

**DRAFT**  
**REMEDIAL ACTION WORK PLAN**

**PHASE I SOIL CAPPING: PARCEL D**  
**FORMER GORHAM MANUFACTURING FACILITY**  
**333 ADELAIDE AVENUE**  
**PROVIDENCE, RHODE ISLAND**

**FEBRUARY 2012**



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**PROVIDENCE, RHODE ISLAND**

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## ACRONYMS

ABB-ES	ABB Environmental Services
AMEC	AMEC Environment & Infrastructure, Inc.
COPC	Constituents of Potential Concern
1,2-DCE	1,2-dichloroethene
ELUR	Environmental Land Usage Restriction
HLA	Harding Lawson Associates
LOW	Limit of Work
MACTEC	MACTEC Engineering and Consulting, Inc.
µg/kg	Micrograms per Kilogram
mg/m <sup>3</sup>	Milligrams per Cubic Meter
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PAH	Polynuclear Aromatic Hydrocarbons
PCE	Tetrachloroethene
PEL	Permissible Exposure Limit
PNOC	Particulates Not Otherwise Characterized
PRA	Providence Redevelopment Agency
RAWP	Remedial Action Work Plan
RDEC	Residential Direct Exposure Criteria
RIDEM	Rhode Island Department of Environmental Management
SI	Site Inspection
SMP	Soil Management Plan
SPLP	Synthetic Precipitation Leaching Procedure
SSIR	Supplemental Site Investigation Report
SVOCs	Semi-volatile Organic Compounds
1,1,1-TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TEQ	Toxic Equivalence
TEXTRON	Textron, Inc.
TPH	Total Petroleum Hydrocarbons
TSDF	Treatment Storage and/or Disposal Facility

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

USEPA United States Environmental Protection Agency

VOCs Volatile Organic Compounds

## 1.0 INTRODUCTION

The Former Gorham Manufacturing Facility is located at 333 Adelaide Avenue, Providence, Rhode Island (Figures 1 and 2). The focus of this Remedial Action Work Plan (RAWP) is Phase I of Parcel D (the Site) (Figure 3). This RAWP provides details for the preferred remedial alternative as specified in the Program Letter issued May 18, 2011 (RIDEM, 2011a), and Remedial Decision letter dated December 12, 2011 (RIDEM, 2011b) for Case No. 2005-059 by the State of Rhode Island Department of Environmental Management (RIDEM) for Phase I of Parcel D. This RAWP incorporates the approved response to comments generated from the public meeting held on July 12, 2011.

Supplemental site investigation activities were conducted between December 2005 and February 2007 to support completion of a human health and ecological risk assessment for Parcel D, including Mashapaug Cove (MACTEC Engineering and Consulting, Inc. (MACTEC), 2006 and 2007). Based on the results of these sampling events, soils exhibiting contaminant concentrations exceeding RIDEM Residential Direct Exposure Criteria (RDEC) for metals, polynuclear aromatic hydrocarbons (PAHs), and dioxin require capping as detailed in this RAWP. This RAWP has been prepared pursuant to Section 9.0 (Remedial Action Work Plans) of the RIDEM *Rules and Regulations for the Investigation and Remediation of Hazardous Materials Releases* (hereafter referred to as the Remediation Regulations) on behalf of Textron, Inc. (Textron) by AMEC Environment & Infrastructure, Inc. (AMEC) (formerly known as MACTEC).

A phased approach to capping Parcel D was developed such that the area along Mashapaug Pond and Cove west and north of the Alvarez High School (Figure 2) would be addressed first, followed by remaining areas of Parcel D, including Mashapaug Cove (Phase II) and the northern portion of Parcel D (Phase III). This RAWP details the work to be performed for the Phase I Cap Construction. Phase II Mashapaug Cove sediment remediation and Phase III Soil Capping will be detailed under separate RAWPs.

### 1.1 Property and Site History

The Former Gorham Manufacturing Facility is a 37-acre parcel of land where Gorham Silver engaged in the manufacture of silverware, both sterling and plated, and bronze castings from approximately 1890 to 1985 (Figure 1). Operations included casting, rolling, polishing, lacquering, forging, plating, annealing, soldering, degreasing, machining, and melting. Vapor degreasers reportedly used trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (1,1,1-TCA). More recent Site conditions are shown in the aerial photograph in Figure 2. In this figure, the Site is located immediately north of Adelaide Avenue and west of the railroad tracks. The former manufacturing facility has been razed. A retail development has been completed on the southeastern portion (Parcel A). A public high school (Alvarez High

School) has been constructed on a second parcel (Parcel B). A grassed lawn area/open space and parking lot is proposed for Parcel C by the City of Providence.

## 1.2 Physical Setting

The 333 Adelaide Avenue property is bordered to the east by railroad tracks (Figure 2). Adelaide Avenue and a residential neighborhood bound the 333 Adelaide Avenue property to the south. To the north and west, the Site is bounded by Mashapaug Pond. Parcel D constitutes the northern portions of the 333 Adelaide Avenue property. On the opposite (northern) shore of Mashapaug Pond is an industrially-zoned area.

Parcel D has been divided into three areas moving from west to east for the purposes of physical description. Phase I capping will be conducted within the western and central areas. Phase III capping will address contamination in the third (eastern) area of Parcel D. Phase II remediation of Parcel D will address Mashapaug Cove.

The first of these areas is the portion of the parcel extending from the southwestern property boundary (Adelaide Avenue/Crescent Street) to the tip of the western peninsula that bends into Mashapaug Pond. This area is heavily wooded with moderate to steep slopes that descend to the Pond. Limited areas along the western shoreline contain industrial fill material (Figure 3). There is no historic information or current visual evidence that would suggest that the remaining portion of the parcel was subject to other industrial uses. There are structures present which based on historic maps, were used for water extraction purposes associated with the former facility's fire suppression system and/or process water.

The second (central) area is the portion that borders the southern shore of Mashapaug Cove. This area includes a steep wooded embankment that leads down to wooded lowland that is adjacent to the cove. A slag pile previously located in the central portion of this area was removed from the property by Textron in July 2006 (Figure 3). Post-excavation confirmatory soil sampling was conducted, indicating isolated exceedances of Remediation Regulation Direct Exposure Criteria. AMEC (formerly MACTEC) submitted a September 2006 *Slag Removal Action Summary Report* to the Consent Order parties summarizing analytical results and the excavation activities completed to date (MACTEC, 2006).

The embankments along the southern end of Mashapaug Cove are underlain by heterogeneous fill, consisting of granular reworked soils with varying amounts of casting sands and construction, demolition, and miscellaneous debris such as fire brick, old wood beams, and metal debris. The fill varies in thickness from one-foot at the northern edge of the former West Parking area (former facility area) to approximately 20-feet along the embankment north of the high school parking lot (Figures 3 and 4). Several historic groundwater well structures that were formerly used for industrial and/or fire suppression purposes are present near the southwestern shore of the cove.



The third portion of the parcel lies to the northeast. It borders the cove and pond and includes the eastern shore of Mashapaug Cove, a steep hill to the east, and a flat upland area that formerly housed an employee recreational building (known as the ‘Casino’) and associated parking lots. In addition, in the northeast corner of the Site is a plot of land that is in active use by the Amtrak High Speed railroad. Also a garage or carriage house was formerly located in the upland area in the northeast corner of the parcel. This structure burned down approximately two years ago. . There is an approximately 30-foot difference in elevation between the former manufacturing facility upland parcel and the shoreline of Mashapaug Cove.

A large portion of Parcel D is currently wooded and heavily vegetated. The Western Peninsula has variable elevation and is a wooded environment. The peninsula is accessible via one or more paths. The tip of the peninsula is relatively open compared to the wooded areas adjacent to it. The Cove shore area is a small, relatively flat area at the bottom of the embankment and is vegetated with brush and saplings. There is a very steep embankment between the developed portion of the property to the south of the Parcel D and the shore of Mashapaug Cove. The Eastern Peninsula has trees and vegetation, but is generally more open and accessible than the areas immediately to the south of Mashapaug Cove. The uplands portion of the Site is currently enclosed by a chain-link fence.

### **1.3 Regulatory Background and Previous Investigations**

Environmental investigations have been carried out at the 333 Adelaide Avenue property beginning in 1985. RIDEM completed a United States Environmental Protection Agency (USEPA) Potential Hazardous Waste Site Identification Form in 1987 in response to a complaint by the Providence Police Department. This occurred after the facility ceased operations in 1986. RIDEM completed a Preliminary Assessment (PA) of the 333 Adelaide Avenue property in 1989 which designated the property as a Medium Priority for a Site Inspection (SI). A SI Report was prepared by Camp Dresser & McKee in 1993 under contract to RIDEM. The SI recommended further investigation of the property. ABB Environmental Services (ABB-ES), subsequently, Harding Lawson Associates (HLA and Harding ESE), MACTEC (now AMEC) completed several environmental investigations on behalf of Textron since 1993.

In 1995, a Remedial Investigation Report (ABB-ES, 1995a) and a Supplemental Remedial Investigation Report (ABB-ES, 1995b) were prepared to assess site conditions, including portions of Parcel D. The results of the earlier investigations (circa 1986 to 1995) were summarized in the Remedial Investigation Report.

A Supplemental Investigation Report (HLA, 1998) was prepared in 1998 for the Site. In 1999 a Site Investigation Summary Report and Risk Assessment (HLA, 1999) was prepared and submitted to RIDEM that addressed the entire 333 Adelaide Avenue property. This report was formally approved by RIDEM in a June 15, 2001 RIDEM Remedial Decision Letter. In April

2001, Harding ESE (now AMEC), prepared and submitted to RIDEM on Textron's behalf the *Remedial Action Work Plan, Former Gorham Manufacturing Facility, Providence, Rhode Island*.

In November 2002, MACTEC (now AMEC) submitted a Method 3 Risk Assessment Work Plan (MACTEC, 2002) to RIDEM to assess the proposed redevelopment of the undeveloped portion of the 333 Adelaide Avenue property (Parcel D) as a park with walking trails. Following review comments from RIDEM in September 2003, MACTEC submitted the *Method 3 Human Health Risk Assessment – Park Parcel* (MACTEC, 2004) to RIDEM in August 2004. No comments were received on this submittal.

Soil conditions at selected locations within the Site, material from the slag pile, and sediment conditions at selected locations in Mashapaug Cove were investigated in December 2005 on RIDEM's behalf and are documented in a Site Investigation Report submitted by Fuss & O'Neill, Inc. to RIDEM in April 2006. Surface soil sampling was also conducted by MACTEC in 1994, 1998, 2001, 2002, 2006 and 2007, including both surface soils and surface sediment found in erosion channels along the bank that leads into the Cove. The 1998 surface soil analytical results for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals are presented in the *Supplemental Site Investigation Report, Proposed Park Subdivision, Former Gorham Manufacturing Facility, 333 Adelaide Avenue, Providence, Rhode Island* (HLA, 1998). Additional surface soil sampling was conducted along the bank of the Cove in 2001 and 2002 by MACTEC. This soil sampling program is summarized and results are presented in the *Method 3 Human Health Risk Assessment – Park Parcel* (MACTEC, 2004). Soil sampling for metals and dioxin along the western side of Parcel D is summarized and results are presented in the Supplemental SIR Addendum (MACTEC, 2006 and 2007).

The previous environmental investigations have demonstrated that soil at the 333 Adelaide Avenue Property, particularly the former manufacturing facility parcel, has been impacted by historical industrial operations. Constituents of potential concern (COPC) in soils at the Site include VOCs (principally the chlorinated hydrocarbons TCE, PCE, and 1,1,1-TCA and their degradation products 1,2-dichloroethene (1,2-DCE) and vinyl chloride), SVOCs (principally PAHs), metals (primarily arsenic, copper, and lead), dioxin, and TPH. The south bank of the Cove is an area of exposed fill material. Variable concentrations of VOCs, PAHs, metals and TPH were reported to be associated with these fill materials.

The available information indicates that limited manufacturing activities (other than withdrawal of groundwater for use in manufacturing operations and the operation of Building V) were conducted within the Phase I Parcel D area. A portion of Building V, the former smelting building, was within Parcel D and the former slag pile was associated with that building. The data suggest that impacted fill from the former manufacturing facility parcel impinges upon the westerly and southerly portions of Parcel D. That fill material generally contains metals and PAHs.

Constituents detected in sediments and surface soils adjacent to the Cove include TPH, SVOCs, VOCs, metals, and dioxins. Sediment samples from drainage swales and erosion channels that serve as a pathway for the discharge into Mashapaug Cove showed sporadic detections of SVOCs, TPH, and some metals. Surface soil samples from low lying areas adjacent to the Cove also showed some detections of metals.

Based on discussions with RIDEM and comments received on earlier reports and Work Plans, MACTEC prepared a Supplemental SI Work Plan in June 2006. On July 31, 2006 MACTEC submitted a *Supplemental Site Investigation Report* (SSIR) to RIDEM. Section 6.0 of the 2006 SSIR proposed three remedial alternatives to address soil contamination. On June 28, 2007 MACTEC submitted an addendum to the SSIR to RIDEM (MACTEC, 2007). The SSIR Addendum detailed compliance sampling performed in February 2007 and the analytical results. These results, together with a site walk of RIDEM and MACTEC in August 2010, and other soil sampling outside the proposed Phase I cap supported the regulatory compliance of the preferred remedial alternative (see Section 4.0). This RAWP details the approach for Phase I soil capping following applicable RIDEM regulations as specified in the Program Letter issued May 18, 2011 (RIDEM, 2011a), and Remedial Decision letter dated December 12, 2011 (RIDEM, 2011b).

#### **1.4 Phased Approach**

A phased remediation approach has been developed for the Parcel D (Figure 3). Phase I will occur first and is scheduled to begin in the spring of 2012. It includes the portion of Parcel D along Mashapaug Pond and Cove west and north of the Alvarez High School (Parcel B) and the proposed open space/fields (Parcel C). Work on the Phase I soil cap will proceed from west to east going away from the school. Phase II consists of Mashapaug Cove, and Phase III consists of the open area north of the stormwater detention basin. This Phase III area will be used for the staging of materials and equipment necessary to complete Phase I and Phase II activities. This area will be referred to as the “lay down” area for the remainder of this document. Groundwater remediation is also being planned for the former Gorham Site concurrently with the Phase I construction.

Completion of the Phase II cove sediment and wetland remediation work is planned for 2013. The Phase III soil cap will be performed following Phase II. As part of the Phase I remedial activities the existing chain-link fence will be relocated or replaced to run along the Parcel D boundary extending from the southwest corner near Adelaide Avenue along Parcel C and connect to the existing fence at the top of slope behind the high school. The chain-link fence following the upland (southern) portion of Parcel D will be maintained through the completion of Phase III when all soils exceeding RIDEM RDEC have been addressed. Both Phase II and Phase III will be described in detail to RIDEM under separate RAWPs. The purpose of this RAWP is to address the Phase I area only.

## 2.0 LIMITED DESIGN INVESTIGATION

Additional soil test pits and analytical testing is proposed for the former slag pile (Figure 4). This will be used to determine if the proposed geotextile liner and soil cover needs to be extended to address the lead contamination. These activities are described in detail under section 3.1.2. This RAWP also includes Engineered Controls and Institutional Controls.

## **3.0 REMEDIAL OBJECTIVE AND REMEDY**

### **3.1 Supplemental Soil Excavation**

#### **3.1.1 Western Shoreline Soil Excavation**

Concentrations of PAHs, lead and dioxin exceeding RIDEM's applicable cleanup standards were detected in surface soils along the western shoreline of Parcel D. These isolated locations will be excavated and the soil moved to a nearby area of proposed for soil cover as part of Phase I. These soil removal areas include the southwestern corner of Parcel D at SS-210/SS-SI210 (PAHs and lead) within a stormwater drainage ditch (Appendix A, Drawing C-106) and two locations on the western peninsula near SS-206 (lead and dioxin), as shown on Appendix A, Drawing C-101. Soil will be removed from these areas, approximately 10 feet x 10 feet to a depth of one foot below ground surface. Confirmatory soil samples will be collected from the bottom and each sidewall of the excavation areas for comparison to Rhode Island RDEC (Appendix C) for PAHs, metals and risk-based derived dioxin concentration of 0.0043 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ) (July 2006 SIR and June 2007 SIR Addendum). Method detection limits (Appendix D) for the confirmation soil samples will be equal to or below the Rhode Island RDEC.

If necessary, based on initial exceedances at confirmatory sample locations, additional material will be removed and the areas in question and subsequently re-sampled to confirm compliance with the applicable standards. This process will be repeated until compliant sample results are identified. Once these cleanup criteria are met, the three areas will be backfilled with clean material.

The excavated area at SS-210/SS-SI210 will be covered with geotextile fabric and backfilled with stone from the Former Slag Pile stockpile in order to secure this area within the stormwater drainage ditch. The two western peninsula locations will be backfilled with clean soil meeting Rhode Island RDEC criteria. Limited tree clearing will be conducted to access these locations and support the removal of soil and backfill with clean material.

#### **3.1.2 Former Slag Area Removal and Testing**

In response to prior RIDEM comments soil will be excavated at two locations in the former slag pile area (Figure 4) and transported offsite for disposal. Following removal of soil from the two locations, ten test pits will be conducted along the perimeter of the former slag pile removal area and at locations within the former slag pile to determine if additional slag material is present. The proposed test pit locations are shown on Figure 4 and will be coordinated in the field with RIDEM. Confirmatory soil sampling will be conducted at the excavations and test pits for total lead and Synthetic Precipitation Leaching Procedure (SPLP) for metals. This data will be used

to define the full extent of the liner and cap and to determine future soil management requirements, as necessary.

A geomembrane liner is proposed for the cap of this former slag pile area to be protective for the proposed future passive recreational use of Parcel D. The cap in this former slag area is described below in Section 3.3.

### **3.2 Remedial Objective for Soil**

The July 31, 2006, SSIR presented contaminant concentrations in surface soils, sediment, and surface water. As part of the phased-approach, this remedial action will focus solely on surface soil in the Phase I area of Parcel D (Figure 3).

The remedial objectives for the Phase I area work consists of the following:

- contain/consolidate identified areas of solid waste
- prevent direct-contact human exposure to contaminated soil and waste exceeding RIDEM RDEC
- minimize leaching of metals from vadose zone soil to groundwater at the location of the former slag pile.

### **3.3 Preferred Remedial Alternative**

The Phase I remedial action will consist of installation of a soil cap(s) at the approximate locations shown on Figure 3. Cap construction will be modified to result in a low-permeability cap at the former location of the slag pile (Appendix A, Drawing C-105). The soil cap will prevent direct contact exposure, and restrict the potential migration of contaminants through the action of wind erosion and surface run-off into Mashapaug Pond. The low-permeability section of the cap above the former slag area will restrict water infiltration and reduce potential leaching of metals from vadose zone soil to groundwater.

The Phase I soil cap contains three distinct components. These components are color-coded on Figure 3 and include an upland fill area cap, a wetland buffer cap, and a former slag area cap. All components of these caps (imported soil) will be tested to meet RIDEM RDEC. Refer to Figure 5 and Drawing C-503 for cross sections of the cap across Phase I, including grading of slopes that exceed a one-to-three slope. Figure 5 depicts the approximate location of the cross sections and Drawing C-503 depicts typical cross sections of the Phase I cap.

During the construction of the Phase I soil cap, soil thickness will be measured following final grading as a quality control (contractor) and quality assurance (Textron/RIDEM) measure to ensure the proper soil cap has been constructed. Stormwater management will be included

with the construction of the cap to maintain its integrity and recharge stormwater runoff into the buffer zone, wetlands, and Cove.

#### Fill Area Cap

The fill area extends along the top of the western slope and extends along the shoreline of the Mashapaug Inner Cove (Appendix A, Drawings C-104, C-105 and C-106). This fill material was historically characterized through soil borings and test pits and found to contain casting sands, concrete, rubble, and other debris. Soil excavated from SS-210/SS-SI210 will be spread within the southwestern most fill area (Appendix A, Drawing C-106) and capped. Soil removed from the western peninsula will be spread under the fill area cap south of Mashapaug Inner Cove. The fill areas (blue) will be covered with a marker fabric and capped with two feet of clean soil (18" cover soil and 6" topsoil). The finished surface will be seeded or stabilized with erosion control matting. The fill area cap located along Parcels B and C will match the existing grade at the high school and proposed grade at the Parcel C boundaries. Note that the soil cap in the northwest corner of Parcel C has been extended to follow the grade and fill material further down slope to address elevated PAHs, lead and dioxin concentrations within the drainage swale (SS-SI-001) (Appendix A, Drawing C-106). The soil cap along the western shoreline has been extended south to the base of the 24-inch tree (co-located with SS-106) to encompass the historical lead exceedance found in this area (Appendix A, Drawing C-106).

#### Wetland Buffer Cap

As the Parcel D cap abuts the shore of Mashapaug Cove, special considerations for wetlands have been included as part of Phase I. The wetland buffer area consists of the area within 50' of the Inner Cove shoreline. The wetland delineation was completed in May 2007 and reviewed in the field with RIDEM in August 2011.

The wetland boundary is shown on Drawings C-104 and C-105 in Appendix A. The "delineated" wetlands are typically located 5' to 10' upland from the shoreline. Thus, the limit of work (LOW) for Phase I will be along a 10' setback from the shoreline of Mashapaug Cove such that all of the remediation work within the freshwater wetlands will be conducted in the future as part of the Mashapaug Cove sediment remediation (Phase II Parcel D remediation). This will allow for improved access to the wetland area for the capping and construction of a natural transition zone from the wetlands into the Cove. The wetland buffer cap will include a geotextile fabric as a marker for the fill material surface and 12-inches of soil over the marker fabric (Appendix A, Drawing C-503). The wetland cap has been extended to include SD-002 (lead contaminated soil), as shown in Appendix A, Drawing C-104. In accordance with state regulations, some remediation activities in the wetland buffer may be exempt from the State wetland permitting requirements as this work is part of a remedial action under the RIDEM Remediation Regulations. These activities will be coordinated with RIDEM to assure compliance with all applicable regulations. However, future construction work within Parcel D not conducted under

the Remediation Regulations will need to comply with all state wetland permitting requirements and regulations.

Clearing and grubbing of the wetland buffer zone scrub material will be conducted, as necessary, to support the installation of the soil cap. One foot of soil at the toe of the LOW will be removed to allow the soil cap to key into the existing grade above the wetland boundary. The soil removed from the toe will be placed under the cap during the grading of the existing site soil.

The finished surface for the wetland buffer cap will be stabilized with erosion control matting, and wetland vegetation will be planted. This cap will restrict the contact with the subsurface soils. Please refer to Appendix B for specifications detailing the existing wetland condition and the planned restoration strategy.

#### Former Slag Area Cap

In response to RIDEM questions regarding the potential leaching from the soil in contact with the former slag pile, the cap design for the former slag area contains a drainage geocomposite layer over the membrane to limit infiltration and restrict contact with the underlying soils. Following the grading of the existing soil, the former slag area will be capped with 6" sand, 40-mil geomembrane, drainage composite layer, 12" clean cover soil, and 6" clean fill topsoil (Appendix A, Drawing C-503). The finished surface for the slag area will be seeded or stabilized with erosion control matting. The haul road access to the former slag area will be improved during construction and removed after construction is complete.

#### Wetland Restoration within the Phase I Cap

Parcel D is located along the shoreline of Mashapaug Cove within Mashapaug Pond within the Pawtuxet River watershed. Existing vegetative communities include forested and scrub-shrub wetlands, mixed oak woodland and mid-successional woodland cover types.

Wetlands at Parcel D occur as fringe features forming a narrow band along the cove shore. Tree species within the wetland areas include, red maple (*Acer rubrum*), silver maple (*A. saccharinum*), and black willow (*Salix nigra*). The shrub layer consists of sweet pepperbush (*Clethra alnifolia*), red osier dogwood (*Cornus stolonifera*), and buttonbush (*Cephalanthus occidentalis*). Sensitive fern (*Onoclea sensibilis*), blue flag iris (*Iris versicolor*), and poison ivy (*Toxicodendron radicans*) occur in the herbaceous understory.

The mixed oak woodland community occurs in the upland areas on the western shore of the cove (west of the slag removal area). Tree species within this area include red oak (*Quercus rubra*), black oak (*Q. velutina*), and to a lesser extent white oak (*Q. alba*). Sweet birch (*Betula lenta*) and black cherry (*Prunus serotina*) are also present within this cover type. The understory includes a mix of low growing shrubs such as low bush blueberry (*Vaccinium*



*angustifolium*), mountain laurel (*Kalmia latifolia*), and huckleberry (*Gaylussacia baccata*). There are few non native invasive species present within this habitat type. In addition, several signs of wildlife usage were observed including a fox den and a painted turtle shell.

The mid-successional community occurs in the perimeter wetland and upland areas along the eastern shore of the cove (east of the slag removal area). Tree species within this area include red maple, red oak, black oak, tree-of-heaven (*Ailanthus altissima*), and gray birch (*Betula populifolia*). The understory within this area is dominated by non native invasive plant species including, Asiatic bittersweet (*Celastrus orbiculatus*), Morrow's honeysuckle (*Lonicera morrowii*), Japanese honeysuckle (*L. japonica*), and Japanese knotweed (*Fallopia japonica*). The dominance of invasive species in this habitat is likely a result of previous disturbances which allowed these opportunistic species to colonize.

### ***Invasive Species Management***

As noted earlier, portions of Parcel D are typical of disturbed sites in that they harbor numerous invasive plant species. Invasive plants of note at this site include; Japanese knotweed, Morrow's and Japanese honeysuckle, and Asiatic bittersweet. If these populations are not addressed they will undoubtedly compromise the integrity of the restoration project. The aggressive nature and superior competitive ability of these plants in disturbed habitats (i.e., newly planted areas), will negatively affect botanical diversity and survivorship of restorative plantings.

Therefore, potential treatment options include chemical and mechanical approaches. Mechanical removal (i.e., cutting) of above ground plant parts can aid in the management of certain invasive species. Mechanical treatment alone will not control the revegetation of the invasive species. Foliar or cut stem, application of herbicidal chemicals (i.e., glyphosate (Rodeo)) will transport the herbicide to belowground parts detrimentally affecting the vigor of the belowground root/rhizome system and effect plant death or vigor. These options will be coordinated with the construction schedule as part of the site clearing and restoration activities.

### ***Revegetation***

Following Phase I remedial construction, the wetland buffer cap surface will be revegetated to stabilize soils and enhance species diversity and structural complexity. These activities will be conducted using best management practices and every effort to minimize impacts to the surrounding landscape will be taken.

The restoration planting plan consists of two distinct vegetation zones. The species composition of each zone reflects morphological and physiological adaptations of the species occupying them to their specific habitats. Since remediation activities will strive to preserve mature trees and other desirable native vegetation when possible, an enhancement planting

approach has been developed. This approach stresses under-story, and shade tolerant plantings as the primary components of the revegetation activities. Species composition within the mixed oak woodland are proposed to be used as a reference condition to guide restoration and revegetation of upland portions of the Phase I of Parcel D. In addition, only woody species have been selected for these plantings in order to enable the anticipated installation between 1 September and 15 November.

The diversity of species outlined in the following zone descriptions is reflective of the inherent uncertainties of restorative planting success. For this reason many of the species are redundant throughout the various zones, these redundancies are also found in nature as certain plant species are tolerant of a wide range of hydrologic and soil saturation scenarios. Due to the uncertainty of post-remediation site hydrology in the restoration area specific elevation boundaries for these zones are not described.

**Forested Wetland**

This zone will occur in areas along the Cove shoreline that will be subject to wetland hydrology after remediation activities. Revegetation will focus on recreation of extant on-site habitats of good quality (i.e., few invasive). Revegetation for these areas will include species selected from Table A. Selections will be based largely on availability and will only use plant species native to Rhode Island.

**TABLE A – FORESTED WETLAND SPECIES**

Common Name	Botanical Name	Wetland Indicator Status
Red Maple	<i>Acer rubrum</i>	FAC
Silver Maple	<i>Acer saccharinum</i>	FACW
Black Willow	<i>Salix nigra</i>	FACW+
Red-osier Dogwood	<i>Cornus sericea</i>	FACW+
Northern Arrowwood	<i>Viburnum dentatum</i>	FACW-
Sweet Pepper Bush	<i>Clethra alnifolia</i>	FAC+
Highbush Blueberry	<i>Vaccinium corymbosum</i>	FACW
Buttonbush	<i>Cephalanthus occidentalis</i>	OBL
Sensitive Fern	<i>Onoclea sensibilis</i>	FACW
Blue Flag Iris	<i>Iris versicolor</i>	OBL

**Mixed Oak Woodland**

This zone will occur in areas upland of the Cove shoreline that will not be subject to wetland hydrology after remediation activities. Revegetation will focus on recreation of extant on-site

habitats of good quality (i.e., few invasive). Revegetation for these areas will include species selected from Table B. Selections will be based largely on availability and will only use plant species native to Rhode Island.

