



Environment

Prepared for:
Textron, Inc.
Providence RI

Prepared by:
AECOM
Providence, RI
October 2012

Remedial Action Work Plan Former Gorham Manufacturing Facility

Textron
Providence, RI

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Providence, RI



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1.0 Introduction

This Remedial Action Work Plan (RAWP) has been prepared by AECOM on behalf of Textron, Inc. (Textron) for the remediation of chlorinated volatile organic compounds (CVOCs) in groundwater at Textron's former Gorham Silver Facility (Site) at 333 Adelaide Avenue in Providence, Rhode Island, Figure 1. The work proposed herein will be performed on the retail parcel of the Site (Parcel A).

The retail parcel is located in Providence, Rhode Island east and southeast of Mashapaug Pond, Figure 1. There are no other surface water features onsite. Narragansett Bay is located approximately 1.5 miles east of the site, and a complex of lakes (including Polo Lake, Roosevelt Lake, Cunliff Lake and others) are located at Roger Williams Park, approximately 3,500 feet to the southeast of the site. Topography over most of the Site is flat at an elevation of approximately 65 feet above mean sea level. Just north of the paved area behind the retail building the topography slopes steeply down to the pond's edge to an elevation of approximately 40 feet above mean sea level.

The Remedial Activities addressed by this RAWP are:

- Installation of 2 groundwater extraction wells to hydraulically control the migration of impacted groundwater flowing towards Mashapaug Pond and the Narragansett Bay Commission (NBC) sewer main and prevent off-site migration of CVOCs in groundwater.
- A groundwater treatment system (maximum 30 gallons per minute) to treat extracted groundwater. The system will consist of air stripping, liquid-phase carbon adsorption, and IX Resin for treatment of extracted groundwater with vapor phase carbon adsorption for treatment of the offgas generated by the air stripper. Treated groundwater water will be discharged to a catch basin located behind the vacant retail plaza. The catch basin discharges to a storm water detention basin located on the northern end of the property that ultimately discharges to the Mashapaug Pond. Pawtuxet River under a Rhode Island Pollution Discharge Elimination System (RIPDES) Permit.

This RAWP has been prepared in accordance with the RI DEM Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations), dated November 2011.

2.0 Remedial Objectives

The remedial objectives for the remediation system are described below.

2.1 Groundwater Objectives

The Site is located in a GB area (categorized as or presumed not to be suitable for drinking water use). The remedial action is designed to contain the groundwater plume exceeding the GB objectives to its current boundaries and to gradually reduce the area exceeding the GB objectives. The proposed system will contain the plume on site, prevent migration of CVOC impacts onto neighboring properties and contain discharge of CVOCs from the retail parcel to Mashapaug Pond and the NBC sewer main, ensuring compliance with applicable GB standards for areas off Parcel A. In addition, the proposed system will also provide some reduction to groundwater concentrations over time. However, because of the presence of dense non-aqueous phase liquid (DNAPL) in the source area of the southern plume and concentrations of TCE and 1,1,1-TCA that suggest the possibility of non-aqueous source material in the source area of the northern plume, a groundwater extraction and treatment system will not achieve Site cleanup in the foreseeable future.

2.2 Surface Water and Sediment Objectives

No specific surface water or sediment objectives are proposed for this remediation. Surface water impacts will be mitigated through the prevention of migration of impacted groundwater to Mashapaug Pond.

2.3 Soil Objectives

No specific soil objectives are proposed for this remediation.

2.4 Air Objectives

During the remediation work, an air monitoring plan will be in place to monitor vapors that may potentially be released as a result of the earth work. If any air impacts are observed, corrective actions will be employed (e.g., covering soil stockpiles).

In accordance with Air Pollution Control Regulation No. 9, obtaining an air permit for groundwater treatment facilities is not required if a pollution control device is used to remove 95% of the contaminants. A registration for air pollution control equipment will be obtained from the Rhode Island Department of Environmental Management (RIDEM) and air pollution control equipment to be used under this RAWP is designed for 95% removal of contaminants. The proposed method for removal of the CVOCs is vapor phase carbon.

3.0 Proposed Remedy

As presented in Section 1, the proposed remedy consists of the following:

Please refer to Appendix A for detailed drawings associated with all the remedial components discussed below in sections 3.1 through 3.6.

3.1 Hydraulic Containment by Groundwater Extraction

The conceptual basis for the groundwater extraction system was developed following performance of an aquifer test at the Site in 2011. The analysis of hydrogeologic parameters and assessment of groundwater capture strategies was documented in a hydraulic evaluation report (AECOM, 2011).

Overburden geology at the Site is representative of glacial deposition of moraine materials in a pro-glacial lake setting. Below approximately 20 feet of fill, the overburden consists of approximately 40 to 45 feet of fine-to-coarse sand, interbedded with fine to very fine sand and silt. Below this unit is a very dense, hard silt, fine sand, and clay layer (likely till), which was observed in several deep wells. Depth to groundwater in the flat portion of the site is approximately 23 feet, and thus, the saturated thickness above the till is approximately 40 feet. Depth to bedrock is estimated to be 200 feet below ground surface (MACTEC, 2006).

The regional hydraulic gradient is eastward toward Narragansett Bay (HLA, 1999); however, local gradients are impacted by surface water features such as Mashapaug Pond and the lake complex at Roger Williams Park (Figure 1). Over much of the site, groundwater flow is to the northwest toward Mashapaug Pond, resulting in a divide approximately 2,000 feet east and southeast of the site (HLA, 1999). Flow east of the divide is to Narragansett Bay while flow southeast of the divide is towards the lake complex in Roger Williams Park. Flow west and northwest of the divide is primarily to the northwest towards Mashapaug Pond.

Local groundwater flow is further divided across the southeastern portion of the site. A leaking 80 inch sewer main, located along the railroad main east of the site, is thought to be a groundwater sink causing groundwater flow on the east and southeastern part of the site to be captured by the sewer (HLA, 1999). This local groundwater flow affects migration of CVOC impacts as described in the subsequent section.

AECOM characterized the hydraulic conductivity of the sand aquifer by a series of aquifer tests. These tests indicated a generally declining hydraulic conductivity with depth and an average hydraulic conductivity of approximately 80 feet per day. The hydraulic conductivity of the underlying till was not directly characterized. However, geologic observations suggest that its hydraulic conductivity is likely several orders of magnitude lower than that of the overlying sand aquifer. Therefore, the till is not considered significant for migration of CVOCs, and groundwater flow in the top of the till will be controlled by the more transmissive overlying aquifer.

3.2 Groundwater Plume

There are two CVOC groundwater plumes on Parcel A at the Site, a northern plume originating in the vicinity of the Retail Building and a southern plume originating east of the closed service station facility. The northern plume flows beneath the Retail Building and discharges to Mashapaug Cove. The southern plume bifurcates, along the on-site groundwater divide, with a portion flowing north to discharge to Mashapaug Cove and another portion flowing northeast toward the 80-inch combined sewer utility that runs parallel to the eastern property boundary.

The northern CVOC plume extends from the area immediately south of the retail building and beneath the retail building north to Mashapaug Pond. The primary CVOCs detected in the northern plume are 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethylene (TCE). 1,1,1-TCA impacts are primarily present in the shallow aquifer, whereas TCE impacts in the area extend to at least 60 feet below ground surface. Impacts at this depth are inferred to be present in the shallow till that underlies the site.

The southern CVOC plume is bifurcated along a groundwater divide present in the retail parking lot. One arm of this plume extends from the southern property boundary, east of the former service station, north-northwest to the retail building, where it co-mingles with the northern CVOC plume before discharging to Mashapaug Pond. The other arm extends northeast toward the Amtrak right-of-way, where a NBC combined sewer main is located that is believed to be receiving groundwater discharge. The primary CVOC in the southern CVOC plume is PCE, which extends to depths of over 60 feet to the top of till. Dense non-aqueous phase liquid (DNAPL) has been observed in soil borings installed in the source area of the southern CVOC plume.

The extent of groundwater impacts from the CVOC plume are depicted on Figure 2. Portions of the southern CVOC plume extend onto the northeastern corner of the school parcel. On Figure 2, the modeled capture zone is overlaid on the plume. While the entire plume is not captured, the plume emanating from each source area is readily captured. The margins of the plume are expected to attenuate after system operation commences.

3.3 Conceptual Design and Well Network

In 2011, AECOM performed a hydrogeologic evaluation for a groundwater extraction and treatment remediation system (AECOM, 2011). This evaluation included development of a preliminary groundwater flow model, through which a conceptual design for the groundwater containment system was developed, based on an objective of containing groundwater on site at concentrations greater than the Rhode Island GB Standards. To better contain all CVOCs emanating from the two source areas on the retail parcel, the final design employs a slightly higher flow rate to obtain a wider capture zone that contains the entire CVOC plume.

The conceptual design includes the installation of two additional recovery wells to be installed and be used in conjunction with the existing recovery well (RW-1) in the full scale groundwater containment system. Refer to Figure 3 for the proposed recovery well locations and trench layout. AECOM proposes to extract groundwater from the three wells at a combined rate of 16 gallons per minute (gpm), pumping 4 gpm each from existing recovery well RW-1 and recovery well RW-2, which is proposed to be located in the vicinity of the northern CVOC source area, and pumping 8 gpm from recovery well RW-3, which is proposed to be located within the southern CVOC source area. A higher pumping rate is specified for recovery well RW-3 to help obtain containment of the southern CVOC plume across both sides of the local groundwater divide.

Groundwater extracted from the recovery wells will be conveyed in dedicated pipes between each well and the treatment system, where the pipes will be manifolded together prior to treatment of the extracted groundwater by air stripping and carbon absorption.

3.4 Extracted Groundwater Treatment

The groundwater treatment system will be constructed off-site in a 30-foot long cargo container, painted hunter green, and will be located behind the retail building in the vicinity of recovery well RW-1 (see Figure 3). The system will be delivered to the site as a “turn-key” system that is pre-wired, piped, and tested. The treatment system will have a fusible disconnect located on the outside of the container that will feed the electrical distribution panel, control panel, and variable frequency drives (VFDs), which will be mounted on the interior of the treatment building. The groundwater containment system operations will involve a variety of analog and digital instruments and a complex of control loops. Control logic will be managed via a custom control enclosure which will house a programmable logic control (PLC) and an auto-dialer for remote alarm notification. The system will allow for remote monitoring, control and data acquisition through a standard phone connection.

The individual piping runs from the recovery wells will each include a check valve, sample port, flow control valve, and flow transmitter installed in line, prior to being manifolded together inside the system enclosure. The flow transmitters will be used in conjunction variable frequency drives (VFDs) to control the operating frequency and thereby the pumping rate of the down-well submersible pumps. The operator will be able to set an individual pumping rate for each down well submersible pumps and the PLC will use a proportional, integral, and differential loop to control the VFDs operating frequency to maintain the set pumping rate. The pumps will be protected from pumping dry with a pump saver that will shut the pump off if there is no water in the recovery well. Such an occurrence is not expected, based on the design pumping rate and the limited drawdown during the aquifer pump test.

After being manifolded into a single stream, the extracted groundwater will be passed through two bag filter housings, fitted with 25-micron bag filters, plumbed in series prior to being treated for CVOCs. The bag filters will be fitted with a pressure switch to monitoring the potential buildup of pressure (i.e., bag filter clogging) and notify the operator that the bags need to be changed prior to triggering a high-pressure system shut down. Following filtration, CVOc treatment will be conducted with a stainless steel low profile air stripper, which was sized based on the design influent concentrations presented in Table 1 below. The inlet groundwater design concentrations are based upon an arithmetic mean of the maximum concentrations detected at nearby groundwater monitoring points.

Table 1 Summary of Design Influent Concentrations in Groundwater

Compound	Influent Concentration (ppb)	6-Tray Air Stripper Effluent Concentrations (ppb)	RIPDES Permit Discharge Limit Monthly Average / Daily Max (ppb)
Trichloroethylene (TCE)	6,592	<1	5.0/5.0
Tetrachloroethylene (PCE)	5,963	<1	4.24/5.0
cis-1,2-Dichloroethylene	371	<1	NA/70
Vinyl chloride	65	<1	1.92/2.0
1,1,1-Trichloroethane	12,674	<1	NA/200
1,1-Dichloroethane	464	<1	NA/70

The low-profile air stripper will be equipped with a differential pressure switch that monitors the pressure across the air-stripper trays to ensure proper treatment is being achieved. If the differential pressure alarm is triggered, due to fouling of the air stripper, the system will be shut down until the air stripper is cleaned

and the condition is corrected. The air stripper sump will have a sight glass, which will be equipped with level controls to operate the air stripper sump transfer pump and a high high-level alarm. If the air stripper sump transfer pump malfunctions or cannot keep up with the water being treated by the air stripper, the high-high-level alarm will turn the down well submersible pump off until the operator corrects the condition causing back-pressure downstream.

The treated groundwater will be pumped from the air stripper sump, using a transfer pump rated for 30 gpm @ 75 psi, through two bag filter housings plumbed in series. The first bag filter housing will have a 25 micron bag filter, followed by a 10 micron bag filter in the second housing, to limit the amount of solids being loaded onto the liquid- phase granular activated (LGAC) vessels. Although no CVOCs are expected to remain in the treated groundwater following air stripping, the treated groundwater will pass through three 500-pound LGAC vessels, bedded with virgin charcoal based carbon. These LGAC vessels will act as the secondary treatment of the recovered groundwater, consistent with the requirements of the Rhode Island Pollutant Discharge Elimination System (RIPDES) permit. The LGAC vessels will be connected via high-pressure hoses and be of sufficient length to allow for lead/lag operations, wherein the order through which the groundwater enters the vessels is varied. This will allow the carbon to be fully exhausted in the first two units, re-bedded, and then reconfiguring the hoses to allow the third vessel to operate as the primary vessel with new virgin carbon in the first two vessels remaining to provide treatment. Pressure switches will be located prior to the bag filters and each LGAC vessel to monitor the operation pressure and alarm the operator if a high pressure is detected. The high pressure alarms will shut the system down, as needed, until the operator addresses the cause of the back pressure (i.e., replaces bag filters or re-beds the LGAC vessels).

Although metals are not expected to be an issue, both copper and zinc were detected during the pump test at levels below the RIPDES discharge limit. Treatment for metals is therefore not required, however in order to ensure that RIPDES permit limitations for metals are not exceeded the system will be complete with a final treatment stage consisting of a 750-pound IX resin (zeolite media) which is expected to maintain effluent metals levels below RIPDES requirements.

3.5 Vapor Treatment

Offgas from the air stripper will be treated with two 1,000-pound vapor-phase granular active carbon (VGAC) vessels, which will be located outside the system building, and will be discharged through a four-inch Schedule 80 PVC stack that will extend approximately 15 feet above the retail building roof line. The exact location of the discharge stack will be determined in the field and will not be within 20 feet of any air intake on the roof top of the retail building. The emissions from the air stripper falls under the State of Rhode Island Department of Environmental Management (RIDEM) Air Pollution Control Regulation §9.3.2 (Exemptions), which allow for air pollution control systems used to treat emissions from site remediation operation to maintain compliance simply by reducing emissions of VOCs by at least 95%.

Based on air-stripper modeling performed by AECOM, the design emissions concentrations are expected to utilize approximately 19 pounds of vapor phase carbon per day. Utilizing two 1,000-pound VGAC vessels in series, this would allow for approximately 100 days before carbon re-bedding is required (i.e., quarterly re-bedding). However, given the conservatism in the design concentrations, the period of time between carbon re-bedding may be greater. Regular monitoring of vapor discharge will allow evaluation of the actual working lifespan of carbon in the vessels.

3.6 Treated Groundwater Discharge

The treated groundwater will discharge through a mechanical flow meter prior to exiting the treatment system enclosure. The treated groundwater will be discharged under a RIPDES permit to the catch basin

behind the building. See Figure 3 for the location of the catch basin. This catch basin discharges to a detention basin that flows into Mashapaug Pond.

4.0 Remediation of impacted groundwater

Components of the remediation are generally described in Section 3 and more specifically described in Appendix A (Design Drawings and Specifications). This RAWP was developed in compliance with the requirements of Section 16 of the Groundwater Quality Regulations (RIDEM, June 2010). Specific design requirements from Section 16.2 of these regulations are presented below along with a discussion of how they are addressed by the remedial action are provided below.

- (a) *Protect public health and the environment.* The remedial activities will be conducted in accordance with a site specific health and safety plan. All wastes and discharges will be managed in accordance with specific permits, regulatory requirements, and good engineering practices.
- (b) *Ensure compliance with the groundwater quality standards for the classification assigned to the groundwater of concern:* The site is within an area classified as GB. Restoring/maintaining the groundwater to GB objectives is the remedial goal for areas off Parcel A.
- (c) *Eliminate or contain the source of groundwater pollution and minimize the impacted area:* Manufacturing is no longer being conducted on site. The proposed system will contain groundwater in excess of GB groundwater standards.
- (d) *Achieve pollutant concentrations that are consistent with the proposed and anticipated future uses of the site:* The current and foreseeable use of the site is commercial. Currently there are soil vapor controls and periodic sampling to protect indoor air in the existing buildings. The proposed system is expected to reduce groundwater impacts and therefore reduce the risk to indoor air.
- (e) *Prevent an adverse impact on surrounding uses of property, groundwater and surface water.* The remedial actions are designed to prevent the migration of groundwater exceeding GB objectives to surrounding properties.
- (f) *Prevent the violation of water quality standards for surrounding groundwater.* The remedial action is designed to contain the groundwater plume exceeding the GB objectives to its current boundaries and to gradually reduce the area exceeding the GB objectives. Surrounding areas are likewise classified GB.
- (g) *Prevent the groundwater at the remediation site from causing a violation of the surface water quality standards established by the Rhode Island Water Quality Regulations:* The downgradient hydraulic containment system is specifically designed to prevent groundwater exceeding the GB objectives from reaching surrounding properties. Monitoring of CVOCs on site is proposed to demonstrate that violations of the Water Quality Regulations do not occur. Compliance sampling is discussed in Section 6.

A discharge zone and/or residual zone in accordance with rules 13.03 or 13.04 of the Groundwater Quality Regulations are not part of this RAWP. However, the Performing Party reserves the right to apply for a discharge zone and/or a residual zone at the conclusion of the remedial action.

5.0 Limited Design Investigation

The proposed remedial action has been evaluated and designed based on data collected during four site investigation events:

- In 1999, media sampling as part of a site investigation and risk assessment (HLA, 1999).
- In 2006, media sampling as part of a supplemental site investigation (Mactec, 2006).
- In 2007 and 2008, source area delineation and slug testing as part of a focused investigation (ENSR, 2008);
- In 2010 and 2012, groundwater sampling, Mashapaug Cove Groundwater Investigation (Mactec, 20010 and 2012).
- In 2011, a hydrogeologic investigation, including a. 48 hour aquifer pump test was performed to evaluate the feasibility of and develop a conceptual design for a pump and treat system (AECOM 2011).

6.0 Points of Compliance

Proposed Point of Compliance (POC) sampling locations are indicated as monitoring wells listed on Table 2, below and depicted on Figures 2 and 3.

Table 2- Point of Compliance Samples

Monitoring Well	Location
CW-01	Sewer Intercept Compliance Well
CW-02	Sewer Intercept Compliance Well
CW-06	TPH Remediation Compliance Well
GZA-3	Mashapaug Pond Compliance Well
MW-109D	Mashapaug Pond Compliance Well
MW-112	Adelaide Ave. Compliance Well
MW-209D	Adelaide Ave. Compliance Well
MW-218D	Adelaide Ave. Compliance Well
MW-218S	Adelaide Ave. Compliance Well
NOTES: D-"deep" well, S-"shallow" well	

POC samples will be collected for groundwater only. Additional monitoring wells within the plume area may also be sampled annually in order to evaluate the nature and extent of the plume while pumping. Once the proposed system is running, POC monitoring wells will be re-evaluated, based upon location and CVOC concentrations detected. Compliance determination is described in further detail in Section 18.

7.0 Proposed Schedule for Remediation

Project construction activities will commence upon receipt of regulatory approvals. The remediation project is currently scheduled to be conducted between October and November 2012. Construction activities are anticipated to take 4 to 6 weeks to complete. Final restoration of pavement may potentially occur the following spring, depending upon weather conditions.

8.0 Contractors and/or Consultants

Textron, Inc. has selected AECOM as the environmental consultant, design engineer, and construction manager for this work.

AECOM
10 Orms Street, Suite 405
Providence, RI 02904
Contact: Richard P. Michalewich Jr., PE RI #9573
(401) 274-5685

AECOM will manage the laboratory, earthwork subcontractor, and any other subcontractors required to complete the work.

Laboratory:

Spectrum Analytical, Inc.
11 Almgren Drive
Agawam, MA 01001

Earthwork Contractor:

Earthwork Industries, Inc.
6 High Street, Unit 4
Plainville, MA 02762

Electrician:

Gilbride Electric, Inc.
21 Progress Avenue #2
Chelmsford, MA 01824

Remediation Equipment Contractor:

National Environmental Systems
84 Dunham Street
Attleboro, MA 02703

9.0 Site Plan

The site plans are presented in Figures 2 and 3. The Design Drawings are included in Appendix A.

10.0 Design Standards and Technical Specifications

The Design Drawings and Specifications (DRAFT Issued for Construction) are included in Appendix A. In accordance with Remediation Regulation 9.10, the Issued for Construction Drawings and Specifications will be stamped by a Rhode Island professional engineer.

11.0 Set-up Plans

Site preparation activities will be conducted prior to the start of excavation work to optimize and expedite sediment and surface soil removal efforts. These activities are described below.

11.1 Health and Safety

AECOM's site specific health and safety plan (HASP) will be implemented for this project.

All construction activities will be assumed to require Level D health and safety protection at a minimum. Workers must be prepared to immediately upgrade to Level C health and safety equipment. An upgrade to Level C could be required at different phases of the project should exposure to volatile vapors require it.

Any personnel entering the work area must be OSHA 40-hour health and safety trained. All on-site personnel must carry a valid OSHA 40-hour training card at all times. No personnel will be allowed on the facility without confirmation of OSHA training.

Necessary safety devices (cones, barricades, etc.) will be utilized to ensure the safety of all workers during remediation activities. Traffic safety will be incorporated into the work.

Breathing zone air quality in the excavation work area will be monitored by AECOM, who will screen for total VOCs with PIDs equipped with both 10.6 electron volt (eV) and 11.7 eV lamps. If the PID indicates a sustained (15 minute) breathing zone airborne concentrations of VOCs at or above 50 ppm, Level C PPE will be required, and respiratory protection should be donned. In addition, respiratory protection should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed. Additional details regarding air monitoring and health and safety procedures are documented in the HASP.

11.2 Site Access

Access to the site will be gained through the existing ingress and egress of the existing parking lots.

11.3 Staging Areas

Staging areas and activities will occur in the existing paved parking areas.

11.4 Decontamination Areas

AECOM does not anticipate encountering impacted soil during the majority of the system installation. Impacted soil and groundwater will most likely be encountered during the installation of proposed extraction wells RW-2 and RW-3. During the installation of these wells, drilling equipment will be decontaminated using a steam cleaner. Decontamination activities will occur in the immediate vicinity of the well locations after each well is installed and completed. Decontamination water will be contained for later treatment and disposal.

11.5 Stockpile Areas

Excavated soil is anticipated to be largely free from environmental impacts. Excavated soil will be temporarily stockpiled on the side of the trenches until backfill activities are conducted. It is anticipated that trenches will be backfilled at the end of each day. Excess soil will be stockpiled on site within the secure work area. If the excess soil exhibits evidence of impacts (i.e., elevated PID readings and/or visual or olfactory indicators), the stockpile areas will be lined and covered with plastic sheeting. Excess stockpiled soils will be shipped off-site as soon as practical and no later than 90 days after excavation.

11.6 Sedimentation and Erosion Control

Prior to commencement of excavation, haybales will be installed around catch basins in the vicinity of the work area. Work will occur in the paved parking areas and minimal to no erosion is anticipated.

11.7 Utility Clearance

According to existing utility plans, potentially active utilities are anticipated to be encountered in the work areas. However, utility clearance with Dig Safe will be completed prior to start of work. When utilities are encountered during excavation, they will be protected against damage and avoided with powered equipment.

12.0 Contingency Plan

In the event of an unexpected incident involving the release of hazardous materials at the Site, the following procedures will be followed and the persons to be notified. This Contingency Plan must be available at the project site at all times during the implementation of the remedial action. This Contingency Plan will be used in coordination with the site specific HASP.

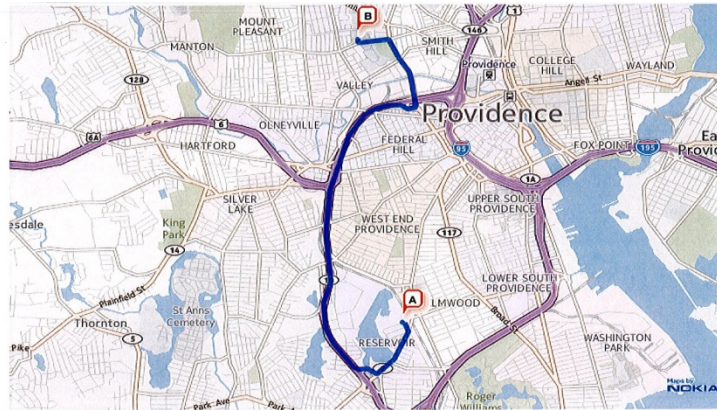
12.1 Names and Phone Numbers of Emergency Coordinators

Emergency Coordinators / Key Personnel			
Name	Title	Telephone Number	Cellular Phone
Richard P Michalewich	Project Manager	978-589-3044	978-799-1543
David Macone	Project Engineer	603-528-8923	978-580-7616
Luis Ferriera	Construction Manager	978-589-3046	978-852-7945
Michael Grasso	District Health & Safety Manager	607-277-5716	607-282-0175
Philip Platcow	Regional Health & Safety Manager	617 -371-4461	617-899-5403
Incident Reporting	Corporate Safety Administrator	800-348-5046	
Organization / Agency			
Name			Telephone Number
Police Department			911
Fire Department			911
State Police			911
Ambulance Service (EMT will determine appropriate hospital for treatment)			911
WorkCare (Consulting Physicians)			888-449-7787
Poison Control Center			800-222-1222
National Response Center			800-424-8802
Underground Utilities			811
RI DEP Spill Reporting Line			401-222-3070

MEDICAL CENTER

Once the injury has been reported, seek treatment at the identified occupational care clinic for non-critical injuries; i.e. injuries of the First Aid variety.

Roger Williams Medical Center
 825 Chalkstone Valley Ave
 Providence, RI
 (401) 456-2000



A 333 Adelaide Ave, Providence, RI 02907

1. Head toward **Downing St** on **Adelaide Ave.** Go for 72 ft.
2. ↑ Continue on **Downing St.** Go for 488 ft.
3. ↘ Bear right onto **Reservoir Ave (RI-2).** Go for 0.5 mi.
4. ↑ Take ramp onto **Huntington Expy (RI-10 N)** toward I-95. Go for 3.0 mi.
5. ↘ Take the **Dean St./Atwells Ave.** exit toward **Providence Place/Promenade Street.** Go for 0.3 mi.
6. ← Turn left onto **Dean St.** Go for 0.3 mi.
7. ↑ Continue on **Pleasant Valley Pky.** Go for 0.2 mi.
8. ↑ Continue on **Raymond St.** Go for 0.2 mi.
9. ← Turn left onto **Chalkstone Ave.** Go for 0.3 mi.
10. → Turn right. Go for 200 ft.
11. Arrive at your destination. **The trip takes 4.9 mi and 9 mins.**

B Roger Williams Medical Center, Providence, RI 02908

When using any driving directions or map, it's a good idea to double check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning

Driving distance is approximately 4.9 miles; driving time is approximately 9 minutes.

When using any driving directions or map, it's a good idea to do a reality check and make sure the road still exists, watch out for construction, and follow all traffic safety precautions. This is only to be used as an aid in planning.

12.2 Emergency Response Procedures and Arrangements

Personnel Injury: Call 911. Section 12.1 provides the phone number and directions to the closest hospital. Procedures for assisting the injured person and for notification are provided in the HASP.

Fire: Call 911. Evacuate work area. Meet the fire department at the facility entrance.

Spills: Contact Richard P. Michalewich, the AECOM project manager, and explain in detail the nature of the spill. Standby for directions, do not respond to the spill unless and until specific directions from the Project Manager/Health and Safety Officer are provided. Call the emergency spill response contractor if the Project Manager is not available or if directed to by the Project Manager. The remediation contractor will be equipped to act as the emergency spill response contractor.

Spills must be immediately reported to the following agencies:

- RI DEM, Joseph Martella (401-222-2797)
- RI DEM Office of Emergency Response (401) 222-3070.
- National Response Center (800) 424-8802.

Emergency Muster Point: The escape route from the Site and an emergency muster point will be determined and provided to all workers during the project mobilization, and will be noted in the space below.

12.3 Procedures to Prevent Ignition and/or Reaction of Flammable Material

Other than small quantities of oil and gasoline used for pump and vehicle operation, no flammable material will be utilized as part of this remediation. Smoking is not allowed at the Site.

13.0 Operating Log

The selected remediation contractor will be required to complete an operating log on a daily basis. At a minimum, the operating log will contain the following information:

1. Date
2. Name, trade, and affiliation of all on-site personnel.
3. On-site equipment and materials.
4. Hours of work for each trade or type of equipment.
5. Major work activities performed, and progress thereof, including estimated quantities of:
 - a. Excavation,
 - b. Temporary Stockpiling,
 - c. Pipe installation,
 - d. Backfilling, and
 - e. Resurfacing.
6. Work activities proposed for the following five work days.
7. Reasons for construction delays.
8. Odor, vapor, or dust mitigation activities performed.
9. Weather conditions and temperature.
10. Unforeseen subsurface conditions.
11. Meetings attended.
12. Accidents, safety, and security issues, including instances of implementation of the Contingency Plan.
13. Tests and inspections performed and the results of tests and inspections.
14. A list of submittals transmitted to or received from the Engineer.
15. If Applicable, Trucking documentation, including:
 - a. Trucking company,
 - b. Truck and trailer registration number,
 - c. Source area of material being shipped,
 - d. Destination facility,
 - e. Estimated quantity, and
 - f. Verification of decontamination.
16. Contractor's signature.

AECOM will provide RIDEM with 48 hour notice before field activities are initiated and following the completion of field activities. Once field activities are initiated, AECOM will provide a weekly construction update. Updates will be provided via electronic mail. At a minimum, these weekly construction updates will provide the following:

1. Summary of work completed the previous week.
2. Summary of work planned for current week.
3. POC sampling results.
4. Discussion of major construction issues and resolutions.

14.0 Security Procedures

The remediation system area is located within the former Gorham facility property. During the construction of the remediation system, trenches will be backfilled each day and cordoned off with caution tape. Construction equipment will either be transported off site or secured and left on site.

After construction of the remediation system, the wellheads will be secured with traffic rated roadboxes secured with bolts. All associated piping will be located below ground under a restored surface. Above ground remediation equipment will be secured in an 8 by 20 foot cargo container which will be surrounded by an 8 feet fence. The fence and structures will be secured with padlocks. Traffic bollards will be installed around the container to prevent vehicles from impacting the remedial equipment. In addition, Providence Police routinely patrol the area.

15.0 Shut-Down, Closure, and Post-Closure Requirements

15.1 Shut-Down Requirements

At the conclusion of work all equipment and materials will be removed from the site. Plastic liners, trash, and all other material will be properly disposed of off-site.

15.2 Closure Requirements

Upon completion of the remediation, AECOM, on behalf of Textron, will submit a Remedy Installation Report to RI DEM. The closure report will follow this format:

- A description of the implemented remedy;
- As-built limits of trenching;
- Well boring and construction logs;
- As built P&ID for the treatment system;
- Operation and Maintenance Manual;
- System start up data,
- Documentation of clean fill used as backfill;
- If needed, recommendations for any additional investigation and remediation.

15.3 Post-Closure Requirements

No post-closure requirements are proposed, unless institutional controls are recommended. See Section 17 for additional information.

16.0 Institutional Controls and Notice

No new Institutional controls are proposed for the former Gorham silver facility property as part of this groundwater remedy.

17.0 Compliance Determination

Compliance determination procedures for the primary source areas and downgradient areas are described below.

17.1 Primary Source Areas

Upon completion of the system installation as described in Section 3, Point of Compliance (POC) samples will be taken at the locations indicated in Table 2. Currently, the next groundwater sampling event is scheduled for February 2013 and semi annually thereafter.

POC samples will be analyzed to determine compliance with the Remedial Objectives defined in Section 2. POC samples will be analyzed by the following methods:

- CVOCs by USEPA Method 8260B

Samples will be analyzed under standard turn-around-times .

Compliance with remedial objectives in the primary source areas will be achieved when POC sampling indicates that the remedial objectives have substantially been met. Minor exceedances will be considered to be in compliance.

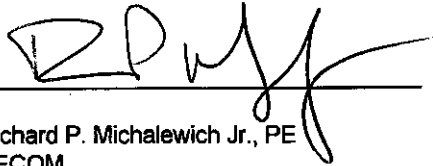
17.2 Downgradient Areas

Compliance with remedial objectives in the downstream areas will be monitored by sampling groundwater from compliance monitoring wells GZA-3, MW-109D, CW-6, CW-1, CW-2, MW-112, MW-209D, MW-218D, and MW-218S. It is anticipated that concentrations of CVOCs in these wells will decrease over time with system operation.

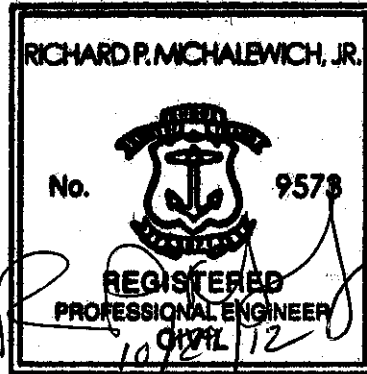
18.0 Certification Requirements

Authorized Statements

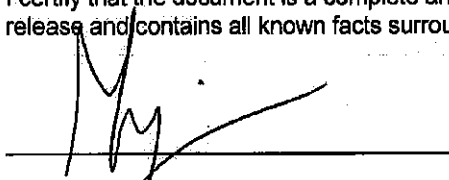
As the authorized representative of AECOM (company that prepared this document) for this Site, I certify that the information contained in this Remedial Action Work Plan is, to the best of my knowledge, complete and accurate.



Richard P. Michalewich Jr., PE
AECOM
Project Manager



As an authorized representative of the performing party responsible for the submittal of this document, I certify that the document is a complete and accurate representation of the contaminated-site and the release and contains all known facts surrounding the release to the best of my knowledge.

