



CITY OF PROVIDENCE, RHODE ISLAND

Department: Providence Water

RFP Title: CMAR Services for Service Water System Upgrades (Expires 6/30/2026)

Opening Date: May 20, 2024

Addendum #: 1

Issue Date: 04/22/2024

The purpose of this addendum is:

The purpose of this Addendum is to provide additional technical information



ADDENDUM NO. 1

TO: ALL CONTRACT DOCUMENT HOLDERS OF RECORD
ALL PROSPECTIVE BIDDERS

FROM: PROVIDENCE WATER
125 DUPONT DRIVE
PROVIDENCE, RHODE ISLAND 02907
PHONE: (401) 521-6300

DATE ISSUED: MONDAY, APRIL 22, 2024

RE: CMAR SERVICES FOR SERVICE WATER SYSTEM UPGRADES
(EXPIRES 6/30/2026)

BID OPENING DATE: MONDAY, MAY 20, 2024 AT 2:15 PM

BID OPENING LOCATION: BOARD OF CONTRACT AND SUPPLY MEETING
CITY COUNCIL CHAMBERS
PROVIDENCE CITY HALL
25 DORRANCE STREET
PROVIDENCE, RHODE ISLAND 02903

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This Addendum No. 1, including all referenced attachments, modifies, amends, and supplements designated parts of the Contract Documents to the above-referenced project and shall be part of the Contract Documents as provided in the "Instructions to Bidders" for the above-referenced project.

The Contract Documents are hereby modified, amended, and supplemented as follows:

PROJECT MANUAL AND SPECIFICATIONS
Providence Water Supply Board
Phillip J. Holton Water Purification Plant Upgrades
Service Water Tank Upgrades

Scituate, Rhode Island

Prepared for:



PROVIDENCE WATER

Providence Water
125 Dupont Drive
Providence, RI 02907

Project No. 3-0848-20223

Prepared by:



Pare Corporation
8 Blackstone Valley Place
Lincoln, RI 02865

FEBRUARY 2024
RI Dept. of Health Submission

Providence Water Supply Board Philip J. Holton Water Purification Plant Upgrades Service Water Tank Upgrades

61 North Road
Scituate, Rhode Island

Owner



PROVIDENCE WATER

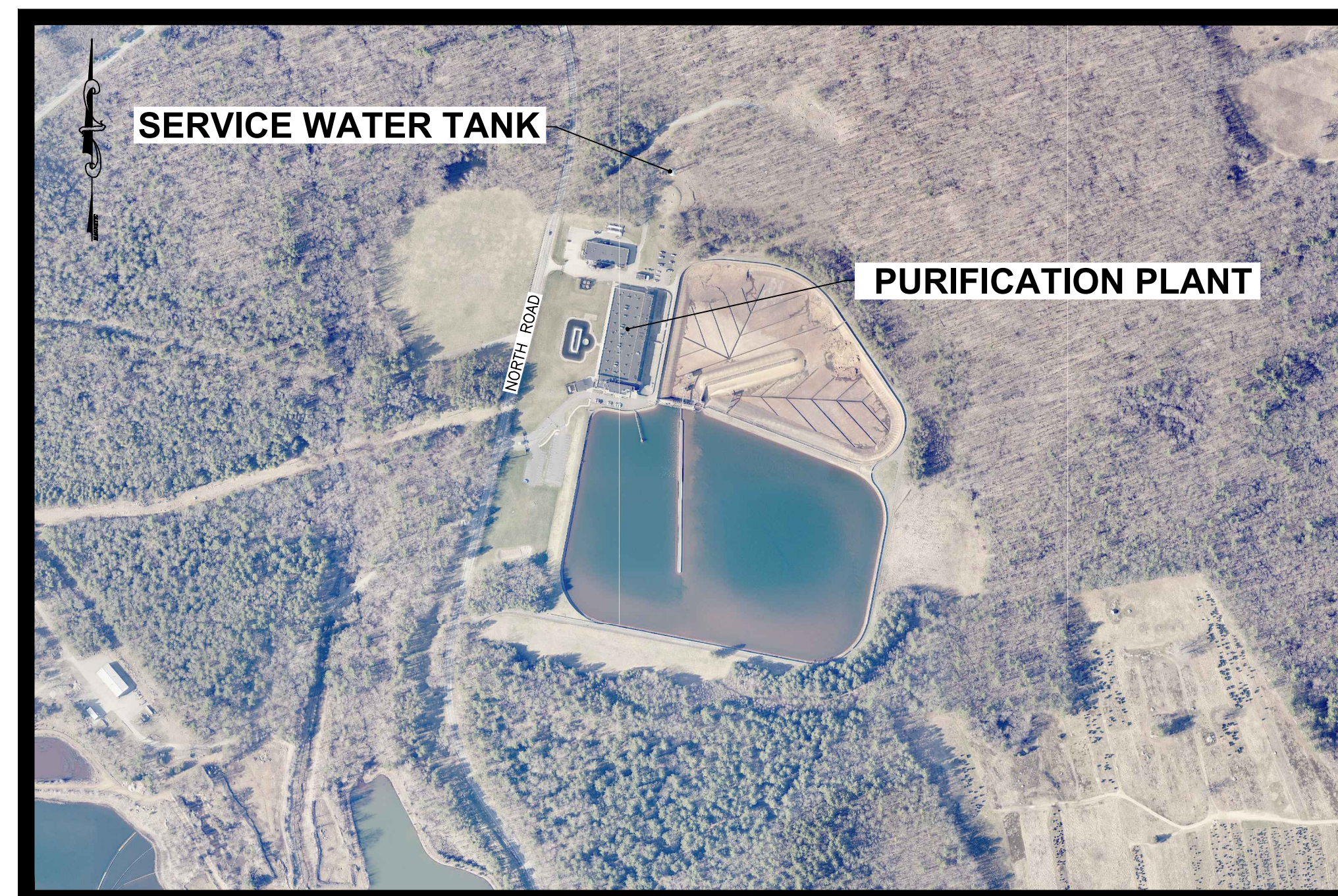
PROVIDENCE WATER SUPPLY BOARD
125 DUPONT DRIVE
PROVIDENCE, RI 02907

Civil Engineer



PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS

8 BLACKSTONE VALLEY PLACE LINCOLN, RI 02865 402-334-4100
10 LINCOLN ROAD, SUITE 210 FOWERSBORO, PA 02035 508-543-1755
14 BOBARKA ROAD, SUITE 28 HOUSTON, MA 01040 413-597-3448



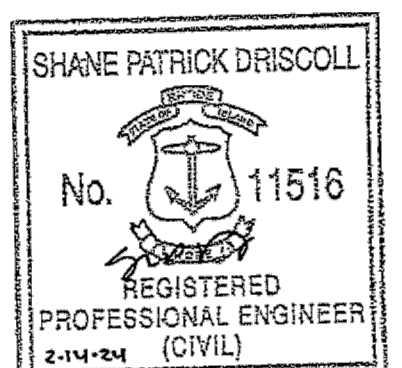
SCALE: N.T.S.

INDEX OF DRAWINGS

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2	C0.1	GENERAL NOTES & LEGEND
3	C1.0	SERVICE WATER TANK SITE PLAN & PROFILE
4	C2.0	SERVICE WATER SYSTEM UPGRADES
5	C3.0	DETAILS 1
6	C3.1	DETAILS 2
7	C3.2	DETAILS 3

FEBRUARY 2024
DEPARTMENT OF HEALTH
PERMITTING SUBMISSION

Pare Project No. 14256.41
Providence Water Project No. 3-0848-20223



SITE INFORMATION:

- PROJECT IS LOCATED ON A.P. 09-1 LOT 007-00 ALONG ROUTE 116, IN THE TOWN OF SCITUATE, RHODE ISLAND. THE SITE IS LOCATED AT PROVIDENCE WATER'S P.J. HOLTON WATER PURIFICATION PLANT.
- SITE OWNER: PROVIDENCE WATER SUPPLY BOARD, 125 DUPONT DRIVE, PROVIDENCE, RI 02907.

GENERAL NOTES:

- THE WORK SHOWN ON THESE DRAWINGS IS FOR UPGRADES TO THE 40,000 GALLON ELEVATED STEEL WATER STORAGE TANK AT PROVIDENCE WATER'S P.J. HOLTON WATER PURIFICATION WORKS IN SCITUATE, RHODE ISLAND. TANK UPGRADES CONSIST OF NEW INTERIOR AND EXTERIOR COATINGS, INTERIOR SACRIFICIAL ANODES, LADDER AND GUARDRAIL MODIFICATIONS, OVERFLOW DOWNSPOUT, LIGHTNING PROTECTION, AND OTHER WATER STORAGE TANK APPURTENANCES. SERVICE WATER SYSTEM UPGRADES CONSIST OF NEW VFDS ON SERVICE WATER PUMPS AND THE ADDITION OF A HYDROPNEUMATIC TANK.
- ELEVATIONS SHOWN IN THESE PLANS ARE IN U.S. SURVEY FEET AND ARE REFERENCED TO THE PROVIDENCE RI MEAN HIGH WATER DATUM UNLESS OTHERWISE NOTED.
- INFORMATION AS SHOWN ON THE DRAWINGS RELATING TO MATERIALS, SIZES, CONDITIONS, AND/OR LOCATIONS OF EXISTING STRUCTURES AND UTILITIES HAS BEEN COMPILED FROM THE BEST AVAILABLE INFORMATION AND IS NOT GUARANTEED CORRECT OR COMPLETE. PRIOR TO BEGINNING WORK, CONTRACTOR SHALL VERIFY LOCATION OF ALL UTILITIES. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ANY UTILITIES IN THE IMMEDIATE AREA OF THIS PROJECT (INCLUDING THOSE TO BE CONNECTED TO) THROUGH THE PERFORMANCE OF TEST PITS OR OTHER INVESTIGATION METHODS, TO ASSURE THAT THESE UTILITIES WILL NOT IMPACT THE WORK IN THIS PROJECT. ANY SUBSTANTIAL DISCREPANCY IN UTILITY LOCATIONS, SIZES, MATERIALS, ETC., IDENTIFIED ON THE DRAWINGS SHALL BE CALLED TO THE OWNER'S ATTENTION IMMEDIATELY, ANY DAMAGE TO UTILITIES CAUSED BY THE CONTRACTOR SHALL BE THE CONTRACTOR'S RESPONSIBILITY, AND COST FOR REPAIR OR REPLACEMENT OF SUCH DAMAGED UTILITIES SHALL BE BORNE BY THE CONTRACTOR.
- CONTRACTOR SHALL VISIT THE SITE PRIOR TO BEGINNING WORK TO VERIFY FIELD CONDITIONS. NOTED DISCREPANCIES BETWEEN DRAWINGS AND ACTUAL FIELD CONDITIONS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IMMEDIATELY.
- ALL EXISTING SIGNS, POLES, AND UTILITY STRUCTURES, BOTH ABOVE AND BELOW GROUND, SHALL BE EITHER BRACED AND PROTECTED OR TEMPORARILY REMOVED AND REPLACED TO FACILITATE CONSTRUCTION OF THIS PROJECT. CONTRACTOR SHALL COORDINATE ACTION WITH OWNER OF SIGNS, POLES, UTILITIES, AND STRUCTURES. THERE WILL BE NO SEPERATE PAYMENT FOR THIS WORK.
- PRIOR TO THE START OF CONSTRUCTION, ALL NECESSARY EROSION AND SEDIMENTATION CONTROLS SHALL BE INSTALLED AND MAINTAINED TO MITIGATE EROSION AND SEDIMENTATION OF DOWNGRAIDENT AREAS, WETLANDS, WATER COURSES, ETC. EROSION CONTROLS SHALL BE MAINTAINED AND REPLACED AS NECESSARY UNTIL DISTURBED SURFACES ARE STABILIZED AND/OR RETURNED TO THEIR ORIGINAL CONDITION.
- CONTRACTOR SHALL PROVIDE ENGINEER WITH SUBMITTALS FOR REVIEW AND APPROVAL OF ALL MATERIALS AND EQUIPMENT PROPOSED TO BE USED FOR THE WATER STORAGE TANK UPGRADES. CONTRACTOR SHALL PROVIDE ENGINEER A MINIMUM OF 10 BUSINESS DAYS TO REVIEW AND PROCESS SUBMITTALS, UNLESS OTHERWISE AGREED UPON BETWEEN ENGINEER AND CONTRACTOR. WORK PERFORMED BY CONTRACTOR PRIOR TO APPROVAL OF ALL REQUIRED SUBMITTALS IS DONE AT CONTRACTOR'S OWN RISK.
- CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL NECESSARY MEANS AND METHODS TO CONSTRUCT ALL EXCAVATIONS FOR THIS PROJECT IN ACCORDANCE WITH APPLICABLE OSHA SAFETY REQUIREMENTS. CONTRACTOR IS SOLELY RESPONSIBLE FOR ALL MATTERS RELATED TO SITE SAFETY AND FOR COMPLYING WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL RULES AND REGULATIONS. OPEN EXCAVATIONS SHALL BE PROTECTED AT ALL TIMES AND NO EXCAVATIONS OR OPEN BELOW GRADE STRUCTURES SHALL BE LEFT OPEN OVERNIGHT.
- CONTRACTOR SHALL CONTACT "DIG SAFE" (TEL. #1-888-DIG-SAFE) A MINIMUM OF 72-HOURS PRIOR TO STARTING WORK. ALL OTHER UTILITY COMPANIES KNOWN TO HAVE UTILITIES IN THE AREA SHALL BE CONTACTED AT THIS TIME PRIOR TO CONSTRUCTION.
- EXACT LOCATION OF NEW PIPES, VALVES FITTINGS, AND APPURTENANCES SHALL BE DETERMINED IN THE FIELD AND MUST BE APPROVED BY THE ENGINEER/OWNER.
- IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO OBTAIN ALL REQUIRED PERMITS, POST REQUIRED BONDS, AND SUPPLY THE NECESSARY NOTICES REGARDING CONSTRUCTION, UTILITIES, AND INCIDENTAL WORK WITH THE OWNER AND APPLICABLE UTILITY COMPANIES.
- ALL COMPONENTS THAT COME IN CONTACT WITH POTABLE WATER SHALL BE NSF 14160/61 CERTIFIED. THE CONTRACTOR SHALL PROVIDE APPLICABLE NSF 14160/61 CERTIFICATION FORMS WITH THEIR SUBMITTALS FOR ALL EQUIPMENT.

SITE RESTORATION NOTES:

- PROVIDENCE WATER HAS REMEDIATED LEAD CONTAMINATION IN SURFICIAL SOILS SURROUNDING THE TANK IN ACCORDANCE WITH RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT SITE REMEDIATION REGULATIONS. PRIOR TO MOBILIZATION BY THE CONTRACTOR AND UPON COMPLETION OF THE PROJECT, PROVIDENCE WATER WILL ANALYZE THE SURFICIAL SOILS SURROUNDING THE TANK FOR LEAD CONTAMINATION. THE REMEDIATION OF ANY NEWLY DISCOVERED LEAD IN SOIL SURROUNDING THE TANK WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- ALL AREAS OF THE SITE THAT ARE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO A CONDITION EQUAL TO OR BETTER THAN WHAT EXISTED PRIOR TO CONSTRUCTION. THE LIMITS OF ALL DISTURBANCE SHALL BE KEPT TO A MINIMUM WITHIN THE PROPOSED AREA OF CONSTRUCTION. ALL AREAS DISTURBED OUTSIDE THE PROJECT LIMITS BY THE CONTRACTOR SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AT NO EXTRA COST TO THE OWNER.
- ALL DISTURBED LAWN AREAS SHALL BE RESTORED WITH A MINIMUM 6 INCHES OF LOAM AND SEED.
- LOAM AND SEED SHALL BE FREE OF SUBSOIL, REFUSE, LITTER, STUMPS, ROOTS, BRUSH, NOXIOUS WEEDS, OR ANY OTHER DELETERIOUS MATERIALS. LARGEST PARTICLE SIZE SHALL BE ½ INCH. LOAM SHALL CONFORM TO SECTION M.18.01 OF THE RIDOT STANDARDS (BLUE BOOK).
- SEED SHALL CONFORM TO SECTION M.18.10.04 (RESIDENTIAL SEED MIX) OF THE RIDOT STATE STANDARDS (BLUE BOOK), UNLESS OTHERWISE SPECIFIED OR APPROVED BY ENGINEER.

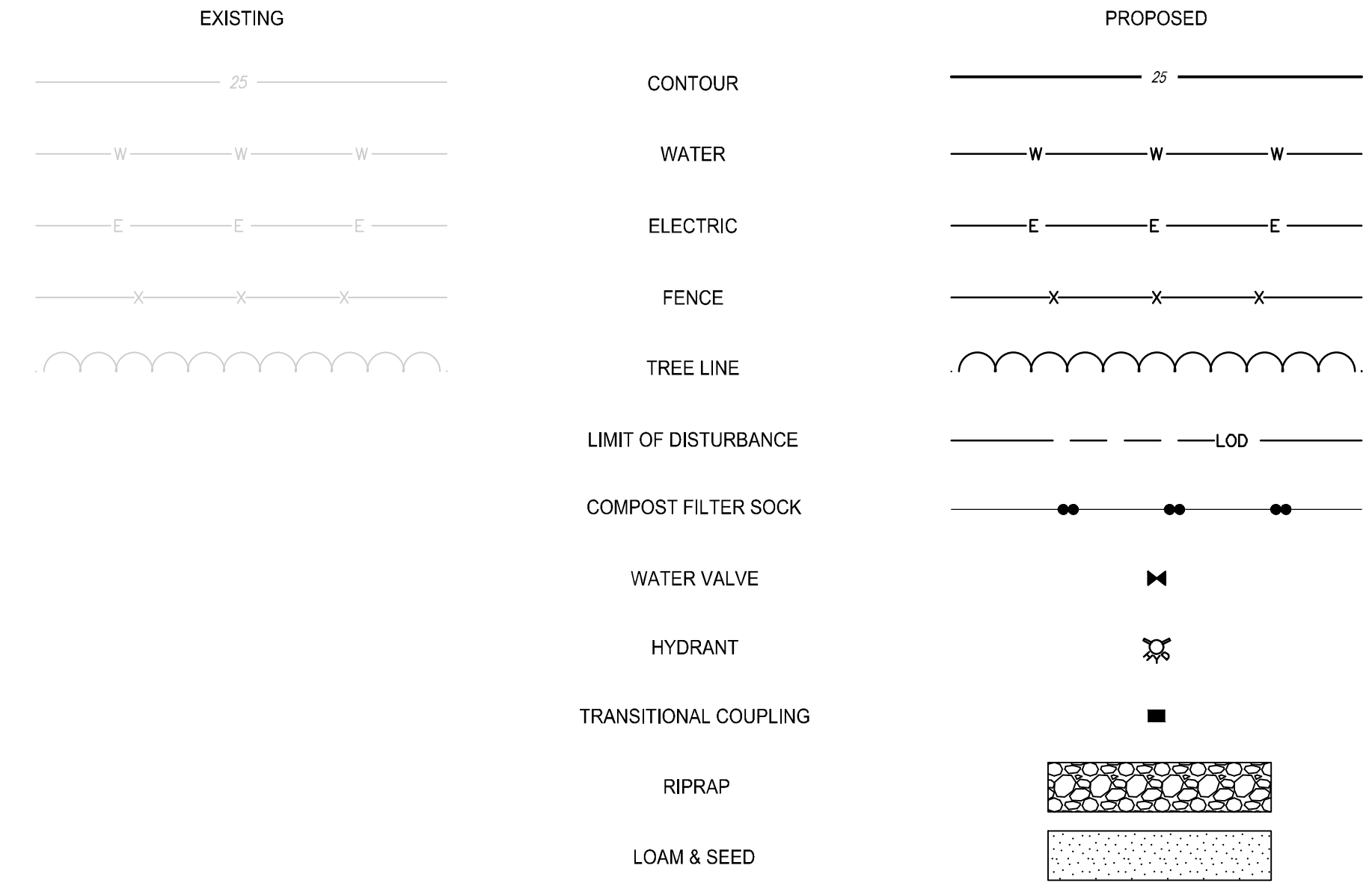
EROSION & SEDIMENTATION CONTROL NOTES:

- PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL SUBMIT, FOR ACCEPTANCE BY ENGINEER, A GENERAL WORK SCHEDULE AND PLAN WHICH INDICATES PLANNED IMPLEMENTATION OF TEMPORARY AND PERMANENT EROSION CONTROL MEASURES TO PROTECT THE CONSTRUCTION AREA AND ALL DOWNGRAIDENT AREAS. THE PLAN SHALL INCLUDE PROCEDURES FOR WINTER WEATHER CONDITIONS AS WELL AS CONTROL OF HAUL ROADS, STOCKPILES, AND COMPLETED WORK AREAS.
- CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL EROSION CONTROLS AND STABILIZATION WITHIN THE PROJECT AREA, AND ASSOCIATED WORK ACTIVITY, FROM THE DATE CONTRACTOR STARTS WORK UNTIL END OF WARRANTY PERIOD FOLLOWING PROJECT COMPLETION. ANY COST FOR FINES IMPOSED BY REGULATING AUTHORITIES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. CONTRACTOR SHALL BE RESPONSIBLE FOR THE REPAIR OF ANY AND ALL EROSION AND SEDIMENTATION DAMAGE TO THE PROJECT AREA AND ADJOINING AREAS THROUGH COMPLETION OF CONSTRUCTION.
- EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE SITE PLAN AND ALL ADDITIONAL NECESSARY CONTROLS SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL PROVIDE ADDITIONAL CONTROLS AS REQUIRED TO PREVENT EROSION BASED ON PROJECT CONDITIONS AND METHODS OF CONSTRUCTION.
- THE CONTRACTOR SHALL INSTALL AND MAINTAIN COMPOST FILTER SOCKS IN EFFECTIVE CONDITION THROUGHOUT THE DURATION OF THE PROJECT AND UNTIL DISTURBED AREAS HAVE BEEN STABILIZED TO PREVENT DISCHARGE AND MIGRATION OF SEDIMENT FROM THE WORK AREA. FOLLOWING SUCCESSFUL STABILIZATION OF DISTURBED AREAS, ALL COMPOST FILTER SOCKS SHALL BE REMOVED. PRIOR TO REMOVAL OF THE COMPOST FILTER SOCKS, ALL ACCUMULATED TRAPPED SEDIMENT MUST BE REMOVED TO A DESIGNATED UPLAND SITE.
- DURING CONSTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING DRAINAGE AND RUNOFF FLOW DURING STORMS AND PERIODS OF RAINFALL THROUGHOUT THE WORK AREA.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR SWEEPING ALL STREETS IMPACTED BY EXCAVATION WORK AND TRACKED AND DISPERSED SEDIMENT ON A DAILY BASIS. CONTRACTOR SHALL INSTALL AND MAINTAIN STABILIZED CONSTRUCTION ENTRANCE TRACK MATS TO REDUCE TRACKING OF SEDIMENT.

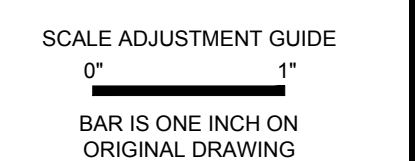
RECOMMENDED CONSTRUCTION SEQUENCING:

THE FOLLOWING SEQUENCE OF WORK OF CONSTRUCTION ACTIVITIES IS PROVIDED FOR CONTRACTOR'S USE AND AS A GUIDE IN PREPARING THE SCHEDULE FOR SEQUENCING OF WORK. CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING A FORMAL CONSTRUCTION SEQUENCE AND SCHEDULE FOR WORK TO THE ENGINEER FOR APPROVAL A MINIMUM OF 10 DAYS PRIOR TO THE COMMENCEMENT OF ANY WORK AND UPDATED SCHEDULES SUBMITTED WEEKLY THROUGHOUT THE DURATION OF THE PROJECT. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE ESTABLISHED SCHEDULE AND THE CONTRACTOR, AND THEIR SUBCONTRACTORS SHALL BE RESPONSIBLE FOR COOPERATING FULLY WITH THE ENGINEER AND THE OWNER IN EFFECTIVELY UTILIZING THE SCHEDULE. THE CONSTRUCTION PHASING SCHEDULE SHALL INCLUDE LINE ITEMS FOR COORDINATION WITH APPLICABLE PUBLIC AGENCIES AND PUBLIC/PRIVATE UTILITIES, WHEN NECESSARY.

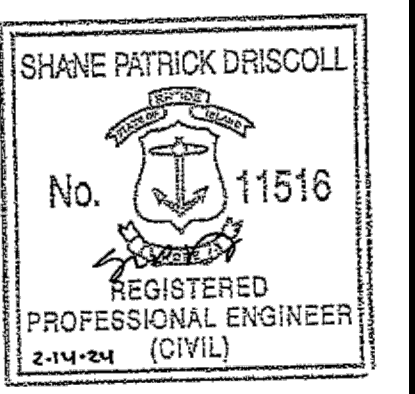
- ISOLATE TANK, INSTALL 8" GATE VALVE ON SERVICE WATER MAIN, INSTALL WATER MAIN FOR HYDRANT. CONTRACTOR SHALL INITIALLY ISOLATE SERVICE WATER TANK FROM PLANT WATER SYSTEM VIA 8" GATE VALVE LOCATED NORTH OF PURIFICATION PLANT BUILDING AND DRAIN TANK VIA HYDRANT LOCATED EAST OF FORESTRY BUILDING.
- PERFORM PRELIMINARY LEAKAGE TEST ON THE TANK IN ACCORDANCE WITH SPECIFICATION SECTION 02510. TANK SHALL BE FILLED VIA A TEMPORARY 2 INCH TAP INSTALLED DOWNSTREAM OF THE NEW 8" GATE VALVE CONNECTED TO THE NEW HYDRANT WITH A BACKFLOW PREVENTER. TANK SHALL BE DRAINED VIA NEW HYDRANT.
- DEMOLISH EXISTING TANK VENT, LADDER, AND OVERFLOW PIPE. INSTALL NEW TANK VENT, AND OVERFLOW PIPE.
- INSTALL CONTAINMENT AROUND TANK, BLAST CLEAN, AND PREPARE TANK SURFACES FOR COATING.
- INSTALL INTERIOR AND EXTERIOR COATING SYSTEMS IN ACCORDANCE WITH SPECIFICATION SECTION 09970.
- PERFORM LEAKAGE AND DISINFECTION TESTS. PROVIDENCE WATER PERSONNEL TO COLLECT SAMPLES FOR BACTERIOLOGICAL TESTING AND VOLATILE ORGANIC COMPOUND (VOC) ANALYSIS IN ACCORDANCE WITH PROJECT SPECIFICATIONS. A TEMPORARY 2 INCH TAP, BACKFLOW PREVENTER, AND NEW HYDRANT SHALL BE USED TO FILL AND DRAIN TANK.
- INSTALL LIGHTNING PROTECTION SYSTEM, HANGERS FOR OVERFLOW PIPE, SPLASH PAD, NEW TANK LADDER.
- INSTALL RIP RAP SWALE.



LEGEND



PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES
SERVICE WATER TANK UPGRADES
 61 North Road
 Scituate, Rhode Island



REVISIONS:

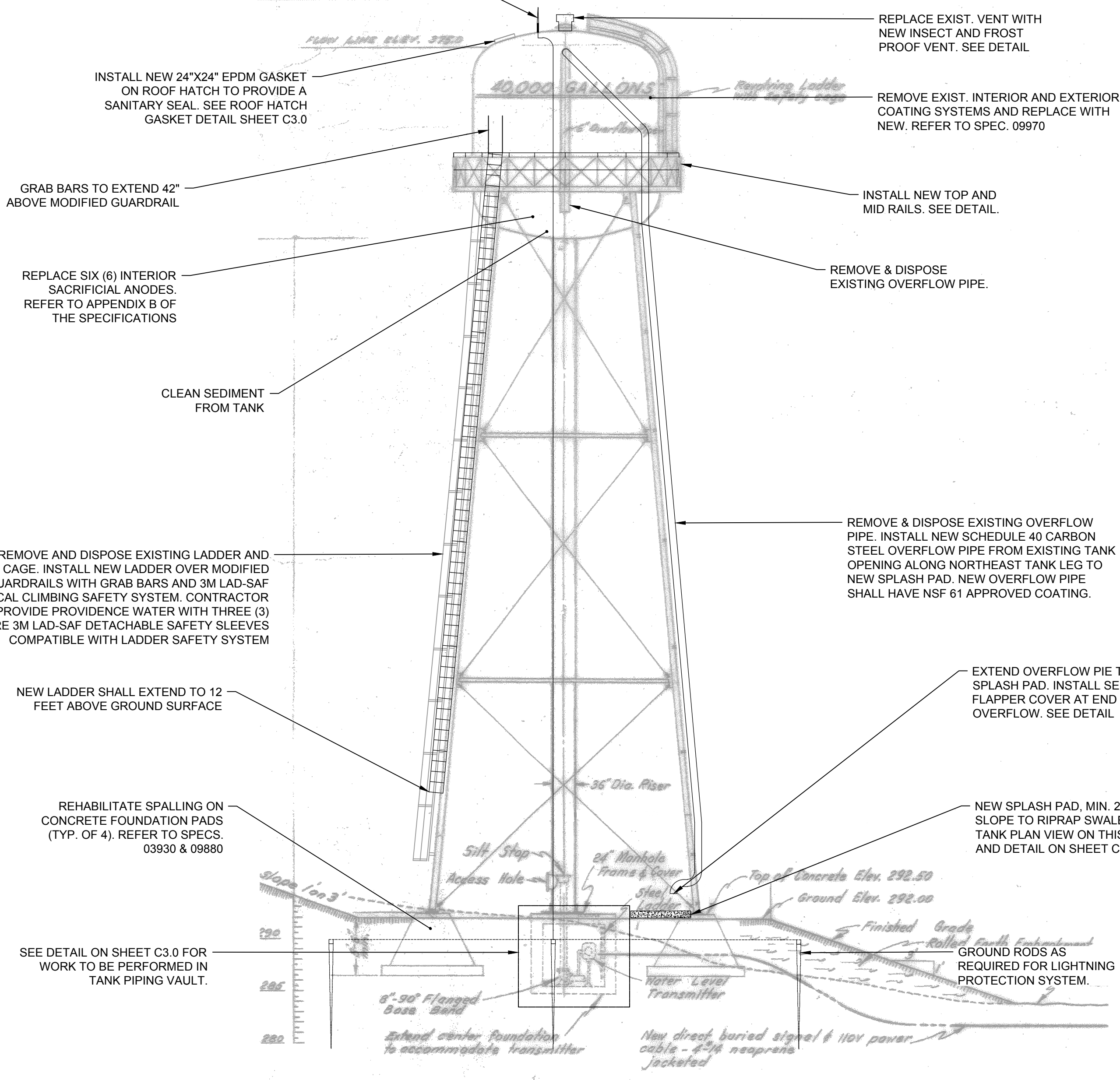
NO.	DATE	DESCRIPTION

PROJECT NO.:	14256.41
DATE:	FEBRUARY 2024
SCALE:	-
DESIGNED BY:	AJH
CHECKED BY:	SPD
DRAWN BY:	AJH
APPROVED BY:	SPD
DRAWING TITLE:	

GENERAL NOTES & LEGEND

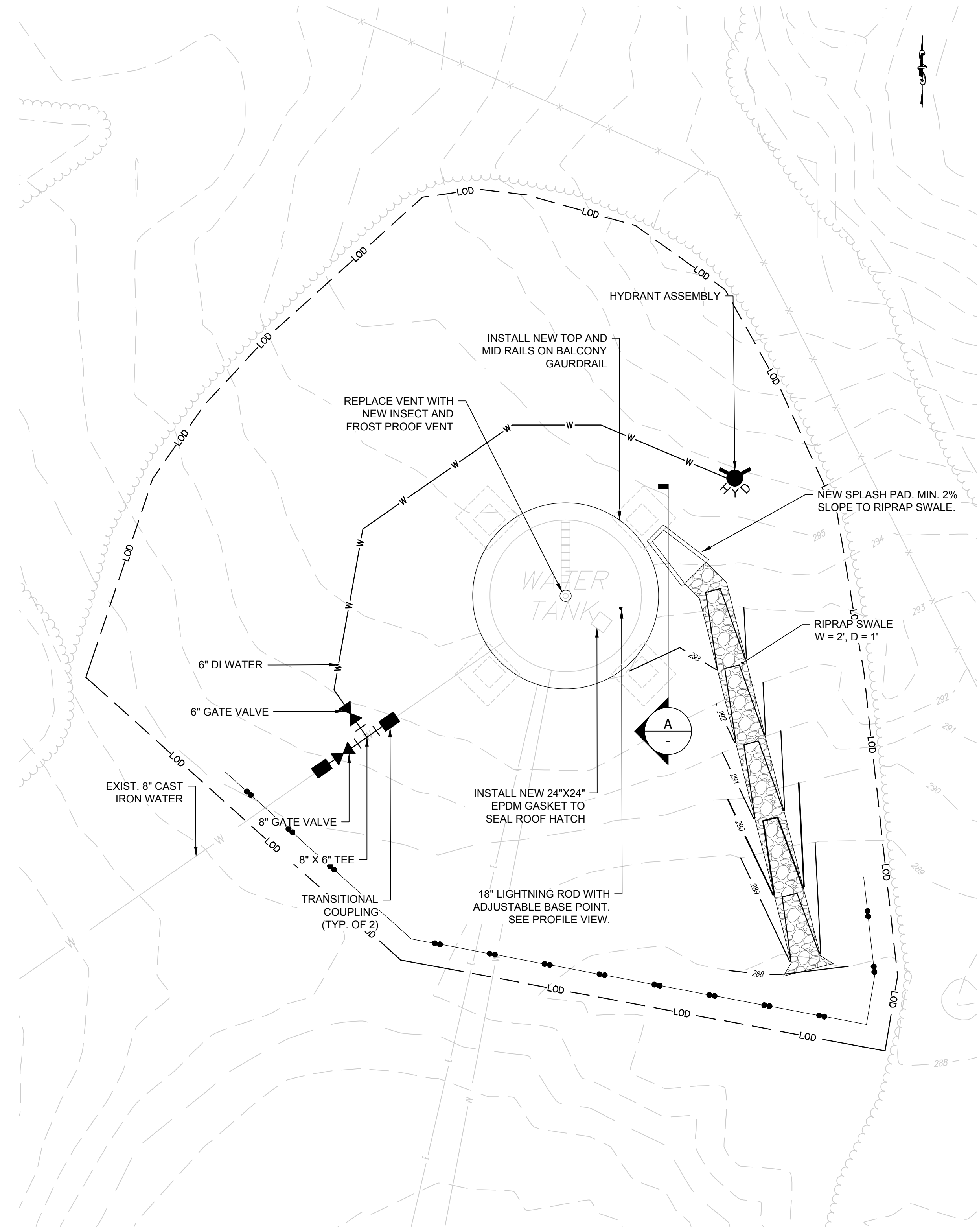
DRAWING NO.:
C0.1
 SHEET NO. 2 OF 7

LIGHTNING ROD WITH ADJUSTABLE BASE POINT, MOUNTED VIA BRONZE NUTS, BOLTS, & U-CLIPS AS REQUIRED. LIGHTNING PROTECTION SYSTEM SHALL COMPLY WITH NFPA 780 & U.L. 69A AND BE DESIGNED AND INSTALLED BY AN LPI CERTIFIED INSTALLER

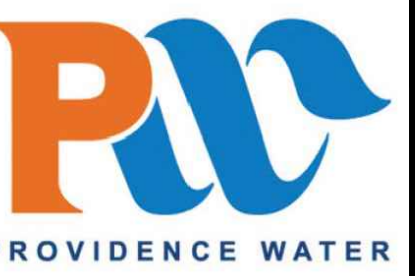


SECTION A - SERVICE WATER TANK ELEVATION
SCALE: 1/8" = 1'

- NOTE:**
- EXISTING CONDITIONS FOR SERVICE WATER TANK UPGRADES REFERENCE DRAWING "120 GENERAL PLAN OF REVISED WATER SERVICE SYSTEM" PREPARED BY PHILIP J. HOLTON JR. AS PART OF "ADDITIONS ALTERATIONS & IMPROVEMENTS IN ACCORDANCE WITH MASTER PLAN" DATED 19 FEBRUARY 1980.
 - ELEVATIONS ON THE PLAN VIEW ON THIS SHEET ARE REFERENCED TO THE NAVD88 DATUM.