**TABLE B – MIXED OAK WOODLAND SPECIES**

Common Name	Botanical Name	Wetland Indicator Status
Red Maple	<i>Acer Rubrum</i>	FAC
Sweet Birch	<i>Betula Lenta</i>	FACU
White Pine	<i>Pinus Strobus</i>	FACU
White Oak	<i>Quercus Alba</i>	FACU
Northern Red Oak	<i>Quercus Rubra</i>	FACU-
Black Oak	<i>Quercus Velutina</i>	UPL
Black Cherry	<i>Prunus Serotina</i>	FACU
Gray Birch	<i>Betula Populifolia</i>	FAC
Mountain Laurel	<i>Kalmia Latifolia</i>	FACU
Lowbush Blueberry	<i>Vaccinum Angustifolium</i>	FACU-
Black Huckleberry	<i>Gaylussacia Baccata</i>	FACU

### 3.4 Installation of Monitoring Wells

As groundwater infiltration and flow from Parcel D to Mashapaug Pond play a critical role in the Site conceptual model, AMEC will restore monitoring well GZA-5 and maintain existing monitoring wells within the Phase I Cap. These monitoring wells will provide information about groundwater flow and aid in developing and monitoring groundwater remedial actions. Monitoring well GZA-5 was removed during the slag excavation activities in the summer of 2006 and will be re-installed through the Phase I Cap as a shallow well to straddle the groundwater table (Appendix A, Drawing C-105).

The number of existing monitoring wells maintained during the soil cap construction may be modified pending the design of the groundwater treatment system and monitoring network.

Existing monitoring wells within the cap (e.g., GZA-3) will be secured and maintained during the construction of the soil cap. Also, a new shallow monitoring well will be installed on the east side of the former slag area cap, outside the impermeable cap over the former slag pile and close to the edge of the cove. This new well, together with the reinstalled GZA-5 and MW-237S (located on the west side of the former slag area cap), will be included in a targeted monitoring program for potential leaching of metals from the former slag pile area. The future groundwater monitoring program for the Gorham Site will be developed in coordination with RIDEM as part of the groundwater RAWP.

### **3.5 Fencing**

The existing chain link fence will be relocated along the boundary between Parcels C and D, extending from Adelaide Avenue to the existing chain link fence in the northwest corner of the high school parking lot (Drawings C-104 and C-106, Appendix A). The chain link fence and access gate in the northwest corner of the retail property (intersection of Parcels A and B) will be replaced or reset and will extend east to the stormwater detention basin fencing.

This fence will remain in place until all three phases of remediation on Parcel D have been completed or when the City of Providence has completed the installation of the planned walking path and fence/plantings along the water side of the path to restrict access to the steep slope down to the shoreline.

## **4.0 POINTS OF COMPLIANCE & COMPLIANCE DETERMINATION**

### **4.1 Points of Compliance**

In accordance with Section 9.06 and 9.18 of the Remediation Regulations, MACTEC has performed confirmatory sampling outside of the cap to determine that remedial objectives have been met. The points of compliance are sample locations outside of the Phase I cap that are detailed in Section 4.2 below.

### **4.2 Compliance Determination**

Textron has proposed a “Recreational Use” Cap that will bring Parcel D into compliance, per the Remediation Regulations, with soil RDEC. The compliance demonstration is accomplished by using Method 1 and Method 2 (dioxin toxic equivalence (TEQ) and several other analytes) soil objectives approach. In the absence of any recreational land use criteria, the RDEC are health protective criteria for recreational land use. The exposure assumptions used to calculate the RDEC clearly overestimate likely recreational exposures and compliance with these criteria will create a health protective environment for use of Parcel D for passive recreational purposes.

The soil cap has been designed to extend over those areas where surface soil exceeds the RDEC. There are three distinct areas outside of the cap (Appendix B drawings C-104 and C-106) that currently exceed the RDEC, but will be excavated and confirmatory soil sampling conducted to determine that the remaining soil is in compliance with the RDEC. These excavation areas will be backfilled with soil meeting the RDEC (Appendix C).

In addition, the cap will be constructed with material that also meets RDECs, so overall, the soils both inside and outside the footprint of the “Recreational Use” Cap will be in compliance with the health protective RDECs. Therefore, upon construction of the “Recreational Use” Cap, Parcel D soils will represent a health protective condition for recreational use by the community.

Procedures for determining compliance with cap construction requirements and specification (e.g., materials, thicknesses, and construction methods) will be detailed in the construction drawings and specifications.

## 5.0 PROPOSED SCHEDULE FOR REMEDIATION

The following schedule is proposed to minimize conflicts with the proposed redevelopment plans. This schedule is contingent upon the timing of approvals and subcontractor availability.

<b><u>Description</u></b>	<b><u>Completion Date</u></b>
Draft Work Plan to RIDEM	February 2012
Issue Final RAWP	Within two weeks upon receipt of comments
Distribute Public Notice Materials or RIDEM comment	Within four weeks of Final RAWP
Mobilization	May 2012
Complete Construction	October 30, 2012

Schedules will be provided to the RIDEM as bids are accepted for the Phase I Parcel D preparation and construction. Follow-up verification and monitoring will also be conducted in a phased approach. Schedules will be provided for the installation of monitoring wells.

## **6.0 CONTRACTORS AND/OR CONSULTANTS**

As part of this RAWP, Textron will subcontract the construction and laboratory services. All other services including environmental, wetland replication oversight, construction management and survey services, can be provided by AMEC.

The construction and earthworks contractor and laboratory has yet to be determined. Potential bidders will be provided with the construction documents and scope of work of the project. Once the work has been awarded by Textron to the contractors, AMEC will notify RIDEM.

## **7.0 DESIGN STANDARDS AND TECHNICAL SPECIFICATIONS**

Technical specifications (Division 1) are included as Appendix B to this RAWP. The specifications outline the required standards, products, and execution to implement the remedial action. The drawings presented in Appendix A provide supplemental design information including quantities of materials, limits of work, and construction components and dimensions. A more detailed set of construction drawings and specifications will be prepared to support the procurement of a construction contractor and the construction activities. These will be provided to RIDEM for their review and comment in draft form.

In some cases, the construction is defined by performance based requirements as noted in the specifications and drawings. In other cases, products are specified by fabricator/vendor/manufacturer and model.

Actual material and products to be incorporated into the work will be based on the proposal of the remediation subcontractor. The subcontractor will propose a material/product for the project and submit requisite product information and literature to AMEC for review and approval. If the submittal satisfactorily meets the requirements of the construction documents (specification and drawings), AMEC will approve the product/material.



## 8.0 SET UP PLANS

Set-up Plans as defined by the Rhode Island Remedial Regulations describe pre-operational staging or construction requirements that must be in place prior to implementation of the remedial action. A Subcontractor Work Plan is required by the subcontractor selected to implement the remedial action. This Plan will include descriptions and information as outlined in Specification Section 01110 “Summary of Work” (Appendix B). The measures and controls required are shown on the Construction Drawings and are described in Specification Section 01500 “Temporary Facilities and Controls. The purpose of these measures and controls include the following:

1. To maintain a healthy and safe work environment for remediation construction and oversight personnel;
2. To minimize erosion of soil and downgradient migration of sediment;
3. To minimize waste generation and migration outside of the Exclusion Zone; and
4. To provide proper collection and storage of generated wastes until characterization and off-site disposal can occur.

## 9.0 EFFLUENT DISPOSAL

Effluents as defined by the Rhode Island Remedial Regulations are any products or by-products from the proposed remedial action. Waste or waste by-products that will be produced as a result of the remedial action include the following:

1. Clearing and miscellaneous debris;
2. Grubbings and tree stumps;
3. Liquid waste (decontamination water, stormwater management water, etc.);
4. Site trash; and
5. Remediation waste (PPE, plastic sheeting, sampling equipment, etc.).

Waste handling and disposal will be in accordance with the requirements of Specification Sections 02110 "Waste Excavation, Removal, and Handling" and 02120 "Off-Site Transportation and Disposal". The remediation subcontractor is required to submit a Work Plan to Textron and AMEC for review and approval prior to commencing construction. The plan will contain project specific proposals for waste handling, transportation, and disposal. Characterization of the waste will occur in accordance with the requirements of the Treatment Storage and/or Disposal Facility (TSDF). Disposal will occur at licensed facilities approved by Textron and AMEC.

## **10.0 CONTINGENCY PLAN/ HEALTH AND SAFETY PLAN**

AMEC's Contingency Plans are documented within the AMEC Health and Safety Plan for Phase I Parcel D Soil Capping. This document contains the names and phone numbers of emergency coordinators and the emergency response procedures and arrangements for the Site. The Health and Safety Plan with contingency procedures will be available on site at all times during the implementation and operations of the Phase I remedial action.

Specification Section 01350 Safety, Health, and Emergency Response requires the selected remediation subcontractor to prepare and follow a site-specific health and safety plan for the work described and referred to in this RAWP.

As part of the site health and safety, dust monitoring will be performed in the work zone and at the work area perimeter during activities that have the potential to disturb soil using hand held real-time continuous air monitoring instruments. Work area perimeter dust monitoring will also be performed using monitors placed in cases designed to protect the logging unit from precipitation. These instruments measure aerosol dust and will be set to automatically store data for subsequent retrieval. One perimeter dust monitor will be placed on each of the four points outside and within 30 feet of the soil capping activities (North, South, East, and West) to confirm that nearby residential populations and retail operations are not impacted by the capping activities. Real-time dust monitoring will continue throughout the capping activities, unless a significant precipitation event occurs, at which time dust monitoring may be suspended per manufacturer specifications and standard industrial hygiene practices.

Continuous visual monitoring of dust (particulate) levels will also be conducted and recorded. If visible dust conditions are sustained for more than one minute within the work zone, dust suppression methods (i.e., water spray) will be implemented to reduce airborne dust levels. Dust suppression will be performed throughout the capping activities as needed and will include spraying of fine mist of water over exposed soils to suppress dust as needed. A portable water tank containing municipal water or a nearby fire hydrant if approved by the city of Providence will be used as the water supply for dust suppression activities. If heavy precipitation (rain or snow) is adequate to suppress dust, additional water spray will not be applied.

## 11.0 OPERATING LOG

All on-site activities will be recorded in an operating logbook to document progress associated with remedial activities at the Phase I Parcel D area. The logbook will include, at a minimum, detailed information on the following:

1. Personnel on-site and their time of arrival and departure.
2. Time of system (if applicable) operation, including startup time, time of shutdown due to equipment malfunction or failure, and time of completion for the remedial activity.
3. Records of materials transported off-site, and materials brought on-site.
4. Instances during remedial activities where a Contingency Plan may be implemented.
5. Records of any accidents or injuries incurred on the site.
6. Documentation of inspections and any instances where remedial activity procedures must be changed and/or equipment must be repaired or replaced. An inspection plan will be designed for all remedial activities to ensure that all equipment or activities are operating properly.
7. Details of the work stages and activities, as will records of sampling and any field screening (e.g., dust monitoring) that is performed.
8. Perimeter air monitoring dust readings will be logged in the Site field logbook, making note of the time the readings were obtained, the concentrations observed, the weather conditions, the prevailing wind direction, and the general site conditions and activities. Time weighted averages of total dust concentrations from perimeter monitoring stations will be compared the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) of particulates not otherwise regulated including aerosol dust (referred to as particulates not otherwise characterized or (PNOC)), which is 15 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ).

In addition to documentation of field activities, quality assurance procedures for cap construction as described in Specifications Sections 02072, 02073, and 02300 will be recorded in the operating log.

The operating log will be readily available at the site during all activities outlined in this RAWP.

## 12.0 SECURITY PROCEDURES

Access to the Phase I work area will be at three locations. One access point is the existing gate on Adelaide Avenue, in the southwestern corner of Parcel C. The gate at this access point will be repaired or replaced, and it will be used after Phase I Construction. In addition, an access road will be constructed in the northwestern corner of the Parcel C down to the western end of the Phase I cap (near Mashapaug Cove). The other two access points will be the existing gate at the slag area and at the laydown area in the northeast of the site (behind the detention basin on Parcel A).

An 8' high security fence and gate will be installed along the LOW at the north end of the Parcel C and it will tie into the existing fence at the school property for vehicular access to the western end of the cap near Mashapaug Cove. It is assumed that plantings along the new fence will not be required with the installation of the fence around Alvarez High School restricting access to the Parcel D and planned remedial activities in support of a recreational use. This fence will be maintained through the completion of the Phase III remediation.

Only authorized personnel (e.g., engineer, construction personnel, and approved visitors) will be permitted to access the work zone. All visitors required to check in with the Site Superintendent upon entering.

Fencing and gates will be secured at the close of each working day. Areas where fencing is removed will be gated and/or properly secured with temporary fencing and signage. Signage will be in English and Spanish and will include a site contact phone number and other pertinent information.

### **13.0 SHUT-DOWN, CLOSURE AND POST-CLOSURE REQUIREMENTS**

Shutdown will consist of final cleanup, removal of temporary facilities and controls, and equipment demobilization from the site. Points of compliance and compliance determination for capping activities are discussed in Section 4.0. Security and siltation fencing will not be removed before construction is complete, specified erosion control measures (e.g., rock dams, erosion control mats, etc.) have been installed, and specified erosion control vegetation is established.

## 14.0 INSTITUTIONAL CONTROLS AND NOTICES

An Environmental Land Usage Restriction (ELUR), in accordance with Rule 8.09 of the Remediation Regulations, will be developed with the City of Providence or Providence Redevelopment Agency (PRA) as property owner and RIDEM and formerly recorded with the property deed at the conclusion of Parcel D remediation activities. A Soil Management Plan (SMP) which will outline the procedures for managing the soils on site should disturbances below the cap be required, will be recorded with the ELUR. This ELUR will address all three phases of Parcel D (upland and Mashapaug Cove). A draft ELUR and SMP has been included in Appendix E for review. Textron will maintain and monitor the completed engineered soil cap in the Phase I area until the responsibility is taken over by the City of Providence or PRA at the time the ELUR is recorded.

## 15.0 CERTIFICATION REQUIREMENTS

The following certifications are provided pursuant to Rule 9.19 of the Remediation Regulations.

The undersigned hereby certifies that to the best of their knowledge the information contained in this report is complete and accurate based on the information available at the time of its preparation. Furthermore, the undersigned certifies that to the best of their knowledge the report is as complete and accurate of a representation of the Site and the release based on the available information, and contains the known facts surrounding the release.

### ***AMEC Environment & Infrastructure, Inc.***

\_\_\_\_\_  
David E. Heislein  
Senior Principal

\_\_\_\_\_  
Date

### ***Textron, Inc.***

\_\_\_\_\_  
Gregory Simpson  
Senior Project Manager, Site Remediation

\_\_\_\_\_  
Date



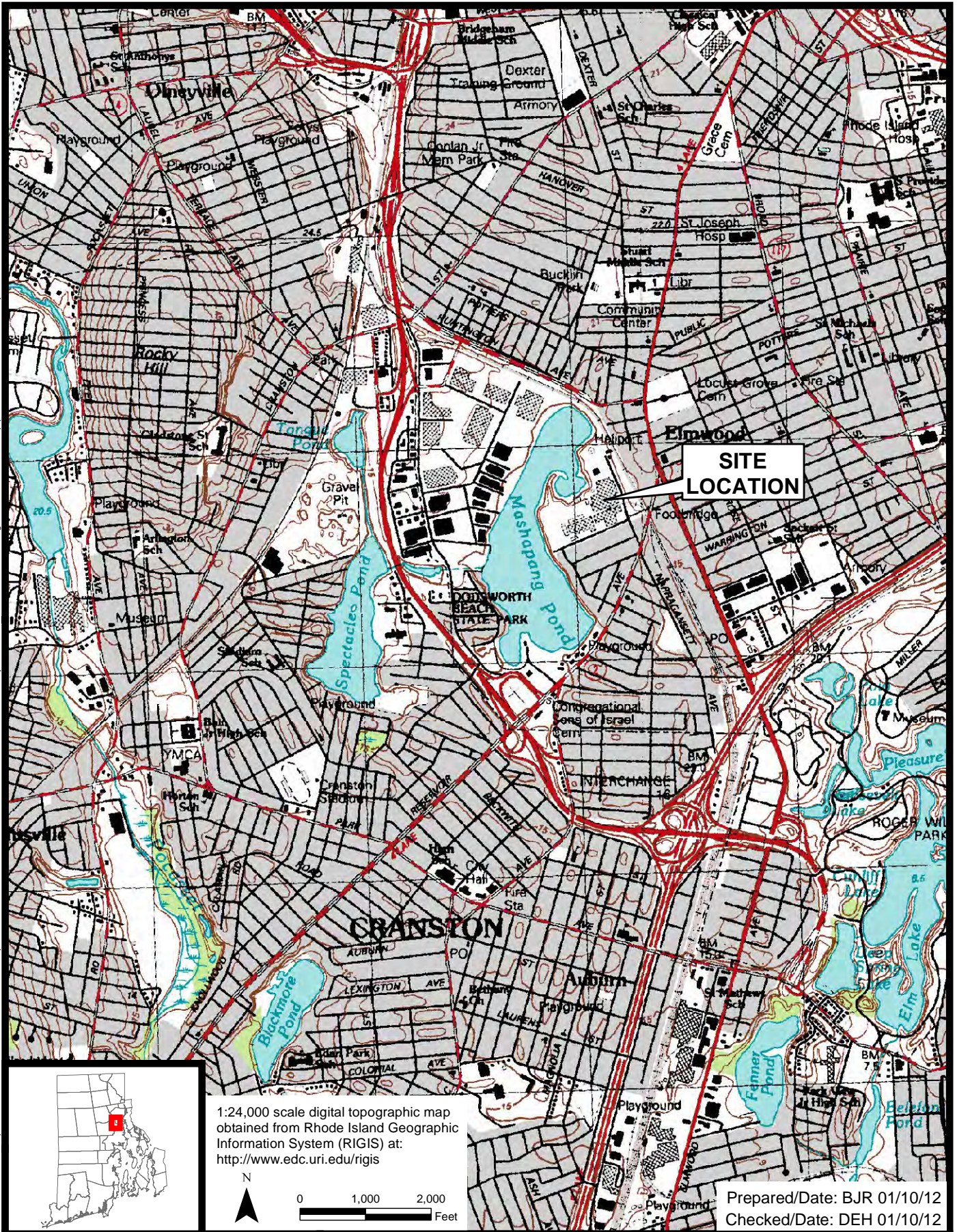
## 16.0 REFERENCES

- ABB Environmental Services (ABB-ES), 1995a. *Remedial Investigation Report, Former Gorham Manufacturing Facility, Providence, Rhode Island*. May.
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- RIDEM, 2011b. *Former Gorham Manufacturing Facility – Park Parcel (a.k.a. Parcel D) – Phase I, Remedial Decision Letter*. December 12.

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

## **FIGURES**





Prepared/Date: BJR 01/10/12  
 Checked/Date: DEH 01/10/12

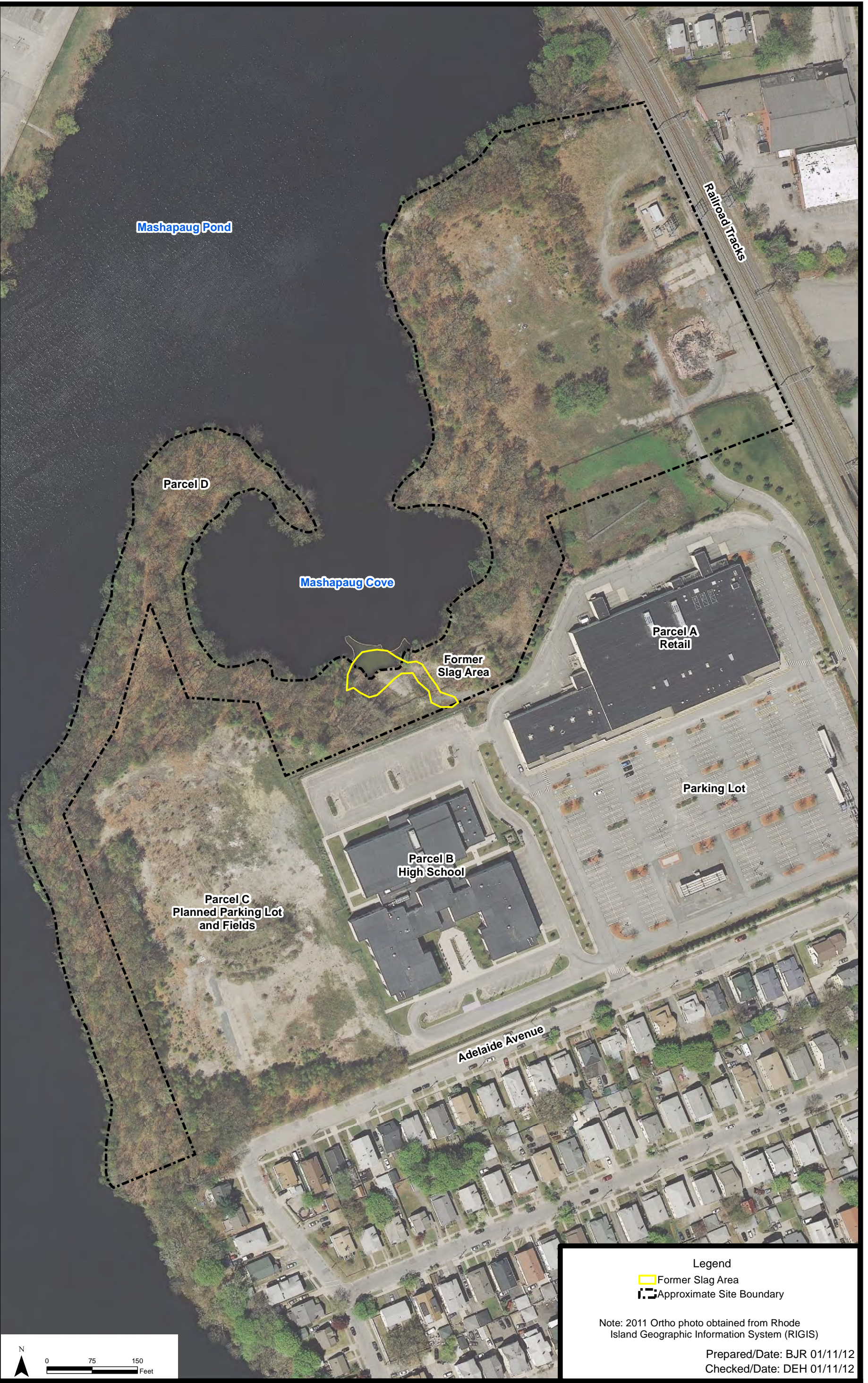
Remedial Action Work Plan  
 Phase I Parcel D  
 333 Adelaide Avenue  
 Providence, RI





Site Location Map  
 Former Gorham Manufacturing Site  
 Project 3650-11-0213 Figure 1



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**Legend**

-  Former Slag Area
-  Approximate Site Boundary

Note: 2011 Ortho photo obtained from Rhode Island Geographic Information System (RIGIS)

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Checked/Date: DEH 01/11/12

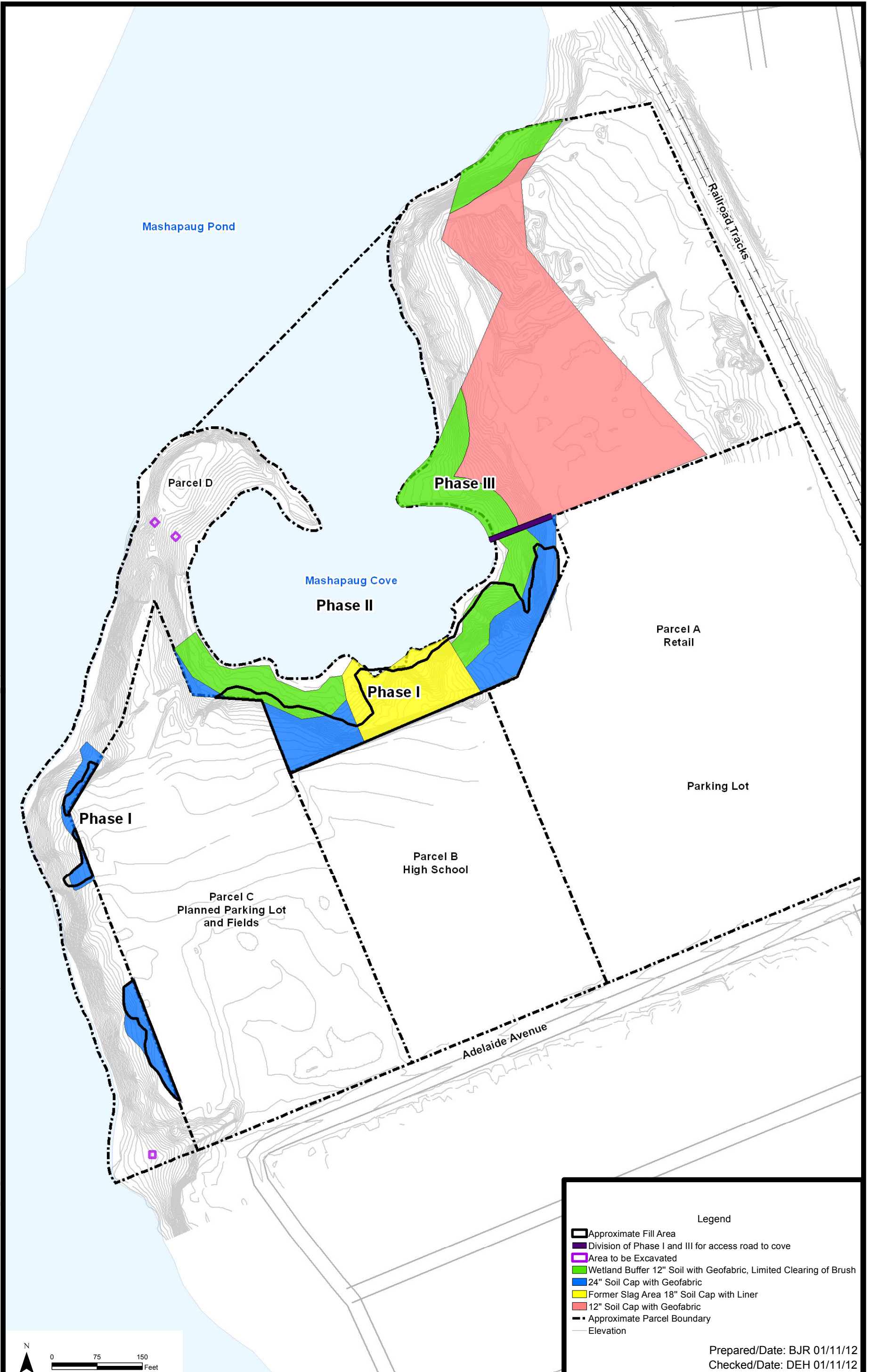
Remedial Action Work Plan  
Phase I Parcel D  
333 Adelaide Avenue  
Providence, RI



Site Plan  
Former Gorham Manufacturing Site  
Project 3650-11-0213  
Figure 2



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Legend

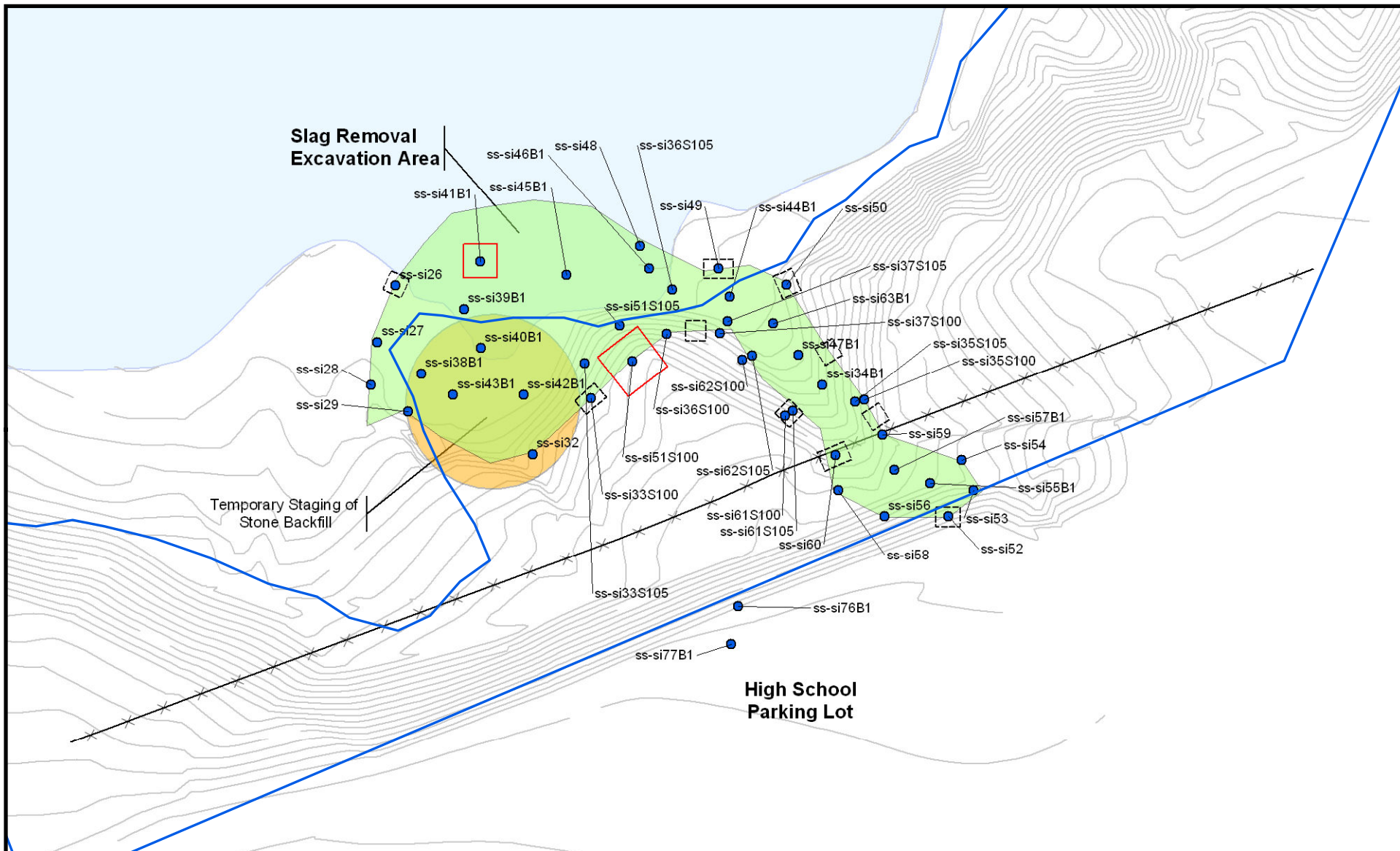
- Approximate Fill Area
- Division of Phase I and III for access road to cove
- Area to be Excavated
- Wetland Buffer 12" Soil with Geofabric, Limited Clearing of Brush
- 24" Soil Cap with Geofabric
- Former Slag Area 18" Soil Cap with Liner
- 12" Soil Cap with Geofabric
- Approximate Parcel Boundary
- Elevation

