2.03 PIPE: SANITARY SEWER PVC (Beyond Foundation)

PIPE CLASS:	P2
PIPE SYMBOL	SAN
CLEANING CLASS	C1
TESTING CLASS	T4

A. Materials: Provide PVC Gravity Sewer Pipe with ring-tite joints complying with ASTM D 3034-SDR35.

B. Appurtenances: Provide elbows, tees, wyes, couplings, caps of the same type and class of material as the pipe, or of a material having equal or superior physical and chemical properties.

C. Installation:

Install pipe in accordance with governing authorities having jurisdiction.

Inspect pipe prior to installation to detect any apparent defects. Mark defective material with white paint and remove from site.

Lay pipe beginning at the low point of the system, true to the grades, inverts and alignment indicated with unbroken continuity of invert.

Install compression gaskets in accordance with manufacturer's instructions as to lubricants, cements, and other special requirements.

D. Installer: A firm specializing and experienced in sanitary sewer system work for not less than two (2) years.

E. Connections: Provide connection to manholes as indicated and in accordance with the sewer authority. Provide labor and materials to rework table as required.

F. Changes in direction/elevation: Roll down or offset at no greater than 45 deg.

G. Cleanouts: Provide cleanouts to grade at all changes of direction / elevation, at intervals as required by Code and as indicated on the drawings.

H. Building Sewer Cleanout: Provide at the point sanitary piping exits the building a cleanout to floor level with specified cover/cap.

I. Bedding: Provide sand/gravel bedding material. No stone, ledge to be within 6" of invert of pipe. Provide pipe cradles in fill or unsuitable material.

J. Cover: Provide minimum of 3'-0" cover. Notify Architect if this requirement does not appear to be attainable.

K. Test: Cap or plug piping at any manhole and fill system to grade, let stand for a period of 2 hours, no appreciable fall in level will be allowed.

2.04 PIPING: SANITARY WASTE and VENT, PVC (BELOW SLAB)

PIPE CLASS:	P1
PIPE SYMBOL	SAN
CLEANING CLASS	C1
TESTING CLASS	T4

A. Material: Provide type PVC Schedule 40 sanitary drainage piping with drainage type fittings, free of defects, as manufactured by Celanese, Yardley or ITT Grinnell.

B. Joints: Solvent fused socket type with chemical designed for use with the type PVC piping system.

C. Cleanouts: Provide cleanouts at changes of direction and at intervals as required by Code and as indicated.

D. Workmanship: Pitch piping at a rate of 1/4 " per foot unless noted otherwise and install parallel or perpendicular to building. Allow for continuous bearing of pipe on soil.

E. Connections: Provide wye branches with 45 deg elbows at connections. Use long sweep bends at bottom of all stacks.

F. Changes in direction/elevation: Roll down or offset at no greater than 45 deg.

G. Cleanouts: Provide cleanouts to grade at all changes of direction / elevation, at intervals as required by Code, and as indicated on the drawings.

H. Building Sewer Cleanout: Provide at the point sanitary piping exits the building a cleanout to floor level with specified cover/cap.

I. Inspection/Testing: Provide labor and equipment to test the underground piping system as follows:

10 feet water head applied to piping for a period of 2 hours.

J. Inspect all joints to insure watertight connections, coordinate approval of local authority prior to backfill.

2.05 PIPING: SANITARY WASTE and VENT - PVC (ABOVE SLAB)

PIPE CLASS:	P1
PIPE SYMBOL	SAN – For VENT see legend
CLEANING CLASS	C1
TESTING CLASS	T4

A. Material: Provide type PVC Schedule 40 sanitary drainage piping with drainage type fittings, free of defects, as manufactured by Celanese, Yardley or ITT Grinnell.

B. Joints: Solvent fused socket type with chemical designed for use with the type PVC piping system.

C. Cleanouts: Provide cleanouts at changes of direction and at intervals as required by Code and as indicated.

D. Workmanship: Pitch piping at a rate of 1/4 " per foot unless noted otherwise and install parallel or perpendicular to building.

E. Supports: See PIPE SUPPORTS.

F. Vents through roof: Provide no-hub cast iron vents through roof. Provide rigid support to structure at and below roof to insure stable vertical vent.

G. Fixture Waste Connections: Exposed piping to plumbing fixtures shall be chrome plated brass with chrome plated brass traps as specified. Fixtures shall be trapped separately with trap screws below water line.

H. Inspection/Testing: Provide labor and equipment to test the piping system as follows:

Fill system to roof for a period of 2 hours.

I. Inspect all joints to insure watertight connections, coordinate approval of local authority prior to closing in.

2.06 PIPING: DOMESTIC WATER, ABOVE GRADE:

PIPE CLASS:	U2
PIPE SYMBOL	CW / HW / HWR See Legend
CLEANING CLASS	C3
TESTING CLASS	T2

A. Material: Pipe shall be Type-L copper tubing with wrought copper fittings as manufactured by Revere, Anaconda, or Chase.

B. Joints: Install with sweat joints with lead free solder; remove all excess flux and solder from piping.

C. Water Hammer Arrestors: At all branches and risers, provide water hammer arrestor as specified under Part 5 -Equipment/Appurtenances.

D. Workmanship: Ream pipe to full inside diameter to remove all burrs before joining. Install piping parallel or perpendicular to building or as indicated. Install in a manner to allow for expansion.

E. Test: Perform a hydrostatic pressure test at 150 psi for a period of 30 minutes until system is proved tight. Test pressure drop shall not exceed 1 psi during test period. For piping that is to be concealed, perform all tests while accessible.

2.07 COPPER PRESS TYPE FITTINGS: (Contractor’s Option)

A. Manufacturers, Copper Press Fittings:

Viega, 17545 Daleview Dr., Lakewood, OH 44107, 877.620.0016 or Ridge Tool Co., 400 Clark Street, Elyria, OH 44035, 800.519.3456

B. Material:

Press Fittings: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM.

C. Installation, Fittings for Copper Tubing:

Press connections: Copper press fittings shall be made in accordance with the manufacturers installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

2.08 PIPE STERILIZATION, DOMESTIC WATER PIPING SYSTEMS:

A. Pipe Sterilization: Sterilize the system with chlorine prior to acceptance for domestic use in accordance with requirements of AWWA C651, AWWA C652, or as described as follows:

The piping system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.

Once clean water has been found to be flowing at all points of outlet, the system, or part thereof, shall be filled with a water/ chlorine solution containing at least 50 parts per million (50mg/L) of chlorine, and the system, or part thereof, shall be valved off and allowed to stand for 24 hours. As an alternate, the system, or part thereof, shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/L) of chlorine and allowed to stand for 3 hours.

Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.

The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

2.09 PIPING: SYSTEM TESTS

A. Provide labor, instruments, and equipment necessary to complete all tests.

B. Maintain a log of tests with dates, times, and type of test. Leaks found during testing periods shall be noted, identified, and corrected.

2.10 SUPPORTS: PIPE HANGERS:

A. General: Provide pipe supports, hangers, or other appurtenance to firmly support the piping systems. All pipes shall be independently supported from the building structure and not from other pipes, flues, conduits, ducts or pipe hangers, etc.

B. Refer to Section 23 02 50 – MECHANICAL PIPE HANGERS AND SUPPORTS for pipe hanging requirements.

2.11 VALVES: DOMESTIC WATER

A. General: Provide valves where indicated and as required for proper isolation and operation of the domestic water distribution system. Provide shut off valves on all piping serving system risers, equipment, fixtures or banks of fixtures, and at wall hydrants.

Valves shall be designated for 125 psi working pressure unless noted otherwise.
Valves 2-1/2" and smaller shall be bronze or brass.
Valves 3” and larger shall be iron body brass mounted flange ends.

B. Valves shall have the name or trademark of the manufacturer and the guaranteed working pressure cast on the body of the valve. Valves shall be as manufactured by Milwaukee, Stockham, Crane or Nibco. Valves for the project shall be the product of one manufacturer.

C. Ball Valves, Class 150: 1/4" to 2" cast bronze 600# W.O.G., full port, screwed ends.

All valves to be installed within insulated pipeline shall be provided complete with valve stem extensions. Stem extensions shall be 2" minimum.

Milwaukee	BA-300
Apollo	77-14
Nibco	T-585-70

D. Drain Valves: 1/4" to 2" cast bronze 600# W.O.G., full port, screwed ends w/ capped hose end, chain and cap.

Milwaukee	BA-1001T
Apollo	78-100

2.12 TRAPS:

A. Every plumbing fixture without a manufacturer's integral trap shall separately trapped by a water seal type trap. The vertical distance between the fixture outlet and the trap weir shall not exceed 14 inches. Plumbing fixtures shall not be double trapped.

B. Each fixture trap shall have a liquid seal of not less than 2" and not more than 4". (Deeper trap seals may apply to special designs for accessible fixtures.)

C. Where trap seals are subject to loss by evaporation, deep seal type traps shall be used.

D. All floor drains shall be provided with deep seal type traps.

2.13 VALVES: SPECIAL TYPES

A. Check Valves: 1/4" to 2" bronze 125#, Y-pattern, threaded ends, lead free.

Milwaukee	509T/1509T
Apollo	163T
Nibco	T-413-Y-LF

B. Balancing Valves: 1/2" to 2"

Provide balancing valves as indicated on the Drawings and at all return water connections to heating and cooling equipment. Balancing valves shall be Model CBV-S soldered or CBV-T threaded type Circuit Balancing Valves, as manufactured by Armstrong or approved equal.

Each valve shall have metering ports incorporating Nordel check valves, on both sides of the seat.

All valves shall be "Y" pattern equal percentage globe style, designed either for presetting with a balance schedule or for proportional balancing. All metal parts are bronze copper alloy. Each valve shall provide four functions:

Precise flow measurement.
Precision flow balancing.
Positive shutoff with a no-drip soft seat.
Diagnostic point for system analysis.

Valves shall have four full 360 degree adjustment turns of the handwheel with a micrometer-type indicator and hidden memory feature to program the valve for a precise, tamper-proof balanced setting. Metering ports shall be interchangeable with drain ports to allow for read-out flexibility when installed in tight piping locations.

2.14 SLEEVES, PLATES:

A. Provide and locate sleeves, plates, anchors, and inserts required; mark openings before floors and walls are constructed or core bored.

B. Provide sleeves for piping passing through floors, walls, roofs, partitions and masonry. Sleeves for concrete or masonry shall be Schedule 40 steel pipe of size to allow for pipe expansion and passage of vapor barrier insulation. Other sleeves shall be 20 gauge galvanized sheet steel with lockseam joint.

1. Terminate sleeves flush with walls, partitions, and ceiling.
2. Terminate sleeves 1/2" above finished floor where piping is exposed.

C. Where ceiling inserts are provided specifically for the use of the Owner, install all work, so as to not interfere, with a separate support system.

2.15 FIRE SAFING: PIPING AND EQUIPMENT OPENINGS:

A. Refer to Section 23 03 00 – MECHANICAL: FIRE SAFING, for requirements.

B. Fire Stop: Pack all piping and equipment openings full depth with approved fire safing material to fully seal all openings.

C. Seal all sleeves, core holes, etc. through floors, walls and ceilings with Nelson “Flame-Seal” Fire Stop Putty, 3-M Systems, Hilti Systems, Metacaulk Firestopping or Dow Corning “Fire-Stop” Sealant. Install in accordance with manufacturer’s printed instructions.

D. Firestopping is to meet UL ratings for each penetration type and material for floors, walls and ceiling. Coordinate with Architectural Drawings for exact requirements and ratings at various conditions.

2.16 UNIONS:

A. Provide union connections at equipment and as indicated. Unions 2" and smaller shall be wrought copper sweat type; larger shall be wrought copper flange type.

2.17 SANITARY/STORM SYSTEM CLEANOUTS:

A. Provide cleanouts at all changes in direction, at intervals as required by Code, and as indicated.

B. Floor cleanouts: Provide with dura-coated iron body, inside caulk outlet, cadmium plated iron plug, lead seal, adjustable nickel bronze top; Zurn or approved equal.

For concrete floor:	ZN-1400	Set flush with floor

C. Wall Cleanout: Provide with cast iron supreme cleanout with cadmium plated plug, lead seal, and round stainless steel access cover with securing screw.

Model:	ZN-1445	With Z-1462 8x8 access
Model:	ZN-1446	With round wall access

PART 3 - INSULATION: PRODUCTS AND INSTALLATION

3.01 INSULATION: GENERAL:

A. Provide all insulation as specified in a neat and workmanlike manner observing the best practices of the trade. All longitudinal seams shall be flat and facing away from view. Insulation shall be smooth throughout. Vapor barriers, where required, shall be continuous. No raw ends of material shall be permitted; cover same with eight ounce canvas or approved equal.

B. Piping and equipment shall be insulated as specified within Section 23 04 00 – MECHANICAL INSULATION.

PART 4 - EQUIPMENT / APPURTENANCES

4.01 ACCESS PANELS:

A. Provide coordination to properly locate panels that are provided within other sections of this Specification.

4.02 VACUUM BREAKERS:

A. Provide approved vacuum breakers at all service sinks and wherever required by governing codes.

B. Provide Watts #288 or approved equal vacuum breaker at hot water heater.

4.03 FLOOR DRAINS:

A. Provide floor drains as indicated as manufactured by MiFab, Josam or Smith. Zurn model numbers are used to set standards.

B. Refer to the SCHEDULE on the Drawings for the types and models of floor drains to be provided.

C. All floor drains shall be fit with "Sure Seal" trap sealing devices as manufactured by Rectorseal. Trap sealing devices shall be ASSE 1072 and IPC approved.

4.04 INSIDE SILL FAUCET:

A. Provide inside sill faucet with vacuum breaker, threaded hose outlet, tee handle, chrome plated, as manufactured by Chicago Faucet Co or approved equal.

Model: Chicago Model #952

4.05 WATER HAMMER ARRESTORS:

A. Provide water hammer arrestors, in domestic water piping systems, properly sized, with adapters, and with nesting type bellows contained within a casing having sufficient displacement volume to dissipate the calculated kinetic energy generated in the piping system. Both casing and bellows constructed of Type 18-8 stainless steel.

Model: Z -1700 “Shoktrols” or equal models by J R Smith or Watts

B. Provide complete submittal with models, sizes and locations for all arrestors.

C. Locations: Provide arrestors at:

At all electric solenoid automatic valve locations.

At all banks of three or more fixtures.

D. Coordinate the location of properly sized access panels with the arrestor location to assure proper access.

4.06 DOMESTIC WATER EXPANSION TANK

A. Provide a potable, domestic water expansion tank on the supply line to the hot water heater. Unit shall be of steel construction, with rigid polypropylene reservoir liner, butyl diaphragm separating the air chamber from the domestic water, stainless steel lined inlet connector, FDA approved materials, field adjustable air pressure charge and with ¾” male connection.

B. Manufacturer: Taco, (refer to the water heater detail on the Drawings for Model and Capacity required.

4.07 HOT WATER RECIRCULATING PUMP:

A. Provide cartridge type circulator with cast bronze body, suitable for 175 psig working pressure and 300 degree F water temperature as manufactured by Taco or Bell & Gossett.

See RECIRCULATING PUMP SCHEDULE for size and capacities.

4.08 WATER HEATERS: HEAT TRAPS

A. Provide heat traps at the inlet and outlet of all water heater tanks. Water heaters with integral factory installed heat traps shall be provided if available.

4.09 HOT WATER TEMPERING VALVE, THERMOSTATIC MIXING VALVE; POINT OF USE:

A. General:

Provide point of use type thermostatic mixing valves where indicated on the Drawings. Thermostatic mixing valves shall be as manufactured by Symmons or Leonard.

Water temperature limiting valve including integral checks and dual stainless steel strainers for double protection against suspended particles in supply lines. Valve made from lead free* metal components.

B. Temperature control range:

60°F - 140°F (15.6°C - 60°C)

C. Minimum supply pressure:

20 psi (138 kPa)

D. Maximum supply pressure:

125 psi (862 kPa)

E. Inlet to outlet temperature differential:

10°F (5.55°C)

Model: 7-400-NI-T-425-400

F. Finish:

Standard rough bronze and copper finish.

G. Testing:

Factory assembled and tested.

H. Installation:

The thermostatic mixing valve must be piped in strict accordance with the manufacturer’s recommendations.

4.10 COIN OPERATED SHOWER SYSTEM:

A. General:

The coin operated shower systems shall be as manufactured by Fluid Manufacturing, 804 Black Diamond Way, Lodi, California 95240. www.fluidmfg.com, and shall be configured as indicated on the drawings.

B. The coin operated shower systems shall include the following components:

Model FM136 24 Vold AC timers

Model KE610 Use Timers

Model FM107 Solenoid Valves

Model FM101L Large, Surface Mount Coin Boxes, (500 coin capacity)

Model FM118T – 9070T100D13 Transformer Control

System III Control Panel for Control of up to 6 Showers.

(Refer to the shower system schematic on the drawings for a full description of the system configuration and components required.)

4.11 GAS FIRED DOMESTIC WATER HEATERS:

A. Provide condensing type, propane fired domestic water heaters as manufactured by AO Smith or approved equal. Units shall operate with minimum 95% thermal efficiency, Units shall be of Model and Capacity as indicated in the SCHEDULE on the Drawings.

B. Water heaters shall have a maximum static working pressure of 160 psi.

C. Water heater(s) shall be provided with modulating gas burner that automatically adjusts the input based on demand, powered anodes that are non sacrificial and maintenance free, and shall have seamless glass-lined steel tank construction, with glass lining applied to all water-side surfaces after the tank has been assembled and welded.

D. Water heaters shall meet the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.

E. Water heater shall be provided with foam insulation and a CSA Certified and ASME rated T&P relief valve and a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up. Units shall be approved for 0″ clearance to combustibles.

F. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivity shall be provided allowing for remote viewing and fault notification via app.

G. Units shall be design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters and shall meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

END OF SECTION 23 10 00

SECTION 23 15 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

B. Refer to all construction documents including all of the Sections of Division 23 for a complete understanding of the electrical components required. Coordinate with all trades.

Section 23 00 00	MECHANICAL GENERAL REQUIREMENTS

C. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 00 50	MECHANICAL: ELECTRICAL COMPONENTS
Section 23 01 50	MECHANICAL: VIBRATION ISOLATION
Section 23 02 50	MECHANICAL: PIPE HANGERS AND SUPPORTS
Section 23 03 00	MECHANICAL: FIRE SAFING / FIRESTOPPING
Section 23 04 00	MECHANICAL: INSULATION
Section 23 04 40	MECHANICAL: PIPE CLEANING TESTING
Section 23 10 00	PLUMBING

1.02 SCOPE:

A. Provide labor, equipment and materials to complete the work indicated on drawings and herein specified.

1.03 RELATED WORK:

A. Work in conjunction with this section shall be as designated below:

General Contractor:

Cutting, Patching, and Painting
Openings in roofs / Flashing
Openings in walls
Equipment foundations and bases
All temporary heating

B. Electrical Contractor:

Power wiring for electrical equipment provided within this section.

1.04 PROJECT ADMINISTRATION:

A. Transmit questions, submissions, notices, and correspondence through the general contractor for transmittal to the Architect.

B. Prepare and transmit to the Architect all submittal requirements within the time period allowed. See Schedule of Submissions.

1.05 SUBMITTALS:

A. See SUBMITTAL GENERAL REQUIREMENTS within Section 23 00 00.

B. The following shop drawings shall be prepared and submitted for approval within the time period stated (see SCHEDULE OF SUBMISSIONS in Section 23 00 00): (The list below is not intended to all inclusive. Provide submittals for all materials and equipment proposed for use on this project.)

Plumbing Fixtures
Fixture Trim

1.06 PROJECT CLOSE-OUT:

A. Review and provide closeout requirements of this section and Section 23 00 00 Mechanical General Requirements, including:

Testing and Adjusting
Operating, Maintenance Instructions
Written Guarantee
Lubrication
Operating, Maintenance Manuals
Cleaning

PART 2 - FIXTURES AND INSTALLATION

2.01 FIXTURES: GENERAL

A. The arrangement and quantity of plumbing fixtures shall be as indicated on the Architectural Drawings.

B. Provide fixtures, carriers, brass and appurtenances complete with trimmings ready for use.

C. Securely support fixtures from the building structure in a rigid manner. Provide hangers, frames, and carriers for proper installation. Wall hung fixtures shall be set tight to wall.

D. Protect all fixtures during construction and thoroughly clean at project closeout.

E. Air Gap: Provide only fixtures with an air gap between the level of supply openings and the level at the point of unrestricted external overflow.

F. Domestic water hot and cold water supplies shall be arranged with cold on the right and hot on the left. Faucets shall be indexed to indicate H and C.

2.02 WATER FLOW RATE:

A. General: Fixtures shall be limited to a flow rate of 1.6 gpm at 80 psig unless noted otherwise.

B. Public facilities:

Lavatories in restrooms of public facilities shall be equipped with faucet outlet devices that limit the flow to a maximum rate of .5 gpm.

Water closets shall use a maximum of 1.6 gallon per flushing cycle.

Urinals shall use a maximum of 1.0 gallon per flushing cycle.

2.03 FIXTURES: MANUFACTURERS

A. General: Plate numbers and manufacturer's names used in the Schedule establish type and quality required.

B. Manufacturers:

Vitreous China	American Standard Kohler Zurn Toto
Brass	Chicago Zurn Symmons Moen Delta Kohler American Standard
Toilet seats	Church American Standard Zurn
Flush valves	Sloan Zurn Toto
Shower Enclosure	Kohler Lasco Aquabath
Stainless steel sinks	Elkay Just
Electric Water Coolers	Elkay Halsey-Taylor Haws

2.04 FIXTURE INSTALLATION:

A. General: Review all drawings and determine the mounting locations and heights. All fixtures intended for handicapped use shall be mounted to suit requirements. Provide carriers and wall supports for the proper mounting height and type of construction indicated. For all exposed hot water piping and drains at fixtures provide insulation as specified and / or required.

B. Review the installation of all fixtures to insure proper clearances. If necessary, request additional detail data prior to the installation of fixtures.

C. Install plumbing fixtures level and plumb according to roughing-in drawings.

D. Install floor-mounted water closets on closet flange attachments to drainage piping.

E. Install counter-mounting fixtures in and attached to casework.

F. Install supports, affixed to building substrate, for wall-mounted lavatories.

G. Indicate on Drawing, those lavatories that are required to be accessible.

H. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to Uniform Federal Accessibility Standards (UFAS).

I. Install accessible, water closets at mounting height for handicapped/elderly, according to Uniform Federal Accessibility Standards (UFAS).

J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 23 10 00 "Plumbing."

K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

L. Install toilet seats on water closets.

M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install shower flow-control fittings with specified maximum flow rates in shower arms.

O. Install traps on fixture outlets.

Exception: Omit trap on fixtures with integral traps.
Exception: Omit trap on indirect wastes unless otherwise indicated.

P. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks.

Q. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 23 00 00 "Mechanical General Requirements."

R. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

2.05 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 23 10 00 "Plumbing."

C. Comply with soil and waste piping requirements specified in Section 23 10 00 "Plumbing."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220000 "Plumbing."

2.06 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

2.07 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

2.08 CARRIER SYSTEMS:

A. Provide fixture carrier systems as indicated at fixtures. Carriers shall be installed per manufacturer’s recommendation and shall be secured to the building with adequate fastening systems.

Manufacturers:	Zurn; or equal system of; Smith Josam
Water Closets:	Zurn system Z1203 or Z1204
Wall hung Urinal:	Use Zurn system Z1218
Wall hung Lavatory:	Use Zurn system Z1231 or Z1236

2.09 FIXTURES: SCHEDULE

A. Provide fixtures as indicated. Shop drawings are required. China fixtures are white unless indicated otherwise.

P-1 Water Closet: Floor Mounted: (HC)

3049.001 "Madera Flo Wise" vitreous china elongated bowl, siphon jet toilet, 1.28 GPF, top spud, 16-1/2" rim

111 ESS-1.28-DFB-TMO-HW Sloan Sensor Flushometer. Exposed flush valve with wall mounted hardwired sensor operator.

9500C Solid plastic open front seat with check hinge

Bolt caps

Wax ring gasket

P-2 Water Closet: Floor Mounted: (HC)

3049.001 "Madera Flo Wise" vitreous china elongated bowl, siphon jet toilet, 1.28 GPF, top spud, 16-1/2" rim

111 ESS-1.28-DFB-TMO-HW Sloan Sensor Flushometer. Exposed flush valve with wall mounted hardwired sensor operator.

9500C Solid plastic open front seat with check hinge

Bolt caps

Wax ring gasket

P-3 Urinal: (Floor Mounted)

6400.001 "Stallbrook" floor mounted vitreous china stall urinal, washout

3/4" top inlet, 1 GPF

Maguire 1233 Strainer 2" inside caulk

186 ESS-0.5-XL-L/OR-HW-24V Sloan Sensor Flushometer. Exposed flush valve with wall mounted hardwired sensor operator.

P-4 Lavatory: (Countertop)

Provide all labor and material required to install and connect this fixture to the plumbing systems. The fixture will be provided by the General Contractor.

Coordinate delivery, unpacking and parts inventory with the General Contractor.

ETF-80 SMT-4-BOX-CP-0.5GPM-MLM-IR-1-T-FCT Sloan Optima Electronic Hand Washing Faucet less Mixer. For use with tempered water

ETF-460-A 1-1/4" Grid type strainer and tailpiece, chrome plated brass

3/8" CP cold water supply with stop

1-1/2" PVC P-trap with clean out

P-5 Lavatory: (Countertop, Handicapped Use)

Provide all labor and material required to install and connect this fixture to the plumbing systems. The fixture will be provided by the General Contractor.

Coordinate delivery, unpacking and parts inventory with the General Contractor.

ETF-80 SMT-4-BOX-CP-0.5GPM-MLM-IR-1-T-FCT Sloan Optima Electronic Hand Washing Faucet less Mixer. For use with tempered water

ETF-460-A 1-1/4" Grid type strainer and tailpiece, chrome plated brass

3/8" CP cold water supply with stop

1-1/2" PVC P-trap with clean out

Provide Handi-Lav-Guard insulation including angle valve and P-trap assembly.

Truebro Model #101

P-6 Shower:

Provide all labor and material required to install and connect this fixture to the plumbing systems. The fixture will be provided by the General Contractor.

Coordinate delivery, unpacking and parts inventory with the General Contractor.

Provide Connections and Fittings as follows:

Symmons Model 4-295-B Fre-Flo institutional type, vandal resistant, shower head with through wall bolting mount with back plate, chrome plated brass.

½" tempered hot water supply with isolation ball valve

Maguire 1266AV 2" shower strainer with 2" FIP outlet

2" P-Trap

P-7 Mop Receptor:

Fiat MSBIDTG-2424 Molded Stone Mop Service Basin

½" hot water supply with ball valve

½" cold water supply with ball valve

830AA Faucet

3" Integral drain with strainer

832AA hose and bracket

889CC mop hanger bracket

SIC3SN Quick drain connector, 3"

3" P-trap

P-8 Drinking Fountain / Bottle Filler:

Halsey Taylor 4420BF1UDBFRK Endura II™ Outdoor Upper Bottle Filling Station Bi-Level with Pet Station Non-Filtered Non-Refrigerated FR.

Unit shall be 316 Stainless, Heavy Duty Vandal Resistant, Laminar Flow, Pet Fountain, Sealed Freeze Resistant. Furnished with Vandal Resistant bubbler.

Product shall be Floor Mount/Freestanding, for Outdoor applications.

Unit shall be lead-free design which is certified to NSF/ANSI 61 & 372 (lead free) and meets Federal and State low-lead requirements.

The installer shall provide an 8" SCH 40 PVC riser with 4" branch connection and 8" cleanout at grade to allow installation of domestic cold water supply with connection at 4'-0" below grade. (Refer to product installation instructions.)

3/8" CP angle supply with stop

1-1/2" PVC P-trap with clean out

1-1/2" waste connection

P-5 Lavatory: (Wall Hung, Handicapped Use)

American Standard 0355.312 "Lucerne", 20.25" x 18.25"

ETF-80 SMT-4-BOX-CP-0.5GPM-MLM-IR-1-T-FCT Sloan Optima Electronic Hand Washing Faucet less Mixer. For use with tempered water

ETF-460-A 1-1/4" Grid type strainer and tailpiece, chrome plated brass

3/8" CP cold water supply with stop

1-1/2" PVC P-trap with clean out

Provide Handi-Lav-Guard insulation including angle valve and P-trap assembly.

Truebro Model #101

END OF SECTION 23 10 00

SECTION 23 80 00 – HVAC: AIR HANDLING SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

Section 23 00 00 MECHANICAL GENERAL REQUIREMENTS

B. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 00 50	MECHANICAL: ELECTRICAL COMPONENTS
Section 23 01 50	MECHANICAL: VIBRATION ISOLATION
Section 23 02 50	MECHANICAL: PIPE HANGERS AND SUPPORTS
Section 23 03 00	MECHANICAL: FIRE SAFING / FIRESTOPPING
Section 23 04 00	MECHANICAL: INSULATION
Section 23 04 40	MECHANICAL: PIPE CLEANING TESTING
Section 23 85 00	HVAC: EQUIPMENT
Section 23 90 00	HVAC: CONTROL SYSTEM / ANALOG
Section 23 94 00	HVAC: CONTROL SEQUENCE OF OPERATIONS
Section 23 95 00	HVAC: TESTING ADJUSTING BALANCING

1.02 SCOPE:

A. Provide labor, equipment and materials to complete the work indicated on drawings and herein specified.

1.03 RELATED WORK:

A. Work in conjunction with this section shall be as designated below:

General Contractor:

Cutting, Patching, and Painting
Openings in roofs / Flashing
Openings in walls
Equipment foundations and bases
All temporary heating

B. Electrical Contractor:

Power wiring for electrical equipment provided within this section.
All duct smoke detectors that are a part of the fire alarm system.

1.04 PROJECT ADMINISTRATION:

A. Transmit questions, submissions, notices, and correspondence through the general contractor for transmittal to the Architect.

B. Prepare and transmit to the Architect all submittal requirements within the time period allowed. See Schedule of Submissions.

1.05 SUBMITTALS:

A. See SUBMITTAL GENERAL REQUIREMENTS within Section 23 00 00.

B. The following shop drawings shall be prepared (see Section 23 00 00) and submitted for approval within the time period stated: (This listing is not intended to all inclusive – provide submittals for all materials and equipment proposed for use on this project)

Air Handling Ductwork Layout Drawings

Air Handling Ductwork Materials

Steel

Flexible duct connectors

Diffusers, Grilles

Duct Access Panels
Access Panels

Sound lining materials

Roof Intake Ventilators
Louvers

1.06 PROJECT CLOSE-OUT:

A. Review and provide close-out requirements of this section and Section 23 00 00 Mechanical General Requirements, including:

Testing and Adjusting
Record Drawings
Operating, Maintenance Instructions
Written Guarantee
Lubrication, Filters
Operating, Maintenance Manuals
Cleaning
Test Log

Letters of compliance.

PART 2 - PRODUCTS AND INSTALLATION

2.01 DUCTWORK: GENERAL

A. Provide all labor, materials, equipment, and supplies to fabricate and install all duct systems, including ductwork, fasteners, hangers, braces, caulking, fire stopping, access doors, flexible connections and all other items necessary and required for a complete and economically operated system as indicated.

B. Provide all labor, materials and supplies to properly install devices in the ductwork, including but not limited to; sensors, fire alarm equipment, control equipment, smoke detectors, flow devices, provided within other sections of the specifications. This work shall be coordinated and installed as required for proper operations.

C. Unless otherwise stated or indicated all ductwork shall be constructed following SMACNA standards of lock forming galvanized steel (ASTM A527) with a minimum galvanized coating of 0.90 oz./sf.

D. Maintain the cleanliness of the duct storage and installation work area such that the duct systems are internally clean. Provide temporary mylar caps during construction to insure that construction dust does not enter the duct systems. All duct openings shall be sealed until connected to equipment. Wipe down all exterior surfaces as necessary prior to project completion.

2.02 SHEET METAL DUCTWORK: RECTANGULAR

A. General:

Provide all of the sheet metal work as indicated on the drawings, as specified, and as required for the air handling, ventilation and exhaust systems. Construct ductwork to meet all functional criteria defined in Section 7 of the 1995 SMACNA “HVAC Duct Construction Standards, Metal and Flexible”, Second Edition, except as noted: All ductwork will not exceed the deflection limits established in The Uniform Mechanical Code Standard 6-1: Standard for Metal Ducts, 1997 Edition.

Ductwork shop drawings must be properly submitted. Any ductwork installed without prior written approval by the specifier shall be replaced at the expense of the contractor.

The contractor must comply with the enclosed specification in its entirety. If on inspections, the specifier finds changes have been made without prior written approval, the contractor will make the applicable changes to comply with this specification, at the contractor’s expense. At the discretion of the specifier, sheet metal gauges, and reinforcing may be randomly checked to verify all duct construction is in compliance.

Erect all ductwork in accordance with the "Standard Practice in Sheet Metal Work" published by the National Association of Sheet Metal Contractors.

B. Duct Sizes / Gauge: Low pressure not to exceed 3” WC static pressure

Rectangular Size	Gauge No.	Center Spacing
0" to 12"	26	48"
13" to 30"	24	48" to 60"

31" to 48"	22	48" to 60"
49" to 60"	20	48" to 60"
61 and more	18	48" to 60"

C. Fabrication:

Provide all ducts true to the dimensions indicated on the drawings.

Galvanized Steel: All interior ducts shall be constructed with G-60 or

better galvanized steel conforming to ASTM A 653/A 653M and A 924 Standards, LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. kitchen exhausts) shall be G-90 or better galvanized steel, LFQ, chemical treat.

Aluminum: If specified, use aluminum alloy sheets, lock forming quality, conforming to ASTM B209, Alloy 3003, Temper H14. Dimensional tolerance per ANSI H35.2.

Rectangular Duct Deflection Limits: Shall conform to the Uniform Mechanical Code Standard 6-1 – Standard for Metal Ducts, 1997 Edition. Maximum allowable deflection for transverse joints and intermediate reinforcements will not exceed 0.250 inch for duct widths up to 100 inches and will not exceed 0.3 percent of the span for widths greater than 100 inches.

Ducts shall be straight and smooth on the inside with neatly finished joints. Outside surfaces shall be finished such that all sharp edges are removed. All notches for connecting sections of duct and all grooving seam notches shall not be cut deeper than necessary to insure tight corners.

Crossbreak all surfaces over 18" wide.

Longitudinal Seams Rectangular: For longitudinal seams, the Pittsburgh lock seam will be used on all ductwork 36" wide and larger, and may be used on ductwork 35" wide and smaller.

D. Joints Rectangular:

To SMACNA standards. Proprietary products must be tested in accordance with SMACNA procedures. Certified test results must be submitted.

Transverse joints, for ductwork 36" wide and larger shall be constructed with duct connector systems as manufactured by:

Ductmate 35 System

Ward Ductconnector

All ductwork shall be constructed in accordance with system manufacturer's recommendations.

Butyl gasket will be used between all flanges.

Slip Joints: Shall be made in the direction of the air flow with slips at least one gauge heavier than the duct, made in the form of a frame, mitered and riveted at corners to prevent leakage. Slip joints will be accepted for use on ductwork 30” wide or less and subjected to 2” static positive pressure or less.

E. Sealing of Duct Joints:

All ducts shall have mastic type sealants conforming to SMACNA's Class A sealing requirements, SMACNA Manual, 1995, Second Edition.

Apply tape over joints on exhaust ductwork joints.

On exposed architectural ductwork in the conditioned space the mastic may be eliminated.

F. Elbows:

Changes in direction, where space permits, shall be fabricated with the inside radius no less than the dimension of the duct in the plane of the elbow. Turning vanes shall be used where short radius or square elbows are used.

Turning vanes shall be provided as follows:

Short radius elbows up to 26" in width shall be equipped with one vane.

Short radius elbows greater than 26" in width shall be equipped with two vanes.

Vanes in square elbows shall be spaced on 3" radius on diagonal for ducts up to 24" wide, 5" radius for ducts 25" to 36" wide and 7" radius for ducts over 37" wide.

All vanes must be rigid so as not to rattle or vibrate in the air stream and all raw or sharp edges must be removed from the blades. Turning vanes as manufactured by Tuttle and Bailey Company or equal may be substituted for the above.

All fasteners and attachment supports shall be galvanized steel or of other, corrosion resistant, approved material.

G. Hangers, Supports:

Provide strap duct hangers of 16 gauge, 1" wide for ducts to 30" wide, and of 10 gauge, for ducts over 30" wide.

H. Installation:

No pipes or conduits shall pass through any duct without written approval. Where it is impossible to reroute such pipe or conduit, the duct shall be increased to that point to maintain a constant cross-sectional area and a streamlined enclosure for the pipe shall be provided.

All ducts shall be securely anchored to the building construction in any approved manner and shall be so installed as to be completely free from vibration under all conditions of operation. Horizontal ducts shall be supported with iron hangers from concrete inserts, or beam clamps. Vertical ducts in shafts shall be supported at each floor. The contractor shall furnish and erect all necessary supports and cross framing as required.

The contractor shall be responsible for the coordination of the sheet metal installation with the work of all other trades and shall prepare and submit for approval, shop fabrication drawings for all sheet metal work.

All ducts shall be independently supported from the building structure and not from other ducts, flues, conduits, pipe, pipe hangers etc.

Hangers shall be placed at all elbows and changes of direction and at intervals of no greater than 8'-0". Hangers shall be cross-braced, at proper intervals, to prevent duct sway.

I. Ductwork leakage:

Review all requirements for leakage testing within this section of the specifications

The contractor shall be responsible for the coordination of the sheet metal installation with the work of all other trades

2.03 FLEXIBLE CONNECTIONS: DUCTWORK

A. At connection of ductwork to air handling equipment, provide flexible material, double layer of fiberglass fabric coated with neoprene, 30 ounce per square yard, rated for 250 deg F continuous use, as manufactured by Ventfabrics Inc or approved equal.

2.04 DAMPERS

A. General: Provide automatic, manual or splitter type volume dampers as indicated on the drawings and where branch ducts split from main ductwork.

B. Volume Dampers, Quadrant Type: All dampers shall be (2) gauges heavier than the ducts in which they are installed. Damper blades shall be riveted to the supporting rods. Cast or malleable brackets shall be riveted to the sides of duct to support damper rod and shall have lock type quadrant at one end.

C. Dampers shall be multi-blade type if cross sectional area of ducts exceeds 1.0 square feet.

D. Splitter Dampers: Provide at all supply takeoffs and as indicated, splitter dampers of length equal to branch duct width to scoop branch duct air out of main duct air stream. Blade of splitter damper shall be adjusted by steel rod fastened to the end of the damper and pilot block with set screws.

E. Access Plate: Provide 6" X 6" minimum access sheet metal plate in duct at location of all volume dampers. Location shall provide hand access to damper blade. Pass insulation over this plate.

F. Automatic Control Dampers: All automatic dampers shall be provided as specified under Automatic Temperature Control. Install all automatic dampers.

2.05 ACCESS DOORS - DUCTWORK:

A. Provide in all ducts where indicated for access to dampers, coils, volume controls, etc. access doors with continuous hinge and cam lock, or double cam lock if necessary. Units shall be complete with 1" insulation on door, 5/8" knock-over edges, 1/2" wide gasket all around and of a minimum size of 14" X 14" overall.

B. Units shall be as manufactured by:

Advanced-Air Model E5A or Model E5B.

C. Units sizes shall be determined by duct size, and purpose of accessibility. All fusible links shall be readily accessible. Access door shall be sized at coils such that door is not less than 8" less than duct size.

2.06 ACCESS PANELS:

A. Furnish access panels where access is required through partitions, ceilings, etc. In all instances, an effort to locate system equipment and appurtenances shall be such that access panels are not required.

B. Access panels shall be installed within other sections of this specification.

C. All access panels shall bear the label fire rating of the wall, ceiling assembly in which the panel is to be installed. For rating requirements, submit size and location to the architect.

2.07 FIRE STOPS: DUCTWORK

A. Where ducts penetrate walls, floors; seal the space around the duct full depth with mineral wool or other non-combustible material. For oversized openings provide sheet metal closure to hold material in place as necessary.

2.08 AIR DIFFUSERS/GRILLES:

A. General: Provide all air diffusers, registers and grilles of size and air capacity as indicated on the drawings. Registers and diffusers shall be as manufactured by Price or Tuttle and Bailey.

B. Exhaust Grilles: Provide heavy gauge extruded aluminum and steel return grilles of type with 45 degree deflection and ½" spacing, as indicated on the drawings. Return grilles over 4 square feet shall be of steel construction.

Model: Price 500/600 Series

2.09 LOUVERS: FIXED

A. Furnish architectural louvers of size, blade style, frame type and location as indicated on the drawings. Unless specifically noted otherwise on the drawings or herein the fixed louvers shall be as follows:

Greenheck Model ESJ-602 single drainable blade

B. Verify size, placement details prior to fabrication. Coordinate shop drawings. Provide installation instructions to installing contractor. Comply with SMACNA recommendations for fabrication, details, and installation procedures except where otherwise indicated.

C. Finish: To be approved by Architect.

D. Materials: Aluminum extrusions; ASTM 221, Alloy 6063-T52

PVC compression gaskets.

Screens: 1/2" mesh, .063 diameter wire.

2.10 LOUVER: INSTALLATION

A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work. Provide full depth sill pan under all louvers.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes to no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section “Joint Sealants” for sealants applied during louver installation..

2.11 GAS FIRED WATER HEATER VENTING:

A. General: Provide water heater venting systems as noted on the drawings and as specified herein. Venting materials and installation shall conform to the requirements of the International Fuel Gas Code and the water heater manufacturer’s standards.

B. Approved Materials:

PVC pipe materials:

DWV ASTM-D2665 or CSA B181.2
Schedule 40, 80, 120 ASTM-D1785 or CSA B137.3
SDR Series ASTM-2241 or CSA B137.3

CPVC pipe materials:

CPVC 41 ASTM-D2846 or CSA B137.6
Schedule 40, 80 ASTM-F441 or CSA B137.6
SDR Series ASTM-F442

Polypropylene:

M & G Duravent PolyPro vent system
Centrotherm InnoFlue vent system

AL29-4C Stainless Steel:

HeatFab Saf-T Vent
Duravent FasNSeal

C. Concentric Vent Termination Kit:

Provide concentric vent termination kits suitable for through roof or through wall installation as indicated on the drawings. Concentric vent termination kits shall be the product of, or approved for use by the water heater manufacturer.

D. System Installation:

The vent pipe shall be supported properly to avoid bending or failure. The water heater manufacturer recommends that the vent pipe be supported every five feet (152 cm) of vertical run and every three feet (91 cm) of horizontal run.

Do not install the vent piping in a manner that will allow water to be trapped in the piping.

All vent (exhaust) pipes shall be pitched a minimum of a ¼ inch per foot back to the water heater (to allow drainage of condensate).

A field supplied condensate Tee fitting and drain hose shall be installed in the intake air piping near the water heater in colder climates with heavy snow accumulations and in areas that regularly experience high humidity. The drain hose should be routed to an adequate floor drain separate from any other condensate drains.

PART 3 - INSULATION PRODUCTS AND INSTALLATION

3.01 INSULATION: GENERAL:

A. Provide all insulation as specified in a neat and workmanlike manner observing the best practices of the trade. All longitudinal seams shall be flat and facing away from view. Insulation shall be smooth throughout. Vapor barriers, where required, shall be continuous. No raw ends of material shall be permitted; cover same with eight ounce canvas or approved equal.

B. Ductwork and equipment shall be insulated as specified within Section 230400 – MECHANICAL INSULATION.

END OF SECTION 23 80 00

SECTION 23 85 00 – HVAC: EQUIPMENT:

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

Section 23 00 00 MECHANICAL GENERAL REQUIREMENTS

B. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 00 50	MECHANICAL: ELECTRICAL COMPONENTS
Section 23 01 50	MECHANICAL: VIBRATION ISOLATION
Section 23 02 50	MECHANICAL: PIPE HANGERS AND SUPPORTS
Section 23 03 00	MECHANICAL: FIRE SAFING / FIRESTOPPING
Section 23 04 00	MECHANICAL: INSULATION
Section 23 04 40	MECHANICAL: PIPE CLEANING TESTING
Section 23 80 00	HVAC: AIR HANDLING SYSTEM
Section 23 90 00	HVAC: CONTROL SYSTEM / ANALOG
Section 23 94 00	HVAC: CONTROL SEQUENCE OF OPERATIONS
Section 23 95 00	HVAC: TESTING ADJUSTING BALANCING

1.02 SCOPE:

A. Provide labor, equipment and materials to complete the work indicated on drawings and herein specified.

1.03 RELATED WORK:

A. Work in conjunction with this section shall be as designated below:

General Contractor:

Cutting, Patching, and Painting
Openings in roofs / Flashing
Openings in walls
Equipment foundations and bases
All temporary heating

Electrical Contractor:

Power wiring for electrical equipment provided within this section.

1.04 PROJECT ADMINISTRATION:

A. Transmit questions, submissions, notices, and correspondence through the general contractor for transmittal to the Architect.

B. Prepare and transmit to the Architect all submittal requirements within the time period allowed. See Schedule of Submissions.

1.05 SUBMITTALS:

A. See SUBMITTAL GENERAL REQUIREMENTS within Section 23 00 00.

B. The following shop drawings shall be prepared (see Section 23 00 00) and submitted for approval within the time period stated above: (This listing is not intended to all inclusive – provide submittals for all materials and equipment proposed for use on this project)

Fans
Exhaust Ventilators

Supports, curbs, frames, vibration isolators for all equipment.

1.06 PROJECT CLOSEOUT:

A. Review and provide closeout requirements of this section and Section 23 00 00 Mechanical General Requirements, including:

Testing and Adjusting
Record Drawings
Operating, Maintenance Instructions
Written Guarantee
Lubrication
Filters
Operating, Maintenance Manuals
Cleaning
Test Log
Letters of compliance.

PART 2 - EQUIPMENT

2.01 INLINE CENTRIFUGAL TYPE EXHAUST AND RETURN EXHAUST FANS; DIRECT DRIVE:

A. General: The fans shall be duct mounted supply, exhaust or return fans shall be of the centrifugal, direct driven in-line type. Fans shall of capacity and model as indicated in the SCHEDULE on the Drawings and shall be Model manufactured by Greenheck Fan Corporation of Schofield, Wisconsin, Loren Cook or Bailey.

B. The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include square duct mounting collars.

C. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.

D. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

E. Motors shall be permanently lubricated and carefully matched to the fan loads. Motors shall be readily accessible for maintenance.

F. A NEMA 1 disconnect switch shall be provided as standard, except with explosion resistant motors, where disconnects are optional. Factory wiring shall be provided from motor to the handy box.

G. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

H. Each fan shall bear a permanently affixed manufacturers nameplate containing the model number and individual serial number for future identification.

2.02 RELIEF / EXHAUST HOOD:

A. Provide roof mounted, gravity relief / exhaust air vents of the size, model and capacity as indicated in the SCHEDULE on the Drawings. Units shall be as manufactured by Greenheck Fan Corporation of Schofield, Wisconsin or Loren Cook.

B. Gravity roof relief ventilators shall be constructed of heavy gauge aluminum or galvanized steel as specified. Hoods shall be constructed of precision formed, arched panels with interlocking seams. Bases shall be constructed so that the curb cap is 6 in. larger that the throat size. Standard base height shall be 12 in. Hood support members shall be constructed of galvanized steel and fastened so that the hood can be either removed completely from the base or hinged open.

C. Birdscreens constructed of 0.5 in. galvanized steel mesh shall be mounted horizontally across the discharge area of the hood. Relief units with throat widths through 48 in. shall ship assembled when throat lengths do not exceed 96 in..

PART 3 - EXECUTION:

3.01 EQUIPMENT INSTALLATION, GENERAL:

A. All equipment shall be installed and connected as indicated on the Drawings and in strict accordance with the manufacturer’s recommendations. Sufficient clearance to allow effective maintenance shall be provided and sufficient clearance for electrical parts shall be maintained per the requirements of the National Electric Code.

3.02 EQUIPMENT START AND TEST, GENERAL:

A. All equipment should be started and tested by the HVAC Contractor once the installation is complete and prior to the start of system balancing work.

3.03 FACTORY START AND TEST, GENERAL:

A. The HVAC Contractor shall schedule manufacturer's start and test work as required such that the work is complete prior to the start of system balancing work. Refer to the individual equipment specifications for manufacturer's start and test requirements.

END OF SECTION 23 85 00

SECTION 23 90 00 – HVAC: CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

Section 23 00 00	MECHANICAL GENERAL REQUIREMENTS

B. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 00 50	MECHANICAL: ELECTRICAL COMPONENTS
Section 23 01 50	MECHANICAL: VIBRATION ISOLATION
Section 23 02 50	MECHANICAL: PIPE HANGERS AND SUPPORTS
Section 23 03 00	MECHANICAL: FIRE SAFING / FIRESTOPPING
Section 23 04 00	MECHANICAL: INSULATION
Section 23 04 40	MECHANICAL: PIPE CLEANING TESTING
Section 23 80 00	HVAC: AIR HANDLING SYSTEM
Section 23 85 00	HVAC: EQUIPMENT
Section 23 94 00	HVAC: CONTROL SEQUENCE OF OPERATIONS
Section 23 95 00	HVAC: TESTING ADJUSTING BALANCING

1.02 SCOPE:

A. Provide labor, equipment, and materials to complete the work indicated on drawings and herein specified.

B. The HVAC controls contractor (henceforth referred to as the “Contractor”) shall provide all power wiring, regardless of voltage, including line voltage wiring to all panels, control devices, not indicated on the Electrical Drawings.

C. Provide all equipment, accessories, wiring and instrument appurtenances required for a complete energy efficient functioning system.

D. The control system shall consist of, but not be limited to, all controls as specified herein including:

sensors
thermostats
valves
dampers, damper operators
switches
gradual switches

relays
wiring, regardless of voltage
wiring conduit systems

E. Provide actuators for equipment such as dampers, etc., where such actuators are not provided by the equipment manufacturers. Coordinate requirements with the HVAC subcontractor.

F. All materials and equipment used shall be standard components, regularly manufactured for this type of work and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

G. Provide all control and interlock wiring for compressor/condenser units, air conditioning units, etc. unless specifically and clearly stated to be provided by others.

H. The ATC contractor shall review and study all HVAC drawings and the entire PROJECT SPECIFICATION, including Division 1 and Division 23 Specification Sections, to familiarize himself with the equipment and systems operation and to verify the quantities and types of dampers, operators, alarms, bells, etc., he has to provide. Numerous references to the ATC contractor are made throughout this specification identifying work to be performed under the HVAC section in addition to work specifically indicated under this paragraph. It will be assumed that, if no specific inquiries are made during the bidding period, the HVAC/ATC subcontractors have reviewed all requirements and interfaces between equipment and controls, to result in a complete, integrated and fully operational HVAC system.

I. Any required changes or updates to the existing workstation hardware/software necessary to meet the requirements stated within this specification are to be included as a part of the work without additional charge.

J. The Contractor may only sub-contract electrical wiring and field device installation to a locally licensed electrical contractor specializing in controls. Only full-time permanent employees of the Contractor shall be used to design, program, commission, train, and service the temperature control system.

K. Drawings are diagrammatic only.

L. The intent of this specification is to provide a system that is consistent with controls currently in place at the facility.

M. All work shall conform to current Codes and Standards.

N. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.03 REFERENCES

A. National Fire Protection Association (NFPA) Standards.

B. National Electric Code (NEC) and applicable local Electric Code.

C. Underwriters Laboratories (UL) listing and labels.

D. UL 916 Energy Management

E. NFPA 70 - National Electrical Code.

F. NFPA 90A - Standard for The Installation of Air Conditioning and Ventilating Systems.

G. Factory Mutual (FM).

H. American National Standards Institute (ANSI).

I. National Electric Manufacturer's Association (NEMA).

J. American Society of Mechanical Engineers (ASME).

K. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

L. Air Movement and Control Association (AMCA).

M. Institute of Electrical and Electronic Engineers (IEEE).

N. American Standard Code for Information Interchange (ASCII).

O. Electronics Industries Association (EIA).

P. Occupational Safety and Health Administration (OSHA).

Q. American Society for Testing and Materials (ASTM).

R. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.

S. Americans Disability Act (ADA)

T. ANSI/EIA 909.1-A-1999 (LonWorks)

U. ANSI/ASHRAE Standard 195-2008 (BACnet)

V. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

W. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.04 RELATED WORK:

A. Work in conjunction with this section shall be as designated below:

General Contractor:

Cutting, Patching, and Painting
Openings in roofs / Flashing
Openings in walls
Equipment foundations and bases
All temporary heating

B. The demarcation of work and responsibilities between the ATC Contractor and other related trades shall be as outlined in the following ATC RESPONSIBILITY MATRIX:

ATC RESPONSIBILITY MATRIX				
WORK	**FURNISH**	**INSTALL**	**Low Volt.**	**LINE**

			WIRING/TUBE	**POWER**
Control systems low voltage and communication wiring	ATC	ATC	ATC	N/A
Line voltage and power wiring	Div 26	Div 26	N/A	Div 26
Control Sysems conduits and raceway	ATC	ATC	ATC	ATC
Automatic dampers	ATC	Div 23	N/A	N/A
Control Relays	ATC	ATC	ATC	N/A
Control systems interface with HVAC Equipment controls	ATC	ATC	ATC	ATC
HVAC Equipment controls interface with control systems	Div 23	Div 23	ATC	Div 26
All control system, equipment, housings, enclosures, and panels.	ATC	ATC	ATC	ATC
Smoke Detectors	Div 26	Div 26	Div 26	Div 26
Fire Alarm shutdown relay interlock wiring	Div 26	Div 26	Div 26	Div 26
Fire Alarm smoke control relay interlock wiring	Div 26	Div 26	ATC	Div 26
Starters, HOA switches	Div 23	Div 26	N/A	Div 26
Control damper actuators	ATC	ATC	ATC	Div 26

*Line voltage wiring required for the automatic control system not indicated on the electrical drawings shall be furnished and installed by the temperature control system contractor in accordance with the requirements of Division 26.

*ATC = Automatic Temperature Control Contractor

1.05 WIRING:

A. The mechanical/temperature controls contractor(s) shall provide all wiring, relays, transformers, devices, etc. necessary (regardless of voltage) for automatic controls.

B. Wiring provided by Mechanical Contractor(s) shall be in accordance with the National Electric Code, local and state codes, and Division 26. Wiring shall be in conduit, regardless of voltage, unless noted otherwise.

1.06 QUALITY ASSURANCE:

A. The control system shall be designed and installed, commissioned, and serviced by manufacturer trained personnel. The ATC Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.

B. Control contractor shall be a manufacturer authorized system installer.

C. The manufacturer shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the control system.

D. The control contractor shall be regularly engaged in the manufacturing, installation and maintenance of digital control systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation, and maintenance of control systems similar in size and complexity to this project. A maintained service organization consisting of at least ten

(10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

E. Installation: None but competent technicians, regularly employed in the control trade, shall install the system.

F. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

1.07 PROJECT ADMINISTRATION:

A. Transmit questions, submissions, notices, and correspondence through the general contractor for transmittal to the Architect.

B. Prepare and transmit to the Architect all submittal requirements within the time period allowed. See Schedule of Submissions.

1.08 INTERFACE WITH OTHER WORK

A. A project supervisor shall be assigned to coordinate all aspects of the project installation. The supervisor shall be a direct employee of the authorized Contractor. The supervisor shall be factory-trained in control technology, systems installation, and commissioning software-based systems.

B. The mechanical subcontractor shall install all wells, pressure tappings, and tappings for flow sensors.

C. Patching and painting required for the installation will be accomplished by the general contractor. The Contractor is responsible for this coordination.

1.09 SUBMITTALS:

A. See SUBMITTAL GENERAL REQUIREMENTS within Section 23 00 00.

B. The following submittals shall be prepared (see Section 23 00 00) and submitted for approval within the time period stated: (This listing is not intended to all inclusive – provide submittals for all materials and equipment proposed for use on this project)

Control Panels
Low Voltage Wiring
Line Voltage Power Wiring
Conduit systems / appurtenances
Wiring Diagrams / Schematics

Automatic dampers and Operators

Sequence of Operations

Operator's User Manual

1.10 QUALITY ASSURANCE/SERVICE RESPONSE:

A. The Control Contractor shall be fully licensed at the time of bid to do business in the project jurisdiction. The Control Contractor must have a branch office with a technical staff, complete spare parts inventory, and test and diagnostic equipment to keep systems in operation 24 hours per day, seven days per week. He shall have emergency service available in the local area for temperature control systems for which he is currently performing on-call emergency service 24 hours per day, seven days per week.

B. Installation: None but competent technicians, regularly employed in the control trade, shall install the system.

C. Equipment Manufacturer: Control equipment shall be as manufactured by;

Honeywell
Siemens Building Technologies
Johnson Control

1.11 EQUIPMENT OPERATION INSTRUCTION AND MAINTENANCE MANUALS:

A. On completion and acceptance of the work, furnish for approval three copies of written instructions on the proper operation and maintenance of all equipment and apparatus furnished under this Section of the Specification. Refer to Section 23 00 00 for additional requirements.

B. Each manual shall be provided with an index sheet listing the contents in alphabetical order and shall contain but not limited to the following material:

Updated copies of all submittal data and shop drawings as specified previously.

Manufacturer's instructions regarding the installation, maintenance and calibration of each component used in the ATC system installed by the ATC contractor.

Copies of all warranties and guarantees issued by each equipment manufacturer.

"As-built" interconnecting wiring diagrams and wire lists of the field installed system with complete, properly identified numbering of each system component and device.

A "User's Manual" detailing the operation of the Automatic Control System. The manual shall describe the hardware operation. This manual shall be submitted under separate cover. The User Manual shall be written for an inexperienced user. It shall describe in layman's language, the functions and procedures of "using" the system.

1.12 VALIDATION:

A. Check out, calibrate and test all connected hardware to insure that the system performs in accordance with the approved specifications and sequences of operation.

1.13 INSTRUCTIONS AND TRAINING:

A. Provide a knowledgeable technician to instruct the Owner's personnel in the proper operation and maintenance of the system. See SECTION 23 00 00.

B. The ATC contractor shall provide three copies of an operator's user's manual describing all operating and routine maintenance service procedures to be used with the system as specified previously. The ATC contractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period.

C. Material to be covered shall be:

Theory
Operational logic, situations
As installed; Hardware
Troubleshooting
Sequence of operations

1.14 GUARANTEE / WARRANTY:

A. All components, parts and assemblies supplied shall be guaranteed against defects in materials and workmanship for a period of one year.

B. Labor to troubleshoot, repair, or replace system components shall be provided by the Contractor at no charge to the owner during the guarantee period.

1.15 PROJECT CLOSE-OUT:

A. Review and provide close-out requirements of this section and Section 23 00 00 Mechanical General Requirements, including:

Testing and Adjusting
Record Drawings
Operating, Maintenance Instructions
Written Guarantee
Lubrication
Operating, Maintenance Manuals
Cleaning
Instructional Period

PART 2 - PRODUCTS AND INSTALLATION:

2.01 ELECTRIC WIRING: GENERAL:

A. Provide electric wiring and connections required for the automatic control system. Wiring shall be in conduit and shall comply with the Building Code and the NEC.

B. The ATC system shall be installed by skilled electricians who are properly trained and qualified for this work.

C. Supervision and checkout of the system shall be by the ATC contractor.

D. All electric wiring and wiring connections required for the installation of the temperature control system, as herein specified, shall be provided by the temperature control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications.

E. Power wiring, including line voltage wiring for the control system shall be provided by the temperature control contractor. This power wiring shall be run to a source as directed by the Electrical Engineer.

2.02 DAMPER ACTUATORS:

A. Damper actuators shall be of corrosion resistant construction (plastics or PVC are unacceptable), and of the proper size to meet system requirements as determined by the ATC contractor. Each actuator shall be provided with the proper spring selected to insure consistent operations over the desired nominal operating span and for proper sequencing with other controls. The actuator assembly shall include the necessary hardware and brackets to allow proper mounting and connection to a standard diameter damper shaft or damper blade.

B. The actuators shall be the electronic, direct-coupled types which do not require any crank arm and linkage. Actuators shall be UL and CSA listed and shall have a minimum of a 2 year warrantee, manufactured under ISO 9001, International Quality Control Standards. The units shall have a reversing switch and a manual override on the cover and shall be protected against overload at all angles of rotation.

C. Damper actuators shall be as manufactured by Belimo or approved equal.

2.03 DAMPERS:

A. Automatic dampers shall be multiple blade, ultra-low leakage type. Dampers shall be installed by the HVAC subcontractor under the supervision of the ATC contractor, except where specifically called for to be provided by equipment manufacturers. Smoke dampers shall be furnished by ATC contractor, unless they are specifically called for to be provided by others, and installed by the HVAC subcontractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the sheet metal subcontractor. All damper frames shall be constructed of 16 gauge galvanized sheet metal and shall have flanges for duct mounting. Damper blades shall not exceed 6" in width. All blades shall be of corrugated type construction, fabricated from two (2) sheets of 22 gauge galvanized sheet steel, spot welded together. Blades shall be suitable for high velocity performance. Damper leakage shall be less than 1% of total CFM, and pressure drop through the dampers shall not exceed 0.125 inches w.g. at 2000 fpm.

B. All damper bearings shall be made of nylon. Bushings that turn in the bearings shall be oil-impregnated sintered metal.