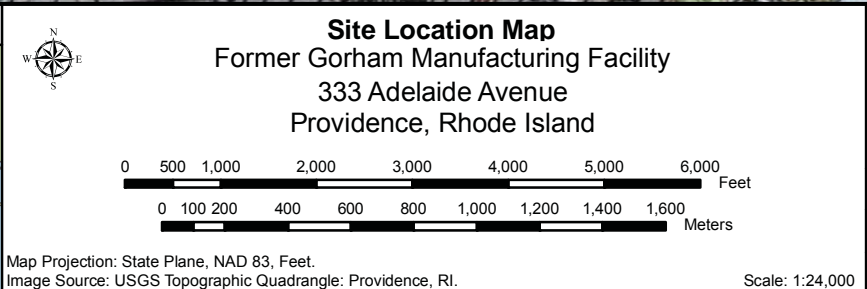
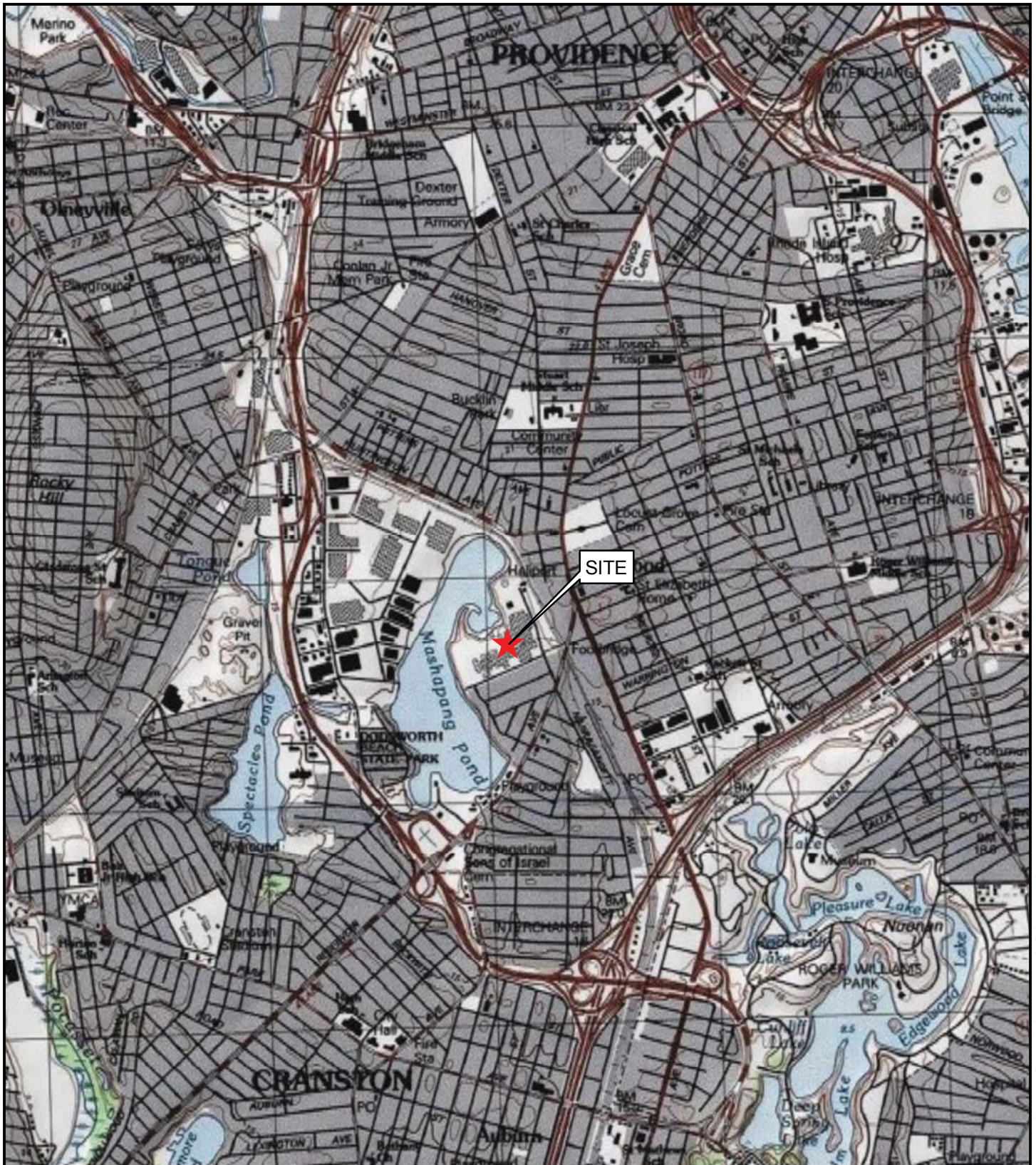


Gregory L. Simpson
Textron, Inc.
Senior Project Manager

19.0 References

- ABB, 1995. Remedial Investigation Report, Gorham Manufacturing Facility, 333 Adelaide Avenue, Providence, RI – Volume 1.
- ABB, 1996. Limited Design Investigation Report.
- AECOM, 2011. Preliminary Hydrogeologic Evaluation of Groundwater Pump and Treat Remediation– Former Gorham Silver Facility, 333 Adelaide Ave., Providence, Rhode Island. December 2011.
- ENSR, 2008. Report on Source Delineation, Former Gorham Silver Facility. Letter to Joseph Martella dated February 27, 2008.
- Harding Lawson Associates, 1999. Site Investigation Summary and Risk Assessment, Volumes 1 and 2.
- Hunter, Inc., 1989. Soil and Groundwater Contamination Site Assessment of the Gorham Manufacturing Facility, Providence, RI.
- MACTEC, 2006. Supplemental Site Investigation Report, Former Gorham Manufacturing Facility.
- MACTEC, 2008 through 2012. Data Summary Report, Mashapaug Cove Groundwater Investigation.
- State of Rhode Island and Providence Plantations, Department of Environmental Management, Office of Waste Management, *Groundwater Quality Rules*, June 2010.
- State of Rhode Island and Providence Plantations, Department of Environmental Management, Office of Waste Management, *Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases*, August 1996, Amended February 2004 and November 2011.

Figures

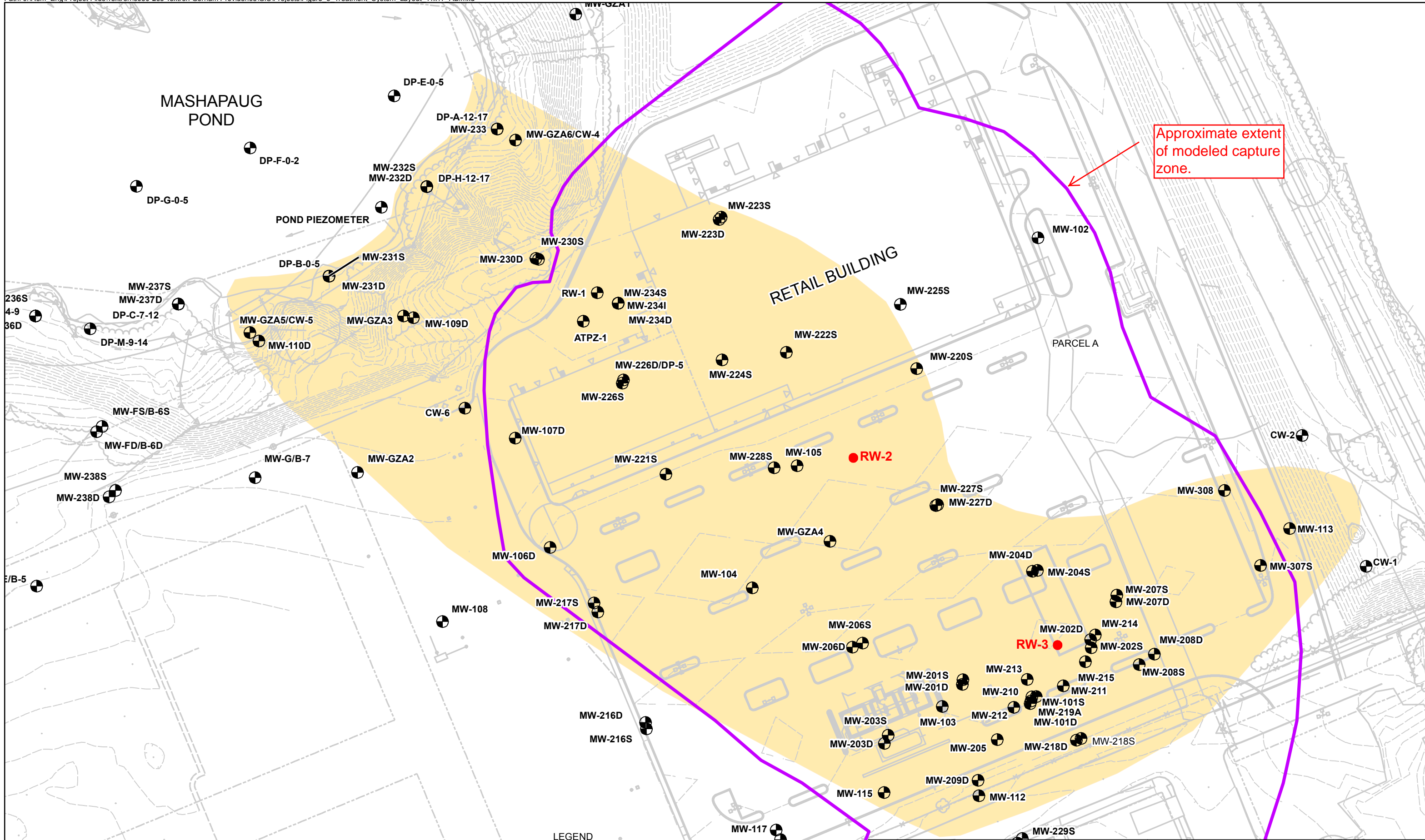


AECOM

Figure 1

Date: April 2011

Project #: 60212521.1.3

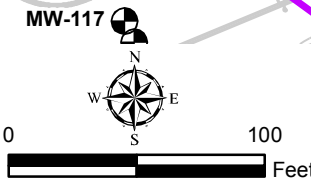


NOTES:
 Assumed there is a sufficient power source, in the electrical room, which will allow a 150 amp breaker to be installed to supply the treatment system with 208V, 3 phase. The electrical usage will be monitored with an E-mon D-mon Electrical Submeter.

NOTES:
 VGAC Discharge Stack to extend approximately 10 ft above the building roof top.

LEGEND

- CVOC Plume
- Capture Zone
- Proposed Recovery Well

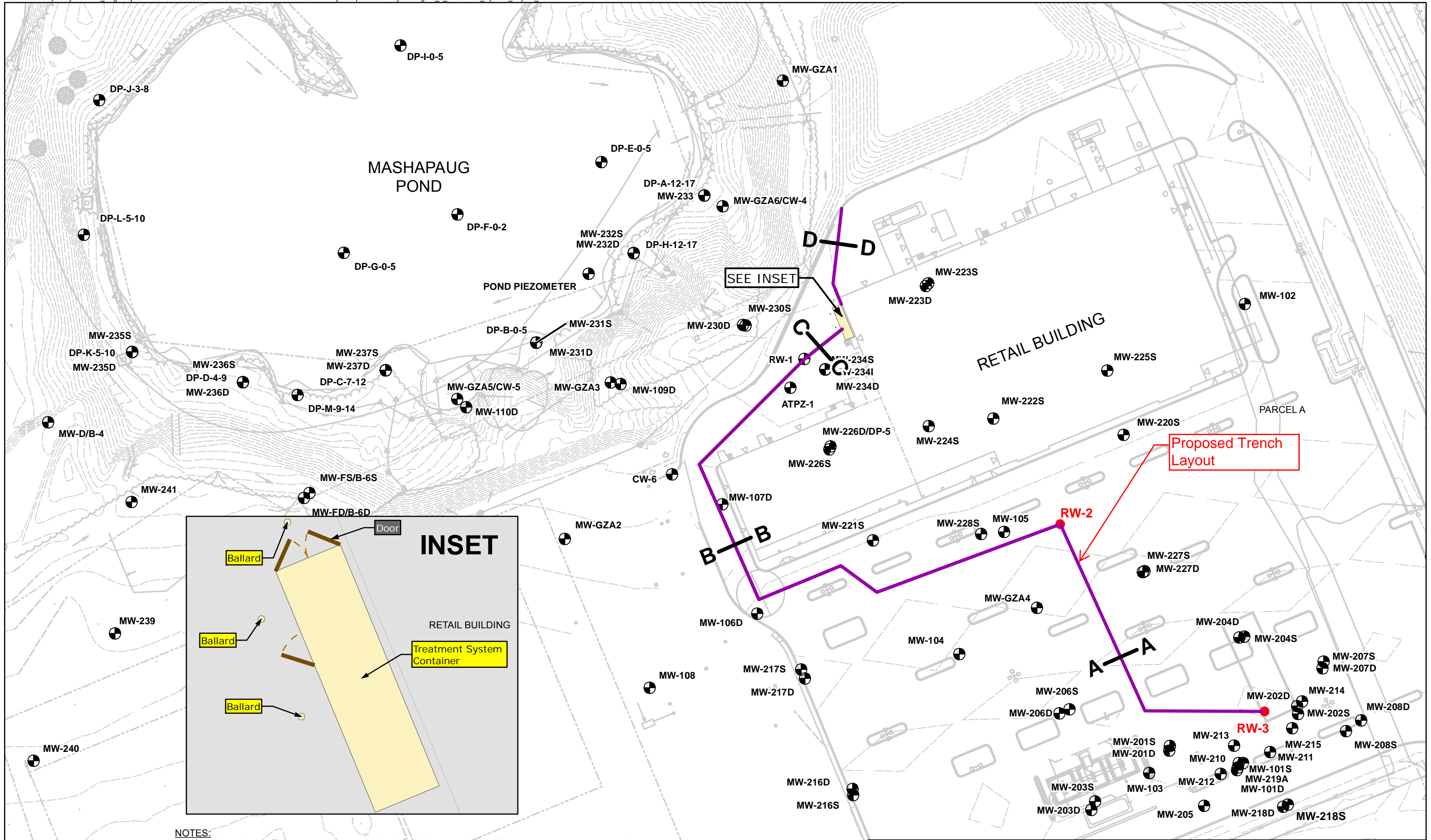


Former Gorham Manufacturing Facility
 PROVIDENCE, RHODE ISLAND
 60212521.1

EXTENT OF RETAIL PARCEL
 CVOC PLUME

DATE: 05/04/12 DRWN: J.E.B.

FIGURE 2



NOTES:
 Assumed there is a sufficient power source, in the electrical room, which will allow a 150 amp breaker to be installed to supply the treatment system with 208V, 3 phase. The electrical usage will be monitored with an E-mon D-mon Electrical Submeter.

VGAC located inside the treatment system container. Discharge stack to extend approximately 10 ft above the building roof top.



Former Gorham Manufacturing Facility PROVIDENCE, RHODE ISLAND 60271240.1.1		TREATMENT SYSTEM LAYOUT	
DATE: 09/14/12	DRWN: J.E.B.	FIGURE 3	

Appendix A

Design Drawings and Specifications and Calculations

October 2012
Project No. 60271240

**CONSTRUCTION SPECIFICATIONS
REMEDIAL SYSTEM INSTALLATION
TEXTRON, INC.
Former Gorham Facility
Adelaide Ave.
Providence, RI**

SECTION 02000A

TRENCH EXCAVATION, BEDDING, AND BACKFILL

PART I - GENERAL

1.01 Scope Of Work

Work required under this section consists of furnishing all necessary labor, materials, tools, equipment, and services in connection with and reasonably incidental to clearing, excavating, constructing pipe bedding, backfilling, and stockpiling and disposing of excess excavated materials, as shown on the drawings and as specified herein.

Work required shall include the furnishing of all materials and equipment necessary for the construction and installation of all sheeting and bracing and other facilities which may be necessary to perform the excavations and place and compact the backfill, and the subsequent removal of such sheeting, bracing, and other facilities, except where it is required or permitted by the Engineer that it remain in place.

1.02 Requirements of Regulatory Agencies

All work performed within the jurisdiction of State, County or other agencies shall conform to all codes and ordinances and to all permit requirements of said agencies or as stated in any required permits.

PART 2 - MATERIALS

2.01 Granular Backfill

Granular backfill shall be clean bank run gravel or sand and gravel conforming to the following gradation requirements:

Sieve Size	Percent Passing
6-inch	100
3-inch	85-100
No. 200	0-20

The source of the material shall be subject to the approval of the Engineer.

2.02 Bedding Material

Bedding material shall consist of clean, granular, well graded sand having a minimum sand equivalent of 50 and conforming to the following gradation requirements:

Sieve Size	Percent Passing
3/4-inch	100
No. 30	20-30
No. 200	0-3

PART 3 - PERFORMANCE

3.01 Clearing Operations

Clearing shall be limited to the area adjacent to the line of work and to such width as will allow excavation of the trench, material excavated, and area for pipe storage, and equipment access.

3.02 Construction Across Improved Areas

Asphaltic concrete pavement, curbs, or driveways removed in connection with construction shall be rebuilt to the same quality as the structure removed. Where pavement, curbs, or driveways must be removed, they shall be neatly cut prior to excavation. The replacing of asphalt concrete pavement shall be as specified under Section 2D, "Paving, Restoration and Resurfacing Work" of the Drawings or as directed by the Engineer.

3.03 Underground Obstructions

Excavation and other work under or adjacent to existing pipelines, conduit runs, or structures of any kind, shall be executed in such a manner as not to interfere with the safe operation and use of such installations. Should any damage be incurred to such existing pipelines, conduit runs, or structures during the operations of the Contractor, he shall immediately notify AECOM and/or the proper authorities, and shall arrange for the immediate repair of the facilities at his own expense.

3.04 Trench Excavation

1. Excavation

The work shall consist of performing all excavation operations regardless of the character of subsurface conditions. The Contractor shall make his own evaluation of the type and extent of materials which may be encountered in the work.

2. Sheeting and Bracing (if necessary)

The Contractor shall furnish, place and maintain such sheeting and bracing as may be required to support the sides of excavations for the protection of workmen, to facilitate the work; to prevent damage to manholes, structures, and pipelines being constructed; to protect adjacent embankments, structures or facilities from damage; and as required by applicable local, State, and Federal (OSHA Part 1926) safety codes.

3. Dewatering (if necessary)

During pipeline excavation and backfill operations, the Contractor shall provide temporary drains, diversion ditches, pumps, cofferdams, or other devices as may be necessary to remove surface water or ground-water from the area of work. Unless otherwise specifically permitted by the Engineer, water, either of surface or subsurface origin, will not be permitted in the trenches at any time during construction and until backfilling over the top of the pipe has been completed; nor will the ground-water level in the trench be permitted to rise above an elevation 6-inches below the invert of the pipe.

Such water shall be pumped to a fractionation tank supplied by the Contractor. The Contractor will be responsible for acquiring, maintaining, and cleaning of the fractionation tank during its use. The Contractor shall allow the fractionation tank to be left on site for up to two weeks after dewatering operations have ceased.

Dewatering trenches, when required, may be accomplished in any manner the Contractor desires, provided the method is acceptable to the Engineer. Any damage resulting from the failure of the chosen method to operate properly shall be the responsibility of the Contractor and shall be repaired in a manner satisfactory to the Engineer, at the Contractor's expense.

4. Structure Clearances

Excavation for manholes and other structures shall be sufficient to leave at least twelve inches between outer surfaces of the structure and the sides of the excavation.

5. Handling of Excavated Soil

Soils resulting from utility trench excavation within potentially contaminated areas will be screened continuously by using a portable Organic Vapor Analyzer (OVA) equipped with a

photo ionization detector by AECOM. Based on a headspace screening procedure performed in accordance with RIDEM guidance, soils with field OVA screening results which exceed site-specific background levels will be segregated for further characterization and proper disposal. Saturated soils shall be stockpiled separately from unsaturated soils. Stockpiles shall be constructed and contained to minimize potential for contact with rainfall and surface water flow. Some excavated soils may be loaded directly into lined and covered roll-off boxes as an alternate storage method. Contaminated soils must be stored on and securely covered with plastic sheeting.

6. Sedimentation Control

If applicable, follow the procedures in the attached Order of Conditions or City Bylaw. Refer to the Drawings for guidance on the implementation of siltation control devices.

3.05 Trench Backfill

No backfilling shall commence until the pipeline has been inspected and approved by the Engineer and until required fittings, if any, are installed and inspected.

In backfilling the trenches, the Contractor shall take all necessary precautions to prevent damage or shifting of pipe. In general, backfilling shall be performed by pushing the material from the end of the trench into, along, and directly over the pipe so that the material will be applied in the form of a rolling slope rather than by side filling which may damage the pipe. Backfilling from the sides of the trench will be permitted after sufficient material has first been carefully placed over the pipe to such a depth as is acceptable to the Engineer.

Any backfill which becomes displaced or depressed during construction, during the warranty period, described in Section 4.11 of the Agreement, shall be refilled, shaped, and restored to proper grade as frequently as is necessary until the surface is unyielding, at the Contractor's expense.

SECTION 02000B

SITE PREPARATION

PART 1 - GENERAL

1.01 Scope of Work

Work required under this section consists of furnishing all labor, materials, tools, equipment, and services necessary to clear the work area of all trees, brush, and other vegetation; rubbish, and other objectionable material. It shall include removing obstructions interfering with the proposed work. All work under this section shall be done in accordance with these specifications and in conformity with the Drawings.

1.02 Limits of Clearing

Clearing and grubbing shall be limited to the area within the site boundaries or the area adjacent to the line of work and to such width as will allow excavation of the trench, storage area alongside the trench for material excavated, and an area for pipe and material storage.

PART 2 - MATERIALS - none

PART 3 - PERFORMANCE

3.01 Clearing and Grubbing Operations

Clearing and grubbing shall consist of the removal and disposal or replacement of those items which interfere with the work.

The refuse resulting from clearing operations shall be hauled to a waste site secured by the Contractor and shall be disposed of in such a manner as to meet all requirements of State, County, and municipal regulations regarding health, safety, and public welfare.

The Contractor shall be responsible for all damages to existing improvements resulting from his operations.

3.02 Stripping

Stripping shall consist of all excavation required to remove topsoil, rubbish, and vegetation below the ground surface not removed by clearing and grubbing operations, and to remove other unsatisfactory material from the foundation area of filled areas when directed by the Engineer. Continuous drainage of all stripped areas shall be maintained to prevent the ponding of water.

SECTION 02000C

PAVING, RESTORATION, AND RESURFACING WORK

PART 1 - GENERAL

1.01 Scope of Work

Work required under this section consists of furnishing all labor, materials, tools, and equipment to restore and repair all damaged asphalt and/or landscaping due to activities associated with this project.

PART 2 - MATERIALS

2.01 Subgrade Material

Subgrade material shall be clean bank run gravel or sand and gravel as specified in Section 2A, "Trench Excavation, Bedding, and Backfill" Part 2, Subpart 2.01.

2.02 Asphaltic Concrete

Only hot batch asphalt will be acceptable when restoring asphalt surfaces. Cold patch asphalt is not acceptable. Bottom course asphaltic concrete shall be a minimum of three inches (3") thick and shall conform to State Specifications for bottom course asphaltic concrete. Top course asphaltic concrete shall be a minimum of one inch (1") thick and shall conform to State Specifications for top course asphaltic concrete.

PART 3 - PERFORMANCE

3.01 Subgrade Preparation

The approved fill shall be spread and compacted as described under Section 2A, "Trench Excavation, Bedding, and Backfill."

3.02 Paving

The asphaltic Concrete shall be spread over the area, brought to the proper grade, and compacted by a vibratory plate compactor. Hand tampers may be used in areas that are inaccessible to the vibratory plate. Compaction equipment shall be as approved by the Engineer. The final grade of the pavement shall be flush with and conform to the grade of the adjacent pavement.

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Settling, cracking, or other defects noted in the pavement during construction or in the warranty period shall be repaired by the Contractor at his expense. Contractor shall maintain pavement condition of public road surfaces for the required time specified by the Town of Manorville in the road opening permit.

3.03 Loaming and Seeding (if necessary)

Loaming and seeding may only be done between April and October. Contractor shall rake loam even, seed, and mulch for erosion protection. Contractor is responsible for seeded area until grass is established.

SECTION 15000A

PIPING

PART 1 GENERAL

1.01 Scope of Work

Work under this section consists of furnishing and installing all piping and fittings and installing all appurtenances provided by the Contractor as shown on the Drawings and as specified herein.

PART 2 MATERIALS

2.01 Pipe Classes

The following pipe classes are defined for this project:

*	PV80	Schedule 80 Polyvinyl Chloride;
*	PV40	Schedule 40 Polyvinyl Chloride.
*	BS	Black Steel
*	HDPE DR-11	High Density Polyethylene (160 psi);

2.02 Polyvinyl Chloride Pipe

1. General

All Polyvinyl Chloride pipe shall be conforming to the United States Product Standard PS 21-70, unless otherwise indicated on the Drawings, and shall conform to ASTM D-1785, PVC 1120, PVC 1220, and/or PVC 2120.

2. Joints and Fittings

Joints shall be socket cemented per ASTM D-2467.

2.03 Black Steel Pipe

1. General

All Black Steel pipe shall be black steel pipe conforming to ASTM A-53A ERW or ASTM A-106A seamless.

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2. Joints and Fittings

Assembly of all joints shall conform to the appropriate standards. On threaded pipe joints, TEFLON® tape shall be applied to the male threads only.

2.04 High Density Polyethylene Pipe

1. General

All High Density Polyethylene pipe shall conform to the ASTM D 3350-05, unless otherwise indicated on the Drawings, and shall conform to ASTM F-714-05, ASTM D 2513-05 and ASTM D 3035-03a.

2. Joints and Fittings

Joints shall be heat or electrofused per ASTM D-2657, ASTM F 2620, ASTM F 1290, ASTM D 3261, and/or ASTM F 1055.

PART 3 PERFORMANCE

3.01 Installation of Pressure Lines

1. General

Pipe, fittings, and appurtenances shall be installed in accordance with the manufacturer's recommendations and ASTM D 2774-04 (HDPE-D11 piping only)

2. Handling

All pipe and fittings shall be carefully examined for defects and no piece shall be installed which is known to be defective. Care should be taken to avoid leaving any foreign matter in the pipe.

3. Alignment

Piping shall be installed as indicated on the Drawings. Piping shall be parallel to existing piping uniformly spaced horizontally and vertically at bends and changes in direction.

All pipe shall be carefully placed and supported at the proper line and grade. Lines shall be sloped back toward the manholes with no low spots. Minor adjustments may be necessary to avoid architectural and structural features. Major relocations shall be approved in writing by the Engineer. The Drawings shall be taken as diagrammatic for piping that is not shown in detail. Sizes of piping and their locations are indicated, but it is not intended to show every offset and fitting nor every structural difficulty. Where necessary to avoid structural or mechanical difficulties, the alignment of pipes shall be varied from that indicated on the Drawings without extra expense to the Client.

4. Joints

All portions of the joints shall be thoroughly cleaned before pipe sections are joined. Sufficient threaded unions shall be used to allow the convenient removal of any pipe without removing adjacent runs or equipment. Omission of joints from the Drawings does not excuse the Contractor from their installation.

5. Cutting and Threading

Cuts shall be clean at right angles to the pipe and reamed to remove all burrs.

3.04 Test for Pressure Piping

1. General

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All pipelines shall be tested to the pressures indicated in this section. Pressure testing will be monitored by AECOM. Only necessary for water lines.

All piping shall be flushed or blown out after installation is completed. After testing, any detected leaks shall be repaired. Repaired piping shall be retested.

The Contractor shall furnish all necessary personnel, supplies, equipment, bulkheads, and whatever additional equipment is required to make any and all tests specified and shall make any and all repairs.

SECTION 15000B
ROADBOXES AND APPURTENANCES

PART 1 - GENERAL

1.01 Scope of Work

Work under this section consists of furnishing all labor, materials, tools, equipment, and services in connection with and reasonably incidental to constructing roadbox structures and installing metal frames, covers, and other appurtenant items, all as shown on the Drawings and specified herein.

PART 2 - MATERIALS

2.01 Roadbox Structures

Roadbox frames and covers shall be designed to H-20 Highway Loading Standards with a 12-inch clear opening unless otherwise indicated on the Drawings. The covers furnished shall be of skid resistant design, shall have a minimum of two bolts to secure the cover, and shall come equipped with a gasket to prevent runoff infiltration.

2.02 Sealant

The joints around the concrete pad of the roadbox structures shall be filled with a silicone base highway sealant such as Dow Corning 888 Highway Sealant or equivalent.

PART 3 - PERFORMANCE

3.01 Construction of Roadbox Structures

All roadboxes shall be installed in a square concrete pad with dimensions equal to or greater than 1.5 times the diameter of the roadbox and a minimum of six inches (6") thick. The concrete shall be a minimum compressive strength of 4,000 psi for all roadboxes. Asphalt surrounding the well will be saw cut at 90 degree angles in preparation of the new roadbox.

3.02 Sealant

A seal shall be installed around the concrete pad of all roadbox structures using a silicone based highway sealant.

SECTION 16000A
ELECTRICAL CONDUIT

PART 1 - GENERAL

1.01 Scope of Work

Work under this section consists of furnishing all labor, materials, tools, equipment, and services in connection with and reasonably incidental to installing electrical conduit and fittings, if any, as shown on the Drawings and specified herein. All work in this section must conform to applicable National Electric Code, local, State, and Federal standards. All work in this section must be performed by a licensed electrician. The Contractor is responsible for ensuring that all electrical work meets the requirements of the applicable electric codes, and the satisfaction of the local electric inspector.

PART 2 - MATERIALS

2.01 Conduit Type

Conduit systems as specified in the drawings, including conduit and fittings, shall be one of the following:

1. Hot dipped, galvanized rigid steel.
2. Rigid aluminum (minimum size of one inch when run is over 15 feet) containing less than 0.4% copper ("copper free" aluminum).
3. Rigid polyvinyl chloride (PVC) schedule 40 minimum only when specifically approved.
4. PVC coated galvanized rigid steel, minimum 40 mils coating.

PART 3 - PERFORMANCE

3.01 Construction Practices

Conduit shall be cold cut square. Field made threads shall be cut clean and true with sharp, unworn dies. The threads shall be cut to the proper length and depth for standard 3/4-inch taper per foot threads. Thread cutting lubricant shall be used. All threaded ends and cut ends shall be reamed after threading to remove burrs and rough edges.

3.02 Bends

1. Number of Bends

All conduit runs shall be installed with a minimum number of bends and offsets. Generally, a run of conduit containing low voltage (600 volt maximum) wire shall have a maximum pulling distance of 300 feet and contain no more than three and one-half quarter bends (315 degrees total), including offsets and bends located immediately adjacent to the pull location. On runs over 300 feet this shall be reduced to two quarter bends (180 degrees total). Exceptions, with the approval of the Engineer, may be made when calculations indicate that cable tension and sidewall pressure at bends do not exceed cable manufacturer's recommendations.

2. Bend Requirements

Underground conduit bends shall be "long radius" bends. The radius of bends for special cases shall be calculated. Careful consideration shall be taken to ensure all conduit meets and/or exceeds NEC requirements for bending. Where bends or offsets are required, they shall be made with suitable conduit bending equipment. A uniform circular cross section of the conduit shall be maintained at bends. No single bend shall be greater than 90 degrees.

3.03 Coupling and Joints

1. Joints

Rigid metallic conduit connections shall be threaded. Thread compound shall not interfere with the grounding continuity of the conduit system. The compound must be a lubricant which will provide corrosion protection and permit the connection to be disassembled at a future date. In hazardous locations conduit must be made up wrench-tight or bonded.

2. Coupling and Joint Restrictions

Couplings and other fittings shall not be installed in the curved portion of bends.

3. Required Fittings

Not all fittings required for a complete conduit system are shown on the Drawings. It shall be the Contractor's responsibility to install the number and type of fittings required for a complete conduit system which complies with all applicable codes and standards. The threads of fittings, including cover screws and bolts, shall be coated with a conductive thread lubricant prior to installation to prevent corrosion.

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4. Pull Fittings

Pull fittings, including 90-degree ell fittings, shall be of adequate size so that cables can be installed without bending on a radius less than NEC code requirements. Careful consideration shall be taken to ensure the choice of fittings meets and/or exceeds NEC requirements for bending.

SECTION 16000B

ELECTRICAL

PART 1 - GENERAL

1.01 Scope of Work

Work under this section consists of furnishing all labor, materials, tools, equipment, and services in connection with and reasonably incidental to installing electrical conduit and fittings, if any, as shown on the Drawings and specified herein. All work in this section must conform to applicable National Electric Code, local, State, and Federal standards. All work in this section must be performed by a licensed electrician. The Contractor is responsible for ensuring that all electrical work meets the requirements of the applicable electric codes, and the satisfaction of the local electric inspector.

PART 2 - MATERIALS

The Contractor shall provide and install a 200-amp circuit breaker panel, with appropriately sized circuit breakers and motor starters for each of the treatment system motors and components.

The Contractor shall install appropriately sized wire and conduit to all motors and sensors.

PART 3 - PERFORMANCE

3.01 Shed Classification

The interior of the treatment system building shall be considered a Class I, Division II location. Explosion-proof equipment, conduit and accessories will be used inside the treatment system enclosure. The Contractor shall ensure that appropriate vapor seals are installed where the conduit passes through the wall of the building, and into the electrical enclosure.

3.02 Electrical Requirements

1. Electrical Service

The Contractor shall provide a 200-amp, 230-volt, 3-phase electric service to the treatment system enclosure. This task includes necessary coordination with the local utility company, providing power service feed to the building, and installing or

coordinating with the utility for the installation of the electric meter. The circuit breaker panel and the system control panel will be located in the electrical enclosure, on the outside of the building.

2. Electrical Leads

The Contractor shall provide power feeds from the circuit breaker panel to the control panel, and to the individual motor starters within the control panel. The Contractor shall wire all motors and sensors in accordance with the manufacturer's instructions and applicable electrical codes. A process and instrumentation diagram (P&ID) is provided for reference as Figure 5. A listing of motors and sensors (provided by AECOM) follows. Power leads shall be placed in separate conduits from low voltage control wires.