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Remedial Action Work Plan  
Phase I Parcel D  
333 Adelaide Avenue  
Providence, RI

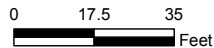


Parcel D Three Phased Remediation  
Former Gorham Manufacturing Site  
Project 3650-11-0213  
Figure 3



**Legend**

- Approximate Fill Area
- Additional Removal Areas
- Test Pit (Final Locations To Be Determined In Field)
- Previous Sample Locations
- Initially Excavated Area
- Fence
- Mashapaug Cove
- Elevation



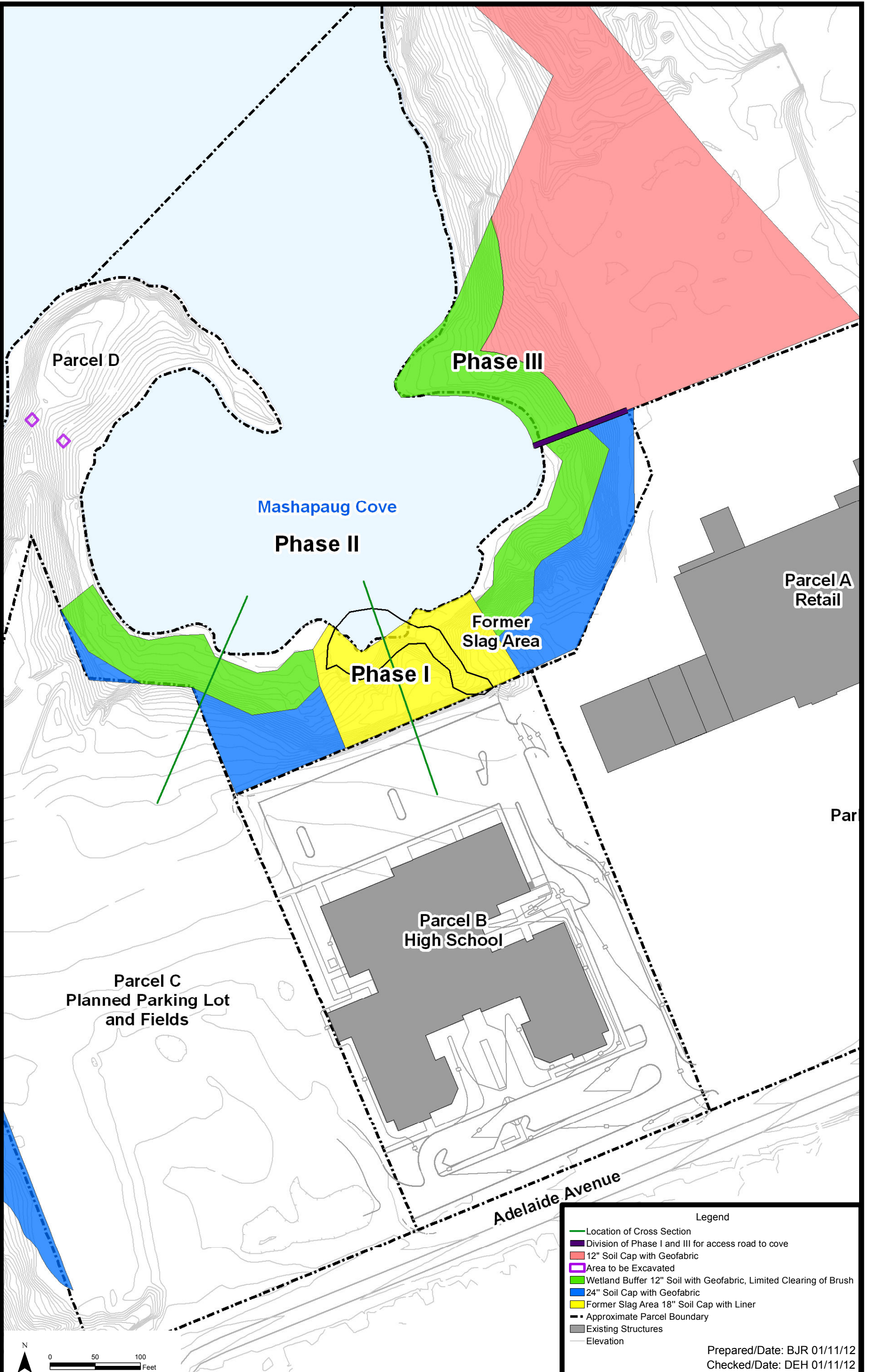
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Figure 4  
 Former Slag Pile Area  
 Former Gorham Manufacturing Site  
 Remedial Action Work Plan  
 Phase I Parcel D  
 333 Adelaide Avenue  
 Providence, RI



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**Legend**

- Location of Cross Section
- Division of Phase I and III for access road to cove
- 12" Soil Cap with Geofabric
- Area to be Excavated
- Wetland Buffer 12" Soil with Geofabric, Limited Clearing of Brush
- 24" Soil Cap with Geofabric
- Former Slag Area 18" Soil Cap with Liner
- Approximate Parcel Boundary
- Existing Structures
- Elevation

Prepared/Date: BJR 01/11/12  
Checked/Date: DEH 01/11/12

Remedial Action Work Plan  
Phase I Parcel D  
333 Adelaide Avenue  
Providence, RI

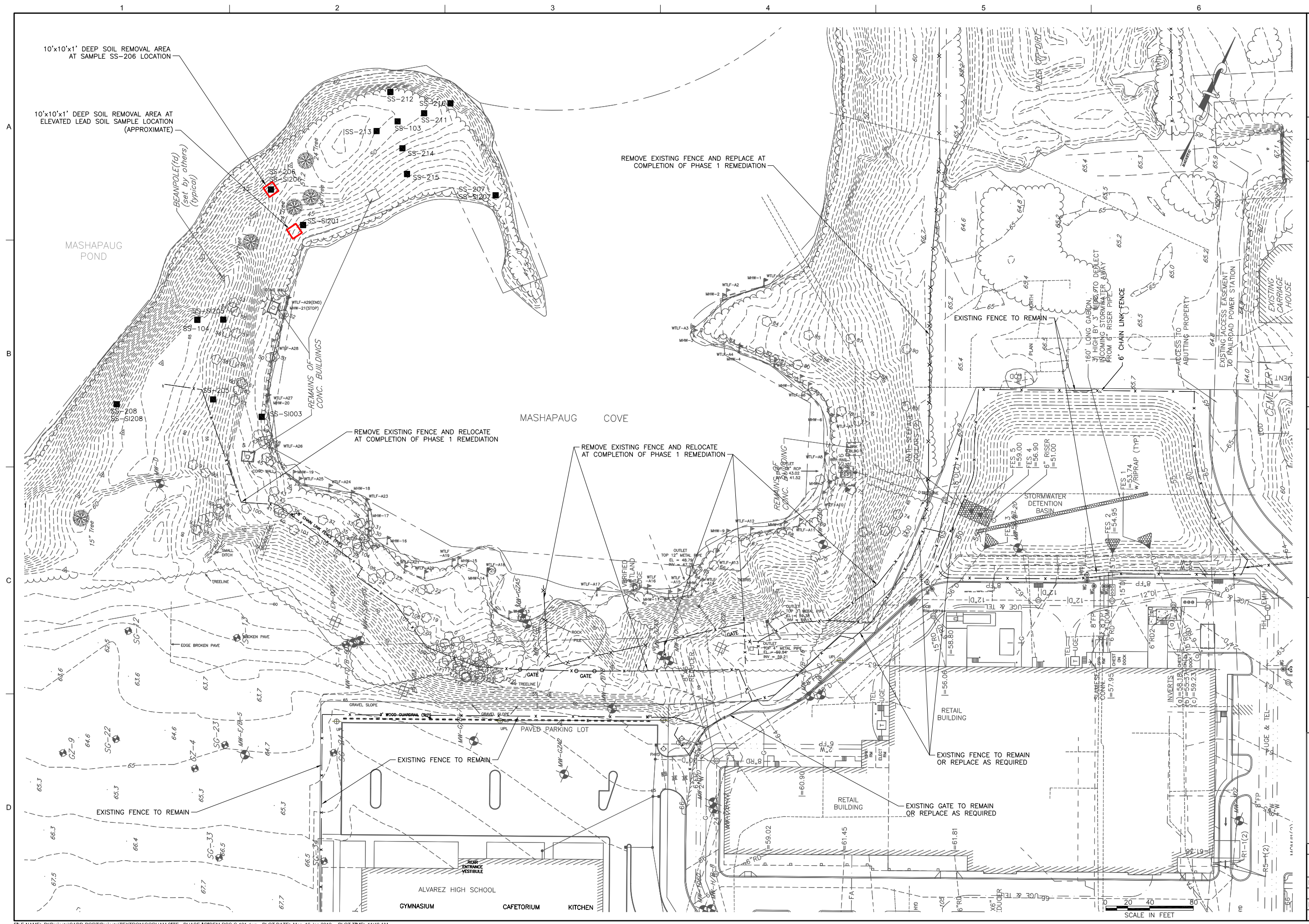


Approximate Location of Cap Cross Section Details  
Former Gorham Manufacturing Site  
Project 3650-11-0213  
Figure 5

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

## **APPENDIX A DRAWINGS**





PHASE 1 RECREATIONAL CAP TEXTRON FORMER GORHAM MANUFACTURING SITE 333 ADELAIDE AVENUE, PROVIDENCE, RI		CIVIL EXISTING CONDITIONS AND SOIL REMOVAL PLAN		DATE: 06/29/07		DWG: C-101		SHEET: 3 OF 16	
NO. DATE		REVISION		CHK		APVD		WJW	
A 06/29/07		DRAFT SUBMITTAL TO RIDEM		JPM		DR		RHH/JPM	
B 05/08/11		SUBMITTAL TO RIDEM		JPM		DEH		DEH	
C 01/17/12		SUBMITTAL TO RIDEM		JPM		DEH		WJW	



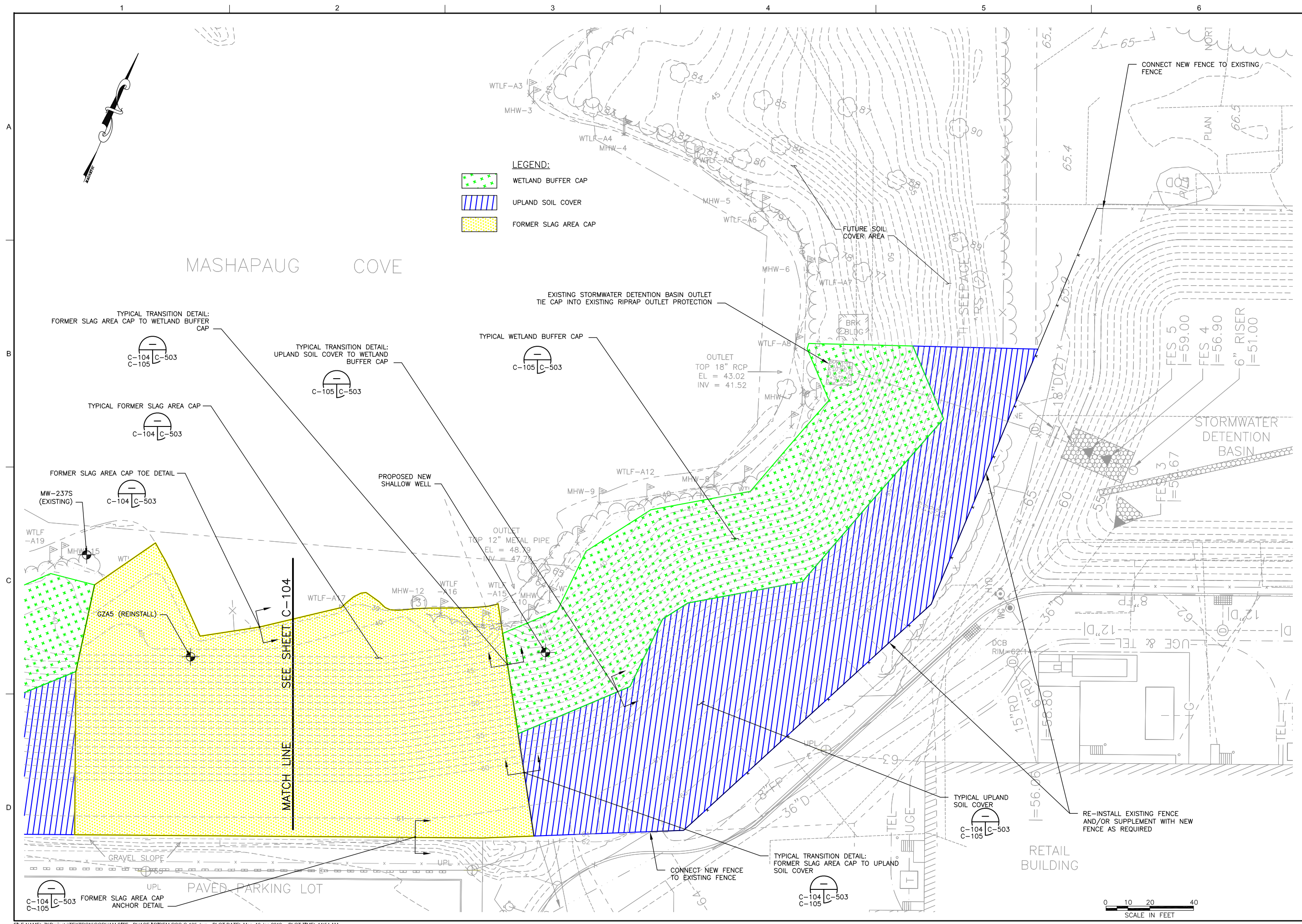
VERIFY SCALE  
 BAR IS ONE INCH ON ORIGINAL DRAWING.  
 DATE: 06/29/07  
 DWG: C-101  
 SHEET: 3 OF 16

THIS DRAWING IS THE PROPERTY OF AMETEC, INCLUDING ALL PATENTED AND PATENTABLE FEATURES AND/OR CONFIDENTIAL INFORMATION AND ITS USE IS CONDITIONED UPON THE USER'S AGREEMENT NOT TO REPRODUCE THE DRAWING, IN WHOLE OR PART, NOR THE MATERIAL DESCRIBED THEREON, NOR THE USE OF THE DRAWING FOR ANY PURPOSE OTHER THAN SPECIFICALLY PERMITTED BY AMETEC.









- LEGEND:**
- WETLAND BUFFER CAP
  - UPLAND SOIL COVER
  - FORMER SLAG AREA CAP

PHASE 1 RECREATIONAL CAP TEXTRON FORMER GORHAM MANUFACTURING SITE 333 ADELAIDE AVENUE, PROVIDENCE, RI		CIVIL <b>FINAL GRADE PLAN 2</b>	
NO.	DATE	REVISION	BY
A	06/29/07	DRAFT SUBMITTAL TO RIDEM	JPM
B	05/08/11	SUBMITTAL TO RIDEM	DEH
C	01/17/12	SUBMITTAL TO RIDEM	JPM
DR		CHK	WJW
DSGN		JPM	DEH
APVD		RHH/JPM	WJW

Environment & Infrastructure, Inc.  
511 Congress Street  
Portland, Maine 04101  
(207) 775-5401

VERIFY SCALE  
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DATE: 06/29/07  
DWG: C-105  
SHEET: 7 OF 16







TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

## **APPENDIX B**

# **SPECIFICATIONS**

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

**APPENDIX B**  
**SPECIFICATIONS**  
**(Division 0)**

## SECTION 00330

### SUBSURFACE INFORMATION

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Various subsurface explorations have been conducted for the sole purpose of assisting the Engineer in the evaluation of the extent of on-site contamination. Logs of these explorations are included in Attachment A.
- B. Explorations are not intended to indicate subsurface conditions except at the locations of the borings and are based on the information available and the Engineer's interpretations at the time borings were made.
- C. Explorations were not made for the purposes of determining or facilitating the constructability of the project or the cost thereof. Therefore, they may not be suitable or adequate for any purpose other than for the Engineer's use in designing the project.
- D. Any reuse of the exploration logs or other subsurface information, including, without limitation, any subsurface investigation prepared by the Engineer on behalf of the Owner, by the Contractor or its subcontractors, regardless of tiers, shall be at its own risk and without legal liability on the Engineer or Client. Therefore, the Contractor shall indemnify and hold the Engineer and Owner harmless from all claims, damages, expenses, or costs resulting from the Contractor's interpretation of this information.
- E. Additional test borings and other exploratory operations may be made by Contractor at no cost to Department.

##### 1.02 SUMMARY OF SOIL PARAMETERS

The Contractor shall review the available subsurface information (and conduct additional explorations as deemed necessary) to develop independent soil parameters for the purposes of shoring design, slope stability, and constructability.

#### PART 2 - PRODUCTS

Not Applicable

#### PART 3- EXECUTION

Not Applicable

END OF SECTION

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00330-1



## SECTION 00330 - B

### EXISTING UTILITIES AND UNDERGROUND STRUCTURES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. There are historical abandoned utilities located within the Work Area of the Site, and there is a storm drain from the detention pond which outlets on the slope of the Site. The storm drain will remain active during the execution of the work. The Contractor shall exercise extreme caution when working in the vicinity of these existing active utilities.
- B. Existing known utilities are shown on the Drawings. Utilities are shown diagrammatically and should be considered incomplete. It should not be inferred that the locations shown are precise, or that all existing utilities or underground structures are depicted.
- C. The Contractor shall locate or have located all existing utilities or underground structures in the vicinity of the Work Area on the Site. All utilities will be identified and marked in the field in accordance with required Rhode Island regulations. The Contractor shall contact Dig-Safe (1-888-DIG-SAFE) prior to commencing an on-site excavation.
- D. The Contractor shall be responsible for any and all work-related damage to any existing utilities, which are not to be abandoned and are to remain in service.
- E. The Contractor shall contact the affected utility or property owner as soon as any damage is discovered.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01510: Construction Facilities and Temporary Controls
- B. Section 01611: Material Handling and Management (to be prepared)
- C. Section 02300: Earthwork

#### PART 2 – PRODUCTS

Not applicable.

#### PART 3 – EXECUTION

Not applicable.

END OF SECTION

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SECTION 00700

GENERAL CONDITIONS

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## 1.0 DEFINITIONS

- A. Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:
- B. Addenda: Written or graphic instruments issued prior to the opening of Bids which modify or interpret the Contract Documents, Drawings, and Specifications, by additions, deletions, clarifications, or corrections.
- C. Bid: The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
- D. Bidder: Any person, firm, or corporation submitting a Bid for the Work.
- E. Bonds: Bid, Performance, and Payment Bonds and other instruments of security, furnished by the Contractor and his surety in accordance with the Contract Documents.
- F. Change Order: A written order to the Contractor authorizing an addition, deletion, or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time issued after the effective date of the Agreement.
- G. Client: A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the Work is to be performed.
- G. Change Directive: A written directive effecting a change in the Work that may or may not involve an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.
- H. Contract Documents: The contract, including, Instructions to Bidders, Bid Bond, Agreement, Notice of Award, Notice to Proceed, Change Order, Drawings, Specifications, and Addenda after the effective date of the Agreement.
- I. Contract Price: The total monies payable to the Contractor under the terms and conditions of the Contract Documents.
- J. Contract Time: The number of calendar days stated in the Contract Documents for the completion of the Work.
- K. Contractor: The person, firm, or corporation with whom the Client has executed the Agreement.
- L. Drawings: The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer.
- M. Engineer: The person, firm, or corporation named as such in the Contract Documents.
- N. Notice of Award: The written notice of the acceptance of the Bid from Contractor to the Successful Bidder.
- O. Notice to Proceed: Written communication issued by the Contractor to the Contractor authorizing them to proceed with the Work and establishing the date of commencement of the Work.
- Q. Project: The undertaking to be performed as provided in the Contract Documents.
- R. Resident Project Representative: The authorized representative of the Contractor who is assigned to the Project site or any part thereof.
- S. Shop Drawings: All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, their Contractor, manufacturer, supplier, or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.
- T. Specifications: A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards, and workmanship.
- U. Contractor: An individual, firm, or corporation having a direct contract with the Contractor or with any other Contractor for the performance of a part of the Work at the site.

- V. Substantial Completion: That date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.
- W. Supplementary Conditions: Modifications to General Conditions required by the Client or Engineer.
- X. Suppliers: Any person, supplier, or organization who supplies materials or equipment for the work, including that fabricated to a special design, but who does not perform labor at the site.
- Y. Work: All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.
- Z. Written Notice: Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at their last given address, or delivered in person to said party or his authorized representative on the Work.

## 2.0 ADDITIONAL INSTRUCTIONS AND DRAWINGS

- A. The Contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary, to carry out the Work required by the Contract Documents.
- B. The additional detail drawings and instruction thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.
- C. In the event that the requirements in these General Conditions conflicts with the Agreement (Master Subcontract Agreement for Remediation Services), the Agreement shall take precedence.
- D. The Engineer will furnish to the Contractor up to 3 sets of Contract Documents free of charge. Additional sets shall be furnished at cost of reproduction.

## 3.0 SCHEDULES, REPORTS, AND RECORDS

- A. The Contractor shall submit to the Engineer such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records, and other data as the Engineer may request concerning Work performed or to be performed.
- B. Prior to the first partial payment estimate the Contractor shall submit schedules showing the order in which they propose to carry on the Work, including dates at which they will start the various parts of the Work, estimated date of completion of each part, and, as applicable:
  - 1. The dates at which special detail drawings will be required; and
  - 2. Respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies, and equipment.
- C. The Contractor shall also submit a schedule of payments that he anticipates he will earn during the course of the Work.

#### 4.0 DRAWINGS AND SPECIFICATIONS

- A. The Drawings and Specifications indicate the Work to be performed by the Contractor. The Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy, or operation by the Client.
- B. In case of conflict between the Drawings and Specifications, the Specifications shall govern. Labeled dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.
- C. Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies, or ambiguities shall be done at the Contractor's risk.

#### 5.0 SHOP DRAWINGS

- A. The Contractor shall provide Shop Drawings as required by the Engineer for the prosecution of the Work and as required by the Contract Documents. The Engineer shall promptly review all Shop Drawings. The Engineer's approval of any Shop Drawing shall not release the Contractor from responsibility for deviations from the Contract Documents. The approval of any Shop Drawing which substantially deviates from the requirement of the Contract Documents shall be evidenced by a Change Order.
- B. When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification that he has reviewed, checked, and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents.
- C. Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or submission has been approved by the Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the Site and shall be available to the Engineer.
- D. Before ordering any material or doing any work, the Contractor shall verify all dimensions and shall be responsible for correctness of same. No extra charge or compensation will be allowed on account of any differences in dimensions or quantities from those indicated on the Contract Drawings, unless such difference is submitted to the Engineer before proceeding with the work.

#### 6.0 MATERIALS, SERVICES, AND FACILITIES

- A. It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.
- B. The Contractor shall provide such temporary enclosures as the Work may warrant. In addition, they shall provide the necessary temporary office, heat, utilities, telephone, and sanitary facilities, as required by the job, the Contractor, or the Engineer.
- C. Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.
- D. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the manufacturer.

- E. Materials, supplies, and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.
- F. Materials, supplies, or equipment to be incorporated into the Work shall not be purchased by the Contractor or their Contractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.
- G. Workmanship shall, at all times, be of a grade expected from skilled workers in each trade. Fitting of all materials shall be done to preserve the strength and durability of the materials and to present a clean, well worked appearance. The standards of all Work shall be such as to produce first-class results throughout. Where different materials abut, or where it is necessary to cut or pass through one material with other, care must be taken not to injure or deface one material in placing the other. Various trades shall, at all times, cooperate in the installation of their work to complete the whole in a satisfactory, acceptable manner.
- H. All materials permanently incorporated into the project shall be new unless otherwise noted.

## 7.0 INSPECTION AND TESTING

- A. All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards.
- B. The Contractor shall provide, at his expense or through agreement with Suppliers and Manufacturers, testing and inspection services required at source of supply or manufacture. The wages and overhead costs of inspectors and testing technicians, employed by the Contractor for inspection and materials quality control of on-site work, shall be paid by the Contractor except those costs associated with failing tests and services required anytime on Saturdays, Sundays, or holidays, or on weekdays outside of the hours 8:00 a.m. to 6:00 p.m. inclusive, shall be borne by the Contractor. The Contractor shall note that work performed on the following holidays shall require inspector's wages and overhead costs to be paid by the said Contractor: New Year's Day, President's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Day before Christmas, and Christmas Day.
- C. The Contractor shall provide all other inspection and testing services not required by the Contract Documents.
- D. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing, or approval.
- E. Neither observations by the Engineer nor inspections, tests, or approval by persons other than the Contractor shall relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.
- F. The Engineer and their representatives will at all times have access to the Work and shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection, or testing thereof.
- G. If any Work is covered contrary to the written request of the Engineer, it must, if requested by the Engineer, be uncovered for their observation and replaced at the Contractor's expense.
- H. If any Work has been covered which the Engineer has not specifically requested to observe prior to its being covered, or if the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer's request, will uncover, expose, or otherwise make available for observation, inspection, or testing as the

Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection, testing, and satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed, an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction and an appropriate Change Order shall be issued.

## 8.0 SUBSTITUTIONS

- A. Whenever a material, article, or piece of equipment is identified on the Drawings or in the Specifications by reference to brand/product name or catalogue/model number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function to that specified. If the Engineer approves the substitution, the Contractor may purchase it for incorporation into the Work. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.
- B. Bids shall be prepared on the basis of the particular equipment and materials specified.
- C. An item shall be considered equal to the item so named or described if:
  - 1. It is at least equal in quality, durability, appearance, and design.
  - 2. Its performance is equal to or better than that specified and proven by an experience record of five years, minimum.
  - 3. It conforms substantially to the detailed requirements for the item specified.
- D. Prior to purchase, fabrication, or use of any substitute materials or equipment, detailed descriptive data shall be submitted to the Engineer for approval. Tests required by the Engineer to establish quality standards shall be at the Contractor's expense. Approval by the Engineer shall be in writing to be effective and their decision to approve or disapprove the item shall be final.
- E. The Contractor, when using substitute material or equipment, shall assume the cost of and responsibility for accomplishing all required changes, including costs of redesign by the Engineer.
- F. These Specifications for bids are not written in such a way or such a manner as to contain proprietary, exclusionary, or discriminatory requirements other than those based on performance, unless such requirements are necessary to test or demonstrate a specific function or to provide for necessary interchangeability of parts and equipment.

## 9.0 PATENTS

The Contractor shall pay all applicable royalties and license fees. They shall defend all suits or claims for infringement of any patent rights and save the Contractor and Client harmless from loss on account thereof, except that the Client shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer(s) is specified, but if the Contractor has reason to believe that the design, process, or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

## 10. SURVEYS, PERMITS, REGULATIONS

- A. The Client shall furnish all land surveys and establish a baseline or survey coordinates for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. The Contractor shall provide construction surveys to establish layout stakes, batter boards, and other working points, lines, and elevations as required.
- B. The Contractor shall carefully preserve bench marks and survey control points. In case of willful or careless destruction, the Contractor shall be charged with the resulting expense to replace and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.
- C. Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Client, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, they shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 13.0, Changes in the Work.

## 11.0 PROTECTION OF WORK, PROPERTY, AND PERSONS

- A. This Project is subject to all of the Safety and Health Regulations (CFR 29 Part 1926 and all subsequent amendments) as promulgated by the U.S. Department of Labor. Contractors are urged to make themselves familiar with the requirements of these regulations.
- B. The Contractor will be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. They will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury, or loss to all employees and other persons who may be affected thereby.
- C. The Contractor will take all necessary precautions to provide the necessary protection to prevent damage to the Work and materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- D. The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. They will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. They will notify Owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will remedy all damage, injury, or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, their Sub-contractors or anyone directly or indirectly employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.
- E. In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Client, shall act to prevent threatened damage, injury, or loss. They will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved.
- F. All equipment used on this Project must be maintained and operated so as to provide maximum safety for workers and the public.



