

**REVISED PHASE III – REMEDIAL ACTION PLAN  
FOR AREAS SOUTH OF THE RACEWAY**

**OXFORD PAPER MILL  
21 CANAL STREET  
LAWRENCE, MASSACHUSETTS**

**RTN 3-2691**

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### **List of Acronyms**

AUL	Activity and Use Limitation
COL	City of Lawrence
COPCs	Contaminants of Potential Concern
CSA	Comprehensive Site Assessment
EPA	Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
HSO <sub>3</sub>	sulfurous acid
IWPA	Interim Wellhead Protection Area
MADEP	Massachusetts Department of Environmental Protection

MCP Massachusetts Contingency Plan

**List of Acronyms (Continued)**

MEK methyl ethyl ketone  
MHD Massachusetts Highway Department  
MIBK methyl isobutyl ketone  
NaOH sodium hydroxide  
Na<sub>2</sub>S sodium sulfide  
OPM Oxford Paper Mill  
OHM Oil and/or Hazardous Materials  
PAH Polycyclic Aromatic Hydrocarbons  
PCB polychlorinated biphenyls  
RAM Release Abatement Measure  
RAO Response Action Outcome  
RTN Release Tracking Number  
S&W Stone & Webster Massachusetts, Inc.  
THF tetrahydrofuran  
TSCA Toxic Substance Control Act  
VOC Volatile Organic Compounds

## **1.0 INTRODUCTION**

The purpose of this Revised Phase III Remedial Action Plan is to address the results and effects of the Revised Phase III Remedial Action Plan for Areas North of the Raceway discussed in Sections 4 and 4.3 that is being submitted simultaneously with this plan and to perform an evaluation of remedial action alternatives to address contaminants of potential concern (COPCs) for a portion of the Oxford Paper Mill (OPM) (the Site) in Lawrence, Massachusetts. The general site location is depicted on Figure 1 and the entire site is depicted on Figure 2. This Phase III is for the areas south of the raceway at the OPM (see Figure 3). This Phase III was conducted by Stone & Webster Massachusetts, Inc. (Stone & Webster or S&W), a Shaw Group Company, in accordance with the Massachusetts Contingency Plan (MCP), 310 CMR 40.0850, on behalf of the City of Lawrence (COL), the owner of the OPM property. OPM has been assigned release tracking number (RTN) 3-2691 by the Massachusetts Department of Environmental Protection (MADEP), to whom this report will be provided.

Since polychlorinated biphenyls (PCBs) are the significant contaminants of concern on the south side and asbestos is the contaminant of concern driving the risk on the north side, the Site has been split into a north side and a south side for purposes of a Phase II and Phase III report. PCBs also are the contaminant of concern for the sediments found in the raceway, which transects the Site, and are being dealt with by GenCorp (property abutter). These three areas will be combined in a final Response Action Outcome (RAO) for the entire site.

The objectives of the Phase III evaluation are to identify and evaluate remedial action alternatives and technologies that would be reasonably likely to achieve a level of no significant risk, and to select a remedial action alternative that will result in a Permanent or Temporary Solution for areas south of the raceway. The contents of this report provide detailed descriptions of each of the selected remedial alternatives with a final recommendation for the most appropriate technology to achieve the remedial goals established for areas south of the raceway at the OPM.

## **2.0 BACKGROUND**

### **2.1 Site Description and General Information**

The former OPM Site, Release Tracking Number 3-2691, is located on approximately three acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Site Locus Map attached as Figure 1). A small portion of the OPM is also located north of Canal Street on the eastern bank of the Spicket River (an urban surface water body that abuts the OPM). The OPM is transected by a raceway, which discharges to the Spicket River. All nine buildings (Building Nos. 1, 2, 3, 4, 5, 6, 13, 1A, and 28) that once occupied the south side of the OPM have been demolished and removed off-site. The majority of the Site has been backfilled with 15 feet or greater of clean fill (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway) prior to

the proposed bridge construction (discussed below). Buildings north of the raceway were demolished in the 1970s. Oxford Paper ceased operations at the Site in the mid-1970s. The COL took ownership of the property in 1983.

Site Subject Area – South of Raceway

The area south of the raceway (the Site) is in an area of commercial development within downtown Lawrence, Massachusetts. The property at one time contained buildings that were once part of a paper mill. Currently, the property does not contain any buildings due to the demolition activities conducted by Massachusetts Highway Department (MHD) in order to develop the property for the relocation of Canal Street and the placement of a bridge over the Spicket River, which ultimately will help revitalize the downtown area of Lawrence. The area south of the raceway contains vegetation that includes trees around the perimeter. The south side of the Site is bounded to the north by the raceway, to the east by the Spicket River, to the west by a commercial parking lot, and to the south by Canal Street. Access to the property is partially restricted by fencing along the south and west boundaries. However, the Site can be accessed from the raceway and Spicket River. A Site Plan for the area south of the raceway is presented in Figure 3.

Properties surrounding the OPM are used for commercial, institutional, and industrial purposes. GenCorp, Inc. (GenCorp), the Everett Mills property, and Union Street are west of the Site. Canal Street and the North Canal are south of the OPM beyond which there are other historic mill buildings. The Spicket River is north and east of the Site. The Lawrence General Hospital is beyond the Spicket River to the north. The Everett Mills property is currently used for commercial purposes. The GenCorp facility, which was formerly occupied by Bolta Products and used for manufacturing rubber and plastic products, is currently vacant. The GenCorp facility was used most recently for manufacturing plastics and vinyl coated fabrics; polyvinyl chloride, resins, methyl isobutyl ketone (MIBK), methyl ethyl ketone (MEK), and tetrahydrofuran (THF) were used as part of these manufacturing operations.

Based on a review of the Massachusetts Geographic Information System (GIS) map, (refer to Figure 4), the OPM is not within an Interim Wellhead Protection Area (IWPA) or Zone II. Mr. Madden at the Lawrence Water Department indicated that the COL obtains its water from the Merrimack River. Water is drawn from one well in the Merrimack River; this well is located in the river at the foot of Ames Street (i.e., at the intersection of Ames Street, Water Street, and Riverside Drive), approximately one and one-half miles west and cross gradient of the OPM. The city's reservoir is approximately one and one-half miles northeast of the OPM on Ames Hill. According to Mr. Madden, several car washes and only one residence have private water supply wells in the city. The closest private well is at a car wash approximately one mile from the OPM. Based on a review of Massachusetts Surface Water Quality Standards (314 CMR 4.00), the Spicket and Merrimack Rivers are Class B surface water bodies (i.e., designated as habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation).

According to the Federal Emergency Management Agency, Flood Insurance Rate Map (FIRM) for the COL, Massachusetts (Community Panel Number 250087 0002B), the northwestern portion of the OPM is within Zone A17 (i.e., an area of 100-year flood) and portions of the north and

southeastern areas of the Site are within Zone B (i.e., an area between the limits of the 100-year and 500-year flood).

## **2.2 Ownership History and Historic Paper Mill Activities**

HMM Associates conducted a preliminary site assessment in 1992, which summarized the history of the OPM. The following information is drawn from the HMM report (HMM, 1992). The HMM report states that paper making had been conducted on the Site for 135 years, first under the name Russell Paper Company, then Champion International, Oxford, Ethyl, and finally Pleasant Valley Paper Mills. Operations ceased completely in 1974. The COL took ownership of the OPM in 1983.

Pulping of the wood chips was done by the “soda and sulphite” chemical process, which produced a foul odor (HMM, 1992) and typically used a base (lime or sodium hydroxide) plus sulfurous acid ( $\text{HSO}_3$ ). Another pulping process, called the kraft chemical pulping process, uses sodium hydroxide ( $\text{NaOH}$ ) and sodium sulfide ( $\text{Na}_2\text{S}$ ), and may have also been used at the Oxford Site. The process was most likely conducted in steel digesters under steam pressure. Some papers were coated with clay, which was stored in silos that were once present on the property. Buildings identified on the Sanborn maps include the “soda pulp mill”, the “chemical mill” (No. 15), a machine building, (No. 3), and a building containing “beating engines” and a “rotary bleacher” (No. 6). Bleaching of pulp may have been done using chlorine or hypochlorite. An open coal bin, boiler room, and “black ash room” are also identified on some Sanborn maps. Note that building numbers, arrangements, and uses changed over the years according to the Sanborn maps.

Contaminants that may be present on the Site, due to former paper mill operations, include polycyclic aromatic hydrocarbons (PAHs) from coal, coal ash, and other combustion operations, chlorinated organic compounds that may have been formed during pulp bleaching operations, and sulfides from chemical pulp residues. The chlorinated organic compounds and sulfides would most likely have been released to surface water and air, as opposed to soil, because they are associated with mill operations that involved water discharges (to the raceway most likely) and air emissions (sulfur compounds and other volatile organic compounds (VOCs) from stacks and process tanks). In addition, underground storage tanks contained fuel oils and therefore, petroleum hydrocarbons (PHCs) may be present in soil and groundwater. Transformers containing PCBs have historically been present on-site.

## **2.3 Previous Response Actions and Assessment Activities**

In order to prepare the Site for construction of a relocated Canal Street and bridge over the Spicket River, MHD has assumed the responsibility to conduct environmental assessment activities associated with the area south of raceway. These activities include the demolition of site buildings, disposal of contaminated and uncontaminated demolition debris associated with these buildings, decontamination of the basements of site buildings and backfill with structural material in anticipation of bridge construction, removal of PCB-contaminated transformers and

soils contaminated by PCBs released from various transformers on-site, and final grading for the area south of the raceway.

In August 2006, S&W prepared a Phase II Comprehensive Site Assessment (CSA) Report for areas south of the raceway that was submitted to the MADEP along with the Phase III report and a conceptual design Phase IV report. The purpose of the Phase II CSA was to develop a field program to fill gaps in data necessary to characterize the source, extent, and migration pathways of oil and/or hazardous material (OHM), and the risk or harm posed to health, safety, and public welfare. The Phase II CSA includes a Method 3 Human Health Risk Characterization. The Method 3 Risk Characterization assumes limitations to future Site use for anything other than use as a bridge crossing and passive park. As part of the final grading for the Site, residual soils containing elevated levels of COPCs will be covered with at least 15 feet of clean fill. As defined in the MCP, these soils are considered to be “isolated” from exposure.

The Transformer No. 6 / Courtyard Area has elevated PCB concentrations and is located on the eastern portion of the Site. This area was covered with 15 feet or greater of clean fill and according to the MCP, the soils located in this area are considered to be “isolated” from exposure.

The MCP (310 CMR 40.0924(2)(b)(3)) defines the following depths as exposure points for the following receptors and activities.

- a. Surficial Activity (0-3 feet)
- b. Utility/maintenance worker (0-6 feet); and
- c. Construction worker (0-15 feet)

In the Risk Characterization Work Plan for the South Side, a soil interval of 0-0.5 feet was determined to be appropriate for the Site trespasser and passive park user. Therefore, as defined in the MCP, all impacted soils are considered to be “isolated” from exposure and there are no complete exposure pathways for impacted soils. The risk characterization showed that there is no complete exposure pathway to groundwater for human receptors. The risk characterization also concluded that a condition of No Significant Risk to public welfare and safety exists at the Site.

Overall, a condition of No Significant Risk has been achieved based on the final Site grade and the proposed future intended use of the Site as a passive park with a bridge built over the Site as part of the Spicket River Bridge Project. An Activity and Use Limitation (AUL) will be implemented at the Site to maintain a condition of No Significant Risk restricting the use of the Site to a bridge and passive park.

As property owner, the COL has responsibility to ensure that the property is sufficiently remediated to satisfy all regulatory requirements and allow for its intended use. This included conducting all necessary environmental assessment and remediation activities that were not dealt with by MHD and GenCorp. To date, the COL, represented by S&W, has conducted

environmental assessment activities for soil conditions below building basements (Building Nos. 1-6, and 28) and the Transformer No. 6 / Courtyard Area on the OPM site.