3. Heater

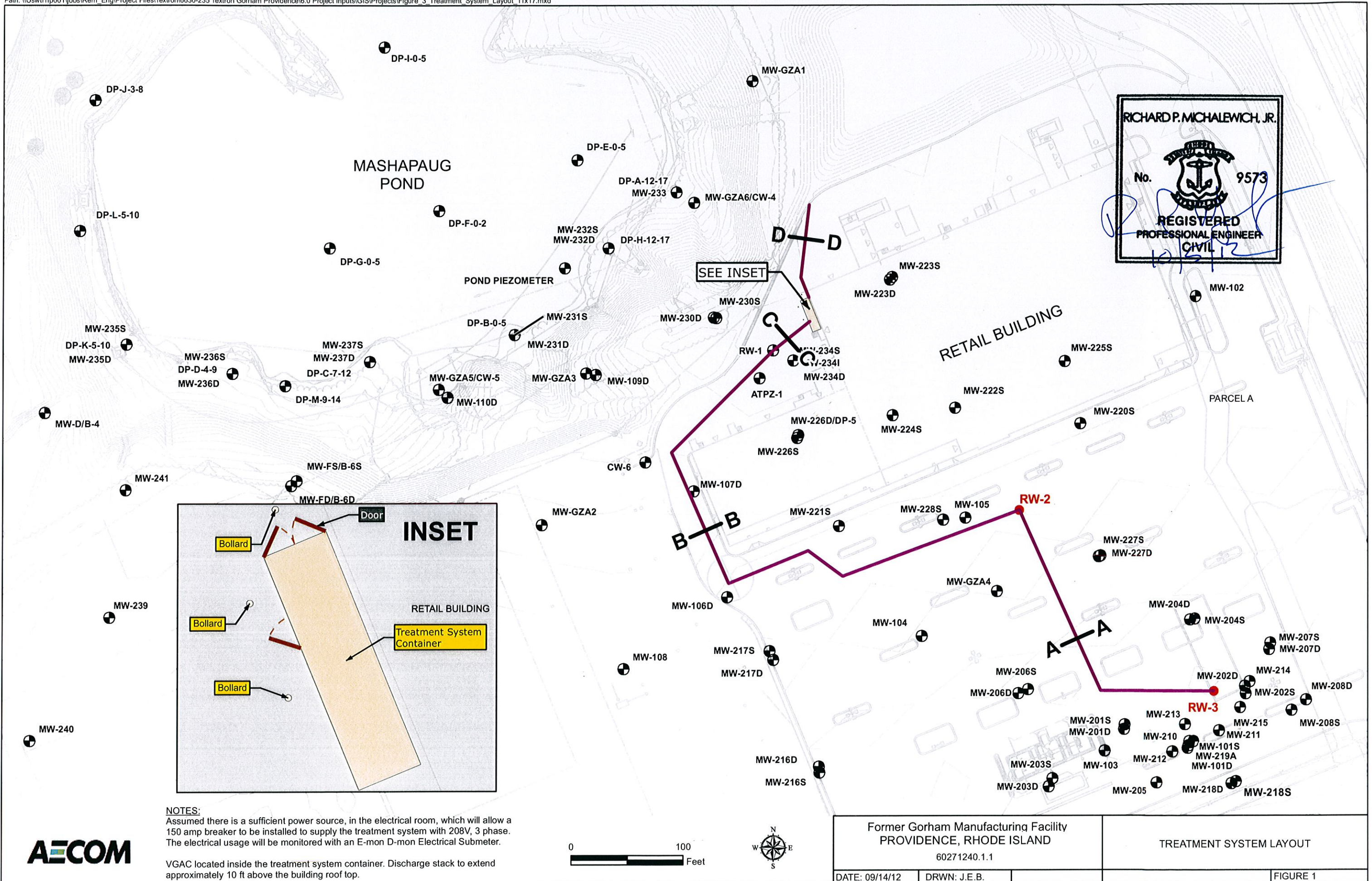
The Contractor shall supply and install an electric heater which provides a minimum of 6,000 BTU/hr, and an interior light for the system enclosure. The heater and light shall both be explosion-proof and approved for use in Class I, Division II locations.

4. Remediation Equipment

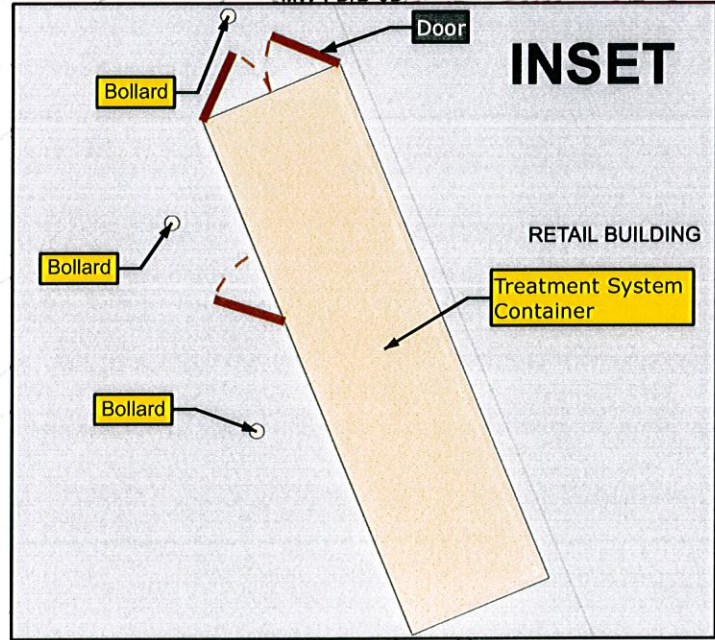
Refer to the attached Equipment Specifications and Calculations for specifications on the remediation equipment.

October 2012
Project No. 60271240

DRAWINGS



RICHARD P. MICHALEWICH, JR.
 No. 9573
 REGISTERED PROFESSIONAL ENGINEER
 CIVIL

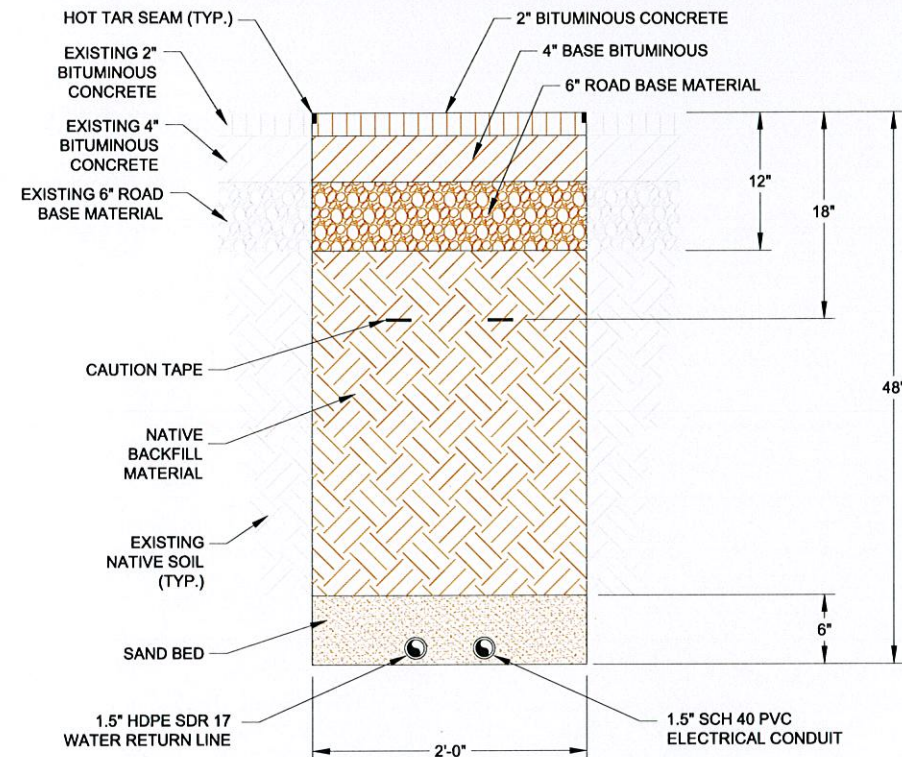


NOTES:
 Assumed there is a sufficient power source, in the electrical room, which will allow a 150 amp breaker to be installed to supply the treatment system with 208V, 3 phase. The electrical usage will be monitored with an E-mon D-mon Electrical Submeter.

VGAC located inside the treatment system container. Discharge stack to extend approximately 10 ft above the building roof top.

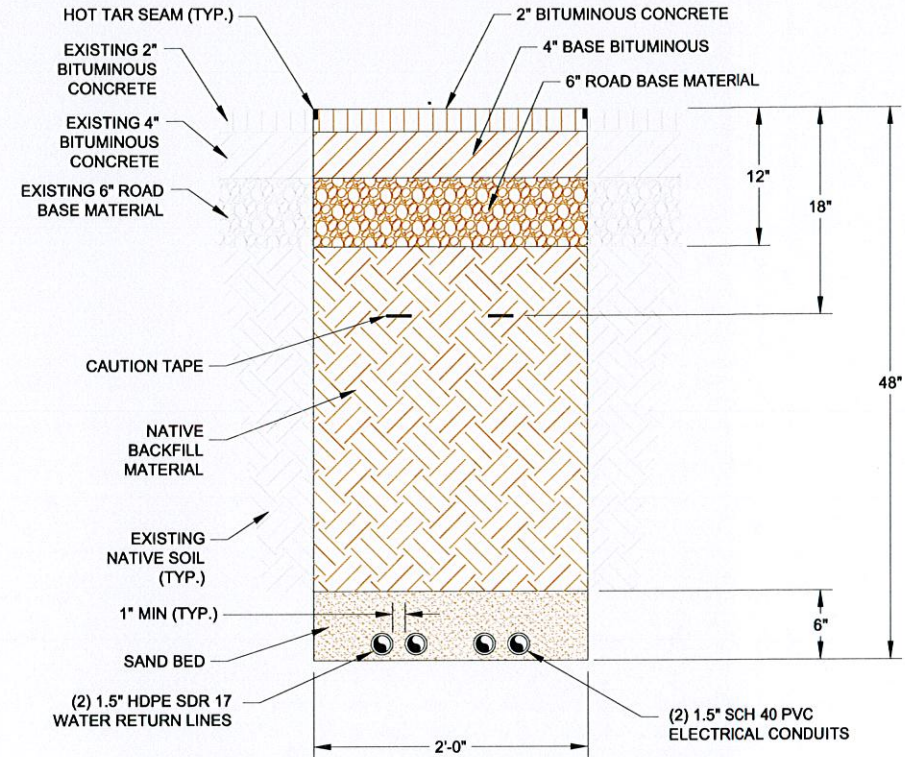


Former Gorham Manufacturing Facility PROVIDENCE, RHODE ISLAND 60271240.1.1		TREATMENT SYSTEM LAYOUT	
DATE: 09/14/12	DRWN: J.E.B.	FIGURE 1	



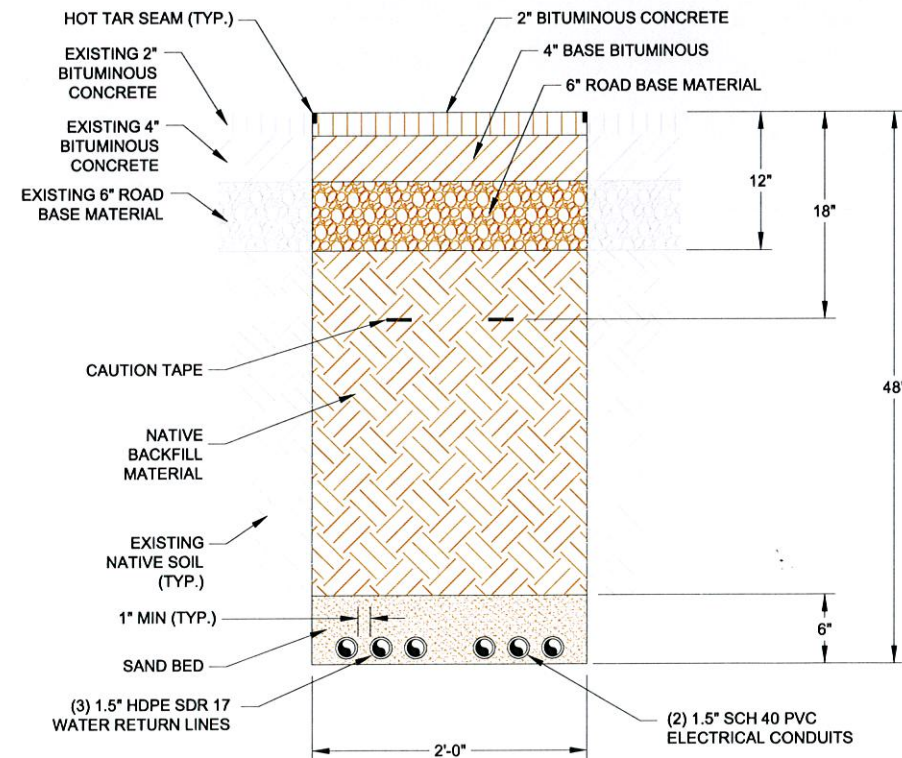
TRENCH CROSS SECTION A-A'

N.T.S.



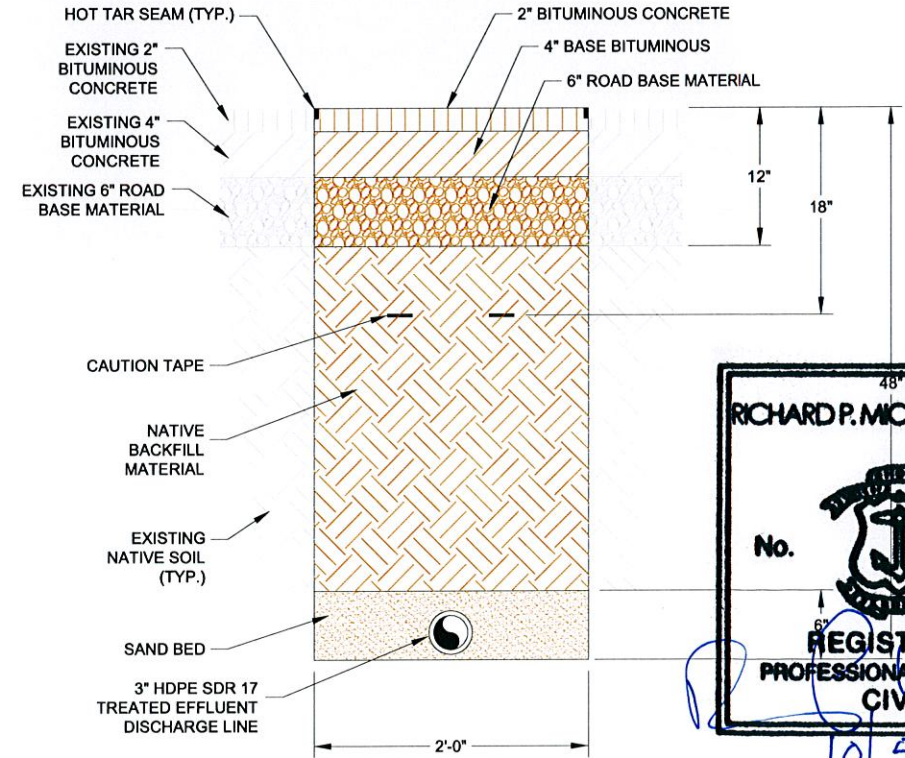
TRENCH CROSS SECTION B-B'

N.T.S.



TRENCH CROSS SECTION C-C'

N.T.S.



TRENCH CROSS SECTION D-D'

N.T.S.



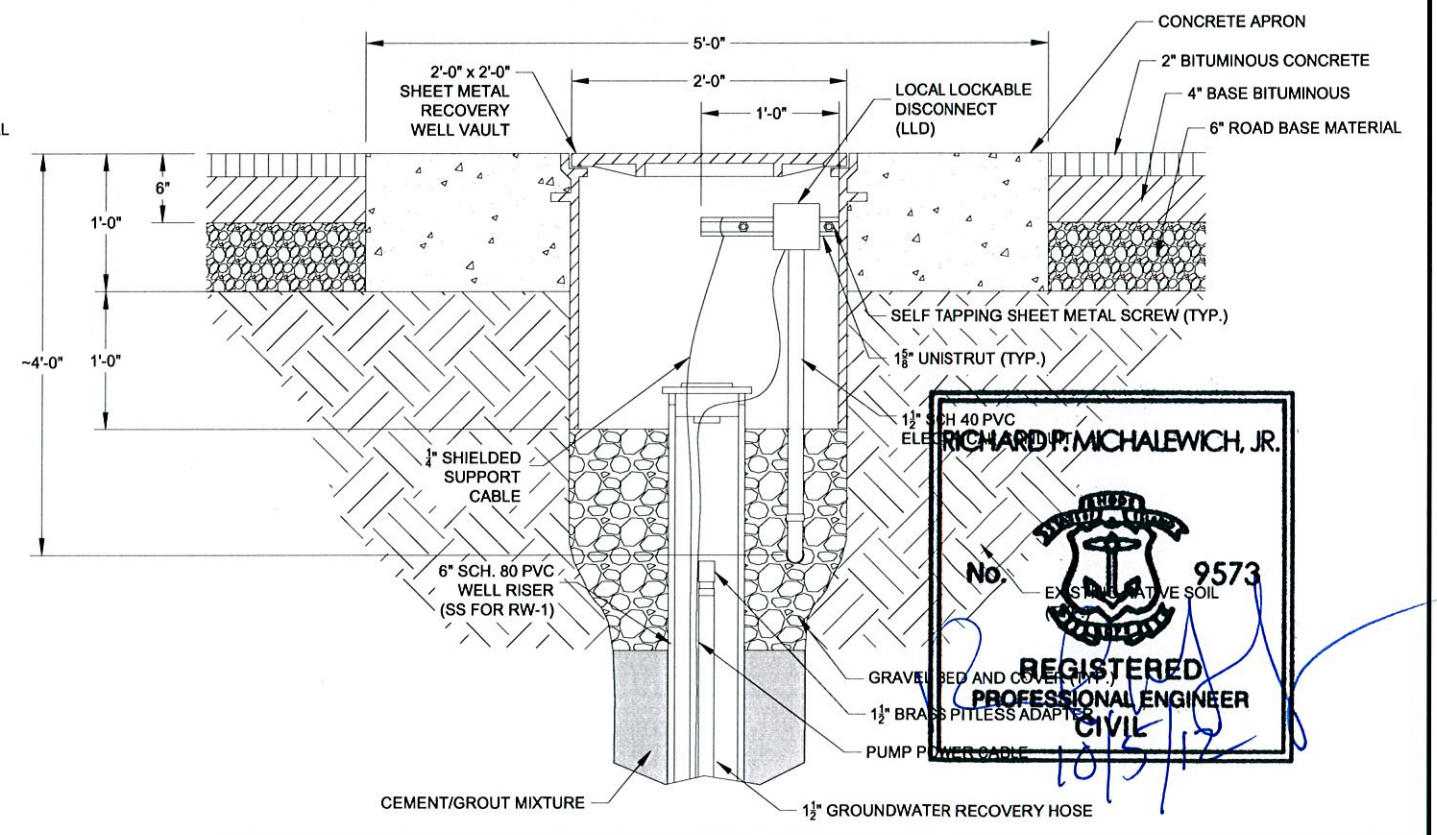
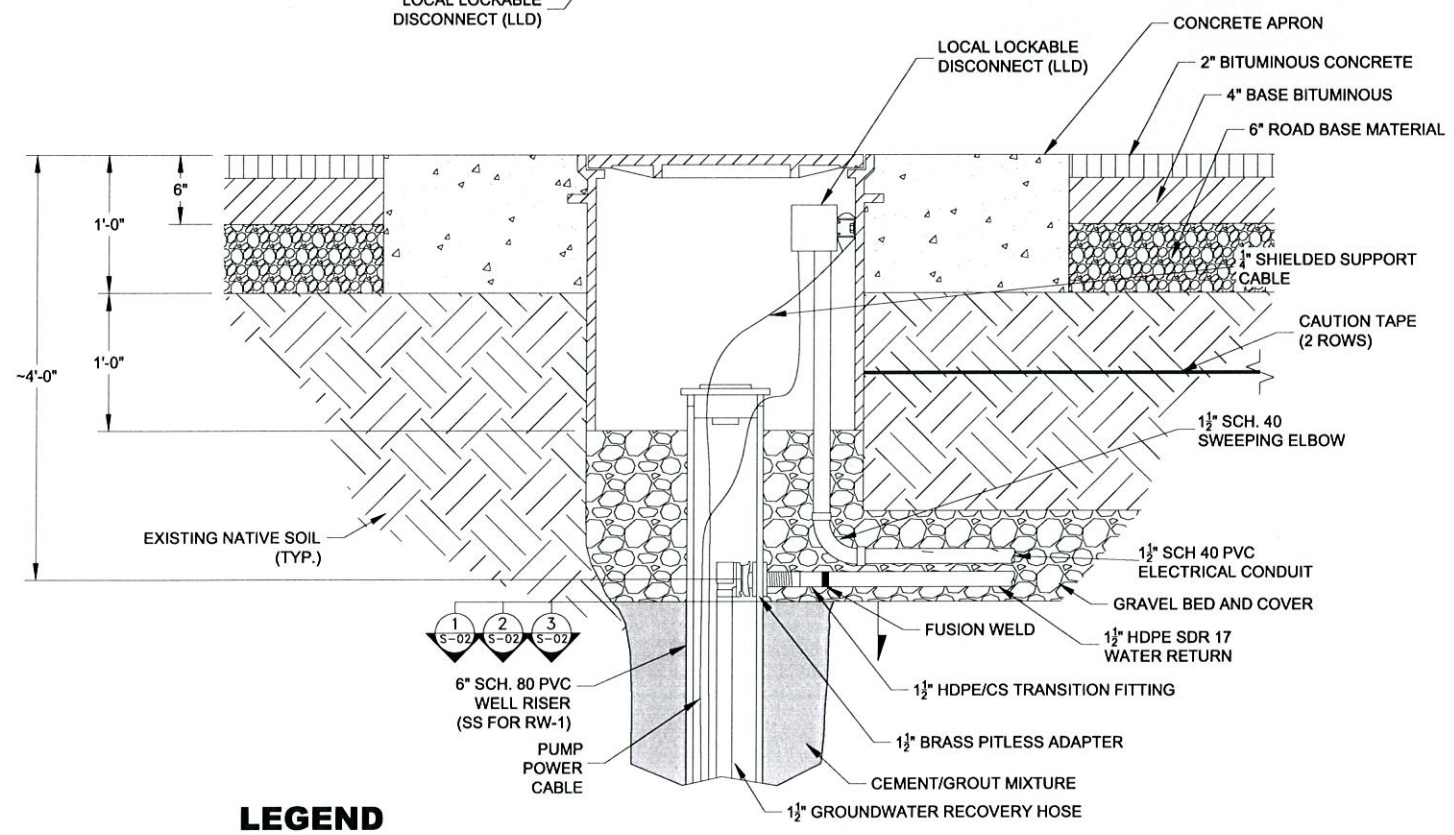
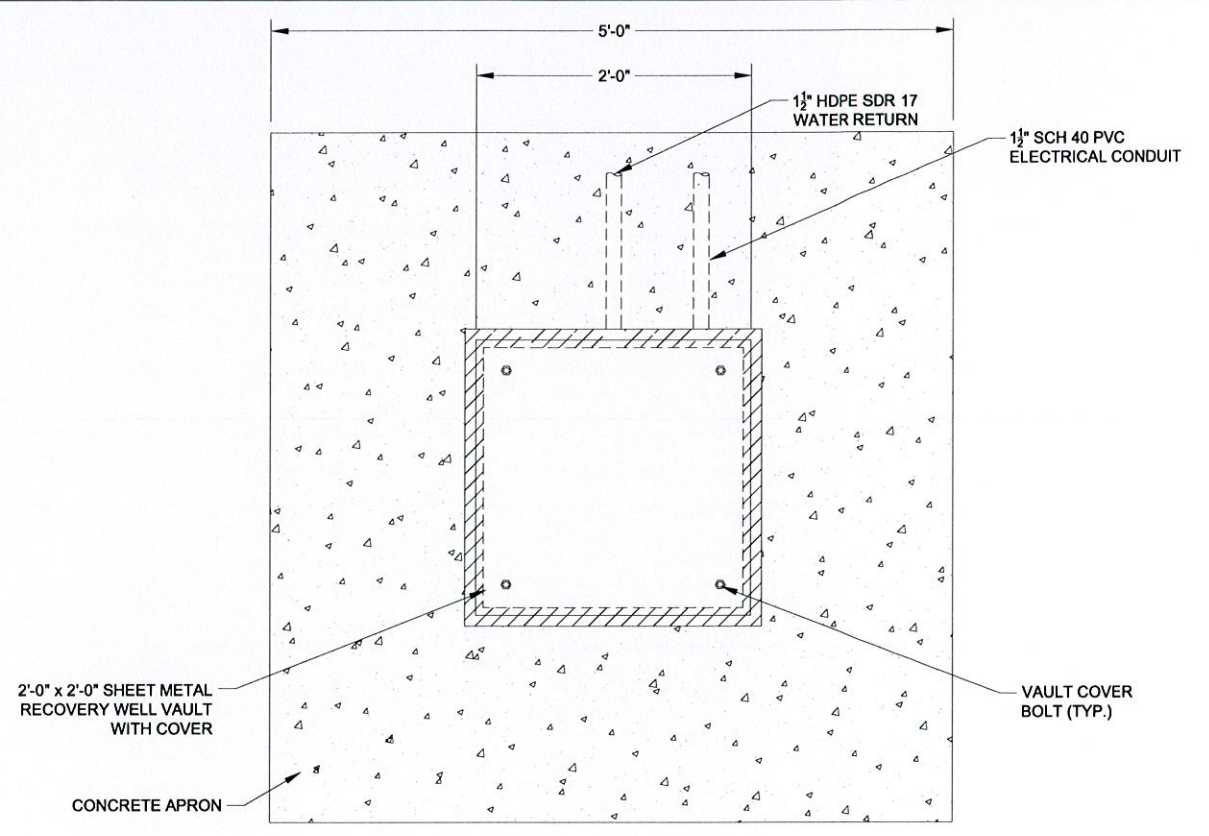
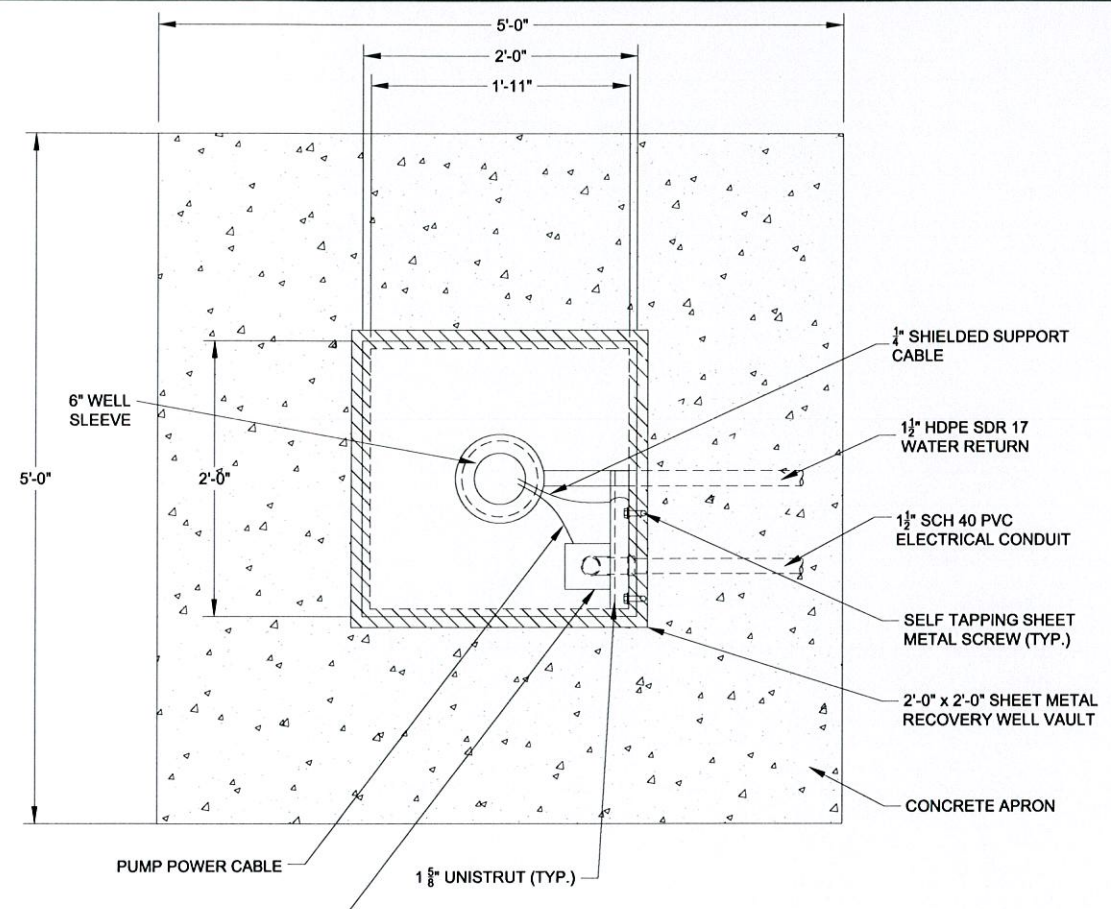
LEGEND

- HDPE HIGH DENSITY POLYETHYLENE
- SCH SCHEDULE
- SDR STANDARD DIMENSION RATIO
- TYP TYPICAL



TEXTRON INC PROVIDENCE, RI 60271240		FIGURE 2 TRENCH CROSS SECTION DETAILS	
DATE: 9/12/12	DRWN: R.W.M.		

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RICHARD P. MICHALEWICH, JR.
 No. 9573
 REGISTERED PROFESSIONAL ENGINEER
 CIVIL

LEGEND

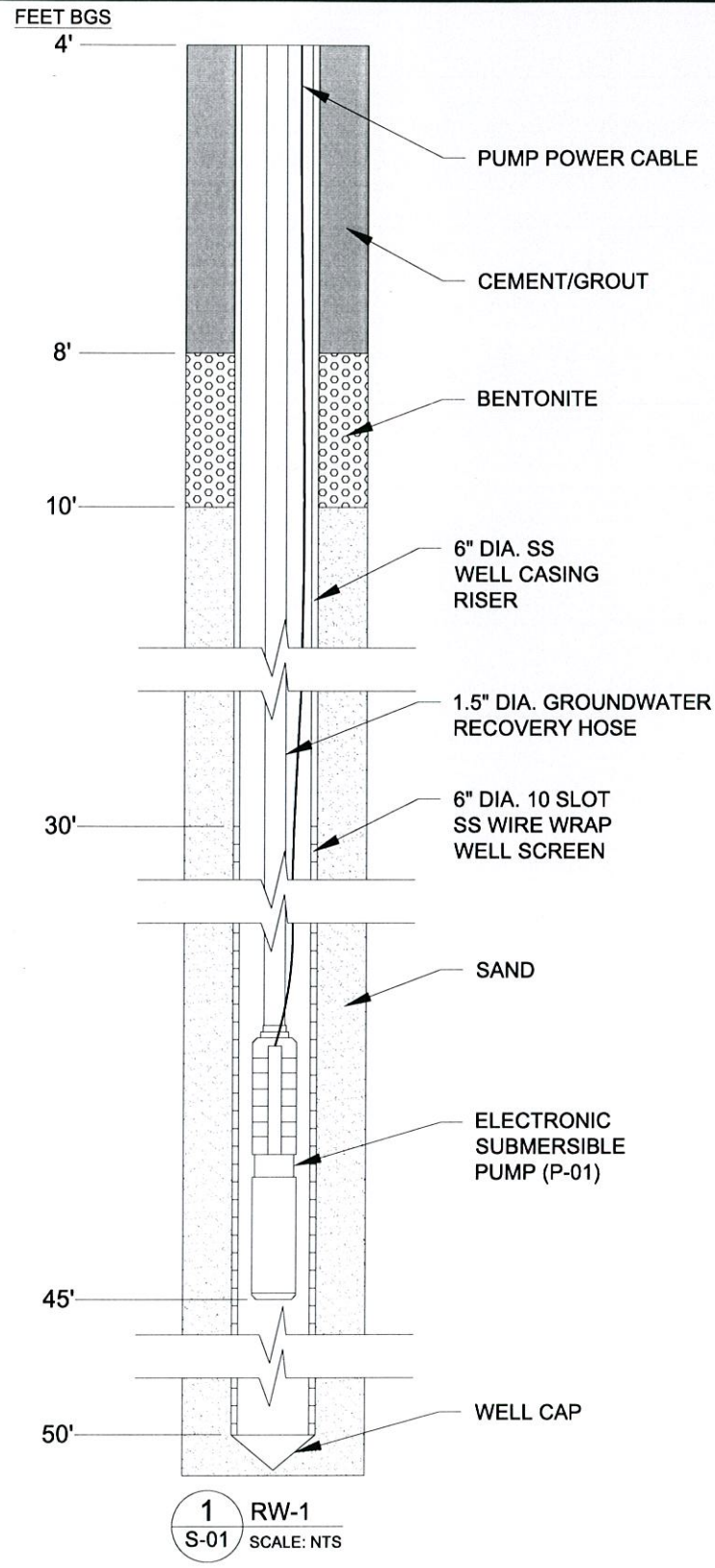
AWG	AMERICAN WIRE GAUGE	SCH	SCHEDULE
BGS	BELOW GROUND SURFACE	SDR	STANDARD DIMENSION RATIO
PVC	POLYVINYL CHLORIDE	SS	STAINLESS STEEL
HDPE	HIGH DENSITY POLYETHYLENE	TBD	TO BE DETERMINED
NTS	NOT TO SCALE	TYP	TYPICAL