- G. The Contractor, or their Sub-contractors, shall be responsible for the proper care and protection of all materials, equipment, etc. during transportation and after delivery at the site. The Contractor and their Sub-contractors shall handle all material as directed so that it may be inspected by the Engineer. All materials capable of being injuriously affected by weather shall be protected from injury while being transported to the site as well as while being stored there.
- H. The Contractor shall take such action as may be required to protect labor, materials, and equipment including the land, trench, and appurtenances in any way connected with the Project, from the effect of extremes of heat, cold, wind, and rain; and other climatological conditions. Such action by the Contractor shall meet the requirements of the Engineer.
- I. The Contractor shall ascertain the true location of all underground structures of any kind whatsoever and shall be completely responsible for same regardless of their indication on Drawings or Specifications. They shall assume the cost of and make such arrangements as may be warranted to protect same or adjust or replace with the appropriate authority.

#### 12.0 SUPERVISION BY CONTRACTOR

- A. The Contractor will supervise and direct the Work. They will be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor will employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the Site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the Site at all times as required to perform adequate supervision and coordination of the Work. There will be no supervision by a designated working foreman without prior approval of the Engineer each time.
- B. If so ordered by the Engineer, the Contractor shall immediately remove any employee, Sub-contractor, or supplier, or any employee of a sub-contractor or supplier, who fails or refuses to carry out orders properly given, or who is, in the judgment of the Engineer, disorderly, unwilling to submit to authority, or lacking in requisite skill, and such person shall not again be employed on the Work.
- C. If, in the opinion of the Engineer, the progress of the work is such that the completion date of the Contract cannot be met for causes other than those provided in Section 15, he may request the Contractor to work additional men, additional hours, or both. The cost of all such overtime shall be borne by the Contractor.

#### 13.0 CHANGES IN THE WORK

- A. The Contractor may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order.
- B. The Engineer, also, may at any time issue a Change Directive, which directs Contractor to perform such additional and/or modified Work prior to agreement by Contractor on an adjustment in compensation or schedule, or both. To the extent that a Change Directive modifies the Work, Contractor may be entitled to an equitable adjustment in compensation or schedule, or both. Contractor shall promptly give written notice to seek an adjustment to the Contractor within (3) business days. Contractor shall promptly proceed to perform the changes in Work, notwithstanding its disagreement with the Change Directive.

#### 14.0 CHANGES IN CONTRACT PRICE

- A. The Engineer may at any time by written order and without notice to the sureties require the performance of extra work or changes in the Work as may be found necessary or desirable. The amount of compensation to be paid to the Contractor for any extra work so ordered shall be made in accordance with whichever of the following plans the Engineer elects: (1) a price agreed upon between the parties and stipulated in the order for the extra work, (2) a price based on the unit prices of the contract, (3) a price determined by adding 15% to the "reasonable cost" of the extra work performed, such "reasonable cost" to be determined by the Engineer in accordance with the following paragraph.
- B. In arriving at the "reasonable cost" for the purposes of (3) above, the Engineer shall include the reasonable cost to the Contractor of all materials used, of all labor common and skilled, of foreman, trucks, and the fair-market rental rate for all machinery and equipment for the period employed directly on the Work. The reasonable cost for extra work shall include the cost to the Contractor of any additional insurance that may be required covering public liability for injury to persons and property, the cost of Workmen's Compensation Insurance, Federal Social Security, and any other costs based on payrolls, and required by law. The cost of extra work shall not include any cost or rental of small tools, buildings, or any portion of the time of the Contractor, their project supervisor or superintendent, or any allowance for use of capital or the premium on the bond as assessed upon the amount of extra work, these items being considered covered by the fifteen percent (15%) added to the reasonable cost.
- C. In the case of extra work which is done by a Sub-contractor of the Contractor, whether these are under the specific contract items provided herein, or otherwise if so approved by the Engineer, the 15% added to the reasonable cost of the Work will be allowed only to the Sub-contractor. On such work, an additional 5% of the reasonable cost (before addition of the 15%) will be paid to the Contractor for his work in directing the operations of the Sub-contractor and for any overhead involved.

#### 15.0 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- A. The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice to Proceed.
- B. The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Client, Engineer, and the Contractor that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic, economic conditions, and other factors prevailing in the locality of the Work.
- C. If the Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by the Engineer, then the Contractor will pay to the Engineer the amount for liquidated damages as specified in the Bid for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.
- D. The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following, and the Contractor has promptly given Written Notice of such delay to the Engineer.
  - 1. to any preference, priority, or allocation order duly issued by the Engineer;
  - 2. to unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the Client, acts of another Contractor in the performance of a contract with the Client, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

3. to any delays of Sub-Contractors of the Contractor occasioned by any of the causes specified in paragraphs 1 and 2 of this section.

#### 16.0 CORRECTION OF WORK

- A. The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the Client and shall bear the expense of making good all Work of Contractors or Sub-contractors destroyed or damaged by such removal or replacement.
- B. All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of Written Notice, the Engineer may remove such Work and store the materials at the expense of the Contractor.
- C. The Engineer or a designated representative of the Engineer has the right to remove and replace rejected work after ten (10) days of receipt of Written Notice at the expense of the Contractor.

#### 17.0 SUBSURFACE CONDITIONS

- A. The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Engineer by Written Notice of:
  1. Subsurface or latent physical conditions at the Site differing materially from those indicated in the Contract Documents; or
  2. Unknown physical conditions at the Site, of an unusual nature, differing materially from those ordinarily encountered.
- B. The Engineer shall promptly investigate the conditions, and if they find that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice; provided that the Engineer may, if he determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

#### 18.0 SUSPENSION OF WORK, TERMINATION, AND DELAY

- A. The Engineer may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor which notice shall fix the date on which Work shall be resumed. The Contractor will resume that Work on the date so fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension. When the whole or any portion of the Work is suspended for any reason, the Contractor shall properly cover, secure, and protect or caused to be so protected, such Work as may be liable to sustain injury from any cause.
- B. If the Contractor is adjudged bankrupt or insolvent, or if they make a general assignment for the benefit of their creditors; or if a trustee or receiver is appointed for the Contractor or for any of their property; or if they file a petition to take advantage of any debtor's act; or to reorganize under the bankruptcy or applicable laws; or if they repeatedly fail to make prompt payments to their Contractors or for labor, materials, or equipment; or if they disregard laws, ordinances, rules, regulations, or orders of any public body having jurisdiction of the Work; or if they disregard the authority of the Engineer; or if they

otherwise violate any provision of the Contract Documents, then the Client may, without prejudice to any other right or remedy and after giving the Contractor and his surety a minimum of ten (10) days from delivery of a Written Notice, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment, and machinery thereon owned by the Contractor, and finish the Work by whatever method the Contractor may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the Contractor. Such costs incurred by the Contractor will be determined by the Engineer and incorporated in a Change Order.

- C. Where the Contractor's services have been so terminated by the Client, said termination shall not affect any right of the Client against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the Client due the Contractor will not release the Contractor from compliance with the Contract Documents.
- D. After ten (10) days from delivery of a Written Notice to the Contractor, the Client may, without cause and prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all Work executed and any expense sustained plus reasonable profit.
- E. If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by the Client or under an order or court or other public authority, or the Client fails to act on any request for payment within thirty (30) days after it is submitted, or the Client fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to the Client and the Engineer, terminate the Contract and recover from the Client payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the Client has failed to make any payment as aforesaid, the Contractor may upon ten (10) days notice to the Client and the Engineer stop the Work. Change Orders shall be issued for adjusting the Contract Price or extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.
- F. If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of a failure of the Client or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the Client or Engineer.

## 19.0 PAYMENTS TO CONTRACTOR

- A. At least ten days before each progress payment falls due (but not more often than once a month), the Contractor will submit to the Engineer a partial payment estimate filled out and signed by the Contractor covering the Work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work, but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the Client, as will establish the Client's title to the material and equipment and protect his interest therein, including applicable insurance. The Engineer will, within ten days after receipt of each partial payment estimate, either indicate in writing their approval of payment and present the partial payment estimate to the Client or return the partial payment estimate to the Contractor indicating in writing their reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate.
- B. Progress payments are detailed in Section 3 of the Agreement (Section 00520) and summarized below:

The Client will retain an amount of the progress payment, each month, in accordance with the following procedures:

1. Retainage shall be 10 percent of the monthly payments claimed.
  2. Upon substantial completion, the amount of retainage will be reduced to 2 percent of the total amount due the Contractor plus an additional retainage based on the Engineer's estimate of the fair value of the punch list items and the cost of completing specified amounts for each incomplete or defective item of work. As these items are completed or corrected, they shall be paid for out of the retainage until the entire project is declared complete. The final 2 percent retainage shall be held during the one-year warranty period and released only after the project has been accepted by the Client.
- C. On completion and acceptance of a part of the Work on which the price is stated separately in the Contract Documents, payment may be made in full, including retained percentages, less authorized deductions.
1. The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.
  2. All Work covered by partial payment made shall thereupon become the sole property of the Client, but this provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work upon which payments have been made or the restoration of any damaged Work, or as a waiver of the right of the Contractor to require the fulfillment of all terms of the Contract Documents.
  3. The Client also reserves the right to occupy certain finished portions of the work before final acceptance. If such right is exercised, the Client will assume all responsibility for his damage to the structure, but assumption of such responsibility by the Client in no way relieves the Contractor of his obligation as defined under Section 29, Guaranty.
  4. Upon completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted by them under the conditions of the Contract Documents. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as

may be lawfully retained by the Client, shall be paid to the Contractor within sixty (60) days of completion and acceptance of the Work.

5. The Contractor will indemnify and save the Client or the Client's agents harmless from all claims growing out of the lawful demands of Sub-contractors, laborers, workmen, mechanics, material men, and furnishers of machinery and parts thereof, equipment, tools and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall, at the Client's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so, the Client may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the Client to either the Contractor, their Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the Contractor shall be considered as a payment made under the Contract Documents by the Client to the Contractor and the Client shall not be liable to the Contractor for any such payments made in good faith.

#### 20.0 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Client of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Contractor and others relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents.

#### 21.0 INSURANCE

Refer to Section 17 of the Agreement (Section 00520) for insurance requirements.

#### 22.0 SEPARATE CONTRACTS

- A. The Client reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate their Work with the others. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.
- B. The Contractor may perform additional Work related to the Project on their own, or may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such contracts (or the Contractor, if they are performing the additional Work themselves), reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work, and shall properly connect and coordinate their Work with the others.
- C. If the performance of additional Work by other subcontractors or the Engineer is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Engineer or others

involved results in additional incurred expense or entitles them to an extension of the Contract Time, they may make a claim thereof as provided in Sections 14 and 15.

#### 23.0 SUBCONTRACTING

- A. The Contractor may utilize the services of specialty Sub-contractors on those parts of the Work which, under normal contracting practices, are performed by specialty Sub-contractors.
- B. The Contractor shall not award Work to Sub-contractor(s), in excess of fifty (50%) percent of the Contract Price, without prior written approval of the Engineer. The Contractor shall obtain the Engineer's approval of all Sub-contractors prior to entering into a sub-contractor's agreement.
- C. The Contractor shall be fully responsible to the Client for the acts and omissions of their Sub-contractors, and of persons either directly or indirectly employed by them, as they are for the acts and omissions of persons directly employed by them.
- D. The Contractor shall cause appropriate provisions to be inserted in all other subcontracts relative to the Work to bind other Sub-contractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of other Sub-contractors and to give the Contractor the same power in regard to terminating any subcontract that the Client may exercise over the Contractor under any provision of the Contract Documents.
- E. Nothing contained in this Contract shall create any contractual relation between any Sub-contractor of the Contractor and the Client.

#### 24.0 ENGINEERS AUTHORITY

- A. The Engineer shall act as the Client's representative during the construction period. They shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed. They shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.
- B. The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship, and execution of the Work. Inspections may be made of the factory or fabrication plant of the source of material supply.
- C. The Engineer will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.
- D. The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

#### 25.0 LAND AND RIGHTS-OF-WAY

- A. Prior to issuance of Notice to Proceed, the Client shall obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.
- B. The Engineer shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.
- C. The Contractor shall provide at their own expense and without liability to the Client any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

26.0 GUARANTY

The Contractor shall guarantee all materials and equipment furnished and Work performed for a period of one (1) year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one (1) year from the date of Substantial Completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. The Engineer will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or perform other Work that may be made necessary by such defects, the Client may do so and charge the Contractor the cost thereby incurred.

27.0 DISPUTE RESOLUTION

Refer to Section 26 of the Agreement (Section 00520) for dispute resolution requirements.

28.0 TAXES

The Contractor will pay all sales, consumer, use, and other similar taxes required by the law of the place where the Work is performed.

END OF SECTION



TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

**APPENDIX B**  
**SPECIFICATIONS**  
**(Division 1)**

SECTION 01110  
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. SECTION INTENT: This section is intended to provide a summary of the project and the various elements of work associated with it. This summary should be used in conjunction with other Specification sections and the construction Drawings. This section does not provide the technical detail for particular Work Items, but describes the work as a whole, providing an overall perspective to the separate tasks and their interrelationships.
- B. GENERAL: The scope of work for the Parcel D Phase I Soil Cap project (the Project) is to cap approximately 3 acres of a wetland buffer area, an upland area, and a former slag area with a combination of soil and soil/geosynthetic material in order to cover soil which exceeds the Rhode Island DEM Residential Direct Exposure Criteria. The scope of work includes but is not limited to the following activities:
  - 1. Clearing and grubbing
  - 2. Subgrade preparation and fill placement
  - 3. Installation of geosynthetic materials
  - 4. Placement of cap soils
  - 5. Restoration

1.02 DEFINITIONS

- A. "Engineer" as used in the Specifications/Drawings shall mean AMEC Earth and Infrastructure, Inc.
- B. "Contractor" as used in these specifications shall refer to the company who has entered into a contractual agreement with the Owner for scope of work and price to complete the work identified in the project's Contract Documents. The term Contractor also includes all agents, employees, vendors, and their sub-contractors.
- C. "Owner" as used in these specifications shall refer to Textron, Inc.

1.03 WORK COVERED BY THE SPECIFICATIONS AND DRAWINGS

- A. The Work for this contract includes:
  - 1. Submit a work plan, health and safety plan, and construction quality control plan to the Engineer. Work plans shall include details on equipment and personnel, schedule, work sequence, and means and methods. Construction Quality Control Plan shall be as specified in Section 01450, "Contractor Quality Control". Health and Safety Plan shall be as detailed in Section 01351, "Safety, Health, and Emergency Response."
  - 2. Mobilize equipment and personnel to the Site.
  - 3. Stage Site to provide temporary facilities, material storage, and staging areas.
  - 4. Repair or replace gate at west entrance on Adelaide Avenue and improve or construct access road to Site.
  - 5. Install security fence north of Parcel C and tie into existing fence at the school property.

6. Install erosion and sedimentation controls (sedimentation barriers, stabilized construction accesses, turbidity curtain) prior to any soil disturbance.
7. Place construction fencing around trees to remain. Clear and grub the Phase I work surface and apply chemical control of invasive species.
8. Excavate contaminated soil from the areas shown on the drawings and backfill with clean soil. Confirmatory soil sampling will be conducted by others prior to backfill.
9. Remove stone pile from slag area and stage at laydown area. Excavate soil below stone pile as shown in the drawings and perform test pits for confirmation sampling. Note: transportation and disposal and confirmation sampling by others.
10. Re-grade solid waste at Phase I work surface.
11. Construct waste fill cap, wetland buffer cap, and a former slag area cap.
12. Stabilize, seed and/or plant capped areas.
13. Remove temporary erosion and sedimentation controls, and remove temporary facilities.
14. Repair and seed disturbed areas used for construction staging and storage.

#### 1.04 WORK SEQUENCE

- A. The work shall be planned, scheduled, and performed in stages in order to complete the work within the requirements of the Specifications and Drawings and the requirements of appropriate regulatory agencies and permits.
- B. The sequence will be in the general sequence described by Article 1.03.
- C. Project Closeout:
  1. Request a Certificate of Substantial Completion;
  2. Perform a Site Inspection with AMEC to accept work and identify remaining work to be completed (punch list);
  3. Complete all remaining work noted in the punch list;
  4. Perform a Final Site Inspection with AMEC to verify all work is complete;
  5. Submit final record documents to AMEC;
  6. Complete final pay requisition with accompanying balancing change order as required; and
  7. Achieve Certificate of Final Completion.

#### 1.05 OTHER GENERAL REQUIREMENTS

- A. Comply with all project related permits and apply/obtain all Contractor responsible permits prior to the commencement of work.
- B. Make arrangements for temporary storage of materials and supplies and for timely delivery to the job site.
- C. Maintain up-to-date records on site.
- D. Maintain the project Site in a neat condition.

## PART 2 - PRODUCTS

Not Applicable

## PART 3 - EXECUTION

### 3.01 HEALTH AND SAFETY

- A. The Contractor is advised that the work will be performed on a Site that contains hazardous waste. The Contractor and its Sub-contractors are responsible for developing a Site-Specific Health and Safety Plan (HASP) for its operations. The Contractor shall implement this plan taking precautions as necessary to protect the public and work force personnel from potential hazards. The Contractor shall utilize personnel with approved hazardous waste training as required.

### 3.02 PROTECTION OF PROPERTY AND OPERATIONS

- A. The Contractor shall utilize every precaution to protect the property from damage during execution of the Work. Any damage that the Contractor may inflict shall be repaired or replaced in a prompt manner as directed by AMEC at no additional cost to the Owner.
- B. The Contractor shall take all measures required to minimize adverse impacts from execution of the work on property abutters and shall not interfere with their operations.
- C. The Contractor shall coordinate site restrictions and vehicular/pedestrian traffic control plans as appropriate.

### 3.03 SUBCONTRACTOR'S USE OF PREMISES

- A. The Contractor shall use only those designated areas of the Site for staging and storage. Staging and storage areas are to be agreed upon and accepted by AMEC and the Owner.
- B. The Contractor shall assume full responsibility for the protection and safe keeping of products and equipment under this Contract that are stored on-site during the project construction.

### 3.04 OTHER REQUIREMENTS

- A. The Contractor is responsible for using special care and or special considerations which may be necessary for proper execution of the work, but which may not be specifically identified in this section. The Contractor shall comply with the entire requirements of the Specifications and Drawings and shall exercise special care wherever required for proper execution of the intended work of this contract.
- B. The Contractor shall comply with all the requirements of any necessary permits.

END OF SECTION

## SECTION 01330

### SUBMITTAL PROCEDURES

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Required submittals are identified in each technical specification section of the Contract Documents. A summary of submittals is provided at the end of this section. Submittals shall be provided to the Engineer, as required, unless otherwise specified. Submittals may include:
1. Data;
  2. Drawings;
  3. Instructions;
  4. Schedules;
  5. Statements;
  6. Reports;
  7. Plans;
  8. Certificates;
  9. Samples;
  10. Records; and
  11. Operation and Maintenance Manuals.

##### 1.02 GENERAL REQUIREMENTS

- A. All costs necessary for compliance with requirements of this Section shall be incidental to the bid items under which labor, equipment, and material is paid.
- B. All data, drawings, and correspondence from subcontractors, manufacturers, or suppliers shall be routed through Contractor. Engineer shall review only such data and details as are transmitted to him by Contractor. All correspondence from Contractor to Engineer shall refer to appropriate specification number and paragraph and/or sheet number of the Drawings containing subject matter of inquiry.
- C. Upon review and acceptance of the Submittal by the Engineer, the Submittal shall become a part of the Contract, and the work executed shall be in conformity with the same. Review of Submittals, however, shall in no way release the Contractor from his responsibility for proper fulfillment, by any fabrication, of the requirements of this Contract.
- D. The Contractor's attention is specifically directed to the fact that no work shall be conducted, nor equipment or materials ordered, nor any construction performed, prior to approval by Engineer of Submittals applicable thereto. Construction performed in violation of this requirement will be neither approved nor certified for payment until applicable Submittals have been submitted and approved. If any equipment or materials are ordered by Contractor prior to submission and approval of Submittals, it is done at Contractor's risk.
- E. The Contractor is responsible for making necessary changes to other items, which may result from deviations or changes requested by the Contractor and approved by Engineer, so that all items of work satisfy the requirements and intent of Contract Documents.

### 1.03 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to submission.
- B. Coordinate each submittal with requirements of work and of Contract Documents.
- C. Contractor's responsibility for errors and omissions in submittals is not relieved by Engineer's review of submittals.
- D. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Engineer's review of submittals, unless Engineer gives written acceptance of specific deviations.
- E. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.
- F. Begin work which requires submittals after return of Engineer's approval.
- G. After Engineer's review, maintain file copies.

### 1.04 ENGINEER'S REVIEW OF SUBMITTALS

- A. The Engineer's review of submittals shall not be construed as a complete check, but is only for general conformance with design concept for the project and general compliance with the information given in the Contract Documents. Review will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, the fabrication processes, the construction methods, and the satisfactory construction of all work.
- B. Engineer's review action codes are listed below.
  - 1. No Exceptions Taken (Code 1): Fabrication and installation may proceed.
  - 2. Make Corrections Noted (Code 2): Contractor shall make the changes noted, and then may proceed with fabrication or installation.
  - 3. Amend and Resubmit (Code 3): Contractor shall make the changes noted, and resubmit for an additional review cycle.
  - 4. Rejected - See Remarks (Code 4): Contractor shall make the changes noted, which may involve a complete new product submittal, and resubmit for an additional review cycle.
- C. After submittals have received a review action 1 or 2 by the Engineer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by a detailed explanation of why a substitution is necessary.

## PART 2 - PRODUCTS

Not Applicable.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. The Contractor shall make submittals as required by the individual specification sections and as summarized in the Index of Submittals provided at the end of this section.
- B. The Engineer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

- C. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings.
- D. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements.
- E. Prior to submittal, all items shall be checked and reviewed by the Contractor and each item shall be certified, signed, and dated by the Contractor. Proposed deviations from the Contract Documents shall be clearly identified.
- F. Submittals shall include items such as:
  - 1. Manufacturer's or fabricator's drawings;
  - 2. Descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves;
  - 3. Test reports;
  - 4. Samples;
  - 5. Operation and Maintenance Manuals (including parts list);
  - 6. Certifications;
  - 7. Warranties; and
  - 8. Other pertinent data.
- G. Submittals requiring Engineer review shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.
- H. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

### 3.02 SUBMITTAL REQUIREMENTS

- A. Transmittal Form:
  - 1. A Transmittal form shall accompany all submittals.
  - 2. The Transmittal form shall be developed and furnished by the Engineer.
  - 3. Transmittals shall include the following information, at a minimum:
    - a. Submittal number in sequence, beginning with 1 (subsequent revised submittals shall be identified with a number and letter);
    - b. Date;
    - c. Project title and project number;
    - d. Contractor's name and address;
    - e. Identification of each item submitted under the single Transmittal with a separate sequential number (e.g., 1.1, 1.2, etc.);
    - f. Reference to the specification number and paragraph and/or Contract Drawing sheet number and detail number (if applicable) pertinent to the data submitted.
    - g. Notification of any deviations from Contract Documents;
    - h. Return date required by Contractor; and
    - i. Other pertinent data.
- B. Contractor Certification: The Contractor's Certification that the submittal meets contract requirements shall contain the following:

1. Contractor firm name;
  2. Point of contact name, signature, and title;
  3. Date; and
  4. Contractor's corrections as noted on submittal data and/or attached sheets(s).
  5. The certification may be provided as part of the Transmittal, on a separate sheet attached to the form, or as a stamp on the submittal itself.
- C. Procedures:
1. The Contractor shall schedule submissions at least 14 days before dates reviewed submittals will be needed, except where different lead time is specified.
  2. The Contractor shall deliver to Engineer four (4) copies of all submittals and Transmittals. To expedite the review of smaller submittals, the Contractor may provide a legible fax or e-mail, if followed by the required number of hard copies.
  3. The Contractor shall maintain one copy of the submittal and Transmittal on site.
  4. At the time of each submission, the Contractor shall call to the Engineer's attention, in writing, any deviations that the submittal may have from the requirements of the Contract Documents.
- D. Submittals shall include:
1. Date and revision dates;
  2. Project title and number;
  3. The names of:
    - a. Engineer;
    - b. Contractor;
    - c. Subcontractor;
    - d. Supplier;
    - e. Manufacturer; and
    - f. Separate detailer when pertinent.
  4. Identification of product or material;
  5. Field dimensions, clearly identified as such;
  6. Specification section number and paragraph or sheet and detail number of the Drawings; and
  7. Applicable standards, such as ASTM number or Federal Specification.
  8. For submittals which include proposed deviations requested by the Contractor, "variation" shall be clearly indicated on the transmittal form. The Contractor shall state the reason for any deviations and annotate such deviations on the submittal. The Engineer reserves the right to rescind inadvertent acceptance of submittals containing unnoted deviations.
- E. Submittals shall be of standardized sizes.
1. Approved standard sizes shall be:
    - a. 24 inches by 36 inches;
    - b. 11 inches by 17 inches; and
    - c. 11 inches by 8 1/2 inches.
  2. Provision shall be made in preparing submittals to afford a binding margin on left hand side of sheet.
  3. Submittals put forward other than as specified herein may be returned for resubmittal without being reviewed.



### 3.03 RESUBMITTALS

- A. The Contractor shall make all corrections required by the Engineer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on a submittal to constitute a change to the Contract, a notice in accordance with the Contract shall be given promptly to the Department and the Engineer.
- B. Identify as a resubmission by adding a letter suffix to the original submittal number (1A for the first resubmission of the first submittal; 1B for the second resubmission; etc.).

### 3.04 REVIEW OF SUBMITTALS

- A. Upon completion of review of submittals, the Engineer will email review action and comments to the Contractor.

### 3.05 DISTRIBUTION OF SUBMITTALS

- A. Two copies of the submittal will be retained by the Engineer, with review action and comments attached to each copy.
- B. Two copies of the submittal will be returned to the Contractor by the Engineer, with review action and comments attached to each copy.
- C. A file of all submittals made to the Engineer, reviews by the Engineer, resubmittals, and final approved submittals shall be maintained by the Contractor.
- D. This file or a copy of the file shall be maintained by the Contractor at the project Site while work is being conducted at the Site.

#### Submittal Summary:

[To be provided with the Draft Construction Documents]

END OF SECTION

## SECTION 01340

## SUBMITTAL SCHEDULE ATTACHMENT

**DIVISION I – GENERAL REQUIREMENTS**

		<b>Revision Date</b>	<b>Rev. No.</b>
01110	Summary of Work	05/22/06	0
	1.01.B Work Plan	TBD	0
01270	Measurement and Payment (No submittals required)		
01330	Submittal Procedures (No submittals required)		
01351	Safety, Health, and Emergency Response	TBD	0
	1.04.A.1 Site Health and Safety Plan	TBD	0
	1.04.A.1.b Emergency Response Plan	TBD	0
	1.04.A.1.c Spill Control Measures and Abatement Plan	TBD	0
	1.21.B SSHO's Daily Inspection Logs	TBD	0
	Employee Medical Examination Statements	TBD	0
01400	Environmental Protection (No submittals required)		
01410	Regulatory Requirements (No submittals required)		
01450	Contractor Quality Control	TBD	0
	1.03.A.1 Contractor Quality Control (CQC) Plan - shall identify personnel, procedures, instructions, records and forms to be used in carrying out the requirements of this project.	TBD	0
	1.03.B Weekly CQC Reports, Test Reports, Deficiency Reports, and Summary	TBD	0
01460	Field Engineering and Survey Control	TBD	0
	1.03.A Qualifications – of persons providing field engineering and survey services	TBD	0
	1.03.B Documentation – verify accuracy of survey work	TBD	0
	1.03.C Results of Field Verification Surveys	TBD	0
	1.03.D Log of Control and Survey Work	TBD	0
	Record Documents: (see also 01780 – “Project Record Documents”)	TBD	0
01510	Temporary Facilities and Control	TBD	0
	1.2.A Temporary Leachate Management Plan	TBD	0
01780	Project Record Documents	TBD	0
	1.03.B Certification that work is complete	TBD	0
	1.05 Warranty copies	TBD	0
	1.07 Project Record Documents with Transmittal Letter and Directory	TBD	0
02101	Clearing and Grubbing (No submittals required)		
02300	Earthwork	TBD	0
	1.04.A Borrow Source(s)	TBD	1
	1.04.B Subcontractors Quality Control Testing Laboratory	TBD	1
	1.04.C Test Reports	TBD	1
02370	Erosion and Sedimentation Control (No submittals required)		
02372	Geomembrane	TBD	0
	1.04.A Liner Manufacturer and Liner Material related Submittals	TBD	0
	1.04.B Installer Capabilities and Information	TBD	0
	1.04.C Shop Drawings and Installation Quality Control	TBD	0

			<b>Revision</b>	<b>Rev.</b>
			<b><u>Date</u></b>	<b><u>No.</u></b>
02373		Geotextiles	TBD	0
	1.04.A.1	Product Data	TBD	0
02444		Chain Link Fences and Gates	TBD	0
	1.4.1	Product data	TBD	0
02526		Abandonment of Monitoring Wells and Piezometers	TBD	0
	1.03.A.1	Well Abandonment Completion Form	TBD	0
02602		Precast Concrete Structures	TBD	0
	1.4.1	Shop Drawings of All Precast Units and Manufacturer's Information	TBD	0
02610		Site Piping	TBD	0
	1.04	Product Data	TBD	0
02920		Seeding	TBD	0
	1.4.A	Grass Seed Vendor's Certificate	TBD	0
	1.4.B	Fertilizer Product Data	TBD	0
	1.4.C	Hydraulic Seeding Method	TBD	0

## SECTION 01351

### SAFETY, HEALTH, AND EMERGENCY RESPONSE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. This Section covers the health and safety requirements to be followed for the Parcel D Phase 1 Soil Cap (the Project), which includes the excavation of contaminated soil and capping of material on the western shore line along Mashapaug Pond and capping a 3 acre area along the Inner Cove of Mashapaug Pond. This Section provides requirements for preparing and submitting a Site Health and Safety Plan (HASP). The requirements shall apply to all work performed at the Site.
- B. Work at the Site will include clearing and grubbing existing vegetation, subgrade preparation, placement of subgrade fill, installation of cap materials, stabilizing cap areas, and site restoration.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01110: Summary of Work
- B. Section 01330: Submittal Procedures

##### 1.03 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
  - 1. CODE OF FEDERAL REGULATIONS (CFR)
    - a. 29 CFR 1910 Occupational Safety and Health Standards
    - b. 29 CFR 1926 Safety and Health Regulations for Construction

##### 1.04 SUBMITTALS

- A. The following shall be submitted in accordance with Section 01340, Submittal Procedures:
  - 1. The HASP shall detail the health and safety procedures to be followed during completion of the work and shall be developed in accordance with this specification. The Contractor shall periodically review the plan during work operations to keep it current and technically correct. The HASP shall include, but not be limited to, the following:
    - a. Activity Hazard Analyses for each task scheduled to be completed as part of the work. Analysis shall detail anticipated or potential safety concerns and provide specific actions or engineering controls to mitigate potential hazards.
    - b. Emergency Response Plan.
    - c. Spill Control Measures and Abatement Plan.

