ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES REQUIRMENT REPORT AND REMEDIAL RESPONSE ACTION PLAN - PUBLIC COMMENT DRAFT

15 PEABODY STREET
SALEM, MASSACHUSETTS

MASSDEP RTN 3-25611

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June 2008

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) prepared this Analysis of Brownfields Cleanup Alternatives Requirement (ABCAR) report for the property located at 15 Peabody Street in Salem, Massachusetts (the "Site") on behalf of the City of Salem (the "City") as part of the City's Brownfields Program funded by a grant from the United States Environmental Protection Agency (EPA).

This work was completed under EPA Brownfields Request for Authorization (RFA) 00897 Addendum A and TRC's Quality Assurance Project Plan (QAPP) approved by EPA on April 10, 2008.

1.1 Purpose

TRC was retained by the City through a contract with Landworks Studios, Inc. (Landworks) to prepare an ABCAR report, a Massachusetts Contingency Plan (MCP) remedial response action plan and bid specifications, and to oversee and document the results of remedial activities at the Site. The purpose of this ABCAR is to evaluate and document practicable remedial alternatives for remediating the Site to limit exposure to Site contaminants by future users of the Site.

This document is intended to comply with the EPA requirements for cleanup alternatives analysis under the EPA Brownfields Cleanup Grant Program in accordance with the *Brownfields Cleanup Grant Major Tasks* checklist dated January 9, 2006. This document is also has been prepared to satisfy the Massachusetts Department of Environmental Protection's (MassDEP) requirements for the selection and design of remedial response actions in accordance with the MCP (310 CMR 40.0000). An MCP Bureau of Waste Site Cleanup (BWSC) Transmittal Form is provided in Appendix A.

1.2 Scope of Work

This report presents an evaluation of feasible remedial alternatives to address extractable petroleum hydrocarbons (EPH), polycyclic aromatic hydrocarbon (PAH) and inorganic contaminant (metals) impacted soil at the Site. Requirements of the analysis include the following:

- Identifying the objectives of the environmental response action and provide an analysis of cleanup alternatives;
- Documenting that the situation meets the need for an environmental response action;
- Providing information pertaining to Site background; threats to public health and/or the environment posed by the Site; enforcement activities; and projected costs; and
- Identifying the proposed action, and explain the rational for its selection.

Upon approval by EPA, the selected cleanup alternative will be implemented as Comprehensive Response Actions during redevelopment of the Site by the City.

2.0 SITE CHARACTERIZATION

2.1 Site Location and Description

According to the City of Salem Assessor's records, the Site is identified on Map 34 as Parcel 435 and consists of a 16,516 square foot (0.38 acre) L-shaped parcel. The Site is bounded by the South River canal to the north, Peabody Street to the south, an electric substation operated by National Grid to the east, and a commercial parking lot and restaurant to the west. The site location is shown on Figure 1.

The Site is currently open space and is almost entirely covered by grass. There is a 10-foot wide asphalt walkway on the western boundary of the Site. A 20-foot wide strip of gravel is present on the northern boundary of the Site, along the South River canal. Site access is controlled by a chain-link fence on the southern and eastern boundaries and by wood posts on the western boundary. The northern boundary of the Site is open to the South River. There is no vehicle access to the Site. A buried 8-inch diameter polyvinyl chloride (PVC) drain pipe extends north across the Site from a catch basin in Peabody Street to the South River. A buried abandoned 30-inch diameter reinforced concrete former drain line, plugged with bricks on both ends, extends north across the Site from a manhole in Peabody Street to the South River. A Site Plan is provided as Figure 2.

2.2 Site History

TRC completed a Phase I Environmental Site Assessment (ESA) and a Phase II Site Investigation at the Site in June 2004 and June 2005, respectively, under the City's EPA Brownfields Assessment Program. The scope of work for the June 2005 Phase II investigation was set forth in an EPA-approved QAPP Addendum (Addendum A) prepared by TRC dated October 15, 2004. Background and historical information presented in this ABCAR were obtained from the following documents:

- *ASTM Phase II Environmental Assessment Supplement* prepared by Gulf of Maine Research Center, Inc., dated March 2001;

- *Phase I Environmental Site Assessment, 15 Peabody Street, Salem, Massachusetts*, prepared by TRC Environmental Corporation, dated June 2004;

- *Phase II Site Investigation Summary Report, 15 Peabody Street, Salem, Massachusetts*, prepared by TRC Environmental Corporation, dated June, 2005; and

- *Tier Classification, 15 Peabody Street, Salem, Massachusetts,* prepared by Apex Companies, LLC, dated January 2007.

There has been no change in Site history since submittal of the Phase I Report and Tier Classification by Apex in January 2007. Findings from the above-referenced documents are summarized below.

Historical records indicate the Site was previously occupied by electric power station facilities from at least 1890 until 1965. Review of Sanborn® Fire Insurance Maps by TRC indicate that the Site was occupied by several structures, including coal sheds and a portion of a power station building, which housed engines and generators. Historical records indicate the portion of the power station on the Site was demolished between 1965 and 1970, leaving the current, smaller power facility on the property abutting the Site to the east. According to historical records, the adjacent properties on both the eastern and western sides of the Site also housed various power station facilities, including a transformer yard to the east of the Site. The Site was donated to the City of Salem by H&M Realty Trust in 1979.

Potential sources of contamination identified at the Site during the June 2004 Phase I ESA included the former use of the Site and abutting properties as an electrical power substation and former petroleum underground storage tanks (USTs) and a petroleum release on the property abutting the Site to the south (1 Peabody Street). The 1 Peabody Street property was listed as a MassDEP Disposal Site (Release Tracking Number [RTN] 3-2790) in January 1990 in response to the presence of petroleum hydrocarbons during removal of four 20,000-gallon number six fuel oil USTs, a 6,000-gallon number two fuel oil UST, and a 2,000-gallon gasoline UST. The 1 Peabody Street site was closed with a Class A-2 Response Action Outcome (RAO-P) in July 2004.

Four groundwater monitoring wells were observed at the Site during the June 2004 Phase I ESA Site reconnaissance. According to local fire department records, the groundwater monitoring wells were installed by the Gulf of Maine Research Center (GMRC), Inc. in January 2001 as part of a previous ESA at the Site.

According to a March 2001 ASTM Phase II Environmental Assessment Supplement report prepared by GMRC, four soil borings (B-101 to B-104) were advanced and four monitoring wells (MW-101 to MW-104) were constructed at the Site to provide a general assessment of subsurface soil and groundwater conditions. The investigation was conducted between December 2000 and March 2001 in response to an October 2000 Phase I Environmental Site Assessment by an unidentified party, which indicated that past use of the Site may have involved the storage and use of oil and hazardous materials and that USTs may have been present on or near the Site. A Ground Penetrating Radar (GPR) survey performed at the Site by TRC in April 2008 did not identify any USTs at the Site.

GMRC reported that the results of the Phase II investigation revealed no evidence of USTs or utilities at the Site. However, volatile organic compounds (VOCs), volatile petroleum hydrocarbons (VPH), EPH, PAH, polychlorinated biphenyls (PCBs) and/or metals were detected in select soil and groundwater samples.

2.3 Land Use and Potential Receptors

The Site is currently vacant and there are no on-Site workers. Based on the Massachusetts Department of Health and Community Development (DHCD) Community Profile, it is estimated that approximately 3,694 people reside within a one-half mile radius of the Site.

The South River canal and Peabody Street border the Site to the north and south, respectively. Further south across Peabody Street are several multi-story multi-family residence. A small parking lot abuts the Site to the west. Further west of the parking lot is a fast food restaurant. Several commercial properties are located south of the Site along Ward Street. Directly east of the Site is a National Grid electric power substation. Salem center is located approximately 0.25-miles northwest of the Site. No schools or institutions are located within 500 feet of the Site.

Based on Site reconnaissance, no wetlands are on or abutting the Site. However, approximately the northern two-thirds of the Site are located within the 100-foot riparian buffer zone of the South River.

There are no public drinking water supplies [i.e., Zone II, Interim Well Head Protection Areas (IWPAs) or Potentially Productive Aquifers (PPAs)] are located within ½ mile radius of the Site. Groundwater beneath the Site has been designated as a Non-Potential Drinking Water Source Area (NPDWSA). According to the City of Salem Board of Health, there are no private drinking water wells within 500 feet of the Site. No Protected Open Space or Areas of Critical Environmental Concern are present within 500 feet of the Site.

The Site is primarily covered by landscape grass area and unpaved bare soil. There is an approximately 10-foot wide asphalt paved sidewalk on the western boundary of the Site. Redevelopment of the Site will include construction of park.

2.4 Summary of Field Activities

TRC conducted subsurface investigations at the Site during January/February 2005 to assess environmental conditions. Additional sampling was conducted at the Site in April 2008 to refine the volumes of environmental media to be remediated at the Site.

The initial investigation in 2005 included: measurement of groundwater elevations and monitoring for the presence of non-aqueous phase liquid (NAPL) during high and low tide at four existing monitoring wells (MW-1 through MW-4); collection of groundwater samples from the four existing monitoring wells for laboratory analysis of VPH, EPH, PCBs and metals; advancement of five soil borings (SB-1 through SB-5); and collection of soil samples for laboratory analysis of VPH, EPH, PCBs and metals.

TRC conducted a GPR and underground electric utility location survey on the Site on March 21, 2008. A copy of the GPR survey report is provided in Appendix B.

During the 2008 confirmation sampling, six soil borings (SB-6 through SB-11) were advanced with a Geoprobe, one of which (SB-10) was completed as a two-inch diameter groundwater monitoring well (MW-5) on April 14, 2008. Soil samples were collected during advancement of soil borings for visual inspection, field screening of total VOC headspace using a photo ionization detector (PID) and for laboratory analysis of VPH, EPH, PCBs and metals. In addition a soil sample collected from SB-6 was also analyzed for VOCs, total petroleum hydrocarbons (TPH), RCRA metals, flashpoint, and pH to develop a remedial waste profile.

Monitoring well MW-5 was developed with a disposable bailer and a peristaltic pump on April 14, 2008. Groundwater elevations were measured in the four existing and one new monitoring well on April 21 and May 20, 2008. Groundwater samples were collected from monitoring wells MW-1 through MW-5 for the analysis of EPH and metals on April 21, 2008 using modified EPA low-flow procedures. Soil boring drilling, well construction, soil sample collection and analysis, groundwater elevation measurement, and groundwater sample collection and analysis were conducted in accordance with the QAPP (Addendum A) approved by EPA on April 10, 2008.

Monitoring well and sampling locations are shown on Figure 2. Soil boring logs and well construction diagrams for April 2008 borings and wells are included in Appendix C. The depth of the soil borings, monitoring well construction details, and groundwater elevation measurements are provided on Table 1. Soil and groundwater laboratory analysis reports for samples collected in April 2008 are included in Appendices D and E, respectively.

2.5 Hydrogeologic Characteristics

The Site is underlain by approximately one-foot of topsoil and sand overlying two to four-feet of sand and gravel-based urban fill materials containing trace amounts of anthropogenic materials (coal, coal ash and slag) as well as layers of pulverized brick and concrete atop primarily fine to course native sands and silt. Bedrock and/or local formation rock was not encountered during drilling activities. Drilling refusal on what appeared to be concrete was encountered in soil borings throughout the Site with the exception of borings along South River (SB-9, SB-10, and SB-11) at depths ranging from two to 7.5-feet below ground surface (bgs). Soil boring logs are provided in Appendix C.

The depth to groundwater at the Site ranges from approximately four to five feet below ground surface (Table 1). The water table surface is generally present in native sand and silt soils. Groundwater elevations measured on April 21, 2008 were used to interpret groundwater elevation contours. Based on the April 21, 2008 contours, groundwater primarily flows northeast toward the South River canal (Figure 3) at a hydraulic gradient of approximately 0.010.

2.6 Nature and Extent of Contamination

2.6.1 Soil Analysis Results

Soil sample results from the 2001, 2005 and 2008 sampling rounds are summarized in Table 2. Concentrations presented in Table 2 are compared to MCP Method 1 S-1/GW-3 soil standards and MassDEP Background concentrations for urban soils containing coal and coal ash to evaluate which areas may require remediation for unrestricted future use.

The primary constituents of concern detected in soil above the Method 1 S-1/GW-3 standards includes EPH C19-C36 aliphatics and C11-C22 aromatics (SB-10) and target compounds benzo(a)anthracene (B-103, B-101, SB-4, SB-6, and SB-8), benzo(a)pyrene (B-104, B-103, B-101, SB-4, SB-6, SB-7, and SB-8), benzo(b)fluoranthene (B-104, B-103, B-101, SB-4, SB-6, and SB-8), dibenzo(a,h)anthracene (B-101, B-103, SB-4, SB-6, and SB-8), antimony (SB-11), arsenic (SB-4), barium (SB-10), cadmium (SB-1, SB-2C, and SB-4), chromium (SB-4), lead

(SB-2C, SB-6, SB-10, and SB-11), and nickel (SB-1, SB-2C, SB-4, SB-6, SB-8, and SB-9). In addition, lead exceeded the MCP Method 3 Upper Concentration Limit (UCL) in a sample collected from SB-10.

Exposure Point Concentrations (EPCs) for soil were calculated using the average of soil samples collected from the Site. The EPCs for benzo(a)pyrene, dibenzo(a,h)anthracene and lead in soil exceed the Method 1 S-1/GW-3 standards (Table 2). In addition, the elevated concentrations of EPH and lead at soil boring SB-10 are considered a hot spot pursuant to the MCP.

