dark olive gray.		50	17.6						
	-0.6	2	7	9		Silty CLAY, some fine to coarse gravel, subangular, medium plasticity, moist, olive.		42	17.7						
	-1.2	3	3	10		As above.		33	24.5						
5	-1.8	4	7	8		Silty CLAY, little fine to coarse gravel, subangular, high plasticity, moist, olive brown.		63	29.5						
	-2.4	5	3	8		As above.		54	36.7						
10			3												
	-4.0	6	3	12		As above, oxidation.		100	25.4						
15			5												
	-5.5	7	11	34		As above, dry, light olive brown.		100	27.7						
20	-6.1		14												
			20												
			24												
						END OF BORING									
25															
30															

U.S.C.S. - UNIFIED SOIL CLASSIFICATION SYSTEM DESIGNATION.
NF, WATER TABLE NOT FOUND.
W_n, W_p, W_L AND I_p - NATURAL WATER CONTENT, PLASTIC LIMIT,
LIQUID LIMIT AND PLASTICITY INDEX (I_p = W_L - W_p) RESPECTIVELY.

UNLESS OTHERWISE SPECIFIED, ARBITRARY COORDINATES USED.
*q_u - UNCONFINED COMPRESSION STRENGTH; REPORTED VALUES
OBTAINED FROM:
A. POCKET PENETROMETER
B. SPRING TEST