C. Replaceable butyl rubber seals shall be provided with the damper. Seals shall be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight closing, low leakage damper. Leakage and flow characteristic charts must be submitted to the Engineer prior to approval of dampers.

2.04 POSITIONERS - PILOT RELAYS:

A. Positive positioning relays shall be furnished and installed on all damper actuators, valve actuators, vane actuators, and all other actuators whenever said actuators are sequenced with any other control device. Additionally, they shall be furnished and installed whenever any control device requires additional power, repeatability, or speed of response, to insure an accurate and operable control system. Positioner shall have field adjustments for both starting pressure and control signal span.

2.05 PANELS:

A. ATC control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have hinged door with locking latch on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of enamel paint. Panel shall be wall mounted or free standing as located on mechanical drawings.

2.06 MISCELLANEOUS DEVICES:

A. Provide all necessary relays, positioners, electric switches, clocks, transformers, etc., to make a complete and operable system.

2.07 START-UP AND COMMISSIONING:

A. General:

When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

The Temperature Control Contractor shall issue a report based on a sampling of the performance metrics of the system's various control loops. The report shall indicate performance criteria, include the count of conforming and non-conforming system elements, list the non-conforming elements along with performance data.

After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed.

2.08 PERFORMANCE VERIFICATION TESTING (PVT) / START-UP AND COMMISSIONING:

A. General:

When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the Temperature Control Contractor. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed.

Performance Verification Testing (PVT):

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Owner. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and

shall include the Contractor's QA representative, the Contractor's PVT administrator and the General Contractor's Representative.

Upon successful completion of the PVT, submit a PVT Report to the Owner and prior to the Owner taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

2.09 TRAINING:

A. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings and a walk through of the facility to identify panel and device locations.

B. The Temperature Control Contractor shall provide the Owner's Representative with a binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

C. Provide 4 hours of training for Owner's designated operating personnel. Training shall include:

D. Explanation of drawings, operations and maintenance manuals

E. Walk-through of the job to locate control components

F. Explanation of adjustment, calibration and replacement procedures

G. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

END OF SECTION 23 90 00

SECTION 23 94 00 – HVAC CONTROL SEQUENCE OF OPERATION

PART 1 - PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

Section 23 00 00	MECHANICAL GENERAL REQUIREMENTS

B. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 00 50	MECHANICAL: ELECTRICAL COMPONENTS
Section 23 85 00	HVAC: EQUIPMENT
Section 23 90 00	HVAC: CONTROL SYSTEM / ANALOG
Section 23 95 00	HVAC: TESTING ADJUSTING BALANCING

1.02 INTENT:

A. The intention of these Specifications and Drawings is to call for finished work, debugged, tested and ready for operation.

B. Equipment and / or materials specified in the singular shall be provided in quantities as required for complete systems.

1.03 GENERAL OPERATIONS

A. Control sequences are generally worded for direct acting type of control. Controls shall be direct or reverse acting to match the fail position of the actuator or device.

B. Label function of all control panel alarms switches, indicators, and manual control devices. Label units of analog indicators.

PART 2 - SEQUENCE OF OPERATIONS

2.01 GENERAL DESCRIPTION:

A. Provide a complete control system with an energy conserving sequence of operations to control the heating, and ventilation systems as indicated for this project.

2.02 OCCUPIED / UNOCCUPIED CONTROL:

A. The HVAC systems shall be sequenced to operate in either the "Occupied", or "Unoccupied" mode of operation through A 7-day programmable time clock located within the mechanical room.

2.03 EXHAUST VENTILATION CONTROL:

A. Occupied:

The 2-position automatic dampers serving the men’s and women’s rooms shall cycle to their fully open positions.

The automatic damper at the exhaust fan discharge shall cycle to its fully open position. Once the damper reaches its fully open position, a damper end switch shall signal the exhaust fan to start.

The exhaust fan shall operate continuously.

B. Unoccupied:

The exhaust fan shall be inoperative.

The automatic damper at the exhaust fan discharge shall cycle to its fully closed position.

The 2-position automatic dampers serving the men’s and women’s rooms shall cycle to their fully closed positions.

END OF SECTION 23 95 00

SECTION 23 95 00 – HVAC TESTING ADJUSTING BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and the following listed sections as a minimum, apply fully to work in this section.

Section 23 00 00	MECHANICAL GENERAL REQUIREMENTS

B. Refer to and coordinate all work with the work of the following listed Sections:

Section 23 80 00	HVAC: AIR HANDLING SYSTEMS
Section 23 85 00	HVAC: EQUIPMENT
Section 23 90 00	HVAC: CONTROL SYSTEM / ANALOG

1.02 SCOPE:

A. Provide for an independent balancing concern to provide labor, equipment and materials to complete the Balancing Adjusting Testing of the heating, ventilating and air conditioning system including temperature controls, and interrelated equipment indicated.

B. This Section specifies the requirements and procedures for testing, adjusting, and balancing air and water distribution systems. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and recording and reporting the results.

C. Testing, adjusting and balancing is the process of checking and adjusting mechanical system parameters to produce the design objectives. It includes:

Balancing of air distribution systems

Adjustment of the total systems to provide the design quantities.

Electrical measurement.

Verification of performance of all equipment and automatic controls.

1.03 RELATED WORK:

A. Work in conjunction with this section shall be as designated below:

General Contractor:	Access to all equipment Coordination.
HVAC Contractor:	Provide coordination and data on equipment furnished.

1.04 PROJECT ADMINISTRATION:

A. Transmit questions, submissions, notices, and correspondence through the general contractor for transmittal to the Architect.

1.05 NOTIFICATION / COORDINATION:

A. The balancing concern shall notify the Engineer at all times when balancing is to be performed. The general contractor and the HVAC contractor shall insure that all systems are ready for balancing/final adjustment prior to notification of the balancing concern to proceed.

B. Systems shall be fully operational prior to beginning testing, adjusting, and balancing procedures.

1.06 SUBMITTALS REQUIRED:

A. Agency Data: Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.

B. Engineer and Technician Data: Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.

C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.

D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this data in the maintenance manual.

E. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems.

1.07 SCHEDULE OF SUBMISSIONS:

A. Balancing Report Prior to substantial completion. 3 Copies.

1.08 QUALITY ASSURANCE:

A. Agency Qualifications:

Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting results.

The independent testing, adjusting, and balancing agency shall be certified by NEEB, TAB and/or SMACNA in those disciplines required for this Project.

B. Codes and Standards:

NEBB: “Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems”.

ASHRAE: ASHRAE Handbook, 1987 Systems Volume, Chapter 57; Testing, Adjusting, and Balancing.

1.09 BALANCING CONCERN:

A. Selection of the Subcontractor for this work shall be subject to the Owner’s approval.

B. Select from the following:

Leonhardt Company, 27 Harvard Street, Brookline, MA

Arden Engineering Service Group, 435 Narragansett Park Dr. Pawtucket, RI.

Thomas-Young Associates, Inc., P.O. Box 567, Marion, MA 02738 (508 748 0204)

1.10 DEFINITIONS:

A. Adjust: To regulate the specified fluid flow rate at the terminal equipment.

B. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.

C. Branch: Duct or pipe serving a single terminal.

D. Branch main: Duct or pipe serving two or more terminals.

E. Main: Duct or pipe containing the system’s major or entire fluid flow.

F. Procedure: Standardized approach and execution of a sequence of work operations to yield reproducible results.

G. Report Forms: Test data sheets arranged for collecting test data in logical order for submission and review. These forms should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.

H. Submain: Duct or pipe containing part of the system’s capacity and serving two or more branch mains.

I. Terminal: The point where the controlled fluid enters or leaves the distribution system.

J. Test: To determine the quantitative performance of equipment.

1.11 COSTS:

A. Carry the amount proposed from anyone of the listed firms as a part of the base bid. Indicate with the bid which of the listed firms is included within the base bid.

PART 2 - BALANCING / FINAL ADJUSTMENT

2.01 GENERAL:

A. Test, adjust and balance the systems provided to achieve design operation and to set and mark all adjustable equipment for economical operation.

B. Obtain design drawings and specifications for the project and become thoroughly acquainted with the design intent.

2.02 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

A. Before operating the system, perform the following steps:

Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

Check volume and fire dampers for correct and locked position, and temperature controls for completeness.

Prepare report test sheets for both fans and outlets. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.

Determine best locations in main and branch ductwork for most accurate duct traverses.

Place outlet dampers in the full open position.

Prepare schematic drawing of system ductwork layouts to facilitate reporting.

Lubricate all motors and bearings.

Check fans for proper direction of rotation.

2.03 SYSTEM TESTS, GENERAL:

A. Scope: Subsequent to final Testing Adjusting and balancing, all control systems shall be adjusted and calibrated such that performance of all equipment is operating as intended.

2.04 MEASUREMENTS, INSTRUMENTS AND SUPPLIES:

A. Provide all required instrumentation to obtain proper measurements. Instruments shall meet the requirements specified in the referenced standards, and shall be calibrated to the tolerances specified therein. Instruments shall be properly maintained and protected against damage.

B. Use only those instruments that have the maximum field measuring accuracy and are best suited to the measurement being made.

C. Apply each instrument as recommended by the manufacturer.

D. Use instruments with the maximum number of scale subdivisions and with the minimum scale range for the value being measured.

E. When averaging values, take a sufficient number of readings to give a repeatability error of less than 5%. When measuring a single point, repeat readings until two consecutive identical readings are obtained.

F. Take all readings with the eye at the level of the indicated value to prevent parallax.

G. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuating readings.

H. Take measurements at locations that will render the most accurate data.

2.05 AIR FLOW BALANCE; GENERAL:

A. Scope: After the completion of the air distribution systems, adjust and balance the systems to deliver air quantities as indicated or as directed.

B. Perform testing, adjusting, and balancing procedures on each system identified in accordance with the detailed procedures outlined in the referenced standards.

C. Preliminary Procedures:

Adjust and balance flows to specified design quantities with a tolerance of +/- 5%.

Adjust and balance supply and return airflows for systems.

Patch ductwork, and housings using materials identical to those removed.

Seal ducts and test for and repair leaks.

Mark equipment settings of controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.

Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

D. Instruments: Calibrate and maintain all instruments used in checking, balancing the system. Perform accuracy tests on instruments whenever requested by Owner, Engineer, or Architect.

E. Air Measurement: Measure air quantities in main ducts by pitot tube traverse of the entire cross section area of the duct. Openings in ducts for tests shall be sealed with snap-in plugs after tests. Outlet and inlet air quantities shall be determined by direct reading velocity meters.

F. Air Quantity Adjustments: Total air quantities shall be obtained by adjusting fan speed. Branch duct quantities shall be adjusted by volume or splitter dampers. Permanently mark set points of all dampers. Only minor air quantity adjustment by outlet dampers will be permitted.

G. Fresh air intake: Test and set all intake dampers, fans, or other devices to be tight closing when off and to allow stated amounts of fresh air intake during operation. Note all amounts of leakage CFM and operating CFM.

H. Exhaust systems: Test and set all exhaust dampers, fans, or other device to exhaust the required amounts of air. Set exhaust systems to be tight closing when off. Note all amounts of airflow CFM.

I. Air System Data:

Fans:	Design RPM Final RPM	Design CFM Final CFM	Design Static Pressure Actual Static Pressure (suction - discharge)

Fan Motor:	Full Load Amps Operating Amps

Grilles, Registers, Diffusers:

Mark drawings with actual CFM at each outlet, inlet to indicate final adjustment air quantity.

PART 3 - REPORT

3.01 GENERAL:

A. The balancing concern shall record and submit for evaluation and review three copies of a complete Balancing Report.

B. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by, the referenced standards.

C. Prepare a report of recommendations for correcting unsatisfactory mechanical performance when system cannot be successfully balanced or performance tested.

3.02 REPORT FORMAT:

A. Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced.

B. In addition to the Report Forms, the Testing Adjusting and balancing results shall also be noted on reproducible drawings of the building provided by the Architect for that purpose. All data as specified herein shall be neatly and accurately indicated.

3.03 REPORT CONTENTS:

A. Identification of testing, adjusting, and balancing agency, Owner, and Project. Include addresses, contact names, and telephone numbers.

B. The seal and name, address, telephone number, and signature of the Test and Balance Engineer.

C. A listing of the instruments used for the procedures, and proof that all instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

D. The appropriate forms containing, as a minimum, the information indicated on the standard report forms prepared by the Associated Air Balance Council (AABC) and the National Environmental Balancing Bureau (NEBB) for each respective item and system. Prepare an accompanying schematic diagram that includes each item of equipment in the system being tested.

END OF SECTION 23 95 00

SECTION 26 0501 - GENERAL REQUIREMENTS FOR ELECTRICAL TRADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specifications Sections apply to Work of this Section.

1.2 DESCRIPTION OF WORK

A. This Section applies equally and specifically to all Contractors supplying labor, equipment and/or materials as required under each Section of this Division.

1.3 INTENT

A. It is the intent of the Drawings and Specifications to call for finished work, tested and ready for operation.

B. Any apparatus, appliance, material or work not shown on the Drawings but mentioned in the Specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed under their respective Divisions without additional expense to the Owner.

C. Minor details not usually shown or specified but necessary for proper installation and operation shall be included in the work as though they were hereinafter shown or specified.

D. Work under each Section shall include giving written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction and any necessary items of work omitted. In the absence of such written notice, it is mutually agreed that work under each Section has included the cost of all required items for the approved, satisfactory functioning of the entire system without extra compensation.

1.4 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. (Do not scale the Drawings). Refer to the Architectural Drawings and Details for exact locations of fixtures and equipment; where same are not definitely located, obtain this information from the Engineer.

B. Work under each Section shall closely follow Drawings in layout of work; check Drawings of other Divisions to verify spaces in which work will be installed. Maintain maximum headroom.

Where space conditions appear inadequate, Engineer shall be notified before proceeding with installations.

C. Engineer may, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades and for proper execution of the work.

D. Where variances occur between the Drawings and Specifications or within either of the Documents, the item or arrangement of better quality, greater quantity or higher cost shall be included in the Contract price. The Engineer shall decide on the item and the manner in which the work shall be installed.

1.5 SURVEYS AND MEASUREMENTS

A. Before submitting his Bid, the Contractor shall visit the site and become thoroughly familiar with all conditions under which his work will be installed as he will be held responsible for any assumptions, omissions or errors he makes as a result of his failure to become familiar with the site and the Contract Documents.

B. The Contractor shall base all measurements, both horizontal and vertical, from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancies between actual measurements and those indicated which prevent following good practice or the intent of the Drawings and Specifications, he shall notify the Engineer and shall not proceed with that work until he has received instructions from the Engineer.

1.6 CODES AND STANDARDS

A. The Codes and Standards listed below apply to all electrical work. Where other Codes or Standards are mentioned in these Specifications, the latest edition or revision shall be followed:
   1. RISBC-1 - International Building Code, 2018 Edition, with State of Rhode Island Amendments
   2. RISBC-5 - NFPA 70, National Electric Code, 2020 Edition, with State of Rhode Island Amendments
   3. RISBC-8 - International Energy Conservation Code, 2018 Edition, with State of Rhode Island Amendments
   4. 450-RICR - Rhode Island Fire Safety Code
   5. NFPA 1 - Fire Code, 2018 Edition
   6. NFPA 72 - National Fire Alarm and Signaling Code, 2019 Edition
   7. NFPA 101 - Life Safety Code, 2018 Edition

B. The following abbreviations may be used within this Division of the Specifications:
   1. IES Illuminating Engineering Society
   2. NEC National Electrical Code
   3. ANSI American National Standards Institute
   4. EPA Environmental Protection Agency
   5. IEEE Institute for Electrical and Electronic Engineers
   6. NEMA National Electrical Manufacturers Association

7. NFPA National Fire Protection Association
8. OSHA Occupational Safety and Health Administration
9. UL Underwriter's Laboratories

C. All materials furnished and all work installed shall comply with the rules and recommendations of the NFPA, the requirements of the local utility companies, the recommendations of the fire insurance rating organization having jurisdiction and with the requirements of all Governmental departments having jurisdiction.

D. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus and Drawings in order to comply with all applicable laws, ordinances, rules and regulations whether or not shown on Drawings and/or specified.

1.7 DEFINITIONS

A. The following definitions shall apply to the following terms as they are used by electrical Drawings and in this Division of the Specifications.

1. Change Order - A Change Order is a written order to the Contractor issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates the Contractor's agreement therewith, including the adjustment in the Contract Sum or the Contract Time.
2. Contract Time - Unless otherwise indicated, the Contract Time is the period of time allotted in the Contract Documents for Substantial Completion of the Work, as defined in 1.7E, including authorized adjustments thereto.
3. Contract Sum - The Contract Sum is stated in the Owner-Contractor Agreement and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.
4. Contractor - The term Contractor, as used in Division 26, means the Electrical Contractor or any Subcontractor to the Electrical Contractor.
5. Date of Substantial Completion of the Work - The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so that the Owner or separate contractors can occupy or utilize the Work or a designated portion thereof for the use for which it is intended.
6. Engineer - The Engineer is the person lawfully licensed to practice engineering, or an entity lawfully practicing engineering, identified as such in the Owner-Contractor Agreement. The term Engineer means the Engineer or the Engineer's authorized representative.
7. Install - To put into place and connect equipment and materials as indicated on the Drawings and in the Specifications so that they are completely functional. The equipment and materials may or may not be provided by the Contractor.
8. Modification - A modification is (1) a written amendment to the contract signed by both parties, (2) a Change Order, (3) a written interpretation by the Engineer necessary for the proper execution or progress of the Work, (4) a written order for a minor change in the work, issued by the Engineer, which does not involve an adjustment in the Contract Sum or extension of the Contract Time and which is consistent with the intent of the Contract Documents.

9. Owner - The Owner is the person or entity identified as such in the Owner-Contractor Agreement. The term Owner means the Owner or the Owner's authorized representative.
10. Product Data - Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.
11. Project - The Project, the total construction of which the Work performed under the Contract Documents is a part.
12. Provide - To supply, put into place and connect equipment and materials as indicated on the Drawings and in the Specifications, so that they are completely functional.
13. Samples - Samples are physical examples which illustrate materials, equipment or workmanship, and establish standards by which the Work will be judged.
14. Shop Drawings - Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.
15. Subcontractor - A Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site. The term Subcontractor means a Subcontractor or a Subcontractor's authorized representative. The term Subcontractor does not include any separate contractor or any separate contractor's subcontractors.
16. Work - The Work comprises the completed construction required of the Contractor by the Contract Documents, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.

1.8 PERMITS AND FEES

A. The Contractor shall give all necessary notices, obtain all permits, pay all Government and State sales taxes and fees where applicable, and other costs, including utility connections or extensions in connection with his work. He shall file all necessary Drawings, prepare all Documents and obtain all necessary approvals of all Governmental and State departments having jurisdiction, obtain all required certificates of inspections for his work and deliver a copy to the Owner's Representative before request for acceptance and final payment for the work.

1.9 COORDINATION WITH OTHER DIVISIONS

A. All work shall be carried out in conjunction with other trades and full cooperation shall be given in order that all work may proceed with a minimum of delay and interference. Particular emphasis is placed on timely installation of major apparatus and furnishing other Contractors, especially the General Contractor, with information as to openings, chases, equipment locations and panels required by other trades.

B. The Contractors are required to examine all of the Project Drawings and mutually arrange work so as to avoid interference. In general, ductwork, heating and sprinkler piping and drainage lines take precedence over water, gas and electrical conduits. The Engineer shall make final decisions regarding the arrangement of work which cannot be agreed upon by the Contractors.

C. Where the work of the Contractor will be installed in close proximity to or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment.

D. If the work under a Section is installed before coordinating with other Divisions or so as to cause interference with work of other Sections, the necessary changes to correct the condition shall be made by the Contractor causing the interference without extra charge to the Owner.

1.10 APPROVALS

A. The equipment, materials, workmanship, design and arrangement of all work installed under the Electrical Sections shall be subject to the approval of the Engineer.

B. Within fifteen (15) days after the awarding of a Contract, the Electrical Contractor shall submit to the Engineer for approval, a list of manufacturers of equipment proposed for the work under the Electrical Sections. The intent to use the exact makes specified does not relieve the Contractor of the responsibility of submitting such a list.

C. If extensive or unacceptable delivery time is expected on a particular item of equipment specified, the Contractor shall notify the Engineer in writing within fifteen (15) days of the awarding of the Contract. In such instances, substitutions may be made pending approval by the Engineer or Owner's representative.

D. Where any specific material, process, method of construction or manufactured article is specified by reference to the catalog number of a manufacturer, the Specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings. In all cases, the Electrical Contractor shall verify the duty specified with the specific characteristics of the equipment offered for approval. Equipment characteristics and mandatory requirements are to be used where the Contractor proposes to use an approved equal.

E. If material or equipment is installed before it is approved, the Contractor shall be liable for its removal and replacement at no extra charge to the Owner if, in the opinion of the Engineer, the material or equipment does not meet the intent of the Drawings and Specifications.

1.11 EQUIPMENT DEVIATIONS

A. Where the Contractor proposes to deviate (substitute) from the equipment as hereinafter specified, he shall do so by making a request in writing. The Contractor shall state in his request for substitution the reason for the deviation and the amount of credit or extra cost involved. A copy of said request shall be included in the Electrical Base Bid along with manufacturer's cuts. The Base Bid shall be based on using manufacturer's equipment as specified with no exceptions.

B. In these Specifications and on the accompanying Drawings, one or more makes of materials, apparatus or appliances may have been specified for use in this installation. This has been done for convenience in fixing the standard of workmanship, finish and design required for installation.

C. The details of workmanship, finish, and design and the guaranteed performance of any material, apparatus or appliance which the Contractor desires to substitute for those mentioned herein shall also conform to these standards. Where no specific make of material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used providing it conforms, in the opinion of and meets with the approval of the Engineer, to the

requirements of these Specifications. Where two or more names are given as equals, the Contractor must use one of the named equals. Where one name only is used and is followed by the words "or approved equal", the Contractor must use the item named, but he may apply for substitution through the prescribed manner.

D. Where the Contractor proposes to use an item of equipment other than specified or details on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new Drawings and detailing required therefore shall, with the approval of the Engineer and Engineer be prepared by the Electrical Contractor at no cost to the Owner.

E. Where such approved deviation requires a different quantity and arrangement of wiring, conduit and equipment from that specified or indicated on the Drawings, the Contractor shall, with the approval of the Engineer, furnish and install any such additional equipment required by the system at no additional cost to the Owner, including any costs added to other trades due to the substitution.

1.12 CHANGES IN WORK

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions to the Owner and Contractor.

B. The Engineer may issue a Change Order which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change. Contractor will prepare and submit an estimate within five days.

C. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors.

D. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment to the Contract Sum and Contract Time.

1.13 MANUFACTURER’S IDENTIFICATION

A. Manufacturer's nameplate, name or trademark and address shall be attached permanently to all equipment and materials furnished under this Division. The nameplate of a Contractor or distributor shall not be acceptable.

B. When stated in other sections of this Division, material and equipment supplied under this Division shall bear the label of or be listed by the Underwriters' Laboratories, Inc., or other accredited authoritative agencies or testing organizations approved by the authority having jurisdiction.

1.14 SHOP DRAWINGS

A. Shop Drawings shall be submitted as indicated in individual sections of this division.

B. If any equipment or materials are not specifically mentioned in individual sections of this division, Contractor shall contact Engineer to determine if shop drawings are required.

C. No material or equipment may be delivered to the job site or installed until the Contractor has in his possession approved shop drawings for the particular material or equipment.

D. Shop drawings shall be submitted as soon as practical within fifteen (15) days after the Award of Contract and before any material or equipment is purchased. The Contractor shall submit for approval copies of all shop drawings to be incorporated in the Electrical Contract. Refer to the General Conditions and Supplementary General Conditions for the quantity of copies required for submission. Where quantities are not specified, provide seven (7) copies for review.

E. Shop drawings shall include manufacturer's names, catalog numbers, cuts, diagrams and other such descriptive data as may be required to identify and approve the equipment. Shop drawings shall also include additional requirements indicated in applicable sections of this Division. No consideration will be given to a partial shop drawing submittal.

F. Where multiple quantities or types of equipment are being submitted, provide a cover sheet (with a list of contents) on the submittal identifying the equipment of material being submitted.

G. Shop drawings shall be specific, with all items submitted for approval clearly identified with red ink. Data of general nature will not be accepted.

H. Failure of the Contractor to submit shop drawings in ample time for review shall not entitle him to an extension of Contract time and no claim for extension by reason of such default will be allowed, nor shall it entitle him to purchase, furnish and/or install equipment which has not been approved by the Engineer.

I. Transmit each submittal with an appropriate transmittal letter. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

J. Identify Project, Contractor, Subcontractor or supplier, pertinent drawing and detail number, and specification section number, as appropriate.

K. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

L. Provide space for Owner or Engineer review stamp.

M. The Contractor shall furnish all necessary templates, patterns, etc., for installation work and for the purpose of making adjoining work conform; furnish setting plans and shop details to other trades as required.

N. Approval rendered on shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings are approved, said approval does not in any way relieve the Contractor from his responsibility or necessity of furnishing material or performing work as required by the Contract Drawings and Specifications. Verify available space prior to submitting shop drawings.

O. Approval of shop drawings shall not apply to quantity nor relieve the Contractor of his responsibility to comply with the intent of the Drawings and Specifications.
   1. Approval of shop drawings is final; no further changes will be allowed without the written consent of the Engineer.

P. Shop drawings not approved by Engineer shall be revised and resubmitted in accordance with procedures outlined above. All changes made shall be identified.

Q. Shop drawings stamped "Make Corrections Noted" are not required to be resubmitted. However, Contractor is responsible for insuring that corrections are made before equipment or materials are purchased.

R. Distribute copies of reviewed submittals to subcontractors and other appropriate parties. Instruct parties to report promptly any inability to comply with provisions.

1.15 RECORD “AS-BUILT” DRAWINGS

A. The Contractor and each subcontractor shall maintain a separate set of electrical contract prints, reserved exclusively for the purpose of marking As-Built conditions.

B. The Contractor and each subcontractor shall record on his respective record prints, clearly, neatly, accurately and promptly as the Work progresses, the following data.
   1. Changes made resulting from formal change orders or other instructions issued by the Engineer; actual installed conditions and locations; exact location of concealed wiring, reference and dimensions from building features; location and identification of all concealed devices and equipment.

C. Upon completion of work, the contractor shall transfer the as-built changes to reproducible media that is in the same format as the original design drawings. (For example, if the design drawings were produced with AutoCad, the as-builts shall also be produced with a compatible version of AutoCad.)

1.16 MATERIALS AND WORKMANSHIP

A. All materials and apparatus required for the work, except as otherwise specified, shall be new and of first-class quality and shall be furnished, delivered, erected, connected and finished in every detail and so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality of material is given, a first-class standard article as accepted by the Engineer shall be furnished.

B. The Contractor shall furnish the services of an experienced superintendent who shall be constantly in charge of the installation of the work, together with all skilled workers, helpers and labor required to unload, transfer, erect, connect, adjust, start, operate and test each system.

C. Unless otherwise specifically indicated on the Drawings or in the Specifications, all equipment and materials shall be installed with the acceptance of the Engineer and in accordance with the recommendations of the manufacturer. This includes the performance of such tests as the manufacturer recommends.

D. All work shall be of a quality consistent with good trade practice and shall be installed in a neat, skillful manner. The Engineer reserves the right to reject any work which has been installed in a sub-standard, dangerous or unserviceable manner. The Contractor shall replace said work in a satisfactory manner at no extra charge to the Owner.

1.17 PROTECTION OF EQUIPMENT AND MATERIALS

A. Work under each Section shall include protecting the work and material of all other Sections from damage by work or workers and shall include repairing all damage thus caused.

B. The Contractor shall be responsible for work and equipment until finally inspected, tested, and accepted. Work and equipment shall be protected from water, dust and dirt and against theft, vandalism, injury or damage. Material and equipment received on site which is not immediately installed, shall be carefully and securely stored. Open ends of work shall be closed with temporary covers or plugs during construction to prevent entry of obstructing or other foreign material.

C. Work under each Section includes receiving, unloading, uncrating, storing, protecting, setting in place and connecting up completely of any equipment supplied under each Section. Work under each Section shall also include exercising special care in handling and protecting equipment and fixtures and shall include the cost of replacing any of the above equipment and fixtures which are missing or damaged by reason of mishandling or failure on the part of the Contractor to protect.

1.18 BASES AND SUPPORTS

A. Unless otherwise specifically noted, the Contractor shall furnish all necessary supports, pads and bases required for all equipment furnished under this Division.

B. Concrete pads shall be furnished and installed by the Contractor, unless indicated otherwise on the Drawings or in the Specifications for switchboards, generators, motor control centers and other freestanding equipment. All pads shall be extended six inches beyond machine base in all directions with top edge chamfered. Insert steel dowel rods into floors to anchor pads. Shop drawings of all foundations and pads shall be submitted to the Engineer for review before they are constructed. When pads are specified to be furnished by others, the Contractor shall furnish all required dimensional and necessary loading information.

C. Construction of foundations, supports, pads, bases and piers where mounted on the floor shall be of the same finish quality as the adjacent and surrounding flooring material.

D. All equipment, unless otherwise shown, shall be securely attached to the building structure in an acceptable manner. Attachments shall be of a strong and durable nature; any attachments that are insufficient, in the opinion of the Engineer, shall be replaced as directed without additional expense to the Owner.

1.19 SLEEVES, INSERTS AND ANCHOR BOLTS

A. The Contractor shall provide, set in place and be held responsible for the location of all sleeves, inserts and anchor bolts required for his work. In the event that failure to do so requires cutting and patching of finished work, it shall be done at the Contractor's expense.

B. All conduits passing through floors, walls or partitions shall be provided with sleeves having an internal diameter of one inch larger than the outside diameter of the conduit or insulation enclosing the conduit.

1.20 FIRE-STOPS

A. The Contractor shall provide UL rated fire-stops for all penetrations through fire-rated walls, ceilings and floors (except slab on grade) in which raceways, conduits, wire, cables, busways or cable trays pass.

B. The fire-stops shall be filled solidly with mineral fiber or other UL approved fire-stopping material classified for the required hourly rating.

C. Penetrations through fire-rated walls, ceilings or floors shall be sealed by a UL approved fire-stop fitting classified for an hourly rating equal to the fire rating of the wall, ceiling or floor.

1.21 SEALS

A. Seal fittings shall be installed on conduits and cables, as required by Articles 500 through 517 of the NEC, which are in or pass through hazardous (classified) areas.

B. Sealing bushings shall be used on conduit and cable ends to prevent the intrusion of water, a damp or corrosive atmosphere, hot or cold air, or dust.

C. Thorough wall and floor seals shall be used to provide a positive means of sealing pipes or conduits which pass through the concrete foundations of a structure below grade or below ground water level. Seals shall also be used at entry points through concrete walls or floor which must be sealed.

1.22 CUTTING AND PATCHING

A. All cutting and patching shall be done by the Contractor, unless indicated otherwise on the Drawings or in the Specifications when cutting and patching is specified for others. The Contractor shall furnish sketches showing the location and sizes of all openings, chases, etc., required for the installation of work.

B. The Contractor working under this Division shall furnish, locate and set inserts and/or sleeves as required before the floors and walls are built. The Contractor shall be responsible for the cost of drilling, cutting and patching as required for conduits, etc., where sleeves and inserts were not installed or correctly located. The Contractor shall do all drilling required for the installation of hangers.

C. All holes cut through concrete slabs shall be done with extreme caution to avoid cutting or damaging structural members. No structural members shall be cut without the written approval of the Engineer. Structural steel members shall be cut in a manner directed by the Engineer.

1.23 SCAFFOLDING, RIGGING, HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

1.24 EXCAVATION AND BACKFILLING

A. All excavation and backfilling required shall be done by the Contractor, unless indicated otherwise on the Drawings or in the Specifications.

B. When excavation and backfilling is specified to be done by others, it is the responsibility of the Contractor to coordinate sizes, depths, fill and bedding requirements with the other party for any excavation work required under this Division.

1.25 WATERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete and floors in wet areas, the method of installation shall be reviewed by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

1.26 ACCESSIBILITY AND ACCESS PANELS

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions and the adequate clearance in double partitions and hung ceilings for the proper installation of the work.

B. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to: Motors; controllers; switchgear, etc. Access doors shall be furnished if better accessibility is required. Approved minor deviations from Drawings may be made to allow for better accessibility, but changes of magnitude or which involve extra cost shall not be made without the approval of the Engineer.

C. Access doors in walls, ceilings, floors, etc., shall be furnished and installed by the Contractor, unless indicated otherwise on the Drawings or in the Specifications. It is the responsibility of the Contractor to coordinate and provide information regarding the sizes and quantities of access doors required for his work. When access doors are specified to be provided by others, the Contractor shall arrange his work in such a manner so as to minimize the quantity of access doors required. All items requiring accessibility shall be located in already accessible areas, such as above lay-in ceilings, etc.

D. Upon completion of the Project, the Contractor shall physically demonstrate that all equipment and devices installed have been located and/or provided with adequate access panels for repair, maintenance and/or operation. Any equipment not so furnished shall be relocated or provided with additional access panels by the installing Contractor at no additional cost to the Owner.

E. Permanent ladders for access to equipment shall be furnished and installed by the Contractor, unless indicated otherwise on the Drawings or in the Specifications.

1.27 TEMPORARY OPENINGS

A. The Contractor shall ascertain from his examination of the Drawings whether any special temporary openings in the building will be required for the admission of apparatus provided under this Division and he shall provide these openings, unless indicated otherwise on the Drawings or in the Specifications.

B. When these openings are specified to be provided by others, the Contractor shall give sufficient notice to the other party in time to arrange for the openings. In the event of failure of the Contractor to give sufficient notice, the Contractor shall assume all costs of providing such openings thereafter.

1.28 SHUTDOWNS

A. When installation of a new system requires the temporary shutdown of an existing operating system, the connection of the new system shall be performed at such time as designated by the Engineer or the Owner's representative.

B. The Engineer and the Owner shall be notified of the estimated duration of the shutdown period at least ten (10) days in advance of the date the work is to be performed.

C. Work shall be arranged for continuous performance whenever possible. The Contractor shall provide all necessary labor, including overtime, if required, to assure that existing operating services will be shut down only during the time actually required to make necessary connections.

1.29 PAINTING

A. All materials shipped to the job site under this Division such as panels, plates, etc., shall have prime coat and standard manufacturer's finish, unless otherwise specified.

B. The Contractor shall perform all painting in areas in accordance with the following:
   1. All concealed, non-insulated hangers, supports and other ferrous metal work, except that which are galvanized, shall be painted. Inaccessible conduits, hangers, support and anchors and ducts shall be coated prior to installation.
   2. The manufacturer's nameplate data on equipment shall not be painted over. Special care shall be taken to avoid covering or spattering paint on the nameplate.
   3. Damaged equipment shop coats shall be touched up in the field.
   4. All conduit junction box covers for the fire alarm system shall be painted red.

1.30 TEMPORARY CONSTRUCTION FACILITIES AND SERVICES

A. Contractor is responsible for providing all temporary facilities and services required. This includes power, lighting, heat, ventilation, water, sanitary facilities, barriers, fences, access roads and structures. Contractor shall keep these areas secure and in a clean and orderly condition, unless indicated otherwise.

1.31 REMOVAL RELOCATION AND/OR ABANDONMENT

A. Certain items of existing equipment, raceways or wiring may be indicated for removal, relocation, disposal or abandonment.
   1. Items noted for removal shall be disconnected and turned over to the Owner or disposed of if the Owner so requests.
   2. Items noted for relocation are intended for reuse in another location as designated on the Drawings. It shall be the responsibility of the Contractor to remove said equipment from its present location, store in a safe place and reinstall in its new location. If upon removal there is any question as to the suitability of the equipment or apparatus, said condition shall be brought to the attention of the Engineer in writing.
   3. Items noted for removal and disposal shall be disconnected, transported and disposed of by the Contractor. The Contractor shall obtain any and all permits, provide all services, meet all legal requirements, and pay all fees for the disposal of all materials indicated.
   4. Items noted for abandonment shall be defined as abandoning in place any item so designated and shall include proper conductor termination within any occupied or open area. In the case of a wiring system, abandonment shall include the disconnection and termination of conductors at their source of supply, such as a circuit breaker. Abandoned conduits shall be capped.

B. The existing mechanical and electrical services in the existing building must remain in operation during the renovation process.

1.32 CLEANING

A. The Contractor shall thoroughly clean all equipment of all foreign substances inside and out before being placed in operation.

B. If any part of a system should be stopped by any foreign matter after being placed in operation, the system shall be disconnected wherever necessary to locate and remove obstructions. The system shall then be cleaned and reconnected. Any work damaged in the course of removing obstructions shall be repaired or replaced when the system is reconnected at no additional cost to the Owner.

C. Upon completion of work under the Contract, the Contractor shall remove from the premises all rubbish, debris and excess materials left over from his work. Any oil or grease stains on floor areas caused by the Contractor shall be removed and floor areas left clean.

1.33 OPERATING INSTRUCTIONS

A. Upon completion of all work and all tests, the Contractor shall furnish the necessary skilled labor and helpers for operating his system and equipment for a period specified under each applicable Section of this Division. During this period, he shall fully instruct the Owner or his representative in the operation, adjustment and maintenance of all equipment furnished. The Contractor shall give at least 48 hours notice to the Owner in advance of this period.

B. The Contractor shall furnish for delivery to the Engineer four (4) complete bound sets of typewritten or blueprinted instructions for operating and maintaining all systems and equipment included in this Division. All instructions shall be submitted in draft for review prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instruction.

C. The Contractor in the above-mentioned instructions shall include the maintenance schedule for the principal items of equipment furnished under this Division.

D. An authorized manufacturer's representative shall attest in writing that his equipment has been properly installed prior to start-up. The following equipment are some of which will require this inspection: sound system; fire alarm system; security or emergency power system. These letters will be bound into the operating and maintenance books.

1.34 ADJUSTING AND TESTING

A. After all the equipment and accessories to be furnished are in place, they shall be put in final adjustment and subjected to such operating tests so as to assure the Engineer that they are in proper adjustment and in satisfactory, permanent operating condition.

B. Where requested by the Engineer, a factory-trained service engineering representative shall inspect the installation and assist in the initial start-up and adjustment to the equipment. The period of these services shall be for such time as necessary to secure proper installation and adjustments. After the equipment is placed in permanent operation, the service engineering representative shall supervise the initial operation of the equipment and instruct the personnel responsible for operation and maintenance of the equipment. The service engineering representative shall notify the Contractor in writing that the equipment was installed according to manufacturer's recommendations and is operating as intended by the manufacturer.

1.35 GUARANTEES

A. The Contractor shall guarantee all materials and workmanship under these Specifications and the Contract for a period of one (1) year from the date of final acceptance by the Owner, unless otherwise indicated in the specifications or on the Drawings.

B. During this guaranteed period, all defects developing through materials or workmanship shall be corrected or replaced immediately by this Contract when directed by the Engineer without expense to the Owner; such repairs or replacements shall be made to their satisfaction.

END OF SECTION 26 05 01

SECTION 26 0513 - MEDIUM VOLTAGE CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all conductors, splices and terminations to provide a complete and functional system.

1.3 QUALITY CONTROL

A. The cable and accessories shall be manufactured by firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. The cable shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, the Contractor shall submit product literature detailing the properties and description of the cable and accessories.

PART 2 - PRODUCTS

2.1 CABLES

A. Cables shall have single stranded aluminum conductor , EPR insulation, concentric copper neutral, and PVC jacket.

B. Cables shall be Type MV-105 and be rated as noted on the drawings with 133% insulation level.

C. Cables shall comply with Article 328, Part III of the NEC and UL1072.

2.2 CONDUCTOR

A. The conductor shall be Class B compressed concentric stranded aluminum.

2.3 CONDUCTOR SHIELD

A. An extruded conducting layer of thermoset compound with an average thickness of not less than 15-mils shall be applied over the conductor and bonded to the insulation.

2.4 INSULATION SHIELD

A. The insulation shall have an extruded conducting thermoset polymeric layer applied over it. The layer shall be identified as being conductive.

B. Directly over the extruded insulation shield shall be bare copper concentric neutral wires.

2.5 TERMINATIONS

A. Elbow connectors: Shall be rated 200A for load break and 600A for dead break.
   1. Load break shall be used for dead front terminations rated 200A at voltages of 15kV or below.
   2. Elbows shall be molded of peroxide cured EPDM insulation with molded semi-conducting shield, capacitive test point, stainless steel pulling eye, grounding tab and built-in stress relief.

B. Cast epoxy-resin type termination: Provide for the live front termination of single conductor, solid insulated, non-metallic jacketed type cable for voltages up to 25 kV.
   1. Termination shall be the product of one manufacturer who shall provide all components in kit form, including complete instructions to be followed for fabrication and installation. The termination shall consist of free flowing epoxy-resin material molded about the insulated conductor and conductor end at the lug or solder seal.
   2. The component materials shall be in packaged form ready for mixing without opening or removing the material from the package. Terminations for shielded conductors shall include taped or preformed stress cones with a shield ground connection brought out through the insulation and covering, and grounded at installation.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify condition of raceways, ductbanks, handholes and manholes before installing cable.

3.2 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions and Article 326 of the NEC.
   1. Cable delivered to the job site shall be inspected for physical damage before acceptance. Handle and store cable to prevent damage before installation. Cable and all accessories shall be protected from weather and field conditions.
   2. All raceways shall be swabbed clean before pulling cables. Avoid abrasion and other damage to cables during installation.
   3. Provide and use a tension monitor gauge during each cable pull, and if maximum pulling tension is exceeded per cable manufacturer's specifications, the cable shall be removed

and replaced. Suitable pulling equipment and lubricants shall be employed. Do not exceed manufacturer's minimum bending radius.

4. Cables installed in manholes shall be looped along walls to provide the longest route. Avoid interference with duct entrance. Rack cables neatly and securely with appropriate racking systems.
5. Cables installed in manholes shall be suitably fireproofed, using approved fireproofing tape and applied in a half-lapped wrapping method.
6. Cable shield grounding shall be provided at each termination.

3.3 INSPECTION

A. Prior to energizing, all cable and terminations shall be inspected for proper workmanship and any damaged or misapplied equipment replaced.

B. Each cable shall be tested before energizing using VLF test method. A written report shall be submitted to the Engineer that details testing procedure and results.

END OF SECTION 26 05 13

SECTION 26 0519 - CONDUCTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all Conductors in accordance with Drawings and Specifications.

1.3 QUALITY CONTROL

A. The Conductors shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. The attached tag, reel or smallest container in which product is packaged shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, Contractor shall submit product data detailing electrical and physical characteristics of all conductors to be used.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Conductor construction and applications shall comply with Article 310.104 of the NEC.
   1. Conductors shall be copper, soft drawn, and annealed, and shall not be less than 98 percent conductive.
   2. Conductors shall be minimum Class B stranding and sized according to Articles 310.106(A) and 310.15 of the National Electric Code (NEC) with exceptions as follows:
      a. Conductors that are flexed such as those routed to door mounted devices shall have a minimum of Class C stranding.
   3. Conductor insulation for circuits rated below 600 volts, except low-level signal cables, shall be type THHN/THWN or XHHW rated for 600 volts, except as specifically noted on the Drawings. Conductor insulation in oily locations shall also be rated type MTW.
   4. Conductors shall be twisted for all low level signals such as annunciators, RTD, telephones, etc. Conductor shielding shall be required when recommended by equipment

manufacturer or when indicated otherwise. Refer to Section 283100 for fire alarm conductor requirements.

5. Conductor marking shall comply with Article 310.120 of the NEC.
6. Conductor identification shall comply with Article 310.110 of the NEC, to indicate each conductor's function.
7. Single conductors, No. 10 AWG or smaller, shall have their outer identification be solid and of continuous color for the entire length to conform to the color code listed below denoting function and/or polarity. Conductors larger than No. 10 AWG may be black and have both ends of each conductor marked with colored tape or labels especially designed for electrical coding.

	120/208 Volt System	**277/480 Volt System**
Phase:	Black, Red, Blue	Brown, Orange, Yellow
Neutral:	White	Gray
Ground:	Green	Green

8. Multi-conductor cables shall be identified as above for power systems and may follow their own color codes for control systems.
9. Grounding conductors and equipment grounds, unless bare, shall have a green covering.
10. Conductors for control circuits above 24 volts shall be a minimum size of No. 14 AWG.
11. Conductors for control circuits 24 volts and below shall be a minimum size of No. 16 AWG.
12. Lighting and power circuit conductors shall be a minimum size of No. 12 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use of other wire, cable, material and methods other than indicated in this section, shall be only as specifically indicated otherwise on the Drawings or with written approval from the Engineer.

B. All wiring and cables shall be installed, as a minimum, as required by the latest edition of the NEC, with special attention to Article 310.

C. Control Wiring:
1. All control wiring shall be installed in strict compliance with all provisions of NEC Article 725; Class1, Class 2 and Class 3 Remote Control, Signaling and Power Limited Circuits; or if classified as non-power limited, in accordance with NEC general requirements. Control cables and wires shall be listed as being suitable for the purpose and location. Cables shall be marked in accordance with NEC Article 725.
2. All control wiring shall be suitably supported; either run in conduit, or attached continuously to building structural members, or independent support system; subject to Engineer's approval. Do not attach to plumbing piping, sprinkler piping, electrical conduit or suspended ceiling. Cable ties shall be used to bundle control or other wiring not installed in conduit. Cable ties installed in environmental air plenums shall be plenum rated.

D. Conductors:
1. A separate neutral conductor shall be provided for all 20A, single pole branch receptacle and lighting circuits on each phase. Where a shared neutral conductor must be used for

single phase circuits on different phases, it shall have an ampacity that is a minimum of 173% of the phase conductors. For example, if the phase conductors are No. 12 AWG, then the neutral must be at least a No. 8 AWG.

2. All conductors in vertical runs of conduit shall be supported within the conduit in accordance with Article 300.19 of the NEC.
3. Conductors with thermoplastic insulation shall not be pulled at temperatures lower than 32O F (0O C).
4. Unless otherwise indicated on the Drawings or specified herein, only conductors of a single voltage level or function type shall be run in one raceway. Low level, control and power circuits shall not be mixed.
5. Conductors shall be connected directly to devices without the use of lugs only when the device is designed for direct connection and has a wire clamp or pressure plate. In addition, solid conductors, where permitted, may be directly connected to devices such as receptacles, where wires shall be formed into a loop to fit around the terminal screws.
6. Conductors shall be connected to devices using ring or locking fork terminals if the device is not designed for direct connection. The terminals shall be sized to match both the wire size, wire type and screw size.
7. Conductor identification shall include at each end of a conductor and at each junction or pull box, the source identification number for each conductor (panel and circuit numbers).
8. Any conductor that is damaged (nicked) shall be re-spliced or replaced.
9. Wires and cables shall be carefully handled during storage and installation to avoid mechanical injury to conductor, insulation, or covering. Any damaged conductors shall not be installed.
10. No wire or cable shall be pulled into raceway systems until work that could cause damage to wiring has been completed.
11. Wires and cables shall, insofar as practical, be continuous from origin to termination without running splices. All splices shall be located in an enclosure suitable for splices.
12. Installation of wires and cables shall include provisions for hangers, racks, cable cleats and supports necessary to make a neat and substantial installation.
13. Wires and cables of all branch circuits at panelboards, fixtures, equipment and wiring devices shall be identified in accordance with Section 260553.
14. Each feeder cable in pull boxes, panels and at equipment shall be tagged with proper feeder number and phase designation.
15. Wiring in panelboard gutters, cabinets, switches, wireways, and such equipment shall be neatly formed and tied with cable ties and straps. Cable ties and straps shall be tool-applied or self-clinching types of one-piece molded construction. Bodies shall be of nylon and clinching clips shall be spring bronze.
16. Feeding tubes shall be used where cables pass into raceways. To avoid injury, cable shall not be subjected to bending less than 6 times its overall diameter.

E. Connectors:
   1. Solderless connectors shall be used for terminals, taps and splices for wires and cables.
   2. Connectors shall be sufficiently large to enclose all strands of conductor. Conductor shall be securely fastened and shall not loosen under vibration or normal strain.
   3. Twist-on wire connectors (wire nuts) shall be used for splices in wires of size No. 10 AWG or smaller. Splices and taps in wires No. 8 and larger shall be made with solderless connectors designed for the purpose.

F. Lubricants: Lubricants shall be used where necessary to pull wire or cable. Lubricant shall not cause deterioration of conductor insulation.

G. Splices and Taps: Splices and taps shall be taped with UL listed tapes providing insulation not less than that of the conductors.

END OF SECTION 26 0519

SECTION 26 0520 - METAL CLAD CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all Metal Clad (MC) Cable in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. MC Cable shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. MC Cable shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, Contractor shall submit product data detailing electrical and physical characteristics of all types of MC cable to be used. Include information on additional or oversized neutral conductors.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Conductors shall be copper, soft drawn, and annealed, and shall not be less than 98 percent conductive.

B. Conductors shall be minimum Class B stranding and sized per applicable codes including NEC Article 310.106(A) and 310.15.

C. Conductor insulation for circuits rated below 600 volts, except low level signal cables, shall be type THHN/THWN or XHHW rated for 600 volts, except as specifically noted on the Drawings.

2.2 CABLE

A. MC Cable shall comply with Article 330, Part III of the National Electric Code (NEC) and UL1569.

B. A suitable cable tape shall be applied over the assembly to hold the core together and provide bedding for the armor.

C. An aluminum or galvanized steel interlocked armor shall be applied over the cable core.

D. An extruded covering of PVC shall be applied over the armor when such covering is required. Minimum thickness at any point shall be not less than 70% of the required average thickness. The covering shall be sunlight resistant.

E. MC Cable shall have a marker tape applied longitudinally under the armor which complies with Article 310.120 of the NEC.

F. MC Cable identification shall comply with the applicable codes, including NEC Article 310.110 to indicate each conductor's function.

G. For fire alarm applications, MC Cable shall be rated as FPL and be 2 hour rated for penetrations.

	120/208 Volt System	**277/480 Volt System**
Phase:	Black, Red, Blue	Brown, Yellow, Orange
Neutral:	White	Gray
Ground:	Green	Green

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable:
1. All MC Cable shall be installed in accordance with Article 330, Part II of the NEC and manufacturer's instructions.
2. Use of other cable, material and methods other than indicated in this section, shall be only as specifically indicated otherwise on the Drawings or with written approval from the Engineer.
3. MC Cable shall be carefully handled during storage and installation to avoid mechanical injury to conductor, insulation, or covering. Any damaged cable shall not be installed.
4. Installation of cable shall include provisions for hangers, racks, cable cleats and supports necessary to make a neat and substantial installation. Cable shall not be supported from conduit, piping or light fixture supports.
5. MC Cable identification shall include at each end of a cable and at each junction or pull box, the source identification number for each conductor (panel and circuit numbers).
6. Each feeder cable in pull boxes, panels and at equipment shall be tagged with proper feeder number and phase designation.
7. Any MC Cable which is damaged, shall be replaced.
8. Fittings used for connecting MC Cable to boxes, cabinets or other equipment shall be identified for such use.

9. MC cable may be used in place of EMT and wire for wiring of lighting and receptacle circuits, where it can be concealed. See Section 260519, para. 3.1 D.1 for neutral conductor requirements.

B. Connectors:
   1. Connectors shall be sufficiently large to enclose all strands of conductor. MC Cable shall be securely fastened and shall not loosen under vibration or normal strain.
   2. Solderless connectors shall be used for terminals, taps and splices for conductors.
   3. Spring type connectors (wire nuts) shall be used for splices in wires of size No. 10 AWG or smaller. Splices and taps in wires of size No. 8 AWG and larger shall be made with solderless connections designed for the purpose.

C. Splices and Taps:
   1. Splices and taps shall be taped with UL listed tapes providing insulation not less than that of the conductors.

END OF SECTION 26 0520

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide a fully functional grounding system consisting of all electrodes, cables, terminations, bushings, markings, jumpers, devices and accessories.

1.3 QUALITY ASSURANCE

A. The equipment and accessories shall be of standard or custom design manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. Components used in the system shall bear the Underwriters' Laboratories (UL) Label where applicable.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing dimensions, components, manufacturer's installation requirements and product limitations.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. All components used in grounding system shall comply with Article 250 of the National Electric Code (NEC).
   1. Ground Rods: Ground rods shall be copper or copper-clad steel 5/8" x 10' minimum.
   2. Mechanical Connectors: Connectors shall be bronze and be UL listed for their application.
   3. Exothermic Connections: Exothermic connections shall be equal to "CADWELD" connections.
   4. Grounding bushings shall be UL listed and sized for their application.

B. CONDUCTORS

C. Conductors installed underground shall be bare stranded copper, of sizes as indicated on the drawings, and in direct contact with the earth. Backfill to be tamped to avoid voids around conductors.

D. Conductors installed in raceways shall be solid or stranded, bare or green insulated for sizes smaller than #10 AWG. For sizes #10 and larger conductors shall be stranded and insulated with green or green with yellow trace insulation.

E. Grounding electrode conductors shall be sized as indicated. Where no size is given, size in accordance with Article 250.66 of the NEC.

F. Bonding jumpers shall be sized in accordance with Article 250.28(D) of the NEC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All products shall be installed in accordance with Article 250 of the NEC and the manufacturer's requirements.

B. The grounding electrode system shall comply with Article 250, Part III of the NEC, and shall include the following electrodes (if available) bonded together:
1. Metal underground water pipe in accordance with Article 250.52(A)(1) of the NEC.
2. Metal in-ground support structure in accordance with Article 250.52(A)(2) of the NEC.
3. Concrete encased electrode in accordance with Article 250.52(A)(3) of the NEC.
4. Ground ring in accordance with Article 250.52(A)(4) of the NEC.
5. Rod and pipe electrodes in accordance with Article 250.52(A)(5) of the NEC.
6. Other listed electrodes in accordance with Article 250.52(A)6 of the NEC.
7. Plate electrodes in accordance with Article 250.52(A)(7) of the NEC.
8. Other local metal underground structures in accordance with Article 250.52(A)(8) of the NEC.

C. When a metal underground water pipe is used as the grounding electrode, a supplemental electrode shall be provided in accordance with Article 250.53(D)(2).
1. Verify that final backfill and compaction has been completed before driving rod electrodes.
2. Install ground rods in locations indicated on Drawings.

D. When the grounding electrode conductor (GEC) is installed in metal raceway, the raceway shall be bonded to the GEC at both ends.

E. All metallic, non-current carrying items within the structure shall be bonded to the grounding systems in accordance with Article 250.104 of the NEC. Such items shall include, but not necessarily be limited to the following: structural steel, metal sheathing, water and gas piping and other equipment that would constitute an electrical hazard if not grounded.

F. All separately derived systems as defined by Article 100 of the NEC shall be grounded in accordance with Article 250.30 of the NEC

3.2 TESTING

A. Testing: Test grounding electrode system using approved methods and instruments. Resistance must not exceed 10 Ohms. Additional grounding electrodes shall be required if resistance exceeds 10 Ohms. Submit a report to the Owner and Engineer detailing test methods and results.

END OF SECTION 26 0526

SECTION 26 05 29 - HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all Supporting Devices in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. The Supporting Devices shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, provide product data detailing electrical and physical characteristics of all supporting devices, including weight loading capacity.

PART 2 - PRODUCTS

2.1 GENERAL

A. All supports shall have corrosion resistant finishes.

B. Provide materials, sizes and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

2.2 MECHANICAL SUSPENSION CHANNEL

A. Channel shall be factory formed of 12 gauge steel and shall have a minimum outside cross section measuring 1-1/2" x 1-1/2"

B. Channel shall be used for supporting wall mounted equipment in wet or damp locations, and for parallel runs of conduit.

2.3 ANCHORS AND FASTENERS

A. Expansion anchors, pre-cast insert system and preset inserts shall be used in concrete structural elements and on solid masonry walls.

B. Beam clamps and spring steel clips shall be used on structural steel elements.

C. Expansion and self-drilling anchors shall be used on concrete surfaces.

D. Toggle bolts and hollow wall fasteners shall be used for plaster, gypsum board and hollow masonry partitions.

E. Sheet metal and wood screws shall be used on sheet metal and wood surfaces respectively.

PART 3 - EXECUTION

3.1 INSTALLATION

A. At a minimum, supporting devices for raceways, boxes, cables and other equipment shall be in accordance with the applicable Articles of the National Electric Code (NEC). Additional support shall be provided where required by the Engineer or the equipment manufacturers.

B. Use of other supporting devices, material and methods other than indicated in this section shall be only as specifically indicated otherwise on the Drawings or with written approval from the Engineer.

C. Nails, strap iron and wire shall not be permitted.

D. Supports shall not be fastened to pipes, ducts or conduits.

E. Structural members shall not be cut or drilled without obtaining permission from the Engineer.

F. Install surface-mounted cabinets and panelboards with a minimum of four anchors.

G. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 0529

SECTION 26 0531 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all Supporting Devices in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. Conduit and fittings shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five (5) years.

B. The Conduits shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, Contractor shall submit product data, detailing electrical and physical characteristics of all types of conduit to be used, including fittings.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Shall be, as a minimum, as required by the National Electric Code (NEC).

2.2 RIGID GALVANIZED STEEL CONDUIT (RGS)

A. Shall consist of steel with thoroughly welded seams, galvanized inside and out, and uniform in wall thickness. Conduit shall be supplied in 10-foot lengths, threaded at each end, with a coupling on one end, and protector on the other end. The rigid steel conduit shall be of sufficient weight, quality, and toughness to be free of blisters and withstand cracking and peeling during bending. Rigid steel conduit shall comply with Article 344, Part III of the NEC and UL6.

B. Threaded fittings shall be made of full weight material and treated with the same protective coatings required for rigid conduit.

C. Conduit bodies shall be manufactured from malleable iron with zinc or cadmium finished both inside and outside or be manufactured with copper free aluminum. Conduit bodies shall have heavy threaded hubs, covers, and, in damp locations, stainless steel screws and neoprene gaskets.

2.3 INTERMEDIATE METAL CONDUIT (IMC)

A. Shall consist of steel with thoroughly welded seams, galvanized inside and out, with uniform wall thickness. Conduit shall be supplied in 10-foot lengths with a coupling on one end. IMC shall comply with Article 342, Part III of the NEC and UL-1242.

B. Fittings shall be the same as specified for rigid steel conduit.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Shall be of welded steel construction and manufactured of lightweight cold rolled steel. The exterior shall be protected by an electro-galvanized coating and the interior shall be coated with enamel or galvanized. Electrical metallic tubing shall comply with Article 358, Part III of the NEC and UL797.

B. Fittings for electric metallic couplings and connectors shall be of the threadless, compression type conduit 2'' and smaller. Set screw fittings shall be used for conduits over 2''. Box connectors shall have insulated throats. Other fittings shall be the same as for rigid steel conduit.

2.5 FLEXIBLE METAL CONDUIT (FMC)

A. Shall be constructed of continuous interlocking bands of zinc coated steel and shall be complete with fittings approved for this type of conduit. A separate identified ground wire shall be utilized for equipment grounding with approved grounding bushings. Flexible metal conduit shall comply with Article 348 of the NEC and UL1.

2.6 RIGID NONMETALLIC CONDUIT (RNC)

A. Shall be equal to Schedule 40 or 80 PVC pipe with solvent connected joints.
   1. When installed underground, Schedule 40 shall be used.
   2. If encased in concrete, type EB may be used.

B. Plastic conduit, fittings, and cement shall be produced by the same manufacturer, and shall be in conformity with Article 352, Part III of the NEC and UL651.

2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Shall be a raceway of circular cross section having an outer liquidtight non-metallic sunlight-resistant jacket over an inner flexible metal core. It shall be in conformity with Article 350, Part III of the NEC and UL360.

B. Liquidtight fittings shall be steel or malleable iron with cadmium or zinc finish, and approved for grounding.

PART 3 - EXECUTION

3.1 GENERAL

A. All wiring, conduit, and fittings, shall be installed, as a minimum, as required by the applicable articles of the NEC.

B. Use of other conduit material and methods, other than indicated in this section, shall be only as specifically indicated otherwise on the Drawings or with written approval from the Engineer.

C. All raceways shall be of the size required by National, State, and local electrical codes for the number of cables indicated.

D. All conduits which cross or run through building control/expansion joints shall have corresponding fittings as required.

E. Metallic conduit systems shall be installed and assembled to provide a continuous circuit of low impedance. All joints shall be tight and where necessary, protected against corrosion.

F. No wire shall be pulled into the conduit system until it is complete in all details. In the case of concealed work, it shall not be pulled into the conduit system until all rough plastering is completed. The ends of the conduits shall be tightly plugged to exclude dust, moisture, plaster, or mortar while the building is under the process of construction.

G. All conduit shall be of the size required by the National, State, and Local Electrical Codes for the number of wires indicated and in no case be smaller than 1/2" except for home run lighting branch circuits and conduits installed in concrete slabs shall be a minimum of 3/4". In addition, home run conduit for lighting branch circuits shall be sized to receive an additional circuit to the number required.

H. Conduit runs are shown diagrammatically; the exact locations shall be determined on the job. Exposed conduit shall be installed parallel with or at right angles to the building walls and beams wherever possible.

I. The Drawings indicate the desired location of equipment. If an indicated location proves to be impractical because of interference with other trades, the Engineer shall be consulted to determine an alternate location.

J. All empty conduits shall include a fish wire for ease of future cable installation.

K. All outlet boxes, switches, receptacles, and conduit runs, etc., shall be poured in place where practical. The Contractor will coordinate this task so that installation can occur while concrete forms are being erected.