2.6.2 Groundwater Analysis Results

Groundwater analytical results from 2001, 2005 and 2008 are summarized in Table 3. Concentrations presented in Table 3 are compared to MCP Method 1 GW-3 groundwater cleanup standards to identify areas that may require remediation. There are no current or potential drinking water resource areas at the Site. Therefore, the MCP Method 1 GW-1 cleanup standards are not applicable. There are no current Site buildings and no future buildings are planned to be constructed at the Site. Therefore, the MCP Method 1 GW-2 standards are not applicable to groundwater. The MCP Method 1 GW-3 standards are applicable to all groundwater in Massachusetts.

The primary constituents detected in groundwater at the Site are petroleum hydrocarbons as indicated by the concentrations of EPH carbon ranges at monitoring well MW-5. Several PAHs, and metal, including lead, were also detected in groundwater. Total lead was detected at a maximum concentration of 12.9 ug/L in monitoring well MW-5 (field duplicate) on April 21, 2008. This lead concentration is slightly above the Method 1 GW-3 standard of 10 ug/L. The April 21, 2008 MW-5 sample and field duplicate sample were analyzed for dissolved lead to determine if the elevated total lead concentration was attributable to sample turbidity. Dissolved lead was not detected within either the MW-5 field or field duplicate groundwater sample. Therefore, lead is not a contaminant of concern for groundwater.

Pyrene also exceeded the Method 1 GW-3 standard in one sample collected from MW-4 on February 21, 2001. However, pyrene was not detected in subsequent groundwater samples collected on February 15, 2005 and April 21, 2008. Therefore, pyrene is not considered a contaminant of concern for groundwater.

2.6.3 Non-Aqueous Phase Liquid

Non-Aqueous Phase Liquid (NAPL) has not been detected in monitoring wells on the Site during any monitoring event (Table 1) or observed during groundwater sample collection. However, the screened intervals of monitoring wells MW-1 though MW-4 are located above the water table. Visual and olafactory evidence of petroleum were observed at a depth of about four to five-feet bgs during the drilling of soil boring SB-5 and construction of monitor well MW-5. NAPL was not observed during water level measurement or groundwater sampling at MW-5 in April 2008. The low concentrations of oil and hazardous materials detected in groundwater monitoring at the Site also support the finding that NAPL is not present at the Site.

2.7 Environmental Fate and Transport

Contaminants of concern detected above the MCP Method 1 S-1/GW-3 soil cleanup standards and MassDEP background values for soil containing coal ash or wood ash associated with fill material in individual soil samples include EPH C19 – C36 aliphatic and C11 – C 22 aromatic hydrocarbons; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenzo(a,h)anthracene; antimony, arsenic; barium; cadmium; chromium; lead; and nickel (Table 2). The distribution of chemical contamination is influenced, in part, by factors such as the physical and chemical properties of the constituents, the nature and location of sources, and Site characteristics such as geology, hydrology, and topography. Characteristics of these compounds that affect mobility, stability, volatility, persistence, and bioaccumulative potential are discussed herein.

2.7.1 Contaminant Properties

To evaluate the fate and transport of chemicals in the environment, it is important to identify the physical and chemical properties that influence fate and transport processes. Chemicals that are structurally similar tend to exhibit like behavior in the environment and as such are grouped into classes. Classes of chemicals detected in soil at the Site include heavy metals, PAHs, PCBs, and petroleum-related compounds.

General definitions of physical properties are discussed below, followed by a description of the characteristics of each chemical class.

Specific Gravity. The specific gravity of a chemical is the ratio of the mass of a given volume of the chemical to an equal volume of water at a specified temperature, usually four degrees Celsius (°C). Specific gravity is a relative measure of density. Compounds with specific gravities greater than 1.0, if they are immiscible with water, will separate as a sinking phase (as dense non-aqueous phase liquid; DNAPL). Immiscible compounds with specific gravities less than 1.0 will tend to float on water (as light non-aqueous phase liquid; LNAPL). LNAPL and DNAPL were not detected at the Site during previous investigations or TRC's investigation based on field instrument readings and visual observations of soil and groundwater samples collected at the Site.

Water Solubility. The solubility of a chemical in water is the maximum amount of chemical that will dissolve in pure water at a specific temperature and pressure. Water solubility is a general predictor of a chemical's potential mobility and distribution in the environment. Chemicals with moderate to high solubility (greater than 100 mg/L) can readily leach from soils into groundwater, and once there, are generally mobile. Compounds that are highly soluble in water will be less likely to volatilize from water and may be more susceptible to microbial degradation. Compounds detected at the Site generally exhibit a low solubility.

Vapor Pressure. The vapor pressure of a liquid or solid is a relative measure of its volatility in its pure form. This value expresses the pressure of the vapor phase of a compound in equilibrium with its liquid or solid phase of the compound at a given temperature. Vapor pressure is important in evaluating migration of chemicals to air from other environmental media; factors such as temperature, wind speed, water solubility and degree of adsorption also play a key role. Chemicals with vapor pressures greater than 10 millimeters of mercury (mm Hg) are considered to be highly volatile. The chemicals detected at the Site exhibit low (e.g., PAHs) to essentially non-existent (e.g., lead) vapor pressures.

Henry's Law Constant. Henry's Law Constant is another measure of chemical volatility. It is expressed as a ratio of concentration of a chemical in air to the chemical's concentration in water (i.e., dissolved state versus pure state). The higher the Henry's Law Constant value, the greater the tendency to volatilize. In general, compounds with values above 10-5 atmospheres-cubic meter per mole (atm-m3/mol) are considered highly volatile. The chemicals detected at the Site exhibit low Henry's Law Constants.

Organic Carbon Partition Coefficient (Koc). This value is a measure of the relative sorption potential of organic compounds. Koc reflects the tendency of an organic compound to be adsorbed onto soils and sediments and is generally independent of soil properties. This value is expressed as the ratio of the amount of a compound adsorbed per unit weight of organic carbon, to the concentration of the compound in solution at equilibrium. Chemicals with a high Koc (greater than 1,000 mL/g) may exhibit a high sorption potential in soils and are less likely to leach into groundwater. Koc values less than 100 mL/g indicate that the chemical has a high potential to leach into groundwater. Most of the chemicals at the Site (excluding lighter-end PAHs) have Koc values toward the higher end and tend to exhibit high sorption potential and limited potential to leach.

Log Kow (log octanol/water partition coefficient). This value is a measure of the tendency of a compound to partition between an organic phase (octanol) and an aqueous phase. Log Kow relates indirectly to water solubility and directly to soil adsorption. Chemicals with low partition coefficients (less than 10) have high water solubilities and low adsorption coefficients, and would, therefore, be expected to have a high potential to leach into groundwater. The main constituents detected in Site soils were PAHs and lead. Log Kow values for PAHs (e.g., benzo(a)pyrene, benzo(g,h,i)perylene, and acenaphthene) provided in the MCP (310 CMR 40.1514(2)) are high, indicating the affinity of these compounds to bind to organic matter rather than leach into groundwater. Lead is insoluble in water and, therefore, not likely to leach into groundwater.

2.7.2 Contaminant Types

Chemical classes detected at the Site include EPH, PAHs, and metals. At the Site, the compounds detected in excess of MassDEP cleanup standards or guidance values appear to be associated with a past petroleum release and urban fill materials that contain coal and coal ash. PCBs were also detected in Site soil, but at concentrations well below the MCP Method 1 Standards in soil.

Lead was the only analyzed constituent detected in groundwater above the MCP Method 1 Standard (in samples collected from MW-5). However, the dissolved lead results from these samples were either not detected or was identified well below the MCP Method 1 Standard suggesting that lead is not a contaminant of concern in groundwater. The characteristics of the various chemical classes at the Site above MCP Method 1 cleanup standards are described below.

Extractable Petroleum Hydrocarbons. EPH compounds consist of petroleum-related compounds containing 9 to 36 carbon atoms. These compounds are generally moderately mobile in soil and have moderate aqueous solubilities. These compounds generally are likely to be conveyed in the dissolved phase in groundwater.

Polycyclic Aromatic Hydrocarbons. PAHs are the products of incomplete combustion of fossil fuels. They are also components of petroleum and coal. Compounds in this class generally have low mobility in soil and possess very low aqueous solubility. Thus, PAHs are not likely to be conveyed in the dissolved phase in groundwater and have low relative mobility. They can migrate with fugitive dusts due to their tendency to strongly partition (adsorb) to soil and soil organic phases.

Arsenic. Arsenic can naturally occur in its elemental form. Arsenic has a very low solubility in water. The transport potential for arsenic in Site soil and groundwater is similar to that of PAHs in that there is little potential for transport via groundwater in the dissolved phase.

Antimony. Antimony can naturally occur in its elemental form but more commonly is found as in a sulfide mineral called stibnite. Antimony has a very low solubility in water. Antimony is used in flame-proofing, paints, ceramics, enamels, a wide variety of alloys, electronics, rubber, and used to increase the hardness and mechanical strength of lead. The transport potential for antimony in Site soil and groundwater is similar to that of PAHs in that there is little potential for transport via groundwater in the dissolved phase.

Barium. Barium is naturally-occurring metal in the sulfate mineral barite, but not by itself due its reactivity in air, and has a low solubility in water. Barium compounds are used by the oil and gas industries to make drilling muds. Barium compounds are also used to make paint, bricks, ceramics, glass, and rubber. Unlike other heavy metals, barium does not tend to bioaccumulate.

Cadmium. Cadmium is a naturally-occurring metal with a low solubility in water and a tendency for bioaccumulation. Cadmium is used in rechargeable batteries, pigments, metal coatings, and stabilizers for plastics.

Chromium. Chromium is a naturally-occurring metal with a low solubility in water. Chromium has a wide variety of uses, especially in the chemical, metallurgical, and refractory industries, including chrome plating, paint pigments, leather tanning. Chromium is present in the environment in several different forms. The most common forms are chromium(0, the metal form), chromium(III), and chromium(VI).

Chromium(III) occurs naturally in the environment and is an essential nutrient. Chromium(VI) and chromium(0) are generally produced by industrial processes. Chromium(VI) requires extreme pH and Eh conditions to predominate over the less toxic Chromium(III). Such pH and Eh conditions are rarely encountered in the natural environment.

Nickel. Nickel is a naturally-occurring metal with very low solubility in water. Nickel is used in alloys, particularly to make stainless steel, nickel plating, to color ceramics, and batteries.

Lead. Lead is a naturally-occurring metal with very low solubility in water and a tendency for bioaccumulation. Lead is also a very commonly employed industrial chemical, and has been used in gasoline, paints, solders, glazes, electronics, batteries, etc. The transport potential for lead in Site soil and groundwater is similar to that of PAHs in that there is little potential for transport via groundwater in the dissolved phase.

2.7.3 Migration Pathways

2.7.3.1 Soil

As discussed above, contaminants detected in Site soils above their applicable MCP Method 1 standards was primarily EPH and lead and to a lesser extent PAHs, antimony, barium, cadmium, chromium, and nickel. The low mobility of these compounds coupled with the flat topography of the Site indicates little likelihood they will be transported off-Site. However, with the exception of EPH carbons ranges, these compounds are relatively resistant to degradation or are elements that cannot be destroyed under normal environmental conditions and will likely persist in Site soils. Future development of the Site could disturb the soil making it available for fugitive dust transport and stormwater runoff if appropriate management procedures and engineering controls are not implemented during activities that could disturb the soil.

2.7.3.2 Groundwater

Total lead was the only contaminant detected in groundwater above the Method 1 GW-3 groundwater cleanup standards; however, dissolved lead was reported below the Method 1 GW-3 groundwater cleanup standard. Therefore, lead is not considered a contaminant of concern in groundwater at this Site.

2.7.3.3 Air

Contaminants that are present are inorganic (e.g., metals) or low volatility organics (e.g., PAHs), with relatively minor volatile organic compound (VOC) Site impacts; therefore, volatilization is not expected to be a significant migration mechanism at the Site.

2.7.3.4 Surface Water

The South River is located adjacent to the Site along the northern property boundary. As discussed above, the contaminants of concern at this Site are confined to Site soils and are not readily mobile due to their low solubility and high retardation factors. Total lead was detected in groundwater at concentrations greater than MCP Method 1 GW-3 standard at one location (MW-5) within 500-feet of surface water at the Site. However, concentrations of dissolved lead at these locations was either none detected and/or below MCP Method 1 GW-3 standards. Therefore, impacts to surface water are not expected to be a significant migration mechanism at the Site.

2.7.3.5 *Sediment*

EPHs were detected at concentrations greater than MCP Method 1 S-1/GW-3 standards in soils greater than four-feet bgs beneath unpaved an unpaved area at the Site. PAHs and metals were detected at concentrations greater than MCP Method 1 S-1/GW-3 standards greater than 1.5-feet bgs beneath unpaved areas at the Site. The ground surface is flat and is primarily covered by well established grass surfaces and stable sand and gravel. In addition, the Site is separated from the South River by a large granite block wall with a height of about three to four-feet above the river surface. An approximately 10-foot section of the granite block wall along the Site is partially collapsed and is temporarily secured with concrete barricades. However, there is no evidence of past or current soil erosion from the Site into the South River. Therefore, it is not likely that contaminants in subsurface soils could migrate to sediment via runoff or flooding.

2.7.3.6 *Food Chain*

The South River is located adjacent to the Site along the northern property boundary is considered a fish habitat as defined in the MCP.

2.8 Risk Characterization

The Site is currently a vacant landscaped area. The City has recently developed a design and specifications for construction of a public park at the Site, which is planned to include recreation areas for children. The park will include a playground area, a walkway that runs from Peabody Street to a large plaza along the river, sitting areas, gaming tables, and a screening wall adjacent to the Mass Electric Site. The park will be covered by concrete surfaces, grass, and various plantings. Plans showing existing conditions and proposed park improvements are included in Appendix H.