TYPICAL BELOW GRADE RECOVERY WELLHEAD DETAILS

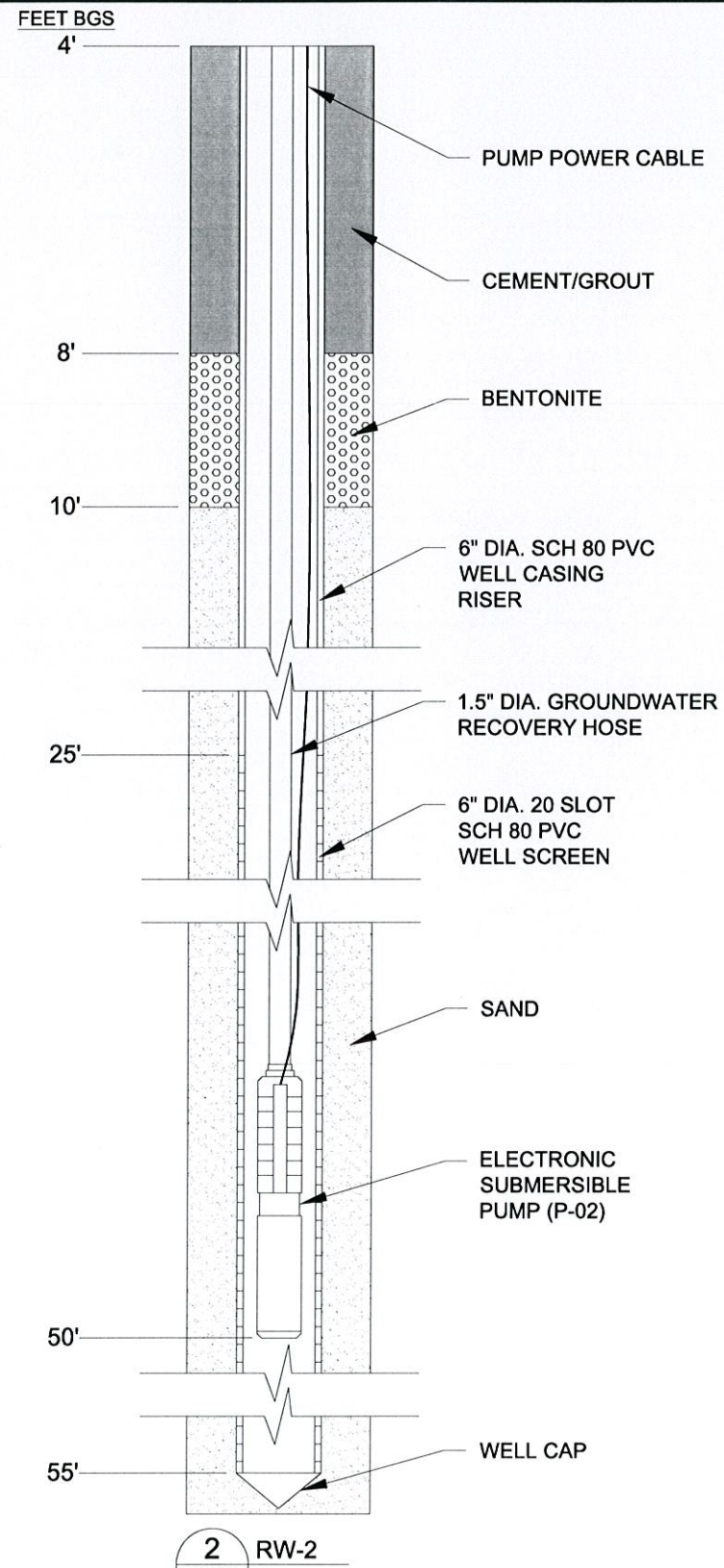
NTS



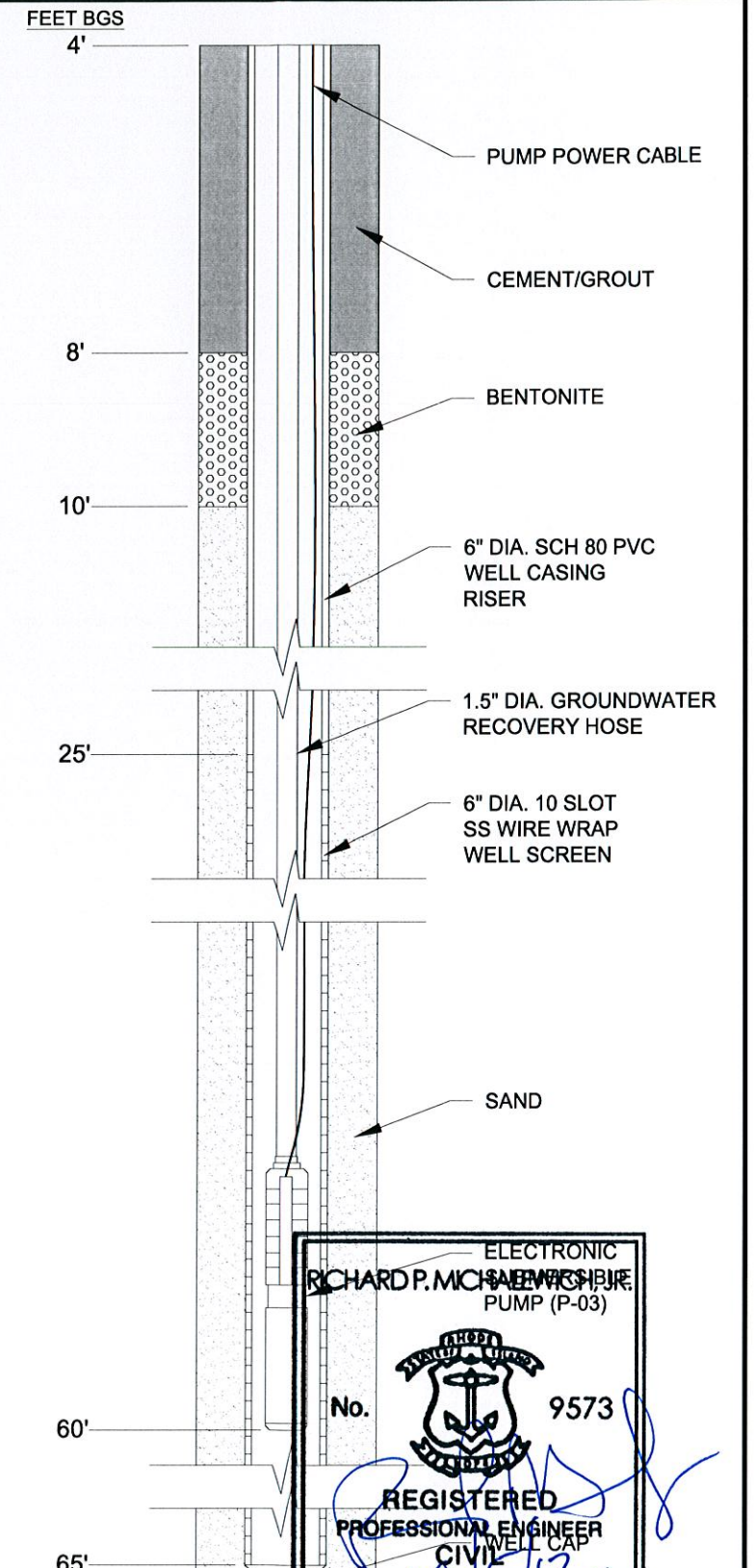
TEXTRON INC PROVIDENCE, RI 60271240		FIGURE 3 RECOVERY WELLHEAD DETAILS SHEET 1 OF 2 (S-01)
DATE: 9/12/12	DRWN: R.W.M.	



1 RW-1
S-01 SCALE: NTS



2 RW-2
S-01 SCALE: NTS



3 RW-3
S-01 SCALE: NTS

ELECTRONIC
PUMP (P-03)
RICHARD P. MICHAELIS
No. 9573
REGISTERED
PROFESSIONAL ENGINEER
CIVIL
10/5/12

LEGEND

AWG	AMERICAN WIRE GAUGE	SCH	SCHEDULE
BGS	BELOW GROUND SURFACE	SDR	STANDARD DIMENSION RATIO
PVC	POLYVINYL CHLORIDE	SS	STAINLESS STEEL
HDPE	HIGH DENSITY POLYETHYLENE	TBD	TO BE DETERMINED
NTS	NOT TO SCALE	TYP	TYPICAL

**TYPICAL BELOW GRADE
RECOVERY WELLHEAD DETAILS
(CONT.)
NTS**



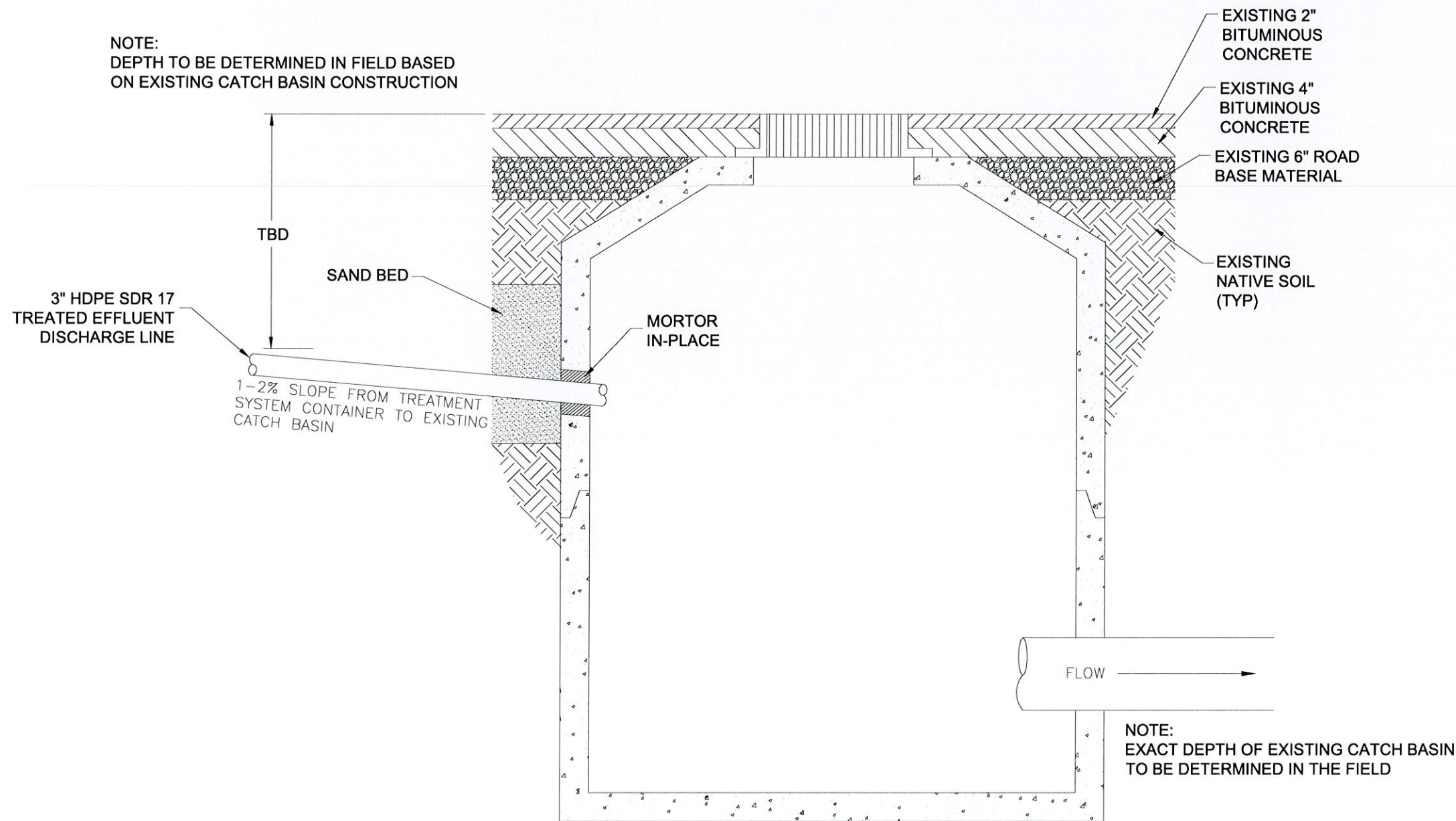
TEXTRON INC
PROVIDENCE, RI
60271240
DATE: 9/12/12 DRWN: R.W.M.

**FIGURE 3
RECOVERY WELLHEAD DETAILS
SHEET 2 OF 2 (S-02)**

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NOTE:
DEPTH TO BE DETERMINED IN FIELD BASED
ON EXISTING CATCH BASIN CONSTRUCTION

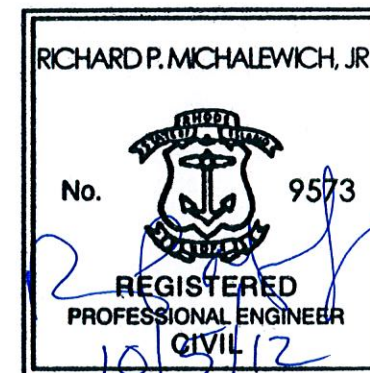


CATCH BASIN TIE-IN DETAIL

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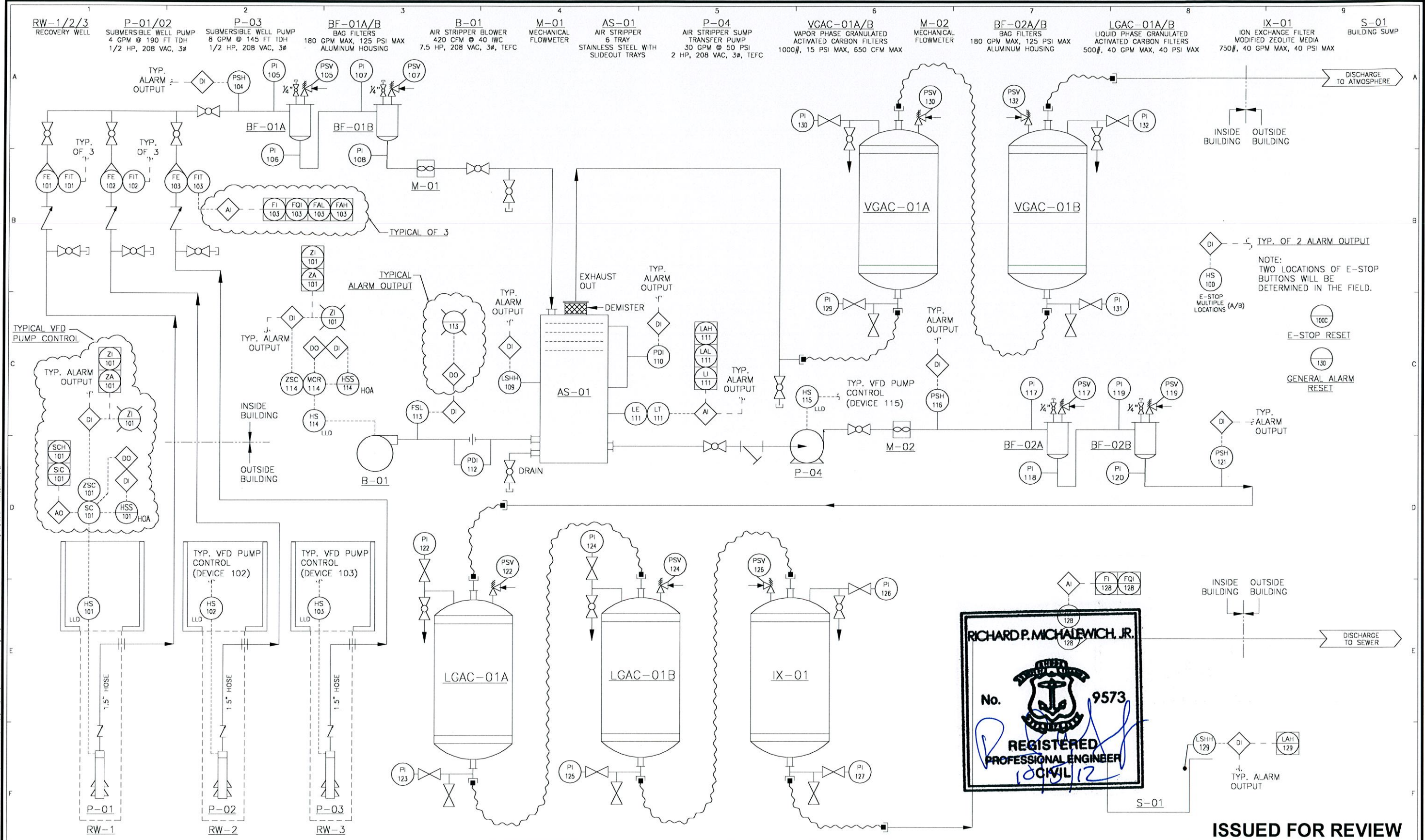
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HDPE	HIGH DENSITY POLYETHYLENE
SDR	STANDARD DIMENSION RATIO
TYP	TYPICAL
TBD	TO BE DETERMINED

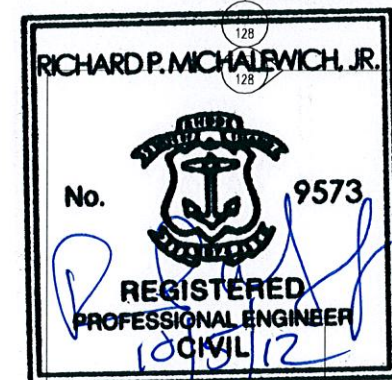


TEXTON INC PROVIDENCE, RI 60271240		FIGURE 4 EXISTING CATCH BASIN TIE-IN DETAIL
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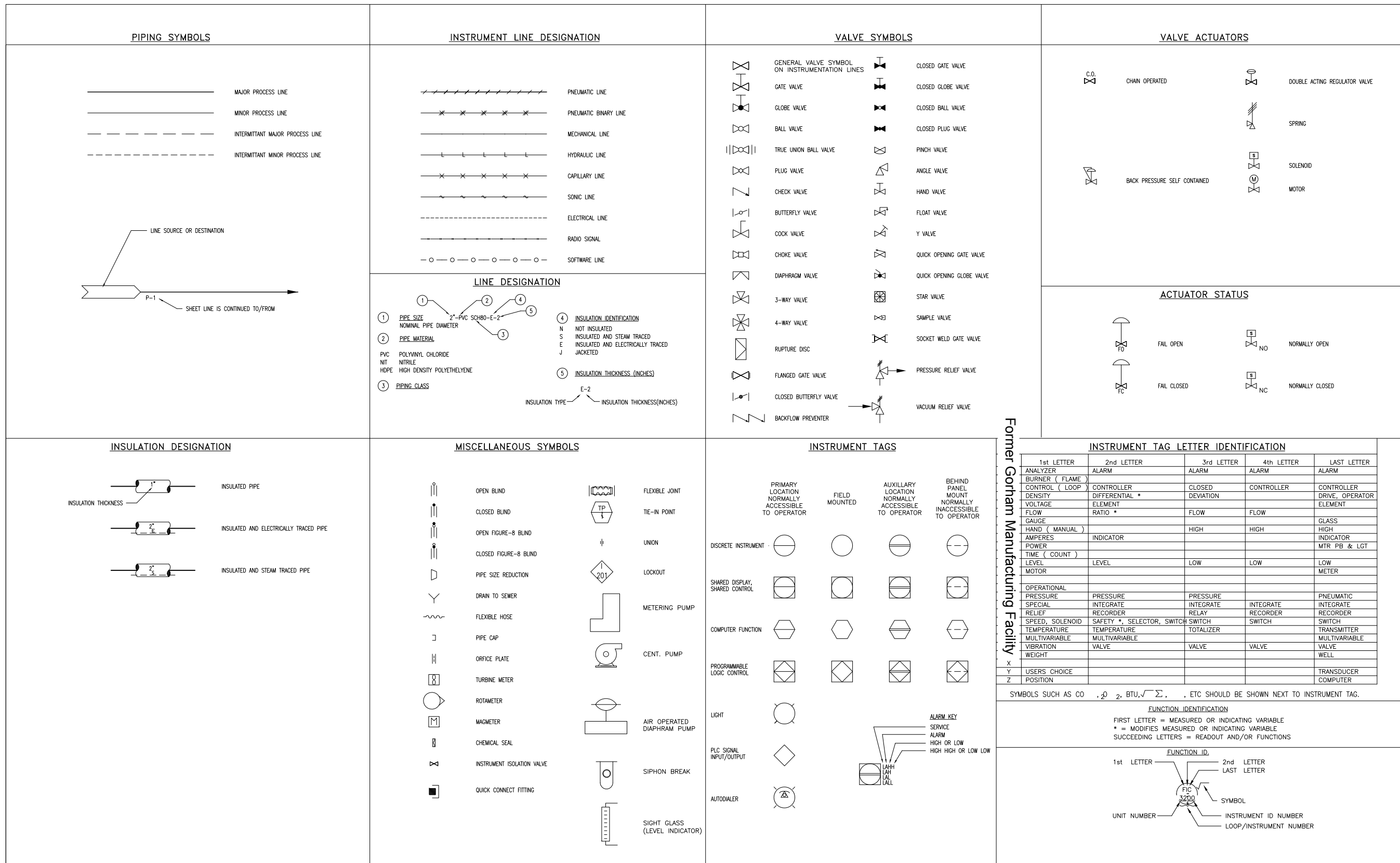
TYP. OF 2 ALARM OUTPUT
 NOTE:
 TWO LOCATIONS OF E-STOP
 BUTTONS WILL BE
 DETERMINED IN THE FIELD.
 E-STOP
 MULTIPLE
 LOCATIONS (A/B)
 100C
 E-STOP RESET
 130
 GENERAL ALARM
 RESET
 TYP. ALARM OUTPUT



ISSUED FOR REVIEW

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Former Gorham Manufacturing Facility
PROVIDENCE, RI

PIPING AND INSTRUMENTATION DIAGRAM
SHEET 2 OF 2

AECOM
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PROJ. NUMBER: 60271240 DATE: 9/12/12

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REVISION:	0

October 2012
Project No. 60271240

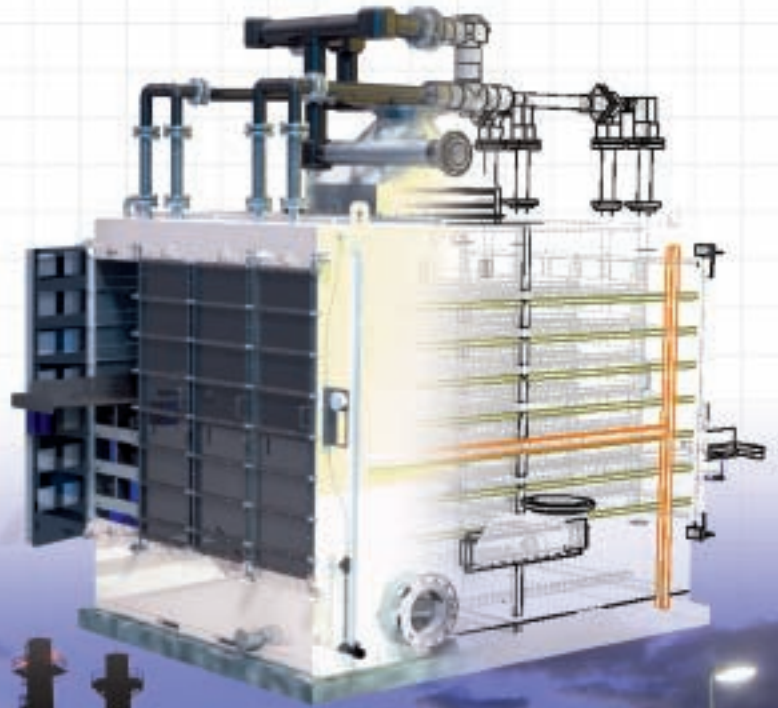
EQUIPMENT SPECIFICATIONS AND CALCULATIONS



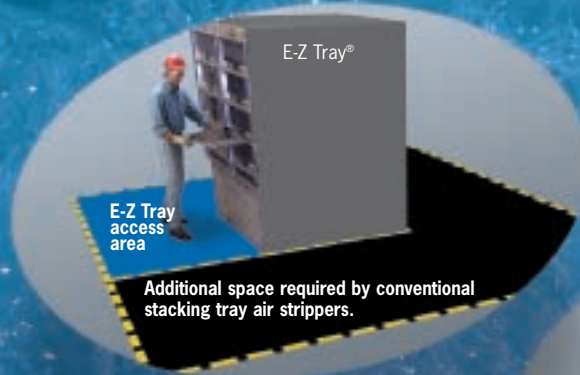
Environmental Systems

A **TestAmerica** Company
THE LEADER IN ENVIRONMENTAL TESTING

Sliding Tray, High-Efficiency Air Strippers for VOC Removal



Flow Rates from 1 to 1,000 gpm and Options to Fit Every Treatment Project



Conventional air strippers need more than twice the access and tray removal space than E-Z Tray® air strippers.



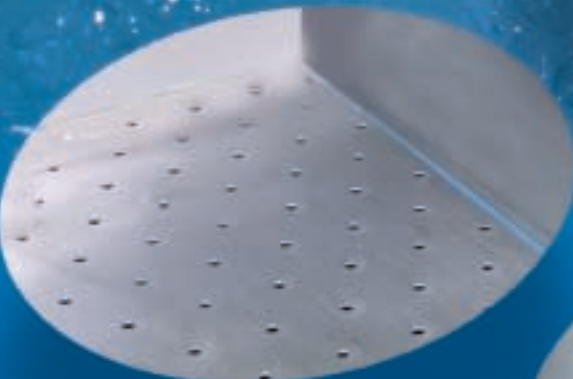
Flow rates available from 1 to 1,000 gpm.



Hinged door option allows for easy access without door removal.



Front access hatches seal tight and are removed quickly with hand-knobs.



Air flows up through perforated trays creating a turbulent froth zone with a high air-to-liquid surface area for mass transfer of volatile organic compounds (VOCs)



Front access slide-out trays allow unit maintenance by one person.



Split-tray option reduces maximum tray weight to only 28 lbs., even on the 1,000 gpm unit!

E-Z Tray®

Easier tray cleaning and superior technical support make E-Z Tray® air strippers a smart choice!

The E-Z Tray® Air Stripper (U.S. Patent Number 5,518,668) is a sliding tray, stainless steel air stripper used to remove volatile organic compounds (VOC) from contaminated groundwater and waste streams. The exclusive design of the E-Z Tray stripper results in very high removal efficiencies in an easier to maintain process unit.

Any air stripping process subject to fouling conditions has to contend with periodic cleaning in order to retain treatment efficiencies and capacity. Tower air strippers can become maintenance headaches when the tower packing becomes clogged and cemented together with bio-fouling or precipitants. When the perforated trays in stacking tray air strippers become fouled they require major disassembly, cranes or hoists, and lots of room.

Unlike these traditional types of air strippers, QED's E-Z Tray air strippers use removable, lightweight, front slide-out trays. This unique feature provides many advantages, including one person cleaning and less building space.

E-Z Tray air strippers are available in configurations with 4 or 6 trays, with maximum flow rates from 1-25 gpm (4-100 Lpm) all the way up to 1,000 gpm (3,784 Lpm).

NEW – High Capacity Process Air Strippers

These air strippers are engineered to serve in larger, process-type projects involving multiple treatment stages, where they are an effective component of large-scale water or wastewater processes in



E-Z Tray Advantages

E-Z Tray

- Single person cleaning
- Easy process monitoring and inspection, even while in operation
- Reduced footprint for installation and maintenance
- High removal efficiencies easier to maintain
- Easily modeled online by customer to help process evaluation

Tower Air Strippers

- Condition of packing and liquid and air flow distribution are very difficult to observe
- Small footprint but very tall structure required
- More difficult to keep at design performance
- More complex process assistance required

Stacking Tray Air Strippers

- Major disassembly steps and crew needed
- Difficult to impossible to observe air and liquid flow distribution during operation
- Lots of space needed for disassembly, to access all sides and to lift and store tray stages
- More difficult to keep at design performance
- Online modeler not offered

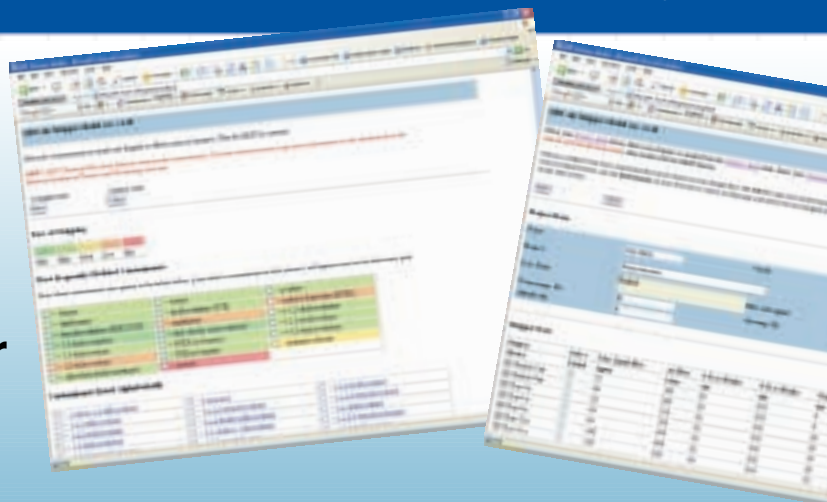
manufacturing, refining, chemical processing and other industries. They can act as a pre-treatment stage for other process elements, such as large aerobic biotreatment units, removing VOCs at much lower airflow rates to reduce the costs of off-gas treatment.

All of this combined with the easier maintenance and smaller footprint of QED's sliding tray air strippers, has led E-Z Tray to become the preferred choice for major remediation and process stream projects in the U.S. and abroad.

The QED VOC Removal Advantage

Proven equipment, expert help with its selection and installation, and support you can count on

Exclusive Online Performance Modeler has been developed to assist you in selecting the most effective air stripping package for your groundwater cleanup project



**E-Z Tray®
Model 6.4**



**E-Z Tray®
Model 16.4**



**E-Z Tray®
Model 24.4**

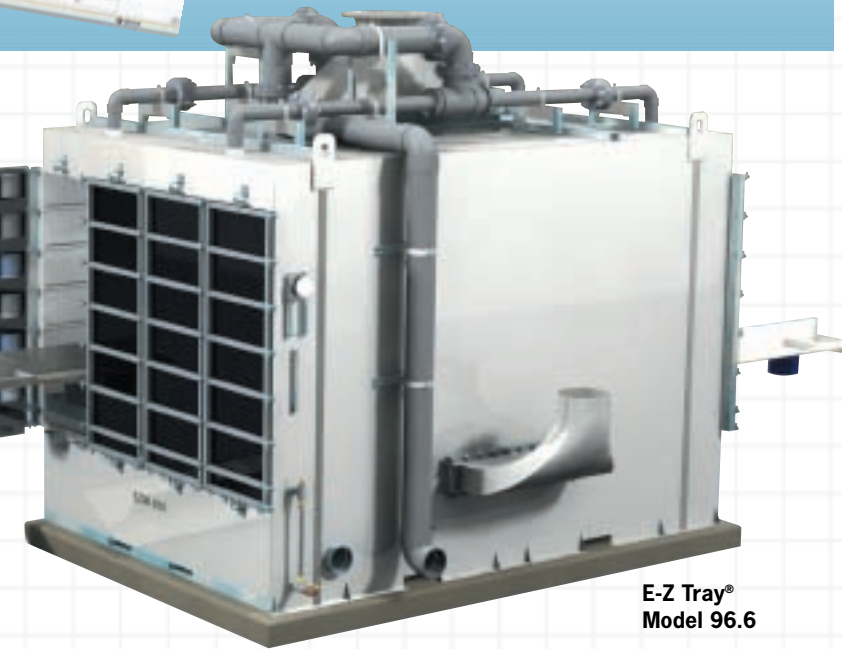
Air Stripper Specifications

Model No.	Maximum Flow Range	Dry Weight	Operating Weight	Shell Dimension (LxWxH)	Trays Per Tier
4.4	1-50 gpm (4-189 Lpm)	630 lbs. (286 kg)	985 lbs. (447 kg)	29 x 27 x 82 in. (74 x 69 x 208 cm)	4 x 29 lbs. (4 x 13 kg)
4.6	1-50 gpm (4-189 Lpm)	780 lbs. (354 kg)	1,219 lbs. (553 kg)	29 x 27 x 102 in. (74 x 69 x 259 cm)	6 x 29 lbs. (6 x 13 kg)
6.4	1-65 gpm (4-246 Lpm)	790 lbs. (358 kg)	1,285 lbs. (583 kg)	37 x 27 x 82 in. (94 x 69 x 208 cm)	4 x 40 lbs. (4 x 18 kg)
6.6	1-65 gpm (4-246 Lpm)	978 lbs. (443 kg)	1,591 lbs. (722 kg)	37 x 27 x 102 in. (94 x 69 x 259 cm)	6 x 40 lbs. (6 x 18 kg)
8.4	1-75 gpm (4-284 Lpm)	955 lbs. (433 kg)	1,580 lbs. (717 kg)	49 x 27 x 82 in. (124 x 69 x 208 cm)	4 x 50 lbs. (4 x 23 kg)
8.6	1-75 gpm (4-284 Lpm)	1,182 lbs. (536 kg)	1,956 lbs. (887 kg)	49 x 27 x 102 in. (124 x 69 x 259 cm)	6 x 50 lbs. (6 x 23 kg)
12.4	1-120 gpm (4-454 Lpm)	1,165 lbs. (528 kg)	2,105 lbs. (955 kg)	73 x 27 x 82 in. (185 x 69 x 208 cm)	4 x 60 lbs. (4 x 447 kg)
12.6	1-120 gpm (4-454 Lpm)	1,442 lbs. (654 kg)	2,606 lbs. (1,182 kg)	73 x 27 x 102 in. (185 x 69 x 259 cm)	6 x 60 lbs. (6 x 447 kg)
16.4	1-150 gpm (4-566 Lpm)	1,625 lbs. (737 kg)	2,870 lbs. (1,302 kg)	49 x 52 x 84 in. (124 x 132 x 213 cm)	8 x 50 lbs. (8 x 23 kg)
16.6	1-150 gpm (4-566 Lpm)	2,011 lbs. (912 kg)	3,553 lbs. (1,612 kg)	49 x 52 x 104 in. (124 x 132 x 264 cm)	12 x 50 lbs. (12 x 23 kg)
24.4	1-250 gpm (4-946 Lpm)	2,100 lbs. (953 kg)	3,980 lbs. (1,805 kg)	73 x 52 x 84 in. (185 x 132 x 213 cm)	8 x 60 lbs. (8 x 27 kg)
24.6	1-250 gpm (4-946 Lpm)	2,599 lbs. (1,179 kg)	4,926 lbs. (2,234 kg)	73 x 52 x 104 in. (185 x 132 x 264 cm)	12 x 60 lbs. (12 x 27 kg)
48.4	1-500 gpm (1,893 Lpm)	5,000 lbs. (2,268 kg)	12,500 lbs. (5,670 kg)	98 x 71 x 84 in. (249 x 180 x 213 cm)	16 x 60 lbs. (16 x 27 kg)
48.6	1-500 gpm (1,893 Lpm)	5,500 lbs. (2,495 kg)	13,000 lbs. (5,897 kg)	98 x 71 x 104 in. (249 x 180 x 264 cm)	24 x 60 lbs. (24 x 27 kg)
96.4	1-1,000 gpm (3,785 Lpm)	11,000 lbs. (4,990 kg)	25,000 lbs. (11,340 kg)	142 x 98 x 84 in. (361 x 249 x 213 cm)	32 x 60 lbs. (32 x 27 kg)
96.6	1-1,000 gpm (3,785 Lpm)	11,500 lbs. (5,216 kg)	30,000 lbs. (13,608 kg)	142 x 98 x 104 in. (361 x 249 x 264 cm)	48 x 60 lbs. (48 x 27 kg)

Standard construction is 304 SS, other alloys upon request. *Allow additional space for accessory components. (blower, piping, etc.)

count on when you need it

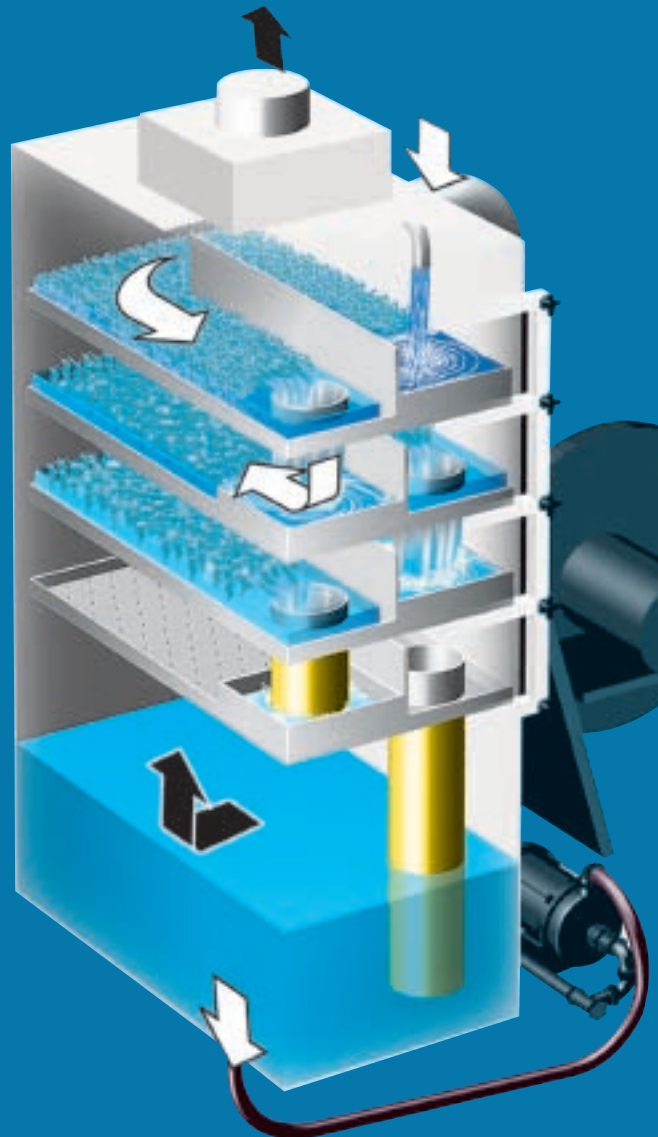
Try it for yourself today! Use our exclusive online stripper modeler at www.qedenv.com/model/model.html to spec the exact size and configuration for your project. Then talk to a QED applications specialist toll-free at **(800) 624-2026** for fast, free system design assistance and a price quote.