L. All conduits passing through floors or walls shall be provided with sleeves having an internal diameter of one inch (1") larger than the outside diameter of the conduit or insulation enclosing the conduit.

M. A 12 inch clearance shall be maintained between conduit and any surfaces with temperatures exceeding 104O F (40O C).

N. All conduit installed below grade shall have sealing bushings installed at each end.

O. Where a conduit enters a box, fitting, or other enclosure, a bushing shall be provided to protect conductors from abrasion.

3.2 RIGID GALVANIZED STEEL CONDUIT (RGS)

A. All interior wiring shall be installed in rigid galvanized steel threaded conduit where in direct contact with the earth, in wet locations or where subject to mechanical injury, except where specifically indicated otherwise.

B. All exterior wiring designated to be run in conduit shall be installed in rigid galvanized steel threaded conduit, except where specifically indicated otherwise.

C. Installation of rigid galvanized steel conduit shall be in accordance with Article 344, Part II of the NEC.

3.3 INTERMEDIATE METAL CONDUIT (IMC)

A. Intermediate metal conduit shall be used where indicated on drawings, and may be substituted for rigid galvanized steel conduit in some instances, with prior approval from the Engineer.

B. Installation of IMC shall be in accordance with Article 342, Part II of the NEC.

3.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Liquidtight flexible metal conduit shall be used in any damp or oily location for the final connection to motors, switches, equipment subject to vibration, or other devices where flexibility is required. The length shall not exceed six (6) feet without approval of the Engineer.

B. Installation of liquidtight flexible metal conduit shall be in accordance with Article 350, Part II of the NEC.

3.5 FLEXIBLE METAL CONDUIT (FMC)

A. Flexible metal conduit may be used in dry locations for the final connection to recessed lighting fixtures, switches, or other devices where flexibility is required. The length shall not exceed six (6) feet without approval of the Engineer.

B. Installation of flexible metal conduit shall be in accordance with Article 348, Part II of the NEC.

3.6 RIGID NONMETALLIC CONDUIT (RNC)

A. Rigid nonmetallic conduit shall be used underground and where noted on the drawings.

B. Installation of rigid nonmetallic conduit shall be in accordance with Article 352, Part II of the NEC.

C. When installed exposed outdoors, provide an expansion fitting for any straight length exceeding 5 feet between securely mounted items such as boxes, cabinets, elbows, or other conduit terminations.

3.7 ELECTRICAL METALLIC TUBING

A. All wiring not subject to the above conditions shall be installed in Electric Metallic Tubing, except where specifically indicated otherwise.

B. Installation of electrical metallic tubing shall be in accordance with Article 358, Part II of the NEC.

END OF SECTION 26 0531

SECTION 26 0533 - BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories and services necessary to provide all outlet, device, junction and pull boxes in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. Boxes shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. Standard boxes shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, Contractor shall submit product data detailing electrical and physical characteristics of all boxes to be supplied, including dimensions.

PART 2 - PRODUCTS

2.1 BOXES

A. All boxes shall comply with Article 314, Part III of the National Electric Code (NEC). Standard boxes shall also comply with UL50.

B. Cast Device Boxes shall be manufactured from malleable iron with zinc or cadmium finish both inside and outside or be manufactured with copper free aluminum. Cast device boxes shall have heavy threaded hubs.
   1. Covers in damp, wet and outdoor locations shall be gasketed, rain tight, and installed with stainless steel screws.

C. Steel Device Boxes such as outlet, ceiling, pull, gang, utility, switch, masonry and concrete boxes shall be of 14 gauge galvanized steel. Steel device boxes shall be provided with all plaster rings, extensions, bars, hangers, etc. to make a complete installation.

D. Large Steel Device Boxes, either of standard size or custom built shall be of 12, 14, or 16 gauge steel, have welded joints and also have an enamel or galvanized finish.

2.2 WARNING SIGNS

A. Warning signs shall be provided in accordance with Article 314.72(E) of the NEC for all boxes when nominal voltage within is greater than 600V.
   1. Signs shall be permanent with letters at least 1/2” in height.
   2. Signs shall read "DANGER HIGH VOLTAGE KEEP OUT".

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES

A. All new boxes shall be installed in accordance with Article 314, Part II of the NEC.
   1. Boxes shall be sized 50% larger than the minimum size required by Article 314 of the NEC.
   2. Use of other boxes, material and methods other than indicated in this section shall be only as specifically indicated otherwise on the Drawings or with written approval from the Engineer.
   3. The Drawings indicate the desired location of equipment. If an indicated location proves to be impractical because of interference with other trades, the Engineer shall be consulted to determine an alternate location.
   4. All surface mounted boxes within 2 feet of the floor and those installed in damp or wet areas shall be cast device boxes.
   5. Boxes shall be provided wherever they are necessary or required to complete installation, even if not specifically shown on Drawings.
   6. Boxes shall be designed to accommodate the equipment or apparatus to be installed either in them or attached to them. Where boxes of a standard size are not available for a particular requirement, special boxes shall be manufactured and finished to comply with the requirements.
   7. Boxes shall be furnished of a size and type to meet the requirements of each type of concrete construction. Standard boxes shall be furnished as required by each type of construction.
   8. Boxes shall be secured firmly in place and set true and square with the building lines. Openings for installation of boxes shall be neatly cut so the device or wall plate will cover the entire opening.
   9. Barriers shall be provided where two or more electric systems have wires or connections in the same box.
   10. Plaster rings shall be furnished of the required depth so as to meet the conditions for all locations where plaster construction is specified to the installed. In concrete ceiling construction, fixture back boxes designed for this purpose shall be provided.

END OF SECTION 26 0533

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Sections of this Specification apply to work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, accessories, and services necessary to provide identification of wire and equipment in accordance with the drawings and specifications.

1.3 QUALITY ASSURANCE

A. All identifying markings shall be checked for accuracy of text and location.

PART 2 - PRODUCTS

2.1 Nameplates shall be black or white plastic with 1/4-inch high, engraved lettering through to a white or black core.

2.2 Wire and cable markers shall be tie-on type tags in a clear plastic sheath or snap on plastic clips. Other markers may be acceptable if approval of Engineer is obtained before installation.

PART 3 - EXECUTION

3.1 NAMEPLATE INSTALLATION

A. Nameplates shall be fastened to equipment with drive screws or rivets, centered on the equipment and mounted parallel to the equipment lines.
   1. In no case shall embossed tape labels be used.
   2. Items of equipment listed below shall be provided with a nameplate:
      a. Distribution Switchboards and Panelboards
      b. Power and Lighting Panelboards
      c. Switchgear
      d. Disconnect Switches
      e. Transfer Switches
      f. Motor Control Centers
      g. Motor Control Devices
      h. Control and Terminal Cabinets
      i. Contactors
      j. Fire Alarm Panels

3.2 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, wiring troughs, outlet and junction boxes and at load terminals. Identify conductor with branch circuit or feeder number, and panel or switchboard designation, for all power and lighting circuits.

END OF SECTION 26 05 53

SECTION 26 1200 - MEDIUM VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to work of this Section.

1.2 DESCRIPTION OF WORK: All labor, materials, equipment, accessories and services necessary to furnish and deliver three-phase, pad-mounted transformers, as specified herein, to a location specified by the owner.

1.3 QUALITY CONTROL:

A. The transformers shall be manufactured by firms regularly engaged in the manufacture of similar equipment and whose products have been in satisfactory use in similar service for not less than five years.

B. The transformers shall be manufactured and installed in compliance with all applicable IEEE/ANSI C57 standards for liquid-filled and pad-mounted transformers.

C. Transformers shall meet minimum efficiency requirements of DOE 2016.

1.4 SUBMITTALS:

A. Submit product information detailing electrical and physical characteristics of the equipment, installation requirements and shop drawings showing all dimensions, weight, lifting provisions and nameplate data, and all manufacturers' test reports for tests described in section 2.2 of this specification.

PART 2 - PRODUCTS

2.1 PAD-MOUNTED TRANSFORMER:

A. The transformer shall be compartment type, self-cooled and suitable for mounting on a concrete or fiberglass pad.

B. The average temperature rise of the windings, measured by the resistance method, shall be 65°C when the transformer is operated at rated kVA output in a 40°C ambient.

C. Coolant and insulating fluid shall be a UL classified, less-flammable liquid comprised of edible vegetable oils and food grade performance enhancing additives.

1. The fluid shall be non-toxic, non-bioaccumulating and completely biodegradable – FR3 or equal.

2. The fluid shall have a minimum open cup flash point of 330°C and minimum open cup fire point of 350°C.

D. The transformer shall meet all UL requirements for classification of less-flammable liquids per NFPA 70 (National Electric Code), section 450.23.

1. Transformer tank shall be capable of withstanding an internal pressure of 12 psig without rupture.

2. Pressure relief device shall have a minimum pressure relief capacity of 350 SCFM at 15 psi.

3. Transformer shall include primary high amp expulsion fuses in series with partial range current limiting back up fuses. Fuses designed to vent during operation shall be located external to the tank.

E. The high and low voltage compartments shall be separated by a steel barrier. The low voltage compartment shall be on the right. The high voltage door shall not be capable of being opened until the low voltage door has been opened.

F. A recessed, captive, penta-head or hex-head bolt that meets the dimensions per IEEE Std C57.12.28 standard shall secure all access doors.

G. The following accessories shall be included:

1. Nameplate in low voltage compartment
2. One inch upper filter press and filling plug
3. Drain/sampling valve located externally
4. Tap changer for de-energized operation
5. Liquid level gauge
6. Pressure relief valve
7. Dial-type thermometer with maximum temperature indicator
8. Pressure/vacuum gauge
9. (2) 2.5% full capacity below normal and (2) 2.5% full capacity above normal taps

H. The transformer shall be of sealed tank construction of sufficient strength to withstand a pressure of 7 psi without permanent distortion. The cover shall be welded and the fastenings tamper resistant. When required, cooling panels will be provided on the back and front of the tank. Lifting eyes and jacking pads will be provided.

I. The core and coil assembly shall be wound core type design with copper or aluminum windings using high grade, grain-oriented silicon steel laminations carefully annealed after fabrication to restore high magnetic permeability.

J. High voltage terminations shall be dead front. Dead front bushings shall be one piece integrated, 15 kV for use with separable connectors. Bushings shall be externally clamped and front removable.

K. Low voltage bushings shall be molded epoxy and provided with blade type spade terminals arranged for vertical take-off. The neutral shall be grounded to the tank by a removable strap.

L. Ratings:

1. Capacity: As noted on drawings
2. Voltage: As noted on drawings
3. Frequency: 60 Hz
4. Impedance: 5.75%
5. BIL: 95 kV primary, 30 kV secondary

2.2 TESTING: The following tests shall be conducted:

A. Ratio

B. Polarity

C. Phase rotation
D. No-load loss
E. Excitation current
F. Impedance voltage
G. Load loss
H. Applied potential
I. Induced potential
J. Impulse test

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Ground transformer in accordance with Section 260526.
B. Verify all dimensions in the field before setting the transformer on pad.
C. Prior to energizing, verify all high and low voltage connections for proper installation and workmanship.
D. Measure secondary voltage and adjust taps if required to attain secondary voltage within 2% of rated voltage.
E. Installation shall be left clean with no foreign materials left inside or around transformer installation.

END OF SECTION 26 1200

SECTION 26 2416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, materials, equipment, accessories, services and tests necessary to provide all panelboards in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. Panelboards shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. Panelboards shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere, the Contractor shall submit product literature detailing all dimensions, voltage, main bus and/or circuit breaker ampacity rating, branch circuit breaker ratings, integrated short circuit capacity, lug sizes, enclosure type and branch circuit breaker arrangement.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be of the dead-front safety type and shall be manufactured in accordance with Article 408 Part IV of the National Electric Code (NEC) and UL67.
   1. Fusible panelboards shall have switch sizes and fuses as indicated on Drawings. Switches shall be horsepower rated with quick-make and quick-break mechanisms.
   2. Panelboard schedules, as shown on the drawings, shall be checked for required breaker or switch sizes prior to fabrication of the panelboards.
   3. Each panelboard shall be provided with a copper ground bus 1/4" x 1" x 8" minimum or equal to 1/3 the capacity of the phase bus. Bus shall be drilled and tapped for ground connections in the field.
   4. Panelboards designated for use as lighting panelboards shall have branch circuit breakers that are UL listed as type SWD for lighting circuits.

5. Minimum short-circuit rating for panelboards and branch devices shall be as indicated on panel schedules. Unless otherwise noted, all panelboards shall be fully rated.

B. Branch Over-Current Protective Devices:
   1. Circuit breaker panelboards shall have automatic short circuit and over-current protective devices having an "on", "off", and tripped position of the operating handle. All multi-pole breakers shall common trip and be so designed that an overload on one pole automatically causes all poles to open. They shall be of the quick-make and quick-break type, and shall have inverse time trips.
   2. Circuit breakers shall be manually operated with a mechanism for adjusting settings for instantaneous and overload trip operation for frame sizes larger than 100A.
   3. Circuit breakers used for air conditioning equipment shall be HACR type.

C. Lighting and power panels shall be equipped with solderless lugs in the mains only, unless otherwise indicated, and of such size as required to accommodate the size cables shown on the drawings. The panels shall be suitable for flush or surface mounting, as shown on the drawings. Lugs shall be designed to accept copper or aluminum wire.

D. Cabinets and trim shall be thoroughly cleaned and trim shall be finished with shop priming coat and one shop finish coat of gray lacquer unless indicated otherwise. Each panel shall be furnished with a hinged door in a cover that is hinged to the cabinet, combination spring lock and catch, directory frame and two (2) keys. All panel locks shall be keyed alike and a neatly typed directory identifying each circuit shall be provided in the frame.

E. Unless indicated elsewhere, load centers shall not be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of panelboards shall be in accordance with Article 408 of the NEC and the manufacturer's instructions.
   1. Panelboards shall be installed plumb and the top of the enclosure shall not exceed six feet above finished floor. For panelboards that exceed six feet overall height, the bottom of the enclosure is no more than four inches above finish floor and the centerline of the top most device handle does not exceed six foot six inches above finished floor.
   2. Each panelboard shall have a neatly typed directory installed identifying loads served by each branch circuit breaker.
   3. All panelboards shall be left clean with all debris removed from gutters and enclosures.
   4. Working clearance around panelboards shall be in accordance with Article 110 of the NEC.
   5. Lighting, receptacle, power and distribution panelboards shall be provided at locations shown on the drawings and in accordance with the panelboard schedules. Panelboards shall be set in place in advance of construction work, permitting them to be built in with the structure and avoiding the need for unnecessary cutting and patching.
   6. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
   7. All unused spaces shall have filler plates installed.
   8. Provide and install a plastic engraved nameplate as described in Section 260553.

9. All terminations shall be properly and accurately torqued per manufacturer's specifications using the appropriate torque screwdriver or torque wrench.
10. All scratches and digs shall be repainted.

END OF SECTION 26 2416

SECTION 26 2726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide all labor, materials, equipment, accessories, services and tests to provide a complete and functional installation.

1.3 QUALITY ASSURANCE

A. All devices shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. All wiring devices (or packages which contain them) shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing the electrical and physical characteristics of the equipment. Literature shall include outline drawings, including all dimensions, colors, configurations and installing provisions and manufacturer's installation requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The drawings indicate the various types, locations and connections of wiring devices to be installed complete with outlet boxes and cover plates.
   1. Duplex receptacles shall be specification grade, three-wire grounding type, 20A, 125V, NEMA 5-20R configuration with binding screws for back and side wiring, unless indicated otherwise.
   2. Special service receptacles shall be as specified on the drawings.
   3. Toggle type switches shall be specification grade, 20 Amp rated (120/277 volt) silent operation and be single pole, two pole, three-way or four-way as noted elsewhere.
   4. Line voltage dimmers shall be compatible with LED fixtures.
   5. Color of devices shall be chosen by the architect unless otherwise noted.

6. Device plates shall be brushed aluminum, one piece, single or multi-gang, unless otherwise noted. Screws shall be of metal with counter-sunk heads with color to match the finish of the plate.
7. Ground fault circuit interrupting receptacles shall be specification grade, 20 Amp, 120 volt rated and will trip at 4-6 milliamperes of ground current. Suitable device plates shall be provided.
8. Poke-through devices shall comply with the requirements of Article 300-21 of the National Electric Code (NEC) (fire spread ratings) and be rated for the floor structure in which it is installed (1, 1-1/2 or 2 hour fire rated floors). Above floor accessories shall include devices for connections of power, data or communication systems as noted elsewhere.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All devices shall be installed according to the NEC. Particular attention is to be paid to the requirements of Articles 110.14 (terminations) and 250.148 (grounding conductors to boxes).

B. The electrical contractor shall confirm the exact location of devices with respect to door swings, structure, equipment arrangement and accessibility before roughing in. Where conflicts are found to exist, the Engineer will establish the exact location of the device.

C. Devices shall be installed only in boxes that are clean and free of excess building materials, dirt or debris.

D. Where devices are to be installed flush in walls suitable plaster rings or box extensions shall be employed to assure a flat, flush and neat installation.

E. Devices installed in unfinished areas or above accessible ceiling spaces shall have galvanized cover plates installed.

F. Device grounding shall be by bonding jumper. Devices employing yoke grounding only, shall not be used.

G. All devices shall be installed plumb and level at the following mounting heights, unless indicated otherwise:

Wall Switches	44" Above Finish Floor
Convenience Receptacles	18" Above Finish Floor
Counter Receptacles	6" Above Counter Top
Dimmers	44" Above Finish Floor
Telephone/Data Outlet	18" Above Finish Floor
Wall Mounted Telephone	44" Above Finish Floor

H. After installation, all devices shall be tested for proper operation and polarity.

END OF SECTION 26 2726

SECTION 26 2813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the Work of this Section.

1.2 DESCRIPTION OF THE WORK

A. All labor, material, accessories and services to provide appropriate fuses in equipment or enclosures in accordance with the Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. All fuses shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.
   1. Fuses provided as part of this Contract shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing the electrical and physical characteristics of the fuses used including ampacity, interrupting rating, time-current curves, voltage, peak let-through rating and manufacturer's application data.

PART 2 - PRODUCTS

2.1 All fuses shall comply with Article 240, Part VI of the National Electric Code (NEC). Class L, RK1 and RK5 fuses shall comply with UL198C.

2.2 Provide fuses with UL class, voltage and current ratings, as indicated on Drawings. If no class is specified, provide fuse class as follows:

A. Main service feeder and lighting load feeder switches larger than 600 Amperes: Class L.

B. Main service feeder and lighting load feeder switches less than 600 Amperes: Class RK1, RK5

C. Motor load feeder switches: Class RK1, RK5 - Dual Element.

D. Motor branch circuits: Class RK1, RK5 - Dual Element.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions and with the label oriented so that the manufacturer's name, type, size and class are easily readable.
   1. Provide one spare fuse for each fuse installed throughout the project.
   2. Provide one fuse puller for each different size fuse installed for Owner's use.

END OF SECTION 26 2813

SECTION 26 2819 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide all labor, materials, equipment, accessories, services and tests to provide a complete and functional installation of switches in accordance with Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. All switches shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. Switches shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing the electrical and physical characteristics of the equipment. Literature shall include outline drawings, including all dimensions, weights and installing provisions and manufacturer's installation requirements.

PART 2 - PRODUCTS

2.1 SWITCHES

A. All switches shall comply with Article 404, Part II of the National Electric Code (NEC) and UL98.
   1. Switches shall be heavy duty type, 2-pole or 3-pole as required, fused or non-fused, with or without neutral, as indicated on the drawings, in NEMA-1 enclosure unless otherwise indicated and of the current and voltage rating to match the equipment served. All switches shall have provisions for terminating equipment ground conductors.
   2. Switches shall be horsepower rated and have quick make quick break mechanisms.
   3. Switches shall have externally operable handles interlocked to prevent opening door with handle in the "ON" position and provision for pad locking handle in the "OFF" position.
   4. Fusible switches shall have reinforced fuse clips and fuses provided in accordance with Section 262813.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Switches shall be provided at locations shown and as required by the NEC.
   1. All switches shall be installed in accordance with the manufacturer's instructions and Article 404, Part I of the NEC.
   2. The drawings indicate the desired location of the switches. If an indicated location proves to be impractical because of interference with other equipment or architectural features the Contractor shall bring the interference to the Engineer's attention and the Engineer shall determine alternate mounting locations.
   3. All equipment shall be labeled in accordance with Section 260553 to indicate equipment served.
   4. Provide adhesive label on the inside of the door for each switch that indicates the UL fuse class and size for replacement.
   5. Switches shall be left in clean condition, with doors closed and no foreign objects left inside or around enclosures.

END OF SECTION 26 2819

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide all labor, materials, equipment, accessories, services and tests to provide a complete and functional installation for manual motor starters, magnetic motor starters and combination magnetic motor starters in accordance with the Drawings and Specifications.

1.3 QUALITY ASSURANCE

A. All devices shall be manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. Motor control equipment shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing the electrical and physical characteristics of the equipment. Literature shall include outline drawings, including all dimensions, colors, configurations, accessories and manufacturer's installation requirements.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. All motor starters shall be horsepower and voltage rated, be of NEMA size as required for motor horsepower and be factory assembled.
   1. All starters with 120 volt coils shall be provided with control transformers, including properly sized fuses and fuse blocks.

B. Manual Motor Starters: Manual motor starters shall be toggle type, single or two pole, horsepower rated with thermal overload and spare set of auxiliary contacts, in a NEMA 1 enclosure unless otherwise indicated on the Drawings. All single phase motors shall be provided with manual motor starters unless otherwise noted.

C. Magnetic Motor Starters: Unless otherwise indicated on the Drawings, magnetic motor starters shall be complete with three-leg solid state overload relay, 120 volt coil, two (2) spare sets of auxiliary contacts, pilot light, hand-off-auto selector switch and NEMA 1 enclosure. All three phase motors shall be provided with magnetic motor starters unless otherwise noted.

D. Combination Magnetic Motor Starters: Combination magnetic starters shall have motor circuit protector breakers with adjustable starting current settings, fusible or non-fusible disconnect switches as indicated on Drawings.
   1. Unless otherwise indicated on the Drawings, combination magnetic starters shall be complete with three-leg solid state overload relay, 120 volt coil, two (2) spare sets of auxiliary contacts, pilot light, hand-off auto selector switch and NEMA 1 enclosure.

E. Solid State Overload Relays: Shall have manual/automatic reset, trip indication, field adjustable trip range and provide phase loss/phase imbalance protection and ambient temperature compensation.

F. All motor starters shall comply with Article 430 Part VII of the National Electric Code (NEC) and UL508.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All starters shall be installed in accordance with Article 430 of the NEC and the manufacturer's instructions.
   1. All starters shall be installed true and plumb, mounted to suitable backboard or support structure, with the center of the enclosure 4'-0" above finished floor.
   2. Select and install overload heater elements in manual starters to match nameplate data of motors served.
   3. Set trip current on solid state overload relays to match nameplate data of motors served.
   4. Install fuses in fusible combination starters and provide adhesive label on the inside of the cover indicating UL fuse class and size for replacement.
   5. Provide and install identification plates indicating load served in accordance with the requirements of Section 260553.
   6. Install fuses for control transformers.
   7. Perform operational tests to assure the proper operation of the equipment.
   8. Starter enclosures shall be left clean and free of foreign objects or construction debris from inside or around the enclosure.

END OF SECTION 26 2913

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the Work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide a fully functional lighting system as described in this Section. The drawings indicate the type, general arrangement, lamps, accessories and control of the various lighting fixtures to be installed. The catalog numbers of the various fixture manufacturers indicate the physical and functional requirements with respect to certified photometrics, light distribution, unit efficiency, operating temperature, data and accessories.

1.3 QUALITY ASSURANCE

A. The luminaires and accessories shall be of standard or custom design manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. The luminaires shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit three copies of product literature detailing dimensions, mounting style, photometric data, lamps, sockets, lenses, air handling characteristics, hardware, materials, lamp and ballasts ratings and manufacturer's instructions and recommendations.

B. Luminaires shall not be purchased or delivered to the project without the approval of the Engineer/Architect.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Construction of all luminaires shall be in accordance with Article 410, Part VII of the National Electric Code (NEC). Flush and recessed fixtures shall also comply with Article 410, Part XI of the NEC.

B. All luminaires provided shall be furnished complete with lamps, all necessary trim, gasketing, diffusers, lenses, ballasts, mounting hardware and accessories as indicated on the Drawings and fixture schedule.
   1. Lamps shall be of the type and wattage indicated on the fixture schedule.
   2. Catalog numbers indicated in schedules do not necessarily include plaster frame, special mounting and other fittings which may be required for proper installation, but these devices shall be provided where applicable and necessary.

2.2 LED LIGHT FIXTURES

A. General:
   1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
   2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
   3. LED drivers shall include the following features unless otherwise indicated:
      a. Minimum efficiency: 85% at full load.
      b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
      c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
      d. Integral short circuit, open circuit, and overload protection.
      e. Power Factor: ≥ 0.95.
      f. Total Harmonic Distortion: ≤ 20%.
      g. Comply with FCC 47 CFR Part 15.
   4. LED modules shall include the following features unless otherwise indicated:
      a. Comply with IES LM-79 and LM-80 requirements.
      b. Minimum CRI 80 and color temperature 3000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
      c. Minimum Rated Life: 50,000 hours per IES L70.
      d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:
   1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:
   1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
   2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Shall be in accordance with Article 410 of the NEC and the manufacturer’s instructions.

B. Luminaires stored at the job site shall be protected from damage due to construction activity and weather. Any damaged equipment shall be replaced.

C. Fixtures installed in suspended ceiling shall have installed a minimum of two hangers independent of the suspended ceiling grid. In no case shall fixtures be suspended from or attached to ductwork or other piping systems.

D. All lenses and reflectors shall be left cleaned and any cracked or broken lenses replaced.

E. Surface ceiling mounted fixtures shall be provided with quarter inch spacers and all pendant or cable hung fixtures shall have appropriate canopies.

F. Recessed luminaires shall have proper housings to suit the ceiling structure they are to be installed in. Fixtures shall be installed so that no light leaks appear between the fixture and the ceiling.

G. Install quantity, type, wattage, and color lamps indicated for each fixture type.

H. Replace all lamps which are found to have failed during any inspection of installed fixtures.

END OF SECTION 26 5100

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract including General and Supplementary General Conditions and other Specification Sections apply to the Work of this Section.

1.2 DESCRIPTION OF THE WORK

A. Provide a fully functional outdoor lighting system as described in this Section. The drawings indicate the type, general arrangement, lamps, accessories and control of the various lighting fixtures to be installed. The catalog numbers of the various fixture manufacturers indicate the physical and functional requirements with respect to certified photometrics, light distribution, unit efficiency and operating temperature data.

1.3 QUALITY CONTROL

A. The luminaires and accessories shall be of standard or custom design manufactured by Firms regularly engaged in the manufacture of similar types and whose products have been in satisfactory use in similar service for not less than five years.

B. The luminaires shall bear the Underwriters' Laboratories (UL) Label.

1.4 SUBMITTALS

A. In addition to submittals specified elsewhere the Contractor shall submit product literature detailing dimensions, mounting style, photometric data, lamps, sockets, lenses, hardware, materials, lamp and ballasts ratings and manufacturer's instructions and recommendations.

B. Luminaires shall not be purchased or delivered to the project without the approval of the Engineer/Architect.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Construction of all exterior fixtures shall be in accordance with Article 410 Parts VII and XII of the National Electric Code (NEC).

B. All luminaires provided shall be furnished complete with lamps, all necessary trim, gasketing, diffusers, lenses, ballasts, mounting bases, poles, pole brackets, accessories, and mounting hardware, as indicated on the Drawings and fixture schedule or as otherwise required.

1. All exterior luminaires shall be UL listed and labeled for use in wet locations.
2. Lamps shall be of the type and wattage indicated on the fixture schedule.

2.2 LED LUMINAIRES

A. General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Material and specifications for each luminaire are as follows:
1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
2. Each luminaire shall be rated for a minimum operational life of 50,000 hours at an average operating time of 11.5 hours per night. This life rating must be conducted 40C ambient temperature.
3. The rated operating temperature range shall be -30°C to +40°C.
4. Each luminaire is capable of operating above 100°F [37°C], but not expected to comply with photometric requirements at elevated temperatures.
5. Photometry must be compliant with IESNA LM-79 and shall be conducted at 25°C ambient temperature.
6. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
7. Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
8. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.

2.3 REFLECTORS: Reflectors shall utilize high purity anodized specular or patterned aluminum with the beam shape indicated.

2.4 ADJUSTABLE FIXTURES

A. In adjustable fixtures, provide aiming lock devices.

B. Fixtures with adjustable lamps and using lamps with asymmetrical light patterns shall have an aiming stop which can be permanently set so that the lamp shall remain correctly positioned after service or re-lamping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All luminaires shall be installed in accordance with Article 410 of the NEC and the manufacturer's instructions.

B. Luminaires stored at the job site shall be protected from damage due to construction activity and weather. Any damaged equipment shall be replaced.

C. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor.

D. All lenses and reflectors shall be left cleaned and any cracked or broken lenses replaced.

E. Adjustable fixtures shall be properly targeted.

F. All luminaires shall be tested for proper operation and cleaned prior to project acceptance.

G. Install quantity, type, wattage and color lamps indicated for each fixture type.

H. Replace all lamps which are found to have failed during any inspection of installed fixtures. Make inspection six months after acceptance of the installation.

END OF SECTION 26 5600

SECTION 31 1000 – SITE CLEARING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including Division 01 – General Requirements, apply to work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

1.2 RELATED SECTIONS

A. Selective Demolition

B. Selective Clearing and Thinning

C. Earthwork

D. Soil Erosion and Sediment Control

1.3 DESCRIPTION OF WORK

A. This work shall consist of clearing and grubbing, clean-up, cutting and removing trees and stumps, stripping and stockpiling topsoil, removing and disposing of all vegetation and any other obstructions and undesirable materials within the project site which are not designated or permitted to remain.

1.4 PROTECTION

A. Prior to commencing the work, all areas shown on the plans as existing tree save areas and new tree line shall be identified, clearly marked and protected until accepted. Storage of building construction items, vehicle parking or access shall be allowed only in areas designated by the A/E, and approved by the Owner. Any damaged plant materials resulting from neglect by the General Contractor or his Subcontractors shall result in a monetary and/or plant material exchange.

B. All other non-treed areas indicated to remain in its natural state shall also be protected by the Contractor. Any resulting damage due to the Contractor's neglect shall be restored to the satisfaction of the A/E. If restoration is not satisfactory, then sufficient monies to cover damage shall be withheld from the Contractor.

C. Contractor shall protect treed and environmentally sensitive areas by installing snow fence or any such barriers necessary to protect these areas. Trees to be saved within work area shall be protected by snow fence installed at the drip line.

1.5 RESTRICTIONS

A. Prior to clearing operations, Contractor shall clearly and plainly mark the limits of clearing and grubbing, as indicated on plans. No clearing or cutting shall be done prior to such field determination. Contractor shall relate the tree lines from the horizontal control geometry and other control points as plan referenced.

B. When limits of clearing have been physically and clearly marked together with building stakes, l then notify the A/E for an on-site review of the clearing limits. Failure of the Contractor to notify the A/E prior to commencing this work shall result in forfeiture of payment for this work.

C. It is the declared and acknowledged intention that, other than those areas required for existing and new building and physical structures, roads, walks, parking areas and site grading, the remainder of site shall remain in its natural state.

1.6 SAFETY

A. All operations required under this section shall be conducted in a safe manner employing whatever means are necessary to provide safety to all persons on the project site.

PART 2 - PRODUCTS

2.1 BALED HAY

A. Hay shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. No salt shall be used.

B. Hay bales shall be approximately 36" long x 18" wide x 24" high.

C. Hay bales shall be anchored with 2" x 2" x 3' long wooden stakes as shown on plans.

2.2 SILT FENCE

A. Silt fence shall be Enviro Fence manufactured by Mirafi, Propex Silt Stop manufactured by Amoco Fabrics Company, or equal.

2.3 COMPOST FILTER SOCK

A. Compost Filter Sock shall be Filtrexx Soxx, manufactured by Filtrex, or equal.

B. Compost Filter Sock is to be approximately 12” diameter.

C. Compost Filter Sock shall be ancored and installed in accordance with manufacturers specifications.

D. Compost use for filter sock shall be as specified by manufacturer.

2.4 TEMPORARY SLOPE SEED MIX FOR STABILIZATION OVER WINTER

A. COMMON NAME	PROPORTION BY WEIGHT	PURITY %	GERMINATION %
1. Red fescue, Creeping or Pennlawn	70	98	90
2. Perennial Ryegrass	15	95	90
3. Colonial Bentgrass or Astoria	15	98	85

PART 3 - EXECUTION

3.1 CLEARING

A. Clearing shall consist of felling and cutting up or trimming of trees, and satisfactory disposal of trees together with downed timber, snags, brush, shrubs, fences, logs, rubbish, rock walls or other debris occurring within areas indicated on the plans as new construction.

B. Trunks of trees may not be cut off more than 6" above original ground surface, in areas to be cleared where grubbing is not required.

C. Trunks of trees at the top of slopes, where rounding of slopes occur to meet existing ground and tree line, shall be cut off flush with or below the final slope line.

3.2 GRUBBING

A. Grubbing shall consist of removal and satisfactory disposal of stumps and buried roots larger than 1-1/2" diameter, to a depth of 18" below surface of original ground, except stumps within proposed building, structural foundation, roadways and parking area shall be entirely removed.

B. Areas to be grubbed shall be as follows:

1. New road and paved areas.
2. Areas occupied by building to a horizontal distance of 6' outside the building walls or to the toe of slopes for buildings on fill.
3. In cut areas for the entire width of cut.
4. In non-paved areas required to be filled, if depth of fill is less than 2'.
5. Except for building, structural foundation, roadways and parking areas, no grubbing shall be required in areas where the height between the subgrade and original ground surface exceeds 3'. The remaining stumps may be left provided they do not extend more than 6" above the ground surface.

3.3 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

A. The Contractor shall dispose of the trees, brush, shrubs and other perishable material by any of the following methods:

1. The Contractor may sell or salvage all merchantable timber from clearing and grubbing operations.
2. The Contractor may chip trees on the site, for use as directed by A/E; all surplus chips shall become the property of the Contractor.

B. No burning of trees, brush, shrubs or perishable material will be allowed on project site.

C. Stumps, roots and perishable materials shall be removed from the project site prior to Earthwork operations.

3.4 STRIPPING

A. The Contractor shall remove to the extent ordered and satisfactorily transport and store all suitable topsoil for use as loam.

B. Stored area shall be on-site. If there are no suitable storage areas located on-site and approved by the A/E, then Contractor shall make provisions to store topsoil elsewhere for use of the project.

C. All stripped topsoil shall remain the property of the Owner (unless otherwise stipulated in writing) and no material shall be hauled off-site until A/E is notified. Failure of the Contractor to notify the A/E prior to hauling any topsoil off-site shall result in forfeiture of payment for this work.

D. Stripped topsoil shall be obtained from open fields, grassed areas, or other areas as deemed appropriate by the A/E, containing organic material suitable for loaming operations. The depth of stripping shall vary based on subsurface information provided elsewhere in these specifications and actual site conditions. In any event, soils shall be removed to the minimum depth of topsoil. Mixing of subsoils shall be accepted. The depth of soil removal shall be verified in the field. All stripped topsoil shall be screened and tested for suitability for use under lawns and adjusted as required.

E. Any stripped topsoil not required for this project shall remain the property of the Owner unless Contractor is directed to remove surplus topsoil from site, which he shall do at no additional

expense to the Owner. If surplus topsoil and subgrade is to remain on site, the material shall be placed and seeded in accordance with the specifications and as directed by A/E at no additional expense to the Owner.

3.5 UNSUITABLE MATERIAL

A. Excavated unsuitable material shall be separated and classified as unsuitable material, unsuitable non-hazardous material and unsuitable hazardous material.

3.6 TEMPORARY CONSTRUCTION FENCE

A. Contractor shall furnish, place and maintain a temporary construction fence of the size, type and locations indicated on the plans or as directed by the A/E.

END OF SECTION 31 1000

SECTION 31 1005 - SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including Division 01 – General Requirements, apply to work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, Latest Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 312000 – Earthwork

1.3 DESCRIPTION OF WORK

A. This work shall consist of clearing and grubbing, clean-up, stripping and stockpiling topsoil, riprap, removing and disposing of all vegetation and any other obstructions and undesirable materials within the project site which are not designated or permitted to remain.

B. When limits of disturbance have been physically and clearly marked, Contractor shall then notify the A/E for an on-site review of the limits.

C. It is the declared and acknowledged intention that, other than those areas required for existing and new building and physical structures, roads, walks, parking areas and site grading, the remainder of site shall remain in its natural state.

1.4 SAFETY

A. All operations required under this section shall be conducted in a safe manner employing whatever means are necessary to provide safety to all persons on the project site.

PART 2 - PRODUCTS

2.1 BALED HAY

A. Hay shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. No salt shall be used.

B. Hay bales shall be approximately 36" long x 18" wide x 24" high.

C. Hay bales shall be anchored with 2" x 2" x 3' long wooden stakes as shown on plans.

2.2 COMPOST FILTER SOCK

A. Compost Filter Sock shall be Filtrexx Soxx, manufactured by Filtrex, or equal.

B. Compost Filter Sock is to be approximately 12” diameter.

C. Compost Filter Sock shall be ancored and installed in accordance with manufacturers specifications.

D. Compost use for filter sock shall be as specified by manufacturer.

PART 3 - EXECUTION

3.1 CLEARING

A. Clearing shall consist of removal of rubbish, rock walls or other debris occurring within areas indicated on the plans as new construction.

3.2 UNSUITABLE MATERIAL

A. Excavated unsuitable material shall be separated and classified as unsuitable material, unsuitable non-hazardous material and unsuitable hazardous material.

3.3 TEMPORARY CONSTRUCTION FENCE

A. Contractor shall furnish, place and maintain a temporary construction fence of the size, type and locations indicated on the plans or as directed by the A/E.

END OF SECTION 311005

SECTION 31 1010 - MAINTENANCE OF SITE

PART 1 - GENERAL

1.1 GENERAL

A. This item shall consist of site maintenance during the demolition and construction phases of the work. Included but not limited to are sweeping adjacent to the project at least once a week and covering stockpiled material as ordered by the A/E.

PART 2 - PRODUCTS - (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 METHODS, EQUIPMENT AND MATERIALS

A. The methods, equipment and materials used for maintenance of the site shall be acceptable to the A/E prior to performing any of the necessary work.

END OF SECTION 31 1010

SECTION 31 1200 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including general and supplemental conditions and Division 1 specifications, apply to this work.

1.2 RELATED SECTIONS

A. Section 31 2000 – Earthwork: for soil materials, excavating, backfilling and site grading.

B. Section 31 1005 – Site Preparation

C. Section 31 3205 – Soil Erosion and Sediment Control

1.3 DESCRIPTION

A. Summary: It is the intent to include under this Contract the selective demolition and removal of existing site structures and accessories of every description within the project limit line (see special notes and limit of construction as noted on the site demolition plans) which at present exists and extends above and below the ground level, including, pavements, floor slabs, foundations and rubble, and where required, to fill the voids with clean, compacted gravel borrow in preparation for new construction. Do not use any rubble to fill voids.

B. Work To Be Performed: Furnish all labor, materials, equipment and services necessary to complete the work indicated, and without limiting the generality thereof includes:

1. Building structures, steel guards, platforms, steps, wood and metal framing, ramps, building walls, foundations, paving materials of all description and all related items necessary to perform and complete such work.
2. Demolition and removal of site improvements.
3. Disconnecting, capping or sealing, and abandoning site utilities in place.
4. Disconnecting, capping or sealing, and removing site utilities.
5. Protection of work, existing construction and equipment to remain in use.
6. Gathering of rubbish and items materials removed under this Section and its removal from the project site.

C. It is not the intent herein to describe all items and work required to be removed under this Section. The Contractor shall assure himself that all of the work to be removed, not otherwise specified herein or described under other Sections, but shown on the Drawings, shall be removed under this Section at no additional cost to the Owner.

D. The Contractor shall also examine other Sections of these specifications and familiarize himself with their provisions regarding the removal of existing items and work. He shall understand

that all items and work not specifically mentioned to be removed by the requirements of other Sections of these specifications shall be removed as part of the work under this Section.

1.4 SCHEDULING

A. Before beginning the removal of work and demolition, the Contractor shall consult jointly with the Owner and Engineer to determine the schedule of work, exact places, times and days during which the removal and demolition work may or may not be carried on, and to determine further reasonable requirements, particularly in regards to noise prevention, dust prevention, weather protection, safety precautions and school schedule.

1.5 EXAMINATION OF PREMISES

A. The Contractor will be held to have examined the premises before submitting proposals for the work and to have satisfied himself as to existing conditions under which he will be obliged to operate or that will in any way affect the work under this Contract, also the character and amounts of materials and debris to be removed. No allowance will be made in this connection for error or negligence of the Contractor.

1.6 USE OF PREMISES

A. All apparatus, storage and the operation of workmen in connection with activities under this Section shall be confined to limits of the Contract as shown on the Drawings and shall not encumber the premises at any time. Storage will not be permitted on the property without the approval of the Owner, and in no case will storage be permitted outside the property without obtaining the necessary permits from the appropriate authorities.

B. All trucks carrying loose, dry material such as debris, plaster, broken concrete masonry, etc., shall be covered by tarpaulins to prevent blowing away or spillage. All spillage of whatever nature shall be promptly taken up and removed.

1.7 ACCESS AND EGRESS

A. The most diligent attention shall be paid to maintaining adequate passage to and from all exits at all times. Before any work is done which will significantly alter access or egress patterns, consult the Owner and Engineer and obtain their approval. Under no circumstances block or interfere with the free flow of people at legally required exits, or in no way alter the required conditions of such exits.

1.8 PROTECTION

A. The Contractor shall take all precautions and use whatever protective devices, shoring, guard rails and the like as may be required to assure that the remaining and adjacent portions of the existing work which is to remain is substantially supported and/or not loaded beyond safe limits.

B. Use tools and methods that will not transfer heavy shocks, vibrations and other disturbances to existing buildings.

C. Do not allow demolition debris to accumulate, and when outside sprinkle it with water to hold down dust when handling and loading.

1.9 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option. All materials are to be disposed legally.

1.10 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of demolition activities indicating the following:

1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
2. Dates for shutoff, capping, and continuation of utility services.

E. Inventory of items to be removed and salvaged.

F. Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

G. Records indicating off-site disposal of building debris and solid waste, including receipted acceptance by each facility.

1.11 QUALITY ASSURANCE

A. Pre-demolition Conference: Conduct conference at Project site to comply with pre-installation conference requirements of Division 1 Section "Project Meetings."

1.12 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of buildings to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Protection of Adjacent Structures:

1. The work of demolishing the buildings and structures shall be carried on in a manner that will insure the safety of adjacent property and persons occupying such property against any damages or injuries which might occur from falling debris or other cause, and so as not to interfere with the use of adjacent buildings, roadways and structures or the free and safe passage to and from the same.
2. Take every precaution to guard against any movement or settlement of adjacent buildings, sidewalks, utilities or streets, and provide and place at the sole expense of the Contractor, bracing or shoring necessary or proper in connection therewith, and be solely and entirely responsible for the complete safety and support of such buildings, and be solely liable for any such movement or settlement and any damage or injury caused thereby or resulting therefrom. If at any time the safety of any adjacent building or structure shall appear to the Engineer, Owner or to the Contractor, to be endangered, then cease operations and at the sole expense of the Contractor, however great the same may be, take all proper means to support such building or structure and do not resume operations until permission has been secured in writing from the Engineer.
3. The Contractor shall take adequate precautions to protect all walks, roads, streets, curbs, pavements, lawns, trees and planting, on or off the premises, and shall repair and replace or otherwise make good, as directed by the Engineer, any such or other damage so caused at no cost to the Owner.

C. Perimeter fencing for the project to be in place prior to any demolition work.

D. Erosion controls to be in place prior to any demolition work.

1.13 SCHEDULING

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations.

B. Any noisy demolition work to occur on third shift.

C. Contractor shall notify Dig-Safe at 811 prior to any work to verify location of all utility lines, pipes, wires and conduits.

PART 2 - MATERIALS

2.1 DISPOSAL OF WORK REMOVED

A. All non-salvageable refuse and debris which accumulates as a result of work under this Section shall be removed. No refuse or debris of any nature shall be allowed to accumulate to the detriment of the work. **Remove refuse and debris from site daily.**

B. All existing items removed under this Section shall become the responsibility of the Contractor and legally disposed of off site at his expense, unless existing items to be removed are specifically noted on the Drawings to be relocated or unless otherwise directed by the Owner to be rendered to and become the property of the Owner.

C. All objects, trim and items identified by the Owner to be rendered to and become the property of the Owner, shall be delivered by the Contractor to a storage facility at no additional cost to the Owner.

D. Burn no debris on the site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

C. Inventory and record the condition of the items to be removed and reinstalled and items to be removed and salvaged.

D. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

B. Contractor shall be solely responsible for disconnecting and sealing indicated utilities serving structures to be demolished before start of demolition work.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off utility services serving structures to be demolished.

1. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

A. Before starting the removal of work, the Contractor shall arrange for the disconnection of active utility services in the areas to be worked in. All work on existing utility services shall be accomplished by the respective trades or utility company having jurisdiction.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain.

E. Adequate protection of persons and property shall be provided at all times. All work shall be executed in such a way as to avoid hazard to person and property, interference with the use of camp sites, and interruption of free passage to and from such camp sites. All demolition work shall conform to the requirements of the Rhode Island Department of Public Safety.

3.4 CONDUCT OF WORK

A. Where new work joins or abuts existing work, cutting shall be carefully and accurately done true to lines indicated. Where concrete work is required to be cut, cutting shall be done by abrasive wheel, saws or coring. No jackhammers will be allowed at these areas unless otherwise approved by the Engineer.

B. All materials indicated on the Drawings to be removed shall be taken down in a manner so as not to damage the existing materials to remain.

C. The work shall be conducted with prime consideration given to the requirements specified herein, and to this end the Contractor shall maintain close coordination and cooperation with the Engineer.

D. The Contractor will have full access to the premises and the property up to the project limit lines. The Contractor shall take reasonable care to minimize disturbances to the adjacent property and abutting property owner.

E. Coordinate and cooperate with work of other trades involved in the disconnecting and/or maintenance of existing active mechanical or electrical lines.

F. Existing and proposed toilet facilities shall not be used for discharging waste, debris or any other type of material required to be disposed of.

3.5 EXPLOSIVES

A. Explosives: Blasting and the use of explosives will not be permitted for demolition of existing structures.

3.6 POLLUTION CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Water supply will be provided for pollution control at no cost to the Owner. Comply with governing environmental protection regulations.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Clean adjacent buildings, streets, trees, plantings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.7 DEMOLITION

A. Building Demolition: Demolish buildings as indicated on plans and remove from the site. Use methods required to complete Work within limitations of governing permits and regulations, and as follows:

1. Break up and remove concrete slabs on grade.
2. Dispose of demolished items and material promptly. On-site storage or sale of removed items is prohibited.

B. Below-Grade Construction: Demolish and remove all foundation walls and other below-grade construction.

C. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified on the plans in conformance with Section 312000 "Earthwork."

D. Damages: Promptly repair damages to adjacent facilities, grounds and landscaping caused by demolition operations.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Disposal of the material shall be done in such a manner that there shall be no accumulation of any demolition material which may, in the opinion of the Owner, any local, State or Federal Official, the Fire Department, or any other public agency having jurisdiction, constitute a hazard. When necessary, a disposal site accepting hazardous materials will be utilized.

B. Burning: Do not burn demolished materials. Burning of any kind is not allowed on the site.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

D. Completely remove all protection when the work is completed or when ordered in writing by the Engineer.

3.9 CLEAN UP

A. Remove from the project site all materials and debris resulting from the work of demolition. Storage of such materials on the project site will not be permitted. The project site shall be safe, clean and holes filled and compacted with clean fill upon completion of the demolition and site clearance work.

B. Repair any sidewalk, curb, or pavement surface which has been damaged or destroyed during the demolition operations. Said repairs to sidewalk or pavement surfaces shall be accomplished by applying bituminous concrete or regular concrete, as applicable in a manner satisfactory to the Engineer and Owner.

END OF SECTION 31 1200

SECTION 31 2000 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 01 – Specifications Section, apply to this Section.

1.2 RELATED REQUIREMENTS

A. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, Latest Edition with latest addenda.

1.3 SPECIAL CONDITIONS

A. The Contractor shall notify "Dig-Safe" in Rhode Island at 811, prior to any excavation.

1.4 SUMMARY

A. This Section includes the following:

1. Preparing and grading subgrade for footings, slabs-on-grade, walks, pavements, and landscaping.
2. Excavating all materials and backfilling for buildings and structures, including open cut rock excavation and trench rock excavation for installation of site utilities.
3. Drainage and moisture-control fill course for slabs-on-grade.
4. Subbase course for walks and pavements.
5. Subsurface drainage backfill for walls and trenches.
6. Excavating and backfilling trenches within building lines.
7. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
8. Grading and compaction requirements.

1.5 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. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. 6 inches beneath bottom of concrete slabs on grade.

5. 6 inches beneath invert elevation of pipe in trenches, and the greater of 24 inches wider than pipe diameter or 42 inches wide.

B. Adjustments in Contract Price will be made due to quantity of rock encountered, based on unit prices for rock removal mutually agreed upon.

1.6 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.

B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.

E. Base Course: The layer placed between the subbase and surface pavement in a paving system.

F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.7 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.

B. Product data for the following:

1. Each type of plastic warning tape.
2. Filter fabric.

C. Samples of the following:

1. A 25 lb. sample of each proposed fill and backfill soil material from on-site or borrow sources for use for grain size analysis, with sample source clearly identified. Submittal shall be a minimum of two weeks prior to anticipated use.
2. 12-by-12-inch sample of filter fabric.
3. The Contractor shall submit a Dewatering Plan before commencing any dewatering operations. The plan shall describe the basic components of the dewatering system proposed and method of operation. The contractor shall furnish all labor, materials, and any incidentals necessary to complete dewatering operations at no additional cost to the owner.

D. Test Reports: In addition to test reports required under field quality control, submit the following:

1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
2. One optimum moisture-maximum density curve for each soil material.
3. Report of actual unconfined compressive strength and/or results of bearing tests of each stratum tested.

E. Site Characterization of All Off-Site Borrow Sources:

The following information shall be submitted to the Owner for review at least two weeks prior to use of an off-site borrow source. No soil materials shall be brought to the site without approval by the Owner. Off-site borrow materials must be free of chemical contamination and must be characterized in accordance with this section. Materials brought on-site by the Contractor and characterized to be contaminated will not be accepted and shall be legally disposed off off-site by the Contractor at no cost to the Owner. Any on-site materials or work adversely impacted by the presence of the contaminated borrow materials shall be replaced or repaired at no cost to the Owner.

1. Site Data: Information regarding the off-site borrow source and material, as follows:

    a. location of the borrow source site;
    b. present and past usage of the source site and material; and
    c. any previously existing report(s) associated with an assessment of the source site as it relates to the presence of oil or hazardous materials.

F. Quality Control Testing for Off-Site Borrow Materials:

1. In the event that site characterization of off-site borrow sources indicates that soils are acceptable for use, then chemical testing will not be required. It is anticipated that chemical testing would not normally be required for material from customarily utilized commercial borrow sources. However, if the materials are suspected of being contaminated based on review of the site characterization data, chemical testing will be required as directed by the Owner's representative. The chemical testing shall be completed by the Contractor at no additional cost to the Owner.
2. Chemical Test Data: Each material source requiring testing shall be sampled by a person experienced in sample collection who is a professional engineer registered in the State of Rhode Island, registered geologist, certified by the Rhode Island Department of Health,

for the following analyses:

a. Volatile Organic Compounds, (EPA 8240 plus Hazardous ubstance List (HSL) Parameters;
b. Acid and Base Neutral Extractable Organic Compounds, (EPA 8270);
c. Pesticides/PCBs (EPA 8080);
d. Total Petroleum Hydrocarbons (Infrared Method)(EPA 9071/418.1);
e. Thirteen Priority Pollutant Metals (EPA 7000 Series)
f. Total Cyanide (EPA 9010); and
g. Total Phenols (EPA 9065).
h. Any additional tests deemed necessary by A/E.

3. Soil samples shall be obtained and tested in accordance with criteria established by the Owner's Representative, and results submitted for review and approval prior to use on site.

G. Photographs of existing adjacent structures and site improvements.

1.8 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of all authorities having jurisdiction.

B. Testing and Inspection Service: Owner will engage soil testing and inspection service, to perform testing of soil materials proposed for use in work and to provide field testing facilities for quality control testing during excavation and fill operations.

1. Cooperate with testing and inspection service as it obtains samples of existing soil materials and furnish testing service with necessary samples of haul-in fill materials.

C. Preconstruction Conference: Conduct conference at Project site to comply with requirements of Division 01 – Section "Project Meetings".

1. Before commencing site construction, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

D. Materials placed and compacted which do not conform to project specifications for the application shall be removed and replaced with suitable material as directed by the A/E at no additional cost to the Owner.

1.9 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities in areas of work. Where utilities are to remain in place, provide adequate means of protecting during excavation operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility Owner immediately for directions. Cooperate with Owner and with public and private utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfactory of utility Owner.
2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by Architect/Engineer and then only after acceptable temporary utility services have been provided.

    a. Provide minimum of 72-hour notice of proposed interruption to Owner. Do not interrupt existing utility until receipt of written notice to proceed.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Gravel Borrow: This material shall conform to RIDOT materials M.01.02 (Column Ib of Table 1).

C. Common Borrow: This material shall conform to RIDOT material specification M.01.01.

D. Bedding Material: This material shall conform to RIDOT material specification M.01.04, Crushed Stone 100% shall pass 1-1/2” sieve.

E. Drainage Fill: Shall conform to pervious fill RIDOT section M.01.03.

F. Filtering Material: This material shall conform to RIDOT material specification M.01.07.

G. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 BRICK AND MORTAR

A. Sewer Brick: Standard size, ANSI/ASTM C 32, Grade SM.

B. Mortar Materials: Dry packaged, proportioned for Type M unit masonry mortar, complying with ANSI/ASTM C 387.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.

1. Tape Colors: Provide tape colors to utilities as follows:

    a. Red: Electric.
    b. Yellow: Gas, oil, steam, and dangerous materials.
    c. Orange: Telephone and other communications.
    d. Blue: Water systems.
    e. Green: Sewer systems.

C. Filter Fabric: Manufacturer's standard non-woven synthetic, chemically resistant, non biodegradable pervious geotextile fabric of polypropylene, nylon or polyester fibers, or a combination.

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:

    a. Grab Tensile Strength (ASTM D 4632): 100 lb.
    b. Apparent Opening Size (ASTM D 4751): #100 U.S. Standard sieve.
    c. Permeability (ASTM D 4491): 150 gallons per minute per sq. ft.
    d. Minimum weight of 6 oz. per square yard.

D. Lean Concrete: Minimum compressive strength equal to 3000 psi, with a slump not exceeding seven inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water, precipitation and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Install dewatering system to maintain groundwater levels at least two (2) feet below the bottom of excavation. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure to convey water removed from excavations and rain water to collecting or run-off areas. Do not use trench excavations for site utilities as temporary drainage ditches.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.3 CUTTING PAVEMENT

A. Excavations made on pavement shall be made in a careful manner so as to cause the least amount of damage to the pavement. Pavement and/or cement concrete will be cut 6 inches either side of the maximum allowable trench width. Any damage to the cut line due to the excavations, backfilling or removal of temporary pavement shall be re-cut to neat lines at no additional cost to the Owner, prior to replacement of the specified finished pavement. The width of pavement removed shall be kept as narrow as practicable. Existing pavement and base course disturbed or damaged beyond the pavement lines indicated shall be replaced by the Contractor to match existing pavement and base course, at no additional cost to the Owner.

B. Contractor shall remove and dispose of existing bituminous concrete pavement off site as necessary to perform work of this contract as indicated. Removal of pavement shall be done in a neat manner by saw cutting a neat edge.

C. Contractor shall saw cut, remove and dispose of concrete and bituminous walk pavement off-site as is necessary to perform the work of this contract. Removal of concrete and bituminous walks shall be performed in a neat manner at the nearest joint of the remaining walk pavement.

D. Excavated pavement shall not be mixed with other excavated material which is to be used as backfill, and shall be removed immediately from the site of the work.

3.4 EXCAVATION

A. Classified Excavation: Excavation is classified and includes excavation to required subgrade elevations. Excavation will be classified as earth excavation or rock excavation as follows:

1. Earth excavation includes excavation of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered that are not classified as rock or unauthorized excavation.
2. Rock excavation shall mean removal and disposal of rock material as directed by A/E.
3. All rock removal shall be in conformance with local and state authorities having jurisdiction over this work.
4. Definition of "rock excavation" shall mean:

    a. Materials that cannot be removed effectively with soil excavating equipment, such as rock material or aggregate conglomerate deposits so firmly cemented as to possess the physical characteristics of solid rock.
    b. Concrete or masonry structures larger than 1 cubic yard in volume, and not less than 13" in least dimension.
    c. Reinforced concrete larger than 1 cubic yard in volume, reinforcement area more than 1/2 percent of cross sectional area perpendicular to reinforcement in either direction, and not less than 8" in least dimension.
    d. Boulder 1 cu. yd. or more in volume, sound rock material in ledges, bedded deposits and unstratified masses which cannot be removed without blasting.
    e. The definition of "Trench Rock" is rock required to be removed and disposed for the installation of trenches requiring an excavation 3' wide or less, and greater than 5' deep, or the removal and disposal of rock encountered in the construction of masonry culverts and structures having a clear span of less than 8 feet.

5. When, during excavation, material is encountered that Contractor may classify as rock excavation or trench rock, such material shall be uncovered and A/E notified by Contractor. Contractor shall not proceed with excavation or rock excavation. Failure on part of Contractor to uncover such material and notify A/E will cause forfeiture of Contractor's right of claim for payment of rock excavation.
6. Soft or disintegrated rock or hardpan which can be removed with a hand pick or power operated excavating machines, or loose or previously blasted rock, will not be considered as rock excavation.
7. Before rock removal commences, the Contractor shall uncover all ledge to be removed. Elevations shall be taken by a registered land surveyor employed by the Owner. The surveyor will be paid by the Contractor.
8. Surveyor shall develop cross sections to show and determine rock quantities for payment purposes. Cross sections shall be reviewed by the A/E. Payment for rock removal shall be based on "Methods of Measurement" or "paylines" as stated within the project specifications and drawings. Contractor shall be paid only in accordance with calculated quantities and not for actual rock removed.
9. Rock excavation may also be accomplished utilizing ripping, hoe ramming or other mechanical means to loosen and remove rock.
10. Wherever rock is shattered below grade and is unfit for foundations, the shattered rock shall be removed and replaced as specified. No extra payment will be made for over excavation or backfill as required.
11. Rock shall be removed to a depth of 12" below lawn areas.

3.5 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate material to facilitate construction of embankments, roads, parking areas, pavements, structures, and other site improvements to the lines and grades indicated, and deeper as required. Where unsuitable materials such as uncontrolled fill, trash, peat, wood, tree stumps, logs, construction/building debris, topsoil, or other materials that may compress, decay, or collapse or are otherwise considered not to be acceptable foundation bearing soils are encountered inside building footprints, excavation and replacement with compacted Engineered Fill or other acceptable, approved materials will be required.

B. Excavation for building foundation construction shall be performed to the top of undisturbed naturally deposited inorganic soils or stable, unshaken bedrock. Engineered Fill shall than be placed and compacted, as described below, to bring the area to foundation or slab subgrade. If unsuitable materials are encountered around the perimeter of the building limits, excavate outward and downward at a 1.5H:1V slope, to the top of undisturbed naturally deposited inorganic soils or stable, unshaken bedrock. “All unsuitable materials within the footprint of the building shall be removed to the top of undisturbed natural deposited inorganic soils or stable, unshaken bedrock.

C. Conduct bulk excavation utilizing appropriate methods and equipment in sufficient quantity and sizes to expeditiously complete the excavation required to perform the work as specified and indicated on Drawings.

D. Coordinate the sequence of excavation with ground conditions and water encountered, weather and precipitation, erosion control, structure forming and construction, cold weather protection, dewatering, utility construction, and as necessary to provide a stable excavation and to ensure the safety of all persons and equipment within the excavation at all times during construction.

E. Continuously remove surplus excavated materials from the site as excavation proceeds, transporting materials over legal haul routes, and permanently disposing of materials at legal disposal areas in accordance with permits obtained by the Contractor and pertinent regulations.

F. Protect soil subgrades from disturbance caused by construction activities, water, and freezing.

G. Exercise care to preserve the material below and beyond the limits of excavation. Where excavation is carried below required grade, backfill to subgrade as specified.

H. Remove unstable bottom material. Remove large stones, debris, and unsuitable soils from the excavation bottoms.

I. Temporary cut slopes shall be constructed no steeper than 1.5H:1V. Some sloughing and ravelling should be anticipated in temporary slopes.

J. Upon completion of excavations, notify the Owner and make the excavation available to the Owner or the Owner's representative to observe the condition of the excavated surface prior to and during subgrade preparation operations.

K. Excavation for the convenience of the Contractor shall conform to the limits acceptable to the Owner and shall be at no additional cost to the Owner.

L. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, Drainage Structures and Mechanical or Electrical Appurtenances: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot. Do not disturb bottom of excavations intended for bearing surface.

3.7 EXCAVATION SUPPORT SYSTEM

A. The Contractor shall furnish, put in place, maintain and remove, as required and/or necessary for safe and proper construction, all excavation support systems which may be required to support the sides of excavation preventing damage to adjacent property and structures.

B. The Contractor shall submit, for review by A/E, design and erection drawings, details, material specifications, and design computations for excavation support systems as required; bearing the seal of a professional Engineer who is experienced in this type of work and is registered in Rhode Island.

C. The excavation support system shall be designed to be compatible with dewatering and pumping systems.

D. Work shall not proceed until such time as the Contractor's submission has been reviewed and questions relative to his proposed method resolved to the satisfaction of the A/E.

E. Support system shall be installed to prevent any movement of earth which could in any way diminish the width of excavation, or cause caving or undermining of structures or pavement beyond that necessary for proper construction or otherwise injure the work or workmen, and to prevent delay of the work.

F. Support system shall be installed in such a manner to avoid loss of material from behind the sheeting. Care shall be taken not to trim beyond the face of which the sheeting will be driven. Care shall be taken to prevent voids behind the sheeting. If such voids do occur they shall immediately be filled with bank run gravel and compacted.

G. The Contractor shall leave in place, to be imbedded in the backfill, all sheeting and bracing which the A/E directs in writing to be left in place. The A/E shall direct at what elevation the sheeting to be left in place shall be cut off.

H. All bracing, which is to be removed, shall be removed in such a manner as not to endanger the construction or other structures. All voids left by the removal shall immediately be filled with bank run gravel and compacted with suitable tools to the satisfaction of the A/E.

I. All bracing, together with the use of prefabricated steel trenching boxes, shall be provided by the Contractor at no additional expense to the Owner.

J. The Contractor shall be responsible for the adequacy of his excavation support system and shall be solely responsible for any damage or injury to new or completed work as a result of failure of or lack of use of shoring, sheeting and bracing.

3.8 PUMPING AND DEWATERING

A. The Contractor shall furnish all pumps, equipment, power and attendance to maintain and operate such pumping and dewatering systems consisting of any means and devices, including spare units in case of breakdown, which accomplish the removal and prompt disposal of all water entering the foundation excavation, pits and trenches. The pumping manner, method or both shall be sufficient to ensure that ground water is controlled at levels which will permit all work to be performed in dry conditions.

B. The Contractor shall submit plans, details, and specifications for his dewatering systems to the A/E for review and comment prior to installation.

C. Operation of the system may be shut down, but the system shall be left in place, and only on the written order of the A/E and after the foundation work is complete to such an extent that it will not be damaged when flooded.

D. Where in the judgment of the A/E, for reasons of safety, or for the benefit and progress of the work, the system should be put back in operation, such emergency work shall begin within four (4) hours of the A/E's verbal notice.

E. Water shall be removed from the site during pumping and dewatering operations by whatever expeditious means available to the Contractor in cooperation with the Owner's representative and their requirements.

F. Water shall not be disposed of in any manner which may cause damage to surrounding lands or structures and in no case shall be disposed of in an existing sanitary sewer, storm drain, or drainage structure.

G. Water level shall be maintained at a depth of 2 feet or greater below excavated surface elevation during construction.

3.9 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.10 CLOSING ABANDONED UNDERGROUND UTILITIES

A. Close open ends of abandoned underground utilities indicated to remain with sufficiently strong closure to withstand pressures which may result after closing.

1. Close open ends-of metallic conduit and pipe with threaded galvanized metal caps or plastic plugs, or other suitable method for type of material and size of pipe. Do not use wood plugs.
2. Close open ends of concrete and masonry utilities with not less than 8" thick brick masonry bulkheads, constructed to fill opening.

    a. Lay brick in mortar, forming a full bed with ends and side joints in one operation and with maximum 3/8" wide joints. Protect fresh masonry from freezing or from rapid drying and maintain protection until mortar has set.

3. Close open ends of all other pipes and conduits with caps specifically made for that material.

3.11 APPROVAL OF SUBGRADE

A. Notify Architect/Engineer when excavations have reached required subgrade.

B. When Architect/Engineer determines that unforeseen unsatisfactory soil is present, continue excavation and replace with systematically placed and compacted backfill or fill material as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect/Engineer at no cost to the Owner.

D. Compacted Fill Surfaces: Compacted Engineered Fill, or other fill materials, which become disturbed, contaminated with clay or otherwise unacceptable to the Owner’s Representative shall be removed and replaced with acceptable Engineered Fill at no additional cost to the Owner.

3.12 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect/Engineer, at no cost to the Owner.

1. Fill unauthorized excavations under other construction as directed by the Architect/ Engineer, at no cost to the Owner.

B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the A/E, at no cost to the Owner.

3.13 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Provide erosion control measures around perimeter of stockpiles. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
2. Establish soil and material stockpiles on site only at locations acceptable to the Owner.

3.14 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. No backfill shall be placed except in the presence of the Owner or Owner’s representative.

3.15 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow, scarify, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil, and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1. Under grassed areas, use common borrow material.
2. Under walks and pavements, use gravel borrow.
3. Under steps and ramps, use gravel borrow.
4. Under building slabs, use gravel borrow except for the last 12" use drainage fill.
5. Under footings and foundations, use gravel borrow.
6. Under piping and conduit, provide gravel borrow and bedding material where indicated under piping or conduit; shape to fit bottom 90 deg. of cylinder.

3.16 MOISTURE CONTROL

A. Uniformly moisten, moisture condition, or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

B. Wet Weather: If fill material placement, spreading, rolling, or compaction operations are interrupted by heavy rain or other unfavorable conditions, do not resume such operations until ascertaining that the moisture content and density of the previously-placed soil are as required by these specifications.

3.17 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
2. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
3. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

D. Material in conformance to paragraph 2.1 herein which are placed and compacted to less than the specified density shall be:

1. Re-compacted as required to achieve specified density.
2. Removed and replaced with properly placed and acceptably compacted material.

E. Compaction by puddling is prohibited.

3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Walks: Plus or minus 0.10 foot.
3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Grade the surface of fill under building slabs smooth and even, free of voids, as specified, and to required elevation. Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.19 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

1. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each subbase and base layer.

3.20 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared subgrade.

1. Compact drainage fill to required cross sections and thickness.
2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.
3. When compacted thickness of drainage fill exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.21 FIELD QUALITY CONTROL

A. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2937 (drive cylinder method), as applicable.

    a. Field in-place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.

    b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the A/E.

2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Architect.
3. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but no fewer than two tests.

B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

3.22 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the A/E; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs within 1 year after project completion, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. All unsuitable material, and suitable material not required for the proper completion of the contract, shall become the property of the Contractor, and shall be removed and properly disposed of off-site at no additional cost to the Owner.

B. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, debris, and pavement, and legally dispose of it off the Owner's property, at no cost to the Owner.

C. Disposal: Transport surplus satisfactory soil to designated storage areas on the Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste material, including unsatisfactory soil, pavement, trash, and debris, and legally dispose of it off the Owner's property, at no cost to the Owner. Contractor to obtain and pay for all necessary permits or licenses for off-site disposal.

END OF SECTION 31 2000

SECTION 31 2010 - EARTHWORK UTILITIES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the contract, including General and Specification Supplementary Conditions and Division 1, apply to the work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction,* Latest Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 31 2000 – Earthwork

B. Section 33 4100 – Storm Drainage System

1.3 DESCRIPTION OF WORK

A. Work under this section includes, but is not necessarily limited to, the following:

1. Excavating and trenching.
2. Filling, backfilling and compaction.
3. Rough grading to required tolerances.
4. Filling, as directed.
5. The placing of earth for forming and shaping embankments.
6. All sheeting and shoring where required and/or necessary.
7. Maintaining benchmarks, monuments, and other reference points, obtaining accurate replacement of final grade of any disturbed or destroyed, or that must be removed due to the nature of the work, furnishing certification by a registered professional surveyor that all disturbed items have been accurately relocated.
8. Written notice of readiness of excavations, fill materials, fill areas, compacted fills, and items requiring review and/or inspection.
9. Maintaining excavations and trenches free of water and performing construction work under dry conditions.
10. Excavations, stock piling and placing material suitable for filling and backfilling.
11. Removing from site all debris, unsuitable material and excess excavated material as specified and/or as directed by A/E.
12. Restoration to original grades and condition properties damaged by any activity related to the work, taking adequate precautions to avoid settlement or cave-in of properties higher than site, silting, erosion, or other damage to properties lower than site.

1.4 QUALITY ASSURANCE

A. If, in the opinion of the A/E, the specified materials do not conform to material specifications any required sieve analysis as deemed necessary by the A/E shall be performed by an independent testing laboratory selected by the A/E. This testing shall be paid for by the Contractor at no expense to the Owner.

1.5 MEASUREMENT AND PAYMENT

A. General: The contract prices bid and payment thereof shall constitute full compensation for all labor, equipment, tools, supplies, materials, and work incidental and necessary to satisfactorily complete the work as specified, as shown on the drawings and as directed.

B. Trench Excavation and Backfill: No separate payment will be made for earth excavation, dewatering, bedding, sand blanket, saw cutting pavement, backfill, compaction or work items necessary to install and backfill all pipe and structures but the cost of the work will be considered to be included in the contract price. Earthwork will be as indicated on the drawings and as specified. This work included the following: Excavation and disposal of pavements; removal, hauling and stockpiling of excavated materials; re-handling, hauling, and placing of stockpiled material in the work to be used as backfill in the upper section of the trench; excavation and disposal of surplus and/or unsuitable materials; placement of fill materials; compaction and grading of fills, backfills, embankments and subgrades; all necessary dewatering; protection of existing pipelines, utilities and structures; sheeting and bracing not left in place; bedding material compacted in place to the lines, grades and limits directed by the A/E; sand blanket compacted in place to the lines, grades and limits directed by the A/E.

C. Furnishings of Water: The furnishings of water used for sprinkling and wetting the material during the construction operations in connection with the compaction of fills, backfills, borrow and embankments will be considered the responsibility of the Contractor. No payment will be allowed for this item of work. Contractor shall obtain appropriate permits for meters and pay for water use.

D. Damaged or Disturbed Items of Work: All damaged or disturbed items of work, or items required to be removed and replaced due to construction purposes and operations that are not listed in the bid, shall be restored, replaced or repaired by the Contractor in a manner satisfactorily to the A/E at no additional expense to the Owner.

E. Test Pits: Excavation and backfilling for test pits, if directed by the A/E, or as indicated on the plans, shall be measured and paid for on a per each basis as listed in the unit price bid.

F. Borrow: Gravel borrow will be compacted in place to the lines, grades and limits as directed by the Engineer.

G. Below Grade Excavation: Bedding material used to replace below grade excavation will be compacted in place to the lines, grades and limits as directed by the Engineer, and paid for on a cubic yard basis as listed in the unit prices bid.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Grain-size distribution curve shall be furnished to A/E by a soil test lab Engineer licensed by the State of Rhode Island and approved by the A/E.

B. Areas from which fill material is obtained shall have been completely stripped of topsoil and subsoil to undisturbed naturally deposited inorganic soil. No fill shall be brought to site or purchased until such material shall have been reviewed by A/E. Fill shall conform in quality to sample as selected by A/E.

C. See Earthwork Specification Section 31 2000 for Soil Materials and Accessories.

PART 3 - EXECUTION

3.1 GENERAL EXCAVATION REQUIREMENTS

A. The extent of excavation open at any one time shall be controlled by the conditions, but shall always be confined to the limits prescribed by the A/E.

B. No excavated material shall be placed on lawns, driveways or other private property without written consent of Owner.

C. The Contractor shall take all necessary measures to protect trees not to be removed from the site of the work against damage from machinery and from excavated material. Branches and roots shall not be cut unless permitted by the A/E.

D. Trees, cultivated plants, shrubs and hedges which might be damaged by the Contractor's operations shall be protected or shall be transplanted, cared for and replanted. If such trees, plants, shrubs or hedges are damaged to the degree that their growth or beauty is affected, they shall be replaced by the Contractor at his own expense. All surfaces which have been damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they were found just prior to the start of construction.

E. The restoration of existing property shall be done as promptly as practicable and not left to the end of the construction work.

F. Excavation and backfill operations adjacent to existing utilities, structures and construction shall be done in such a manner as will prevent the loss of ground or caving in of excavations, the undermining, damage or disturbing of existing pipelines, utilities, and structures or any completed construction of the project. Backfill shall be placed, compacted, and done in such a manner as to prevent future settlement and damage to the existing pipelines, utilities, structures, or construction. Existing pipelines, utilities, structures, new construction, or property damaged due to excavation, backfilling and settlement of the backfill, shall be the responsibility of the
Contractor and shall be corrected in a manner satisfactory to the A/E, at no additional expense to the Owner.

G. Unsuitable excavated material shall systematically be separated and removed from suitable material to the satisfaction of A/E.

H. Unsuitable material shall be promptly removed off-site at no expense to the Owner.

I. Surplus suitable material shall be the property of the Owner and stored on site as directed, or at the Owner's request, this material shall be removed from the site by the Contractor at no additional cost to the Owner.

J. Support banks of excavations, as required by local, state and federal regulations, to protect persons and property, using suitable combinations of shoring, sheet piling, bracing or other methods.

K. Excavations shall be carried to design depths.

L. If excavation is carried beyond line or below grade, except as directed, or subgrade is made unsatisfactory by act or neglect of Contractor, he shall remove such unsatisfactory material. No extra payment will be made for replacement with bank run gravel or first-class bedding.

M. Contractor shall provide adequate dust control during earthwork operations.

N. Contractor shall provide and maintain temporary barricades and traffic controls as required.

3.2 PROJECT CONDITIONS

A. "Dig-Safe" Damage Prevention System: All Contractors or Subcontractors performing drilling, boring, augering, jetting, sheeting or pile installation, demolition, excavation or like work shall, prior to commencement of these activities, contact utility companies having responsibility for underground transmission systems for information relative to locations of existing underground utilities and/or appropriate dig-safe damage prevention and notification agency. Provide Dig-Safe number to clerk of the works in writing.

B. Adequate protection measures shall be provided to protect workmen and pedestrians passing by the site. Streets adjacent property shall be fully protected throughout the operations.

C. Shoring, sheeting, and bracing and/or prefabricated trenching boxes shall be provided to prevent caving, erosion, or gullying sides of excavation.

D. Provide for surface drainage and erosion control during the period of construction in a manner to avoid creating a nuisance to adjacent areas. Keep all excavations free of water during the entire progress of the work, regardless of the cause, source, or nature of the water.

3.3 CUTTING PAVEMENT

A. Excavations made on pavement shall be made in a careful manner so as to cause the least amount of damage to the pavement. Roadway pavement in state highways, local roads, private ways, sidewalks, and easements having Class 1 and Class 2 Bituminous concrete pavement shall be cut prior to trench excavation. Pavement and/or cement concrete will be cut

6 inches either side of the maximum allowable trench width. Any damage to the cut line due to the excavations, backfilling or removal of temporary pavement shall be recut to neat lines at no additional cost to the Owner, prior to replacement of the specified finished pavement. The width of pavement removed shall be kept as narrow as practicable. Existing pavement and base course disturbed or damaged beyond the payment lines indicted shall be replace by the Contractor to match existing pavement and base course, at no additional cost to the Owner.

B. Contractor shall remove and dispose of existing bituminous concrete pavement off-site as is necessary to perform work of this contract as indicated. Removal of pavement shall be done in a neat manner by saw cutting a neat edge.

C. Contractor shall saw cut, remove and provide off-site disposal of concrete and bituminous walk pavement as is necessary to perform the work of this contract. Removal of concrete and bituminous walks shall be performed in a neat manner at the nearest joint of the remaining walk pavement.

D. Excavated pavement shall not be mixed with other excavated material which is to be used as backfill and shall be removed immediately from the site of the work.

3.4 ROCK EXCAVATION AND DISPOSAL

A. Rock excavation shall mean removal and disposal of rock material as directed by A/E.

B. The Contractor shall be solely responsible for any damage, direct or indirect, arising from rock removal operations and shall hold the Owner and A/E harmless from any costs, liens, charges, claims, or suits, including the costs of defense arising from such damage, real or alleged. No blasting will be allowed at this project without permission fro the Owner.

C. All rock removal shall be in conformance with local and state authorities having jurisdiction over this work.

D. Definition of "Rock Excavation" shall mean:

1. Materials that cannot be removed without systematic drilling and hoe ramming, such as rock material in ledges.
2. Concrete or masonry structures larger than 1 cubic yard in volume, and not less than 13" in least dimension.
3. Reinforced concrete larger than 1 cubic yard in volume and not less than 9” in least dimension.
4. Boulders 1 cubic yard or more in volume, sound rock material in ledges, bedded deposits and unstratified masses, which cannot be removed by normal excavation techniques.

E. When, during excavation, material is encountered that Contractor may classify as rock excavation, such material shall be uncovered and A/E notified by Contractor. Contractor shall not proceed with excavation of this material until A/E has classified material as earth excavation or rock excavation. Failure on part of Contractor to uncover such material and notify A/E will cause forfeiture of Contractor's right of claim for payment of rock excavation.

F. Excavated rock shall be removed from the site or deposited in such areas or locations selected by the Contractor with the approval of the A/E and the Owner.

G. Soft or disintegrated rock or hardpan which can be removed with a hand pick or power operated excavating machines, or loose or previously blasted rock will not be considered as rock excavation.

H. Before rock excavation commences, the Contractor shall uncover all ledge to be removed. Elevations shall be taken by a registered land surveyor, not employed by the Contractor. Surveyor will be paid by Contractor. After completing rock removal, elevations shall be taken again by the surveyor. Amounts of ledge removed shall be within the limits indicated on the drawings and will be agreed to by the Contractor and Owner. Excess rock removal and backfill material will be at contractor's expense.

I. Contractor shall develop cross sections to show and determine rock quantities for payment purposes. Cross sections shall be reviewed by the A/E.

J. The Contractor shall obtain written permission and approval of method from local or other authorities having jurisdiction before proceeding with the work. Explosives shall not be stored, handled and employed at this project without permission from the Owner. In general, no blasting will be allowed. Any damage caused by the work of the Contractor shall be repaired to the full satisfaction of the A/E.

K. Wherever rock is shattered below grade and is unfit for foundations the shattered rock shall be removed and replaced as specified. No extra payment will be made for overbreak or backfill as required.

L. No blasting shall be permitted without permission from the Owner. The Contractor shall familiarize all personnel on the project, the A/E and the general public with the implemented system.

M. No explosives, caps, detonators and fuses shall be stored on the site.

N. The Contractor shall be responsible for determining any safety requirement on this particular site so as not to endanger life, property, utility services, any existing or new construction, or any property adjacent to the site.

3.5 TRENCH EXCAVATION

A. Trenches shall be excavated in such a manner and to such widths as indicated on the contract drawings to allow pipes to be laid and joints to be formed and to allow for sheeting and shoring, dewatering and for removing and replacing unsuitable materials. Trenches shall be excavated to lines and grades shown on the drawings and shall include the removal of materials such as clay, pavements, sand gravel, soft or disintegrated rock, which will be removed without blasting or drilling, and boulders less than 1 cubic yard volume.

B. Wherever rock is encountered in trench excavation, rock shall be removed by a method acceptable to the A/E to the lines and grades indicated on the plans, or to a minimum depth of 12 inches beneath the pipe barrel.

C. Final decision as to suitability of excavated material for use as backfill or fill shall be made by the A/E. If, in the judgment of the A/E, the excavated material is unsuitable, the Contractor shall import bank run gravel to make up the deficiency.

3.6 TRENCH BACKFILL

A. Trenches and structure excavations shall not be backfilled until all required inspections have been satisfactorily performed and until the work as installed conforms to other requirements specified in the several sections covering the installation of the work. Trenches and other excavations shall be backfilled as soon as practicable with the specified material.

B. All pipes under this contract are to be laid in "first class bedding" as indicated on the contract drawings. Prior to backfilling the trench, the space on both sides of the pipe to a depth equal to half the diameter of the pipe shall be backfilled with "first class bedding" material. This layer shall be carefully tamped using tools acceptable to the A/E to obtain maximum compaction around and under the pipe at the same time being extremely careful not to cause movement of the pipe in either a lateral or vertical direction.

C. Gravel borrow backfill shall be deposited in the trench uniformly on both sides of the pipe for the entire width of the trench and to a depth not less than 12 inches over the top of the pipe. This layer shall be thoroughly compacted to the satisfaction of the A/E.

D. The balance of the backfill, to subgrade or finish grade as indicated, shall be made using trench excavated materials unless the Contractor is otherwise directed by the A/E to use bank run gravel as hereinbefore specified. The balance of backfill shall be random backfill spread in layers not exceeding 6 inches, each layer shall be dampened, thoroughly compacted by tampering or other acceptable method and shall contain no rock, stones or boulders larger than 6-inches in their greatest dimensions. The material shall be free from frozen material, clods of earth, brush or any other perishable or objectionable matter which would prevent proper consolidation or might cause subsequent settlement.

E. Compaction by water-jetting, puddling or ramming is prohibited. Where it is necessary to obtain maximum compaction, power tampers shall be used. The method of compacting shall be reviewed by the A/E.

F. During filling and backfilling operations pipelines will be reviewed by the A/E to determine whether any displacement of the pipe has occurred. If the inspection of the pipelines shows poor alignment, displaced pipe or any another defects, the defects designated by the Owner shall be remedied in a satisfactory manner by the Contractor at no additional expense to the Owner.

G. The backfill material shall be compacted to at least 95% of the maximum laboratory dry density as determined in accordance with ASTM D 1557, Method D.

3.7 MANHOLE AND/OR CATCH BASIN EXCAVATION

A. Excavations shall be of sufficient size to permit connections to and construction of the structures as shown and specified and to allow for sheeting and bracing, pumping and drainage and for removing and replacing unsuitable material as required.

B. Excavation shall include the removal of materials such as clay, pavements, sand, gravel, soft or disintegrated rock, and other materials which will be removed without blasting or drilling, and boulders less than 1 cubic yard in volume.

C. The extent of excavation shall be 24 inches wider than the base of the structures, and 6 inches below the base of the structures.

3.8 MANHOLE, AND CATCH BASIN BACKFILL

A. Manholes, drop inlets and catch basins excavations shall not be backfilled until all required inspections have been satisfactorily performed and until the work as installed conforms to other requirements specified in the several sections covering the installation of the work.

B. All manholes, drop inlets and catch basins shall be laid on a 6-inch layer of "first class bedding". This layer shall be carefully tampered using acceptable methods and tools to obtain maximum compaction under the structures.

C. The balance of the backfill, to subgrade or finish grade as indicated, shall be made using acceptable backfill materials. The balance of backfill shall be spread in layers not exceeding 6 inches, each layer shall be dampened, thoroughly compacted by tamping or other method and shall contain no rock, stones or boulders larger than 6-inches in their greatest dimensions. The material shall be free from frozen material, clods of earth, brush or any other perishable or objectionable matter which would prevent proper consolidation or might cause subsequent settlement.

D. Compaction by waterjetting, puddling or ramming is prohibited. Where it is necessary to obtain maximum compaction, such as under paved and parking lot areas and slabs on grade, power tampers shall be used. The method of compacting shall be reviewed by the A/E.

E. Compact soil to at least 95% of the maximum laboratory dry density determined in accordance with ASTM D 1557 Method D.

3.9 STRUCTURE EXCAVATION

A. All structure excavations shall conform to Section 31 20 00 - “Earthwork”.

3.10 BACKFILL AND COMPACTED FILL

A. Fill, backfill and compact fills as necessary to complete the work with hand and/or suitable power equipment.

B. No fill material shall be placed on frozen soil, nor shall snow, ice or frozen earth be brought in as fill. Fill material shall not be placed on material which has been affected by frost moisture.

C. Surface of backfill or fill in reach being constructed shall be maintained approximately level.

D. Acceptable on-site material and/or off-site borrow, shall be placed in successive, even, horizontal layers to a depth no greater than 6" loose measure. Stones larger than 6" shall be removed prior to compaction of each lift.

E. After each layer of backfill or fill has been spread, cleared of large stones and inspected, lift shall be compacted by not less than 4 complete coverages with specified roller, to 95 percent maximum dry density specified, as determined by laboratory tests in accordance with ASTM D 698-66, and field tests in accordance with ASTM D 1556-64.

F. Backfill or fill around pipes within building using hand tools to a point of 12" above pipe. Compact remainder of such backfill or fills using small tools such as power-driven tampers and vibrators, to suit fill materials.

G. Keep power-driven, rider-operated spreading, compacting and other heavy equipment away from walls, a minimum distance equal to height of fill above footings.

H. Where backfill or fill is placed around, or on, two sides of any structure, carry it up evenly. Avoid displacement or other damage to such structure.

I. Work shall be done in a manner that damage to construction, particularly dampproofing or waterproofing and other protective covering is avoided. Should damage occur, stop work in that area, repair damage, and request review of repairs before resuming work in this area.

3.11 COMPACTION EQUIPMENT

A. Rubber-tired roller-compactor, having 4 wheels equipped with pneumatic tires of such size and ply as can be maintained at pressures between 80 and 100 psi with 25,000 lb. wheel load during rolling operation. Roller-wheels shall be located abreast, and so designed that each wheel will carry approximately equal load in traversing over even ground. Spacing of wheels shall be such that distance between nearest edges of adjacent tires will not be greater than one-half width of one tire at operating pressure for 25,000 lb. wheel load. Roller shall have body suitable for ballast loading such that load per wheel may be varied, if so directed, between 10,000 lb. and 25,000 lb. Roller shall be towed at speeds not exceeding 10 miles per hour.

B. Acceptable drum type vibratory compactor operating at not less than 2000 vibrations per minute.

C. In any event, regardless of equipment used, compaction of soil shall meet the relative densities stated in this section.

END OF SECTION 31 2010

SECTION 31 2319 – DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to work of this section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
2. Division 31 Section "Earthwork" for excavation, backfilling, and site grading.
3. Division 33 Section "Subdrainage" for permanent foundation wall, underfloor, and footing drainage.
4. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda and revisions.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Design dewatering system, including comprehensive engineering analysis by a qualified State of Rhode Island registered professional engineer, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

B. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

C. Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a State of Rhode Island registered professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and Designer.

B. Field quality-control reports.

C. Other Informational Submittals:

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to dewatering including, but not limited to, the following:
   a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
   b. Geotechnical report.
   c. Proposed site clearing and excavations.
   d. Existing utilities and subsurface conditions.
   e. Coordination for interruption, shutoff, capping, and continuation of utility services.
   f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   g. Testing and monitoring of dewatering system.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Engineer no fewer than five days in advance of proposed interruption of utility.

2. Do not proceed with interruption of utility without Engineer's Construction Manager's Owner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is included elsewhere in the Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 31 2319

SECTION 31 3205 - SOIL EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 01 – General Requirements, apply to this Section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, Latest Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 31 1005 – Site Preparation

1.3 DESCRIPTION OF WORK

A. Furnish and install temporary control measures as needed during the progress of the work or as ordered by the A/E during the life of the contract to control water pollution through use of mulches, grasses, hay bale check dams, netting, fiber mats, silt fences, compost filter socks, and other erosion control devices and methods.

B. The Contractor shall attend a pre-construction meeting to discuss in detail his intended construction sequence and accompanying soil erosion and sediment control program.

C. The Contractor is responsible for compliance with the rules and regulations governing the enforcement of the Rhode Island Freshwater Wetlands Act.

1.4 SUBMITTALS

A. Submittals listing proposed materials including manufacturer's product data and test reports verifying conformance with design guidelines shall also be provided.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Silt Fence: Silt fence shall be Enviro Fence by Mirafi, Propex Silt Stop manufactured by Amoco Fabrics Company, or equal.

B. Baled Hay Erosion Check: The baled hay shall be approximately 36"x 18"x 24".

C. Hay Bales: Hay bales shall be mowings of acceptable herbaceous growth reasonably free from noxious weeds or woody stems and shall be reasonably dry. Hay bales shall be approximately 36" long x 18" wide x 24" high. Bales shall be anchored with 2" x 2" x 3' long wooden stakes.

D. Compost Filter Sock: Compost Filter Sock shall be Filtrexx Soxx, manufactured by Filtrex, or equal, shall be approximately 12” diameter and shall be ancored and installed in accordance with manufacturers specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time. Temporary pollution control measures will be used to correct conditions that develop during construction, that were not foreseen during the design stage, that are needed prior to installation of permanent pollution control features, or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project, at no additional cost to the Owner.

B. Where erosion has been identified during the pre-construction meeting, or has been identified during construction as being a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion control measures may be required between successive construction stages.

C. Contractor shall have on-site all necessary hay bales, silt fence, and storm drainage piping etc., prior to undertaking any work that may cause erosion.

D. The A/E will limit the area of excavation, borrow and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible, justified and indicated on plans at no additional costs to Owner.

E. In the event of conflict between these requirements and pollution control laws, rules and regulations of the federal, state or local agencies, the more restrictive laws, rules, or regulations shall apply.

3.2 INSTALLATION LOCATION OF COMPOST FILTER SOCK, BALED HAY AND SILT FENCES

A. During the construction phase, baled hay will be placed and maintained around all catch basins. Compost filter sock and/or silt fences will be installed prior to clearing and grubbing. Silt and debris will be removed from catch basins and base of compost filter socks, silt fences and baled hay at end of construction. The use of silt baskets in catch basins shall be used.

3.3 SPECIAL INSTRUCTIONS

A. Compost filter socks, silt fence and/or baled hay shall be inspected during storm events, after each rainfall of one-inch magnitude or greater, prior to weekends, and prior to any forecasted storm events. Weekly inspection reports by the Contractor shall be submitted to the A/E by the Contractor.

B. Damage to compost filter sock, silt fence or hay bales shall be repaired immediately upon discovery and not more than 4 hours from time of observed damage.

C. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled, and are ordered by the A/E, such work shall be performed by the Contractor at his own expense.

D. It is also the Contractor's responsibility to maintain the placement of compost filter sock, hay bales and silt fences.

E. Contractor shall also be required to install and maintain temporary erosion control measures within a time frame agreeable to the A/E.

F. Temporary pollution control may include construction work outside the project limits where such work is necessary as a result of utility installations and equipment storage sites.

G. The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor.

H. Contractor is responsible for all dewatering and erosion control.

END OF SECTION 31 3205

SECTION 31 3700 – RIPRAP

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

1.2 DESCRIPTION OF WORK

A. This work shall consist of the furnishing and placing of riprap consisting of sound, durable, angular shaped stones placed on prepared bedding and in conformity with these specifications and the lines, grades, thickness and typical details shown on the drawings.

B. The location of the riprap shall be as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The riprap shall be in accordance with the latest revision of the Rhode Island Department of Transportation, Standard Specifications for Rhode Island Bridge Construction, Section M.10.03 RIPRAP.

B. Bedding for riprap shall conform to quality requirements of Section M.10.03.1 of the before mentioned Standard Specifications.

C. The stone for riprap shall conform to Section M.10.03.2 of the Standard Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The riprap shall be installed in accordance with the Standard Specifications Section 920.03 Construction Methods.

END OF SECTION 31 3700

SECTION 31 3719 - GROUTED BOULDERS, STACKED GROUTED BOULDERS, AND GROUTED BOULDER RETAINING WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This WORK shall consist of installing grouted boulders, stacked grouted boulders, and grouted rock retaining walls constructed at the location (s) shown on the DRAWINGS.

1.2 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 31 2300, Excavation and Fill.
2. Section 31 2319, Dewatering.
3. Section 31 2333, Trenching and Backfilling.
4. Section 31 3700, Riprap

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T85, Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate.
   b. T103, Standard Method of Test for Soundness of Aggregates by Freezing and Thawing.
   c. T104, Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
2. ASTM International (ASTM):
   a. C39, Standard Test Method for Compressive Cylindrical Concrete Specimens.

b. C150, Standard Specification for Portland Cement.

c. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft^3 (600 kN-m/m^3)).

1.4 DEFINITIONS

A. Terms “boulders,” and “rock, “may be used interchangeably in this section.

1.5 SUBMITTALS

A. CONTRACTOR shall submit a mix design in writing to ENGINEER for approval prior to placement of any grout.

B. CONTRACTOR shall cooperate with ENGINEER in obtaining and providing samples of all specified materials.

C. CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.

1.6 QUALITY ASSURANCE

A. Mock-up:

1. Prior to the construction of any grouted rock walls, CONTRACTOR or SUBCONTRACTOR who is constructing the walls for CONTRACTOR shall show ENGINEER an example of similar rock walls that they had constructed previously.

2. After acceptance of this previous WORK, CONTRACTOR or SUBCONTRACTOR shall construct approximately one hundred (100) square feet of grouted rock wall as shown on the DRAWINGS for approval by ENGINEER.

3. If the construction is approved, CONTRACTOR or SUBCONTRACTOR shall construct the rest of the grouted rock wall. If the construction is not approved, CONTRACTOR shall make any changes required by OWNER and ENGINEER to obtain approval and construct the remainder of the wall as approved.

PART 2 PRODUCTS

2.1 MATERIALS

A. Boulders

1. Boulders shall meet the requirements of Section 313700 Riprap.

2. Rhyolite rock shall not be used for any grouted boulders.

3. Gradation:

a. Each load of boulders shall conform to the dimensions specified on the DRAWINGS and in Section 31 37 00 Riprap, Boulders, Soil Riprap, and Bedding

b. Boulders for a boulder edge shall have a maximum ratio of largest to smallest rock dimension shall be 1.5 or as shown on the DRAWINGS. Grouted walls shall be constructed of rock having a mean diameter of nine (9) inches to eighteen (18) inches.

c. Control of gradation will be by visual inspection.

1. In the event ENGINEER determines the boulders to be unacceptable, ENGINEER will pick two random truckloads to be dumped and checked for gradation.

2. Mechanical equipment and labor needed to assist in checking gradation shall be provided by CONTRACTOR at no additional cost to OWNER if the boulders do not meet the specified gradation.

3. If the boulders do meet the gradation specified, OWNER will pay for the equipment and labor required for checking.

4. Color:

a. The color of boulders shall meet the requirements of Section 313700, Riprap, Boulders, Soil Riprap, and Bedding.

B. Grout:

1. Concrete for the grout shall be an approved batch meeting the following requirements:

a. All grout shall have a minimum 28-day compressive strength equal to 3,200 psi.

b. One cubic yard of grout shall contain a minimum of six (6) sacks of Type II Portland cement.

c. A maximum of 25% Type F Fly Ash may be substituted for the Portland cement.

d. Aggregate for the grout shall consist of 70% natural sand (fines) and 30% 3/8-inch rock (coarse).

e. Slump shall be four (4) inches to six (6) inches.

f. Air entrainment shall be 5.5% - 7.5%.

g. Grout shall contain one and one-half (1-1/2) pounds of Fibermesh, or approved equivalent, per cubic yard of grout.

h. Grout shall contain one and one-half (1-1/2) pounds of Fiber mesh, or approved equivalent, per cubic yard of grout.

i. Color Additive in required amounts shall be used when so specified by contract.

PART 3 EXECUTION

3.1 GROUTED BOULDERS AND STACKED GROUTED BOULDERS

A. Grouted boulders shall be placed at the locations as shown on the DRAWINGS and installed with the following requirements:

1. Subgrade:

a. The subgrade to receive each boulder shall be excavated and any unstable material shall be removed.

b. Grouted Boulders shall be placed on subgrade without granular bedding unless approved by ENGINEER.

c. Material approved by ENGINEER shall be placed and compacted in a maximum of four-inch (4") lifts to ninety five percent (95%) of Maximum Standard Proctor Density (ASTM D698) to re-establish the subgrade of each boulder.

d. Unstable material shall be removed from the PROJECT site and disposed of by CONTRACTOR. Removal and replacement of unstable material shall only be completed at the direction of ENGINEER and shall be paid for under Muck Excavation.

e. Subgrade shall be excavated a minimum of 6" to a maximum of 12" behind boulders.

f. Backfill behind boulders shall be compacted to ninety five percent (95%) Maximum Standard Proctor Density (ASTM D698). Care shall be taken during compaction to avoid disturbing and/or damaging the integrity of the boulder channel edge.

g. Finished grades and subgrade for boulders shall be determined from the height of each boulder used.

2. Boulders

   a. The top of all boulders shall be as indicated on the DRAWINGS.

   b. The boulders shall be carefully picked and arranged so that adjacent rock surfaces match within two (2) inches in top elevation and two (2) inches along the vertical exposed face or channel side of rock.

   c. Boulders shall be placed such that adjacent boulders “touch” each other and voids do not exceed four (4) inches. It is the intent of construction to minimize voids and grout placed between boulders.

   d. CONTRACTOR shall, if deemed necessary, support the boulders from falling over before and during the placement of grout, backfill, and completing compaction WORK on either side of the boulder.

   e. Smaller rocks shall be “chinked in” to fill all voids behind the boulders. Smaller rocks shall also be used to "chink in gaps larger than four (4) inches. Placement shall be approved by ENGINEER prior to grouting.

3. Grouting:

   a. Prior to placing the grout, any type of debris, fines, smaller rock, or silt shall be removed from around or under and on the boulders.

   b. Dewatering shall be implemented to guarantee that the grout will not be placed in water and for a period of twenty-four (24) hours after the grout has been placed.

   c. Keep boulders receiving grout wet at all times prior to receiving grout.

   d. The concrete grout shall be placed by injection methods by pumping under low pressure, through a two- (2") inch maximum diameter hose to ensure complete penetration of the grout into the void area as detailed on the DRAWINGS. The grout mix shall be stiffened and other measures taken to retain the grout between the boulders.

   e. Grout placement shall begin at the bottom of the lowest boulder and proceed upward to ensure no air voids exist between the grout, sub-base, and boulders.

   f. Grout shall be placed up to a height of one-half (1/2) of the diameter of the top row of boulders or as directed by ENGINEER and shall be placed in the voids and behind the boulders and not on the surface of the rocks.

   g. A “pencil” vibrator shall be used to make sure all voids are filled between the boulders from the subgrade and around the boulders to a depth as shown on the DRAWINGS. The “pencil” vibrator may be used to smooth the appearance of the surface, but CONTRACTOR shall use a wood float to smooth and grade the grout around the boulders.

h. Grout between boulders shall be recessed one third (1/3) the diameter of the boulders on the side facing the channel.

i. Grout should be troweled out and finished to minimize visibility.

j. Clean and wash any spillage before the grout sets so the visual surfaces of boulders will be free of grout to provide a clean, natural appearance, or if washing does not clean off grout residue, CONTRACTOR shall wash off any grout residue with muriatic acid and water, using a brush to scrub off the residue.

k. Grout shall receive cold or hot weather protection in accordance with Section 33000, Cast-in-Place Concrete.

3.2 GROUTED BOULDER RETAINING WALLS

A. Grouted boulder retaining walls shall be placed at locations as shown on the DRAWINGS and installed with the following requirements:

1. The grouted boulder walls shall be constructed to the dimensions shown on the DRAWINGS and shall be constructed with a one (1) horizontal to four (4) vertical batter on the front and back face, with a minimum width of one (1) foot at the top of the wall.

2. The stone of the wall shall be laid to form substantial masonry presenting a neat, finished appearance.

3. Headers shall hold the heart of the wall to the face and shall occupy at least twenty percent (20%) of the area and they shall be evenly distributed.

4. The length of stretchers shall not exceed three (3) times their rise.

5. Spalls and pinners shall be used in the backing only where necessary and will not be allowed in the face.

6. Face Stones:

a. Face stones shall be laid to break joints so that each rock laid rests on two beneath it.

b. Rock shall be hand graded so that only the larger stones are used in the face.

c. All face stones shall be pitched to a string line on straight walls or laid to batter stakes for curved walls such that the batter is consistent with respect to all parts of the wall and shall meet the minimum requirements set forth in the detail.

d. The degree of roughness on the exposed face shall be measured with a six-foot (6') straightedge supported between adjacent projections and stone face.

e. Variations in excess of three (3) inches, measured from the straight edge to the extreme depression in the stone, will not be permitted.

f. Rear faces shall present approximately plane surfaces and shall in general conform to the detail.

7. Grouting:

a. Prior to placing the grout, any type of debris, fines, smaller rock, or silt shall be removed from around or under and on the boulders.

b. Dewatering shall be implemented to guarantee that the grout will not be placed in water and the area will remain dewatered for a period of twenty-four (24) hours after the grout has been placed.

c. The surface of the boulders receiving grout shall be wet at all times prior to receiving grout.

d. Grout shall be placed to fill all voids between, under and the throughout the boulder walls and shall be recessed approximately one-third (1/3) the diameter of the boulders from the face of the wall in order to give a “dry stacked” appearance.

e. A “pencil” vibrator shall be used to make sure all voids are filled between the boulders from the subgrade and around the boulders to a depth as shown on the DRAWINGS. The “pencil” vibrator may be used to smooth the appearance of the surface, but CONTRACTOR shall use a wood float to smooth and grade the grout around the boulders.

f. Any “loose” rocks shall be regrouped by machine or hand methods.

g. Clean and wash any spillage before the grout sets on the outside face and top of walls such that the visual surfaces of the rocks are free of grout to provide a clean natural appearance, or, if washing does not clean off grout residue, then CONTRACTOR shall wash off any grout residue with muriatic acid and water, using a brush to scrub off the residue.

h. Grout shall receive cold or hot weather protection in accordance with Section 33000, Cast-in-Place Concrete.

END OF SECTION 31 3719

SECTION 31 4000 - SHORING AND BRACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction,* 2004 Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 31 2000 – Earthwork

B. Section 31 2010 – Earthwork Utilities

1.3 SUMMARY

A. Extent of shoring and bracing work includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.

2. Maintenance of shoring and bracing.

3. Removal of shoring and bracing, as required.

B. Building excavation is specified in another Section 310000 - Earthwork.

1.4 SUBMITTALS

A. Layout Drawings: Provide layout drawings for shoring and bracing system and other data prepared and sealed by a registered Professional Engineer licensed in the State of Rhode Island. System design and calculations must be acceptable to local authorities having jurisdiction and the A/E.

1.5 QUALITY ASSURANCE

A. Supervision: Engage and assign supervision of shoring and bracing work to a qualified foundation consultant.

B. Regulations: Comply with local codes and ordinances of governing authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Before starting work, check and verify governing dimensions and elevations. Survey condition of adjoining properties. Take photographs to record any prior settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. Locate datum level used to establish benchmark elevations sufficiently distant so as not to be affected by movement resulting from excavation operations.

C. During excavation, resurvey benchmarks weekly, employing a licensed Land Surveyor licensed in the State of Rhode Island. Maintain accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags or other damage is evident.

1.7 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity, steam and other utility services and structures.

B. Notify municipal agencies or service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal and discontinuing of services, as affected by this work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide suitable shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

1. If wood is part of shoring system near existing structures, use pressure preservative treated materials or remove during placement of backfill.

PART 3 - EXECUTION

3.1 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.2 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to A/E.

C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

D. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to A/E, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

END OF SECTION 31 4000

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. RIDOT - State of Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, 2010.

C. City of Providence Standard Technical Specifications for Streets and Roads, Traffic, and Streetscape Construction, current edition.

1.2 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.

B. Related Requirements:

1. Division 02 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Division 31 "Earthwork" for subgrade preparation, fill material, unbound-aggregate subbase and base courses.
3. Division 32 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
4. Division 32 "Unit Paving" for bituminous setting bed for pavers.
5. Division 32 "Pavement Markings."

1.3 DEFINITIONS

A. RIDOT - State of Rhode Island Department of Transportation.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of RIDOT - State of Rhode Island Department of Transportation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:

a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.
2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
3. Job-Mix Designs: For each job mix proposed for the Work.

B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Paving Fabric: 12 by 12 inches (300 by 300 mm) minimum.

C. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and testing agency.

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by RIDOT.

B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of RIDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

E. Flood Testing: At the discretion of the Landscape Architect, the Contractor shall flood test all asphalt pavement for proper drainage by flooding with water in ample quantities to demonstrate the correct shaping of the pavement.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Base Coarse: Comply with Section “Earthwork” for pavement base material.

C. Subbase Course: Comply with Section “Earthwork” for pavement subbase material.

D. Mineral Filler: Comply with RIDOT requirements.

E. Reclaimed Asphalt Pavement: Comply with RIDOT requirements.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320, Comply with RIDOT requirements.

B. Prime Coat: Asphalt emulsion prime to comply with RIDOT requirements.

C. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Fog Seal: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled tires asphalt shingles or glass from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D 1073 or AASHTO M 29, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: Comply with RIDOT requirements.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content and preconsumer recycled content conforming with Comply with RIDOT requirements.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by RIDOT and designed according to procedures for mix design for asphalt concrete and other hot-mix types; and complying with the following requirements:

1. Provide mixes for pavement course and mixes with a history of satisfactory performance in geographical area where Project is located and comply with RIDOT requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth (0.5 to 1.40 L/sq. m per 25 mm depth). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.9 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to RIDOT requirements.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Flood Testing: All asphalt pavements shall be flood tested for proper drainage by flooding with water in ample quantities to demonstrate the correct shaping of the pavement.

1. Landscape Architect must be present to witness the flood tests. The Contractor shall notify the Landscape Architect a minimum of 3 working days prior to the flood testing.
2. Flood test immediately after the asphalt is capable of handling traffic, but within 24 hours. If, after 20 minutes of drying time there are birdbaths evident, pavement with excessive ponding shall be repaired. Areas with ponding which have a water depth of 3/16 inch or more shall be corrected.
3. Repair: Any areas requiring correction by means of remedial overlay shall be prepared by grinding the pertinent areas and placement of fine asphalt concrete patch mix over a tack coat. No cold tar patching, skin patching or sand mix patching will be acceptable.

G. Replace and compact hot-mix asphalt where core tests were taken.

H. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION 32 1216

SECTION 32 1373 – CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. RIDOT - State of Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction, 2010.

C. City of Providence Standard Technical Specifications for Streets and Roads, Traffic, and Streetscape Construction, current edition.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer and testing agency.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products prior to commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 4.4 deg C.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. General: Pavement sealants shall be a polyurethane based complying with ASTM C-920, Type S (single componenent),or Type M (multicomponent),Use group T (traffic) or NT (non-traffic), Class 35 (minimium) and the following. Any sealants used shall be recommended for the specific use by the manufacturer. Sealant and backer-rod materials shall be compatible as noted by the manufacturers submitted.

1. Horizontal joints in areas of vehicular traffic shall comply with: ASTM C-920, Grade P (pourable or self-leveling) Use T. Color Grey.
2. Horizontal joints in areas of pedestrian, or light vehicular traffic shall comply with ASTM C-920, Grade NS (non-sag), use T or NT. Submitted product shall be available in a minimum of 7 standard colors.
3. Vertical Joints: Shall comply with ASTM C-920, Grade NS (non-sag), use T or NT. Submitted product shall be available in a minimum of 7 standard colors.

B. Typical Manufacturers (non exclusive):

1. BASF.
2. Bostik.
3. Pecora.
4. Sika.
5. Tremco.
6. W. R. Meadows.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform

beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for sealants in areas of vehicular traffic per manufacturers recommended recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

SECTION 32 1613 – CONCRETE CURB

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Precast concrete curbing and accessories.

B. Excavation, preparation of subgrade, installation, and backfilling.

1.2 RELATED SECTIONS

A. Section 033001 - Concrete.

1.3 REFERENCES

A. ASTM C150 - Portland Cement.

B. ASTM C260 - Air-Entraining Admixtures for Concrete.

C. ASTM C330 - Lightweight Aggregates for Structural Concrete.

D. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. State Standards: Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

G. RIDOT Standard Details, July 31, 2009, with latest revisions.

1.4 QUALITY ASSURANCE

A. Provide one person thoroughly trained and experienced in the skills required, familiar with the design and application of work of this Section, present during progress of the work of this Section and directing work performed under this Section.

1.5 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Indicate unit configuration, reinforcing, and dimensions.

1.6 COORDINATION

A. Coordinate work under provisions of Section 013100.

B. Coordinate the work with pavement placement.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products under provisions of Division 01.

B. Protect concrete curbing materials before, during and after installation and protect the installed work and materials of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Curbing: Curbing shall conform to Section 906 the Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

2.2 FABRICATION

A. Form precast concrete curbing in accordance with State Standards.

B. Forms: Metal, surfaces clean cut, free from blow holes or pitted areas. Do not pour concrete when ambient temperature is below 45 degrees F at the mixing site.

C. Precast curbing shall be subject to inspection at point of manufacture and on the project, and units showing defects or damage before completion of the project shall be removed and re-placed at no additional cost to the Owner.

D. Cast straight curb in lengths not to exceed 6 feet (1800 mm). Radius curb shall be cast to the radius designated on the Drawings.

E. Dowel units together with 5/8 inch (16 mm) by 4 inch (100 mm) dowels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify work of other trades is complete to the point where this installation may properly com-mence.

B. Verify concrete curbing may be installed in accordance with the Drawings, applicable codes, regulations, and referenced standards.

C. In the event of discrepancy, immediately notify the Architect.

D. Do not proceed with installation in areas of discrepancy until discrepancies have been resolved.

3.2 PLACEMENT OF CONCRETE CURBING

A. Concrete curbing and related backfilling shall be placed in accordance with the RIDOT Standards.

B. Install units without damage to shape or finish. Replace or repair damaged units.

C. Install units in alignment with adjacent work.

END OF SECTION 32 1613

SECTION 33 1000 – WATER SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 31 1005 - Site Preparation

B. Section 31 2000 - Earthwork

C. Section 31 2010 - Earthwork Utilities

1.3 DESCRIPTION OF WORK

A. The Contractor shall accept the premises as they stand and do everything necessary to complete the work in accordance with this contract. The Contractor shall obtain all permits necessary to complete the work. The work covered under these items includes the furnishing of all labor, equipment, and materials, and in performing all operations in connection with furnishing and installing water pipe, pipe fittings, valves, valve boxes, hydrants, water service connections, fire protection service connections, connections of existing and new piping, miscellaneous metal for strapping piping, underground line markers, accessories, miscellaneous and appurtenant work for providing construction of indicated and/or as directed, complete in place tested, disinfected and accepted, in accordance with the specifications, drawings and the requirements of the City of Providence and RIDEM.

B. Piping for water mains, water services and appurtenances shall be of the types and materials specified. The pipe, fittings, valves, hydrants, specials, etc., accessories and appurtenances shall be new and unused. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved methods. The full length of each section of piping shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relayed. Pipe shall not be placed in water, or when trench or weather conditions are unsuitable for the work, except by permission of the A/E. Water shall be kept out of the trench until the joints have been completed, or until caulking is completed. Any section of pipe found to be defective before or after laying shall be replaced by the Contractor with sound pipe, without additional expense to the Owner. All bends, tees and such other locations indicated or as directed shall be firmly blocked with concrete thrust blocks

of sizes and shape indicated and as directed, and strapped where required, to prevent the pipe, pipe fittings and appurtenances from being blown off the lines when under pressure. Where connections are made between new work and existing work the connections shall be made using the specials and fittings specified, as indicated, or as required. All connections between new work and existing work shall only be coordinated and installed in a manner acceptable to the Owner previously reviewed by the A/E. The locations of connection between new and existing work are shown on the drawings. The exact locations of connections of new work to existing work shall be as directed by the A/E. The Contractor shall make the necessary excavations as directed to uncover existing work for the purpose of determining the exact locations for all connections of new work to existing work.

C. It is intended herein that the Contractor provide a water and fire protection supply distribution system satisfactory in every respect to the Owner and ready for operation.

D. Refer to Division 33, Section “Utility Earthwork” for excavation and backfill required for water systems.

E. Water services to the existing structures shall be maintained without interruption during the entire construction period. Coordinate this phase of construction with Plumbing Contractor, Fire Protection Contractor and any Authorities having jurisdiction.

1.4 SERVICE APPLICATION

A. The Contractor shall be responsible for making and paying for service application for main supply, if required. The Contractor shall pay all fees and charges until completion of the contract.

1.5 SUBMITTALS

A. Copies of all shop drawings and product data sheets required to establish compliance with those specifications shall be submitted to the A/E.

B. Coordination drawings showing pipe sizes and valves, and specialty locations and elevations. Include details of underground structures, connections, anchors, and reaction backing. Show other piping and clearances from water system piping. Indicate interface and spatial relationship between piping and proximate structures.

C. Record drawings at Project closeout of installed water system piping and products according to Division 01 Section 01 7700 "Closeout Procedures".

D. Test reports specified in "Field Quality Control".

1.6 "DIG-SAFE" DAMAGE PREVENTION SYSTEM

A. All Contractors or Subcontractors performing drilling, boring, augering, jetting, sheeting or pile installation, soil preloading for consolidation, demolition, excavation or like work shall, prior to commencement of these activities, contact utility companies having responsibility for under-

ground transmission systems for information relative to locations of existing underground utilities and/or an appropriate dig damage prevention and notification agency.

1.7 QUALITY ASSURANCE

A. Comply with standards of authorities having jurisdiction for fire protection systems. Include materials, installation, and testing.

B. Comply with standards of authorities having jurisdiction for potable water piping. Include materials, installation, testing, and disinfection.

C. Comply with NFPA 24 "Standard for Installation of Private Fire Service Mains and Their Appurtenances" for materials, installations, tests, and flushing.

D. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

E. Product Options: Water systems specialties and accessories are based on specific types, manufacturers, and models indicated. Components by other manufacturers will not be considered, unless noted otherwise.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends, flange faces, and weld ends.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect valves from weather. Store valves indoors and maintain temperature than ambient dew point temperature. Support valves off ground or pavement in water tight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.9 PROJECT CONDITIONS

A. Site Information: Reports on subsurface condition investigations made during the design of the Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions (between soil borings). Owner assumes no responsibility for interpretations or conclusions drawn from this information.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Line Markers for Metallic Pipelines: Manufacturer's standard permanent, bright colored, continuous-printed polyethylene tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide blue tape with black printing reading **"CAUTION WATER LINE BURIED BELOW"** as manufactured by Seton or equal.

2.2 PIPE AND PIPE FITTINGS

A. Ductile-Iron Piping: Piping where noted on drawing shall be double cement lined ductile iron push on joint pipe, bitumen coated, Class Thickness No. 52 in accordance with ANSI Standard A21.50, A21.51 and AWWA C-151.

B. Fittings: Fittings shall be ductile-iron, cement lined, compact, mechanical joint conforming to ANSI 21.10 and AWWA C-153.

1. Cement lining for cast-iron fittings shall be batched and applied in accordance with AWWA specifications C104-64. Cement linings shall be double thickness not less than 1/8" for diameters 4" through 12".
2. Mechanical joint fittings and adapters shall conform to ANSI A21.10 for diameters 4" to 12".
3. The fittings shall be smooth and free from defects of every nature which would make them unfit for the use for which they are intended. No plugging or filling will be allowed.
4. Fittings shall receive an exterior coating of hot bituminous asphalt paint.

C. Couplings shall be furnished with corrosion-proof vinyl coating on middle ring and followers.

D. Copper Piping: Service pipe shall be of seamless copper tubes suitable for use as underground water service connections conforming to ASTM Specification B-88-47, Type K and Federal Specification WW-T-799, Type K, including the latest revision thereof. The copper shall be deoxidized with phosphorous and shall have a purity of at least 99.90 percent as determined by electrolytic assay, silver being counted as copper. Samples for chemical analysis shall consist of

clean drillings or milling taken from tubes selected for testing purposes. The tubes shall be sound and of uniform thickness throughout. They should be free from cracks, seams, slivers, scale and other surface defects. The manufacturer must guarantee to the Owner that the tubes furnished shall be of the best quality of material and of composition within the specified limits, and that each tube has been subjected to the specified hydrostatic pressure before leaving the shop.

1. Fittings: Fittings for service pipe shall be of the cast bronze, compression, flared tube type. Metal shall contain approximately 85% copper, 5% tin, 5% lead and 5% zinc. Threads shall be iron pipe size.

2.3 FLEXIBLE COUPLINGS

A. Where flexible couplings are called for on the drawings, or use is directed by the A/E, they shall be Dresser, Skinner, Smith Blair or equal for Class 52 Ductile Iron Pipe. Coupling shall be furnished with corrosion-proof vinyl coating on middle ring and followers. Adapters shall conform to the manufacturer's specifications.

2.4 STRAP RODS

A. Where called for on the drawings or for purpose of anchoring pipe or fittings shall be 3/4" round steel or wrought iron. Clamps shall be not less than 2" wide and 3/8" round. Clamps and rods are to be protected against corrosion by heavy coat of bituminous asphalt varnish after final assembly. Where pipe or fittings will be exposed under normal conditions, joints shall be sufficiently restrained so as to prevent blow off of pipe or fittings or movement of same during normal use.

2.5 THRUST BLOCKS

A. Concrete for thrust blocks shall be 4000 psi, in 28 days or higher if so indicated.
B. Area of Bearing Surface for Concrete Thrust Blocks

Pipe Size in.	90° Bend or 1/4 Bend sq ft	45° Bend or 1/8 Bend sq ft	Tees, Hydrants, Caps, Plugs sq ft
2 - 4	2	2	2
6	5	3	4
8	8	5	6
10	13	7	9
12	18	10	13
14	25	14	18
16	32	18	23

Areas in this table were derived using 225 psi water pressure and 2000 lb/sq. ft. soil resistance. This is typical of sand and gravel with clay. For other soils, multiply the take valves by the following factors:

Soft clay 4	Sand and gravel cemented with clay 0.5
Sand 2	Shale, hardpan 0.4
Sand and gravel 1.3	

2.6 VALVES

A. Resilient Seat Gate Valves: Gate valves for buried service shall be mechanical joint o-ring stem seals, manufactured in accordance with American Water Works Association Standard Specifications for Gate Valves for Ordinary Water Works Service, AWWA designation C-509 of latest revision, as manufactured by Mueller Co., A-2370-20, U.S. Pipe or approved equal. Gate valves shall be double disc, parallel seats, non-rising stem designed for 175 psi working pressure for valve diameters 12” or smaller.

B. Tapping Valves: Tapping valves shall be mechanical joint, open right, vertical gate valves meeting the requirements of AWWA C500, as manufactured by Mueller H-667, U.S. Pipe or American Flow Control, or approved equal. The valves shall be double disc, parallel seat wedge design and design rated for 200 psi minimum working pressure. The valves shall be flanged inlet and mechanical joint outlet; inlet flange shall be ASA-125 lb. with protruding aligning lip to register with the counter bore of the tapping sleeve.

C. Valve Boxes: Valve boxes shall be 5-1/4 - inch minimum diameter two piece, buffalo type, adjustable of the sliding type, round body, heavy pattern, with at least ten inches of overlap of top section over the other and with flanged top section. The castings shall be made of gray cast-iron, true to pattern and free from flaws. They shall be thoroughly coated with an asphaltum varnish, inside and out. The covers shall have the word "WATER" cast in the top. At the completion of the work valve boxes shall be set plumb and flush with the road surface.

D. Valve Key: The Contractor shall furnish one standard valve operating key, and provide a suitable mounting bracket adjacent to the hydrant wrench in the maintenance room or in a location directed by the Owner.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Cutting Pavement: Excavations made on pavement shall be made in accordance with the details shown on the drawings and as specified in Division 33 – “UTILITIES EARTHWORK” Section.

B. Trench Excavation: Trenches shall be excavated to lines and grades shown on the drawings and shall be as specified in Division 33 “UTILITY EARTHWORK” Section.

C. Excavation Support System: The Contractor shall furnish, put in place, maintain and remove, as required and/or necessary for safe and proper construction, all excavation support systems which may be required to support the sides of the excavation, preventing damage to persons, adjacent property and structures.

D. Pumping and Dewatering: The Contractor shall furnish all pumps, equipment, power and attendance to maintain and operate such pumping and dewatering systems consisting of any means and devices, including spare units in case of breakdown, which accomplish the removal and prompt disposal of all water entering the excavation. The pumping manner, method or both shall be sufficient such that the natural state of the soil is not significantly disturbed and that ground water is controlled at levels which will permit all work to be performed in dry conditions.

E. Trench Backfill: Trenches and other excavations shall not be backfilled until all required inspections have been satisfactorily performed and until the work as installed conforms to other requirement specified in the several sections covering the installation of the work. Trenches and other excavations shall be backfilled as soon as practical. Backfill to subgrade or finish grade as indicated shall be made using trench excavated materials, unless the Contractor is otherwise directed by the A/E to use bank run gravel. Backfill shall be spread in layers not exceeding 8", each layer shall be dampened, thoroughly compacted by tamping or by other acceptable method to at least 95% of the maximum laboratory dry density determined in accordance with ASTM D 1557, Method D and shall contain no rock, stones or boulders larger than 6" in their greatest dimensions. The material shall be free from frozen material, clods of earth, brush or any other perishable or objectionable matter which would prevent proper consolidation or might cause subsequent settlement.

3.2 IDENTIFICATION MARKERS

A. Install identification marker two (2) feet above top of pipe or in accordance with requirements of the State of Rhode Island.

3.3 INSPECTION

A. All pipe, fittings, valves and hydrants shall be carefully inspected for defects immediately prior to placing in the trench.

3.4 INSTALLATION OF PIPE

A. Each pipe shall be handed into the trench carefully and in a workmanlike manner. The Contractor shall furnish all slings and straps to permit satisfactory support of all parts of pipe when it is being handled. The Contractor shall take all necessary precautions to prevent movement of pipe in the event of the trench flooding. Any length of pipe broken or damaged due to mishandling or negligence on the part of the Contractor shall be replaced at no cost to the Owner.