2.8.1 Human Health

TRC completed a Method 3 human health risk characterization to evaluate the need for response actions at the Site. The risk characterization was based upon the assumption that future use of the Site will be a recreational park. However, future unlimited Site use has also been evaluated to determine the need for an Activity and Use Limitation (AUL) on the property. Future receptors evaluated include park users, construction workers, and residents. MassDEP Shortforms were used to evaluate site-related exposures to each of the identified potential future receptor populations. The risk characterization was based on the assumption the specific areas of elevated EPH and lead soil contamination identified at soil borings SB-10 and SB-2C (Area 1) and elevated PAH contamination at soil borings SB-4 and SB-6 (Area 2) were excavated and removed or capped and not subject to potential human exposure. Based on the results of the risk characterization, the Site is suitable for its intended use as a park following removal, treatment, or isolation of soils in Areas 1 and 2. However, an AUL will be necessary to limit potential future residential Site use and potential future use of the Site for gardening. The risk characterization and associated risk calculations are provided in Appendix G.

2.8.2 *Public Safety*

The risk of harm to safety, as described in 310 CMR 40.0960, was evaluated for the disposal Site. The Site location does not contain the following items related to a release of OHM:

- There are no rusted or corroded drums or containers, open pits or lagoons, at the Site.
- There is no threat of fire or explosion, or the presence of explosive vapors from the release at the Site; and
- There are no uncontainerized materials exhibiting the characteristics of corrosivity, reactivity, or flammability.

Based on the above information, it was determined that the Site does not pose a risk to safety due to the presence of dangerous structures related to the release at the Site.

2.8.3 *Public Welfare*

No community in the vicinity of the Site is believed to be currently experiencing, or expected to experience, significant adverse impacts as a result of the degradation of public or private resources directly attributable to the soil and groundwater contamination at the Site. No other non-pecuniary effects are known to be present, or to be accruing, due to soil and groundwater contamination at this Site. Therefore, there is No Significant Risk to public welfare at the Site.

2.8.4 *Environment*

In general, the 0.38-acre Site is located within an urbanized setting that provides limited habitat for terrestrial ecological receptors. Currently, vegetation comprised primarily of grass species is present within the Site but provides less than 1.0 acre of habitat. The most significant ecological area is the South River that is present along northern portion of the Site. Land use surrounding the Site generally consists of commercial and residential development.

There is no evidence of contaminants present within surface soil that could potentially adversely affect terrestrial ecological receptors or evidence of migration of subsurface soil contaminants to surface water and sediment associated with the South River. At this time existing data for the Site are not sufficient to require a Stage I Environmental Risk Characterization.

3.0 ALTERNATIVES ANALYSIS

3.1 Remedial Action Objectives and Cleanup Goals

The objective of remediation at the Site is to achieve an MCP Permanent Solution and Response Action Outcome (RAO) by demonstrating that a condition of No Significant Risk has been achieved by:

- Preventing current and future recreational and construction/utility worker exposure to EPH and lead in soil near soil boring SB-10 (Area 1);
- Preventing current and future recreational and construction/utility worker exposure to urban fill containing elevated concentrations of PAHs near soil borings SB-4 and SB-6 (Area 2); and
- Preventing future residential use and vegetable gardening activities throughout the Site.

3.2 Identification of Remedial Alternatives

TRC evaluated several potential alternatives for addressing contaminated soil at the Site. From the evaluation, TRC identified a limited number of practicable remedial alternatives that could be implemented at the Site based on available Site data and TRC experience. The no action alternative was also included as part of the evaluation to establish a basis for conducting remedial actions at the Site. The remedial alternatives identified for consideration under this alternatives analysis include:

- No action;
- In-situ Bioventing;
- In-situ Chemical Oxidation;
- Soil Excavation; and
- Soil Excavation and Capping with and AUL

3.3 Evaluation and Comparison of Remedial Alternatives

Each remedial alternative identified above was first evaluated to determine whether it could achieve a condition of No Significant Risk at the Site as required by the MCP. Those alternatives that were deemed capable of achieving No Significant Risk were further evaluated with respect to the comparative evaluation criteria specified at 310 CMR 40.0858 of the MCP. These criteria include: effectiveness, short- and long–term reliability, difficulty of implementation, cost, potential risks and timeliness. The cost estimates presented in this document are ballpark estimates that were prepared solely for the relative comparison of the identified alternatives and should not be used as design-level estimates. A description of each alternative and the results of the comparative analysis are presented in the following subsections.

3.3.1 Remedial Alternative #1: No Action

The No Action alternative involves no remedial actions and maintaining current Site conditions. Under the No Action alternative, future construction/utility workers and recreational users of the park may be exposed to elevated concentrations of EPH, lead and PAHs that were detected in soil. The No Action alternative will not achieve a condition of No Significant Risk as required by the MCP and would not prevent exposure to Site contaminants. Therefore, the No Action alternative will not meet the remedial action objectives and cleanup goals and will not be evaluated further with respect to the comparative evaluation criteria.

3.3.2 Remedial Alternative #2: In-situ Bioventing

Remedial Alternative #2 consists of delivery of ambient air to the subsurface soils to create an aerobic environment to enhance bioremediation (microbial degradation) of organic compounds (EPH in Area 1 and PAH in Area 2) through a process called bioventing. Based on estimated design parameters, two bioventing points would be installed in Area 1 and six bioventing points would be installed in Area 2. Air would be injected from the ground surface to a depth of six-feet bgs in Area 1 and four-feet bgs in Area 2 using a blower installed in an on-site shed. It is assumed that bioventing would be conducted monthly for a period of 5 years. This Alternative would not address lead in soil in Area 1.

A general, order of magnitude cost for implementing Remedial Alternative #2 is $228,650. Specific cost components related to this remedy are detailed in Table 4.

3.3.3 Remedial Alternative #3: In-situ Chemical Oxidation (ISCO)

Remedial Alternative #3 consists of injecting chemical oxidation reagents to destroy organic compounds (EPH in Area 1 and PAH in Area 2). Under this remedial alternative, chemical oxidizing reagents would be injected directly into the subsurface soils prior to re-development activities using a direct push drilling rig.

The injection points would be spaced five-feet on center within the areas requiring remediation for a total of 38 injection points. The reagents would be injected from a distance of one-foot bgs to six-feet bgs with 10 injection wells in Area 1 and from one to four-feet bgs at 28 injection wells in Area 2. Based on similar project experience, two injections are typically required to oxidize contaminants in-situ. Therefore, the cost estimate is based on two injection events. The rate of ISCO reagent injection would be 22 pounds per foot for the first injection and 18 pounds per foot for the second. This Alternative would not address lead in soil in Area 1.

The estimated cost for implementing Remedial Alternative #3 is $165,330. Specific cost components related to this remedy are detailed in Table 5.

3.3.4 Remedial Alternative #4: Soil Excavation

Remedial Alternative #4 consists of removing soils targeted for remediation during re-development of the Site and backfilling with clean soil. Under this remedial alternative, soil in Area 1 and Area 2 will be excavated and disposed off site. The depth to groundwater at the Site is expected to be between four and five feet below the ground surface. Some minor excavation dewatering will likely be required in order to excavate soils within Area 1 depending on the groundwater elevation at the time of the work. TRC anticipates that up to 1,000 gallons and of groundwater would be pumped from the excavation using a submersible pump or a vacuum tank truck. Excavation water may be temporarily stored onsite in a holding tank (i.e. fractionation tank) pending transportation via a vacuum tank truck for disposal at a licensed disposal facility.

Estimated soil volume to be excavated, removed, and backfilled is:

Area 1 $$\frac{(800\,sf \times 6\,ft)}{27\frac{cy}{cf}} = 177cy$$

Area 2 $$\frac{(3000\,sf \times 4\,ft)}{27\frac{cy}{cf}} = 444cy$$

In addition about 327 cubic yards of park construction derived soil containing detectable oil and hazardous materials will be excavated and disposed of off-Site.

The estimated cost for implementing Remedial Alternative #4 is $276,786. Specific cost components related to this remedy are detailed in Table 6.

3.3.5 Remedial Alternative #5: Soil Excavation and Capping with AUL

Remedial Alternative #5 consists of removing soils targeted for remediation during re-development of the Site and backfilling with clean soil. Under this remedial alternative, soil in Area 1 will be excavated and disposed off site and soil in Area 2 will be capped with a four-inch thick permanent concrete cap constructed as part of park redevelopment. The depth to groundwater at the Site is expected to be between four and five feet below the ground surface. Some minor excavation dewatering will likely be required in order to excavate soils within Area 1 depending on the groundwater elevation at the time of the work. TRC anticipates that up to 1,000 gallons and of groundwater would be pumped from the excavation using a submersible pump or a vacuum tank truck. Excavation water may be temporarily stored onsite in a holding tank (i.e. fractionation tank) pending transportation via a vacuum tank truck for disposal at a licensed disposal facility.

Estimated soil volume to be excavated, removed, and backfilled is:

Area 1 $$\frac{(800\,sf \times 6\,ft)}{27\frac{cy}{cf}} = 177cy$$

In addition about 65 cubic yards of park construction derived soil containing detectable oil and hazardous materials will be excavated and reused on-Site beneath a landscape mound. A minimum of one-foot of clean soil will be placed over the soil containing detectable oil and hazardous materials to further reduce the potential for human and environmental exposures at the

Site. About 262 cubic yards of park construction derived soil containing detectable oil and hazardous materials that will not fit under the grass mound will be excavated and disposed of or recycled off-Site. Trees and vegetation will also be planted within unpaved areas of the Site to promote phytoremediation of contaminants toward background conditions.

The estimated cost for implementing Remedial Alternative #5 is $241,915. Specific cost components related to this remedy are detailed in Table 7.

3.3.6 Comparison to Comparative Evaluation Criteria

This section presents a relative comparison of the selected remedial alternatives to the comparative evaluation criteria contained in 310 CMR 40.0858 of the MCP.

Effectiveness – Under the four remedies considered, soils will be removed, treated, or isolated to address EPH and PAHs. However, Alternatives #2 and #3 will not address lead in soil in Area 1. Alternatives #4 and #5 both address lead in soil in Area 1 by removal and off-Site disposal or recycling. Therefore, Alternatives #4 and #5 are considered the most effective for reducing risks and achieving a Permanent Solution under the MCP, 310 CMR 40.1000, and achieving or approaching background conditions for the Site.

Reliability – Remedial Alternatives #4 and #5 are more reliable than the other alternatives in preventing exposure to future users of the Site because the contaminated soil is completely removed. Because of the relatively simple nature of design and construction, there is very low potential for failure associated with Remedial Alternatives #4 and #5. In-situ chemical oxidation and bioventing rely on direct contact of the additive (oxidant or air) with the contaminated soil. Since there is some variability in the soil that may prevent or limit distribution of the additives, Alternatives #2 and #3 are less reliable than Alternative #4.

Difficulty of Implementation – Excavation and off-site disposal of contaminated soil and/or capping would be comparatively easy to implement and could be performed as part of the redevelopment of the Site. Alternatives #2 and #3 would be more difficult to implement, since they rely on installation of multiple injection points, piping and/or electrical equipment, which would in turn require modifications to the current re-development design. In addition, under Alternative #3, special permits may be required to inject oxidants into the ground nearby the South River.

Cost-Benefit – The cost to implement Remedial Alternative #5 is less than the other alternatives and is considered more beneficial to the current re-development plans for the Site.

Potential Risks – The potential short-term and long-term risks associated with each alternative are considered low to moderate. Potential short-term risks associated with soil excavation/disposal include possible accidental spills of contaminated soil during soil transport, which could result in short-term exposure to the contaminated soil by surrounding human populations. However, any accidental spill of contaminated soil would be immediately cleaned-up so the duration of any potential human exposure to the contaminated soil would be extremely short-term. The short term risks for bioventing would be low, whereas the short term risks for

ISCO would be higher (i.e., moderate) due to concerns over worker health and safety while working with chemical reagents which are strong oxidizers.

Timeliness – The following estimated time frames are associated with implementation of each alternative:

- Remedial Alternative #2: In-situ Bioventing – 5 years
- Remedial Alternative #3: ISCO – 12 months
- Remedial Alternative #4: Soil Excavation – 1 month
- Remedial Alternative #5: Soil Excavation and Capping with AUL – 2 months

Based on the above, remedial Alternative #4 is the timeliest of the alternatives. However, the additional time required for Alternative #5 is associated with construction of a concrete cap in Area 2 during Site redevelopment. Because this activity would occur during planned park construction, there is no adverse impact to the timeliness of Alternative #5.

3.4 Selection of Remedial Alternative

The No Action Alternative (Remedial Alternative #1) was included in this analysis for comparative purposes only and is not a feasible alternative because it does not meet the remedial action objectives. Alternatives #2 and #3 do not meet the remedial action objective because they do not address concentrations of lead in soil. Remedial Alternatives #4 and #5 were considered the most effective in terms of its ability to achieve a Permanent Solution and a level of No Significant Risk. Remedial Alternatives #4 and #5 are more reliable, easier to implement and would take less time to complete than Alternatives #2 and #3. The cost to implement Remedial Alternative #5 is lower than the cost to implement Alternative #4. Therefore, Alternative #5 is chosen as the preferred remedial alternative.

4.0 RESPONSE ACTION PLAN

4.1 Disposal Site Ownership and Regulatory Status

The name, address, telephone number and relationship to the Site of the person assuming responsibility for conducting the response actions are provided below.

