SUPPLEMENTAL SITE INVESTIGATION WORK PLAN

PARK PARCEL/MASHAPAUG COVE

FORMER GORHAM MANUFACTURING SITE

333 ADELAIDE AVENUE

PROVIDENCE, RHODE ISLAND

JUNE 2006

MACTEC

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333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND

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LIST OF ACRONYMS

AVS/SEM	acid volatile sulfides/simultaneously extracted metals
COCs	constituents of concern
COPC	constituents of potential concern
DCE	1,2-dichloroethene
DO	dissolved oxygen
EM	electromagnetic
GPS	Global Positional System
GZA	Goldberg Zoino & Associates
HLA	Harding Lawson Associates
MACTEC	MACTEC Engineering and Consulting, Inc.
MS/MSD	matrix spike/matrix spike duplicate
ug/L	microgram per liter
OHM	oil or hazardous materials
PAH	polynuclear aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
ppm	parts per million
QA/QC	quality assurance/quality control
RAWP	Remedial Action Work Plan
RIDEM	Rhode Island Department of Environmental Management
RIDOH	Rhode Island Department of Health

SVOCs	semivolatile organic compounds
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
Textron	Textron, Inc.
TOC	total organic carbon
TPH	total petroleum hydrocarbons
URI	University of Rhode Island
USEPA	U. S. Environmental Protection Agency
USTs	underground storage tanks
VOCs	volatile organic compounds

1.0 INTRODUCTION

This Work Plan describes activities that will be undertaken to address data gaps and support completion of a Supplemental Site Investigation Report (SSIR) including a human health and ecological risk assessment for the Park Parcel at the former Gorham Manufacturing Site located at 333 Adelaide Avenue, Providence, Rhode Island (the Park Parcel is hereafter referred to as "the Site") (Figure 1). This Work Plan has been prepared pursuant to Rule 8.00 (Risk Management) of the Remediation Regulations this Work Plan on behalf of Textron, Inc. (Textron) by MACTEC Engineering and Consulting, Inc. (MACTEC, formerly Harding Lawson Associates [HLA]). In particular, the investigation will collect the information to identify nature and extent of contamination and to support human health and ecological risk assessments for the Park Parcel (including the adjacent Mashapaug Cove). This Work Plan also includes a geophysical survey of the Cove for the potential presence of drums. The Scope of Work (SOW) has incorporated comments provided by RIDEM on a November 2005 version of this Work Plan (RIDEM, 2006a) and comments provided after a meeting held on May 9, 2006 attended by RIDEM, Textron, and MACTEC (RIDEM, 2006b).

The former Gorham Manufacturing Site covers 37 acres and is currently owned by the City of Providence (the City). The southeastern third of the Site has been redeveloped as a retail complex. An adjacent area to the west is slated for development by the City in 2006. As part of the redevelopment of the Property, the City has subdivided the remaining eight-acre portion of the property, known as the Park Parcel. This Work Plan describes sampling activities on the Park Parcel including portions of Mashapaug Pond. Figure 2, an aerial photograph of the Site circa 2003, identifies Park Parcel and Mashapaug Cove and shows Site conditions at that time.

In 1999, a Method 1 risk assessment, performed consistent with the Remediation Regulations for all of the property, identified remedial requirements for based on industrial/commercial direct exposure criteria and GB leachability criteria. An agreement between Textron and the City of Providence, who took possession of the Property, identified Textron's responsibility as cleanup to industrial/commercial land use requirements for the entire Property, including the Park Parcel. A Remedial Action Work Plan (RAWP), submitted in 2001, identified the plan to achieve the industrial/commercial remedial requirements. Some components of the RAWP have been

completed, others are on-going, and some will be implemented during redevelopment of the Property.

In August 2004, subsequent to discussion with RIDEM representatives concerning their comments on an earlier work plan, a Method 3 risk assessment (consistent with the Remediation Regulations) for the proposed use of the Park Parcel as a passive recreational area (MACTEC, 2004) was submitted to RIDEM for review and approval. Although no formal comments have been received on the document, recent correspondence from RIDEM (March 14, 2006 and April 5, 2006 letters to Textron) and requirements of the CONSENT ORDER (Park Parcel) executed on March 29, 2006 requires that additional investigation be conducted to characterize nature and extent of contamination of the Park parcel (including Mashapaug Cove) In 2005, RIDEM collected additional samples from the Park Parcel (including from Mashapaug Cove) to provide some information concerning current conditions, including chemical analysis for various classes of chemicals. A Work Plan for the risk assessment for the Park Parcel (including Mashapaug Cove) will be submitted to RIDEM following a review of the supplemental site investigation data that will be collected per this Work Plan.

This Work Plan identifies data collection activities to support the requirements identified above. The supplemental site investigation results will be incorporated into an SSIR. The results of the survey for drums within the Cove will also be assessed to determine if any additional action is necessary.

2.0 GENERAL SITE INFORMATION

2.1 SITE HISTORY

The former Gorham Manufacturing Site 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 1986. 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). The former Gorham Manufacturing Site is shown in Figure 2 as the area north of Adelaide Avenue and west of the railroad tracks. The former manufacturing facility has been razed, partly remediated and is in the process of redevelopment. Development has been completed on the southeastern portion. A second parcel will be developed in 2006. This area has a soil cap in place and is undergoing active groundwater remediation. Other than some historical groundwater pumping wells used for industrial purposes, no industrial or commercial activities are known to have occurred along the banks and shore of Mashapaug Pond or Mashapaug Cove, including the Western Peninsula. Fill material from the former manufacturing area extends to some portions of the pond's bank area, particularly along the southern shore of Mashapaug Cove.

In 1967, the business and property were purchased by Textron and operated as a division of that company until 1986, when Textron relocated the Gorham Division and sold the facility to the Winoker Group. The Winoker Group subsequently sold the facility to another group of investors, the Adelaide Development Corporation, which in turn sold the facility to the Seaman Equity Group. In 1990, Seaman defaulted on its taxes and the City of Providence foreclosed. The City of Providence currently owns the property at 333 Adelaide Avenue.

The 333 Adelaide Avenue property, particularly the former manufacturing facility, has been the subject of environmental investigations and remedial activities beginning in 1985. 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 the Park Parcel and Mashapaug Cove. A Supplemental Investigation Report (HLA, 1998a) was prepared in 1998 for the Park Parcel. In 1999, a Site Investigation Summary Report and Risk Assessment (HLA, 1999)

was prepared and submitted to RIDEM and in 2000, HLA prepared a Response to RIDEM Comments on the Site Investigation Summary Report and Risk Assessment (HLA, 2000).

In November 2002 MACTEC submitted a Method 3 Risk Assessment Work Plan (MACTEC, 2002) to RIDEM to assess the Park Parcel. 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.

The eastern portion of the former manufacturing area has been redeveloped. This eastern portion now consists of a large supermarket, other retail stores, and a gasoline station. The area surrounding the new retail facilities is currently a paved parking lot and roadways. The western portion of the former manufacturing area has been proposed for the construction of a YMCA. Construction of a high school for the City of Providence will soon be underway in the area between the existing retail facilities and the proposed YMCA.

2.2 PHYSICAL DESCRIPTION OF PARK PARCEL AND SURROUNDING AREA

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

The embankments along the southern end of Mashapaug Cove are underlain by heterogeneous fill, consisting of granular reworked soils with lesser amounts of casting sands, construction and demolition and miscellaneous debris. The fill varies in thickness from one-foot at the northern edge of the former West Parking area to up to approximately 20-feet along the southern shore of the Cove embankment (Figure 2).

A large portion of the Park Parcel is currently wooded and heavily vegetated. There is approximately 30-feet of difference in elevation between the former manufacturing facility upland parcel and the lower shoreline of Mashapaug Cove. 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 more open than the wooded areas adjacent to it. The Cove shore area is a small, relatively flat area at the bottom of the embankment with brush and saplings. There is a very

steep embankment between the developed portion of the property to the south of the park Parcel 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.

2.3 SUMMARY OF ENVIRONMENTAL CONDITIONS

Environmental investigations have been carried out at the Site since 1985. The results of the earlier investigations were summarized in the Remedial Investigation Report (ABB-ES, 1995a). Subsequent environmental investigations by MACTEC have been documented in submittals to RIDEM which include a Supplemental Investigation Report (ABB-ES, 1995b). In December 1998 a Supplemental Site Investigation Report (HLA, 1998b) specific to the Park Parcel was submitted to RIDEM and 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, including the Park Parcel and Mashapaug Cove. This report was formally approved by RIDEM in a June 15, 2001 RIDEM Remedial Decision Letter. Current soil conditions at selected locations within the Park Parcel and sediment conditions at selected locations in Mashapaug Cove are documented in a Site Investigation Report submitted by Fuss & O'Neill, Inc to RIDEM in April 2006.

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 volatile organic compounds (VOCs) (principally chlorinated hydrocarbons), semi-volatile organic compounds (SVOCs) (principally polycyclic aromatic hydrocarbons [PAHs}), metals, and total petroleum hydrocarbons (TPH). The south bank of the Cove is an area of exposed fill material. Variable concentrations of VOCs, PAHs, metals and TPH are associated with these fill materials.

The available information indicates that no active industrial/commercial activities (other than withdrawal of groundwater for use in manufacturing operations) were conducted within the Park Parcel. The data suggest that impacted fill from the former manufacturing facility parcel impinges upon the southerly portion of the Park Parcel. That fill material contains metals and PAHs. A slag pile is located on the south bank of the cove. This pile may have originated from smelting operations during historical silverware manufacturing. Removal of this pile is scheduled for May 2006.

Groundwater beneath the Site flows predominantly in a northerly direction and discharges into Mashapaug Cove. There is a groundwater divide approximately parallel to the eastern property boundary, in the southeastern portion of the Site. The depth to groundwater beneath the Site ranges from approximately 3-feet along the north bank area to 30-feet below grade in the southeastern area of the Site. Historical investigations have identified low levels of VOCs (PCE, TCE and 1,1,1-TCA) in groundwater entering Mashapaug Cove along the southern shore. There are no buildings proposed in the Park Parcel; therefore, potential vapor migration from groundwater to soil gas and indoor air of occupied buildings is not a concern for the Park Parcel. This VOC groundwater plume has been determined not to pose an ecological risk to aquatic life within the Cove (Section 2.3; MACTEC, 2004).

Groundwater beneath the Site is classified as GB, as it has been designated as not being suitable for public or private drinking water use. As of 1995 groundwater beneath the Site was not used as a source of drinking water and there were no public or private wells within a four-mile radius of the Site (ABB-ES, 1995). The nearest public water supply is the Scituate Reservoir located approximately nine miles to the west.

Mashapaug Pond has been classified as having Class C water quality or eutrophic conditions (low dissolved oxygen and excessive algae/nutrients). According to this classification, the water is not suitable for drinking purposes; however, it is suitable, with certain restrictions, for recreational activities. In August 2002, RIDEM and Rhode Island Department of Health (RIDOH) issued a letter (RIDEM and RIDOH, 2002a) to inform the public concerning water quality in Mashapaug Pond and to identify safe uses of the pond. That letter concluded that fish caught from the pond are not safe to eat due to contamination by polychlorinated biphenyls (PCBs) and dioxins, that bacteria levels are apparently high following rainstorms rendering the pond unsafe for swimming, and blue-green algae found in the pond can produce toxins that can harm humans and animals that swim in or drink pond water during algal blooms, further rendering the pond unsafe for direct contact and consumption at those times. None of these conditions has been attributed to conditions at the Park Parcel itself or the former manufacturing facility.

A "Do's and Don'ts Flyer" was released by RIDEM and RIDOH (RIDEM and RIDOH, 2002b) that indicates that catch and release fishing and boating are safe activities for Mashapaug Pond. The flyer strongly urges people not to drink pond water, not to eat fish caught in the pond, not to

swim, wade, play, or bathe in pond water, and not to boat whenever thick scum, algal mats, or foul odors occur on the pond. This advisory concerning safe uses of the pond indicates that a park visitor would be unlikely to have significant exposures to Site-related constituents during recreational activities at the pond.

Constituents detected in sediments and surface soils adjacent to the Cove include TPH, SVOCs and metals. The 2005 sediment samples identified various chlorinated VOCs in cove sediments. Sediment samples from drainage swales and erosion channels that serve as a pathway for the discharge of site materials 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. These are described in more detail in the following section.

3.0 HISTORICAL DATA AND POTENTIAL DATA GAPS

MACTEC has reviewed soil and groundwater data collected between 1985 and 2005 for the upland portions of the former manufacturing area and the Park Parcel, and available surface water and sediment data from Mashapaug Pond. The following text includes a brief summary of pertinent surface water and sediment data from within both the Mashapaug Cove and Mashapaug Pond, groundwater discharge to Mashapaug Cove and surface soil data from along the banks of the Cove. This data was then compared to site-related constituents identified on the Site to identify potential data gaps that would support the risk assessment for this Park Parcel.

3.1 INITIAL DATA EVALUATION

The following subsection summarizes the surface water and sediment data collected related to Mashapaug Cove and Mashapaug Pond, and groundwater and surface soil associated with the banks of the Cove.