Environmental assessment work at the OPM site is being conducted under two separate Release Abatement Measure (RAM) plans, one by Stone & Webster and the other by MHD. S&W's RAM Plan deals with soils under the sub-basements and basements of site buildings as well as elevated PCBs contaminated soils in the Transformer No. 6 / Courtyard area. MHD's RAM Plan deals with the demolition of site buildings that were south of the raceway, disposal of contaminated and uncontaminated demolition debris associated with these buildings, decontamination of the basements of site buildings and backfill with structural material in anticipation of bridge construction, removal of PCB-contaminated transformers and soils contaminated by PCBs released from these transformers, and final grading for the southern portion of the site.

## **2.4 Regional and Site Specific Geology**

Based on the soil survey for the northern part of Essex County, Massachusetts, the overlying surficial deposits consist primarily of loamy soils formed over compact glacial till. Two drumlins are located near the Site, including Prospect Hill to the northeast and a smaller hill located to the northwest. The thickness of glacial till is often on the order of 15 to 20 feet, although thicknesses of up 175 feet have been observed in the drumlin area (Eckenfelder, Inc., 1998).

According to the GenCorp Phase II Groundwater Model Report prepared by Eckenfelder, Inc. in 1998, bedrock underlying the OPM site lies within the Merrimack Belt lithotectonic zone. Major faults further subdivide the Merrimack belt into individual tectonic zones – each of which has a different and distinct lithology. Furthermore, the OPM site is located north of the Clinton-Newbury fault, which is accompanied by a series of many smaller faults and associated disrupted geologic strata. The bedrock lithology consists of a series of meta-sedimentary rock types of the Berwick formation. The encountered bedrock of the OPM site is composed of phyllite, argillite, and quartzite with minor amounts of calcareous metagraywacke and schist (Eckenfelder, Inc., 1998).

The area south of the raceway is relatively flat. The western portion of the Site is at a higher elevation than the eastern portion. The average elevation of the Site is approximately 30 feet above mean sea level (msl).

The soils onsite are part of Urban Land, which consists of nearly level to moderately steep areas where the soils have been altered or obscured by urban works and structures. The site soils are part of the Paxton-Woodbridge-Monatauk association where the area is nearly level to steep, well drained and moderately well drained, loamy soils formed over compact glacial till (Soil Survey of Essex County, Massachusetts Northern Part, 1981).

The geology on the south side of the OPM was assessed through a subsurface boring program. Based on observations of the split spoon samples, the general geologic profile was found to

consist primarily of an assemblage of loamy and sandy soils. The mixture of differing sediment sizes indicates that the materials are not well sorted, and are consistent with glacial deposits. The soil borings also revealed similar conditions of differing amounts of loam, sand and gravel with coal ash, bricks, and debris encountered throughout the area south of the raceway.

Bedrock was not encountered on the south side of the OPM. Bedrock coring was not conducted as part of the Phase II CSA. Soil borings were advanced from 0 to 28 feet below ground surface (bgs).

## **2.5 Nature and Extent**

The following section of this report provides a summary of the nature and extent of the contamination that has been identified for areas south of the raceway at the OPM. A detailed description of the nature and extent of site contamination is presented in Section 6.0 of the Phase II CSA dated August 2006, prepared by Stone & Webster. In general, contamination in sub-basement soil (0 to 6 feet below basement floors (bbf)) consisted of extractable petroleum hydrocarbons (EPH) carbon fraction ranges, PAHs, metals, and PCBs. However, confirmatory sampling showed concentrations below the MCP Method 1 Standards in soil below Buildings Nos. 2 (lead) and 3 (EPH), indicating that these contaminants were removed. Confirmatory sampling for both of these areas was completed after excavation operations were done to determine if these contaminants were removed. PCB contamination exists below the eastern portion of Building No. 6 and throughout the Transformer No. 6 / Courtyard area. PAH contamination in sub-basement soils south of the raceway are attributed to coal and coal ash that was used as fill material for this area and are considered exempt from the MCP. PAHs are considered background in areas south of the raceway due to the detection of all PAHs in soil samples at concentrations less than the corresponding MADEP background levels for fill material. Some PAH contaminated soil has been removed from the site when the lead, PCB, and EPH removal activities took place. A detailed description of the rationale is provided in Section 5.6 of the August 2006 Phase II CSA Report.

### **Soil**

For screening purposes, the analytical results for soils were compared to applicable MCP Standards. Building sub-basement soil and Transformer No. 6 / Courtyard area samples were compared to Method 1 Cleanup Standards. Results of the Phase II CSA established that Method 1 Standards were exceeded in sub-basement soils of Building Nos. 2, 3, and 6 as well as soil samples collected in the Transformer No. 6 / Courtyard area of the OPM. Table 2-1 presents the remaining site soil samples collected during all site investigations and are compared to the applicable Method 1 Standards for areas south of the raceway.

Specifically, below Building Nos. 2, 3, and 6 concrete basement floors (0 to 6 feet), sub-basement soils contained concentrations of PAHs, metals (namely arsenic and lead), and PCBs above applicable MCP Standards. PAHs are considered to be background and are attributed to the coal ash fill material. Building Nos. 2, 3, and 6 soil data collected from all site investigations are presented in Table 5-1 of the Phase II CSA. The remaining site soil data from these

investigations are presented in Table 2-1. The laboratory analytical reports for Building Nos. 2, 3, and 6 soil data are presented in Appendices C, D, and G of the Phase II CSA. PCB contaminated soils also are present above both the EPA action level and Method 1 Standards in the Transformer No. 6 / Courtyard area. Transformer No. 6 / Courtyard area soil data collected from the Phase II CSA are also summarized in Table 2-1. The laboratory analytical reports for the Transformer No. 6 / Courtyard area soil data are presented in Appendix I of the Phase II CSA. Asbestos samples were not collected during sub-basement investigations by Stone & Webster. However, soils south of the raceway contain asbestos and are being dealt with under MHD's contract. MHD has removed asbestos contaminated soils and debris during the demolition process of all site buildings. MHD has also removed soil for the COL after it was determined to be contaminated through S&W investigations. A summary of minimum and maximum statistics for sub-basement and Transformer No. 6 / Courtyard area soils analytical data for soils remaining on-site are presented in Table 2-2. This table was generated from data presented in Table 2-1 and Table 1 of the Method 3 Risk Characterization for the south area Phase II CSA.

As mentioned in the Method 3 Risk Characterization in the Phase II CSA (Section 8.0), soils that are located at a depth of 15 feet or greater are defined under the MCP as being "isolated" from exposure. All soils located beneath the basement and sub-basement of the former site buildings and soils located below the Building No. 6 / Courtyard Area are considered "isolated" from exposure (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway).

Due to the information provided above and the removal of contaminated soil beneath the sub-basement and basement floors of former paper mill buildings by MHD for the COL, as determined by the confirmatory sampling conducted by S&W, the Transformer No. 6 / Courtyard Area is the only portion of the Site where significant contamination exists. The total volume of impacted soil in the Transformer No. 6 / Courtyard Area is approximately 1,000 cubic yards. This impacted area is also regulated by the EPA's Toxic Substance Control Act (TSCA).

### **Groundwater**

Based on the groundwater sampling conducted by S&W in April and May of 2005 in and around the Transformer No. 6 / Courtyard area, it is apparent that the PCB concentrations present are above the GW-3 MCP Method 1 clean-up standard (0.3µg/L). The laboratory analytical reports for the Transformer No. 6 / Courtyard area groundwater data are presented in Appendix I of the Phase II CSA. The PCB contaminated groundwater is confined to the boundaries of the transformer pit. As determined by S&W's modeling efforts (Section 7.5 of Phase II CSA), the residual PCB soil concentrations are expected to degrade or remain in the general area of the releases. Therefore, the fate and transport evaluation has revealed that PCB contaminated groundwater is not expected to significantly migrate from the Transformer No. 6 / Courtyard area and does not need to be remediated. A summary of minimum and maximum statistics of PCB groundwater concentrations for monitoring wells located in the Transformer No. 6 / Courtyard area is presented in Table 2-3.

## 2.6 Selection of Remediation Goals

Selection of an appropriate and cost-effective remedial action plan requires the development of remediation goals based upon site-specific data. The MCP calls for selection of remedial action alternatives that reduce, to the extent feasible, the overall mass of contaminants in the environment to background levels, and therefore favors active removal or recovery alternatives over containment only. The goal for the areas south of the raceway is to achieve a permanent solution through an RAO.

Stone & Webster has identified the following remediation goals and some of the remedial action alternatives that may be capable of achieving each goal.

Remediation Goals	Activities to Attain the Remediation Alternative	Potential as or Feasible as a Remediation Goal?
Perform response actions on the entire south side to achieve background or approaching background conditions for a Class A-1 RAO.	<ul style="list-style-type: none"> <li>▪ Excavation and disposal of 23,000 cubic yards of contaminated soil at the Site</li> </ul>	No
Perform response actions only on portions of the Site to attain of condition of no significant risk for a Class A-2 RAO, without land use restrictions.	<ul style="list-style-type: none"> <li>▪ Excavation and disposal of all contaminated Transformer No. 6 / Courtyard area soils</li> <li>• Phytoremediation</li> <li>• Enhanced Bioremediation</li> <li>▪ Soil Flushing</li> </ul>	No No No
Perform response actions to create a condition of no significant risk with the implementation of an Activity and Use Limitation and a Class A-3 RAO, which would limit land use to current utilization.	<ul style="list-style-type: none"> <li>▪ Excavation and disposal of 1,000 cubic yards of contaminated Transformer No. 6 / Courtyard area soils</li> <li>▪ On-site stabilization/solidification</li> <li>▪ Enhanced Bioremediation</li> <li>▪ Phytoremediation</li> <li>▪ Soil Flushing</li> </ul>	Yes No No No
Perform response actions to create a condition of no significant risk with the implementation of an Activity and Use Limitation, OHM material in soil located at a depth greater than 15 feet from ground surface, and a Class A-4 RAO, which would limit land use to current utilization.	<ul style="list-style-type: none"> <li>▪ Placement of clean fill to form a 15 foot barrier between the OHM and the ground surface</li> <li>▪ On-site stabilization/solidification</li> <li>▪ Enhanced Bioremediation</li> <li>▪ Phytoremediation</li> <li>▪ Soil Flushing</li> </ul>	Completed No No No
Perform response actions for a Temporary Solution or a Class C RAO.	<ul style="list-style-type: none"> <li>▪ Institutional Controls</li> </ul>	Yes

Based on the results of the site assessment activities and risk characterization, Stone & Webster has selected three remediation goals, as identified in the table, to achieve an RAO at the Site. The first goal is the performance of response actions to attain a condition of no significant risk without the need for an AUL. The second goal is the reduction of exposure to contaminant

concentrations in soil through soil removal or barrier to attain a condition of no significant risk with the implementation of an AUL. The third remediation goal would be to perform response actions to attain a Temporary Solution. The results of the Phase III will determine the appropriate remediation goal for the site based on a review of the pros and cons of remediation alternatives.

### **3.0 IDENTIFICATION OF REMEDIAL ACTION ALTERNATIVES**

Remediation technologies are available to address the presence of EPH carbon fraction ranges, PAHs, metals, and PCBs in south area soil matrixes at the OPM. Each of these can be considered a stand-alone technology or as part of an integrated remedial approach. As part of the Phase III evaluation, several alternatives were identified and screened based on effectiveness, reliability, implementability and cost to implement. Based on these factors, appropriate alternatives will be selected for detailed evaluation.

#### **3.1 Description of Remedial Action Alternatives**

Remedial action alternatives for areas south of the raceway include in-situ and ex-situ treatment, containment and other miscellaneous options. In-situ treatment involves treatment of contaminated soil in place onsite. This does not involve removing soils. In-situ treatment includes the following technologies: enhanced bioremediation, phytoremediation, and soil flushing. Ex-situ treatment involves treatment of contaminated soils after they have been removed from the ground. Ex-situ treatment includes: chemical extraction, solidification/stabilization, separation, soil washing, and chemical reduction/oxidation. Containment would not involve extensive excavation activities and/or off-site removal and would consist of in place capping of contaminated areas on site. Other options include excavation and disposal of contaminated soils, institutional controls or no further action with institutional controls. Descriptions of these remedial alternatives are provided in Table 3-1.