Ms. Lynn Goonin Duncan
Director
Department of Planning and Community Development
120 Washington Street
Salem, Massachusetts 01970
(978) 745-9595

The Licensed Site Professional (LSP) overseeing the response actions is:

Mr. Matthew E. Robbins, PG
LSP License Number: 9495
TRC Environmental Corporation
Wannalancit Mill – 650 Suffolk Street
Lowell, Massachusetts 01854
(978) 656-3549

One RTN is associated with the Site. The City of Salem submitted a Release Notification Form (RNF) to the MassDEP per the MCP which was received by MassDEP on January 25, 2006, notifying the MADEP of impacted soil at the Site. The release was assigned RTN 3-25611. A Phase I Completion Statement was prepared and received by MassDEP on January 25, 2007. A Tier Classification was prepared and submitted to MassDEP in February 2007 and the Site was classified as a Tier II Site.

4.2 Proposed Response Actions

Alternative #5 as described in the Alternatives Analysis will be implemented in conjunction with the redevelopment of the Site as a park that will be conducted by the City of Salem. The objectives of the proposed RAM are to remove soil with EPH and lead impacted soils in Area 1 and construct a 3000 square foot permanent concrete cap over PAH impacted soils in Area 2 to eliminate the potential risk to future construction/utility workers and park users of the Site. Approximately 177 cubic yards of contaminated soil will be excavated from Area 1 to achieve this objective. The approximate limits of excavation have been determined by the analytical data from the January 2001, January 2005, and April 2008 soil sampling efforts as shown on Figure 4. It is expected that up to 65 cubic yards of additional construction derived soil with concentrations above reportable limits will be reused on-Site and 262 cubic yards will be disposed or recycled off-Site during construction of the park. An AUL will be recorded for the Site to limit potential future residential Site use and potential future use of the Site for gardening.

4.2.1 Soil Excavation

Excavation will be conducted using conventional excavation equipment such as an excavator, backhoe or Bobcat®. TRC personnel will be present during Site activities to oversee the excavation, stockpiling and off-Site transport of soil. During excavation, excavated soils will be visually examined and screened using a PID to segregate highly contaminated soils from less contaminated or uncontaminated soils. Soils that are excavated from each area described above will be segregated and stockpiled separately from one another in order to maximize off-Site soil disposal options.

4.2.2 Soil Management

Soil will either be stockpiled pending characterization or directly loaded onto trucks for transportation to the disposal facility. At this time one representative sample of the soil has been collected and analyzed for disposal characterization parameters (Table 7). The results of this sample may be sufficient to be used to characterize the soil for disposal, depending on the permit conditions of the receiving facility(s). In that case, the soil may be directly loaded onto trucks for transportation under an MCP Bill of Lading.

If additional characterization of the soil is required, the soil will be stockpiled on 6-mil polyethylene plastic sheeting and sampled for characterization parameters. A row of hay bales will be placed around the stockpile and the bottom layer of plastic sheeting will be draped over the hay bales to create a berm to contain the soil. The soil stockpile will be covered with 6-mil polyethylene sheeting that will be held in place using hay bales or something similar. Following characterization, the soil will be transported off-site for disposal under a MassDEP Bill of Lading (BOL) or uniform Hazardous Waste Manifest as applicable. Stockpiled soil will be removed from the Site within 120 days of stockpiling as required by the MCP.

Based on available soil analytical data it is expected that petroleum contaminated soil will be transported to an asphalt recycling facility for treatment and that lead contaminated soils will be transported to a landfill for disposal as non-hazardous material after stabilization.

4.2.3 Erosion Control

Erosion will be controlled by placing an erosion control barrier around the perimeter of the Site and by covering all stockpiled soil with plastic sheeting as described above. Sedimentation will be controlled by placing hay bales around catch basins and/or installing "silt bags" (i.e. geotextile liners) into catch basins to prevent any eroded soil from entering the storm drain system. A construction entrance will be constructed to prevent transport of contaminants off-Site from vehicles entering and leaving the Site.

4.2.4 Environmental Monitoring

TRC will be on-site during response action activities to direct the excavation, segregate and stockpile soil, and perform soil screening and environmental monitoring of the breathing zone for VOCs using a PID.

Ambient air monitoring will also be performed around the perimeter of the Site during excavation activities. Air monitoring will be performed using hand-held monitoring equipment to ensure that the remedial activities are not resulting in odor and/or nuisance dust conditions for surrounding populations. If nuisance and/or dust conditions are found to exist, corrective actions will be implemented, which may include one or more of the following actions:

- Temporarily discontinuing or slowing work;
- Implementing dust suppression (i.e., wetting soils);
- Covering soil stockpiles; or
- Other necessary corrective actions.

4.2.5 Confirmation Sampling

TRC will collect up to ten confirmatory soil samples from the side walls and floor of the excavation. The samples will be analyzed for EPH, PAHs and lead with a standard turnaround time of 5 days. Construction fencing and/or barricades will be maintained around the excavations to restrict access to the area pending receipt of the confirmatory sample results and backfilling.

4.2.6 Backfill

Once the laboratory results confirm that the objectives of the response action have been achieved, Area 1 will be backfilled flush to grade with about 177 cubic yards of clean, imported backfill. Imported backfill will be tested at least once from each source to confirm that it is not contaminated with oil or hazardous materials.

4.2.7 Cap Construction

A permanent cap consisting of about 3000 square feet of four-inch thick concrete will be placed over Area 2, as specified on the Site Plan. In addition, about 2383 square feet of four-inch thick concrete and 1707 feet of two-inch thick poured rubber will be placed over the eastern and northern portion of the Site to further limit potential exposures to soils at the Site (Figure 4).

4.2.8 Landscape Restoration

The areas of soil excavation within the remediation grove totaling about 2941 square feet will be restored with 6 inches of loam and planted with grasses, vegetation, and trees selected to promote further reduction of residual PAH concentrations toward background conditions.

4.3 Health and Safety

TRC has prepared Health and Safety Plan addressing environmental sampling activities and implementation of the remedial response actions at the Site. The City's remedial contractor will prepare a Health and Safety Plan addressing implementation of the remedial response actions at the Site.

4.4 Permits and Approvals

The City's remedial contractor will prepare and submit a Fence Permit Application to the City of Salem Department of Inspectional Services for installation of a temporary security fence and/or barrier around the rail trail embankment soil excavation area.

The City's remedial contractor will secure a Dig Safe® authorization to perform subsurface digging at the Site prior to remedial implementation.

Public involvement notices have been submitted to the Mayor's Office and the Board of Health concurrent with RAM Plan accordance with the MCP.

4.5 Property Issues

Remedial response actions will be performed on property owned by the City of Salem. The City of Salem Department of Planning and Community Development will coordinate performance of response action on the Site with City's Public Works and Parks and Recreation Departments. The Department of Planning and Community Development with also provide the City's Animal Control Officer with advance notice of the start of work at the Site in anticipation of potential displacement of rodents from the stone wall along the South River.

4.6 Reporting

At the completion of site work, the LSP of Record will conduct a final inspection in accordance with the MCP (310 CMR 40.0879) and a Phase IV As-Built Construction Report and Completion Statement in accordance with the MCP (310 CMR 400875). The As-Built report will include a description of soil removal activities and cap construction, a summary of environmental monitoring and the analytical results of confirmatory soil sampling. Following completion of park construction, an AUL and Class A-3 RAO will be prepared and submitted to MassDEP.

4.7 Schedule

Excavation activities will be conducted as part of the construction of the park, which is tentatively scheduled to commence during the fall of 2008. Excavation activities can likely be completed in five days. If required, laboratory results for excavated soil characterization sample(s) will be available approximately two weeks following completion of excavation and the stockpiled soil will be removed from the site within 120 days as required by the MCP (310 CMR 40.0030). A Phase IV As-Built Construction Report, AUL and RAO should be submitted to MassDEP for this work by the end of the spring of 2009, depending on the park construction schedule.

5.0 FEASIBILITY OF ACHIEVING BACKGROUND

The remedial alternative selected for this Site (Excavation of Soils and Capping) will not achieve background conditions. However, based on the analysis of remedial response action alternative the achievement of background conditions will be disproportionate to the incremental cost to achieve a condition of No Significant Risk.

6.0 DATA USABILITY

The data associated with soil samples collected on April 14, 2008 and groundwater samples collected on April 21, 2008 were reviewed. In general, the data are usable for MCP decisions based on a review of accuracy, precision, and sensitivity of the data. Although there were select quality control (QC) nonconformances, the data are valid as reported and may be used for decision-making purposes with the following caution.

- Potential uncertainty exists for the arsenic results in soil samples SB-6/2, SB-7/3, and SB-10/3 due to laboratory duplicate variability. These results are slightly below the project action levels and therefore the decision-making process may be affected by the variability.

Details on the data usability assessment are provided in Appendix F.

Table 1
Summary of Soil Boring and Monitoring Well Construction and Water Levels
15 Peabody Street
Salem Massachusetts

GMRC Soil Boring/Well Designation	TRC Soil Boring/Well Designation*	Drilling/Install Date	Drilled Depth (feet BGS)	Height of PVC Casing (feet AGS)	Well Depth (feet BTOC)	Well Depth (feet BGS)	Well Screen Interval (feet BGS)	Elevation of PVC Casing (feet)	2/7/2001 Depth to Groundwater (feet BTOC)	2/7/2001 Depth to Groundwater (feet BGS)	2/7/2001 Groundwater Elevation (feet)	2/15/2001 Depth to Groundwater (feet BTOC)	2/15/2001 Depth to Groundwater (feet BGS)	2/15/2001 Groundwater Elevation (feet)
B-101/MW-101	MW-4	1/29/2001	11.5	3.0	14.0	11.0	6-11	103.66	7.50	4.50	96.16	7.40	4.40	96.26
B-102/MW-102	MW-3	1/29/2001	12.0	3.4	14.4	11.0	6-11	104.65	8.51	5.10	96.14	8.41	5.00	96.24
B-103/MW-103	MW-2	1/29/2001	11.5	3.2	10.2	7.0	2-7	103.16	8.31	5.10	94.85	8.41	5.20	94.75
B-104/MW-104	MW-1	1/29/2001	11.5	2.6	9.5	7.0	2-7	102.85	7.35	4.80	95.50	7.35	4.80	95.50
NA	SB-1	1/19/2005	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2A	1/19/2005	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2B	1/19/2005	3.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2C	1/19/2005	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-3	1/19/2005	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-4	1/19/2005	10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-5A	1/19/2005	5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-5B	1/19/2005	5.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-6	4/14/2008	7.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-7	4/14/2008	4.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-8	4/14/2008	4.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-9	4/14/2008	7.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-10/MW-5	4/14/2008	12.0	-0.31	12.00	12.0	2-12	99.80	NA	NA	NA	NA	NA	NA
NA	SB-11	4/14/2008	8.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GMRC - Gulf of Maine Research Company
TRC - TRC Company
* Identification assigned by TRC during the June 2005 Phase II.
BGS - Below Ground Surface
AGS - Above Ground Surface
BTOC - Below Top of Casing

Table 1
Summary of Soil Boring and Monitoring Well Construction and Water Levels
15 Peabody Street
Salem Massachusetts

GMRC Soil Boring/Well Designation	TRC Soil Boring/Well Designation*	2/19/2005 - Low Tide			2/19/2005 - High Tide			4/21/2008 - Low Tide			5/20/2008 - Low Tide		
		Depth to Groundwater (feet BTOC)	Depth to Groundwater (feet BGS)	Groundwater Elevation (feet)	Depth to Groundwater (feet BTOC)	Depth to Groundwater (feet BGS)	Groundwater Elevation (feet)	Depth to Groundwater (feet BTOC)	Depth to Groundwater (feet BGS)	Groundwater Elevation (feet)	Depth to Groundwater (feet BTOC)	Depth to Groundwater (feet BGS)	Groundwater Elevation (feet)
B-101/MW-101	MW-4	7.20	4.20	96.46	7.23	4.23	96.43	7.45	4.45	96.21	7.27	4.27	96.39
B-102/MW-102	MW-3	8.15	4.74	96.50	8.15	4.74	5.85	8.39	4.98	96.26	8.22	4.81	96.43
B-103/MW-103	MW-2	7.85	4.64	95.31	6.90	3.69	8.10	8.01	4.80	95.15	7.98	4.77	95.18
B-104/MW-104	MW-1	7.15	4.60	95.70	6.50	3.95	96.35	7.22	4.67	95.63	7.18	4.63	95.67
NA	SB-1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-2C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-5A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-5B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
NA	SB-10/MW-5	NA	NA	NA	NA	NA	NA	3.91	4.22	95.89	2.83	3.14	96.97
NA	SB-11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

GMRC - Gulf of Maine Research Comp
TRC - TRC Company
* Identification assigned by TRC during
BGS - Below Ground Surface
AGS - Above Ground Surface
BTOC - Below Top of Casing

Table 2
Summary of Analytical Results for Soil - 2001, 2005, and 2008
15 Peabody Street
Salem, Massachusetts

