Environmental
Strategies
& Management

184 West Main Street, Norton, MA 02766 ♦ Tel: (508) 285-9700 ♦ Fax: (508) 285-9957

DRAFT

MASSACHUSETTS CONTINGENCY PLAN
INTERIM PHASE II
COMPREHENSIVE SITE ASSESSMENT

FORMER LEWIS CHEMICAL PROPERTY
"O" & 12-24 FAIRMOUNT COURT
HYDE PARK, MASSACHUSETTS
MassDEP RTN 3-1616

February 27, 2007

Prepared for:

City of Boston Public Facilities Commission
Acting through its Department of Neighborhood Development
26 Court Street, 9th Floor
Boston, MA 02108

Prepared by:

Environmental Strategies & Management, Inc.
184 West Main Street
Norton, MA 02766
(508) 285-9700

ES&M Project No. 2006-056

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1.0 INTRODUCTION

1.1 Statement of Purpose

The City of Boston Public Facilities Commission, through its Department of Neighborhood Development (DND), retained Environmental Strategies & Management, Inc. (ES&M) to conduct a Phase II Comprehensive Site Assessment (CSA) at the former Lewis Chemical Corporation site located in Hyde Park, Massachusetts (the "Site"). This project is funded by a Brownfields grant through the United States Environmental Protection Agency (EPA).

This Interim Phase II CSA Report has been prepared to comply with the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000. The purpose of this Interim Phase II CSA Report is to document the results of Comprehensive Site Assessment activities, as described in 310 CMR 40.0835. The Interim Phase II CSA Report includes relevant information, data, findings and opinions, and is presented in a format consistent with 310 CMR 40.0835(4). While the Phase II site assessment was successful at defining the nature and extent of chlorinated solvents (the primary contaminants of concern), a complex issue regarding the nature and extent of polychlorinated biphenyls (PCBs) was identified. This issue will be discussed in detail in this report. It is for this reason that this report is an interim Phase II report rather than a final Phase II report.

This Interim Phase II CSA report is organized in the following manner:

- Section 1 presents introductory information;
- Section 2 provides general site information including a review of past site uses;
- Section 3 presents details of the Phase II subsurface investigation methods and results;
- Sections 4 and 5 describe the fate and transport characteristics of the contaminants of concern, and nature and extent of impact at the site;
- Section 6 includes a summary of the Method 3 Risk Characterization; and
- Section 7 presents a summary of the Phase II findings and conclusions.

1.2 Summary of Phase I Investigation

A Phase I Brownfields site assessment was conducted at the Site[1] in 2002 by ES&M under the direction of the Massachusetts Department of Environmental Protection (MassDEP). The historic uses of the Site were researched and reported during the Phase I investigation. The investigation revealed information about Lewis Chemical's operations including chemical handling and processing procedures which involved chlorinated solvents.

The Phase I site assessment included:

- Background research to better understand the types of chemical involved, and how they

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[1] At the time of this investigation, the "0" Fairmount Court parcel was not in the control of DND, and was therefore not included in the investigation.

were stored and processed;

- A detailed site inspection to identify sources of contamination and potential pathways into the environment;
- A geophysical survey to determine the presence of underground features such as tanks and drums;
- A field investigation program, including the installation of soil borings and monitoring wells, and the collection and analysis of soil, groundwater, surface water, and sediment samples to broadly evaluate current environmental conditions across the Site; and
- The completion of an Imminent Hazard evaluation to determine if an immediate threat to human health or the environment exists, and if accelerated clean up efforts are required.

A summary of the Phase I results are as follows:

- The background research identified the types of chemicals that were present during operation of the facility, and provided details of where chemical processing operations were conducted.
- The site inspection identified a series of floor drains in the basement of the building. These drains provided a pathway for spilled chemicals inside the building to enter the subsurface. The site inspection also identified areas where process waste and construction-related debris were possibly buried.
- The geophysical survey identified two underground storage tanks along with numerous other objects, some of which were thought to be buried drums.
- The field investigation program identified impacted soil and groundwater at several locations at the Site, particularly between the building and the Neponset River. Most of the contaminants identified were consistent with the chemicals that Lewis Chemical had stored and processed. The highest VOC concentrations in soil and groundwater coincided with the locations of the interior floor drains. The investigation also identified PCBs in soil and lead in surficial soil.
- The sediment and surface water sampling program in the Neponset River identified SVOCs, VOCs, and metals along the shoreline adjacent to the Lewis Chemical building.
- There were no Imminent Hazard conditions identified during the Phase I investigation.

1.3 Regulatory Status

The Site was first listed by MassDEP in 1987 and was issued Release Tracking Number (RTN) 3-1616. Due to many years of non-compliance by the previous owner(s), the Site was previously classified as default Tier 1D. A Tier Classification was completed in conjunction with a Phase I Addendum in May 2005. The Site is currently classified as a Tier 1B site.

The City of Boston foreclosed on the property on October 18, 2000 due to failure of payment of back taxes. In accordance with Massachusetts General Law Ch. 21E, Section 2 (as amended), the

City of Boston is NOT deemed an "owner" or "operator" of the Site, and is therefore entitled to certain liability protection under the Statute, as well as exemptions under the MCP. As required under the Statute, the City desires to divest itself of the property. Since further investigation of the site was warranted in order to develop future re-use plans, the City elected to voluntarily conduct further response actions under the MCP. Specifically, the City acquired grant funds under the EPA Brownfields program to complete this Phase II assessment.

1.4 Public Involvement History

On February 3, 2005, the DND received a petition dated February 2, 2005 forwarded by thirteen petitioners requesting that the former Lewis Chemical site be designated as a Public Involvement Plan (PIP) site. In accordance with M.G.L. ch. 21E and the MCP, a Public Involvement Plan was developed. On March 8, 2005, DND and ES&M conducted interviews with the PIP petitioners to gather their comments and concerns about the site. During the week of March 8, 2005, DND also interviewed municipal officials including members of the Mayor's Office of Neighborhood Service, Boston Public Health Commission, Boston Conservation Commission, and the Office of Boston City Councilor Robert Consalvo. A draft PIP was presented at a public meeting in April 2005, and the final PIP document was issued on May 16, 2005.

1.5 Phase II Scope of Work

The Phase II CSA field activities were described in the Phase II Scope of Work prepared by ES&M and submitted to MassDEP in May 2005. Following the acquisition of additional funding, DND elected to enhance portions of the Phase II field investigation program through the collection and laboratory analysis of additional soil, soil gas, surface water, and sediment samples. This additional work allowed for a more thorough assessment of the nature and extent of contamination, and also allowed for a more complete risk characterization.

2.0 GENERAL SITE INFORMATION

2.1 Site Name, Location and Locus Map [310 CMR 40.0835(4)(a)]

The Lewis Chemical Site is comprised of several parcels totaling approximately 27,182 square feet of land located at "0" and 12-24 Fairmount Court in Hyde Park, Massachusetts. A large, vacant building is located on the property. The property abuts a parcel of land along the banks of the Neponset River, owned by the State of Massachusetts, Department of Conservation and Recreation (DCR). Together these parcels of land ("0" and 12-24 Fairmount Court, and the DCR property) comprise the upland portion of the "Site", as defined under the MCP. Based on the delineation of chlorinated solvents conducted on the above parcels, the "Site" also includes a limited portion of the Neponset River, which abuts the DCR parcel to the south. Surrounding properties are mixed commercial and residential. Active railroad tracks used by Massachusetts Bay Transit Authority (MBTA) commuter rail and associated with the Penn Central Railroad right-of-way are located adjacent to the Site towards the northeast. A Site Locus Map is included as Figure 1.

2.2 Detailed Site Map(s) [310 CMR 40.0835(4)(b)]

This Phase II report includes numerous detailed site maps. Figures 2 through 5 show the locations of soil, groundwater, soil gas and surface water/sediment sampling locations during the Phase I and Phase II investigations. Figures 6 and 7 show water table elevation and potentiometric surface contours. Figures 9 through 23 show concentrations of contaminants in soil, groundwater, soil gas and surface water/sediment across the site.

2.3 Disposal Site History [310 CMR 40.0835(4)(c)

ES&M conducted a Phase I Brownfields Site Investigation in 2002 and completed a Phase I Initial Site Investigation and Tier Classification in 2005. The investigations included research into the historic uses of the Site. The information obtained about Lewis Chemical Company provided insight relative to their chemical handling and processing procedures, which extensively involved chlorinated solvents.

2.3.1 Ownership and Prior Usage

The Site has a history of industrial use and was formerly the location of the Lewis Chemical Company (Lewis Chemical). From 1940 until the early 1960s, a leather manufacturing company reportedly operated at the Site, although very little specific information was ever found relative to this operation. Lewis Chemical operated at the Site from 1963 until 1983 and was involved in the collection, transportation, storage, and processing of hazardous waste. Numerous violations of federal, state, and local laws regarding the safe handling, transport, storage, and treatment of hazardous materials, as well as complaints from local residents, were documented during Lewis Chemical's time of operation. Lewis Chemical was forced to terminate operations under a Court Order issued by MassDEP in 1983. The City of Boston foreclosed on the property on October 18, 2000.

2.3.2 Release History

Several environmental investigations were conducted at the Site prior to ES&M's involvement in 2002. Available reports include "Phase I Preliminary Assessment" completed in 1986 by Wehran Engineering; "Site Report Relative to Hazardous Materials" completed in 1988 by Environmental Impact Services, Inc. (EIS); and "Environmental Assessment" completed in 1991 by HTS Environmental Group. These investigations identified impacts to soil, groundwater, and surface water at the Site from historical uses. In addition, MassDEP conducted sampling in 1998 that revealed VOCs and metals in surface water and sediment in the Neponset River.

Lewis Chemical Corporation (12 Fairmount Court, Hyde Park, MA) was listed on the Comprehensive Environmental Response, Compensation, and Liability System (CERCLIS) database on May 1, 1983, as a potential or confirmed hazardous waste site and was assigned EPA ID MAD053455911. The Lewis Chemical Corporation site was then designated archived on September 10, 1986. The archive designation means that the assessment was completed and EPA determined that no steps would be taken to include Lewis Chemical on the National Priorities List (NPL). No further action is currently planned for archived sites under the Superfund program.