3.1.1 Surface Water

Surface water samples were first collected by the University of Rhode Island (URI) in 1986 at two locations (W3 and W5 on Figure 3) and analyzed for metals. These data were non-detect. In 1987 RIDEM collected a surface water sample from the Pond on the outside of the Site's western peninsula that contained low concentrations of VOCs (11 micrograms per liter (ug/L) trans 1,2-dichloroethene (DCE), 3 ug/L 1,1,1-TCA, 19 ug/L TCE and 1 ug/L PCE, Figure 3). In 1986 Goldberg Zoino & Associates (GZA) also collected one surface water sample (MP-1) in Mashapaug Cove and analyzed the sample for VOCs. It was found to contain 22 ug/L TCE and 24 ug/L of cis-1,2 DCE. GZA then collected more surface water samples from MP-1, MP-2 and two sample locations along the western and southern banks of the Cove at surface water discharge points into the Cove. VOC analysis of these samples only reconfirmed the presence of TCE at MP-1 while no VOCs were detected at the other surface water sample locations.

In 1999 MACTEC collected four surface water samples from Mashapaug Pond. One sample was collected from the Pond near the mouth of Cove (SW-1) and three from inside the Cove (SW-2,

SW-3, and SW-4) as shown on Figure 3. SW-1 was collected as a background sample to determine potential effects of groundwater discharge from the Site on surface water quality. Based on historical Pond data these samples were analyzed for VOCs. SW-1 was found to contain 3 ug/L of cis 1,2-DCE and 1 ug/L of TCE, while the surface water samples (SW-2, SW-3 and SW-4) within the Cove detected cis-1,2 DCE (4-6 ug/L) and TCE (1-2 ug/L).

Nutrient data was also collected six times from throughout the Mashapaug Pond by URI between 1999 and 2001. The Narragansett Bay Commission also collected five surface water samples from Mashapaug Pond for metals analyses. Cadmium and copper were found at the highest concentrations along the southwest bank of the Pond, while chromium and silver were equally distributed throughout the Pond. Surface water sample W5, located in the deepest portion of the Pond was non-detect for metals. This data also confirmed the identification of high nutrient and fecal coliform concentrations and bacteria counts in the surface water outside the Cove; these high bacteria counts resulted in the posting of restrictions on recreational activities in Mashapaug Pond by RIDEM and RIDOH in 2002.

Further investigation of Mashapaug Cove surface water was conducted by MACTEC in 1994 and 1995 to assess the potential for contamination of the Cove surface water from storm water discharge from the Site. As discussed in the August 2004 Method 3 Human Health Risk Assessment – Park Parcel (MACTEC, 2004), two water storm water samples were collected in 1994 from the north bank area during a rain event and were analyzed for VOCs, TPH and total TAL inorganics. TCE was detected in one sample (SR-001) at 8 ug/L and is likely due to precipitation that infiltrated through fill material and drained into the storm water discharge pipe (MACTEC, 2004). Low concentrations of metals were found in the storm water, while no TPH was detected.

3.1.2 Sediments

In 1986, URI collected three sediment samples from Mashapaug Pond and one sediment sample from within Mashapaug Cove (Figure 3). These samples were analyzed for PAHs, PCBs and metals. PAHs and lead concentrations were greatest at the northern end of Mashapaug Pond, while PCBs were uniformly distributed throughout the entire Pond. Among the four sediment samples, the sample collected within the Cove contained the highest concentrations of cadmium, chromium, copper, nickel, silver and zinc. In 1987 RIDEM collected one sediment sample from the Pond on the outside of the Site's western peninsula; metals, VOCs and PCBs were all non-detect at this sample location (Figure 3).

In September, 2005, a local citizen (R. Dorr) reportedly collected sediment samples from two locations within the cove and one location outside the cove. MACTEC has reviewed a copy of these unpublished results. They appear to indicate the presence of metals and chlorinated VOCs at elevated concentrations.

In December 2005, Fuss & O'Neill, under contract to RIDEM, collected five sediment samples from the cove. These samples, published in the Supplemental Site Investigation Report (Fuss & O'Neill, 2006) indicate elevated metals, chlorinated VOCs, PAHs, and dioxin in cove sediments. The highest concentrations were generally found in the two samples collected from the center of the cove. Maximum concentrations included: arsenic (45 mg/kg); copper (1500 mg/kg), lead (590 mg/kg), silver (120 mg/kg), trichloroethene (5.6 mg/kg), and vinyl chloride (5.0 mg/kg). The highest PAH levels were reported in the sample nearest to the southern cove shore with concentrations generally reported between 1 and 5 mg/kg for individual compounds.

3.1.3 Park Parcel Surface Soils

Figure 4 shows the locations of soil samples collected during previous investigations from the Park Parcel. Soils found on the surface of the bank to Mashapaug Cove may be indicative of COPC found in the Cove surface water and sediment. In 1987 RIDEM collected a surface soil sample from a drainage ditch leading along the bank leading into the Cove. This soil sample was analyzed for TPH, PCBs and metals. TPH was found to be approximately 75,000 parts per million (ppm) while the PCBs and metals were non-detect (RIDEM, 1987). Surface soil sampling was also conducted by MACTEC in 1994, 1998, 2001 and 2002 that include both surface soils and surface

sediment found in erosion channels along the bank that lead into the Cove (SD-001 through SD-008). Both the 1994 and 1998 surface soil analytical results for VOCs, SVOCs, TPH and metals are presented in the Supplemental Site Investigation Report Proposed Park Subdivision, dated December 1998 (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). Samples SS-300 through SS-306 were collected from the Cove shore area (Figure 4). These surface soil samples were analyzed for VOCs, PAHs and metals. Arsenic was consistent with background concentrations except for the isolated area on the northeastern shore of the Cove (BK-4). Lead was found in the surface soils along the shoreline of the Cove and copper was found at increased concentrations along the western boundary area along Mashapaug Cove (MACTEC, 2004).

Five surface soil samples were collected by RIDEM in 2005 from the Park Parcel along the south shore of the cove. Notable findings included lead (up to 14,000 mg/kg), and various PAHs (up 20 mg/kg). PCBs were not detected above 0.1 mg/kg. Dioxins and furans were reported at concentrations generally below 1 ug/kg.

3.1.4 Drums

In 1987, RIDEM reported the presence of a drum in Mashapaug Cove. This drum was rusted and in pieces. RIDEM collected a sample of the material within the drum and analyzed it for metals and PCBs. All compounds were non-detect (RIDEM, 1987).

3.2 CONCEPTUAL SITE MODEL

Previous investigations identified potential source areas from which site related oil or hazardous materials (OHM) may have been released, the migration pathways through which OHM may have been transported and/or translocated to surface water and sediments of Mashapaug Cove, and the locations where possible exposure may occur. Human Health risks were evaluated and a Remedial Action Work Plan (RAWP), submitted in 2001, that identified the plan to achieve the industrial/commercial remedial requirements. These remedial actions have been implements on the land parcels with the exception of the Park Parcel. Contamination on the Park Parcel and in the

adjacent cove is predominantly TPH, PAHs and metals in soils and sediment, and chlorinated VOCs in sediment and groundwater. The 2004 Method 3 Risk Assessment for the Park Parcel (MACTEC, 2004) and the 1999 Site Investigation Summary Report (HLA, 1999) reached the following conclusions:

- Soil containing fill and other industrial residuals (collectively termed "fill") from past operations at the adjacent former industrial parcel are present in portions of the Park area.
- The entire Park Parcel does not exhibit contamination – a significant portion of the Park Parcel (approximately 50%) appears to be free of site-related fill.
- Predominant constituents of fill are metals (copper, silver, and lead), PAHs, and limited petroleum residuals.
- The TPH in soil is associated with releases from former underground storage tanks (USTs) located in the Central Portion of the Site.
- Arsenic in soil appears to be uniformly distributed in soils at the Site and does not appear to be associated with fill material. As discussed in previous reports (HLA, 1999, 2000), arsenic concentrations in uncapped soils on the undeveloped upland parcel may be representative of background concentrations found in this urban area.
- Exposed surface soils from the former UST area and exposed fill materials along the embankment could be transported in surface water runoff along the drainage swales and erosion channels along the embankment bordering the southern shore of Mashapaug Cove. Surface soil and fill could be transported and deposited in the Cove.
- Groundwater beneath the Site flows predominantly in a northerly direction and discharges to the Mashapaug Cove. The depth to groundwater beneath the Property ranges from approximately 3-feet along the north bank area to 30-feet below grade in the southeastern area of the Site.
- There is a plume containing low levels of VOCs flowing into the Cove near the southern shore. The source area of the VOC groundwater contamination is beneath former Buildings W and T, located in the south-central portion of the Property.
- Groundwater near the Park Parcel and the surface water within Mashapaug Cove was previously tested for VOCs which were determined not to be an issue with respect to migration to Mashapaug Cove (potential aquatic life concerns).

Since that submittal, the additional RIDEM samples collected in late 2005 indicate significant levels of chlorinated VOCs in cove sediment along with elevated metals and PAHs.

3.3 POTENTIAL RECEPTORS

3.3.1 Potential Human Receptors – Mashapaug Cove

Potential human receptors at Mashapaug Cove might include potentially any visitors to the Park Parcel such as neighborhood or other local residents (all age groups), high school students and employees (if the school is built), clients and employees of the proposed YMCA facility (if it is built), maintenance personnel for the Park Parcel, perhaps local recreational anglers, and possibly boaters/canoers. Depending on the reason for their visit and the final design of the proposed Park and its walking trail, receptors might have varied exposures to soil, sediments, and surface water. It is likely that potential direct contact exposure to sediments would be more likely to occur at the shoreline of the Cove, where water is very shallow, rather than in the middle of the open water area where contact with bottom sediments is actually unlikely. The Cove is very shallow, in most areas has a mucky bottom, and is heavily vegetated during the summer months. Those conditions are not conducive to recreational swimming by park visitors. In addition, advisories from RIDEM and RIDOH discourage people from contacting the surface water due to off-site, storm water related bacterial problems and nutrient-related blue-green algae blooms in the Pond (Appendix A). While recreational anglers might visit the Pond, their exposures are more likely to be associated with surface water and sediment contact rather than fish consumption. The RIDEM/RIDOH advisory indicates that fish from Mashapaug Pond should not be eaten because of dioxin and PCBs that have been detected in fish samples from the Pond.

The actual list of human receptors that would be evaluated in the expanded risk assessment as well as the exposure profiles for those receptors will be derived during the future risk assessment activities.

3.3.2 Potential Ecological Receptors – Mashapaug Cove

Potential ecological receptors for surface water and sediments of the Cove could potentially include aquatic and emergent plants, benthic invertebrates, amphibians, fish, reptiles, semi-aquatic wildlife,

and birds. During the development of a risk assessment work plan and a habitat assessment, representative receptor groups or species will be identified as the focus of the future screening level ecological risk assessment and for a more comprehensive ecological risk assessment (if required).

3.4 DATA GAPS

In order to complete the risk assessment for the Park Parcel, including Mashapaug Cove, MACTEC reviewed the historical Site data and Mashapaug Cove/Pond data, and the potential human health and ecological receptors identified for the Park Parcel and Mashapaug Cove under the existing and expected future use scenarios. Based on this data review, data gaps for Mashapaug Pond surface water and sediment and Park Parcel soil were identified. These are discussed by media below.

3.4.1 Surface Water

The most recent surface water samples from the Cove were collected in 1999. The three samples collected from the Cove (SW-2, SW-3 and SW-4, Figure 3) and the one background sample collected from the boundary of the Cove (SW-1) were analyzed for VOCs. Those samples contained low levels of chlorinated solvents.

In order to evaluate potential human health and ecological risks associated with site-related constituents, current surface water conditions within the cove and at locations outside of the cove are needed. The sample set needs to be robust enough (e.g. 10 to 15 samples) to provide for statistical analysis during the risk assessment. Analysis should include site-related constituents that may have or may be migrating from the Site to the Cove, including VOCs, PAHs, and metals. Cove surface water samples should be collected in locations intended to be representative of the entire Cove and should include locations that are appropriate to characterize potential impacts to surface water associated with existing discharge points and the location of the northern groundwater VOC plume.

3.4.2 Sediment

The five samples collected by RIDEM in late 2005 identify the general nature of impact to cove sediment. Additional sampling is needed to evaluate the distribution of COPCs within the cove. Samples from locations outside of the cove are needed to establish conditions beyond the cove.

Sediment samples should include cove locations immediately downgradient of several existing erosion channel discharge points and near an existing storm water drainage outfall on the southern bank of the Cove. Other sediment samples should be collected along the shoreline and in the open water portion of the Cove to characterize human health and ecological receptor exposures.

The locations of sediment and surface water samples representative of human and ecological exposures for the Cove may not be completely consistent with each other. Human health exposures to surface water and sediment would most likely occur near the shoreline where wading may occur. Sediment exposure for people would almost always be limited to areas where the depth of surface water is one or two feet or less. Human exposure to sediments in the middle of the Cove would not be expected at all. Ecological aquatic receptors would be present throughout the Cove so representative exposures would not be limited to the near-shore areas for those aquatic receptors, but instead would be throughout the Cove.