Analysis	Analyte	S-1/GW-3	UCLs	Background	MW-1		MW-2	MW-3	MW-4	SB-1	SB-2C	SB-3		SB-4	SB-6
				Sample ID:	B-104	B-104	B-103	B-102	B-101	SB-1	SB-2C	SB-3	SB-3	SB-4	SB-6
				Sample Depth (Ft.):	3	5 - 7	3	3	3	1.5 - 5.5	1.5 - 5.5	1 - 5	1 - 5	1.5 - 5	2
				Sample Date:	1/29/2001	1/29/2001	1/29/2001	1/29/2001	1/29/2001	1/19/2005	1/19/2005	1/19/2005	1/19/2005 Field Dup	1/19/2005	4/14/2008
VOCs (mg/kg)	Tetrachloroethylene	30	10,000	NS	0.112 U	0.112 U	0.088 U	**0.134**	0.088 U	NA	NA	NA	NA	NA	0.002 U
	Trichloroethylene	90	10,000	NS	0.078 U	0.078 U	0.078 U	**0.871**	0.078 U	NA	NA	NA	NA	NA	**0.014**
	Vinyl Acetate	NS	NS	NS	1.28 U	1.28 U	1.28 U	**12.2**	1.28 U	NA	NA	NA	NA	NA	NA
	Chloroform	400	8,000	NS	0.063 U	0.063 U	**0.095**	0.063 U	0.063 U	NA	NA	NA	NA	NA	0.004 U
	1,2,4-Trimethylbenzene	100(1)	5,000(1)	NS	0.055 U	0.055 U	**0.216**	0.055 U	0.055 U	NA	NA	NA	NA	NA	0.002 U
VPH (mg/kg)	C9-C10 Aromatics	100	5,000	NS	2.05 U	2.31 U	2.13 U	2.12 U	2.04 U	7.2 U	**39**	8.8 U	9.7 U	18 U	NA
	C9-C12 Aliphatics	1,000	20,000	NS	2.4 U	2.71 U	2.51 U	2.49 U	2.39 U	7.2 U	**22**	8.8 U	9.7 U	18 U	NA
	Naphthalene	500	10,000	1	**0.155**	0.013 U	0.012 U	**0.158**	**0.603**	0.36 U	0.29 U	0.44 U	**0.48**	**9.5**	NA
	Xylenes	500	10,000	NS	0.066 U	0.074 U	**0.195**	0.068 U	0.065 U	0.36 U	0.29 U	0.44 U	0.48 U	0.89 U	NA
EPH (mg/kg)	C9-C18 Aliphatics	1,000	20,000	NS	20.3 U	22.9 U	20.6 U	20.1 U	50.9 U	**21**	**310**	12 U	12 U	16 U	35.3 U
	C19-C36 Aliphatics	3,000	20,000	NS	**325**	**27.4**	**398**	**7.6**	**72.1**	25 U	**860**	**76 J**	**36 J**	**95**	**51.7**
	C11-C22 Aromatics	1,000	10,000	NS	**229**	**21.8**	**237**	**15.7**	**182**	**67**	**940**	**82 J**	**48 J**	**350**	**344**
	Acenaphthene	1,000	10,000	2	5.6 U	0.6 U	**1.2**	0.6 U	**1.6**	0.63 U	0.63 U	0.59 U	0.60 U	**0.97**	**5.3**
	Acenaphthylene	10	10,000	1	5.6 U	0.6 U	0.6 U	0.6 U	1.4 U	0.63 U	0.63 U	0.59 U	0.60 U	0.78 U	**0.3**
	Anthracene	1,000	10,000	4	5.6 U	0.6 U	**3.9**	0.6 U	**4**	0.63 U	0.63 U	0.59 U	0.60 U	**3.6**	**10.5**
	Benzo(a)anthracene	7	3,000	9	5.6 U	0.6 U	**7.8**	0.6 U	**8.4**	0.63 U	**1.6**	0.59 U	0.60 U	**12**	**17.7**
	Benzo(a)pyrene	2	300	7	**6.5**	0.6 U	**4.6**	0.6 U	**8.1**	0.63 U	**1.4**	0.59 U	0.60 U	**9.0**	**16.6**
	Benzo(b)fluoranthene	7	3,000	8	**8.7**	0.6 U	**10.5**	0.6 U	**8.8**	0.63 U	**2.1**	0.59 U	0.60 U	**17**	**23.0**
	Benzo(g,h,i)perylene	1,000	10,000	3	**7.2**	0.6 U	**3.5**	0.6 U	1.4 U	0.63 U	0.63 U	0.59 U	0.60 U	**5.9**	**7.7**
	Benzo(k)fluoranthene	70	10,000	4	5.6 U	0.6 U	**2.8**	0.6 U	**5.1**	0.63 U	0.63 U	0.59 U	0.60 U	**5.8**	**7.6**
	Chrysene	70	10,000	7	6	0.6 U	**8.4**	0.6 U	**8.9**	0.63 U	**1.3**	0.59 U	0.60 U	**16**	**18.9**
	Dibenzo(a,h)anthracene	0.7	300	1	5.6* U	0.6 U	**2.2**	0.6 U	**2.8**	0.63 U	0.63 U	0.59 U	0.60 U	**2.2**	**1.9**
	Fluoranthene	1,000	10,000	10	**10.9**	**11**	**14.2**	**1.1**	**18.7**	0.63 U	0.63 U	**1.5**	**1.5**	**29**	**55.3**
	Fluorene	1,000	10,000	2	5.6 U	0.6 U	**1.4**	0.6 U	**1.7**	0.63 U	0.63 U	0.59 U	0.60 U	**1.2**	**5.4**
	Indeno(1,2,3-cd)pyrene	7	3,000	3	**7.2**	0.6 U	**2.7**	0.6 U	**3.6**	0.63 U	0.63 U	0.59 U	0.60 U	**6.1**	**8.7**
	2-Methylnaphthalene	300	5,000	1	5.6 U	0.6 U	0.6 U	0.6 U	1.4 U	0.63 U	0.63 U	0.59 U	0.60 U	0.78 U	**1.2**
	Naphthalene	500	10,000	1	**0.268**	0.6 U	**0.542**	0.6 U	1.4 U	0.63 U	0.63 U	0.59 U	0.60 U	0.78 U	**2.0**
	Phenanthrene	500	10,000	20	**7.8**	**1.0**	**17.1**	**0.8**	**14.1**	0.63 U	0.63 U	**0.82**	**0.85**	**20**	**48.2**
	Pyrene	1,000	10,000	20	**11.4**	**1.2**	**19.1**	**0.9**	**21.1**	0.63 U	**1.8**	**1.4**	**1.4**	**24**	**53.5**
PCB Aroclors (mg/kg)	Aroclor 1260	2	100	NS	**0.156**	0.032 U	**0.217**	0.028 U	0.028 U	0.037 U	**0.050**	**0.053**	**0.064**	0.046 U	0.118 U
	PCBs	2	100	NS	**0.156**	0.032 U	**0.217**	0.028 U	0.028 U	0.037 U	**0.050**	**0.053**	**0.064**	0.046 U	0.118 U
Metals (mg/kg)	Antimony	20	300	7	NA	NA	NA	NA	NA	**2.1 J**	**3.3 J**	**1.8 J**	**1.9 J**	**3.2 J**	4.71 U
	Arsenic	20	200	20	**19.1**	**13.3**	**7.2**	**18.4**	**14.3**	**5.0 J**	**13.1 J**	**11.7 J**	**12.5 J**	**38.5 J**	**19.8**
	Barium	1,000	10,000	50	**85.4**	**49.6**	**115**	**161**	**251**	**40.7**	**36.8**	**79.7**	**53.5**	**107**	**424**
	Beryllium	100	2,000	0.9	NA	NA	NA	NA	NA	0.30 U	**0.39 J**	**0.47 J**	**0.46 J**	**0.61 J**	0.30 U
	Cadmium	2	300	3	**0.42**	**0.34**	**0.26**	**0.27**	**0.62**	**3.0**	**4.2**	**1.8 J**	**2.0 J**	**3.7**	**0.90**
	Chromium	30	2,000	40	**20.5**	**27.2**	**11.8**	**22.6**	**12.8**	**15.6**	**23.4**	**13.9**	**13.3**	**34.2**	**24.1**

Table 2
Summary of Analytical Results for Soil - 2001, 2005, and 2008
15 Peabody Street
Salem, Massachusetts

Analysis	Analyte			Sample Location:	MW-1		MW-2	MW-3	MW-4	SB-1	SB-2C	SB-3		SB-4	SB-6
				Sample ID:	B-104	B-104	B-103	B-102	B-101	SB-1	SB-2C	SB-3	SB-3	SB-4	SB-6
				Sample Depth (Ft.):	3	5 - 7	3	3	3	1.5 - 5.5	1.5 - 5.5	1 - 5	1 - 5	1.5 - 5	2
				Sample Date:	1/29/2001	1/29/2001	1/29/2001	1/29/2001	1/29/2001	1/19/2005	1/19/2005	1/19/2005	1/19/2005 Field Dup	1/19/2005	4/14/2008
		S-1/GW-3	UCLs	Background											
	Lead	300	3,000	600	**65.1**	**31.9**	**89.2**	**125**	**162**	**188 J**	**555 J**	**24.5 J**	**17.9 J**	**107 J**	**321**
	Nickel	20	7,000	30	NA	NA	NA	NA	NA	**21.8**	**36.2**	**12.3**	**12.6**	**32.7**	**30.3**
	Silver	100	2,000	5	0.56 U	0.63 U	0.57 U	0.56 U	0.56 U	**8.3 J**	**4.7 J**	**1.7 J**	1.6 U	**11.2 J**	**0.60**
	Vanadium	600	10,000	30	NA	NA	NA	NA	NA	**17.0**	**59.7**	**37.6**	**33.3**	**39.6**	**53.1**
	Zinc	2,500	10,000	300	NA	NA	NA	NA	NA	**91.3 J**	**188 J**	**60.4 J**	**75.9 J**	**170 J**	**368**
	Mercury	20	300	1	**0.277**	**0.097**	**0.46**	**0.395**	**0.422**	**0.25 J**	**0.65 J**	**0.16 J**	**0.19 J**	**0.17 J**	NA

Notes:

mg/kg = milligram per kilogram (dry weight) or parts per million (ppm).
NA - Sample not analyzed for the listed analyte.
J - Estimated value.
U - Compound was not detected at specified quantitation limit.
Values in **Bold** indicate the compound was detected.
Values shown in Bold and shaded type exceed the MCP Method 1 S-1/GW-3 standards.
Values shown in Bold and with double line border exceed the listed UCLs.
VOCs - Volatile Organic Compounds.
VPH - Volatile Petroleum Hydrocarbons.
EPH - Extractable Petroleum Hydrocarbons.
PCBs - Polychlorinated Biphenyl.
UCLs - MCP Method 3 Upper Concentration Limits.
Background - Background Concentration for soil containing coal ash/wood ash.
(1) - MCP Method 1 standards for C9-C10 aromatic hydrocarbons used.
* - Reporting limit is greater than the listed standard.
EPC - Exposure Point Concentration. EPCs were calculated using the arithmetic mean concentration for each analyte. For non-detect values (qualified with a "U"), half of the quantitation limit was used in the EPC calculation. For field duplicates, only the higher values of the pairs are used.

Table 2
Summary of Analytical Results for Soil - 2001, 2005, and 2008
15 Peabody Street
Salem, Massachusetts