The Site, first listed by the MassDEP in 1987, was issued Release Tracking Number (RTN) 3-1616. The Site is currently classified as a Tier 1B site under the MCP.

3.0 SUBSURFACE EXPLORATION PROGRAM [310 CMR 40.0835(4)(D)]

3.1 Subsurface Investigation Overview

A subsurface investigation was completed by ES&M at the Site between June 2005 and November 2006. The investigation included:

- the excavation of test pits,
- the completion of soil borings and installation of monitoring wells,
- the completion of bedrock coring and the installation of bedrock monitoring wells,
- the installation of piezometers,
- the collection and laboratory analysis of soil, groundwater, soil gas, surface water and sediment samples, and
- the completion of aquifer slug tests.

The subsurface investigation program was conducted in accordance with the Phase II Scope of Work (SOW) dated May 2005 (with additional sample collection and laboratory analysis above and beyond the SOW as authorized by DND); the Health and Safety Plan (HASP) dated March 15, 2005 and the Revised Quality Assurance Project Plan (QAPP), dated September 29, 2005. The HASP and QAPP were prepared by ES&M and submitted to EPA for approval prior to the initiation of field activities. All investigative work was completed in accordance with these documents.

3.2 Test Pits, Soil Boring Completion, and Monitoring Well Installation

3.2.1 Test Pits

A test pit investigation was completed on June 1 & 2, 2005 to obtain detailed information about the nature of three potential source areas that were identified during ES&M's Brownfields Site Investigation:

- Fill area (southern corner of property);
- Underground storage tank (UST) area adjacent to northwest side of building; and
- Possible buried drum area northeast of building (as identified by the GPR study conducted during Phase I field activities).

Earthworks Industries was contracted by ES&M to excavate eleven test pits using a backhoe. ES&M conducted continuous air monitoring for oxygen (O_2), lower explosive limit (LEL), dust, and volatiles as outlined in the HASP. There were no exceedances of applicable threshold limits, therefore the work was conducted using Level D Personal Protective Equipment (PPE). The location of each test pit is shown on Figure 2. Observations, screening results and sample details (where applicable) are described below and are detailed on the test pit logs included in Appendix A.

UST AREA				
Test Pit ID	*Soil Description*	*Observations*	*Screening Results (ppm)*	*Samples Collected*
TP-01	urban fill, dark brown and black, sand and gravel	• Uncovered UST (21′ long, 8′ dia. Steel Tank) • 8000 gal. tank contained approx. 600 gallons of liquid.	SW Corner (4′) ND N End (9′) 1.6	Product Sample TP1-B (9′)
TP-02	Sand	• No second UST was found	Center (2′) ND Bottom (6′) ND	TP-02 (6′)
TP-06	urban fill, dark brown and black, sand and gravel	• Brick ring structure 6′ in diameter, approximately 2′ bgs	Center (2.5′) 46 West (2′) ND	TP-06 (2.5′)
FILL AREA				
Test Pit ID	*Soil Description*	*Observations*	*Screening Results (ppm)*	*Samples Collected*
TP-03	Brown, sand and gravel at 5.5′ (beneath papery material)	• 2′x4′ sheets of papery material, stacked in neat piles 5.5′ deep	Center (5.5′) ND	No Sample
TP-04	Dark brown to black (with pieces of crushed drum, pieces of papery material)	• Native fill at 2′ bgs	Bottom (2′) black ND Bottom (2′) brown ND	TP-04
SUSPECTED DRUM BURIAL AREA				
Test Pit ID	*Soil Description*	*Observations*	*Screening Results (ppm)*	*Samples Collected*
TP-05	Brown, medium to fine sand and gravel, trace cobble	• Identified old water shut-off pipe to former building • 1″ inactive water line at 6′ bgs	North (4.5′) ND Center (4.5′) ND South (4.5′) ND	No Sample
TP-07	Light brown sand, cobbles, large pieces of asphalt coarse to fine sand and gravel	• Looking for 10′ long flat object on GPR • Encountered asphalt, granite curbing, poly-sheeting, and pallet bands • Soil looked disturbed, lots of buried asphalt could be the cause of GPR anomaly	Composite ND Near poly-sheeting ND	No Sample
TP-08	Light brown coarse to fine sand and gravel	• Encountered many large flat rocks • Boulder on east side 3.5′ bgs	Composite ND	No Sample
TP-09	0-1′ dark brown sand and gravel 1-3′ large chunks of asphalt & cement, rusty metal	• Large pieces of asphalt • Re-bar, 18″ sieve	Composite (6′) ND	No Sample
TP-10	Light brown coarse to fine sand and gravel	• Encountered concrete and asphalt	Composite (5′) ND	No Sample
TP-11	Light brown coarse to fine sand and gravel	• Encountered much asphalt	Composite (5′) ND	No Sample

ND = Not Detected; ppm = parts per million

3.2.2 Overburden Soil Borings and Monitoring Wells

Monitoring wells ESM-01 through ESM-10 were completed during the Phase I Site Investigation. Monitoring wells ESM-11 through ESM-16 were completed during this Phase II assessment to evaluate the adjacent "0" Fairmount Avenue parcel and to further define the extent of VOC impact in the vicinity of TP-06 (near the UST), and wells ESM-03 and ESM-05 (adjacent to the Neponset River). The locations of monitoring wells installed to date are shown on Figure 3. All boring locations were pre-marked, and DigSafe utility locator service was notified prior to drilling activities. A Drilling Permit from the City of Boston Department of Inspectional Services was also obtained prior to drilling, as required for all construction activities in accordance with the Massachusetts State Building Code (780 CMR).

Soil-Exploration of Fitchburg, MA, was contracted by ES&M to complete the drilling utilizing a hollow-stem auger drill rig. At each boring location, continuous split-spoon samples were collected at two-foot intervals until auger refusal was encountered. A photoionization detector (PID) equipped with an 11.7 eV lamp was used to field screen the soil samples utilizing the MassDEP jar headspace technique. One or more samples from each boring location were selected for laboratory analysis based on visual observation and PID field screening results.

On July 13, 2005, four monitoring wells were installed at the Site. On this date, two monitoring wells (ESM-11 and ESM-12) were completed on the adjacent parcel ("0" Fairmount Avenue), and two monitoring wells (ESM-13 and ESM-14) were installed in the area of TP-06.

On August 31, 2005, two additional monitoring wells (ESM-15 and ESM-16) were installed using direct push technology inside the building in the areas up-gradient of the trench drains. Soil samples were collected continuously during drilling for visual observations and field screening with a PID and the jar headspace method. ES&M conducted continuous air monitoring for oxygen (O_2), lower explosive limit (LEL), dust, and volatiles as outlined in the Health and Safety Plan. There were no exceedances of applicable threshold limits. Samples collected from ESM-15 and ESM-16 were submitted for laboratory analysis.

On September 1, 2005, soil borings ESMB-01 and ESMB-02 were completed inside the garage bays on the southern portion of the building, up-gradient of monitoring well ESM-15. Soil samples were collected continuously during the drilling of ESMB-01 and ESMB-02 for visual observations and field screening with a PID and the jar headspace method. The sample collected from ESMB-02 was submitted for laboratory analysis.

All soil samples collected for laboratory analysis were properly preserved and submitted under chain of custody to Groundwater Analytical in Buzzards Bay, MA for analysis of volatile organic compounds (VOC) by EPA Method 8260B, poly-chlorinated biphenyls (PCB) by EPA 8082, VPH and EPH by the MassDEP Method, and Lead by EPA 6010B. The laboratory analytical results for soil sampling are discussed in Section 5[2].

Monitoring wells were installed in these soil borings to intersect the water table at depths ranging from four to ten feet below ground surface. Since the borings extended to refusal (assumed to be near the bedrock/overburden interface), the wells were screened across the saturated, unconsolidated zone. All of the monitoring wells were constructed with 0.010-slotted polyvinyl chloride (PVC) screen. The annular space between the borehole wall and the screened interval was backfilled with clean, #1 graded sand to approximately two feet above the top of the screen. A bentonite seal approximately one to two feet thick was placed above the screen. The remaining annular space was filled with clean native material to approximately

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[2] The laboratory report and the chain of custody erroneously indicate that the sample from ESMB-02 was collected on 8/31/05 rather that 9/1/05.

four to six inches below surface grade. All wells were completed at surface grade with a gripper and steel road box to protect the wells and to prevent infiltration of surface water. Well construction diagrams and PID screening values are included on the drilling logs contained in Appendix A. The locations of the monitoring wells and soil borings are shown on Figure 3.

3.2.3 Shallow Soil Borings

Between August 30 and September 1, 2005, 22 shallow soil borings were completed throughout the property to delineate the extent of contamination in areas of concern identified during the Phase I investigation. Sampling grids were established in three areas: Area I located between the building and the MBTA property, Area II located in the southwestern portion of the property including the tank farm and the fill area, and Area III located between the building and the Neponset River. Figure 4 shows the sampling grids and soil boring locations.

The borings were completed using a GeoProbe™ 6610 DT direct push rig. Soil samples were collected continuously in 5-foot intervals for categorization and field screening. A PID equipped with an 11.7 eV lamp was used to field screen the soil samples utilizing the MassDEP jar headspace technique. One sample from each boring location was selected, based on visual observation and/or PID field screening results, for laboratory analysis.

All soil samples were properly preserved and submitted under chain of custody to Groundwater Analytical for analysis of VPH and EPH by the MassDEP Method, VOCs by EPA Method 8260B, Lead by EPA 6010B, and PCBs by EPA 8082. The laboratory analytical results for soil samples are discussed in Section 5. The boring logs are included in Appendix A.