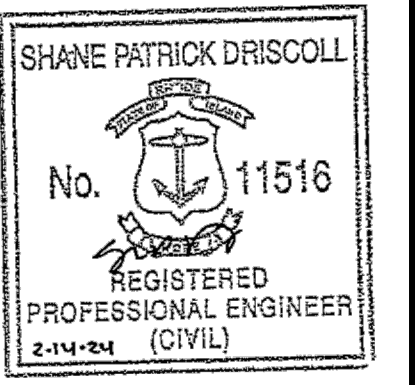


PLAN
SCALE: 1" = 10'



SCALE ADJUSTMENT GUIDE
 0" 1"
 BAR IS ONE INCH ON ORIGINAL DRAWING

PROVIDENCE WATER SUPPLY BOARD
 P.J. HOLTON WATER PURIFICATION PLANT UPGRADES
 SERVICE WATER TANK UPGRADES
 61 North Road
 Scituate, Rhode Island



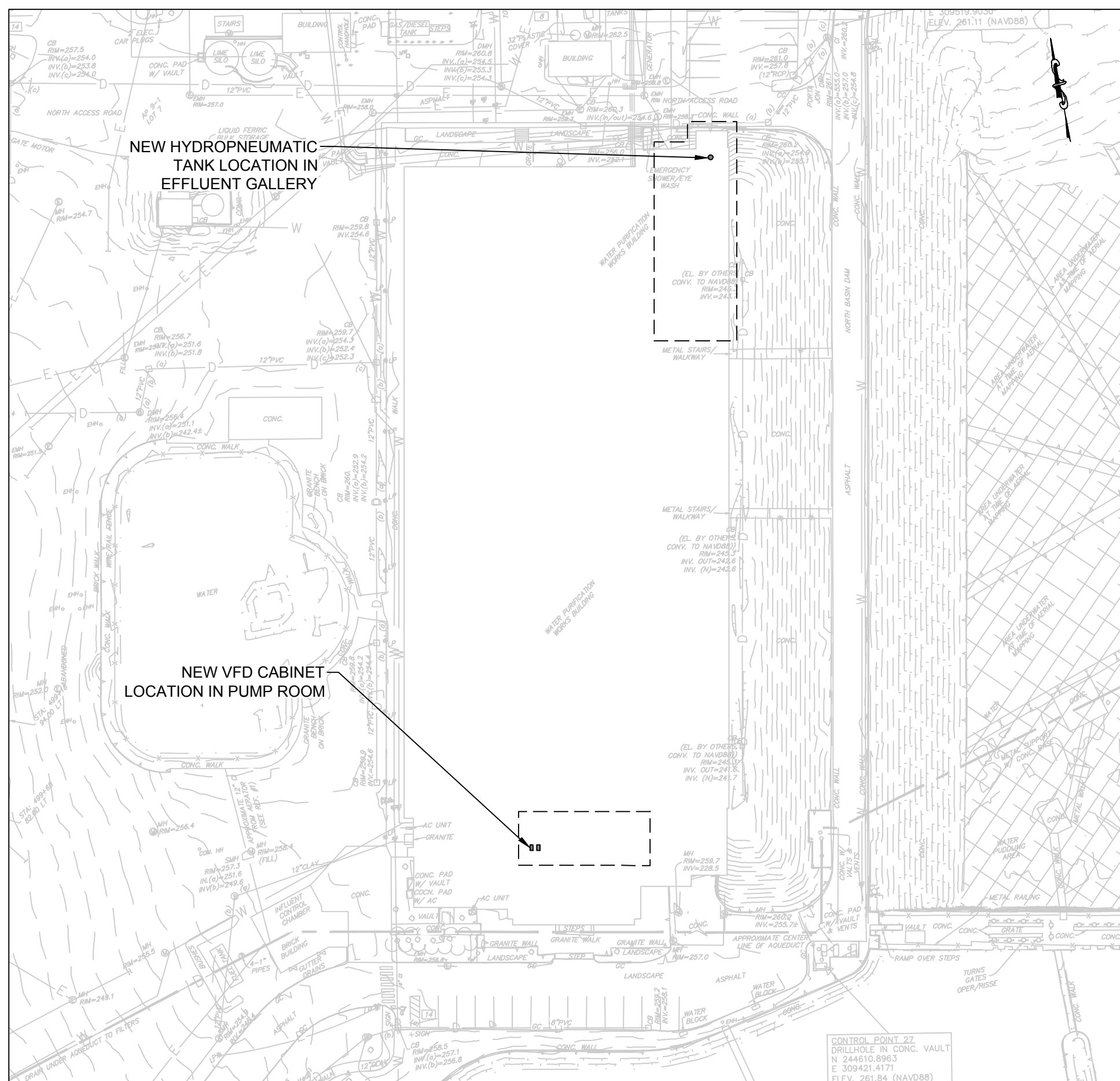
REVISIONS:

NO.	DESCRIPTION

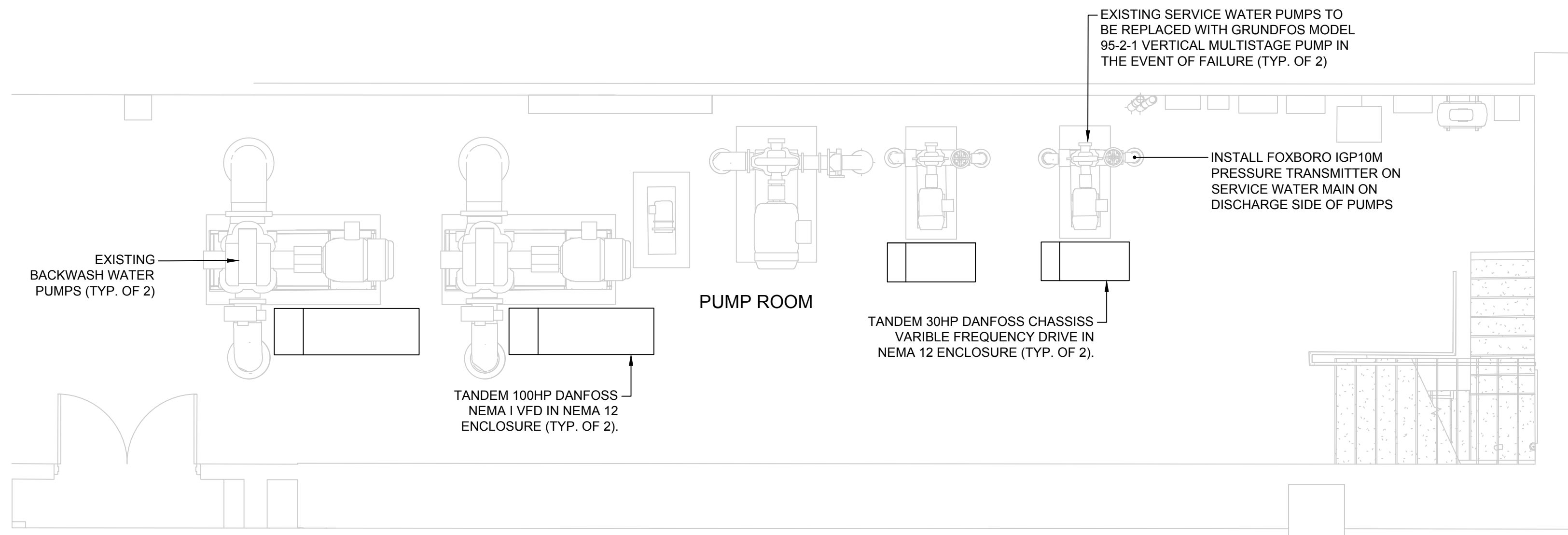
PROJECT NO.: 14256.41
 DATE: FEBRUARY 2024
 SCALE: AS NOTED
 DESIGNED BY: AJH
 CHECKED BY: SPD
 DRAWN BY: AJH
 APPROVED BY: SPD
 DRAWING TITLE:

SERVICE WATER SYSTEM UPGRADES

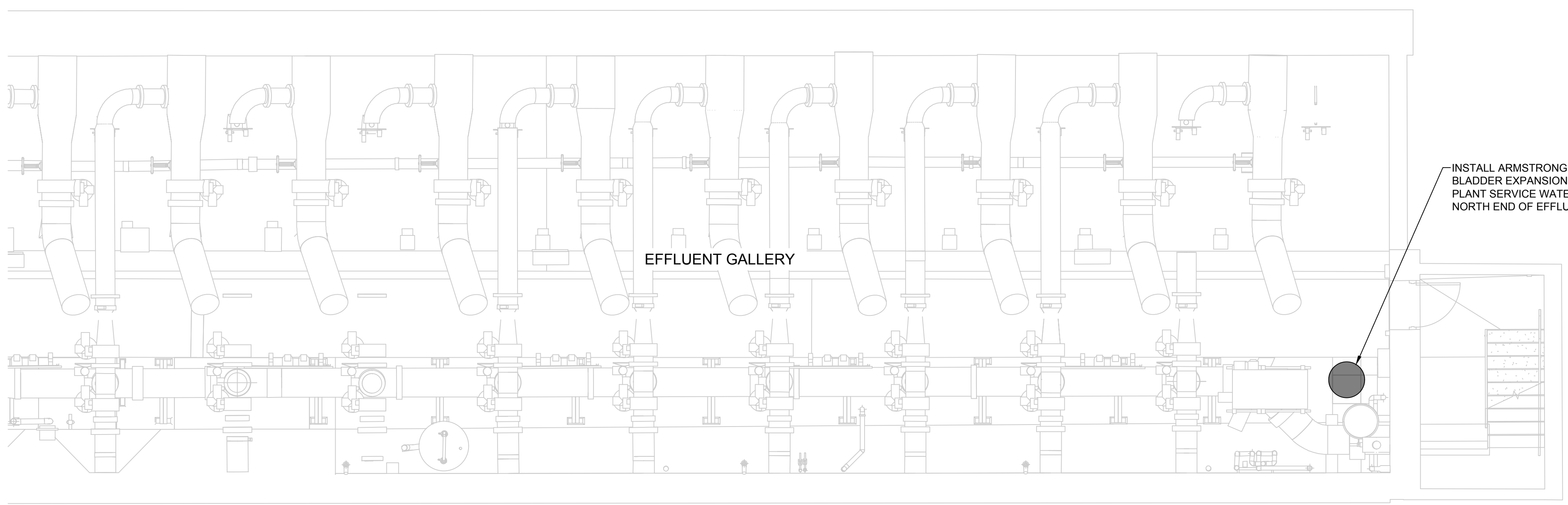
DRAWING NO.: C2.0
 SHEET NO. 4 OF 7



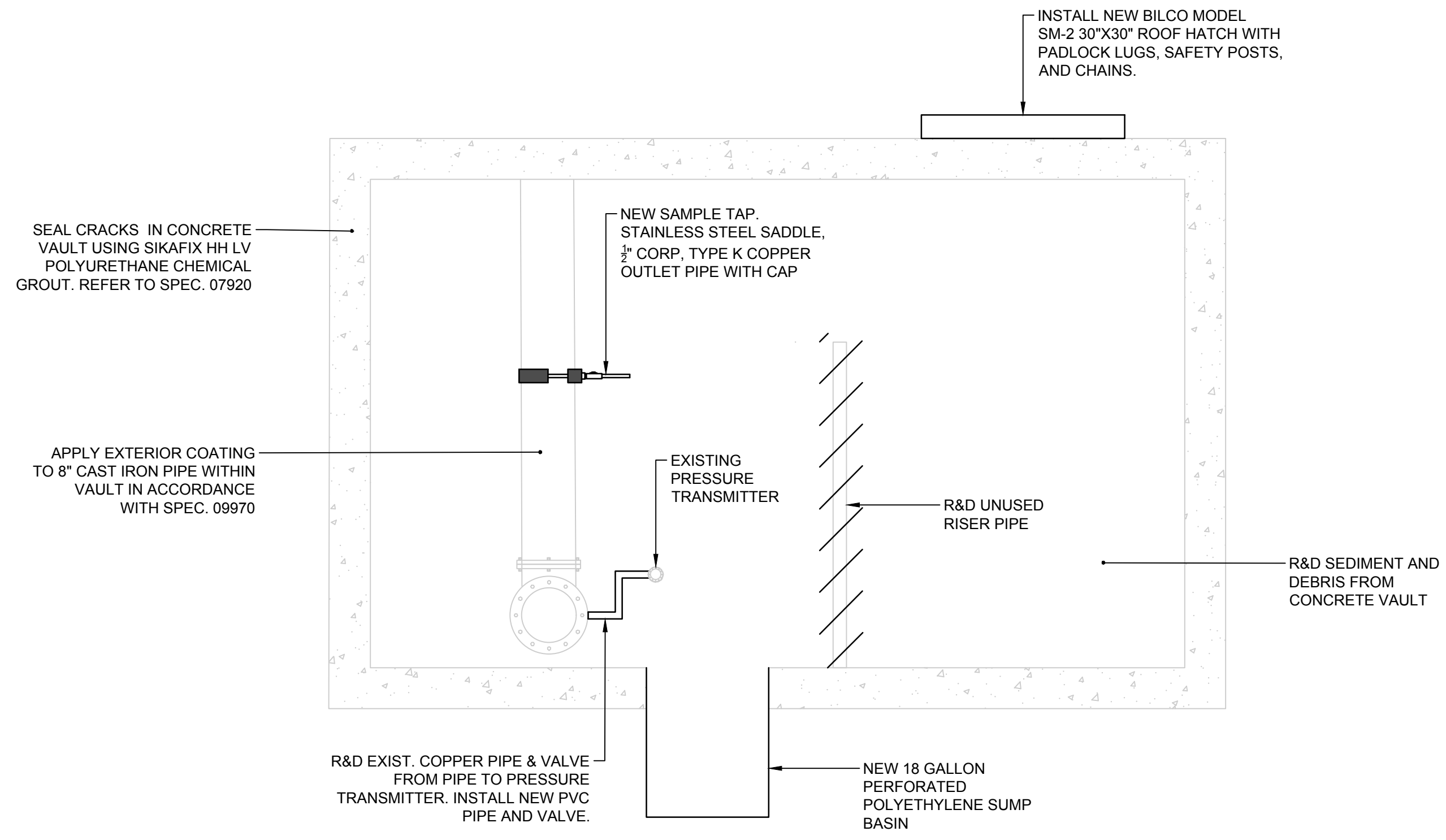
INSET
 SCALE: 1" = 60'



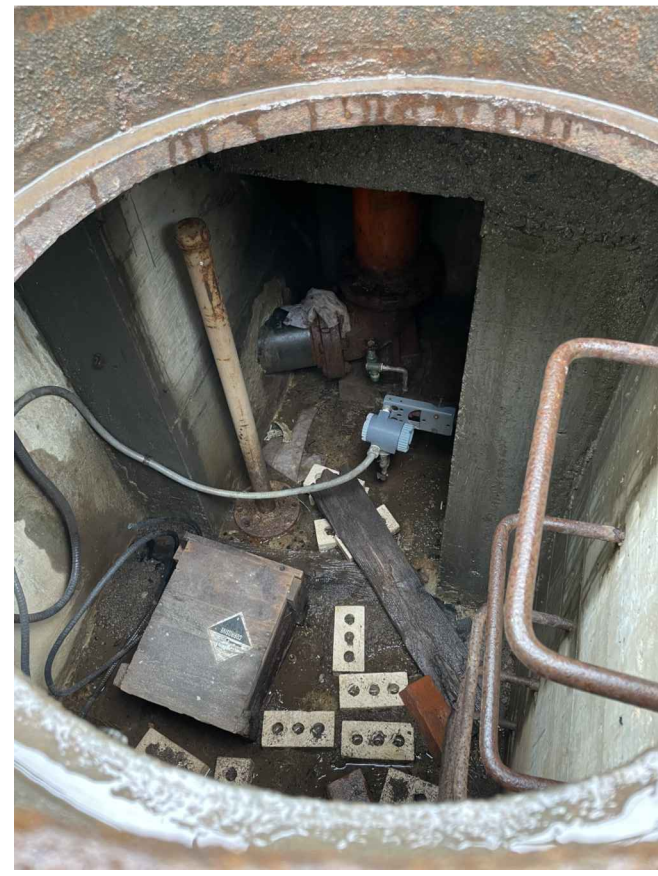
SERVICE WATER PUMP UPGRADES
 SCALE: 1/4" = 1'



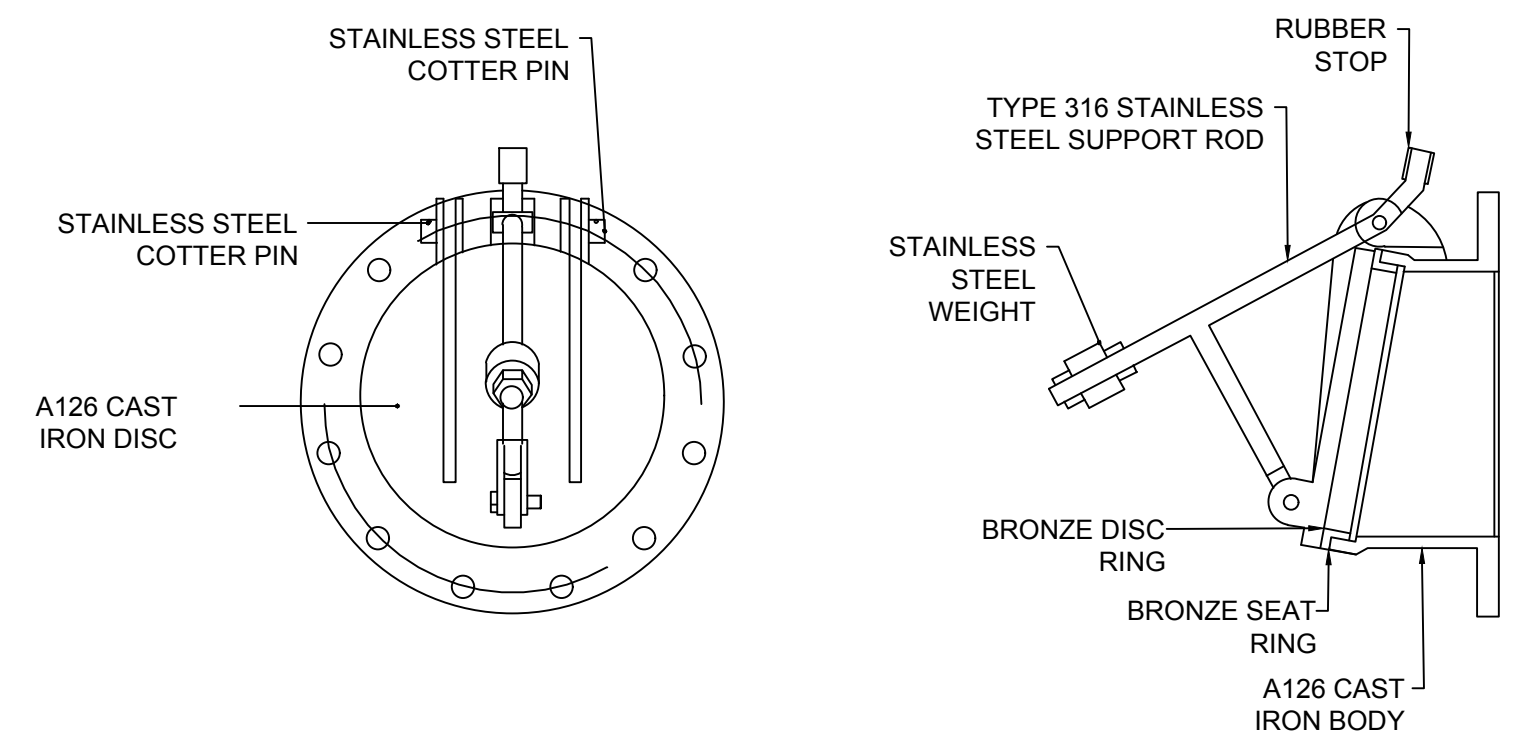
SERVICE WATER HYDROPNEUMATIC TANK UPGRADE
 SCALE: 1/8" = 1'



CONCRETE VAULT
NOT TO SCALE

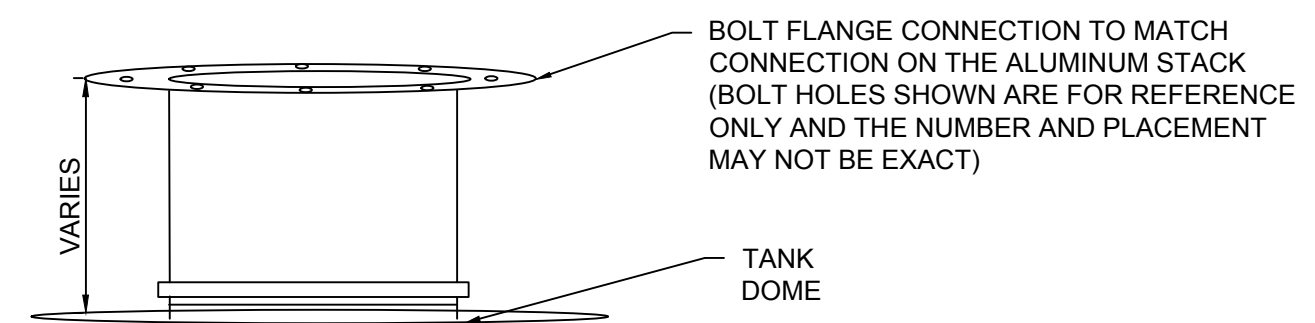


CONCRETE VAULT
NOT TO SCALE



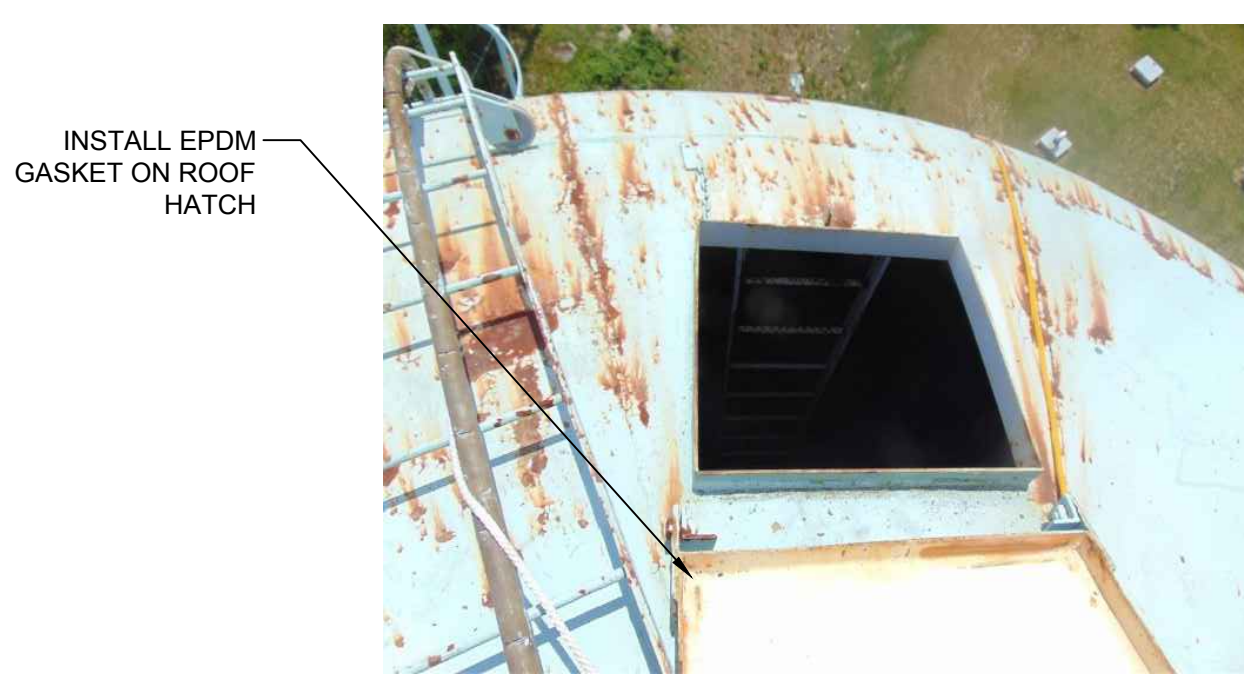
- NOTES:
1. FLAP VALVE SHALL BE FOR AN 8 INCH DIAMETER OVERFLOW PIPE
2. FLAP VALVE SHALL BE EQUIPPED WITH A 24 MESH TYPE 316 STAINLESS STEEL INSECT SCREEN

FLAP VALVE DETAIL
NOT TO SCALE



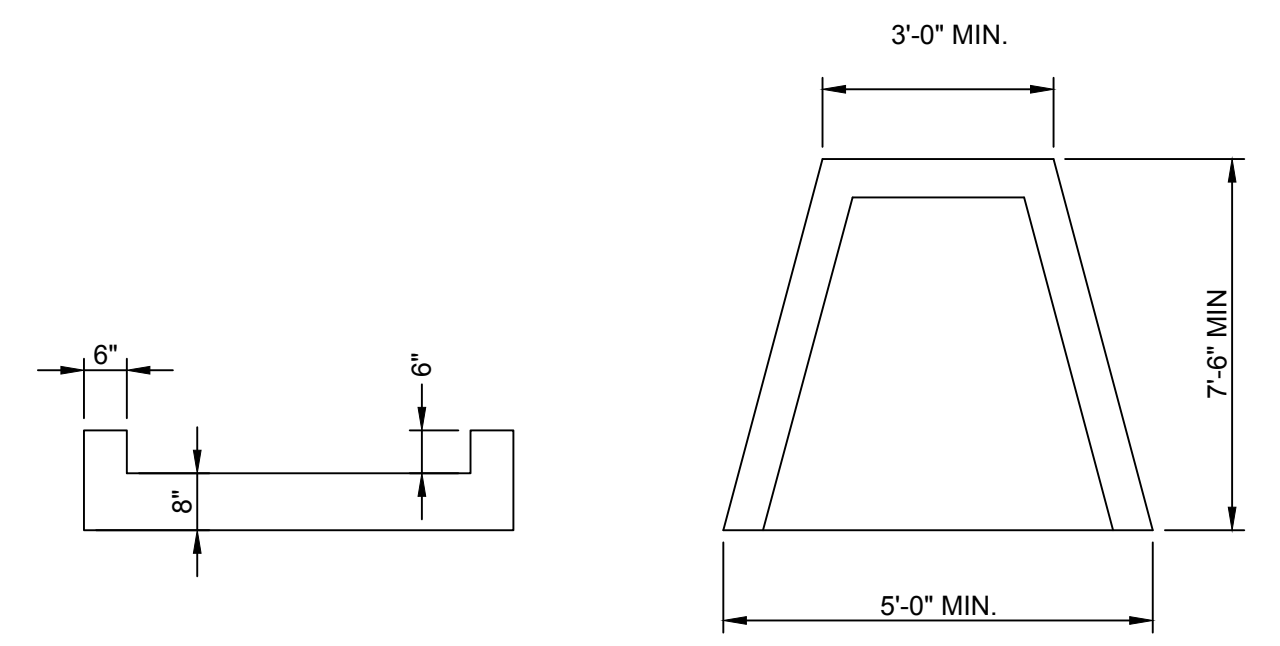
NOTE: VENT DETAIL BASED ON TOMCAT CONSULTANTS, LLC T.A.P. CO. MODEL SD 18-14 INSECT/FROST PROOF VENT.

SHORT WELD-IN STACK WITH BOLT FLANGE
NOT TO SCALE



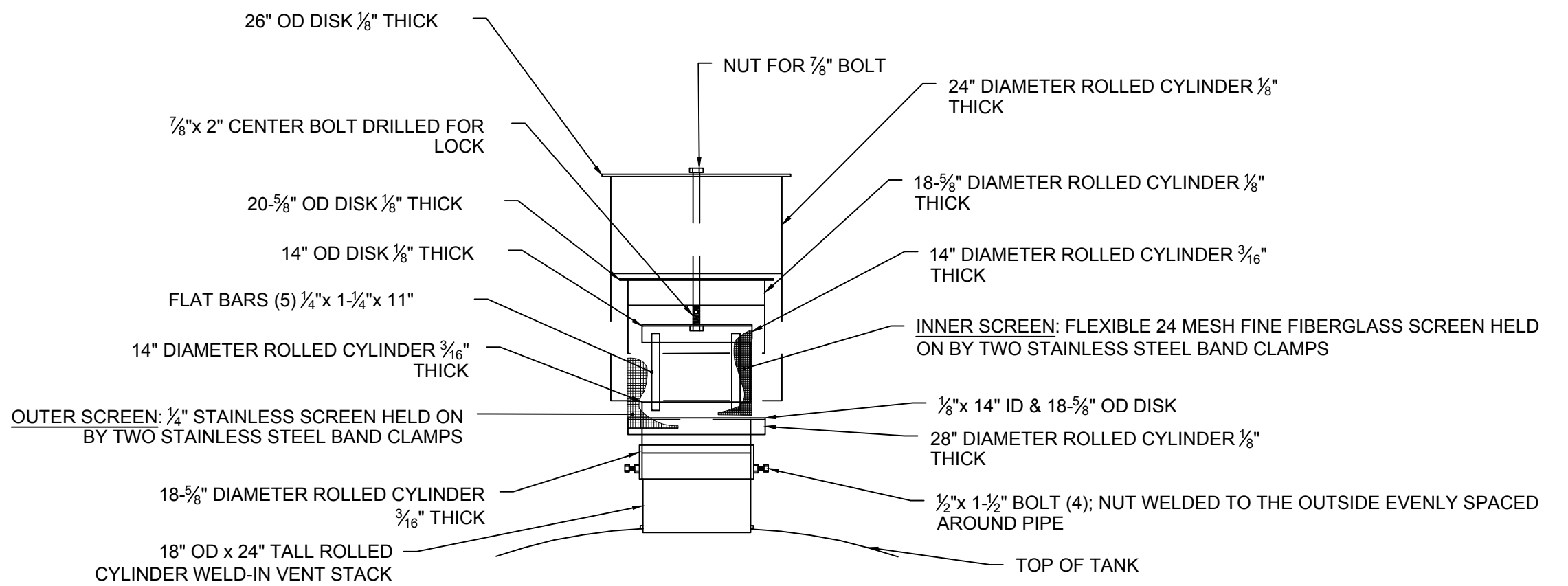
INSTALL EPDM GASKET ON ROOF HATCH

ROOF HATCH GASKET
NOT TO SCALE



NOTE: CONCRETE COMPRESSIVE STRENGTH 4,000 PSI @ 28 DAYS.