#### **3.2 Initial Screening of Remedial Action Alternatives**

As presented in Table 3-1, Stone & Webster has performed an initial screening of the applicable remediation technologies to select remedial action alternatives for detailed evaluation. During the initial screening, a technology was considered feasible if the technology was reasonably likely to achieve a Permanent Solution pursuant to the MCP and achieve the remedial goals set for areas south of the raceway at a reasonable cost. The screening of alternatives indicated that:

- Enhanced bioremediation, solidification/stabilization, and separation do not adequately address all of the contaminants of concern at the site;
- Phytoremediation is not feasible due to the amount of time it would take to remediate the site; and
- Soil flushing, chemical extraction, soil washing, and chemical reduction/oxidation are not feasible due to the extremely high costs and the availability of other options that are less

expensive.

Therefore, the initial screening identified three remedial technologies that are feasible for areas south of the raceway at the OPM and need further evaluation to determine the most appropriate action. The three possible remedial actions are: (1) no further action with institutional controls; (2) soil excavation and off-site disposal; or (3) a soil containment barrier – the placement of 15 feet or greater of clean fill to separate the OHM and the final site ground surface. An evaluation of these feasible remedial actions is presented in Section 4.0.

#### **4.0 EVALUATION OF FEASIBLE REMEDIAL ACTION ALTERNATIVES**

The following section discusses and compares the three remedial action alternatives chosen from the initial screening: no further action, soil excavation and off-site disposal, and a soil containment barrier – the placement of 15 feet or greater of clean fill to separate the OHM from the ground surface. Prior to bridge construction on the south side of the OPM, 15 feet or greater of clean fill will be placed throughout the area for the final site grade. According to the Phase II Report, the Transformer No. 6 / Courtyard Area is one area that must be addressed in order to achieve one of the three remediation goals selected for areas south of the raceway at the OPM.

Note that the revised Phase III Plan for the North Area which is being submitted simultaneously with this plan presents two new remediation alternatives. This is further discussed in Section 4.3. One alternative is the containment/capping of the Wedge Area and North Area after excavation, transportation and disposal of 1,855 cubic yards of asbestos contaminated soil from the north area off-site. The other alternative is the containment/capping of the Wedge area, North Area and an additional area south of the Wedge Area and adjacent to the raceway after excavation and relocation of 1,855 cubic yards of asbestos contaminated soil in the north area and south area.

Each technology is described in detail with site specific information explaining how it would be applied to achieve site cleanup goals. The general effectiveness, implementability, and estimated cost of each technology are then presented.

#### **4.1 No Further Action - Institutional Controls**

No further action is used on sites where remedial actions are either not necessary or not possible. This alternative often relies on the presence of permanent structures and/or institutional controls (such as fencing). No further action often relies on natural degradation of contaminants of concern.

Selection of the no further action alternative for areas south of the raceway at the OPM was elected for further evaluation as a base alternative. With this selection, the contaminated media located throughout the site would remain in place, and fencing would be installed and maintained completely surrounding areas that may pose an imminent hazard and/or risk to the public. A Class C RAO, which is not a permanent solution, would be completed for the site and periodic maintenance reports would be required to indicate that the effectiveness of the fencing remained. Additional sampling would be required and eventually a Permanent Solution would

have to be achieved through the performance of response actions because COPCs at the site do not readily undergo natural attenuation.

#### *4.1.1 Effectiveness*

A no further action alternative would not be effective as a Permanent Solution, but rather as a temporary solution because a condition of no significant risk would not be reached by this alternative. No further action would not eliminate any contamination, but would rather reduce potential exposure to the contaminants of concern. Also, the entire south area will be used as an area to support a bridge as well as a passive park in the future and the area currently does not have the means to separate the contaminants of concern from the future construction and maintenance workers, and park users. Installing a fence around the area would not allow the space to be used as a park in the future.

#### *4.1.2 Short Term and Long Term Reliability*

No further action would be reliable as a short term solution as long as the fences remained in good repair and were periodically checked. For the long term this solution is not reliable because a permanent solution has not been achieved and the contaminants of concern do not undergo significant natural attenuation. No contamination would be removed in this process and a level of no significant risk would not be reached for areas south of the raceway at the OPM.

#### *4.1.3 Difficulty in Implementing Alternative*

Minimal work would be required to install additional fencing, and therefore would not be difficult to implement.

#### *4.1.4 Cost of the Alternative*

Minimal work would be required, and therefore this option would involve minor additional costs for the installation of fencing around sections of areas that are currently not fenced or for the installation of new permanent fencing. Periodic site visits would be required to assess the condition of the fences and to ensure that certain areas of the site remain inaccessible. A maintenance schedule would have to be developed and the execution of the schedule would have to be monitored. The cost of a new permanent fence around the entire south area would range from \$35,000 to \$45,000. The cost of maintenance (assuming 8 hours a day four times a year for 10 to 20 years at \$60/hour) would be \$20,000 to \$40,000. The cost of the five year evaluation would be \$20,000 and additional costs for one of the other alternatives. Therefore, the cost of this option would range from \$75,000 to \$105,000.

#### *4.1.5 Risks of the Remedial Action Alternative*

Due to the presence of PCBs located in the Transformer No. 6 / Courtyard Area as well as the area not being controlled by an engineered barrier, the no further action alternative would not permanently eliminate risk for areas south of the raceway at the OPM and therefore only a Class

C RAO, Temporary Solution could be obtained. This alternative will disrupt the intended use of the property for areas south of the raceway and additional remedial actions would be required within five years.

#### *4.1.6 Benefits of the Alternative*

No further action would be the least cost for the owner and would include minimal work.

#### *4.1.7 Timeliness of Alternative*

No further action will not require additional time and is immediately implementable. This alternative would not eliminate any source of OHM from the Site.

#### *4.1.8 Relative Effectiveness of the Alternative upon Non-Pecuniary Interests*

The no further action alternative would not impact current site activities and would allow for the site to remain as is with areas not accessible to the public. The no further action alternative would impact future site activities. This alternative does reduce the overall use and aesthetics of the site. The fences and the inaccessibility of the portions of the property decrease the value gained by not spending money on the remediation.

#### *4.1.9 Summary of Detailed Evaluation*

According to the MCP, the goal of the Phase III is the identification, evaluation, and selection of a comprehensive remedial action alternative that will address the identified risk, which is likely to achieve a permanent solution. A detailed evaluation has been conducted in accordance with the requirements specified in 310 CMR 40.0850, which presents the detailed evaluation criteria to be utilized in the comparison of potential alternatives. This remedial alternative does not present a permanent solution for the site, but does have short term merit as a temporary solution due to the minimal cost required.

## **4.2 Soil Excavation with Off-Site Disposal**

Soil excavation with off-site disposal of contaminated media was elected for further evaluation as a remedial action alternative for areas south of the raceway at the OPM. This is a common method of directly removing contaminated material from a site. This remedial action alternative involves removal of media from within areas of contamination with ultimate disposal of contaminated materials to an appropriately permitted off-site disposal facility.

This option has been evaluated for the removal of PCB contaminated soils located in the Transformer No. 6 / Courtyard Area that cumulatively presents significant risk for the COL. The volume of contaminated soil to be removed from this area is approximately 1,000 cubic yards. Of the estimated 1,000 cubic yards of soil to be removed under this alternative, approximately 500 cubic yards would consist of TSCA regulated material and another 500 cubic yards of contaminated soil would be generated from the sloping of the side walls in this area. Since this

process physically removes the PCB contaminated soils from the Transformer No. 6 / Courtyard Area, this alternative is usually the quickest method of site remediation. If the site is fully accessible and proper field screening and sampling is conducted, this method also provides the greatest assurance that cleanup levels will be achieved. Restoration of the excavation area(s) would be completed once confirmatory samples have been collected and confirmed to meet site cleanup standards.

The excavation and disposal of the entire south area (approximately 23,000 cubic yards) would allow for the submittal of a Class A-1 RAO without the implementation of an AUL. This would also allow for the Site to achieve background or approach background conditions and ultimately be a permanent solution for the Site. The costs associated with a Class A-1 RAO for areas south of the raceway would be significant. The excavation and disposal of only Transformer No. 6 / Courtyard Area soils (approximately 1,000 cubic yards) would allow for the submittal of an RAO with the implementation of an AUL if a 15 foot clean fill soil containment barrier were placed between the OHM and the ground surface. Due to the presence of PAHs at locations below the clean backfill throughout the south area at the OPM, an AUL would still be placed on the property. The removal of Transformer No. 6 / Courtyard Area soils would reduce the average concentrations of COPCs across the entire south area.

According to S&W's site investigations for areas south of the raceway, soil contamination was determined to be approximately 20 feet bgs from elevation 22 inside the Transformer No. 6 / Courtyard Area. This elevation refers to the elevation during site investigations and does not reflect the final grade for the site. The final grade for the site is approximately at elevation 45.

The activities associated with this alternative are:

- Design of the final landscaping plan for the area after excavation
- Preparation of specifications for performing the work
- Permitting (Conservation Commission, MADEP, etc.)
- Attendance at Town Meetings
- Excavation
- Confirmatory Sampling
- Transportation and disposal
- Backfill and grading
- Landscaping and planting grass, etc.
- Preparation of MADEP Submittals (Release Abatement Measure (RAM) Plan, RAM Completion, RAO, etc.)
- Load and go and stockpile characterization of soil for off-site disposal
- Health and Safety Plan

#### 4.2.1 Effectiveness

If proper field screening and sampling procedures were performed, soil excavation of the entire south area would be the most effective alternative. This is the only alternative that would achieve a permanent solution without the requirement for the implementation of an AUL.

#### 4.2.2 Short Term and Long Term Reliability

Soil excavation is the most reliable of the alternatives both short term and long term, since the mass of contamination would be removed by a proven technology. A level of no significant risk could be reached and concentrations of contaminants would be significantly reduced for areas south of the raceway at the OPM. Excavation and off-site disposal does not require future activities to manage remaining contamination.

#### 4.2.3 Difficulty in Implementing Alternative

Excavation of soils for off-site disposal is complex and requires use of large open areas for stockpiling soils and storing equipment. Off-site disposal of 1,000 cubic yards of Transformer No. 6 / Courtyard Area material would not be a significant undertaking. Due to the PCB levels in the soils below the Transformer No. 6 / Courtyard Area (greater than 50 ppm), a load and go operation during the excavation of these soils would be achieved rather than stockpiling.

An even greater undertaking would be the off-site disposal of 23,000 cubic yards of all Site soils. Staging areas and disposal facilities that could accept such a large volume of soil would have to be identified. Numerous logistic issues relative to the future land use, as a passive park, would have to be resolved. Overall this would be a difficult undertaking, but no more difficult than any other type of contaminated soil removal project. Also since the possibility of asbestos fibers becoming airborne exists, extensive measures are needed to control asbestos fiber releases to the ambient air. Continuous wetting of soil to prevent asbestos fiber releases into ambient air is needed. Perimeter air monitoring for asbestos is also needed for this remedial alternative. However, extensive measures would be in place and, therefore, this remedial option could be implemented.

#### 4.2.4 Cost of the Alternative

Capital costs for excavation are relatively moderate but could increase significantly with the presence of rocks and old building foundations once excavation activities are underway. There are no operating and maintenance costs associated with excavation. Disposal costs for this alternative would be increased since the majority of the soils located beneath the Transformer No. 6 / Courtyard Area are regulated by the TSCA (concentrations greater than 50 ppm). Even though the volume of soil that would be excavated from the Transformer No. 6 / Courtyard Area is not significant, the price per ton associated with TSCA regulated soils would increase the cost of disposal significantly.