##### 1.05 REGULATORY REQUIREMENTS

- A. Work performed under this contract shall comply with applicable Federal, state, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, 29 CFR 1910.

#### 1.06 PRE-CONSTRUCTION CONFERENCE

- A. As part of the Pre-construction Conference the Contractor, or his/her representative, the on-site construction superintendent and designated Site Safety and Health Officer (SSHO) will provide general details of the Contractor's HASP.
  - 1. Recommended discussion topics include:
    - a. Discussion and review of the Contractor's accident prevention plan.
    - b. Review of any specific local health and safety requirements.
    - c. Review of the Contractor's list of anticipated phases of work requiring an activity hazard analysis.
    - d. Review of accident investigation and reporting requirements.
  - 2. The discussions at the pre-construction safety conference shall become a matter of record and shall be included as amendments to the Contractor's accident prevention plan.

#### 1.07 SAFETY AND HEALTH PROGRAM

- A. The site-specific program requirements of the OSHA Standards shall be integrated into one site-specific document. The HASP shall interface with the employer's (Contractor's) overall Safety and Health Program. Any portions of the overall Safety and Health Program that are referenced in the HASP shall be included as appendices to the HASP.

#### 1.08 SITE HEALTH AND SAFETY PLAN

- A. Preparation and Implementation. A HASP shall be prepared covering on-site work to be performed by the Contractor and all their sub-contractors. The Contractor's SSHO shall be responsible for the development, implementation and oversight of the HASP. The HASP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each phase of the work. The HASP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. The level of detail provided in the HASP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial HASP is prepared and submitted. Therefore, the HASP shall address, in as much detail as possible, anticipated tasks, their related hazards, and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in Section 1.09 Hazard/Risk Analysis.
- B. Acceptance and Modifications. Prior to submittal, the HASP shall be signed by the SSHO and the Site Superintendent. The HASP shall be submitted for review 7 days prior to execution of work at the site. On-site work shall not begin until the plan has been accepted. A copy of the written HASP shall be maintained on site. As work proceeds, the HASP shall be adapted to new situations and new conditions. Changes and modifications to the accepted HASP shall be made with the knowledge and concurrence of the SSHO, the Site Superintendent, and the Engineer. Disregard for the provisions of this specification or the accepted HASP shall be cause for stopping of work until the matter has been resolved.

#### 1.09 HAZARD/RISK ANALYSIS

- A. The HASP shall include a safety and health hazard/risk analysis for site tasks and operations to be performed as part of the contract. The hazard/risk analysis shall provide information necessary for determining safety and health procedures, equipment, and training to protect on-site personnel, the environment, and the public. The following elements, at a minimum, shall be addressed.

1. Site Tasks and Operations (Work Plan). The HASP shall summarize the tasks and objectives of the site operations of this project, and the logistics and resources required to achieve those tasks and objectives safely.
2. Hazards. The following potential hazards may be encountered during site work. They are not complete lists; therefore, they shall be expanded and/or revised as necessary during preparation of the HASP.
  - a. Safety Hazards. Potential safety hazards associated with the work could be related to operation of heavy construction equipment.
  - b. Chemical Hazards. Potential chemical hazards that may be encountered during Site work shall be discussed in the HASP. The Hazard/Risk Analysis section of the HASP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, anticipated on-site and off-site exposure level potentials, and regulatory (including Federal, state, and local) or recommended protective exposure standards. The HASP shall also address employee exposure to hazardous substances brought on site, and shall comply with the requirements of 29 CFR 1910, Section 1910.1200 and 29 CFR 1926, Section 1926.59, Hazard Communication.
  - c. Physical Agents. Potential physical hazards during work on the Site could include: heat stress and cold stress; noise related hazards; physical strain from heavy lifting; and slips, trips, and falls.
  - d. Biological Hazards. Potential biological hazards associated with the work on the Site could include poison ivy and insect and animal bites.
3. Action Levels. Action levels shall be established in the HASP for situations anticipated or potential at the Site.

#### 1.10 ACTIVITY HAZARD ANALYSES

- A. Prior to beginning work, Activity Hazard Analyses shall be prepared for each anticipated activity, by the Contractor or Subcontractor performing that work. Analyses shall define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. The activity hazard analyses shall be continuously reviewed and when appropriate modified to address changing site conditions or operations, with the concurrence of the SSHO, and the Site Superintendent. Activity hazard analyses shall be attached to, and become a part of, the HASP.

#### 1.11 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

- A. An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site safety, health, and emergency response.

#### 1.12 TRAINING

- A. Personnel shall receive training in accordance with the Contractor's written safety and health training program and 29 CFR 1910 Section 1910.120, 29 CFR 1926 Section 1926.65, and 29 CFR 1926 Section 1926.21.
  1. Site-specific Training. Site-specific training sessions shall be documented, scheduled in advance, and attendance shall be mandatory and shall be extended to the Engineer.
    - a. Initial Session (Pre-entry Briefing). Prior to commencement of on-site field activities, all site employees, including those assigned to non-hazard areas, shall attend a site-specific safety and health training session

of appropriate duration. Training shall be conducted by the SSHO or other qualified individual to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment.

- b. Periodic Sessions. Periodic on-site training shall be conducted by the SSHO at least weekly for personnel assigned to work at the Site during the following week. The training shall address safety and health procedures, work practices, any changes in the HASP, activity hazard analyses, work tasks, or schedule; results of previous week's monitoring; review of safety discrepancies; and accidents.

#### 1.13 PERSONAL PROTECTIVE EQUIPMENT

- A. PPE Program. In accordance with 29 CFR 1910 Section 1910.120 (g)(5) and 29 CFR 1926 Section 1926.65 (g)(5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation is to be included in the Contractor's Safety and Health Program. The HASP shall detail the minimum PPE ensembles (including any necessary respiratory protection) and specific materials from which the PPE components are constructed for each site-specific task and operation to be performed. On-site personnel shall be provided with appropriate personal protective equipment. Protective equipment and clothing shall be kept clean and well maintained. The PPE Section of the HASP shall include site-specific procedures to determine PPE program effectiveness and for cleaning, maintenance, inspection, and storage of PPE.
- B. Levels of Protection. The SSHO shall establish appropriate levels of protection for each work activity based on review of historical site information, existing data, an evaluation of the potential for exposure (inhalation, dermal, ingestion) during each phase of the work.

#### 1.14 MEDICAL SURVEILLANCE

- A. The Contractor's medical surveillance program shall be detailed in the HASP.
- B. A medical examination statement shall be obtained for all employees conducting work at the site similar to the one provided at the end of this specification.

#### 1.15 HEAT AND COLD STRESS MONITORING

- A. The Site SSHO shall develop a heat stress and cold stress monitoring program for on-site activities. Schedules for work and rest, and physiological monitoring requirements, shall be described in the HASP. Details regarding the monitoring program shall be included in the HASP only as changes to the program are anticipated. Personnel shall be trained to recognize the symptoms of heat and cold stress. The SSHO and an alternate person shall be designated to be responsible for the heat and cold stress monitoring program.

#### 1.16 SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

- A. The HASP shall describe the standard operating safety procedures, engineering controls, and safe work practices to be implemented for the work. Possible procedures may include, but shall not be limited to, the following:
  - 1. General Site Rules/Prohibitions,
  - 2. Material Handling Procedures, and
  - 3. Spill and Discharge Control

1.17 PERSONNAL HYGENE

- A. Personnel, equipment, and material entering the Site shall adhere to the personal hygiene provisions identified in the HASP. A discussion of personal hygiene and procedures to be followed by site workers shall be submitted as part of the HASP.

1.18 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

- A. The HASP shall describe the emergency and first aid equipment to be available on site, the specific locations of the equipment and identification of individuals trained in the use of such equipment who are first aid and/or CPR certified by a recognized training organization (e.g., American Red Cross).

1.19 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

- A. An Emergency Response Plan that meets the requirements of 29 CFR 1910 Section 1910.120 (l) and 29 CFR 1926 Section 1926.65 (l), shall be developed and implemented as a Section of the HASP. This Plan/Section shall be formatted as a stand alone document.
- B. In the event of any emergency associated with closure activities, the Contractor shall, without delay, alert all on-site employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Engineer, and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to such expected emergencies.
- C. The Contractor shall alert local emergency response personnel and dispatchers of the work in progress.

1.20 INSPECTIONS

- A. The SSHO shall perform inspections of the jobsite and the work in progress to ensure compliance with the Safety and Health Program, and other occupational health and safety requirements of the contract. Procedures for correcting deficiencies should be included.
- B. Safety inspection logs shall be used to document the inspections, noting safety and health deficiencies, and corrective actions taken. The SSHO's Daily Inspection Logs shall be attached to and submitted with the Daily project reporting and shall include the date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer. In the event of an accident, the Engineer shall be notified immediately of any reportable accident; an appropriate Accident Report shall be completed and submitted by the Contractor within 24 hours of the accident.



EMPLOYEE MEDICAL EXAMINATION STATEMENT:

I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

Were no limitations to performing the required work tasks. ( )

Were identified physical limitations to performing the required work tasks. ( )

Date medical exam completed \_\_\_\_\_

[Employee's][Visitor's] Signature \_\_\_\_\_

Date \_\_\_\_\_

Printed Name \_\_\_\_\_

Contractor's Site Safety and Health Officer Signature \_\_\_\_\_

Date \_\_\_\_\_

Printed Name \_\_\_\_\_

END OF SECTION

## SECTION 01450

### CONTRACTOR QUALITY CONTROL

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

This section covers quality control procedures and testing to be completed during Work. Prior to commencement of Work, the Contractor shall prepare a Contractor Quality Control (CQC) Plan detailing the procedures to be followed and testing to be completed. Quality control testing shall be executed as required in this Specification.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01330: Submittal Procedures
- B. Section 01780: Project Record Documents

##### 1.03 SUBMITTALS

- A. Pre-construction Submittals:
  - 1. Contractor Quality Control (CQC) Plan – shall identify personnel, procedures, instructions, records and forms to be used in carrying out the requirements of this project. The CQC Plan shall provide the Contractor with a means to provide and maintain effective Quality Control for construction, sampling and testing activities. No work on-site shall be permitted until comments received are adequately addressed by the Contractor and the CQC Plan is approved by the Engineer.
- B. Weekly CQC Reports, Test Reports, Deficiency Reports, and Project Summary.

##### 1.04 CONSTRUCTION QUALITY ASSURANCE

- A. The Client is responsible for providing Construction Quality Assurance (CQA) services during the execution of the Work in accordance with applicable regulations.
- B. The Contractor's Quality Control procedures shall include coordinating and assisting the Engineer in conducting CQA services as required.

#### PART 2 - PRODUCTS

Not applicable.

#### PART 3 - EXECUTION

##### 3.01 GENERAL REQUIREMENTS

- A. The quality of all Work shall be the responsibility of the Contractor.
- B. Perform sufficient inspections and tests of all items of work, on a continuing basis, including that of sub-contractors, to ensure conformance to applicable specifications and drawings with respect to the quality of materials, workmanship, construction, and functional performance.
- C. Provide qualified personnel, appropriate facilities, instruments, and testing devices

necessary for the performance of the quality control function.

- D. Controls shall be adequate to cover all construction operations, shall be keyed to the proposed construction sequence, and shall be coordinated by the Contractor's quality control personnel.

### 3.02 CONTRACTOR QUALITY CONTROL (CQC) PLAN

- A. Prepare and submit a CQC Plan to the Engineer for approval.
- B. Comments or approval from the Engineer will be submitted to the Contractor within 14 calendar days following receipt of the plan. Contractor shall adequately respond to comments to the satisfaction of the Engineer within 7 calendar days following receipt of any comments from the Engineer.
- C. No work on site shall be permitted until the comments received are adequately addressed by the Contractor and the CQC Plan is approved by the Engineer.
- D. The CQC Plan, at a minimum, shall include the following:
  - 1. A description of the Quality Control Organization, including charts showing lines of internal Contractor authority, and external Contractor, subcontractor, and Owner's Representative relationships. The Quality Control Organization shall include the names, qualifications, duties, and responsibilities of each person assigned to a quality control function. The Quality Control Organization chart shall identify a Contractor's Quality Control Manager whose responsibilities and qualifications are described in the Article entitled "Contractor Quality Control Organization" in this section.
  - 2. Method of performing, documenting and enforcing quality control operations of both Contractor and subcontract work including inspection and testing.
  - 3. Inspections as described in the article entitled, "Inspections" in this section.
  - 4. Provide a list of analytical or testing laboratories to be used by the Contractor for testing required by these technical specifications with specific test methods to be performed by each laboratory indicated.
  - 5. Protocol describing corrective actions to be taken by the Contractor with specifically defined feedback systems. The Engineer will then decide what further corrective action, if any, shall be taken by the Contractor. Personnel responsible for initiating and carrying out corrective action shall be indicated in the protocol.
- E. Submit Weekly CQC Reports, Test Reports, Deficiency Reports and Project Summary as required by this specification.

### 3.03 NOTIFICATION OF CHANGE

- A. After submittal and approval of the CQC Plan, the Engineer shall be notified in writing of any proposed changes to the CQC Plan.

### 3.04 CONTRACTOR QUALITY CONTROL ORGANIZATION

- A. CQC Manager:
  - 1. Identify an individual, within the Contractor's organization at the work site, who shall be responsible for overall management of the CQC Plan and have the authority to act in all CQC matters for the Contractor.
  - 2. The CQC Manager for this contract shall be a qualified construction manager/engineer or comparable individual with a minimum of 2 years of applicable experience, at the Project Manager, Project Engineer, Superintendent or

CQC Manager level, whose responsibility is to ensure compliance with the contract plans and specifications. The CQC Manager shall be independent of the Project Superintendent.

3. The CQC Manager shall be on-site whenever work is in progress so that he/she may be in charge of the CQC Plan for the project.
4. All submittals for approval shall be reviewed and modified or corrected as needed by the CQC Manager the authorized assistants prior to forwarding each submittal to the Engineer.

### 3.05 INSPECTIONS

- A. The CQC Plan shall include the following inspections and tests:
1. The Contractor shall perform preparatory inspections prior to beginning each feature of work on any on-site construction work conducted by the Contractor or a subcontractor. Preparatory inspections for the applicable feature of work shall include:
    - a. review of submittal requirements and all other Contract requirements with the performance of the work;
    - b. check to assure that provisions have been made to provide required field work control testing;
    - c. examine the work area to ascertain that all preliminary work has been completed;
    - d. verify all field dimensions and advise the Engineer of any discrepancies;
    - e. perform a physical examination of materials and equipment to assure that they conform to approved shop drawings or submittal data and that all required materials and/or equipment are on hand and comply with the contract requirements.
  2. Perform initial inspection as soon as work begins on a representative portion of the particular feature of work, and include examination of the quality of workmanship as well as review of control testing for compliance with control requirements.
  3. Perform follow-up inspections continuously as any particular feature of work progresses to ensure compliance with Contract requirements, including control testing, until completion of that feature of work.

### 3.06 TESTING

- A. The Contractor shall be responsible for all required testing, documentation, and corrective measures. The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements.

END OF SECTION

## SECTION 01460

### FIELD ENGINEERING AND SURVEY CONTROL

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Established survey control points are available on site for construction purposes. The Contractor shall verify locations of survey control points prior to starting work. The Contractor shall safeguard all survey control points. Should any of these points be damaged or destroyed, the Contractor shall replace the control point at no cost to the Client. The Contractor shall assume the entire expense of rectifying work improperly constructed due to failure to maintain and protect such established survey control points.
- B. The Contractor shall be responsible for the layout of the proposed work as shown on the Drawings and any additional survey control points, grid coordinate locations, lines, grades, and levels necessary for the proper construction and testing of the work required in the Contract Documents. Survey control shall include, but not be limited to, maintaining appropriate slopes and specified thicknesses.
- C. The Subcontractor shall employ a surveyor using standard practices and datum for the State of Rhode Island to provide the surveying functions necessary for the proper execution of the work, and to document and record the completed work.
- D. The Contractor is responsible for scheduling the surveys to coincide with his construction activities. If the survey documentation shows improper slopes, elevations, locations, or lift thicknesses, the Contractor shall correct the deficiency and re-survey the re-work. Phases of survey layout and documentation may include, but not be limited to:
  - 1. Initial field verification survey, see paragraph 1.06;
  - 2. Constructed limits of capping system;
  - 3. Utility and storm drain features installed or re-located as part of the work;
  - 4. Final grade elevations and topographic survey of surficial features, including all repaired areas and improved Access Roads.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01110: Summary of Work
- B. Section 01330: Submittal Procedures
- C. Section 01780: Project Record Documents

##### 1.03 SUBMITTALS

- A. On request, submit data demonstrating qualifications of persons providing field engineering and survey services.
- B. On request, submit documentation verifying accuracy of survey work.
- C. The Contractor shall perform a field verification of survey of all proposed work areas as part of the work prior to the start of construction activities to verify/establish current conditions. The Contractor shall then compare the existing condition information shown on the Contract Drawings to the current conditions determined during the field verification activities. Where discrepancies exist, the Contractor shall submit to the Engineer the results of the field verification survey and results of the comparison with the Contract Drawings. All discrepancies shall be resolved by the Engineer prior to initiation of construction activities affected by discrepancies.
- D. Maintain a complete and accurate log of control and survey work as it progresses. Submit Record Documents specified in Section 01780, "Project Record Documents".

1.04 FIELD ENGINEERING AND SURVEY REQUIREMENTS

- A. Provide field engineering and survey services using appropriate construction practices. Use skilled persons, trained and experienced in the necessary tasks and techniques for the proper execution of the work. Locate and layout the work by survey instrumentation and similar appropriate means.
- B. The Contractor shall perform the layout and shall document completed construction on Record Drawings, including the features listed in this Specification.
- C. The Contractor shall sufficiently establish the existing ground elevations before earthwork is started. Survey constructed final grades subsequent to excavation and filling existing grades. The Contractor shall sufficiently survey to verify quantities included in requests for payment.
- D. Vertical and horizontal control shall be sufficient to assure work is constructed within 0.1 foot of proposed fill thickness requirements (or proposed grades as indicated where settlement is not a concern) and location.
- E. Verification surveys, surveys for measurement and payment, and Project Record documentation shall be provided in electronic file format compatible with AutoCAD 2006.

1.05 TECHNICAL REQUIREMENTS OF SURVEY

- A. Horizontal ground control shall originate and terminate on Rhode Island State Plane NAD 83. Vertical control shall be tied to Rhode Island State Plane NGVD 1929.
- B. Map Accuracy - Ninety percent of the elevations determined from the solid-line contours for the topographic maps shall have an accuracy with respect to true elevation of 0.5 contour interval (0.5 foot) or better, and the remaining 10 percent of such elevations shall not be in error by more than one contour interval (1 foot).
- C. Vertical Control: A permanent project benchmark for vertical control has been set and is shown on the Drawings. Additional project benchmarks shall be based on the existing site benchmark.
- D. Horizontal Control: Several existing horizontal control points are shown on the Drawings.
- E. Spot Elevations: Survey shall be constructed to provide an accuracy of 0.1 feet vertically. No grade shots exceeding 500 feet shall be taken. Ninety percent of all spot elevations placed on the maps shall have an accuracy of at least 0.1 feet, and the remaining 10 percent shall not be in error by more than one-half (1/2) of the contour interval (0.5 feet).
- E. Accuracy - Accuracies and accuracy tests apply to the stereo compilation scale of the original manuscript (i.e., if the manuscript is compiled at a scale of 1 inch = 100 feet and then reduced to 1 inch = 200 feet, then the accuracies will apply to the original 1 inch = 100 feet scale). This is also true if the manuscript is enlarged to 1 inch = 50 feet or some larger scale.

1.06 FIELD VERIFICATION SURVEY

- A. The existing conditions depicted on the Drawings are based on an existing survey prepared by Cabco Consult (2007).

END OF SECTION

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01460-2

## SECTION 01510

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Work Included:
1. Provide such temporary enclosures facilities and controls as the work may warrant. General locations as depicted on the Contract Drawings may be modified as required by the Contractor upon approval of the Engineer and Client.
  2. Required facilities include:
    - a. Contractor's office (construction trailer) and storage facilities. Include adequate facilities for the Engineer (in the Contractor's trailer or separate), which shall include lighting, one desk, one metal five-drawer file storage cabinet, and two padded folding chairs.
    - b. Sanitary facilities (self-contained toilet units) conforming to local codes and OSHA requirements.
    - b. Fire protection.
    - c. Safety equipment.
    - d. Site security fence.
    - e. Soil stockpile areas (see Section 02300, "Earthwork", for information).
    - f. Decontamination pad.
  3. Other facilities that may be necessary or provided, depending on the Contractor's approach to the work and the preference of the Contractor, include, but are not limited to:
    - b. Yard lighting (if necessary).
    - c. Construction warning, protection, and control devices for maintenance and safety of vehicular and pedestrian traffic (if necessary).
  4. Completely remove all temporary equipment and materials upon completion of the work and repair all damage caused by the installation of temporary utilities.
  5. Make all necessary applications and arrangements for electric power, light, water and other utilities with the property owner and/or tenants. Notify the local electric power company if unusually heavy loads, such as welders, will be connected.
- B. Other Requirements:
1. Obtain permits as required by local governmental authorities.
  2. Obtain easements, when required, across private property other than that of the Owner for temporary power service.
  3. Comply with the latest National Electrical Code.
  4. Comply with all local, State and Federal codes, laws, and regulations.
  5. Allow access to and use of facilities provided by the Contractor to the Engineer and Owner.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Contractor's facilities shall be of size and content for adequate administration of the contract, storage of materials required, and provision for personnel shelter.
- B. Equipment required for personal safety of workmen shall be furnished in full compliance with specific safety requirements of local, state, and Federal agencies, including OSHA.
- C. Signs, barricades, warning lights, and all necessary equipment for the protection of the traveling public shall be furnished and maintained as specified in the Manual on Uniform Traffic Control Devices (Part VI).

## PART 3 - EXECUTION

### 3.01 PERFORMANCE

- A. Field Office and Storage Trailers: Site in locations approved by the Engineer and properly set up for all anticipated weather conditions.
- B. All structures other than storage trailers installed under this Section shall be provided with, as a minimum, the following services:
  - 1. Fire Extinguisher: Non-toxic, dry chemical, fire extinguisher meeting Underwriters Laboratories, Inc. approval for Class A, Class B, and Class C fires with a minimum rating of 2A, 10B, 10C.
  - 2. One 36 unit industrial quality first aid kit
- C. Sanitary Conveniences for Project Personnel:
  - 1. Provide and maintain in sufficient numbers, for the use of all persons employed on the work, and properly screen from public observation, at suitable locations, in accordance with State and local ordinances.
  - 2. Rigorously enforce the use of the approved sanitary facilities provided.
  - 3. When no longer required, remove from the site and dispose of the contents in a satisfactory manner.
- D. Obey and enforce other local sanitary regulations and orders, taking such precautions against infectious diseases as may be deemed necessary.
- E. Provide sufficient drinking water for all employees from approved sources.
- F. Conduct operations in a manner which, with the use of proper equipment provides maximum safety for workmen and the traveling public.
- G. Vehicles leaving the Site shall be inspected by the Subcontractor to ensure that no soil adheres to its wheels, tracks, undercarriage, or bucket.
- H. Remove all soil using high pressure water, steam, or other appropriate method.
- I. Decontamination Pad:
  - 1. A decontamination (decon) pad will be constructed to facilitate the cleaning of equipment and trucks prior to leaving the Site.
  - 2. The decon pad shall consist of an impermeable liner, a collection sump, and an aggregate (stone/gravel) working base.
    - a. The subgrade surface for the liner shall be free of stones, debris, or other objects greater than ½ inch in size.
  - 3. Aqueous waste collected from the sump shall be collected in a portable storage tank adjacent to the decon pad.



4. Following characterization, the Contractor shall transport the fluids off-site to a licensed disposal facility in accordance with Section 02120, “Off-Site Transportation and Disposal”.
5. Upon completion of the project, the Contractor shall demolish the decon pad and dispose off-site in accordance with all applicable regulations.

END OF SECTION

## SECTION 01560

### DUST AND ODOR CONTROL

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall execute the work by methods that minimize the generation of dust and nuisance odors. The Contractor shall employ dust control measures to minimize the creation of airborne dust during execution of the work. At a minimum, standard dust control techniques shall be employed in areas of heavy equipment traffic such as watering down the site. The dust control measures will be such that, at a minimum, air quality is in compliance with applicable OSHA regulations.
- B. The Contractor shall provide an odor control system to control odors as necessary to address complaints from the adjacent properties (high school and retail buildings) and the local community. Odor control agents such as an odor-control foam, misting system, or other method selected by the Contractor and approved by the Engineer shall be available on site and shall be applied as needed to control nuisance odors. At a minimum, an odor control foam system shall be available on site. Other systems may be required as necessary to meet the performance objectives.
- C. The performance objective for odor control will be to control, eliminate, or mask any odors that generate complaints, from neighboring residents, the public, state or local officials, or the Engineer.
- D. No additional payments will be made due to shutdowns as a result of emissions whether exceeding standards or posing a nuisance. If the initial emission controls are found to be inadequate, the Contractor shall provide additional measures at no additional cost.
- E. Dust and odor control systems shall be implemented as necessary to meet local, state, and/or federal regulations for air emissions and dust and to control nuisance odors.
- F. Sufficient volumes of water and/or odor control foam shall be readily available or stored on site to address continuous application as necessary.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01110: Summary of Work

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Water: Shall be free from oil, acid, and injurious alkali or vegetable matter, and other deleterious materials or contaminants. Water shall not be brackish.
- B. Odor control foam. Odor control foam shall be a biodegradable, non-flammable, and non-toxic water-based material designed for the control of VOCs, dust, and odor. It shall be capable of being spray applied to form a uniform encapsulating layer between contaminated materials and the environment, suppressing VOCs, dust, odors, and gas.

## 2.02 EQUIPMENT

- A. Equipment for dust and odor control shall include appropriate measures (e.g., heat tape, tank heaters) to prevent freezing or impair operation due to temperatures below freezing.

## PART 3 - EXECUTION

### 3.01 SPRINKLING WATER

- A. Apply by approved methods and with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.
- B. Disperse through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.
- C. Apply water until the surface is wet, but avoid ponding, run off, or muddy conditions.

### 3.02 TESTING

- A. All equipment, if not in regular use, shall be tested as requested by the Engineer.

END OF SECTION

## SECTION 01780

### PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Keep accurate record documents for all additions, substitutions of material, variations in work, and any other revisions to the Contract Documents.
- B. Provide a final survey of project site and as-built drawings of the completed work within 14 days of final completion.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01330: Submittal Procedures
- B. Section 01460: Field Engineering and Survey Control

##### 1.03 PROJECT CLOSEOUT

- A. The Contractor shall comply with the procedures stated in the General Conditions of the Contract for issuance of Certificate of Substantial Completion.
- B. The Contractor shall submit written certification that that the Work is complete in accordance with Contract Documents and ready for the Department's inspection/review.
- C. Provide submittals as required by these Specifications.