B. Ends of pipe shall be thoroughly cleaned before joint is made. The surface of the joint shall be painted with required lubricant applied in accordance with the manufacturer's direction. The lubricant shall be of type recommended by pipe manufacturer. Pipes shall be jointed in strict accordance with pipe manufacturer's directions and work shall be done by skilled workmen.

C. No pipe or fittings shall be laid in water or on a frozen trench bottom or when, in the opinion of the A/E, the trench conditions or the weather are unsuitable for such work. All joints shall be checked by feeler ring gauge to insure proper positioning of rubber gaskets.

D. Comply with requirements of NFPA 24 for materials and installation.

E. Install ductile-iron pipe and ductile-iron fittings according to AWWA C600.

1. Install polyethylene encasement according to AWWA C105 on ductile-iron pipe, ductile-iron fittings, and ferrous couplings where specified.

F. Install copper tube and wrought-copper fittings according to CDA No. 404/0 “Copper Tube Handbook”.

3.5 DUCTILE-IRON FITTINGS

A. Ductile-iron fittings of the proper type shall be furnished and installed wherever shown on the drawings and as required by the A/E. All ductile-iron fittings shall be double cement lined.

B. The bells of ductile-iron fittings shall be supported on wood blocks or skids to prevent settlement and resulting shear action to attached pipes. Wood blocks at fittings shall remain in place. At all plugged tees the plug shall be strapped to tee.

C. Bends and tees shall be installed in the mains where shown on the contract drawings. Vertical bends where shown on the drawings shall be anchored in both directions with pipe-clamps and tie-rods. All other fittings shall be equipped with proper sized thrust blocks poured against undisturbed earth. The Contractor shall provide the necessary tie rods and clamps. Tie rods and clamps shall be as manufactured by the Grinnell Company, Inc. or approved equal.

3.6 PLACEMENT OF THRUST BLOCKS

A. Thrust blocks shall be sized according to table on detail sheet of construction plans to prevent movement of the pipe and shall in all cases be poured against undisturbed earth. Where thrust blocks are in contact with the pipe, concrete shall be kept clear of pipe joints.

B. Concrete thrust blocks shall be constructed at all underground ductile-iron fittings that result in a change of direction of pipe line.

3.7 INSTALLATION OF VALVES

A. Valves shall be installed in the mains approximately where shown on the contract drawings. Each valve shall be equipped with a gate box set vertically with top even with finished grade.

3.8 DEFLECTION

A. Wherever curves are negotiated by deflecting successive lengths of pipe the deflection of each length of pipe shall not exceed 3 degrees.

3.9 FIELD QUALITY CONTROL

A. Testing:
   1. The pipe line shall be tested with potable water, both for strength and tightness as Specified below. The Contractor shall furnish all labor and equipment necessary for tests. Tests shall be made by sections, between main line valves, one section at a time. Water for testing will be available from the existing water system and will be furnished without charge. Water shall not be wasted.
   2. Air shall be expelled by filling the main slowly and permitting air to escape at high points. Air bleeder shall be installed in location directed by the A/E.
   3. The pipe shall be filled with water and kept full for a period of not less than twenty-four (24) hours preceding the test and until there is no leakage observable which the section under tests is subjected to system's normal static pressure. Normal static pressure shall be an average for the area.
   4. Pressure shall be applied and maintained by means of a pressure pump and a by-pass on which a water meter and pressure gauge are mounted. Observations shall be made and metered water readings taken at varying pressures up to 175 lbs. per sq. in. Not less than 150 lbs. pressure shall be maintained for a period of one hour.
   5. Any defective joints shall be immediately repaired, and any cracked or otherwise defective pipe shall be replaced by the Contractor and the test repeated. As soon as satisfactory "test for strength" has been obtained, the by-pass with water meter and pressure gage shall be left in service, and the section shall remain under a pressure of not less than 100 lbs. per square inch until the leakage in the entire section does not exceed thirty (30) gallons per day per mile of pipe per inch of nominal pipe diameter. In no case shall leakage tests be for less than four hours. Pipe sections under test shall be isolated from the existing system with plugs and blocking to avoid any cross connection during disinfection and testing.
   6. In the event the leakage exceeds the above stated maximum allowable, the Contractor shall take such steps as are required and necessary, or as directed by the A/E, to reduce leakage to below the allowable maximum amount and shall replace any and all defective joints or piping and the test shall be repeated until the leakage requirements are complied with.
   7. All visible leaks shall be repaired in any event.
   8. The Contractor shall make all necessary arrangements for obtaining supply, furnish all pumps, piping, hose, installing corporation cocks if necessary, etc., and remove same, except corporation cocks, when work is completed. No separate payment will be made by the Owner to the Contractor for testing. All work shall conform to AWWA C600-65 or the latest revision thereof.

B. Flushing of Main:
   1. After testing and prior to disinfection the main shall be well flushed through the hydrants.

C. Chlorination of Mains:
   1. Before the system is put into service and generally at the time pipe is tested, the pipe and appurtenances shall be sanitized by introducing into the system a quantity of chlorine solu-

tion such as will result in a minimum residual chlorine content of 50 PPM of free chlorine in the water contained in the pipe being sterilized. The main shall be filled with water with chlorine being introduced gradually (care being taken to get all air out of the main), and allowed to stand for at least 24 hours. Just before the system or any part of system is placed in service, it shall be flushed out as may be necessary, until tests show that system or part thereof is reasonably free of objectionable bacteria, or excess chlorine content and suitable for carrying potable drinking water. All work shall conform to AWWA C-601-72 or the latest revision thereof.

2. After sanitizing the system or any part of the system is completed, an approved laboratory will take samples of water from the sterilized main and if tests of such samples are satisfactory main will be approved for use. In the event that such tests are not satisfactory, the main shall be re-sterilized to the extent that tests are approved. The cost of all tests required for approval shall be borne by the installation contractor.

END OF SECTION 33 1000

Section 33 3000 - SANITARY SEWERAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction,* 2004 Edition with latest addenda.

1.2 RELATED SECTIONS

A. Section 31 2000 – Earthwork

B. Section 31 1005 – Site Preparation

C. Section 31 4000 – Shoring and Bracing

D. Section 31 2010 – Earthwork Utilities

1.3 DESCRIPTION OF WORK

A. The Contractor shall furnish all plant, labor, equipment, appliances and materials, and perform all operations in connection with construction of sanitary sewerage system at the locations and to the lines and grades indicated on contract drawings and/or as directed. The work includes pipe, pipe fittings and accessories, connections to structures, testing of piping, material tests, jointing and jointing materials, by-pass sewage handling, services of manufacturer's representatives, and all other related and appurtenant work, complete in place in accordance with contract drawings and specification, and/or as directed.

B. Refer to Section 330000 "Earthwork Utilities" for the requirements for excavation, backfill, bedding, etc.

1.4 QUALITY ASSURANCE

A. Installers Qualifications: Installer shall be a licensed drain layer with the State of Rhode Island and with at least 3 years of successful installation experience on projects with sanitary sewerage work similar to that required for project.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings for sanitary sewerage systems, showing the layout and dimensions in accordance with specifications.

B. Record Drawings: At project closeout, submit record drawings of installed sanitary sewerage piping and products, in accordance with requirement of Division 1.

1.6 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall arrange for the delivery of the products at approved locations in the vicinity of that portion of the project in which the products are to be installed. To this end, he shall do such work as is necessary for access and for delivery of the products. All products shall be stored in an approved, orderly manner so that there will be a minimum of re-handling from the storage area to the final position in the trench and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that the progress of the work is at no time delayed and also so that large quantities of products shall not be stored for excessive lengths of time in crowded locations or in locations where large storage areas might be considered objectionable. Storage of products will be restricted to approved or permitted areas.

B. Products shall not be stored on areas over the newly laid pipeline or other pipe lines which might be damaged by the superimposed load. Products may not be stored on private property unless permission to do so has been granted by the property Owner.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Line Markers for Non-Metallic Pipelines: Manufacturer's standard permanent detection tape, bright-colored, continuous-printed polyethylene tape with a metallic core for easy detection of non-metallic underground installations, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green detection tape with black printing reading "CAUTION SEWER LINE BURIED BELOW" as manufactured by Seton or equal.

2.2 PIPE

A. Polyvinyl Chloride Pipe (6"-15") and Fittings: Polyvinyl chloride (PVC) sewer pipe and fittings shall be in accordance with the latest issue of ASTM Specification 3044, SDR-35 and applicable documents. The PVC sewer pipe and fittings shall be composed of clean, virgin class 12454-B compounds and shall be bell and spigot with rubber ring joints. The bell shall consist of an integral wall section with a solid cross section rubber ring securely locked in place to prevent dislocation of the ring. Standard lengths shall be twenty (20) feet and 12.5 feet, plus or minus 1 inch. Minimum "pipe stiffness" at 5% deflection shall be 46 for all sizes when tested in accordance with ASTM Designation D 2412, external loading properties of plastic pipe by parallel-plate loading. All fittings and accessories shall be manufactured and furnished by the pipe

supplier and have bell and/or spigot configurations compatible with that of the pipe fittings and shall be of the same strength and quality as the pipe.

2.3 MANHOLES

A. Precast Concrete Manholes: Manholes barrels, cone sections, bases and entrance slabs shall consist of precast reinforced concrete manufactured in accordance with ASTM Standard Specifications for "Reinforced Concrete Manhole Risers and Tops", Designation C 478 latest revision. The horizontal joints between sections shall be sealed using a flexible butyl resin sealant and shall conform to Federal Specifications SS-S-210A and AASHTO M-198B. In addition the horizontal joints on the inside and outside of manhole shall be sealed with a "Quick Plug" as manufactured by Parson or equal.

B. Drop Manholes: Drop piping shall be in accordance with details shown on contract drawings. The concrete encasement for the drop piping shall be 3000 psi. Forms shall be used for the concrete encasement. The manhole shall be as specified for either cast-in-place or precast concrete manholes.

C. Pipe Connectors: Resilient complying with ASTM C 923. For pipes, the pipe connectors shall be Kor-N-Seal.

D. Manhole Steps: Manhole steps shall be of safety type and shall be cast into the units during process of manufacture. Steps shall be polyprolylene or aluminum forgings alloy 6016, Temper T-6 and those parts which are embedded in the concrete shall be thoroughly cleaned and given a heavy coating of zinc chromate or other approved paint.

E. Frame and Covers: Manhole frames and covers shall be of tough gray cast iron, true to pattern and free from flaws. The bearing surfaces of the covers and frames shall be machined so as to give continuous contact throughout their circumference. The design on the cover top shall be the diamond with "sewer" lettering and the year of installation cast into the top surface. Before delivery, the frames and covers shall be thoroughly cleaned and coated with hot coal tar.

F. Brick: Brick shall be Grade SS, ASTM Designation C 32. All brick shall be uniform and regular in shape and size.

G. Mortar: Type II cement shall be used, unless otherwise authorized in writing.
Sand shall be well graded and with no grain larger than will pass a No. 8 sieve.
Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C207-79.
The mortar shall be composed of Portland Cement, hydrated lime, sand and water in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime. The portions of cement and lime may vary from 1:1/4 for dense hard burned brick to 1:3/4 for softer brick. In general, mortar for Grade SS brick shall be mixed in the proportions of 1:1/2:41/2.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Dig-Safe Damage Prevention System: All Contractors or Subcontractors performing drilling, boring, augering, jetting, sheeting or pile installation, demolition, excavation or like work shall, prior to commencement of these activities, contact utility companies having responsibility for underground transmission systems for information relative to locations of existing underground utilities and/or an appropriate dig safe damage prevention and notification agency.

B. Protection of Water and Drain Lines:
   1. Horizontal Separations: If during construction of the sanitary sewer line the existing or proposed water main line is exposed in the sewer trench and the sewer line is closer than 10 feet from the water main, the sewer line shall be sleeved.
   2. Vertical Separation: Whenever the sewers cross under the water mains, the vertical separation of the top of the sewer shall be at least 18 inches below the bottom of the water main. When this vertical separation does not exist, the sewer line shall either be encased in concrete, constructed of Class 52 ductile iron mechanical joint pipe or be sleeved for a distance of 10 feet on each side of water main.

3.2 IDENTIFICATION MARKERS

A. The line markers shall be installed two feet above the top of the buried pipeline.

3.3 INSPECTION

A. All sanitary sewerage system products shall be subject to inspection and approval by the Engineer at the place of manufacture and/or at the site after delivery. The products shall be subject to rejection at any time due to failure to conform to the specifications. Rejected products shall be removed from the site immediately. All the products shall be carefully examined for defects, and if any are found to be broken or defective, prior to or after being placed, they shall be removed and replaced by the Contractor without any further compensation.

3.4 PRODUCT HANDLING

A. Each product shall be handled into its position in the trench in such a manner and by such means as the manufacturer recommends as satisfactory, and these operations will be restricted to those considered safe for the workmen and such as to cause no injury to the product or any property.

B. The Contractor will be required to furnish slings, straps and/or other devices to provide satisfactory support of the pipe when it is lifted. Transportation from delivery areas to the trench shall be restricted to operations which can cause no injury to the product. The products shall not be dropped from trucks or into the trench.

C. The Contractor shall have on the job-site with each crew, all the proper tools to handle the products being installed. The use of hammer and chisel, or any other method which results in rough edges, chips and damages, shall be prohibited.

3.5 CONTROL OF ALIGNMENT AND GRADE

A. All work shall be constructed in strict accordance with the lines and grades shown on the contract drawings and the Contractor shall be held fully responsible for keeping correct alignment and grade.

B. All lines, grades, measurements, layout staking and reference staking necessary for the proper location and satisfactory completion of the pipeline, appurtenances and other construction, shall be the responsibility of the Contractor.

C. All stakes, references and batter boards including original, additional or replacement which may be required for the construction operations, shall be furnished, set and properly referenced by the Contractor. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions shall be called to the Engineer's attention by the Contractor for correction or interpretation prior to proceeding with the work.

D. Upon request of the Engineer, the Contractor shall furnish copies of all data used in setting and referencing all stakes and other layouts markings used by the Contractor.

E. All staking shall be performed by qualified engineering or surveying personnel who are trained, experienced and skilled in construction layout and staking of the type required under the contract and who are acceptable to the Engineer. The personnel shall perform this staking under the direct supervision of a land surveyor registered with the State of Rhode Island.

F. The Contractor shall use a laser beam to assist in setting the pipe, provided he can demonstrate satisfactory skill in its use.

G. The use of string levels, hand levels, carpenters' levels or relatively crude devices for transferring grade or setting pipe will not be permitted.

H. During construction, the Contractor shall provide the Engineer, at his request, all reasonable and necessary materials, opportunities and assistance for checking the control of the work, as established by the Contractor. The Contractor will be informed of the results of these checks, but the Engineer by so doing, in no way relieves the Contractor of his responsibility for the accuracy of the layout work. The Contractor shall, at his expense, correct or replace as required, any deficient layout and construction work which may be the result of inaccuracies in his staking operations or of his failure to report inaccuracies found in work done by the Engineer or by others. If, as a result of these accuracies, the Engineer is required to make further studies, redesign, or both, all expenses incurred by the Engineer due to such inaccuracies will be deducted from any monies due to the Contractor.

I. The Contractor's field survey notes shall be kept neat, orderly and in conformance with accepted practice. Copies of all field survey books and notes shall be made available to the Engineer upon request.

J. The Contractor shall carefully preserve bench marks, reference points and stakes, and in case of willful or careless destruction, by his own men, he will be charged with the resulting expense and shall be responsible for any mistakes or delay that may be caused by their unnecessary loss or disturbance.

3.6 INSTALLATION OF PIPE

A. Each pipe length shall be inspected for cracks, defects in coating or lining, and any other evidences of unsuitability. Before lowering in place, the pipe shall be struck with a suitable tool to verify its soundness.

B. Pipe shall be laid in the dry and at no time shall water in the trench be permitted to flow into the sewer.

C. The pipe shall then be laid on the trench bedding as shown on the standard trench section, and the spigot pushed home. Jointing shall be in accordance with the manufacturer's instructions and appropriate ASTM standards, and the Contractor shall have on hand for each pipe-laying crew, the necessary tools, gauges, pipe cutters, etc., necessary to install the pipe in a workmanlike manner. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow.

D. Blocking under the pipe will not be permitted except where a concrete cradle is proposed, in which case precast concrete blocks shall be used.

E. After the pipe has been set to grade, additional bedding material shall be placed in 6-inch layers up to the spring line of the pipe. Tamping bars shall be carefully employed to assure compaction of the bedding under the lower quadrants of the pipe for the full width of trench excavation.

F. After this, the gravel borrow shall be carefully placed in maximum 6-inch layers to a depth of 6 inches over the crown of the pipe. Each layer shall be thoroughly compacted with mechanical equipment. Extra care shall be taken that the equipment does not damage the pipe.

G. At this point, the pipe shall be checked for line and grade and any debris, tools, etc., shall be removed.

H. If inspection of the pipe is satisfactory, the Contractor may then refill or backfill the remainder of the trench in accordance with Section 330000 "Earthwork Utilities", and in accordance with the details shown on the drawings.

I. If a trench box is being used and the trench box is below the spring line of the pipe, the trench box shall be lifted vertically and the stone bedding shall be thoroughly compacted to the trench wall. The trench box shall not be pulled horizontally along the trench.

J. At any time that work is not in progress, the end of the pipe shall be suitability closed to prevent the entry of animals, earth, etc.

K. At the end of each day's work or at intervals of no more than 200 feet of pipe, the Engineer, with the Contractor, will inspect the pipe for alignment. Unsatisfactory work shall be dug up and re-installed to the satisfaction of the Engineer.

3.7 EXISTING MANHOLE CONNECTIONS

A. Where required for connections, openings shall be cut in the manholes at the proper location and shall be sealed watertight.

B. The inverts of all newly connected manholes shall be reconstructed of brick and mortar and formed to accommodate the new sewer connections.

C. Bricks shall be laid in a workmanlike manner, true to line and the joints shall be carefully struck and pointed on the inside. Bricks shall be thoroughly wet when laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The outside of the brickwork shall be neatly plastered with 1/2" layer of cement mortar as the work progresses. The brickwork shall be satisfactorily bonded to the concrete. No brick masonry shall be laid in water, or any water allowed to rise on the brickwork until the masonry has set.

3.8 BY-PASS SEWAGE HANDLING

A. As the construction of the new sewer progresses and it becomes necessary to interrupt live sewage flow in the existing sanitary sewer, the Contractor shall be required to divert such flows around the area of interruption at no additional cost.

B. The existing sewage flow rate shall be continually maintained and no loss of sewer service up or downstream of the interruption shall occur. The Contractor shall utilize quality materials and equipment in good repair in meeting the requirements of this special provision and all damages resulting from interruptions in the functioning of the by-pass sewage handling system shall be borne totally by the Contractor. The Contractor shall complete the adjacent construction in a timely fashion to minimize the duration of by-pass sewage handling required. Existing sewage flows shall be diverted and maintained until the new sewer construction is leakage tested and accepted for service by the Engineer.

3.9 TESTING GRAVITY SEWERS

A. General: Acceptance of the testing method will be made by the Engineer with due consideration for surface conditions, size and type of pipe. The Contractor shall have the proper plugs, weirs, and other equipment required to perform all tests as required by the Engineer. Testing of each section of sewer installed shall include the portions of service connections that are to be installed under the contract. The Contractor shall test

each section of pipeline as soon as possible, and there shall not be more than 500 feet of untested pipeline in the ground.

B. Joint Testing: The Contractor shall test each pipe joint with low pressure air with approved apparatus. The pressure shall be maintained at 3.5 psi for a period of 30 seconds with no drop of pressure. If the pressure drops the Contractor shall make the necessary repairs as approved by the Engineer and retest the joint at no additional compensation.

C. Low Pressure Air Test:
1. After completing backfill of the pipeline, the Contractor shall, at his expense, conduct a line acceptance test using low pressure air. The test shall be performed according to stated procedures and in the presence of the Engineer. The line shall be flushed and cleaned prior to testing.
2. All pneumatic plugs shall be seal tested before being used in the actual test installation. One (1) length of pipe shall be laid on ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
3. After a manhole to manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average back pressure of any groundwater that may be over the pipe. At least two minutes shall be allowed for the air pressure to stabilize.
4. After the stabilization period (3.5 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "acceptable". If the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average back pressure of any groundwater that may be over the pipe) shall not be less than 4 minutes.
5. If the installation fails the air test, the Contractor shall, at his expense, determine the source of leakage. He shall then repair or replace all defective materials and/or workmanship to Engineers satisfaction and the pipeline shall be retested, all performed at no additional compensation to the Contractor.

3.10 TESTING OF MANHOLES

A. General: Tests shall be made, and observed by the Engineer on each manhole, at the option of the Engineer and/or field conditions the manhole test shall either be an infiltration test or a vacuum test.

B. Infiltration Test Before or After Backfilling: If the groundwater table is above the highest joint in the manhole, and if there is no visible leakage into the manhole, the manhole may be considered as watertight. If there is leakage the Contractor shall make the necessary repairs to the satisfaction of Engineer and retested all at no additional compensation. If repairs cannot be made, the Contractor shall remove the manhole and install a new manhole and retest at no additional compensation.

C. Vacuum Test Before Backfilling: Install vacuum tester and inflate compression band to effect a seal between the vacuum base and the manhole, connect vacuum pump to the outlet part with the valve open, draw a vacuum of 10 inches of mercury (HG), and close the valve. The manhole shall pass the test if the vacuum remains at 10 inches of HG or drops to 9 inch of HG in a time greater than 60 seconds for a 48-inch diameter manhole. If the manhole fails the initial test, the Contractor shall make proper repairs or replace the manhole and retest at no additional compensation.

END OF SECTION 33 3000

SECTION 33 3010 – SEPTIC SYSTEMS/ONSITE WASTEWATER TREATMENT SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 01 – General Requirements, apply to this Section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, 2004 Edition with latest addenda.

C. Rhode Island Department of Environmental Management - *Rules Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems*, (250-RICR-150-10-6).

1.2 RELATED SECTIONS

A. Division 01 – General Requirements.

B. Section 31 1005 - Site Preparation

C. Section 31 2000 - Earthwork

D. Section 31 2010 – Earthwork Utilities

E. Section 31 2319 – Dewatering

F. Section 31 4000 – Shoring and Bracing

G. Section 33 3000 - Sanitary Sewerage Systems / Appendix A

1.3 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with storm drainage work similar to that required for project and be a licensed Onsite Wastewater Treatment System Installer with the State of Rhode Island, Department of Environmental Management.

B. Codes and Standards:

1. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of storm drainage system's materials and products.

2. Environmental Compliance: Comply with applicable portions of RIDEM regulations pertaining to sanitary sewer and storm drainage systems.

3. Department of Environmental Management, Office of Water Resources Rules Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems, (250-RICR-150-10-6).

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for septic systems materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed sewagesystem and products, in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.1 IDENTIFICATION

A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading **"CAUTION DRAINAGE LINE BURIED BELOW"**.

1. Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:

a. Allen Systems Inc.
b. Emed Co., Inc.
c. Seton Name Plate Corp.

2.2 PRODUCTS

A. Sewer pipe fittings:

1. PVC Sewer Pipe and Fittings as specified on the Drawings.

B. Precast Concrete Tanks and Structures:

1. Precast reinforced concrete with bituminous waterproof coating as specified on the Drawings. Tanks to be designed for vehicular H20 loading and to be of sufficient weight to prevent floating when groundwater is present.

2. Manufacturer to supply certification of water tightness with precast product and Vendor to supply Engineer with certification.

C. Filter:

1. Zabel A300 12X28 or approved equal.

D. Sand, Bottomless Sand Filter Media and Septic Gravel

1. All imported granular fill as specified on the Drawings shall comply with Section 312000 Earthwork and/or as required by RIDEM Rules Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems.

2. Vendor to coordinate sample delivery and testing of all fill materials prior to delivery and installation. Engineer reserve the right to obtain a sample of fill material upon installation for testing. Fill material will neeed to be removed and replaced if testing results indicate non compliance with RIDEM Rules Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems.

3. All Bottomless Sand Filter Media must conform to specifications idicated on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials and systems in accordance with manufacturer's instructions, RIDEM Regulations, RIDEM approved plans and approval submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

B. Test systems for proper operation and adjust precast concrete structures, treatment components, pumps, piping and other components as may be required. Prior to final acceptance, clean out systems and protect work from damage.

C. Coordinate all phases of the onsite wastewater treatment system with design engineer, RIDEM and treatment system manufacturer.

END OF SECTION 33 3010

SECTION 33 4100 - STORM DRAINAGE SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Division 01 – General Requirements, apply to this Section.

B. Rhode Island Department of Transportation – *Standard Specifications for Road and Bridge Construction*, Latest Edition with latest addenda.

1.2 RELATED SECTIONS

A. Extent of storm drainage system work is indicated on the contract drawings, and by the requirements of this section.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with storm drainage work similar to that required for project and be a licensed drain layer with the State of Rhode Island.

PART 2 - PRODUCTS

2.1 PIPES AND PIPE FITTINGS

A. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

B. Reinforced Concrete Pipe: ASTM C 76, Class III unless otherwise indicated.
   1. Fittings: Reinforced concrete, same strength as adjoining pipe, tongue-and-groove gasketed joints complying with ASTM C 443.

C. High Density Polyethylene Pipe (HDPE): AASHTO M252/M294 Type S.
   1. Fittings: HDPE, AASHTO M252/M294 Type S.
   2. Couplers: Join pipe with couplers to provide soil-tight joints, and where necessary, provide gaskets in fine sand or silt conditions.

2.2 FILTER FABRIC

A. Filter Fabric shall be Mirafi S800 or RS380i as indicated on the plans.

2.3 FILTER STONE

A. Filter Stone shall conform to the requirements of RIDOT Standard M.01.07.

B. Filter Stone shall be washed at least twice and contain little to no fines.

PART 3 - EXECUTION

3.1 INSTALLATION OF IDENTIFICATION

A. General: During back-filling/top-soiling of storm drainage systems, install continuous underground-type plastic line marker, located directly over buried line at 24" above top of pipe.

3.2 INSTALLATION OF PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.
   1. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
   2. Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
   3. Place bell ends or groove ends of piping facing upstream.
   4. Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
   5. Concrete Pipe: Install in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual".
   6. HDPE Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D2321.

3.3 PRECAST CONCRETE MANHOLES

A. General: Place precast concrete sections as indicated. Where manholes occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 3" above finish surface, unless otherwise indicated.

B. Install in accordance with ASTM C891.

C. Provide rubber joint gasket complying with ASTM C443 at joints of sections.

D. Apply bituminous mastic coating at joints of sections.

3.4 TAP CONNECTIONS

A. Make connections to existing piping and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.

3.5 DRAINAGE AGGREGATE

A. Install the drainage aggregate to the line, grades and sections shown on the project construction plans.

B. Place the drainage aggregate to a minimum fiished thickness and widths shown on the details herein or as directed by the Engineer.

C. Filter Fabric shall be installed prior to aggregate placement in accordance with the details provided on the drawings.

3.6 BACKFILLING

A. General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.

3.7 FIELD QUALITY CONTROL

A. Testing: Perform testing of completed piping in accordance with local authorities having jurisdiction.

END OF SECTION 33 4100

Appendix A

Additional OWTS Materials / RIDEM Permit Applications and Approvals

1150 Pawtucket Avenue
Rumford, RI 02916-1897
(401) 434-8880 Office
(401) 434-1615 Fax

www.cwltd.net

"Bathhouses and Onsite Wastewater Treatment System Replacement"

For

Rhode Island Department of Environmental Management
Burlingame State Park and Campground

Burlingame Park Road
Charlestown, Rhode Island

Assessors Map 15 – Lot 10
Area: 847 Acres±

July 2022
Rev.: January - March 2023

Prepared by

Caputo & Wick Ltd.
1150 Pawtucket Avenue
Rumford, Rhode Island 02916-1897
401-434-8880

“Mills Camp Bathhouse and Onsite Wastewater Treatment System Replacement”

For

Rhode Island Department of Environmental Management
Burlingame State Park and Campground

Burlingame Park Road
Charlestown, Rhode Island

Assessors Map 15 – Lot 10
Area: 847 Acres±

July 2022
Rev.: January 2023

Prepared by

Caputo & Wick Ltd.
1150 Pawtucket Avenue
Rumford, Rhode Island 02916-1897
401-434-8880

Environmental Management

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
ONSITE WASTEWATER TREATMENT SYSTEM CONSTRUCTION PERMIT

www.dem.ri.gov/septic

JAN 23 2023

Office of Water Resources

FOR RIDEM USE ONLY

APPLICATION No. 2205-1140 DATE RECEIVED 01/23/23 AMOUNT RECEIVED $ waived CHECK # _____ NOTE _____

TYPE OF APPLICATION (CHECK ALL THAT APPLY)

- ☐ NEW BUILDING CONSTRUCTION
- ☐ ALTERATION
- ☐ REPAIR
- ☐ TRANSFER
- ☒ A/E TECHNOLOGY TYPE T
- ☐ VARIANCE
- ☐ REDESIGN
- ☐ JOINT OWTS / WETLANDS PD

SITE INFORMATION

BURLINGAME STATE PARK AND CAMPGROUND (MILLS CAMP) 1-100 BURLINGAME PARK ROAD, CHARLESTOWN

NO. STREET / CITY/TOWN / POLE #

PLAT NUMBER 15 LOT NUMBER 10 SUBDIVISION LOT NUMBER N.A.

LOT SIZE 847 SF/ACRES

SUBDIVISION NAME N.A.

SUBDIVISION SITE SUITABILITY CERTIFICATION # N.A.

OWNER INFORMATION

STATE OF RI DEM

LAST NAME / FIRST NAME / M.I.

235 PROMENADE ST. PROVIDENCE 02908

NO. STREET / CITY/TOWN / ZIP CODE

RIDEM APPLICATION HISTORY

PREVIOUS SITE TESTING ☒ YES ☐ NO APPLICATION # 2205-1140

DEPTH TO APPROVED WATER TABLE 48" HOW DETERMINED SOIL EVALUATION

TEST HOLE # TB DATE EXCAVATED 12/23/21 WETLANDS within 200' OF OWTS ☐ YES ☒ NO

WETLAND DETERMINATION ☐ YES ☒ NO RIDEM FILE # _____ DATE ____/____/____

LARGE SYSTEM ☒ YES ☐ NO OCI FILE # IF APPLICABLE _____

DESIGN INFORMATION

BUILDING USE: ☐ Residential ☐ Commercial _____ ☒ Other BATHHOUSE

WATER SUPPLY: ☐ public water ☒ public well ☐ private well

OF DESIGN UNITS 150

UNIT DESIGN FLOW 50 gallons per SITE (unit) TOTAL DAILY FLOW 7,500 gallons

TANK SIZE 15,000 gallons DESIGN LOADING RATE 3.5 gpd/sf

MINIMUM REQUIRED LEACHFIELD AREA 2,143 square feet

LEACHFIELD TYPE GRAVEL SAND TREATMENT (GST)

TOTAL AREA OF LEACHFIELD PROVIDED 4,900 square feet

CERTIFICATION

I, KEVIN HARROP (print), the undersigned licensed OWTS designer, certify that I prepared this application and accompanying forms, submittals, plans and sketches in accordance with the RULES of the RIDEM pertaining to OWTS and that all the information provided on this application and accompanying forms, submittals, plans and sketches is true and accurate.

Designer's Signature Kevin Harrop License # D3155

Designer's Email kharrop@cwltd.net Phone # 401-434-8880

Business/Company Name CAPUTO and WICK LTD

I certify that a) I am the owner of the property indicated under the site information on this application, b) I will hire a licensed OWTS installer to install the system proposed herein, c) the system will be installed in strict accordance with this application, d) I will hire and retain the licensed OWTS designer of record to witness and inspect the installation of the system, e) I assume all responsibility for the truth and accuracy of this application and all liability and responsibility for any improper installations of the system on this site and agree to hold the RIDEM harmless from any and all claims relating whatsoever to the system. In the case of a transfer application, I acknowledge that the permit application and plans previously approved and accompanying this application are the operative documents subject to certification.

Owner's Phone Number (401) 222-4700 ext 2774307

Owner's Email MEGAN.DIPRETE@DEM.RI.GOV

Owner(s) Signature M. DiPrete

PERMIT APPROVAL SECTION: DO NOT WRITE BELOW THIS LINE

Based upon the representations of the owner and the owner's agents, including the representations of the owner's OWTS designer, and the truth and accuracy of all information submitted, this application for an OWTS is hereby approved. The RIDEM assumes no responsibility or liability for the future safe operation or maintenance of the aforesaid system, of the fitness or suitability of this system to this site, nor does it assume any responsibility for the accuracy and truth of the owner's, or the owner's agent's representations. This approval is subject to future suspension or revocation in the event that subsequent examination reveals any data indicated on any application, form, submittal, plan or sketch to be incorrect, or not in compliance with the RULES or any conditions at the site are such that the approved design is not in accordance with the RULES, or in the event that the system discharges inadequately treated wastewater to waters of the State or fails to operate satisfactorily in any other manner.

IMPORTANT: Additional terms of approval as circled.

A. Bottom of leaching area excavation must be inspected by the RIDEM prior to placement of any gravel or stone.
B. System installation must be inspected by RIDEM prior to covering any component of the system with backfill.
C. Applicant shall comply with all requirements, conditions and stipulations of variance(s) approved on _____.
D. Joint Permit: Designer of record must contact RIDEM prior to start of any site construction.
E. A/E Technology: additional installation, operation or maintenance requirements may apply (see A/E Technology Certification.)
F. Copy of this form and Operation/Maintenance contract must be filed in land evidence records prior to conformance.
G. Proposed construction falls within "Coastal Zone". Contact Rhode Island Coastal Resources Management Council.
H. Proper erosion and sedimentation controls must be installed prior to start of construction.
I. Transfer: See original permit for all applicable conditions.
J. Other
- See attached monitoring and reporting requirements

Signature of RIDEM Official	Date of Approval	Date of Expiration
M. DiPrete	2/2/23	2/2/28

DESIGNER

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
ONSITE WASTEWATER TREATMENT SYSTEM CONSTRUCTION PERMIT
www.dem.ri.gov/septic

FOR RIDEM USE ONLY

APPLICATION No. _____ DATE RECEIVED ____/____/____ AMOUNT RECEIVED $_____ CHECK #_____ NOTE_____

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- ☐ ALTERATION
- ☐ REPAIR
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- ☒ A/E TECHNOLOGY TYPE _____
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Designer's Signature K R Harrop License # D3155

Designer's Email Kharrop@cwltd.net Phone # 401-434-8880

Business/Company Name CAPUTO and WICK LTD

I certify that a) I am the owner of the property indicated under the site information on this application, b) I will hire a licensed OWTS installer to install the system proposed herein, c) the system will be installed in strict accordance with this application, d) I will hire and retain the licensed OWTS designer of record to witness and inspect the installation of the system, e) I assume all responsibility for the truth and accuracy of this application and all liability and responsibility for any improper installations of the system on this site and agree to hold the RIDEM harmless from any and all claims relating whatsoever to the system. In the case of a transfer application, I acknowledge that the permit application and plans previously approved and accompanying this application are the operative documents subject to certification.

Owner's Phone Number (401) 222-4700 ext. 2774307

Owner's Email MEGAN.DIPRETE@DEM.RI.GOV

Owner(s) Signature _____

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IMPORTANT: Additional terms of approval as circled.

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C. Applicant shall comply with all requirements, conditions and stipulations of variance(s) approved on _____.
D. Joint Permit: Designer of record must contact RIDEM prior to start of any site construction.
E. A/E Technology: additional installation, operation or maintenance requirements may apply (see A/E Technology Certification.)
F. Copy of this form and Operation/Maintenance contract must be filed in land evidence records prior to conformance.
G. Proposed construction falls within "Coastal Zone". Contact Rhode Island Coastal Resources Management Council.
H. Proper erosion and sedimentation controls must be installed prior to start of construction.
I. Transfer: See original permit for all applicable conditions.
J. Other

Signature of RIDEM Official	Date of Approval	Date of Expiration

DEM SEE INSTRUCTIONS ON REVERSE SIDE

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
235 Promenade Street, Providence, Rhode Island 02908

February 2, 2023

State of Rhode Island
Rhode Island Department of Environmental Management Division of Planning and Development
235 Promenade Street
Providence, RI 02908

RE: Mills Camp Bathhouse
Burlingame State Park and Campground
Charlestown, RI
OWTS Application No. 2205-1140

Dear Applicant:

Attached herewith are revised monitoring and reporting requirements applicable to the above listed permit. As you are aware the above listed Onsite Wastewater Treatment System (OWTS) permit is granted based on a maximum daily design flow of **7,500** gallons per day and includes 1 - 15,000 gallon septic tank, 1 - 7,500 gallon anoxic tank, 1 - 6,000 gallon recirculation tank, 2 - Advantex AX 100 filter pods followed by a 6 x 6 pump chamber to a Gravel Sand Treatment (GST) type of leaching system.

Advanced treatment systems are utilized to mitigate against possible adverse impacts of residual onsite wastewater pollutants on groundwater quality and surface water quality. Owners of advanced OWTSs with design flows ≥2,000 gallons per day are subject to regular monitoring and reporting. The following stipulations now apply to your permit:

1. The following discharge limits as measured at the 6 x 6 pump chamber shall apply:

Orenco Systems, Inc. AdvanTex AX-100 – Mode 1	
Biochemical Oxygen Demand (5 Day)	≤ 20 mg/L
Total Suspended Solids	≤ 20 mg/L
Oil & Grease	≤ 5 mg/L

2. Wastewater flow shall not exceed a maximum daily flow of **7,500** gallons per day. Wastewater flow shall be monitored and recorded to ensure compliance with this stipulation.

3. Sampling and testing shall be conducted quarterly at the compliance point specified in Item 1 above. Sampling and measurements shall be representative of the monitored activity. The Permittee shall sample and test the wastewater in each system as follows:

Dissolved Oxygen (mg/L) – *Field Test*
Effluent Temperature (°F) – *Field Test*
pH (s.u.) – *Field Test*
Biochemical Oxygen Demand (5-Day) (mg/L)
Total Suspended Solids (mg/L)
Oil and Grease (mg/L)
Alkalinity (mg/L)

4. Corrective Action – Corrective action must be taken as soon as practicable following receipt of monitoring results which indicate that system modifications or maintenance is required. The system must be resampled no sooner than seven (7) days after any adjustment is made to the system and within thirty (30) days of the routine quarterly sample date. Samples must be analyzed for each of the parameters listed in Item 3 for any post corrective action sampling events.

5. Annual Report – All monitoring results including wastewater flow data shall be submitted to the DEM in the form of an annual report. The annual report is due **February 15th** of each year. The annual report must summarize all monitoring results and corrective actions implemented during the previous calendar year. A clear determination regarding the compliance status of the OWTS must be made as part of the annual report. The annual report must include a copy of the most recent Operation and Maintenance Contract as proof of compliance with this requirement.

6. The Permittee shall properly operate and maintain all facilities and equipment associated with the OWTS in accordance with the most recent operation and maintenance (O&M) plan. The O&M plan specifies procedures for operation, process control, record keeping, monitoring, weekly maintenance checks, other routine and periodic maintenance, safety and security. Also, the O&M plan includes a contingency plan to address emergency actions and procedures in the event of equipment failure and power loss.

7. Your permit approval is for the discharge of sanitary waste only. No toxic, hazardous or industrial processing waste may be discharged into the system.

8. All septage, sludges, screenings or other pollutants removed from the system shall be disposed in accordance with all applicable state and federal laws.

9. The permit may be automatically transferred by the Permittee to a new owner provided:

    a. The current Permittee notifies the DEM by certified mail at least thirty (30) days in advance of the proposed transfer date;

    b. The notice includes the name and address of the new Permittee and a written agreement between the existing and new Permittee containing a specific date for the transfer of permit responsibility, surety and liability between them and;

    c. The DEM does not notify the existing Permittee and the proposed new Permittee of its intent to modify or reissue the permit.

10. The operator or person in responsible charge of the OWTS shall have at a minimum a Rhode Island Class 1 Wastewater Treatment Plant Operator Certification or an equivalent certification from another jurisdiction acceptable to the DEM. If the operator is not employed directly by the Permittee, a service agreement with the operator shall be entered into and continuously maintained, and a copy of the active service agreement shall be submitted to the DEM as part of the annual report.

11. The permit may be modified, suspended, or revoked for cause. The DEM reserves the right to revise the permit to ensure compliance with applicable state and federal regulations. Failure to comply with the conditions of this permit approval letter may result in an enforcement action.

12. The Permittee shall allow the DEM or their authorized representative to access the OWTS and work areas to inspect equipment, practices, records pertinent to this permit and stipulated compliance requirements, and to sample and monitor the wastewater for the purposes of determining compliance.

13. In the event of treatment interruption, bypass or sewage overflow, the Permittee shall notify the DEM verbally within twenty-four (24) hours. Such incident shall be reported in writing within five (5) days after it becomes known to the Permittee, the report shall include the date and time(s) of the incident, the duration of the incident, and actions taken to correct the problem and prevent a reoccurrence.

14. For purposes of notification, monitoring, compliance or inquiries pursuant to this permit, all correspondence, telephone calls and other contacts must reference the OWTS permit number and shall be directed to:

The Rhode Island Department of Environmental Management
Onsite Wastewater Treatment Systems Program
235 Promenade Street
Providence, RI 02908
Telephone: (401) 222-3961
www.dem.ri.gov/septic

Should you have any questions concerning these permit requirements, please contact Tom Angelone by email at tom.angelone@dem.ri.gov or by phone at 401-222-3961, extension 2777607.

Very truly yours,

2-2-2023

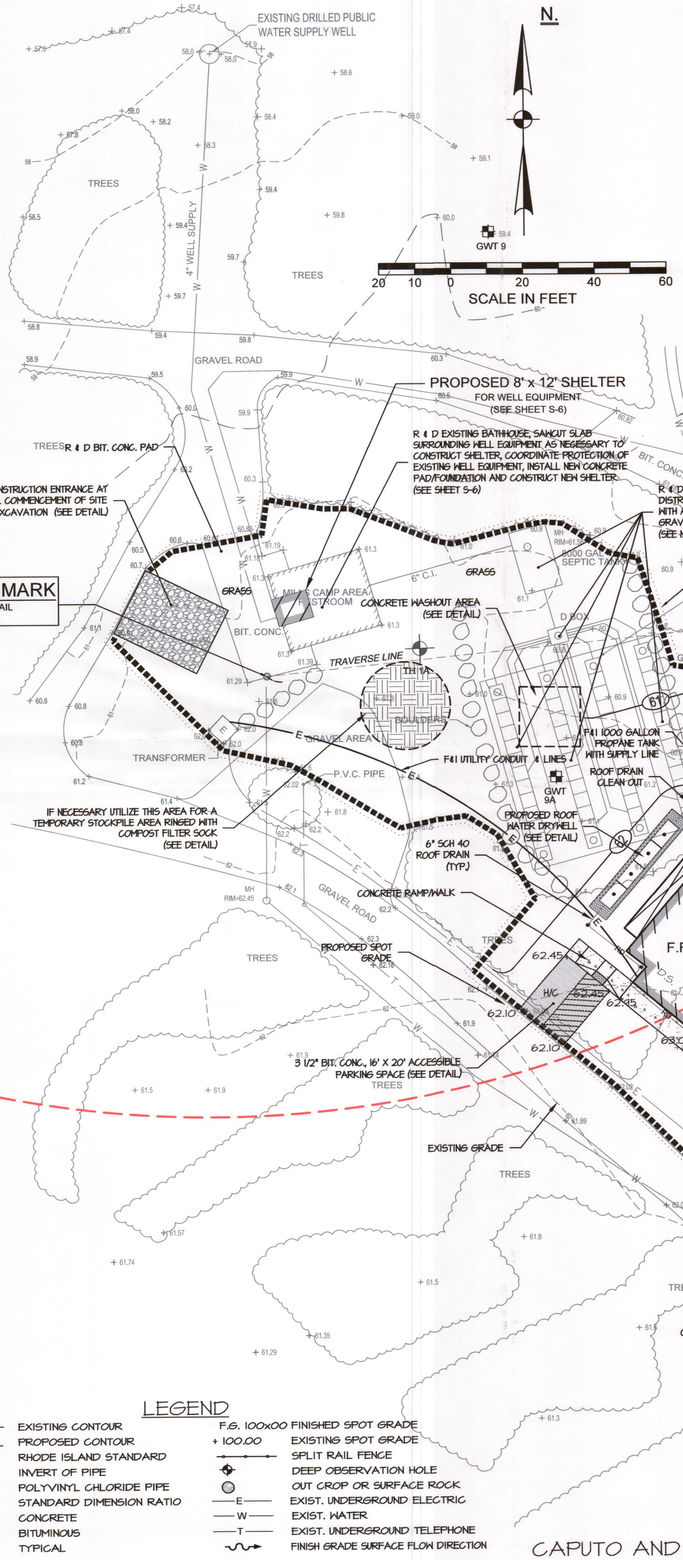
Mohamed J. Freij, P.E., PLS
Supervising Sanitary Engineer

KF

Enclosure(s)

cc: Joseph L. Warner Jr., Charlestown Building Official

BURLINGAME STATE PARK AND CAMPGROUND



Copy of Permitted Operation Maintenance contract must be filed in land evidence records prior to conformance"

TH-1A – GROUND ELEV: 61.2 – AUGUST 17, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX	TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.				
Ap	0 – 9"	C	S	2.5YR 6/3			Ls	2gbd	VFr	3
Bw	9" – 23"	C	W	10YR 5/6			Ls	2gbd	Fr	3
C1	23" – 49"	C	S	2.5YR 7/3			Ls	2gbd	Fr	3
C2	49" – 120"	–	–	2.5YR 7/3	5YR 4/4	M M P	Ls	2gbd	Fr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 49" (ELEV.: 57.1) PERFORMED BY: KAMAL HINGORANY

TH-1B – GROUND ELEV: 61.5 – AUGUST 17, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX	TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.				
Ap	0 – 6"	C	S	2.5YR 6/3			Ls	2gbd	VFr	3
Bw	6" – 25"	C	W	10YR 5/6			Ls	2gbd	Fr	3
C1	25" – 60"	C	S	2.5YR 7/3			Ls	2gbd	Fr	3
C2	60" – 120"	–	–	2.5YR 7/3	5YR 4/4	M M P	Ls	2gbd	Fr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 60" (ELEV.: 56.5) PERFORMED BY: KAMAL HINGORANY

TH-7A – GROUND ELEV: 61.3 – DECEMBER 23, 2021

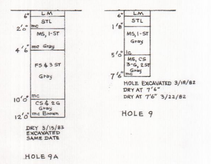
HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX	TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.				
Ap	0 – 2"	C	S	10YR 4/3			Ls	gr	VFr	3
Bw	2" – 24"	C	S	10YR 5/6			Ls	gr	VFr	3
C1	24" – 58"	C	S	5Y 5/8			Ls	gr	VFr	3
C2	58" – 120"	C	S	5Y 5/2	5YR 5/8	F F D	Ls	m	Fi	6

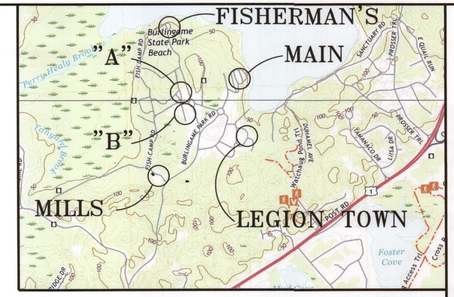
SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 58" (ELEV.: 56.5) PERFORMED BY: KAMAL HINGORANY

TH-7B – GROUND ELEV: 61.9 – DECEMBER 23, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX	TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.				
Ap	0 – 2"	C	S	10YR 4/3			Ls	gr	VFr	3
Bw	2" – 18"	C	S	10YR 5/6			Ls	gr	VFr	3
C1	18" – 48"	C	S	5Y 5/8			Ls	gr	VFr	3
C2	48" – 100"	C	S	5Y 8/8	5YR 5/8	F F D	Ls	gr	VFr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 48" (ELEV.: 57.9) PERFORMED BY: KAMAL HINGORANY





LOCUS MAP

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
OWTS PROGRAM
PLAN # 2205-1140 DATE 2/2/23
APPROVED [signature]
NO CHANGES ALLOWED WITHOUT PRIOR APPROVAL
APPROVED PLANS MUST BE KEPT AT CONSTRUCTION SITE

NOTES:

1. ALL WORK SHALL CONFORM TO THE RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, OFFICE OF WATER RESOURCES "RULES AND REGULATIONS ESTABLISHING MINIMUM STANDARDS RELATING TO LOCATION, DESIGN, CONSTRUCTION AND MAINTENANCE OF ONSITE WASTEWATER TREATMENT SYSTEMS", LATEST EDITION.
2. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO CAPUTO AND WICK LTD. FOR APPROVAL OF ALL PROPOSED CONSTRUCTION MATERIALS AND EQUIPMENT PRIOR TO ANY CONSTRUCTION.
3. EXISTING ONSITE WASTEWATER TREATMENT SYSTEM (OWTS) PRECAST STRUCTURES ARE TO BE PUMPED OUT, RINSED WITH CLEAN WATER AND PUMPED OUT AGAIN. PUMPING MUST BE PERFORMED BY A STATE LICENSED SEPTIC HAULER AND THE CONTENTS OF THE TANK DISPOSED OF PROPERLY. AFTER PUMPING, THE EXISTING OWTS STRUCTURES MUST BE FILLED WITH FLOWABLE FILL OR REMOVED AND REPLACED WITH GRAVEL BORROW AND 4" LOAM AND SEED.
4. REMOVE ALL A HORIZON SOIL, B HORIZON SOIL AND SCARIFY 3" OF THE C1 HORIZON SOIL BELOW THE GRAVEL SAND TREATMENT (GST) SYSTEM AND THOUGHLY MIX WITH ASTM C-33 SAND (SEE NOTE 16) TO INTERFACE THE FILL WITH THE SOIL, AND REPLACE ALL REMOVED SOIL WITH ASTM C-33 SAND. A AND B SOIL HORIZON LAYERS ARE TO BE REMOVED IN THIS APPLICATION DUE TO COMPACTION CAUSED BY VEHICLE TRAFFIC OVER THE PROPOSED GRAVEL SAND TREATMENT SYSTEM LOCATION.
5. UNSUITABLE MATERIAL USED TO BACKFILL THE TEST HOLES SHALL BE REMOVED AND REPLACED WITH WITH ASTM C-33 SAND (SEE NOTE 16).
6. ASTM C-33 SAND (SEE NOTE 16) MUST BE PLACED ON SCARIFIED, RELATIVELY DRY NATURAL SOIL. THE CONTRACTOR SHALL PROVIDE FOR DEWATERING AS REQUIRED AND ALL WORK SHALL BE PERFORMED UNDER DRY CONDITIONS.
7. BUILDING SEWER PIPE TO BE 4" P. V. C. SCH. 40 UNLESS OTHERWISE NOTED.
8. PLACE 6" MINIMUM COMPACTED CRUSHED STONE UNDER SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER, ADVANTEX TREATMENT TANKS AND SYSTEM STRUCTURES.
9. INLET AND OUTLET TEES FOR SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK AND PUMP CHAMBER ARE TO BE LOCATED DIRECTLY BELOW ACCESS COVERS.
10. SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER AND ADVANTEX TREATMENT TANK RISERS/COVERS TO BE AT FINISH GRADE.
11. IF CONDITIONS ENCOUNTERED DURING CONSTRUCTION VARY SUBSTANTIALLY FROM THOSE SHOWN ON THIS PLAN, NOTIFY CAPUTO AND WICK, LTD. BEFORE PROCEEDING WITH CONSTRUCTION, IF IN DOUBT, ASK.
12. NEW SEPTIC TANK SHALL MEET ALL OF THE REQUIREMENTS OF 250-RICR-150-10-6.27.
13. INSPECTION OF THE SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER AND ADVANTEX TREATMENT TANK SHALL BE PART OF THE MAINTENANCE SERVICE FOR THE OWTS AND ALL COMPONENTS SHALL BE CLEANED WHEN REQUIRED.
14. IT IS RECOMMENDED THAT THE SEPTIC TANK BE INSPECTED TWICE A YEAR, AND BE CLEANED WHEN THE SOLIDS EQUAL ONE THIRD THE LIQUID DEPTH OR AT THE END OF EACH CAMPING SEASON.
15. MINIMUM PERIMETER INVERT ELEVATION = 61.25. NO FINISHED GRADE BELOW 61.25 FROM THE EDGE OF THE GRAVEL SAND TREATMENT (GST) SYSTEM FOR A 10 FOOT MINIMUM.
16. THE SAND MEDIA USED IN CONSTRUCTION SHALL MEET THE ASTM C-33 SPECIFICATIONS AND ANY OTHER REQUIREMENTS STATED IN 250-RICR-150-10-6.37.2.B. SIEVE ANALYSIS FROM PROPOSED SOURCE IS REQUIRED TO BE SUBMITTED TOGETHER WITH SHOP DRAWINGS. TESTING OF SAND MATERIAL DELIVERED TO THE SITE IS REQUIRED.
17. OWTS INSTALLER MUST BE FAMILIAR WITH ADVANTEX PRODUCTS AND GEOMATRIX GRAVEL SAND TREATMENT (GST LEACHING) SYSTEMS PROPOSED FOR THIS SITE. SEE ADVANTEX INSTALLATION MANUAL AND THE LATEST GST LEACHING SYSTEMS RHODE ISLAND INSTALLATION AND OPERATION MANUAL FOR ADDITIONAL GUIDELINES FOR INSTALLATION.
18. INSTALLATION SHALL BE IN STRICT CONFORMANCE WITH THE ORENCO ADVANTEX INSTALLATION MANUAL AND OTHER APPLICABLE SECTIONS OF 250-RICR-150-6. THE INSTALLATION SHALL ONLY BE PERFORMED BY A RHODE ISLAND DEM LICENSED INSTALLER WHO HAS RECEIVED TRAINING AND IS AUTHORIZED IN WRITING BY THE VENDORS TO INSTALL THE SYSTEM. AUTHORIZATION FROM THE VENDORS SHALL BE SUBMITTED TO ENGINEER PRIOR TO ANY CONSTRUCTION.
19. REFER TO 250-RICR-150-10-6 AND RIDEM GUIDELINES FOR ADDITIONAL INFORMATION CONCERNING THE INSTALLATION, OPERATION AND MAINTENANCE OF THE SYSTEM. THE INSTALLER AND OWNER SHOULD REVIEW AND APPLY 250-RICR-150-10-6 AND RIDEM GUIDELINES. THE SYSTEM TO BE CONSTRUCTED BY A INSTALLER LICENSED BY RIDEM AND THOROUGHLY FAMILIAR WITH THE INSTALLATION OF ADVANTEX TREATMENT DEVICES AND GST SYSTEMS.
20. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH THE DESIGN ENGINEER IN ORDER TO FACILITATE WITNESSING THE REQUIRED PHASES OF THE SYSTEM INSTALLATION AS STATED IN 250-RICR-150-6.47 OF THE "REGULATIONS". FAILURE OF THE CONTRACTOR TO NOTIFY THE DESIGN ENGINEER IN A TIMELY MANNER MAY REQUIRE THE CONTRACTOR TO EXCAVATE AND EXPOSE SYSTEM COMPONENTS FOR OBSERVATION.
21. THE DESIGNER EXPRESSLY DISCLAIMS ANY RESPONSIBILITY FOR THE INSTALLATION AND MAINTENANCE OF THE SYSTEM. IT SHALL BE THE RESPONSIBILITY OF THE INSTALLER TO CONSTRUCT THE SYSTEM IN ACCORDANCE WITH THE ABOVE REFERENCED REGULATIONS.
22. CONTRACTOR SHALL CONTACT "DIG-SAFE" PRIOR TO CONSTRUCTION. LOCATION OF UTILITIES ON THIS PLAN ARE FROM EXISTING INFORMATION, BUT ARE ONLY TO BE CONSIDERED APPROXIMATE.
23. THERE ARE NO PUBLIC WELLS, EXISTING OR PROPOSED, FOUND TO BE LOCATED WITHIN 500 FEET OF THE PROPOSED OWTS EXCEPT AS SHOWN.
24. NO FRESHWATER WETLANDS OBSERVED WITHIN 200 FEET OF THE PROPOSED OWTS. THIS SITE DOES NOT LIE WITHIN A CRITICAL RESOURCE AREA.
25. I CERTIFY THAT THERE ARE NO WELLS FOUND TO BE LOCATED WITHIN 200 FEET OF THE PROPOSED LEACHING AREA, OTHER THAN AS SHOWN ON THIS PLAN. I ALSO CERTIFY THAT THERE ARE NO EXISTING OR PROPOSED DRAINS, FOUNDATION DRAINS OR SUB DRAINS FOUND TO BE LOCATED WITHIN 25 FEET OF THIS PROPOSED OWTS.
26. ALL PIPE JOINTS, PIPE CONNECTIONS AND ACCESS COVERS ARE TO WATERTIGHT.
27. PRESSURE PIPE SHALL BE INSTALLED TO MAINTAIN SLOPE BACK TO TANK/PUMP CHAMBER TO DRAIN BETWEEN PUMPING CYCLES. ELIMINATE ANY HIGH OR LOW POINTS THAT MAY PREVENT DRAINING AND/OR AIR POCKETS
28. CONTRACTOR TO PAY ANY REQUIRED INSTALLATION FEES.
29. CONTROL PANEL AND ALARM TO BE MOUNTED INSIDE BUILDING IN A CONSPICUOUS LOCATION, EXACT LOCATION TO BE COORDINATED WITH OWNER. ALL CONTROL PANELS AND JUNCTION BOXES SHALL BE NEMA 4X.
30. THE PUMP DOSING CONTROLS WILL BE FIELD TESTED IN THE PRESENCE OF THE DESIGN ENGINEER AND ORENCO REPRESENTATIVE. ADJUSTMENT TO CONTROLS ARE THE CONTRACTORS RESPONSIBILITY. CONTRACTOR MUST MAKE WATER AVAILABLE FOR TESTING OF THE CONTROL FLOATS.
31. ALL TREES AND SHRUBS SHALL BE CLEAR AND NO NEW ONES SHALL BE PLANTED WITHIN 10' OF THE GRAVEL SAND TREATMENT (GST) SYSTEM.
32. THE GRAVEL SAND TREATMENT (GST) SYSTEM LOCATION SHALL BE STAKED OUT AND PROTECTED PRIOR TO ANY SITE PREPARATION ACTIVITIES.
33. NO IMPERVIOUS SURFACE IS TO PLACED ABOVE THE GRAVEL SAND TREATMENT (GST) SYSTEM.
34. MATERIAL AND EQUIPMENT FROM ALTERNATE MANUFACTURERS MAY BE USED IF EQUAL. APPROVAL FOR ALTERNATE MATERIAL AND/OR EQUIPMENT IS REQUIRED FROM THE OWNER AND ENGINEER. FULL SPECIFICATIONS FOR ALTERNATE EQUIPMENT MUST BE PROVIDED BY THE CONTRACTOR. IF ACCEPTABLE, THE CONTRACTOR MUST PREPARE AND SUBMIT FOR AN RIDEM OWTS CONSTRUCTION PERMIT BASED UPON THE REDESIGN.

Environmental Management
JAN 23 2023
Office of Water Resources

DESIGN DATA

DAILY SEWAGE FLOW:
50 GPD/CAMPSITE x 150 CAMPSITES = 7500 GALLONS PER DAY (G.P.D.)
GROUND WATER TABLE : 48"
DEPTH TO IMPERVIOUS : NOT ENCOUNTERED
SOIL CLASS: B, SOIL CATEGORY: 3, LOADING RATE: 0.70 GALS./S.F./DAY
SEPTIC TANK REQUIREMENTS VOLUME = 2 X 7,500 G.P.D = 15,000 GALLONS
LEACHING AREA REQUIREMENTS:
GRAVEL SAND TREATMENT (GST) SYSTEM WITH CATEGORY 1 TREATMENT
(ORENCO ADVANTEX TREATMENT AX100)
ASSIGNED EFFLUENT LOADING RATE = 3.5 GPD PER S. F.
SQUARE FOOTAGE OF GST REQUIRED =7500 GPD / 3.5 GPD PER S.F. = 2,143 S.F.
LENGTH OF GST 6212 REQUIRED: 2,143 S.F. / 17.5 S.F. / L.F. = 123 L.F.
LENGTH OF GST 6212 SPECIFIED: 280 L.F.
TOTAL GST SYSTEM CAPACITY = 280 L.F. X 17.5 S.F. / L.F. X 3.5 GPD / S.F. = 17,150 GPD
17,150 GPD > 7,500 GPD ~ CAPACITY = 229% OF ANTICIPATED DESIGN FLOW

CERTIFICATION:

THIS SURVEY HAS BEEN CONDUCTED AND THE PLAN HAS BEEN PREPARED PURSUANT TO SECTION II OF THE RULES AND REGULATIONS ADOPTED BY THE RHODE ISLAND STATE BOARD OF REGISTRATION FOR PROFESSIONAL LAND SURVEYORS ON NOVEMBER 28, 2015, AS FOLLOWS:

TYPE OF BOUNDARY SURVEY: NOT A BOUNDARY SURVEY
MEASUREMENT SPECIFICATION:
OTHER TYPE OF SURVEY:
DATA ACCUMULATION SURVEY (LOCATIONS) CLASS III
TOPOGRAPHIC SURVEY ACCURACY T-2 (IMMEDIATE AREA AROUND DWELLING AND OWTS AS IDENTIFIED)

THE PURPOSE OF THIS SURVEY IS TO DEPICT THE EXISTING CONDITIONS IN THE PROJECT AREA FOR CONSTRUCTION AND THE DESIGN OF A NEW ONSITE WASTEWATER TREATMENT SYSTEM.