A summary of the costs associated with the excavation/disposal alternative of contaminated soils from the Transformer No. 6 / Courtyard Area is provided in the following table.

<b>Excavation/Disposal Alternative</b>	<b>Estimated Cost (\$)</b>
Transformer No. 6 / Courtyard Area	\$200,000

Note: A 15% contingency is included in the above costs.

Also there would be additional costs for backfill material for the Transformer No. 6 / Courtyard Area excavation in order to get the area to site grade. An estimated amount for this additional cost is not included in the table above.

#### *4.2.5 Risks of the Remedial Action Alternative*

The Transformer No. 6 / Courtyard area, which is the area that requires remediation through soil excavation and off-site disposal, is located in an area that the public has no access to on a daily basis. The OPM will be closed to the public during construction activities and therefore the risk of soil excavation/disposal impacting the public would be minimal. However, construction activities would involve exposing workers to contaminated soils through the use of heavy machinery and open excavations on-site. This alternative would require the development and implementation of a site specific health and safety plan to reduce risk (asbestos fibers and PCBs) during the performance of this alternative. The other risk would be of discovering, during construction, more contamination to be removed than currently identified, which could significantly increase the cost.

#### *4.2.6 Benefits of the Alternative*

Since contamination would be removed and a condition of no significant risk would be reached, excavation and off-site disposal would be the most beneficial for Transformer No. 6 / Courtyard Area soils at OPM. Soil excavation and disposal would result in a condition of no significant risk for the Transformer No. 6 / Courtyard Area. An AUL would be required if this area were excavated.

#### *4.2.7 Timeliness of Alternative*

If a large enough crew were obtained, the implementation of this project could be completed in approximately one month. The upfront work for the design would most likely take two weeks. The on-going construction work by the MHD on the south side of the OPM would not affect the excavation and disposal work that could be implemented on the areas south of the raceway.

#### *4.2.8 Relative Effectiveness of the Alternative upon Non-Pecuniary Interests*

The overall value of the OPM would be increased by this alternative. An AUL would be placed on the Transformer No. 6 / Courtyard Area and the rest of the site.

#### *4.2.9 Summary of Detailed Evaluation*

According to the MCP, the goal of the Phase III is the identification, evaluation, and selection of a comprehensive remedial action alternative that will address the identified risk and which is likely to achieve a permanent solution. A detailed evaluation has been conducted in accordance with the requirements specified in 310 CMR 40.0850, which presents the detailed evaluation criteria to be utilized in the comparison of potential alternatives. The excavation/disposal alternative of Transformer No. 6 / Courtyard Area soils would be effective at achieving a condition of No Significant Risk. Due to high costs associated with excavating and disposing of

TSCA regulated soils in the Transformer No. 6 / Courtyard Area, this option would be less beneficial for the project.

### **4.3 Containment Barrier over Transformer No. 6 / Courtyard Area**

Containment is a remedial action alternative where physical barriers are installed in an effort to prevent further contaminant migration and/or to eliminate potential exposure to contamination. For the entire area south of the raceway as part of this remedial action will be contained under 15 feet or greater of clean fill (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway) placed by MHD in order to prepare the site for the proposed bridge construction. Containment in this context means a secure soil (clean fill) barrier meeting the requirements applicable to the solid waste regulations.

A Revised Phase III Remedial Action Plan for areas North of the Raceway is being submitted simultaneously with this Phase III plan. The south area, south and adjacent to the raceway is further shown in Shadley Associates Figure, “Contaminated Soil Onsite Capacity” in Appendix B. The alternatives submitted in the Revised Phase III for the North Area are closely entwined with the preliminary design in development by Shadley Associates for the proposed development of the north and south areas as a passive public park. The first alternative would have no affect on the south area. The second alternative would entail excavating areas in the north area and south area to receive the asbestos contaminated soil that will be excavated in the wedge and north areas. The excavated area in the north would have a volume capacity of 700 cubic yards and the excavated area in the south area would have a volume capacity of 1,160 cubic yards as shown in Appendix B.

These excavated and relocated asbestos contaminated soils would become an integral part of the walkways to be constructed adjacent to the raceway. Estimated costs for relocating approximately 1,155 cubic yards of asbestos contaminated soil and the covering with a geotextile cap to the south area (\$450,000) are accounted for in the Revised North Area Phase III Plan.

It is expected that as a result of relocating some of the asbestos contaminated soil to the south area that a new risk characterization plan will need to be completed to conclude that a condition of no significant risk to public welfare and safety exists at the Site due to the relocation of the asbestos contaminated soils. Since cost details for the two options under this alternative are provided in the Revised Phase III for the North Side; no cost impacts are provided here.

#### **4.3.1 Effectiveness**

By installing a clean fill containment barrier over the entire area south of the raceway, COPCs are isolated from public contact, and further contaminant migration is prevented.

#### **4.3.2 Short Term and Long Term Reliability**

The containment barrier for the areas south of raceway is a reliable remedial solution on both a short and long term basis, as long as excavation activities conducted by future construction and utility/maintenance workers do not disturb the contaminated soils found in the Transformer No. 6 / Courtyard Area. Containment barrier disturbance is highly unlikely in these areas. The most likely cause of accidental disturbance would be the installation of new utilities or the construction of a new park structure. As a long term measure, this alternative will not be as reliable if maintenance and inspection was not performed; if they are performed it will be very reliable. A conservative measure would be that due to the levels of PCB contamination found in the Transformer No. 6 / Courtyard Area, the potential exposures could be managed through the implementation of a Soil Management Plan and Health and Safety Plan during any planned or emergency excavation activities.

#### 4.3.3 *Difficulty in Implementing Alternative*

There is very little difficulty from the COL's standpoint in implementing this remedial alternative. The clean fill containment barrier alternative would be less difficult to achieve than no further action/institutional controls as well as the excavation only alternative of the Transformer No. 6 / Courtyard Area.

MHD is backfilling the entire area south of the raceway with at least 15 feet of clean fill (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway) as part of the final site grade from their scope of work. Therefore, the COL would not be responsible for the implementation or costs associated with this remedial option. Due to levels of PCB contamination found in the soils in the Transformer No. 6 / Courtyard Area, this alternative would require the development and implementation of a site specific health and safety plan to reduce the risk of contact with the PCBs during the performance of this alternative.

#### 4.3.4 *Cost of the Alternative*

There would be no capital costs for the COL associated with the placement of the clean fill containment barrier over the Transformer No. 6 / Courtyard Area. This work will be completed by MHD as a part of their scope of work for the project. MHD costs are approximately \$300,000 to backfill the entire area south of the raceway for bridge construction. There would be minimal costs, if any, to the COL associated with maintenance and inspection of the Transformer No. 6 / Courtyard Area once the bridge over the site has been constructed.

A summary of the costs for the COL associated with the clean fill containment barrier remedial alternative for contaminated soils found in the Transformer No. 6 / Courtyard Area is provided in the following table.

<b>Containment Barrier Alternative</b>	<b>Estimated Cost (\$)</b>
Transformer No. 6 / Courtyard Area	\$0

#### 4.3.5 *Risks of the Remedial Action Alternative*

Two risks are associated with the placement of the clean fill containment barrier in the Transformer No. 6 / Courtyard Area. They are 1) the exposure encountered by construction workers and the public during the placement of the containment barrier, and 2) future disruption and integrity of the clean fill containment barrier.

#### Public and Environmental Risks During Construction

Public health risk is best minimized by closing and/or marking off areas during remediation activities. Exposure risk to contamination and physical hazard risk to construction activities are of key concern, and can be eliminated from the public by closing and/or marking off construction areas. Workers should be properly trained and outfitted with the necessary personal protection equipment to minimize their risks.

Environmental risks are controlled by proper containment of the contaminated materials by dust control and runoff control measures.

#### Containment Barrier Disruption

As identified above, contamination areas left in place and contained always will be susceptible to future disruption. This is not especially true for the Transformer No. 6 / Courtyard Area, where this area will be located under the footprint of the bridge over the site. Due to the bridge, there will be greater public restrictions near the Transformer No. 6 / Courtyard Area. Future site facility construction, while not currently planned, may include additional structures or utility work. Other risks associated with the placement of the containment barrier include excessive erosion in the Transformer No. 6 / Courtyard Area from bridge and ground run-off which could degrade the clean fill and expose the impacted soils. Although this is highly unlikely but possible, the proper erosion control measures will be in place on the bridge (pipes underneath controlling run-off) and on the ground. If the area around the clean fill containment barrier is maintained, there is little risk associated with this option.

#### *4.3.6 Benefits of the Alternative*

Risk reduction at practically no cost to the COL is the primary benefit of the containment barrier remedial option. This is the lowest cost alternative, even lower than the no further action/institutional controls remedial option, which does not eliminate risk. Providing a containment barrier over the contaminated areas in place will always require attention since the contamination remains on site and may present a future human risk.

#### *4.3.7 Timeliness of Alternative*

Constructing a clean fill containment barrier over the Transformer No. 6 / Courtyard Area would require very little time. Timing is dictated by MHD's schedule as to when they plan on completely filling in the Transformer No. 6 / Courtyard Area. To date they have filled in approximately eight feet over this area and will continue to fill in this area in the near future to reach final site grade.

#### *4.3.8 Relative Effectiveness of the Alternative upon Non-Pecuniary Interests*

The overall value of the property would be increased by this alternative because complete use of the site would be gained for passive and bridge construction activities. An AUL would have to be placed on the site and future development of the passive park would be restricted over the containment barrier overlying the Transformer No. 6 / Courtyard Area. Due to the current and projected use of the site as a passive park/bridge footprint, the implementation of an AUL would not have a significant impact on the projected utilization of the park.

#### *4.3.9 Summary of Detailed Evaluation*

According to the MCP, the goal of the Phase III is the identification, evaluation, and selection of a comprehensive remedial action alternative that will address the identified risk and which is likely to achieve a permanent solution. A detailed evaluation has been conducted in accordance with the requirements specified in 310 CMR 40.0850, which presents the detailed evaluation criteria to be utilized in the comparison of potential alternatives. One option for containment was evaluated. The evaluation determined that the placement of the containment barrier is the least expensive remediation option and provides the best fit to institute a Permanent Solution for the entire site.

A selection of an alternative is presented in Section 5.0.

## **5.0 SELECTION OF THE FINAL REMEDIAL ACTION ALTERNATIVE**

Three remedial alternatives have been evaluated for areas south of the raceway at the OPM: no further action with institutional controls, soil excavation and off-site disposal, and a soil containment barrier – the placement of 15 feet or greater of clean fill to separate the OHM and the final site ground surface. No further action with institutional controls was evaluated as a baseline; however this would not be effective for areas south of the raceway at the OPM, due to the future use as a passive park. If no further action was conducted for areas south of the raceway at the OPM, contamination would remain on site, exposure to the contamination would still be present and a permanent solution would not be reached.

Due to the level and characteristics of the PCB contamination of the Transformer No. 6 / Courtyard Area soil, the best remedial alternative is the placement of the clean fill containment barrier since it would achieve a permanent solution for this heavily contaminated area. The placement of the containment barrier over the Transformer No. 6 / Courtyard Area as opposed to excavating this area would save the project a significant amount in costs. The significant costs

are due more to the price per ton to transport TSCA regulated soil rather than the volume of soil that would be transported. Based on cost and risk reduction, the containment barrier is the best remedial alternative for not only the Transformer No. 6 / Courtyard Area but for the entire south area.

The table below summarizes the costs, cleanup time, and feasibility associated with all remediation goals for areas south of the raceway.

<b><u>Remediation Goal</u></b>	<b><u>Cost</u></b>	<b><u>Cleanup Time</u></b>	<b><u>Feasibility</u></b>
Class A-1 RAO	Significant	6 months	Not Feasible
Class A-2 RAO	Not Applicable	Not Applicable	Not Feasible
Class A-3 RAO, AUL	\$200,000	1 month	Not Feasible
Class A-4 RAO, AUL	\$0	Not Applicable	Feasible
Class C RAO	\$105,000	Less than 3 months	Not Feasible

Based upon the table above, the Class A-4 RAO and AUL option for areas south of the raceway is the best remedial goal for the COL. The costs associated with this remedial goal are being absorbed by MHD as part of their scope of work for preparing the Site for bridge construction. The feasibility, cleanup time, and the cost for this remedial option make it most practical for site closure and the COL. A Class A-2 RAO is not applicable due to the AUL restriction anticipated to be placed on the areas south of the raceway.