There is a storm water management system currently in place that drains the redeveloped portion of the property and includes a storm water collection basin (located north of the supermarket building) and a storm water discharge outlet pipe for the system is located on the southeastern shoreline of the Cove. This storm water management system may have an impact (potentially metals and PAHs) on surface water and sediment quality within the Cove, particularly in the area of the discharge.

One assumption that should incorporated into this sampling and analysis plan design is that if the Cove has been or is being impacted by the Property, that impacts would be greater near the Cove shoreline adjacent to the former manufacturing area (southern shore of the cove) and the storm water discharge points than they would be in the portion of the Cove that is further from the former manufacturing area and storm water discharge points. At some point, conditions away from the potential source areas would likely be representative of background conditions in the Cove. These background conditions in this urban pond are likely the result of cumulative impacts of point sources and non-point sources throughout the drainage area of the Pond. Additional investigation beyond that proposed here may be necessary to determine the background conditions and to distinguish the potentially site-related area (if there is one) from the background condition.

3.4.3 Drums

The presence one rusted drum was noted during a previous investigation. There has been no survey of the cove bottom to assess the potential presence of other drums or debris. A geophysical survey such as a magnetometer survey should be conducted to evaluate conditions within the Cove. This should be accomplished with transects across the cove with a spacing of 10-feet to provide sufficient detail to determine areal anomalies grid line. Global Positional System (GPS) should be used with the EM to track the survey points and potential findings. Potential metal targets should be incorporated into the sediment sampling plan to determine if drums are present.

3.4.4 Park Parcel Soils

A visual inspection of the Park Parcel should be conducted along the bank of the Mashapaug Cove for the presence of surficial debris. If found this debris should be photographed and removed in an expeditious manner.

As shown on Figure 4, soil samples have been collected during previous investigations across all of the Park Parcel. RIDEM has indicated in comment letters (RIDEM 2006a, 2006b) and at meetings that additional analysis is desired to address several objectives:

- Provide additional characterization for PAHs, dioxins, pesticides, and PCBs in bank surface soils along the general shoreline (outside of the cove);
- Characterize soil conditions beneath the slag pile (to be removed concurrent with this sampling);
- Characterize current conditions at several historic discharge pipes and/or erosional drainage pathways along the south bank of the cove; and
- Provide sufficient data density to determine the extent of a planned soil cap at the northeastern upland portion of the Park parcel.

These data needs should be addressed by the soil sampling program.

3.4.5 Biota Sampling

No sampling and analysis of fish tissue or any other biota tissue is required for this phase of investigation. The results of the initial phase of surface water and sediment investigation will be used, in conjunction with exposure models and food chain evaluation models, to determine if the

site-related impacts (if any) to surface water and sediment have the potential to translate into a substantial ecological food chain exposure for ecological receptors (particularly semi-aquatic wildlife and birds). If the evaluation of site-related constituents in surface water and sediment concludes that food chain exposures might be substantial, additional investigation to address that issue may be proposed. With respect to fish tissue data for human health risk assessment, there is an advisory in place that indicates that fish from the pond should not be consumed. In addition, the results from the proposed surface water and sediment investigation will be used to determine if accumulation of site-related constituents in fish tissue from sediments and surface water might potentially represent a substantial human exposure (again using modeling techniques to evaluate accumulation potential).

4.0 SAMPLING PROGRAM

This section describes the sampling scope of work that will be completed to address the data needs discussed in Section 3.0.

4.1 SURFACE WATER

Surface water grab samples will be collected from 15 locations within Mashapaug Pond. These are shown on Figure 5. Three of these samples will be collected from outside the Cove to provide a sufficient background data set within the general pond area to compare to cove results during the risk assessment (SW-10 through SW-12). The remaining 12 samples will be collected from locations within Mashapaug Cove and co-located with sediment core samples. The rationale for each surface water sampling location and the analytical parameters are shown in Table 1. The sample set will also include one field duplicate sample, one equipment rinse blank and extra volume from one location for a matrix spike/matrix spike duplicate (MS/MSD) analysis.

All surface water samples will be analyzed for VOCs, PAHs and the 13 priority pollutant metals (PPM), both total and dissolved. Three locations will also be analyzed for dioxins plus furans, pesticides and PCBs. These analyses have been added after discussions with RIDEM and will be collected from two locations within the cove (SED-19 and SW-27) and from one location that represents general conditions outside the cove and within the pond (SW-11)

A shallow draft boat or barge will be used to access Mashapaug Cove. GPS will be used to navigate to the sampling locations. Care will be taken when anchoring or stabilizing the vessel that bottom sediment is minimally disturbed

Surface water samples will be collected following the general procedures provided below:

- Navigate to a surface water sampling locations using GPS.
- Measure depth of water at the sample location using a weighted tape, engineers rule or other devise, being careful not to disturb the pond sediment.
- Collect the sample using a peristaltic pump fitted with a polyethlylene sampling tube that is suspended so that the intake is at least one foot below the pond surface. A weight may be

used to position the tubing at the required depth. Use the pump to collect pond water directly into the sample containers.

- For parameters that require filtering (e.g. dissolved metals), the sample will be collected by fitting a 0.45-micron filter in the discharge line and sampling into the appropriate containers
- Record the following parameters by measuring directly in the water body, if possible: pH, specific conductivity, temperature, dissolved oxygen (DO). Record the sample field ID, date and time of collection, depth of sample below pond surface, sampling device used, name of samplers, observations etc. in a field log book.
- Cover the bottle labels with clear tape and place the filled sample bottles in a cooler with ice.
- When collecting quality assurance duplicates (e.g. field duplicates or extra volume for matrix spike samples), the samplers should fill all containers for a given analytical parameter before moving on to the next parameter

All surface water samples will be stored in laboratory-prepared sample bottles. All samples will be maintained in chain-of-custody controlled sample coolers for shipment to the laboratory. Surface water samples will be analyzed for VOCs (USEPA Method 8260b), PAHs (USEPA Method 8270c) and filtered and unfiltered 13 Priority Pollutant Metals (Table 1). Quality assurance and quality control samples for the surface water program will include one field duplicate, one equipment rinse blank, and extra sample material for matrix spike analysis.

Three surface water samples will be collected from outside the mouth of the Cove (SW-10 through SW-12), beyond the end of the Park Parcel, to further bound the site-related COPCs, and establish background conditions for the Cove (Figure 5). Finally, twelve surface water samples (SW-16 through SW-27) will be collected within the inner Cove to address the drainage discharge points and VOC plume nature and extent, potential near shore human health exposure and ecological exposures (SW-16 through SW-27). A total of three quality assurance/quality control (QA/QC) surface water samples will also be collected. All of these surface water samples will be analyzed for VOCs, PAHs, total and dissolved metals and hardness (Table 1).

4.2 SEDIMENT

Sediment samples are planned for 23 locations within Mashapaug Pond. These locations are shown as SED-10 through SED-32 on Figure 5. Six locations (SED-10 through SED-15) are outside of the cove. The remaining 17 locations are within the general footprint of the cove. The location rationale and analytical suite for each sample are shown in Table 2. All sample provide data to evaluate the nature and extent of impact while some also target secondary objectives such as potential VOC groundwater discharge, potential impact from stormwater discharge or overland erosion, conditions opposite the slag pile, etc.

At each location, samples will be collected from two depths. A sample will be obtained from the upper foot of the sediment column to characterize conditions at the sediment water interface for risk assessment purposes. A deeper sample will also be collected to provide information on the vertical extent of impact COPCs. The depth selected for analysis will be a field decision and will consider factors such as the presence of different sediment strata, observations of impact (e.g. discoloration, odor, or the presence of debris), and the depth of sampling reached at each location. The default sampling objective will be to obtain the majority of sample from a depth of 30 to 36-inches, as requested by RIDEM, with a subset of samples obtained from deeper sediment horizons, particularly if a transition is observed from organic muck to native underlying sandy soil. These deep samples will facilitate decisions on the adequacy of characterization and potential remedial actions, if warranted.

All shallow sediment samples will be analyzed for Site PAHs, the thirteen priority pollutant metals (PPM), total petroleum hydrocarbons, dioxins/furans, PCBs, pesticides, and total organic carbon (TOC). The deeper samples will be analyzed for the principal Site-related COPCs (VOCs, PPM, and PAHs). VOCs will be analyzed from all shallow samples collected from locations within the cove and will be analyzed from the deep samples if field indications of VOCs are observed (odor and PID response).

Five samples will be collected for additional analysis for acid volatile sulfides and simultaneously extracted metals (AVS/SEM). These require collection and capping of the container at the sediment/water interface and will be collected near shore opposite locations: SED-15; SED-20; SED-22; SED-24; and SED-26. These locations address possible historic pipe discharge points along the south shore of the cove. AVS/SEM is used to determine if sufficient sulfides are present in the sediment to limit the bioavailability of metals since the toxicity of metals to ecological

receptors is limited if the AVS is in excess of SEM. The rationale and summary of analytical parameters for the sediment are presented in Table 2.

Sediment samples will be collected following the general procedures provided below:

- Sediment samples will be collected by advancing a metal tube fitted with a Lexan or similar plastic liner by vibration or weight into the sediment. The objective at each location will be to advance up to 10 feet into sediment surface to extract a sediment core.
- Place the core tube on the deck of the vessel and extract the plastic liner. Affix a location ID to the top of the filled liner. Transfer the liner to shore for opening.
- Place the filled liner on a suitable work space for opening and slit the liner to expose the contents. Screen the core material with a PID and record the results. Visually characterize the contents noting changes in strata.
- Collect VOC samples first from the desired interval(s). Using a stainless steel (SS) spoon, place sediment in a SS mixing bowl and mix to homogenize. Fill the appropriate sample bottles from this bowl.
- AVS/SEM samples will be collected by pushing the container into the cove bottom sediment. Care will also be taken during the sample container filling to ensure that the sediment matrix disturbance is minimized (no mixing or blending). AVS/SEM sample containers will be completely filled, leaving no headspace and capped prior to removal from the water.

The geophysical survey will be completed prior to the sediment sampling. Preliminary results will be reviewed and, if suspected metal anomalies (targets) are identified, additional sediment cores may be collected to determine the nature of these targets. If the targets are located near planned sediment cores, the locations of the cores may be shifted to provide data from the target. Additional samples, if collected, will be analyzed for VOCs, PAHs, and the thirteen Priority Pollutant Metals.

The sediment sampling program will include quality assurance and quality control samples. At a minimum, these will consist of two field duplicates, one equipment rinse blank, and extra material for two matrix spike analyses.

4.3 SOIL

A total of 38 samples of surficial soils are planned to address data needs identified in Section 3.4. Sampling locations are shown on Figure 6 and the rationale and analytical requirements of each are described in Table 3. The soil samples will address several different objectives.

Eleven samples will be collected from locations on the bank bordering Mashapaug Pond (excluding the cove area which will be discussed separately below). Nine of these will provide additional data from previous sample locations where analysis was limited generally to metals (SS-SI101, SS-SI202, SS-SI205, SS-SI206, SS-SI207, SS-SI208, SS-SI209, SS-SI210 and SS-SIBK2). These samples will be analyzed for PAHs, dioxins/furans, pesticides, and PCBs, with the exception of SS-SIBK2 where RIDEM has requested analysis for SVOCs (PAHs). The remaining two samples (SS-SI001 and SS-SI002) are new locations to provide additional density of coverage along the pond border and will be analyzed for the full analytical data suite (VOCs, PAHs, PPM, dioxins/furans, PCBs and pesticides). SS-SI001 is located midway between existing sample SS-105 and existing sample SS-208, at RIDEM's request. Sample SS-SI002 is located along the northern shore of the Park Parcel to provide data along this stretch of shoreline and will be collected from a drainage pathway that drains to Mashapaug Pond.

Thirteen samples will be collected from the portion of the Park Parcel that borders Mashapaug Cove (SS-SI003 through SS-SI011 and SS-SI026 through SS-SI029). These have several location-specific objectives. Four samples (SS-SI003 through SS-SI 006) are located along the immediate shore to provide additional characterization data at RIDEM's request near existing locations SD-002, SS-302 and SD-005). These samples will be analyzed for the full analytical data suite to provide information on existing conditions along a stretch of shore that is not currently being considered for a remedial cap. Five samples (SS-SI007 through SS-SI-011) will be collected from erosional channels that lead into the cove, some of which are reportedly below historic drainage pipes that exited the southern portion of the property. These samples will also be analyzed for the full analytical data suite. And finally, four samples (SS-SI026 through SS-SI029) will be collected to characterize surface soil conditions from the footprint of the slag pile once it has been removed. The slag pile removal is planned concurrently with this sampling effort. The locations of these are not shown on Figure 6 and will be determined in the field once the dimensions of the pile are defined by the removal action. These samples will be analyzed for PAHs, PPM, dioxins/furans, PCBs and pesticides.