[signature] 8/10/2022
DAVID T. BRAY PLS NO. 1899 DATE
CAPUTO AND WICK LTD., COA NO. A177

DAVID T. BRAY
No. 1899
PROFESSIONAL LAND SURVEYOR
8-10-2022

KEVIN R. HARROP
No. 9200
REGISTERED PROFESSIONAL ENGINEER
CIVIL
D3155

LEGEND

100	EXISTING CONTOUR	F.G. 100x00	FINISHED SPOT GRADE
100	PROPOSED CONTOUR	+ 100.00	EXISTING SPOT GRADE
RI. STD.	RHODE ISLAND STANDARD		SPLIT RAIL FENCE
INV.	INVERT OF PIPE		DEEP OBSERVATION HOLE
P. V. C.	POLYVINYL CHLORIDE PIPE		OUT CROP OR SURFACE ROCK
S. D. R.	STANDARD DIMENSION RATIO	E	EXIST. UNDERGROUND ELECTRIC
CONC.	CONCRETE	W	EXIST. WATER
BIT.	BITUMINOUS	T	EXIST. UNDERGROUND TELEPHONE
TYP.	TYPICAL		FINISH GRADE SURFACE FLOW DIRECTION

STATE OF RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING AND DEVELOPMENT

DEMOLITION AND REBUILD OF BATHHOUSES
BURLINGAME STATE PARK AND CAMPGROUND
CHARLESTOWN, RHODE ISLAND

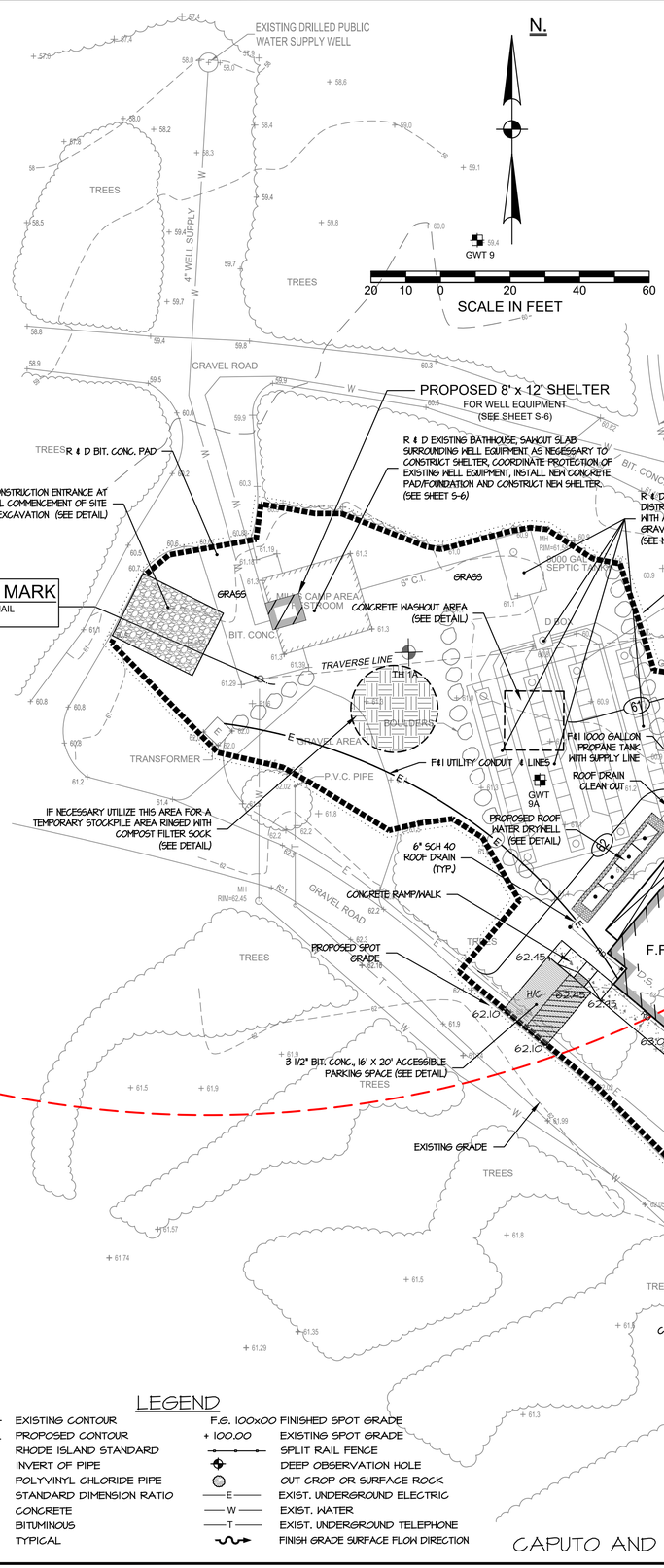
MILLS CAMP BATHHOUSE - SITE PLAN

Dwg: Scale: 1" = 20'
Contract No. x Date: JANUARY, 2023
C-1.1
9

OWTS SUBMISSION - JANUARY 9, 2023

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BURLINGAME STATE PARK AND CAMPGROUND



TH-1A – GROUND ELEV: 61.2 – AUGUST 17, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX		TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.					
Ap	0 – 9"	C	S	2.5YR 6/3				Ls	2gbd	VFr	3
Bw	9" – 23"	C	W	10YR 5/6				Ls	2gbd	Fr	3
C1	23" – 49"	C	S	2.5YR 7/3				Ls	2gbd	Fr	3
C2	49" – 120"	–	–	2.5YR 7/3	5YR 4/4	M M P		Ls	2gbd	Fr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 49" (ELEV.: 57.1) PERFORMED BY: KAMAL HINGORANY

TH-1B – GROUND ELEV: 61.5 – AUGUST 17, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX		TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.					
Ap	0 – 6"	C	S	2.5YR 6/3				Ls	2gbd	VFr	3
Bw	6" – 25"	C	W	10YR 5/6				Ls	2gbd	Fr	3
C1	25" – 60"	C	S	2.5YR 7/3				Ls	2gbd	Fr	3
C2	60" – 120"	–	–	2.5YR 7/3	5YR 4/4	M M P		Ls	2gbd	Fr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 60" (ELEV.: 56.5) PERFORMED BY: KAMAL HINGORANY

TH-7A – GROUND ELEV: 61.3 – DECEMBER 23, 2021

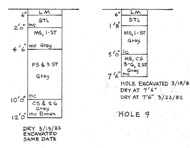
HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX		TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.					
Ap	0 – 2"	C	S	10YR 4/3				Ls	gr	VFr	3
Bw	2" – 24"	C	S	10YR 5/6				Ls	gr	VFr	3
C1	24" – 58"	C	S	5Y 5/8				Ls	gr	VFr	3
C2	58" – 120"	C	S	5Y 5/2	5YR 4/6	F F D		Ls	m	Fi	6

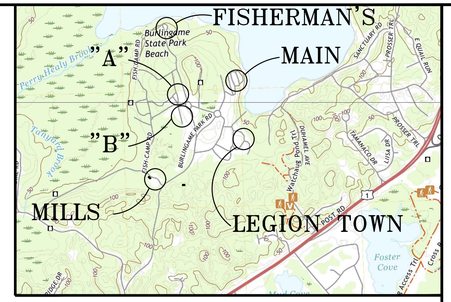
SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 58" (ELEV.: 56.5) PERFORMED BY: KAMAL HINGORANY

TH-7B – GROUND ELEV: 61.9 – DECEMBER 23, 2021

HORIZON	DEPTH	HORIZON BOUNDARIES		SOIL COLORS		RE-DOX		TEXTURE	STRUCTURE	CONSISTENCE	SOIL CATEGORY
		DIST	TOPO	MATRIX	RE-DOX FEATURES	Ab. S. CONTR.					
Ap	0 – 2"	C	S	10YR 4/3				Ls	gr	VFr	3
Bw	2" – 18"	C	S	10YR 5/6				Ls	gr	VFr	3
C1	18" – 48"	C	S	5Y 5/8				Ls	gr	VFr	3
C2	48" – 100"	C	S	5Y 8/8	5YR 5/8	F F D		Ls	gr	VFr	3

SOIL CLASS: B OBSERVED STANDING GROUNDWATER – NA OBSERVED WEEPING GROUNDWATER – NA
ESTIMATED SEASONAL HIGH WATER TABLE – 48" (ELEV.: 57.9) PERFORMED BY: KAMAL HINGORANY





LOCUS MAP

NOTES:

1. ALL WORK SHALL CONFORM TO THE RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, OFFICE OF WATER RESOURCES "RULES AND REGULATIONS ESTABLISHING MINIMUM STANDARDS RELATING TO LOCATION, DESIGN, CONSTRUCTION AND MAINTENANCE OF ONSITE WASTEWATER TREATMENT SYSTEMS", LATEST EDITION.
2. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO CAPUTO AND WICK LTD. FOR APPROVAL OF ALL PROPOSED CONSTRUCTION MATERIALS AND EQUIPMENT PRIOR TO ANY CONSTRUCTION.
3. EXISTING ONSITE WASTEWATER TREATMENT SYSTEM (OWTS) PRECAST STRUCTURES ARE TO BE PUMPED OUT, RINSED WITH CLEAN WATER AND PUMPED OUT AGAIN. PUMPING MUST BE PERFORMED BY A STATE LICENSED SEPTIC HAULER AND THE CONTENTS OF THE TANK DISPOSED OF PROPERLY. AFTER PUMPING, THE EXISTING OWTS STRUCTURES MUST BE FILLED WITH FLOWABLE FILL OR REMOVED AND REPLACED WITH GRAVEL BORROW AND 4" LOAM AND SEED.
4. REMOVE ALL A HORIZON SOIL, B HORIZON SOIL AND SCARIFY 3" OF THE C1 HORIZON SOIL BELOW THE GRAVEL SAND TREATMENT (GST) SYSTEM AND THOUGHLY MIX WITH ASTM C-33 SAND (SEE NOTE 16) TO INTERFACE THE FILL WITH THE SOIL AND REPLACE ALL REMOVED SOIL WITH ASTM C-33 SAND. A AND B SOIL HORIZON LAYERS ARE TO BE REMOVED IN THIS APPLICATION DUE TO COMPACTION CAUSED BY VEHICLE TRAFFIC OVER THE PROPOSED GRAVEL SAND TREATMENT SYSTEM LOCATION.
5. UNSUITABLE MATERIAL USED TO BACKFILL THE TEST HOLES SHALL BE REMOVED AND REPLACED WITH WITH ASTM C-33 SAND (SEE NOTE 16),
6. ASTM C-33 SAND (SEE NOTE 16) MUST BE PLACED ON SCARIFIED, RELATIVELY DRY NATURAL SOIL. THE CONTRACTOR SHALL PROVIDE FOR DEWATERING AS REQUIRED AND ALL WORK SHALL BE PERFORMED UNDER DRY CONDITIONS.
7. BUILDING SEWER PIPE TO BE 4" P. V. C. SCH. 40 UNLESS OTHERWISE NOTED.
8. PLACE 6" MINIMUM COMPACTED CRUSHED STONE UNDER SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER, ADVANTEX TREATMENT TANKS AND SYSTEM STRUCTURES.
9. INLET AND OUTLET TEES FOR SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK AND PUMP CHAMBER ARE TO BE LOCATED DIRECTLY BELOW ACCESS COVERS.
10. SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER AND ADVANTEX TREATMENT TANK RISERS/COVERS TO BE AT FINISH GRADE.
11. IF CONDITIONS ENCOUNTERED DURING CONSTRUCTION VARY SUBSTANTIALLY FROM THOSE SHOWN ON THIS PLAN, NOTIFY CAPUTO AND WICK, LTD. BEFORE PROCEEDING WITH CONSTRUCTION. IF IN DOUBT, ASK.
12. NEW SEPTIC TANK SHALL MEET ALL OF THE REQUIREMENTS OF 250-RICR-150-10-6.27.
13. INSPECTION OF THE SEPTIC TANK, ANOXIC TANK, RECIRCULATION TANK, PUMP CHAMBER AND ADVANTEX TREATMENT TANK SHALL BE PART OF THE MAINTENANCE SERVICE FOR THE OWTS AND ALL COMPONENTS SHALL BE CLEANED WHEN REQUIRED.
14. IT IS RECOMMENDED THAT THE SEPTIC TANK BE INSPECTED TWICE A YEAR, AND BE CLEANED WHEN THE SOLIDS EQUAL ONE THIRD THE LIQUID DEPTH OR AT THE END OF EACH CAMPING SEASON.
15. MINIMUM PERIMETER INVERT ELEVATION = 61.25. NO FINISHED GRADE BELOW 61.25 FROM THE EDGE OF THE GRAVEL SAND TREATMENT (GST) SYSTEM FOR A 10 FOOT MINIMUM.
16. THE SAND MEDIA USED IN CONSTRUCTION SHALL MEET THE ASTM C-33 SPECIFICATIONS AND ANY OTHER REQUIREMENTS STATED IN 250-RICR-150-10-6.37.2.B. SIEVE ANALYSIS FROM PROPOSED SOURCE IS REQUIRED TO BE SUBMITTED TOGETHER WITH SHOP DRAWINGS. TESTING OF SAND MATERIAL DELIVERED TO THE SITE IS REQUIRED.
17. OWTS INSTALLER MUST BE FAMILIAR WITH ADVANTEX PRODUCTS AND GEOMATRIX GRAVEL SAND TREATMENT (GST LEACHING) SYSTEMS PROPOSED FOR THIS SITE. SEE ADVANTEX INSTALLATION MANUAL AND THE LATEST GST LEACHING SYSTEMS RHODE ISLAND INSTALLATION AND OPERATION MANUAL FOR ADDITIONAL GUIDELINES FOR INSTALLATION.
18. INSTALLATION SHALL BE IN STRICT CONFORMANCE WITH THE ORENCO ADVANTEX INSTALLATION MANUAL AND OTHER APPLICABLE SECTIONS OF 250-RICR-150-6. THE INSTALLATION SHALL ONLY BE PERFORMED BY A RHODE ISLAND DEM LICENSED INSTALLER WHO HAS RECEIVED TRAINING AND IS AUTHORIZED IN WRITING BY THE VENDORS TO INSTALL THE SYSTEM. AUTHORIZATION FROM THE VENDORS SHALL BE SUBMITTED TO ENGINEER PRIOR TO ANY CONSTRUCTION.
19. REFER TO 250-RICR-150-10-6 AND RIDEM GUIDELINES FOR ADDITIONAL INFORMATION CONCERNING THE INSTALLATION, OPERATION AND MAINTENANCE OF THE SYSTEM. THE INSTALLER AND OWNER SHOULD REVIEW AND APPLY 250-RICR-150-10-6 AND RIDEM GUIDELINES. THE SYSTEM TO BE CONSTRUCTED BY A INSTALLER LICENSED BY RIDEM AND THOROUGHLY FAMILIAR WITH THE INSTALLATION OF ADVANTEX TREATMENT DEVICES AND GST SYSTEMS.
20. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH THE DESIGN ENGINEER IN ORDER TO FACILITATE WITNESSING THE REQUIRED PHASES OF THE SYSTEM INSTALLATION AS STATED IN 250-RICR-150-6.47 OF THE "REGULATIONS". FAILURE OF THE CONTRACTOR TO NOTIFY THE DESIGN ENGINEER IN A TIMELY MANNER MAY REQUIRE THE CONTRACTOR TO EXCAVATE AND EXPOSE SYSTEM COMPONENTS FOR OBSERVATION.
21. THE DESIGNER EXPRESSLY DISCLAIMS ANY RESPONSIBILITY FOR THE INSTALLATION AND MAINTENANCE OF THE SYSTEM. IT SHALL BE THE RESPONSIBILITY OF THE INSTALLER TO CONSTRUCT THE SYSTEM IN ACCORDANCE WITH THE ABOVE REFERENCED REGULATIONS.
22. CONTRACTOR SHALL CONTACT "DIG-SAFE" PRIOR TO CONSTRUCTION. LOCATION OF UTILITIES ON THIS PLAN ARE FROM EXISTING INFORMATION, BUT ARE ONLY TO BE CONSIDERED APPROXIMATE.
23. THERE ARE NO PUBLIC WELLS, EXISTING OR PROPOSED, FOUND TO BE LOCATED WITHIN 500 FEET OF THE PROPOSED OWTS EXCEPT AS SHOWN.
24. NO FRESHWATER WETLANDS OBSERVED WITHIN 200 FEET OF THE PROPOSED OWTS. THIS SITE DOES NOT LIE WITHIN A CRITICAL RESOURCE AREA.
25. I CERTIFY THAT THERE ARE NO WELLS FOUND TO BE LOCATED WITHIN 200 FEET OF THE PROPOSED LEACHING AREA, OTHER THAN AS SHOWN ON THIS PLAN. I ALSO CERTIFY THAT THERE ARE NO EXISTING OR PROPOSED DRAINS, FOUNDATION DRAINS OR SUB DRAINS FOUND TO BE LOCATED WITHIN 25 FEET OF THIS PROPOSED OWTS.
26. ALL PIPE JOINTS, PIPE CONNECTIONS AND ACCESS COVERS ARE TO WATERTIGHT.
27. PRESSURE PIPE SHALL BE INSTALLED TO MAINTAIN SLOPE BACK TO TANK/PUMP CHAMBER TO DRAIN BETWEEN PUMPING CYCLES. ELIMINATE ANY HIGH OR LOW POINTS THAT MAY PREVENT DRAINING AND/OR AIR POCKETS
28. CONTRACTOR TO PAY ANY REQUIRED INSTALLATION FEES.
29. CONTROL PANEL AND ALARM TO BE MOUNTED INSIDE BUILDING IN A CONSPICUOUS LOCATION, EXACT LOCATION TO BE COORDINATED WITH OWNER. ALL CONTROL PANELS AND JUNCTION BOXES SHALL BE NEMA 4X.
30. THE PUMP DOSING CONTROLS WILL BE FIELD TESTED IN THE PRESENCE OF THE DESIGN ENGINEER AND ORENCO REPRESENTATIVE. ADJUSTMENT TO CONTROLS ARE THE CONTRACTORS RESPONSIBILITY. CONTRACTOR MUST MAKE WATER AVAILABLE FOR TESTING OF THE CONTROL FLOATS.
31. ALL TREES AND SHRUBS SHALL BE CLEAR AND NO NEW ONES SHALL BE PLANTED WITHIN 10' OF THE GRAVEL SAND TREATMENT (GST) SYSTEM.
32. THE GRAVEL SAND TREATMENT (GST) SYSTEM LOCATION SHALL BE STAKED OUT AND PROTECTED PRIOR TO ANY SITE PREPARATION ACTIVITIES.
33. NO IMPERVIOUS SURFACE IS TO PLACED ABOVE THE GRAVEL SAND TREATMENT (GST) SYSTEM.
34. MATERIAL AND EQUIPMENT FROM ALTERNATE MANUFACTURERS MAY BE USED IF EQUAL. APPROVAL FOR ALTERNATE MATERIAL AND/OR EQUIPMENT IS REQUIRED FROM THE OWNER AND ENGINEER. FULL SPECIFICATIONS FOR ALTERNATE EQUIPMENT MUST BE PROVIDED BY THE CONTRACTOR. IF ACCEPTABLE, THE CONTRACTOR MUST PREPARE AND SUBMIT FOR AN RIDEM OWTS CONSTRUCTION PERMIT BASED UPON THE REDESIGN.

DESIGN DATA

DAILY SEWAGE FLOW:
50 GPD/CAMPSITE x 150 CAMPSITES = 7500 GALLONS PER DAY (G.P.D.)
GROUND WATER TABLE : 48"
DEPTH TO IMPERVIOUS : NOT ENCOUNTERED
SOIL CLASS: B, SOIL CATEGORY: 3, LOADING RATE: 0.70 GALS./S.F./DAY
SEPTIC TANK REQUIREMENTS VOLUME = 2 X 7,500 G.P.D = 15,000 GALLONS
LEACHING AREA REQUIREMENTS:
GRAVEL SAND TREATMENT (GST) SYSTEM WITH CATEGORY 1 TREATMENT
(ORENCO ADVANTEX TREATMENT AX100)
ASSIGNED EFFLUENT LOADING RATE = 3.5 GPD PER S. F.
SQUARE FOOTAGE OF GST REQUIRED =7500 GPD / 3.5 GPD PER S.F. = 2,143 S.F.
LENGTH OF GST 6212 REQUIRED: 2,143 S.F. / 17.5 S.F. / L.F. = 123 L.F.
LENGTH OF GST 6212 SPECIFIED: 280 L.F.
TOTAL GST SYSTEM CAPACITY = 280 L.F. X 17.5 S.F. / L.F. X 3.5 GPD / S.F. = 17,150 GPD
17,150 GPD > 7,500 GPD ~ CAPACITY = 229% OF ANTICIPATED DESIGN FLOW

LEGEND

—— 100 ——	EXISTING CONTOUR	F.G. 100x00	FINISHED SPOT GRADE
—(100)—	PROPOSED CONTOUR	+ 100.00	EXISTING SPOT GRADE
RI. STD.	RHODE ISLAND STANDARD		SPLIT RAIL FENCE
INV.	INVERT OF PIPE		DEEP OBSERVATION HOLE
P. V. C.	POLYVINYL CHLORIDE PIPE		OUT CROP OR SURFACE ROCK
S. D. R.	STANDARD DIMENSION RATIO	—E—	EXIST. UNDERGROUND ELECTRIC
CONC.	CONCRETE	—W—	EXIST. WATER
BIT.	BITUMINOUS	—T—	EXIST. UNDERGROUND TELEPHONE
TYP.	TYPICAL		FINISH GRADE SURFACE FLOW DIRECTION

CERTIFICATION:

THIS SURVEY HAS BEEN CONDUCTED AND THE PLAN HAS BEEN PREPARED PURSUANT TO SECTION 9 OF THE RULES AND REGULATIONS ADOPTED BY THE RHODE ISLAND STATE BOARD OF REGISTRATION FOR PROFESSIONAL LAND SURVEYORS ON NOVEMBER 25, 2015, AS FOLLOWS:

TYPE OF BOUNDARY SURVEY: NOT A BOUNDARY SURVEY
MEASUREMENT SPECIFICATION:
OTHER TYPE OF SURVEY:
DATA ACCUMULATION SURVEY (LOCATIONS) CLASS III
TOPOGRAPHIC SURVEY ACCURACY T-2 (IMMEDIATE AREA AROUND DWELLING AND OWTS AS IDENTIFIED)

THE PURPOSE OF THIS SURVEY IS TO DEPICT THE EXISTING CONDITIONS IN THE PROJECT AREA FOR CONSTRUCTION AND THE DESIGN OF A NEW ONSITE WASTEWATER TREATMENT SYSTEM.

David T. Bray 8/10/2022
DAVID T. BRAY PLS NO. 1899 DATE
CAPUTO AND WICK LTD., COA NO. A177

DAVID T. BRAY — No. 1899 — PROFESSIONAL LAND SURVEYOR — 8-10-2022

KEVIN R. HARROP — No. 9200 — REGISTERED PROFESSIONAL ENGINEER CIVIL — D3155

STATE OF RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING AND DEVELOPMENT

DEMOLITION AND REBUILD OF BATHHOUSES
BURLINGAME STATE PARK AND CAMPGROUND
CHARLESTOWN, RHODE ISLAND

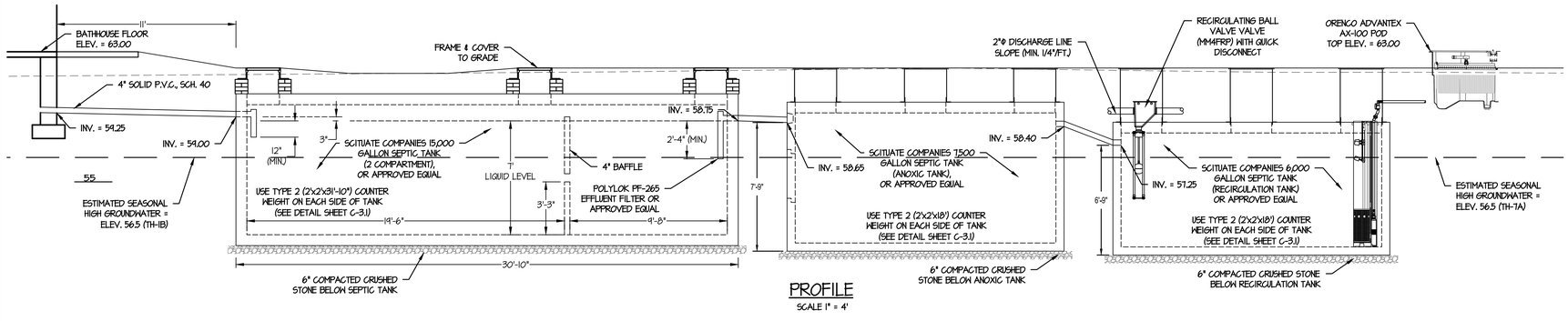
MILLS CAMP BATHHOUSE - SITE PLAN

Dwg: Scale: 1" = 20'
Contract No. x Date: JANUARY, 2023

C-1.1
9

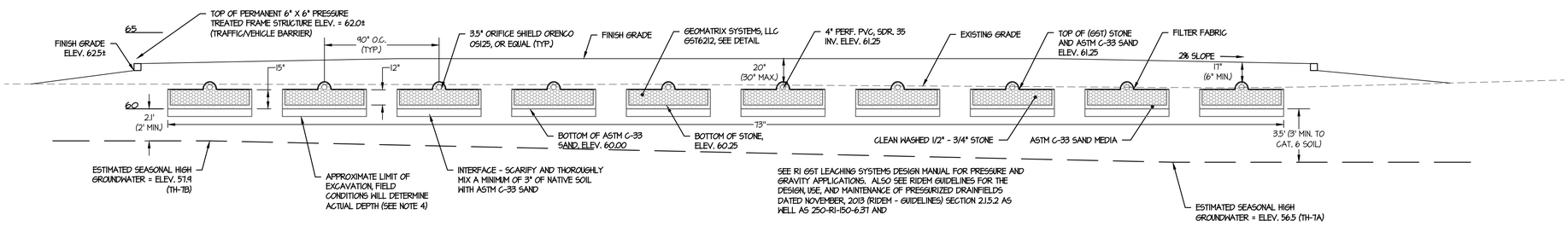
OWTS SUBMISSION - JANUARY 9, 2023

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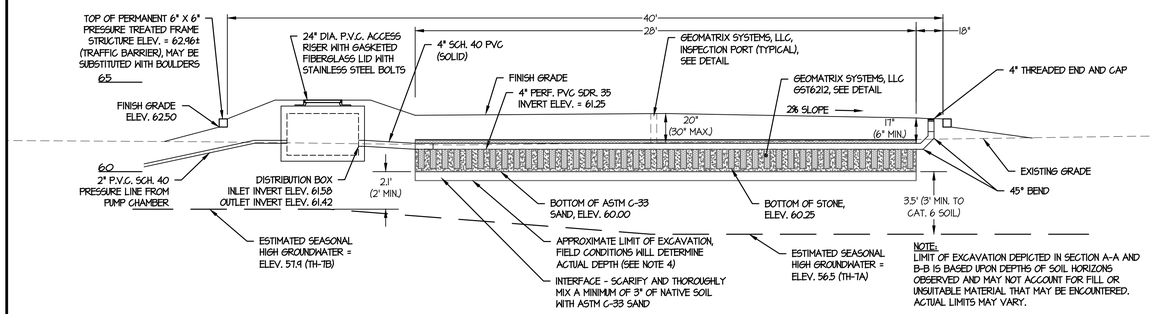
PROFILE

SCALE 1" = 4'



GRAVEL TREATMENT SYSTEM (GST) SECTION B-B

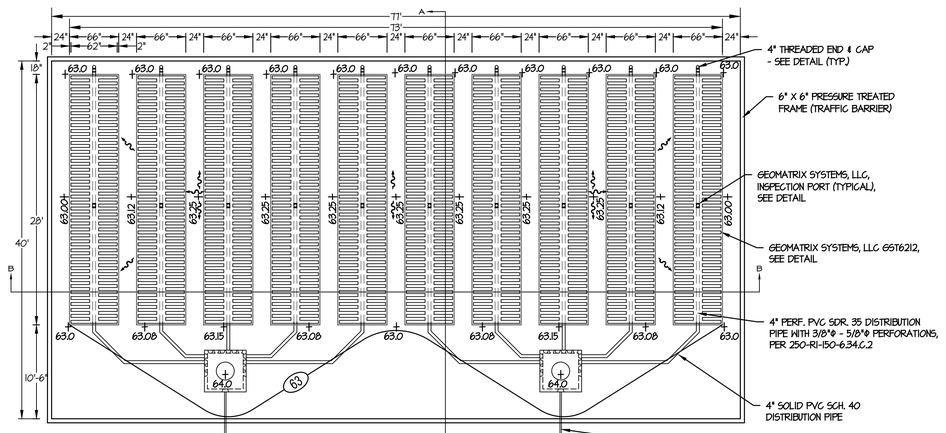
SCALE 1" = 4'



NOTE:
LIMIT OF EXCAVATION DEPICTED IN SECTION A-A AND B-B IS BASED UPON DEPTHS OF SOIL HORIZONS OBSERVED AND MAY NOT ACCOUNT FOR FILL OR UNSUITABLE MATERIAL THAT MAY BE ENCOUNTERED. ACTUAL LIMITS MAY VARY.

GRAVEL TREATMENT SYSTEM (GST) SECTION A-A

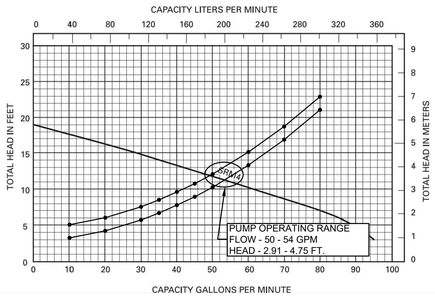
SCALE 1" = 4'



GRAVEL SAND TREATMENT SYSTEM (GST) PLAN VIEW

SCALE 1" = 8'

ELEVATION SCHEDULE	
DESCRIPTION	ELEVATION
INVERT AT FOUNDATION - TO SEPTIC TANK	54.25
INVERT IN - SEPTIC TANK	54.00
LIQUID LEVEL IN SEPTIC TANK	58.75
INVERT IN - ANOXIC TANK	58.65
INVERT OUT - ANOXIC TANK	58.40
INVERT IN RECIRC TANK	57.25
BOTTOM OF RECIRCULATION TANK	50.50
TOP OF ADVANTEX AX-100	63.00
INVERT OUT - RECIRCULATION TANK TO PUMP BASIN	54.17
INV. IN PUMP BASIN	54.00
TOP OF PUMP BASIN RIM	62.25±
ELEVATION HIGH LEVEL ALARM/ALT. PUMP	59.33
ELEVATION PUMP ON	58.67
ELEVATION PUMP OFF	56.83
ELEVATION LOW LEVEL ALARM	56.67
INV. 2" OUT PUMP BASIN	60.00
BOTTOM OF PUMP BASIN	53.50
INVERT INTO DISTRIBUTION BOX	61.58
INVERT OUT OF DISTRIBUTION BOX	61.42
ELEV. TOP OF COVER STONE ABOVE DISTRIBUTION PIPE	61.75
INV. 4" PERF. DISTRIBUTION PIPE GST	61.25
BOTTOM OF GST STONE	60.25
BASE OF GST SAND	60.00
EST. SEASONAL HIGH GW	57.9 (TH-1B)
MAX. FINISHED GRADE AT GST	64.08
MIN. FINISHED GRADE AT GST	62.08



PUMP CURVE: MYERS SRM4

PUMPING AND SYSTEM SPECIFICATIONS/DATA:

PUMP CHAMBER PUMP MODEL:
- MYERS SRM4 SUBMERSIBLE SEWAGE PUMP
  - HORSEPOWER - 0.4; SINGLE PHASE
  - 2" INCH DISCHARGE; 230 VOLTS; 60 HZ 6 AMPS
- LIFT OUT (2)
- MYERS SRA 200 WITH STAINLESS STEEL BRACKETS

CONTROL PANEL MODEL
- MYERS CE-2IDW ALTERNATING
  - ENCLOSURE - NEMA 1 (NEMA 4X IF EXPOSED TO WEATHER)
  - VOLTAGE - 230
  - HIGH LEVEL ALARM - VISUAL AND AUDIO

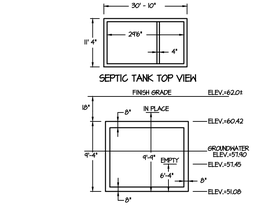
FLOATS MODEL
- MYERS MODEL 20VM SJE OR EQUAL

PUMP CHAMBER DISCHARGE VOLUME PER CYCLE:
- 6' X 6' INTERIOR @ 1' - 10" = 66 CUBIC FEET X 7.48 GALLONS/CF = 494 GAL./CYCLE
- 2" PIPE DRAIN BACK: APPROXIMATELY 8 GAL.
- 494 GALLONS/CYCLE - 8 GALLONS = 486 GAL./CYCLE
- 7500 GPS/ 2 GST SYSTEMS = 3750 GPD/486 GAL./CYCLE = 7.7 ~ 8 CYCLES/DAY/GST

FLOATS - ON, OFF, HIGH AND LOW WATER:
- HIGH WATER - ELEVATION 58.83
- PUMP ON - ELEVATION 58.67
- PUMP OFF - ELEVATION 56.83
- LOW WATER - ELEVATION 56.67

ORENCO AX-100 TREATMENT SYSTEM DATA REVIEWED AND PROVIDED BY ATLANTIC SOLUTIONS (CONTROL PANEL - TIME DOSED)

GRAVEL SAND TREATMENT (GST) SYSTEM DATA REVIEWED BY GEOMATRIX SYSTEMS LLC.



BUOYANCY CALCULATIONS FOR 15,000 GALLON SEPTIC TANK

MUST SET IN DRY CONDITIONS

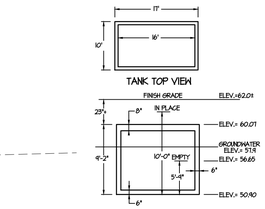
VOLUMES
- TOP SLAB: 11.33' WIDE X 30.83' LONG X 0.67' THICK = 232.96 C.F. (CUBIC FOOT)
- SIDES: 2 SIDES x 10.00' LONG X 8.00' HIGH X 0.67' WIDE = 106.67 C.F.
  2 SIDES x 30.83' LONG X 8.00' HIGH X 0.67' WIDE = 328.84 C.F.
- BOTTOM: 11.33' WIDE X 30.83' LONG X 0.67' THICK = 232.96 C.F.
- BAFFLE: 10.00' LONG X 7.25' HIGH X 0.33' WIDE = 23.92 C.F.
- TOTAL VOLUME OF CONCRETE FOR TANK = 925.40 C.F.
- EARTH: 11.33' WIDE X 30.83' LONG X 1.50' THICK = 524.16 C.F.

CONSTANTS (HEIGHTS)
- CONCRETE: 150 POUNDS/C.F.
- EARTH: 100 POUNDS/C.F.
- WATER: 62.4 POUNDS/C.F.
- COUNTER HEIGHT: 22,306.5 POUNDS (TYPE 2 - SEE SCHEDULE SHEET C-3.1)

WEIGHT OF TANK IN PLACE
- CONCRETE: 925.40 C.F. X 150 POUNDS/C.F. = 138,810 POUNDS (EMPTY TANK)
- COUNTER HEIGHT: = 22,307 POUNDS
- EARTH: 524.16 C.F. X 100 POUNDS/C.F. = 52,416 POUNDS (EARTH COVER)
- TOTAL HEIGHT OF TANK SET IN PLACE = 213,533 POUNDS (EMPTY)

DETERMINE BUOYANCY POINT FOR EMPTY TANK PRIOR TO BACKFILL
- BOTTOM SLAB AREA: 11.33' WIDE X 30.83' LONG = 349.44 S.F.(SQUARE FEET)
- TANK: 349.44 S.F. X BP' X 62.4 POUNDS/C.F. = 138,810 POUNDS (EMPTY TANK)
  BP' = 138,810 POUNDS ± 62.4 POUNDS/C.F. ± 349.44 S.F.
  BP' = 6.37' ~ 6'-4"± (ELEV. 57.45 - EMPTY TANK IS BUOYANT)

DETERMINE BUOYANCY POINT FOR EMPTY TANK IN PLACE
- BP = 213,533 POUNDS ± 62.4 POUNDS/C.F. ± 349.44 S.F.
- BP = 4.79' ~ 4'-9"± (ELEV. 60.83')



BUOYANCY CALCULATIONS FOR 7,500 ANOXIC TANK

MUST SET IN DRY CONDITIONS

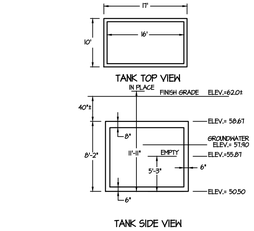
VOLUMES
- TOP SLAB: 10.00' WIDE X 17.00' LONG X 0.67' THICK = 113.33 C.F. (CUBIC FOOT)
- SIDES: 2 SIDES x 9.00' LONG X 7.00' HIGH X 0.50' WIDE = 63.00 C.F.
  2 SIDES x 17.00' LONG X 7.00' HIGH X 0.50' WIDE = 119.00 C.F.
- BOTTOM: 10.00' WIDE X 17.00' LONG X 0.50' THICK = 85.00 C.F.
- TOTAL VOLUME OF CONCRETE FOR TANK = 380.33 C.F.
- EARTH: 10.00' WIDE X 17.00' LONG X 3.33' THICK = 566.10 C.F.

CONSTANTS (HEIGHTS)
- CONCRETE: 150 POUNDS/C.F.
- EARTH: 100 POUNDS/C.F.
- WATER: 62.4 POUNDS/C.F.
- COUNTER HEIGHT: 12,614.4 POUNDS (TYPE 2 - SEE SCHEDULE SHEET C-3.1)

HEIGHT OF TANK AND EARTH COVER
- CONCRETE: 380.33 C.F. X 150 POUNDS/C.F. = 57,050 POUNDS (EMPTY TANK)
- COUNTER HEIGHT: = 12,614 POUNDS
- EARTH: 566.10 C.F. X 100 POUNDS/C.F. = 56,610 POUNDS (EARTH COVER)
- TOTAL HEIGHT OF TANK SET IN PLACE = 126,274 POUNDS (EMPTY)

DETERMINE BUOYANCY POINT FOR EMPTY TANK PRIOR TO BACKFILL
- BOTTOM SLAB AREA: 10.00' WIDE X 17.00' LONG = 170.00 S.F.(SQUARE FEET)
- TANK: 170.00 S.F. X BP' X 62.4 POUNDS/C.F. = 57,050 POUNDS (EMPTY TANK)
  BP' = 57,050 POUNDS ± 62.4 POUNDS/C.F. ± 170.00 S.F.
  BP' = 5.37' ~ 5'-3"± (ELEV. 55.87 - EMPTY TANK IS BUOYANT)

DETERMINE BUOYANCY POINT FOR EMPTY TANK IN PLACE
- BP = 126,274 POUNDS ± 62.4 POUNDS/C.F. ± 170.00 S.F.
- BP = 11.90' ~ 11'-11"± (ELEV. 62.40)



BUOYANCY CALCULATIONS FOR 6,000 RECIRCULATION TANK

MUST SET IN DRY CONDITIONS

AREAS
- TOP: (11.0' X 7.0' + 4ft S.F.) - (11' X 1.25'^{2} + 4.41 S.F.) = 44.04 S.F. (SQUARE FEET)

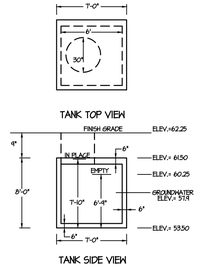
VOLUMES
- TOP SLAB: 44.04 S.F. X 0.50' THICK = 22.05 C.F. (CUBIC FOOT)
- SIDES: 2 SIDES x 7.0' LONG X 7.0' HIGH X 0.50' THICK = 49.00 C.F.
  2 SIDES x 6.0' LONG X 7.0' HIGH X 0.50' THICK = 42.00 C.F.
- BOTTOM: 7.00 WIDE X 7.00' LONG X 0.50' THICK = 24.50 C.F.
- TOTAL VOLUME OF CONCRETE FOR TANK = 137.55 C.F.
- EARTH: 44.04 S.F. X 0.75' THICK = 33.01 C.F.

CONSTANTS (HEIGHTS)
- CONCRETE: 150 POUNDS/C.F.
- EARTH: 100 POUNDS/C.F.
- WATER: 62.4 POUNDS/C.F.

WEIGHT OF TANK AND EARTH COVER
- CONCRETE: 137.55 C.F. X 150 POUNDS/C.F. = 20,633 POUNDS (EMPTY TANK)
- EARTH: 33.01 C.F. X 100 POUNDS/C.F. = 3,301 POUNDS (EARTH COVER)
- TOTAL WEIGHT OF TANK SET IN PLACE = 23,940 POUNDS (EMPTY)

DETERMINE BUOYANCY POINT FOR EMPTY TANK PRIOR TO BACKFILL
- BOTTOM SLAB AREA: = 28.78 S.F.
- CHAMBER: 44.00 S.F. X BP' X 62.4 POUNDS/C.F. = 20,633 POUNDS (EMPTY TANK)
  BP' = 20,633 POUNDS ÷ 62.4 POUNDS/C.F.÷ 44.00 S.F.
  BP' = 6.73' ~ 6'-8"± (ELEV. 60.25 - MUST BE SET IN DRY CONDITION)

DETERMINE BUOYANCY POINT FOR EMPTY TANK IN PLACE
- BP = 23,940 POUNDS ± 62.4 POUNDS/C.F. ± 44.00 S.F.
- BP = 7.85' ~ 7'-10"± (ELEV. 61.33)



BUOYANCY CALCULATIONS FOR PUMP CHAMBER

MUST SET IN DRY CONDITIONS

BURLINGAME STATE PARK AND CAMPGROUND

STATE OF RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING AND DEVELOPMENT

DEMOLITION AND REBUILD OF BATHHOUSES
BURLINGAME STATE PARK AND CAMPGROUND
CHARLESTOWN, RHODE ISLAND

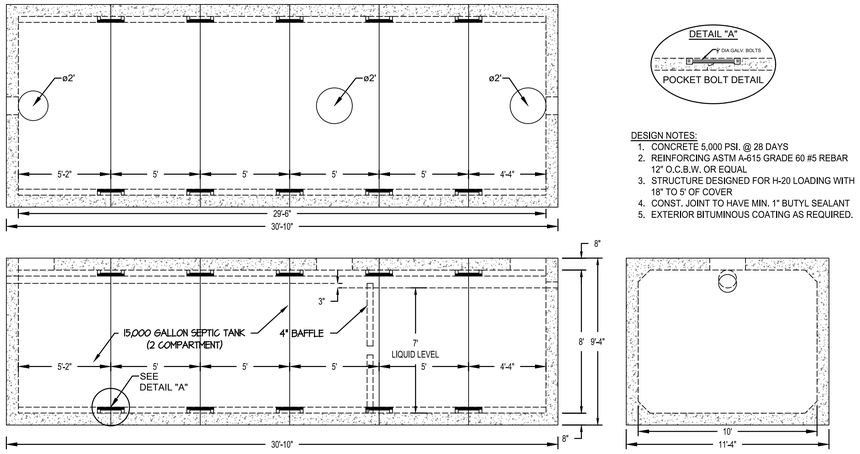
MILLS CAMP BATHHOUSE - OWTS DETAILS

Dwg:
Scale: 1" = 20'
Contract No. x
Date: JANUARY, 2023

C-2.1
15

OWTS SUBMISSION - JANUARY 9, 2023

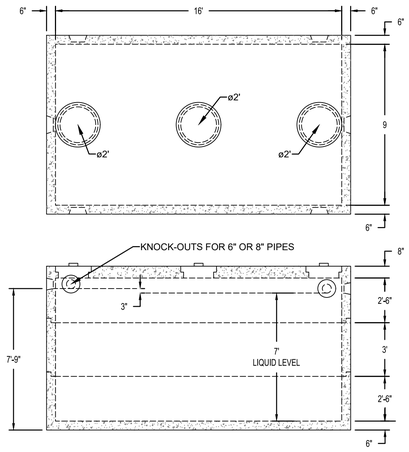
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DESIGN NOTES:
1. CONCRETE 5,000 PSI. @ 28 DAYS
2. REINFORCING ASTM A-615 GRADE 60 #5 REBAR 12" O.C.B.W. OR EQUAL
3. STRUCTURE DESIGNED FOR H-20 LOADING WITH 18" TO 5' OF COVER
4. CONST. JOINT TO HAVE MIN. 1" BUTYL SEALANT
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.

15,000 GALLON TWO COMPARTMENT SEPTIC TANK

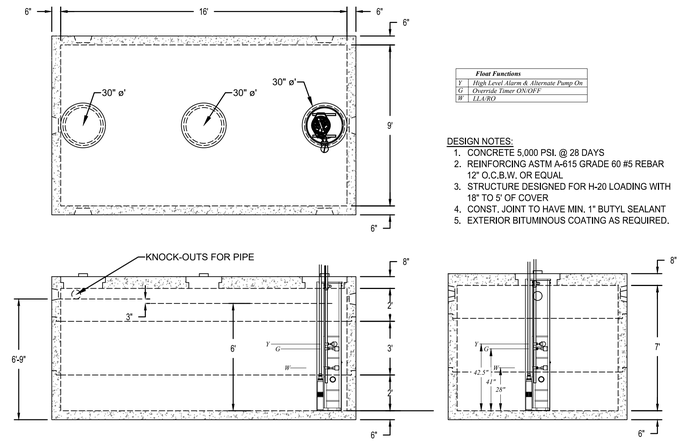
SCALE 1" - 4'



DESIGN NOTES:
1. CONCRETE 5,000 PSI. @ 28 DAYS
2. REINFORCING ASTM A-615 GRADE 60 #5 REBAR 12" O.C.B.W. OR EQUAL
3. STRUCTURE DESIGNED FOR H-20 LOADING WITH 18" TO 5' OF COVER
4. CONST. JOINT TO HAVE MIN. 1" BUTYL SEALANT
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.

7, 500 GALLON ANOXIC TANK

SCALE 1" - 4'



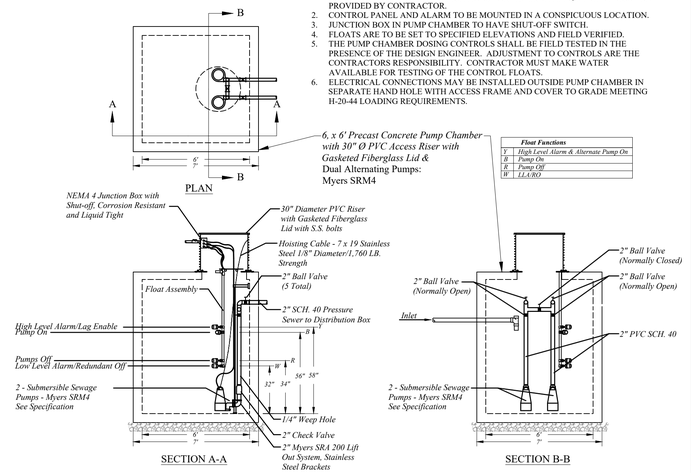
Float Functions	
Y	High Level Alarm & Alternate Pump On
G	Override Timer ON/OFF
W	LEAD

DESIGN NOTES:
1. CONCRETE 5,000 PSI. @ 28 DAYS
2. REINFORCING ASTM A-615 GRADE 60 #5 REBAR 12" O.C.B.W. OR EQUAL
3. STRUCTURE DESIGNED FOR H-20 LOADING WITH 18" TO 5' OF COVER
4. CONST. JOINT TO HAVE MIN. 1" BUTYL SEALANT
5. EXTERIOR BITUMINOUS COATING AS REQUIRED.

6,000 GALLON RECIRCULATION TANK

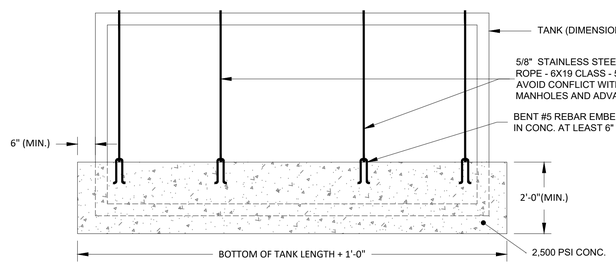
SCALE 1" - 4'

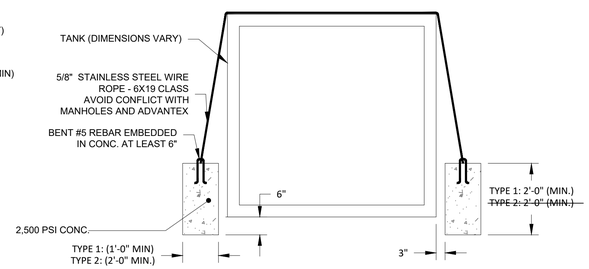
PUMPING NOTES:
1. EQUIPMENT FROM OTHER MANUFACTURER'S MAY BE USED IF EQUAL. APPROVAL FOR ALTERNATE EQUIPMENT REQUIRED FROM ENGINEER PRIOR TO CONSTRUCTION. FULL SPECIFICATIONS FOR ALTERNATE EQUIPMENT MUST BE PROVIDED BY CONTRACTOR.
2. CONTROL PANEL AND ALARM TO BE MOUNTED IN A CONSPICUOUS LOCATION.
3. JUNCTION BOX IN PUMP CHAMBER TO HAVE SHUT-OFF SWITCH.
4. FLOATS ARE TO BE SET TO SPECIFIED ELEVATIONS AND FIELD VERIFIED.
5. THE PUMP CHAMBER DOSING CONTROLS SHALL BE FIELD TESTED IN THE PRESENCE OF THE DESIGN ENGINEER. ADJUSTMENT TO CONTROLS ARE THE CONTRACTORS RESPONSIBILITY. CONTRACTOR MUST MAKE WATER AVAILABLE FOR TESTING OF THE CONTROL FLOATS.
6. ELECTRICAL CONNECTIONS MAY BE INSTALLED OUTSIDE PUMP CHAMBER IN SEPARATE HAND HOLE WITH ACCESS FRAME AND COVER TO GRADE MEETING H-20-44 LOADING REQUIREMENTS.



PUMP CHAMBER DETAIL

SCALE 1" - 4'





COUNTER WEIGHT: TANK ANTI-FLOATATION SECTIONS

SCALE 1" = 2'

ANTI-FLOATATION AREA

~~15,000 GALLON TANK (TYPE 1):~~	~~2 SIDES x 32.83'LONG X 1.00' WIDE~~	~~= 65.66 S.F.~~
~~15,000 GALLON TANK (TYPE 1):~~	~~2 SIDES x 31.83'LONG X 1.00' WIDE~~	~~= 63.66 S.F.~~
15,000 GALLON TANK (TYPE 2):	2 SIDES x 31.83'LONG X 2.00' WIDE	= 127.32 S.F.
~~8,000 GALLON TANK (TYPE 1):~~	~~2 SIDES x 19.00'LONG X 1.00' WIDE~~	~~= 38 S.F.~~
~~8,000 GALLON TANK (TYPE 2):~~	~~2 SIDES x 19.00'LONG X 2.00' WIDE~~	~~= 76 S.F.~~
~~7,500 GALLON TANK (TYPE 1):~~	~~2 SIDES x 18.00'LONG X 1.00' WIDE~~	~~= 36 S.F.~~
7,500 GALLON TANK (TYPE 2):	2 SIDES x 18.00'LONG X 2.00' WIDE	= 72 S.F.
~~6,000 GALLON TANK (TYPE 1):~~	~~2 SIDES x 18.00'LONG X 1.00' WIDE~~	~~= 36 S.F.~~
6,000 GALLON TANK (TYPE 2):	2 SIDES x 18.00'LONG X 2.00' WIDE	= 72 S.F.

ANTI-FLOATATION VOLUMES

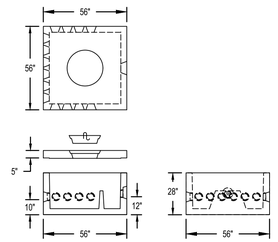
~~15,000 GALLON TANK (TYPE 1):~~	~~65.66 S.F. X 2.00' HIGH~~	~~= 131.32 C.F.~~
~~15,000 GALLON TANK (TYPE 1):~~	~~63.66 S.F. X 2.00' HIGH~~	~~= 127.32 C.F.~~
15,000 GALLON TANK (TYPE 2):	127.32 S.F. X 2.00' HIGH	= 254.64 C.F.
~~8,000 GALLON TANK (TYPE 1):~~	~~38 S.F. X 2.00' HIGH~~	~~= 76 C.F.~~
~~8,000 GALLON TANK (TYPE 2):~~	~~76 S.F. X 2.00' HIGH~~	~~= 152 C.F.~~
~~7,500 GALLON TANK (TYPE 1):~~	~~36 S.F. X 2.00' HIGH~~	~~= 72 C.F.~~
7,500 GALLON TANK (TYPE 2):	72 S.F. X 2.00' HIGH	= 144 C.F.
~~6,000 GALLON TANK (TYPE 1):~~	~~36 S.F. X 2.00' HIGH~~	~~= 72 C.F.~~
6,000 GALLON TANK (TYPE 2):	72 S.F. X 2.00' HIGH	= 144 C.F.

CONSTANTS (WEIGHTS)

CONCRETE:	150 POUNDS/C.F.
WATER:	62.4 POUNDS/C.F.
SUBMERGED CONCRETE:	87.6 POUNDS/C.F.

WEIGHT OF ANTI-FLOATATION IN PLACE

~~15,000 GALLON TANK (TYPE 1):~~	~~131.32 C.F. X 87.6 POUNDS/C.F.~~	~~= 11,503.6 POUNDS~~	
~~15,000 GALLON TANK (TYPE 1):~~	~~127.32 C.F. X 87.6 POUNDS/C.F.~~	~~= 11,153.2 POUNDS~~	
15,000 GALLON TANK (TYPE 2):	254.64 C.F. X 87.6 POUNDS/C.F.	= 22,306.5 POUNDS	
~~8,000 GALLON TANK (TYPE 1):~~	~~76 C.F. X 87.6 POUNDS/C.F.~~	~~= 6,657.6 POUNDS~~	
~~8,000 GALLON TANK (TYPE 2):~~	~~152 C.F. X 87.6 POUNDS/C.F.~~	~~= 13,315.2 POUNDS~~	
~~7,500 GALLON TANK (TYPE 1):~~	~~72 C.F. X 87.6 POUNDS/C.F.~~	~~= 6,307.2 POUNDS~~	
7,500 GALLON TANK (TYPE 2):	144 C.F. X 87.6 POUNDS/C.F.	= 12,614.4 POUNDS	
~~6,000 GALLON TANK (TYPE 1):~~	~~72 C.F. X 87.6 POUNDS/C.F.~~	~~= 6,307.2 POUNDS~~	
6,000 GALLON TANK (TYPE 2):	144 C.F. X 87.6 POUNDS/C.F.	= 12,614.4 POUNDS	



DISTRIBUTION BOX WITH 14 OUTLETS

SCALE 1" - 4'

BURLINGAME STATE PARK AND CAMPGROUND

STATE OF RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING AND DEVELOPMENT

DEMOLITION AND REBUILD OF BATHHOUSES
BURLINGAME STATE PARK AND CAMPGROUND
CHARLESTOWN, RHODE ISLAND

OWTS PRECAST STRUCTURES DETAILS

Dwg:
Scale: 1" = 20'
Contract No. X
Date: JANUARY, 2023

C-3.1
21

OWTS SUBMISSION - JANUARY 9, 2023

J:\Rhodeisland\Charlestown\RIDEM - Burlingame\009 - 025 and S-6 Site Design.dwg

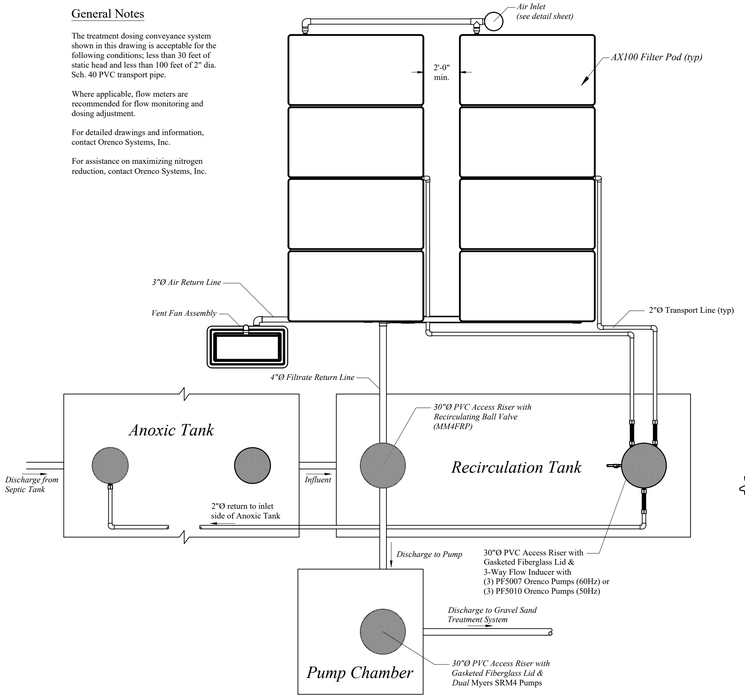
General Notes

The treatment dosing conveyance system shown in this drawing is acceptable for the following conditions; less than 30 feet of static head and less than 100 feet of 2" dia. Sch. 40 PVC transport pipe.

Where applicable, flow meters are recommended for flow monitoring and dosing adjustment.

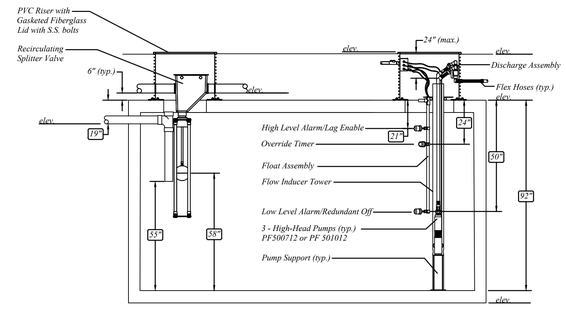
For detailed drawings and information, contact Orenco Systems, Inc.

For assistance on maximizing nitrogen reduction, contact Orenco Systems, Inc.



AdvanTex AX100 SYSTEM - MANIFOLDED VENT INLET
2 POD CONFIGURATION

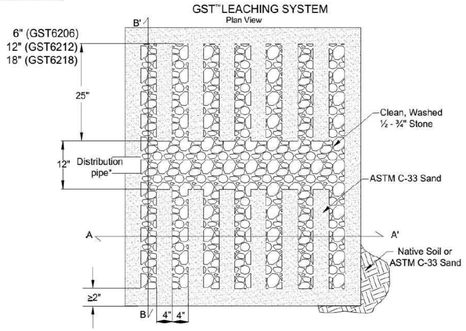
SCALE 1" - 4'



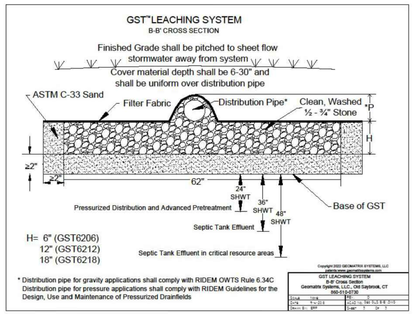
RECIRCULATION TANK FLOAT AND RSV SETTINGS

NOT TO SCALE

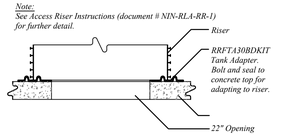
GST Schematics



* Distribution pipe for gravity systems shall comply with RIDEM OWTS Rule 6.34C Distribution pipe for pressure applications shall comply with RIDEM Guidelines for the Design, Use and Maintenance of Pressurized Drainfields.