## **6.0 PROJECTED SCHEDULE FOR IMPLEMENTATION OF THE CONCEPTUAL DESIGN**

The conceptual design report is attached to this Phase III Remedial Action Plan as Appendix A. The conceptual design encompasses design information pertaining to the areas south of the raceway at the OPM. The purpose of the conceptual design is to provide an overview of the Site use once all of the remediation is complete. The entire site (north and south of the raceway) will be developed into a park and the area south of the raceway will support a newly designed bridge. Canal Street will be relocated to accommodate the new bridge construction. The bridge and passive park is a key part of the revitalization of the downtown area of Lawrence once it is completed. Completion of the work and the submittal of a RAO are anticipated to occur within the next two years.

## **7.0 LIMITATIONS**

This report was prepared for the use of the COL. The observations made and results presented in this report are believed to be representative of current conditions at the time of Stone & Webster's assessment. Any additional information regarding Site conditions or past/current Site use should be brought to Stone & Webster's attention so it may be addressed and incorporated in

the Site study. This information could potentially result in modification of Stone & Webster's conclusions and recommendations.

Stone & Webster is not responsible for the accuracy and veracity of information provided to us by outside parties with respect to areas south of the raceway at the OPM and adjacent properties. This report presents the opinions of Shaw/Stone & Webster Massachusetts Inc. with the respect to the environmental conditions of areas south of raceway at the OPM. The actual determination of compliance of present or former operators of areas south of the raceway at the OPM with federal or state regulations can only be made by the appropriate regulatory agencies. The opinions rendered herein are not intended to imply a warranty or a guarantee and are based solely upon areas south of the raceway at the OPM conditions at the time of our investigation.

Chemical analyses were performed for certain parameters during this assessment. The parameters selected were based upon site knowledge and potential sources. However, chemical constituents not searched for during the studies may be present in soil and/or groundwater at areas south of raceway at the OPM. Chemical conditions reported reflect conditions only at the locations tested at the time of testing and within the limitations of the methods used. Such conditions can differ rapidly from area to area and from time to time. No warranty is expressed or implied that chemical conditions other than those reported do not exist within areas south of the raceway at the OPM.

Negative findings at a test location do not guarantee that the soil or groundwater at a greater depth is free of contaminants because geologic and/or hydrologic conditions may be present that prevents upward diffusion of contaminants from deeper horizons. Additionally, positive findings at a sample location can arise from soil contamination only and do not confirm that the underlying groundwater has been impacted.

## REFERENCES

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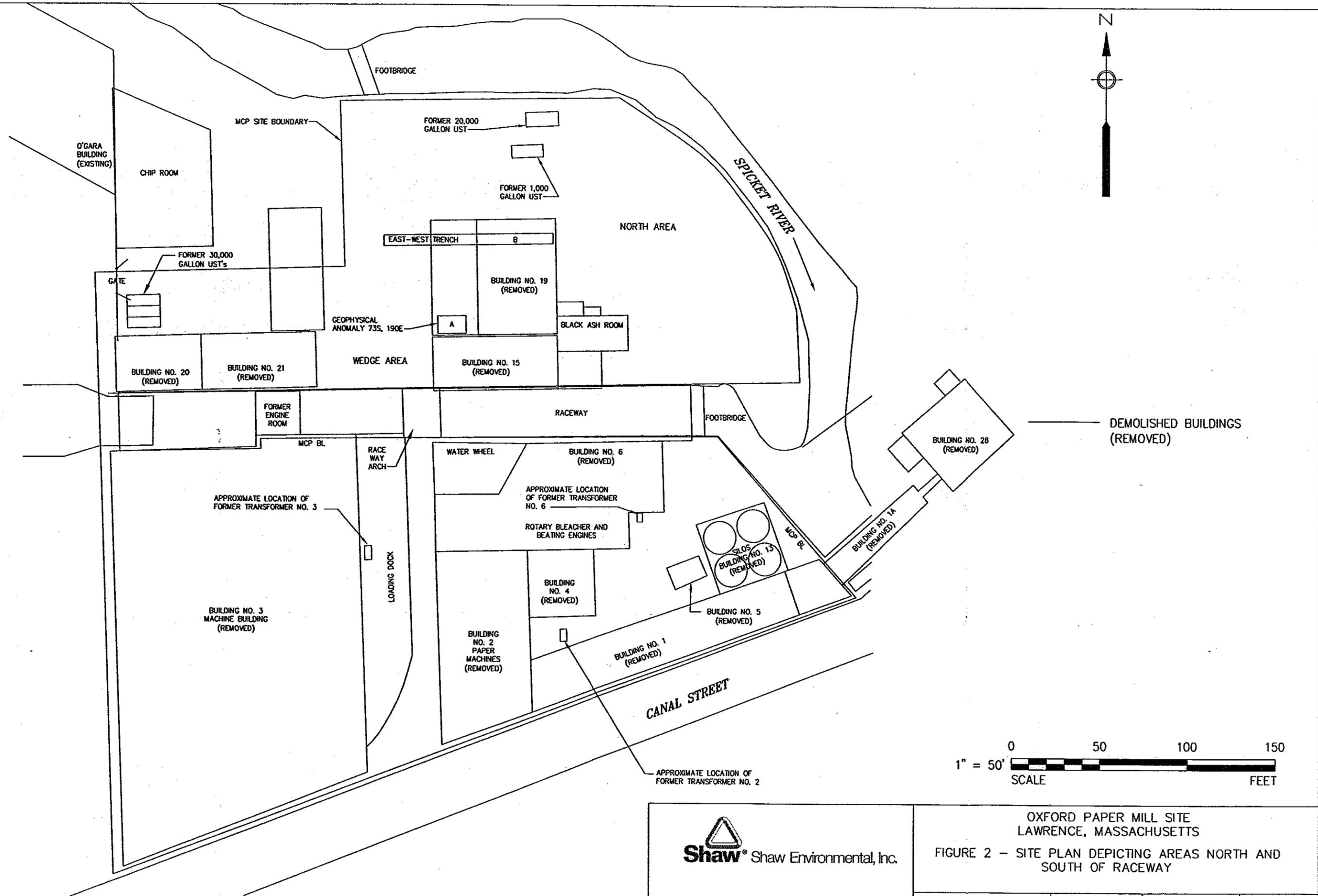
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## **FIGURES**

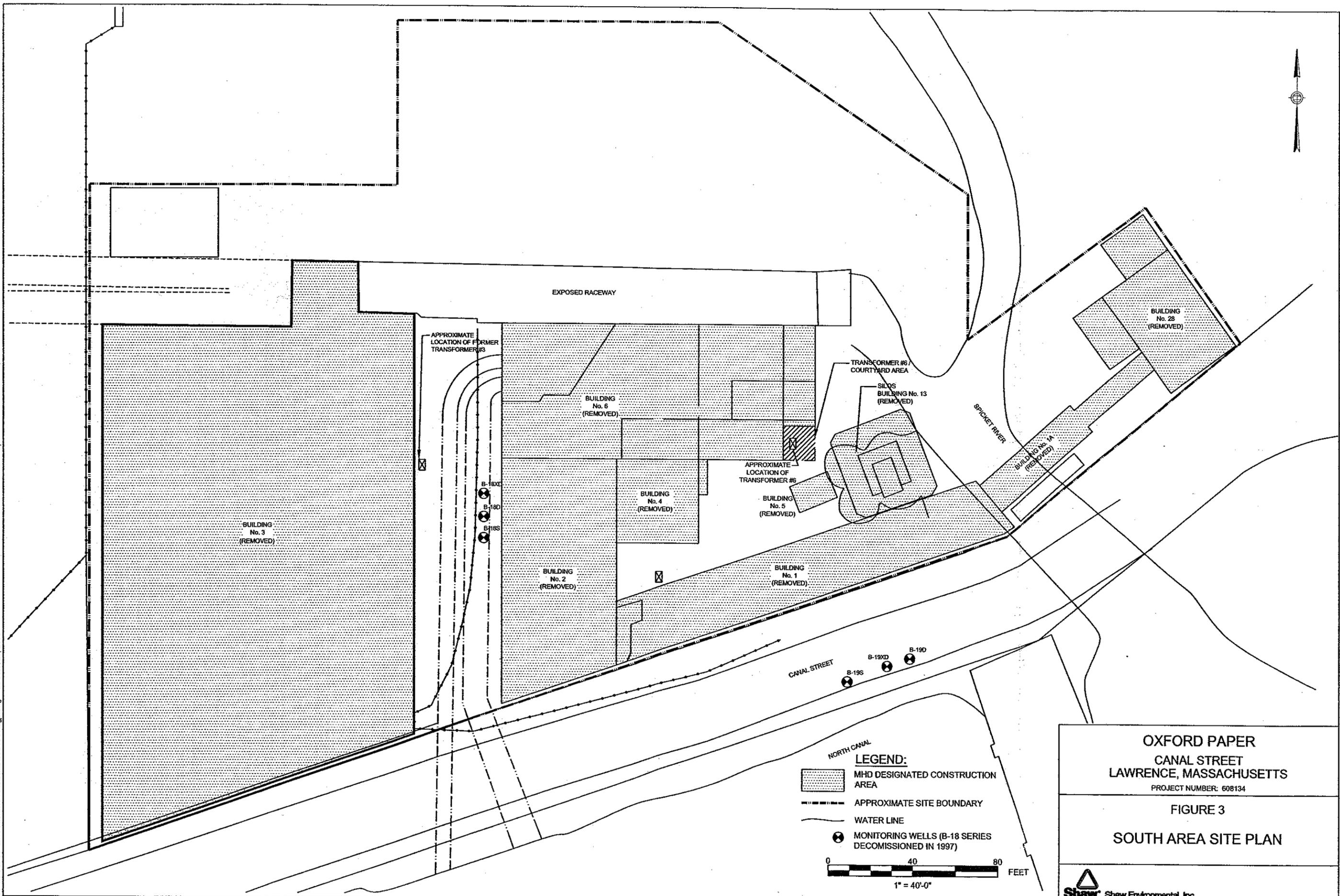


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OXFORD PAPER MILL SITE  
 LAWRENCE, MASSACHUSETTS  
 FIGURE 2 - SITE PLAN DEPICTING AREAS NORTH AND SOUTH OF RACEWAY

/S:\BIBOSF01\ENV\IR\Oxford-Mills\ask\BIB09\FIGURE\_3.dwg MARCH 20, 2006



**LEGEND:**

- MHD DESIGNATED CONSTRUCTION AREA
- APPROXIMATE SITE BOUNDARY
- WATER LINE
- MONITORING WELLS (B-18 SERIES DECOMMISSIONED IN 1997)

0 40 80 FEET  
1" = 40'-0"

**OXFORD PAPER**  
CANAL STREET  
LAWRENCE, MASSACHUSETTS  
PROJECT NUMBER: 608134

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FIGURE 3  
SOUTH AREA SITE PLAN

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Shaw Environmental, Inc.