Fourteen samples (SS-SI012 through SS-SI025) are planned at locations on the upland area of the northeastern portion of the Park Parcel. Ten samples (SS-SI012 through SS-SI021) will provide spatial coverage across the northern portion of this area of the Park parcel. Each of these samples will be collected from within the boundaries of a grid segment as shown on Figure 6. The specific location of a sample within each grid segment will be based on field observations. The objective of these samples is to provide spatial coverage across this portion of the property to determine if a soil cap that is planned for adjacent portions of the property should be extended across a portion of this northern area. These samples will be analyzed for PAHs, PPM, dioxins/furans, PCBs and pesticides. Samples in this portion of the Site will be supplemented by several bank samples discussed previously (SS-SI-101, SS-SI-202, SS-SI002) as shown on Figure 6. The remaining four samples from this northeastern portion of the Park Parcel will be collected from surface soils beneath a large pile of construction debris. The approximate location of this pile, which is scheduled for removal by the Cite of Providence, is shown on Figure 6. Ingress to soil beneath the pile will be obtained by moving debris from fur perimeter locations to provide a way to obtain samples from beneath the debris.

The sampling program is shown on Table 3. All samples will be collected from the upper six inches of the soil column to provide data suitable for risk assessment purposes. Samples will be collected using hand methods such as a stainless steel shovel, hand auger, and/or trowel. The soil sampling program will include an equipment rinse blank, two field duplicates and a sample with extra material for matrix spike analysis.

5.0 SCHEDULE

The field tasks described in this Work Plan are planned to commence as soon as practical. MACTEC anticipates the following start dates and durations:

- Surface Soil Sampling: Field start on June 5, 2006 and duration of approximately four days;
- Cove Geophysical Survey: Field start is planned for mid-June with an anticipated duration of two to three days;
- Cove Surface Water and Sediment Sampling: Field will follow immediately after the geophysical survey and has a planned duration of 5 days.

6.0 REFERENCES

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TABLES

Table 1. Proposed Surface Water
Sampling Rationale and Analytical Parameters

Former Gorham Manufacturing Facility
Providence, Rhode Island

Surface Water Sample Location	SAMPLING RATIONALE						ANALYTICAL PARAMETERS						
	VOC Plume South Bank Area	Erosion Channels	Stormwater Discharge	Human Health Assessment (Near Shore)	Ecological Assessment	Nature & Extent	Background	VOCs	PAHs	Total 13 PPM	Dissolved 13 PPM	Dioxins / Furans	Pesitcides / PCBs	Hardness
SW-10						X	X	X	X	X	X			X
SW-11						X	X	X	X	X	X	X	X	X
SW-12						X	X	X	X	X	X			X
SW-16				X	X	X		X	X	X	X			X
SW-17				X	X	X		X	X	X	X			X
SW-18	X	X			X	X		X	X	X	X			X
SW-19	X	X	X		X	X		X	X	X	X	X	X	X
SW-20			X	X	X	X		X	X	X	X			X
SW-21				X	X	X		X	X	X	X			X
SW-22		X		X	X	X		X	X	X	X			X
SW-23	X			X	X	X		X	X	X	X			X
SW-24	X	X		X	X	X		X	X	X	X			X
SW-25	X			X	X	X		X	X	X	X			X
SW-26		X		X	X	X		X	X	X	X			X
SW-27	X	X			X	X		X	X	X	X	X	X	X

VOCs = volatile organic compounds
13 PPM = 13 Priority Pollutant Metals
PAHs = polynuclear aromatic hydrocarbons

Table 2. Proposed Sediment
Sampling Rationale and Analytical Parameters

Former Gorham Manufacturing Facility
Providence, Rhode Island

Sediment Sample Location	SAMPLING RATIONALE								ANALYTICAL PARAMETERS							
	VOC Plume South Bank Area	Erosion Channels	Stormwater Discharge	Arsenic Area	Human Health Assessment (Near Shore)	Ecological Assessment	Nature & Extent	Background	VOCs	PAHs	Total 13 PPM	Dioxins / Furans	Pesticides / PCBs	TPH	AVS/SEM	TOC
SED-10								X		X	X	X	X	X		X
SED-11								X		X	X	X	X	X		X
SED-12								X		X	X	X	X	X		X
SED-13				X	X	X	X			X	X	X	X	X		X
SED-14				X		X	X			X	X	X	X	X		X
SED-15				X	X	X	X			X	X	X	X	X	X	X
SED-16					X	X	X		X	X	X	X	X	X		X
SED-17				X	X	X	X		X	X	X	X	X	X		X
SED-18	X	X				X	X		X	X	X	X	X	X		X
SED-19	X	X	X			X	X		X	X	X	X	X	X		X
SED-20			X		X	X	X		X	X	X	X	X	X	X	X
SED-21					X	X	X		X	X	X	X	X	X		X
SED-22		X			X	X	X		X	X	X	X	X	X	X	X
SED-23	X				X	X	X		X	X	X	X	X	X		X
SED-24	X	X			X	X	X		X	X	X	X	X	X	X	X
SED-25	X				X	X	X		X	X	X	X	X	X		X
SED-26		X			X	X	X		X	X	X	X	X	X	X	X
SED-27	X	X				X	X		X	X	X	X	X	X		X
SED-28	X			X	X	X	X		X	X	X	X	X	X		X
SED-29	X			X	X	X	X		X	X	X	X	X	X		X
SED-30	X			X	X	X	X		X	X	X	X	X	X		X
SED-31	X			X	X	X	X		X	X	X	X	X	X		X
SED-32	X			X	X	X	X		X	X	X	X	X	X		X

VOCs = volatile organic compounds
TOC = total organic carbon
AVS = acid volatile sulfides
SEM = simultaneously extracted metals
13 PPM = 13 Priority Pollutant Metals
PAHs = polynuclear aromatic hydrocarbons

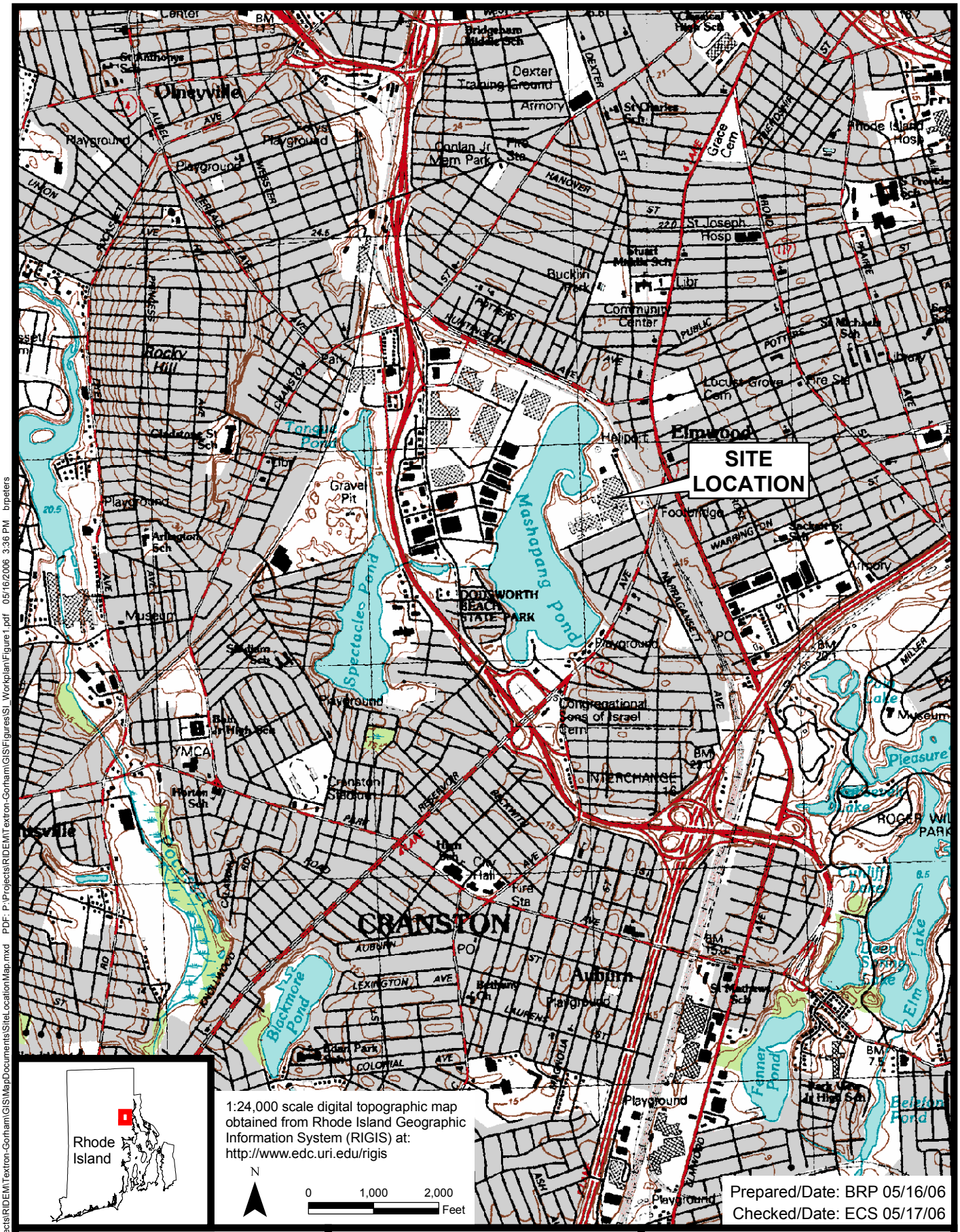
Table 3. Proposed Soil
Sampling Rationale and Analytical Parameters

Former Gorham Manufacturing Facility
Providence, Rhode Island

Soil Sample Location	SAMPLING RATIONALE							ANALYTICAL PARAMETERS				
	Additional Characterization of Bank Soils Adjacent to the Pond (except the cove)	Additional Characterization of Soils bordering the cove	Erosion Channels at Historic Discharge Pipes or Drainage Pathways	Cahracterization of Soils Beneath Slag Pile (post removal)	Additional Characterization of Northeast Parcel	HH Risk Assessment	Nature & Extent	VOCs	PAHs	Total 13 PPM	Dioxins / Furans	Pesticides / PCBs
SS-SI101	X					X	X		X		X	X
SS-SI202	X					X	X		X		X	X
SS-SI205	X					X	X		X		X	X
SS-SI206	X					X	X		X		X	X
SS-SI207	X					X	X		X		X	X
SS-SI208	X					X	X		X		X	X
SS-SI209	X					X	X		X		X	X
SS-SI210	X					X	X		X		X	X
SS-SIBK2	X					X	X		X			
SS-SI001	X					X	X	X	X	X	X	X
SS-SI002	X		X			X	X	X	X	X	X	X
SS-SI003		X				X	X	X	X	X	X	X
SS-SI004		X				X	X	X	X	X	X	X
SS-SI005		X				X	X	X	X	X	X	X
SS-SI006		X				X	X	X	X	X	X	X
SS-SI007		X	X			X	X	X	X	X	X	X
SS-SI008		X	X			X	X	X	X	X	X	X
SS-SI009		X	X			X	X	X	X	X	X	X
SS-SI010		X	X			X	X	X	X	X	X	X
SS-SI011		X	X			X	X	X	X	X	X	X
SS-SI012					X	X	X		X	X	X	X
SS-SI013					X	X	X		X	X	X	X
SS-SI014					X	X	X		X	X	X	X
SS-SI015					X	X	X		X	X	X	X
SS-SI016					X	X	X		X	X	X	X
SS-SI017					X	X	X		X	X	X	X
SS-SI018					X	X	X		X	X	X	X
SS-SI019					X	X	X		X	X	X	X
SS-SI020					X	X	X		X	X	X	X
SS-SI021					X	X	X		X	X	X	X
SS-SI022					X	X	X		X	X	X	X
SS-SI023					X	X	X		X	X	X	X
SS-SI024					X	X	X		X	X	X	X
SS-SI025					X	X	X		X	X	X	X
SS-SI026		X		X		X	X		X	X	X	X
SS-SI027		X		X		X	X		X	X	X	X
SS-SI028		X		X		X	X		X	X	X	X
SS-SI029		X		X		X	X		X	X	X	X

VOCs = volatile organic compounds
13 PPM = 13 Priority Pollutant Metals
PAHs = polynuclear aromatic hydrocarbons

FIGURES



Supplemental RI
Former Gorham Manufacturing Site
Providence, Rhode Island

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Site Location Map
Project 3650-05-0041
Figure 1

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Supplemental RI
Former Gorham Manufacturing Site
Providence, Rhode Island

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Existing Site Conditions

Project 3650-05-0041

Figure 2

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SED 3
URI-SW-1986
W3
SW-1
RIDEM-SW-1987
RIDEM-SED-1987
SED 4
W2
Cove-2
SD-1005
SED 2
Cove-1
SW-3
SW-2
SD-1004
SD-1002
SW-4
SD-1003
Cove-3
MP-2
MP-1
SD-1001
W4
W1
SED 5
W5
URI-SW-1986
W7
W6
W8

N
0 140 280
Feet

Legend

- URI Sediment Sample Location 1986
- URI Surface Water Sample Location 1986
- GZA Surface Water Sample Location 1986
- RIDEM Sediment Sample Location 1987
- RIDEM Surface Water Sample Location 1987
- RIDEM Sediment Sample Location 2005
- USEPA Water Column Station Surface Water Sampling 2001
- Sediment Samples Cove-1 through Cove-3 were collected by R. Dorr on September 5, 2005.
- Surface water samples SW-1 through SW-4 were collected on April 15, 1999 by Harding Lawson Associates.
- Approximate Park Parcel