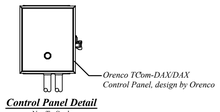


* Distribution pipe for gravity applications shall comply with RIDEM OWTS Rule 6.34C Distribution pipe for pressure applications shall comply with RIDEM Guidelines for the Design, Use and Maintenance of Pressurized Drainfields



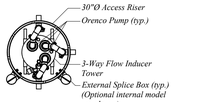
30" Riser Attachment Detail for Concrete Tank

Scale: NTS



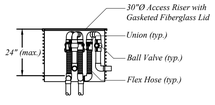
Control Panel Detail

Not To Scale



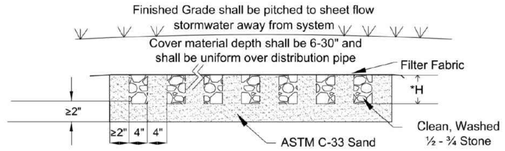
3-Way Flow Inducer
Typical Plumbing Example

Scale: 1" = 3'-0"

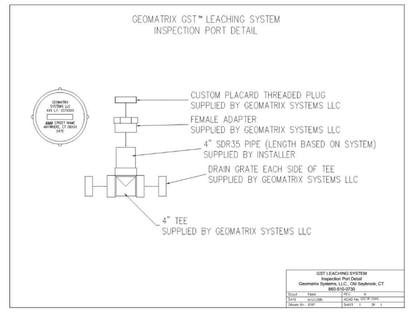


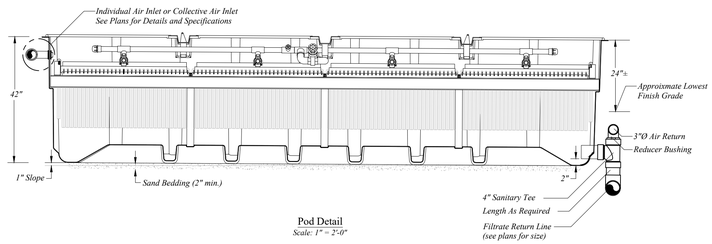
3-Way Flow Inducer
Typical Plumbing Profile

Scale: 1" = 3'-0"



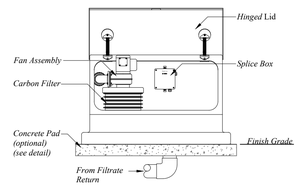
*H= 6" (GST6206)
12" (GST6212)
18" (GST6218)





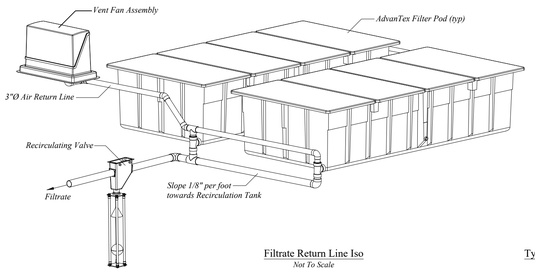
Pod Detail

Scale: 1" = 2'-0"



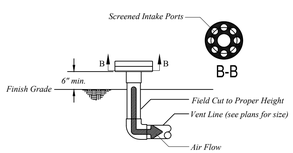
Above Ground Fan Assembly

Scale: 1" = 2'-0"



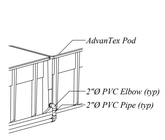
Filtrate Return Line Iso

Not To Scale



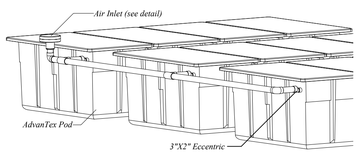
Collective Air Inlet Detail

Scale: 1" = 2'-0"



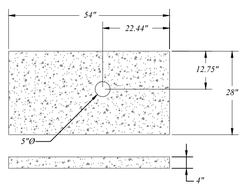
Typical Pod Inlet Connection

Not To Scale



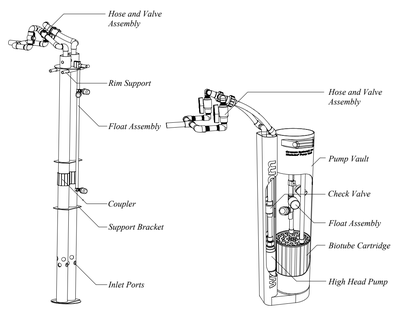
Collective Air Inlet Option

Not To Scale



Fan Assembly Pad Detail

Scale: 1" = 2'-0"

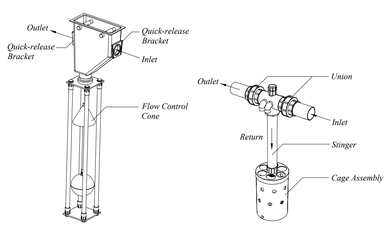


Duplex Flow Inducer Tower Detail

Scale: NTS

Duplex Pump Vault Detail

Scale: NTS



Recirculating Ball Valve Detail

Scale: NTS

Recirculating Splitter Valve Detail

Scale: NTS

COLLECTIVE AIR INLET DETAIL

SCALE: VARIES

AdvanTex AX100 SYSTEM - MISCELLANEOUS DETAILS

SCALE: VARIES

CAPUTO AND WICK LTD. - 1150 PAWTUCKET AVENUE - RUMFORD R.I. 02916

BURLINGAME STATE PARK AND CAMPGROUND

STATE OF RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING AND DEVELOPMENT

DEMOLITION AND REBUILD OF BATHHOUSES
BURLINGAME STATE PARK AND CAMPGROUND
CHARLESTOWN, RHODE ISLAND

OWTS DETAILS

Dwg:

Scale: 1" = 20'

Contract No. x

Date: JANUARY, 2023

C-3.2

22

OWTS SUBMISSION - JANUARY 9, 2023

J:\Rhodeisland\Charlestown\RIDEM - Burlingame\009 - 025 and S-6 Site Design.dwg

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

20.0179 7A,7B
SHEET 1-2
12/23/21

Site Evaluation Form
Part A – Soil Profile Description Application Number _____

Property Owner: RHODE ISLAND STATE OF (DEM) DIVISION OF PARKS
Property Location: 1-100 BURLINGAME PARK RD, CHARLESTOWN, RI PLAT 15 LOT 10
Date of Test Hole: 12/23/21
Soil Evaluator: KAMAL HINGORANY License Number: D4005
Weather: CLOUDY Shaded: Yes ☒ No ☐ Time: 10:30AM

TH 7A Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Contr.				
Ap	0-2	C	S	10yr 4/3	-		-		Ls	gr	Vfr	3
Bw	2-24	C	S	10yr 5/6	-		-		Ls	gr	Vfr	3
C_1	24-58	C	S	5y 5/8	-		-		Ls	gr	Vfr	3
C_2	58-120	C	S	5y 5/2	5yr 5/6	F	F	D	Ls	m	Fi	6

TH 7B Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox			Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab.	S.	Contr.				
Ap	0-2	C	S	10yr 4/3	-		-		Ls	gr	Vfr	3
Bw	2-18	C	S	10yr 5/6	-		-		Ls	gr	Vfr	3
C_1	18-48	C	S	5y 5/8	-		-		Ls	gr	Vfr	3
C_2	48-100	C	S	5y 8/8	5yr 5/8	F	F	D	Ls	gr	Vfr	3

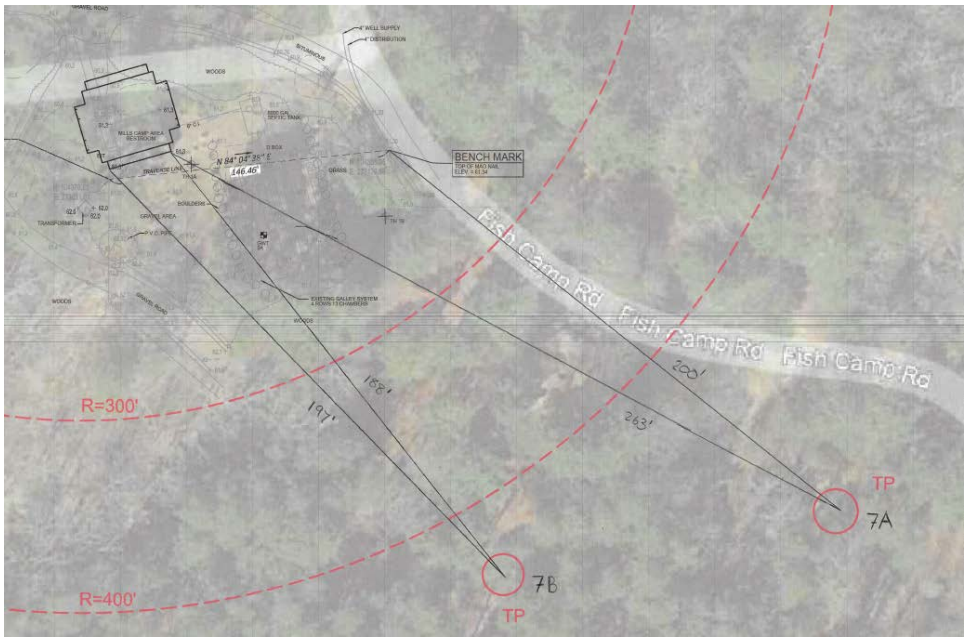
TH 7A Soil Class B Total Depth 120" Impervious/Limiting Layer Depth 120"(og) GW Seepage Depth - SHWT 58"(og)
TH 7B Soil Class B Total Depth 100" Impervious/Limiting Layer Depth 100"(og) GW Seepage Depth - SHWT 48"(og)

Comments: _____

Part B 20.0179 7A, 7B
SHEET 2-2
12/23/21

Site Evaluation – to be completed by Soil Evaluator or Class II or III Designer
Please use the area below to locate:
1. Test holes and bedrock test holes,
2. Approximate direction of due north,
3. Offsets from all test holes to fixed points such as street, utility pole, or other permanent, marked object.*
*OFFSETS MUST BE SHOWN

Key:
- Approximate location of test holes
- Approximate location of bedrock test holes
- x% Estimated gradient and direction of slope
- N Approximate direction of due north



SHWT THs	
TH	Depth
7A	58"
7B	48"

1. Relief and Slope: _____
2. Presence of any watercourse, wetlands or surface water bodies, within 200 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐ XX
3. Restrictive Layer or Bedrock within 4' below original ground within 25 feet of test hole? Provide all test hole locations & depths above. NO ☒ YES ☐
4. Presence of existing or proposed private drinking water wells within 200 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐ XX
5. Public drinking water wells within 500 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐
6. Is site within the watershed of a public drinking water reservoir or other critical area defined in Rule 6.42? NO ☒ YES ☐ XX
7. Has soil been excavated from or fill deposited on site? If yes, locate on above sketch. NO ☒ YES ☐
8. Site's potential for flooding or ponding: NONE ☒ SLIGHT ☐ MODERATE ☐ SEVERE ☐
9. Landscape position: SHOULDER
10. Vegetation: GRASS/DIRT
11. Indicate approximate location of property lines and roadways.
12. Additional comments, site constraints or additional information regarding site: _____
ITEMS 2,4 AND 6 DONE BY CAPUTO & WICK

Certification

The undersigned hereby certifies that all information on this application and accompanying forms, submittals and sketches are true and accurate and that I have been authorized by the owner(s) to conduct these necessary field investigations and submit this request.

Part A prepared by: KAMAL HINGORANY (Signature) D4005 (License #)
Part B prepared by: KAMAL HINGORANY (Signature) D4005 (License #)

DO NOT WRITE IN THIS SPACE

Witnessed Soil Evaluation Decision: Concur ☐ Inconclusive ☐ Disclaim ☐
Unwitnessed Soil Evaluations Decision: Accept ☐ Inconclusive ☐ Disclaim ☐

Wet Season Determination required ☐ Additional Field Review Required ☐

Explanation: _____

_____

_____

_____ _____
Signature Authorized Agent Date

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS
Department of Environmental Management
Office of Water Resources
Onsite Wastewater Treatment Systems Program

20.0179 1A,1B
SHEET 1-2

Site Evaluation Form
Part A – Soil Profile Description **Application Number** _____

Property Owner: RHODE ISLAND STATE OF (DEM) DIVISION OF PARKS
Property Location: 1-100 BURLINGAME PARK RD, CHARLESTOWN, RI PLAT 15 LOT 10
Date of Test Hole: 8/17/21
Soil Evaluator: KAMAL HINGORANY License Number: D4005
Weather: CLOUDY Shaded: Yes ☐ No ☒ Time: 9:30 AM

TH 1A Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
Ap	0-9	C	S	2.5YR 6/3	-	-	Ls	2gbd	VFr	3
Bw	9-23	C	W	10YR 5/6	-	-	Ls	2gbd	Fr	3
C_1	23-49	C	S	2.5YR 7/3	-	-	Ls	2gbd	Fr	3
C_2	49-120	-	-	2.5YR 7/3	5YR 4/4	M M P	Ls	2gbd	Fr	3

TH 1 B Horizon	Depth	Horizon Boundaries		Soil Colors		Re-Dox	Texture	Structure	Consistence	Soil Category
		Dist	Topo	Matrix	Re-Dox Features	Ab. S. Contr.				
Ap	0-6	C	S	2.5YR 6/3	-	-	Ls	2gbd	VFr	3
Bw	6-25	C	W	10YR 5/6	-	-	Ls	2gbd	Fr	3
C_1	25-60	C	S	2.5YR 7/3	-	-	Ls	2gbd	Fr	3
C_2	60-120	-	-	2.5YR 7/3	5YR 4/4	M M P	Ls	2gbd	Fr	3

TH 1A Soil Class B Total Depth 120" Impervious/Limiting Layer Depth 120" (og) GW Seepage Depth - SHWT 49" (og)
TH 1B Soil Class B Total Depth 120" Impervious/Limiting Layer Depth 120" (og) GW Seepage Depth - SHWT 60" (og)

Comments: _____

Part B

Site Evaluation – to be completed by Soil Evaluator or Class II or III Designer

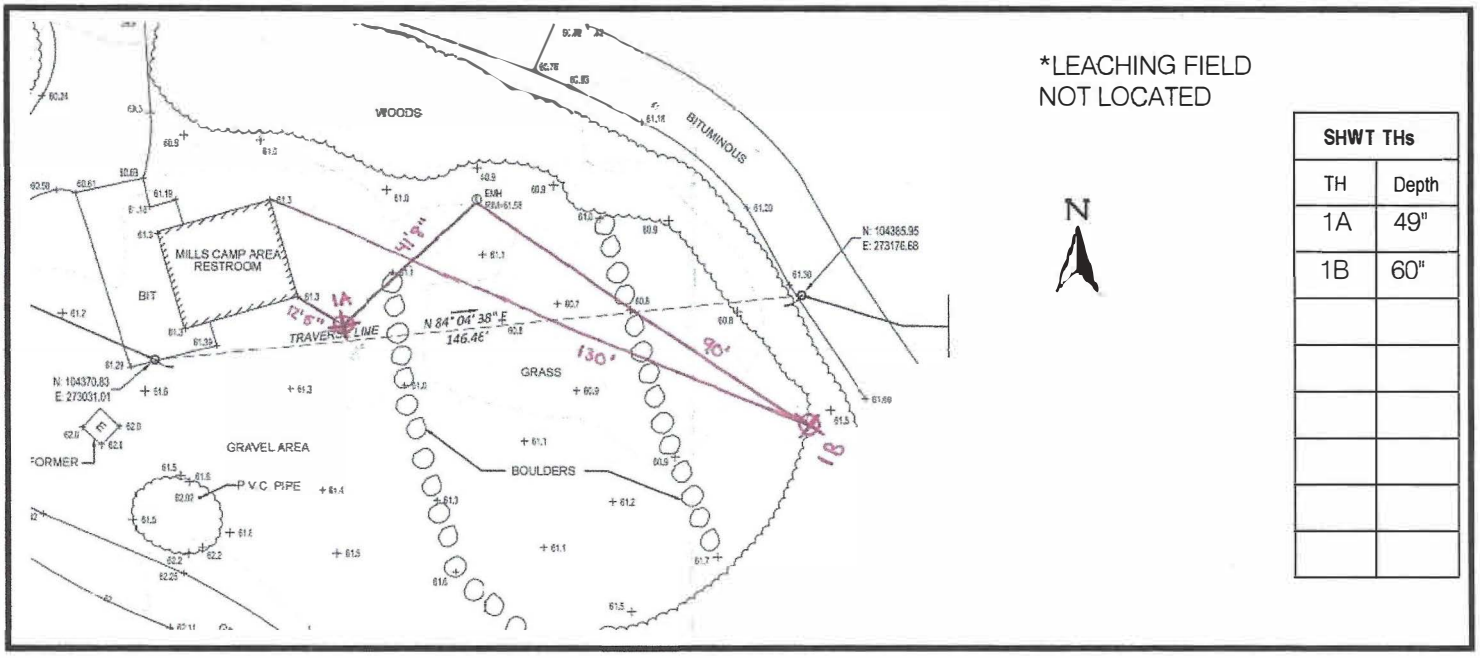
20.0179 1A,1B
SHEET 2-2

Please use the area below to locate:

1. Test holes and bedrock test holes,
2. Approximate direction of due north,
3. Offsets from all test holes to fixed points such as street, utility pole, or other permanent, marked object.*

***OFFSETS MUST BE SHOWN**

Key:
- Approximate location of test holes
- Approximate location of bedrock test holes
- Estimated gradient and direction of slope
- Approximate direction of due north



*LEACHING FIELD NOT LOCATED

SHWT THs	
TH	Depth
1A	49"
1B	60"

1. Relief and Slope: _____
2. Presence of any watercourse, wetlands or surface water bodies, within 200 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐
3. Restrictive Layer or Bedrock within 4' below original ground within 25 feet of test hole? Provide all test hole locations & depths above. NO ☒ YES ☐
4. Presence of existing or proposed private drinking water wells within 200 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐
5. Public drinking water wells within 500 feet of test holes? If yes, locate on above sketch. NO ☒ YES ☐
6. Is site within the watershed of a public drinking water reservoir or other critical area defined in Rule 6.42? NO ☒ YES ☐
7. Has soil been excavated from or fill deposited on site? If yes, locate on above sketch. NO ☒ YES ☐
8. Site's potential for flooding or ponding: NONE ☒ SLIGHT ☐ MODERATE ☐ SEVERE ☐
9. Landscape position: SHOULDER
10. Vegetation: GRASS
11. Indicate approximate location of property lines and roadways.
12. Additional comments, site constraints or additional information regarding site: _____

Certification

The undersigned hereby certifies that all information on this application and accompanying forms, submittals and sketches are true and accurate and that I have been authorized by the owner(s) to conduct these necessary field investigations and submit this request.

Part A prepared by: _____ D4005
Signature License #

Part B prepared by: _____ D4005
Signature License #

DO NOT WRITE IN THIS SPACE

Witnessed Soil Evaluation Decision: Concur ☐ Inconclusive ☐ Disclaim ☐

Unwitnessed Soil Evaluations Decision: Accept ☐ Inconclusive ☐ Disclaim ☐

Wet Season Determination required ☐ **Additional Field Review Required** ☐

Explanation: _____

_____

_____

_____ _____
Signature Authorized Agent Date

Revised 11/25/18

Mills Camp Bathhouse and System Replacement Project
Burlingame State Park and Campground
Charlestown, Rhode Island

DESIGN NARRATIVE

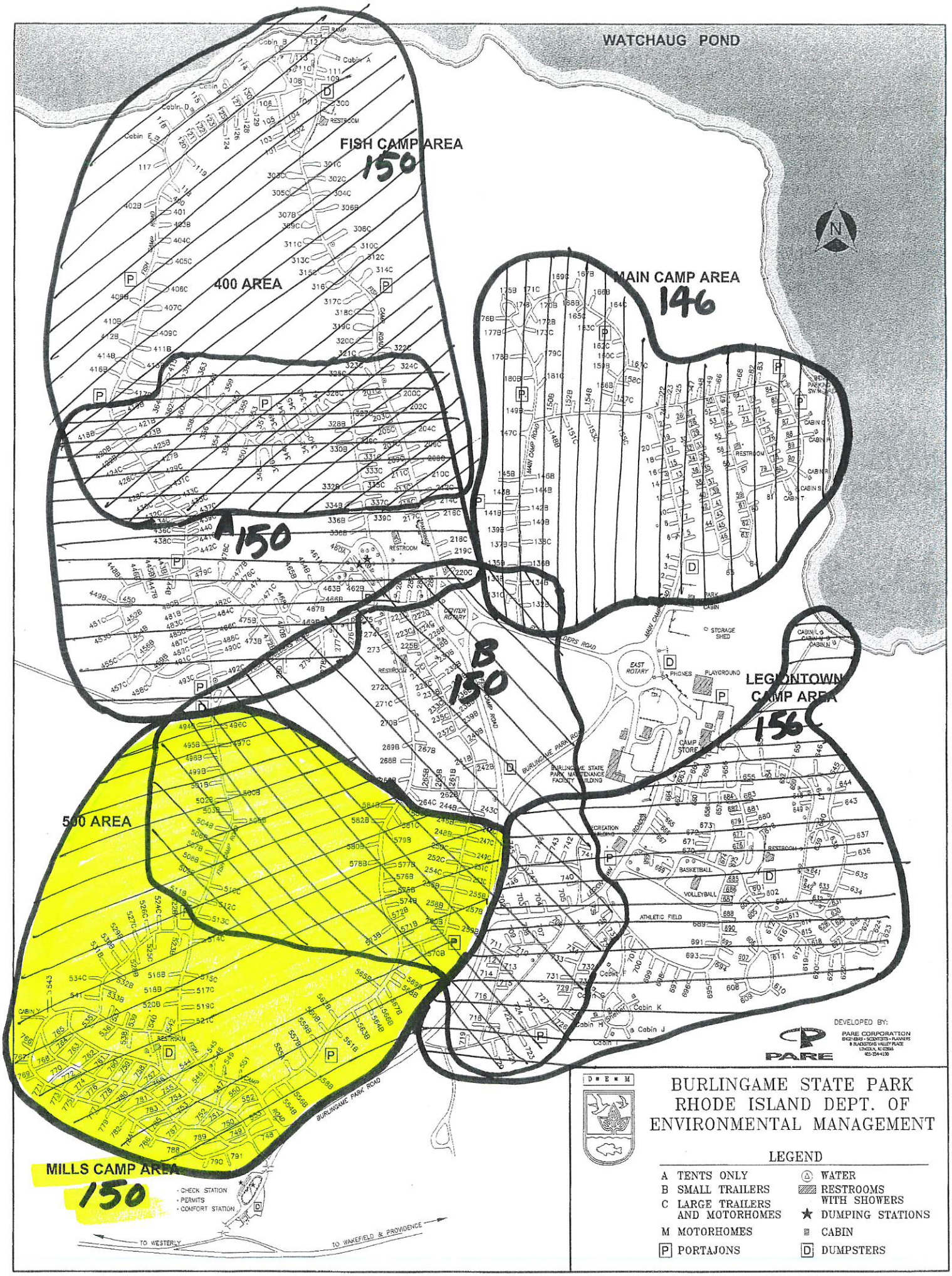
RIDEM is in the process of replacing the Bathhouse and Onsite Wastewater System (OWTS) at this location. Soil logs can be found on Sheet C-1.1 together with the proposed site layout and System Design Data and Notes. Details for the system are on Sheets C-2.1, C-3.1 and C-3.2.

Soil evaluations for this OWTS location were conducted on August 17, 2021, and December 23, 2021, soils are Category 3 and the Estimated Seasonal High Water Table depth at the OWTS is 48" or at elevation 57.9±.

In total the six bathhouses for the overall campground accommodate approximately 720 campsites. Utilizing the RIDEM wastewater design flow for a campground with washroom and toilets of 50 gallons per day we determine a daily flow for the entire campground to be approximately 36,000 gallons per day (GPD). The average daily flow per acre of the campground is (36,000 GPD / 847 Acres) 42.5 GPD/Acre. The average daily flow for each bathhouse is approximately 6,000 GPD. In calculating an estimated daily flow for the Mill Camp Bathhouse OWTS we took a conservative approach utilizing 150 campsites at 50 GPD/campsite to determine a design flow for the Mill Camp Bathhouse to be 7,500 GPD which is greater than the 6,000 GPD average. Please see the attached campsite map which depicts the campsites (as highlighted) chosen to be included within the 150 sites utilized for sizing the OWTS. Please note that sites throughout the campground overlap to agree with the conservative estimate. The system as sized is oversized and is considered a large system. The system is used on a seasonal basis between the months of April and October.

The OWTS will utilize Two (2) Orenco AdvanTEX AX100 Pods for advanced treatment. This system is a Category 1 advanced treatment technology. The system will treat the wastewater and reduce the biochemical oxygen demand (BOD) and comply with the latest Orenco system design criteria and thus the RIDEM OWTS criteria. See attached Final Design Review Letter.

The systems drainfield is designed as a Geomatrix Gravel Sand Treatment (GST) System. The Loading Rate for Category 1 Technology for the GST is 3.5 GPD/square feet (SF). The minimum size drainfield is 7,500 GPD/3.5 GPD/SF which equals 2,143 SF. We propose to use the GST 6212 and the minimum size drainfield requirement for this application is 123 lineal feet (LF). We propose to use the 280 lineal feet (LF) of GST 6212 which provides 17.5 S.F. per LF, which equals 4,900 SF. and is greater than 2,143 SF (minimum size). The GST system has been divided into to equal drainfields and the GST are spaced 7'6" on center. The two drainfields consist of 5 rows each 28 feet long and 62" wide with a stone depth of 12" below the 4" perforated distribution pipe. See pump selection and system specifications on Sheet C-2.1 for additional information.



D E M

BURLINGAME STATE PARK
RHODE ISLAND DEPT. OF ENVIRONMENTAL MANAGEMENT

LEGEND

A TENTS ONLY	△ WATER
B SMALL TRAILERS	▨ RESTROOMS WITH SHOWERS
C LARGE TRAILERS AND MOTORHOMES	★ DUMPING STATIONS
M MOTORHOMES	▪ CABIN
P PORTAJONS	D DUMPSTERS

PROTECTING THE WORLD'S WATER

01/19/2023

Kevin Harrop
Caputo & Wick
1150 Pawtucket Ave
Rumford, RI 02916

Subject: Final Design Review of Burlingame Park/Mills Camp

Kevin,

Orenco Systems, Inc. ("Orenco") has received the Plans with all required fields completed (attached to this letter), a copy of the plan set showing the designed site layout and configuration plans, and other documents that comprise the Final Design for the Burlingame Park project. Orenco staff reviews the Final Design of all wastewater collection and treatment systems for commercial applications to ensure that the design is compliant with the most current version of the system's applicable design criteria published by Orenco for the specified parameters provided by the system's designer in the Plans. The findings and conclusions of my review of this Final Design are as follows:

Design Basis

The system has been designed for a Type 2, Park application. Influent flow and constituent concentrations and effluent constituent concentration requirements have been provided by the system's designer on the attached Plans and were used in my review of the Final Design.

The influent flow on the Plans were not extrapolated from the metered flows from the subject site, but in our experience, they are consistent with influent flows from other, similar Type 2, Park systems that Orenco has previously observed. As such, I have no reason to doubt the accuracy of the designer's findings and assumptions as to the influent flow, and find that it was reasonable for the designer to use them as the design basis for the system.

System Design

The proposed Final Design of the system consists of a park. Influent will enter a 15,000 gallon Primary Tank, which will then flow into a 7,500 gallon Pre-Anoxic Tank. From here, flow will gravity discharge into a 6,000 gallon Recirculation Tank. The recirc-filtrate blend in this tank will pump into (2) AX100 pods and the filtrate will enter a splitter valve in the front of the Recirculation Tank where it will either be recirculated again or siphon to a drain field..

Design Criteria

The applicable design criteria for this system, which I used to conduct the review of its Final Design, is revision 8.0 of document NDA-ATX-1, titled *Orenco® AdvanTex® Design Criteria, Commercial Treatment Systems*, which was published by Orenco in October, 2020. A copy of the design criteria can be downloaded from Orenco's online document library at www.orenco.com/corporate/doclibrary.cfm.

Findings

The findings of my review as to whether the Final Design complies with Orenco's design criteria for treating wastewater to the effluent constituent concentration requirements provided in the Plans are as follows:

Primary Treatment

The Final Design specifies the use of 1 - 15,000 U.S. Gallon Primary concrete and 1 - 7,500 U.S. Gallon Primary concrete tanks in series for primary treatment. Using the flow data specified on the Plans the hydraulic retention times for grease capture and primary treatment calculate as follows:

Primary Tank(s) Hydraulic Retention Time (HRT)[1]				
Design Average Flow (gpd)	Design Maximum Day Flow (gpd)	Effective Combined Primary Tankage (gpd)	Avg HRT (days)	Max Day HRT (days)
3,500	7,500	22,500	6.4	3.0

[1] Design Max Day Flow is the maximum daily flow a facility is expected to receive no more than one day within any week's time.

The Primary Tank Sizing Recommendations states that the recommended primary tankage for a Park treatment system should be sized to at a minimum of 3 days of hydraulic retention time at the Design Max Day Flow. Therefore, the configuration and specifications of the primary treatment tanks in the Final Design satisfy Orenco's recommendation for primary tankage for this Park application. This pre-anoxic tank should be sized equal to one day at maximum day design flow and is considered part of the overall primary tank volume.

Recirculation Tank — Standard Stage

The Final Design further specifies the use of 1 - 6,000 U.S. Gallon concrete tank for recirculation and blending of the AdvanTex-treated effluent with primary tank effluent. Using the flow data specified on the Plans the tank is sized to be equal to 80% of the Maximum Day Design Flow. The recirculation tank for the standard stage should be sized at a minimum of 75% of the Maximum Day Design Flow. Therefore, the specification of the recirculation-blend tank in the Final Design satisfies Orenco's design criteria.

Hydraulic Load — Standard Stage

The Final Design specifies the use of 2 - AX100 pods, which contain a nominal surface area of 200 square feet of treatment media. Using the flow data specified on the Plans the hydraulic loading rate for the system calculates as follows:

Hydraulic Loading Rate (HLR) — Standard Stage				
Design Average Flow (gpd)	Design Maximum Day Flow (gpd)	Nominal Textile Area (sq. ft.)	Average HLR (gal. per day/sq. ft.)	Peak HLR (gal. per day/sq. ft.)
3,500	7,500	200	17.5	37.5

According to the AdvanTex System Loading Chart in the applicable design criteria, the standard AdvanTex treatment system (Stage 1) should not be hydraulically loaded more than 25 gpd/square foot at Design Average Flow or 50 gpd/square foot at Design Max Day Flow. Therefore, the specified type and number of AdvanTex pods in the Final Design satisfy Orenco's design criteria to achieve the effluent quality listed in the design criteria at a 95% confidence level for this Type 2, Park application.

Organic Load — Standard Stage

The following influent characteristics provided on the Plans were estimated and not derived from direct sampling. Even though the influent characteristics were not derived from direct sampling, the values provided are consistent with values we have seen in other, similar Type 2, Park applications.

Influent (Primary Tank Effluent) Characteristics — Loading to Textile	
Average BOD_5 (mg/L)	Average TSS (mg/L)
250	200

Based on the average influent biochemical oxygen demand (BOD_5) concentration and flow data specified on the Plans, the system will receive approximately 7.3 pounds of BOD_5 per day at Design Average Flow, and 15.6 pounds of BOD_5 per day at Maximum Day Design Flow. Using this information, the organic loading rate of the system calculates as:

Organic Loading Rate (OLR) — Standard Stage				
Average Organic Load (lbs/day)	Maximum Organic Load (lbs/day)	Nominal Treatment Area (sq. ft.)	Average OLR (lbs BOD/sq. ft./day)	Maximum OLR (lbs BOD/sq. ft./day)
7.3	15.6	200	0.04	0.08

Conclusions

I have reviewed the Final Design of the Burlingame Park wastewater treatment system, and have found that the design is compliant with the most current version of the system's applicable design criteria published by Orenco for the specified parameters provided by the system's designer in the Plans. In addition, I noted no anomalies in the site layout or configuration of the system during my review.

Compliance Table — Meets Minimum Design Standards	
	Standard Stage
Recirc Tank Size	Yes
Hydraulic Load	Yes
Organic Load	Yes

As such, the system as designed satisfactorily complies with Orenco's design criteria to meet the following effluent limits specified in the Plans at a 95% confidence level, provided that all influent flows and constituent concentrations specified in the Plans are not exceeded:

Expected Effluent Quality	
Constituent	**Average (mg/L)**
BOD_5	20
TSS	20

It is important to note that even though the AdvanTex Treatment System has the capability to meet or exceed the required treatment parameters, there is no way that Orenco can guarantee that a particular system will be operated or maintained in a manner consistent with the Final Design reviewed. Once the facility is placed into operation, the influent flows and constituent concentrations to the facility should be monitored, and if flow or any of the influent constituent concentrations exceed those listed in the Plans, measures should be taken to reduce the flow or constituent concentration to those listed. However, if additional treatment capacity becomes necessary, the system is designed to have the capability to expand to account for the new flow or constituent concentration.

Proper air ventilation is a critical feature of all commercial AdvanTex Treatment Systems, and as such, adequate active ventilation is required for all systems. In addition, please note that disposing of toxics or chemicals into the system is strictly prohibited. Examples of toxics include restaurant degreasers, cleansers, wax strippers for linoleum, carpet shampoo, waste products, or any other toxins. Furthermore, water softener brine discharge is prohibited from being discharged into the AdvanTex Treatment System. Failure to adhere to these policies will void Orenco's limited product warranties.

If you have any questions about my review process, findings, or conclusions, please feel free to call or e-mail me.

Sincerely,



Caleb Castleman
Systems Engineering
Orenco Systems Inc.
(800) 348-9843 ext. 548
ccastleman@orenco.com

Project: Burlingame State Park and Camp Ground
Location: Mills Camp

Description	Input values	Units
Finish Grade	62.00	Elevation
Water Table Elevation	57.90	Elevation
Bottom of Tank Elevation	51.08	Elevation
Lowest Pipe Invert	58.75	Elevation
Counter Weight (Type 2)	22,306.50	lbs
Soil Above Tank	18.00	Inches
Length of Tank	30.83	Feet
Width of Tank	11.33	Feet
Depth of Tank	9.33	Feet
Top of Concrete Thickness	8.00	Inches
Bottom of Concrete Thickness	8.00	Inches
Sides Concrete Thickness	8.00	Inches
Two Compartment Tank		
Compartment Wall Thickness	4.00	Inches
Compartment Wall Height	87.00	Inches
	Computed Value	
Submerged Depth	6.82	Feet
Top/Bottom Surface Area of Tank	349.44	SF
Displaced Volume	2,382.05	CF
Volume of Tank Top	232.96	CF
Volume of Tank Sides	435.56	CF
Volume of Tank Bottom	232.96	CF
Volume of Baffle	24.17	CF
Weight of Tank Top	34,944.44	lbs
Weight of Tank Sides	65,333.33	lbs
Weight of Tank Bottom	34,944.44	lbs
Weight of Baffle	3,625.00	lbs
Total Weight of Tank	138,847.22	lbs
Volume of Soil	524.17	CF
Weight of Soil Above Tank	52,416.67	lbs
Uplift Created by Submerged Tank	148,639.76	lbs
Total Weight of Tank, Counter Weight and Soil	213,570.39	lbs
Exceeds Displaced Volume by	64,930.63	lbs
Buoyance Point for Empty Tank	6.37	Feet (above bottom)
Buoyance Point for Empty Tank	57.45	Elev
Buoyance Point for Tank in Place	9.79	Feet (above bottom)
Buoyance Point for Tank in Place	60.88	Elev

(Soil friction has not been taken into account)

Project: Burlingame State Park and Camp Ground
Location: Mills Camp

Description	Input values	Units
Finish Grade	62.00	Elevation
Water Table Elevation	57.90	Elevation
Bottom of Tank Elevation	50.90	Elevation
Lowest Pipe Invert	58.40	Elevation
Counter Weight (Type 2)	12,614.40	lbs
Soil Above Tank	23.00	Inches
Length of Tank	17.00	Feet
Width of Tank	10.00	Feet
Depth of Tank	9.17	Feet
Top of Concrete Thickness	8.00	Inches
Bottom of Concrete Thickness	6.00	Inches
Sides Concrete Thickness	6.00	Inches
Two Compartment Tank		
Compartment Wall Thickness	0.00	Inches
Compartment Wall Height	0.00	Inches
	Computed Value	
Submerged Depth	7.00	Feet
Top/Bottom Surface Area of Tank	170.00	SF
Displaced Volume	1,190.00	CF
Volume of Tank Top	113.33	CF
Volume of Tank Sides	208.00	CF
Volume of Tank Bottom	85.00	CF
Volume of Baffle	0.00	CF
Weight of Tank Top	17,000.00	lbs
Weight of Tank Sides	31,200.00	lbs
Weight of Tank Bottom	12,750.00	lbs
Weight of Baffle	0.00	lbs
Total Weight of Tank	60,950.00	lbs
Volume of Soil	325.83	CF
Weight of Soil Above Tank	32,583.33	lbs
Uplift Created by Submerged Tank	74,256.00	lbs
Total Weight of Tank, Counter Weight and Soil	106,147.73	lbs
Exceeds Displaced Volume by	31,891.73	lbs
Buoyance Point for Empty Tank	5.75	Feet (above bottom)
Buoyance Point for Empty Tank	56.65	Elev
Buoyance Point for Tank in Place	10.01	Feet (above bottom)
Buoyance Point for Tank in Place	60.91	Elev

(Soil friction has not been taken into account)

Buoyancy Calculations | 6,000 Gallon Recirculation Tank | 3/4/2022

Project: Burlingame State Park and Camp Ground
Location: Mills Camp

Description	Input values	Units
Finish Grade	62.00	Elevation
Water Table Elevation	57.90	Elevation
Bottom of Tank Elevation	50.50	Elevation
Lowest Pipe Invert	57.25	Elevation
Counter Weight (Type 2)	12,614.40	lbs
Soil Above Tank	40.00	Inches
Length of Tank	17.00	Feet
Width of Tank	10.00	Feet
Depth of Tank	8.17	Feet
Top of Concrete Thickness	8.00	Inches
Bottom of Concrete Thickness	6.00	Inches
Sides Concrete Thickness	6.00	Inches
Two Compartment Tank		
Compartment Wall Thickness	0.00	Inches
Compartment Wall Height	0.00	Inches
	Computed Value	
Submerged Depth	7.40	Feet
Top/Bottom Surface Area of Tank	170.00	SF
Displaced Volume	1,258.00	CF
Volume of Tank Top	113.33	CF
Volume of Tank Sides	182.00	CF
Volume of Tank Bottom	85.00	CF
Volume of Baffle	0.00	CF
Weight of Tank Top	17,000.00	lbs
Weight of Tank Sides	27,300.13	lbs
Weight of Tank Bottom	12,750.00	lbs
Weight of Baffle	0.00	lbs
Total Weight of Tank	57,050.13	lbs
Volume of Soil	566.67	CF
Weight of Soil Above Tank	56,666.67	lbs
Uplift Created by Submerged Tank	78,499.20	lbs
Total Weight of Tank, Counter Weight and Soil	126,331.20	lbs
Exceeds Displaced Volume by	47,832.00	lbs
Buoyance Point for Empty Tank	5.38	Feet (above bottom)
Buoyance Point for Empty Tank	55.88	Elev
Buoyance Point for Tank in Place	11.91	Feet (above bottom)
Buoyance Point for Tank in Place	62.41	Elev

(Soil friction has not been taken into account)

Project: Burlingame State Park and Camp Ground
Location: Mills Camp

Description	Input values	Units
Finish Grade	62.25	Elevation
Water Table Elevation	57.90	Elevation
Bottom of Chamber Elevation	53.50	Elevation
Lowest Pipe Invert	59.00	Elevation
Counter Weight	0.00	lbs
Soil Above Chamber	9.00	Inches
Chamber Length	7.00	Feet
Chamber Width	7.00	Feet
Diameter of Openning	2.50	Feet
Chamber Interior Height	7.00	Feet
Top of Concrete Thickness	6.00	Inches
Bottom of Concrete Thickness	6.00	Inches
Concrete Wall Thickness	6.00	Inches
	Computed Value	
Submerged Depth	4.40	Feet
Top Surface Area of Chamber	44.09	SF
Surface Area of Chamber Sides	182.00	
Bottom Surface Area of Chamber	49.00	SF
Displaced Volume	215.60	CF
Volume of Chamber Top	22.05	CF
Volume of Chamber Sides	91.00	CF
Volume of Chamber Bottom	24.50	CF
Weight of Chamber Top	3,306.84	lbs
Weight of Tank Side	13,650.00	lbs
Weight of Chamber Bottom	3,675.00	lbs
Total Weight of Chamber	20,631.84	lbs
Volume of Soil	33.07	CF
Weight of Soil Above Chamber	3,306.84	lbs
Uplift Created by Submerged Chamber	13,453.44	lbs
Total: Chamber, Counter Weight and Soil	23,938.69	lbs
Exceeds Displaced Volume by	10,485.25	lbs
Buoyance Point for Empty Chamber	6.75	Feet (above bottom)
Buoyance Point for Empty Chamber	60.25	Elev
Buoyance Point for Chamber in Place	7.83	Feet (above bottom)
Buoyance Point for Chamber in Place	61.33	Elev

(Soil friction has not been taken into account)

Technical Data Sheet

Duplex Control Panels

Applications

Orenco Duplex Control Panels are used to control dual pumps, alarms, and other equipment as specified in pressure sewers and onsite septic systems.



Orenco® DAX2 Control Panel

c UL us LISTED

General

Orenco Duplex Control Panels are specifically engineered for pressure sewer (STEP) systems and onsite septic treatment systems that require the use of two alternating pumps. Standard features include circuit breakers, an automatic/manual/off motor control toggle for each pump, an audio/visual high level alarm, an alarm reset, and a duplex alternator. Other standard features and options are listed on page 2. Orenco panels are designed for use with mechanical and/or mercury float switches. Listed per UL 508 in the US and Canada.

Standard Models

DAX1, DAX2

Product Code Diagram

DAX [ ] [ ] [ ]

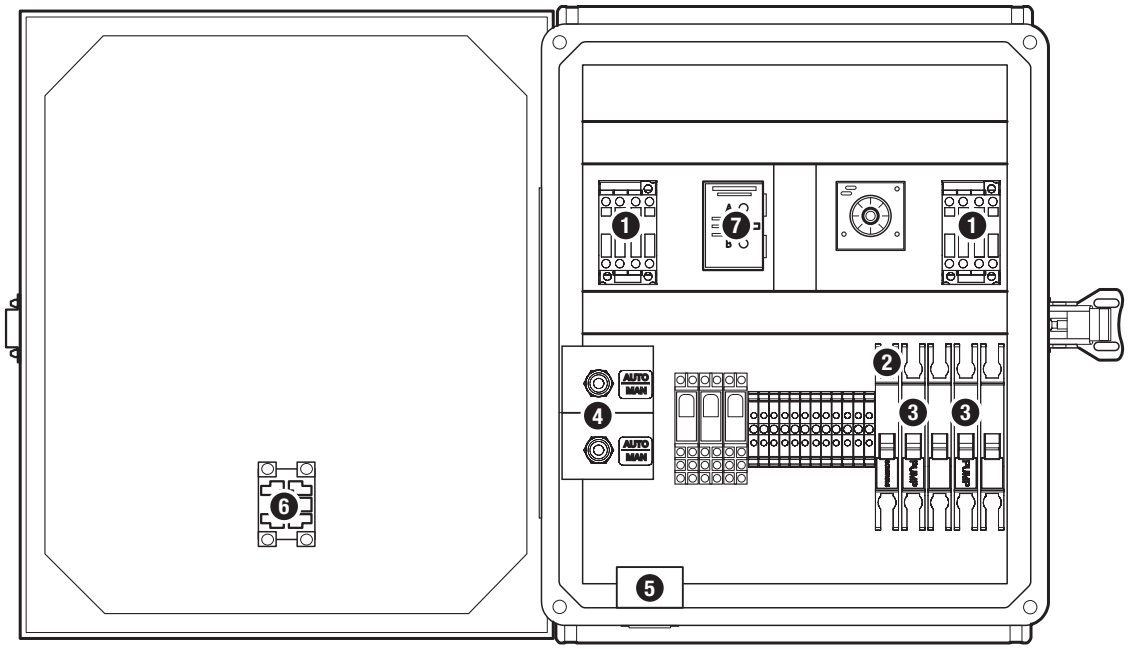
- [ ] (third box): Standard options (list in order):
  - PT = programmable timer
  - RO = redundant off relay
  - CS = current sensor
  - ETM = elapsed time meter
  - CT = event counter
  - HT = heater
  - SA = surge arrestor
  - PRL = pump run light
  - PL = power light
- [ ] (second box): Intrinsically safe relays:
  - Blank = standard, no IR relays
  - IR = intrinsically safe relays
- [ ] (first box): Pump voltage:
  - 1 = 120 VAC
  - 2 = 120 VAC or 240 VAC
- DAX: DAX series duplex control panel

Materials of Construction

Enclosure	UV-resistant fiberglass, UL Type 4X
Hinges	Stainless steel

Specifications

Panel Ratings	
DAX1:	120 V, 1 hp, 16 amps, single phase, 60 Hz.
DAX2:	240 V, 3 hp, 16 amps, single phase, 60 Hz.
Dimensions	
Height, in. (mm)	15.5 (394)
Width, in. (mm)	13.5 (343)
Depth, in. (mm)	6.7 (170)



Orenco® DAX2PTRO 240 V panel

Standard Components

Feature	Specification(s)
1. Motor-Start Contactor	120 V, 16 FLA, 1 hp (0.75 kW), 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA). 240 V, 16 FLA, 3 hp (2.24 kW), 60 Hz; 2.5 million cycles at FLA (10 million at 50% of FLA).
2. Controls Circuit Breaker	10 A, OFF/ON switch. Single-pole 120 V. DIN rail mounting with thermal magnetic tripping characteristics.
3. Pump Circuit Breakers	20 A, OFF/ON switch. Single-pole 120 V or double-pole 240 V. DIN rail mounting with thermal magnetic tripping characteristics.
4. Toggle Switches	20 A, 1hp (0.75 kW). Single-pole, double-throw HOA switch,
5. Audible Alarm	95 dB at 24 in. (610 mm), warble-tone sound.
6. Visual Alarm	7/8-in. (22-mm) diameter red lens, "Push-to-silence." UL Type 4X rated, 1 W LED light, 120 V.
7. Duplex Alternator	120 V. Cross-wired style for independent lag pump function. Selector switch for locking one pump into lead position.
Audible Alarm Silence Relay (Not shown)	120 V. Automatic reset. DIN rail mount.

Optional Features

Feature	Specification(s)	Code Adder
Intrinsically Safe Control Relays	Listed per UL 698A, for Class 1 Div. 1, groups A, B, C, D hazardous locations (requires larger enclosure).	IR
Programmable Timer	120 V. Repeat cycle from 0.05 seconds to 30 hours. Separate variable controls for OFF & ON time periods.	PT
Redundant Off Relay	120 V. Provides a secondary off. Sounds alarm on low level condition. DIN rail mount.	RO
Elapsed Time Meter	120 V, 7-digit, non-resettable. Limit of 99,999 hours; accurate to 0.01 hours.	ETM
Event Counter	120 V, 6-digit, non-resettable.	CT
Heater	Anti-condensation heater. Self-adjusting: radiates additional wattage as temperature drops.	HT
Surge Arrestor	Status light on unit; protects incoming power supply from electrical surges.	SA
Pump Run Light	7/8-in. (22-mm) diameter green lens. UL Type 4X rated, 1 W LED light, 120 V.	PRL
Power Light	7/8-in. (22-mm) diameter green lens. UL Type 4X rated, 1 W LED light, 120 V.	PL

Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

Orenco SYSTEMS

Technical Data Sheet

PF-Series Submersible Effluent Pumps: 1-Phase, 60-Hz, 4-inch (100-mm)

Applications

Our PF-Series 4-inch (100-mm) Submersible Effluent Pumps are designed to transport screened effluent (with low TSS counts) from septic tanks or dosing tanks. These pumps are constructed of lightweight, corrosion-resistant stainless steel and engineered plastics, and are field-serviceable and repairable with common tools. They're also CSA- and UL-certified to U.S. and Canadian safety standards for effluent pumps.

PF-Series pumps are used in a variety of applications, including pressurized drainfields, packed-bed filters, mounds, aerobic units, effluent irrigation, liquid-only (effluent) sewers, wetlands, lagoons, and more. These pumps are designed to be used with a Biotube® pump vault or after a secondary treatment system.



C US
LR80980
LR2053896

Powered by Franklin Electric

Features/Specifications

To specify this pump for your installation, require the following:

- Minimum 24-hour run-dry capability (liquid end) with no deterioration in pump life or performance*
- 1/8-inch (3-mm) bypass orifice to ensure flow recirculation for motor cooling and to prevent air bind
- Liquid-end repair kits available for better long-term cost of ownership
- TRI-SEAL™ floating impeller design on 10, 20, and 30 gpm (0.6, 1.3, and 1.9 L/sec) models; floating stack design on 50 and 75 gpm (3.2 and 4.7 L/sec) models
- Franklin Electric Super Stainless motor, rated for continuous use and frequent cycling
- Type SOOW 600-V motor cable (model PF751512 uses 14 AWG, SJOOW, 300-V cord)

** Not applicable for 5-hp (3.73 kW) models*

Standard Models

See specifications chart on page 2 for a list of standard pumps. For a complete list of available pumps, call Orenco.

Product Code Diagram

PF ☐ ☐ ☐ ☐ ☐ - ☐ - ☐

- CLK = ClickTight™ compatible
- Cord length, ft (m):‡
  Blank = 10 (3) 20 = 20 (6)
  30 = 30 (9) 50 = 50 (15)
- Check valve:
  Blank = no internal check valve
  CV = internal check valve†
- Voltage, nameplate:
  1 = 115* 2 = 230
- Frequency:
  1 = single-phase 60 Hz
- Horsepower (kW):
  05 = ½ hp (0.37) 07 = ¾ hp (0.56)
  10 = 1 hp (0.75) 15 = 1½ hp (1.11)
  20 = 2 hp (1.50) 30 = 3 hp (2.24)
  50 = 5 hp (3.73)
- Nominal flow, gpm (L/sec):
  10 = 10 (0.6) 20 = 20 (1.3)
  30 = 30 (1.9) 50 = 50 (3.2)
  75 = 75 (4.7)
- Pump, PF Series

* ½-hp (0.37 kW) only
† Available for 10 gpm (0.6 L/sec), 1/2 hp (0.37 kW)
‡ Note: 20-ft cords are available only for pumps through 1½ hp

Specifications

Pump Model	Design gpm (L/sec)	Horsepower (kW)	Phase	Nameplate voltage	Actual voltage	Design flow amps	Max amps	Discharge size and material[1]	Length in. (mm)	Min. liquid level in. (mm)	Weight lb (kg)	Rated cycles per day
PF100511 [9]	10 (0.6)	0.50 (0.37)	1	115	120	12.7	12.7	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100511CV [9]	10 (0.6)	0.50 (0.37)	1	115	120	12.7	12.7	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100512 [9]	10 (0.6)	0.50 (0.37)	1	230	240	6.3	6.3	1 ¼ in. GFP	23.0 (660)	16 (406)	26 (12)	300
PF100712 [4, 5, 9]	10 (0.6)	0.75 (0.56)	1	230	240	8.3	8.3	1 ¼ in. GFP	25.9 (658)	17 (432)	30 (14)	300
PF101012 [5, 6, 9]	10 (0.6)	1.00 (0.75)	1	230	240	9.6	9.6	1 ¼ in. GFP	27.9 (709)	18 (457)	33 (15)	100
PF200511 [9]	20 (1.3)	0.50 (0.37)	1	115	120	12.3	12.5	1 ¼ in. GFP	22.3 (566)	18 (457)	25 (11)	300
PF200512 [9]	20 (1.3)	0.50 (0.37)	1	230	240	6.4	6.5	1 ¼ in. GFP	22.5 (572)	18 (457)	26 (12)	300
PF201012 [4, 5, 9]	20 (1.3)	1.00 (0.75)	1	230	240	10.5	10.5	1 ¼ in. GFP	28.4 (721)	20 (508)	33 (15)	100
PF201512 [4, 5]	20 (1.3)	1.50 (1.11)	1	230	240	12.4	12.6	1 ¼ in. GFP	34.0 (864)	24 (610)	41 (19)	100
PF300511 [9]	30 (1.9)	0.50 (0.37)	1	115	120	11.8	11.8	1 ¼ in. GFP	21.3 (541)	20 (508)	28 (13)	300
PF300512 [9]	30 (1.9)	0.50 (0.37)	1	230	240	6.2	6.2	1 ¼ in. GFP	21.3 (541)	20 (508)	25 (11)	300
PF300712 [9]	30 (1.9)	0.75 (0.56)	1	230	240	8.5	8.5	1 ¼ in. GFP	24.8 (630)	21 (533)	29 (13)	300
PF301012 [4, 9]	30 (1.9)	1.00 (0.75)	1	230	240	10.4	10.4	1 ¼ in. GFP	27.0 (686)	22 (559)	32 (15)	100
PF301512 [4, 5]	30 (1.9)	1.50 (1.11)	1	230	240	12.6	12.6	1 ¼ in. GFP	32.8 (833)	24 (610)	40 (18)	100
PF302012 [5, 6, 7]	30 (1.9)	2.00 (1.49)	1	230	240	11.0	11.0	1 ¼ in. SS	35.5 (902)	26 (660)	44 (20)	100
PF303012 [5, 6, 7, 8]	30 (1.9)	3.00 (2.23)	1	230	240	16.8	16.8	1 ¼ in. SS	44.5 (1130)	33 (838)	54 (24)	100
PF305012 [5, 6, 7, 8]	30 (1.9)	5.00 (3.73)	1	230	240	25.6	25.8	1 ¼ in. SS	66.5 (1689)	53 (1346)	82 (37)	100
PF500511 [9]	50 (3.2)	0.50 (0.37)	1	115	120	12.1	12.1	2 in. SS	20.3 (516)	24 (610)	27 (12)	300
PF500512 [9]	50 (3.2)	0.50 (0.37)	1	230	240	6.2	6.2	2 in. SS	20.3 (516)	24 (610)	27 (12)	300
PF500712 [9]	50 (3.2)	0.75 (0.56)	1	230	240	8.5	8.5	2 in. SS	23.7 (602)	25 (635)	31 (14)	300
PF501012 [9]	50 (3.2)	1.00 (0.75)	1	230	240	10.1	10.1	2 in. SS	27.0 (686)	26 (660)	35 (16)	100
PF501512 [4]	50 (3.2)	1.50 (1.11)	1	230	240	12.5	12.6	2 in. SS	32.5 (826)	30 (762)	41 (19)	100
PF503012 [4, 5, 7, 8]	50 (3.2)	3.00 (2.23)	1	230	240	17.7	17.7	2 in. SS	43.0 (1092)	37 (940)	55 (25)	100
PF505012 [5, 6, 7, 8]	50 (3.2)	5.00 (3.73)	1	230	240	26.2	26.4	2 in. SS	65.4 (1661)	55 (1397)	64 (29)	100
PF751012 [9]	75 (4.7)	1.00 (0.75)	1	230	240	9.9	10.0	2 in. SS	27.0 (686)	27 (686)	34 (15)	100
PF751512	75 (4.7)	1.50 (1.11)	1	230	240	12.1	12.3	2 in. SS	33.4 (848)	30 (762)	44 (20)	100

1 GFP = glass-filled polypropylene; SS = stainless steel. The 1 ¼-in. NPT GFP discharge is 2 7⁄8 in. octagonal across flats; the 1 ¼-in. NPT SS discharge is 2 1⁄8 in. octagonal across flats; and the 2-in. NPT SS discharge is 2 7⁄8 in. hexagonal across flats. Discharge is female NPT threaded, U.S. nominal size, to accommodate Orenco® discharge hose and valve assemblies. Consult your Orenco Distributor about fittings to connect hose and valve assemblies to metric-sized piping.

2 Minimum liquid level is for single pumps when installed in an Orenco Biotube® Pump Vault or Universal Flow Inducer. In other applications, minimum liquid level should be top of pump. Consult Orenco for more information.

3 Weight includes carton and 10-ft (3-m) cord.

4 High-pressure discharge assembly required.

5 Do not use cam-lock option (Q) on discharge assembly.

6 Custom discharge assembly required for these pumps. Contact Orenco.

7 Capacitor pack (sold separately or installed in a custom control panel) required for this pump. Contact Orenco.

8 Torque locks are available for all pumps and are supplied with 3-hp and 5-hp pumps.

9 ClickTight™ compatible.

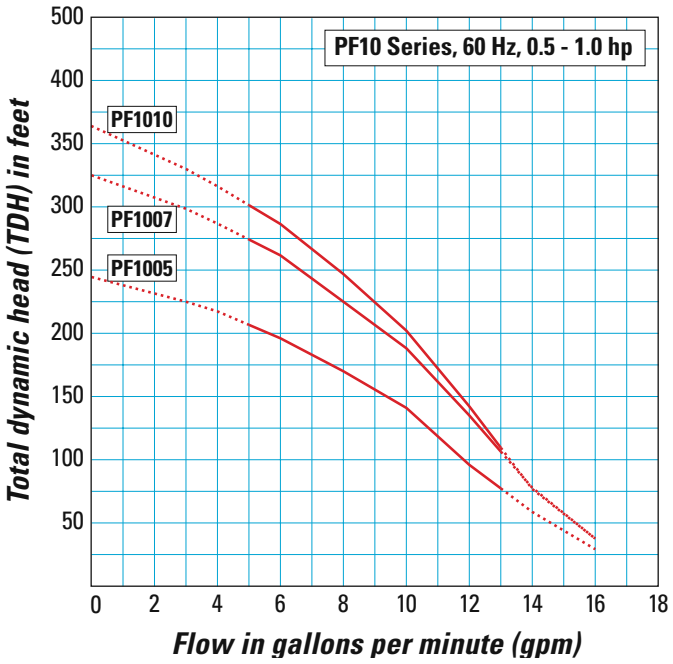
Materials of Construction

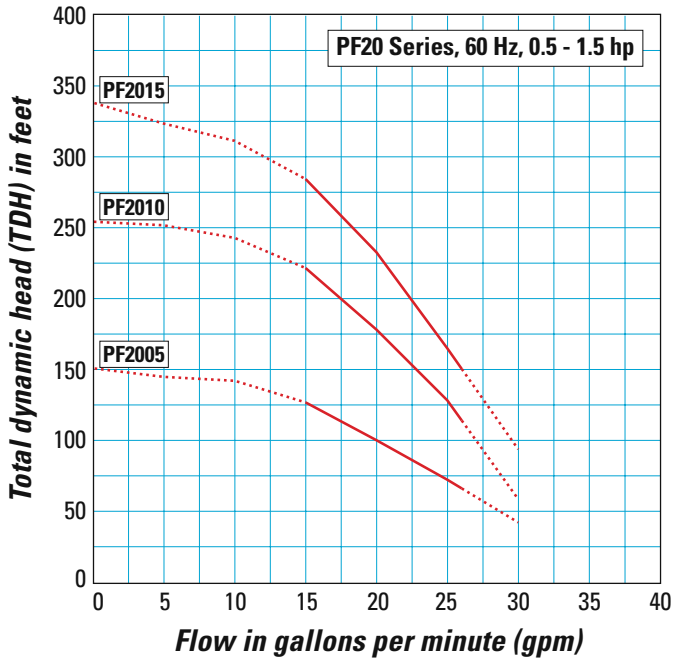
Discharge	Glass-filled polypropylene or stainless steel
Discharge bearing	Engineered thermoplastic (PEEK)
Diffusers	Glass-filled PPO (Noryl GFN3)
Impellers	Celcon® acetal copolymer on 10-, 20-, and 30-gpm models; 50-gpm impellers are Noryl GFN3
Intake screen	Polypropylene
Suction connection	Stainless steel
Drive shaft	7/16-in. hexagonal stainless steel, 300 series
Coupling	Sintered stainless steel, 300 series
Shell	Stainless steel, 300 series
Motor	Franklin motor exterior constructed of stainless steel. Motor filled with deionized water and propylene glycol for constant lubrication. Hermetically sealed motor housing ensures moisture-free windings. All thrust absorbed by Kingsbury-type thrust bearing. Rated for continuous duty. Single-phase motors are equipped with surge arrestors for added security. Single-phase motors through 1.5 hp (1.11 kW) have built-in thermal overload protection, which trips at 203-221˚ F (95-105˚ C).

Using a Pump Curve

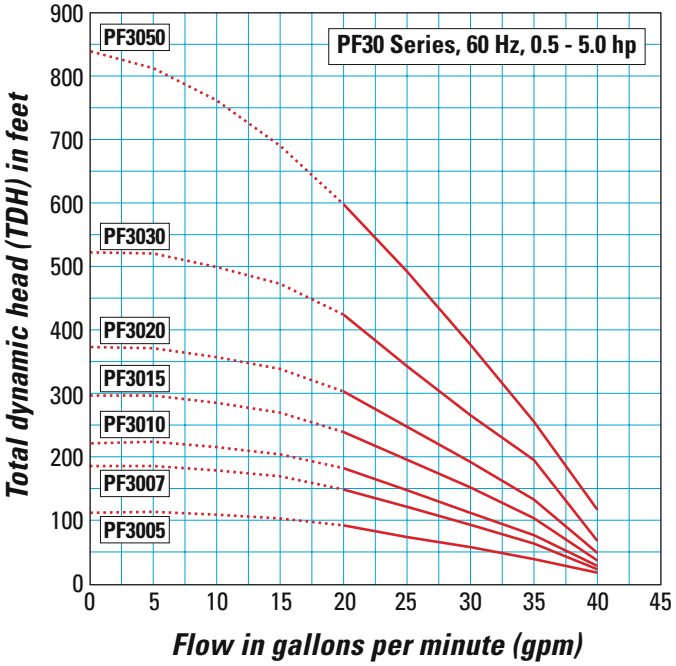
A pump curve helps you determine the best pump for your system. Pump curves show the relationship between flow and pressure (total dynamic head or "TDH"), providing a graphical representation of a pump's optimal performance range. Pumps perform best at their nominal flow rate. These graphs show optimal pump operation ranges with a solid line and show flow rates outside of these ranges with a dashed line. For the most accurate pump specification, use Orenco's PumpSelect™ software.