Analysis	Analyte			Sample Location:	SB-7	SB-8	SB-9		SB-10		SB-11			
				Sample ID:	SB-7	SB-8	SB-9	SB-9	SB-10	SB-10	SB-11	SB-11	SB-11	
				Sample Depth (Ft.):	3	3	2	5	3	4	3	6	6	
				Sample Date:	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008 Field Dup	*EPC*
		S-1/GW-3	UCLs	Background										
VOCs (mg/kg)	Tetrachloroethylene	30	10,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.06***
	Trichloroethylene	90	10,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.17***
	Vinyl Acetate	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***2.95***
	Chloroform	400	8,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.04***
	1,2,4-Trimethylbenzene	100[(1)]	5,000[(1)]	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.05***
VPH (mg/kg)	C9-C10 Aromatics	100	5,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***6.86***
	C9-C12 Aliphatics	1,000	20,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***5.08***
	Naphthalene	500	10,000	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	***1.25***
	Xylenes	500	10,000	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.15***
EPH (mg/kg)	C9-C18 Aliphatics	1,000	20,000	NS	34.6 U	33.3 U	34.1 U	38.6 U	36.8 U	**781**	36.0 U	36.5 U	36.4 U	***74.22***
	C19-C36 Aliphatics	3,000	20,000	NS	34.6 U	33.3 U	34.1 U	38.6 U	36.8 U	**3,510**	**45.6**	36.5 U	36.4 U	***310.4***
	C11-C22 Aromatics	1,000	10,000	NS	**69.5**	**150**	34.1 U	38.6 U	**61.7**	**3,480**	**40.9**	**100**	**61.5**	***355.9***
	Acenaphthene	1,000	10,000	2	**0.4**	**1.5**	0.2 U	0.2 U	**0.2**	1.3 U	0.2 U	0.2 U	0.2 U	***0.92***
	Acenaphthylene	10	10,000	1	**0.2**	**0.3**	0.2 U	0.2 U	0.2 U	1.3 U	0.2 U	0.2 U	0.2 U	***0.43***
	Anthracene	1,000	10,000	4	**1.3**	**4.0**	0.2 U	0.2 U	**0.5**	1.3 U	0.2 U	0.2 U	0.2 U	***1.84***
	Benzo(a)anthracene	7	3,000	9	**3.7**	**8.0**	0.2 U	**0.2**	**1.2**	1.3 U	**0.3**	0.2 U	0.2 U	***3.65***
	Benzo(a)pyrene	2	300	7	**3.2**	**7.8**	0.2 U	**0.2**	**1.4**	1.3 U	**0.4**	0.2 U	0.2 U	***3.40***
	Benzo(b)fluoranthene	7	3,000	8	**5.7**	**11.6**	0.2 U	**0.3**	**1.8**	1.3 U	**0.5**	0.2 U	0.2 U	***5.11***
	Benzo(g,h,i)perylene	1,000	10,000	3	**2.2**	**4.5**	0.2 U	**0.2**	**0.9**	1.3 U	**0.3**	0.2 U	0.2 U	***1.97***
	Benzo(k)fluoranthene	70	10,000	4	**2.2**	**4.5**	0.2 U	0.2 U	**0.7**	1.3 U	0.2 U	0.2 U	0.2 U	***1.89***
	Chrysene	70	10,000	7	**4.4**	**9.2**	0.2 U	**0.4**	**1.5**	1.3 U	**0.4**	0.2 U	0.2 U	***4.30***
	Dibenzo(a,h)anthracene	0.7	300	1	**0.6**	**1.2**	0.2 U	0.2 U	**0.2**	1.3* U	0.2 U	0.2 U	0.2 U	***0.92***
	Fluoranthene	1,000	10,000	10	**10.8**	**13.4**	**0.2**	**0.5**	**3.6**	**3.5**	**0.5**	**0.3**	**0.2**	***9.73***
	Fluorene	1,000	10,000	2	**0.5**	**1.7**	0.2 U	0.2 U	**0.2**	1.3 U	0.2 U	0.2 U	0.2 U	***0.97***
	Indeno(1,2,3-cd)pyrene	7	3,000	3	**2.4**	**4.8**	0.2 U	**0.2**	**0.9**	1.3 U	**0.3**	0.2 U	0.2 U	***2.18***
	2-Methylnaphthalene	300	5,000	1	**0.2**	**0.5**	0.2 U	0.2 U	0.2 U	**1.7**	0.2 U	0.2 U	0.2 U	***0.55***
	Naphthalene	500	10,000	1	**0.5**	**0.9**	0.2 U	0.2 U	0.2 U	**1.9**	0.2 U	0.2 U	0.2 U	***0.51***
	Phenanthrene	500	10,000	20	**7.8**	**19.1**	0.2 U	**0.6**	**2.8**	**4.3**	**0.3**	0.2 U	0.2 U	***8.09***
	Pyrene	1,000	10,000	20	**10.0**	**22.8**	**0.2**	**0.7**	**3.9**	**2.4**	**0.7**	0.2 U	**0.4**	***9.77***
PCB Aroclors (mg/kg)	Aroclor 1260	2	100	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.06***
	PCBs	2	100	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.06***
Metals (mg/kg)	Antimony	20	300	7	4.61 U	4.43 U	4.54 U	5.15 U	4.91 U	4.88 U	**32.6**	4.88 U	4.85 U	***4.78***
	Arsenic	20	200	20	**15.3**	**12.0**	**4.91**	**5.65**	**19.1**	**7.58**	**10.5**	3.05 U	3.03 U	***13.21***
	Barium	1,000	10,000	50	**82.7**	**108**	**82.8**	**31.9**	**3,570**	**1,100**	**194**	**16.0**	**14.8**	***363.1***
	Beryllium	100	2,000	0.9	0.29 U	**0.32**	**0.30**	0.33 U	**0.33**	0.31 U	0.30 U	0.31 U	0.31 U	***0.27***
	Cadmium	2	300	3	0.29 U	**0.72**	0.29 U	0.33 U	**1.03**	0.31 U	**1.22**	**0.39**	0.31 U	***1.09***
	Chromium	30	2,000	40	**15.6**	**15.8**	**7.06**	**19.8**	**19.1**	**6.03**	**11.3**	**13.6**	**13.6**	***17.47***

Table 2
Summary of Analytical Results for Soil - 2001, 2005, and 2008
15 Peabody Street
Salem, Massachusetts

Analysis	Analyte			Sample Location:	SB-7	SB-8	SB-9		SB-10		SB-11			
				Sample ID:	SB-7	SB-8	SB-9	SB-9	SB-10	SB-10	SB-11	SB-11	SB-11	
				Sample Depth (Ft.):	3	3	2	5	3	4	3	6	6	
				Sample Date:	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008	4/14/2008 Field Dup	*EPC*
		S-1/GW-3	UCLs	Background										
	Lead	300	3,000	600	**53.9**	**91.2**	**28.3**	**67.9**	**8,490**	**893**	**334**	**29.8**	**20.9**	***647.6***
	Nickel	20	7,000	30	**13.9**	**26.0**	**8.46**	**21.9**	**18.1**	**8.66**	**11.9**	**11.9**	**11.1**	***19.57***
	Silver	100	2,000	5	0.58 U	**0.82**	0.57 U	0.65 U	**0.64**	0.61 U	0.60 U	**1.15**	0.61 U	***1.78***
	Vanadium	600	10,000	30	**26.7**	**106**	**12.8**	**37.4**	**21.5**	**22.2**	**18.9**	**21.4**	**21.0**	***36.45***
	Zinc	2,500	10,000	300	**71.0**	**205**	**45.5**	**105**	**827**	**75.0**	**258**	**30.7**	**29.2**	***193.1***
	Mercury	20	300	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	***0.32***

Notes:

mg/kg = milligram per kilogram (dry weight) or parts per million (ppm).

NA - Sample not analyzed for the listed analyte.

J - Estimated value.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

Values shown in Bold and shaded type exceed the MCP Method 1 S-1/GW-3 standards.

Values shown in Bold and with double line border exceed the listed UCLs.

VOCs - Volatile Organic Compounds.

VPH - Volatile Petroleum Hydrocarbons.

EPH - Extractable Petroleum Hydrocarbons.

PCBs - Polychlorinated Biphenyl.

UCLs - MCP Method 3 Upper Concentration Limits.

Background - Background Concentration for soil containing coal ash/wood ash.

(1) - MCP Method 1 standards for C9-C10 aromatic hydrocarbons used.

* - Reporting limit is greater than the listed standard.

EPC - Exposure Point Concentration. EPCs were calculated using the arithmetic mean concentration for each analyte. For non-detect values (qualified with a "U"), half of the quantitation limit was used in the EPC calculation. For field duplicates, only the higher values of the pairs are used.

Table 3
Summary of Analytical Results for Groundwater - 2001 and 2005
15 Peabody Street
Salem, Massachusetts

Analysis	Analyte	Sample Location:	MW-1			MW-2			MW-3			MW-4				MW-5	
		Sample ID:	MW-104	MW-1	MW-1	MW-103	MW-2	MW-2	MW-102	MW-3	MW-3	MW-101	MW-4	MW-4	MW-4	MW-5	MW-5
		Sample Date:	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	2/15/2005 Field Dup	4/21/2008	4/21/2008	4/21/2008 Field Dup
	Analyte	**Method 1 GW-3**															
VOCs (ug/L)	1,2,4-Trimethylbenzene	50,000[1]	0.7 U	NA	NA	0.7 U	NA	NA	**2.3**	NA	NA	0.7 U	NA	NA	NA	NA	NA
	1,3,5-Trimethylbenzene	50,000[1]	1.0 U	NA	NA	1.0 U	NA	NA	**1.2**	NA	NA	1.0 U	NA	NA	NA	NA	NA
VPH (ug/L)	Ethylbenzene	5,000	0.4 U	5 U	NA	0.4 U	5 U	NA	**0.5**	5 U	NA	0.4 U	5 U	5 U	NA	NA	NA
	MTBE	50,000	2.1 U	5 U	NA	2.1 U	5 U	NA	**1.2**	5 U	NA	2.1 U	5 U	5 U	NA	NA	NA
	Naphthalene	20,000	3.2 U	5 U	NA	3.2 U	5 U	NA	**223**	**140**	NA	**58.7**	**18**	**21**	NA	NA	NA
EPH (ug/L)	C9-C18 Aliphatics	50,000	144 U	200 U	150 U	144 U	200 U	150 U	144 U	200 U	150 U	**196**	200 U	200 U	150 U	150 U	150 U
	C19-C36 Aliphatics	50,000	84.0 U	200 U	150 U	**91.8**	200 U	150 U	**1,730**	200 U	150 U	**1,450**	200 U	200 U	150 U	150 U	150 U
	C11-C22 Aromatics	5,000	48.0 U	**120**	100 U	48.0 U	**120**	100 U	**408**	**190**	**186**	**666**	**120**	**110**	**154**	**178**	**184**
	Acenaphthene	6,000	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**9.4**	**12**	**13.8**	5.0 U	5 U	5 U	**6.5**	2.0 U	2.0 U
	Acenaphthylene	40	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	5 U	5 U	5 U	2.0 U	2.0 U	2.0 U
	Anthracene	30	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**5.4**	5 U	**2.9**	**6.4**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Benzo(a)Anthracene	1,000	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**4.92**	5 U	2.0 U	**11.8**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Benzo(a)Pyrene	500	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**3.15**	5 U	2.0 U	**9.6**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Benzo(b)Fluoranthene	400	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**3**	5 U	2.0 U	**8.4**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Benzo(g,h,i)Perylene	20	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**2.02**	5 U	2.0 U	**5.6**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Benzo(k)Fluoranthene	100	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**2.45**	5 U	2.0 U	**9.8**	5 U	5 U	**2.3**	2.0 U	2.0 U
	Chrysene	70	10.8 U	5 U	2.0 U	10.8 U	5 U	2.0 U	**3.66**	5 U	2.0 U	**12.8**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Dibenz(a,h)Anthracene	40	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**0.605**	5 U	2.0 U	**1.5**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Fluoranthene	200	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**12.4**	5 U	**2.0**	**23.8**	5 U	5 U	2.0 U	2.0 U	2.0 U
	Fluorene	40	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**5.8**	5 U	**14.2**	5.0 U	5 U	5 U	**7.5**	2.0 U	2.0 U
	Indeno(1,2,3,c,d)Pyrene	100	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**1.85**	5 U	2.0 U	**5.2**	5 U	5 U	2.0 U	2.0 U	2.0 U
	2-Methylnaphthalene	20,000	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**6.4**	5 U	**14.1**	5.0 U	5 U	5 U	2.0 U	2.0 U	2.0 U
	Naphthalene	20,000	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**152**	5 U	**99.4**	**63.3**	**13**	**12**	**31.5**	2.0 U	2.0 U
	Phenanthrene	10,000	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**21**	5 U	**19.7**	**24.6**	**8**	**8**	**13.0**	2.0 U	2.0 U
	Pyrene	20	5.0 U	5 U	2.0 U	5.0 U	5 U	2.0 U	**10**	5 U	2.0 U	**23.4**	5 U	5 U	2.0 U	2.0 U	2.0 U
PCB Aroclors (ug/L)	PCBs	10	0.05 U	0.20 U	NA	0.05 U	0.20 U	NA	0.05 U	0.20 U	NA	**0.1**	0.20 U	0.20 U	NA	NA	NA
Metals, total (ug/L)	Antimony	8,000	NA	**8.1 J**	2.50 U	NA	3.7 UJ	2.50 U	NA	**6.1 J**	2.50 U	NA	2.5 UJ	2.5 UJ	2.50 U	2.50 U	2.50 U
	Arsenic	900	NA	**3.9**	**5.05**	NA	**1.8**	**2.15**	NA	**1.2**	1.00 U	NA	**3.1**	**3.2**	**2.23**	**20.4**	**19.9**
	Barium	50,000	NA	**20**	**18.0**	NA	**12**	**13.2**	NA	**67**	**55.1**	NA	**52**	**53**	**52.4**	**78.2**	**78.1**
	Beryllium	200	NA	NA	2.50 U	NA	NA	2.50 U	NA	NA	2.50 U	NA	NA	NA	2.50 U	2.50 U	2.50 U
	Cadmium	4	NA	**0.1**	2.00 U	NA	**0.05**	2.00 U	NA	**0.02**	2.00 U	NA	**0.03**	**0.03**	2.00 U	2.00 U	2.00 U
	Chromium	300	NA	**3.6**	**2.10**	NA	**3.7**	**1.68**	NA	**4.6**	1.00 U	NA	**4.6**	**5.1**	1.00 U	**2.01**	**1.98**
	Lead	10	NA	0.09 U	2.00 U	NA	**0.43**	2.00 U	NA	0.08 U	2.00 U	NA	**1.2**	**1.2**	2.00 U	**12.7**	**12.9**
	Nickel	200	NA	**0.56**	5.00 U	NA	**0.50**	5.00 U	NA	**0.37**	5.00 U	NA	0.40 U	0.40 U	5.00 U	5.00 U	5.00 U
	Selenium	100	NA	NA	0.556 U	NA	NA	0.556 U	NA	NA	0.556 U	NA	NA	NA	0.556 U	0.556 U	0.556 U
	Silver	7	NA	NA	2.00 U	NA	NA	2.00 U	NA	NA	2.00 U	NA	NA	NA	2.00 U	2.00 U	2.00 U
	Thallium	3,000	NA	NA	1.00 U	NA	NA	1.00 U	NA	NA	1.00 U	NA	NA	NA	1.00 U	1.00 U	1.00 U

Table 3
Summary of Analytical Results for Groundwater - 2001 and 2005
15 Peabody Street
Salem, Massachusetts

Analysis		**Sample Location:**	**MW-1**			**MW-2**			**MW-3**			**MW-4**				**MW-5**	
		Sample ID:	MW-104	MW-1	MW-1	MW-103	MW-2	MW-2	MW-102	MW-3	MW-3	MW-101	MW-4	MW-4	MW-4	MW-5	MW-5
		Sample Date:	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	4/21/2008	2/15/2001	2/15/2005	2/15/2005	4/21/2008	4/21/2008	4/21/2008
	Analyte	**Method 1 GW-3**												Field Dup			Field Dup
	Vanadium	4,000	NA	NA	100 U	NA	NA	100 U	NA	NA	100 U	NA	NA	NA	100 U	100 U	100 U
	Zinc	900	NA	**4.2**	20.0 U	NA	3.0 U	20.0 U	NA	3.0 U	20.0 U	NA	**3.9**	**4.5**	20.0 U	**24.5**	**24.6**
Metals, dissolved																	
(ug/L)	Barium	50,000	**44**	NA	NA	**20**	NA	NA	**125**	NA	NA	**93.3**	NA	NA	NA	NA	NA
	Chromium	300	2.0 U	NA	NA	2.0 U	NA	NA	**2.0**	NA	NA	2.0 U	NA	NA	NA	NA	NA
	Lead	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.00 U	2.00 U

Notes:

ug/L - microgram per liter or parts per billion (ppb).
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated nondetect.
Values in **Bold** indicate the compound was detected.
Values shown in Bold and shaded type exceed the MCP Method 1 GW-3 standards.
VOCs - Volatile Organic Compounds.
VPH - Volatile Petroleum Hydrocarbons.
EPH - Extractable Petroleum Hydrocarbons.
PCBs - Polychlorinated Biphenyls.
(1) - MCP Method 1 standards for C9-C10 aromatic hydrocarbons used.