3.2.4 Piezometer Installation

On March 27 and 28, 2006, three piezometer couplets (PZ-1 S/D, PZ-2 S/D and PZ-3 S/D) were installed on the banks of the Neponset River. The piezometers are constructed with 5/8-inch diameter steel well materials, including a one-foot section of screen at the bottom. The piezometers were driven into the ground with vibratory equipment. Each couplet includes a shallow and a deep piezometer. The shallow piezometers were driven approximately two feet into the ground. The deep piezometers were driven approximately five to 10 feet into the ground. The locations of each piezometer couplet are shown on Figure 3. Well logs including elevation data for the piezometers are included in Appendix A.

On November 15, 2006, four temporary groundwater sample points were installed using a Model 14 KVA sampler to collect groundwater samples from beneath the Neponset River. Three sample points were installed on the south side of the river opposite the Site, and one sample point was installed on the north side of the river, down stream of PZ-03. A disposable KVA sampler point was attached to polyethylene tubing and pounded into the riverbed to a depth of approximately two feet below the river bottom. Samples of groundwater were collected using dedicated polyethylene tubing and a peristaltic pump. The temperature of the groundwater was measured and compared to the temperature of the river[3] to ensure that representative groundwater samples were being collected. Pertinent sample information and analytical methods were recorded on a chain of custody form. Samples were sent by courier to Resource Laboratory in Portsmouth, NH for laboratory analysis of VOCs by EPA Method 8260B. The laboratory analytical results for groundwater sampling are discussed in Section 5.

3.2.5 Bedrock Well Installation

Three bedrock monitoring wells were installed (ESM-03, ESM-05, and ESM-08) between March 31, 2006 and April 3, 2006. A hollow stem auger drilling rig was utilized to reach competent bedrock. A section of steel casing was then grouted into place to seal off the overburden aquifer. A diamond bit core barrel was used to core into bedrock at five foot intervals. Every ten feet, an isolated groundwater sample was collected for VOC analysis using the inflatable packer testing method. A packer system with a submersible pump set between an inflatable packer and the bottom of the hole was used to collect groundwater samples from water-bearing fractures in the bedrock. The groundwater samples were sent under chain of custody for expedited turn-around to Resource Laboratory in Portsmouth, NH for analysis of VOCs by EPA Method 8260B. Bedrock samples from each ten foot core interval were examined and categorized, and the Rock Quality Designation (RQD) was calculated. The RQD is an indication of rock quality and fracturing. Bedrock with high RQD (75 to 100%) is considered good to excellent (i.e., not highly fractured), while lower RQD indicates a higher degree of fracturing.

Competent bedrock was encountered at 20 feet below ground surface (bgs) at ESM-03B, and coring was advanced to 70 feet bgs. Packer test groundwater samples were collected every ten feet. Based on the results of the packer testing, a well couplet was installed in ESM-03B. Well ESM-03B-D was screened from 60 to 70 feet bgs and well ESM-03B-S was screened from 30 to 40 feet bgs.

Competent bedrock was encountered at ESM-05B at 20 feet bgs and coring was advanced to 70 feet bgs. Packer test groundwater samples were collected every ten feet. Based on the results of the packer testing, the bedrock monitoring well installed in ESM-05B was screened from 30 to 40 feet bgs.

Competent bedrock was encountered at ESM-08B at 40 feet bgs and coring was advanced to 60 feet bgs. A packer test groundwater sample was collected from the 40 to 50-foot interval. Based on the results of the packer testing and the objective to maintain the screen intervals of all three bedrock wells at the same approximate elevation, the bedrock monitoring well installed in ESM-08B was screened from 45 to 55 feet bgs.

Boring logs for the bedrock monitoring wells showing bedrock descriptions, RQD (as %), packer testing analytical data for trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1-trichloroethane (TCA), and well completion details are included in Appendix A. The locations of the bedrock monitoring wells are shown on Figure 3.

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[3] The temperature of groundwater at the Site was initially measured and found to be significantly higher than surface water. Water from the piezometers was confirmed to be at a temperature consistent with groundwater.

3.3 Elevation Survey and Groundwater Monitoring

Relative top-of-casing elevations of the monitoring wells and the locations of all investigation points were determined by ES&M personnel on April 6 & 11, 2006. Top-of-casing (TOC) elevations were established by the differential leveling method. An on-site benchmark was established and given an arbitrary datum of 100 feet, since no established benchmarks relative to NGVD were found near the Site. The locations of the wells and other investigation points were measured relative to site features for placement on site maps (Figures 2 through 5).

On April 6, 2006, the depths to groundwater in monitoring wells, bedrock wells, and piezometers were measured using an electronic interface probe. The depth to groundwater beneath the Site ranged from 4.80 to 13.40 feet below ground surface. Non-aqueous phase liquids (NAPL) were not detected in any of the monitoring wells during this monitoring event.

Groundwater samples were collected from all Site-related monitoring wells, bedrock wells, and piezometers between April 6 and April 10, 2006. Samples were collected from all shallow overburden monitoring wells (ESM-01 through ESM-16) and two bedrock monitoring wells (ESM-03B-S and ESM-05B) using the EPA low flow sample collection method. Dedicated disposable Teflon™ tubing was inserted into each well. Groundwater was then purged using a peristaltic pump. The purge water passed through a flow cell monitored by a YSI 600 XL water quality meter. Water quality parameters including temperature, conductivity, dissolved oxygen, pH, and oxidation-reduction potential were monitored until readings were stable. Groundwater samples were then collected in suitable, pre-cleaned, laboratory-supplied containers.

Groundwater samples were collected from the piezometers using dedicated disposable Teflon™ tubing and a peristaltic pump. Water was removed from each piezometer until the groundwater became clear. Groundwater samples were then collected in suitable, pre-cleaned, laboratory-supplied containers.

Groundwater samples from ESM-03B-D and ESM-08B were collected using dedicated, pre-cleaned bailers. Approximately three well volumes of water were purged and the wells were allowed to recharge prior to sample collection. Groundwater samples were then collected in suitable, pre-cleaned, laboratory-supplied containers.

Pertinent sample information and analytical methods were recorded on a chain of custody form. Samples were sent by courier to Resource Laboratory in Portsmouth, NH for laboratory analysis of VOCs by EPA Method 8260B and PCBs by EPA Method 8082. Select samples were also analyzed for RCRA 8 metals by EPA Method 6010B, volatile petroleum hydrocarbons (VPH) by the MassDEP method and extractable petroleum hydrocarbons (EPH) by the MassDEP method. Two trip blanks (provided by the laboratory) and two field duplicates accompanied the samples during shipment to the laboratory.

3.4 Soil Gas Investigation

On March 28, 2006, six soil gas points were installed in the basement of the vacant building. The locations of the points are shown on Figure 5. Each point was installed by drilling through the concrete basement floor, then using a hand-held hammer drill to drive a steel rod three feet into the soil. An aluminum screened drive point with a length of Teflon™ tubing attached was placed into the borehole created by the rod, and the annular space was filled with clean, #1 graded sand to just below the floor. The floor was then sealed to grade with quick drying, hydraulic concrete.

On March 29, 2006, each section of tubing was purged with a hand pump, and soil gas samples were collected from each of the six points using laboratory-supplied SUMMA canisters and pre-calibrated regulators. Each canister was set in the morning and retrieved approximately 8 hours later. The samples were sent by courier under chain of custody to Alpha Analytical in Westborough, MA for laboratory analysis of VOCs via EPA Method TO-14. The laboratory analytical results for soil gas are discussed in Section 5.

3.5 Sediment and Surface Water Sample Collection

On May 30, 2006, sediment samples were collected from seven locations and surface water samples were collected from nine locations adjacent to the Site in the Neponset River. The locations of each sample collection point are shown on Figure 5. Sediment samples were collected using a Wildco Ponar dredge sampler. Surface water samples were collected approximately two feet above the river bottom using a Koehler bomb sampler. At each location, the surface water sample was collected before the sediment was disturbed. At two of the locations (SW-05 and SW-07), sediment samples could not be collected. The riverbed in those two locations contained only gravel and large rocks.

All sediment and surface water samples were collected in suitable, pre-cleaned, laboratory-supplied containers. Pertinent sample information and analytical methods were recorded on a chain of custody form. Samples were sent by courier to Resource Laboratory in Portsmouth, NH for laboratory analysis of VOCs by EPA Method 8260B, polycyclic aromatic hydrocarbons (PAHs) by EPA method 8270, and RCRA 8 metals by EPA Method 6010B. The laboratory analytical results for sediment and surface water sampling are discussed in Section 5.

3.6 Site Hydrogeological Characteristics

3.6.1 Surficial Features

Drainage patterns at, and in the vicinity of the Site, were determined by reviewing topographic maps of the area and by conducting field reconnaissance. The land surface not covered by the building is mostly unpaved and overgrown with brush and small trees. A driveway enters the Site from the northeast and is partially asphalt paved. Land surface generally slopes toward the Neponset River to the southeast; however, to the east and southwest on the property, the surface elevation rises sharply before dropping toward the Neponset River.

3.6.2 Soil Classification

Overburden material has been characterized and classified based upon soil samples collected during drilling activities across the Site. During the Phase I drilling, the overburden material was classified as widely graded fill material including medium to fine sand and gravel with traces of cobble, wood, ash, and concrete debris. These observations ranged from 4 to 8 feet below grade on the southeastern portion of the Site near the river, to 8 to 13 feet on the northern portion of the property. Extensive filling was observed in the borings for ESM-02 (to 14 feet) at the western end of the property and ESM-07 (to 11 feet) at the southern end. Below the fill material, overburden material consists of organic silt and clay ranging from five feet below grade in borings ESM-04 and ESM-05 to approximately 14 to 15 feet below grade at ESM-2. Below the silt material, overburden material consisted of coarse to fine sands transitioning to a dense fine sand material encountered at the bottom of each boring. Observations made during drilling activities for the Phase II confirmed these finding. Overburden material on the "0" Fairmount Avenue parcel, which was not investigated during the Phase I, consists of widely graded sand and gravel with traces of cobble and asphalt debris to a depth of 15 feet bgs. Below 15 feet, overburden material consists of silty sand transitioning to silt.