# MA DEP - Bureau of Waste Site Cleanup

## Site Scoring Map: 500 feet & 0.5 Mile Radii

### SITE NAME:

Oxford Paper Mill  
Canal Street  
LAWRENCE, MA  
939758n 228732ew



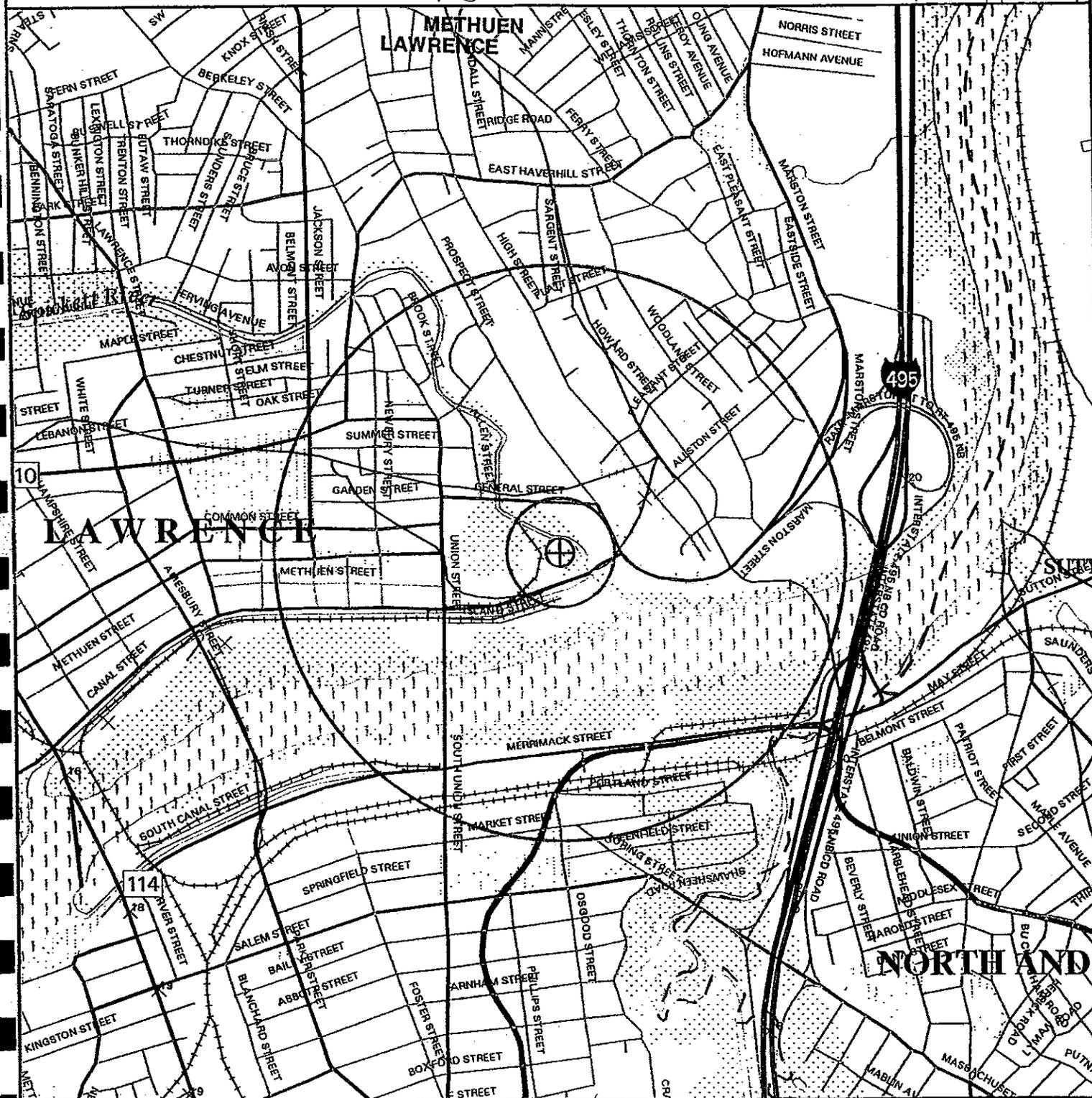
Site Location

The information shown on this map is the best available at the date of printing. Please refer to the data source descriptions document.



Massachusetts Geographic Information System

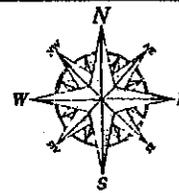
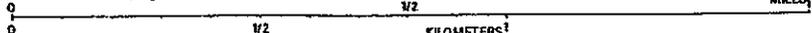
Massachusetts Executive Office of Environmental Affairs - 2003



- Roads: Limited Access, Divided, Major Road, Connector, Street, Track, Trail
- Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
- Basins: Major, Sub; Streams: Perennial, Intermittent, Man Made Shore, Dams
- Potentially Productive Aquifers: Medium, High Yield
- Non-Potential Drinking Water Source Area: Medium, High Yield

- EPA Sole Source Aquifer; FEMA 100-year floodplain
- Public Water Supplies: Ground, Surface, Non Community
- Approved Zone 2; MWPA; Surface Water Supply Zone A
- Hydrography: Water Features, Public Surface Water Supply
- Wetlands: Fresh, Salt, NHESP Wetlands Habitat
- Protected Open Space; ACEC
- DEP Permitted Solid Waste Facilities; Certified Vernal Pools

SCALE 1:15000



May 30, 2003

# NRS SCORING MAP DATA SOURCES

**AQUIFERS:** USGS-WRD/MassGIS, 1:48,000. Automated by MassGIS from the USGS Water Resources Div. Hydrologic Atlas series manuscripts. The definitions of high and medium yield vary among basins. Source dates 1977-1988.

**SOLE SOURCE AQUIFERS:** US EPA/MA DEP/MassGIS, various scales. They are defined by EPA as aquifers that are the 'sole or principal source' of drinking water for a given aquifer service area. Last updated May 1996.

**NON POTENTIAL DRINKING WATER SOURCE AREAS:** DEP-BWSC (Bureau of Waste Site Cleanup). Those portions of high and medium yield aquifers, which may not be considered as areas of groundwater conducive to the locations of public water supplies. Please refer to the MCP guidelines for the definitions of these areas.

**DEP APPROVED ZONE II's:** MA DEP, 1:25,000. As stated in 310 CMR 22.02 'that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated.' Digitized from data provided to DEP in approved hydrologic engineering reports. Data is updated continuously.

**INTERIM WELLHEAD PROTECTION AREAS:** DEP-DWS (Division of Water Supply), 1:25,000. These polygons represent an interim Zone II for a groundwater source until an actual one is approved by the DEP Division of Water Supply. The radius of an IWWA varies according to the approved pumping rate. Updated in parallel with the Public Water Supplies data.

**PUBLIC WATER SUPPLIES:** DEP-DWS, 1:25,000. Community and non-community surface and withdrawal points were field collected using Global Positioning System receivers. The attributes were added from the DEP Division of Water Supply database. Continuously updated.

**HYDROGRAPHY:** USGS/MassGIS, 1:25,000 USGS Digital Line Graph (DLG) data modified by MassGIS. Approximately 40% of the data was provided by USGS and MassGIS created the remainder to USGS specifications. Source dates 1977-1997.

**DRAINAGE BASINS:** USGS-WRD/MassGIS, 1:24,000. Automated by MassGIS from USGS Water Resources Division manuscripts with approximately 2400 sub-basins as interpreted from 1:24,000 USGS quadrangle contour lines. 1987-1993.

**WETLANDS:** Umass Amherst RMP/MassGIS, 1:25,000. Includes nonforested wetlands extracted from the 1971-1991 Land Use datalayer, which was photointerpreted from summer-CIR photography. Interpretation was not done in stereo. Also included, in most areas, forested wetlands from USGS Digital Line Graph (DLG) data.

**PROTECTED OPEN SPACE:** EOE (Executive Office of Environmental Affairs) MassGIS, 1:25,000. Includes federal, state, county, municipal, non-profit and protected private conservation and outdoor recreation lands. Ongoing updates.

**ACECs:** DEM, 1:25,000. Areas of Critical Environmental Concern are areas designated by the Secretary of ECEA as having a number of valuable environmental features coexisting. Projects in ACECs are subject to the highest standards of review and performance. Last updated October 1996.

**ROADS:** USGS/MassGIS/MHD, 1:100,000. MassGIS extracted roads from the USGS Transportation DLG files. MA Highway Dept. updated roads through 1999. MassGIS and MA DEP GIS group further edited this layer. Numbered routes are part of the state, U.S. or Interstate highway systems.

**POLITICAL BOUNDARIES:** MassGIS/USGS, 1:25,000. This datalayer was digitized by MassGIS from mylar USGS quads. Source date is approximately 1985.

**DEP PERMITTED SOLID WASTE FACILITIES:** DEP-DSW (Division of Solid Waste), 1:25,000. Includes only facilities regulated since 1971. Data includes sanitary landfills, transfer stations and recycling or composting facilities. Facility boundaries were compiled or approximate facility point locations drafted onto USGS quadrangles and automated by the DEP Division of Solid Waste. Last updated 1997.

**NHESP ESTIMATED HABITATS OF RARE WETLANDS WILDLIFE:** Polygons show estimated habitats for all processed occurrences of rare wetlands wildlife. Data collected by Natural Heritage & Endangered Species Program and compiled at 1:24,000 or 1:25,000 scale. For use with Wetlands Protection Act Only. Effective 1999 - 2001.

**NHESP CERTIFIED VERNAL POOLS:** Points show all vernal pools certified by NHESP/MADFW (Fisheries and Wildlife) as of June 30, 1999. Data compiled at 1:24,000 or 1:25,000 scale. Effective 1999 - 2001.