**E-Z Tray®
Model 96.6**

How it Works

As contaminated groundwater enters through the top of the air stripper, millions of air bubbles are forced by blower pressure up through the perforated trays. This creates a turbulent froth zone with an extremely high air-to-liquid surface area for mass transfer of volatile organic compounds (VOCs) from liquid to air. Using the froth instead of a conventional tower packing delivers high VOC removal efficiencies even under fouling conditions, and is easier to inspect and maintain.



Active Area	Nominal Air Flow	Additional Space for Tray Removal*
2.8 ft. ² (0.26 m ²)	210 cfm (5.95 m ³ /min)	27 in. (69 cm)
2.8 ft. ² (0.26 m ²)	210 cfm (5.95 m ³ /min)	27 in. (69 cm)
3.8 ft. ² (0.35 m ²)	320 cfm (9.06 m ³ /min)	35 in. (89 cm)
3.8 ft. ² (0.35 m ²)	320 cfm (9.06 m ³ /min)	35 in. (89 cm)
5.6 ft. ² (0.52 m ²)	420 cfm (11.89 m ³ /min)	47 in. (119 cm)
5.6 ft. ² (0.52 m ²)	420 cfm (11.89 m ³ /min)	47 in. (119 cm)
8.8 ft. ² (0.82 m ²)	600 cfm (16.99 m ³ /min)	71 in. (180 cm)
8.8 ft. ² (0.82 m ²)	600 cfm (16.99 m ³ /min)	71 in. (180 cm)
11.1 ft. ² (1.03 m ²)	850 cfm (24.07 m ³ /min)	47 in. (119 cm)
11.1 ft. ² (1.03 m ²)	850 cfm (24.07 m ³ /min)	47 in. (119 cm)
17.5 ft. ² (1.63 m ²)	1,300 cfm (36.81 m ³ /min)	72 in. (183 cm)
17.5 ft. ² (1.63 m ²)	1,300 cfm (36.81 m ³ /min)	72 in. (183 cm)
27 ft. ² (2.51 m ²)	2,600 cfm (73.62 m ³ /min)	72 in. (183 cm)
27 ft. ² (2.51 m ²)	2,600 cfm (73.62 m ³ /min)	72 in. (183 cm)
54 ft. ² (5.02 m ²)	5,200 cfm (147.25 m ³ /min)	2 x 72 in. (2 x 183 cm)*
54 ft. ² (5.02 m ²)	5,200 cfm (147.25 m ³ /min)	2 x 72 in. (2 x 183 cm)*

QED Quality Control, Manufacturing Standards and Customer Service

Experienced site owners, including major oil companies, are increasingly choosing E-Z Tray[®] air strippers from QED due to their unique features and solid technical support, including:

- **Lower long-term O&M costs due to easier tray maintenance than tower-type or stacking tray air strippers.**
- **Lightweight, slide-out trays don't require hoists, regardless of the size of the air stripper.**
- **E-Z Tray air strippers need less building space, which can lower building costs.**
- **QED's staff and resources are #1 in air stripper technical and service support, including for unusual applications.**
- **Online Performance Modeler tool available 24/7 to help you select the proper air stripper.**
- **QED quote & delivery times are quick and dependable.**



Visit qedenv.com/air-strippers to view and use the exclusive Online Performance Modeler, which allows you to model your process conditions and select the most efficient air stripping package for your VOC removal project. You can also view case studies where E-Z Tray air strippers were the top choice in successful projects.

The World Leader in Air-Powered Remediation

For Remediation, Landfills and Groundwater Sampling



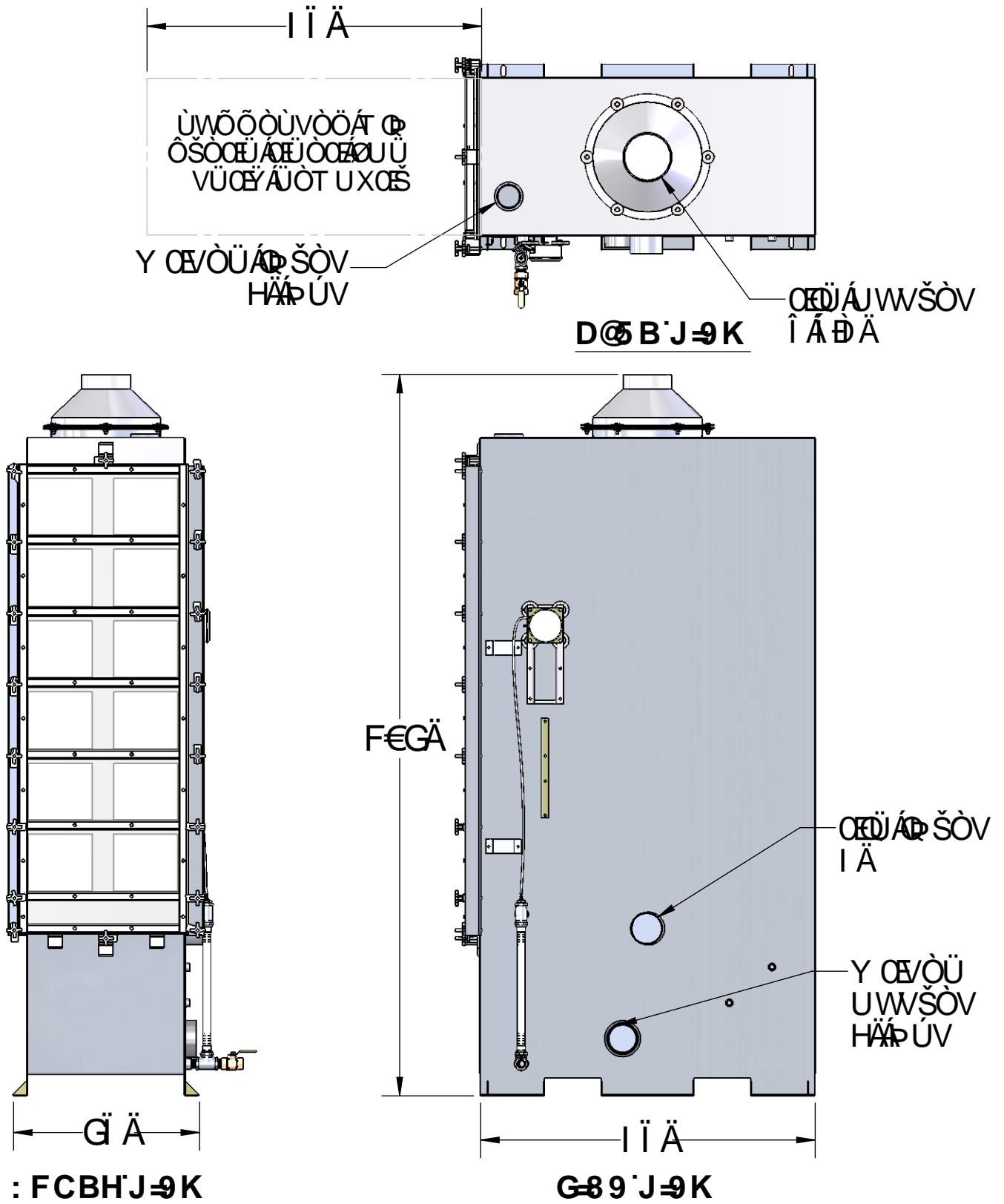
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ØZÈ È ÙÀΟΕΥΑΎΝΨΘΎΟΥÜÁΎΨÝD

ØΥÄ Å ÜÖÁÛÓÓØΨΘΎΎΠÜÓΣØSÁΎK

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ΠΥVÁUÁÛÓΣØ

ΠΥVÁUÁÛÓΠΥÜNÓNΨΠÉØÜÜÁÛÓØØÜÒΠÓØÁΎΨÝ

QED Air Stripper Model ver. 2.0	10/23/2012
--	-------------------

Site Data

Name: David Macone	e-mail: David.Macone@AECOM.com
Project: Former Gorham Silver Facility	
Units: English	Altitude: 75 ft
Air Temp: 55 F	Flow: 30 gpm
Water Temp: 55 F	
Stripper: EZ-Tray 8.x - Click for details	Stripper Air Flow: 420 cfm
Stripper Max Flow: 75 gpm	

Water Results

Contaminant	Influent (ppb)	Target (ppb)	4-Tray Results (ppb)	4-Tray % Removal	6-Tray Results (ppb)	6-Tray % Removal
trichloroethylene (TCE)	329615	0	70.2	99.979	1.0	100.000
tetrachloroethylene (PERC,PCE)	298155	0	9.2	99.997	< 1	100.000
c-1,2-dichloroethylene	18535	0	12.1	99.935	< 1	100.000
1,1-dichloroethylene	11030	0	< 1	100.000	< 1	100.000
vinyl chloride (chloroethylene)	3260	0	< 1	100.000	< 1	100.000
1,1,1-trichloroethane	633700	0	65.8	99.990	< 1	100.000
1,1-dichloroethane	23220	0	25.6	99.890	< 1	100.000

Air Results

Contaminant	4-Tray (ppmV)	4-Tray (lb/hr)	6-Tray (ppmV)	6-Tray (lb/hr)
trichloroethylene (TCE)	561.8934	4.95032	562.0113	4.95136
tetrachloroethylene (PERC,PCE)	402.7667	4.47865	402.7790	4.47879
c-1,2-dichloroethylene	42.8043	0.27825	42.8314	0.27842
1,1-dichloroethylene	25.4881	0.16568	25.4890	0.16569
vinyl chloride (chloroethylene)	11.6850	0.04897	11.6854	0.04897
1,1,1-trichloroethane	1064.0971	9.51825	1064.2063	9.51923
1,1-dichloroethane	52.5074	0.34842	52.5635	0.34879

Warnings

Warning: trichloroethylene (TCE) concentration is > 25% of solubility -- see disclaimer. Typical water solubility is 1100000 ppb.

Warning: tetrachloroethylene (PERC,PCE) concentration is > 25% of solubility -- see disclaimer. Typical water solubility is 150000 ppb.

Warning: 1,1,1-trichloroethane concentration is > 25% of solubility -- see disclaimer. Typical water solubility is 1500000 ppb.

Notes

Copyright -- QED Treatment Equipment, PO Box 3726, Ann Arbor, MI 48106.

PH-> 1-800-624-2026 or 1-734-995-2547, FX-> 1-734-995-1170. E-mail-> info@qedenv.com. WEB-> www.qedenv.com.

The QED modeler estimates unit performance for the listed contaminants. **Results assume** -

1. Contaminants are in the dissolved-phase, within a water matrix
2. Stripper Influent air is contaminant-free
3. Influent liquid does not have surfactants, oil, grease, other immiscible phase(s) or other Henry's constant altering additions present, such as dissolved phase polar organic contaminants
4. The air stripper is operated within the given parameters listed above and as instructed in the E-Z Tray O&M manual

Stripper performance shall meet or exceed either the required effluent concentration(s) or effluent estimates, whichever is greater, for the conditions supplied and assumes the influent concentrations of each contaminant are less than 25% solubility in water. QED makes no claim of the model's accuracy beyond the 25% solubility in water limit.

Contact Us

Fill out your contact and project information and click Send to have a QED Treatment application specialist contact you.

Name -	<input type="text" value="David Macone"/>		
Company -	<input type="text" value="Company"/>		
Phone -	<input type="text" value="Phone"/>	Fax -	<input type="text" value="Fax"/>
e-mail -	<input type="text" value="David.Macone@AECOM.com"/>	Project -	<input type="text" value="Former Gorham Silver Facility"/>

Application Notes

Save Data

Use the following URL to reconstruct your data form for future remodeling with changes. This URL can be saved in any text file for record keeping and later retrieval. This run's URL:

```
http://64.9.214.199/cgi-bin/remodel.pl?
u=e&tw=55&ta=55&f=30&a=75&s=8.x&n=David&e=David.Macone@AECOM.com&p=Fo
rme&c=189,329615;182,298155;81,18535;16,11030;195,3260;9,633700;15,23
220;
```

Table 1 - RW-1 Expected System Influent Concentrations

Textron, Inc.
333 Adelaide Avenue
Providence, Rhode Island

Compound	RW-1 AREA														Avg
	MW-234S			MW-230S	MW-234I			MW-234D			MW-230D	RW1		MW-JS	
	11/30/09	06/03/11	06/10/11	12/02/09	11/30/09	06/03/11	06/10/11	12/02/09	06/03/11	06/10/11	12/01/09	07/27/11	07/29/11	May-1989	
Total Suspended Solids	---	---	---	---	---	---	---	---	---	---	---	5000	5000	---	5000.00
1,1 - Dichloroethane	166	18.1	---	131	4.2	5.2	---	3.7	<1	---	0.9	17.2	95.2	---	62.41
1,1 - Dichloroethylene	37.1	<1.0	---	32.3	13.4	11.6	---	19.6	13.5	---	1.7	1.2	41.2	---	19.61
1,1,1 - Trichloroethane	1060	35	---	697	8.5	27.6	---	12	24	---	5.8	47.7	917	---	398.97
Vinyl Chloride	0.5	<1.0	---	0.4	0.6	<1.0	---	2.7	2.4	---	1	<1	<20	---	1.86
Trichloroethylene	489	35	---	3484	20.8	27.6	---	23.2	24	---	34.4	29.6	772	---	694
cis-1,2 - Dichloroethylene	100	<1.0	---	87.4	22.1	27.5	---	97.9	95.8	---	1.6	2.9	33.8	---	39.17
Tetrachloroethylene	2.6	3.3	---	1.3	1	<1.0	---	1	1.3	---	0.2	1.1	<20	---	2.83
Silver	---	<0.25	<5	---	---	<0.25	<5	---	<0.25	<5	---	---	---	<10	---
Arsenic	---	<1.5	<4	---	---	<1.5	<4	---	<1.5	<4	---	---	---	<10	---
Cadmium	---	<0.2	<2.5	---	---	<0.2	<2.5	---	<0.2	3	---	<3	<3	<5	---
Copper	---	1	<5	---	---	1.1	<5	---	1.4	97.8	---	<2.4	4.8	<20	3.30
Total Iron	---	---	6,360	---	---	---	30,100	---	---	89,800	---	49	24.9	<100	41.30
Nickel	---	<0.2	<5	---	---	2.6	5.1	---	31.6	169	---	<9	<5	<4	2.76
Lead	---	<0.2	<7.5	---	---	<0.2	<7.5	---	<0.2	11	---	<7.5	<0.28	5	2.16
Selenium	---	<1.0	<15	---	---	<1.0	<15	---	<1.0	<15	---	---	---	<10	---
Zinc	---	<4.5	<7.5	---	---	<4.5	<5	---	<4.5	89.6	---	26.8	16.9	<20	9.21
Trivalent Chromium	---	---	<5	---	---	---	<5	---	---	<5	---	---	---	---	---
Hexavalent Chromium	---	---	<5	---	---	---	<5	---	---	<5	---	---	---	---	---
Antimony	---	<0.8	<6	---	---	<0.8	<6	---	<0.8	19	---	<6	<6	<100	---

Note: Based on groundwater data presented in the Shaw - Status Report Actives for February and August 2011 and February and August 2012, AECOM - Preliminary Hydrogeologic Evaluation of Groundwater Pump and Treat Remediation submitted in December 2011, AECOM - RIPDES Application and RIPDES Discharge Monitoring Report (DMR) for July 1, 2011 through September 30, 2011 submitted on July 8 and October 13, 2011 respectively, and the Hunter Inc - Soil and Groundwater Contamination Site Assessment submitted on May 25, 1989 for groundwater metals data only.

Data not used in averaging or considered a maximum concentration.

* = Filtered Sample

Table 2 - RW-2 Expected System Influent Concentrations

Textron, Inc.
333 Adelaide Avenue
Providence, Rhode Island

Compound	RW-2 AREA									Avg
	DP2S 03/12/08	DP2D 03/13/08	MW-222S 03/28/08	MW-224S 03/28/08	MW-228D 04/01/08	MW-228S 04/01/08	MW-220S 7/28/2011	GZA-4 May-1989	MW-105 May-1989	
Total Suspended Solids	---	---	---	---	---	---	---	---	---	---
1,1 - Dichloroethane	<50	1710	270	577	9.7	44.3	---	---	---	439.3
1,1 - Dichloroethylene	194	748	139	447	422	103	---	---	---	342.2
1,1,1 - Trichloroethane	1030	52800	4500	17800	3.5	114	---	---	---	12707.9
Vinyl Chloride	<50	<100	<100	<100	1.9	<1	---	---	---	29.6
Trichloroethylene	23900	21600	2070	6440	912	578	---	---	---	9250.0
cis-1,2 - Dichloroethylene	408	1260	<100	244	76.4	16.5	---	---	---	342.5
Tetrachloroethylene	<500	107	<100	<100	5.4	3610	---	---	---	678.7
Silver	---	---	---	---	---	---	---	1	<1	0.75
Arsenic	---	---	---	---	---	---	---	<10	<1	---
Cadmium	---	---	---	---	---	---	---	<5	<5	---
Copper	---	---	---	---	---	---	---	60	150	105.00
Total Iron	---	---	---	---	---	---	85.2	<100	600	245.07
Nickel	---	---	---	---	---	---	---	<40	70	45.00
Lead	---	---	---	---	---	---	---	22	<5	12.25
Selenium	---	---	---	---	---	---	---	<10	<10	---
Zinc	---	---	---	---	---	---	---	70	140	105.00
Trivalent Chromium	---	---	---	---	---	---	---	---	---	---
Hexavalent Chromium	---	---	---	---	---	---	---	---	---	---
Antimony	---	---	---	---	---	---	---	<100	<100	---

Note: Based on groundwater data presented in the Shaw - Status Report Actives for February and August 2011 and February and August 2012, AECOMs - Preliminary Hydrogeologic Evaluation of Groundwater Pump and Treat Remediation submitted in December 2011, and Hunter Inc - Soil and Groundwater Contamination Site Assessment submitted on May 25, 1989 for groundwater metals data only

Table 3 - RW-3 Expected System Influent Concentrations

Textron, Inc.
333 Adelaide Avenue
Providence, Rhode Island

Compound	RW-3 AREA																			
	MW-101D				MW-101S				MW-201D				MW-202D				MW-202S			
	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12
Total Suspended Solids	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1,1 - Dichloroethane	<10	<10	<10	<5	<1	<1	<1	<0.5	<100	<10	<50	<5	<10	<1	<10	<0.5	<1	<1	<1	<0.5
1,1 - Dichloroethylene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
1,1,1 - Trichloroethane	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Vinyl Chloride	<20	<20	<20	<5	<2	<2	<2	<0.5	<200	<20	<100	<5	<20	<2	<20	<0.5	<2	<2	<2	<0.5
Trichloroethylene	<20	<20	58	<5	<2	<2	<2	<0.5	380	230	150	210	<20	<2	<20	<0.5	<2	<2	<2	<0.5
cis-1,2 - Dichloroethylene	<20	<20	200	<5	11	3.3	6.9	14	<200	<20	<100	<5	<20	2.9	<20	<0.5	<2	5.7	3	2.5
Tetrachloroethylene	570	3800	220	490	16	34	45	29	9600	8400	10000	6600	5100	210	200	610	30	56	120	73
Silver	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Arsenic	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cadmium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Copper	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total Iron	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nickel	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Lead	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Selenium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Trivalent Chromium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Hexavalent Chromium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Antimony	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Compound	RW-3 AREA																				
	MW-207D				MW-207S				MW-218D				MW-218S				MW-213	MW-101S	MW-R	Avg	
	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	02/28/11	08/23/11	08/28/12	08/08/12	7/28/2011	May-1989	May-1989		
Total Suspended Solids	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		---
1,1 - Dichloroethane	<1	<1	<1	<0.5	<10	<1	<10	<0.5	<10	<1	<1	<0.5	<1	<1	<1	<0.5	---	---	---	3.67	
1,1 - Dichloroethylene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
1,1,1 - Trichloroethane	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Vinyl Chloride	<2	<2	<2	<0.5	<20	<2	<20	<0.5	<20	<2	<2	<0.5	<2	<2	<2	4.5	---	---	---	7.17	
Trichloroethylene	<2	23	<2	<0.5	45	<2	<20	23	<20	12	11	17	<2	<2	<2	<0.5	---	---	---	33.46	
cis-1,2 - Dichloroethylene	<2	30	<2	<0.5	40	<2	20	15	<20	<2	<2	2.7	<2	<2	<2	8.5	---	---	---	15.97	
Tetrachloroethylene	10	1100	120	34	1300	130	340	530	300	300	190	230	<2	2.3	<2	2.3	---	---	---	1399.08	
Silver	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<10	<10	---	
Arsenic	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<10	<10	---	
Cadmium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<5	<5	---	
Copper	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<20	<20	---	
Total Iron	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	77.6	100	<100	75.87
Nickel	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<40	<40	---	
Lead	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	15	12	13.50	
Selenium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<10	<10	---	
Zinc	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<20	20	15.00	
Trivalent Chromium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Hexavalent Chromium	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Antimony	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<100	<100	---	

Note: Based on groundwater data presented in the Shaw - Status Report Actives for February and August 2011 and February and August 2012, AECOMs - Preliminary Hydrogeologic Evaluation of Groundwater Pump and Treat Remediation submitted in December 2011, and Hunter Inc - Soil and Groundwater Contamination Site Assessment submitted on May 25, 1989 for groundwater metals data only.

Table 4 - Expected System Influent Concentrations

Textron, Inc.
333 Adelaide Avenue
Providence, Rhode Island

Average & Maximum System Influent Concentrations

Compound	RW-1		RW-2 Area		RW-3 Area	
	Avg	Max	Avg	Max	Avg	Max
Total Suspended Solids	---	---	---	---	---	---
1,1 - Dichloroethane	62.4	166.0	439.3	1,710.0	3.7	50.0
1,1 - Dichloroethylene	19.6	41.2	342.2	447.0	100.0	200.0
1,1,1 - Trichloroethane	399.0	1,060.0	12,707.9	52,800.0	100.0	200.0
Vinyl Chloride	1.9	1.0	29.6	50.0	7.2	100.0
Trichloroethylene	694.0	3,484.0	9,250.0	23,900.0	33.5	380.0
cis-1,2 - Dichloroethylene	39.2	100.0	342.5	1,260.0	16.0	100.0
Tetrachloroethylene	2.8	3.3	678.7	3,610.0	1,399.1	9,600.0
Silver	---	---	0.75	1.00	---	---
Arsenic	---	---	---	---	---	---
Cadmium	---	---	---	---	---	---
Copper	3.30	4.80	105.00	150.00	---	---
Total Iron	41.30	49.00	245.07	600.00	75.87	100.00
Nickel	2.76	5.10	45.00	70.00	---	---
Lead	2.16	5.00	12.25	22.00	13.50	15.00
Selenium	---	---	---	---	---	---
Zinc	9.21	26.80	105.00	140.00	15.00	20.00
Trivalent Chromium	---	---	---	---	---	---
Hexavalent Chromium	---	---	---	---	---	---
Antimony	---	---	---	---	---	---

Note: 1) Where compound sometimes detected, convert ND to 1/2 ND, but not used when detections were never above the detection limit.

2) Italic values indicate detection limits were used.

Expected Flow Rate

Pumping Rate (gpm):	5.0	5.0	8.0	Total Pumping Rate
				18.0

Maximum Flow Rate

Pumping Rate (gpm):	7.0	7.0	16.0	Total Pumping Rate
				30.0

Weighed Average & Maximum System Influent Concentrations

Compound	Expected System Influent Concentrations @ 18 gpm		Expected System Influent Concentrations @ 30 gpm	
	Avg	Max	Avg	Max
Total Suspended Solids	5000	5000	5000	5000
1,1 - Dichloroethane	141.0	543.3	119.0	464.4
1,1 - Dichloroethylene	144.9	224.5	137.7	220.6
1,1,1 - Trichloroethane	3,685.2	15,050.0	3,111.6	12,674.0
Vinyl Chloride	11.9	58.6	11.2	65.2
Trichloroethylene	2,777.1	7,775.6	2,338.1	6,592.3
cis-1,2 - Dichloroethylene	113.1	422.2	97.6	370.7
Tetrachloroethylene	811.1	5,270.4	905.2	5,963.1
Silver	0.75	1.00	0.75	1.00
Arsenic	---	---	---	---
Cadmium	---	---	---	---
Copper	69.00	77.40	54.15	77.40
Total Iron	113.26	224.72	107.28	204.77
Nickel	23.88	37.55	23.88	37.55
Lead	10.00	14.17	10.56	14.30
Selenium	---	---	---	---
Zinc	38.39	55.22	34.65	49.59
Trivalent Chromium	---	---	---	---
Hexavalent Chromium	---	---	---	---
Antimony	---	---	---	---


FPZ, Inc

 150 N. Progress Drive
 Saukville, WI 53080 - U.S.A.
 Tel. (262) 268-0180
 Fax (262) 268-0415
 E-mail usa@fpz.com

REGENERATIVE BLOWERS - PRESSURE
SCL K07 / K08 / K09 / K10 / K11 / K12
MS SERIES

SN 1805-12 1/2

TECHNICAL CHARACTERISTICS

- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position
- Recognized TEFC - cURus motor

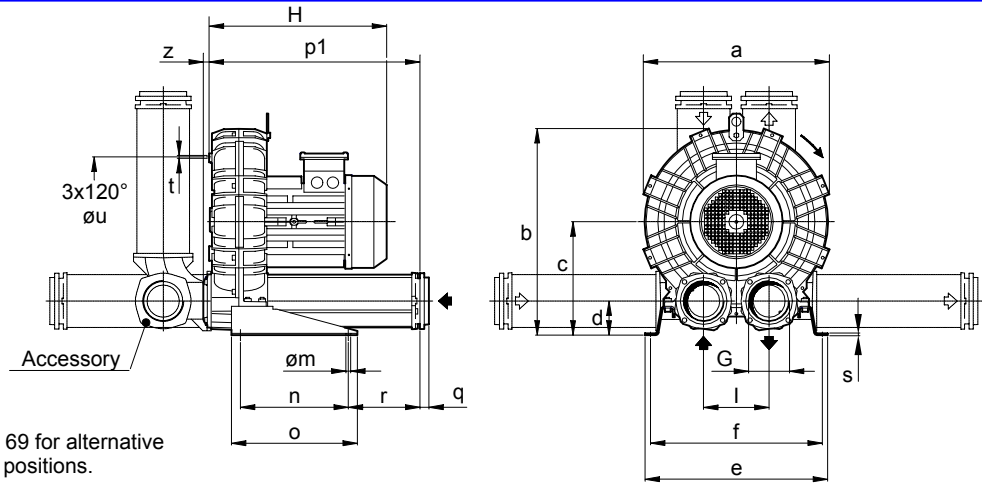
OPTIONS

- Special voltages (IEC 38)
- Surface treatments

ACCESSORIES

- Inlet and/or inline filters
- Additional inlet/outlet silencers
- Safety valves
- Flow converting device
- Optional connectors

 Dimensions in inches.
 Dimension for reference only.

 See page 69 for alternative
 mounting positions.


Model	a	b	c	d	e	f	G	l	m	n	o	p1	q	r	s	t	u	z
K07-MS	16.69	18.84	10.59	3.23	18.43	17.24	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.39	0.20	M8	11.61	0.63
K08-MS	17.00	19.64	10.50	3.23	18.82	17.64	3" NPT	6.10	0.51	11.81	13.78	20.16	0.98	5.30	0.20	M8	12.2	0.63
K09-MS	19.37	22.09	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K10-MS	20.31	22.56	12.40	3.78	20.00	18.82	4" NPT	7.17	0.51	11.81	13.78	23.07	0.98	7.83	0.20	M8	14.17	0.63
K11-MS	21.34	23.74	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.46	0.98	8.03	0.20	M8	15.35	0.63
K12-MS	21.57	23.82	13.07	3.58	21.26	20.00	4" NPT	7.87	0.51	11.81	13.78	23.58	0.98	8.03	0.20	M8	15.35	0.51

Model	Maximum flow Scfm		Installed power Hp		Maximum differential pressure Δp (In WG)		Noise level Lp dB (A) ⁽¹⁾		Overall dimensions H Inches	Weight Lbs
	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm	60 Hz 3500 rpm	50 Hz 2900 rpm		
K07-MS	294	243	4	4	50	63	78.7	76.7	15.45	103.00
			5 1/2	5 1/2	75	86	79.0	77.0	15.45	107.10
			7 1/2	7 1/2	130	138	79.3	77.3	18.37	145.70
			10	10	181	161	79.6	77.6	18.37	154.50
K08-MS	381	316	5 1/2	5 1/2	40	52	79.7	77.7	15.45	115.70
			7 1/2	7 1/2	80	90	80.0	78.0	18.37	154.30
			10	10	115	125	80.3	78.3	18.37	163.10
K09-MS	471	390	15	15	181	181	80.6	78.6	19.15	184.00
			7 1/2	7 1/2	50	63	80.2	78.2	18.84	166.50
			10	10	80	95	80.5	78.5	18.84	175.10
			15	15	140	155	81.0	79.0	19.63	196.20
K10-MS	556	460	20	20	181	181	81.3	79.3	23.74	269.00
			7 1/2	7 1/2	36	51	80.1	78.1	18.84	170.90
			10	10	64	80	80.5	78.5	18.84	179.50
			15	15	120	135	81.0	79.0	19.63	200.60
K11-MS	650	539	20	20	167	191	81.4	79.4	23.74	273.40
			25	25	211	201	81.6	79.6	24.61	298.70
			10	10	40	53	82.0	80.0	19.04	194.90
			15	15	82	97	82.4	80.4	19.83	216.00
K12-MS	726	602	20	20	125	141	82.7	80.7	23.94	288.80
			25	25	162	201	85.6	83.6	24.81	313.10
			15	15	52	90	82.9	80.9	19.95	223.70
			20	20	85	130	83.2	81.2	24.06	296.50
			25	25	120	160	86.1	84.1	24.92	320.80

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from +5° to +104°F.
- Specifications subject to change without notice.