3.6.3 Bedrock Classification

During the Phase I investigation, the characterization of bedrock in the vicinity of the Site was based upon a review of the "Bedrock Geologic Map of Massachusetts" (E-an Zen, editor; 1983). The bedrock in this area consists primarily of granite, gneiss and schist, described as "plutonic and metamorphic rocks of probable Proterozoic age" which "may include plutonic and volcanic rocks of Paleozoic age or younger."

Bedrock at the Site was more specifically classified based on rock core samples collected during the drilling of bedrock wells ESM-03B, ESM-05B, and ESM-08B. Competent rock was encountered at 20' bgs at ESM-03B and ESM-05B, adjacent to the Neponset River. Competent rock was encountered at 40' bgs at ESM-08B. Bedrock at ESM-03B was primarily classified as argillaceous shale, conglomerate, and schist. Fracturing was mostly diagonal and horizontal, and most fractures were water bearing. A zone of hard granite was encountered at 45' bgs. Beneath the granite, rock was argillaceous and porous. There were many diagonal fractures, some of which were filled with minerals. Bedrock at ESM-05B was classified as argillaceous shale and conglomerate in alternating zones. Fracturing was mostly diagonal and became less frequent with depth. Bedrock at ESM-08B was also classified as argillaceous shale and conglomerate, but with few horizontal fractures.

3.6.4 Groundwater Flow Characteristics

Water table elevations were calculated using top-of-casing survey data and the depth to groundwater measurements collected on April 6, 2006. The depth to groundwater beneath the Site on this date ranged from 4.80 to 13.40 feet below ground surface. A Summary of Water Table Elevation Measurements is included as Table 1.

Based upon these data, the following observations are made regarding groundwater flow at this Site:

- groundwater in the unconsolidated overburden flows generally towards the Neponset River (east) with an approximate horizontal gradient of 0.03 feet/foot.
- Groundwater in the bedrock aquifer also flows towards the east, with an approximate horizontal gradient of 0.1 feet/foot.
- Vertical groundwater flow direction and gradients were calculated at the three overburden/bedrock couplets, and are summarized as follows:
  - At ESM-8, groundwater flow is up (from bedrock to overburden) at a gradient of 0.122 ft/ft.
  - At ESM-5, groundwater flow is down (from overburden to bedrock) at a gradient of 0.0034 ft/ft.
  - At ESM-3, groundwater flow is down at a gradient of 0.021 ft/ft between overburden at the mid-depth bedrock well, and down at a gradient of 0.005 ft/ft between overburden and the deep bedrock well.
  - At all three piezometer pairs located between the building and the river, the groundwater flow direction is up, indicating discharge into the river.

Maps showing the approximate configuration of the water table (overburden aquifer) and the potentiometric surface of the bedrock aquifer on April 6, 2006 are included as Figure 6 and Figure 7, respectively.

3.6.5 Overburden Aquifer Characterization

Aquifer slug tests were performed on April 11, 2006 at monitoring wells ESM-03, ESM-05, and ESM-13. The aquifer slug tests were performed to estimate the hydraulic conductivity of the shallow overburden aquifer. Hydraulic conductivity (K) is a coefficient that characterizes the rate that water can move through permeable material. Figure 3 shows the locations of the tested wells.

Testing was conducted by inserting a 1.5-inch diameter PVC cylinder (slug) into each well and allowing the water level to return to static conditions. The slug was then rapidly removed and the resulting change in water level was measured by a submersible pressure transducer and recorded with an InSitu MiniTroll™ microprocessor controlled data logger at predetermined time intervals. Duplicate slug tests were performed at each well to measure reproducibility and similar results were obtained.

After testing was complete, water level data stored in the data logger was downloaded to a personal computer for analysis. The slug test data was analyzed using methods derived for unconfined aquifers by Bouwer and Rice (Bouwer and Rice, 1976, Water Resources Research, V.12, no. 3, pp. 423-428) and updated by Bouwer (Bouwer, 1989, Ground Water, V.27, no. 3, pp. 304-309). Automatic matching of a straight line to the data, and parameter estimation based on the match, were completed with the aid of AQTESOLV™ for Windows, Version 2.5, an interactive software package developed by Geraghty and Miller (1995). This method is appropriate for monitoring wells screened across the water table where the initial water table displacement is less than 25% of the effective screen length under static conditions (Butler, 1998).

The data plots showing the displacement (base 10 log) versus time exhibited a "double straight line effect" on wells ESM-03 and ESM-13; this is often encountered in wells screened across the water table. The first straight line segment of the plot is interpreted as representative of monitoring well sand pack drainage; the second straight line segment is representative of the hydraulic conductivity of the overburden formation surrounding the well. A normalized head was used in order to calculate the hydraulic conductivity of the aquifer without the effects of the sand pack. This normalized head was determined by finding where the displacement measured at time "t" and the initial displacement have a ratio between 0.2 and 0.3. Automatic curve matching via the Bouwer-Rice method was then used in AQTESOLVE to estimate the hydraulic conductivity of the aquifer.

Data from well ESM-05 showed a convex upward tail, which is assumed to be due to water released from storage. A normalized head was calculated for ESM-05, but this procedure was not successful at refining the hydraulic conductivity estimate.

The saturated thickness for each well location was calculated by subtracting the depth to water from the depth to bedrock. The horizontal and vertical hydraulic conductivities were assumed to be homogenous and correction was made for the porosity of the monitoring well filter sand pack. Based on an average of the slug tests performed on wells ESM-03 and ESM-13, hydraulic conductivity was estimated around 1.9 gallons per day per square foot (gal/day/ft^2). ESM-5 had a significantly larger hydraulic conductivity than ESM-03 and ESM-13, estimated to be around 192 gallons per day per square foot. This difference was noted during sample collection and during slug testing when it was observed how much more quickly water levels in ESM-5 recovered. It should be noted that the results of the slug tests are only an indication of the aquifer properties in the vicinity of the monitoring wells tested. Slug test data for each location is included in Appendix B.

4.0 ENVIRONMENTAL FATE AND TRANSPORT [310 CMR 40.0835(4)(E)]

The characteristics and physical parameters of OHMs affect its fate and transport in the environment. Chemicals of Potential Concern (COPC) identified in soil, groundwater, soil gas, surface water and sediment at the Site include VOCs, PAHs, petroleum hydrocarbons, PCBs, and heavy metals (primarily lead). The list of COPCs is provided in Table 6 of the MCP Method 3 Risk Assessment prepared by Woodard and Curran (Appendix C).

The environmental fate and transport characteristics of VOCs, metals and PCBs, as well as migration pathways specific to this site, are discussed below:

- Volatile organic compounds (primarily chlorinated VOCs) are mobile in the environment, and can migrate with groundwater and/or volatilize/intrude into indoor air. At this site, numerous historic releases of chlorinated VOCs occurred, both inside the building (via the trench drain) and possibly outside the building. The solvents are found in both soil and groundwater (overburden and bedrock). As will be discussed in the Conceptual Site Model (Section 5.3), VOCs in the overburden have migrated vertically into bedrock near well ESM-3 due to their density (relative to water) and fractures in this area, but have not migrated into bedrock as much near well ESM-5.

The Phase II field investigation suggests that VOCs in the overburden aquifer likely discharge into the Neponset River, where they become diluted. Groundwater data from piezometers installed on the south side of the river show that VOCs are not migrating in groundwater beneath the river. Soil gas data collected from beneath the building confirms the volatility of these compounds and their potential to intrude into indoor air.

- Metals (primarily lead) are typically not easily mobilized in the environment, but can be persistent. At the Lewis Chemical site, a wide range of lead concentrations were detected, up to 4800 mg/kg. With a few exceptions, most of the elevated lead concentrations were found in the upper three feet of soil. Since lead is not volatile and its solubility in water is low, its distribution in the environment is mostly limited to upland soils.
- PCBs are not easily mobilized in the environment or soluble in groundwater under normal conditions, although they are persistent in the environment and are known to bio-accumulate. At this site, PCBs were detected in soil at a number of locations, although at generally low concentrations compared to MCP Method 1 Standards. However, PCBs in groundwater were elevated above the solubility limit in samples collected from ESM-05 and PZ-02. It is believed that the solubility of PCBs in this portion of the Site is greatly increased because of the presents of chlorinated solvents.

The potential for chemicals of potential concern to migrate to and intrude into indoor air at this site was evaluated through the collection of soil gas samples.

5.0 NATURE AND EXTENT OF CONTAMINATION [310 CMR 40.0835(4)(F)]

5.1 Source(s) of Oil and/or Hazardous Materials

The concentrations of oil and/or hazardous materials (OHM) detected at the Site appear to be related to historical waste handling, storage, and treatment operations conducted by Lewis Chemical Company between the years of 1963 and 1983. While there are a number of COPCs identified, chlorinated VOCs are of primary concern, as they are found above risk-based concentrations in soil, groundwater, and soil gas. VOCs in groundwater are found within close proximity of the Neponset River, and under the building. The two breached areas of the trench drain are likely contaminant migration pathways to the subsurface. Floor drains located in the shipping and receiving area and within the former tank farm pad are other likely contaminant migration pathways. Additionally, documented and undocumented spills and general poor waste handling activities likely contributed to the distribution of OHM in the subsurface.

5.2 Results of Subsurface Investigation

This section discusses the results of the field investigation and the laboratory analyses conducted on soil, groundwater, sediment, surface water, and soil gas samples collected during the Phase II investigation. This section also discusses ES&M's conclusions based on the results in conjunction with observations made during field activities. For reference purposes only, laboratory analytical results discussed in this section and presented on Tables 2 through 4 for soil and groundwater samples were compared to MCP Method 1 standards. For this site, an MCP Method 3 Risk Characterization approach was used to evaluate potential risks associated with exposure to OHM by incorporating site-specific information. Therefore, the Method 1 Standards are only for relative comparison, and do not represent any level of risk. Section 6.0 summarizes the Method 3 Risk Characterization, which is included as Appendix C of this report.