Prepared/Date: BRP 06/01/06
Checked/Date: ECS 06/01/06

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Former Gorham Manufacturing Site
Providence, Rhode Island

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Historic Surface Water
and Sediment Locations

Project 3650-05-0041 Figure 3

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Mashapaug Pond

Mashapaug Cove

SS-201
TP-037 (89)
SS-100
TP-033 (89)
TP-038 (89)
MW-O/B-21
SS-202
TP-032 (89)
TP-039 (89)
MW-M/B-19
TP-034 (89)
TP-036 (89)
MW-Q/B-23
TP-020 (94)
TP-018 (94)
Railroad Tracks
TP-035 (89)
BK-5
JTP-1
SS-101
TP-030 (89)
TP-019 (94)
TP-017 (94)
JTP-2
SS-203
SS-400
SS-402
MW-P/B-22
JTP-4
SS-304
SS-204
JTP-3
BK-4
SS-401
SS-300
TP-029 (89)
MW-N/B-20
SS-301
SS-102
MW-GZA6
SS-1003
(approximate)
SS-001-002N
SS-001
SS-001-002E
SS-001-002W
SD-008
SD-006-002N
SD-006-002W
SD-007
SS-001-002S
SS-1002
(approximate)
EX-002
TP-009 (94)
SS-303
SD-006
MW-109D
MW-GZA3
TP-011 (94)
SD-006-002E
SD-006-002S
Slag Pile
(approximate)
SS-1004
(approximate)
TP-037 (94)
MW-110D
MW-GZA5
TP-038 (94)
SD-003
EX-003
SS-1005
(approximate)
TP-039 (94)
MW-FS/B-6S
MW-FD/B-6D
EX-004
SD-001
SS-1001
(approximate)
SD-004
SD-005
SS-302
SS-306
SS1305
SD-002
SS-208
SS1205
SS-104
SS-212
SS-216
SS-211
SS-103
SS-207
SS-213
SS-214
SS-215
SS-206
SS-105
SS-106
SS-209
BK-2
SS-109
SS-210
Park
Parcel
Existing Retail
Parking Lot
Planned Development 2006
Adelaide Avenue

Legend

- Soil Boring
- Soil Boring/Monitoring Well
- Monitoring Well
- Surface Soil
- Test Pit
- Contours
- Paved Area
- Approximate Property Boundary
- Structure
- Approximate Park Parcel

N

0 75 150 Feet

Prepared/Date: BRP 05/19/06
Checked/Date: ECS 05/19/06

Supplemental RI
Former Gorham Manufacturing Site
Providence, Rhode Island

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Historic Soil Locations
Park Parcel
Project 3650-05-0041 Figure 4

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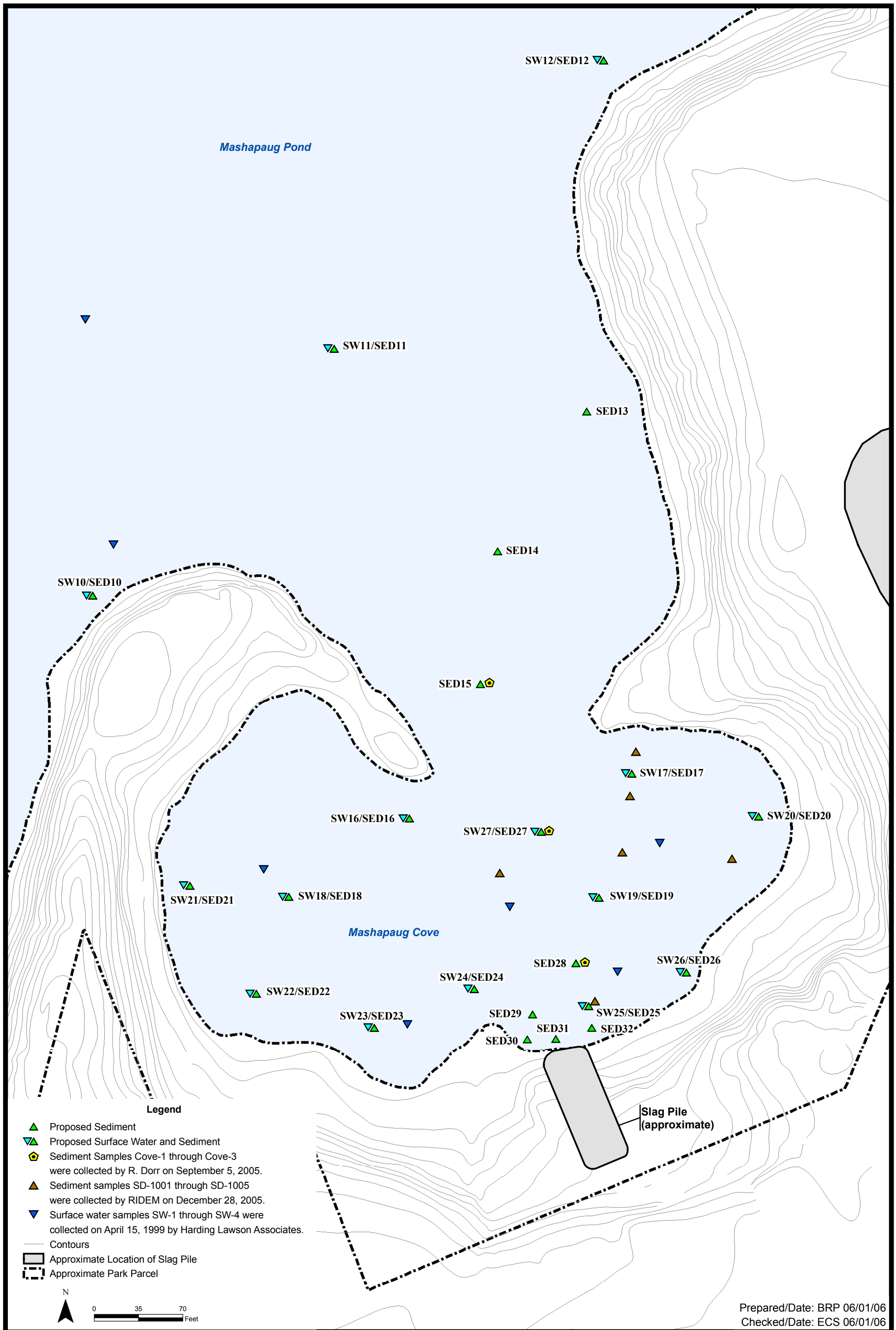

Supplemental RI
Former Gorham Manufacturing Site
Providence, Rhode Island

MACTEC

Proposed Surface Water
and Sediment Locations

Project 3650-05-0041

Figure 5

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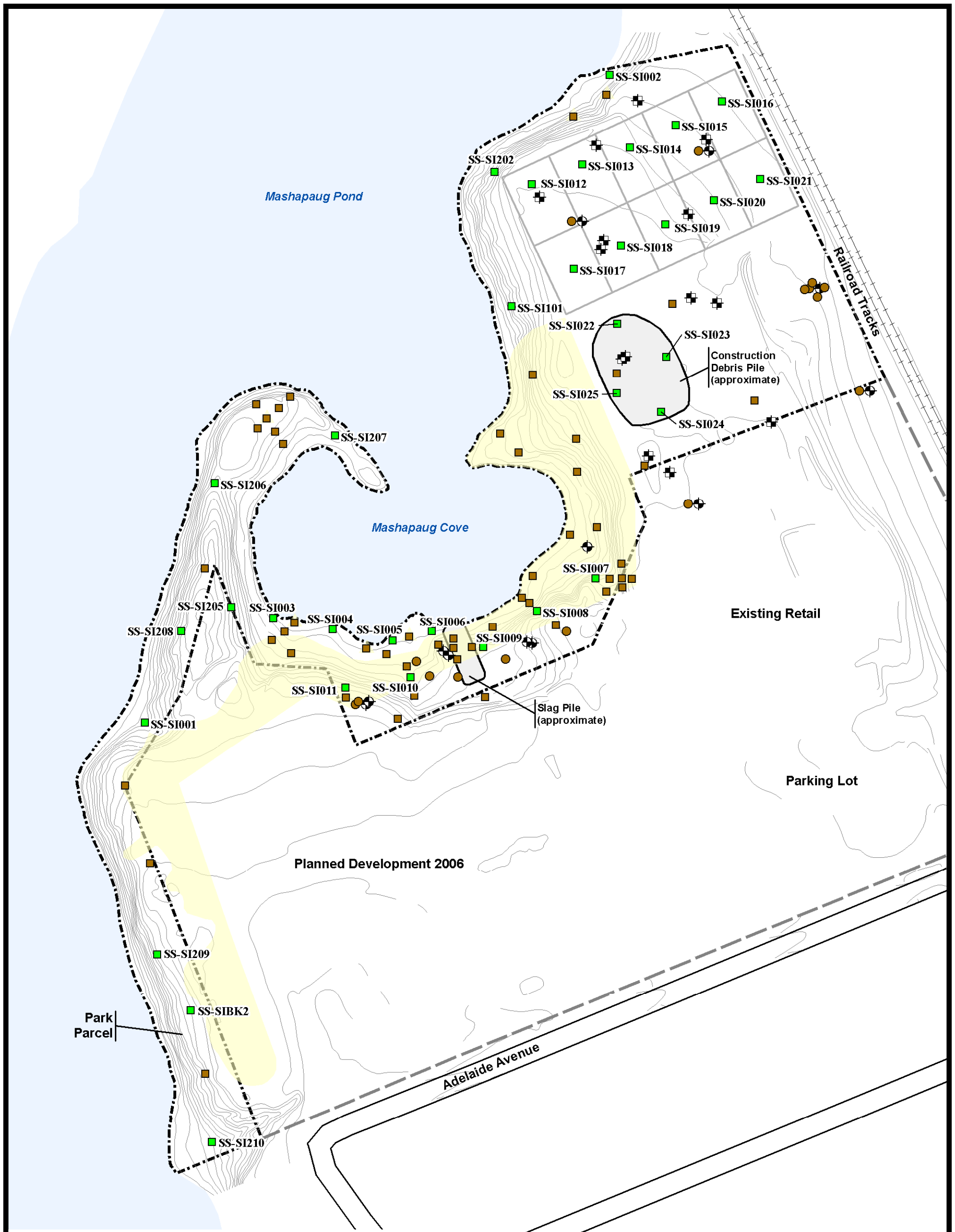

Supplemental RI
Former Gorham Manufacturing Site
Providence, Rhode Island

MACTEC

Proposed Soil Locations

Project 3650-05-0041

Figure 6

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APPENDIX A

PROJECT HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
TO SUPPORT
2006 SUPPLEMENTAL SITE INVESTIGATION AND SLAG REMOVAL WORK PLAN ACTIVITIES

FORMER GORHAM MANUFACTURING SITE
333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND

Prepared for:

Textron, Inc.
40 Westminster Street
Providence, Rhode Island 02903

Prepared by:

MACTEC Engineering and Consulting, Inc.
107 Audubon Road
Wakefield, Massachusetts 01880

MAY 2006

Project: 3650050041.01

Table of Contents

1.0 INTRODUCTION

This HASP was prepared to govern MACTEC field tasks planned for Spring 2006 at the Former Gorham Manufacturing Site (Site), 333 Adelaide Avenue, Providence Rhode Island as described in the Supplemental Site Investigation (SSI) Work Plan (MACTEC May 2006) and the Slag Removal Work Plan (MACTEC May 2006). The Site is a 37-acre property that was used historically for the manufacture of silverware. All structures relating to the former facility have been demolished and the property has been partially redeveloped. Refer to SSI Work plan (Section 2.0) for a description and layout of the Site.

This Health and Safety Plan (HASP) has been prepared in conformance with the MACTEC Engineering and Consulting, Inc. (MACTEC) Health and Safety Program and is intended to meet the requirements of 29 CFR 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all MACTEC personnel, contractor personnel, or third parties that enter the site while MACTEC is engaged in field tasks.

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT PERSONNEL

2.1.1 Project Manager

The project manager (PM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP; the necessary resources to meet requirements of this HASP; the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements; and the means and materials necessary to resolve any health and safety issues that are identified or that developed on the project.

2.1.2 Field Operations Leader

The Field Operations Leader (FOL) is the PM's designee who is on-site directing the performance of the field scope of work. The FOL will direct daily operations and is vested with the authority to stop work and expel subcontractors or other workers or visitors due to unsafe working conditions (e.g. weather hazards, safety hazards, health hazards, equipment hazards, etc).

2.1.3 Site Health and Safety Officer

The Site Health and Safety Officer (HSO) will work in concert with the FOL to implement the HASP, maintain safe working conditions, conduct safety inspections and briefings, and investigate accidents and incidents. The HSO will have at least an indirect line of reporting to the Division ES&H Manager (HSM) for the duration of his/her assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the MACTEC Health and Safety Program. The HSO will investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting a MACTEC site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

2.1.4 Assignments

The following is a list of key personnel who will be involved in this project:

Name	Responsibilities
David Heislein	Project Manager
Tom Hanlon	Field Operations Leader
Eric Sandin	Health & Safety Officer and/or Field Operations Leader
Cynthia Sundquist	Division Environmental, Safety and Health Manager

2.2 TRAINING

Training is defined under the MACTEC Health and Safety Program, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange).