##### 1.04 FINAL CLEANING

- A. Execute final cleaning of Site prior to final project inspection.
  - 1. Clean and remove debris from drainage systems.
  - 2. Clean project site areas, including sweeping paved areas and raking landscaped surfaces.
  - 3. Remove waste and surplus materials, rubbish, and construction facilities from the Site.

##### 1.05 WARRANTIES

- A. Provide duplicate notarized copies of all warranties associated with the work.
- B. Execute and assemble transferable warranty documents from sub-contractors, suppliers, and manufacturers.
- C. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 14 business days after acceptance, listing the date of acceptance as start of warranty period.

##### 1.06 MAINTENANCE OF RECORD DOCUMENTS

- A. Record documents shall be stored in a dry, safe place apart from construction documents, and be available for inspection by the Engineer. The record documents shall not be used for construction purposes.
- B. Clearly label each document "Project Record." During the execution of the work, keep

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- record documents current.
- C. Provide files and racks for storage of documents.
- D. Maintain one copy of the following documents at the job site:
1. Drawings showing progress of work;
  2. Specifications;
  3. Addenda;
  4. Reviewed submittals;
  5. Change Orders;
  6. Other modifications to the Contract;
  7. Health and Safety Plan;
  8. Construction Quality Control Plan
  9. Work Plan(s);
  10. Applicable permit documents;
  11. Contractor's certifications;
  12. Shop drawings and product data;
  13. Daily reports, including:
    - a. Records of all site work;
    - b. Inspection records; and
    - c. Reports on any emergency response actions.
  14. Construction photographs;
  15. Deficiency reports;
  16. Sampling documentation and chain of custody forms;
  17. All analytical laboratory testing data;
  18. All geotechnical laboratory testing data and construction materials field/laboratory testing reports;
  19. Quality Control Project Summary, compiled upon project completion;
  20. Field notes and records of quantities for progress payments;
  21. All survey data required for measurement and payment;
  22. Operations and maintenance manuals for all equipment installed; and
  23. As-Built Drawings: Legibly mark on Drawings to record actual construction during work.
    - a. Horizontal and vertical surveyed locations of buried features.
    - b. Field changes of dimension and detail;
    - c. Details not on original Drawings; and
    - d. Additional equipment installed.
- E. Specifications and addenda shall be legibly marked up to record changes made by Change Order or Field Order, or other method.

## 1.07 SUBMITTALS

- A. At the completion of construction, the Contractor shall deliver three sets of project record documents to the Engineer as a condition of final payment. Submit project record documents in accordance with Section 01330, "Submittal Procedures", and as specified herein.
- B. Accompany the project record documents with a transmittal letter containing the following:
1. Date;
  2. Project title and number;
  3. Contractor's name and address;
  4. Title and number of each record;
  5. Certification that each document as submitted is complete and accurate; and

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6. Signature of the Contractor or his authorized representative.
- C. For each set of project record documents include a directory listing the names, addresses, and telephone numbers of the Contractor, sub-contractors, and major equipment suppliers. Also, include operation and maintenance instructions for installed materials and equipment.

#### 1.08 FINAL SURVEY

- A. The Contractor shall perform a topographic survey of the Site within the limit of disturbance at the completion of field operations as describe in Section 01460 Field Engineering and Surveying. The survey shall be performed by a Land Surveyor registered in the State of Rhode Island. The survey shall consist of a ground control survey and shall include the following:
  1. Topographic elevations of final constructed grade on a 5 foot maximum grid pattern within the limit of disturbance shall be provided at 1-foot intervals including 1-foot contours, if applicable;
  2. Establish appropriate horizontal and vertical control at the site (i.e., locating existing/new benchmarks); and
  3. All constructed features.
- B. Provide electronic files of digital mapping data on CD. Data shall be compatible with AutoCAD 2006 computer software.

END OF SECTION

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

**APPENDIX B**  
**SPECIFICATIONS**  
**(Division 2)**

## SECTION 02072

### GEOMEMBRANE

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Work provided in this Section includes furnishing labor, equipment, materials, testing, and incidentals required to install a 40-mil textured (both sides) Linear Low Density Polyethylene (LLDPE) geomembrane as shown on the Drawings and as specified herein as part of the multi-layer cap construction in the former Slag Area.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02300: Earthwork  
Section 02373: Geocomposite Drainage Net

##### 1.03 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American Society for Testing and Materials (ASTM):
  1. ASTM D 638, Standard Test Method for Tensile Properties of Plastics
  2. ASTM D 792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
  3. ASTM D 1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting
  4. ASTM D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
  5. ASTM D 1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique
  6. ASTM D 1603 Standard Test Method for Carbon Black in Olefin Plastics
  7. ASTM D 4437 Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
  8. ASTM D 5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method
  9. ASTM D 5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
  10. ASTM D 5994 Standard Test Method for Measuring the Core Thickness of Textured Geomembrane
- B. Geosynthetic Research Institute (GRI):
  1. GM11 Accelerated Weathering of Geomembranes Using a Fluorescent UVA-Condensation Exposure Device
  2. GM12 Asperity Measurement of Textured Geomembranes Using a Depth Gage

##### 1.04 SUBMITTALS

Submit the following in accordance with Section 01330 – Submittal Procedures.

- A. Submittals relating to liner Manufacturer and liner material:
  1. List of material properties and samples of liner meeting the requirements herein with attached certified test results.



2. Manufacturer's quality control program and manual including description of in-house laboratory facilities.
  3. A list of ten completed facilities totaling a minimum of five million square feet, for which the Manufacturer has manufactured LLDPE geomembrane. The following information shall be provided for each facility.
    - a. Name and purpose of facility, its location and date of installation.
    - b. Name of Owner, Project Manager, Design Engineer and Installer.
    - c. Geomembrane thickness and surface area.
  4. Qualifications statement in accordance with Sub-Part 1.07.
- B. The origin of the resin to be used in the manufacturing of geomembrane used on-site including the suppliers name and production plant, as well as brand name and tracking number.
- C. Copy of quality control certificates in conformance with Sub-Parts 2.1 and 2.2. Certification that the LLDPE geomembrane and extrudate produced for this project have compatible properties. Quality control reports for the time period materials were produced for this project.
- D. A "Sample Warranty" in accordance with Sub-Part 1.09.
- E. Prior to shipment of liner material to the Site, provide samples from rolls to be provided. Only ship to the Site, material that is approved by the Engineer.
- F. Submittals relating to the Installer:
1. Information on equipment and personnel.
  2. Anticipated average daily production.
  3. Number of crews employed and number available for this work.
  4. Qualifications in accordance with Sub-Part 1.07
  5. A list of five completed facilities totaling 2 million square feet for which the Installer has installed 40 mil LLDPE geomembrane with a geocomposite drainage net (GCN) underlayment. The following information shall be provided for each facility:
    - a. Name and purpose of facility, its location and date of installation.
    - b. Name of Owner, Design Engineer, Manufacturer and name and telephone number of Manufacturer's Representative at the facility who can discuss the project.
    - c. Surface area of the installed 40 mil LLDPE geomembrane.
    - d. Type of seaming, patching and tacking equipment.
    - e. A copy of the Manufacturer's certification or approval letter.
- G. Within 60 days prior to liner installation submit the following:
1. Shop Drawings:
    - a. Proposed panel layout showing the installation layout identifying field seams as well as any variance or additional details which deviate from the Drawings.
    - b. Details of seaming the geomembrane, anchoring, connections, penetrations and other construction details, which deviate from these specifications.
- H. Installation Quality Control:
1. A quality control manual that specifically defines the quality control program during installation for this project. The manual shall include daily procedures, welding techniques, field testing procedures, lab testing procedures, specific steps that are to be taken in the event of a failure or defect, personnel requirements, levels of authority and other information necessary to ensure a high quality geomembrane installation.

2. Resume of the Installation Supervisor to be assigned to and on-site during the project.
  3. Resume of the Master Seamer to be assigned to the project.
  4. A list of personnel performing field seaming operations along with pertinent experience information.
- I. Quality Control
1. In addition to Manufacturer and Installer requirements for qualifications and certification specified in Sub-Part 1.6, Quality Control consists of conformance testing of the material delivered to the site and field quality control during installation.
  2. Conformance testing requirements are specified in Sub-Part 2.2. The purpose of conformance testing is to verify that the supplied material conforms to the Specifications and to the Manufacturer's quality control certificates.
  3. Field quality control requirements are specified in Sub-Part 3.6. The purpose of field quality control procedures is to verify that the geomembrane has been installed in accordance with the specifications and Manufacturer's recommendations.
  4. Quality Control Forms:  
The forms in attached Attachment B, for geomembrane quality control documentation, shall be used for field installation documentation. Alternative forms may be used for documentation as submitted and approved by the Engineer.
- J. Geomembrane Quality Control Documentation:
1. Project Files:
    - a. Two duplicate project files shall be maintained. One shall be maintained by the Engineer's Field Representative and the other shall be maintained by the Contractor. The Contractor shall provide the Engineer's Field Representative with daily documentation by the end of the following work day. At the end of each work week, the Engineer and Contractor will update and check the files to assure that copies of pertinent project information are included in each file.
    - b. Blank copies of the following project forms shall be available onsite throughout the duration of the project and are included in attached Attachment B:

<u>Form No.</u>	<u>Title</u>
1	Material Delivery Inventory
2	Installation and Seaming Report
3	Field Seaming Destructive Testing Report
4	Non-Destructive Seam Testing Report

#### 1.05 JOB CONDITIONS

- A. Site information: See Section 00330 – Existing Conditions for additional information.
- B. Existing Utilities: See Section 00330 – Existing Conditions for additional information.

#### 1.06 DEFINITIONS

- A. Geonet:  
A net-like polymeric material formed from intersecting ribs integrally joined at the junctions manufactured for use as drainage media with foundation, soil, rock, earth, or any other geotechnical-related material as an integral part of a human-made project, structure, or system.

- B. Geotextile:  
A woven or nonwoven permeable man-made textile used with geotechnical engineering-related materials.
- C. Composite Drainage Net (CDN):  
The CDN shall be composed of one layer of ribbed polyethylene geonet with a nonwoven polypropylene or polyester geotextile, thermally bonded to each side of the geonet.
- D. Minimum Average Roll Value (MinARV):  
Minimum of a series of average roll values representative of the product furnished.
- E. Maximum Average Roll Value (MaxARV):  
Maximum of a series of average roll values representative of the product furnished.
- F. Overlap:  
Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

#### 1.07 QUALIFICATIONS

- A. Manufacturer:  
The Manufacturer of the lining material described hereunder shall have previously demonstrated its ability to produce this geomembrane by having at least 5 years continuous experience in the manufacturing of LLDPE geomembrane and successfully manufactured a minimum of 50 million square feet of similar material for hydraulic liner installations.
- B. Installer:  
The Installer shall be the Manufacturer or an approved Installer trained and certified to install the Manufacturer's geomembrane. Installation shall be performed under the constant direction of a single Installation Supervisor who shall remain on site and be in responsible charge, through the geomembrane installation, for geomembrane layout, seaming, patching, testing, repairs and other site activities required by the Installer. The Installer shall also provide a Master Seamer (who may also be the Installation Supervisor). The Installation Supervisor/Master Seamer shall have installed or supervised the installation and seaming of a minimum of two million square feet of 40 mil LLDPE and/or HDPE geomembrane liner.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. The geomembrane rolls shall be packaged and shipped by appropriate means to prevent damage of the geomembrane rolls. Off-loading and storage of the geomembrane is the responsibility of the Installer. The Installer shall be responsible for replacing any damaged or unacceptable material at no additional cost to the Owner.
- B. Roll Identification:  
The Manufacturer shall provide geomembrane rolls marked or tagged with the following information:
  - 1. Manufacturer's name,
  - 2. Product identification;
  - 3. Thickness;
  - 4. Roll dimensions;
  - 5. Manufacturer's roll and lot number; and
  - 6. Date of manufacture.
- C. Damage during off-loading shall be documented by the Engineer's Field Representative. Damaged rolls must be separated from the undamaged rolls until the proper disposition of that material has been determined by the Engineer's Field Representative.

- D. The geomembrane rolls shall be stored so as to be protected from puncture, dirt, grease, water, mud, mechanical abrasions and excessive heat that may damage the geomembrane material. The rolls shall be stored on a prepared surface (not wooden pallets or hard abrasive surfaces) and shall not be stacked more than two rolls high.

#### 1.09 MATERIAL WARRANTY

The LLDPE geomembrane Manufacturer shall warrant the geomembrane against manufacturing defects and material degradation under outdoor or radiological exposure for a period of 20 years on a prorated basis from the date of final payment and acceptance. The Manufacturer shall repair or replace, at no expense to the Owner, any material which fails from the above causes within the warranty period. The Manufacturer shall furnish a written warranty covering the requirements of this Sub-Part.

#### 1.10 GUARANTEE

The Installer shall guarantee the LLDPE geomembrane against defects in installation and workmanship for the period of 1 year commencing with the date of final payment and acceptance by the Engineer. The guarantee shall include the services of qualified personnel, all materials required for the repairs and testing at no expense to the Owner.

#### 1.11 DEFINITIONS AND RESPONSIBILITIES

##### A. Contractor:

The Contractor is the firm or corporation with whom the Owner has entered into agreement to construct the project. The Contractor is responsible for submittals by the Manufacturer and the Installer as required by the Specifications. The Contractor is also responsible for scheduling and coordination of the required work with the Manufacturer and the Installer to complete the project.

##### B. Engineer's Field Representative:

The Engineer's field representative shall oversee the installation of the geomembrane by the Installer. The Engineer's field representative will be responsible for inspections and reviewing testing results for conformance with the specified requirements. The Engineer's field representative will compile QC test results daily and document all QC activities in weekly reports submitted to the Engineer.

##### C. Manufacturer:

The Manufacturer is the firm or corporation contracted by the Contractor for production of the geomembrane material to be used in the project. The Manufacturer shall produce a consistent product meeting the project specifications and shall provide quality control documentation for the product specified herein.

##### D. Installer:

The Installer is the firm or corporation contracted by the Contractor for installation of the geomembrane. The Installer shall be the Manufacturer or an approved Installer trained and certified to install the Manufacturer's geomembrane. The Installer shall be responsible for field handling, storing, placing, seaming, sampling, testing and other aspects of the geomembrane installation.

##### E. Quality Control Laboratory:

An independent Quality Control Laboratory (QCL) hired by the Engineer to perform conformance testing of the liner material. The QCL shall have GRI certification.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. General

1. The resin from which the geomembrane is made shall be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min. Formulated sheet density shall be 0.939 g/ml or higher.
2. The blended resin shall contain two to three percent carbon black, anti-oxidants and heat stabilizer, but no fillers or extenders. The resin shall be virgin material, with no more than two percent rework. If rework is used, it must be of the same formulation as the parent material. No post-consumer resin of any type shall be added to the formulation.
3. The geomembrane material shall be so produced as to be free of holes, blisters, thin areas, inconsistent texturing, undispersed raw materials, or any sign of contamination by foreign matter.
4. The sheets shall be manufactured in a minimum 15-ft seamless width.

#### B. Properties:

1. The geomembrane rolls shall be 40-mil textured LLDPE and shall meet the specified physical, mechanical, and chemical property requirements listed in attached Table 02072-1.
2. Interface Strength Requirements: In addition to the general material properties requirements, the Manufacturer shall provide geomembrane material meeting the minimum project-specific interface strength requirements listed in Table 02072-2:

Table 02072-2: Interface Strength Requirements

Interface	Peak Shear Strength <sup>1</sup>	Residual Shear Strength <sup>1</sup>
Geocomposite/Geomembrane	25 degrees	22 degrees
Geocomposite/ Cover Soil	25 degrees	22 degrees
Geomembrane/Sand	25 degrees	22 degrees

#### Notes:

1. Cohesion = 0 conditions.
2. Site-specific soils taken from samples used for borrow source testing in Specification 02300 will be provided to the QAL along with the Manufacturer provided geomembrane material.

#### C. Other Materials:

1. Extrudate welding rods (for fusion welds) shall be compatible and similar to the geomembrane and supplied by the Manufacturer and shall be delivered in the original sealed containers. Each container shall have a label bearing the brand name, Manufacturer's lot number and complete directions as to proper storage.
2. Boots and shrouds for pipe penetration shall fit snugly around the pipe. Prefabricated material shall be designed to fit site specific conditions for the intended slope and size of pipe and be made of compatible and similar materials as the geomembrane.

### 2.02 CONFORMANCE TESTING

#### A. Tests:

Conformance testing shall be performed by the independent Quality Control Laboratory (QCL) provided and paid for by the Engineer. The Manufacturer shall obtain the samples from the roll, mark the machine direction and identification number and ship the samples to the QCL. The following conformance tests shall be conducted at the laboratory prior to shipment to the site:

1. Thickness
2. Density
3. Tensile properties
4. Tear resistance
5. Carbon black content
6. Carbon black dispersion
7. Asperity height

B. Frequency:

These conformance tests shall be performed in accordance with Table 02372-1, at a frequency of one sample per lot or one sample per 100,000 square feet, whichever provides the largest number of tests.

C. Acceptance or Rejection:

Conformance test results shall be reviewed by the Engineer and accepted or rejected, prior to shipment of the geomembrane. Test results shall meet, or exceed, the property values listed in Table 02072-1. The course of action implemented for retesting failing tests shall be approved by the Engineer. In case of failing test results, the Manufacturer may request that another sample be retested by the independent laboratory with Manufacturer's technical representative present during the testing procedures. This retesting shall be paid for by the Manufacturer. The Manufacturer may also have the sample retested at two different laboratories approved by the Engineer, paid for by the Manufacturer. If both laboratories report passing results, the material shall be accepted. If both laboratories do not report passing results, geomembrane material from the lot or bracketed square footage representing the failing sample will be considered out of specification and rejected.

## PART 3 - EXECUTION

### 3.01 SUBGRADE PREPARATION

- A. Preparation of the subgrade shall be as specified in Sections 02300 – Earthwork.
- B. The surface of the subgrade shall be smooth, uniform, relatively free from abrupt changes in grade, rocks and stones greater than 1-inch, sharp objects, debris and deleterious materials. During actual placing and seaming of the geomembrane, the subgrade surface shall be kept free of standing water. If the subgrade below the geomembrane becomes wet and unstable, it shall be recompacted in accordance with Section 02300 - Earthwork. Before the GCN and geomembrane installation begins, the Engineer and Installer shall verify and sign off that the surface area to be lined has been properly prepared.

### 3.02 ANCHOR TRENCH

- A. The anchor trench shall be constructed as shown on the Drawings and/or as specified herein.
- B. The anchor trench shall be adequately drained to prevent water ponding and softening of adjacent soils. The anchor trench shall be backfilled and compacted.
- C. Geosynthetic material in the anchor trench shall be temporarily anchored with sandbags or other suitable materials until final approvals are obtained.

- D. Backfilling of the anchor trench shall be conducted when the geomembrane is in its most contracted (taut) state.
- E. Care shall be taken when backfilling and compacting the trenches to prevent any damage to the lining materials.

### 3.03 GEOMEMBRANE PLACEMENT

#### A. Weather Conditions:

Geomembrane placement shall not proceed at an ambient temperature below 32 degrees F or above 104 degrees F unless otherwise authorized, in writing, by the Engineer. Geomembrane placement shall not be performed during precipitation, excessive moisture, in an area of ponded water, or excessive winds that adversely affect the geomembrane placement.

#### B. Method of Placement

1. Each panel of the geomembrane shall be rolled out and installed in accordance with the approved shop drawings prepared by the Installer. The layout shall be designed to keep field seams of the LLDPE geomembrane liner to a minimum and consistent with proper methods of LLDPE geomembrane installation. Panel layout and deployment shall be such that seams run down slope (i.e., perpendicular to top of slope). End seams across slopes greater than 25 percent shall be avoided. See additional seam requirements in Sub-Part 3.4.
2. Geomembrane rolls shall be placed in a manner to prevent the material from being stretched during deployment and disturbing the underlying sand cushion layer. If a sheet must be placed a distance greater than its width over the sand, a slip sheet shall be used.
3. The Engineer's field representative shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Also, inspect geomembrane prior to geocomposite drainage layer installation. Defective or damaged panels shall be replaced or repaired, in accordance with Sub-Part 3.7.7 of the specifications.
4. The Installer shall avoid dragging the geomembrane sheets on rough soil subgrade.
5. Geomembrane shall be anchored as shown on the Drawings and/or consistent with Manufacturer's recommendations.
6. Personnel working on the geomembrane shall not smoke, wear damaging shoes or involve themselves in any activity that may damage the geomembrane.
7. Edges and large exposed areas of the geomembrane shall be properly weighted to avoid uplift due to wind.
8. Vehicular traffic except for proper installation vehicles (ATVs) across the geomembrane shall not be allowed. Any vehicle used prior to or after liner placement shall be first approved by the Engineer's field representative.
9. Repaired areas and destructive sample locations shall be recorded and indicated on the as-built drawings.
10. When tying into previously installed geomembrane, excavation, if required, adjacent to installed liner shall be performed by hand to prevent damage.
11. The geomembrane shall be kept free of debris, unnecessary tools and materials. In general, the geomembrane area shall remain neat in appearance.
12. Equipment necessary to perform the installation (generators, compressors, etc.) at a minimum shall have a scrap geomembrane sheet placed underneath to protect the installed geomembrane from possible damage.

13. No welder or testing equipment shall be allowed to remain on top of the installed geomembrane overnight. Equipment must be removed and stored off the installed geomembrane.
14. No fueling of equipment will be allowed on top of the installed geomembrane. No fuel containers shall be allowed on the geomembrane.

#### 3.04 FIELD SEAMS

- A. Individual panels of geomembrane shall be laid out and overlapped by a minimum of 4-inches prior to welding. The area to be welded shall be cleaned and prepared in accordance with the quality control welding procedures approved by the Engineer's field representative.
- B. Double track hot wedge fusion welds shall be used for straight long seams to the maximum extent possible.
- C. Extrusion welds shall be used in areas inaccessible for double track hot wedge fusion welding, including patches, repairs and penetration boots.
- D. The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the geomembrane material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.
- E. No "fish mouths" or wrinkles will be allowed within the seam area. Where "fish mouths" or wrinkles occur, the material shall be cut, overlapped and an extrusion weld patch shall be applied. Welds upon completion of the work shall be tightly bonded. Any geomembrane area showing injury due to excessive scuffing, puncture, or distress from any cause shall be replaced or repaired with an additional piece of geomembrane. The number of patches per 100-ft length of seam length shall not exceed five. If more than five patches per 100-ft length are necessary, then the entire 100-ft length of seam shall be removed. Further welding will cease at this time and the Engineer's field representative shall be notified.
- F. Seams shall have a seam number that corresponds with the panel layout numbers. The numbering system shall be used in the development of the as-built drawings. Seam numbers shall be derived from the combination of the two panel numbers that are to be welded together. Patches, boots and repairs shall be numbered using a system that includes the panel number where the patch, boot or repair is located.
- G. Fusion welded "T" seams (i.e., the result of the geomembrane panels placed perpendicular to each other) shall be double welded where possible. The extrusion process shall be used for the second weld.
- H. Extrudate shall be free of dirt, dry and protected from damage.
- I. If an extrusion welder is stopped for longer than one minute, it shall be purged to remove heatdegraded extrudate. Purged extrudate shall not be placed on the installed geomembrane.
- J. Seams constructed on sloped surfaces shall be perpendicular to the top and toe of the slope (vertical seams).
- K. Panels placed on sloped surfaces (steeper than 25%) shall extend a minimum of 5-ft inward (on the flat) from the top of slope or edge of trench.
- L. End seams shall be staggered a minimum of 5-ft in length between contiguous panels. No end seams are allowed on slopes 25 percent (4 horizontal and 1 vertical) or greater, unless otherwise approved by the Engineer's field representative.
- M. To prevent moisture buildup during fusion welding, it may be necessary to place a movable protective layer of plastic (skid sheet) directly below each overlap of geomembrane that is to be seamed.



- N. Seam welds shall extend the full extent into the anchor trench.
- O. Factory seams, field seams and repair welds shall meet seam strength requirements specified in Table 02072-3.

**Table 02372-3: Seam Properties of LLDPE Geomembrane, Textured on Both Sides**

Property	Unit	Test Method	Value
Shear Strength (min. avg.)	lb/in	ASTM D 4437	44
Peel Strength (min. avg.)	lb/in	ASTM D 4437	40 & FTB

- P. Seams shall be "shingled" or "rain-lapped."

3.05 SEAMING WEATHER CONDITIONS

A. Normal Weather Conditions

- 1. The normal required weather conditions for seaming are:
  - a. Ambient temperature higher than 32 degrees F and lower than 104 degrees F.
  - b. No precipitation or other excessive moisture, such as fog or dew.
  - c. No excessive winds.
- 2. These weather conditions shall be fulfilled during seaming process.

B. Cold Weather Conditions

- 1. If the ambient air temperature is below 32 degrees F, the following procedures shall be implemented:
  - a. Preheating the surface of the geomembrane to achieve normal temperature range.
  - b. Preheating may be waived by the Engineer's field representative if the Installer demonstrates that satisfactory welds of equivalent quality may be obtained without preheating at the expected temperature of installation.
  - c. Preheating devices shall be approved by the Manufacturer.
  - d. Care shall be taken to assure that surface temperatures are not lowered below the minimum required surface temperature for welding due to winds.
  - e. Additional destructive test samples shall be taken at the discretion of the Engineer's field representative.
  - f. Test seams, as described in Sub-Part 3.6.1, shall be performed under similar ambient temperature conditions as the actual seams.

C. Warm Weather Conditions

- 1. If the ambient air temperature is above 104 degrees F, no seaming of geomembrane shall be permitted unless the Installer can demonstrate, to the satisfaction of the Engineer's field representative that geomembrane seam quality is not adversely impacted.
- 2. Test seams shall be performed under similar ambient air temperature conditions as the actual seams.
- 3. Additional destructive tests shall be taken at the discretion of the Engineer's field representative.

3.06 FIELD QUALITY CONTROL

A. Start-up Testing

- 1. A test weld 3-ft long from each welding machine shall be run upon the beginning of each shift and every four hours thereafter, under the same conditions as exist

for the geomembrane welding. The test weld shall be marked with date, time of day, Seamer's initials, temperature and speed settings (for fusion welds) or temperature and preheat settings (for extrusion welds), and machine number. The Installer shall provide a calibrated tensiometer, on-site before and during geomembrane installation for the purpose of testing samples. Six 1-in wide specimens shall be cut from each test weld and tested on-site in the presence of the Engineer's field representative (three for peel and three for shear strength) in accordance with Table 02072-3.

2. Test seams shall be performed under the same conditions as the actual seams and shall be at least 3-ft long and 1-ft wide after seaming. Material for test seams shall be cut out of the approved geomembrane rolls.

B. Nondestructive Seam Testing

1. The Installer shall perform a nondestructive test on field seams over their full length. The purpose of this test is to assure continuity and integrity of the seams. Vacuum and air pressure tests shall be used for nondestructive testing. The vacuum test shall be used for extrusion welds. The air pressure test shall be used for double track fusion welds.

2. Vacuum Testing

- a. Equipment for testing single wedge fusion seams and extrusion seams shall be comprised of the following:

- 1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly and a vacuum gauge.
- 2) A vacuum tank and pump assembly equipped with a pressure controller and pipe connections.
- 3) A rubber pressure/vacuum hose with fittings and connections.
- 4) A plastic bucket and wide paint brush or mop.
- 5) A soapy solution.

- b. The following procedures shall be followed by the Installer:

- 1) Excess sheet overlap shall be trimmed away.
- 2) Clean the window, gasket surfaces and check for leaks.
- 3) Energize the vacuum pump and reduce the tank pressure to approximately 5 psi.
- 4) Wet a strip of geomembrane approximately 12-in by 48-in (length of box) with the soapy solution.
- 5) Place the box over the wetted area and compress.
- 6) Close the bleed valve and open the vacuum valve.
- 7) Ensure that a leak-tight seal is created.
- 8) For a minimum period of 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles.
- 9) If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3-in overlap and repeat the process.
- 10) Areas where soap bubbles appear shall be marked and repaired in accordance with Sub-Part 3.7.7 and then retested.

- c. If the seam is not accessible to vacuum box equipment and cannot be tested prior to final installation, the seaming operations shall be observed by the Engineer's field representative for uniformity and completeness.

3. Air Pressure Testing (for double track fusion seams only).

- a. The following procedures are applicable to those processes which produce a double seam with an enclosed space.
- b. Equipment for testing double fusion seams shall be comprised of the following:
  - 1) An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi and mounted on a cushion to protect the geomembrane.
  - 2) A manometer equipped with a sharp hollow needle, or other approved pressure feed device.
- c. The following procedures shall be followed by the Installer:
  - 1) Seal both ends of the seam to be tested. The length of seam shall not exceed 500-ft without approval by the Engineer's field representative.
  - 2) Insert needle or other approved pressure feed device into the tunnel created by the double wedge fusion weld.
  - 3) Energize the air pump to a pressure between 25 and 30 psi. After allowing two minutes for relaxation, the pressure shall be monitored over a test period not less than five minutes.
  - 4) If the loss of pressure exceeds 4-psi or the pressure does not stabilize, the weld shall be considered faulty (unless the Installer can demonstrate that monitoring for an additional five minutes does not cause an additional loss in pressure in excess of 1 psi, and that the pressure stabilizes within the second monitoring period). Locate the faulty area, repair in accordance with Sub-Part 3.7.7 and retest.
  - 5) If the pressure loss is less than 4 psi after five minutes, cut the air channel on the opposite end the pressure device to confirm there is no blockage and verify the length of the seam tested. Remove needle of other approved pressured feed device and seal both ends with an extrusion weld. Remove needle or other approved pressure feed device and seal.