Table 5
Alternative #3 - In-situ Chemical Oxidation Cost Detail
15 Peabody Street, Salem, MA

	Quantity	Unit Cost	Cost
Oversight			
Public Involvement	1 LS	$4,500	$4,500
Design and Bid Package	1 LS	$24,500	$24,500
Oversight and Confirmation Sampling	1 LS	$15,000	$15,000
Reporting	1 LS	$15,000	$15,000
Subtotal			**$59,000**
First Injection			
Bench-scale Testing	1 LS	$10,000	$10,000
Mobilization	1 LS	$500	$500
Drilling	8 days	$2,200	$17,600
Reagent	1848 lbs	$3	$5,544
Oversight	8 days	$1,000	$8,000
Equipment Rental	8 days	$100	$800
Subtotal			**$42,444**
Second Injection			
Mobilization	1 LS	$500	$500
Drilling	8 days	$2,200	$17,600
Reagent	2412 lbs	$3	$7,236
Oversight	8 days	$1,000	$8,000
Equipment Rental	8 days	$100	$800
Semi-Annual Monitoring	4 Each	$4,500	$18,000
Semi-Annual Reporting	4 Each	$2,500	$10,000
Well Abandonment	75 LF	$10	$750
Confirmitory Sampling	10 EA	$100	$1,000
Subtotal			**$63,886**
		Total Cost	**$165,330**

Table 4
Alternative #2 - In-situ Bioventing Cost Detail
15 Peabody Street, Salem, MA

	Quantity	Unit Cost	Cost
Oversight			
Public Involvement	1 LS	$4,500	$4,500
Design and Bid Package	1 LS	$24,500	$24,500
Oversight and Confirmation Sampling	1 LS	$15,000	$15,000
Reporting	1 LS	$15,000	$15,000
Subtotal			**$59,000**
Bioventing Construction and Operation			
Bench-scale Testing	1 LS	$10,000	$10,000
Drilling and Piping Installation	7 days	$2,200	$15,400
Electric Installation	1 days	$2,000	$2,000
Install Fencing	1 days	$2,000	$2,000
Blower Enclosure	1 LS	$5,000	$5,000
Blower	1 each	$2,000	$2,000
Piping	250 feet	$10	$2,500
Operation Labor	60 days	$800	$48,000
Field Equipment Rental	60 days	$100	$6,000
Electricity	5 YR	$1,000	$5,000
Semi-Annual Monitoring	10 Each	$4,500	$45,000
Semi-Annual Reporting	10 Each	$2,500	$25,000
Confirmitory Sampling	10 EA	$100	$1,000
Well Abandonment	75 LF	$10	$750
subtotal			**$169,650**
		Total Cost	**$228,650**

Table 6
Alternative #4 - Excavate and Off-Site Disposal Cost Detail
15 Peabody Street, Salem, MA

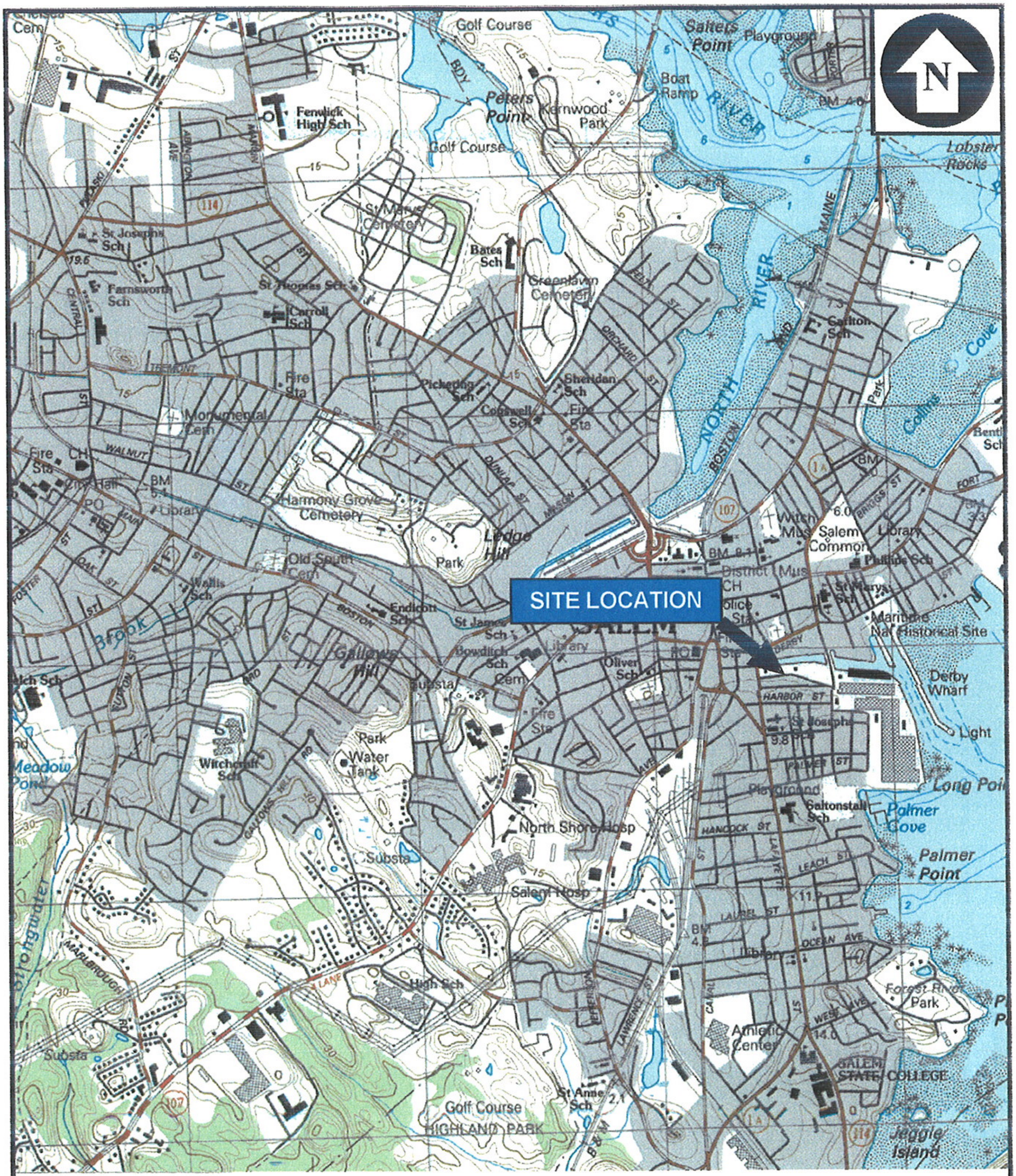
	Quantity		Unit Cost	Cost
Oversight				
Public Involvement	1	LS	$4,500	$4,500
Design and Bid Package	1	LS	$24,500	$24,500
Oversight and Confirmation Sampling	1	LS	$15,000	$15,000
Reporting	1	LS	$15,000	$15,000
Subtotal				**$59,000**
Site Preparation				
Mobilization	1	LS	$500	$500
Temporary Fencing	280	LF	$10	$2,800
Temporary Gate	1	EA	$900	$900
Erosion Controls	280	LF	$15	$4,200
Stockpile Erosion Controls	50	LF	$15	$750
Well Abandonment	75	LF	$10	$750
Shoring	600	SF	$9	$5,400
Subtotal				**$15,300**
Area 1 Soil Removal				
Excavate 6 FT Soil	177	CY	$5	$885
Waste Disposal Samples	2	EA	$250	$500
Soil Transportation and Disposal	266	TONS	$57	$15,162
Place and Grade 6 FT Backfill	266	TONS	$20	$5,320
Dewatering Tank Rental	1	LS	$500	$500
Tank Cleaning	1	LS	$1,000	$1,000
Water Transportation and Disposal	1000	GAL	$1	$850
Subtotal				**$24,217**
Area 2 Soil Removal				
Excavate 4 FT Soil	444	CY	$5	$2,220
Waste Disposal Samples	2	EA	$250	$500
Soil Transportation and Disposal	666	TONS	$57	$37,962
Place and Grade 4 FT Backfill	666	TONS	$20	$13,320
Subtotal				**$54,002**
Cap Construction				
Concrete Plaza North Cap	2383	SF	$10	$23,830
Play Area Cap	1707	SF	$11	$18,777
Subtotal				**$42,607**
Remediation Grove				
Excavate 3 FT Soil	327	CY	$5	$1,634
Soil Transportation and Disposal	490	TONS	$57	$27,940
Place and Grade 1 FT Backfill	163	TONS	$20	$3,268
Loam	96	CY	$49	$4,704
Planting	2941	SF	$15	$44,115
Subtotal				**$81,660**
Total				**$276,786**

Table 7
Alternative #5 - Excavate, Cap and AUL Cost Detail
15 Peabody Street, Salem, MA

	Quantity		Unit Cost	Cost
Oversight				
Public Involvement	1	LS	$4,500	$4,500
Design and Bid Package	1	LS	$24,500	$24,500
Oversight and Confirmation Sampling	1	LS	$15,000	$15,000
Reporting	1	LS	$15,000	$15,000
AUL	1	LS	$4,000	$4,000
Subtotal				**$63,000**
Site Preparation				
Mobilization	1	LS	$500	$500
Temporary Fencing	280	LF	$10	$2,800
Temporary Gate	1	EA	$900	$900
Erosion Controls	280	LF	$15	$4,200
Stockpile Erosion Controls	50	LF	$15	$750
Well Abandonment	75	LF	$10	$750
Shoring	600	SF	$9	$5,400
Subtotal				**$15,300**
Area 1 Soil Removal				
Excavate 6 FT Hot Spot Soil	177	CY	$5	$885
Waste Disposal Samples	2	EA	$250	$500
Soil Transportation and Disposal	266	TONS	$57	$15,162
Place and Grade 6 FT Backfill	266	TONS	$20	$5,320
Dewatering Tank Rental	1	LS	$500	$500
Tank Cleaning	1	LS	$1,000	$1,000
Water Transportation and Disposal	1000	GAL	$1	$850
Subtotal				**$24,217**
Cap Construction				
Concrete Plaza North Cap	2383	SF	$10	$23,830
Concrete Plaza South Cap	3000	SF	$10	$30,000
Play Area Cap	1707	SF	$11	$18,777
Subtotal				**$72,607**
Remediation Grove				
Excavate 3 FT Soil	327	CY	$5	$1,634
Reuse Soil Under Mound (13 FT Height)	65	CY	$0	$0
Soil Transportation and Disposal	229	TONS	$57	$13,069
Place and Grade 1 FT Backfill	163	TONS	$20	$3,268
Loam	96	CY	$49	$4,704
Planting	2941	SF	$15	$44,115
Subtotal				**$66,790**
Total				**$241,914**

Table 8
Summary of Analytical Results for Waste Soil Disposal Sample - April 2008
15 Peabody Street
Salem, Massachusetts

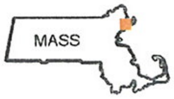
Analysis	Sample Location: / Sample Depth (ft.): / Sample Date: / Analyte	SB-06-2 / 2 / 4/14/2008	
VOCs			
(mg/kg)	Acetone	0.085	U
	tert-Amylmethyl Ether	0.001	U
	Benzene	0.002	U
	Bromobenzene	0.002	U
	Bromochloromethane	0.002	U
	Bromodichloromethane	0.002	U
	Bromoform	0.002	U
	Bromomethane	0.009	U
	2-Butanone (MEK)	0.034	U
	n-Butylbenzene	0.002	U
	sec-Butylbenzene	0.002	U
	tert-Butylbenzene	0.002	U
	tert-Butylethyl Ether	0.001	U
	Carbon Disulfide	0.006	U
	Carbon Tetrachloride	0.002	U
	Chlorobenzene	0.002	U
	Chlorodibromomethane	0.001	U
	Chloroethane	0.017	U
	Chloroform	0.004	U
	Chloromethane	0.009	U
	2-Chlorotoluene	0.002	U
	4-Chlorotoluene	0.002	U
	1,2-Dibromo-3-Chloropropane	0.002	U
	1,2-Dibromoethane	0.001	U
	Dibromomethane	0.002	U
	1,2-Dichlorobenzene	0.002	U
	1,3-Dichlorobenzene	0.002	U
	1,4-Dichlorobenzene	0.002	U
	Dichlorodifluoromethane	0.017	U
	1,1-Dichloroethane	0.002	U
	1,2-Dichloroethane	0.002	U
	1,1-Dichloroethylene	0.004	U
	cis-1,2-Dichloroethylene	0.002	U
	trans-1,2-Dichloroethylene	0.002	U
	1,2-Dichloropropane	0.002	U
	1,3-Dichloropropane	0.001	U
	2,2-Dichloropropane	0.002	U
	1,1-Dichloropropene	0.002	U
	cis-1,3-Dichloropropene	0.001	U
	trans-1,3-Dichloropropene	0.001	U
	Diethyl Ether	0.017	U
	Diisopropyl Ether	0.001	U
	1,4-Dioxane	0.085	U
	Ethyl Benzene	0.002	U
	Hexachlorobutadiene	0.002	U
	2-Hexanone	0.017	U
	Isopropylbenzene	0.002	U
	p-Isopropyltoluene	0.002	U
	MTBE	0.004	U
	Methylene Chloride	0.017	U
	MIBK	0.017	U
	Naphthalene	0.004	U
	n-Propylbenzene	0.002	U
	Styrene	0.002	U