All workers with a potential for exposure to lead at any level must receive the following training:

1. Lead exposures according to the requirements of the Hazard Communication Standard in Construction (29 CFR 1926.56), including warning signs and labels, MSDSs, and employee information and training.

All workers with a potential exposure to lead at or above the action limit of 0.03 mg/m^3 (involved in the excavation of the slag material) must receive the following training:

1. The contents of the standard (29 CFR 1926.62/1910.1025) and it's appendices.

2. The specific nature of the operations that could result in exposure to lead above the action limits.
3. The purpose of the medical surveillance program in regards to monitoring for lead. Information must include the adverse health effects associated with excessive exposure to lead (especially reproductive effects).
4. The engineering controls (if any) and work practices (e.g., wetting soil to control dust) to be used at the site.
5. Instructions that chelating agents should not be used to remove lead from their bodies except under the direction of a licensed physician. (NOTE: Chelating agents remove metals from the body by binding to the metal, making is soluble so that it can be excreted in the urine. The problem with them is that they are indiscriminate and remove essential metals from the body as well. Chelation is a last resort to be used only when extremely high lead levels are found in the blood.)
6. Inform workers that copies of the standard and it's appendices are available to them if interested.
7. The contents of any compliance plan.
8. The employees right of access to records under 29 CFR 1910.1020.

2.3 MEDICAL SURVEILLANCE

All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the MACTEC Health and Safety Program. Personnel who have not received medical clearance **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange).

In addition, those workers involved in the Excavation of the Slag Material will receive blood lead analysis (lead and zinc protoporphyrin levels) prior to the start up of this task.

All workers will be notified, in writing, of the results of the biological monitoring within 5 working days. (NOTE: blood levels in excess of 30 mg/100 g of whole blood require removal from work involving lead exposures.)

3.0 SCOPE OF WORK

This HASP was prepared to govern MACTEC field tasks as described in the Supplemental Site Investigation (SSI) Work Plan (MACTEC May 2006) and the Slag Removal Work Plan (MACTEC May 2006). The major activities described in these plans consist of:

Slag Pile Removal Work Plan Tasks:

- Erosion Controls and Chain Link Fence
- Tree and Shrub Removal
- Temporary Access Road Grading and Loading Pad
- Reconstruction or Decommissioning of Monitoring Well GZA-5
- Excavation of Slag Material
- Metal Debris Removal
- Transport Off-site
- Site Restoration
- Field Screening via Soil Sampling

Supplemental Site Investigation Work Plan:

- Surface Soil Sampling
- Geophysical Survey of Mashapaug Cove
- Surface Water Sampling
- Sediment Sampling

MACTEC will oversee subcontractor(s) and provide health and safety oversight for the majority of the Slag Removal work tasks.

For the SSI, MACTEC personnel will perform the surface soil sampling and will use a subcontractor for work tasks performed on Mashapaug pond. MACTEC personnel will remain on shore and will handle samples once they are brought to shore by the subcontractor. The subcontractor shall execute work under their own corporate health and safety program and shall be expected to comply with this Site HASP and MACTEC's safety and Health program. MACTEC will provide copies of MACTEC applicable boating safety programs including:

- Safe Boating Checklist
- Trailering Checklist
- Inland Special Circumstances
- Float Plan
- Aquatic Nuisance Plants

4.0 HAZARD EVALUATION AND TASK ANALYSIS

Job hazards include health hazards such as exposure to chemical contaminants and safety hazards such as injuries from equipment or physical conditions.

4.1 HEALTH HAZARDS

Contaminants of Concern (COCs) that could be potential health hazards are listed in Table 4-1. The COCs listed have been detected in soil, sediment and groundwater during previous

investigations. The table includes the maximum concentrations detected historically across the entire Site in soils and in those samples from the portion of the Site where activities are planned (the Park Parcel). The maximum concentrations from sediment samples collected by RIDEM from Mashapaug Cove in 2005 are also shown. Established exposure limits, where applicable are shown in the table. Remedial measures have been implemented across some areas of the Site that would limit contact with COCs in surface soils. A soil cap has been constructed to isolate soils in the developed southeastern parcel. Portions of the Park Parcel, where soil sampling is planned during the SSI, will also be capped as part of planned remedial action.

The primary contaminants of concern at the facility are metals such as arsenic, copper, and lead, chlorinated solvents such as trichloroethene (TCE) and tetrachloroethylene (PCE) and their degradation byproducts, polynuclear aromatic hydrocarbons (PAHs) and petroleum fuel hydrocarbons. PCE, TCE and the degradation product vinyl chloride are treated as potential human carcinogens by the National Institute for Occupational Safety and Health. Health hazards to workers from COCs are principally related to the inhalation of dust with inorganic COCs such as lead or exposure to chlorinated solvents and PAHs via inhalation or dermal contact.

Most activities that utilize heavy equipment have the potential to produce excessive noise. Exposure to noise over the OSHA action level (85 decibels) can cause temporary hearing impairment. Noise can also impair voice communication, increasing the risk of accidents.

Mashapaug pond water is known to contain dioxins, furans and polychlorinated biphenyls (PCBs) that are not thought to have originated at the Site but create a health hazard from ingestion.

Various biological hazards may be present at the Site, depending on the season. Poison ivy is known to be present in and around the work area. Although the Site is in an urban setting, ticks should be assumed to be present and could result in exposure to Lyme disease. Flying insects such as mosquitoes, wasps, hornets, and bees may be encountered as well as spiders such as the brown recluse.

4.2 SAFETY HAZARDS

Potential safety hazards include work around operating construction equipment such as excavators and dump trucks.

Surface hazards from working or walking on uneven ground, such as slips, trips, and falls, are present.

Heat stress and cold stress are not thought to be likely given the planned work schedule in May and June 2006 and the performance of work activities in Level D personal protective equipment. If PPE levels are upgraded during the performance of Site tasks, there would be an increased potential for temperature-related stresses.

Some tasks include handling of sharp objects (e.g. the retrieval of waste metal, fence construction, and sediment sampling) and therefore there is the risk of contact with sharp surfaces.

The sediment and surface water tasks include working on and near water and therefore include the potential for drowning and accidents related to boating safety. Although MACTEC personnel will not be working from watercraft, the subcontractor must comply with MACTEC water safety procedures as attached to this HASP. The pond is not generally used for recreational activities by the public due to its industrial setting, known impacts and published health advisories so the potential for interaction with the public while performing tasks on the pond is low.

The Job Hazard Analyses attached (Attachement B) provide extra detail and identify safe working procedures for various tasks described above.

4.3 CONCLUSIONS/HAZARD EVALUATION

A potential respiratory hazard associated with contaminants in soil exists for invasive activities, particularly those activities that will disturb soils using equipment that could generate dust (e.g., road grading, tree grubbing and excavation of the slag pile). This hazard should be mitigated by the use of engineering controls such as water to suppress visible dust and dust that exceeds 0.5 mg/m^3 in air. Dermal exposure should be suppressed by use of task-specific personal protective equipment. Inhalation of VOCs, especially vinyl chloride (present in sediment), is possible from impacted soil and sediment and should be monitored to prevent respiratory exposure

Low to moderate health hazards are associated with those activities in which dermal contact with contaminated environmental media can be made. These include sampling or excavation of soils and sediment with organic or inorganic constituents of concern.

A low to moderate degree of safety hazard is associated with expected general and specific site activities. Of particular concern are working on water, working near excavation equipment, working near onsite treatment facilities, collecting metal debris, and walking on irregular surfaces and debris.

Job Hazard Analysis has been performed for the tasks judged to have the highest degree of potential hazard.

4.4 PROTECTIVE MEASURES

4.4.1 4.4.1 Engineering Controls

Due to the nature of tasks to be conducted, engineering controls may be warranted for site activities to suppress dust from the breathing zone. In particular, water may be used to suppress dust during excavation of the slag. This material presents low hazard for dust generation in its present form as rock-size fragments but contains lead and other metals that could be released as dust if the slag is crushed. Levels of dust will be monitored and water will be used periodically as necessary to dampen the material and suppress potential dust. Road grading activities that extend onto the Park Parcel may also require dust suppression.

4.4.2 Levels of Protection

All activities will be initiated at modified Level D with provisions to upgrade to Level C respiratory protection.

Table 4-1
Contaminants of Concern

Compound	Maximum in Soils (Sitewide Historic Results)[1]	Maximum in Park Parcel Soil[2, 3]	Maximum in Pond Sediment [3]	Maximum in Groundwater[1]	Threshold Limit Values
Arsenic	124	67.8	45	NA	0.01 mg/m^3
Cadmium	14	7.8	4.1	NA	0.005 mg/m^3
Chromium	1,540	1,330	100	NA	0.05 mg/m^3 (TLV) Cr^{+6}
Copper	26,300	8,760	1,500	NA	1 mg/m^3
Lead	22,600	14,000	590	NA	0.05 mg/m^3
Nickel	5,380	390	810	NA	1 mg/m^3
Silver	472	250	120	NA	0.01 mg/m^3
Zinc	6,850	4,760	1,200	NA	10 mg/m^3 (total dust) 5 mg/m^3 (respirable dust)
Cyanide	4	1.35	ND	NA	5 mg/m^3
1,2-dichloroethylene	<.050	ND	0.42	0.94	200 ppm
1,1-dichloroethane	NA	ND	1.4	<0.125	100 ppm
ethylbenzene	NA	ND	ND	NA	100 ppm
tetrachloroethene (PCE)	7.6	1.1	ND	50	25 ppm
1,1,1-trichloroethane (TCA)	0.041	ND	1.3	3	10 ppm
trichloroethene	0.195	6.1	5.6	7.2	50 ppm
toluene	<0.025	ND	ND	NA	50 ppm
vinyl chloride	NA	ND	5	<0.025	1 ppm
xylenes	NA	1	ND	NA	100 ppm
Benzo(a)pyrene	25.3	13	1.8	NA	0.2 mg/m^3 (coal tar pitch vol)
Benzo(a)anthracene	25.3	15	2	NA	0.2 mg/m^3 (coal tar pitch vol)

Compound	Maximum in Soils (Sitewide Historic Results)[1]	Maximum in Park Parcel Soil[2,3]	Maximum in Pond Sediment [3]	Maximum in Groundwater[1]	Threshold Limit Values
Dibenzo(a,h)anthracene	4.8	0.7	0.22	NA	0.2 mg/m^3 (coal tar pitch vol)
Benzo(b)fluoranthene	21.3	20	2.9	NA	0.2 mg/m^3 (coal tar pitch vol)
Indeno(1,2,3-cd)pyrene	11.7	5.4	0.7	NA	0.2 mg/m^3 (coal tar pitch vol)
Total Petroleum Hydrocarbons	NA	13,300	2600	NA	NA

[1] From Table 4.2 MACTEC Health and Saftey Plan 2001

[2] Database Query, April 2004

3 Supplemental Site Investigation Report, Fuss & O'Neill April 2006

Table 4-2
Personal Protective Equipment Lists

Gorham Manufacturing Facility
Providence, Rhode Island

LEVEL OF PROTECTION	EQUIPMENT
C	Full-face, air-purifying respirator with MSA GMC-H (or equivalent) cartridge (changed daily)
C	Coveralls (TYVEK™, or polycoated disposable coveralls if wet conditions are encountered in subsurface materials)
C	Vinyl Gloves (inner)
C	Nitrile Gloves (outer)
C	Boots (chemical-resistant, steel-toed) or regular safety boots/shoes with vinyl boot covers
C	Hardhat (for work near heavy equipment)
LEVEL OF PROTECTION	**EQUIPMENT**
D	Coveralls
D	Nitrile Gloves (for activities with direct contact with media; work gloves for activities with no handling of media (e.g. fence construction)
D	Boots (steel-toed, steel shank)
D	Hardhat (for work near heavy equipment)
D	Earplugs (for work near heavy equipment)
D	Safety glasses (for potential splash or projectile hazards)
* Modified D	Chemical-Resistant Clothing (coated TYVEK™)

4.5 AIR MONITORING AND ACTION LEVELS

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO. Monitoring of the ambient air in the breathing zone with a PID and a dust meter will be conducted periodically during work tasks that are invasive such as road grading, tree grubbing, and slag pile excavation. The monitoring requirements for each work task are described in Section 4.6 below. Contaminant specific data regarding permissible exposure levels are shown on Table 4-1.

Potential risks from respirable dust exist due to the presence of lead and other metals such as

chromium, arsenic, and silver in site soils. Tasks that could generate dust will require monitoring using a dust meter. The dust meter will be positioned immediately downwind of the active work zone. The sustained respirable dust meter action level is 0.5 mg/m^3. MACTEC believes that this action level is protective of worker health under the OSHA lead standard and given the known levels of contaminants in Site soils. If this level is exceeded, MACTEC will instruct the contractor to use water to suppress dust as an engineering control. If this action level is still sustained, MACTEC will halt work and require upgrade to Level C personal protective equipment (PPE).