SPLASH PAD
NOT TO SCALE



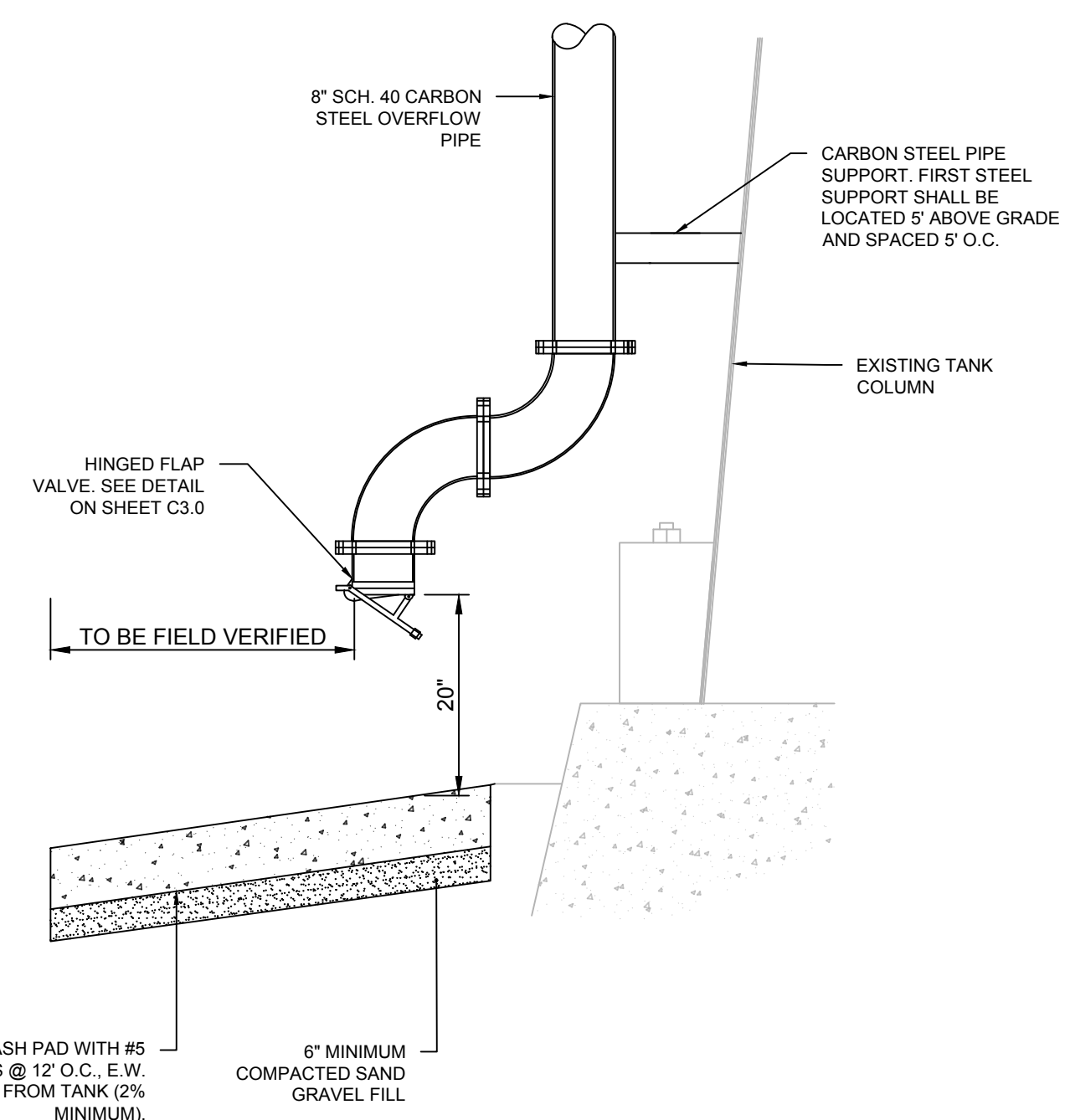
NOTE: WELD IN VENT STACK SHALL BE APPROPRIATELY SIZED TANK. REFER TO SPECIFICATION SECTION 11200 (2.2) (A).

INSECT AND FROST PROOF VENT
NOT TO SCALE

REPLACE SIX (6) SACRIFICIAL ANODES IN TANK INTERIOR. REFER TO APPENDIX B OF SPECIFICATIONS



SACRIFICIAL ANODES
NOT TO SCALE



TANK OVERFLOW DETAIL
NOT TO SCALE

**PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES**

TABLE OF CONTENTS

DIVISION 0 PROCUREMENT AND CONTRACTING REQUIREMENTS (Not Included)

Issued by the Owner and Construction Manager (CM)

DIVISION 1 GENERAL REQUIREMENTS (Not Included)

01010	General Description of Work
01015	Contractor's Use of the Premises
01019	Contract Considerations
01045	Cutting, Coring, and Patching
01200	Meetings
01300	Submittals
01311	Construction Scheduling
01400	Quality Control
01500	Temporary Controls
01511	Construction Facilities and Temporary Services
01600	Material and Equipment
01700	Contract Closeout

DIVISION 2 SITE WORK

02200	Earthwork
02211	Rock Removal
02370	Stormwater Pollution Prevention
02510	Leakage Detection for Water Storage Tanks
02511	Disinfection of Water Utility Storage Tanks
02616	Ductile Iron Pipe and Fittings
02640	Valves, Tapping Sleeves, and Appurtenances
02704	Pipeline Pressure, Leakage, and Disinfection

DIVISION 3 CONCRETE

03930	Concrete Rehabilitation
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DIVISION 5 METALS

05120	Structural Steel Framing
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DIVISION 7 THERMAL AND MOISTURE PROTECTION

07920	Fluid Applied Waterproofing
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DIVISION 9 FINISHES

09880	Protective Coatings (Tank Foundations)
09970	Steel Water Storage Tank Painting

**PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES**

TABLE OF CONTENTS (CONTINUED)

DIVISION 11 EQUIPMENT

11200 Water Storage Tank Appurtenances

APPENDIX A Providence Water Service Water Tank Inspection Report

APPENDIX B Cathodic Protection System

DIVISION 0 (Not Included)

PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 1 (Not Included)

GENERAL REQUIREMENTS

DIVISION 2

SITE CONSTRUCTION

**PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES**

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The work under this section includes providing approved earth borrow, sand, bank run gravel, and gravel bedding, when directed for backfills and refills of excavations; excavation and disposal at approved locations of pavements, surplus and unsuitable materials; installation of underground water main piping; protection of new work; compaction of trench bottom, backfills and subgrades; excavation and backfilling of all other appurtenant work as required or as directed.
- B. This work also includes the furnishing of all labor, equipment and materials, and performing all operations in connection with excavating rock/ledge less than 1 c.y. in volume.
- C. The work also includes excavation and backfill relating to demolition work.

1.02 REFERENCES

- A. Within this section, the State of Rhode Island Department of Transportation "Standard Specifications for Road and Bridge Construction", latest edition, shall be referred to as the State Standards.
- B. American Society for Testing and Materials (ASTM) publications:
 - C136-76 Sieve or Screen Analysis of Fine and Coarse Aggregates
 - D422-63 Particle Size Analysis of Soils
(R 1972)
 - D1140-54 Amount of Material in Soils Finer than No. 200 (74 micrometer)
(R 1971) sieve
 - D1556-82 Density of Soil in Place by the Sand Cone Method
 - D1557-78 Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using
10-lb (4.54 kg) Rammer and 18-in (457mm) Drop
 - D2167-66 Density of Soil in Place by the Rubber Balloon Method
(R1977)
 - D2419-74 Test for Sand Equivalent Value of Soils and Fine Aggregates
(1979)
 - D2487-83 Classification of Soils for Engineering Purposes
 - D2922-81 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow
Depth)

**PROVIDENCE WATER SUPPLY BOARD
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D3017-78 Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods
(Shallow Depth)

1.03 RELATED WORK SPECIFIED ELSEWHERE

Section 02211 – Rock Removal

1.04 LAWS AND REGULATIONS

- A. All work under this Contract shall be accomplished in accordance with regulations of local, county, and State and Federal agencies, and national or utility company standards as they apply.

1.05 SUBSURFACE DATA

- A. Test pits have been performed and the information is available to the Bidders. Upon notification to the Owner, the Bidders will be allowed the right to make any subsurface explorations they deem necessary to satisfy themselves of the existing ground conditions. Any subsurface investigation made by the Bidder shall be at their expense.

1.06 QUALITY ASSURANCE

- A. Qualification of Workmen

Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of work described for this section, and who shall be present at all times during progress of the work of this section, and who shall direct all work performed under this section.

1.07 JOB CONDITIONS

- A. All excavated earth materials approved by the Owner or the Engineer as suitable for reuse shall be used for backfilling excavations and for rough grading as necessary for the completion of the contract work. All surplus or unsuitable materials, rock from rock excavation, and boulders and pavement materials, shall be removed and legally disposed of off-site by the Contractor at no additional expense to the Owner.

- B. Unsuitable Materials:

1. Unsuitable materials are herein defined as organic material, peat, organic silt or combinations thereof; and any existing materials of such gradation that more than 40% of its total weight passes the No. 200 sieve in a standard gradation analysis (ASTM D422). All materials of whatever description, which are too loose or saturated for use as backfill to provide satisfactory bearing, shall also be considered as unsuitable. Tests required to evaluate such conditions shall be made at the Contractor's expense. If unsuitable material is encountered at the depths indicated on the drawings for bottom limit of excavation, the Contractor shall immediately notify the Owner or the Engineer and shall not proceed further until instructions are given.
2. The Contractor shall satisfactorily excavate and remove all unsuitable material to lines, grades and limits indicated on the drawings or as directed in writing by the Owner or the Engineer, and shall legally dispose of such material off-site. All resulting below

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grade excavations shall be refilled with compacted common earth borrow.

- C. Disposition of Existing Utilities:
1. Call Dig Safe seventy-two (72) hours before commencing with any excavation, in order that all pertinent utility companies become informed of such work.
 2. If active utilities existing on the site are encountered they shall be carefully protected from damage. When an active utility line is exposed during construction, the Contractor shall document its location and elevation and notify in writing both the Engineer and the utility Owner notified in writing.
 3. Active utility lines damaged in the course of construction operations shall be repaired or replaced at no additional cost to the Owner.

1.8 SUBMITTALS

- A. Certified Laboratory Test Reports: Before delivery of materials, five (5) certified copies of the reports of all tests required herein, under materials and in referenced publications, shall be submitted to the Owner. These reports shall be submitted a minimum of ten (10) working days prior to the intended use of the materials on-site. The testing shall have been performed in an independent laboratory retained by the Contractor and approved by the Owner or the Engineer. Additional testing shall be submitted when the source of materials is changed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Common borrow shall be a well-graded granular material of which at least 80 percent by weight shall be retained on the No. 200 sieve. It shall be free from peat, organic matter and debris, and shall not contain any stones or clay lumps in excess of 8 inches in their greatest dimensions. The Contractor shall submit a sample of the material he proposes to use as borrow backfill, together with results from an approved laboratory showing grain size analysis and proctor density relationships for those soils. Any materials of whatever description, are too uniformly graded or saturated to be readily compactable, shall be not utilized for earth borrow.
- B. Structural backfill shall be composed of hard, durable stone and coarse to fine sand, free of peat, vegetable or organic matter, clay lumps and other debris. The gravel refill shall be readily compactable and shall not contain any stones that are in excess of two-thirds of the depth of the layer to be compacted. Structural backfill shall conform to the following gradation requirements:

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U.S. Standard Sieve Size	Percent Passing by Weight
1"	55 – 100
No. 4	20 – 95
No. 40	0 – 50
No. 200	0 – 10

- C. Sand Gravel Fill placed directly under structure based slabs and foundations to indicated thicknesses be imported material forming to Item M.01.02.1 of the State Standrds, modified such that the maximum particle size does not exceed 3 inches.
- D. Pipe bedding shall conform to the requirements for State Standard "Gravel Borrow" with the exception that 100 percent shall pass the 1-1/2 inch mesh sieve or shall be approved 1-inch commercial grade crushed stone or gravel. Filter stone shall conform to all requirements of the State Standards for filter stone. Filter stone shall conform to the following gradation limits:

U.S. Standard Sieve Size	Percent Passing by Weight
1"	100
3/4"	75 – 85
1/2"	10 – 40
3/8"	0 – 20
No. 4	0 – 5

- D. Crushed stone for pipe bedding shall consist of clean, hard, durable fragments of crushed rock and shall be free from clay, organic matter, or other objectionable material. Crushed stone shall conform to the following gradation limits:

U.S. Standard Sieve Size	Percent Passing by Weight
1"	100
3/4"	90 - 100
1/2"	20 – 50
3/8"	0 – 20
No. 4	0 – 5

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- E. Sand shall consist of clean, hard, durable particles not frozen, and conform to the following gradation requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
3/8"	100
No. 4	80 – 100
No. 10	30 – 50
No. 40	5 – 25
No. 100	0 – 5

- F. Except as otherwise specified, all fills, refills, and backfills within the project area, and for utilities and appurtenances, shall be made with gravel borrow or structural fill as hereinafter specified.

Gravel borrow sub-base for gravel roadways, utilities and pipe backfill, shall be composed of hard, durable stone and coarse to fine sand, not frozen and free from loam and undesirable organic matter, containing no stone having any dimension greater than two-thirds of the depth of layer to be compacted. Gravel borrow or bank-run gravel shall conform to the following gradation requirements:

U.S. Standard Sieve Size	Percent Passing by Weight
1"	55 – 100
No. 4	20 – 95
No. 40	0 – 50
No. 200	0 – 10

- G. Initial backfill over pipes shall consist of a well-graded granular material of up to 1 inch in size. All material is to be devoid of stones (greater than 1 in.), sharp stones and crushed rock (larger than ¾ in.), lumps or frozen ground, and clayey materials that can be sensitive to water. Initial backfill material is to be placed to a minimum depth of 12 inches over the top of the pipe.
- H. Final backfill over pipes shall be of good quality and be free of cinders, frozen materials, ashes, refuse, boulders, rocks, or organic material. Excavated native granular material free from perishable and objectionable objects and containing no stones larger than 6 inches in diameter shall be used for backfilling the trench as required.

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I. Gravel for under structure base slabs shall conform to the following gradation:

U.S. Standard Sieve Size	Percent Passing by Weight
3/4"	100
3/8"	50 – 85
No. 4	25 – 75
No. 10	5 – 35
No. 40	0 – 10
No. 100	0 – 5

- J. All refills and fills not supporting or influencing structures, pavement or utilities, shall be made with approved granular material containing sound stone, gravel and sand, free of frozen materials, silt, clay, vegetation, roots, peat, muck or other unsuitable matter.
- K. The use of on-site materials for fills, refills or backfills within the building area will not be permitted unless representative samples have been tested and material meets the above gradation requirements. Additional material required for structure fill shall be provided from off-site sources and shall meet the above gradation requirements.
- L. Cost for sampling, transporting and making all laboratory tests required to obtain characteristics of materials proposed to be used for fills, refills, backfills, including gradation tests and determination of moisture density relationships, will be borne by the Contractor.

PART 3 EXECUTION

3.01 GENERAL

- A. All topsoil and unsuitable or excess materials shall be stripped to their entire depths from areas of new construction or regrading. Materials suitable for reuse shall be stored in approved locations that will not interfere with construction operations. Topsoil shall be stripped and stored before any underlying excavating is begun. Stripped topsoil to be reused shall be free from clay, large stones and debris. All unsuitable materials shall be excavated and legally disposed of off-site by the Contractor.
- B. Earth excavation shall include the excavation, removal and satisfactory disposal of all materials of whatever nature encountered from within the limits indicated or specified or as directed by the Engineer or Owner in writing. It shall include, but not be limited to, earth materials such as peats, organic or inorganic silts, clay, sand and gravel, cobbles and boulders less than 1 cubic yard in volume, soft or disintegrated rock which, in the opinion of the Owner or the Engineer, can be removed without blasting or drilling, pavement, and all obstructions not specifically included in another section.
- C. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace, if required, to ensure the safety of workers and the general public. Dewater as needed for construction. Barricade all open excavations when not actively working in

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them.

- D. All excavation operations shall be accomplished to prevent the undermining or disturbance of existing pipelines, utilities and structures, of any completed construction.
- E. All excavations shall be backfilled as specified.

3.02 EXCAVATION FOR STRUCTURES

- A. Excavation under slabs shall be to the exact elevations required except as otherwise indicated on the drawings.
- B. Additional Excavation. When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.
 - 1. If the "assumed" bearing materials, as shown on the drawings and specifications, are not encountered at the subgrade elevations indicated, carry excavations deeper and replace excavated material as directed by the Engineer.
 - 2. Removal of unsuitable material and its replacement as directed will be paid on the basis of contract conditions relative to changes in work.
- C. Excavation for Structures - Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings to permit placing and removal of concrete formwork, other construction and for inspection.
 - 1. In excavating for footings, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
- D. Frost Protection:
 - 1. Make no excavations to full depth indicated when freezing temperature may be expected. Protect the bottom so excavated areas remain free from frost if progress is delayed. Protect the subgrade of in-place footings from frost. Should protection fail, remove frozen materials and replace with concrete or gravel fill as directed, at no cost to the Owner.

3.03 EXCAVATION FOR UTILITIES

- A. Excavation shall be made to the alignment, invert and finish grades shown on the drawings, or as modified by the Owner or the Engineer. Excavations shall be accurately graded to allow satisfactory construction of the contract work.
- B. The bottoms of excavations shall be thoroughly compacted and in approved condition prior to placing gravel bedding. Gravel bedding shall be placed in layers not exceeding 6 inches in loose depth and each layer shall be compacted by at least two (2) passes of an approved plate-type vibratory compactor. The moisture content of the gravel shall be adjusted by moistening or drying so that proper compaction will be obtained. Where crushed stone bedding is used for pipe bedding, the Owner or the Engineer may waive the compaction requirement.
- C. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and

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compacted, and after gravel bedding, if required, has been placed and compacted. The bottom quadrant of each pipe barrel shall have complete and uniform bearing for the full length of each pipe. The trench bottom shall again be thoroughly compacted just prior to final shaping for bedding and installation of pipe.

- D. Excavation operations adjacent to and below existing structures and utilities shall be done manually and in a manner to prevent disturbance of, or damage to, the existing structures and utilities.
- E. The Contractor shall be responsible for keeping all excavated and construction material a safe distance back from the edge of excavations to avoid overloading the sides of excavations and to prevent slides or cave-ins.
- F. If an excavation is made deeper or wider than that shown on the drawings, there will be no extra payment for such unauthorized excavation, unless directed in writing by the Owner or the Engineer. Backfill of all unauthorized excavations shall be made by the Contractor with either selected materials from excavations or from borrow, as directed by the Owner or the Engineer, and at no expense to the Owner.
- G. If a pipe is to be placed in fill, or the top of the pipe is within 2 feet of existing ground surface, the fill shall first be placed as specified herein to a height of not less than 2 feet over the top of the pipe and for a width of 5 feet beyond each side of the pipeline. Following placement of such fill, excavation and backfill shall proceed as specified herein.
- H. Where the Contractor elects to use shoring installed as the excavation progresses, to maintain or otherwise protect the sides of the excavation from cave-ins or loss of ground, shoring shall be adequately braced to prevent cave-ins or loss of ground, and portions of the shoring or bracing shall be left in place as directed by the Engineer to maintain stability as backfilling progresses.
- I. No excessive trench widths will be allowed to avoid the use of sheeting or shoring and bracing. The trench width for unbraced excavations at, and below, a level 1-foot above the top of the pipe, shall not exceed the maximum trench width indicated on the drawings for the size pipe being installed.
- J. Where existing subsurface utilities, structures or other facilities adjacent to or crossing through the excavation require temporary support or protection, such temporary support or protection shall be satisfactorily provided by the Contractor at no additional expense to the owner. All necessary measures shall be taken by the Contractor to prevent lateral movement or settlement of existing facilities or of work in progress.
- K. Grading shall be done as necessary to prevent surface water from flowing into excavations and, any water accumulating therein shall be removed by pumping or other approved method. The pipelines shall not, at any time, be used for trench drainage.
- L. Excavations shall be adequately sheeted, shored and braced, as required, to permit proper excavation of the work and to protect all slopes and earth banks. Sheeting shall be installed as required to prevent cave-ins or settlement and to protect workmen, adjacent structures and utilities. Shoring and sheeting may be removed as the backfilling progresses, but only when banks are safe against caving. The Engineer may direct that sheeting, shoring and bracing be left in place at any time during the progress of the work, and direct that timber be used for

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sheeting and bracing and authorized to be left in place and cut off at a specified elevation. In removing sheeting or bracing, care shall be taken to prevent voids. Voids, if formed, shall immediately be filled with sand. The installation of sheeting, shoring and bracing shall comply with the safety precautions as outlined in the Associated General Contractors of America, Manual of Accident Prevention in Construction, and all local, county, state and federal regulations. Dewatering shall be performed, as required, for all excavations below groundwater level.

3.04 ROCK EXCAVATION (over 1 c.y.)

- A. All rock encountered within the limits of excavation shall be removed as may be required by the Owner or the Engineer to complete the work of this contract as shown on the drawings and as specified herein. No blasting will be permitted. Excavate for and remove rock by mechanical means.
- B. Rock excavation shall include the excavation, removal and disposal of all boulders, 1 cubic yard or more in volume, and shall be in accordance with Section 02211, Rock Removal.
- C. No separate or additional compensation shall be allowed for over breakage in rock excavation, nor for excavations in rock carried below the depths or beyond the lines indicated and/or specified, unless such additional excavation is specifically directed by the Engineer.
- D. Where rock is encountered, it will be measured in cubic yards in its original position, prior to excavation, computed to the payment lines indicated or directed by the Owner or the Engineer.
- E. When rock is encountered, the Contractor shall then notify the Engineer that the rock surface is ready for measurement. If the Contractor fails to give such notice, the Engineer will assume that the measurements taken at the time he first sees the material in question will give the true quantity of excavation.

3.05 DEWATERING

- A. Excavations may, to some extent, be below existing groundwater levels, causing the site to be subject to surface water and groundwater flow during the course of construction.
- B. The Contractor shall control and pitch the grading to prevent water from running into the excavated areas of the structures or to prevent damage to other structures or work already accomplished.
- C. The Contractor shall furnish all pumping and other dewatering equipment to keep excavated areas dry during construction. The groundwater shall be pumped adequately so that it is maintained a minimum of two (2) feet below the bottom of the excavation at all times. Filters shall be used on the dewatering devices to prevent the removal of fines from the soil. Water shall not be directed onto adjacent property.
- D. Operation and Performance: Operate the dewatering system continuously, 24 hours per day, 7 days per week, until such time as construction work below existing water levels is complete, unless directed otherwise by the Engineer or Owner. Measure and record the performance of the dewatering system at the same time each day by use of suitable observation wells or piezometers installed in conjunction with the dewatering system. After placement of initial

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slabs and backfill, the water level may be allowed to rise, but at no time is it to be higher than one (1) foot below the prevailing level of excavation or backfill.

3.06 BACKFILLING OF UTILITY TRENCHES

- A. Unless directed otherwise by the Engineer, excavations shall not be backfilled until all work has been satisfactorily performed, and not until the work as installed conforms to all requirements specified in these sections. Each layer of backfill material shall be compacted in such a manner as to permit the proper and desired compaction of the filled excavation.
- B. All excavations shall be backfilled as soon as practicable with approved excavated material. If suitable material as approved by the Engineer is not available from the excavations in the quantities required for proper backfilling of excavations, the Contractor shall provide approved bank-run gravel or earth borrow for backfills from off-site sources, as required.
- C. Placement of gravel bedding shall be done in accordance with the following procedure:
 - 1. The bottoms of excavations shall be thoroughly compacted and in approved conditions prior to placing gravel bedding. Gravel bedding shall be placed in layers not exceeding 4 inches in loose depth and each layer shall be compacted by at least two (2) passes of an approved plate-type vibratory compactor. The moisture content of the gravel bedding shall be adjusted by moistening or drying so that proper compaction will be obtained.
 - 2. Gravel bedding shall be graded, compacted and shaped so that the full length of pipe barrel has complete and uniform bearing for the bottom quadrant of each pipe. Bell holes and depressions for joints shall be dug after the gravel bedding has been graded and compacted, and shall be the proper clearance for joining of pipes.
 - 3. The Contractor shall exercise care in all operations to prevent disturbing joints, displacement of or damage to the pipes already installed. As the work progresses, the pipelines will be checked by the Engineer to determine whether any disturbance, displacement or damage has occurred. If inspection shows poor alignment, displaced or damaged pipe, disturbed joints or other defects, the Engineer shall require that all designated defects be remedied in a satisfactory manner by the Contractor at no additional expense to the Owner.
- D. All other backfill placed in trenches below a level 12 inches above the top of pipe shall consist of selected backfill placed in layers not exceeding 4 inches in loose depths. Selected backfill shall be compatible materials as approved by the Engineer, not frozen, and free of clods or earth, stones larger than 2 inches in diameter, or unsuitable materials. The selected backfill shall be deposited uniformly on both sides of the pipe and shall be thoroughly compacted by tamping under and on each side of the pipe to provide uniform support around the pipe, free from voids.
- E. The balance of backfill in trenches shall be compatible materials as approved by the Engineer, not frozen, and without any stones larger than 8 inches in their greatest dimension. All trench backfilling shall be carefully placed to avoid disturbance of new work and of existing utilities or structures. The moisture content of backfill shall be such that proper compaction will be obtained. Trench backfill shall be compacted to the minimum densities specified hereinafter. Unless otherwise approved by the Engineer in writing, the trench backfill shall be spread in layers not exceeding 12 inches in loose depth, and each layer shall be compacted by at least four (4) passes of an approved plate-type vibratory compactor. It is the responsibility of the

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Contractor to assure that the minimum specified densities are obtained. Puddling or jetting of backfill with water will not be permitted.

- F. During filling and backfilling operations, pipelines will be checked by the Engineer to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displaced pipe or any other defects, the defects designated by the Engineer shall be remedied in a satisfactory manner by the Contractor at no additional expense to the Owner.
- G. Any backfill that fails to comply with the minimum density requirements specified hereinafter shall be re-compacted or, if necessary, removed to the limits directed by the Engineer. The trench shall then be refilled with approved materials and by approved methods. The backfill shall be compacted by approved methods to the minimum requirements specified hereinafter. The Contractor at no additional expense to the Owner shall perform all of this work.
- H. After backfilling trenches the Contractor shall maintain the filled surfaces in good condition, with a smooth surface level with adjacent undisturbed surfaces. Any subsequent settling shall be immediately repaired by the Contractor in a manner satisfactory to the Owner and the Engineer, and such maintenance shall be provided by the Contractor for the remainder of this contract at no additional expense to the Owner.
- I. The finished surfaces of filled excavations shall be compacted and reasonably smooth, and free from surface irregularities. Subgrade upon which either topsoil is to be placed, or pavements are to be constructed, shall be maintained in a satisfactory condition until the finish courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.
- J. Prior to placing base course material in areas to be paved, all soft or unsuitable material shall be removed and replaced with suitable material from excavation or earth borrow, as approved by the Engineer. All low sections, holes or depressions shall be brought to the required grade with material approved by the Engineer. The entire surface shall be shaped to line, grade and cross-section and thoroughly compacted.

3.07 COMPACTION

- A. Fills placed under pavements such as roadways, parking lot subbase and utilities, shall be compacted to not less than 95 percent of the ASTM maximum dry density.
- B. Backfill material shall be placed in lifts no greater than 6 inches and compacted to 95 percent of maximum density under slabs and 95 percent of maximum density under footings. Maximum density will be determined by AASHTO T-180 Method A or D. Density of soil in place will be determined by AASHTO T-191 or by a nuclear moisture density gauge approved by the Engineer. The method of correcting for oversize particles in soil compaction test results shall conform to AASHTO T-224-671.
- C. All disturbed in-situ material shall be compacted to 95 percent of maximum density under slabs and footings. Maximum density will be determined by AASHTO - T-180 Method A or D. Density of soil in place will be determined by AASHTO T-191 or by a nuclear moisture density gauge approved by the Engineer.

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- D. All percentages of compaction specified herein shall be related to the maximum dry density as established by Method D, ASTM D1557-70, and verified in the field by ASTM D1556-68, D2167-66 or an approved nuclear density testing device. Prior to placing, at least one (1) laboratory test shall be made on a representative sample of each of the fill and backfill materials proposed to be furnished for the earthwork operations to determine gradation and moisture density characteristics. The Contractor shall arrange and provide the services of a geotechnical engineer, approved by the Engineer, to perform laboratory tests on samples of fill and backfill material proposed to be used by the Contractor for earthwork operations, and to perform field density tests.
- E. Field density tests to determine the actual in-place densities being attained will be made at no additional expense to the Owner and in sufficient quantity to determine that the required compaction is being attained, but in no case less than the following frequency:
1. Trench bedding and backfill: One test for each compacted backfill layer in each section of trench. For trenches greater than 50 feet in length, provide one test every 50 feet for each compacted backfill layer.
 2. Under foundation slabs or paved areas: One test per 5,000 square feet but no less than 3 tests per lift.

All retesting necessitated due to failure of the backfill to comply with the minimum percent of compaction shall be performed at no additional expense to the Owner.

- F. Where vibratory compaction equipment is specified herein, or is directed to be used by the Engineer, all such equipment whether plate-type or roller shall be furnished with a vibrating surface at least 24-inches in width and capable of operating at a minimum of 2,000 blows per minute. Equipment not specifically designed as vibrating compaction equipment shall not be permitted for compaction of either existing in-place materials or of fills, refills and backfills. Jackhammers, rubber-tired vehicles and similar equipment not specifically designed and manufactured for the compaction of granular materials will not be approved for use.
- G. Surfaces to be compacted, unless otherwise specified, shall be compacted by not less than six (6) complete passes of the approved vibratory compactors in order to obtain the required percentage of compaction. A complete pass shall consist of the entire coverage of the surface area to be compacted with one trip of the equipment. Each trip of the equipment shall overlap the previous trip by at least one (1) foot.
- H. Dumping, spreading, preparing and compacting of several layers of fill material across the site may be performed simultaneously, providing there is sufficient total area to permit these operations to proceed in a systematic manner.
- I. No rolling equipment shall be used to compact fill, refill or backfill material within four (4) feet of the vertical faces of any concrete walls or utility pipes. Plate vibratory tampers shall be used in these restricted areas and in other areas too confined to satisfactorily use rolling equipment.
- J. It is the intent of these compaction requirements that the minimum in-place dry density of the compacted materials resulting from the specified minimum number of passes of the compaction equipment will be equal to or greater than the minimum percentages specified herein. Additional passes of the specified equipment shall be required if the minimum in-

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place dry densities, as specified, are not obtained with the minimum passes indicated.

3.08 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

- A. Excavation and backfill operations shall be done in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work. Backfill shall be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work.
- B. Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional expense to the Owner.
- C. Any damage due to excavation, backfilling or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Owner and the Engineer, shall be borne by the Contractor at no additional expense to the Owner.

3.09 TEST PITS

- A. Test pits shall be dug by the Contractor at the locations selected, and to the dimensions directed by the Engineer, for compaction testing or to establish locations of existing pipelines or any other buried item for which the exact location is to be determined. The excavation, protection and backfilling of test pits shall be in accordance with the provisions of this section. Test pits shall be backfilled with approved materials and compacted to the densities specified.

END OF SECTION

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SECTION 02211

ROCK REMOVAL

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Removal and disposal of identified rock, ledge, and boulders previously identified and discovered during excavation for utilities and structures.
- B. Mechanical trench rock removal.

1.02 RELATED WORK

- A. Section 02200 – Earthwork

1.03 SHOP DRAWINGS

- A. Submit shop drawings under provisions of Section 01300, Submittals.

1.04 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:
 - 1. 24 inches outside of concrete forms other than at footings.
 - 2. 12 inches outside of concrete forms at footings.
 - 3. 12 inches outside of minimum required dimensions of concrete cast against grade.
 - 4. 6 inches beneath bottom of concrete slabs on grade.
 - 5. 12 inches beneath water mains.
- B. Unit prices for rock excavation include replacement with approved materials.
- C. Rock and Boulders less than one (1) cubic yard in size that require removal and replacement with common borrow and/or imported material shall not be considered for payment. The cost for removal and replacement of rock and boulders less than one (1) cubic yard in size is considered incidental to the work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1 c.y. for bulk excavation, footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping or blasting:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,700 lbf; measured according to SAE J-1179.

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2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbf breakout force; measured according to SAE J-732.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify site conditions and note irregularities affecting work of this section.
- B. Beginning work of this section means acceptance of existing conditions.

3.02 ROCK AND BOULDER REMOVAL

- A. Where rock or boulders are exposed on the sides, or in the bottom, of excavations, they shall be wholly or partially removed as specified or directed. Rock and boulders shall be removed to not less than the trench width payment lines indicated, to not less than two (2) feet outside structure walls, and to not less than twelve (12) inches below the underside of pipes or six (6) inches below the underside structure foundation slabs.
- B. Depressions resulting from the removal of boulders shall be refilled with approved compacted gravel bedding, earth borrow or other excavated material as directed. Unauthorized excavations in rock or excavations made beyond the indicated or directed limits, shall be refilled with approved compacted gravel bedding or earth borrow as directed by, and at no expense to, the Owner.

3.03 ROCK REMOVAL – MECHANICAL METHOD

- A. Excavate for and remove rock by the mechanical method.
- B. Cut away rock at excavation bottom to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings and base slabs.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- E. Remove excavated material from site and stockpile at location determined by Owner.
- F. Correct unauthorized rock removal in accordance with backfilling and compaction requirements of Section 02200.

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3.05 FIELD QUALITY CONTROL

- A. Provide for visual inspection of bearing surfaces and cavities formed by removed rock.
- B. The Contractor is to notify the Engineer prior to construction of any structures within the rock excavation for approval.