5.2.1 Test Pits

UST Area

Test pits completed in the UST area identified the location of one 8,000-gallon UST (twenty-two feet long by eight feet in diameter) containing approximately 550 gallons of petroleum and water. The UST was later removed under a Release Abatement Measure (RAM) Plan submitted by ES&M in February 2006. Fleet Environmental was contracted by DND to remove and dispose of the liquids and the UST. ES&M collected composite samples of soil for closure purposes in accordance with MassDEP Policy WSC-402-96 "Underground Storage Tank Closure Assessment Manual" (April 9, 1996). Figure 8 shows the location of the former UST and RAM-related soil samples. The RAM Completion Report, submitted by ES&M on June 13, 2006, describes the RAM activities in detail. Soil analytical results were included in the data used for the Method 3 Risk Characterization appended to this report. Based on the condition of the tank upon removal, field observations, and laboratory results, ES&M concludes that the UST was in good condition and did not substantially contribute to environmental concerns at this site.

Also in the UST area, a number of bricks arranged in a five-foot diameter circle were found approximately two feet bgs during the excavation of TP-06. The soil sample from TP-06 (2.5' bgs) had a concentration of 360 mg/kg of tetrachloroethene (PCE) and a concentration of 110 mg/kg of C5 to C8 aliphatic hydrocarbons. It was initially thought that this structure was a former dry well; however, further test pitting did not reveal any physical structures beneath the brick ring. Additional investigation of this area was completed during the installation of overburden monitoring wells ESM-13 and ESM-14. This investigation did not reveal any defined source of VOCs in soil or groundwater.

Fill Area

The test pits conducted in the fill area southwest of the building revealed substantial solid waste (stacks of paper or cardboard-like material) buried up to five feet below grade. Samples of this material found in the fill area were collected and analyzed for leaching potential of metals by Toxicity Characteristic Leaching Procedure (TCLP) analysis and for asbestos content. The material did not leach any metals, and was classified as "non-asbestos".

Suspected Drum Area

Six test pits were completed in the "suspected buried drum area" identified during the GPR survey. Large pieces of asphalt, granite curbing, pallet bands, abandoned utility lines, and scrap metal re-bar were found. No drums or pieces of drums were found in any of the test pits, and VOCs were not detected during field screening of soil samples. The anomalies detected by the GPR study were most likely caused by the large pieces of asphalt and granite.

5.2.2 Summary of Soil Laboratory Analytical Results

A summary of all laboratory analytical data collected during the Phase I and II investigations for soil is included as Table 2. Samples of soil from across the Site were analyzed for VPH (Table 2.1), EPH (Table 2.2), metals (Table 2.3), PCBs (Table 2.4), and VOCs (Table 2.5). For reference purposes, the lower of the MCP Method 1, S-1/GW-2 or S-1/GW-3 standards are included on the table. Note that the Method 1, S-1 Standards are the most stringent residential soil standards under the MCP, and are therefore extremely conservative for use at this site. Copies of the laboratory analytical reports for soil are included in Appendix D. The main highlights of these tables are as follows:

- Concentrations of petroleum hydrocarbons (VPH and EPH) were generally very low across the Site compared to Method 1 standards. While VPH and/or EPH category compounds were detected in the vicinity of the UST and test pit TP-06, the concentrations of these petroleum-related compounds are not considered to be a factor in the risk characterization.
- Detectable concentrations of lead were found primarily in the surficial soils (0-6" bgs) across the Site with the exception of samples ESMB-02, I-A-03-M, TP-03, and TP-06, where lead was detected at greater soil depths. Figure 9 shows the concentrations of total lead detected in surficial soils (0-3' bgs). Figure 10 shows the concentrations of total lead detected in subsurface soils (>3' bgs). The data do not appear to show any pattern to indicate the source or origin of lead.
- PCBs were detected in surficial and subsurface soils throughout the Site; however, the majority of the results were below Method 1 Standards. A total of 61 samples were analyzed for PCBs. Of those 61 samples, only four samples (or 6.5%) were above 10 mg/kg, and 14 samples (or 23%) were above the most stringent Method 1 Standard of 2 mg/kg. Only aroclor 1248 was detected in soil. Similar to the observations regarding lead, there was no pattern to the distribution of PCBs that would suggest a distinct source. Furthermore, none of the background files reviewed for this site indicated that PCBs were a part of Lewis Chemical's business.

  Of particular note are the PCB soil results from samples TKFMDR and ESM-05. The TKFMDR sample was collected from a floor drain within the former tank farm containment area, just outside and to the southwest of the building. If PCBs were present within the containment area along with chlorinated solvents, PCBs could have dissolved into the solvents and become significantly more mobile in the subsurface. This would explain the concentrations of PCBs in groundwater at ESM-05 and PZ-02, as well as the concentration of PCBs in soil well below the water table (13 to 15 foot depth interval) at ESM-05.

  Figure 11 shows the concentrations of PCBs detected in surficial soils (0-3' bgs). Figure 12 shows the concentrations of PCBs detected in subsurface soils (>3' bgs).

- VOCs were found in soil samples across the Site, with the highest concentrations detected near wells ESM-03 and ESM-05. Both wells are located between the building and the Neponset River, and both wells are located near suspected infiltration points (floor drains). For graphic purposes, trichloroethene (TCE) was chosen as a representative analyte, however a review of Table 2.5 shows that many different compounds have been detected. Figure 13 shows the concentrations of TCE detected in surficial soils (0-3′ bgs). Figure 14 shows the concentrations of TCE detected in subsurface soils (>3′ bgs).

5.2.3 Summary of Groundwater Laboratory Analytical Results

A summary of the laboratory analytical data collected for groundwater is included as Table 3. Samples of groundwater from across the Site were analyzed for VPH (Table 3.1), EPH (Table 3.2), metals (Table 3.3), PCBs (Table 3.4), and VOCs (Table 3.5). Table 4 shows the groundwater samples results of the packer testing completed during the installation of bedrock wells ESM-03B, ESM-05B, and ESM-08B. For reference purposes only, the lower of the MCP Method 1, GW2 or GW3 standards are included on the tables. Copies of the laboratory analytical reports for groundwater are included Appendix E.

- Petroleum hydrocarbons (VPH and EPH) were detected in groundwater primarily near the northwest corner of the building. Concentrations of C5-C8 aliphatics (150,000 µg/l), toluene (40,000 µg/l), and xylenes (6,700 µg/l) were detected in samples from monitoring well ESM-03. It is unlikely that these compounds are related to a release of a petroleum fuel, which would typically also include aromatics, longer chain aliphatics, and/or EPH-category compounds. It is more likely that the elevated concentrations of C5-C8 aliphatics are related to non-chlorinated solvents that may have been handled by Lewis Chemical and introduced into the ground via the interior trench drain.
- Metals (arsenic, barium, lead, selenium, and silver) were found in groundwater across the Site. All of the concentrations detected were below Method 1, GW-3 groundwater standards.
- PCBs (specifically, aroclor-1242) were detected in groundwater from monitoring wells near the southeast corner of the building, and from well ESM-14. As previously mentioned, groundwater near the southeast corner of the building was also impacted by chlorinated VOCs, which are believe to increase the solubility of PCBs, making them more mobile in the subsurface. PCBs were not detected in any of the groundwater samples collected from the bedrock wells. Figure 15 shows the concentrations of PCBs detected in groundwater.
- VOCs were found in groundwater from monitoring wells across the Site, with the highest concentrations detected in wells located between the building and the Neponset River. Figures 16 through 19 show concentrations of toluene, TCE, TCA, and PCE, respectively, detected in samples from both overburden and bedrock monitoring wells. Packer testing completed during the installation of the bedrock wells showed concentrations of VOCs increasing with depth at bedrock well ESM-03B and decreasing with depth at bedrock ESM-05B. Only one packer test was completed at bedrock well ESM-08B, and that sample indicated concentrations of TCE up to 350 µg/l.

5.2.4 Summary of Sediment/Surface Water Laboratory Analytical Results

A summary of the laboratory analytical data for sediment samples is included as Table 5. Samples of sediment collected from the Neponset River in the vicinity of the Site were analyzed for metals (Table 5.1), PAHs (Table 5.2) and VOCs (Table 5.3). There are no MCP Method 1 standards for sediment to which results may be compared. Therefore, the results were incorporated into the ecological risk characterization included in Appendix C. Since no analytes were detected in the surface water samples, tables were not generated for this media. Copies of the laboratory analytical reports for sediment and surface water are included in Appendix F.

5.2.5 Summary of Soil Gas Laboratory Analytical Results

A summary of the laboratory analytical data for soil gas is included as Table 6. Samples of soil gas collected from six locations beneath the building were analyzed for VOCs. Copies of the laboratory analytical reports for soil gas are included Appendix G.

- VOCs were detected in soil gas beneath the building at all six locations.
- The highest concentrations of vinyl chloride and cis 1,2 DCE were at SG-2; the highest concentrations of PCE and toluene were at SG-4; and the highest concentrations of TCA, TCE, 1,1 DCA, 1,1 DCE, 1,2 DCA and ethylbenzene were at SG-6. These three points were near the southeast wall, in close proximity to the trench drain.

Figures 20 through 23 show concentrations of toluene, TCE, TCA, and PCE detected in soil gas beneath the building.

5.3 Conceptual Site Model

The source, nature, and extent of OHM impact to soil, groundwater, sediment, and soil gas were investigated during this Phase II CSA. Field investigation data confirm that OHM, in particular chlorinated solvents, were introduced into the environment as a result of poor waste handling practices. This section presents a conceptual site model to describe the source of the various OHM and how contaminants migrated in the environment.

5.3.1 Petroleum Hydrocarbons

VPH and EPH detected in soil were confined to the area surrounding the former UST. With the exception of VPH detected in groundwater at monitoring well ESM-03, concentrations of VPH and EPH in groundwater were relatively low compared to Method 1 standards. The concentrations of VPH constituents found at ESM-03 are likely related to a non-chlorinated solvent rather than a petroleum fuel. The concentrations of VPH and EPH found in soil and groundwater near the UST can be attributed to possible overflows during filling activities, but do not appear to be the result of a failed tank. Had the tank failed, the concentrations of VPH and EPH-category compounds would have been much higher, and the tank would have shown evidence of failure (i.e., holes) upon removal.