A PID will be used at the site for soil sampling, sediment sampling, and excavation tasks as described below on Section 4.6. The action level for upgrade from Level D to Level C respiratory protection (full face cartridge respirator) during tasks conducted on the Park Parcel is sustained PID readings of 9 ppm in the breathing zone. Vinyl chloride has been reported in one recent sediment sample at levels above 1 mg/kg but has not been detected in Site soils. During the sediment sampling task, a PID will be used to screen the soil tubes upon opening. If a positive response is observed (i.e. >0.5 ppm response above general background), vinyl chloride will be measured using Dräger tubes. If vinyl chloride is detected in the breathing zone (at a minimum distance of one foot above the exposed sediment core) work will be halted until the levels subside or personnel will be required to upgrade to Level B respiratory protection.

Monitoring of the work environment will be undertaken to ensure that Immediately Dangerous to Life or Health (IDLH) or other dangerous conditions are identified. Due to the nature of tasks to be conducted and the physical conditions of the site, this monitoring will include evaluations for hazardous concentrations of airborne contaminants.

4.5.1 Personal Monitoring

MACTEC cannot rule out the possibility of lead levels in the breathing zone above the action limit of 0.03 mg/m3 in the breathing zone when excavating the slag material, therefore, personal monitoring will be conducted during this operation. Personal monitoring will be conducted to characterize the worker exposure to lead through the monitoring of representative employees. Employee selection will be based on work task and duration of exposure. Sampling will be representative of a full shift and will include at least one sample for each job classification. Sampling and analysis will be done in accordance with NIOSH methodology that is summarized below. Contact the HSM if there are any questions regarding the sampling.

1. One worker per task per job classification will be selected. The worker selected will be the one thought to have the greatest exposure for the longest duration (if two workers have equal exposures, personal monitoring can be rotated if sampling is to be conducted on more than one day). The exposures to all other workers will assumed to be the same as the chosen individual, or lower. Record the name, social security number, job classification, and company of all workers for whom the sample represents plus record the date(s), number, duration, and location, of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable.

Record the type of respiratory protection devices worn, if any, and any environmental variables (e.g., rain, mist, snow, wind, temperature) that could affect the measurement of employee exposure. See **MACTEC Air Monitoring Worksheet** (Attachment A).

2. Full shift (at least 7 hours) breathing zone samples will be conducted using personal sampling pumps, calibrated before and after each use, and set at 2 liters per minute. Minimum sample volume is 200 liters. Two or three piece mixed cellulose-ester filters with 0.8-micrometer pore size and 37 mm diameter will be used to collect the.
3. Collect samples, closed face, and ship together along with one open and one closed blank. Open blanks are filter cassettes that are handled in the same manner that the samples are, except that no air is drawn through them (e.g., remove the end plugs and store until sampling is complete, then replace the plugs.) Closed blanks are media blanks to ensure that the cassettes were not contaminated prior to sampling. Samples should be analyzed using NIOSH method 7082 (Atomic Absorption).
4. At least one sample per task per site location will be taken in the initial monitoring phase. If the results show lead levels below 0.03 mg/m^3, no further testing will be required in that area for that task. If levels are found to be above 0.03 mg/m^3, repeat testing may be needed if task duration is longer than 3 months. If conditions or tasks change that may result in new or additional exposures to lead, additional samples will be taken.
5. Notify all affected workers (both MACTEC and subcontractor personnel), in writing, of the results of the analysis within 5 working days of their receipt. Affected workers include not only the worker wearing the pump and filter, but also the others working in the same general area as well.

4.5.2 Perimeter Monitoring

Perimeter monitoring will be conducted to document the dust emissions generated while excavating the slag. Sampling will be conducted as follows:

- Perimeter monitoring stations will be setup on four sides of the exclusion zone (e.g., north, south, east, and west).
- A portable weather station will be established to record wind direction, speed, etc.
- Monitoring will be conducted using a_____.

4.6 WORK TASK SUMMARY

The field activities summarized in Section 2.0 have varying health and safety risks associated with them. The hazard evaluation associated with each activity and personal protective requirements are summarized as follows:

Task A: Erosion Controls and Chain Link Fence

Hazard Evaluation: Low degree of hazard. Exposure to COCs exist primarily via dermal contact. Physical hazards on site include uneven ground and sharp fencing material.

Respiratory Protection and Monitoring: Level D.

Protective Clothing: Level D with leather work gloves.

Task B: Tree and Shrub Removal

Hazard Evaluation: Low to moderate degree of hazard. Exposure to COCs exists primarily through inhalation of dust and dermal contact. Poison ivy is present in and around the work area. Cutting tools and a wood chipper present physical hazards.

Respiratory Protection and Monitoring: Modified Level D with work gloves (nitrile gloves not required).

Protective Clothing: Modified Level D.

Task C: Temporary Access Road Grading and Loading Pad

Hazard Evaluation: Exposure potential via inhalation during grading activities. Physical hazards on site include working around heavy equipment and uneven ground.

Respiratory Protection and Monitoring: Level D (see Table 2-2). Use dust monitor station immediately downwind. If sustained levels of 0.5 mg/m^3 are observed, implement engineering controls such as water suppression and continue dust montiroing. If levels are still sustained above 0.5 mg/m3 upgrade to Level C. If PID readings in the breathing zone are detected during the work activity above 9 ppm, upgrade to Level C respiratory protection.

Protective Clothing: Modified Level D.

Task D: Reconstruction or Decommissioning of Monitoring Well GZA-5

Hazard Evaluation: Low degree of hazard. Highest Exposure potential via dermal contact with impacted soils and inhalation of VOCs.

Respiratory Protection and Monitoring: Level D. Monitor periodically during sampling with a PID. If readings in the breathing zone are detected during the work activity above 9 ppm, upgrade to Level C respiratory protection.

Protective Clothing: Level D.

Task E: Excavation of Slag Material

Hazard Evaluation: Low to moderate degree of hazard. Exposure potential via inhalation and slop stability considerations. Heavy equipment operation within limited work area.

Respiratory Protection and Monitoring: Modified Level D (see Table 2-2). Use dust monitor station immediately downwind. If sustained levels of 0.5 mg/m^3 are observed, implement engineering controls such as water suppression and continue dust monitoring. If levels are still sustained above 0.5 mg/m3 upgrade to Level C. Monitor periodically during sampling with a PID. If readings in the breathing zone are detected during the work activity above 9 ppm, upgrade to Level C respiratory protection.

Protective Clothing: Modified Level D.

Task F: Metal Debris Removal

Hazard Evaluation: Low to moderate degree of hazard. Sharp edges of debris present potential physical hazard.

Protective Clothing: Level D, working gloves.

Task G: Transport Off-site

Hazard Evaluation: Low to moderate degree of hazard. Exposure potential via inhalation during loading of material into trucks. Use dust monitor station immediately downwind. If sustained levels of 0.5 mg/m^3 are observed, implement engineering controls such as water suppression and continue dust montiroing. If levels are still sustained above 0.5 mg/m3 upgrade to Level C. Physical hazards associated with loading and transport of slag material using heavy equipment.

Respiratory Protection and Monitoring: Level D.

Protective Clothing: Level D.

Task H: Site Restoration

Hazard Evaluation: Low to medium degree of hazard. Heavy equipment presents physical hazard.

Protective Clothing: Level D.

Task I: Surface Soil Sampling

Hazard Evaluation: Exposure potential via inhalation or dermal contact with organic contaminants.

Respiratory Protection and Monitoring: Level D (see Table 2-2). Monitor periodically during sampling with a PID. If readings in the breathing zone are detected during the work activity above 9 ppm, upgrade to Level C respiratory protection.

Protective Clothing: Level D.

Task I: Surface Water and Sediment Sampling

Hazard Evaluation: Surface waters do not pose a dermal or inhalation hazard. Exposure is possible primarily via dermal contact with low or moderate levels of organic or inorganic contaminants that may be present in sediment. The greatest potential for exposure exists when opening the plastic sediment tubes. Safety hazards include all aspects of working near and on water including the potential for drowning and boating accidents.

Respiratory Protection and Monitoring: Level D (see Table 2-2). Monitor the opening of each sediment tube with a PID. If readings are detected during the work activity, screen for vinyl chloride using a draeger tube. If vinyl chloride is detected or VOCs are present in the breathing zone above 9 ppm, upgrade to Level C respiratory protection.

Protective Clothing: Level D.

Task J: Geophysics

Hazard Evaluation: Geophysics is not an invasive activity and there is little exposure to COCs. Safety hazards are present when operating a boat on water.

Respiratory Protection and Monitoring: None required.

Protective Clothing: Level D.

5.0 SITE CONTROL

5.1 ZONATION

The general zonation protocols that should be employed at hazardous waste sites are described in Appendix G of the original 1994 HASP. The site-specific zonation that will be used for this project is described as follows:

The exclusion zone will be established as a 15-foot radius surrounding the excavations, stockpiles or on-site treatment equipment. The support zone will be established based on site access and road layouts. As discussed in Section 5.0 of this HASP, a decontamination station will be established within the contaminant reduction zone, between the exclusion and support zones.

Signs:

The following sign must be posted at the entrance to any area with a potential for lead levels to exceed the PEL (Slag excavation area).

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

5.2 COMMUNICATIONS

Site communications will be as follows:

_____ Verbal
_____ Two-way radio
_____ Cellular telephone
_____ Hand signals
- Hand gripping throat ..... Out of air, can't breathe
- Grip partner's wrist or both hands around waist ..... Leave area immediately
- Hands on top of head ..... Need assistance
- Thumbs up ..... OK, I am all right, I understand
- Thumbs down ..... No, negative

_____ Horn
- Help ..... Three short blasts (. . .)
- Evacuation ..... Three long blasts (_ _ _)
- All Clear ..... Alternating long and short blasts (_ . _ .)

_____ Siren
_____ Other:

5.3 WORK PRACTICES

Work practices will conform to MACTEC corporate safety and health requirements. Briefings of specific safety practices will be conducted prior to the initiation of activities at the site.

5.4 DECONTAMINATION/DISPOSAL

Used PPE will be removed at the end of each work task or the end of the work day and placed in contractor trash bags for offsite disposal. Mud and dirt will be removed from disposable PPE to extent practical prior to placement in the bags and workboots will be rinsed at a designated location to remove accumulated dirt.

A sign will be placed near the decontamination station is and/or where equipment is decontaminated that states:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, OR FEDERAL REGULATIONS.

All workers **MUST** shower at the end of the workday if there is a potential for lead levels to be above the PEL (Level C PPE is worn).

5.5 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both on- and off-site will be directed through the HSO or designee. Points of contact at the redevelopment site will interact with the HSO or designee for communicating redevelopment-specific requirements.

5.6 EMERGENCY MEDICAL TREATMENT/FIRST AID

Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

5.6.1 Emergency Telephone Numbers

Police Department (Providence)	911
Primary Hospital: Rhode Island Hospital	(401) 444-4000

Fire Department (Providence)	911
Poison Control Center (Boston)	(800) 682-9211
Site HSO: To be determined (task specific)	(781) 245-6606
Project Manager: David Heislein	(781) 245-6606
MACTEC RHSM: C.E. Sundquist	(207) 828-3309 (207)650-7593 (Cell)
Textron Inc.: Mr.Dave McCabe	(401) 457-3577

5.6.2 Routes to Emergency Medical Facilities

The primary source of medical assistance for the site is Rhode Island Hospital

Exit the Site on Downing Street. At first major intersection, take a right onto Reservoir Avenue (Route 2). Watch for sign for route 10 South (approximately 1 mile along Reservoir Avenue). Take Route 10 to Route 95 North. Take Exit 18 (Thurbers Avenue); bear left onto Thurbers Avenue. At red light take right onto Eddy Street. Proceed 1-1/4 miles on Eddy Street to the Hospital.

6.0 ADMINISTRATION

6.1 PERSONNEL AUTHORIZED DOWNRANGE

Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the RHSM. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

CERTIFIED MACTEC TEAM PERSONNEL:

Eric Sandin*+

OTHER CERTIFIED PERSONNEL:

*FIRST-AID-TRAINED
+CPR-TRAINED

6.2 HASP APPROVALS

By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site. Signatures also serve as certification of completion of the hazard assessments as required by 29CFR1910.132.