END OF SECTION

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SECTION 02270

STORMWATER POLLUTION PREVENTION

PART 1 GENERAL

1.1 WORK INCLUDED

- A. The work included for erosion control shall include but not necessarily be limited to:
1. Furnishing and installation of straw bales, silt fence, erosion netting, fiber rolls (straw wattles), compost filter socks, swales, soil berms, mulches, grasses, channels, crushed stone, riprap, grading to control runoff, and all other devices required to control erosion from the limits of the contract areas onto adjacent downgradient areas.
 2. Continual maintenance of all installed devices to control erosion.
 3. Removal and cleanup.

1.2 RELATED WORK

- A. Section 02200 – Earthwork

1.3 APPLICABLE REGULATIONS

- A. In order to prevent erosion and sedimentation from construction activities related to the performance of this project, the Contractor and his subcontractors shall comply with permits issued for the project, all applicable Federal, State and local laws and regulations concerning erosion and sediment control, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

1.4 DESIGN CRITERIA

- A. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
- B. Stabilize disturbed earth surfaces in the shortest practical time and employ any and all such temporary erosion control devices as may be necessary until such time as adequate soil stabilization has been achieved or permanent erosion control devices are operational.
- C. The erosion control devices specified herein represent the minimum required work for erosion control. The Contractor shall add to these minimum devices any and all measures to effectively prevent migration of sediment from the limits of the work area.
- D. Within this section, the Rhode Island Soil Erosion and Sediment Control Handbook prepared by the U.S. Department of Agriculture Soil Conservation Service and the Rhode Island Department of Environmental Management shall be the guideline of analysis and the standard source for control measures.

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1.5 SUBMITTALS

A. Implementation Plan

Prior to commencement of the work, the Contractor shall:

1. Meet with the Engineer to develop mutual understandings relative to compliance with the provisions of this Section and administration of the erosion and sediment control program.
2. Should the Contractor desire to change or modify the specified erosion controls then they shall submit in writing plans to the Engineer for implementing erosion and sediment control including, but not limited to, placement of straw bales, silt fence, containment berms, temporary channels, and settling ponds, as well as a description of all construction techniques intended to minimize erosion and sedimentation, and a program for maintenance of these facilities throughout the performance of construction activities.
3. The Contractor, should he desire to modify the specified plan, shall submit to the Owner and Engineer his detailed erosion and sedimentation plan for approval at least two (2) weeks prior to initiation of work.

PART 2 PRODUCTS

2.1 STRAW BALES

- A. Bales shall be made of straw or hay with forty pounds (40 lbs) minimum weight and one hundred and twenty pounds (120 lbs) maximum weight. They should be either wire bound or string tied. Wood stakes shall be a minimum of two inches by two inches (2" x 2") nominal size by a minimum of three feet (3') long. As an alternate, one inch (1") diameter steel rods or steel reinforcing bars may be used.

2.2 SILT FENCE

- A. Silt fences or sedimentation barriers shall consist of wood posts with industrial support netting and sediment control filter fabric attached. It shall be placed as shown on the Contract Drawings. The cost of this work shall include the periodic maintenance of these materials and the ultimate removal upon completion of the project.
- B. The filter fabric material shall be Type #3401 as manufactured by E.I. Dupont de Nemours & Co., Mirafi #100 as manufactured by Celanese Fibers Marketing Co. Inc., Bidim C-28 or C-34 manufactured by Monsanto Co. or approved equivalent. The posts shall be at least four and one-half feet (4½') long and control fabric shall be at least three feet (3') wide.

2.3 EROSION NETTING

- A. Erosion netting of erosion control blanket shall be a machine-produced one hundred percent (100%) biodegradable mat with an agricultural straw fiber matrix with a typical functional longevity of approximately twelve (12) months. The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The

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blanket shall be covered on the top and bottom sides with one hundred percent (100%) biodegradable natural woven fiber netting.

- B. The straw erosion control blanket shall be S150BN as manufactured by North American Green or approved equivalent.

2.4 FIBER ROLLS (STRAW WATTLES)

- A. Fiber rolls shall consist of wood excelsior, rice or wheat straw, or coconut fibers that are rolled or bound into a tight tubular roll. Fiber rolls shall be either prefabricated rolls or rolled tubes of erosion netting.

2.5 COMPOST FILTER SOCKS

- A. Compost filter socks shall consist of a biodegradable mesh tube filled with sanitized, mature compost with no identifiable feedstock constituents or offensive odors. Compost used in filter socks shall meet all local, State, and Federal quality requirements.
- B. The compost filter socks shall be Filtrexx Siltsoxx, Rexius Ecoberm, or approved equivalent.

PART 3 EXECUTION

3.1 GENERAL EROSION CONTROL REQUIREMENTS

- A. All materials and installation shall be in accordance with the Contract Drawings.
- B. The Owner and the Engineer have the authority to control the surface area of each material exposed by construction operations and to direct the Contractor to immediately provide permanent or temporary erosion control measures to prevent contamination of adjacent streams, watercourses, lakes, ponds, or other areas of water impoundment. Every effort shall be made by the Contractor to prevent erosion on the site and abutting properties.
- C. All slopes shall be stabilized by mulching, seeding, or otherwise protected as the work progresses to comply with the intent of this specification. All damaged slopes shall be repaired as soon as possible. The Owner and Engineer shall limit the surface area of earth material exposed if the Contractor fails to sufficiently protect the slopes to prevent pollution.
- D. The Contractor shall at all times have on hand the necessary materials and equipment to provide for early slope stabilization and corrective measures to damaged slopes.
- E. The erosion control features installed by the Contractor shall be maintained by the Contractor, and he shall remove such installations upon completion of the Work or if ordered by the Owner or the Engineer.
- F. The Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. The Contractor shall cease any of his operations, which will

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increase pollution during rainstorms.

- G. The Contractor shall place additional erosion and sedimentation controls as required by laws and regulations.

3.2 STRAW BALE INSTALLATION

- A. Bales shall be set lengthwise on the contour for sheet flow applications. They shall be held in place by two wooden stakes in each bale as detailed on the Contract Drawings. Bales shall be maintained or replaced until they are no longer necessary for the purpose intended or are ordered removed by the Owner or the Engineer.
- B. Bales shall be set with bindings parallel to grade and entrenched to a minimum depth of four inches (4"). Stakes shall be driven a minimum of twelve inches (12") into the ground and cut off flush with the top of the bale.
- C. After the bale lines are staked, the end joints shall be chinked with loose straw to close any gaps. Excavated soil shall then be backfilled against the uphill side of the barrier to a depth of four inches (4") above the downhill grade.
- D. Following compaction of the backfill, loose straw shall be scattered over the surface directly behind the barrier.
- E. Straw bale checks should be placed in diversions generally at fifty-foot (50') intervals and in accordance with the RIDOT Standard Details. Sediment shall be removed from behind the checks when it has accumulated to one-half ($\frac{1}{2}$) the original height of the dam measured at the low point.

3.3 SILT FENCE INSTALLATION

- A. Silt fence shall be installed utilizing posts four and one-half feet (4½') long minimum staked at least eight feet (8') on center. Prior to installation, a six inch by six inch (6" x 6") anchor trench shall be installed at the base of the fence and the final height will be at minimum two feet (2').

3.4 FIBER ROLL (STRAW WATTLE) INSTALLATION

- A. For assembly of fiber rolls in the field, roll length of erosion control blanket into a tube of minimum eight inches (8") in diameter. Bind roll at each end and every four feet (4') along length of roll with jute-type twine. Stake fiber rolls into a two to four inch (2" - 4") trench. Drive stakes at the end of each fiber roll and space four feet (4) maximum on center. Use wood stakes with a nominal classification of three-quarter inch by three-quarter inch ($\frac{3}{4}$ " x $\frac{3}{4}$ ") and a minimum length of two feet (2'). If more than one (1) fiber roll is placed in a row, the rolls shall be overlapped, not abutted.

3.5 COMPOST FILTER SOCK INSTALLATION

- A. Compost filter socks shall be installed and maintained in accordance with the manufacturer's recommendations. Filter socks shall be anchored to the slope with 1" x 1" x 3'-0" (min.) wooden stakes driven through the center of the sock at regular intervals.

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The ends of filter socks shall be directed upslope to prevent stormwater from bypassing the erosion control barrier.

3.6 DIVERSIONS

- A. Diversions for directing surface runoff away from and/or around trenching and other construction operations shall be installed and stabilized in advance of new work. The Contractor shall select the cross-section shape (parabolic, vee-shaped or trapezoidal) such that the equipment he has on-site will be available for as needed maintenance.
- B. The minimum capacity of the diversion shall be sized to accommodate a two-year (2-yr) design storm.
- C. Periodic cleaning shall be done to maintain capacity.

3.7 REMOVAL AND CLEANUP

- A. All temporary erosion control facilities and accumulated sediments shall be removed in a neat and workmanlike manner when all disturbed areas have been satisfactorily stabilized.
- B. All debris removed, sediments and other earth materials shall not leave the project site, but shall be hauled to and stockpiled at the location designated by the Owner or the Engineer. All loading, hauling and stockpiling shall be performed by the contractor at no additional expense.

3.8 DEWATERING DISCHARGES

- A. All pumped discharges and surface water flow from work areas shall be passed through a filter barrier of straw bales before being discharged into gutters, ditches, drainage swales, storm sewer systems, wetlands, natural water bodies, streams or rivers. The method of all such discharges shall be subject to the approval of the Owner or the Engineer. The sizing of sedimentation basins, if required, shall provide for a maximum velocity of one foot per second (1 ft./s).

END OF SECTION

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SECTION 02510

LEAKAGE DETECTION FOR WATER STORAGE TANKS

PART 1 - GENERAL

1.1 SCOPE

- A. This section specifies requirements for the testing of potable water systems. The work covered under this section includes, but is not necessarily limited to:

1. Leakage tests

NOTE: Testing will be performed prior to commencement of any demolition, blasting, surface preparation, and/or coating work, and prior to reconnecting the tank to the plant water system following tank upgrades. No physical connections (temporary or permanent) between new pipe and existing pipe will be allowed during the test without the use of an approved backflow prevention device.

- B. All materials included in this section that are to come into contact with potable water shall be either NSF 61 or NSF 60 approved as applicable.

1.2 REFERENCES

- A. American Water Works Association (AWWA):

1. AWWA C652: Standard for Disinfection of Water Storage Facilities

1.3 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements as specified in Section 01300 – Submittal Procedures
- B. Certified reports for all the required tests shall be provided from an approved qualified independent testing laboratory.
- C. Shop drawing of temporary connection backflow preventer.

1.4 QUALITY CONTROL

- A. Provide in accordance with requirements as specified in Section 01400 – Quality Control.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTER

- A. Backflow prevention devices required to fill the tanks with the existing water system prior to acceptance of pressure test, disinfections, and flushing, shall be of the appropriate size as required and shall be reduced pressure double check type as manufactured by Watts, Febco, Hersey, Zurn Wilkinson, or approved equivalent.

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PART 3 - EXECUTION

3.1 TANK HYDROSTATIC LEAKAGE TESTING

- A. The preliminary leakage test shall be performed following installation of the 8-inch gate valve on the service water main and hydrant as shown on the drawings and prior to any demolition, blasting, surface preparation, and/or coating work. The final leakage test shall be performed prior to reconnecting the tank to the plant water system. The tank shall be filled via a temporary 2-inch tap installed downstream of the new 8-inch gate valve on the service water main connected to the new hydrant with an approved backflow preventer. The contractor shall fill the tank to the maximum working level. The test shall consist of taking a measurement of the initial water height and allowing the water to sit over 24 hours. If at the end of the 24 hours the water level has dropped, then the Contractor shall identify the source of the leak and repair it, accordingly. Any leaks in the shell or bottom shall be repaired by chipping, gouging, or oxygen gouging to remove any defective welds, and rewelded. No repair work shall be done on any joints unless the water in the tank is at least two (2) feet below the joint being repaired. Damp spots will not be permitted at any location on the tank wall. Damp spots are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary.

END OF SECTION

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SECTION 02511

DISINFECTION OF WATER UTILITY STORAGE TANKS

PART 1 - GENERAL

1.1 SCOPE

- A. This section specifies requirements for the testing and disinfection of potable water tanks.

NOTE: Testing will be performed prior to connecting the tank to the existing potable water system. No physical connections (temporary or permanent) between the tank and the system will be allowed during the test without the use of an approved backflow prevention device.

- B. All materials included in this section that are to come into contact with potable water shall be either NSF 61 or NSF 60 approved as applicable.

1.2 REFERENCES

- A. American Water Works Association (AWWA):
1. AWWA B300: Standards for Hypochlorites
 2. AWWA B301: Standard for Liquid Chlorine
 3. AWWA C600: Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 4. AWWA C652: Standard for Disinfection of Water Storage Tanks

1.3 SUBMITTALS

- A. Submittals shall be provided in accordance with the requirements as specified in Section 01300.
- B. Certified reports for all the required test shall be provided from an approved qualified independent testing laboratory.
- C. Shop drawing of temporary connection backflow preventer.
- D. Detail of temporary connection between existing and new water pipelines.

1.4 QUALITY CONTROL

- A. Provide in accordance with requirements as specified in Section 01400.
- B. Sampling for laboratory analysis following disinfection shall be conducted by qualified personnel familiar with sampling procedures and protocols.
- C. Reference Standards: Except as modified or supplemented herein, the testing of the pipeline system shall meet the requirements of the following standard specifications:
1. American Water Works Association (AWWA) C600, Latest Revision – Pressure and Leakage Tests; and C651 – Latest Revision, Disinfection Water Mains.

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2. NSF/ANSI 60: National Sanitation Foundation Standard for Drinking Water Treatment Chemicals
3. NSF/ANSI 61: National Sanitation Foundation Standard for Drinking Water System Components

PART 2 - PRODUCTS

2.1 LIQUID CHLORINE

- A. Liquid chlorine shall conform to AWWA Standard B301, current edition. Liquid chlorine shall be NSF 60 certified for potable water use.

2.2 HYPOCHLORITE

- A. Hypochlorite shall conform to AWWA Standard B300, current edition. Hypochlorite shall be NSF 60 certified for potable water use.

2.3 BACKFLOW PREVENTER

- A. Backflow prevention device for any connection between the existing water system and new water pipes prior to acceptance of pressure test, disinfections and flushing, shall be of the appropriate size as required and shall be double check-reduced pressure type as manufactured by Watts, Febco, Hersey, or approved equivalent.
- B. Backflow prevention device shall be NSF-61 certified.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning and Inspection: The interior of all tank components shall be thoroughly cleaned of all foreign material and inspected for cracks, flaws, or other defects before installation, and shall be kept clean until the work is accepted.

3.2 DISINFECTION AND WATER QUALITY TESTING OF POTABLE WATER TANK

- A. An approved backflow prevention device shall be installed at any connections between the existing water system and new water pipes and utilized prior to acceptance of pressure test, disinfections, and flushing.
- B. The Contractor shall submit a tank disinfection procedure in accordance with AWWA C652 Chlorination Method 1, Method 2 or Method 3 to Providence Water Supply Board and the Engineer for review prior to chlorinating the tank. Please note that the Engineer will have to submit the tank disinfection procedure to HEALTH for review and approval. Disinfection shall meet with the approval of the Engineer, AWWA C652, and the requirements of HEALTH.
- B. The Contractor shall provide all labor, material and facilities required to chlorinate and disinfect the tank.

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- C. Two (2) consecutive sets of acceptable samples taken at least 24 hours apart shall be collected by Providence Water personnel. Each sample shall be analyzed for total coliform and heterotrophic plate count (HPC). Providence Water personnel shall take single samples to be analyzed for volatile organic compounds (VOCs), pH, chlorine, fluoride, and iron. Following collection and analysis of samples, Providence Water personnel shall notify the contractor when the tank can be drained and put in service.
- D. If the tank does not pass the VOC, HPC, or coliform sampling and it is required that the tank be drained and refilled, the Contractor will be billed for the water used at the water rates in place at that time.
- E. After the required retention period, any water discharged from tank and mains shall be dechlorinated per AWWA C651 to meet Rhode Island Department of Environmental Management Water Quality Regulations (250-RICR-150-05-1) instream standard of 0.019 ppm. The Contractor shall be responsible for satisfactory disposal of all flushed water and chlorinated water at no additional expense to the Owner.
- F. The samples shall be collected from a sample tap on the outlet piping from the storage facility or from a sample tap connected directly to the storage facility, or sampling from the top of the tank or hatch may be required. In any case, the operation shall be such to ensure that the sample collected is actually from water that has been in the storage facility. Sample equipment and methods shall follow aseptic techniques for bacteria sampling.
- G. Recommended Additional Samples: During the disinfection operation and the required sampling of water from the storage facility it is recommended that samples be taken from water inflowing to the storage facility to determine if coliforms and VOCs are present in the typical potable water.
- H. The water quality test results shall be submitted to the RI Department of Health Office of Drinking Water Quality on official reporting forms, for review and approval. Subject to satisfactory bacteriological and VOC testing and acceptable aesthetic quality, such water may be served to the distribution system.

END OF SECTION

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SECTION 02616

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE

- A. This section specifies requirements for furnishing and installing ductile iron pipelines complete and in place for water distribution systems.
- B. All materials to come in contact with potable water shall be NSF 60 or 61 certified as appropriate.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. AWWA C104: Standard for Cement Mortar Lining
 - 2. AWWA C110: Standard for Ductile Iron and Gray Iron Fittings for Water
 - 3. AWWA C111: Standard for Rubber Gasket Joints
 - 4. AWWA C150: Standard for the Thickness Design of Ductile Iron Pipe
 - 5. AWWA C151: Standard for Ductile Iron Pipe, Centrifugally Cast
 - 6. AWWA C153: Standard for Ductile Iron Compact Fittings
 - 7. AWWA C600: Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 - 8. AWWA C651: Standard for Disinfecting Water Mains
 - 9. Providence Water – Requirements for Water Mains, Services, and Appurtenances (Latest Edition)

1.03 MARKING

- A. Marking of all pipe shall conform to the requirements of AWWA C151, latest revision, and marking of all fittings shall conform to the requirements of AWWA C153 or C110, latest revision.

1.04 MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall furnish at no additional expense to the Owner, the services of pipe manufacturer's representatives for instruction of the Contractor's personnel who will be installing the pipe. The instruction shall include proper handling, installation, and jointing and other construction areas, and shall be for such lengths of time required to fully familiarize the Contractor's personnel with the proper techniques.

1.05 QUALITY CONTROL

- A. Manufacturers' Recommendations:
 - 1. Using Providence Water's Project Management software, The Contractor shall submit for approval of the manufacturer's recommendations for the storage, protection, handling and installation of the ductile iron pipe, pipe fittings and appurtenances, which shall be strictly adhered to by the Contractor.

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- B. Certificate of Compliance:
 - 1. Each shipment of pipe, pipe fittings, and appurtenances, shall be accompanied by the manufacturer's notarized certificate certifying conformance with all requirements of these specifications.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials to be incorporated into the work shall be new and purchased specifically for this contract.
- B. All hardware shall be Corten as manufactured by Romac Industries.

2.02 DUCTILE IRON PIPE

- A. Buried ductile iron pipe shall be Class 52 or 53, as indicated on the Contract Drawings, and shall conform to AWWA specifications C150 and C151, latest revision. Ductile iron pipe shall have push-on type joints. Push-on type joints shall be used with the exception that mechanical joints shall be used at all fittings and along straight pipe sections where mechanical joint restraint is required. Ductile iron pipe shall be restrained with Field Lok 350 Gaskets as manufactured by US Pipe or approved equivalent, where required by the drawings or as required by the Engineer. All mechanical type joints shall be restrained with MEGALUGS Series 1100. All pipe shall have a double bituminous seal coating on all exterior surfaces.
- B. All buried ductile iron pipe shall be zinc coated in conformance with ISO 8179-1 "Ductile Iron Pipes – External Zinc-based coating - Part 1" Metallic Zinc with Finishing Layer, latest edition.
- D. Interior ductile iron pipe shall be Class 53, with flanged joints, and shall conform to AWWA specifications C150 and C151, latest revision.

2.03 FITTINGS

- A. Fittings shall be ductile iron, mechanical joint, class 350 cement-mortar lined and provided with an asphaltic coating 1 mil +/- thick on the exterior. Buried fittings shall be zinc coated. Fittings and plugs for use with the ductile iron pipe specified shall be ductile iron, with a working pressure rating of not less than 350 psi, class 350 conforming to AWWA C153, for buried ductile iron pipe.
- B. Sleeve couplings and accessories shall be pressure rated to at least equal to that of the pipe. Couplings shall be ductile iron.

2.04 JOINTS

- A. Push-on and mechanical type joints for pipe as specified above shall conform to AWWA C111, latest revision. Gasket material for all jointing requirements shall be styrene butadiene (SBR). All lubricants shall be certified NSF approved for use in potable water systems. All mechanical joint types shall be restrained by the Megalug restraining system.

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2.05 CEMENT MORTAR LINING

- A. The interior of all ductile iron pipe shall be covered with a double cement-mortar continuous lining not less than 1/8" thick for 12" pipe and smaller, and applied in accordance with AWWA/ANSI C104/A21.4, latest revision.

2.06 STORAGE OF MATERIALS

- A. Pipe and related materials shall be stored in locations and in a manner approved by the Owner or the Engineer. The locations and manner of storage shall be as to minimize handling of the materials.
- B. All pipe shall be stored with a plastic covering over each end of the pipe. The purpose of the covering is to prevent deleterious material from entering the pipe during storage. The covering shall be secured in-place with a cord or cable and each pipe opening shall be provided with its own covering.
- C. The Contractor shall, at all times, be solely responsible for the safe storage of all materials.

2.07 TESTING

- A. Manufacturer Testing:
 - 1. Testing of ductile iron pipe shall be done in accordance with AWWA C151, latest revision.
 - 2. Testing of ductile iron fittings shall be done in accordance with AWWA C153 or C110, latest revision.
 - 3. Testing of jointing material shall be done in accordance with AWWA C111, latest revision.
 - 4. Testing of the interior coating shall be done in accordance with AWWA C104, latest revision.
 - 5. Certified test reports shall be submitted by the pipe manufacturer.
 - 6. The Owner and the Engineer shall be notified at least ten (10) days in advance of the date and location of the testing in order to witness the tests.
 - 7. The Contractor shall furnish to the Owner and the Engineer notarized test reports by an independent testing laboratory, which show compliance of all materials furnished to the requirements specified herein. The test reports shall indicate results and methods employed.
- B. Field Testing
 - 1. Field-testing of ductile iron pipe installed for water service shall be performed according to the requirements as specified in Technical Specification 02704, Pipeline Pressure, Leakage, and Disinfection.

2.08 IDENTIFICATION

- A. Provide 6" blue metalized detection tape with white printing reading "CAUTION WATER LINE BURIED BELOW" for water pipes, as manufactured by Seton.

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2.09 BURIED PIPE INSULATION

- A. Insulation to be installed as directed by the engineer.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

- A. General:
1. All pipe shall be installed in accordance with AWWA C151, latest revision and manufacturer requirements.
 2. All pipe and accessories shall be carefully inspected by the Contractor for defects before installation and all defective unsound or damaged materials shall be rejected.
 3. The Engineer will make such additional inspections as he deems necessary and the Contractor shall furnish all necessary assistance for such inspection.
 4. Proper implements, tools, and facilities satisfactory to the Owner and the Engineer shall be provided by the Contractor for the proper and satisfactory execution of the work.
 5. At no time will work be allowed to proceed without the Owner's representative present to inspect the work.
- B. Pipe, accessories, and appurtenances shall be new and unused, and shall be of the types and materials specified, as indicated or as directed.
- C. The interior of pipe and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations.
- D. Pipelines shall be constructed in dry trenches and shall not be laid when the conditions of the trench or the weather is unsuitable for such work.
- E. The trench bottom and gravel bedding shall be shaped and compacted to give substantially uniform unyielding circumferential support to the lower fourth of the full length of each pipe.
- F. Holes for the bells shall be excavated so that after placement the pipe and coupling receive uniform bearing pressure from the trench bottom. No blocking shall be allowed.
- G. Each pipe shall be laid to the line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line.
- H. As the work progresses, the interior and exterior of the pipes and couplings shall be cleaned of all dirt and superfluous material of every description.
- I. When required to keep interior of pipe clean, a suitable drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed.
- J. At times when work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other substance will enter the pipe or fitting.
- K. Any pipe that has been disturbed after laying shall be taken up and re-laid at no additional expense to the owner.

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- L. All materials found to be defective during the progress of the work will be rejected by the Engineer and the Contractor shall promptly remove such defective material from the site of the work and replace with new material at no additional expense to the Owner.
- M. The Contractor shall be responsible for the safe storage and proper handling of all materials.
- N. No shims or mounds of earth shall be used to raise the pipe to grade.
- O. All pipe shall be maintained accurately to the required line and grade.
- P. No pipe shall be covered until the Engineer has inspected the joints.
- Q. The pipeline shall not be used to convey trench drainage during construction.
- R. Pipes shall be protected at all times during construction against flotation. They shall be thoroughly secured, properly supported and bedded to prevent settlement or disturbance. Compaction of bedding and backfill material shall be in strict accordance with Section 02200, Earthwork.
- S. Bends, crosses, tees, caps, plugs, valves, and other appurtenances shall be strapped and clamped where indicated and/or as directed. Steel bars, rods and plates shall be of structural steel. Straps, bridle rods, clamps, anchors and such other parts shall be provided to the details as directed and as approved. After installation, all parts of the strapping and clamping devices shall be given two (2) heavy coats of an approved coal-tar base protective coating.

3.02 JOINTING

- A. No pipes shall be jointed until couplings and ends of pipe have been inspected to determine that the joint surfaces are free from any defects in materials or workmanship, and free from dirt or other foreign matter.
- B. Pipe, pipe fittings and accessories shall be stored, installed, joined and protected by the Contractor in strict accordance with the printed recommendations of the manufacturer of the piping material, and as approved.
- C. Field assembled joints shall be checked with a suitable gauge as recommended by the manufacturer to ensure that the rubber rings are properly located.
- D. Jointing by pushing the pipe home with a backhoe bucket or other heavy equipment will not be permitted. Utilizing the backhoe and a sling to suspend pipe while pushed home by bar or jack is permitted.
- E. Protect the end of the pipe from damage at all times by using a timber header between the end of the pipe and the bar or jack.
- F. If inspection indicates that the rings are improperly located, the Contractor shall disassemble, and properly reinstall the pipe.
- G. Pipe stoppers shall be installed, sealed and blocked in such a manner as to prevent any leakage

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and so as to withstand an internal hydrostatic pressure of not less than 5 psi.

1. Timber blocking shall be of adequate size and arrangement to prevent the stopper from being blown off the line.
 2. Timber bracing shall extend back to the undisturbed end of the trench.
- H. Ductile iron pipe and fittings shall be provided with two brass wedges for 12” and smaller diameter pipe and four brass wedges for larger diameter pipe at each joint.
- I. Bolts and nuts used with all mechanical joints shall be tightened to the manufactures specified torque with a torque wrench to verify that all bolts and nuts receive the same tightening. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet or wrench be used to secure greater leverage.

3.03 PIPE REMOVAL

- A. Where old pipe conflicts with new pipe, old pipe shall be cut and capped on both ends and the caps shall be secured. No fitting or pipe deflections will be allowed on new pipe to go over or under old pipe. In areas where water mains are to be removed, the contractor shall disconnect each service lateral from the main at the corporation prior to removal of the main. The contractor shall be responsible for the legal disposal of the removed water main pipe.

3.04 IDENTIFICATION MARKERS

- A. The line markers shall be installed two feet above the top of the buried pipeline. Where this is not possible, line markers shall be installed as close to two feet above the top of the buried pipeline as possible.

END OF SECTION

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SECTION 02640

VALVES, TAPPING SLEEVES, & APPURTENANCES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included:

The work under this Section includes the furnishing, installation and testing of all valves, tapping sleeves, transition couplings, hydrants, and appurtenances as indicated on the Drawings or as may be required by the Owner or the Engineer.

B. All materials included in this section that are to come into contact with potable water shall be either NSF 61 or NSF 60 approved as applicable.

C. Related Work Described Elsewhere:

02200 – Earthwork

02616 – Ductile Iron Pipe and Fittings

D. Reference Providence Water – Requirements for Water Mains, Services, and Appurtenances

1.02 QUALITY ASSURANCE

1. Manufacturer's Recommendations:

Using Providence Water's Project Management software, The Contractor shall submit for approval of the manufacturer's recommendations for the storage, protection, handling and installation of the valves, hydrants and appurtenances, which shall be strictly adhered to by the Contractor.

2. Certificate of Compliance:

Each shipment of valves, tapping sleeves, transition couplings, hydrants and appurtenances shall be accompanied with the manufacturer's notarized certificate certifying conformance with all requirements of the Specifications.

1.03 MARKING

A. Marking of all tapping sleeves shall conform to the requirements of AWWA 110 latest revision, marking of all valves shall conform to the requirements of AWWA 515 latest revision, and marking of all hydrants shall conform to the requirements of AWWA 502 latest revision.

1.04 MANUFACTURER'S REPRESENTATIVE

A. The Contractor shall furnish at no additional expense to the Owner, the services of the manufacturer's representative for instruction of the Contractor personnel who will be installing the tapping sleeves, transition couplings, valves and hydrants. The instruction shall include proper handling, installation and jointing, and other construction areas and

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shall be for such lengths of time required to fully familiarize the Contractor's personnel with proper techniques. This information shall be bound and indexed for each type of unit as herein specified.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials to be incorporated into the work shall be new and purchased specifically for this Contract. All material shall be made in the United States of America and shall be provided with documentation indicating the location of the foundry and/or place of origin, unless otherwise approved.
- B. All coatings and/or protective oils used on materials that will eventually be in contact with potable water must be ANSI/NSF approved.
- C. All hardware for valves, tapping sleeves, and appurtenances shall be stainless steel for corrosion resistance.

2.02 TAPPING SLEEVES AND TAPPING VALVES

- A. All tapping sleeves shall comply in all respects to AWWA Standard C-110 and the following design standards:
 - 1. Tapping sleeve shall be installed at the locations shown on the plans and details.
 - 2. The tapping sleeve shall be a mechanical type joint to provide pressure-tight installation and be suitable for use with the existing pressurized pipe material. Outlet flange shall be Class 125C, ANSI B16.1.
 - 3. Mechanical joint tapping sleeves shall have totally confined end gaskets and be designed to withstand a minimum of 200 psi working pressure. Nuts and bolts shall be Type 304 stainless steel. Nuts shall be coated per manufacturer's recommendations to prevent galling.
 - 4. The test plug shall be ¾" NPT, type 304 stainless steel.
 - 5. Mechanical joint tapping sleeve body and outlet shall be thick gauge ASTM A240 type 304/304L stainless steel.
 - 6. Tapping valves shall comply with Section 2.03 - Gate Valves except one end shall be flanged and the other end shall be mechanical.
 - 7. Tapping valves shall be provided with an oversized opening to allow the use of full size cutters.
 - 8. Mechanical tapping sleeves shall be ROMAC Industries, Inc. Model STS420, or approved equivalent.

2.03 BURIED GATE VALVES

- A. Resilient seated gate valves shall meet AWWA C-515 and be UL listed and FM approved. Valves shall be ductile iron-body, stainless steel mounted, non-rising stem, 3-inch through 16-inch in diameter as shown on plans. All valves shall OPEN RIGHT. All valves shall be mechanical joint.
- B. Sizes 3-inch through 16-inch shall be suitable for 250 psig maximum working pressure and 400 psig test pressure.

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- C. Manganese bronze stem material shall have a minimum tensile strength of 70,000 psi, yield strength of 35,000 psi and maximum elongation of 15 percent. Valve shall have a minimum of two O-ring stem seals.
- D. Operating nuts shall be 2-inch square at the base, tapering to 1-15/16 inches square at the top and shall be manufactured of cast or ductile iron and attached to the stem with a nut or pin at the factory. Nuts shall be painted red and marked with an “arrow” to indicate direction of opening.
- E. All hardware shall be Corten as manufactured by Romac Industries.
- F. Rubber seats shall be new and of a compound natural or synthetic – designated for water service application. Reclaimed rubber is not acceptable. Seats shall be either bonded or mechanically attached to the gate. When mechanically attached, all exposed hardware shall be 18-8 Type 304 stainless steel.
- G. The interior and exterior of valves shall be fully epoxy coated 8 mils thick. Epoxy shall be certified NSF approved for use in potable water systems. Field touch-up of the bonded epoxy within the body of the valve will be allowed; however, touch-up kit must be provided by the manufacturer of the valve and must meet the same NSF approval as the original bonded epoxy.
- H. Valves sized 3-inch to 12-inch shall be by Mueller or approved equivalent.
- I. Valves sized 16-inch shall be by American Flow Control and shall have a gear actuator with a minimum 2:1 gear ratio.

2.04 STRAIGHT AND TRANSITION PIPE COUPLINGS

- A. Straight and Transition Couplings shall be restrained, couplings to be Romac Alpha or approved equal.

2.05 FLANGED COUPLING ADAPTERS

- A. Flanged coupling adapters shall be Romac Restrained Flanged Coupling Adapter or approved equivalent. All nuts, washers and bolts shall be stainless steel.
- B. Mechanical restraint shall be an integral part of the follower gland utilizing multiple single tooth wedges. Each follower gland shall incorporate cam action, independent wedge engagement and meet applicable requirements of ANSI/AWWA C111/A21.11.

2.06 VALVE BOXES AND COVERS

- A. A gate valve box shall consist of three pieces – over, upper section, and lower section – all of which are manufactured of cast iron. The lower section shall have an inside diameter of not less than 5 1/4 – inches and a length of at least 36-inches. It shall be designed to telescope into the upper section. Upper section length shall be 26-inches. Covers shall have the word “WATER” cast upon them.
- B. An approved operating Key shall be provided.