5.3.2 Metals

Metals were detected in soil and groundwater throughout the Site. With the exception of lead, the concentrations of metals detected in soil were consistent with or below MassDEP-identified concentrations occurring in "natural soils". The elevated concentrations of lead were found primarily in the surficial soil, although the highest concentration was found in a soil sample from TP-3 at a depth of 5.5 feet. No historical Site usage or activity was specifically identified to account for the source and distribution of lead at this site.

5.3.3 PCBs

PCBs (aroclor 1248) were detected in soil in several areas across the Site. In most soil samples the PCB concentrations were below 10 mg/kg. Of the sample results above 10 mg/kg, one sample was collected from boring I-B-05 (near the UST area) and the rest collected near the southern corner of the building near the banks of the river. For the most part, concentrations of PCBs in soil across this site were relatively low compared to Method 1 Standards, and no specific source of PCBs was identified.

Concentrations of PCBs (aroclor 1242) were detected in groundwater well above the solubility limit in several monitoring wells. It is believed that PCBs, which are much more soluble in the presence of solvents, are found in groundwater at high concentrations because of this "co-solvent" effect. It is believed that a likely source of entry into the groundwater was through the former tank farm drain, where PCBs were detected in drain sludges, and where releases of chlorinated solvents were documented. If PCBs were released into this drain followed by solvents, the PCBs would dissolve in the solvents and migrate with the solvents to groundwater.

While much is known about the distribution of PCBs in soil and groundwater, the extent of PCBs at this site relative to the Neponset River is not determined at this time because of PCB impact to the river from other sources. The Neponset River and Mother Brook (which flows into the Neponset River several hundred feet upstream of the Site) have been the subject of extensive study and clean up by others. In 2004, the US Geological Survey (USGS) completed an initial study of the river, which identified PCBs in sediment and surface water throughout the river. This study, however, did not at that time identify the L. E. Mason site (located on Mother Brook) as a major source of PCBs to Mother Brook (and therefore, also to the Neponset River). L. E. Mason is a MassDEP-listed site that has been the subject of significant assessment and clean up of PCBs, both on site and in Mother Brook. In 2000 and 2001, PCBs were detected in upland soils at concentrations up to 4,600 mg/kg and in sediment collected from Mother Brook directly adjacent to L. E. Mason's manufacturing facility at concentrations up to 2,100 mg/kg. [By comparison, the highest concentration of PCBs detected at the Lewis Chemical site was 70 mg/kg, and the majority of the samples collected were below 10 mg/kg.] L. E. Mason subsequently conducted an Immediate Response Action (IRA), which included the diversion of Mother Brook and the excavation and off-site disposal of more than 2,000 tons of PCB-impacted soil and sediment. Even after this removal action, residual PCB concentrations in Mother Brook sediments were as high as 83 mg/kg near the facility, and as high as 52 mg/kg downstream of the L. E. Mason property. Additional remediation work was planned for the summer of 2006 (information not currently available) to remove impacted sediments in Mother Brook to the confluence with the Neponset River (upstream of the Lewis Chemical site).

Based on ES&M's review of available reports, and on discussions with USGS, ES&M believes that the L. E. Mason site is a source of PCBs in the Neponset River. It is our understanding that USGS has completed additional assessment of the Neponset River and Mother Brook, and those findings are due to be published in the summer of 2007.

Because of this complex situation with additional sources, the fact that PCB concentrations on the upland portion of the subject site are generally below the most stringent MCP soil standards, and because USGS has undertaken a second study of PCB levels in the Neponset River, this Phase II CSA did not include the collection of additional sediment samples for PCBs. Hence, we are unable to determine whether the relatively low concentrations of PCBs on the Lewis Chemical site have contributed to PCBs in the Neponset River. Based on our understanding of both the L. E. Mason site and the Lewis Chemical site, our opinion is that PCBs at the Lewis Chemical site have not exacerbated conditions in the Neponset River. Once the USGS report is issued in the Summer of 2007, additional documentation in support of this opinion will be developed.

5.3.4 VOCs

Floor drains along the western edge of the building were in poor condition, which allowed releases to migrate into the underlying soil. These open-bottom drains are the most likely pathway for solvents to the environment. The floor drain in the "tank farm" pad on the southern side of the building was also a pathway for OHM to the environment.

Groundwater flows across the Site toward the Neponset River (southwest). Solvents and other chemicals being processed at the Site were released to the floor drains and the tank farm pad, and then filtered through the open bottoms of the drains and over the open sides of the tank farm pad to soil, and eventually to groundwater. Overburden soil data collected during drilling activities identified a silty soil layer in several areas of the Site. In the northern portion of the building (near well ESM-16), the silt layer begins immediately below the foundation and continues to a depth approximately eight feet bgs. This silty layer appears to slope towards the river. VOCs introduced through the floor drain in this area migrated toward ESM-03 along the silt layer and with groundwater, down into the fractured bedrock. Packer testing data from the installation of bedrock well ESM-03B confirm concentrations of VOC increasing with depth[4]. Figure 24 shows a cross-section of this area to illustrate this point.

In the southern portion of the building, some of the silt layer is preceded by a sand layer immediately beneath the foundation of the building. At ESM-15, silty sand was encountered from zero to ten feet bgs, but at borings ESMB-01 and ESMB-02, silty sand was not encountered until five feet and seven feet bgs, respectively. Consequently, the silt layer in this part of the site may slope away from the river, and it is possible that a portion of the released solvents migrated along this silt layer. This may explain elevated concentrations of solvents in the vicinity of well ESM-15 upgradient of the trench drains. Bedrock in this area (vicinity of ESM-05B) is more competent than the bedrock near ESM-03B. Packer testing results indicate concentrations of VOCs decreasing with depth. The more competent bedrock in this area may have confined more of the solvents to the overburden, explaining why the highest

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[4] Although the limits of impact to the bedrock aquifer were technically not defined vertically near ESM-3, additional drilling to define the vertical extent is not practical. It is ES&M's opinion that the vertical extent of solvents was defined at this site for all practical purposes, and that additional drilling (either deeper at ESM-3 or at other locations) would be prohibitively expensive and would not substantially add to the assessment of this site.

concentrations of VOCs were found in the overburden in monitoring well ESM-05. Figure 25 shows a cross-section of the ESM-05 area to illustrate this point.

While solvents primarily migrated vertically near well ESM-3, the solvents appeared to have migrated more horizontally near well ESM-5. Groundwater/surface water monitoring and sampling data suggests that VOCs have, and likely still are, migrating into the Neponset River were they adsorb to sediment and dilute into the river water. The piezometer data confirm that groundwater containing VOCs has not migrated horizontally under the river to the opposite shore.

6.0 RISK CHARACTERIZATION [310 CMR 40.0835(4)(H)]

A characterization of risk to human health, safety, public welfare, and the environment was completed for the Site in accordance with procedures outlined in the MCP (310 CMR 40.0900) and in a manner consistent with scientifically acceptable risk assessment practices established by the MassDEP and EPA. For this Site, an MCP Method 3 Risk Characterization approach was used to evaluate potential risks associated with exposure to soil, groundwater, indoor/ambient air, and sediment by incorporating site-specific information. Woodard and Curran, Inc was contracted by DND to conduct a Method 3 Risk Characterization in accordance with MCP 310 CMR 40.0970 to characterize the risk of harm to health, public welfare, and the environment at the Site. The text and tables from the risk characterization are provided in Appendix C, and the remainder of the appendixes are included on the attached CD. This section summarizes the approach and outcome of the risk evaluation.

6.1 Evaluation of the Risk of Harm to Human Health

Chemicals of Potential Concern (COPC) identified in soil, soil gas, groundwater, and sediment at the Site include VOCs, PAHs, petroleum hydrocarbons, PCBs, and/or heavy metals. Two Hot Spots (Hot Spots #1 and #2, shown on Figure 3) were identified at the Site near the banks of the Neponset River. Elevated levels of chlorinated VOCs are present in both soil and groundwater at these two locations.

Relevant exposure media include soil, groundwater, sediment, indoor air, and ambient air. Surface water is not a medium of concern as COPCs were not detected in this medium based on 2006 analytical results. Based on site characteristics, potential human receptors and exposure pathways evaluated include the following:

- **Current/Future Recreational User:** The Neponset River is a Class B waterway, suitable for swimming, boating, and other recreational activities (310 CMR 4.00). Boaters on the Neponset River may potentially encounter COPCs in sediment in the river, as well as in soil on the banks of the river adjacent to the Site. Routes of exposure potentially include incidental ingestion of and dermal contact with sediment and bank soil and inhalation of fugitive dust (e.g., windblown) from bank soil. Recreational users were assumed to not encounter any upland soils at the Site, as the Site is fenced off behind the steep riverbank. As described below, a separate evaluation for the trespasser scenario, in which a youth is exposed to COPCs in upland Site soils, was conducted in which risks were quantified.

- **Current/Future Youth Trespasser:** The Site is located in a mixed residential/commercial area. Site access is limited by locked chain-link fencing around the perimeter of the property; however, there is visual evidence of trespassing. Given that portions of the Site are unpaved and that COPCs are present in surface (i.e., 0-3 feet bgs) soil, there is the potential for trespassers to encounter COPCs in surface soil under current conditions, and to all soil (0 to 15 feet bgs) under future scenarios. Potential routes of exposure include dermal contact with and incidental ingestion of COPCs in soil and the inhalation of COPCs bound to fugitive dust from soil.

- **Current/Future Facility Worker:** Currently the Site building is vacant, but the property will likely be redeveloped as a commercial or industrial property in the future. It was assumed that all impacted soils at the Site (0-15 feet bgs) may be exposed under future redevelopment scenarios. Future facility workers may potentially encounter COPCs in impacted soil via incidental ingestion, dermal contact and inhalation of fugitive dust. Due to the presence of VOCs in shallow groundwater and soil gas at the Site, it was assumed future facility workers may potentially inhale VOCs, which could migrate from the subsurface into the indoor air of a hypothetical future building.