Health and Safety Officer	Date
Project Manager	Date
Regional Health and Safety Manager	Date

6.3 FIELD TEAM REVIEW

I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

SITE/PROJECT: Former Gorham Manufacturing Facility - Providence, RI

6.4 MEDICAL DATA SHEET(S)

Telephone:Area Code ( )

This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the MACTEC Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project:_____

Name:_____

Address:_____

Home Telephone: Area Code ( )_____

Age: _____ Height: _____ Weight: _____

In case of emergency, contact: _____

Address:_____

Telephone: Area Code ( )_____

Do you wear contact lenses? Yes ( ) No ( )

Allergies:_____

List medication(s) taken regularly:_____

Particular sensitivities:_____

Previous/current medical conditions or exposures to hazardous chemicals:

_____

Name of Personal Physician:_____

NAME:

This Medical Data Sheet will be completed by all on-site personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the MACTEC Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project:_____
Name:_____
Address:_____
Home Telephone:_____
Age: _____ Height: _____ Weight: _____
In case of emergency, contact: _____
Address:_____
Telephone:_____
Do you wear contact lenses? Yes ( ) No ( )
Allergies:_____
List medication(s) taken regularly:_____
Particular sensitivities:_____
Previous/current medical conditions or exposures to hazardous chemicals:

_____
Name of Personal Physician:_____
Telephone:_____

6.4.1 Emergency Telephone Numbers

Update all phone numbers

Police Department (Providence)	(401) 272-3121
Primary Hospital: Rhode Island Hospital	(401) 444-4000
Fire Department (Providence)	(401) 421-1293
Poison Control Center (Boston)	(800) 682-9211
Site HSO: # _____	(781) 245-6606
Field Operations Leader: # _____	(781) 245-6606
Project Manager: Mr. Dave Heislein	(781) 245-6606
MACTEC RHSM: Ms. Cindy Sundquist	(207) 828-3309 Cell: (207) 650-7593
Textron Inc.: Mr. Dave McCabe	(401) 457-6007
DIGSAFE PERMIT NO.	

6.4.2 Routes to Emergency Medical Facilities

The primary source of medical assistance for the site is Rhode Island Hospital

Exit the Site on Downing Street. At first major intersection, take a right onto Reservoir Avenue (Route 2). Watch for sign for route 10 South (approximately 1 mile along Reservoir Avenue). Take Route 10 to Route 95 North. Take Exit 18 (Thurbers Avenue); bear left onto Thurbers Avenue. At red light take right onto Eddy Street. Proceed 1-1/4 miles on Eddy Street to the Hospital.

HEALTH AND SAFETY PLAN
PART II

FORMER GORHAM MANUFACTURING SITE
333 ADELAIDE AVENUE
PROVIDENCE, RHODE ISLAND

ATTACHMENTS

MACTEC

MAY 2006

ATTACHMENT A

AIR MONITORING DATA WORK SHEET

Air Monitoring Work Sheet

Sample Date: _____ Project Number: _____ Page ___ of ___

Sampled by: _____ Project Name: _____

Collection media: _____ Compound(s) sampled for: _____ Barometric pressure: _____ Temperature: _____

Sample Number	Pump Number and Type	Pump Flow Rate	Sample Start Time	Sample Stop Time	Total Sample Time	Total Sample Volume	Sample Location (if personal, note name and job)	Sample Results (mg/m^3)

Notes (describe activities, unusual circumstances, weather conditions, etc.): _____

Sampler's Signature: _____

ATTACHMENT B

JOB HAZARD ANALYSIS FORMS

- FIELD WORK – GENERAL
- SOIL SAMPLING
- SITE MOBILIZATION AND PREPARATION
- INSECT BITES AND STINGS

Minimum Recommended PPE*: hard hat, steel-toed boots, safety glasses
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization/ See Mobilization/Demobilization and Site Preparation JHA Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazard trees. ▪ Always know the wherabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Review Emergency Evacuation Procedures (see below).
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head agains falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.
	3C) Damage to eyes	3C) Protect eyes: ▪ Watch where you walk, ecpecially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3D) Bee and wasp stings	3D) See JHA for Insect Stings and Bites
	3E) Ticks and infected mosquitos	3E) See JHA for Insect Stings and Bites

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4A) Back Injuries	4A) Back Injuries ▪ Site personnel will be instructed on proper lifting techniques. ▪ Mechanical devices should be used to reduce manual handling of materials. ▪ Team lifting should be utilized if mechanical devices are not available.
	4B) Slips/Trips/Falls	4B) Slips/Trips/Falls ▪ Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. ▪ Site SHSO inspect the entire work area to identify and mark hazards.
	4C) Vehicular Traffic	4C) Vehicular Traffic ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	4D) Overhead Hazards	4D) Overhead Hazards ▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. ▪ All ground personnel will stay clear of suspended loads. ▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. ▪ All overhead hazards will be identified prior to commencing work operations.
	4E) Dropped Objects	4E) Dropped Objects ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.
	4F) Noise	4F) Noise ▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	4G) Eye Injuries	4G) Eye Injuries ▪ Safety glasses meeting ANSI Standard Z87 will be worn.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4H) Heavy Equipment (overhead hazards, spills, struck by or against)	4H) Heavy Equipment ▪ Equipment will have seat belts. ▪ Operators will wear seat belts when operating equipment. ▪ Do not operate equipment on grades that exceed manufacturer's recommendations. ▪ Equipment will have guards, canopies or grills to protect from flying objects. ▪ Ground personnel will stay clear of all suspended loads. ▪ Ground personnel will wear high visibility vests ▪ Spill and absorbent materials will be readily available. ▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment. ▪ Ground personnel will stay out of the swing radius of excavators. ▪ Eye contact with operators will be made before approaching equipment. ▪ Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. ▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading).
	4I) Struck by vehicle/equipment	4I) Struck by vehicle/equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times and will wear high visibility vests. ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop!
	4J) Struck/cut by tools	4J) Struck/cut by tools ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Guards will be kept in place while using hand and power tools.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4K) Caught in/on/between	4K) Caught in/on/between ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.
	4L) Contact with Electricity/Lightning	4L) Contact with Electricity/Lighting ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the "Hard" or "Extra Hard" service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.
	4M) Equipment failure	4M) Equipment failure ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.
	4N) Hand & power tool usage.	4N) Hand & power tool usage ▪ Daily inspections will be performed. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Environmental health considerations	4O) Heat Stress	4O) Take precautions to prevent heat stress ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments. ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability).
4. Environmental health considerations (Continued)	4O) Heat Stress (Continued)	▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	4P) Wet Bulb Globe Temperature (WBGT) Index	4P) WBGT ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). ▪ Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed). WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES 80-90 degrees F — Fatigue possible with prolonged exposure and physical activity. 90-105 degrees F — Heat exhaustion and heat stroke possible with prolonged exposure and physical activity.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		105-130 degrees F — Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.
	4Q) Cold Extremes	4Q) Take precautions to prevent cold stress injuries ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.
	4R) Wind	4R) Effects of the wind ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.

Heat Index Chart

Temperature	% Relative Humidity																
		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
	110	108	112	117	123	130											
	105	102	105	108	113	117	122	130									
	100	97	98	102	104	107	110	115	120	126							
	95	91	93	95	96	98	100	104	106	109	113	119	124	130			
	90	86	87	88	90	91	92	95	97	98	100	103	106	110	114	117	121
	85	81	82	83	84	85	86	87	88	89	90	92	94	96	97	100	102
	80	76	77	78	78	79	79	80	81	82	83	84	85	86	87	88	89

Legend	
80-89 degrees	Fatigue is possible with prolonged exposure and/or physical activity.
90-104 degrees	Sunstroke, heat cramps and heat exhaustion are possible with prolonged exposure and/or physical activity.
105-129 degrees	Sunstroke, heat cramps and heat exhaustion are likely. Heat stroke is possible with prolonged exposure and/or physical activity.
[illegible] degrees	Heatstroke/sunstroke is highly likely with continued exposure.

Wind Chill Chart

Wind (mph)	Temperature (°F)																	
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for sampling event	1A) Chemical exposure	1A) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.
2. Carrying equipment to site location	2A) Back or muscle strain	2A) Back or muscle strain ▪ Use proper lifting techniques when lifting pumps or generators ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items
3. Calibrate monitoring equipment	1A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Preparing sampling location	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP.
	4B) Contact with biting insects (i.e., spiders, bees, etc.)	4B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	4C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4D) Back strain due to lifting or moving equipment to sampling locations	4D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques
	4E) Foot injuries from dropped equipment	4E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
5. Collecting soil samples	5A) Working around drill rigs	5A) See JHA - Drilling
	5B) Encountering underground or overhead utilities	5B) Have all utilities located.
	5C) Fire/Explosion/Contamination hazard from refueling generators	5C) Fire/Explosion/Contamination hazard from refueling generators ▪ Turn the generator off and let it cool down before refueling ▪ Segregate fuel and other hydrocarbons from samples to minimize contamination potential ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited ▪ See JHA for Gasoline use
	5D) Electrocution	5D) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5E) Exposure to contaminants	5E) Exposure to Contaminants ▪ Stand up wind when sampling ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 4C) under Safe Practices above

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5F) Exposure to preservatives	5F) Exposure to preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ Review MSDSs
	5G) Slips/trips/falls	5G) Slips/trips/falls ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear
	5H) Lifting Injury	5H) Lifting injury ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples
	5I) Eye injury	5I) Eye Injury ▪ Wear eye protection when using picks or similar devices to loosen soil
	5J) Fire	5J) Fire ▪ When using gas powered auger, maintain fire watch whenever fueling or otherwise handling gasoline ▪ See JHA - Gasoline
6. Soil sampling using floor corer	6A) Back injury	6A) Back Injury ▪ Use proper lifting techniques when moving floor corer and generator ▪ Use mechanincal aids if available ▪ Use two person lift for heavy items.
	6B) Electric Shock	6B) Electric Shock ▪ Use electric cords free from defects ▪ Keep cords out of water ▪ Ensure all electrical equipment is properly grounded ▪ Use GFCI
	6C) Hearing	6C) Hearing ▪ Wear hearing protection
	6D) Fire	6D) Fire ▪ When using generator, maintain fire watch whenever refueling or otherwise handling gasoline ▪ See JHA - Gasoline
	6E) Contamination	6E) Contamination ▪ Use appropriate PPE for the contaminants of concern (see HASP). ▪ Minimize sample contact ▪ Label sample in accordance with procedures ▪ Monitor breathing zone levels.

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) N/A	1A) Prior to leaving for site ▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. ▪ Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: ▪ Flat tires ▪ Windshield wipers worn or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads ▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) ▪ Ensure vehicle is equpped with warning flashers and/or flares and that the warning flashers work ▪ Cell phones are recommended to call for help in the event of an emergency ▪ Vehicles carrying tools must have a safety cage in place. All tools must be properly secured ▪ Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. ▪ Ensure sufficient gasoline is in the tank
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! ▪ Seat belts must be used at all times when operating any vehicle on company business. ▪ Drive at safe speed for road conditions ▪ Maintain adequate following distance ▪ Pull over and stop if you have to look at a map ▪ Try to park so that you don't have to back up to leave.
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.
	3B) Rocky or one-lane roads	3B) Rocky or one-lane roads ▪ Stay clear of gullies and trenches, drive slowly over rocks. ▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3C) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists ▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms. ▪ Drive to avoid accident situations created by the mistakes of others.
	3D) When angry or irritated	3D) When angry or irritated ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.
	3E) Turning around on narrow roads	3E) Turning around on narrow roads ▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a backer if available.
	3F) Sick or medicated	3F) Sick or medicated ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.
	3G) On wet or slimy roads	3G) On wet or slimy roads ▪ Drive slow and safe, wear seatbelts.
	3H) Animals on road	3H) Animals on road ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies ▪ Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. ▪ Tightly secure all loads to the truck bed to avoid load shifting while in transit.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5D) Caught in/on/between	5D) Caught in/on/between ▪ Do not place yourself between two vehicles or between a vehicle and a fixed object.
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
	5F) Vehicle accident	5F) Vehicle accident ▪ Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
7. Installation of soil erosion and sediment controls	7A) Overexertion	7A) Overexertion ▪ Workers will be trained in the proper method of placing erosion controls. ▪ Do not bend and twist at the waist while lifting or exerting force.
	7B) Struck by Equipment/Supplies	7C) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
8. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

Minimum Recommended PPE*: Long sleeved shirt and pants, light colored clothing
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Traveling/working in areas with potential Tick Bites – Example outdoor wooded areas or fields.	1. Lyme Disease, Rocky Mountain Spotted Fever, etc.	1A) Spray clothing with insect repellant as a barrier. 1B) Wear light colored clothing that fits tightly at the wrists, ankles, and waist. 1C) Each outer garment should overlap the one above it. 1D) Cover trouser legs with high socks or boots. 1E) Tuck in shirt tails. 1F) Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours. 1G) If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal. 1H) Do not try to remove the tick by burning with a match or covering it with chemical agents. 1I) If you can not remove the tick, or the head detaches, seek propmt medical help. 1J) Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Symptoms specific to Lyme disease include: confusion, short-term memory loss, and disorientation.
2. Working/traveling in areas with potential bee and wasp stings- Example wooded areas and fields	2. Allergic reactions, painful stings	2A) Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. 2B) If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication with you at all times. 2C) Wear long sleeve shirts and trousers; tuck in shirt.. Bright colors and metal objects may attract bees. 2D) If you are stung, cold compresses may bring relief. 2E) If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury. 2F) If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. Give victim antihistime, (Benadryl, chlo-amine tabs).
3. Traveling/working in areas of potential Mosquito Bites- Example- Woods, fields, near bodies of water and etc.	3. Skin irritation, encephalitis	3A) Wear long sleeves and trousers. 3B) Avoid heavy scents. 3C) Use insect repellants. If using DEET, do not apply directly to skin, apply to clothing only. 3D) Carry after-bite medication to reduce skin irritation.