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2.07 THRUST RESTRAINTS

- A. Restraining devices shall be utilized on all mains under the following conditions:
 - 1. Pipeline direction changes (tees, bends)
 - 2. Dead end lines (caps or plugs)
 - 3. Transition pieces (reducers)
 - 4. Couplings
 - 5. All mechanical joints
- B. Thrust blocks shall be designed to withstand the force imparted by the main with a minimum 1½ times the anticipated working pressure but not less than 150 p.s.i. Maximum lateral bearing capacity shall be 1,500 lb/sf. Sizing guidelines for thrust blocks are detailed on the project Drawings.
- C. Thrust restraint shall also be provided via restrained joint, ductile iron pipe meeting AWWA C151/A21.512 and AWWA C111/A21.11. Restrained joint pipe lengths (restrained length) shall be sufficient to restrain thrust imparted by 1½ times the anticipated working pressure but not less than 150 psi. Pipe restrained joints shall be manufactured by EBAA Iron Sales, Inc. Series 1100 Megalug restraining system.
- D. Thrust restraint utilizing tie-rods shall not be utilized unless approved by the Engineer or specifically indicated. Tie-rod diameters shall be 2 times the diameter required to restrain the main. All rods, nuts and other appurtenances shall be stainless steel.

2.09 HYDRANTS

- A. All fire hydrants shall comply in all respects to AWWA C-502 and the following design standards:
 - 1. Hydrants shall be dry-barrel, post-type. The main hydrant valve shall be of the compression type that opens against pressure in the main and be constructed of solid rubber that may be reinforced with steel. The connecting line or hydrant lateral shall be 6 inches in diameter, as per AWWA Standard M17.
 - 2. The depths of bury shall have a typical bury of 5 feet, but at all times be installed to meet manufacturer's specifications for proper operation of the traffic breakaway feature. Hydrant extensions, which may be required, shall be manufactured by the same manufacturer of the hydrants being installed. Contractor shall field verify exact bury depths of all proposed hydrants prior to ordering. Should extensions be necessary on new hydrants, the contractor shall not be entitled to additional compensation or time.
 - 3. Hydrant shall be furnished with a sealed reservoir located in the bonnet so that all threaded and bearing surfaces are lubricated each time the hydrant is operated.
 - 4. The bottom nut is to be bronze or fusion-bonded epoxy coated ductile or cast iron. An O-ring seal shall be provided in the main valve assembly to insure that water cannot leak from the hydrant shoe, or elbow, into the hydrant barrel or drain way. O-ring seals in the main valve area shall seat against bronze or fusion-bonded epoxy coated cast iron. Hydrants shall have a bronze seat ring threaded to a bronze sub-set.
 - 6. Hydrant shall be equipped with 5-¼ inch main valve opening.
 - 7. Hydrants shall have a 150 PSI working pressure. Each hydrant shall be able to deliver

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- 500 gallons per minute through its two hose nozzles when opened together with a loss of not more than 2 psi through hydrant.
8. Hydrant shall have at least two (2) bronze or copper lined drain outlets with a minimum net diameter of ¼-inch. The shoe of the hydrant shall be 6 inch mechanical joint D-150, suitable for use either with centrifugally cast pipe or Class D Pit Cast Pipe. Lugs will be case on either side shoe, securely anchoring the hydrant. Hydrants shall be furnished with a breakable feature that will break cleanly upon impact. This shall consist of a 2-part breakable safety flange with a breakable stem coupling. Hydrant nozzles must be able to be rotated to any position without disassembly of ground-line flange.
 9. Hydrants shall open to the RIGHT (clockwise) and shall have a direction-to open arrow with the word "OPEN" imprinted on the hydrant and utilize a breakaway design. Each hydrant shall have two 2 ½ inch nozzles, 180-degrees apart, and one 4 ½ - inch steamer port nozzle. All nozzle threads are to be National Standard Threat. Lead shall not be used to secure nozzles to the hydrant barrel. Nozzle caps shall be cast iron and shall be secured to the hydrant barrel with rustproof steel chains.
 10. The above grade stem shall be factory-coated with "Caution" yellow enamel.
 11. Hydrant exteriors, above the ground line, shall be painted with on coat of primer and two finish coats of "Ivy Green" paint that will produce a surface to which subsequent coats of paint, having a linseed oil base, will readily adhere. Bonnets shall be painted, in the same manner, to match existing colors ("Safety Yellow")
 12. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism or obstructing the discharge from any outlet.
 13. Hydrants shall be furnished with caps, double galvanized steel hose cap chain, galvanized steel pumper hose cap chain, a galvanized steel chain holder and any other hooks and/or appurtenances required for proper use.
 14. All hydrants shall be equipped with a 6" gate valve, or 8" gate valves and 8" lateral when tee to hydrant distances are greater than 10 feet, in accordance with Section 2.3 above, and be fully restrained as shown on the drawings. Restrained joints shall be by Megalug Thrust Restraint Wedge manufactured and sold by EBAA Iron Sales Inc. In the event a bell and spigot joint is located between the tee and hydrant, the bell and spigot joint shall be restrained with a Field Lok gasket or approved equivalent (from Providence Water's approved manufacturer's list)
 15. Hydrants shall be Mueller A423 or Kennedy K81D. No substitutions will be allowed.
 16. Hydrants shall be installed with sufficient height that when installed a 15-inch hydrant wrench will not contact the ground when making a full 360-degree turn on any nozzle cap.
 17. A drainage pit with a volume of 10 cubic feet shall be provided at the base of the fire hydrant barrel. The pit shall be filled with gravel or crushed stone to a depth of 6 inches above the hydrant drain opening and covered with filter fabric prior to backfilling. The gravel or crushed stone aggregate shall provide void space greater than the volume of the hydrant barrel.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. All tapping sleeves, valves, hydrants, and accessories shall be carefully inspected by

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- the Contractor for defects before installation and all defective, unsound or damaged materials shall be rejected.
2. The Owner or the Engineer will make such additional inspections as deemed necessary and the Contractor shall furnish all necessary assistance for such inspection.
 3. Proper implements, tools and facilities satisfactory to the Owner or the Engineer shall be provided by the Contractor for the proper and satisfactory execution of the work.
- B. Tapping sleeves, valves, couplings and appurtenances shall be new and unused and shall be of the types and materials specified as indicated or as directed.
- C. The interior of tapping sleeves, valves, and fittings shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operation.
- D. Tapping sleeves, valves, and fittings shall be constructed in dry trenches and shall not be laid when the conditions of the trench or the weather are unsuitable for such work.
- E. Tapping sleeves, valves, and couplings shall be laid to the line and grade in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line.
- F. At times when work is not in progress, open ends of tapping sleeves, valves and fittings shall be securely closed so that no trench water, earth or other substances will enter.
- G. Any tapping sleeves, valves or fittings that have been disturbed after laying shall be taken up and re-laid.
- H. All materials found to be defective during the progress of the work will be rejected by the Engineer and the Contractor shall promptly remove such defective material from the site of the work and replace with new material at no additional expense to the Owner.
- I. The Contractor shall be responsible for the safe storage and proper handling of all materials.
- J. No shims or mounds of earth shall be used to raise the equipment to grade.
- K. No tapping sleeve, valve, or appurtenance shall be covered until the joints have been inspected.
- L. Installed materials shall be protected at all times during construction against flotation; they shall be thoroughly secured, properly supported and bedded to prevent settlement or disturbance. Compaction of bedding and backfill material shall be in accordance with Section 02200, EARTHWORK.
- M. Tapping sleeves shall be installed where indicated or as directed by the Owner or the Engineer and shall be installed according to the manufacturer's recommended procedures.
- N. Valves and joint restraints shall be installed where indicated or as directed by the Owner or the Engineer and shall be installed according to the manufacturer's recommended procedures.

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3.02 SETTING VALVES AND VALVE BOXES

- A. Valves shall be set in the pipelines as directed. Blocking or supports of a permanent nature shall be placed under each valve to ensure against settlement.
- B. Each valve shall be tightly closed before being placed in the line and shall remain so until the joints on each side are completely tightened.
- C. Valve boxes shall be set for all valves and shall be locking type. They shall be carefully fitted together and to the valve and securely held during backfilling. They shall be centered over the valve-operating nut. The bedding material around them shall be thoroughly tamped in place and the box cover set to the finished grade.

3.3 TESTING

- A. All materials shall be tested for tightness as soon after installation as possible in accordance with Section 02704, PIPELINE PRESSURE, LEAKAGE, AND DISINFECTION.
- B. All materials found to be defective during testing shall be replaced with new and approved material at no additional expense to the Owner.

3.4 TEST REPORTS AND CERTIFICATES

- A. In addition to other requirements specified herein, the Contractor shall furnish to the Engineer notarized test reports and methods of test by an approved independent testing laboratory to show compliance of all materials furnished under this section of the Specifications with all the requirements herein.
- A. Each shipment of tapping sleeves, valves, and other appurtenances shall be accompanied by the manufacturer's notarized certificate of conformance certifying that materials to be furnished under these items meet all requirements herein.
- B. All testing of materials furnished under this section of the Specifications shall be provided by the Contractor at no additional expense to the Owner.

END OF SECTION

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SECTION 02704

PIPELINE PRESSURE, LEAKAGE, AND DISINFECTION

PART 1 GENERAL

1.01 SCOPE

- A. This section specifies requirements for the testing and disinfections of underground potable water pipelines. The work covered under this section includes, but is not necessarily limited to:

1. Leakage tests
2. Disinfection

NOTE: Testing will be performed prior to connecting new pipeline sections to any existing potable water system piping. No physical connections (temporary or permanent) between new pipe and existing pipe will be allowed during the test without the use of an approved backflow prevention device.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
1. AWWA B300: Standards for Hypochlorites
 2. AWWA C600: Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 3. AWWA C651: Standard for Disinfecting Water Mains
 4. Providence Water: Requirements for Water Mains, Services, and Appurtenances (latest edition).

1.03 SUBMITTALS

- A. Certified reports for all required tests shall be provided from an approved, qualified, independent testing laboratory.
- B. Shop drawing of temporary connection backflow preventer.
- C. Detail of temporary connection between existing and new water pipelines.

PART 2 PRODUCTS

2.01 HYPOCHLORITE

- A. Hypochlorite shall conform to AWWA Standard B300, current edition. Hypochlorite shall be NSF 60 certified for potable water use.

2.02 BACKFLOW PREVENTER

- A. Backflow prevention device for any connection between the existing water system and new water pipes prior to acceptance of pressure test, disinfections and flushing, shall be of the appropriate size as required and shall be double check type as manufactured by Watts, Febc, Hersey, or approved equivalent.

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- B. Backflow prevention device shall be NSF-61 certified.

2.03 GAUGES

- A. Gauges used by the contractor in performance of the leakage tests shall be NIST certified and certification shall be traceable back to NIST.

PART 3 EXECUTION

3.01 PREPARATION

- A. **Cleaning and Inspection:** The interior of all pipe, fittings, valves and appurtenances shall be thoroughly cleaned of all foreign material and inspected for cracks, flaws, or other defects before installation, and shall be kept clean until the work is accepted.

3.02 FIELD QUALITY CONTROL

- A. **Alignment Tests:** Each section of pipe will be checked by the Owner or the Engineer in order to determine whether any displacement of the pipe has occurred. The Contractor shall provide suitable assistance to the Owner or the Engineer. The Contractor shall repair any poor alignment, displaced pipe or other defects discovered, as directed by the Engineer.

- B. **Hydrostatic Tests:** After the pipe has been laid and the trench has been backfilled, all newly laid pipe or any valve section thereof, shall be subjected to a pressure and leakage test in accordance with AWWA C600-latest edition, Providence Water standards, and as approved by the Engineer. The Contractor shall provide all pumps, pipe, connections, gages, measuring devices, and all other apparatus necessary for the test and shall conduct the test in the presence of and to the satisfaction of the Engineer. The Owner will supply water to the Contractor for testing purposes at no expense to the Contractor.

1. **Test Pressure -** The required minimum test pressure shall be 1-1/2 times the working pressure measured at the point of lowest elevation of the pipeline and corrected to the elevation of the test gauge, but shall not be less than 150 psi. Test pressures shall not vary by more than plus or minus 5 psi for the duration of the test.
2. **Duration of Test -** two (2) hours minimum.
3. **Air Removal -** Prior to performance of the test the pipeline shall be completely filled with water for a period of 72 hours. Expel air by means of air relief valves, hydrants or other means as required. If permanent air vents or taps are not located at all high points, the Contractor shall install corporation stops at such points so air can be expelled. After the tests are completed, plug all temporary taps.
4. **Allowable Leakage:**
 - a. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valve section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
 - b. No pipe installation will be accepted if the leakage is greater than that determined by the following formula in which "L" is the allowable leakage in gallons per hour; "S" is the length of pipe tested in feet; "P" is the average test pressure during the leakage test in pounds per square inch (gauge); and "D" as the nominal diameter of the pipe in inches.

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$$L = \frac{SD \sqrt{P}}{133,200}$$

5. Repair of Leaks - If the test discloses leakage greater than the allowable leakage the Contractor shall, at his own expense, locate and repair the defective joints until leakage is within the specified allowable. The Contractor shall repair any specific leaks regardless of the test results if, in the opinion of the Engineer, they are serious enough to endanger the future serviceability of the pipeline.

3.03 DISINFECTIONS OF POTABLE WATER LINES

A. General:

1. Flushing and disinfections of potable waterlines shall be done in accordance with the procedure set forth in AWWA C651 - Disinfecting Water Mains, latest edition, and shall be witnessed by the Engineer unless otherwise approved. The Contractor shall provide all temporary blowoffs, pumps, chlorination equipment, chlorine and all other necessary apparatus required. The Owner will supply water to the Contractor for disinfections purposes at no expense to the Contractor.
2. All valves on the new main shall be operated during the disinfections procedure in order to ensure complete disinfections.
3. The form of chlorine proposed by the Contractor for disinfections shall be approved by the Engineer.
4. The Contractor shall take adequate measures to prevent backflow of flushing water and chlorinated water into the existing water distribution system.
5. Contractor shall not make physical connection to the existing water main prior to satisfactory results of chlorination. An approved backflow prevention device shall be utilized to transfer water from the existing system to the new piping network.
6. Unless precluded by unexpected events, the Contractor shall notify the Owner at least three (3) working days prior to a water main shutdown. The Owner shall determine if the operation of valves will be performed by The Owner's work forces, the Contractor, or a Owner Subcontractor. The immediacy of water main shutdowns or valve operation is not warranted by the Owner. In the operation of valves, for the purpose of shutting down existing mains, the Owner does not guarantee or imply that shut down will be completely effective in stopping the flow of water to open ends. If so directed by the Owner, the Contractor shall operate all valves required to shut down (and subsequently reopen) existing water mains. If the Contractor is unable to shut down a valve after two (2) hours of attempting to do so, the Owner will direct the Contractor as to how to proceed.

B. Pipe Cleaning:

1. If the pipe contains dirt or heavy encrusted matter that, in the opinion of the Engineer, will not be removed during the flushing operation, the Contractor shall clean and swab the interior of the pipe with a one (1) percent hypochlorite disinfecting solution.
2. The pipeline shall be flushed to remove all remaining foreign material prior to disinfections, except when the tablet method is used. The flushing operation shall develop a minimum velocity of 3.0 ft/sec. It will be the Contractor's responsibility to properly size and locate corporations within test sections to adequately flush all piping

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at least 2 times its volume at the desired velocity. A minimum of a six-inch (6") supply line will be required to adequately flush all piping for this project.

3. Main line valves shall not be utilized to fill, flush, test or chlorinate water mains unless authorized and supervised by the Engineer.

C. Chlorine Application:

1. In general, chlorine shall be applied using the continuous feed method, as specified in AWWA C651.
2. Introduce water into the line at a constant rate while adding chlorine to the water at a constant rate, such that the water will have not less than 25 mg/L free chlorine. Maintain the chlorinated water in the pipeline for a minimum of 24 hours, after which period the treated water shall have a free chlorine residual of not less than 10 mg/L throughout the entire length. Repeat the above procedure if the residual, at the end of the 24 hours, fails to meet the minimum concentration. Chlorinated water, above the normal system prevailing concentration, shall not be allowed to remain in the pipeline for a period longer than 5 days.
3. Fire hydrants may not be used for sampling points but may be utilized as a feed source if properly flushed and the Owner's required temporary piping system installed.

D. Final Flushing:

1. After the required retention period, flush all heavily chlorinated water from the main until the chlorine concentration is no higher than that prevailing in the system, or is acceptable for domestic use. The Contractor shall be responsible for satisfactory disposal of all flushing water and chlorinated water at no additional expense to the Owner.
2. Prior to discharging, a reducing agent shall be applied to the water to be wasted, to neutralize thoroughly the chlorine residual remaining in the water. (See Appendix C of AWWA C651 for neutralizing chemicals).

E. Analytical Tests:

1. After completion of the final flushing and prior to placing the pipeline in service, two (2) consecutive sets of acceptable samples taken at least 24 hours apart shall be collected by Providence Water personnel. Each sample shall be analyzed for total coliform and heterotrophic plate count (HPC). Providence Water personnel shall take single samples to be analyzed for pH, chlorine, and iron.
2. No VOC samples will be taken for water mains.
3. All samples must meet Providence Water Standards.

- F. Repetition of Procedure - If the original disinfections fails to produce satisfactory samples, repeat the disinfections procedure until satisfactory results are obtained at no additional expense to the Owner. The Owner reserves the right to charge for the cost of additional water and cost to preform additional sampling, should the first round of sampling fail to produce satisfactory results.

END OF SECTION

DIVISION 3

CONCRETE

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SECTION 03930

CONCRETE REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

- A. This specification describes the patching and overlay of damaged/spalled elevated tank foundations using portland cement concrete.

1.02 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 45°F (7°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

1.05 SUBMITTALS

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

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PART 2 PRODUCTS

2.01 MANUFACTURER

- A. **Sikacrete 211 SCC Plus**, as manufactured by Sika Corporation, is considered to conform to the requirements of this specification.

2.02 MATERIALS

- A. Portland cement concrete:
1. The repair concrete shall be self consolidating and polymer modified. It shall be comprised of selected portland cements, specially graded aggregates, admixtures for controlling setting time and plasticizers for workability as well as silica fume and a migrating corrosion inhibitor.
 2. The materials shall be non-combustible, both before and after cure.
 3. The materials shall be supplied as a factory-blended unit.
 4. The portland cement concrete must be placeable from 1 in. to 8 in. in depth and appropriate for full-slab depth repair and replacement.
- B. The portland cement concrete aggregate shall conform to ASTM C-33. (similar to No.8 distribution per ASTM C-33, Table II) and be clean, well-graded, having low absorption and high density.

2.03 PERFORMANCE CRITERIA

- A. Typical Properties of the mixed portland cement concrete:
1. Initial spread: SCC, 27-33 in. approx.
 2. Spread at 30 min: > 15 in.
 3. Application time: 60 min.
- B. Typical Properties of the cured portland cement concrete:
1. Compressive Strength (ASTM C-39 modified)
 - a. 1 day: 2,000 psi min. (13.8 MPa)
 - b. 7 day: 6,000 psi min. (41.4 MPa)
 - c. 28 day: 7,000 psi min. (48.3 MPa)
 2. Flexural Strength (ASTM C-78) @ 28 days: 1,000 psi (6.9 MPa)
 3. Splitting Tensile Strength (ASTM C-496) @ 28 days: 1,000 psi (6.9 MPa)
 4. Bond Strength (ASTM C-882 modified) @ 28 days: 2,500 psi (17.2 MPa)
 5. Shrinkage (ASTM C-157): < 0.05%
 6. Chloride ion permeability (ASTM C-1202): < 650 Coloumbs
 7. The portland cement concrete shall not produce a vapor barrier.

Note: Above tests performed with curing conditions @ 71°F – 75°F and 45-55% relative humidity.

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PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Areas to be repaired must be clean, sound, and free of contaminants. All loose and deteriorated concrete shall be removed by mechanical means. Mechanically prepare the concrete substrate to obtain an exposed aggregate surface with a minimum surface profile of +/- 1/8 in. (CSP 7-8 per ICRI Guidelines). Saturate surface with clean water. Substrate should be saturated surface dry (SSD) with no standing water during application. Area to be patched shall not be less than 1 in. in depth.
- B. Where reinforcing steel with active corrosion is encountered, sandblast the steel to a white metal finish to remove all contaminants and rust. Where corrosion has occurred due to the presence of chlorides, the steel shall be high pressure washed after mechanical cleaning. Prime steel with 2 coats of Sika Armatex 110 EpoCem as directed by manufacturer. (See Spec Component SC-201-0699)

3.02 MIXING AND APPLICATION

- A. Start mixing with 5.5 pints of water. An additional 0.5 pint can be added if needed. **Do not overwater**, as excess water will cause segregation. Add entire contents of one bag of Sikacrete 211 SCC Plus while continuing to mix to a uniform consistency, maximum 3 minutes. Mechanically mix with a low-speed (400-600 rpm) drill or in an appropriate-size mortar mixer or concrete mixer.
- B. Placement Procedure: Pre-wet surface to SSD (Saturated Surface Dry) with no standing water. Ensure good intimate contact with the substrate is achieved. To accomplish this, material should be scrubbed into substrate filling all pores and voids. While the scrub coat is still plastic, force material against edge of repair, working toward center. If repair area is too large to fill while scrub coat is still wet use Sika Armatex 110 EpoCem in lieu of scrub coat (See Spec Component SC-200). After filling, consolidate, then screed. Allow concrete to set to desired stiffness, then finish with trowel, manual or power, for smooth surface. Broom or burlap drag for rough surface.
- C. Alternatively the material may be poured or pumped into formed areas. To ensure proper filling and adhesion vibrate the material during placement or pump the repair material under pressure. Vibrate form while pouring or pumping. Pump with a variable pressure pump. Continue pumping until a 3 to 5 psi increase in normal line pressure is evident then STOP pumping. Form should not deflect. Vent to be capped when steady flow is evident, and forms stripped when appropriate.
- D. As per ACI recommendations for portland cement concrete, curing is required. Moist cure with wet burlap and polyethylene, a fine mist of water or a water-based* compatible curing compound. Moist curing should commence immediately after finishing. Protect newly applied material from rain, sun, and wind until compressive strength is 70% of the 28-day compressive strength. To prevent from freezing cover with insulating material. Setting time is dependent on temperature and humidity.

*Pretesting of curing compound is recommended.
- E. Adhere to all procedures, limitations and cautions for the portland cement mortar in the manufacturers current printed technical data sheet and literature.

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3.03 CLEANING

- A. The uncured portland cement mortar can be cleaned from tools with water. The cured portland cement mortar can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

DIVISION 5

METALS

**PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES**

SECTION 05120

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Structural steel repair of elevated water storage tank, including, but not limited to, the following:
 - a. modification to catwalk guardrail to meet OSHA requirements;
 - b. modifications to storage tank overflow pipe; and
 - c. installation of a new tank access ladder with grab bars and fall protection system.
 2. Drawings and general provisions of the Contract, including Division 00 and 01, apply to this Section.

1.2 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, holes, and other pertinent data.
 2. Include embedment drawings.
 3. Indicate welds by standard American Welding Society (AWS) symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified Professional Engineer registered in the State of Rhode Island responsible for their preparation. This shall include, at a minimum, the modifications to the guardrail.
- C. Welding certificates.
- D. Qualification Data: For installer, fabricator, professional engineer, and testing agency.
- E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Direct-tension indicators.
 4. Tension-control, high-strength bolt-nut-washer assemblies.

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5. Shop primers.

F. Source quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Channels, Angle Shapes: ASTM A 36/A 36M.

B. Plate and Bar: ASTM A 36/A 36M.

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C. Welding Electrodes: Comply with AWS requirements.

1. E60 series electrodes shall be used for field welding to existing steel.
2. E70 series electrodes shall be used for shop fabrication of new steel components.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.
2. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type:
 - a. Finish: Plain.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy hex or round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

2.3 PRIMER

A. Surface Preparation, Priming, and Painting shall be according to the requirements of Section 09970 Steel Water Storage Tank Painting.

2.4 FABRICATION

A. Structural Steel: Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design".

B. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.5 SHOP PRIMING

A. All shop fabricated structural steel components shall be shop primed except for the following:

1. Surfaces to be field welded.
2. Surfaces to be high-strength bolted with slip-critical connections.

B. Surface Preparation, priming, and painting shall be according to the requirements of section 09970.

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2.6 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, member sizes, and plate sizes for all tank components to be repaired or replaced.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during removal and replacement of deteriorated tank components and during the erection of new components to maintain stability of all tank components and to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

3.3 ERECTION

- A. Set structural steel components accurately in locations and to elevations indicated on the approved Shop Drawing and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design".
- B. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- C. Align and adjust various members forming part of complete structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- D. Splice members only where indicated on the approved Shop Drawings.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

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- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, Pre-tensioned, or Slip critical as specified on the approved Shop Drawings.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings-Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Touchup Painting: Cleaning and touchup painting are specified in Section 09970 Steel Water Storage Tank Painting.

END OF SECTION

DIVISION 7

THERMAL & MOISTURE PROTECTION

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SECTION 07920

FLUID APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. This specification describes the injection of cracks and joints with infiltrating water with a low viscosity hydrophobic polyurethane resin chemical grout in the underground tank piping vault as shown on the drawings.

1.02 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001:2008 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractors shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by the manufacturer's representative.
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- B. Store and condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if they appear to be imminent.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified repair material.

1.05 SUBMITTALS

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).

1.06 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

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PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Hydrophobic Polyurethane Chemical Grout:
 - a. SikaFix HH LV as manufactured for Sika Corporation, Lyndhurst, New Jersey, is considered to conform to the requirements of this specification.
- B. Substitution: The use of other than the specified products will be considered providing the contractor requests their use in writing to the Engineer. This request shall be accompanied by (a) A certificate of compliance from an approved independent testing laboratory that the proposed substitute products meet or exceed the specified performance criteria, tested in accordance with the specified test standards; and (b) Documented proof that the proposed substitute products have a two year proven record of performance of the chemical injection grouting of a crack, confirmed by actual field tests and five successful installations that the Engineer can investigate.

2.02 MATERIALS

- A. Expanding Polyurethane Chemical Grout
 - 1. The grouting compound shall be a non-toxic, non-flammable, high flash point (270 F) hydrophobic polymer of the type which is applied in a crack or open joint by use of a packer. When the grout is mixed with water the material will expand up to 2 to 5 times its original volume and cure to a pale yellow closed cell polyurethane foam.
- B. The use of injection packers is usually required for the application of the polyurethane chemical grout.

2.03 PERFORMANCE CRITERIA

- A. Properties of the mixed polyurethane chemical grout.
 - 1. Pot Life: approximately 5 hours, providing no moisture enters the system
 - 2. Mixed Viscosity: 450 - 850 cps ASTM D- 2196 A
 - 3. Color: pale yellow
 - 4. Flash point 270F
 - 5. Density 8.7 – 9.2 lbs./gal. ASTM D 3754- 95
 - 6. Solids 100%
 - 7. Corrosiveness - non- corrosive
- B. Properties of the cured polyurethane chemical grout
 - 1. Tensile Strength: 150 psi ASTM D-190-63
 - a. Elongation: 250%
 - 2. Absorption 10% After 6 months immersion
 - 3. Shrinkage: Less than 4% ASTM D-1042
 - 4. Density 8.70 – 9.17 lbs./gal ASTM D3574

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Note: Above tests performed with curing conditions @ 71°F – 75°F and 45-55% relative humidity.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Expanding polyurethane chemical grout - When crack (s) is contaminated on the outside it will be necessary to clean the crack surface to exactly locate the crack. If the crack encounter high water flow, it will be necessary to seal the surface of the crack with a surface sealing material. The surface sealing can be done before or after drilling the injection holes. Then, begin drilling 5/8" diameter holes along the side of the crack at 45 angles. Drill the hole to intersect the crack midway through the substrate. Install the injection packers in holes. Prior to product application moisture must be present. If concrete being injected contains insufficient moisture to activate the grout, inject the crack with a small amount of water prior to the application of the chemical grout.

3.02 MIXING AND APPLICATION

- A. Mixing the polyurethane chemical grout for the injection of cracks:

1. The material can be agitated vigorously shaking the 5 gallon pail or by mixing thoroughly for about 2 minutes max. with low speed (400-600 rpm), drill and paddle, bung mixer.

Caution: Do not allow water to enter this mix and avoid “whipping” air into the material.

- B. Placement procedure: set packers as required by the manufacturer.

1. Begin by drilling 5/8" diameter holes along the side of the crack at a 45° degree angle. Drill the hole to intersect the crack midway through the substrate. Spacing of the injection ports depends on crack width, but normal spacing varies from 6” to 36”. It is necessary to flush the drilled holes with water to remove drill dust from the holes and cracks, and insure that the crack is wet enough to react with the grout when introduced to the crack. On structures open on both sides, provide packers on opposite sides at staggered elevations. Install the injection packers in the holes.

If the crack or joint to be injected is 1/2” or greater at surface, pack an open cell polyurethane foam saturated with the mixed polyurethane chemical grout into the crack/ joints. Spray the saturated foam with a small amount of water to activate the grout and create a surface seal.

Injection pressure will vary from 200 psi to 2500 psi depending on the width of the crack, thickness of the concrete and condition of the concrete.

- C. Placement Procedure: The polyurethane chemical grout for the pressure injection grouting.

1. Inject the prepared cracks with a minimum of 250 psi in order to achieve maximum filling and penetration without the inclusion of air pockets or voids in the polyurethane chemical grout. Begin the pressure injection at the lowest packer and continue until there is the

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appearance of the polyurethane chemical grout at an adjacent packer, thus indicating travel. When travel is indicated, a decision to discontinue or continue the pressure injection from that packer should be made by the contractor, based on his experience, with the approval of the engineer. Continue the procedure until all pressure-inject able cracks have been filled.

2. Pump polyurethane chemical grout for 45 seconds and then pause to allow the material to flow into all of the cracks and crevices. Watch for material flow and water movement to appear on the surface. When movement stops, begin injection into the next packer. When sealing vertical cracks, begin injecting at the bottom of the crack and work vertically. If site temperatures are extremely low, heat bands or heated water baths may be used on the pails, before and during use to maintain the products temperature. Re-inject to assure that all voids are properly sealed off.
3. If penetration of any cracks is impossible, consult the engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the engineer for acceptance prior to proceeding.
4. Adhere to all limitations and cautions for the polyurethane chemical grout as stated in the manufacturers current printed literature.

Caution: Expanding chemical grout is exerting outward pressures of up to 450 psi. The review of drawings of the area to be repaired is desirable.

3.03 CLEANING

- A. Clean-up: Completely flush pump and hoses with SikaFix Pump Flush. Use sharp sided tool such as putty knife or trowel to remove excess material from walls, floors, etc. Wait for material to cure before removing. May be sanded off if necessary.
- B. The uncured polyurethane chemical grout can be cleaned from tools with an approved solvent. The cured polyurethane chemical grout can only be removed mechanically.
- C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

Note: Tests were performed with material and curing conditions at 71-75F and 45-55% relative humidity.

END OF SECTION

DIVISION 9

FINISHES

PART 1 GENERAL

1.01 SUMMARY

- A. This specification describes the coating of storage tank concrete foundations with an anti-carbonation, protective coating following concrete rehabilitation in accordance with section 03930.

1.02 QUALITY ASSURANCE

- A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001:2008 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.
- B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by manufacturer's representative
- C. Install materials in accordance with all safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. All materials must be delivered in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers. Damaged material must be removed from the site immediately.
- B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.
- C. Condition the specified product as recommended by the manufacturer.

1.04 JOB CONDITIONS

- A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 45°F (7°C) and rising.
- B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.

1.05 SUBMITTALS

- A. Submit two copies of manufacturer's literature, to include: Product Data Sheets, and appropriate Material Safety Data Sheets (MSDS).
- B. Submit copy of Certificate of Approved Contractor status by manufacturer.

1.06 WARRANTY

- A. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

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PART 2 PRODUCTS

2.01 MANUFACTURER

- A. **Sikagard 670W**, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio, 43302 is considered to conform to the requirements of this specification.

2.02 MATERIALS

A. Protective Acrylic Coating:

1. Product shall be 100% Acrylic Emulsion with the following properties:
 - a. Non-vapor barrier
 - b. Must resist ingress of chlorides
 - c. Must resist ingress of carbon dioxide
 - d. The material shall be non-combustible, both before and after cure.

2.03 PERFORMANCE CRITERIA

A. Properties of the protective acrylic coating:

1. Pot Life: indefinite
2. Tack Free Time 1 Hour @ 73°F, 50% Relative Humidity. Final Cure < 24 Hours
3. Carbon Dioxide Diffusion: μCO_2 1,100,000 Carbon Dioxide Diffusion Resistance at 5 mils (120 microns) $\text{SdCO}_2 = 433$ ft (132 m) equivalent air thickness. i.e. Approx. 13-in. of standard concrete cover.
4. Water Vapor Diffusion: $\mu\text{H}_2\text{O}$ 13,140. Water Vapor Diffusion Resistance at 5 mils (120 microns) $\text{SdH}_2\text{O} = 1.3$ ft (0.4 m) equivalent air thickness.
5. Moisture Vapor permeability (ASTM E96) 17.9 perms
6. Solids content: By weight: 60% By Volume: 46%
7. Flame spread and smoke development (ASTM E-84-94)
 - a. Flame Spread 0
 - b. Smoke Development 5
 - c. Class Rating A
8. Resistance to wind driven rain (TT-C-555B): No passage of water through coating.

Note: Tests above were performed with the material and curing conditions @ 71°F – 75°F and 45-55% relative humidity.