BASE MAP IS A PORTION OF THE FOLLOWING 7.5' X 15' USGS TOPOGRAPHIC QUADRANGLES: SALEM, MA, 1985

0 1000 2000 3000

scale in feet



QUADRANGLE LOCATION

15 PEABODY STREET
SALEM, MASSACHUSETTS

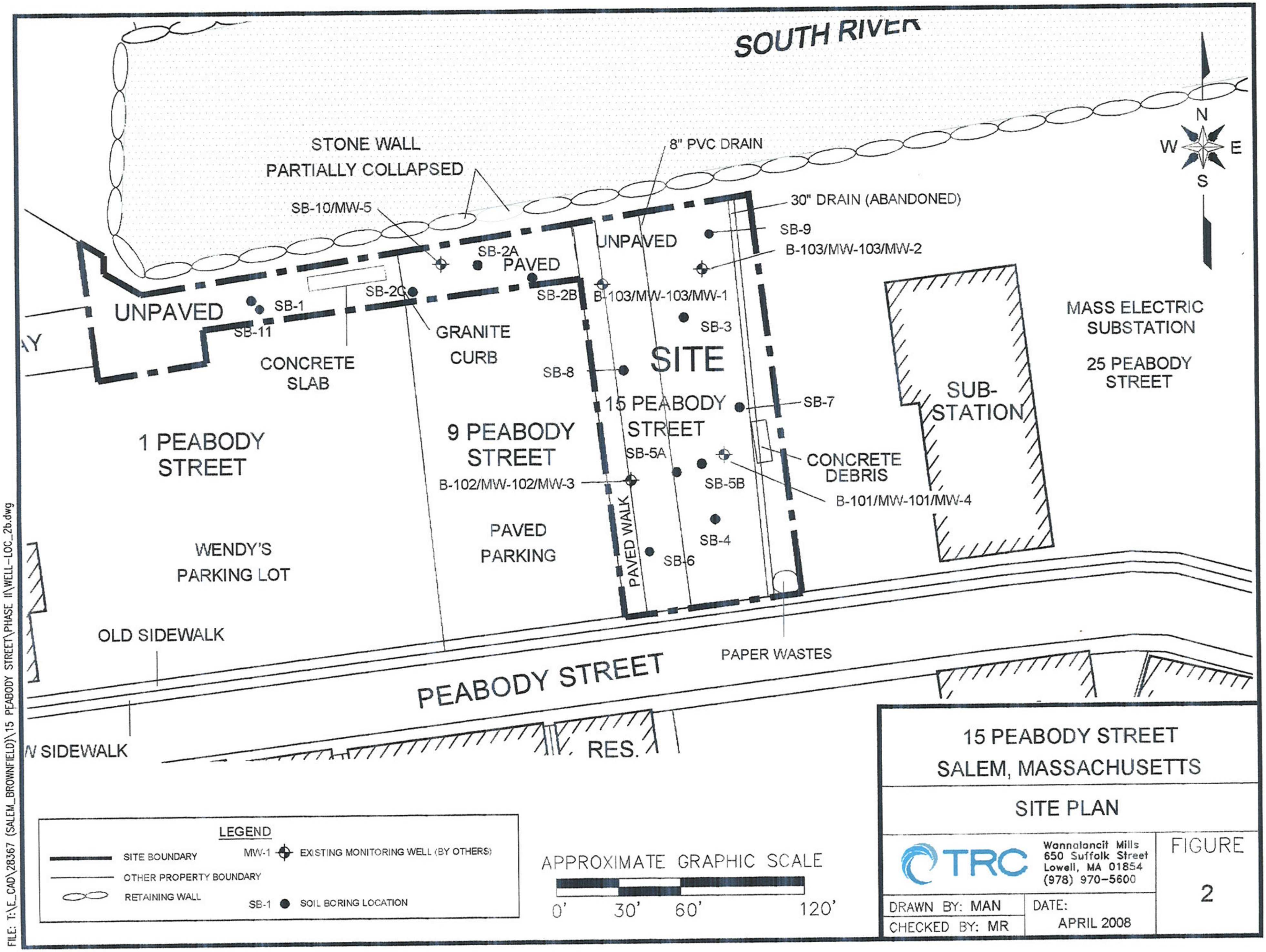
SITE LOCATION MAP

TRC
Wannalancit Mills
650 Suffolk Street
Lowell, Ma. 01854
(978) 970-5600

FIGURE 1

DRAWN: MAN
CHECKED: MR
SCALE: AS SHOWN
Date 3/20/08

28367/15PEOBODY_TOPO_2



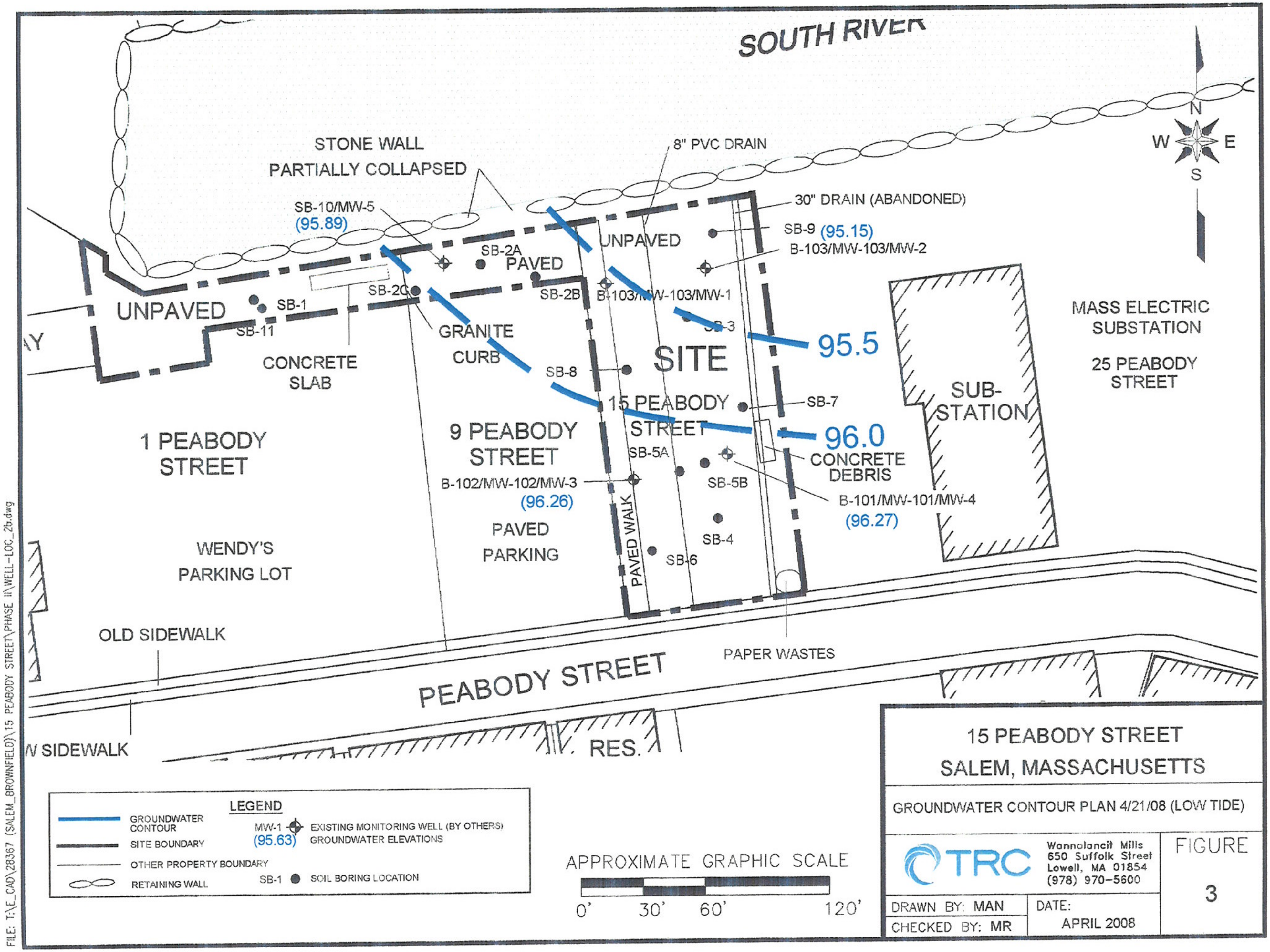
15 PEABODY STREET
SALEM, MASSACHUSETTS

SITE PLAN

TRC
Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
(978) 970-5600

FIGURE 2

DRAWN BY: MAN
CHECKED BY: MR
DATE: APRIL 2008



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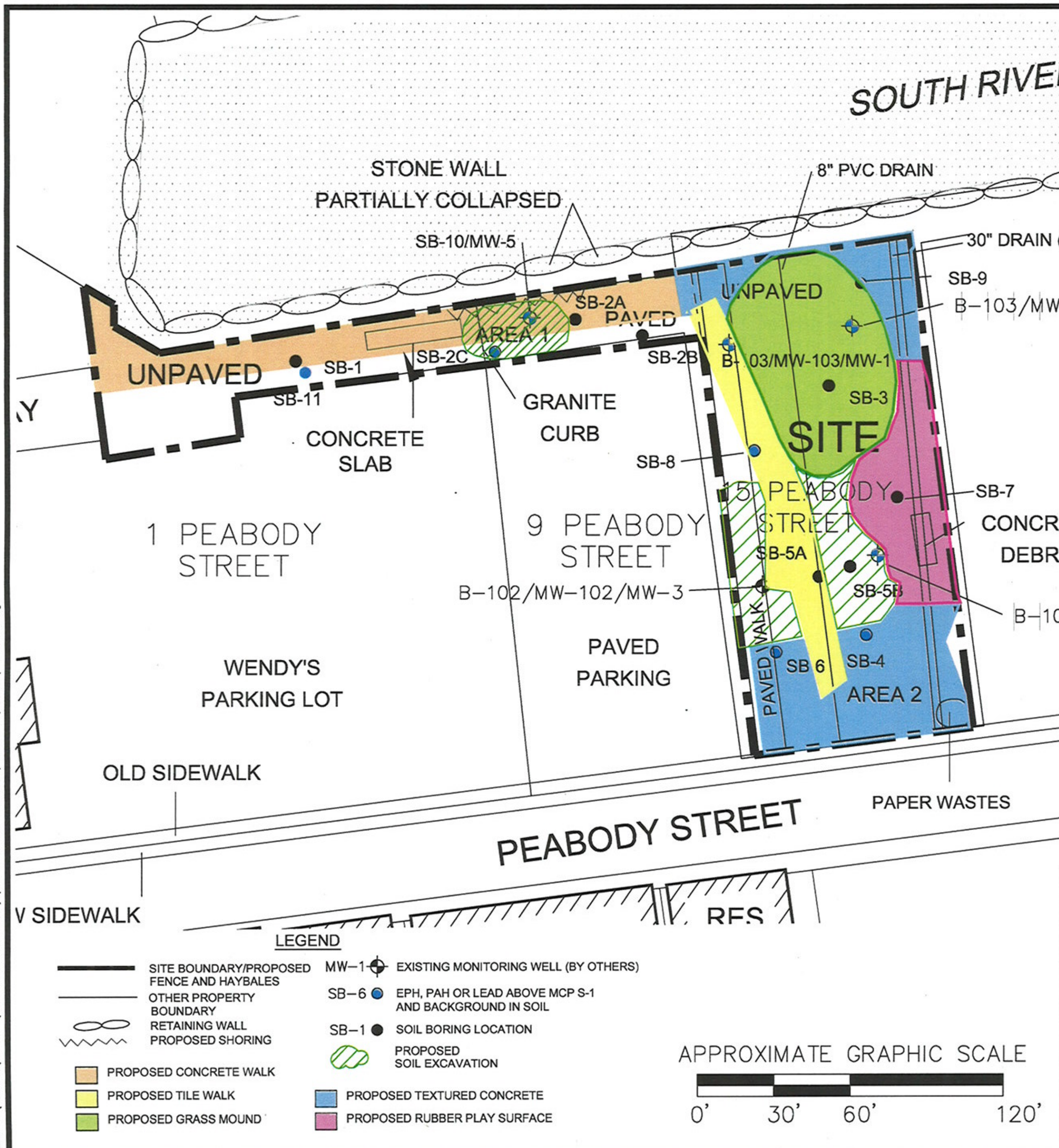

15 PEABODY STREET
SALEM, MASSACHUSETTS

CLEANUP SITE PLAN

TRC
Wannalancit Mills
650 Suffolk Street
Lowell, MA 01854
(978) 970-5600

FIGURE 4

DRAWN BY: MCB
CHECKED BY: MR
DATE: JUNE 2008

FILE: T:\E_CAD\28367 (SALEM_BROWNFIELD)\15 PEABODY STREET\PHASE II\CleanUp-Plan2.dwg