- **Future Construction Worker** During future Site redevelopment activities, construction workers may be exposed to COPCs in soil, groundwater, or ambient air during activities requiring excavation. Potential routes of exposure include dermal contact with COPCs in soil and groundwater, and incidental ingestion of COPCs in soil. Construction workers may also inhale volatile COPCs that have migrated from the subsurface into the ambient air of an excavation trench or inhale COPCs bound to air-borne soil-derived particulates. Incidental ingestion of contaminated groundwater was assumed to be unlikely, as was exposure to sediment; therefore, these exposure pathways for this scenario were not evaluated.

- **Hypothetical Future Site Resident** It was assumed that the Site might be redeveloped for residential use (most likely as multi-family residences, such as condominiums or apartments) in the future. Thus, risks were quantified for a future residential scenario in which hypothetical Site residents may have dermal contact with or incidentally ingest COPCs in impacted soil and inhale COPCs entrained in fugitive dust. Risks associated with the consumption of homegrown produce were not quantified for this scenario; instead, it was assumed that this activity would be restricted through an Activity and Use Limitation (AUL). It was assumed that residents might potentially inhale VOCs that have migrated from the subsurface into indoor air of a home. Additionally, given the close proximity of the Site to the river, it was assumed that the resident may use the river for recreational purposes, and may therefore may be exposed COPCs in sediment and bank soil via dermal contact or incidental ingestion.

Cumulative non-cancer risk estimates, expressed as Hazard Indices (HIs), were calculated for each of these scenarios at each relevant exposure point (i.e., Hot Spot #1, Hot Spot #2 and "Site-wide") and compared to promulgated MCP risk limits. Cumulative receptor non-cancer risks, expressed as a Hazard Quotient (HI), were compared to one, the MCP Cumulative Non-cancer Risk Limit. Cumulative cancer risks, expressed as an Excess Lifetime Cancer Risk (ELCR), were compared to the MCP risk limit of 1 x 10^{-5}.

Human Health Risk Characterization Results

Both non-cancer and cancer risks quantified for the recreational user and trespasser scenarios do not exceed the MCP cumulative risks limits of one and 1 x 10^{-5}, respectively. This indicates that concentrations of COPCs in soil and/or sediment at the Site do not pose a significant risk of harm to human health for the types of exposure scenarios consistent with current Site uses.

For future redevelopment scenarios, the evaluation found that the risks estimated for future on-site facility workers and residents exceed the MCP risk limits, primarily due to vapor intrusion of VOCs in soil gas beneath the existing building foundation into indoor air of the building. For the residential scenario, PCBs and heavy metals in soil also contribute to cumulative risks.

Concentrations of VOCs in groundwater pose a significant risk of harm to construction workers at Hot Spot #1; however, cumulative risks estimated for the construction worker scenario at other Site exposure points do not exceed MCP risk limits.

Based on this evaluation, a condition of No Significant Risk (NSR) of harm to human health exists at the Site for current exposure scenarios, but does not exist at the Site for future redevelopment scenarios.

6.2 Comparison to Applicable or Suitably Analogous Health Standards

The MCP requires that all applicable or suitably analogous health standards be identified and compared to exposure point concentrations in a Method 3 Risk Characterization (310 CMR 40.0993(3)). The EPA residential lead hazard standard of 400 mg/kg in soil (40 CFR 745, Section 403 of the Toxic Substances Control Act) was identified as the only potentially applicable or suitably analogous health standard for the Site, since the Site may potentially be redeveloped for residential purposes. However, the average concentrations of lead in both "Site-wide" and Hot Spot #2 soils are below the EPA lead standard. (Lead was not detected/analyzed in Hot Spot #1 soil).

6.3 Evaluation of the Risk of Harm to Public Welfare, Safety and the Environment

Based on observations made and information collected during environmental investigations of the Site, conditions at the Site do not pose a threat of physical harm or bodily injury to people. Furthermore, neither Woodard & Curran nor ES&M identified release-related conditions that may pose a risk to public safety. **Therefore, a condition of No Significant Risk of harm to safety has been achieved at the Site.**

There is no adverse impact to the surrounding community from the Site. However, one of the public welfare criteria involves a comparison of analytical data to MCP Upper Concentrations Limits (UCLs). Concentrations of trichloroethene and C19-C36 aliphatics in groundwater exceed their UCLs. **Therefore, a condition of No Significant Risk to Public Welfare has not been achieved at the Site.**

Based on the way the Site is currently developed and will likely be redeveloped in the future, and because undeveloped areas comprise less than one acre of the Site, potential ecological risks for terrestrial receptors were not evaluated, in accordance with MassDEP ecological risk assessment guidance (MassDEP 1996). No observations of readily apparent harm to the environment have been made at the Site; however, sediment concentrations of selenium and VOCs exceed ecological screening benchmarks used in a Stage I Ecological Screening. **Therefore, a condition of No Significant Risk of harm to the environment has not been demonstrated at the Site for current and reasonably foreseeable future conditions.**

7.0 DATA USABILITY ASSESSMENT [310 CMR 40.0017]

7.1 Presumptive Certainty Evaluation

In accordance with 310 CMR 40.0017, any person undertaking response actions under the MCP shall ensure that analytical and environmental monitoring data used in support of LSP Opinions with respect to assessment, removal, or containment actions is scientifically valid and defensible, and of a level of precision and accuracy commensurate with its stated or intended use. Furthermore, 40.0017 (3)(i) also provides that all response action submittals shall include details on any known conditions or findings which may affect the validity of analytical data, including unsatisfactory results obtained on QA/QC blank, duplicate, surrogate, or spiked samples.

The MassDEP has provided guidance of the particular components of a recommended QA/QC and data reporting program that may be electively used by parties conducting response actions. This guidance, entitled Compendium of Quality Assurance and Quality Control Requirements and Performance Standards for Selected Analytical Methods Used in Support of Response Actions for the MCP (BWSC-CAM) summarizes these data quality requirements necessary to achieve a level of "presumptive certainty" regarding environmental monitoring and analytical data collected in support of MCP decisions.

The soil, groundwater, surface water, and sediment data collected during this Phase II CSA were collected, analyzed, and reported in accordance with the BWSC-CAM. [Note that data from the Phase I investigation, which was used for delineation purposes, was collected prior to implementation of the CAM policy.] The collection and analytical methods relative to soil gas and asbestos are not covered under the CAM. Data collected during this Phase II CSA were reported in nineteen laboratory reports. Sixteen of those reports are categorized as CAM-compliant, two are for Non-CAM methods, and one is CAM Non-Compliant. Laboratory prepared Data Certification Summaries are included the lab reports. In addition, Lab Results Quality Review forms were completed by ES&M for each lab report. Any project specific method modifications, non-conformances, or observations are detailed in the Project Narrative section of the laboratory reports. Laboratory narratives either indicate that required QA/QC was met or sufficiently explained any non-conformances which were then evaluated to not negatively impact the value of the data. Site history, release history and observations made during sampling are consistent with the nature and level of contamination identified in the analytical data. A summary of laboratory reports and their CAM compliance status is included below:

Lab ID	Sample Date	CAM Form Included	Lab Presumptive Certainty?	QC Performance Standards Met	CAM COMPLIANCE	Result?
84427	06/01/05	Yes	NO	No	Non-Compliant	Presumptive Certainty, Except for Data pertaining to sample ID "TANK 1" for 8021 analysis (only used to determine contents of UST prior to removal).
85632	07/13/05	Yes	Yes	No	Compliant	Presumptive Certainty
87113	08/30/05	Yes	Yes	No	Compliant	Presumptive Certainty
87813	08/31/05	Yes	Yes	Yes	Compliant	Presumptive Certainty
10061	03/23/06	Yes	Yes	No	Compliant	Presumptive Certainty
10068	03/23/06	Yes	Yes	Yes	Compliant	Presumptive Certainty
10070	03/24/06	Yes	Yes	Yes	Compliant	Presumptive Certainty
10079	03/27/06	Yes	Yes	No	Compliant	Presumptive Certainty
10088	03/28/06	Yes	Yes	Yes	Compliant	Presumptive Certainty
10094	03/29/06	Yes	Yes	Yes	Compliant	Presumptive Certainty
L0604251	03/29/06	No	No	N/A	NON-CAM	Presumptive Certainty
10103	03/30/06	Yes	Yes	No	Compliant	Presumptive Certainty
10105	03/31/06	Yes	Yes	Yes	Compliant	Presumptive Certainty
10154	04/06/06	Yes	Yes	No	Compliant	Presumptive Certainty
10170	04/10/06	Yes	Yes	No	Compliant	Presumptive Certainty
10171	04/10/06	Yes	Yes	No	Compliant	Presumptive Certainty
10426	05/30/06	Yes	Yes	No	Compliant	Presumptive Certainty
96205	06/21/06	No	No	N/A	NON-CAM	Presumptive Certainty
11371	11/15/06	Yes	Yes	No	Compliant	Presumptive Certainty

Copies of the ES&M Lab Report Quality Review documents for each lab report are included at the beginning of Appendices D, E, F, and G. The Phase II data was determined to be scientifically valid and defensible, and of a sufficient level of precision, accuracy, and completeness to be used in this Phase II CSA.

7.2 Representativeness Evaluation

A representativeness evaluation has been performed to evaluate the adequacy of the spatial and temporal data sets to support this Phase II CSA. In summary, sufficient spatial and temporal data are available to render conclusions on potential risks to the receptors identified, on current and future non-health risks, and to support this Phase II assessment. The datasets adequately defined the nature and extent of soil, groundwater, sediment, and soil gas impact at the Site.