PART 3 EXECUTION

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3.01 SURFACE PREPARATION

- A. Substrate must be clean, sound, and free of surface contaminants. Remove dust, laitance, grease, oils, curing compounds, form release agents and all foreign particles by mechanical means. Substrate shall be in accordance with ICRI Guideline No. 03732 for coatings and fall within CSP1 to CSP3.

3.02 MIXING AND APPLICATION

- A. Mixing: Stir materials to ensure uniformity using a low speed (400-600 rpm) drill and paddle. To minimize color variation, blend two batches of material.(boxing)
- B. Coating Application: Apply by brush, roller, or spray over entire area moving in one direction. A minimum of two coats are required. Each coat should be applied at a rate not to exceed 250-sq. ft. per gallon. Total dry film thickness shall be a minimum 2.5 – 3 dry mils per coat. Allow a minimum of 1 hour prior to re-coating.
- C. When applying the coating, never stop the application until the entire surface has been coated. Always stop application at an edge, corner, or joint. Never let a previously coated film dry; always coat into a wet film. Always apply the coating at a 45° angle to an edge, corner, or joint.
- D. If substrate has been previously coated and presents a “chalky” condition, apply 1 coat of Sikagard 552W or Sika Latex R, primer/surface conditioner by brush, roller, or spray at a rate not to exceed 300 sq. ft. per gallon.
- E. Adhere to all limitations and cautions for the acrylic coating in the manufacturer's printed literature.

3.03 CLEANING

- A. The uncured acrylic coating can be cleaned from tools with water. The cured acrylic coating can only be removed mechanically.
- B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

END OF SECTION

**PROVIDENCE WATER SUPPLY BOARD
P.J. HOLTON WATER PURIFICATION PLANT UPGRADES**

SECTION 09970

STEEL WATER STORAGE TANK PAINTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Divisions 00 and 01, apply to this Section.

1.2 SUMMARY

- A. The Contractor shall supply all labor, materials and equipment necessary for the blast cleaning, containment, surface preparation, and the spot cleaning and painting of the interior and exterior surfaces of the rehabilitated tank structures. Work to include all required sampling and testing, and the final disinfection of the water storage facility, as specified herein.
- B. All materials that are to come in contact with potable water shall be NSF 60 or 61 approved.
- C. Related Sections:
1. Section 05120 – Structural Steel Framing
 2. Section 11200 – Water Storage Tank Appurtenances

1.3 REFERENCE STANDARDS

- A. The latest edition of the following standards and specifications shall be used with regard to materials, design, construction, inspection and testing to the extent specified herein:
1. ANSI/NSF 61 - Drinking Water System Components - Health Effects.
 2. NSF/ANSI 600 - Health Effects Evaluation and Criteria for Chemicals in Drinking Water
 3. Recommended Standards for Water Works (Ten States), 2012 Edition
 4. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
 5. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.
 6. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 7. AWWA C 652 - Disinfection of Water-Storage Facilities.
 8. AWWA D 102 - Coating Steel Water Storage Tanks.
 9. International Concrete Repair Institute (ICRI) Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
 10. OSHA 1926
 11. SSPC-SP 1 - Solvent Cleaning.
 12. SSPC-SP 2 - Hand Tool Cleaning.
 13. SSPC-SP 3 - Power Tool Cleaning.
 14. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.
 15. SSPC-SP 7 – Brush-Off Blast Cleaning.

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16. SSPC-SP 10/NACE 2 - Near-White Metal Blast Cleaning.
17. SSPC-SP 11 - Power Tool Cleaning to Bare Metal.
18. SSPC-SP 12 – Water Jetting Prior to Recoating
19. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.
20. SSPC-PA 1 – Painting Application Specification.
21. SSPC-PA 3 – Painting Application Guide for Safety in Paint Application.
22. SSPC Vis-1 - Pictorial Surface Preparation Standards for Painting Steel Structures.

1.4 DEFINITIONS

- A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.5 QUALITY ASSURANCE

- A. Qualifications: Prospective Contractors shall sufficiently demonstrate experience in the rehabilitation of similar tank structures and shall have specific experience in lead-paint removal and disposal. Contractors shall use only thoroughly trained and experienced workers completely familiar with the work required for the tank rehabilitation work. All cleaning, surface preparation and painting work shall be performed by a qualified company having at least ten (10) years of experience and shall have performed steel tank cleaning and painting work for at least twenty (20) steel water storage tanks. In addition, this shall include at least 5 projects completed in the New England area in the last 5 years. The Contractor shall not sell, transfer or otherwise dispose of the Contract to any third party.
- B. The Contractor shall be a qualified rigger or shall engage the services of a qualified rigger on the job at all times when rigging is being used. The foreman in charge shall have all rigging inspected by the rigger prior to use.
- C. The Contractor shall abide by all local, state and federal laws for confined space entry.
- D. All colors, unless specified herein, shall be selected by the Owner. The color selected will not necessarily conform to the manufacturer's color chart and any tinting required shall be done by the paint manufacturer to conform to the approved sample.
- E. Only non-lead-based pigmentation shall be allowed for both interior and exterior primers and top coats.

1.6 SUBMITTALS

- A. Shop Drawings: Submit the following in accordance with Section 01300 – “Submittals”:
 1. Product Data: Submit manufacturer's product data for each coating, including generic description, product line number, complete technical data, surface

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preparation, and application instructions.

2. Product Data: Submit technical data sheets for each coating, giving descriptive data. Curing times, mixing, thinning, and application requirements.
 - a. Provide material analysis, including vehicle type and percentage by weight and by volume of vehicle, resin and pigment.
 - b. Provide upon request of the Engineer, specific ASTM Performance Criteria for the submitted materials.
3. Product Data: Provide verification from the coating manufacturer that the interior coatings to be in contact with potable water do not contain any of the following Per- and Polyfluoroalkyl Substances (PFAS):
 - a. Perfluorooctanoic acid (PFOA);
 - b. Perfluorooctane sulfonic acid (PFOS);
 - c. Perfluorononanoic acid (PFNA);
 - d. Hexafluoropropylene oxide dimer acid (HFPO-DA, GenX Chemicals);
 - e. Perfluorohexane sulfonic acid (PFHxS); and
 - f. Perfluorobutane sulfonic acid (PFBS).
4. Product Data: Submit manufacturer's Safety Data Sheets (SDS) and other safety requirements.
5. Color Samples: Submit manufacturer's color samples showing full range of standard colors.
 - a. Submit three (3) samples of each coating and color selected, showing bare, prepared surface and each successive coat.
 - b. Samples shall be submitted on hardboard or metal as appropriate to coating system (size not less than 5" x 11"). Label samples on back identifying manufacturer, product name, and color number.
6. Manufacturer's Quality Assurance: Submit manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.
7. Applicator's Quality Assurance: Submit list of a minimum of twenty (20) completed projects of similar size and complexity to this Work. Include for each project, including projects where the specified coating system has been successfully applied.
 - a. Project name and location.
 - b. Name of Owner.
 - c. Name of Contractor.
 - d. Name of Engineer.
 - e. Name of coating manufacturer.
 - f. Approximate area of coatings applied.
 - g. Date of completion.

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8. Applicator's Quality Assurance: Provide certification that specialized equipment as may be required by manufacturer for proper application of coating materials shall be utilized.
 9. Warranty:
 - a. Submit manufacturer's 15-year corrosion, color, and gloss warranty for the exterior coating system.
 - b. Submit manufacturer's 10-year corrosion, color, and gloss warranty for the interior coating system.
 10. Containment system design details including materials of construction, methods of support, and any other equipment or appurtenances that is required for the stability and maintenance of the containment system.
 11. Worker safety plan as it pertains to the OSHA and environmental regulations associated with confined space entry; air emissions associated with cleaning, blasting, or painting operations; and residual blast waste handling.
 12. A plan for providing adequate cross ventilation and containment during any welding, abrasive blasting, painting and curing of the interior of the tank.
 13. A certified test report shall be submitted indicating results from the dry film thickness and holiday tests.
 14. A plan for chlorinating method to be used shall be submitted with the calculation for the amount of chlorine to be added to the tank.
- B. Pre-Installation meetings:
1. Schedule a conference and inspection to be held on-site before field application of coating systems begins.
 2. Conference shall be attended by Contractor, Engineer, Owner's representative, coating applicators and a representative from the coating material manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:
1. Coating or material name.
 2. Manufacturer.
 3. Color name and number.
 4. Batch or lot number.
 5. Date of manufacture.
 6. Mixing and thinning instructions.

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- B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
 2. Keep containers sealed until ready for use.
 3. Do not use materials beyond manufacturer's shelf life limits.
 4. Comply with all health and fire safety regulations.
- C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.8 ADDITIONAL REQUIREMENTS

- A. Weather:
1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in strict accordance with manufacturer's instructions.
 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point, or in accordance with manufacturer's instructions if more stringent.
 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
 4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
 5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.
- B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWA D102.
- C. Dust and Contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.
 3. The Contractor shall furnish all materials, equipment and labor for the design, fabrication, and erection of a Class 1A containment system for the containment and management of abrasive blast residuals in accordance with SSPC Guide 6 (Con). This temporary system shall include all suitable dust collectors, ventilators, decontamination trailers, air quality monitors, personal monitors, and any other incidental equipment necessary for the safe and effective removal of lead-based paints.
 4. Work to be performed in accordance with RIDEM regulations for fugitive dust

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(250-RICR-120-05-5).

D. Existing Conditions

1. Phillip J. Holton Service Water Tank
 - a. Constructed in 1959
 - b. Last Painted – 1990s
 - c. Last Inspected – May 2022
 - d. Exterior and interior paint chip analysis performed by Phoenix Environmental Laboratories in June 2022 confirmed that lead is present in the exterior and interior coatings.

E. Worker Protection

1. Contractor shall be responsible for all employee health and safety in accordance with Federal, State and local requirements.
2. Contractor will conform to the applicable OSHA requirements for the workers' protection as stipulated in 29CFR 1910.1025. Sanitary facilities shall include change rooms and shower facilities.
3. Shower facilities shall be those specifically designed for decontamination purposes and shall be equipped with a wastewater filtration system rendering wastewater non-hazardous. The Contractor shall maintain the filtration system in accordance with manufacturer's instructions and shall properly dispose of all filtered residuals and spent filter media.
4. The Contractor shall monitor the concentrations of lead with suitable air monitoring devices relative to the permissible exposure limits and the action levels associated with worker protection.
5. The Contractor shall provide OSHA approved respiratory and other protective equipment for worker protection during the cleaning and blasting operations required for this project. Protective clothing may be required if lead concentrations exceed the action or permissible levels of lead concentrations.
6. Contractor shall certify to the Owner that all employees or other subcontractor employees, as applicable, are medically qualified to perform the proposed tank cleaning and associated lead paint removal work, and that there are no pre-existing medical conditions relating to lead exposure.
7. The Contractor shall furnish and display appropriate warning signs in the designated work areas when the lead exposure levels exceed the permissible exposure limits in accordance with OSHA and State Health regulations.

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PART 2 PRODUCTS

2.1 GENERAL

- A. All tank painting shall be in accordance with the latest edition of AWWA D102, the Steel Structures Painting Council Specification SSPC-PA1, approved paint manufacturer specifications, and as specified herein.
- B. Each paint system shall be from a single manufacturer. Materials specified are those that have been evaluated for the specific service. Products of the Tnemec Company, Inc. are listed to establish a standard of performance and quality.
- C. All paint systems shall be environmentally (VOC) compliant in accordance with all Federal and Rhode Island regulations and the latest OTC (Ozone Transport Commission) VOC regulations.
- D. The interior paint system shall conform to Inside Coating System No. 5 as defined in AWWA D102 and shall be NSF approved. The Rhode Island Department of Health has a zero (0) VOC extractable requirement for potable water in contact with new lining systems. The interior finish lining shall be 100% solids by volume and contain no Xylene, Xylol and/or MEK solvents.
- E. All materials in contact with potable water shall not contain the following per- and polyfluoroalkyl substances (PFAS):
 - 1. Perfluorooctanoic acid (PFOA);
 - 2. Perfluorooctane sulfonic acid (PFOS);
 - 3. Perfluorononanoic acid (PFNA);
 - 4. Hexafluoropropylene oxide dimer acid (HFPO-DA, GenX Chemicals);
 - 5. Perfluorohexane sulfonic acid (PFHxS); and
 - 6. Perfluorobutane sulfonic acid (PFBS).
- F. The exterior paint system shall conform to Outside Coating System No. 4 or No. 6 as defined in AWWA D102.
- G. All paint coating and other related products, such as solvents and thinners, shall be supplied by the same paint manufacturer. The specified painting systems are based on products manufactured by the Tnemec Company in Kansas City, Missouri.

2.2 EXTERIOR COATING SYSTEM

- A. The exterior coating system shall be a three-coat zinc, epoxy, polyurethane, and fluoropolymer coating system applied to all exterior surfaces of the tank, including all appurtenances such as railings, columns, structural support systems and members, overflow pipe, steel riser pipe, vent pipes, vents, frames, hatch covers, ladders, ladder safety cage, panels, cabinets, etc.
- B. Coating System (product and dry film thickness):

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Surface Preparation:	SSPC-SP-6 to Commercial Blast Standard	
First Coat:	Tnemec Series 94-H ₂ O Hydro-Zinc	2.5-3.5 mils
Stripe Coat:	Tnemec Series 21 Epoxoline	3.0-3.5 mils
Third Coat:	Tnemec Series 1095 Endura-shield (100g/litre)	2.5-3.0 mils
Fourth Coat:	Tnemec Series V701 HydroFlon (100g/litre)	2.5-3.0 mils

- C. No substitutions from the specified coating system will be allowed.
- D. Stripe coat shall be applied to weld seams and leading edges.
- E. The finish color of the top coat for the tank shall be selected by the Owner.
- F. Furnish to the Owner two (2) gallons of exterior top coat of the same type and color used on the work.

2.3 INTERIOR COATING SYSTEM

- A. The interior coatings shall be a urethane zinc rich primer followed by a one-coat (plus stripe coat) epoxy coating system applied to all interior surfaces of the tank including the floor, roof, hatches, column pipe, steel riser pipe, structural support systems, and other appurtenances.
- B. Coating System (product and dry film thickness):

Surface Preparation:	SSPC-SP-10 to Near-White Standard	
First Coat:	Tnemec Series 94-H ₂ O Hydro-Zinc	2.5-4.0 mils
Pit Filling:	Tnemec Series 215 Surfacing Epoxy, as required	
Stripe Coat:	Tnemec Series 21 Epoxoline	3.0-4.0 mils
Finish Coat:	Apply ONE full finish coat of Tnemec Series FC22 Epoxoline, WH08-White	25-30 mils
- C. No substitutions from the specified coating system will be allowed.
- D. Pit filling shall be completed with Tnemec Series 215 Surfacer or approved equivalent.
- E. Stripe coat shall be applied to weld seams and leading edges at 3.0-4.0 mils DFT.
- F. Interior ceiling weld seam openings shall be sealed with De-Neef DeneSeal P-2235 100% solids and shall be an NSF 600 Standard Sealant.

2.4 DEHUMIDIFICATION AND HEATING

- A. As required to perform the work within the paint manufacturers specifications or other project requirements, the Contractor shall furnish and maintain on site a dehumidification and indirect hot-air heating system that is capable of maintaining a controlled atmosphere for the interior of the tank during the surface preparation, coating application procedures, and full cure of the interior coating system. The systems shall include all equipment, materials, labor, and power supply for operation. The specified surface preparation

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standard (SSPC SP 10) must be maintained with the use of this equipment. While this equipment is in use, and prior to coating, should the surface preparation quality fall below the specified standard, the Contractor shall re-clean the affected surfaces, at his own expense, to the specified standard prior to coating. The Contractor shall utilize dehumidification and heating equipment to maintain minimum surface temperatures and minimum dew point requirements for the interior coating system on an as needed basis throughout the application and cure-to-immersion service time frames, as established by the coating manufacturer.

- B. The Contractor shall submit detailed information to include the manufacturer of the unit, dimensions, power requirements, flow rates, and moisture removal.
- C. The Contractor shall submit a plan indicating the location of all proposed equipment.

PART 3 EXECUTION

3.1 GENERAL

- A. After the tank has been drained, Contractor shall ensure that all sediment has been removed from the tank floor and inlet/outlet piping, as necessary and determined by the Engineer.
- B. No paint shall be applied when the temperature of the surface to be painted is below the minimum temperature specified by the paint manufacturer, or less than 5 degrees above the dew point temperature. Paint shall not be applied to wet or damp surfaces or when the relative humidity exceeds 85%. Follow paint manufacturer's recommendations for the specific paint system used.
- C. The Contractor shall remove and legally dispose of all sediment, including the debris from the tank interior visible after the tank has been drained, prior to any coating.
- D. Before painting, remove slag, weld metal splatter and sharp edges by chipping or grinding. All surfaces that have been welded, abraded or otherwise damaged shall be cleaned and primed in the field in accordance with the paint system requirements.
- E. All areas blasted in the field shall be coated the same day before any oxidation occurs.
- F. Take precautionary measures to prevent fire hazards and spontaneous combustions. Remove empty paint containers from site.
- G. Place cotton waste, cloths, and hazardous material in containers, and remove from site daily.
- H. Protect elements surrounding work of this section from damage or disfiguration.
- I. During application of coating materials, post 'Wet Paint' signs.
- J. During application of solvent based materials, post 'No Smoking' signs.

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3.2 EXAMINATION

- A. Site Verification of Conditions:
1. Examine areas and conditions under which application of coating systems shall be performed for conditions that will adversely affect execution, permanence, or quality of coating system application.
 2. Correct conditions detrimental to timely and proper execution of Work.
 3. Do not proceed until unsatisfactory conditions have been corrected.
 4. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.3 TANK DRAINING COORDINATION

- A. Owner will be responsible for draining the elevated water storage tank. The Contractor shall pump out and remove any remaining water within the bottom of the tank and remove any sediment as part of the initial cleaning of the tank's interior.

3.4 SITE MOBILIZATION AND PREPARATION

- A. The Contractor may be required to temporarily remove any existing chain-link fence around the tanks to facilitate the installation of the proper containment system required for the performance of the contract work. The Contractor shall make this determination during the bidding phase at the time of the site examination in order to include the cost of the temporary removal and re-attachment of the existing chain-linking fencing, if required, upon completion of the contract work.
- B. Contractor shall complete any site clearing or tree trimming necessary to perform the project scope of work.
- C. The Contractor shall furnish and install other temporary fencing around the limit of work, including staging areas for equipment and stored materials around the immediate grounds, to secure the work and equipment during the course of the contract.
- D. The Contractor shall adjust scaffolding as required to protect existing enclosures and antennas that are to remain.

3.5 PREPARATION

- A. Interior surfaces shall be abrasive blast cleaned in accordance with SSPC SP-10, Near-White Blast Cleaning. Exterior surfaces shall be abrasive blast cleaned in accordance with SSPC-SP-6, Commercial Blast Cleaning. Entire tank exterior must be shrouded during abrasive blast cleaning. The coatings to be removed contain lead, therefore acceptable coating removal methods include wet abrasive blast cleaning, water jetting with or without abrasives, vacuum abrasive blast cleaning, and chemical stripping.

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Certain coating removal methods require subsequent dry abrasive blasting to achieve the specified surface preparation. Should these methods be selected, the Contractor shall ensure that no fugitive dust escapes the containment system during dry abrasive blasting. This is to be accomplished by the use of negative air and/or dust collection systems adequately sized to effectively control dust.

- B. The ground surface shall be protected from exposure to water and debris from surface preparation. Paint chips and water to be collected and disposed offsite in accordance with applicable laws and regulations.

It is acknowledged that the water storage tank was painted with lead-based paint. As a result, lead contamination in surficial soils surrounding the tank has been remediated in accordance with Rhode Island Department of Environmental Management Site Remediation Regulations. The contractor shall follow the specifications and take all reasonable measures protect the surrounding soils from impacts due to surface preparation and painting work. Prior to mobilization by the contractor and upon completion of the project, Providence Water personnel will collect and analyze surficial soils surrounding the tank for lead. The remediation of any newly discovered lead in the soil surrounding the tank will be the responsibility of the contractor.

C.

- D. Surface preparation shall not be done simultaneously with priming. An entire area or section shall be cleaned and inspected by the Engineer before primer is applied to that area. No primer is to be applied until the entire area has been viewed and approved by the Engineer. Any defect not properly cleaned as specified will be cause for rejection of the entire area in question and no priming shall be done on this area until satisfactory corrections are made and approved by the Engineer.

- E. The blast cleaning procedure shall use angular grit abrasive. The size and gradation shall be such as to produce a 2.0-3.0 mils angular anchor profile that is sharp and clean with no embedded spent abrasive material.

- F. The abrasive blast cleaning shall be effective in removing corrosion deposits and scale as defined in the surface preparation SSPC SP-10 specification and as shown in the visual standards SSPC Vis-1.

- G. Maintain ambient conditions prior to, during the coating application, and through full cure to immersion service for the interior painting process. The use of dehumidification and heating equipment shall be required to maintain the coating manufacturer's minimum curing conditions criteria.

- H. Surface Preparation:

1. General Requirements:

- a. Prior to application of primer, surfaces shall be prepared to receive specified coating system in compliance with manufacturer's recommendations and specifications of Steel Structures Painting Council (SSPC).

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- b. Clean surfaces of residual deposits of grease, scale, rust, oil, dirt, and other foreign matter, immediately prior to priming. Surfaces to be coated shall be clean, dry, smooth and free from dust and foreign matter which will adversely affect adhesion or appearance.
2. Ferrous Metal Surfaces:
- a. Surfaces shall be free of residual deposits of grease, rust, scale, dirt, dust, and oil.
 - b. Surfaces shall be cleaned in compliance with specifications of Steel Structures Painting Council.
- I. The Contractor shall repair all pitted areas of the tank surfaces that show loss of 35% or more of existing plate thickness and/or any areas of severe undercut or reduction of weldment below the surface of the shell plates, or as directed by the Engineer. Pitted areas of the tank surfaces that show loss of 50% or more of the existing plate thickness or areas on the tank that are concentrated with pits shall be repaired by an approved welding method, such as plating. All pits and plating shall be welded in such a manner as to ensure 100% fusion with the parent metal and to bring pits or plating flush with original plate surface. All pits and plating shall be free of surface porosity and ground flush to ensure continuity of the applied coatings. All welding will be at the direction of the on-site inspector and is to be in accordance with AWWA D-100 Standards, latest revision thereof.
- J. Pit welded areas are to be re-cleaned and spot blasted prior to applying coating systems. Surfaces that are damaged by pit welding shall be sand blasted and spot painted to match surrounding undamaged surfaces.

3.6 ABRASIVE BLASTING RESIDUAL WASTE PROVISIONS

- A. General: The Contractor is responsible for the collection, handling, storage, testing and legal disposal of the abrasive blasting materials and residual waste generated as part of the tank rehabilitation. The cost for transporting and legal disposal of materials categorized as hazardous waste shall be the responsibility of the contractor.
- B. The Contractor shall collect all abrasive blasting residual waste daily. These residuals shall be collected using a vacuum system with suitable HEPA filters. Blast residuals shall be stored in suitable storage containers in accordance with federal and state regulations and be properly secured and protected within the enclosed project area.

3.7 APPLICATION

- A. All coatings materials shall be stored, mixed, applied and cured within ambient temperature ranges identified by the painting manufacturer. Application and curing shall also be accomplished within the relative humidity range. Natural ambient conditions for curing periods shall be anticipated by the Contractor and have Engineer's approval.

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- B. No coating work shall be done if the ambient temperatures (air, coating materials and substrate) are not within the allowable ranges unless the Contractor is able to control these conditions using effective equipment.
- C. The coating materials shall be applied in strict accordance with the respective coating manufacturer's written recommendations.
- D. Spot field prime coat materials shall be applied to the surface after blast cleaning before any rust back occurs or before the end of each day of surface preparation effort, whichever comes first.
- E. The full intermediate prime coat shall be applied to the entire tank surface (interior and exterior). Unprimed areas, abraded areas and areas considered in an advanced state of deterioration by the Engineer shall be blast cleaned and the remaining shop primed areas shall be brush cleaned prior to application of the full intermediate prime coat.
- F. Spray guns shall be held perpendicular to the surface being coated in such a manner that all dry overspray is kept at a minimum. All spray application of coatings shall utilize a cross spray technique to maximize coverage of all irregular surfaces.
- G. All coating material for interior surfaces shall be applied by airless spray equipment of a type and size suitable for the respective material. Coating material shall be applied around rivets, welds, edges and inside angles by use of a brush.
- H. All coating material for exterior surfaces shall be applied by brush, roller or airless spray equipment of a type and size suitable for the respective material. Use of airless spray equipment shall be allowed only if adequate containment is provided to minimize overspray and emissions to the surrounding areas meeting the approval of the Engineer. Application of prime coat to the base and six inches up the side walls shall be by brush, as well as to all rivets, welds, edges and inside angles to ensure proper coverage and application.
- I. After surface preparation, interior weld seams, leading edges and nut and bolt assemblies shall be "stripe-coated" by brush method with one coat of primer. Application may be performed prior to or following the application of the full prime coat on prepared surfaces. "Stripe-coat" shall be the same as the full prime coat but be a contrasting color for inspection purposes.
- J. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping.
- K. Apply coatings in accordance with manufacturer's instructions.
- L. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.
- M. Keep containers closed when not in use to avoid contamination.
- N. Do not use mixed coatings beyond pot life limits.

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- O. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.
- P. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- Q. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- R. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.
- S. The exterior prime coat is the only coat that will be permitted to be sprayed. The other coats on the tank exterior must be applied by roller. Paint application methods shall be approved by the Engineer.

3.8 VENTILATION

- A. During application of coatings inside the tank, adequate ventilation shall be provided, and all equipment shall be nonsparking and explosion-proof. Necessary precautions shall be taken to ensure safe working conditions are maintained during use of paints which contain toxic and flammable solvents.
- B. Effectiveness of the ventilation system shall be checked by making periodic explosive meter readings, in which the concentration of volatile material shall not exceed 20 percent of the lower explosive limit.
- C. Continuous forced ventilation at a rate of at least one complete air change every 4 hours shall be provided for at least 48 hours after coating application is completely cured in accordance with the paint manufacturer's recommendations. Tank manholes shall be kept open for an additional 7 days. The Contractor may use heat to obtain proper curing and to ensure that the painting is completed within the project schedule.

3.9 CONTAINMENT SYSTEMS

- A. General
 - 1. A containment system will be employed at this tank site that meets the Class 1A Standard as outlined within the SSPC-SP Guide 6 (Guide for Containing Surface Preparation Debris Generated During Paint Preparation Operations). This may be accomplished by modular containment systems that isolate work areas or by encapsulating the entire tank.
 - 2. The Contractor shall be fully responsible for the design and support system associated with the containment system. Full decking and associated handrails are required at each work level and stairs and handrails are required as per OSHA regulations.
 - 3. Engineered drawings of the scaffold and containment complying with OSHA

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regulations and stamped by a Registered Professional Structural Engineer licensed in the State of Rhode Island.

4. The scaffold design shall be such that no excessive loads or forces are applied to the tank, which could cause damage during various weather conditions that could be experienced while the scaffold/containment system is in place. The Contractor shall spread the load of the roof containment system over a large area to eliminate any steel deflection greater than 1-inch. The scaffolding/containment design is to include the weight of containment materials and decking as well as all cell coax cables and antennae.
5. Scaffolding system shall be designed and installed in accordance with OSHA 1926.
6. The Containment structure shall be properly grounded.
7. Cost for hazardous material collection, storage and disposal will be included in the Base Bid and all lead-based waste material will be handled in accordance with all State and Federal requirements.

B. Air Quality Monitoring

1. During the surface preparation phase on the tank's exterior, air quality monitoring shall be conducted. The Contractor shall pay for the services of a State licensed testing laboratory to set up, monitor, maintain, and remove air quality monitoring stations at the tank site.
2. The air quality monitoring will be used to determine the background air quality before work commences, during the blasting and substrate preparation period and upon completion of the surface preparation.
3. If during the monitoring of air quality, the data collected indicates that a breach of containment occurred, and material escaped the containment area the Contractor will be responsible for all cleanup costs necessary to return the affected area to its original condition.
4. In addition to the initial air quality monitoring with instruments, if during the daily observations dust or debris is seen escaping the containment area by the Engineer, the work shall be halted to correct the problem.

3.10 ACCEPTANCE

- A. The base for acceptance of the coating work are listed below. Deviations beyond these parameters shall, at the Engineer's discretion, be corrected by the Contractor at his own expense and in accordance with the manufacturer's recommendations.
1. No runs or sags
 2. No overspray or roughness

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3. No holidays or pinholes
 4. No color or gloss variations
 5. Allowable film thickness +2.0 mils over specified thickness.
- B. Wet and dry film thickness measurements shall be made for each 100 square feet of surface painted. Additional coats shall be applied as required to attain the minimum dry film thickness specified for the painting system.
- C. The paint on all interior surfaces below the overflow shall be tested with a High Voltage holiday detector after the paint has cured for at least 5 days. The holiday testing shall be in accordance with NACE SP0188-2016. Locations where holidays are detected shall be repaired and retested.

3.11 REPAIR

- A. Damaged Materials: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.12 CLEANING

- A. At completion of day's work, remove from site rubbish and accumulated materials.
- B. Leave storage area clean and in same condition indicated for equivalent spaces in Project.
- C. The Contractor shall at all times keep the premises free from accumulation of waste materials and rubbish caused by his employees or work. At the completion of the painting, the Contractor shall remove all tools, scaffolding, surplus materials, and rubbish from and about the tanks.

3.13 WASTE MANAGEMENT

- A. Place materials defined as hazardous or toxic waste in designated containers.
- B. Do not dispose of paints or solvents by pouring on the ground. Place in designated containers for proper disposal.
- C. Contractor shall be responsible for all costs associated with containment, sediment and waste disposal that may result from execution of this project.

3.14 FIRST ANNIVERSARY INSPECTION

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- A. The Contractor shall perform a first anniversary inspection of the tank and make repairs to the paint system in accordance with AWWA D102.
- B. Contractor shall inspect the interior tank by means of a human licensed underwater diver. The inspection shall be documented via photographs and video recording.
- C. The Contractor shall coordinate and schedule the inspection with the Owner and provide at least 30 days advance notice.

END OF SECTION

DIVISION 11

EQUIPMENT

**PROVIDENCE WATER SUPPLY BOARD
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SECTION 11200

WATER STORAGE TANK APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section pertains to the replacement of select structural components and appurtenances to the existing service water tank.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, accessories, appurtenances, and furnished specialties for all tank rehabilitation items.
- B. Shop Drawings: Signed and sealed by a Professional Engineer registered in the State of Rhode Island. Show fabrication and installation details for all tank rehabilitation items, including the following:
 - 1. Plans, elevations, sections, details, and attachments to other work.
 - 2. Structural analysis data signed and sealed by the Professional Engineer registered in the State of Rhode Island responsible for their preparation.
- C. Welding certificates.
- D. See Section 01300 – Submittal Requirements for other contract submittal requirements.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
- B. Pipe Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

PART 2 - PRODUCTS

2.1 PAINT MATERIALS

- A. See Section 09970 – Steel Water Storage Tank Painting, for painting and material requirements.

2.2 ROOF VENT

- A. A properly sized aluminum vent assembly shall be furnished and installed to replace the existing roof vents. Each vent shall conform to AWWA D100 and vent shall open downward and be fitted with four mesh outer and twenty-four mesh inner non-corrodible screens. Roof vent model shall be Model SD 18-24 (18" OD x 24" tall weld-in vent stack) as manufactured by Tomcat Consultants/T.A.P Co. of Rosebud, MO, or approved equivalent.

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Each vent shall be installed along with an adequately sized short weld-in vent stack with bolt flange, as manufactured by Tomcat Consultants/T.A.P. Co of Rosebud, MO.

2.3 OVERFLOW

- A. Existing overflow pipe on the existing service water tank shall be modified as shown on the drawings. Overflow pipe extension shall be 8" in diameter. Overflow pipe shall be schedule 40 carbon steel pipe and have a minimum wall thickness of 1/4". The new overflow pipe shall extend from the end of the existing overflow pipe down the exterior of the tank terminated approximately 20" above grade and discharge onto a concrete splash pad. The point of discharge shall have a 90° bend and be equipped with a 24-mesh Type 316 stainless steel screen and a weighted flap valve.

2.4 WEIGHTED FLAP VALVE

- A. The flap valve shall have a cast iron body and cover. The valve shall have resilient to bronze seats and the hinge pin and cotter pins shall be stainless steel.
- B. The valve shall be constructed with a 10° offset from vertical to ensure positive closure. The weighted flap shall have a weight attached to the lid and allow adjustment.
- C. The valve lid shall have a mechanical stop to ensure the lid cannot over rotate.
- D. The flange shall be drilled using ANSI 125# template.
- E. All iron parts shall be coated with a two-part epoxy with 3-4 mils dry film thickness to prevent rusting or corrosion.
- F. The valve shall be machined, assembled, and tested in the USA for quality assurance.
- G. The manufacturer shall show proof of ISO 9001:2008 certification.
- H. The valve and accessories shall be manufactured by Troy Valve, Model A2540, or approved equivalent.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION OF NEW TANK COMPONENTS

- A. See Section 09970 – Steel Water Storage Tank Painting for surface requirements.
- B. Field Cleaning: After completion of tank structural appurtenances, remove burrs, dirt, and construction debris and repair damaged finishes. Remove weld splatter, sharp edges on weld seams, scabs and slivers by grinding. Remove weld flux, slag, fins, and laminations.
- C. Field Surface Preparation: After field cleaning, prepare steel surfaces where shop prime coat has been damaged according to the Specifications listed above for shop cleaning, and remove dust or residue from cleaned surfaces.
- D. If surface develops rust before prime coat is applied, repeat field surface preparation.