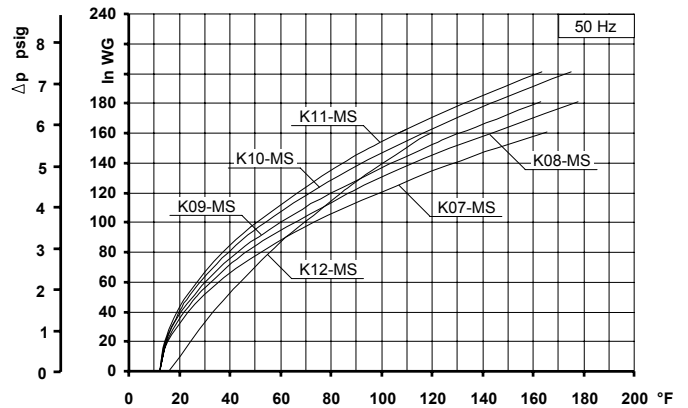
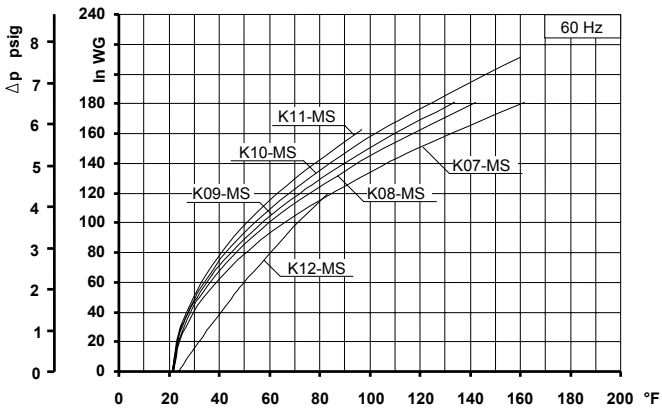
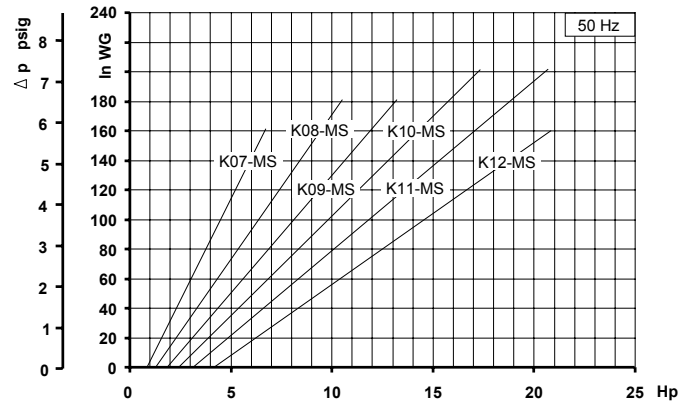
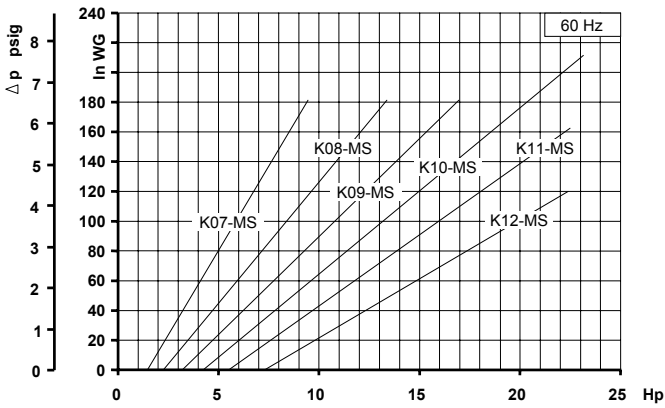
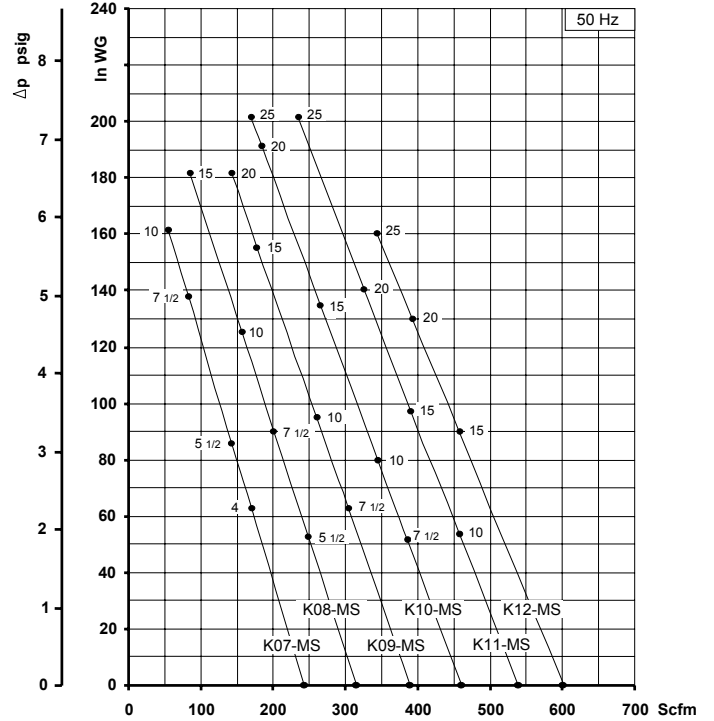
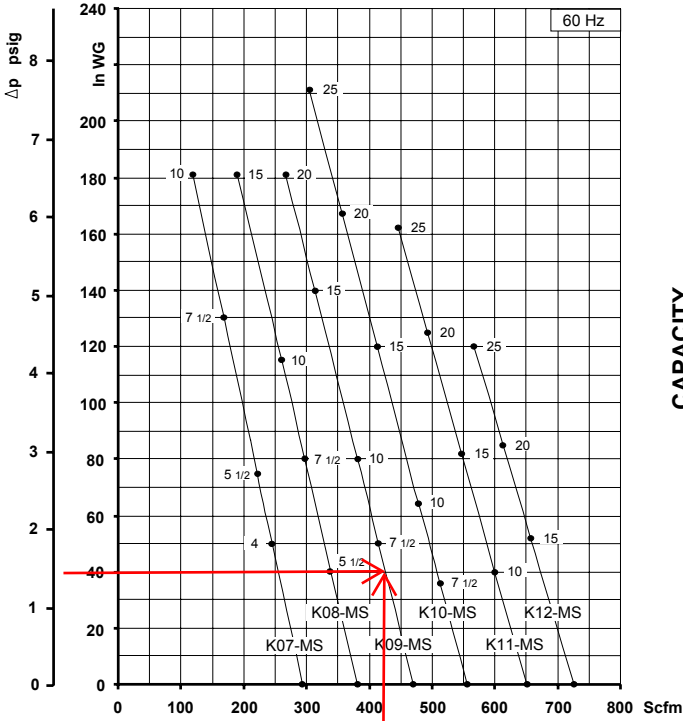


REGENERATIVE BLOWERS - PRESSURE 9

SCL K07 / K08 / K09 / K10 / K11 / K12

MS SERIES

SN 1805-12 2/2



Curves refer to air at 68°F temperature and 29.92 In Hg atmospheric pressure (abs) measured at inlet port.
 Values for flow, power consumption and temperature rise: +/-10% tolerance.
 Data subject to change without notice.



ITT

Commercial Water

Goulds Pumps

G&L Series NPE

316L SS

NPE Series End Suction Centrifugal Pumps

Bombas Centrífugas de Succión Final Serie NPE



Goulds Pumps is a brand of ITT
Residential and Commercial Water.

*Goulds Pumps es una marca de fábrica
de ITT Agua Residencial y Comercial.*

www.goulds.com

Engineered for life

A Full Range of Product Features
Una Gama Total de Características del Producto

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

Materiales Superiores de Construcción: Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.

Impulsor de Eficiencia Superior: El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.

Características de la Carcasa y del Adaptador: Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.

Sello Mecánico: Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.

Motores: Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balinas de bolas para trabajo continuo en todas las condiciones de funcionamiento.

Model: 1ST1E5D4

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

NPE Product Line Numbering System
Línea de Producto NPE Sistema de Numeración

Example Product Code, Ejemplo Código del Producto

1 ST 2 C 1 A 4 F

Seal Vent/Flush Option, Opción de Sello Válvula/Chorro Seal Ven Mechanical Seal and O-ring

4 = Pre-engineered standard
 For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'

4 = Estándar aprobado
 Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (¾" seal), Sello Mecánico John Crane Tipo 21 (sello de ¾")					
Seal Code, Código del Sello	Rotary, Rotativo	Stationary, Estacionario	Elastomers, Elastómeros	Metal Parts, Partes Metálicas	Part No., Pieza Número
4	Carbon	Silicon Carbide	Viton	316 SS	10K55
5	Silicon		Viton		10K62
6	Carbide		Viton		10K62

Impeller Option . . . No Adder Required

For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional

Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impulsor con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, Código del Impulsor	Pump Size, Tamaño de la Bomba		
	1 x 1¼ - 6	1¼ x 1½ - 6	1½ x 2 - 6
	Diameter	Diameter	Diameter
K	-	6½	-
G	-	5½	5½
H	-	5½	5
A	6½	5¼	4¾
B	5¾	5½	4¾
C	5¾	5½	4¾
D	4¾	4¾	4¾
E	4¾	4¾	4¾
F	4¾	3¾	-

Driver, Conductor

1 = 1 PH, ODP 7 = 3 PH, XP
 2 = 3 PH, ODP 8 = 575 V, XP
 3 = 575 V, ODP 9 = 3 PH, TEFC
 4 = 1 PH, TEFC Premium Eff.
 5 = 3 PH, TEFC Premium Eff.
 6 = 575 V, TEFC Premium Eff.

HP Rating, HP Potencia

1 = 1 HP E = 1 HP 2 = 2 HP 3 = 3 HP
 4 = 4 HP 5 = 5 HP 6 = 6 HP 7 = 7 HP

Driver: Hertz/Pole/RPM, Conductor: Hercios/Polo/RPM

1 = 60 Hz, 2 pole, 3500 RPM
 2 = 60 Hz, 4 pole, 1750 RPM
 3 = 60 Hz, 6 pole, 1150 RPM
 4 = 50 Hz, 2 pole, 2900 RPM
 5 = 50 Hz, 4 pole, 1450 RPM

Material

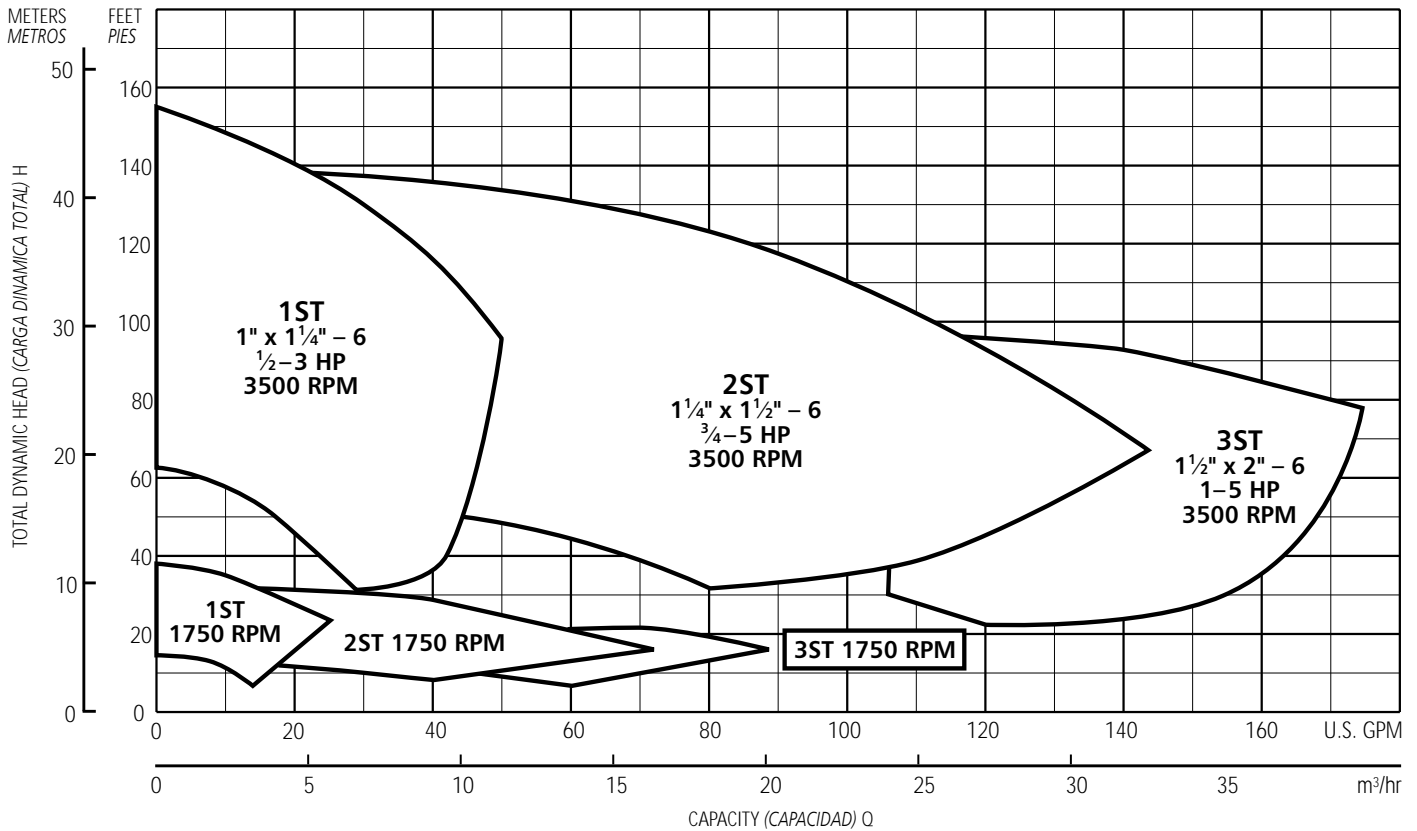
ST = Stainless steel, Acero inoxidable

Pump Size, Tamaño de la Bomba

1 = 1 x 1¼ - 6 2 = 1¼ x 1½ - 6 3 = 1½ x 2 - 6

For frame mounted version, substitute the letters "FRM" in these positions.
 Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

Performance Coverage (60 Hz)
Alcance de Funcionamiento (60 Hz)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds check available service factor.

NOTAS:

No se recomienda para funcionamiento superior al impreso en la curva H-Q.

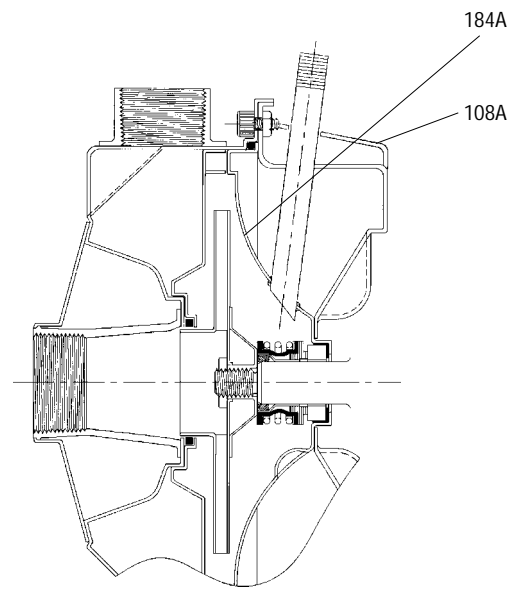
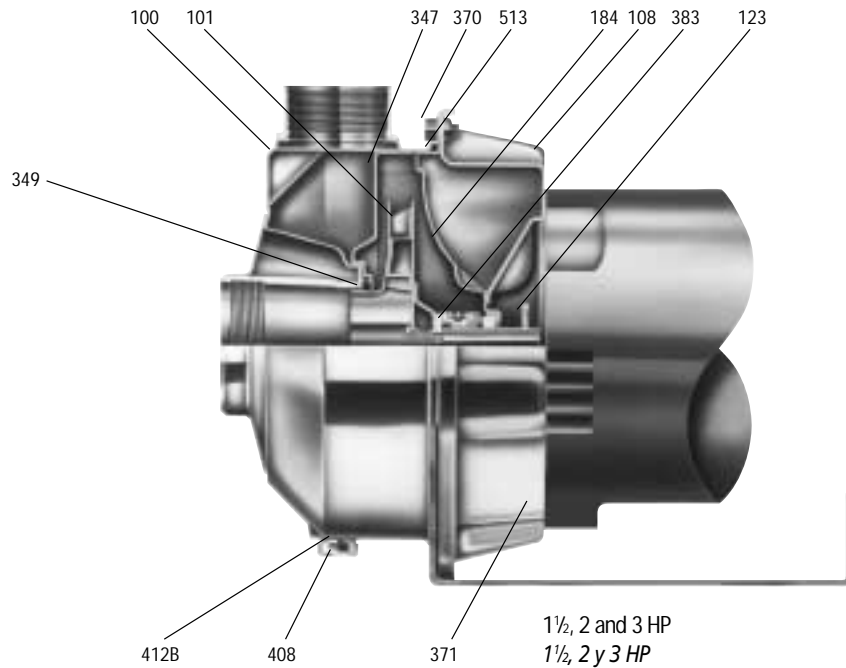
Para condiciones de aplicaciones críticas consultar con la fábrica.

No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds.

NPE Close Coupled Pump Major Components: Materials of Construction

Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., Parte No.	Description, Descripción	Materials, Materiales
100	Casing, Carcasa	
101	Impeller, Impulsor	
108	Motor adapter, Adaptador del motor	AISI 316L SS, AISI 316L Acero inoxidable
108A	Motor adapter seal vent/flush, Sello válvula/chorro del adaptador del motor	
123	Deflector, Deflector	BUNA-N
184	Seal housing, Alojamiento del sello	
184 A	Seal housing seal vent/flush, Sello válvula/chorro del alojamiento del sello	AISI 316L SS, AISI 316L Acero inoxidable
347	Guidevane, Difusor	
349	Seal ring, guidevane; Anillo del sello, difusor	Viton
370	Socket head screws, casing; Encajes cabezas de tornillos, carcasa	AISI 410 SS, AISI 410 Acero inoxidable
371	Bolts, motor; Tornillos, motor	Plated steel, Acero chapeado
383	Mechanical seal, Sello mecánico	**see chart, ver tabla
408	Drain and vent plug, casing; Enchufes de drenaje y válvula, carcasa	AISI 316L SS, AISI 316L Acero inoxidable
412B	O-ring, drain and vent plug; Anillo 'O', enchufe de drenaje y válvula	Viton
513	O-ring, casing; Anillo 'O', carcasa	
Motor	NEMA standard, 56J flange;	
Motor	NEMA estándar, brida 56J	

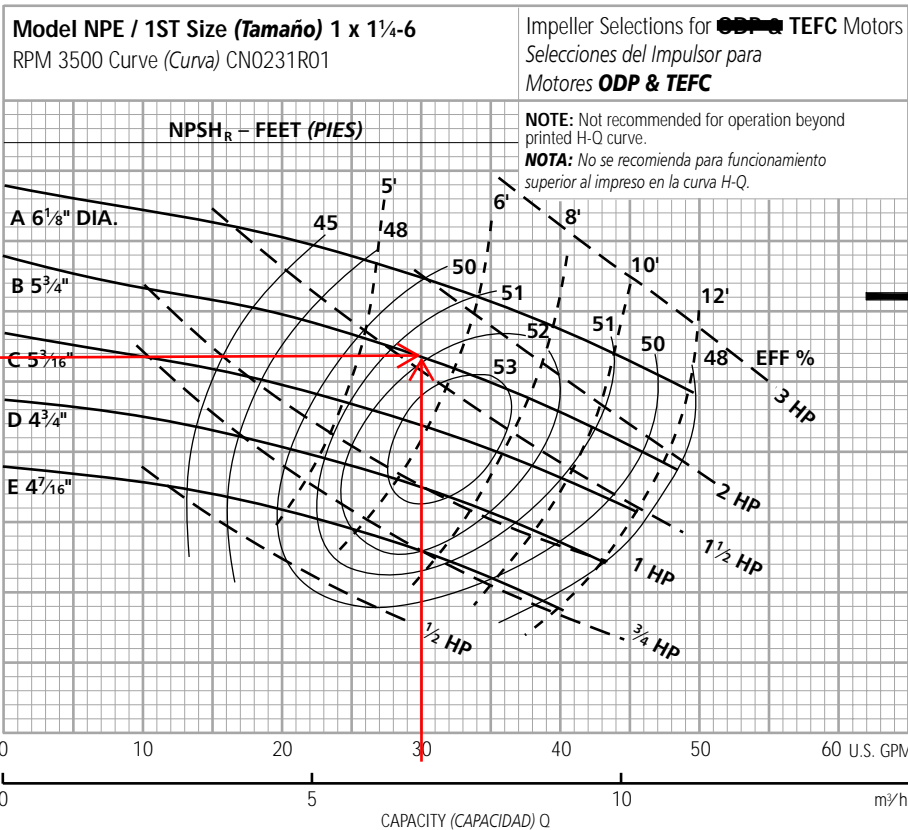


1/2, 3/4 and 1 HP
1/2, 3/4 y 1 HP

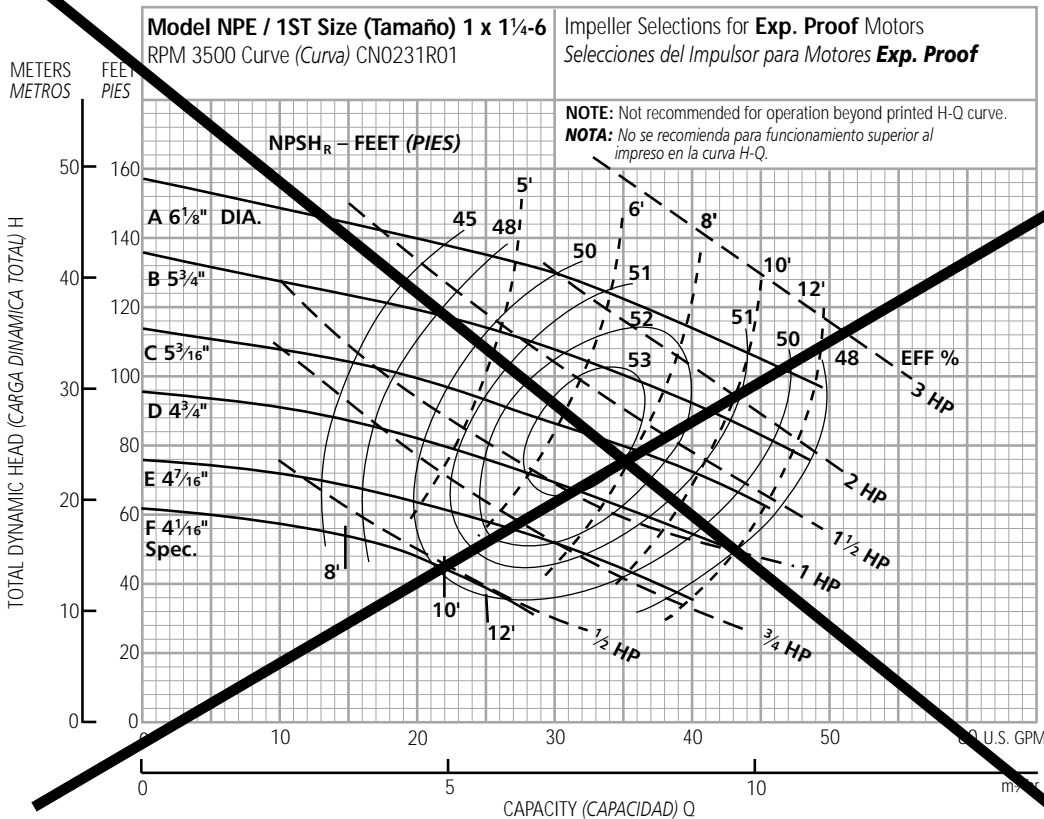
Footed motor for 1750 RPM and 5 HP ODP and TEFC, all explosion proof see page 13.

Motor con pie para 1750 RPM, 5 HP ODP y TEFC, a prueba de explosiones en la página 13.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



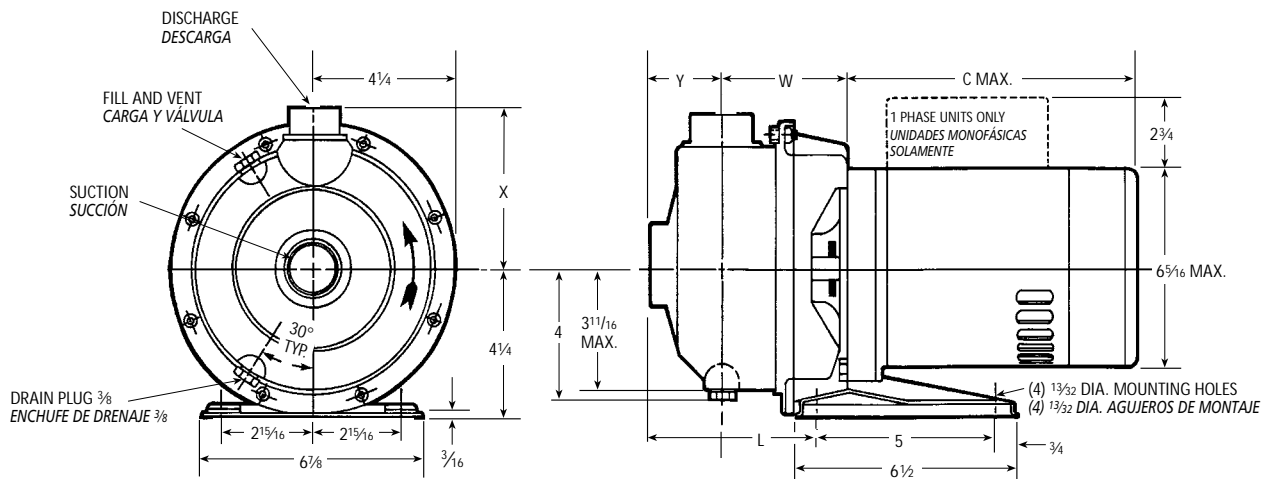
108 ft



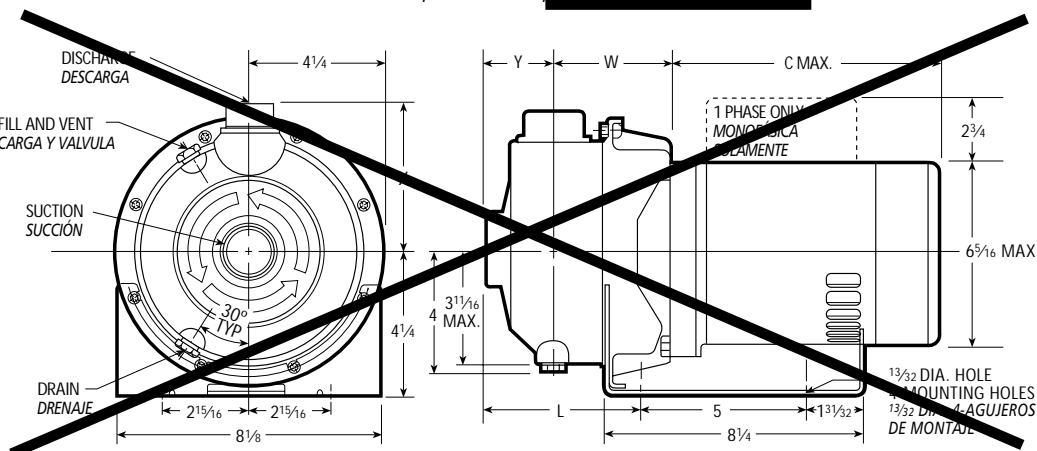
NPE Close Coupled – Dimensions, Weights and Specifications

NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

Clockwise Rotation Viewed from Drive End
 Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC 1/2 and 1 HP



ODP and TEFC 1 1/2, 2 and 3 HP, ODP y TEFC 1 1/2, 2 y 3 HP

Specifications

Especificaciones

Capacities to:
 75 GPM (283L/min) at 1750 RPM
 150 GPM (550L/min) at 3500 RPM

Heads to:
 39 feet (12 m) at 1750 RPM
 150 feet (46 m) at 3500 RPM

Working pressures to:
 125 PSIG (9 bars)

Maximum temperatures to:
 212°F (100°C) with standard seal or
 250°F (121°C) with optional high
 temperature seal.

Direction of rotation:
 Clockwise when viewed from
 motor end.

Motor specifications:
 NEMA 56J frame, 1750 RPM,
 1/2 HP. 3500 RPM 1/2 through 5 HP.
 Open drip-proof, totally enclosed
 fan-cooled or 2 HP explosion proof
 enclosures. Stainless steel shaft
 with ball bearings.

Single phase: Voltage 115/230
 ODP and TEFC. (3 HP model –
 230 V only) Built-in overload with
 auto-reset provided.

Three phase: Voltage 208-230/
 460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors,
 overload protection must be
 provided in starter unit. Starter and
 heaters must be ordered separately.

Capacidades:
 75 GPM (283L/min) a 1750 RPM
 150 GPM (550L/min) a 3500 RPM

Cargas:
 39 pies (12 m) a 1750 RPM
 150 pies (46 m) a 3500 RPM

Presión de trabajo:
 125 PSIG (9 bars)

Temperatura máxima:
 212 °F (100°C) con sello estándar o
 250 °F (121°C) con sello opcional
 para alta temperatura.

Dirección de rotación:
 En dirección de las agujas del reloj
 visto desde el extremo final del
 motor.

Motores:
 Armazón 56J NEMA, 1750 RPM
 1/2 HP. 3500 RPM 1/2 a 5 HP.
 Cubiertas abiertas resguardadas,
 totalmente encerradas enfriadas por
 ventilador o a prueba de explosiones
 de 2 HP. Eje de acero inoxidable con
 balineras de bolas.

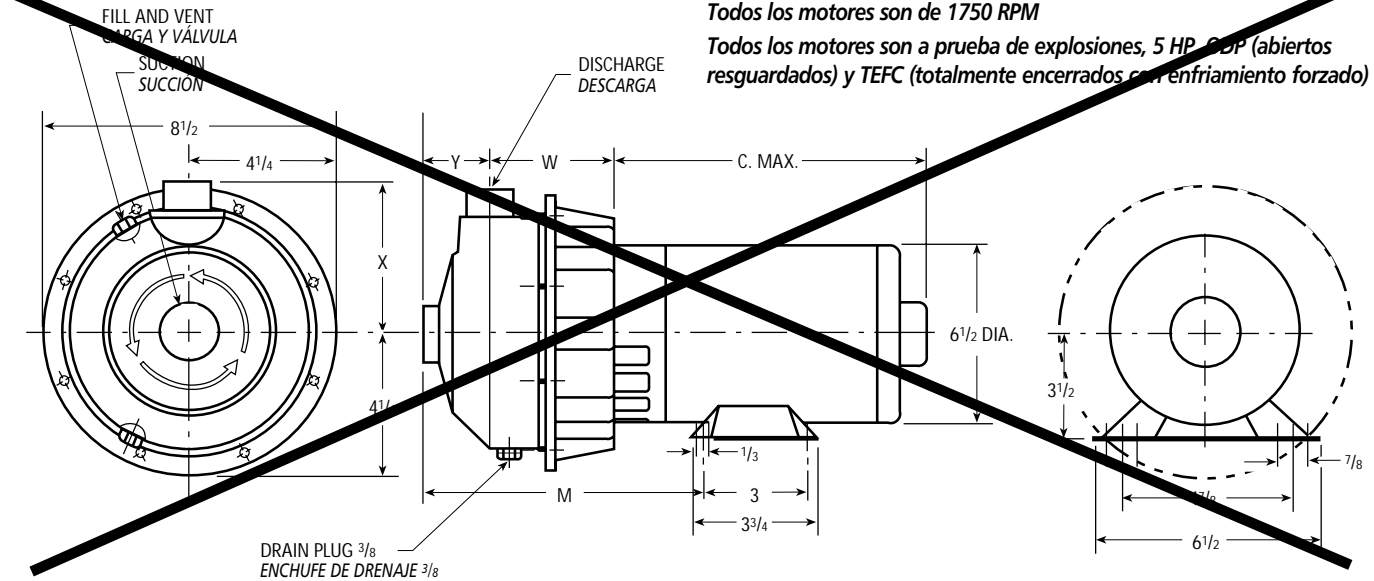
Monofásicos: Voltaje 115/230
 ODP y TEFC. (modelo 3 HP – 230
 voltios solamente) Se proporciona
 protección térmica contra sobrecarga
 construida con reseteo automático.

Trifásicos: Voltaje 208-230/460
 ODP, TEFC y EX PROOF.

NOTA: Para motores trifásicos se
 debe de proporcionar la protección
 térmica contra sobrecarga en la
 unidad de arranque. El arrancador y
 los calentadores se deben pedir por
 separado.

NPE Close Coupled with Footed Motor, 1750 RPM and Explosion-proof Motors
NPE Acople Cerrado con Motor con Patas, 1750 RPM y Motores a Prueba de Explosión

All 1750 RPM Motors
 All Explosion Proof Motors and 5 HP ODP and TEFC
 Todos los motores son de 1750 RPM
 Todos los motores son a prueba de explosiones, 5 HP ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)



Dimensions – Determined by Pump,
Dimensiones – Determinadas por la Bomba

Pump, Bomba	Suction, Succión	Discharge, Descarga	HP	W	X	Y	L	M
1ST	1 1/4	1	1/2 – 3	3 5/16	4 3/8	2	4 9/16	7 5/16

Available Motor Weights and Dimensions,
Pesos y Dimensiones Disponibles del Motor

HP	Motor Weights, Pesos del Motor						C Max. Length, (Longitud)
	1 Phase, Monofásicos			3 Phase, Trifásicos			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
1/2	16	21	47	19	18	27	9 15/16
3/4	19	24	44	21	21	28	10 1/4
1	22	26	49	23	21	28	11
1 1/2	28	35	56	27	27	37	11 1/4
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 1/16
5	42	—	—	42	45	—	14 1/4

Dimensions in inches, weights in pounds.
 Dimensiones en pulgadas, pesos en libras.

NOTES:

- Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
- Motor dimensions may vary with motor manufacturers.
- Dimensions in inches, weights in pounds.
- For explosion proof motor dimensions consult factory for information.
- Not to be used for construction purposes unless certified.

NOTAS:

- Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.
- Las dimensiones del motor puede que varíen con los fabricantes.
- Dimensiones en pulgadas, pesos en libras.
- Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.
- No usar para propósitos de construcción sin certificar.

Project #: 60271240
Client: Textron Inc
Site: Providence, RI
Subject: P-04 Pump Sizing

Page: 1 of 2
Date: September 17, 2012
By: David Macone, PE
App.: _____

AECOM

Air Stripper (AS-01) Sump Pump (P-04)

Engineering Calculations

Air Stripper (AS-01) Sump Pump (P-04) TDH Assumptions:

Data used to generate the TDH number below was procured from the following sources:

- 1) The following table used to calculate TDH was generated to size the Air Stripper (AS-01) Sump Pump (P-04) and motor that will be used to pump the primary treated groundwater through the second set of Bag Filters (BF-02A/B), the Liquid Phase Granular Activated Carbon Units (LGAC-01A/B), the Ion Exchange Unit (IX-01) and effluent discharge piping.
- 2) The effluent discharge piping will be installed to promote gravity feeding.
- 3) Elevation assumed from finish grade, which the concrete slab, which was assigned an elevation of 0 ft.
- 4) Design maximum discharge rate of 30 gpm was used for these calculations.
- 5) All piping used in this calculation was 2-inch, Sch 80 PVC, smooth bore.
- 6) All piping fittings used in this calculation are 2-inch, Sch 80 PVC.
- 7) Table for calculating head loss per 100 feet of pipe can be found at The Engineering Tool Box, www.engineeringtoolbox.com
- 8) Table for calculating equivalent length of straight pipe per 100 feet of pipe for valves and fittings can be at The Engineering Tool Box, www.engineeringtoolbox.com

Air Stripper (AS-01) Sump Pump (P-04) TDH Summary:

Distance :	145.0	ft	assumed horizontal length between equipment
Elevation Change:	6.0	ft	assumed inlet height to T-01
Total Equivalent Pipe Length:	282.6	ft	based on assumed pipe run and fittings
Head Loss/100 LFT:	1.8	ft	with a velocity of 2.87 ft/sec
Total Dynamic Head:	18.0	FT TDH	
	8.0	PSI	

Air Stripper (AS-01) Sump Pump (P-04) Sizing Requirements:

Pumping Rate:	30	gpm
Safety Factor:	30%	
Total Dynamic Head:	18.0	FT TDH

See Attachments

Redi-Flo4 Environmental Submersible Pumps

Submittal Data

3450 RPM

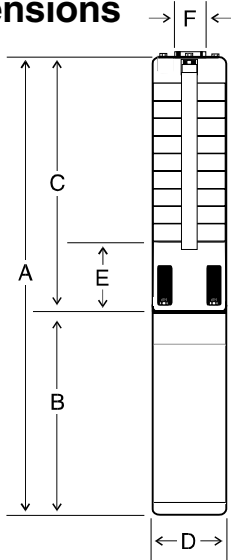
60 Hertz



JOB or CUSTOMER:	
ENGINEER:	
CONTRACTOR:	
SUBMITTED BY:	DATE:
APPROVED BY:	DATE:
ORDER NO:	DATE:
SPECIFICATION REF:	

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS

Dimensions



Technical Data

FLOW RANGE: 1.2 to 7 U.S. GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
 Maximum Operating Temperature: 104°F (40°C)
 Maximum Submergence Pressure: 220 PSI
 Maximum Number of Starts Per Hour: 100
 Minimum Recommended Flow Past Motor: 0.25 ft./sec.