### 3.07 DESTRUCTIVE SEAM TESTING

#### A. Purpose

The purpose of the destructive testing is to evaluate seam strength properties. A minimum of one test sample shall be obtained per 500-ft of performed seam length. The location of samples shall be determined by the Engineer's field representative. Selection of such locations may be prompted by suspicion of overheating, contamination, or other potential cause that may adversely impact the welds. Location of samples shall not be revealed to Installer in advance. Sampling shall be performed by the Installer. Testing of field samples shall be performed by the Engineer's Quality Control Laboratory (QCL).

#### B. Sampling Procedures

- 1. Samples shall be cut by the Installer at locations chosen by the Engineer's field representative as the seaming progresses.
- 2. The seams shall not be covered by another material before they have been tested and accepted by Engineer's field representative.
- 3. Upon obtaining each sample, assign a number to the sample and mark it accordingly.
- 4. Record sample location on layout drawing.
- 5. Record purpose of the sample, statistical routine or suspicious weld area.

6. Holes in the geomembrane resulting from destructive seam testing shall be immediately repaired in accordance with Sub-Part 3.7.7.
- C. Size and Disposition of Samples
1. Two samples, 12-inch wide by 18-inch shall be taken for field testing. Each of these samples shall be cut with a 1-in wide die, with the seam centered parallel to the width. The distance between these two samples shall be 36-in. If all samples pass the field test described in Sub-Part 3.7.4, a sample for laboratory testing shall be taken from the 36-inch portion.
  2. The laboratory sample shall be cut into three parts and distributed as follows:
    - a. One portion to the Installer for optional laboratory testing, 12-in by 12-in.
    - b. One portion for QCL testing, 12-in by 12-in.
    - c. One portion to the Engineer for archive storage, 12-in by 12-in.
- D. Field Testing
- The following shall be performed by the Installer in the presence of the Engineer's field representative:
1. The Installer shall cut six 1-in wide replicate specimens from the field testing samples to be tested for shear and peel strength, in accordance with the criteria set in Table 02072-2.
  2. The Installer shall test three specimens for shear seam strength and three for peel strength. Replicate test specimens shall pass for the seam to be acceptable.
  3. Samples shall be tested with a tensiometer equipped with a drive/pull apparatus adjusted to a pull rate of 2-in per minute for both peel and sheer testing. Each sample shall be tested until film tearing bond (FTB) is achieved. At a minimum, the required pass criteria for peel shall be as specified in Attachment B.
  4. Any specimen that fails through the weld or through the fusion at the weld sheet interface is a non-FTB break and shall be considered a failure even if it achieves the acceptable strengths.
  5. A specimen that does not break at the full extent of the test apparatus will be considered a passing test.
  6. Alternate testing to evaluate both sides of dual wedge welds.
- E. Quality Control Laboratory Testing
1. The Installer shall package and ship destructive test samples to the Engineer's independent Quality Control Laboratory (QCL) as directed by the Engineer's field representative by overnight delivery service. Shipping costs and destructive tests are to be paid by the Contractor.
  2. Laboratory testing shall include shear and peel strength tests performed in accordance with ASTM D 4437. The minimum acceptable values obtained in these tests shall be in accordance with Table 020723-3.
  3. At least five specimens shall be tested each for shear and peel strength. A passing test shall meet the minimum required values in the five specimens tested for each method.
  4. The QCL shall provide verbal test results to the Engineer's field representative no more than 24 hours after they receive the samples. The Engineer's field representative shall review the laboratory results as soon as they become available.
- F. Procedures for Destructive Test Failure
1. The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted in the field or by the QCL. The Installer has two options.

- a. The Installer can repair the seam between (1/2 distance or as directed by the Engineer's field representative) any two passing test locations in accordance with Sub-Part 3.7.7.
    - b. The Installer can retrace the welding path to an intermediate location a minimum of 10 feet on each side of the failed sample. The sample shall be tested in the field. Subsequent failure of test samples shall cause the testing to move further down the seam until the extent of faulty seam has been determined.
  - 2. Acceptable repaired seams shall be bound by two passing locations on each side of the original sample. In cases where repaired seam exceeds 150-ft, a sample taken from the zone in which the seam has been repaired must pass destructive testing. Repairs shall be made in accordance with Sub-Part 3.7.7.
  - 3. The Engineer's field representative shall document all actions taken in conjunction with destructive test failures.
- G. Repair Procedures
  - 1. Any portion of the geomembrane exhibiting signs of any kind of defect, or failing a destructive or a nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be made by the Engineer's field representative.
  - 2. The repair procedures available include:
    - a. Patching, used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.
    - b. Spot welding or seaming, used to repair small tears, pinholes, or other minor, localized defects.
    - c. Capping, is used to repair large lengths of failed seams.
    - d. Removing bad seam and replacing with a strip of new material welded in place.
  - 3. For any repair method, the following provisions shall be satisfied:
    - a. Surfaces of the geomembrane which are to be repaired using extrusion methods shall be abraded no more than one hour prior to the repair.
    - b. Surfaces shall be clean and dry at the time of the repair.
    - c. Seaming equipment used in repairing procedures shall be qualified.
    - d. Patches and caps shall extend at least 4-inches beyond the edge of the defect.
    - e. Patches shall have rounded corners.
- H. Repair Verification
 

Each repair shall be numbered and logged by the Installer. Each repair shall be nondestructively tested using the methods described in Sub-Part 3.6.2 as appropriate. Repairs which pass the nondestructive test shall be taken as an indication of an adequate repair. Repairs more than 150-ft long may be of sufficient length to require destructive test sampling, at the discretion of the Engineer's field representative. A failed test of the repaired section indicates that the repair shall be redone and retested until passing test results are achieved. The Engineer's field representative shall observe nondestructive testing of repairs. The Installer shall record the number of each repair, date and test outcome.
- I. Wrinkles
 

Large wrinkles that remain in the sheet as result of temperature expansion or uneven surface preparation may need removal as determined by the Engineer's field representative in consideration of applied loads on the wrinkle. Should the wrinkle need removing, the lower down-slope edge of the wrinkle shall be cut, overlapped and repaired

as described in 3.7.6. Both ends of the wrinkle repair shall be patched. Caution must be taken in removing any wrinkles. Wrinkles are needed to allow for future contraction of the geomembrane liner, especially in cold weather.

3.08 DISPOSAL OF WASTE MATERIAL

Upon completion of installation, the Installer shall properly remove and dispose of all trash, waste material, tools, and equipment used in connection with the performed work and shall leave the premises in a neat and acceptable condition.

3.09 AS-BUILT DRAWINGS

The Installer shall prepare and submit to the Engineer an as-built drawing reflecting the actual installation of geomembrane liner, including the location of seams, the location of destructive samples, and the location of repair work. The as-built drawing shall be submitted to the Engineer within seven days of the completion of the geomembrane. In addition, a copy of the complete documentation package will accompany the as-built drawing.

**Table 02072-2: Material Properties, LLDPE Geomembrane, Textured Both Sides**

Property	Unit	Test Method	Value
Thickness – specified	mil	ASTM D 5994	40
Thickness – min. average	mil	ASTM D 5994	38
Asperity height (min. avg.)	mil	GRI GM12	10
Tensile Properties (min. avg.)		ASTM D 638(Type IV @ 2 in/min)	
1. Break Strength	lb/in		60
2. Break Elongation	%		150
Tear Resistance (min. avg.)	lb	ASTM D 1004	22
Puncture Resistance (min. avg.)	lb	FTMS 101 Method 2065	48
Density	g/cc	ASTM D 792 or ASTM D 1505	< 0.939
Carbon Black Content (range)	%	ASTM D 1603	2.0 to 3.0
Carbon Black Dispersion (10 different views, all 10 in Cat-1 or Cat-2)	N/A	ASTM D 5596	Cat-1 or Cat-2
Interface Friction		ASTM D 5321 <sup>1,2,3</sup>	25 degrees peak 22 degrees residual

(Interface Friction - Textured Geomembrane to Geocomposite, Geocomposite to Cover Soil; and Geomembrane to Sand)

1. For textured LLDPE only; perform test at normal stresses of 1.5, 3, and 4.5 psi with a displacement rate of at least 0.2 in/min, under inundated conditions, report peak and residual values.
2. The interface friction testing between the Textured Geomembrane to Geocomposite Drainage Material and the Textured Geomembrane to Sand used at the site shall be performed in accordance with the requirements of this Section. Both interfaces shall demonstrate adequate interface friction and cohesion to provide an acceptable factor of safety. The interface friction and cohesion values obtained by the Contractor from quality control testing, as described in this Section, shall be evaluated by the Engineer. Any materials that have been placed and do not provide an acceptable factor of safety shall be removed or reworked by the Installer at no additional cost to the Owner.
3. Sand/Cover Soil shall be compacted to 90% of density, as percentage of the maximum dry density as determined by ASTM D 698 with the moisture content a maximum of 3% wet of optimum.
4. The above tests shall be performed by the manufacturer of the LLDPE geomembrane for identification of the manufacturer's product. The above test results shall be submitted to the Engineer for approval of the product. The geomembrane to be supplied for the project shall meet these properties.

END OF SECTION

SECTION 02072 - ATTACHMENT B

PROJECT FORMS  
FOR  
INSTALLATION OF  
LINEAR LOW DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE



## SECTION 02073

### GEOCOMPOSITE DRAINAGE NET (GCN)

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Work provided in this Section includes furnishing labor, equipment, materials, testing, and incidentals required to install a Geocomposite Drainage Net as shown on the Drawings and as specified herein as part of the multi-layer cap construction in the former Slag Area.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02072: Geomembrane
- B. Section 02300: Earthwork

##### 1.03 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic definition only.

- A. American Society for Testing Materials (ASTM):
  1. ASTM D 1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique (R 1990).
  2. ASTM D 1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics (R 1979).
  3. ASTM D 3776, Standard Test Methods for Mass Per Unit Area Weight of Woven Fabric (R 1990).
  4. ASTM D 3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
  5. ASTM D 4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  6. ASTM D 4595, Standard Test Method for Tensile Properties of Geotextiles by Wide-Width Strip Method.
  7. ASTM D 4632, Standard Method for Grab Breaking Load and Elongation of Geotextiles.
  8. ASTM D 4716, Standard Test Methods for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
  9. ASTM D 1593, Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
  10. ASTM F 904, Standard Test Method for Comparison of Bond Strength of Ply Adhesion of Similar Laminates Made from Flexible Materials.
  12. ASTM G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- B. Geosynthetic Research Institute (GRI):
  1. GRI-GC8, Determination of the Allowable Flow Rate of a Drainage Geocomposite.

#### 1.04 SUBMITTALS

Submit to the engineer for approval the following in accordance with Section 1330 – Submittal Procedures.

##### A. Shop Drawings

1. Material specifications, descriptive drawings, and literature.
2. Description of method of tying or joining GCN materials.
3. Layout and installation drawings.
4. The manufacturer of the GCN shall submit documents to the Engineer for review that the GCN to be supplied to the project site has proven installation. As a minimum, the manufacturer shall certify that
  - (a) The proposed GCN has been installed at least 10 million square feet. The proposed GCN has been installed at least 10 projects that are in operations for a minimum two years.
  - (b) The proposed GCN has been installed at least 5 superfund projects.

##### B. Samples: Sewn or heat seamed joints of geotextile.

##### C. Quality Control Submittals:

1. Manufacturer's Certificate of Compliance.
2. Installation Procedures.
3. Interface Friction: Perform direct shear tests (ASTM D5321) on a sample of GCN and Cover Soils and GCN and Type 1 Geomembrane material specified. Run the tests at confining stresses of 1, 2, and 4 psi and displacement rate of 0.02 in/min. The GCN/Geomembrane interface shall be saturated. The vegetative support material shall be prepared at a moisture content and compacted as specified in Section 02300 – Earthwork. Demonstrate a minimum interface friction angle of 25 degrees. Other combinations of shear strength parameters which can be shown by standard analytical techniques to provide adequate static and dynamic factors of safety against slope failure may be acceptable if approved by the Engineer.
4. Report of geocomposite transmissivity testing results in accordance with ASTM D4716. Testing shall be performed at gradients of 0.1 and 0.3 and at a normal load of 1,000 psf using vegetative support layer soil as the upper contact surface.
5. Mill Certificate or Affidavit:
  - a. Signed by a legally authorized official from the company manufacturing the materials.
  - b. Attest that the geosynthetic materials for the project meet the chemical, physical, and manufacturing requirements stated in this Specification.
  - c. Provide certification and quantity of any patches applied in the manufacturing facility resulting from lamination burn through.

#### 1.05 JOB CONDITIONS:

- A. Site Information: See Section 00330 – Existing Conditions for additional information.
- B. Existing Utilities: See Section 00330 – Existing Conditions for additional information.

#### 1.06 DEFINITIONS

##### A. Geonet:

Geonets are a net-like polymeric material formed from intersecting ribs integrally joined at the junctions manufactured for use as drainage media with foundation, soil, rock, earth, or any other geotechnical-related material as an integral part of a human-made project, structure, or system.

- B. Geotextiles:  
Geotextiles are woven or nonwoven permeable man-made textile used with geotechnical engineering-related materials.
- C. Geocomposite Drainage Net (GCN):  
Geocomposite Drainage Net (GCN) is composed of one layer of ribbed polyethylene geonet with a nonwoven polypropylene or polyester geotextile, thermally bonded to each side of the geonet.
- D. Minimum Average Roll Value (MinARV):  
MinARV is the minimum of a series of average roll values representative of the product furnished.
- E. Maximum Average Roll Value (MaxARV):  
MaxARV is the maximum of a series of average roll values representative of the product furnished.
- F. Overlap:  
Overlap is the distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver marked or tagged with the following:
  - 1. Manufacturer's name.
  - 2. Product identification.
  - 3. Lot number.
  - 4. Roll number.
  - 5. Roll dimensions.
- B. Materials shall be wrapped in original, unopened package during shipment and storage.
- C. Unload and store materials with minimum handling.
- D. Store materials on pallets such that the rolls or panels are protected from equipment, mud, soil, dust, debris, and direct rays of the sun.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Composite Drainage Net shall be Model TENFLOW 770-2 as manufactured by TENAX<sup>®</sup> Corporation or approved equal. Should the Contractor submit an alternate product, then transmissivity testing with 1,000 hours at the specified boundary conditions must be submitted prior to material being considered for use on the project.
- B. Geonet:
  - 1. Manufactured from domestic polyethylene resin extruded ribs manufactured to form a porous net of uniform pattern with distinct openings.
  - 2. The geonet shall conform to the requirements in Table 02073-1.

**Table 02073-1: Geonet Physical Property Requirements**

Property	Test Method	Requirement <sup>2</sup>
Tensile strength, lb/ft (minimum)	ASTM D4595	450
Reduction Factor for Compressive Creep @ 2,000 psf after 10,000 hours, (maximum) <sup>1</sup>	ASTM D1621	1.1
Density, g/cm <sup>3</sup> (minimum)	ASTM D1505	0.94
Melt Flow Index, g/10 min. (maximum)	ASTM D1238	1.0
Carbon Black content, %	ASTM D4218	2-3
Thickness, mils (minimum)	ASTM D5199	340

Notes:

<sup>1</sup> Properties prior to lamination.

<sup>2</sup>The creep reduction factor is determined from 10,000 hour test duration, extrapolated to 30 years and using a compressive load of 2,000 psf. SIM method is acceptable for confirmation only, but is not acceptable for baseline data to determine the creep reduction factor.

C. Nonwoven Geotextile:

1. Pervious sheet of polypropylene or polyester filaments oriented into a stable network so that the filaments retain their relative position with respect to each other.
2. Composed of continuous filaments held together by needle-punching.
3. The edges of the geotextile shall be salvaged or otherwise finished to prevent the other material from pulling away.
4. Geotextile continuous filament process shall allow increased UV resistance and ability to manufacture orange textile for use as visual warning barrier to delineate potential over-excavation of cap.
5. The geotextile shall be high UV resistant, continuous filament, needle punched, non-woven polypropylene geotextile. The geotextile color shall be orange to serve as a visual warning barrier. The strength retained after 500 hours of UV exposure shall be at least 95% per ASTM G154. The geotextile shall meet the property requirements listed in Table 02073-2.

**Table 02073-2: Geotextile Physical Property Requirements**

Property	Test Method	Units	Value
Color	Orange		
Serviceability Class	Class 2		
AOS (MaxARV)	ASTM D4751	US Sieve (mm)	70 (0.21)
Permittivity (MARV)	ASTM D4491 Falling head	sec <sup>-1</sup>	0.5
Grab Tensile Strength (MARV)	ASTM D4632	lbs	157
Trapezoid Tear (MARV)	ASTM D4533	lbs	56
Puncture Strength (MARV)	ASTM D4833	lbs	56
CBR Puncture Strength (MARV)	ASTM D6241	lbs	346
UV Resistance @500 Hours (MIN)	ASTM G154	%	95

D. Geocomposite:

1. The geocomposite shall conform to the requirements in Table 02073-3

**Table 02073-3: Geocomposite Physical Property Requirements**

Property	Test Method	Requirement
Ply Adhesion, lb/in	ASTM F904	0.5
Transmissivity 1,000 psf Load in Soil Boundary Condition and after 100 hours, and gradient: m <sup>2</sup> /sec 0.1 0.3	GRI-GC8	8.0x10 <sup>-3</sup> 4.0x10 <sup>-3</sup>
Interface Friction Angle between Geomembrane/GCN and GCN/Cover Soil, degrees	ASTM D5321	25 peak 22 residual

2.02 SOURCE QUALITY CONTROL

- A. Contractor shall provide Certification of Compliance in accordance with SECTION 01330 – Submittal Procedures, showing test results for all physical properties specified at a minimum frequency of one test per 100,000 square feet.

## PART 3 - EXECUTION

### 3.01 PLACEMENT OF GCN

- A. Place and anchor the GCN in the manner at the locations shown in the Drawings and as directed by the Engineer. At or before the time of installation, GCN shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. Place GCN with the long dimensions downslope, with panel upslope overlying the panel downslope in a shingle fashion, unless otherwise directed by the Engineer. Install GCN smooth and free of tensions, stress, folds, wrinkles, or creases. GCN panels shall be laid smooth to provide a minimum width of 4 inches of geonet overlap along each joint and 1 foot at the end of rolls. GCN joints shall be tied at 5-foot intervals along edges and 2 foot along end using a method approved by the Engineer. Plastic ties or tying materials shall be of contrasting color to the GCN panels for inspection. Metallic connectors shall not be allowed. Secure and leak proof bags of sand shall be used to secure the GCN during installation. Securing pins shall not be used.
- B. Protect GCN at all times during construction from contamination by surface runoff. Remove contaminated GCN and replace with uncontaminated GCN.
- C. Should the geotextile on the GCN be damaged during any step of the installation, torn or punctured sections shall be repaired by placing a piece of geotextile which extends at least 6 inches in all directions beyond the damaged area. Geotextile repair patches shall be secured by sewing or bonding as approved by the Engineer.
- D. The orientation of GCN panels shall result in approximate alignment of the drainage paths between bottom ribs of the geonet with the drainage paths indicated by the elevations shown.
- E. Overlap the excess geotextile at each edge of the geonet panels in a manner that results in a smooth geotextile surface free of wrinkles and openings across the overlapped panels of geonet. Seam the geotextile so that no slack material remains between seams. Acceptable seaming methods shall be in accordance with Section 02072 - Geomembrane.

### 3.02 PLACEMENT OF MATERIAL ON GCN

- A. Place Cover Soils on GCN as specified in Section 02300 - Earthwork. If damage occurs to the GCN during the spreading operation, the overlying material shall be carefully removed from the GCN and the damaged area repaired as specified.
- B. To protect the GCN from UV deterioration, protective plastic covering will be placed above the GCN on the slope. This coverage will be removed progressively as fill is placed against the slope. The Contractor shall furnish and install the protective plastic covering.
- C. Spread overlying Cover Soils in the direction of GCN overlap.

END OF SECTION

## SECTION 02300

### EARTHWORK

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, equipment, and materials necessary for excavation, filling/backfilling, compaction, testing, and grading. The Work shall be as shown on the Drawings, the Shop Drawings, and as specified herein. Work includes, but is not limited to the following:
  - 1. Grading and compacting existing fill to establish subgrade;
  - 2. Placing, grading, and compacting cap soil layers including the following materials:
    - a. Sand;
    - b. Cover Soil; and
    - c. Plantable Soil.
  - 3. Borrow Source testing, field testing, and contractor quality control testing;
- B. In preparation for excavation, clearing shall occur in accordance with Section 02231 – Clearing and Grubbing.
- C. Control of surface water run-off during construction shall be in accordance with Section 02370 - Erosion and Sedimentation Control.
- D. Removal of larger waste debris including concrete and metal shall occur in accordance with Sections 02110–Waste Excavation, Removal, and Handling and Section 02120–Off-Site Transportation and Disposal.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 00330: Existing Conditions.
- B. Section 01110: Summary of Work.
- C. Section 01330: Submittals Procedures.
- D. Section 02110: Waste Excavation, Removal, and Handling
- E. Section 02120: Off-Site Transportation and Disposal.
- F. Section 02231: Clearing and Grubbing.
- G. Section 02240: Dewatering.
- H. Section 02370: Erosion and Sedimentation Control.
- I. Section 02072: Geomembrane.
- J. Section 02073: Geocomposite
- K. Section 02074: Geotextile.
- L. Section 02921: Seeding and Soil Supplements.

##### 1.03 REFERENCES

- A. The publications listed below form a part of this Specification to the extent referenced. The current version/edition of the publication is referenced, unless otherwise noted. The publications are referred to in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C 33 - Standard Specification for Concrete Aggregates;
  - 2. ASTM C 88 - Standard Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate;
  - 3. ASTM C 127 - Test Method for Specific Gravity and Absorption of Coarse Aggregate;
  - 4. ASTM C 136 - Sieve Analysis of Fine and Coarse Aggregates;

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5. ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils;
  6. ASTM D 535 - Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine;
  7. ASTM D 854 - Test Method for Specific Gravity of Soils;
  8. ASTM D 1140 - Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve;
  9. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>);
  10. ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soils and Rock by Mass;
  11. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System);
  12. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth);
  13. ASTM D 2974 - Standard Test Method for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils;
  14. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock by Nuclear Methods (Shallow Depth);
  15. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction;
  16. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils;
- C. Standards Specifications for Road and Bridge Construction, 2004, by the Rhode Island State Department of Transportation (RIDOT).
- D. 'Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases', (Remediation Regulations) by the Rhode Island Department of Environmental Management (RIDEM), Office of Waste Management, as amended February 2004.
- E. Quarried Stone for Erosion and Sediment Control, by the National Stone Association, dated 1978.

#### 1.04 DEFINITIONS

- A. Satisfactory Soils:
1. Satisfactory Soils shall meet the requirements specified in Part 2 of this Section and shall be used in areas as shown on the Drawings, Shop Drawings, and as approved by the Engineer. In addition, Satisfactory Soils shall satisfy the following conditions:
    - a. Satisfactory Soils shall be free of all Unsatisfactory Soils/Materials listed below; and
    - b. Satisfactory Soils shall be free of material greater than 6 inches any direction, unless otherwise specified or approved by the Engineer. Furthermore, the maximum particle size shall not exceed one half of the specified maximum lift thickness, unless otherwise specified.
- B. Unsatisfactory Soils/Materials:
1. Unsatisfactory Soils/Materials include but are not limited to highly plastic/fat silt and clay, organic soils, and/or peat (classified as MH, CH, OL, OH, or PT via ASTM D 2487), stumps/brush, trash, refuse, debris, frozen soils, soils containing materials greater than the allowable size (see above), saturated soils, fine-grained soils above their liquid limit at the time of compaction, and soils that are either too wet or too dry to compact.
- C. Cohesionless and Cohesive Soils:

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02300-2



1. Cohesionless soils include gravels, sand-gravel mixtures, sands, and gravelly-sands, classified as GW, GP, SW, or SP by the Unified Soil Classification System (ASTM D 2487).
  2. Cohesive soils include clayey gravels, sand-clay mixtures, clayey sands, clays, and silts, classified as GC, SC, CL, CH, ML, or MH by the Unified Soil Classification System (ASTM D 2487).
  3. Soils classified as GM and SM will be identified as cohesionless only when the 'fines' are determined to be non-plastic.
  4. Testing required for the classification of soil shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.
- D. Percent Compaction:
1. Degree of compaction (percent compaction) required is expressed as a percentage of the maximum dry density, at the optimum moisture content.
  2. Maximum dry density and optimum moisture content shall be obtained by the test procedure presented in ASTM D 1557, unless otherwise specified.

#### 1.05 QUALITY ASSURANCE

- A. Codes and Standards:
1. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

#### 1.06 SUBMITTALS

Submit to the Engineer for approval (unless otherwise specified) the following in accordance with Section 01340, "Submittals":

- A. Borrow Source(s):
1. The Contractor shall provide the proposed source(s) of borrow materials prior to initiation of work. Any available/previous geotechnical laboratory testing data shall be provided.
- C. Contractor's Quality Control Testing Laboratory (QCTL):
1. The name and qualifications of an independent third-party geotechnical testing laboratory to be used for borrow source testing and field quality control testing shall be submitted within 7 days following notice to proceed.
    - a. The Contractor's QCTL shall meet the requirements of ASTM D 3740, at a minimum.
- D. Test Reports:
1. The Contractor's QCTL shall submit 2 copies of the following test reports directly to the Engineer, with at least 1 copy to the Contractor:
    - a. All test reports for borrow source materials; and
    - b. Field quality control test reports.

#### 1.07 SITE CONDITIONS

- A. Known existing site conditions are described in Section 00330–Existing Conditions.
- B. Protection of Persons and Property:
1. Barricade and mark open excavations occurring as part of this Work in accordance with applicable standards.
  2. Protect structures, utilities, pavements, sidewalks, fences, and other facilities designated to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations and heavy truck/equipment traffic.

## PART 2 - PRODUCTS

### 2.01 REGRADED FILL

- A. Location/Use:
  - 1. Regraded Fill shall be used as necessary, to achieve the subgrade elevations indicated on the Drawings.
- B. Regraded Fill shall consist of Satisfactory Soils suitable for embankment construction. It shall be free from frozen materials, perishable rubbish, peat, and other Unsatisfactory Soils/Materials. It shall be of such a nature and character that it can be compacted to the specified density (see Part 3 of this Section).
- C. Regraded Fill shall have a maximum nominal particle size of 6 inches or less. Furthermore, the maximum particle size shall not exceed one half of the specified maximum lift thickness, unless otherwise specified.
- D. The moisture content shall be sufficient to provide the required compaction and a stable embankment and/or subgrade. In no case shall the moisture content exceed 3% above optimum as determined by ASTM D 1557.
- E. Satisfactory Soils obtained from on-site excavations of existing fill and/or subgrade preparations may be re-used on-site as Regraded Fill, as approved by the Engineer.

### 2.02 CRUSHED STONE

- A. Location/Use:
  - 1. Stone Check Dams.
  - 2. Construction Entrance.
- B. Crushed Stone shall consist course aggregate consisting of 100 percent crushed bedrock. It shall not contain crushed or uncrushed gravel and shall be free soft, friable particles or any Unsatisfactory Soils/Material.
- C. Gradation shall meet the requirements of RIDOT Type II Crushed Stone as specified in RIDOT Specification Table 1, Subsection M.01.09 and shown in Table 02300-1.

**Table 02300-1: Crushed Stone Gradation Requirements**

Sieve Size	Percent Passing
2-1/4'	100%
2'	90-100%
1-1/2'	30 - 55%
1-1/4'	0 - 25%
1'	0 - 5 %

### 2.03 SAND

- A. Location/Use:
  - 1. Slag Area Cap System.
- B. As defined in RIDOT Specification Subsection M.01.03 for Pervious Fill.
- C. Clean, naturally occurring granular bank run or plant-processed soil materials that shall not contain Unsatisfactory Soil/Materials.
- C. Gradation shall generally meet the requirements of RIDOT Type IV as specified in RIDOT Specification Table 1, Subsection M.01.09 with the following exception:
  - 1. Maximum particle size shall be 1/2 inches.
  - 2. The modified Type IV gradation in Table 02300-2.