7.3 Conceptual Site Model

The following information regarding the Conceptual Site Model is described in this report in the sections noted:

CSM Component Description	Phase II CSA Section
History of disposal site as applicable to the potential presence of oil and hazardous materials	Section 2.3.2 – Release History
Geologic and hydrogeologic setting	Section 3.6 – Site Hydrogeologic Characteristics
Description of the known/estimated volume/mass and types of contaminant(s) released	Section 5.0 – Nature and Extent of Contamination
The approximate date/time period of the release(s)	Section 2.3.1 – Ownership and Prior History – (1963 – 1983)
The location(s) of the initial release(s) and affected media	Section 5.1 – Source(s) of Oil and/or Hazardous Materials
Description of contaminant behavior in the environment, including migration pathways and rate, and fate; density; hydrodynamics and transport factors; and degradation rates	Section 4.0 - Environmental Fate and Transport, and Section 5.3 – Conceptual Site Model
Contaminated/uncontaminated media properties	Sections 2.0 – General Site Information, 3.6 – Site Hydrogeologic Characteristics & 5.2 – Results of Subsurface Investigation
Mechanisms and points of exposure by human and ecological receptors	Section 6.0 - Risk Characterization & Appendix C – Method 3 Risk Assessment

7.4 Work Plan, Data Quality Objectives and Data Collection Approach

7.4.1 Summary of Work Completed

See Section 3.0 for a complete summary of work completed at this site during the Phase II Comprehensive Site Investigation. Also see Section 1.2 for a summary of the results of the Phase I Investigation.

7.4.2 Data Quality Objectives

The data quality objectives were to use data under this Phase II CSA to define the nature and extent of OHM, and to conduct a site-specific risk characterization. Data collected on or after August 1, 2003 satisfies the requirements of the MCP at 310 CMR 40.0017 and 310 CMR 40.0191(2)(c) as described in the CAM. Data collected during the Phase I Investigation (prior to the CAM) was completed under the MassDEP SARSS IV program in association with the EPA Brownfields Grant program. Data collected during the Phase II CSA investigation was also completed under the EPA Brownfields Grant Program. Data collection and analysis for both Phase I and Phase II was completed in accordance with EPA-approved Quality Assurance Project Plans (QAPP).

7.4.3 Data Collection Approach

The work scope describing how data would be collected under this Phase II CSA was included in the Phase II Scope of Work (ES&M, May 2005), and the Quality Assurance Project Plan

(ES&M, May 2005, amended August 2005). The overall approach was to collect a sufficient number of samples to define the nature and extent of OHM in soil, groundwater, surface water/sediment and soil gas.

7.4.4 Use of Field/Screening Data

Throughout the response actions, field screening was used to determine which samples would be collected for laboratory analysis. This approach resulted in "bias-high" sample collection and is viewed as a conservative approach to site assessment. Instances where field screening results for a particular boring indicated "non-detect", samples were collected from the soil at the water table and submitted for laboratory analysis.

7.4.5 Selection of Sampling Locations and Depths

Sample locations were selected based on field screenings, visual/olfactory observations, and overall representativeness to demonstrate extent of impact, and to determine exposure point concentrations for risk characterization purposes.

Sample locations were also selected in areas of no known sources or releases to confirm that no sources exist and to establish background levels. Sample collection depths were selected based on the highest field screening levels and most obvious visual/olfactory impact, or in cases where no impact was noted, samples were collected at the water table.

All samples were collected in accordance with our Data Quality Objectives.

7.4.6 Number and Spatial Distribution of Sampling Locations

The horizontal and vertical extent of impact from the source has been sufficiently demonstrated through the spatial distribution of sample locations. The spatial distribution of sampling locations and the number of samples collected are sufficient to characterize conditions within the Site.

7.4.7 Temporal Distribution of Samples

Samples used to characterize conditions at the site were collected in 2002 during the Phase I Investigation and between 2005 and 2006 during the Phase II Investigation. The majority of the data used under this Phase II CSA and for the risk characterization were collected in 2005 and 2006.

7.4.8 Critical Samples

The collection of soil and groundwater samples in the areas of monitoring well ESM-03 and ESM-05 constitute the collection of "critical samples". These are the areas closest to the suspected source areas and they exhibit the highest concentrations of VOCs. Furthermore, data from these areas provide important information relative the horizontal and vertical extent of impact.

7.5 Completeness

All areas of the site have been investigated and soil and groundwater conditions have been sufficiently characterized. As previously discussed, a complex issue relative to PCBs in soil and groundwater exists at this site, and data do not currently exist to fully understand the relationship of those PCBs to PCBs in the Neponset River. It is expected that sufficient information will be available to render an opinion on this issue after USGS publishes the next study in the summer of 2007.

7.6 Uncertainty and Inconsistency

Records of historical site uses and activities adequately explain the occurrence and distribution of VOCs but they do not explain the occurrence and distribution of lead and PCBs at the Site. However, this investigation has delineated the extent of lead on-site and in the river, and has provided enough information to characterize the risk posed by the occurrence of lead at the Site. The extent of PCBs on-site has been delineated and there is enough information to characterize the risk posed by PCBs on-site, but not in the river. Section 5.3.3 discusses the issue of PCBs in the river.

8.0 PHASE II SUMMARY AND CONCLUSIONS [310 CMR 40.0835(4)(l)]

Based on the information contained in this Interim Phase II Comprehensive Site Assessment report, the following summary and conclusions are made for the Site:

- Lewis Chemical operated a chemical recycling facility located at 12-24 Fairmount Court in Hyde Park, MA from circa 1963 to 1983. During their tenure at this location, numerous spills of solvents were document. A series of floor drains have been identified, which are likely migration pathways for the solvents to enter the environment.

- A Phase I investigation was completed in 2002, which identified several areas of potential concern at the Site:

    - Fill area southwest of the building – Test pits conducted during this Phase II determined that the buried material is a paper-like material that does not contain asbestos or leachable metals.

    - UST area – Several test pits were excavated to confirm the location of a suspected UST and to determine its contents. This tank and its contents (heating oil and water) were subsequently removed. Confirmatory soil samples demonstrate only residual concentrations of petroleum-related compounds in this portion of the site.

    - Suspected drum area – A ground penetrating radar survey conducted in 2002 identified a number of buried objects in the open field north of the building. A number of test pits were excavated. However, no drums were found and no impacted soil was observed. The objects identified by the GPR appear to be demolition debris (asphalt, concrete and granite curbing).

- In addition to the test pit program, the Phase II field investigation included a number of activities to define the nature and extent of OHM:
    - Completion of 22 soil borings, with collection of soil samples from various depths and analyzed for a full suite of laboratory analytes,
    - Installation of three piezometer pairs, and four shallow piezometers,
    - Completion of soil borings and installation of six shallow (overburden) monitoring wells,
    - Completion of three bedrock monitoring wells, and collection of groundwater samples at 10-foot intervals in bedrock,
    - Collection of soil gas samples from six locations beneath the building;
    - Collection of seven sediment and nine surface water samples from the Neponset River, and
    - Collection of water table and potentiometric surface data, and collection of groundwater samples.

Data from the Phase II field investigation, in conjunction with background research, has been reviewed and evaluated. ES&M therefore offers the following conclusions:

- Three areas previously identified in the Phase I – fill area, UST area, and suspected drum area – have been assessed. These areas are no longer considered areas of concern for this Site in terms of oil and/or hazardous material.

- The primary area of concern at the Lewis Chemical site is beneath the building, and between the building and the Neponset River. Releases and spills of solvents during Lewis Chemical's operation of the site entered the subsurface via a series of floor drains inside the building and within the tank farm pad. Chlorinated solvents have consequently impacted shallow groundwater, and have migrated into the bedrock aquifer northwest of the building.

- Solvents in shallow groundwater migrate with groundwater into the Neponset River, and have impacted sediments adjacent to the site. Groundwater with solvents discharges into the Neponset River water, but solvent concentrations are diluted to non-detectable levels.

- Solvents in groundwater beneath the building are volatilizing from groundwater into the gaseous phase, resulting in elevated concentrations of solvents in soil gas. This condition must be mitigated under any redevelopment plan.

- The other primary risk contributors are the concentrations of solvents in groundwater that exceed the Upper Concentration Limits (UCLs). The UCLs are concentrations that may indicate the potential for significant risk to public welfare and the environment. UCL exceedances were observed in groundwater samples collected from wells ESM-5 and ESM-3.

- PCBs have been detected in soil across the Site, although generally at low concentrations. PCBs were detected in groundwater near the southern corner of the building at concentrations well above the solubility limit. The elevated concentrations of PCBs in groundwater appear to be the result of a "co-solvent" effect, whereby chlorinated solvents in groundwater are enhancing the solubility of PCBs. Because of significant PCBs in the Neponset River sediments from upstream sources, it is not possible at this time to determine whether PCBs on the Lewis Chemical site have contributed to, or exacerbated the PCB levels in the river.

The conclusions of the Method 3 Risk Characterization are as follows:

- A condition of No Significant Risk (NSR) of harm to human health exists at the Site for current exposure scenarios, but does not exist for future redevelopment scenarios.

- A condition of No Significant Risk of harm to safety has been achieved at the Site.

- A condition of No Significant Risk to Public Welfare has not been achieved at the Site.

- A condition of No Significant Risk of harm to the environment has not been achieved at the Site for current and reasonably foreseeable future conditions.

9.0 LIMITATIONS ON WORK PRODUCT

1. The observations described in this report were made under the conditions stated therein. The conclusions presented were based solely upon the services described, and not on scientific procedures which were beyond the scope of described services. Where access to portions of the Site or to structures on the Site was unavailable or limited, ES&M renders no opinion as to the presence of hazardous materials or oil in that portion of the Site or structure.

2. This report is for the sole and exclusive use of DND, and is not intended for the use of or reliance upon by any third parties without the prior written approval of ES&M.

3. Certain information provided by state and local officials, as well as other parties herein referenced, was used to develop this report. The accuracy or completeness of the information provided by these sources was not independently verified.

4. The conclusions and recommendations contained in this report are based in part, where noted, upon the data obtained from a limited number of soil and/or groundwater samples

obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further exploration. Additionally, variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. ES&M reserves the right to modify the conclusions of this report should further information become available.

5. Any water level readings made in test pits, borings, and/or observation wells were made at the times and under the conditions stated on the report. However, fluctuations in the level of groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time measurements were made.