## **TABLES**

Table 2-1 - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1 Standards	Building No. 1												Building No.2 - Confirmatory Sampling						Building No.3																					
		B-1-1 (0-0.5) 8/9/01 S&W	B-1-1 DUP (0-0.5) 8/9/01 S&W	B-1-2 (0-0.5) 8/9/01 S&W	B-1-3 (0-0.5) 8/9/01 S&W	B-1-4 (0-0.5) 8/9/01 S&W	B-1-4 DUP (0-0.5) 8/9/01 S&W	B-1-5 (0-0.5) 8/9/01 S&W	B-1-5 (0-2) 8/9/01 S&W	B-1-6 (0-2) 8/9/01 S&W	B-1-7 (0-0.5) 8/9/01 S&W	TP2-1 (5' bgs) 3/8/04 S&W	TP2-2 (4' bgs) 3/8/04 S&W	TP2-3 (4' bgs) 3/8/04 S&W	B-1 (0-0.5) 5/7/01 S&W	B-1 (0.5-2) 5/7/01 S&W	B-1 (2-4) 5/7/01 S&W	B-2 (0-2) 5/7/01 S&W	B-3 (0-0.5) 5/7/01 S&W	B-3 (4-6) 5/7/01 S&W	B-5 (0-0.5) 5/7/01 S&W	B-5 (4-6) 5/7/01 S&W	B-6 (0-0.5) 5/7/01 S&W	B-7 (0-0.5) 5/7/01 S&W																	
<b>Analytes</b>																																									
<b>Metals</b>																																									
Arsenic	20 / 20	5.2		5.8		NT		2.3		8.0		NT		11		NT		NT		6.2		NT		NT		NT		NT		NT		NT		NT		NT		10			
Barium	5,000 / 5,000	19		19		NT		30		43		NT		67		NT		NT		120		NT		NT		NT		NT		NT		NT		NT		NT		25			
Beryllium	3 / 3	0.3U	0.30	0.3U	0.30	NT		0.2U	0.20	0.29		NT		0.2U	0.20	NT		NT		0.2U	0.20	NT		NT		NT		NT		NT		NT		NT		NT		0.3			
Cadmium	30 / 30	0.3U	0.30	0.3U	0.30	NT		0.2U	0.20	0.2U	0.20	NT		0.2U	0.20	NT		NT		0.2U	0.20	NT		NT		NT		NT		NT		NT		NT		NT		0.2U			
Chromium	200 / 200	12		13		NT		21		12		NT		32		NT		NT		25		NT		NT		NT		NT		NT		NT		NT		NT		18			
Lead	300 / 300	5.2		5.5		NT		12		58		NT		11		NT		NT		30		98	1.4	130	1.4	21	1.2	NT		NT		NT		NT		NT		4.8			
Selenium	800 / 800	1U	1.0	1U	1.0	NT		1U	1.0	1U	1.0	NT		1U	1.0	NT		NT		1U	1.0	NT		NT		NT		NT		NT		NT		NT		NT		2U			
Silver	200 / 200	1U	1.0	1U	1.0	NT		1U	1.0	1.2		NT		1U	1.0	NT		NT		3.3		NT		NT		NT		NT		NT		NT		NT		NT		1U			
Zinc	5,000 / 5,000	24		26		NT		44		94		NT		38		NT		NT		45		NT		NT		NT		NT		NT		NT		NT		NT		24			
Mercury	30 / 30	0.06U	0.06	0.06U	0.06	NT		0.05U	0.05	0.068		NT		0.049		NT		NT		0.078		NT		NT		NT		NT		NT		NT		NT		NT		0.05U			
<b>Polychlorinated Biphenyls - PCBs</b>																																									
Aroclor-1016	2 / 2	U	0.130	U	0.130	U	0.110	U	0.110	U	0.110	U	0.100	NT		U	0.110	U	0.110	U	0.110	NT		NT		U	0.110	U	0.110	U	0.120	U	0.110	U	0.110	U	0.110	U	0.120		
Aroclor-1254	2 / 2	U	0.130	U	0.130	U	0.110	U	0.110	U	0.110	U	0.100	NT		U	0.110	U	0.110	U	0.110	NT		NT		U	0.110	U	0.110	U	0.120	U	0.110	U	0.110	U	0.130	U	0.110	U	0.120
Aroclor-1260	2 / 2	U	0.130	U	0.130	U	0.110	U	0.110	U	0.110	U	0.100	NT		U	0.110	U	0.110	U	0.110	NT		NT		U	0.110	U	0.110	U	0.120	U	0.110	U	0.110	U	0.130	U	0.110	U	0.120
<b>Volatile Organic Compounds - VOCs</b>																																									
Acetone		U	0.050	NT		NT		U	2.8	NT		NT		U	2.8	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		U			
Benzene	700 / 900	0.0051	0.0025	NT		NT		U	0.140	NT		NT		U	0.140	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		U			
Chloroform	10 / 300	U	0.0025	NT		NT		U	0.140	NT		NT		U	0.140	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		U			
Ethylbenzene	2,500 / 500	U	0.0025	NT		NT		U	0.140	NT		NT		U	0.140	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		U			
Trichloroethene (TCE)	2 / 2,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
<b>Polyaromatic Hydrocarbons (PAH)</b>																																									
Acenaphthene	5,000 / 4,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Anthracene	5,000 / 5,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Benzo(a)anthracene	300 / 300	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.26	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Benzo(b)fluoranthene	300 / 300	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.37	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Benzo(k)fluoranthene	3,000 / 3,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Benzo(g,h,i)perylene	2,500 / 2,500	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Benzo(a)pyrene	30 / 30	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.23	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Chrysene	40 / 40	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.26	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Dibenzo(a,h)anthracene	30 / 30	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Fluoranthene	5,000 / 5,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.46	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Indeno(1,2,3-cd)pyrene	300 / 300	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Naphthalene	40 / 3,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		U	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Phenanthrene	2,500 / 100	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.28	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
Pyrene	5,000 / 5,000	U	0.440	U	0.440	NT		U	0.410	U	0.370	NT		U	0.360	NT		NT		0.37	0.370	NT		NT		U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370	U	0.370		
<b>Extractable Petroleum Hydrocarbons (EPH)</b>																																									
C <sub>9</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	4.3	U	4.4	U	4.1	U	3.7	U	3.6	U	3.6	NT		U	3.8	U	3.7	U	3.6	NT		NT		U	3.7	U	3.7	U	3.8	65	3.8	U	3.7	26	3.8	11	4.5		
C <sub>15</sub> -C <sub>24</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	4.3	U	4.4	93	4.1	U	3.7	U	3.6	U	3.6	NT		U	3.8	U	3.7	U	3.6	NT		NT		U	3.7	9.1	3.7	12	3.8	1200	3.8	U	3.7	53	3.8	22	4.5		
C <sub>11</sub> -C <sub>24</sub> Aromatics Hydrocarbons	5,000 / 5,000	U	4.3	U	4.4	62	4.1	U	3.7	9.1	3.6	6.0	3.6	NT		U	3.8	U	3.7	7.4	3.6	NT		NT		U	3.7	22	3.7	31	3.8	480	3.8	4.8	3.7	190	3.8	33	4.5		
Acenaphthene	5,000 / 4,000	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	NT		U	0.4	U	0.4	U	0.4	NT		NT</																	



Table 2-1 Con't - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1 Standards	Bulk No. 3																																							
		B-31 (0-0.5) 5/7/01 S&W	B-32 (0-0.5) 5/7/01 S&W	B-32 DUP (0-0.5) 5/7/01 S&W	B-33 (0-0.5) 5/7/01 S&W	B-34 (0-0.5) 5/7/01 S&W	B-36 (0-0.5) 5/7/01 S&W	B-36 (0.5-2) 5/7/01 S&W	B-36 (2-4) 5/7/01 S&W	B-36 (4-6) 5/7/01 S&W	B-37 (0-0.5) 5/7/01 S&W	B-38 (0-0.5) 5/7/01 S&W	B-38 (0.5-2) 5/7/01 S&W	B-38 (2-4) 5/7/01 S&W	B-38 (4-6) 5/7/01 S&W	B-39 (0-0.5) 5/7/01 S&W	B-40 (0-0.5) 5/7/01 S&W	B-41 (0-0.5) 5/7/01 S&W	B-43 (0-0.5) 5/7/01 S&W	B-43 DUP (0-0.5) 5/7/01 S&W	B-44 (0-0.5) 5/7/01 S&W	B-44 (0.5-2) 5/7/01 S&W	B-45 (0-0.5) 5/7/01 S&W	B-47 (0-0.5) 5/7/01 S&W																	
Analytes																																									
Metals																																									
Arsenic	20/20	6.6	NT	NT	NT	NT	62	67	50	14	NT	35	65	43	7.0	NT	7.6	8.8	25	NT	12	10	17	NT																	
Barium	5,000/5,000	33	NT	NT	NT	NT	91	NT	NT	NT	NT	59	NT	NT	NT	NT	69	30	200	NT	56	44	58	NT																	
Beryllium	3/3	0.34	NT	NT	NT	NT	0.30	0.30	NT	NT	NT	0.53	NT	NT	NT	NT	0.48	0.4	0.44	NT	0.27	0.33	0.38	NT																	
Cadmium	30/30	0.2U	0.20	NT	NT	NT	0.33	NT	NT	NT	NT	0.41	NT	NT	NT	NT	0.2U	0.20	0.2U	0.20	0.2U	0.20	0.41	0.33	0.31	NT															
Chromium	200/200	25	NT	NT	NT	NT	26	NT	NT	NT	NT	15	NT	NT	NT	NT	16	15	23	NT	40	32	29	NT																	
Lead	300/300	4.8	NT	NT	NT	NT	310	NT	NT	NT	NT	71	NT	NT	NT	NT	8.0	13	100	NT	20	45	33	NT																	
Selenium	800/800	1U	1.0	NT	NT	NT	6.2	NT	NT	NT	NT	1U	1.0	NT	NT	NT	1U	1.0	0.8U	0.80	0.8U	0.80	1U	1.0	1U	1.0	1U	1.0	NT												
Silver	200/200	1U	1.0	NT	NT	NT	2U	2.0	NT	NT	NT	1U	1.0	NT	NT	NT	1U	1.0	0.8U	0.80	0.8U	0.80	1U	1.0	1U	1.0	1U	1.0	NT												
Zinc	5,000/5,000	81	NT	NT	NT	NT	61	NT	NT	NT	NT	45	NT	NT	NT	NT	13	48	68	NT	51	53	46	NT																	
Mercury	30/30	0.05U	0.05	NT	NT	NT	0.44	NT	NT	NT	NT	0.31	NT	NT	NT	NT	0.05U	0.05	0.05U	0.05	0.21	NT	0.056	0.12	0.11	NT															
Polychlorinated Biphenyls - PCBs																																									
Aroclor-1016	2/2	U	0.110	U	0.110	U	0.120	U	0.110	U	0.140	U	0.140	NT	NT	NT	U	0.120	U	0.120	NT	NT	NT	U	0.140	U	0.110	U	0.120	U	0.110	U	0.310	U	0.210	U	0.220	U	0.110	U	0.110
Aroclor-1254	2/2	U	0.110	U	0.110	U	0.120	U	0.110	U	0.140	U	0.140	NT	NT	NT	U	0.120	U	0.120	NT	NT	NT	U	0.140	U	0.110	U	0.120	U	0.110	U	0.310	U	0.210	U	0.220	U	0.110	U	0.110
Aroclor-1260	2/2	U	0.110	U	0.110	U	0.120	U	0.110	U	0.140	U	0.140	NT	NT	NT	U	0.120	U	0.120	NT	NT	NT	U	0.140	U	0.110	U	0.120	U	0.110	U	0.310	U	0.210	U	0.220	U	0.110	U	0.110
Volatile Organic Compounds - VOCs																																									
Acetone		0.12	0.084	NT	NT	NT	NT	NT	0.12	0.058	NT	NT	NT	NT	NT	NT	U	0.082	NT	NT	NT	NT	NT	U	0.068	2.2	0.054	U	0.060	U	0.058	0.2	0.054	NT	0.2	0.054	NT	0.2	0.054	NT	
Benzene	700/900	U	0.0042	NT	NT	NT	NT	NT	U	0.0029	NT	NT	NT	NT	NT	NT	U	0.0041	NT	NT	NT	NT	NT	U	0.0034	U	0.0027	U	0.003	U	0.0029	U	0.0027	NT	U	0.0027	NT	U	0.0027	NT	
Chloroform	10/300	U	0.0042	NT	NT	NT	NT	NT	U	0.0029	NT	NT	NT	NT	NT	NT	0.001	0.0041	NT	NT	NT	NT	NT	U	0.0034	0.0045	0.0027	U	0.003	U	0.0029	0.0029	0.0027	NT	U	0.0027	NT	U	0.0027	NT	
Ethylbenzene	2,500/500	U	0.0042	NT	NT	NT	NT	NT	U	0.0029	NT	NT	NT	NT	NT	NT	U	0.0041	NT	NT	NT	NT	NT	U	0.0034	U	0.0027	U	0.003	U	0.0029	U	0.0027	NT	U	0.0027	NT	U	0.0027	NT	
Trichloroethene (TCE)	2/2,000	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		
Polycyclic Aromatic Hydrocarbons (PAH)																																									
Acenaphthene	5,000/4,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	U	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Anthracene	5,000/5,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	1.3	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Benzo(a)anthracene	300/300	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	3.0	1.5	0.28	0.360	NT	U	0.380	NT	U	0.380	NT	
Benzo(b)fluoranthene	300/300	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	2.8	1.5	0.32	0.360	NT	U	0.380	NT	U	0.380	NT	
Benzo(k)fluoranthene	3,000/3,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	3.0	1.5	0.23	0.360	NT	U	0.380	NT	U	0.380	NT	
Benzo(g,h)perylene	2,500/2,500	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	1.0	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Benzo(a)pyrene	30/30	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	2.9	1.5	0.27	0.360	NT	U	0.380	NT	U	0.380	NT	
Chrysene	40/40	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	3.1	1.5	0.33	0.360	NT	U	0.380	NT	U	0.380	NT	
Dibenz(a,h)anthracene	30/30	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	U	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Fluoranthene	5,000/5,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	5.7	1.5	0.67	0.360	NT	U	0.380	NT	U	0.380	NT	
Indeno(1,2,3-cd)pyrene	300/300	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	1.1	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Naphthalene	40/3,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	U	1.5	U	0.360	NT	U	0.380	NT	U	0.380	NT	
Phenanthrene	2,500/100	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	4.0	1.5	0.45	0.360	NT	U	0.380	NT	U	0.380	NT	
Pyrene	5,000/5,000	U	0.510	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	NT	U	0.490	NT	NT	NT	NT	NT	U	0.380	U	0.380	U	0.810	4.5	1.5	0.39	0.360	NT	U	0.380	NT	U	0.380	NT	
Extractable Petroleum Hydrocarbons (EPH)																																									
C <sub>7</sub> -C <sub>11</sub> Aliphatics Hydrocarbons	5,000/5,000	20	3.6	U	3.8	U	3.9	U	3.8	24	4.5	18	4.9	NT	NT	NT	4.2	4.1	4.7	3.8	NT	NT	NT	10	4.8	6.3	3.8	6.5	4.0	9.9	3.7	12	3.8	7.0	3.6	U	3.8	U	3.8	U	3.9
C <sub>10</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000/5,000	1500	3.6	21	3.8	9.5	3.9	14	3.8	120	4.5	120	4.9	NT	NT	NT	7.8	4.1	26	3.8	NT	NT	NT	100	4.8	4.5	3.8	380	4.0	66	3.7	47	3.8	42	3.6	61	3.8	23	3.8	7.1	3.9
C <sub>11</sub> -C <sub>15</sub> Aromatics Hydrocarbons	5,000/5,000	350	3.6	53	3.8	19	3.9	21	3.8	120	4.5	150	4.9	NT	NT	NT	11	4.1	32	3.8	NT	NT	NT	34	4.8	22	3.8	120	4.0	120	3.7	150	3.8	26	3.6	62	3.8	13	3.8	14	3.9
Acenaphthene	5,000/4,000	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.5	NT	NT	NT	U	0.4	U	0.4	NT	NT	NT	U	0																