(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1" NPT

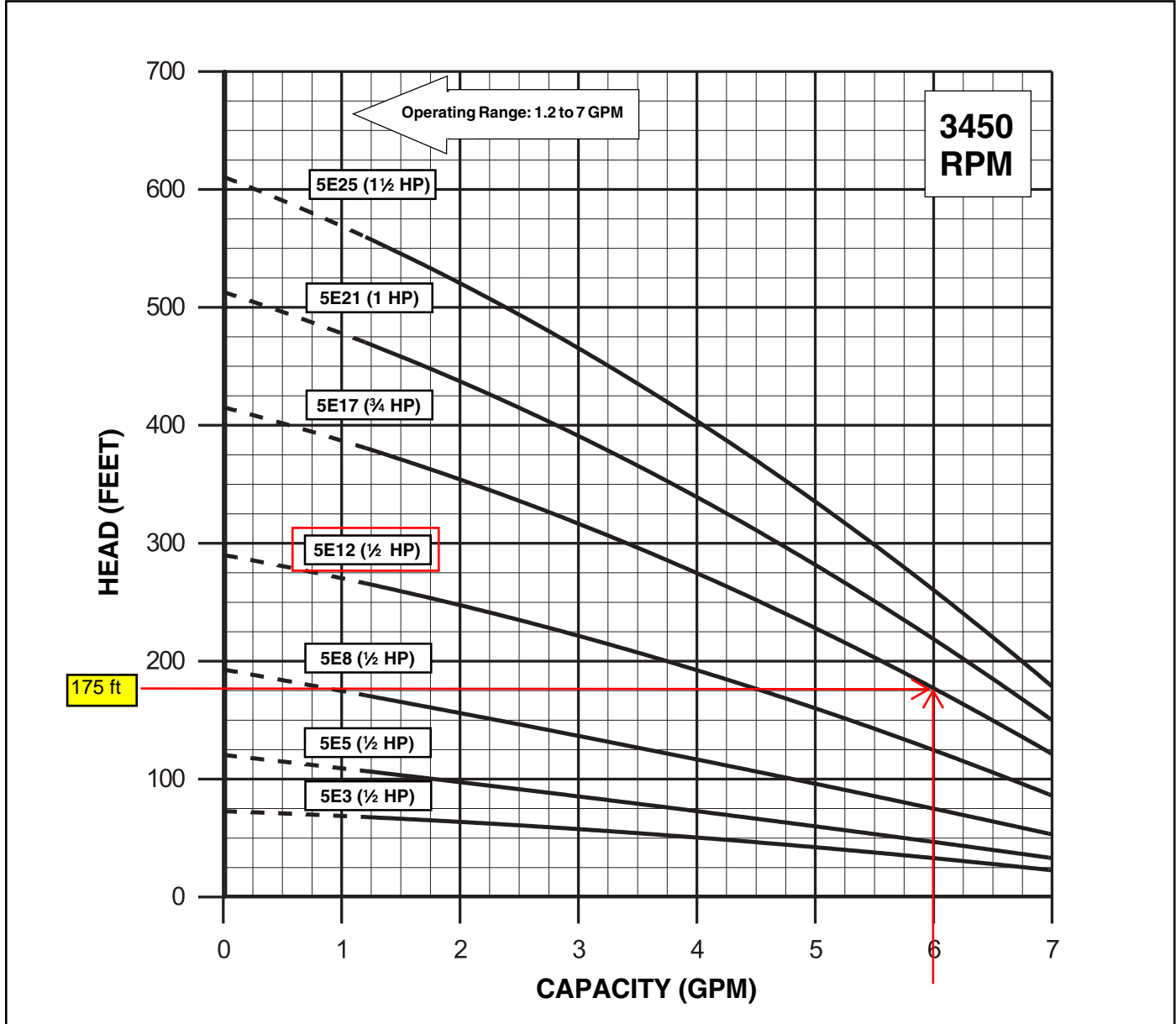
MATERIALS OF CONSTRUCTION: See reverse side.

INSTALLATION: Unit to be installed vertically for submerged operation.

Electrical Data, Dimensions, and Weights ①

Pump Type	Motors				DIMENSIONS IN INCHES							
	HP	SF	PH	Volts	Overall Length A	Motor Length B	Pump End Length C	Max. Dia. D	Inlet E	Disch. Pipe Size (NPT) F	Net Weight (Lbs.) ^②	Ship. Weight (Lbs.) ^②
5E3	½	1.60	1	230	19 ⅜	10 13/16	8 9/16	3 31/32	3 ¼	1	24	26
5E5	½	1.60	1	230	21 ⅛	10 13/16	10 5/16	3 31/32	3 ¼	1	25	27
5E8	½	1.60	1	230	23 9/16	10 13/16	12 ¾	3 31/32	3 ¼	1	27	28
5E12	½	1.60	1	230	26 13/16	10 13/16	16	3 31/32	3 ¼	1	28	29
5E17	¾	1.50	1	230	31 7/16	11 3/8	20 3/16	3 31/32	3 ¼	1	31	32
5E21	1	1.40	1	230	35 7/16	12	23 7/16	3 31/32	3 ¼	1	33	35
5E25	1 ½	1.30	1	230	40 5/16	13 9/16	26 ¾	3 31/32	3 ¼	1	35	37

① Data for Grundfos MS402E motors. ② Does not include motor leads.



Materials of Construction

REDI-FLO4 PUMP END

Description	Material
Check Valve Housing, Check Valve, Diffuser Chamber, Impeller, Suction Interconnector, Inlet Screen, Pump Shaft, Straps, Cable Guard, Priming Inducer	304 SS
Check Valve Seat	304 SS & Teflon®
Impeller Seal Ring	Teflon®
Coupling	316/431 SS
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS

Description	Material
Connector Sleeve	304 SS
Connector Potting	Scotch Cast #4® Epoxy w/FPM Cap
Connector Plug	FPM
Lead Insulation	Teflon®
Conductor	Stranded Copper, 12 AWG

NOTES: Specifications are subject to change without notice.
 Teflon® is a registered trademark of DuPont.
 Scotch Cast #4® is a registered trademark of 3M Company.

GRUNDFOS ENVIRONMENTAL MOTOR

Description	Material
NEMA Top, Studs & Fasteners, Stator Housing, Fill Plug Screw	304 SS
Nuts	316 SS
Sand Slinger	FPM
Shaft Extension	431 SS
Diaphragm	FPM
Fill Plug Washer	Teflon®



GRUNDFOS Pumps Corporation • 3131 N. Business Park Ave. Fresno, CA 93727
Customer Service Centers: Allentown, PA • Fresno, CA
Phone: (800)333-1366 • Fax: (800)333-1363
Canada: Oakville, Ontario • **Mexico:** Apodaca, N.L.

Redi-Flo4 Environmental Submersible Pumps

Submittal Data

3450 RPM

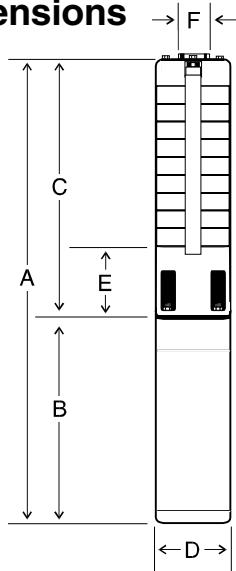
60 Hertz



JOB or CUSTOMER:	
ENGINEER:	
CONTRACTOR:	
SUBMITTED BY:	DATE:
APPROVED BY:	DATE:
ORDER NO:	DATE:
SPECIFICATION REF:	

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENTS

Dimensions



Technical Data

FLOW RANGE: 5 to 14 U.S. GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
 Maximum Operating Temperature: 104°F (40°C)
 Maximum Submergence Pressure: 220 PSI
 Maximum Number of Starts Per Hour: 100
 Minimum Recommended Flow Past Motor: 0.25 ft./sec.

(NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1 1/4" NPT

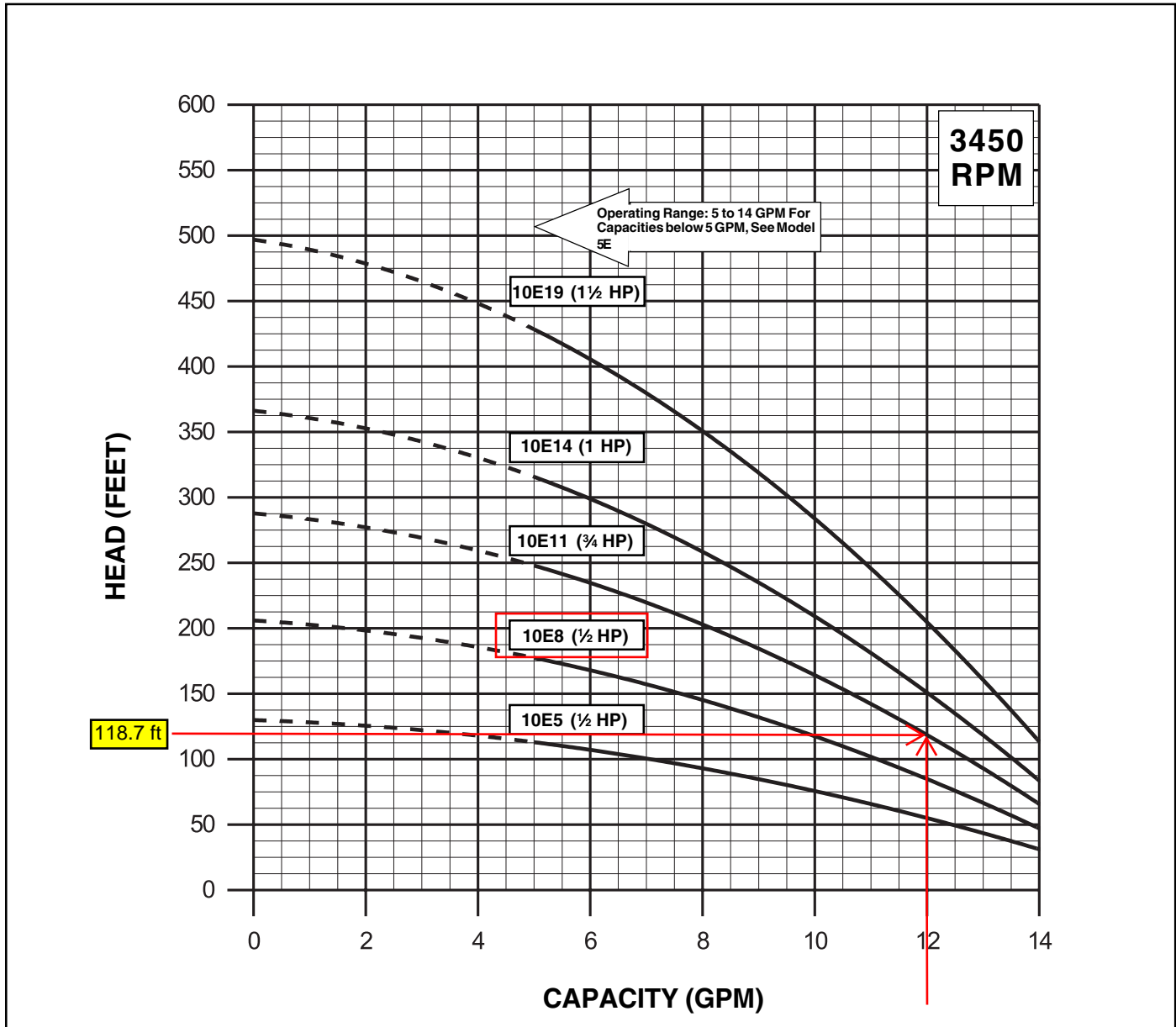
MATERIALS OF CONSTRUCTION: See reverse side.

INSTALLATION: Unit to be installed vertically for submerged operation.

Electrical Data, Dimensions, and Weights †

Pump Type	Motors				DIMENSIONS IN INCHES							
	HP	SF	PH	Volts	Overall Length A	Motor Length B	Pump End Length C	Max. Dia. D	Inlet E	Disch. Pipe Size (NPT) F	Net Weight (Lbs.)†	Ship. Weight (Lbs.)†
10E5	1/2	1.60	3	230	21 1/8	10 13/16	10 5/16	3 31/32	3 1/4	1 1/4	25	26
10E8	1/2	1.60	1	230	23 9/16	10 13/16	12 3/4	3 31/32	3 1/4	1 1/4	26	28
10E11	3/4	1.50	1	230	26 9/16	11 3/8	15 3/16	3 31/32	3 1/4	1 1/4	28	30
10E14	1	1.40	1	230	29 11/16	12	17 11/16	3 31/32	3 1/4	1 1/4	31	32
10E19	1 1/2	1.30	1	230	35 3/8	13 9/16	21 13/16	3 31/32	3 1/4	1 1/4	35	37

† Data for Grundfos MS402E motors. † Does not include motor leads.



Materials of Construction

REDI-FLO4 PUMP END

Description	Material
Check Valve Housing, Check Valve, Diffuser Chamber, Impeller, Suction Interconnector, Inlet Screen, Pump Shaft, Straps, Cable Guard, Priming Inducer	304 SS
Check Valve Seat	304 SS & Teflon®
Impeller Seal Ring	Teflon®
Coupling	316/431 SS
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS

Description	Material
Connector Sleeve	304 SS
Connector Potting	Scotch Cast #4® Epoxy w/FPM Cap
Connector Plug	FPM
Lead Insulation	Teflon®
Conductor	Stranded Copper, 12 AWG

NOTES: Specifications are subject to change without notice.
Teflon® is a registered trademark of DuPont.
Scotch Cast #4® is a registered trademark of 3M Company.

GRUNDFOS ENVIRONMENTAL MOTOR

Description	Material
NEMA Top, Studs & Fasteners, Stator Housing, Fill Plug Screw	304 SS
Nuts	316 SS
Sand Slinger	FPM
Shaft Extension	431 SS
Diaphragm	FPM
Fill Plug Washer	Teflon®



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Down Well Submersible Pumps (P-01, -02, & -03)

ID	Ground Elevation (ft)	Expected Drawdown (ft)	Assumed Pipe Elevation (ft)	Max. Pumping Rate (gpm)	Distance (ft)	Size of Pipe (in)	Pipe Fittings & Qty	Equivalent Pipe Length for Pipe Fittings (ft)	Total Equivalent Pipe Length (ft)	Delta Elevation (ft)	Head Loss/100 per 100 LFT	Pressure Drop Across Equipment (ft)	Total Dynamic Head for Pipe Only (ft)	Safety Factory (%)	Total Dynamic Head	
															(ft)	(psi)
RW-01 Submersible Pump (P-01)	-25.0	-10.0	-	6	40	1.5	1 Tee 1 45° 1 90° 1 GV	8.0 2.1 7.5 1.0	58.6	40.0	0.3	-	0.2	30%	84.9	37.7
RW-02 Submersible Pump (P-02)	-25.0	-10.0		6	580	1.5	1 Tee 3 45° 2 90° 1 GV	8.0 6.3 15.0 1.0	610.3	40.0	0.3		1.8		87.0	38.7
RW-03 Submersible Pump (P-03)	-25.0	-10.0		12	860	1.5	1 Tee 4 45° 3 90° 1 GV	8.0 8.4 22.5 1.0	899.9	40.0	1.7		15.3		104.6	46.5
Manifold Header Piping	0.0			5.0	30.0	15	2 90°	17.2	32.2	5.0	1.8		0.6			
Bag Filter & Piping	0.0		4.0	30.0	20	4 90°	34.4	54.4	6.0	1.8	0.5	1.0				
Air Stripper Intake & Nozzle	0.0		10.0			2.0						23.1				

Notes: Estimated elevation are based on ground surface, which is generally flat across the site, therefore assumed elevation of 0 ft.

The Down Well Submersible Pump intakes will be set at an elevation between -40.0 to -60.0 ft below grade.

Assumed influent nozzle to air stripper, is approximately 10 ft, and the losses are 10 psi (23.1 ft).

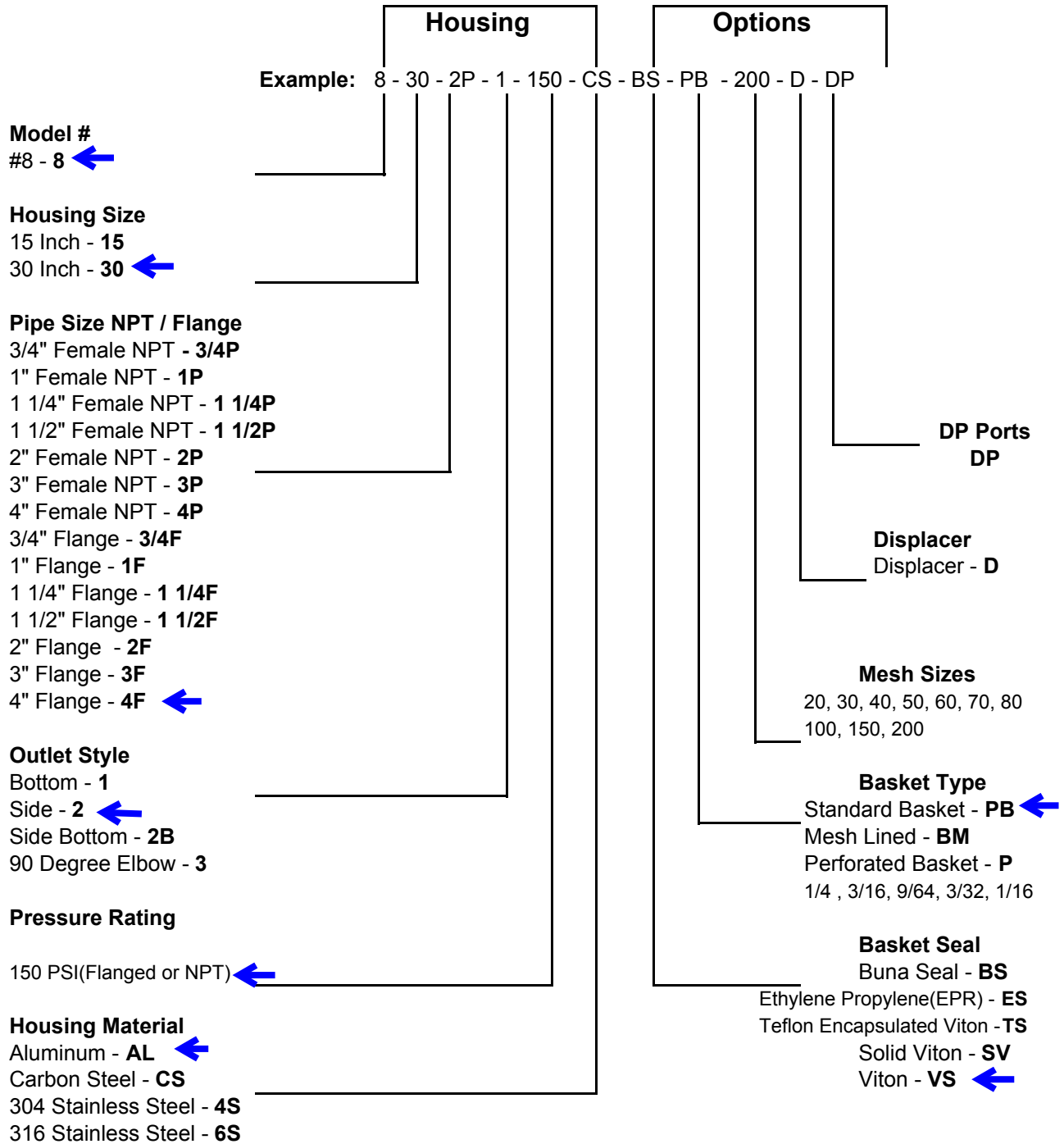
Pressure Drop per 100 ft for a 1.5" pipe at 6 gpm is 0.3 ft of water column with a velocity of 0.946 ft/sec.

Pressure Drop per 100 ft for a 1.5" pipe at 15 gpm is 1.7 ft of water column with a velocity of 2.37 ft/sec.

Pressure Drop per 100 ft for a 2.0" pipe at 30 gpm is 1.8 ft of water column with a velocity of 2.87 ft/sec.

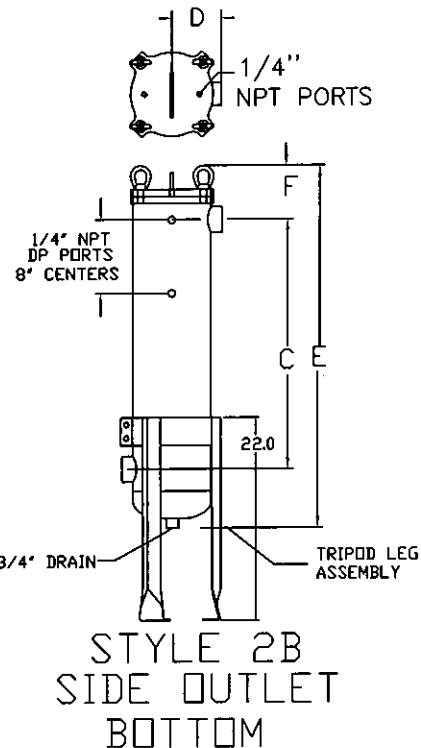
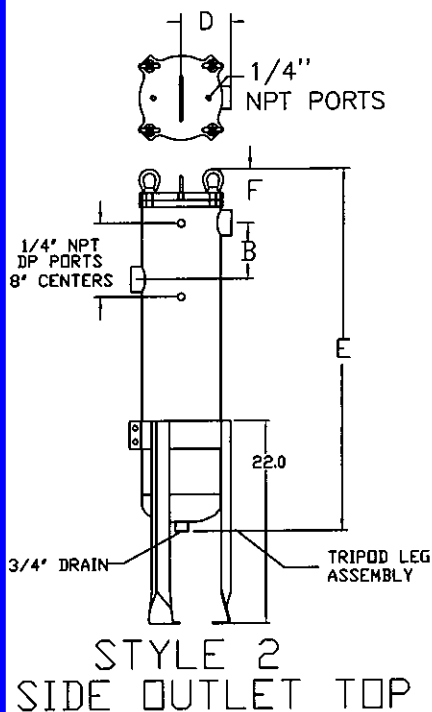
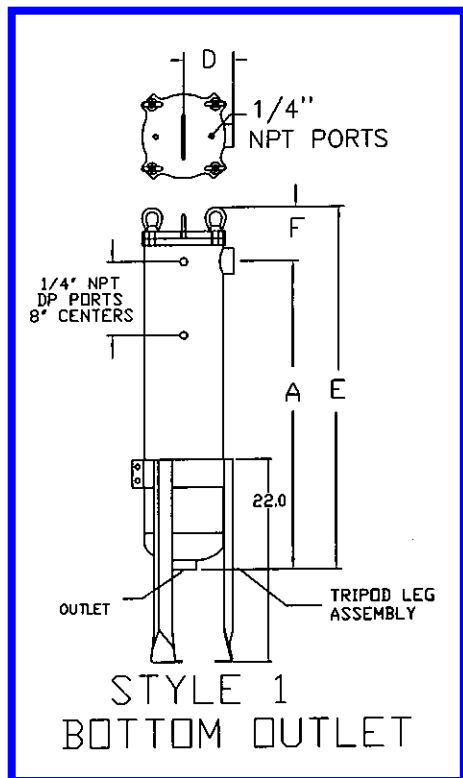
Sch 80 PVC		
Pipe Diameter (in)	Pipe Fitting	Equivalent Length Pipe (ft)
1.5	Tee	8.0
	45° Elbow	2.1
	90° Elbow	7.5
	Gate Valve	1
2.0	Tee	12.0
	45° Elbow	2.6
	90° Elbow	8.6
	Gate Valve	1.5

How to Order a Filter Bag Housing



- * Carbon Steel & Stainless Housing only available with Eye Bolt Covers
- * Aluminum Housings only available with Standard Covers
- * All Filter Bag Housings come with Carbon Steel Legs & Standard 304 SS Basket
- * 304 Stainless & 316 Stainless Legs are available & 316 SS Baskets are available

ALUMINUM



SIZE	PIPE SIZE IN NPT	A	B	C	D	E	F	SIZE	PIPE SIZE IN NPT	A	B	C	D	E	F
8-15	.075	30.5	5.6	13	5.3	24.3	5.6	8-30	.075	34.5	5.6	27	5.3	38.3	5.6
	1.00	30.5	5.6	13	5.3	24.5	5.7		1.00	34.5	5.6	27	5.3	38.5	5.7
	1.25	30.5	5.6	13	5.3	24.9	5.9		1.25	34.5	5.6	27	5.3	38.9	5.9
	1.50	30.5	5.6	13	5.3	25.6	6.1		1.50	34.5	5.6	27	5.3	39.6	6.1
50 GPM	2.00	30.5	6.1	13	5.3	25.7	6.3	100 GPM	2.00	34.5	6.1	27	5.3	39.7	6.3
	3.00	30.5	7.3	13	5.3	26.8	6.9		3.00	34.5	7.3	27	5.3	40.8	6.9
	4.00	30.5	8.3	13	5.3	27.9	7.4		4.00	34.5	8.3	27	5.3	41.9	7.4

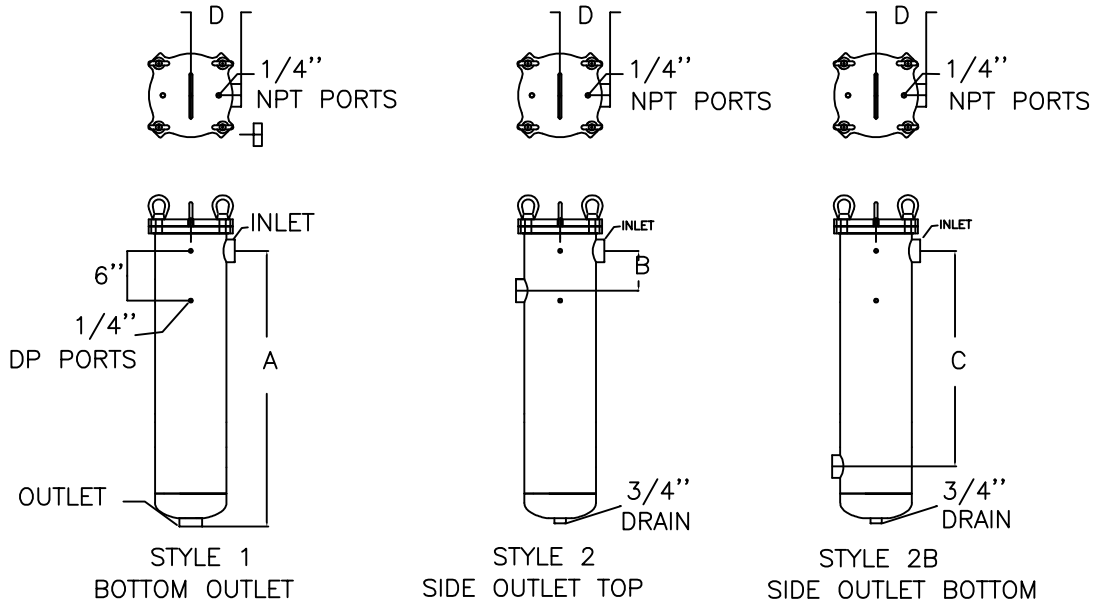
> STANDARD FEATURES

- * EYE BOLT COVER
- * 304 STAINLESS BASKET
- * BUNA SEAL
- * 1/4" NPT GAUGE PORT
- * ADJUSTABLE C.S. LEGS

> OPTIONS

- * 316 STAINLESS BASKET
- * PERFORATION @ MESH SIZES
- * DP PORTS
- * O-RING SEAL MATERIALS
- * 304,316 ADJUSTABLE LEGS
- * STYLE 3 90 ELBOW
- * FLANGE CONNECTIONS

ALUMINUM



> STANDARD FEATURES

- * EYE BOLT COVER
- * 304 STAINLESS BASKET
- * BUNA SEAL
- * 1/4" NPT PORTS
- * ADJUSTABLE C.S. LEGS

> OPTIONS

- * 316 STAINLESS BASKET
- PERFORATION—MESH SIZES
- * DP PORTS
- * O—RING MATERIALS
- * ADJUSTABLE 304,316 LEGS

#1 SIZE	PIPE SIZE IN. NPT	A	B	C	D
	100 GPM	0.75	18.5	5.6	13
1.00		19.3	5.6	13	5.3
1.25		19.8	5.6	13	5.3
1.50		20	5.6	13	5.3
2.00		20.5	6.1	13	5.3
3.00		22.3	7.3	13	5.3
4.00		23.1	8.3	13	5.3
#2 SIZE	PIPE SIZE IN. NPT	A	B	C	D
	220 GPM	0.75	31.4	5.6	26
1.00		31.8	5.6	26	5.3
1.25		32.3	5.6	26	5.3
1.50		32.6	5.6	26	5.3
2.00		33.2	6.1	26	5.3
3.00		34.6	7.3	26	5.3
4.00		35.6	8.3	26	5.3



Contents:
Liquid Filters
Vapor Filters
Filtration Media
<ul style="list-style-type: none"> • Anthracite • Birm® • Re-Activated Carbon • Virgin Carbon • EC-100® • Filter-Lite • Manganese Greensand • MTBE Removal Carbon • Filter Sand
Special Products

FILTRATION MEDIA :
8x30 VIRGIN CARBON
~~4x10 VIRGIN CARBON~~

GENERAL DESCRIPTION

Select virgin carbon is quality screened during our purchasing process for activity, density and fines. The use of virgin carbon is recommended where drinking water quality is necessary. All carbon either sold by itself or installed in our filtration units is traced by lot number to the installation or sale.

8x30 (Liquid Phase) Standard Specifications:	Standard	Value
Iodine Number	ASTM D-4607	1200 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	8x30 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

4x10 (Vapor Phase) Standard Specifications:	Standard	Value
Carbon Tetrachloride Activity Level	ASTM D-3467	60 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	4x10 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

Packaging:		
50 Pound Bags	50 Pound Drums	Bulk Tanker
1,000 Pound Bulk Sacks	200 Pound Drums	

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Tetrasolv Filtration, Inc. • 1200 East 26th Street • Anderson, Indiana 46016 • USA
 Toll Free: 800-441-4034 Telephone: 765-643-3941 • Fax: 765-643-3949
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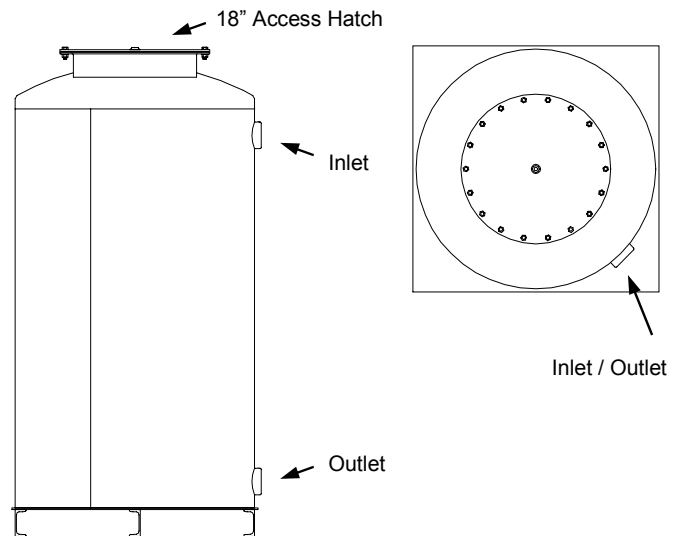
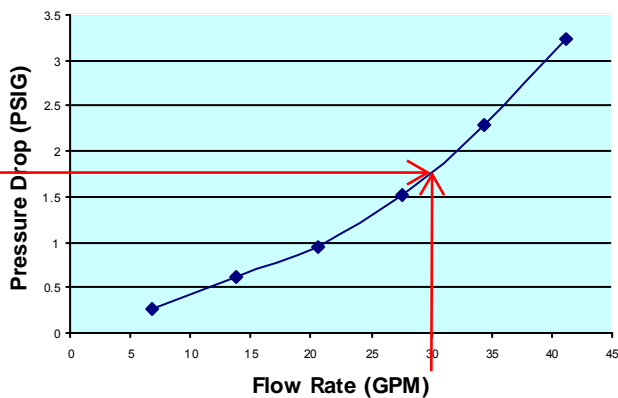


The AF-500 filter is a media filter vessel designed to treat liquid streams. While the typical design application is a activated carbon adsorbion unit, the filter can easily accommodate many medias. Some applications include:

- Dissolved Organic Removal (Activated Carbon)
- Suspended Solids Removal (Sand Filter)
- Dissolved Minerals (Softener Resin)
- Oil and Grease Removal (Organo-Clays)
- Dissolved and Precipitated Metals Removal
- Special Organics (Resin/Carbon Blend)
- Catalytic Reactor (Chlorine and Peroxide Removal)
- Bio-Remediation Contactor Unit



PRESSURE DROP GRAPH
(As Filled - 8*30 GAC)



AF-500 SPECIFICATIONS

Overall Height	5'2"	Vessel/Internal Piping Materials	CS (SA-36) / SCH 40 PVC
Diameter	30"	Internal Coating	Coal Tar Epoxy Resin
Inlet / Outlet (FNPT)	2"	External Coating	Epoxy Mastic
Drain / Vent (FNPT)	OPT / 1/4"	Maximum Pressure / Temp	40 PSIG / 140° F
GAC Fill (lbs)	500	Cross Sectional Bed Area	4.9 FT ²
Shipping / Operational Weight (lbs)	875/1,765	Bed Depth/Volume	3.4 FT / 16.7 FT ³

Tetrasolv Filtration
1200 East 26th Street - Anderson, Indiana 46016 U.S.A
Phone (765) 643-3941 Fax (765) 643-3949 Email: info@tetrasolv.com

Carbon Usage

Pumping Rate (gpm): 18 (anticipated flow rate)

	1/n	K	C0*	Ce**	F***	(x/m)C0	(x/m)Ce	CUR	CUR	CUR	
	-	-	mg/L	mg/L	L/d	mg/g	mg/g	g/d	lb/d	lb/1000 gal	
TCE	0.62	28	0.001	0.00005	98118	0.39	0.06	241	0.5	0.01	
c-DCE	0.59	12	0.001	0.00005	98118	0.20	0.03	457	1.0	0.01	
PCE	0.56	51	0.001	0.00005	98118	1.07	0.20	87	0.2	0.00	
1,1,1-trichloroethane	0.34	2.5	0.001	0.00005	98118	0.24	0.09	390	0.9	0.01	
1,1-dichloroethylene	0.54	4.9	0.001	0.00005	98118	0.12	0.02	793	1.7	0.02	
1,1-dichloroethane	0.53	1.8	0.001	0.00005	98118	0.05	0.01	2015	4.4	0.05	
vinyl chloride	NR	NR	0.001	0.00005	98118	-	-	-	-	-	
								Total	3984	8.8	0.09

1/n and K values taken from DG 1110-1-2, 2001

Carbon Amount per Vessel(lb): 500
 # of Carbon Vessels: 2
Changeout (d) 114

Notes:

- *This is assuming 99% removal efficiency from Air Stripper
- **This is assuming 95% removal efficiency from GAC filter
- ***Flow is 18 GPM (anticipated flow rate)

Pumping Rate (gpm): 30 (max flow rate)

	1/n	K	C0*	Ce**	F***	(x/m)C0	(x/m)Ce	CUR	CUR	CUR	
	-	-	mg/L	mg/L	L/d	mg/g	mg/g	g/d	lb/d	lb/1000 gal	
TCE	0.62	28	0.001	0.00005	163530	0.39	0.06	402	0.9	0.01	
c-DCE	0.59	12	0.001	0.00005	163530	0.20	0.03	762	1.7	0.02	
PCE	0.56	51	0.001	0.00005	163530	1.07	0.20	146	0.3	0.00	
1,1,1-trichloroethane	0.34	2.5	0.001	0.00005	163530	0.24	0.09	651	1.4	0.02	
1,1-dichloroethylene	0.54	4.9	0.001	0.00005	163530	0.12	0.02	1322	2.9	0.03	
1,1-dichloroethane	0.53	1.8	0.001	0.00005	163530	0.05	0.01	3358	7.4	0.08	
vinyl chloride	NR	NR	0.001	0.00005	163530	-	-	-	-	-	
								Total	6640	14.6	0.16

1/n and K values taken from DG 1110-1-2, 2001

Carbon Amount per Vessel(lb) 500
 # of Carbon Vessels: 2
Changeout (d) 68

Notes:

- *This is assuming 99% removal efficiency from Air Stripper
- **This is assuming 95% removal efficiency from GAC filter
- ***Flow is 30 GPM (max flow rate)

PROTECT V

Carbon Adsorber Canisters



Description

The PROTECT V vapor phase carbon adsorber canisters are air or vapor treatment units for use in applications requiring higher pressures or slight vacuum conditions. PROTECT V canisters contain all of the operating elements required for utilization of granular activated carbon in air or vapor treatment, including a flat carbon bed support across the entire bed cross sectional area and plenum area below this support for effective air introduction and distribution across the bed. The canisters are constructed of unlined carbon steel with a stainless steel screen bed support for use with activated carbon in air treatment.