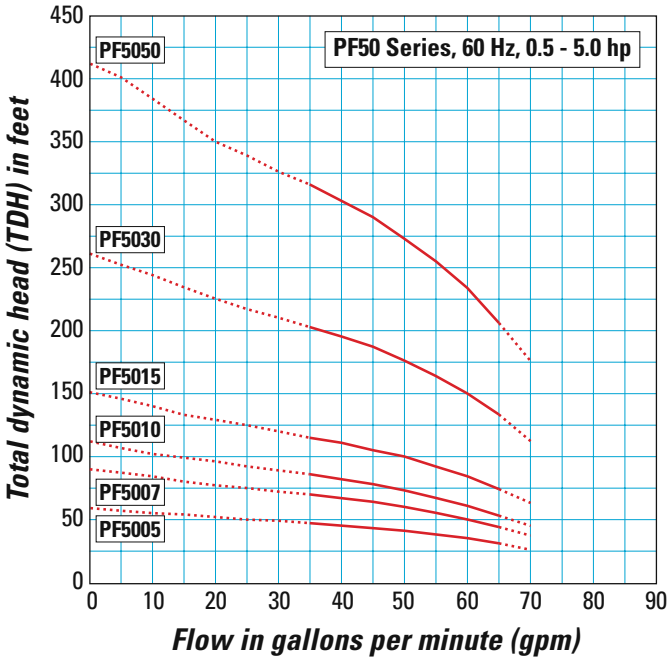
Pump Curves

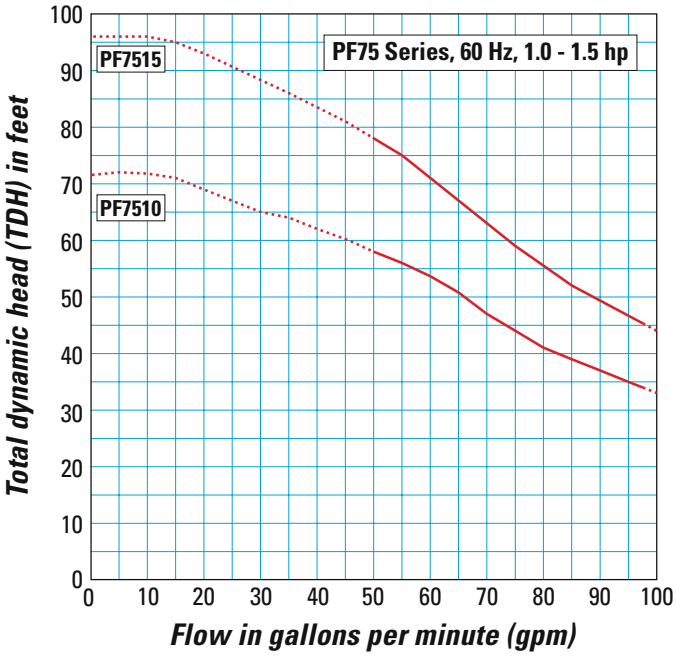




Pump Curves, cont.







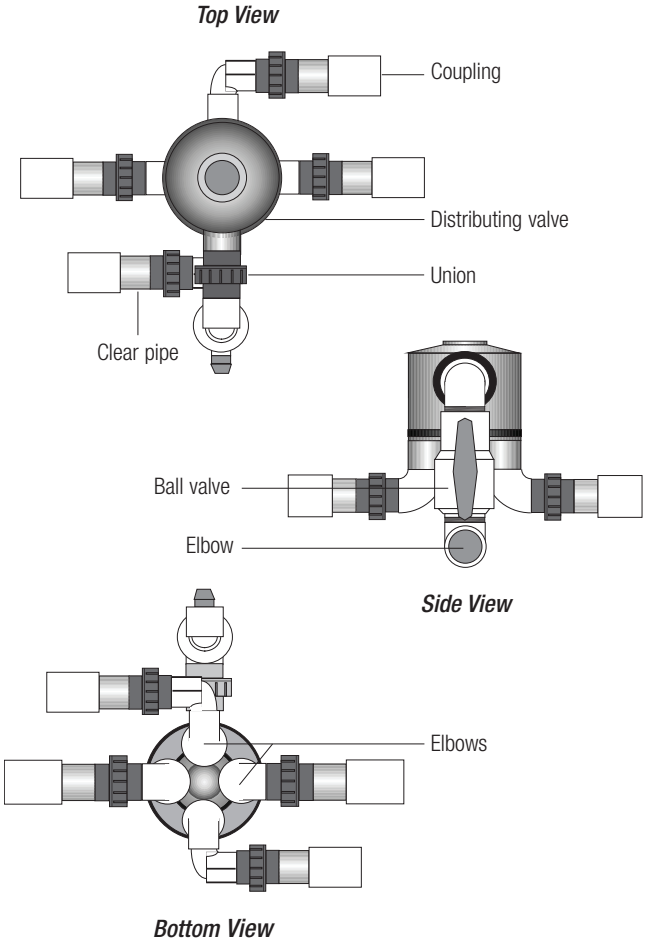
Orenco® SYSTEMS

Technical Data Sheet

Distributing Valves

Applications

Automatic Distributing Valve Assemblies are used to pressurize multiple zone distribution systems including textile filters, sand filters and drainfields.



General

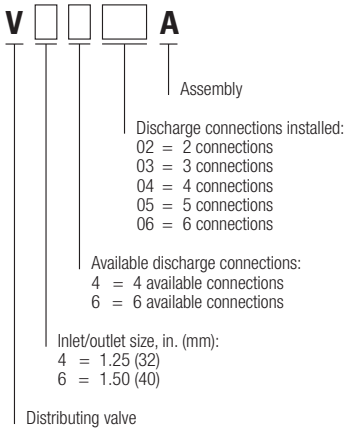
Orenco's Automatic Distributing Valve Assemblies are mechanically operated and sequentially redirect the pump's flow to multiple zones or cells in a distribution field. Valve actuation is accomplished by a combination of pressure and flow. They allow the use of smaller horsepower pumps on large sand filters and drainfields. For example, a large community drainfield requiring 300 gpm (18.90L/sec) can use a six-line valve assembly to reduce the pump flow rate requirement to only 50 gpm (3.14L/sec).

Orenco only warrants Automatic Distributing Valves when used in conjunction with High-Head Effluent Pumps with Biotube® pump vaults to provide pressure and flow requirements, and to prevent debris from fouling valve operation. An inlet ball valve, a section of clear pipe, and a union for each outlet are provided for a complete assembly that is easy to maintain and monitor. Ideal valve location is at the high point in the system. Refer to Automatic Distributing Valve Assemblies (NTP-VA-1) for more information.

Standard Models

V4402A, V4403A, V4404A, V4605A, V4606A, V6402A, V6403A, V6404A, V6605A, V6606A.

Product Code Diagram



Materials of Construction

All Fittings	Sch. 40 PVC per ASTM specification
Unions	Sch. 80 PVC per ASTM specification
Ball Valve	Sch. 40 PVC per ASTM specification
Clear Pipe	Sch. 40 PVC per ASTM specification

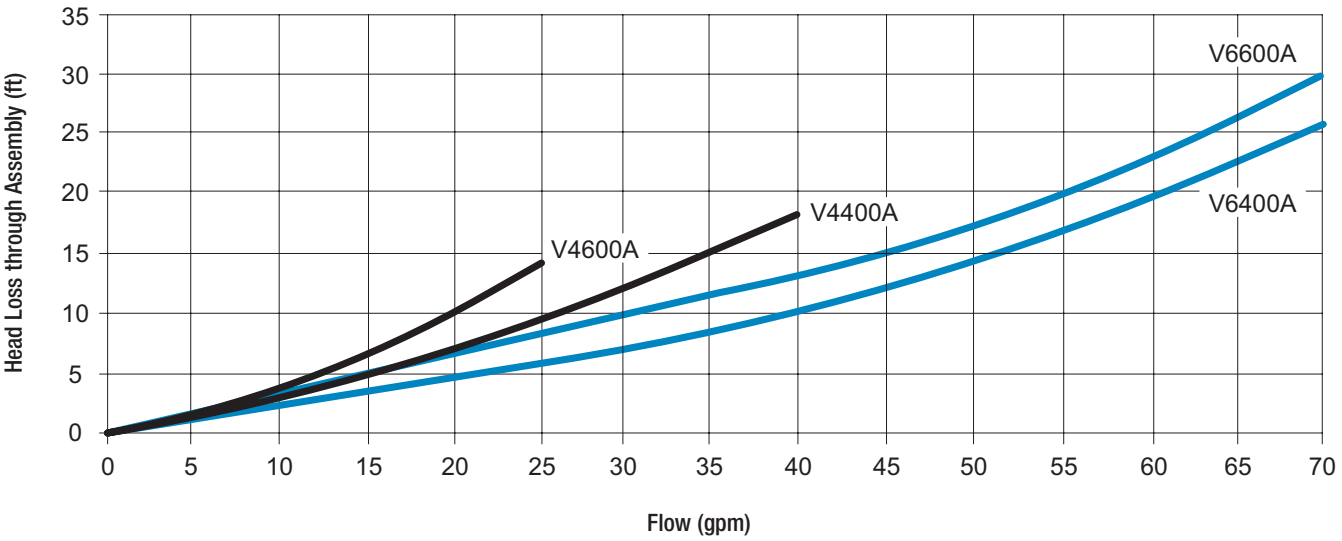
Specifications

Model	Inlet Size, in. (mm)	Outlets Size, in. (mm)	Flow Range, gpm (L/sec)	Max Head, ft (m)	Min. Enclosure*
V4402A	1.25 (32)	1.25 (32)	10 – 40 (0.63 – 2.52)	170 (51.816)	VB1217
V4403A	1.25 (32)	1.25 (32)	10 – 40 (0.63 – 2.52)	170 (51.816)	VB1217
V4404A	1.25 (32)	1.25 (32)	10 – 40 (0.63 – 2.52)	170 (51.816)	VB1217
V4605A	1.25 (32)	1.25 (32)	10 – 40 (0.63 – 2.52)	170 (51.816)	RR2418
V4606A	1.25 (32)	1.25 (32)	10 – 40 (0.63 – 2.52)	170 (51.816)	RR2418
V6402A	1.50 (38)	1.50 (38)	15 – 100 (0.95 – 6.31)	345 (105.16)	RR2418
V6403A	1.50 (38)	1.50 (38)	15 – 100 (0.95 – 6.31)	345 (105.16)	RR2418
V6404A	1.50 (38)	1.50 (38)	15 – 100 (0.95 – 6.31)	345 (105.16)	RR2418
V6605A	1.50 (38)	1.50 (38)	15 – 100 (0.95 – 6.31)	345 (105.16)	RR2418
V6606A	1.50 (38)	1.50 (38)	15 – 100 (0.95 – 6.31)	345 (105.16)	RR2418

** When using an enclosed basin, choose the next larger-sized diameter.*

Table 1. Automatic Distributing Valve Assembly Headloss Equations

Model Series	Equation	Operating Range, gpm (L/sec)
V4400A	$H_L = 0.085 \times Q^{1.45}$	10 - 40 (0.63 – 2.52)
V4600A	$H_L = 0.085 \times Q^{1.58}$	10 - 25 (0.63 – 1.57)
V6400A	$H_L = 0.0045 \times Q^2 + 3.5 \times (1 - e^{-0.060})$	15 - 70 (0.95 – 4.42)
V6600A	$H_L = 0.0049 \times Q^2 + 5.5 \times (1 - e^{-0.10})$	15 - 70 (0.95 – 4.42)



Orenco Systems® Inc. , 814 Airway Ave., Sutherlin, OR 97479 USA • 800-348-9843 • 541-459-4449 • www.orenco.com

Orenco SYSTEMS

Technical Data Sheet

AdvanTex® AX100 Textile Filter

Applications

Orenco's AdvanTex® AX100 Treatment System is an innovative technology for onsite treatment of domestic-strength wastewater. The heart of the system is the AdvanTex Filter, a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent textile material treats a tremendous amount of wastewater in a small space. AX100 Treatment Systems are ideal for:

- New construction
- System upgrades and repairs
- Small sites
- Poor soils
- Pretreatment
- Nitrogen reduction
- Price-sensitive markets

For sizing, see AdvanTex® Design Criteria (NDA-ATX-COMM-1-PKG).



The heart of the AdvanTex® AX100 Treatment System is this sturdy, watertight fiberglass basin filled with an engineered textile material.

Features/Specifications

To specify this product, require the following:

- Wastewater treatment to better than secondary treatment standards
- Consistent treatment, even during peak flows
- Timer operation for flow monitoring, flow modulation, and surge control
- Fixed-film, engineered textile media, operated in an unsaturated condition
- Consistent media quality
- Low energy consumption
- Low maintenance requirements
- Complete pre-manufactured package, ready to install
- Watertight construction, corrosion-proof materials, and components
- Foam-core lid provides insulation value of R-6 (RSI-1.1)
- Quiet operation

Standard Model

AX100

Specifications**

Length, in. (mm)	191 (4851)
Width, in. (mm)	94 (2388)
Height, in. (mm)	42 (1067)
Area (footprint), ft^2 (m^2)	128 (11.9)
Dry Weight, lb (kg)	1616 (733)

* *Covered by U.S. patent numbers 6,540,920; 6,372,137; 5,531,894; 5,480,561; 5,360,556*

** *Nominal values provided. See AdvanTex® Treatment System drawings for exact dimensions.*

Technical Data Sheet

AdvanTex® Vent Fan Assembly

Orenco Systems® Incorporated
800-348-9843

Applications

Orenco's AdvanTex® Vent Fan Assembly consists of a water-proof fiberglass enclosure with equipment for venting onsite wastewater treatment systems. One enclosure can hold a vent fan with carbon filter and an optional heater.

The vent fan is used in commercial-sized AdvanTex Treatment Systems to gently pull air through the textile media, ensuring that adequate oxygen is available for biological treatment. The carbon filter scrubs the air that the system exhausts. An optional heater can be added where climate requires heating of the air that enters the AdvanTex textile filter pods.



Standard Models

AXVFACF — AX above ground Vent Fan Assembly with LMF-3 Fan

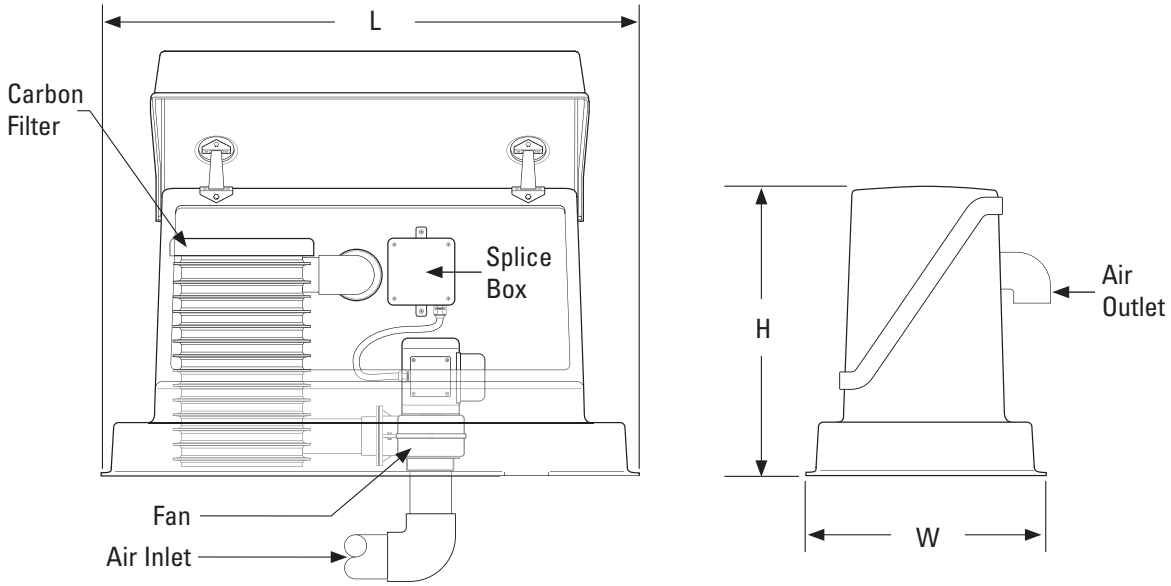
AXVFACF-HT — AX above ground Vent Fan Assembly with LMF-3 Fan and HT10 Heater

Enclosure

Physical Specifications

Materials of Construction	
Shell	Fiberglass-reinforced polyester (FRP)
Hardware	Stainless steel
Exterior finish	Green, textured, UV resistant
Straps	Nylon

Dimensions	
Length (L)	50 in. (1270 mm)
Width (W)	24 in. (610 mm)
Height (H)	30 in. (762 mm)
Volume	15.1 ft^3 (0.43 m^3)
Area (footprint)	8.3 ft^2 (0.77 m^2)



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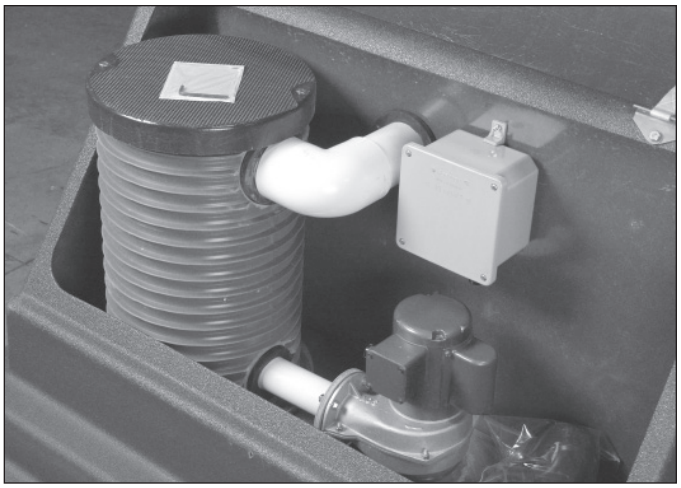
Fan

Physical Specifications

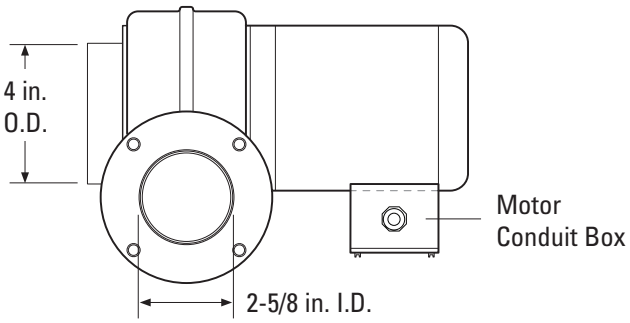
Dimensions	
Inlet O.D.	4 in. (100 mm)
Inlet nominal pipe size	4 in. (100 mm)
Outlet I.D.	2-5/8 in. (67 mm)
Outlet Flange O.D.	4-7/8 in. (124 mm)

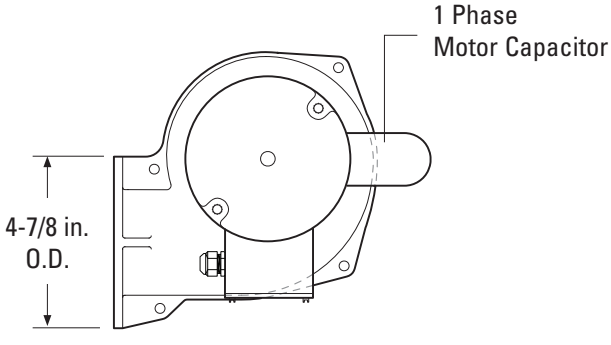
Materials of Construction	
Housing	Aluminum
Wheel	Steel

Performance Data	60 Hz	50 Hz
Horsepower (kW)	0.08 (0.06 kW)	0.08 (0.06 kW)
Phase	1 phase	1 phase
Volts	115/230	110/220
Amperage	1.4 A/0.7 A	1.8 A/0.9 A
RPM	3400	2900
CFM at 0" H_2O static pressure	245	205
CFM at 0.4" H_2O static pressure	220	170
CFM at 0.8" H_2O static pressure	190	130
CFM at 1.5" H_2O static pressure	120	N/A





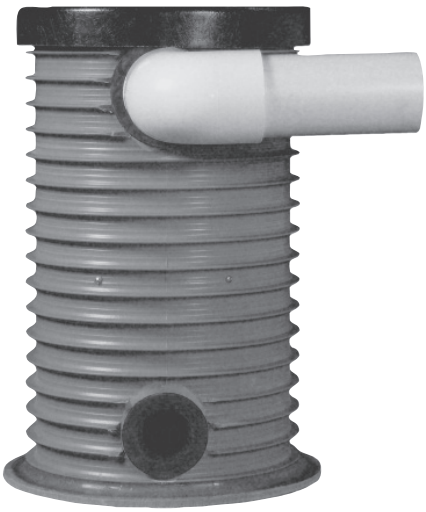




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AdvanTex® Vent Fan Assembly (continued)

Carbon Filter Basin

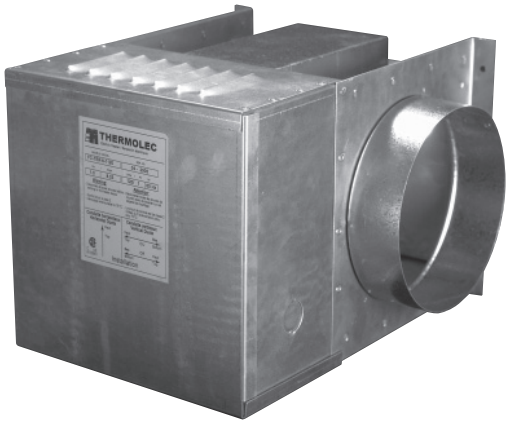


Physical Specifications

Dimensions	
Outlet diameter	Accepts nominal 3-in. PVC pipe
Inlet diameter	Accepts nominal 2-in. PVC pipe
Height	21.5 in. (546 mm)
Diameter	12 in. (305 mm)

Materials of Construction	
Housing	PVC
Bottom	Fiberglass-reinforced polyester (FRP)
Interior supports	Polypropylene grid and polyethylene screen
Support rings	PVC
Lid	Fiberglass
Fill material	Activated carbon

Heater (Optional)



Physical Specifications

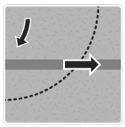
Dimensions	
Outlet diameter	Fits nominal 3-in. Class 125 PVC pipe
Length (inlet to outlet)	11.75 in. (297 mm)
Width	11.25 in. (286 mm)
Depth	8.25 in. (210 mm)

Performance Data

Watts	1000
Volts	120
Amps	8.3

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TENCATE Mirafi®



Miragrid® 22XT

Miragrid® 22XT geogrid is composed of high molecular weight, high tenacity polyester multifilament yarns woven in tension and finished with a PVC coating. Miragrid® 22XT geogrid is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Miragrid 22XT geogrid is used as soil reinforcement in MSE structures such as segmental retaining walls, precast modular block walls, wire faced walls, geosynthetic wrapped faced walls and steepened slopes. Miragrid 22XT is also used in MSE stabilized platforms for voids bridging, embankments on soft soils, landfill veneer stability, reducing differential settlement and for foundation seismic stability.

TenCate Geosynthetics Americas is accredited by Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP).

MECHANICAL PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUE
			MD
Tensile Strength @ Ultimate	ASTM D6637 (Method B)	lbs/ft (kN/m)	20559 (300.0)
Tensile Strength @ 5% strain	ASTM D6637 (Method B)	lbs/ft (kN/m)	6700 (97.8)
Mass/Unit Area[1]	(ASTM D5261)	oz/yd^2 (g/m^2)	28.2 (956)
			MINIMUM ROLL VALUE
Creep Rupture Strength[2]	ASTM D5262/D6992	lbs/ft (kN/m)	14277 (208.3)
Long Term Design Strength[3]		lbs/ft (kN/m)	12361 (180.4)

PHYSICAL PROPERTIES	UNIT	ROLL CHARACTERISTIC
Roll Dimensions[4] (width x length)	ft (m)	12 x 200 (3.6 x 61)
Roll Area	yd^2 (m^2)	267 (220)
Estimated Roll Weight	lbs (kg)	470 (213)
Label Roll Color		WHITE

[1] Typical Value
[2] 75-year design life based on NTPEP Report REGEO-2016-01-069. .
[3] Long Term Design Strength for sand, silt, clay. RF_{CR} = 1.44; RF_{ID} = 1.05; RF_D = 1.1 (Installation damage reduction factor for other soils available upon request).
[4] Special order roll lengths are available upon request

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TENCATE GEOSYNTHETICS

PENTAIR



MYERS®

MODEL SRM4

4/10 HORSEPOWER RESIDENTIAL SEWAGE PUMP

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MYERS® MODEL SRM4
Residential Sewage Pump

The Right Choice

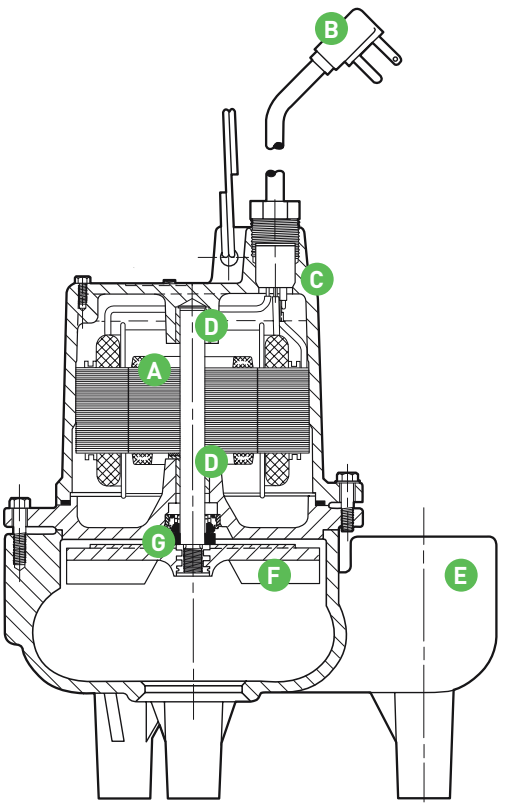
The SRM4 solids handling pump is the most reliable 4/10 horsepower residential sewage pump available today. The SRM4 is a plumbers/contractors dream! Its recessed impeller design allows 2" solids to pass freely through the volute without the chance of jamming the impeller. The SRM4 series pump has a national field-proven record of reliability. Look to your Myers distributor for the answer to your residential sewage handling needs ... and across the counter will be the Myers mini solids handling, the SRM4. It works for you! For more information, call your Myers distributor today, or the Myers Ohio sales office at 419-289-6898.



Product Capabilities		
Capacities To	95 gpm	360 lpm
Heads To	18 ft. 19 ft. shutoff	5.5 m 5.8 m
Pump Down Range Float Switch	7 to 14 in.	178 to 356 mm
Solids Handling Capacity	2 in.	50.8 mm
Liquids Handling	raw sewage, effluent, drain water	
Intermittent Liquid Temp.	up to 140˚F	up to 60˚C
Motor Electrical Data	4/10 HP shaded pole 1650 RPM	
Electrical	115V, 12A or 230V, 6A, 1Ø, 60 Hz.	
Acceptable pH Range	6 – 9	
Discharge, NPT	2 in.	50.8 mm
Min. Sump Diameter Simplex Duplex	 18 in. 30 in.	 457 mm 762 mm

Note: Consult factory for applications outside these recommendations.

Pump Features and Applications



A. 4/10 HP Motor
Pressed in place and oil-filled for best alignment and heat transfer. Built-in overload protection.

B. Power Cord
Quick-disconnect watertight fitting.

C. Motor Housing
Heavy cast iron for efficient heat transfer.

D. Dual Thrust Washers, Sleeve Bearings
Oil lubricated, enhance smooth operation and extend pump life..

E. Cast Iron Volute
Passes 2" diameter solids.

F. Recessed Impeller
Operates out of volute passage, allowing maximum flow of liquids and solids.

G. Mechanical Shaft Seal
Carbon and ceramic faces, body is stationary, prevents string or trash from winding on seal..

Mechanical Float Switch
Mercury-free, 90° angle operation. (Piggyback models only).

Durable Motor Will Deliver Many Years Of Reliable Service.

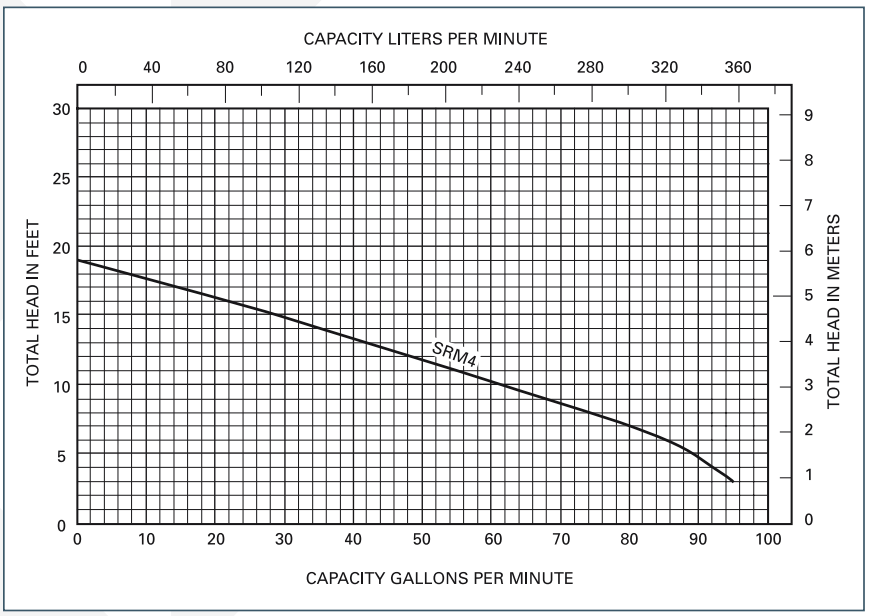
- Oil-filled motor for maximum heat dissipation and continuous bearing lubrication.
- Overload protected shaded pole motor eliminates starting switches.
- Recessed vortex impeller provides minimal radial loading for long bearing life.

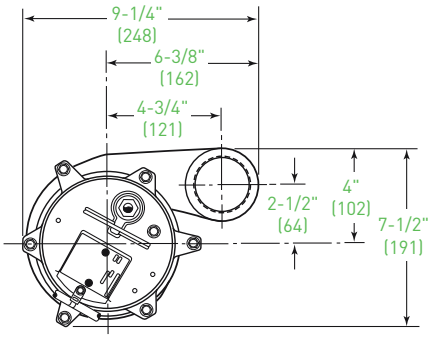
The SRM4P Is Engineered For Many Years Of Maintenance-Free Operation.

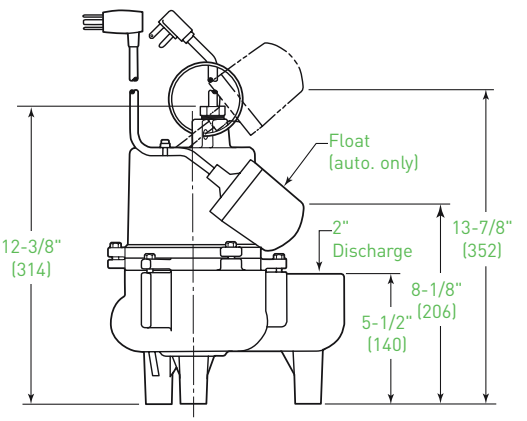
- Wide-angle piggy-back float switch for maximum draw down. (Automatic models.)
- Pump can be operated manually by unplugging piggy-back switch and plugging pump directly into outlet (Automatic models).
- Recessed vortex impeller operates completely out of volute and provides free flow through passage for solids and liquids.

Performance Data and Dimensions [Dimensions in mm]

1650 RPM







PENTAIR

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January 13, 2023

David T. Bray, PLS
President
Caputo & Wick LTD
1150 Pawtucket Ave.
Rumford, RI 02916-1897
Phone: (401) 434-8880

RE: Burlingame State Park and Camp Ground, Charlestown, RI

Dear Mr. Bray:

This letter will confirm that you have been trained and certified to design GST™ Leaching Systems by Geomatrix Systems, LLC ("Geomatrix") in the State of Rhode Island.

This letter also confirms that Geomatrix has reviewed the design of the GST Leaching System proposed for installation at Burlingame State Park and Camp Ground, Charlestown, RI and found the site and design to be suitable and in compliance with the approved design manuals for the aforementioned product.

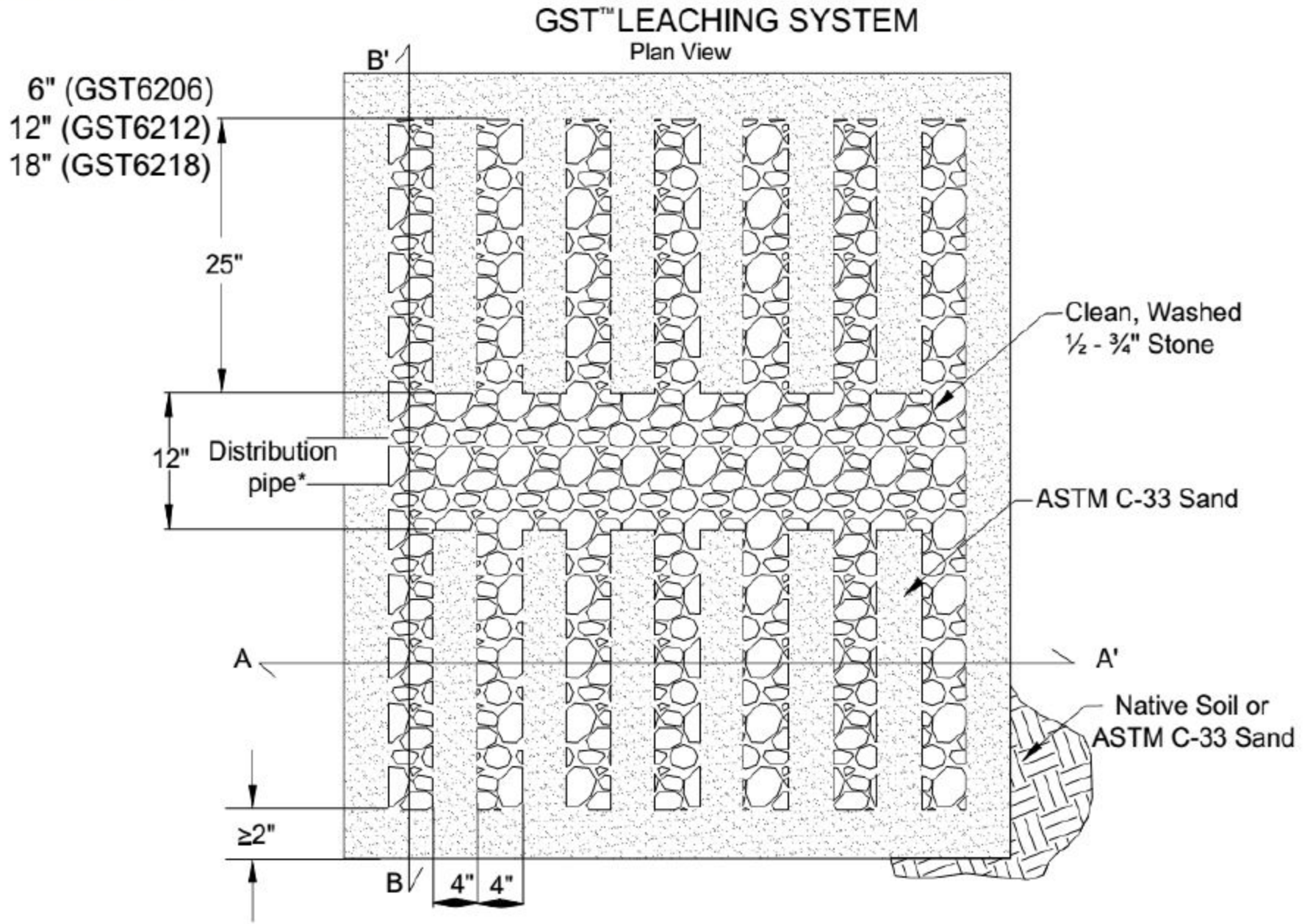
If you have any questions, please contact me.

Sincerely,
GEOMATRIX SYSTEMS, LLC



David Jewett

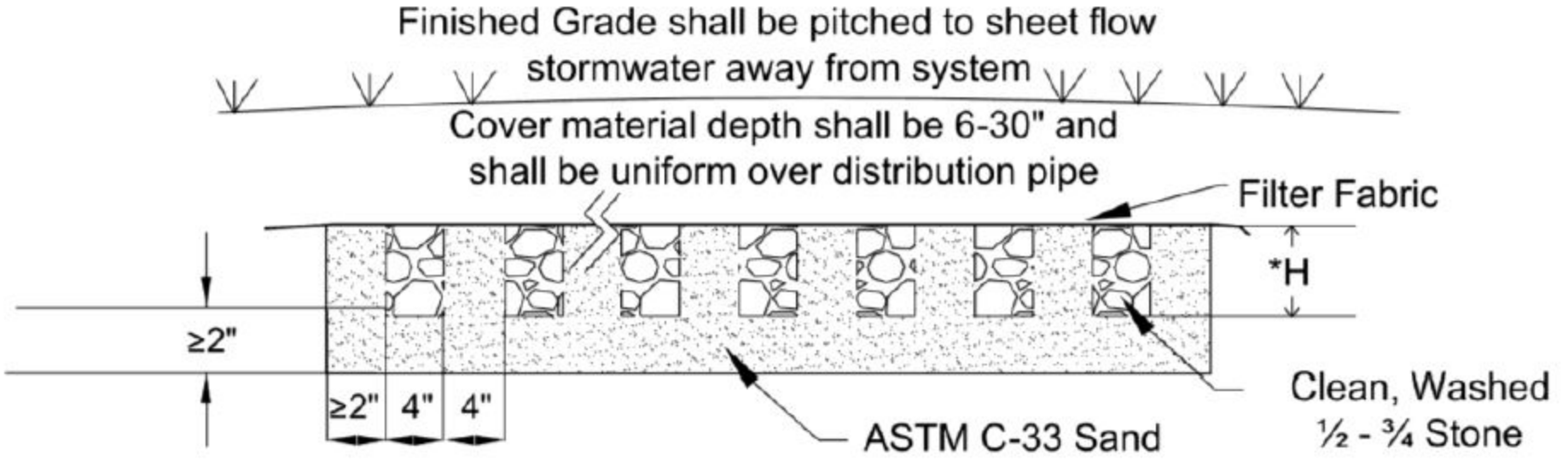
GST Schematics



* Distribution pipe for gravity systems shall comply with RIDEM OWTS Rule 6.34C
Distribution pipe for pressure applications shall comply with RIDEM Guidelines for the Design, Use and Maintenance of Pressurized Drainfields.

GEOMATRIX GST™ LEACHING SYSTEM

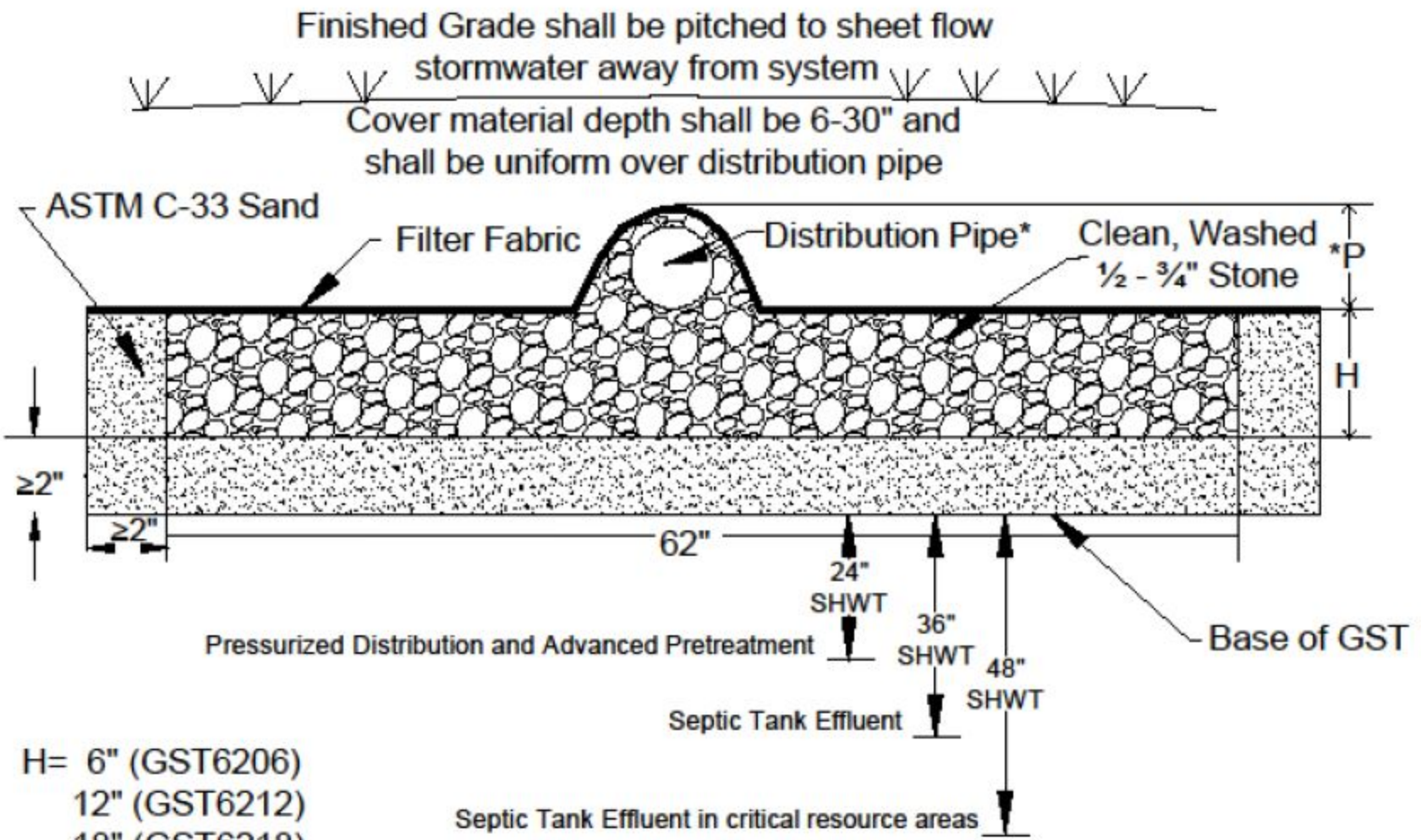
A-A' CROSS SECTION



*H= 6" (GST6206)
12" (GST6212)
18" (GST6218)

GST™ LEACHING SYSTEM

B-B' CROSS SECTION



H= 6" (GST6206)
12" (GST6212)
18" (GST6218)

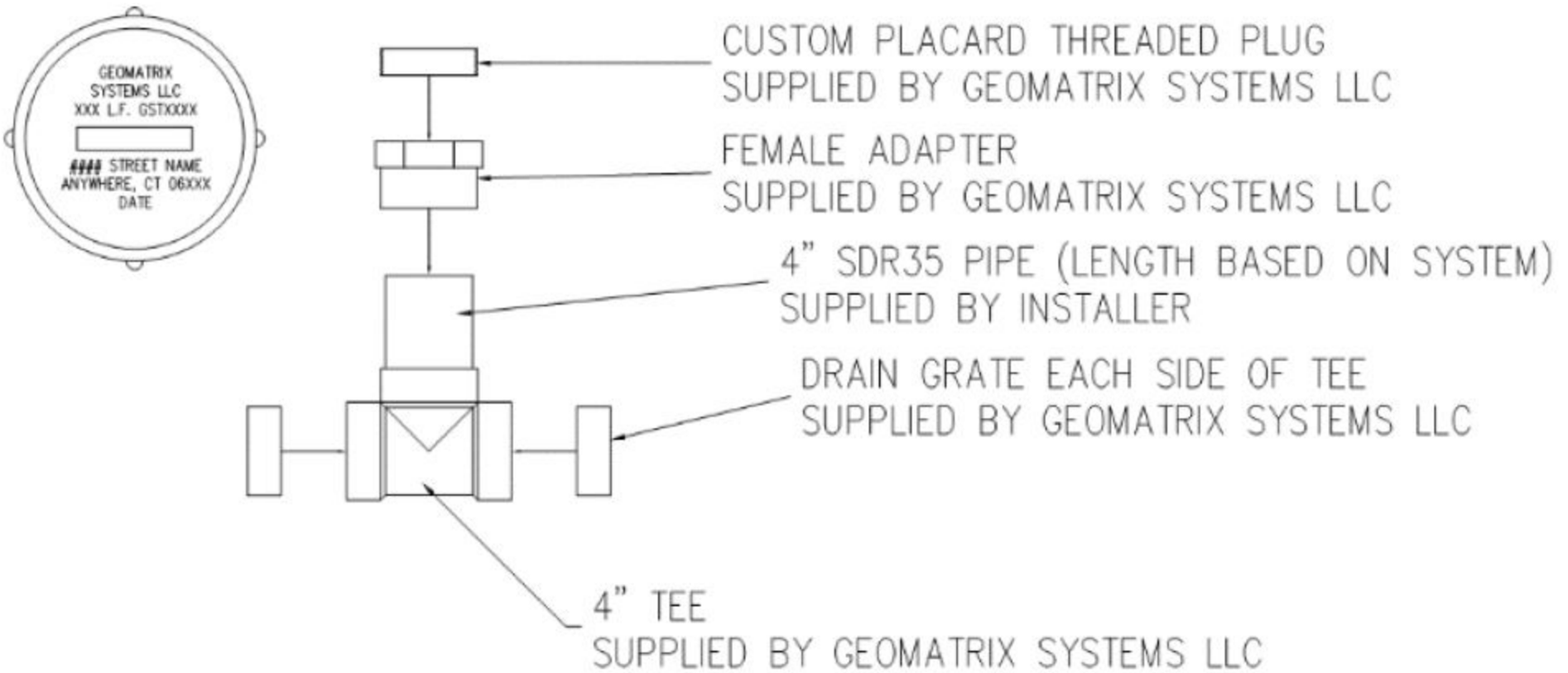
* Distribution pipe for gravity applications shall comply with RIDEM OWTS Rule 6.34C
Distribution pipe for pressure applications shall comply with RIDEM Guidelines for the Design, Use and Maintenance of Pressurized Drainfields

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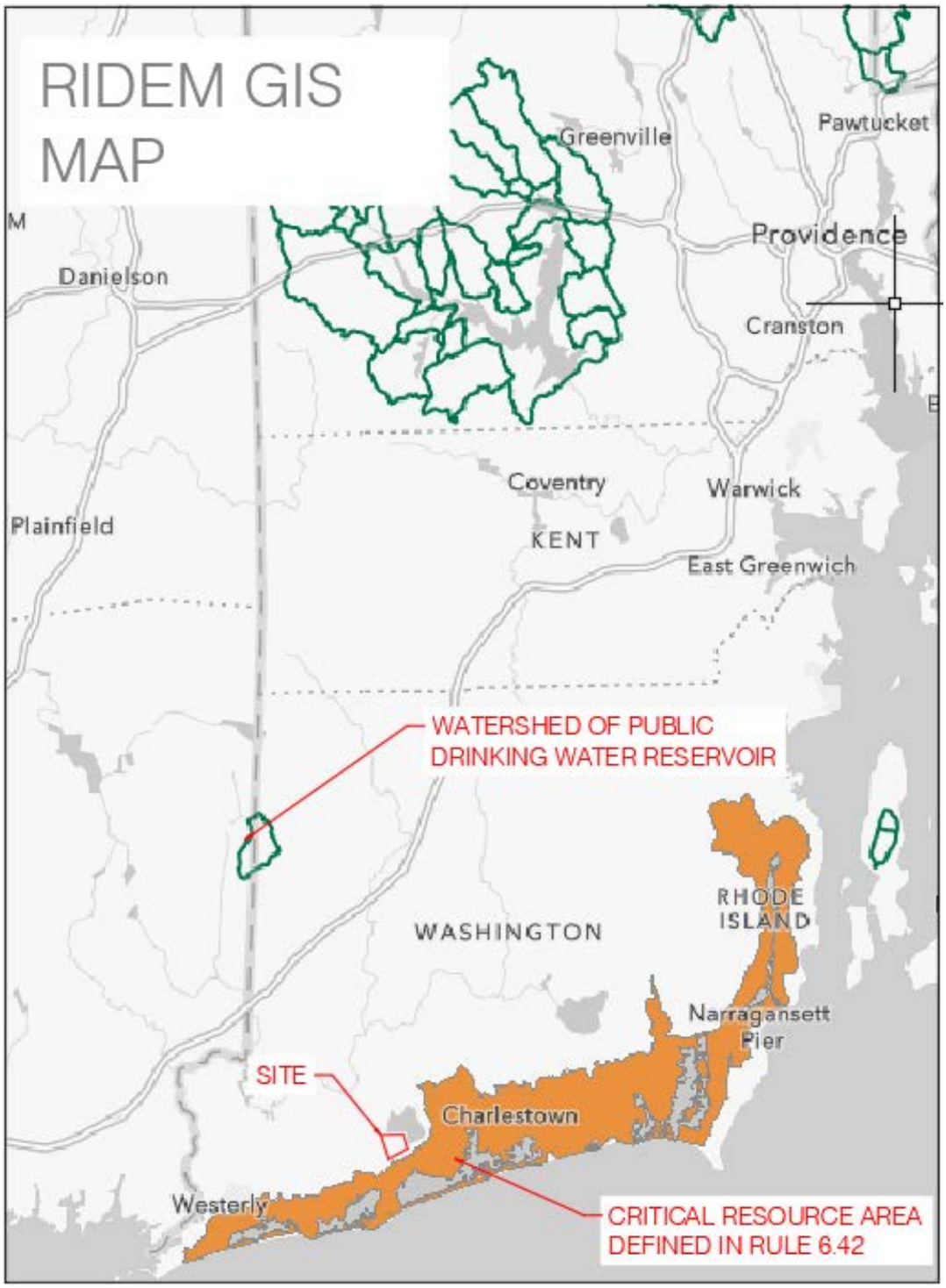
GST LEACHING SYSTEM
B-B' Cross Section
Geomatrix Systems, LLC., Old Saybrook, CT
860-510-0730

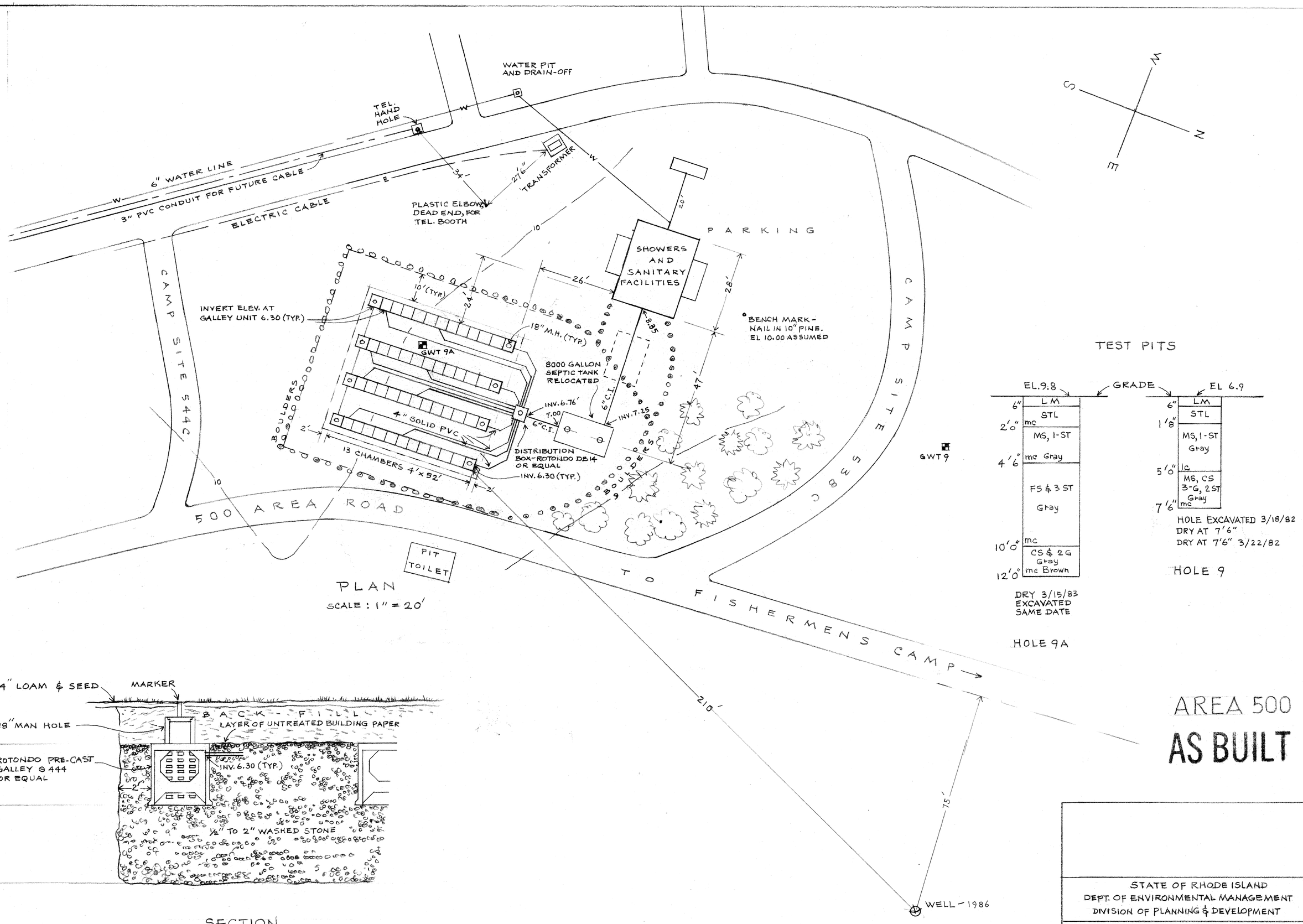
SCALE: NONE	REV: D
DATE: 9-4-2018	ACAD No. G60 GLS B-B'.DWG
DRAWN BY: ERP	SHEET 3 OF 3

GEOMATRIX GST™ LEACHING SYSTEM
INSPECTION PORT DETAIL



GST LEACHING SYSTEM Inspection Port Detail Geomatrix Systems, LLC., Old Saybrook, CT 860-510-0730	
SCALE NONE	REV. A
DATE 6/2/2015	ACAD No. GSTIP.DWG
DRAWN BY: ERP	SHEET 1 OF 1


RIDEM GIS MAP
Greenville
Pawtucket
Providence
Danielson
Cranston
Coventry
Warwick
Plainfield
KENT
East Greenwich
WATERSHED OF PUBLIC DRINKING WATER RESERVOIR
RHODE ISLAND
WASHINGTON
Narragansett Pier
SITE
Charlestown
Westerly
CRITICAL RESOURCE AREA DEFINED IN RULE 6.42



PLAN

SCALE : 1" = 20'

SECTION

SCALE: 1"=4'

TEST PITS

HOLE 9

EL. 9.8 — GRADE — EL 6.9

	HOLE 9	HOLE 9A
6"	LM	LM
1'8"		STL
2'0"	STL mc	
4'6"	MS, 1-ST mc Gray	MS, 1-ST Gray
5'0"		lc
7'6"	FS & 3 ST Gray	MS, CS 3-G, 2 ST Gray mc
10'0"	mc	
12'0"	CS & 2G Gray mc Brown	

HOLE EXCAVATED 3/18/82
DRY AT 7'6"
DRY AT 7'6" 3/22/82

DRY 3/15/83
EXCAVATED
SAME DATE

HOLE 9A

AREA 500
AS BUILT

STATE OF RHODE ISLAND
DEPT. OF ENVIRONMENTAL MANAGEMENT
DIVISION OF PLANNING & DEVELOPMENT

SEWAGE DISPOSAL PLAN AREA 500
BURLINGAME STATE PARK CHARLESTOWN, R.I.

DRAWN BY EVW	DATE: 8/26/83	SHEET 2 OF 3

(2)

“Building – “B” Bathhouse and Onsite Wastewater Treatment System Replacement”

For

Rhode Island Department of Environmental Management
Burlingame State Park and Campground

Burlingame Park Road
Charlestown, Rhode Island

Assessors Map 15 – Lot 10
Area: 847 Acres±

July 2022
Rev.: February 2023

Prepared by

Caputo & Wick Ltd.
1150 Pawtucket Avenue
Rumford, Rhode Island 02916-1897
401-434-8880

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
ONSITE WASTEWATER TREATMENT SYSTEM CONSTRUCTION PERMIT
www.dem.ri.gov/septic

FOR RIDEM USE ONLY

APPLICATION No. 2205-1139 DATE RECEIVED 02 / 28 / 23 AMOUNT RECEIVED $ waived CHECK # — NOTE GSA

TYPE OF APPLICATION (CHECK ALL THAT APPLY)

- ☒ NEW BUILDING CONSTRUCTION
- ☐ ALTERATION
- ☐ REPAIR
- ☐ TRANSFER
- ☒ A/E TECHNOLOGY TYPE ORENCO AdvanTex
- ☐ VARIANCE
- ☐ REDESIGN
- ☐ JOINT OWTS / WETLANDS PD

SITE INFORMATION

BURLINGAME STATE PARK AND CAMPGROUND (BUILDING 6) | 1-100 BURLINGAME PARK ROAD | CHARLESTOWN
NO. STREET | CITY/TOWN | POLE #

PLAT NUMBER 15 LOT NUMBER 10 SUBDIVISION LOT NUMBER N.A.

LOT SIZE 847 SF/ACRES

SUBDIVISION NAME N.A.

SUBDIVISION SITE SUITABILITY CERTIFICATION # N.A.

OWNER INFORMATION

STATE OF RI DEM
LAST NAME | FIRST NAME | M.I.

235 PROMENADE ST. | PROVIDENCE | 02908
NO. STREET | CITY/TOWN | ZIP CODE

RIDEM APPLICATION HISTORY

PREVIOUS SITE TESTING ☒ YES ☐ NO APPLICATION # 2205-1139

DEPTH TO APPROVED WATER TABLE 48" HOW DETERMINED SOIL EVALUATION

TEST HOLE # 4C DATE EXCAVATED 8/19/21 WETLANDS within 200' OF OWTS ☐ YES ☒ NO

WETLAND DETERMINATION ☐ YES ☒ NO RIDEM FILE # _____ DATE ___/___/___

LARGE SYSTEM ☒ YES ☐ NO OCI FILE # IF APPLICABLE

Environmental Management

DESIGN INFORMATION

BUILDING USE: ☐ Residential ☐ Commercial FEB 21 2023
☒ Other BATHHOUSE

WATER SUPPLY: ☐ public water ☒ public well ☐ private well

Office of Water Resources

OF DESIGN UNITS 150

UNIT DESIGN FLOW 50 gallons per SITE (unit) TOTAL DAILY FLOW 7,500 gallons

TANK SIZE 15,000 gallons DESIGN LOADING RATE 3.5 gpd/sf

MINIMUM REQUIRED LEACHFIELD AREA 2,143 square feet

LEACHFIELD TYPE GRAVEL SAND TREATMENT (GST)

TOTAL AREA OF LEACHFIELD PROVIDED 5,040 square feet

CERTIFICATION

I, KEVIN HARROD (print), the undersigned licensed OWTS designer, certify that I prepared this application and accompanying forms, submittals, plans and sketches in accordance with the RULEs of the RIDEM pertaining to OWTS and that all the information provided on this application and accompanying forms, submittals, plans and sketches is true and accurate.

Designer's Signature Kevin Harrod License # D3155

Designer's Email kharrod@csnth.net Phone # 401-454-9980

Business/Company Name CAPUTO NEWELL LTD

I certify that a) I am the owner of the property indicated under the site information on this application, b) I will hire a licensed OWTS installer to install the system proposed herein, c) the system will be installed in strict accordance with this application, d) I will hire and retain the licensed OWTS designer of record to witness and inspect the installation of the system, e) I assume all responsibility for the truth and accuracy of this application and all liability and responsibility for any improper installations of the system on this site and agree to hold the RIDEM harmless from any and all claims relating whatsoever to the system. In the case of a transfer application, I acknowledge that the permit application and plans previously approved and accompanying this application are the operative documents subject to certification.

Owner's Phone Number (401) 222-4700 ext. 2774307

Owner's Email MEGAN.DIPRETE@DEM.RI.GOV

Owner(s) Signature [signature]

PERMIT APPROVAL SECTION: DO NOT WRITE BELOW THIS LINE

Based upon the representations of the owner and the owner's agents, including the representations of the owner's OWTS designer, and the truth and accuracy of all information submitted, this application for an OWTS is hereby approved. The RIDEM assumes no responsibility or liability for the future safe operation or maintenance of the aforesaid system, of the fitness or suitability of this system to this site, nor does it assume any responsibility for the accuracy and truth of the owner's, or the owner's agent's representations. This approval is subject to future suspension or revocation in the event that subsequent examination reveals any data indicated on any application, form, submittal, plan or sketch to be incorrect, or not in compliance with the RULES or any conditions at the site are such that the approved design is not in accordance with the RULES, or in the event that the system discharges inadequately treated wastewater to waters of the State or fails to operate satisfactorily in any other manner.

IMPORTANT: Additional terms of approval as circled.

A. Bottom of leaching area excavation must be inspected by the RIDEM prior to placement of any gravel or stone.
B. System installation must be inspected by RIDEM prior to covering any component of the system with backfill.
C. Applicant shall comply with all requirements, conditions and stipulations of variance(s) approved on _____.
D. Joint Permit: Designer of record must contact RIDEM prior to start of any site construction.
E. A/E Technology: additional installation, operation or maintenance requirements may apply (see A/E Technology Certification.)
F. Copy of this form and Operation/Maintenance contract must be filed in land evidence records prior to conformance.
G. Proposed construction falls within "Coastal Zone". Contact Rhode Island Coastal Resources Management Council.
H. Proper erosion and sedimentation controls must be installed prior to start of construction.
I. Transfer: See original permit for all applicable conditions.
J. Other
other - Hydraulic testing requirements

Signature of RIDEM Official	Date of Approval	Date of Expiration
[signature]	2/27/23	11/27/25

DESIGNER