3.2 FIELD PAINTING

- A. See Section 09970 – Steel Water Storage Tank Painting of these Contract Specifications.

**PROVIDENCE WATER SUPPLY BOARD
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3.3 FIELD QUALITY CONTROL

- A. Testing: The Contractor, overseen by the Engineer, will engage a qualified testing agency to perform the following field quality control testing:
 - 1. Tank Weld Test: See Specification Section 05120 – Structural Steel Framing for weld testing provisions.
 - 2. Leakage Test: See Specification Section 02510 – Leakage Detection for leakage and other final testing associated with completed tank restoration.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 CLEANING AND DISINFECTION

- A. See Section 09970 – Steel Water Storage Tank Painting and Section 02511 – Disinfection of Water Utility Storage Tanks for final cleaning and disinfection requirements of the elevated storage tank upon completion of restoration and painting work.

END OF SECTION

APPENDIX A

PROVIDENCE WATER SERVICE WATER TANK INSPECTION REPORT

**Interior and Exterior Inspection Report
Philip J. Horton - Elevated Tank
CorrTech Report No. 15746-FOR-01-1**



Prepared For:

**Providence Water Supply Board
125 Dupont Drive
Providence, RI 02907**

***CORR*TECH**
CORROSION UNDERSTOOD
25 South Street
Hopkinton, MA 01748

6/3/2022

STATEMENT OF LIMITATION

Conclusions presented in this document are based on the services described and performed and not on tasks or procedures beyond the scope of the contracted services or time and budgetary constraints imposed by contract limitations.

CorrTech, Inc. has performed this assessment in a professional manner using the degree of skill and care exercised for similar projects under similar conditions by reputable and competent consultants, and in accordance with the procedures established within CorrTech's quality assurance, quality control protocol.

CorrTech, Inc. shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld or not fully disclosed at the time the evaluation was performed.



Report Prepared by: Max Mizejeski
Corrosion Technician



Report Reviewed by: Gary M. Roberts
Project Manager

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APPLICABLE STANDARDS	1
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GLOSSARY OF TERMS	

INTRODUCTION

On May 20, 2022, CorrTech representatives, Max Mizejeski, Scott Leighton, and Sanskriti Tripathi performed a corrosion and structural assessment of the exterior and interior of a drinking water storage tank for Providence Water Supply Board. The inspection was conducted to establish the current condition of the tank's coatings and steel substrate. The tank inspected included:

Philip J. Holton WTP 40,000-gallon Elevated Tank

For applicable standards used in this inspection, please see below.

The interior of the reservoir was inspected with the TankRover remotely operated vehicle, while full. The TankRover is the only piece of equipment like it in the United States and was developed by CorrTech. By using the TankRover the interior of the tank was inspected with no special preparation, confined space entry, no additional disinfection and no downtime.

The TankRover is equipped with a surface-cleaning tool used to remove loose rust or debris in order to view the potential metal loss under the coating. The unit has high-powered thrusters, which are used to maneuver throughout the tank and are used to wash away bottom sediment for observations. Video is recorded with audio narration on site with digital stills captured for the report.

The TankRover and all tether were prepared for the inspection by disinfecting equipment with a 200 ppm chlorine spray in accordance with AWWA C652.

The exterior portions of the tank were inspected by walking the roof and shell portions that were accessible from the ground.

The objectives of the assessment were to:

1. Perform field inspections and tests to assess the structural integrity of the tank.
2. Assess condition of any protective coatings present
3. Review the safety compliance of tank ladders and access.
4. Review sanitary protection equipment
5. Provide recommendations for rehabilitation.

APPLICABLE STANDARDS

- American Water Works Association (AWWA) Standard D100, Welded Carbon Steel Tanks for Water Storage
- AWWA Standard D101, Inspecting Steel Tanks, Standpipes, Reservoirs, and Elevated Tanks for Water Storage
- AWWA Standard D106, Sacrificial Anode Cathodic Protection Systems for the Interior submerged Surfaces of Steel Water Storage Tanks
- AWWA Standard D652, Disinfection of Water Storage Facilities
- AWWA Manual M42, Steel Water Storage Tanks
- Rhode Island Department of Public Health Regulation R46-13-DWQ, Rules and Regulations Pertaining to Public Drinking Water

EXECUTIVE SUMMARY

The condition and recommendations for the tank are briefly summarized in this section. For detailed information regarding tank conditions and specific recommendations please refer to the designated section for the tank.

The exterior coating was in poor condition with significant delamination along the bottom of the legs and risers. More moderate delamination was observed on the shell and roof of the tank.

The interior was in better condition with only localized areas of corrosion along the weld seams of patch plates. The six (6) anodes installed in the tank were intact and potential readings indicated that they were protecting the interior submerged surfaces.

The following recommendations are included in this report:

- Install an AWWA complaint pressure/vacuum vent
- Install a gasket on the roof hatch
- Modify the overflow pipe so that it discharged 16-in. to 24-in. above grade
- Install a splash pad under the modified overflow pipe, once complete
- Modify the roof railings to meet current OSHA standards
- Install a self-closing swing gate at the top of the ladder
- Recoat the tank exterior surfaces
- Clean tank foundation pads and make repairs, as necessary
- Conduct the next tank inspection in 2027

TANK DATA FOR PHILIP J. HOLTON SERVICE TANK							
Site Information	Fencing In Place:	Yes			Locks on Gates:	Yes	
Address:	61 N Rd, Hope, Road			Vault Lock in Place:	N/A		
Tank Information	Tank Name:	Philip J. Holton Service Water Tank			Tank Diameter:	24 -ft	
Tank Height:	10-ft	Tank Capacity:	40,000	Previous Cleaning Date:	Unknown		
Previous Inspect. Date:	2014			Previous Coating Application:	Unknown		
Foundation	Height:	5-in	Adequate Drainage:	Yes		Chime Plate Size:	N/A
# of Anchors:	4	Anchor Bolt Diameter:	1-in		Chair Thickness	0.5-in	
Anchor Chair Dimensions:	3-in x 3-in						
Shell Manhole	# of Manholes	1		Dimensions:	18 x 14-in		
Ladder	Height from Ground:	10-ft			Safety Cage:	Yes	
Anti Climb Lock :	Yes			Climbing Safety System Style:	Rail		
Rung to Rung Dim:	12-in	Distance from Shell:	11-in		Width:	14-in	
Overflow	Diameter:	8-in	Air Gap	Approx. 68-ft	Overflow Protection	Screen	
Screen Condition:	Intact	Screen Type:	Coarse			Splash Pad	No
Roof Hatch	Dimensions:	24 x 24-in		Sanitary Neck	4-in.		
# of Hatches:	1	Hatch Cover Overlap	2-in		Lock	Yes	
Roof Vent	Style:	Mushroom			Diameter:	8-in	
Cap to Roof Distance:	10-in	Screen Condition:	Damaged		Type:	Coarse	
Roof Handrail Hts	Top Rail:	37-in	Mid Rail:	19-in	Toe Kick Plate:	4-in	
Interior	Sediment Depth:	2-3-in around riser			Sediment Coverage:	10%	
Inlet/Outlet Pipe:	Combined		Sediment Ring:	Yes			
Interior Ladder	Climbing Safety System:	None			Style:	Fixed	
Columns:	No	Column Number:	N/A		Interior Column Style	N/A	

OBSERVATIONS

Photos provided in the report were created from a digital camera and interior pictures were captured in digital format from the interior video. The interior images are as clear as our printed technology will allow. The copies in the report provide a reference for our comments. Keep in mind that for underwater video snaps, the video provides the greatest detail and should be viewed as part of the report.

Narration on the video is done in the field and some of the comments may be different than the written report.

TESTING

Cathodic Protection Survey

This tank was equipped with six (6) sacrificial anodes, three (3) at the bottom of the bowl around the riser pipe, and three (3) attached to the ladder inside the riser pipe. A silver/silver chloride reference electrode was lowered into the tank from the roof hatch to collect tank-to-electrolyte potential measurements.

Position	Potential Measurements
Top	-1.1 V
Middle	-1.2 V
Bottom	-1.21 V

All tank-to-electrolyte potential measurements indicate adequate levels of cathodic protection are being provided to submerged steel portions of the tank interior at this time.

Dry Film Thickness Readings

A Positector 6000 gauge was used to take dry film coating thickness readings on the exterior shell and roof. These reading measure the thickness of the paint remaining on the substrate. For complete data, see APPENDIX II.

Location	Number of Readings	Average	Minimum	Maximum
Shell - Batch	45	8.4	5.1	12.4
Roof – Batch	45	11.4	4.2	30.3
Riser/Legs	45	9.8	5.3	19.6

(All measurements taken in mils)

INTERIOR

Roof Structure:

The roof is a self-supporting domed structure. There were no signs of significant metal loss and no visible light penetrations.

Roof Coating:

The coating was mostly intact with corrosion bush and delamination across approximately 5% of the roof plates.

Shell Structure:

There were no signs of deformations, bowing or buckling, in the shell plates. No metal loss was apparent during this inspection.

Shell Coating:

The shell was 99% intact with a few spots of minor corrosion development. There were 4-5 patch plates along the shell and all of them had minor corrosion in some part of their welds.

Floor Structure:

There were no deformations, bowing or buckling, in the floor plates. There were no signs of metal loss.

Sediment:

Sediment has accumulated at the center of the tank around the riser pipe as well as at the bottom of the riser. It is difficult to make an accurate measurement of the sediment depth, but it is estimated to be approximately 2-3-in deep at the center of the tank and roughly 6-in at the bottom of the riser.

Floor Coating:

From what was visible of the floor coating no corrosion or delamination was observed.

Piping:

The inlet and outlet pipes are combined into a single pipe at the bottom of the riser pipe. The pipe had a solid cover on top of it.

EXTERIOR

Foundation:

The concrete foundations for the legs are showing significant spalling and cracking.

Manholes:

There is one manway on the riser pipe. It has moderate corrosion blush around its outer edge and the bolts. The manway neck had significant coating delamination.

Ladder:

The ladder was in acceptable condition to climb, free from any major deformations or corrosion. It was equipped with a safety cage and a rail climb.

Overflow:

The overflow pipe has an internal weir funnel that exits through the top of the shell, goes through the balcony, and discharges immediately below, approximately 68-feet above grade. The overflow was protected with an intact screen.

Shell Coating:

The shell coating was approximately 85% intact with several areas of delamination and some minor biological growth. No significant corrosion was found on the shell.

Roof Hatch:

The hatch was initially blocked by the rotating roof ladder. The ladder was movable, but required significant effort to do so.

The hatch was intact but had no gasket.

Roof Vent:

A mushroom style vent was located at the center of the roof. A coarse screen is present inside of the cap but has been damaged.

Handrails:

Handrails enclose the balcony but there are none on the roof. The handrails do not meet OSHA standards of a top rail height of 42-in. The top rail was measured at 37-in.

Roof Coating:

20% of the roof has corrosion and delamination coverage. Corrosion is mostly focused along the weld seams and is more severe closer to the center of the roof.

RECOMMENDATIONS

The roof vent does not meet current AWWA D100 standard or the generally accepted Ten States standard for sanitary protection. Fine mesh screens are subject to clogging due to freeze up in the winter so a special vent assembly is needed. Vents should be installed which can relieve both a positive or negative pressure should the fine mesh screen become clogged. An AWWA vacuum/pressure relief vent provides for the safe use of insect screen and should be designed for easy inspection and maintenance of the screens.

A gasket should be installed on the roof hatch to provide a sanitary seal.

Overflow pipe needs to be replaced or modified to meet current standards:

Per AWWA D100, the overflow pipe should extend down to within 16-24-in above ground for maintenance and be fitted with a corrosion resistant 24-mesh screen with or without a self-closing flapper cover. Rubber type duck bill check valves can be used in lieu of the flapper cover. Discharge point must be onto a splash pad or drainage structure to prevent erosion of the tank foundation. In areas where freezing is common rubber duckbill check valves may need to be protected against freeze up.

In accordance with the requirements of AWWA D100, overflows must discharge over a drain inlet or splash pad to prevent erosion of material from around the tank. A suitable method of erosion protection should be installed at this site.

During the next tank rehabilitation project modifications to the roof hand railings should be considered to bring the railing into compliance with current OSHA and AWWA requirements. Per AWWA D100 handrails on balconies, around roof hatches and rest platforms are required to be 42-in high with a 21-in high mid-rail and 4-in toe kick. These safety features allow safe access to roof surfaces to safely inspect and maintain vent screens and collect water samples.

Self-Closing Swing Gate

In order to be in compliance with OSHA Standard 1910.23(a)(2) all railing openings or platform pass through openings should be equipped with a self-closing swing gate. Although this standard strictly addresses new construction after November 19, 2018 it is advisable to modify existing tanks with this safety device. If existing ladders are substantially modified or replaced on an existing tank, then this new standard would apply.

Exterior Coating should be replaced:

Tank exterior should be fully blasted and coated in the next 2-3-years using a properly written job specification and certified coating inspection. To ensure longest possible service life from the new coating, contractors should follow the AWWA D102 standard and use a full-time coatings inspector to ensure proper surface preparation and application.

Providence Water Supply Board	Philip J. Holton WTP Elevated Tank	15746-FOR-01-1	7
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Concrete Foundation Repair Required

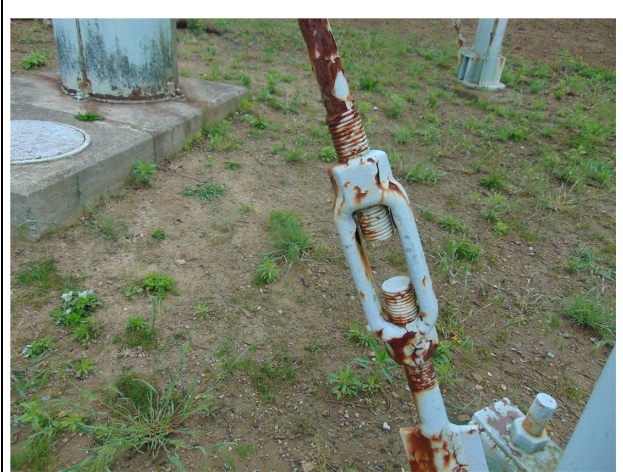
Repairs should be made to the exposed portion of the foundation pads due to cracking and spalling that was noted during the inspection. Cracking or spalling of the concrete foundation allows for water intrusion, freeze thaw damage and vegetation intrusion. Long term degradation could lead to structural stability issues. Repairing the concrete foundation with proper materials and techniques will prolong the lifespan of the structure.

Per AWWA guidelines it is recommended that this tank be inspected again in 2027.

Appendix I: Photographs



1) 1-Tank overview



4) 4-Engaged turnbuckle with corrosion bluish



2) 2-Site overview



5) 5-Spalling on concrete foundation pad



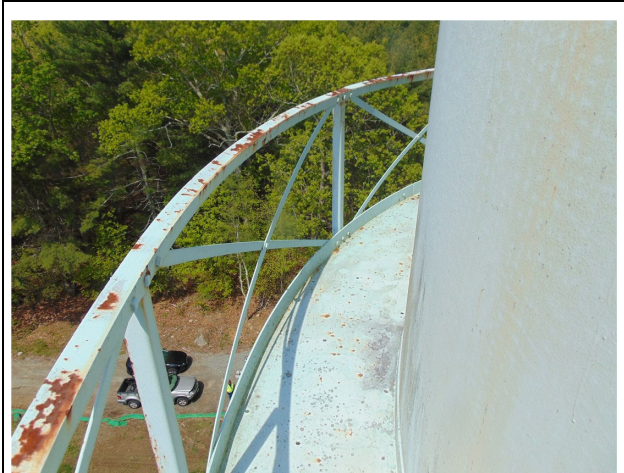
3) 3-Tank leg base



6) 6-Corrosion on anchor chair



7) 7-Bottom of bowl with corrosion



10) 10-Tank balcony with minor delamination



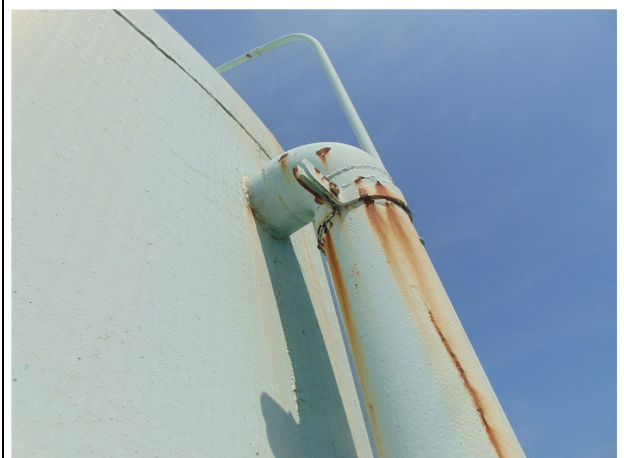
8) 8-Overflow pipe



11) 11-Delamination on shell



9) 9-Ladder with safety cage



12) 12-Corrosion on overflow pipe



13) 13-Biological growth on shell



16) 16-Typical condition of roof and vent overview



14) 14-Corrosion and delamination on the roof



17) 17-Corrosion on vent and damaged screen



15) 15-Rotating roof ladder



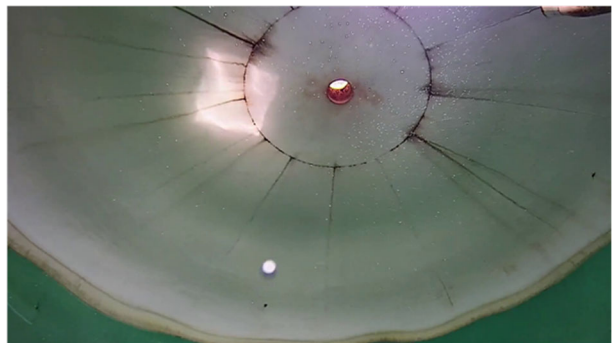
18) 18-Roof hatch



19) 19-Corrosion on interior weld seams



20) 20-Overflow weir funnel



21) 0:16-Interior roof



22) 1:51-Corrosion cell on roof



23) 2:05-Interior ladder



24) 3:15-Corrosion around patch plates



25) 3:30-Intact coating on lower shell



26) 4:54-Sacrificial anode



30) 6:47-Delamination inside riser pipe



27) 5:14-Intact coating on bowl



31) 8:18-Bottom of riser pipe with inlet/outlet



28) 5:47-Riser pipe opening and anode overview



32) 8:34-Riser Manway



29) 6:32-Interior of riser pipe

Appendix II
Exterior Paint Thickness Readings

B9

Created: 2022-05-20 08:51:32
PosiTector Body S/N: 871573
Probe Type: PosiTector 6000 F
Probe S/N: 423385
CAL: Cal 1

Exterior legs & riser

Summary

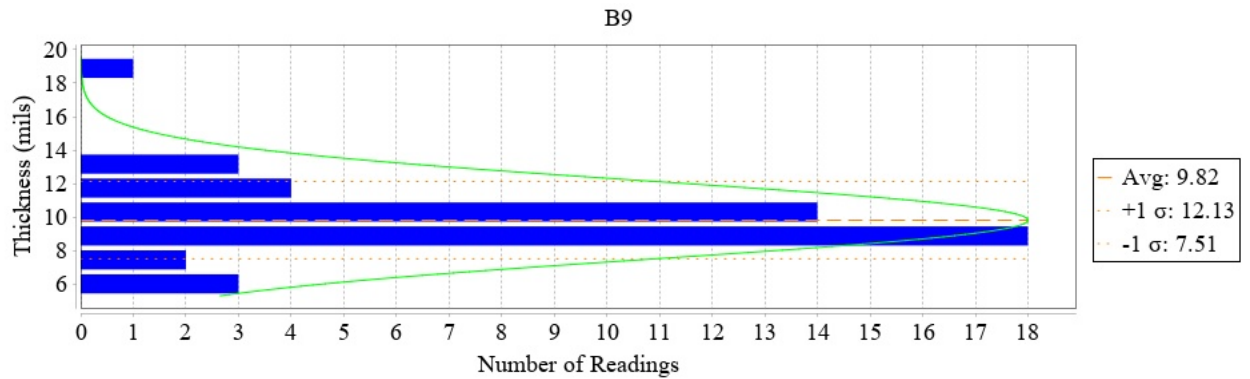
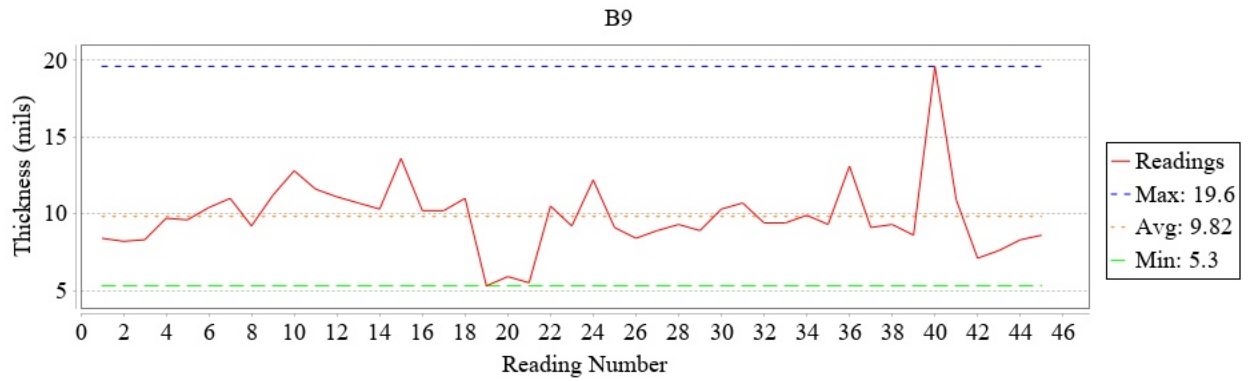
	#	x	σ	↓	↑
Thickness (mils)	45	9.82	2.31	5.3	19.6

Readings

#	Thickness (mils)	Time
1	8.4	2022-05-20 08:51:43
2	8.2	08:51:48
3	8.3	08:51:49
4	9.7	08:51:53
5	9.6	08:51:54
6	10.4	08:51:55
7	11.0	08:51:59
8	9.2	08:52:00
9	11.2	08:52:01
10	12.8	08:52:10
11	11.6	08:52:11
12	11.1	08:52:12
13	10.7	08:52:28
14	10.3	08:52:29
15	13.6	08:52:30
16	10.2	08:52:31
17	10.2	08:52:32
18	11.0	08:52:33
19	5.3	08:52:44
20	5.9	08:52:45
21	5.5	08:52:46
22	10.5	08:52:56
23	9.2	08:52:57
24	12.2	08:52:59
25	9.1	08:53:10
26	8.4	08:53:11
27	8.9	08:53:13
28	9.3	08:53:23
29	8.9	08:53:24
30	10.3	08:53:25
31	10.7	08:53:33
32	9.4	08:53:35
33	9.4	08:53:35
34	9.9	08:53:37

B9 Readings

#	Thickness (mils)	Time
35	9.3	08:53:38
36	13.1	08:53:39
37	9.1	08:53:42
38	9.3	08:53:43
39	8.6	08:53:45
40	19.6	08:53:46
41	10.9	08:53:47
42	7.1	08:53:48
43	7.6	08:53:50
44	8.3	08:53:51
45	8.6	08:53:52



B11

Created: 2022-05-20 11:02:19
PosiTector Body S/N: 871573
Probe Type: PosiTector 6000 F
Probe S/N: 423385
CAL: Cal 1

Exterior roof

Summary

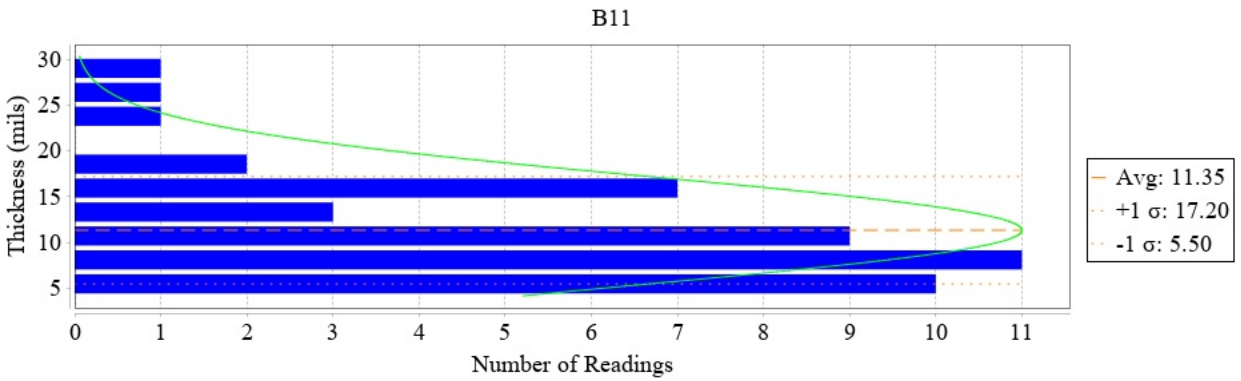
	#	x	σ	↓	↑
Thickness (mils)	45	11.35	5.85	4.2	30.3

Readings

#	Thickness (mils)	Time
1	16.9	2022-05-20 11:40:38
2	18.5	11:40:40
3	25.1	11:40:41
4	5.6	11:40:43
5	15.3	11:40:44
6	11.7	11:40:45
7	4.2	11:40:47
8	4.7	11:40:48
9	7.1	11:40:49
10	13.0	11:40:51
11	12.0	11:40:52
12	12.2	11:40:53
13	14.0	11:40:55
14	30.3	11:40:56
15	16.6	11:40:57
16	7.0	11:40:59
17	8.0	11:41:00
18	9.9	11:41:00
19	9.7	11:41:02
20	6.3	11:41:03
21	5.7	11:41:03
22	9.3	11:41:05
23	16.2	11:41:06
24	5.6	11:41:07
25	7.3	11:41:08
26	7.2	11:41:09
27	6.5	11:41:11
28	11.7	11:41:15
29	11.9	11:41:16
30	7.4	11:41:17
31	9.4	11:41:18
32	8.5	11:41:19
33	24.9	11:41:20
34	16.1	11:41:22

B11 Readings

#	Thickness (mils)	Time
35	19.5	11:41:23
36	14.9	11:41:24
37	6.7	11:41:39
38	9.8	11:41:42
39	10.1	11:41:43
40	6.8	11:41:45
41	8.7	11:41:46
42	10.1	11:41:47
43	16.8	11:41:48
44	7.0	11:41:49
45	4.5	11:41:50



B10

Created: 2022-05-20 11:01:06
PosiTector Body S/N: 871573
Probe Type: PosiTector 6000 F
Probe S/N: 423385
CAL: Cal 1

Exterior shell

Summary

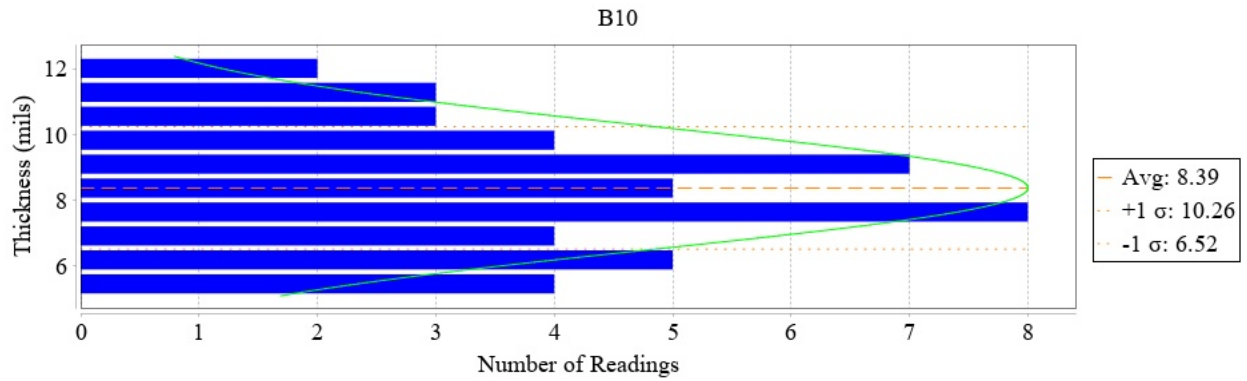
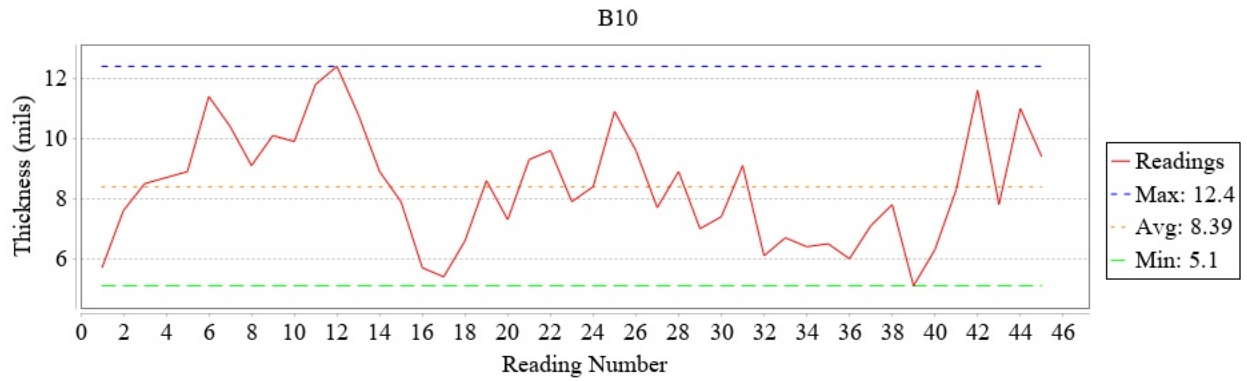
	#	x	σ	↓	↑
Thickness (mils)	45	8.39	1.87	5.1	12.4

Readings

#	Thickness (mils)	Time
1	5.7	2022-05-20 11:01:09
2	7.6	11:01:10
3	8.5	11:01:11
4	8.7	11:01:13
5	8.9	11:01:14
6	11.4	11:01:15
7	10.4	11:01:17
8	9.1	11:01:17
9	10.1	11:01:18
10	9.9	11:01:20
11	11.8	11:01:20
12	12.4	11:01:21
13	10.8	11:01:23
14	8.9	11:01:24
15	7.9	11:01:25
16	5.7	11:01:28
17	5.4	11:01:28
18	6.6	11:01:29
19	8.6	11:01:34
20	7.3	11:01:35
21	9.3	11:01:36
22	9.6	11:01:37
23	7.9	11:01:38
24	8.4	11:01:39
25	10.9	11:01:46
26	9.6	11:01:47
27	7.7	11:01:48
28	8.9	11:01:49
29	7.0	11:01:50
30	7.4	11:01:51
31	9.1	11:01:54
32	6.1	11:01:55
33	6.7	11:01:56
34	6.4	11:01:57

B10 Readings

#	Thickness (mils)	Time
35	6.5	11:01:58
36	6.0	11:01:59
37	7.1	11:02:06
38	7.8	11:02:07
39	5.1	11:02:08
40	6.3	11:02:11
41	8.3	11:02:12
42	11.6	11:02:13
43	7.8	11:02:16
44	11.0	11:02:17
45	9.4	11:02:18



Appendix III
Paint Sample Laboratory Results



Tuesday, June 21, 2022

Attn:
Corrtech
25 South Street
Hopkinton MA 01748

Project ID: PROVIDENCE WATER 15746
SDG ID: GCL53711
Sample ID#s: CL53711 - CL53713

This laboratory is in compliance with the NELAC requirements of procedures used except where indicated.

This report contains results for the parameters tested, under the sampling conditions described on the Chain Of Custody, as received by the laboratory. This report is incomplete unless all pages indicated in the pagination at the bottom of the page are included.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

A scanned version of the COC form accompanies the analytical report and is an exact duplicate of the original.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Sincerely yours,

A handwritten signature in black ink that reads "Phyllis Shiller". The signature is written in a cursive style with a large initial "P".