The PROTECT V vapor phase carbon adsorber canisters are available in 2 convenient sizes that will contain 1000 or 2000 pounds of granular activated carbon for treating air or vapor sources typically up to 750 cfm at pressures up to 15 psig and up to 15 inches of Mercury of vacuum.

The PROTECT V vapor phase adsorbers can be provided with any of Calgon Carbon's wide variety of vapor phase activated carbon products that can be selected for a specific air or vapor treatment application. Most commonly used are Type AP4-60 grade virgin activated carbon, which is a 4mm pelletized activated carbon with a carbon Tetrachloride Number of 60 for higher purity air or vapor, or optimal usage for low levels of organic contamination, or Type VPR quality controlled reactivated grade vapor phase carbon for a more economical carbon product for general air treatment.

Features

The PROTECT V vapor phase carbon adsorber canisters offer several important features that make it an effective value driven option for higher pressure air or vapor phase treatment applications:

- Sturdy carbon steel construction
- Capable of operating up to 15 psig which will manage most vent or higher pressure exhaust fan situations.
- Capable of operating up to 5 inches of Mercury vacuum.
- Exterior painted with a durable urethane finish
- Operating temperature up to 200°F
- Top 16 inch diameter access port for activated carbon media fill and removal
- Carbon bed support across the full canister cross sectional area, consisting of 20 mesh type 316 stainless steel screen placed on slotted steel plate for vapor distribution across the entire bed for maximum activated carbon utilization and low pressure drop.
- Top lifting lugs and bottom fork guides for portability



Specifications

Canister	Sturdy $\frac{3}{16}$ " thick carbon steel canister with $\frac{3}{16}$ " thick steel concave bottom head (inside flat bottom) and top dished head
Pressure	Recommended 15 psig maximum operating pressure (shop hydrotested in excess of recommended pressure)
Vacuum	Recommended maximum 15" Hg vacuum operation
Temperature	Recommended 200°F maximum
Internal coating	None – unfinished steel
External Coating	Direct-to-Metal polyurethane
Inlet (bottom side)	6" FPT coupling (shipped with plug)
Inlet distributor	Stainless steel screen bed support on slotted steel plate
Vent / sample port	$\frac{3}{4}$ " FPT coupling
Outlet (top side)	6" FPT coupling (shipped with plug)
Drain	$\frac{3}{4}$ " FPT coupling with $\frac{3}{4}$ " threaded plug
Access Port	16" diameter access port with threaded clamp ring and BUNA-N gasket.
Dimensions	Refer to Model chart

PROTECT V Carbon Adsorber Canisters



Installation

PROTECT V canisters are shipped ready for installation with the dry activated carbon fill installed in the unit. The canisters are self supporting and should be set on a level accessible area as near as possible to the emission source. Standard installation does not utilize any anchoring devices. Installation is simple, requiring a flexible hose, duct or pipe to connect the vent or emission source to the 6 inch FPT bottom inlet of the canister.

The PROTECT V canister's treated air discharge is a 6 inch FPT connection on the upper side of the vessel and can be left open or equipped with flexible hose, duct or pipe to direct the treated air to a desired discharge point. If the canister is located outside and to be vented directly, then a U-shaped outlet pipe or rain hat (such as a pipe tee) is recommended to be installed to prevent precipitation from entering the unit.

The recommended air flow for the PROTECT V canisters are listed in the table. If higher flows are anticipated, then either a larger canister should be utilized or two or more PROTECT V canisters can be placed in parallel operation.

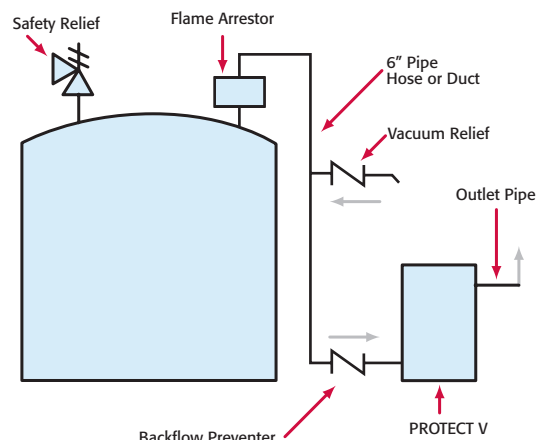
The recommended maximum static pressure and vacuum capabilities are also listed. These ratings should not be exceeded, as the canister could be irreparably damaged.

PROTECT V canisters can be used to treat vents directly from storage tank or other process vessels. The motive force for the air or vapor can be produced by either a blower or by using the positive pressure inside the tank or process vessel. In many cases, the pressure or surge of pressure within the tank or vessel is sufficient to overcome the pressure drop across the canister, thus eliminating the need for a blower. Please consult the pressure drop data in this bulletin for more information.

When PROTECT V canisters are used to control vapors from organic solvent storage tanks, refer to the typical installation drawing in the bulletin and the following recommended precautions:

- A safety relief valve must be provided on the storage tank. This protects the storage tank should the canister become plugged or blocked in any fashion. Such a vent would open in an emergency situation, thereby relieving pressure within the storage tank.
- Under appropriate conditions, a flame arrestor and/or backflow preventer must be installed as shown in the typical installation drawing. This prevents backflow of air through the canister when the storage tank is being emptied.
- High organic compound concentration in the vented air or vapor – defined as being greater than 0.5 to 1.0 volume % - may cause an elevated heat of adsorption in the carbon bed. This effect can be dissipated by pre-wetting the carbon to provide a heat sink, adding dilution air to the vented air or vapor to reduce the concentration, or by adding water spray to the vented air or vapor to provide an ongoing heat sink.

Typical PROTECT V Installation at Storage Tank



If PROTECT V canisters are used to control organic compound emissions from air-strippers, soil venting or other high moisture content air or vapor streams, then it is recommended that the humidity in the air stream be reduced to under 50%. High humidity may cause water vapor to condense within the carbon pores, filling the pores with water and preventing the air or vapor with organic contamination from accessing the internal surface of the activated carbon where adsorption takes place. Therefore, lower humidity will optimize the adsorptive capacity of the activated carbon. Also, for applications that may carry condensed water, it is recommended to install a drain or condensate trap on the inlet duct or piping.

Carbon Exchange or Replacement

When the treated air or vapor exceeds the desired contaminant concentration, the granular activated carbon in the PROTECT V canister should be replaced with fresh activated carbon. The canister is to be isolated from the process by either closing and locking the inlet and outlet valves, or physically disconnecting the canister from the inlet and outlet pipe or hose. The carbon exchange procedure can either take place where the canister is installed, or the disconnected canister can be moved to another location for this activity.

The spent granular activated carbon can be removed by using a vacuum media removal procedure through the top access port. Fresh granular activated carbon can be filled using bags or "supersacks" by loading into the canister through the top access port. Once the fresh carbon is installed, the access port securely closed, and the inlet and outlet connections are reestablished, follow the procedures under the Installation section.

Contact Calgon Carbon Corporation for resupply of the carbon products for effective air or vapor treatment. Calgon Carbon Corporation can also provide complete turnkey services, including removal and management of the spent carbon and refilling the canister with the fresh carbon.

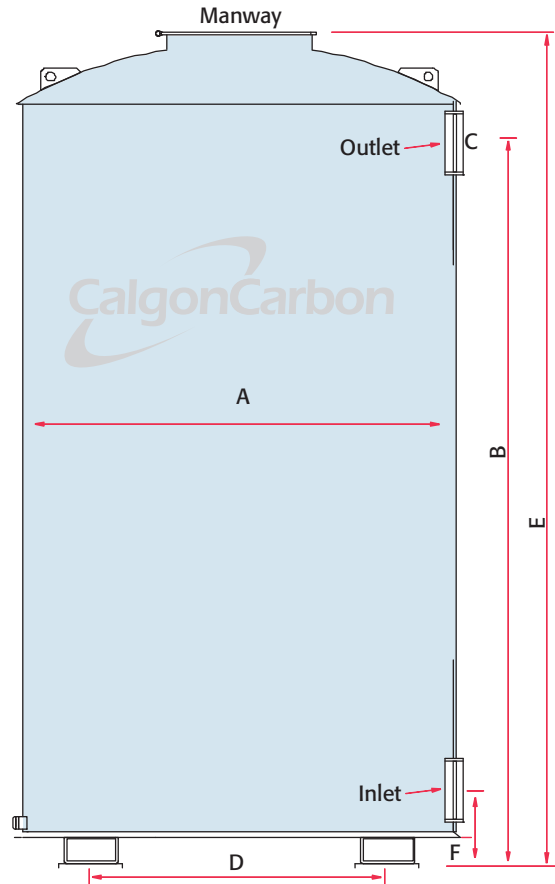
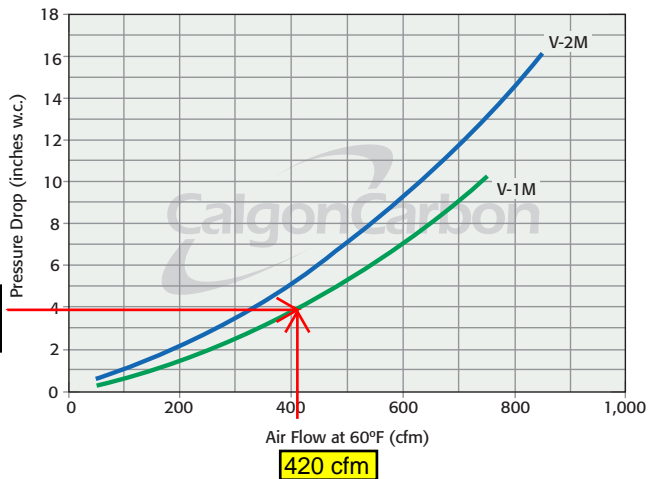
PROTECT V

Carbon Adsorber Canisters

Pressure Drop Curve

Pressure drop through a PROTECT V canister is a function of the process air flow as shown in the graph. If higher flows or lower pressure drop is needed, multiple canisters can be installed in parallel operation. The maximum pressure in the canister should not exceed 15 psig, regardless of the pressure drop across the unit.

Pressure Drop Curve



Drawing not to scale.

Calgon Carbon Air Purification Systems

The PROTECT V canisters are designed for a variety of higher pressure air or vapor applications at low to moderate air flows. Calgon Carbon Corporation offers a wide range of carbon adsorption systems and services for a range of air or vapor flow rates and carbon usages to meet specific applications.

Model Information

Model Number	V-1M	V-2M
GAC or media volume (cu ft)	36	72
GAC amount (pounds)	1000	2000
Recommended max flow rate (cfm)	675	750
Weight, empty (pounds)	1000	1150
Approximate operating weight (pounds)	2000	3150
Diameter (A) in.	45.5	48
Height to outlet (B) in. (approx)	70.5	82.5
Inlet /Outlet (C) fpt, in.	6	6
Forkguides (D) in.	33	33
Overall Height (E) in. (approx)	84	96
Height to inlet (F) in. (approx)	8	8
Overall width; in. (approx)	45.5	48

PROTECT V

Carbon Adsorber Canisters



Safety Considerations

While complying with the recommended installation instructions, plant operators should also be aware of these additional heat-related safety considerations:

- When in contact with activated carbon, some types of organic chemical compounds, such as those from the ketone and aldehyde families and some organic acids or organic sulfur compounds, may react on the carbon surface causing severe exotherms or temperature excursions. **If you are unaware or unsure of the reaction of an organic compound on activated carbon, appropriate tests should be performed before placing a PROTECT V canister in service.**
- Heat of adsorption can lead to severe temperature excursions at high concentrations of organic compounds in the inlet air or vapor. Heating may be controlled by diluting the inlet air or adding water vapor as a heat sink, by time weighting the inlet concentration to allow heat to dissipate, or by pre-wetting the carbon.
- **Do not use PROTECT V canisters with ST1-X carbon in petrochemical or chemical industry applications.**
- ST1-X carbon can liberate heat by reacting chemically with oxygen. To prevent heat buildup within a canister, the carbon must not be confined without adequate air flow to dissipate the heat. In situations where there is insufficient or disrupted air flow through the vessel, the chemical reaction can be prevented by sealing the inlet and outlet connections to the canister.
- For temperatures greater than 140°F, Calgon Carbon recommends that personnel protection be provided. The form of protection is determined per the end users specific plant practices and standards. Also note that at elevated temperatures, the paint may discolor.

Safety Message

Activated carbon will preferentially remove oxygen from air. In closed or partially closed containers or vessels, oxygen depletion may reach hazardous levels. If workers are to enter a container or vessel containing activated carbon, appropriate air sampling and work procedures for potentially low oxygen content spaces should be followed, including all applicable Federal and State requirements.

Warranty

Calgon Carbon Corporation warrants that the PROTECT V canister will be free from defects in materials and workmanship for a period of 90 days following the date of purchase. In the event of a breach of this warranty, Calgon Carbon Corporation will, in its discretion, repair or replace any defective parts or the complete unit during the warranty period. This warranty does not apply to defects caused by (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the PROTECT V canister in a manner for which it is not designed, (v) external causes such as, but not limited to, power failure or electrical power surges, or (vi) improper storage and handling of the PROTECT V canister. **Except as expressly provided in this warranty statement, Calgon Carbon Corporation disclaims all other warranties, whether express or implied, oral or written, including without limitations all implied warranties or merchantability or fitness for particular purpose. Calgon Carbon Corporation does not warrant that the PROTECT V canisters are error-free or will accomplish any particular result. Any advice or assistance furnished by Calgon Carbon Corporation in relation to the PROTECT V canister provided for hereunder shall not give rise to any warranty or guarantee of any kind. This warranty will take precedence over any and all other warranties unless specifically disclaimed and referenced by Calgon Carbon Corporation.**

Limitations of Liability

Calgon Carbon Corporation's liability and the Buyer's exclusive remedy for any cause of action arising out of this transaction, including, but not limited to, breach of warranty, negligence and/or indemnification, is expressly limited to a maximum of the purchase price of the canister sold hereunder. All claims of whatsoever nature shall be deemed waived unless made in writing within forty-five (45) days of the occurrence giving rise to the claim. Under no circumstance shall Calgon Carbon Corporation be liable for any incidental, consequential, punitive, exemplary, or special damages of any kind arising as a result of or in connection with the PROTECT V canisters regardless of the cause giving rise to any claim. Nor shall Calgon Carbon Corporation be liable for loss of profits or fines imposed by governmental agencies. In no event shall Calgon Carbon Corporation's liability exceed the purchase price paid by purchaser, for any reason, whether by reason of breach of contract, tort, indemnification, warranty or otherwise. This limitation of liability statement will take precedence over any and all other liability provisions unless specifically disclaimed and referenced by Calgon Carbon Corporation.



Making Water and Air Safer and Cleaner

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Your local representative



Contents:
Liquid Filters
Vapor Filters
Filtration Media
<ul style="list-style-type: none"> • Anthracite • Birm® • Re-Activated Carbon • Virgin Carbon • EC-100® • Filter-Lite • Manganese Greensand • MTBE Removal Carbon • Filter Sand
Special Products

FILTRATION MEDIA :
~~8x30 RE-ACTIVATED CARBON~~
4x10 RE-ACTIVATED CARBON

GENERAL DESCRIPTION

Select Re-Activated carbon from domestic sources is quality screened during our purchasing process for activity, density and fines. The use of re-activated carbon is recommended as a lower cost alternative for most sites where drinking water quality is not necessary. In many cases our re-activated carbon meets and exceeds imported virgin carbon. In addition all carbon either sold by itself or installed in our filtration units is traced by lot number to the installation or sale.

8x30 (Liquid Phase) Standard Specifications:	Standard	Value
Iodine Number	ASTM D-4607	800 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	8x30 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

4*10 (Vapor Phase) Standard Specifications:	Standard	Value
Carbon Tetrachloride Activity Level	ASTM D-3467	40 Minimum
Moisture Content	ASTM D-2867	5% Maximum (as packed)
Particle Size	ASTM D-2862	4x10 US Mesh
Ash		10% Maximum
Total Surface Area (N2BET)		1050 Minimum
Pore Volume (cc/g)		0.75

Packaging:		
50 Pound Bags	50 Pound Drums	Bulk Tanker
1,000 Pound Bulk Sacks	200 Pound Drums	

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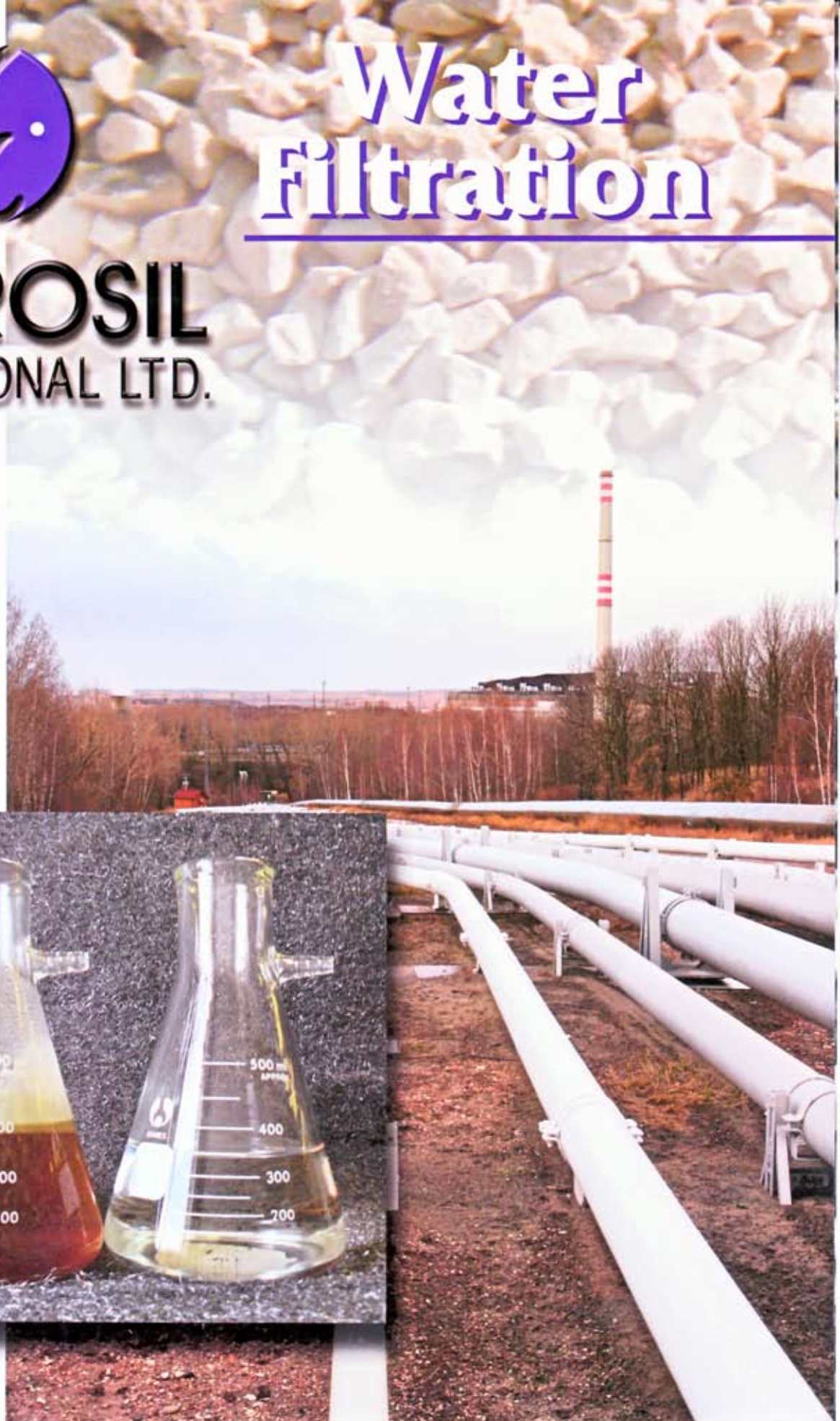
Tetrasolv Filtration, Inc. • 1200 East 26th Street • Anderson, Indiana 46016 • USA
 Toll Free: 800-441-4034 Telephone: 765-643-3941 • Fax: 765-643-3949
www.tetrasolv.com • info@tetrasolv.com





Water Filtration

HYDROSIL
INTERNATIONAL LTD.



The Media Is The Key....

The KEY

to successful water treatment and filtration is selecting the right combination of media and hardware. For treatment of hydrocarbons, heavy metals, and other organic contaminants, the optimal solution is efficient oil and water separation followed by the HS-200 series. Because HS-200 series can adsorb up to 70% of its weight in hydrocarbons, its life inside a still bed canister is much longer than that of other process media such as granular activated carbon.

HS-200 KING OF LIQUID FILTRATION

- NO SWELLING UPON WATER EXPOSURE
- MORE ACTIVE INGREDIENTS PER CUBIC FOOT THEN OTHER ORGANOCCLAYS
- CAN BE USED AT FULL STRENGTH OR CUSTOM BLENDED
- PROLONGS LIFE OF ACTIVATED CARBON AND RESINS THEREBY REDUCING COSTS AND INCREASING EFFICIENCY
- COST EFFECTIVE AND ENVIRONMENTALLY SOUND TECHNOLOGY

HYDROSIL INTERNATIONAL LIMITED

is a modified Zeolite provider setting new standards in economical water treatment, including treatment of processed water and wastewater. Hydrosil's corporate headquarters and manufacturing facilities are located in Elgin, IL. With over 16 years of filtration experience, we specialize in our own Zeolite based organoclay products called HS-200.

ZEOLITE BASE

Zeolite is the base of our filtration media. Zeolite belongs to a family of naturally occurring volcanic minerals with unique physical and chemical characteristics. Generally speaking, natural zeolites are hydrated aluminosilicates. They consist of an open, three-dimensional cage-like structure and a vast network of open channels extending throughout. Loosely bound, positively charged atoms called cations are attached at the junctures of the negatively charged aluminosilicate lattice structure. Zeolite has a crystalline structure (similar to a honeycomb) consisting of a network of interconnected tunnels and cages. Zeolite has a high specific surface area; it's rigid framework eliminates shrinking and swelling. Perhaps the most commercially valuable and dynamic property of zeolite is its cation exchange capacity. The most common exchangeable cations found in zeolite molecules are ammonia, sodium, calcium, potassium, and magnesium, many which are desirable in numerous biological and industrial processes. The ability to release beneficial elements while capturing and binding other, often less desirable, materials makes zeolite an ideal media for selective adsorption of certain elements and compounds from soil, water and air.

The cornerstone of Hydrosil International's success is the HS-200 series, the future of Zeolite based organoclays. Our proprietary modification process transforms high-grade Zeolite into a powerful, selective water treatment adsorbent that bonds with hydrocarbons, organics and other contaminants upon contact, locking them inside its molecular structure. Hydrosil's Contaminant Encapsulation Technology yields a granular filtration media capable of adsorbing approximately 70% of its weight in hydrocarbons. Extensive application use and field testing of the HS-200 series, analyzed by independent laboratories, has demonstrated removal of a wide range of contaminants to nondetectable levels. The resulting discharge water meets or exceeds typical regulatory requirements.



HS-200 Applications

HS-200 series has been used against a wide array of industrial waste streams:

- Creosote Plants
- Wood Processing
- Pulp and Paper Mills
- Carbon Black Plants
- Oil Production
- Firefighting Academy
- Industrial Laundry Services
- Shipyards
- Plastic Manufactures
- Tank and Storage Vessel Cleaning
- Pesticide Manufacturers
- Condensate Systems
- Pipeline Pressure Testing Runoff
- Industrial Water Runoff



The HS-200 Series Blends

HS-250 a blend of HS-200 and 8x30 Anthracite Coal

- Contains 66% more active ingredient per cubic foot than activated clays on the market

HS-250-AC a blend of HS-200 and 6x12 Virgin Activated Carbon

- This blend is the best of both worlds with the added benefits of Virgin Activated Carbon

HS-270 a blend of HS-200 and 8x30 Anthracite Coal

- Was created to be a 1 to 1 replacement for Organoclays/Activated Clays on the market that have swelling issues

HS-200 Series, the Results Are In

The following Constituents have had a 95%+ Reduction when treated with the HS-200 series

Acenaphthene	Chrysene	PCP (Pentachlorophenol)
Acenaphthylen	COD's	Phenanthrene
Ammonia	Copper	Phenolics (recoverable)
Anthracene	1,1 Dichloroethane	Pyrene
Arsenate	1,2 Dichloroethene	Selenate
Arsenic	1,4 Dioxane	TCE (Trichloroethylene)
Benzo (a) Anthracene	Fluoranthene	TOC (Total Organic Compounds)
Benzo (b) Fluoranthene	Fluorene	Total Phosphorous
Benzo (a) Pyrene	Gasoline Range Hydrocarbons	TPH (Total-Petroleum Hydrocarbons)
Benzo (g,h,i) Perylene	Lead	TSS's
BOD's	Mercury	Vinyl Chloride
BTEX	2-Methylnaphthalene	Zinc
Cadmium	Motor Oil	
4-Chloro-3-Methylphenol	Naphthalene	
Chromate	Nickel	
Chromium	Oil and Grease	

HS-200 Series Versatility

- **Free Standing Mode:**
Used on its own, HS-200 series can be loaded in drums for use as an efficient stillbed filtration medium. Other applications include tank cleaning, oil spill mitigation, and lining/capping projects.
- **Pre-Treatment Mode:**
HS-200 Series can be used upstream to enhance the performance and extend the useful life of other filtration processes and media such as reverse osmosis, activated carbon and resins.
- **Post-Treatment Mode:**
HS-200 Series utilized downstream of an oil-water separator or coalesce filter, has the ability to act as an effective cleaning and polishing agent.

Application Parameters:

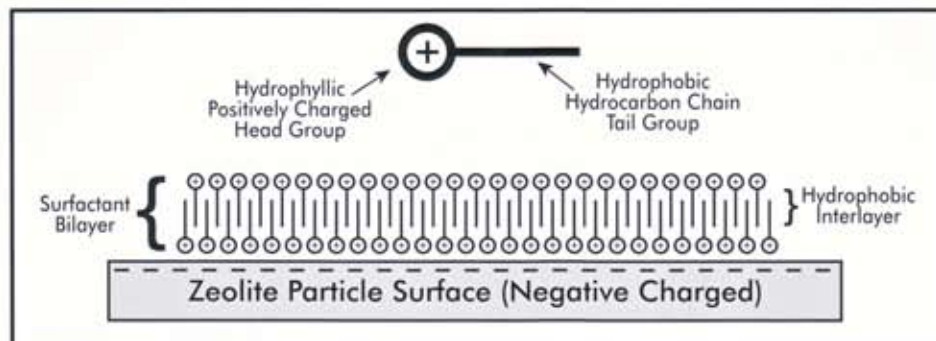
Bulk Density: 58 lbs/Ft³ (928 kg/M³)

10 - 15 minutes depending on solubility of contaminant(s) to be removed.

Temperature Range: 33 - 170 F^o (1 - 77 C^o)

pH Range: 4 - 10

Pre-treatment prior to activated carbon and ion exchange resin columns; Pre-treatment for RO systems; Polishing for oil and water separators and DAF units.



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INTERNATIONAL LTD.

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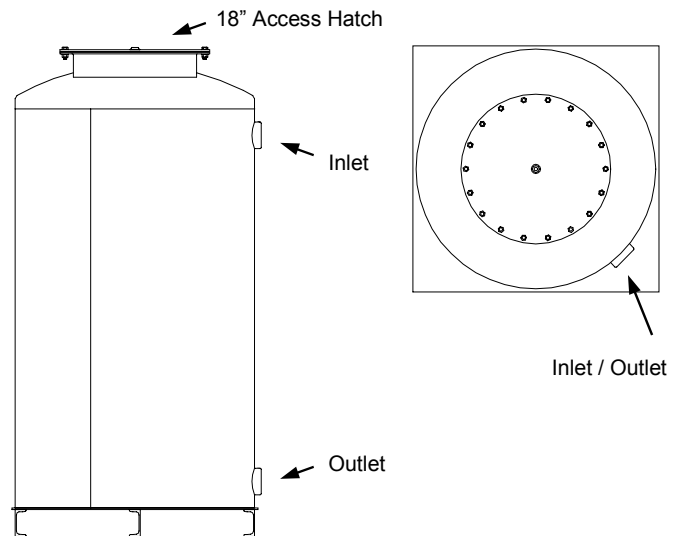
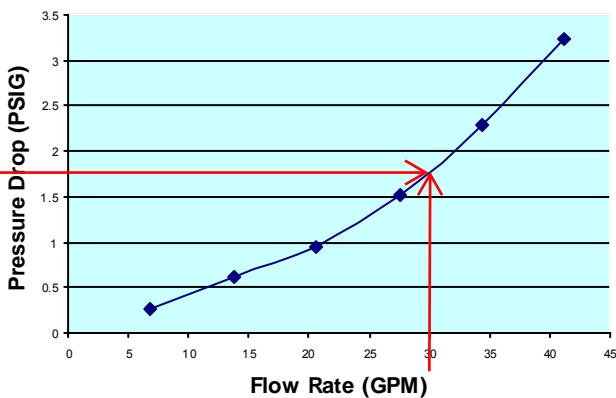
phone: 1-847-741-1600
phone: 1-800-PURPLE.1
Hydrosilintl.com

The AF-500 filter is a media filter vessel designed to treat liquid streams. While the typical design application is a activated carbon adsorbtion unit, the filter can easily accommodate many medias. Some applications include:

- Dissolved Organic Removal (Activated Carbon)
- Suspended Solids Removal (Sand Filter)
- Dissolved Minerals (Softener Resin)
- Oil and Grease Removal (Organo-Clays)
- Dissolved and Precipitated Metals Removal
- Special Organics (Resin/Carbon Blend)
- Catalytic Reactor (Chlorine and Peroxide Removal)
- Bio-Remediation Contactor Unit



PRESSURE DROP GRAPH
(As Filled - 8*30 GAC)



AF-500 SPECIFICATIONS			
Overall Height	5'2"	Vessel/Internal Piping Materials	CS (SA-36) / SCH 40 PVC
Diameter	30"	Internal Coating	Coal Tar Epoxy Resin
Inlet / Outlet (FNPT)	2"	External Coating	Epoxy Mastic
Drain / Vent (FNPT)	OPT / 1/4"	Maximum Pressure / Temp	40 PSIG / 140° F
GAC Fill (lbs)	500	Cross Sectional Bed Area	4.9 FT ²
Shipping / Operational Weight (lbs)	875/1,765	Bed Depth/Volume	3.4 FT / 16.7 FT ³

Project #: 60216659-03
 Client: Textron Inc
 Site: Providence, RI
 Subject: IX Resin Usage

Page: 1 of 2
 Date: October 17, 2012
 By: David Macone, PE
 App.: _____



IX Resin Usage Calculation

IX Resin Usage Assumptions:

Data used to generate the IX resin usage rate was procured from the following sources:

- 1) Referred to the Expected System Influent Concentrations Summary Tables.
- 2) Hydrosil International LTD, has recommended that the modified zeolite, will remove 1% by weight.

Metals Expected Concentrations

	Expected		Maximum	
	Avg	Max	Avg	Max
Pumping Rate (gpm):	18		30	
Silver (µg/l):	0.75	1.00	0.75	1.00
Copper (µg/l):	69.00	77.40	54.15	77.40
Total Iron (µg/l):	90.61	179.78	85.82	163.82
Nickel (µg/l):	23.88	37.55	23.88	37.55
Lead (µg/l):	10.00	14.17	10.56	14.30
Zinc (µg/l):	38.90	55.22	34.65	49.59

Note: The Air Stripper is expected to remove a minimum of 20% of the Total Iron, therefore the expected influent concentrations have been adjusted.

Metals Loading

	Expected		Maximum	
	Avg	Max	Avg	Max
Pumping Rate (gpm):	18		30	
Meals Loading Rate (# per day):	0.050	0.079	0.076	0.124

Project #: 60216659-03
Client: Textron Inc
Site: Providence, RI
Subject: IX Resin Usage

Page: 1 of 2
Date: October 24, 2012
By: David Macone, PE
App.: _____



IX Resin Duration to Exhaustion

IX Resin Weight: 750 # of modified zeolite
1% Removal per #: 7.5 # of metal removed
Safety Factor: 0%

	Expected		Maximum	
Pumping Rate (gpm):	18		30	
	Avg	Max	Avg	Max
Days to Exhaustion:	148.7	95.0	99.2	60.5

See Attachments