**Table 02300-2: Sand Gradation Requirements**

Sieve Size	Percent Passing
1/2'	100%
#4	30 - 100%
#200	0-8%

2.04 RIPRAP

- A. Location/Use:
  - 1. Slag Area Cap Toe Detail;
  - 2. Transition Detail: Upland Cap to Wetland Buffer Cap; and
  - 3. Typical Drainage Area Cap.
- B. As defined in RIDOT Specification M.10.03 shall consist of broken stone produced from sound ledge or large boulders with at least three fractured faces on each particle and be free from shale, organic matter, overburden material, and/or other Unsatisfactory Soil/Materials. Rounded stones are not acceptable except at locations approved by the Engineer.
- C. Riprap shall meet the National Stone Association (NSA) gradations for the classifications of riprap (designated by the Modified NSA Numbers) as specified in RIDOT Specification M.10.03 and noted in the Table 02300-3.

**Table 02300-3: Riprap Gradation Requirements**

NSA Modified No.	Sieve Size		
	100% Passing	0-50% Passing	0-15% Passing
R-3	8'	4'	2'
R-4	14'	7'	4'

2.05 COVER SOIL

- A. Location/Use:
  - 1. Slag Area Cap;
  - 2. Upland Cap; and
  - 3. Drainage Area Cap
- B. Cover Soil shall consist of Satisfactory Soils suitable for embankment construction. It shall be free from frozen materials, perishable rubbish, peat, and other Unsatisfactory Soils/Materials. It shall be of such a nature and character that it can be compacted to the specified density (see Part 3 of this Section).
- C. Cover Soil shall have a maximum nominal particle size of 3 inches or less. Furthermore, the maximum particle size shall not exceed one half of the specified maximum lift thickness, unless otherwise specified. Acceptable materials will be classified as GM, GC, SW, or SP as determined by ASTM D2487.
- D. The moisture content shall be sufficient to provide the required compaction and a stable embankment and/or subgrade. In no case shall the moisture content exceed 3% above optimum, which shall be determined in accordance with ASTM D 1557.
- E. Cover Soil shall meet the Rhode Island Industrial/Commercial Direct Exposure Criteria for Volatile Organic Compounds (VOCs), Semi-Volatile Compounds (SVOCs), Total Metals (RCRA 18), Total Petroleum Hydrocarbons (TPH) as compared to Table 1 of the RIDEM 'Remediation Regulations'.

2.07 PLANTABLE SOIL

- A. As defined in Section M.18.02 of the RIDOT Specifications.
- B. Loose, friable topsoil, free of refuse, brush, stumps, roots, rocks, cobbles, stones, noxious weeds, litter and any other materials that are longer than 1 inch in any dimension and which will prevent the formation of a suitable seed bed.
- C. Organic matter shall not constitute less than 4 percent or more than 20 percent as determined by loss-on-ignition testing of oven dried samples.
- D. A pH between 5.5 and 7.5.
- E. Plantable Soil shall meet the Rhode Island Industrial/Commercial Direct Exposure Criteria for Volatile Organic Compounds (VOCs), Semi-Volatile Compounds (SVOCs), Total Metals (RCRA 18), Total Petroleum Hydrocarbons (TPH) as compared to Table 1 of the RIDEM "Remediation Regulations".

2.08 BORROW SOURCE TESTING

- A. Borrow source testing, including geotechnical characterization requirements, shall be conducted on all soil materials proposed for construction. Minimum third-party geotechnical laboratory testing requirements and frequency for materials are listed as follows:

1.	Crushed Stone:	<u>Test</u>	<u>Methodology</u> <sup>1</sup>	<u>Frequency</u> <sup>2</sup>
		Sieve Analysis	ASTM C 136	1 test/source/material
2.	Sand:	<u>Test</u>	<u>Methodology</u> <sup>1</sup>	<u>Frequency</u> <sup>2</sup>
		Particle-Size Analysis (to #200 Sieve)	ASTM D 422	1 test/source/material
		Modified Proctor	ASTM D 1557	1 test/source/material
3.	Riprap:	<u>Test</u>	<u>Methodology</u> <sup>1</sup>	<u>Frequency</u> <sup>2</sup>
		Sieve Analysis	ASTM C 136	1 test/source/material
:				
5.	Cover Soil	<u>Test</u>	<u>Methodology</u> <sup>1</sup>	<u>Frequency</u> <sup>2</sup>
		Particle-Size Analysis (to #200 Sieve)	ASTM D 422	1 test/500 cy
		Modified Proctor	ASTM D 1557	1 test/source/material
		VOCs	EPA 8250B	1 test/500 cy
		SVOCs	EPA 8270C	1 test/500 cy
		TPH	EPA 8100M	1 test/500 cy
		RCRA Metals (total only)	EPA 6010B	1 test/500 cy
6.	Plantable Soil	<u>Test</u>	<u>Methodology</u> <sup>1</sup>	<u>Frequency</u> <sup>2</sup>
		Particle-Size Analysis (to #200 Sieve)	ASTM D 422	1 test/500 cy
		Organic Content	ASTM D 2974	1 test/500 cy
		pH	ASTM D 4972	1 test/500 cy
		VOCs	EPA 8250B	1 test/500 cy
		SVOCs	EPA 8270C	1 test/500 cy
		TPH	EPA 8100M	1 test/500 cy
		RCRA Metals (total only)	EPA 6010B	1 test/500 cy

Borrow Source Testing Notes:

1. Other testing methods may be considered acceptable, based on prior approval of the Engineer.
2. Testing frequency shall be as listed, at any change in borrow source, or at any discernable change in material delivered to the site (as determined by the Engineer).

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Engineer, in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

### 3.02 EXCAVATION DEWATERING

- A. General:
  1. Perform dewatering as necessary for the control and collection of ground and surface water entering trenches and/or excavations.
  2. Perform dewatering as necessary to provide a safe working environment.
  3. See Section 02240 - Dewatering for additional information.

### 3.03 STABILITY OF EXCAVATIONS

- A. General:
  1. Slope sides of excavations to comply with applicable codes and ordinances.
    - a. Shore and brace excavations where sloping is not possible because of space restrictions or stability of material excavated.
  2. Maintain excavations in a safe condition until completion of backfilling, or longer if specified or directed by the Engineer.
- B. Shoring, Sheet piling, and Bracing:
  1. Utilize where necessary to meet safety requirements and/or as shown on the Drawings.
    - a. Establish requirements for trench shoring and bracing to comply with codes and ordinances of authorities having jurisdiction.
  2. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

### 3.04 COLD WEATHER PROTECTION

- A. Protect exposed subgrade surfaces against freezing when atmospheric temperature is less than 35°F.
- B. Fill materials shall not be placed atop frozen subgrade surfaces.

### 3.05 EXCAVATION

- A. General:
  1. Excavation consists of removal of material encountered when establishing required subgrade.
  2. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times.
- B. Subgrade Excavation:
  1. Any large, concrete or metal debris encountered during excavation shall be removed from the Site as described in Section 02221–Select Site Demolition.

2. Establish grades within a maximum 33.33 percent (3 horizontal (H) to 1 vertical (V)) and a minimum 5.00 percent (20H to 1V).
3. Conform to grades within a tolerance of one inch deviation over 50 feet of slope. This relates to an allowable minimum slope of 4.83 percent (20.69H to 1V) and an allowable maximum slope of 33.51 percent (2.98H to 1V).

### 3.06 SUBGRADE PREPARATION

- A. General:
  1. Remove vegetation, debris, Unsatisfactory Soils/Materials, obstructions, and deleterious materials from subgrade surfaces prior to placement of fills.
  2. Bench, plow, strip, scarify, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
- B. Regraded Fill Placement
  1. Regraded Fill soil shall be obtained from cut areas within the limit of disturbance.
  2. Regraded Fill shall be placed in areas where fill is required to achieve subgrade elevations.
  3. Regraded Fill shall be placed in compacted lifts no greater than 12 inches in depth.
  4. Compaction of Regraded Fill shall be as specified in Sub-Part 3.11
  5. Prior to placing Regraded Fill the surface shall be relatively smooth/even, free of loose soil, ponded water, and debris. Any loose, soft, wet, frozen, or otherwise unsuitable/unsatisfactory soils or materials observed should either be re-compacted or undercut to a suitable subgrade, as approved by the Engineer.
  6. Any undercut/excavated material should be replaced/backfilled with Regraded Fill or Sand, as approved by the Engineer.
    - a. Fill materials shall be placed and compacted as specified herein.
  7. Prior to placing Regraded Fill the exposed subgrade shall be benched, plowed, or scarified such that fill material will bond with existing subgrade surface.
    - a. Limit extent of disturbance, as indicated on the Construction Drawings and/or approved by the Engineer.

### 3.07 HANDLING AND TEMPORARY ON-SITE STORAGE OF EXCAVATED MATERIALS

- A. General:
  1. During daily excavation activities, locate and retain excavated soils/materials away from the edge of excavations.
    - a. Temporary/daily stockpiles shall be maintained a sufficient distance from the top of the riverbank to prevent loading of the slope and to provide for stability of the slope.
- B. Satisfactory Soils:
  1. Satisfactory Soils obtained from on-site excavations and/or subgrade preparations shall be re-used as Subgrade Fill, and used insofar as practical for rough site grading and backfill, as specified herein.
    - a. Satisfactory Soils and/or Regraded Fill shall have a maximum nominal particle size of 6 inches. Furthermore, the maximum particle size shall not exceed ½ of the specified maximum lift thickness, unless otherwise specified.

2. Excess amounts of Satisfactory Soils shall be transported to the designated Waste Staging and Storage Area as shown on the Drawings, and as approved by Owner and the Engineer.
  - a. Stockpiles shall be constructed in accordance with Section 02110 - Waste Excavation, Removal, and Handling.
  - b. Soils suspected to be hazardous waste based on visual examination shall be segregated from those suspected to be non-hazardous.
    - 1) Final determination of hazardous versus non-hazardous shall be based on sampling, analysis, and characterization.
- C. Unsatisfactory Soils/Materials:
  1. Unsatisfactory Soils/Materials obtained from on-site excavations and/or subgrade preparations that can be improved or modified (i.e., thawed, screened, and/or moisture-conditioned) to meet the definition of Satisfactory Soils may be re-used as Subgrade Fill, as approved by the Engineer.
  2. Unsatisfactory Soils/Materials that cannot be improved or modified to meet the definition of Satisfactory Soils shall be transported to the designated Waste Staging and Storage Area as shown on the Drawings, and as approved by Owner and the Engineer.
    - a. Stockpiles shall be constructed in accordance with Section 02110 - Waste Excavation, Removal, and Handling.
    - b. Soils suspected to be hazardous waste based on visual examination shall be segregated from those suspected to be non-hazardous.
      - 1) Final determination of hazardous versus non-hazardous shall be based on sampling, analysis, and characterization.

### 3.08 SAMPLING, ANALYSIS, AND CHARACTERIZATION

- A. Excess Satisfactory Soils:
  1. Stockpiles of excess Satisfactory Soils shall be sampled, analyzed, and characterized as specified in Section 02110– Waste Excavation, Removal, and Handling.
- B. Unsatisfactory Soils/Materials:
  1. Stockpiles of excess Unsatisfactory Soils/Materials shall be sampled, analyzed, and characterized as specified in Section 02110– Waste Excavation, Removal, and Handling.

### 3.09 TRANSPORTATION AND DISPOSAL

- A. Excess Satisfactory Soils:
  1. Transportation and/or disposal shall be in accordance with Section 02120– Off-Site Transportation and Disposal.
- B. Unsatisfactory Soils/Materials:
  1. Transportation and/or disposal shall be in accordance with Section 02120– Off-Site Transportation and Disposal.

### 3.10 PLACEMENT OF FILL/BACKFILL MATERIALS

- A. General:
  1. Place specified fill/backfill materials in lifts as specified herein as required to achieve specified subgrade elevations.
  2. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  3. Backfill excavations as promptly as work permits, but not until completion of the following:

- a. Acceptance by Engineer of construction below finish grade.
  - b. Inspection, testing, approval, and recording locations of underground utilities.
  - c. Removal of trash and debris.
- B. Fill/Backfill Placement:
- 1. Place fill/backfill materials in layers not more than 12 inches (prior to compaction) for material to be compacted by heavy compaction equipment (i.e., vibratory roller), unless otherwise specified.
  - 2. Place fill/backfill materials in layers not more than 8 inches (prior to compaction) for material to be compacted by hand-operated tampers or hydraulic equipment, unless otherwise specified.
  - 3. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content. Compact each layer to required percentage of maximum dry density (Sub-Part 3.11).
  - 4. Place fill/backfill materials evenly around/adjacent to structures, to the required elevations.
    - a. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
  - 5. Do not backfill anchor trenches until authorized by the Engineer.
    - a. Use care in backfilling to avoid damage or displacement of the geosynthetics.

### 3.11 COMPACTION

- A. General:
  - 1. Provide soil compaction during construction as necessary to achieve minimum percent/degree of compaction, as specified herein.
  - 2. Maximum dry density and optimum moisture content shall be determined in accordance with ASTM D 1557 (or Engineer-approved equivalent).
- B. Percent Compaction Requirements:
  - 1. Foundations and/or Pre-Cast Structures:
    - a. Fill/backfill materials placed beneath or adjacent to foundations or pre-cast structures shall be compacted to at least 95% of maximum dry density, unless otherwise specified or approved by the Engineer.
  - 2. Pavement Areas:
    - a. Fill/backfill materials placed beneath areas to be surfaced with asphaltic concrete pavement shall be compacted to at least 95% of maximum dry density, unless otherwise specified or approved by the Engineer.
  - 3. Cap Areas:
    - a. Fill/backfill materials shall be compacted to at least 90% of maximum dry density, unless otherwise specified or approved by the Engineer.
  - 4. Pipe/Conduit Trenches:
    - a. Compact pipe/conduit bedding (Sand) and each layer of backfill (Sand) to six (6) inches over the pipe to at least 90% of maximum dry density.
    - b. Backfill placed above 6 inches over the pipe shall be compacted in accordance with the applicable surface treatment, as shown on the Drawings and as specified above.



- C. Moisture Control:
1. Where the subgrade or a layer of fill/backfill must be moisture-conditioned before compaction, uniformly apply water to the surface, in proper quantities to prevent free water appearing on surface during or subsequent to compaction operations.
  2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled as specified herein or spread and allowed to dry. Assist drying by dicing, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

### 3.12 FINAL GRADING

- A. General:
1. The Contractor shall uniformly grade areas within the Limits of Disturbance. Smooth finished surface within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
  2. Establish grades within a maximum 33.33 percent (3 horizontal (H) to 1 vertical (V)) and a minimum 5.00 percent (20H to 1V). Select areas at Cap Transitions and upslope of the existing Stormwater Detention Basin outfall may be as steep as 50 percent (2H:1V), however, the extent of the areas shall be minimized.
  3. Conform to grades within a tolerance of one inch deviation over 50 feet of slope. This relates to an allowable minimum slope of 4.83 percent (20.69H to 1V) and an allowable maximum slope of 33.51 percent (2.98H to 1V). For the 50 percent (2H:1V) slope areas, a maximum slope of 50.17 percent (1.99H to 1V) is allowable.

### 3.13 VEGETATION STABILIZATION

- A. Refer to Section 02921–Seeding and Soil Supplements.  
B. Refer to Section 02370–Erosion and Sedimentation Control.

### 3.14 FIELD QUALITY CONTROL TESTING

- A. Quality Control Testing During Construction:
1. Allow testing service to examine and test subgrade surfaces and fill/backfill layers. Before further construction work is performed, test results meeting the requirements of Sub-Part 3.11 of this Section shall be obtained.
  2. Perform field density tests in accordance with ASTM D2922 (nuclear method), or other Engineer approved methods, as applicable.
    - a. Foundations and/or Pre-Cast Structures:
      - 1) For each layer of fill/backfill placed, conduct 1 compaction test for every 100 linear feet of foundation/structure, but in no case less than 3 tests.
      - 2) Exception: 1 test is acceptable for each layer of backfill around pre-cast below-grade vault structures.
    - b. Pavement Areas:
      - 1) For each layer of fill/backfill placed, conduct at least 1 compaction test for every 1000 square feet, but in no case less than 3 tests per lift.
    - c. Cap Areas:
      - 1) For each layer of fill placed, conduct at least 1 compaction test for every 8,000 square feet, but in no case less than 3 tests per lift.

- 2) For every 8,000 square feet of cover soils placed, conduct at least 1 thickness test. 90% of fill thickness tests shall be within 10% of specified thickness and no test shall be less than 80% of thickness. Additional fill shall be placed in areas that do not meet minimum thickness requirements.
- d. Pipe/Conduit Trenches:
  - 1) For each layer of fill placed, conduct at least 1 compaction test for every 100 linear feet of trench.
- e. Anchor Trenches:
  - 1) For each layer of fill placed, conduct at least 1 compaction test for every 100 linear feet of trench.
3. If in opinion of Engineer, based on testing service reports and inspection, subgrade soils or fill/backfill materials which have been placed are below specified density, the Contractor shall provide additional compaction and testing at no additional expense to the Owner.

### 3.15 MAINTENANCE

- A. Protection of Graded Areas:
  1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas:
  1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

END OF SECTION

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

**APPENDIX C**  
**RHODE ISLAND RESIDENTIAL DIRECT EXPOSURE CRITERIA**

**Table C-1**  
**RIDEM Direct Exposure Criteria**  
**Remedial Action Work Plan**  
**Phase I Parcel D**  
**Former Gorham Manufacturing Site**  
**Providence, RI**

Parameter	Residential Direct Exposure Criteria
<b>Volatile Organics (mg/Kg)</b>	
1,1,1,2-Tetrachloroethane	2.2
1,1,1-Trichloroethane	540
1,1,2,2-Tetrachloroethane	1.3
1,1,2-Trichloroethane	3.6
1,1-Dichloroethane	920
1,1-Dichloroethene	0.2
1,2-Dibromo-3-chloropropane	0.5
1,2-Dichloroethane	0.9
1,2-Dichloropropane	1.9
4-Methyl-2-pentanone	1200
Acetone	7800
Benzene	2.5
Bromodichloromethane	10
Bromoform	81
Bromomethane	0.8
Carbon tetrachloride	1.5
Chlorobenzene	210
Chloroform	1.2
cis-1,2-Dichloroethylene	630
Dibromochloromethane	7.6
Ethylbenzene	71
Ethylene dibromide (EDB)	0.01
Isopropyl benzene	27
Methyl ethyl ketone	10000
Methyl tert butyl ether (MTBE)	390
Methylene chloride	45
Styrene	13
Tetrachloroethylene	12
Toluene	190
trans-1,2-Dichloroethylene	1100
Trichloroethene	13
Vinyl Chloride	0.02
Xylene	110
<b>Semivolatile Organics (mg/Kg)</b>	
1,1'-Biphenyl	0.8
1,2,4-Trichlorobenzene	96
1,2-Dichlorobenzene	510
1,3-Dichlorobenzene	430
1,4-Dichlorobenzene	27
2-Methylnaphthalene	123
2,4,5-Trichlorophenol	330
2,4,6-Trichlorophenol	58
2,4-Dichlorophenol	30
2,4-Dimethylphenol	1400
2,4-Dinitrophenol	160
2,4-Dinitrotoluene	0.9
2-Chlorophenol	50
3,3-Dichlorobenzidine	1.4
4-Chloroaniline	310
Acenaphthene	43
Acenaphthylene	23
Anthracene	35
Benzo(a)anthracene	0.9
Benzo(a)pyrene (cPAH)	0.4
Benzo(b)fluoranthene	0.9

**Table C-1**  
**RIDEM Direct Exposure Criteria**  
**Remedial Action Work Plan**  
**Phase I Parcel D**  
**Former Gorham Manufacturing Site**  
**Providence, RI**

Parameter	Residential Direct Exposure Criteria
Benzo(g,h,i)perylene	0.8
Benzo(k)fluoranthene	0.9
bis(2-Chloroethyl)ether	0.6
bis(2-Chloroisopropyl)ether	9.1
Bis(2-ethylhexyl) phthalate	46
Chrysene	0.4
Dibenzo(a,h)anthracene	0.4
Diethyl phthalate (PAE)	340
Dimethylphthalate	1900
Fluoranthene	20
Fluorene	28
Hexachlorobenzene	0.4
Hexachlorobutadiene	8.2
Hexachloroethane	46
Indeno(1,2,3-cd)pyrene	0.9
Napthalene (PAH)	54
Pentachlorophenol	5.3
Phenanthrene	40
Phenol	6000
Pyrene	13
<b>Pesticides/PCBs (mg/Kg)</b>	
Chlordane	0.5
Dieldrin	0.04
PCBs	10
<b>Inorganics (mg/Kg)</b>	
Antimony	10
Arsenic	7
Barium	5500
Beryllium	1.5
Cadmium	39
Chromium (+6)	390
Chromium (Trivalent)	1400
Copper	3100
Cyanide	200
Lead	150
Manganese	390
Mercury (inorganic; mercuric salts)	23
Nickel (soluble salts)	1000
Selenium	390
Silver	200
Thallium (chloride)	5.5
Vanadium	550
Zinc	6000

mg/Kg = milligram per kilogram

Rhode Island Department of Environmental Management (RIDEM), 2011. Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases. DEM-DSR-01-93. November.

Prepared by / Date: KJC 01/13/12  
Checked by / Date: DLC 01/13/12

TEXTRON, INC.  
FORMER GORHAM MANUFACTURING FACILITY, PROVIDENCE, RI  
DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

**APPENDIX D**  
**LABORATORY METHOD DETECTION LIMITS**

Table D-1  
 Method Detection Limits and  
 Method Reporting Limits for SVOCs  
 in Soil (USEPA Method 8270C)

Remedial Action Work Plan  
 Phase I Parcel D  
 Former Gorham Manufacturing Site  
 Providence, RI

<b>Analyte</b>	MDL mg/kg	MRL mg/kg	MS/MSD %REC	MS RPD	BS/BSD %REC	RPD
2-Methylnaphthalene	0.072	0.333	40 - 140	30	40 - 140	30
Acenaphthene	0.081	0.333	40 - 140	30	40 - 140	30
Acenaphthylene	0.064	0.333	40 - 140	30	40 - 140	30
Anthracene	0.053	0.333	40 - 140	30	40 - 140	30
Benzo(a)anthracene	0.058	0.333	40 - 140	30	40 - 140	30
Benzo(a)pyrene	0.055	0.167	40 - 140	30	40 - 140	30
Benzo(b)fluoranthene	0.074	0.333	40 - 140	30	40 - 140	30
Benzo(g,h,i)perylene	0.072	0.333	40 - 140	30	40 - 140	30
Benzo(k)fluoranthene	0.097	0.333	40 - 140	30	40 - 140	30
Chrysene	0.055	0.167	40 - 140	30	40 - 140	30
Dibenzo(a,h)Anthracene	0.051	0.167	40 - 140	30	40 - 140	30
Fluoranthene	0.058	0.333	40 - 140	30	40 - 140	30
Fluorene	0.085	0.333	40 - 140	30	40 - 140	30
Indeno(1,2,3-cd)Pyrene	0.108	0.333	40 - 140	30	40 - 140	30
Naphthalene	0.076	0.333	40 - 140	30	40 - 140	30
Phenanthrene	0.083	0.333	40 - 140	30	40 - 140	30
Pyrene	0.077	0.333	40 - 140	30	40 - 140	30

<b>Surrogate</b>	%REC
surr: 1,2-Dichlorobenzene-d4	30 - 130
surr: 2-Fluorobiphenyl	30 - 130
surr: Nitrobenzene-d5	30 - 130
surr: p-Terphenyl-d14	30 - 130

MDL = method detection limit  
 MRL = method reporting limit  
 mg/kg = milligrams per kilogram

**Preservation: Non Preserved**  
**Container: 4 oz. jar**  
**Amount Required: 30g**  
**Hold Time: 14 days**

Table D-2  
Method Detection Limits and  
Method Reporting Limits for  
Metals in Soil

Remedial Action Work Plan  
Phase I Parcel D  
Former Gorham Manufacturing Site  
Providence, RI

<b>Analyte - Method 6010 BICP</b>	MDL mg/Kg	MRL mg/Kg	DUP RPD	MS %REC	MS RPD	BS %REC	BS RPD
Antimony	0.8	6.7	35	75 - 125	35	80 - 120	30
Arsenic	0.6	3.3	35	75 - 125	35	80 - 120	30
Beryllium	0.02	0.14	35	75 - 125	35	80 - 120	30
Cadmium	0.09	0.67	35	75 - 125	35	80 - 120	30
Chromium	0.2	1.3	35	75 - 125	35	80 - 120	30
Copper	0.5	1.3	35	75 - 125	35	80 - 120	30
Lead	0.3	6.7	35	75 - 125	35	80 - 120	30
Nickel	0.3	3.3	35	75 - 125	35	80 - 120	30
Selenium	0.8	6.7	35	75 - 125	35	80 - 120	30
Silver	0.20	0.67	35	75 - 125	35	80 - 120	30
Zinc	0.7	3.3	35	75 - 125	35	80 - 120	30

<b>Analyte - Method 7000</b>	MDL mg/Kg	MRL mg/Kg	DUP RPD	MS %REC	RPD	BS %REC	RPD
Thallium	0.55	1.65	35	75 - 125	35	80 - 120	30

**Preservation: Non Preserved**  
**Container: 4 oz. jar**  
**Amount Required: 10g**  
**Hold Time: 180 days**

<b>Analyte - Method 7471A</b>	MDL mg/Kg	MRL mg/Kg	DUP RPD	MS/MSD %REC	RPD	BS/BSD %REC	RPD
Mercury	0.010	0.033	35	75 - 125	35	80 - 120	20

**Preservation: Non Preserved**  
**Container: 4 oz. jar**  
**Amount Required: 10g**  
**Hold Time: 28 days**

MDL = method detection limit  
MRL = method reporting limit  
mg/kg = milligrams per kilogram



Table D-3  
Method Detection Limits and Reporting Limits  
for Dioxin/Furans in Soil (USEPA Method 8290)

Remedial Action Work Plan  
Phase I Parcel D  
Former Gorham Manufacturing Site  
Providence, RI

MAE Extraction

Analyte	CAS#	Solid(ng/kg) / Wipe(ng/m2)		Control limits		
		MDL	PRL	Lower	Upper	RPD
2,3,7,8-TCDF	51207-31-9	0.43	1.0	70	130	20
2,3,7,8-TCDD	1746-01-6	0.36	1.0	70	130	20
1,2,3,7,8-PeCDF	57117-41-6	0.44	5.0	70	130	20
2,3,4,7,8-PeCDF	57117-31-4	0.33	5.0	70	130	20
1,2,3,7,8-PeCDD	40321-76-4	0.54	5.0	70	130	20
1,2,3,4,7,8-HxCDF	70648-26-9	2.50	5.0	70	130	20
1,2,3,6,7,8-HxCDF	57117-44-9	0.72	5.0	70	130	20
2,3,4,6,7,8-HxCDF	60851-34-5	2.50	5.0	70	130	20
1,2,3,7,8,9-HxCDF	72918-21-9	0.42	5.0	70	130	20
1,2,3,4,7,8-HxCDD	39227-28-6	2.50	5.0	70	130	20
1,2,3,6,7,8-HxCDD	57653-85-7	0.63	5.0	70	130	20
1,2,3,7,8,9-HxCDD	19408-74-3	0.43	5.0	70	130	20
1,2,3,4,6,7,8-HpCDF	67562-39-4	2.50	5.0	70	130	20
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.70	5.0	70	130	20
1,2,3,4,6,7,8-HpCDD	35822-39-4	0.48	5.0	70	130	20
OCDF	39001-02-0	1.19	10.0	70	130	20
OCDD	3268-87-9	1.85	10.0	70	130	20
Total TCDF	55722-27-5	0.43	1.0	70	130	20
Total TCDD	41903-57-5	0.36	1.0	70	130	20
Total PeCDF	30402-15-4	0.77	5.0	70	130	20
Total PeCDD	36088-22-9	0.54	5.0	70	130	20
Total HxCDF	55684-94-1	2.50	5.0	70	130	20
Total HxCDD	34465-46-8	2.50	5.0	70	130	20
Total HpCDF	38998-75-3	2.50	5.0	70	130	20
Total HpCDD	37871-00-4	0.48	5.0	70	130	20

Labelled Analyte	Control limits	
	Lower	Upper
<sup>13</sup> C <sub>12</sub> -2,3,7,8-TCDF	40	135
<sup>13</sup> C <sub>12</sub> -2,3,7,8-TCDD	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8-PeCDF	40	135
<sup>13</sup> C <sub>12</sub> -2,3,4,7,8-PeCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8-PeCDD	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8-HxCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,6,7,8-HxCDF	40	135
<sup>13</sup> C <sub>12</sub> -2,3,4,6,7,8-HxCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8,9-HxCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8-HxCDD	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,6,7,8-HxCDD	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8,9-HxCDD	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,4,6,7,8-HpCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8,9-HpCDF	40	135
<sup>13</sup> C <sub>12</sub> -1,2,3,4,6,7,8-HpCDD	40	135
<sup>13</sup> C <sub>12</sub> -OCDD	40	135
<sup>37</sup> Cl <sub>4</sub> -2,3,7,8-TCDD	40	135

MDL = method detection limit  
MRL = method reporting limit  
ng/kg = nanograms per kilogram

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DRAFT REMEDIAL ACTION WORK PLAN – PHASE I SOIL CAPPING: PARCEL D

## **APPENDIX E**

### **ENVIRONMENTAL LAND USE RESTRICTION AND SOIL MANAGEMENT PLAN**

*(Being completed with the City of Providence and Textron)*