Phyllis Shiller
Laboratory Director

NELAC - #NY11301
CT Lab Registration #PH-0618
MA Lab Registration #M-CT007
ME Lab Registration #CT-007
NH Lab Registration #213693-A,B

NJ Lab Registration #CT-003
NY Lab Registration #11301
PA Lab Registration #68-03530
RI Lab Registration #63
UT Lab Registration #CT00007
VT Lab Registration #VT11301



Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823

Sample Id Cross Reference

June 21, 2022

SDG I.D.: GCL53711

Project ID: PROVIDENCE WATER 15746

Client Id	Lab Id	Matrix
A-EXT SHELL	CL53711	BULK
B-LEG/RISER	CL53712	BULK
C-INTERIOR	CL53713	BULK



Environmental Laboratories, Inc.
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
 Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

June 21, 2022

FOR: Attn: Corrtch
 25 South Street
 Hopkinton MA 01748

Sample Information

Matrix: BULK
 Location Code: CORRT-MA
 Rush Request: Standard
 P.O.#: 15746-1

Custody Information

Collected by:
 Received by: SW
 Analyzed by: see "By" below

Date Time

05/21/22
 06/10/22 11:14

Laboratory Data

SDG ID: GCL53711
 Phoenix ID: CL53711

Project ID: PROVIDENCE WATER 15746
 Client ID: A-EXT SHELL

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Chromium	2.8	1.5	mg/Kg	1	06/18/22	CPP	SW6010D
Lead	14100	15	mg/Kg	10	06/18/22	CPP	SW6010D
Total Metals Digest	Completed				06/10/22	B/AG	SW3050B

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

Results are reported on an ``as received`` basis, and are not corrected for dry weight.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director

June 21, 2022

Reviewed and Released by: Helen Geoghegan, Project Manager



Environmental Laboratories, Inc.
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
 Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

June 21, 2022

FOR: Attn: Corrtch
 25 South Street
 Hopkinton MA 01748

Sample Information

Matrix: BULK
 Location Code: CORRT-MA
 Rush Request: Standard
 P.O.#: 15746-1

Custody Information

Collected by:
 Received by: SW
 Analyzed by: see "By" below

Date

05/21/22
 06/10/22

Time

11:14

Laboratory Data

SDG ID: GCL53711
 Phoenix ID: CL53712

Project ID: PROVIDENCE WATER 15746
 Client ID: B-LEG/RISER

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Chromium	10600	110	mg/Kg	100	06/21/22	EK	SW6010D
Lead	72200	110	mg/Kg	100	06/21/22	EK	SW6010D
Total Metals Digest	Completed				06/10/22	B/AG	SW3050B

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

Results are reported on an ``as received`` basis, and are not corrected for dry weight.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director

June 21, 2022

Reviewed and Released by: Helen Geoghegan, Project Manager



Environmental Laboratories, Inc.
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
 Tel. (860) 645-1102 Fax (860) 645-0823

Analysis Report

June 21, 2022

FOR: Attn: Corrtch
 25 South Street
 Hopkinton MA 01748

Sample Information

Matrix: BULK
 Location Code: CORRT-MA
 Rush Request: Standard
 P.O.#: 15746-1

Custody Information

Collected by:
 Received by: SW
 Analyzed by: see "By" below

Date Time

05/21/22
 06/10/22 11:14

Laboratory Data

SDG ID: GCL53711
 Phoenix ID: CL53713

Project ID: PROVIDENCE WATER 15746
 Client ID: C-INTERIOR

Parameter	Result	RL/ PQL	Units	Dilution	Date/Time	By	Reference
Chromium	452	11	mg/Kg	10	06/15/22	EK	SW6010D
Lead	530	1.1	mg/Kg	1	06/15/22	EK	SW6010D
Total Metals Digest	Completed				06/11/22	B/AG	SW3050B

RL/PQL=Reporting/Practical Quantitation Level ND=Not Detected BRL=Below Reporting Level

Comments:

Results are reported on an ``as received`` basis, and are not corrected for dry weight.

All soils, solids and sludges are reported on a dry weight basis unless otherwise noted in the sample comments.

If you are the client above and have any questions concerning this testing, please do not hesitate to contact Phoenix Client Services at ext.200. The contents of this report cannot be discussed with anyone other than the client listed above without their written consent.

Phyllis Shiller, Laboratory Director

June 21, 2022

Reviewed and Released by: Helen Geoghegan, Project Manager



Environmental Laboratories, Inc.
 587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
 Tel. (860) 645-1102 Fax (860) 645-0823

QA/QC Report

June 21, 2022

QA/QC Data

SDG I.D.: GCL53711

Parameter	Blank	Blk RL	Sample Result	Dup Result	Dup RPD	LCS %	LCSD %	LCS RPD	MS %	MSD %	MS RPD	% Rec Limits	% RPD Limits
-----------	-------	--------	---------------	------------	---------	-------	--------	---------	------	-------	--------	--------------	--------------

QA/QC Batch 628525 (mg/kg), QC Sample No: CL53429 (CL53711, CL53712)

ICP Metals - Soil

Chromium	BRL	0.33	14.4	14.4	0	98.7	103	4.3	92.2			75 - 125	35
Lead	BRL	0.33	5.29	5.07	4.20	98.8	100	1.2	96.7			75 - 125	35

Comment:

Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.

QA/QC Batch 628566 (mg/kg), QC Sample No: CL54454 (CL53713)

ICP Metals - Soil

Chromium	BRL	0.33	24.7	27.2	9.60	110	101	8.5	121			75 - 125	35
Lead	BRL	0.33	114	165	36.6	107	99.7	7.1	112			75 - 125	35


Comment:

Additional Criteria: LCS acceptance range is 80-120% MS acceptance range 75-125%.

r = This parameter is outside laboratory RPD specified recovery limits.

If there are any questions regarding this data, please call Phoenix Client Services at extension 200.

- RPD - Relative Percent Difference
- LCS - Laboratory Control Sample
- LCSD - Laboratory Control Sample Duplicate
- MS - Matrix Spike
- MS Dup - Matrix Spike Duplicate
- NC - No Criteria
- Intf - Interference


 Phyllis Shiller, Laboratory Director
 June 21, 2022

Tuesday, June 21, 2022

Criteria: RI: Com

State: RI

Sample Criteria Exceedances Report

GCL53711 - CORR-MA

SampNo	Acode	Phoenix Analyte	Criteria	Result	RL	Criteria	RL Criteria	Analysis Units
CL53711	PB-SM	Lead	RI / Direct Exposure Criteria / Inorganics (Com)	14100	15	500	500	mg/Kg
CL53712	PB-SM	Lead	RI / Direct Exposure Criteria / Inorganics (Com)	72200	110	500	500	mg/Kg
CL53713	PB-SM	Lead	RI / Direct Exposure Criteria / Inorganics (Com)	530	1.1	500	500	mg/Kg

Phoenix Laboratories does not assume responsibility for the data contained in this exceedance report. It is provided as an additional tool to identify requested criteria exceedences. All efforts are made to ensure the accuracy of the data (obtained from appropriate agencies). A lack of exceedence information does not necessarily suggest conformance to the criteria. It is ultimately the site professional's responsibility to determine appropriate compliance.



Environmental Laboratories, Inc.
587 East Middle Turnpike, P.O.Box 370, Manchester, CT 06045
Tel. (860) 645-1102 Fax (860) 645-0823



Analysis Comments

June 21, 2022

SDG I.D.: GCL53711

The following analysis comments are made regarding exceptions to criteria not already noted in the Analysis Report or QA/QC Report: None.

CHAIN OF CUSTODY RECORD



587 East Middle Turnpike, P.O. Box 370, Manchester, CT 06040
 Email Makrina Nolan: makrina@phoenixlabs.com Fax (860) 645-0823
 Client Services (860) 645-1102

Customer: 25 South Street Unit E
 Address: Hopkinton, MA 01748
 CorTech Inc.

Project: Providence Water 15746
 Report to:
 Invoice to: CorTech
 QUOTE #

Temp 19.3 C Pg of

Data Delivery/Contact Options:

Fax: _____
 Phone: _____
 Email: mmiezejeski@corctech-inc.com

Coolant: Yes No
 IPK ICE

Project P.O. 15746 - 1

This section MUST be completed with Bottle Quantities.

PHOENIX USE ONLY SAMPLE #	Customer Sample Identification	Sample Matrix	Date Sampled	Time Sampled	Analysis Request	MA	CI	RI	Time	Date	Accepted by:	Comments, Special Requirements or Regulations:
53711	A-Ext. Shell	SOB	5/21		Waste Water	<input type="checkbox"/> MCP Certification <input type="checkbox"/> GW-1 <input type="checkbox"/> GW-2 <input type="checkbox"/> GW-3 <input type="checkbox"/> S-1 GW-1 <input type="checkbox"/> S-2 GW-1 <input type="checkbox"/> S-3 GW-1 <input type="checkbox"/> SW Protection	<input type="checkbox"/> RCP Cert <input type="checkbox"/> GW Protection <input type="checkbox"/> SW Protection <input type="checkbox"/> GA Mobility <input type="checkbox"/> GB Mobility <input type="checkbox"/> Residential DEC <input type="checkbox"/> I/C DEC <input type="checkbox"/> Other	<input checked="" type="checkbox"/> (Residential) <input type="checkbox"/> (Comm./Industrial) Direct Exposure <input type="checkbox"/> GA Leachability <input type="checkbox"/> GB Leachability <input type="checkbox"/> GA-GW Objectives <input type="checkbox"/> GB-GW Objectives	1 Day* 2 Days* 3 Days* Standard Other	6-10-02	11:14	Max Miezjeski UPS Tupulum
53712	B-leg/riser	SOB	5/21		Waste Water							
53713	C-Interior	SOB	5/21		Waste Water							

Client Sample - Information - Identification
 Sampler's Signature: *[Signature]* Date: 6-3-02
 Matrix Code: DW=Drinking Water GW=Ground Water SW=Surface Water WM=Waste Water
 RW=Raw Water SE=Sediment SL=Sludge S=Soil SD=Solid W=Wipe Oil=Oil
 B=Bulk L=Liquid X=(Other)

Data Format
 Excel
 PDF
 GIS/Key
 EQUIS
 Other
 Data Package
 Tier II Checklist
 Full Data Package*
 Phoenix Std Report
 Other
 * SURCHARGE APPLIES

State where samples were collected: RI
 * SURCHARGE APPLIES

GLOSSARY OF TERMS FOR STEEL/CONCRETE TANKS

Adhesion- State in which two surfaces are held together by interfacial forces which may consist of valence forces or interlocking action or both

Aggregate- Granular material, such as sand, gravel, crushed stone, crushed hydraulic-cement concrete, or iron blast-furnace slag used with a hydraulic cementing medium to produce either concrete or mortar.

Bugholes- Small regular or irregular cavities, usually not exceeding 15 mm in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and compaction.

Cathodic Protection - The use of a sacrificial metal or energized substance to polarize the structures surfaces and prevents corrosion.

Chalking - The degradation of a paint binders when exposed to ultra-violet light which creates a loose residue on the surface.

Chemical Attack- Decomposition of a coating or concrete due to the action of a chemical.

Chime- Portion of tank floor plate that extends outside the tank shell and rests on top of the foundation.

Contraction Joint- Formed, sawed, or tooled groove in a concrete structure to create a weakened plane and regulate the location of cracking resulting

Corrosion Cell - A concentrated localized site of accelerated corrosion that creates pitting.

Disbondment- The loss of adhesion between a coating and the substrate.

Dry Film Thickness - Total thickness of a paint film when completely cured.

Efflorescence- A white crystalline or powdery deposit on the surface of concrete. Efflorescence results from leaching of lime or calcium hydroxide out of a permeable concrete mass over time by water, followed by reaction with carbon dioxide and acidic pollutants.

Finish- The texture of a concrete surface after compaction and finishing operations have been performed.

Finial Vent - The central roof vent on top of a water tank.

Grout- A plastic mixture of cementitious materials and water used as a filler for cracks, or other void spaces, in concrete surfaces to be coated.

Holiday - A hole or void in a protective coating that may be invisible to the unaided eye that extends to the substrate.

Honey Comb- Voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.

Hydraulic, Hydrostatic Pressure- A force exerted on the concrete/coating interface due to the level of the ground water.

Isolation Joint- A separation between adjoining parts of a concrete structure

Joint Sealant- Compressible material used to exclude water and solid foreign materials from joints.

Lap Joint Seam- Overlapping seam between roof plates that is open and un-welded on the interior.

Laitance- A thin, weak brittle layer of cement and aggregate fines on a concrete surface. The amount of laitance is influenced by the degree of working or the amount of water in the concrete.

Lead Abatement - The removal of a lead bearing paint system.

Lead Encapsulation - The covering over of a lead based paint by applying a compatible topcoat.

Osmotic Blister - Raised coating area created by buildup of fluid under the coating. Fluid moves through coating in response to water/solvent concentrations between coating and tank water.

Osmotic Pressure- A force exerted on the concrete /coating interface through the capillaries in the concrete due to a moisture differential across the coating.

Overflow Weir Box- internal or external box that captures water above the operating height of the tank and directs it to an overflow pipe.

Pack Rust/Crevice Corrosion- Advanced form of steel corrosion that forms visible layers of oxidized steel swollen larger than the original steel plate thickness, usually found between steel plates or surfaces.

Pinholes- Film defect characterized by small pore-like flaws in a coating which extend entirely through the applied film and have the general appearance of pinpricks, fine holes, or voids when viewed by reflected light.

Plastic Cracking or Shrinkage- Cracking that occurs in the surface of fresh concrete soon after it is placed and while it is still plastic,

Porosity- The ratio usually expressed as a percentage, of the volume of voids in a material to the total volume of the material, including the voids.

Reflective Cracking-Cracking that develops in a coating directly over a dynamic crack in concrete.

Rigging plug- Thread steel nipple welded to a tank roof for the purposes of rigging painting cables. Usually sealed with a threaded plug when not in use.

ROV - Remotely operated vehicle, underwater inspection device "TankRover" by CorrTech

Screen Mesh- Number of openings per linear inch of screen.

Silt - Material that accumulates in the bottom of a water tank originating from treatment by products, raw water particles and distribution system debris.

Silt Stop- Solid cylinder installed on a floor inlet or outlet pipe to extend the pipe above the floor. Pipe prevents floor sediment from being stirred up or sucked out of the tank during flow.

Static Cracks- A crack in the concrete surface whose width does not change.

GLOSSARY OF TERMS FOR STEEL/CONCRETE TANKS

Stitch or Skip Weld- Method of welding two pieces of steel together with intermittent short sections of weld bead. Leaves open lap joints along the unwelded sections.

Tubercle - Domed shaped buildup of corrosion products over an active corrosion site. Promotes metal loss through pitting due to differential oxygen concentrations.

Ultrasonic Measurement - The use of high frequency sound waves passed through a material to measure the time required to return. The time required to pass through the material is correlated to the speed of sound in the substrate to yield an actual thickness at a specific location.

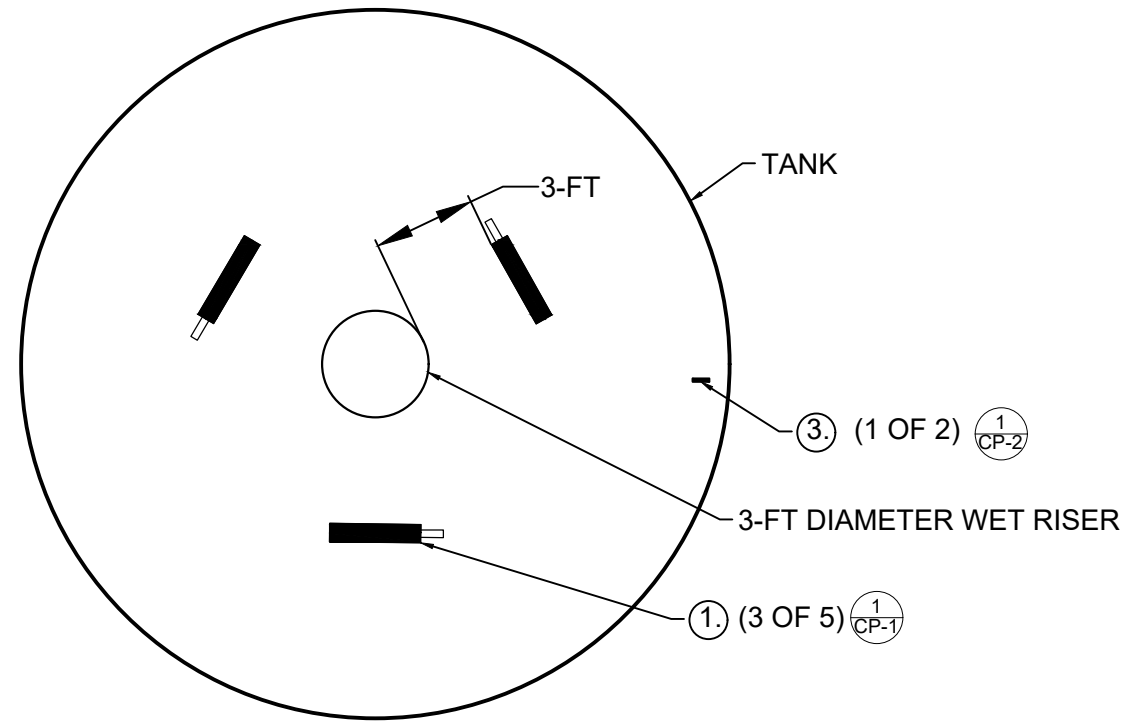
Vapor Barrier- Waterproof membrane placed under concrete floor slabs that are placed on grade.

APPENDIX B

CATHODIC PROTECTION SYSTEM

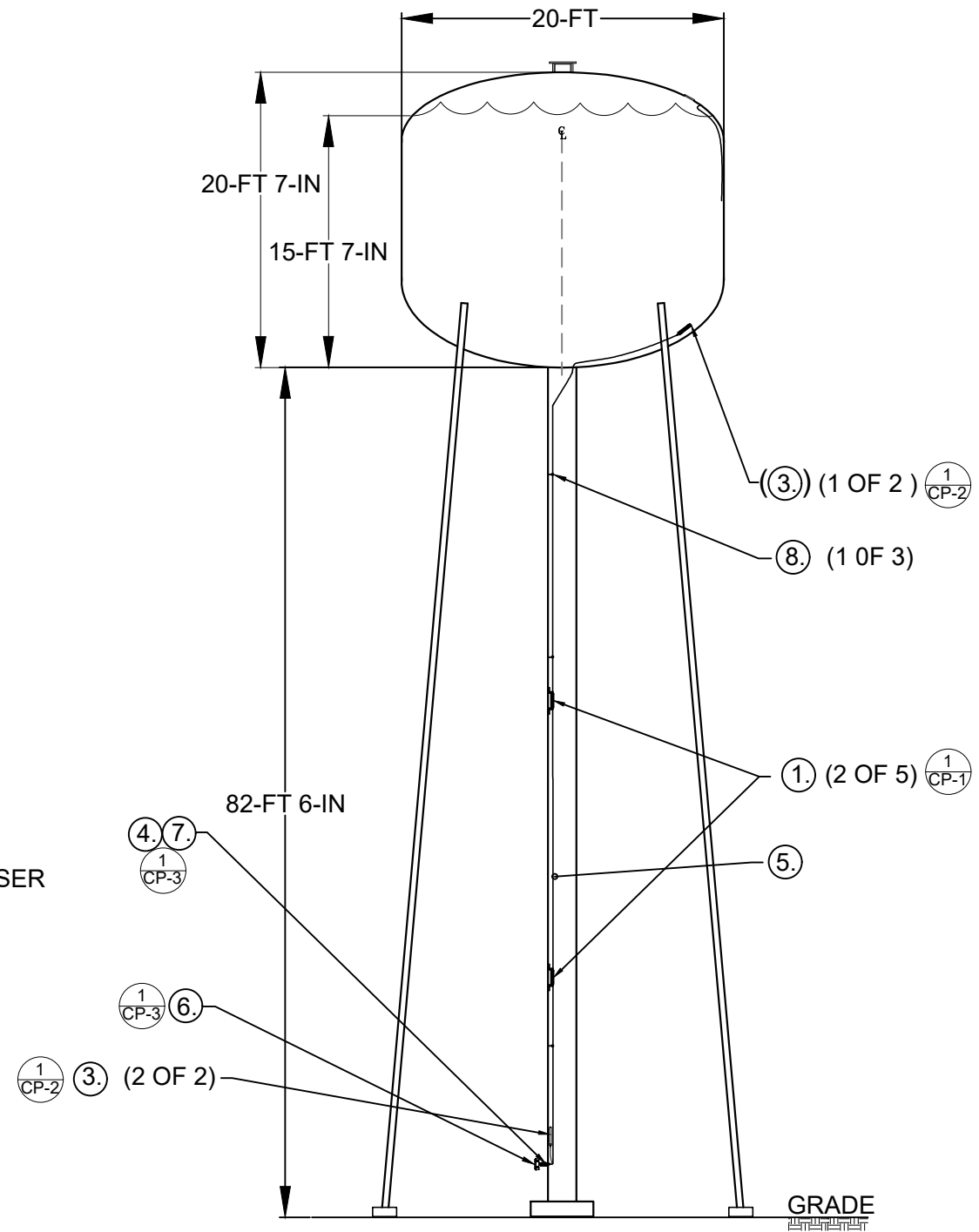
NOTES:

- REFER TO BOM/PARTS LIST FOR ALL FNS (FIND NUMBERS.) PARENTHESIS SURROUNDING FNS REPRESENT PREVIOUS CALL OUT REFERENCE.



FLOOR ANODE LAYOUT

- 3 ANODES, TRIANGULAR LAYOUT PATTERN.



40,000-GALLON ELEVATED WATER STORAGE TANK

CATHODIC PROTECTION SYSTEM LAYOUT: PROFILE

NO.	DATE	DESCRIPTIONS	BY	APPROD.
00	11/17/23	INITIAL CP DESIGN	RHG	SHP
REVISIONS				
CATHODIC PROTECTION SYSTEM GENERAL ARRANGEMENT				
DATE:	DRAWING NUMBER:	SHEET NUMBER:	REV.	
11/21/23	16753-CAD-01-1	1 OF 4	00	



25 SOUTH STREET
HOPKINTON, MA 01748
(508) 435-0090
www.cortech-inc.com

DESIGNED: SHP
DRAWN: RHG
CHECKED: JBP



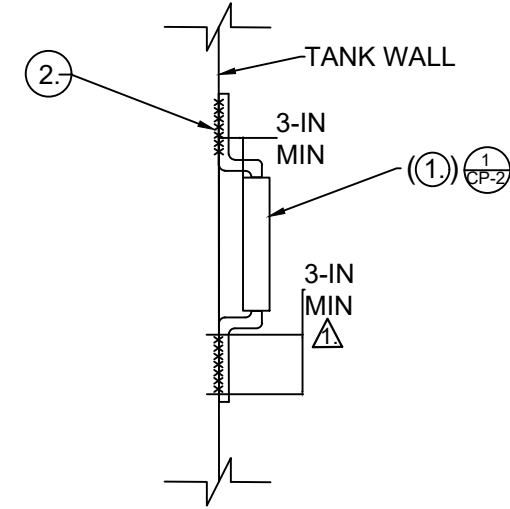
ENGINEER-IN-CHARGE
DIRECTOR

CLIENT:
PROVIDENCE WATER SUPPLY BOARD
125 DUPONT DRIVE
PROVIDENCE, RI 02907

PROJECT:
PROVIDENCE WATER
40,000 GAL WATER STORAGE TANK,
JOB NO. 16753

NOTES:

- REFER TO BOM/PARTS LIST FOR ALL FNS (FIND NUMBERS.) PARENTHESIS SURROUNDING FNS REPRESENT PREVIOUS CALL OUT REFERENCE.



ANODE WELDMENT DETAILS

- REMOVE COATING TO BARE STEEL, WELD 3-IN MINIMUM OF WIRE CORE ON BOTH ENDS, AND RE-COAT WIRE CORE. DO NOT COAT ANODES.

1
CPD-1

BOM/PARTS LIST

FN	QTY	ITEM	NOTES	P/N
1	5	ANODE, 36LB, MAGNEZIUM		
2	AR	FILLET WELD		
3	2	REFERENCE CELL, SILVER CHLORIDE		
4	1	3/4" NPT FITTING		
5	AR	CABLE, HMWPE		
6	1	JUNCTION BOX, NEMA 4X, 8" X 6" X 4" W/ LATCH		
7	1	WALL PENETRATION GLAND (CONAX)		
8	3	3/8" X 3" CARBON STEEL EYELETS		

NO.	DATE	DESCRIPTIONS	BY	APPROV
00	11/17/23	INITIAL CP DESIGN	RHG	SHP
REVISIONS				



25 SOUTH STREET
HOPKINTON, MA 01748
(508) 435-0090
www.cortech-inc.com

DESIGNED SHP
DRAWN RHG
CHECKED JBP



ENGINEER-IN-CHARGE
DIRECTOR

CLIENT:
PROVIDENCE WATER SUPPLY BOARD
125 DUPONT DRIVE
PROVIDENCE, RI 02907

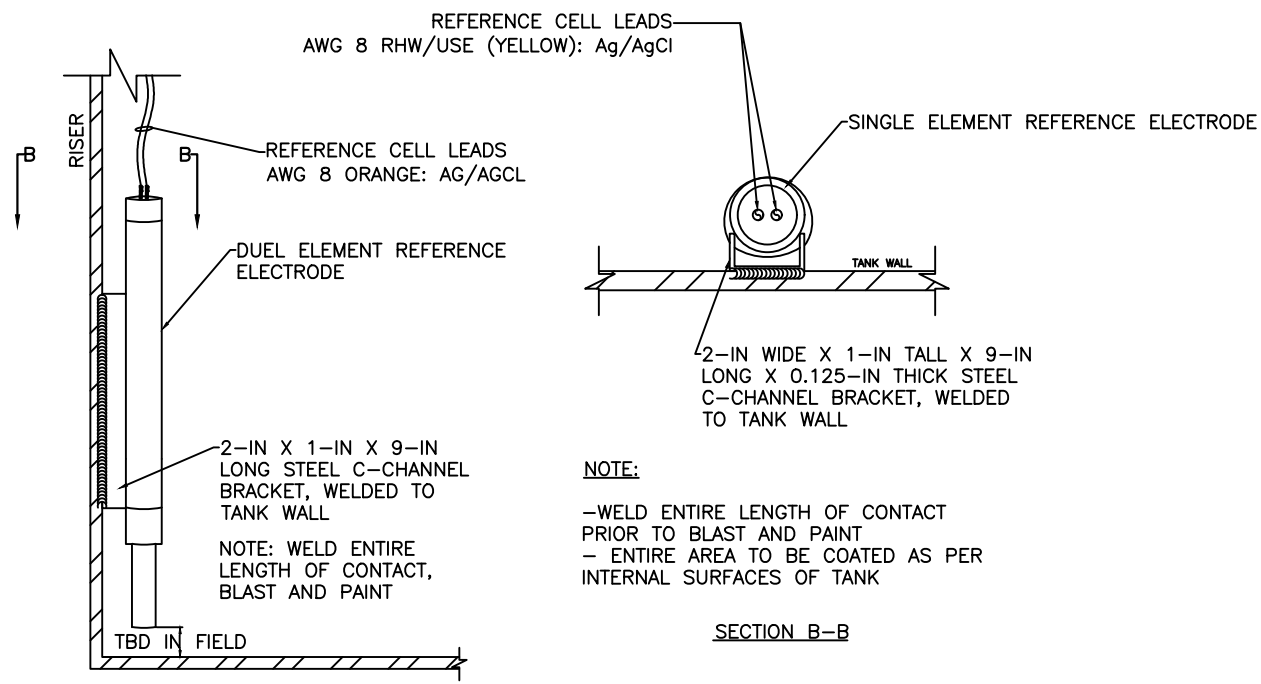
PROJECT:
PROVIDENCE WATER
40,000 GAL WATER STORAGE TANK,
JOB NO. 16753

**CATHODIC PROTECTION SYSTEM
GENERAL ARRANGEMENT**

DATE	DRAWING NUMBER	SHEET NUMBER	REV.
11/21/23	16753-CAD-01-1	2 OF 4	00

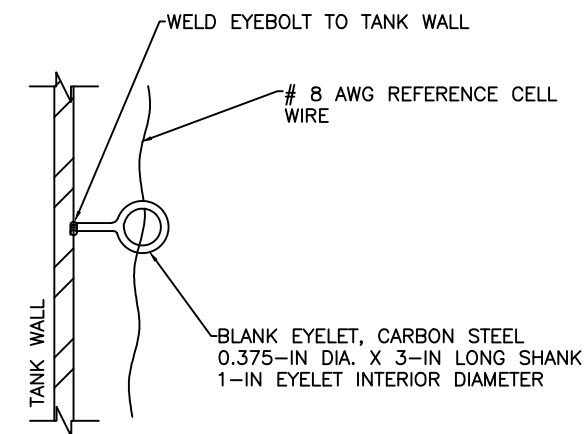
NOTES:

- REFER TO BOM/PARTS LIST FOR ALL FNS (FIND NUMBERS.) PARENTHESIS SURROUNDING FNS REPRESENT PREVIOUS CALL OUT REFERENCE.



NOTE:
 -WELD ENTIRE LENGTH OF CONTACT PRIOR TO BLAST AND PAINT
 - ENTIRE AREA TO BE COATED AS PER INTERNAL SURFACES OF TANK

REFERENCE ELECTRODE
 1
 CP-2



NOTE:
 -WELD ENTIRE LENGTH OF CONTACT PRIOR TO BLAST AND PAINT
 - ENTIRE AREA TO BE COATED AS PER INTERNAL SURFACES OF TANK

EYELET
 2
 CP-2

NO.	DATE	DESCRIPTIONS	BY	APPRD
00	11/17/23	INITIAL CP DESIGN	RHG	SHP
REVISIONS				

DATE:	DRAWING NUMBER:	SHEET NUMBER:	REV.
11/21/23	16753-CAD-01-1	3 OF 4	00



25 SOUTH STREET
 HOPKINTON, MA 01748
 (508) 435-0090
 www.corrtech-inc.com

DESIGNED: SHP
 DRAWN: RHG
 CHECKED: JBP



ENGINEER-IN-CHARGE
 DIRECTOR

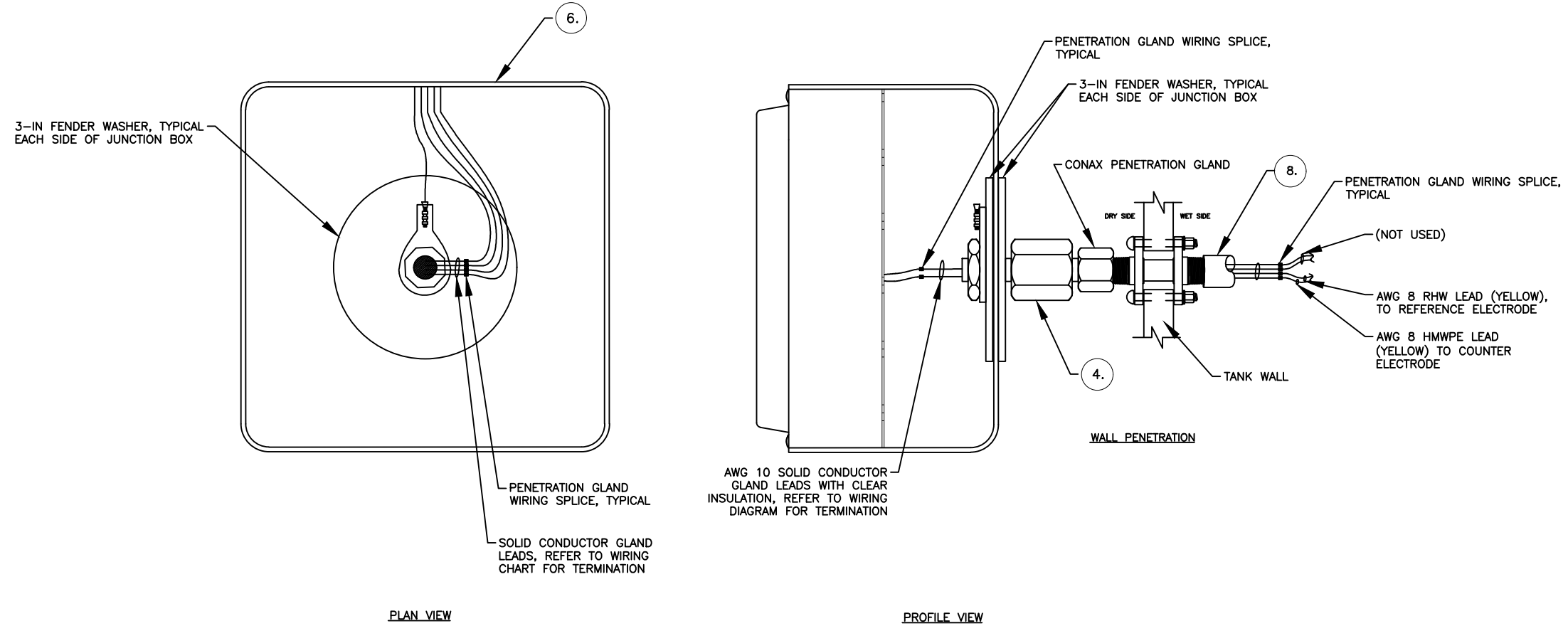
CLIENT:
 PROVIDENCE WATER SUPPLY BOARD
 125 DUPONT DRIVE
 PROVIDENCE, RI 02907

PROJECT:
 PROVIDENCE WATER
 40,000 GAL WATER STORAGE TANK,
 JOB NO. 16753

CATHODIC PROTECTION SYSTEM
 GENERAL ARRANGEMENT

NOTES:

- REFER TO BOM/PARTS LIST FOR ALL FNS (FIND NUMBERS.) PARENTHESIS SURROUNDING FNS REPRESENT PREVIOUS CALL OUT REFERENCE.



CP TEST STATION



Wire No.	Dry-Side Designation (Wire Gauge/Color)	Wet-Side Designation (Wire Gauge/Color)	Wire Termination
1	12/BLACK	8/BLACK	REFERENCE CELL 1
2	12/BLACK	8/BLACK	REFERENCE CELL 2
3			NOT USED
4			NOT USED

WIRING DIAGRAM

NO.	DATE	DESCRIPTIONS	BY	APPRD
00	11/17/23	INITIAL CP DESIGN	RHG	SHP



25 SOUTH STREET
HOPKINTON, MA 01748
(508) 435-0090
www.corrtech-inc.com

DESIGNED: SHP
DRAWN: RHG
CHECKED: JBP



ENGINEER-IN-CHARGE
DIRECTOR

CLIENT:
PROVIDENCE WATER SUPPLY BOARD
125 DUPONT DRIVE
PROVIDENCE, RI 02907

PROJECT:
PROVIDENCE WATER
40,000 GAL WATER STORAGE TANK,
JOB NO. 16753

**CATHODIC PROTECTION SYSTEM
GENERAL ARRANGEMENT**

DATE:	DRAWING NUMBER:	SHEET NUMBER:	REV.
11/21/23	16753-CAD-01-1	4 OF 4	00