Table 2-1 Con't - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1	Building No. 3										Building No. 3 Confirmatory Sampling																					
		B-48 (0-0.5') 5/7/01 S&W	B-48 (0.5-2') 5/7/01 S&W	B-48 (2-4') 5/7/01 S&W	B-48 (4-6') 5/7/01 S&W	B-48 (0-0.5') 5/7/01 S&W	B-48 (0-0.5') 5/7/01 S&W	B-4 (1) (4' bgs) 6/3/02 S&W	B-4 (2) (4' bgs) 6/3/02 S&W	B-4 (3) (4' bgs) 6/3/02 S&W	B-4 (4) (4' bgs) 6/3/02 S&W	B-4 (5) (4' bgs) 6/3/02 S&W	B-4 (6) (4' bgs) 6/3/02 S&W	B-4 (7) (4' bgs) 6/3/02 S&W	B-4 (8) (4' bgs) 6/3/02 S&W	B-4 (9) (4' bgs) 6/3/02 S&W	B-4 (10) (4' bgs) 6/3/02 S&W	B-4 (11) (4' bgs) 6/3/02 S&W	B-4 (12) (4' bgs) 6/3/02 S&W	B-24 (1) (1' bgs) 5/10/02 S&W	B-24 (2) (1' bgs) 5/10/02 S&W	B-24 (3) (1' bgs) 5/10/02 S&W	B-24 (4) (1' bgs) 5/10/02 S&W	B-24 (5) (1' bgs) 5/10/02 S&W	B-24 (6) (1' bgs) 5/10/02 S&W								
<b>Analytes</b>																																	
<b>Metals</b>																																	
Arsenic	20 / 20	65		8.9		6.2		7.5		14		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Barium	5,000 / 5,000	130		NT		NT		NT		73		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Beryllium	3 / 3	0.2U	0.20	NT		NT		NT		0.3		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Cadmium	30 / 30	0.72		NT		NT		NT		0.37		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Chromium	200 / 200	55		NT		NT		NT		26		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Lead	300 / 300	150		NT		NT		NT		170		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Selenium	800 / 800	1.2		NT		NT		NT		1U	1.0	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Silver	200 / 200	1U	1.0	NT		NT		NT		1U	1.0	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Zinc	5,000 / 5,000	84		NT		NT		NT		74		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
Mercury	30 / 30	0.4		NT		NT		NT		0.39		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT			
<b>Polychlorinated Biphenyls - PCBs</b>																																	
Aroclor-1016	2 / 2	U	0.120	NT		NT		NT		U	0.120	U	0.115	U	0.108	U	0.109	U	0.109	U	0.107	U	0.155	U	0.120	U	0.111	U	0.117	U	0.106	U	0.110
Aroclor-1254	2 / 2	U	0.120	NT		NT		NT		U	0.120	U	0.115	U	0.108	U	0.109	U	0.109	U	0.107	U	0.155	U	0.120	U	0.111	U	0.117	U	0.106	U	0.110
Aroclor-1260	2 / 2	U	0.120	NT		NT		NT		U	0.120	U	0.115	U	0.108	U	0.109	U	0.109	U	0.107	U	0.155	U	0.120	U	0.111	U	0.117	U	0.106	U	0.110
<b>Volatile Organic Compounds - VOCs</b>																																	
Acetone		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzene	700 / 900	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Chloroform	10 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Ethylbenzene	2,500 / 500	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Trichloroethene (TCE)	2 / 2,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
<b>Polycyclic Aromatic Hydrocarbons (PAH)</b>																																	
Acenaphthene	5,000 / 4,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Anthracene	5,000 / 5,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(a)anthracene	300 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(b)fluoranthene	300 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(k)fluoranthene	3,000 / 3,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(a,h)perylene	2,500 / 2,500	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(a)pyrene	30 / 30	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Chrysene	40 / 40	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Dibenzo(a,h)anthracene	30 / 30	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Fluoranthene	5,000 / 5,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Indeno(1,2,3-cd)pyrene	300 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Naphthalene	40 / 3,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Phenanthrene	2,500 / 100	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Pyrene	5,000 / 5,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
<b>Extractable Petroleum Hydrocarbons (EPH)</b>																																	
C <sub>9</sub> -C <sub>11</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	3.9	NT		NT		U	4.0	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
C <sub>10</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	3.9	NT		NT		U	4.0	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
C <sub>11</sub> -C <sub>14</sub> Aromatics Hydrocarbons	5,000 / 5,000	25	3.9	NT		NT		38	4.0	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Acenaphthene	5,000 / 4,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Acenaphthylene	2,500 / 1,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Anthracene	5,000 / 5,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(a)anthracene	300 / 300	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(a)pyrene	30 / 30	0.54	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(b)fluoranthene	300 / 300	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(g,h,i)perylene	2,500 / 2,500	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Benzo(k)fluoranthene	3,000 / 3,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Chrysene	40 / 40	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Dibenzo(a,h)anthracene	30 / 30	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Fluoranthene	5,000 / 5,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Fluorene	5,000 / 4,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Indeno(1,2,3-cd)pyrene	300 / 300	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
2-Methylnaphthalene	2,000 / 1,000	U	0.4	NT		NT		U	0.4	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT	
Naphthalene	40 / 3,000	U	0.																														





Table 2-1 Con't - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1 Standards	Building No. 4				Building No. 5				Building No. 6																																	
		B-4-1 (0-0.5)	B-4-2 (0-0.5)	B-4-3 (0-0.5)	B-5-1 (0-0.5)	B-6-1A (0-0.5)	B-6-2 (0-0.5)	B-6-5 (0-0.5)	B-6-5 (0-2)	B-6-6 (0-2)	B-6-7 (0-0.5)	B-6-8 (0-0.5)	B-6-9 (0-0.5)	B-6-10 (0-0.5)	B-6-11 (0-0.5)	B-6-12 (0-0.5)	B-6-13 (0-0.5)	B-6-13 DUP (0-0.5)	B-6-14 (0-0.5)	B-6-15 (0-0.5)	B-6-15 DUP (0-0.5)	B-6-16 (0-0.5)																					
Date Sampled	S-3 GW-2/GW-3	6/20/01	6/20/01	6/20/01	8/9/01	7/21/03	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/10/01	7/21/03	7/22/03	7/22/03	7/22/03	7/22/03																					
Sampling Company	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W																					
Analytes		Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL																				
<b>Metals</b>																																											
Arsenic	20 / 20	9.0		NT		7.2		11		NT		8.9		6.8		NT		NT		3.9		11		18		NT		0.25	1.16	12.6	1.17	NT		7.35	1.16	6.34	1.27	NT					
Barium	5,000 / 5,000	21		NT		38		67		NT		40		120		NT		NT		30		52		34		NT		41.2	1.16	37	1.17	NT		48.3	1.16	53.1	1.27	NT					
Beryllium	3 / 3	0.35		NT		0.3U	0.30	0.2U	0.20	NT		0.2U	0.20	0.7U	0.70	NT		NT		0.24		0.26		0.2U	0.20	NT		0.235	0.231	0.293	0.234	NT		U	0.232	U	0.254	NT					
Cadmium	30 / 30	0.3U	0.30	NT		0.3U	0.30	0.2U	0.20	NT		0.2U	0.20	0.46		NT		NT		0.2U	0.20	0.27		0.2U	0.20	NT		U	0.231	U	0.234	NT		U	0.232	U	0.254	NT					
Chromium	200 / 200	21		NT		23		32		NT		21		47		NT		NT		38		38		51		NT		48.2	1.16	33.5	1.17	NT		33.2	1.16	35.3	1.27	NT					
Lead	300 / 300	4.5		NT		5.1		11		NT		24		540		NT		NT		6.9		71		110		NT		6.88	1.16	10.7	1.17	NT		35.3	1.16	32.5	1.27	NT					
Selenium	800 / 800	1U	1.0	NT		1U	1.0	1U	1.0	NT		1U	1.0	3U	3.0	NT		NT		1U	1.0	2U	2.0	NT		1U	1.0	U	1.16	U	1.17	NT		U	1.16	U	1.27	NT					
Silver	200 / 200	1U	1.0	NT		1U	1.0	1U	1.0	NT		1U	1.0	3U	3.0	NT		NT		1U	1.0	2U	2.0	NT		1U	1.0	U	1.16	U	1.17	NT		U	1.16	U	1.27	NT					
Zinc	5,000 / 5,000	24		NT		25		38		NT		52		180		NT		NT		28		100		74		NT		52	5.79	44	5.86	NT		63.8	5.8	73.1	6.34	NT					
Mercury	30 / 30	0.05U	0.05	NT		0.05U	0.05	0.049		NT		0.3		0.96		NT		NT		0.05U	0.05	NT		6.0		NT		2.6		NT		0.061	0.049	0.123	0.057	NT		0.818	0.047	0.741	0.049	NT	
<b>Polychlorinated Biphenyls - PCBs</b>																																											
Aroclor-1016	2 / 2	U	0.130	U	0.150	U	0.130	U	0.110	U	0.114	U	0.120	NT		U	0.260	U	0.120	U	0.110	U	0.110	U	0.340	U	0.130	U	0.120	U	0.113	U	0.107	U	0.105	U	0.112	U	0.106	U	0.106	U	0.101
Aroclor-1254	2 / 2	U	0.130	U	0.150	U	0.130	U	0.110	U	0.114	U	0.120	NT		U	0.280	U	0.120	U	0.110	U	0.110	U	0.340	U	0.130	U	0.120	U	0.113	U	0.107	U	0.105	U	0.112	U	0.106	U	0.106	U	0.101
Aroclor-1260	2 / 2	U	0.130	U	0.150	U	0.130	U	0.110	U	0.114	U	0.120	NT		U	0.260	U	0.120	U	0.110	U	0.110	U	0.340	U	0.130	0.18	0.120	U	0.113	U	0.107	U	0.105	U	0.112	U	0.106	U	0.106	U	0.101
<b>Volatile Organic Compounds - VOCs</b>																																											
Acetone		U	0.066	NT		NT		U	2.8	NT		NT		0.2	0.065	NT		NT		U	0.054	NT		U	0.084	NT		U	0.059	NT		0.65J	0.068	0.31J	0.047	NT		U	0.044	U	0.058	NT	
Benzene	700 / 900	U	0.0033	NT		NT		U	0.140	NT		NT		U	0.0032	NT		NT		U	0.0027	NT		U	0.0042	NT		U	0.003	NT		U	0.003	U	0.002	NT		U	0.002	U	0.003	NT	
Chloroform	10 / 300	U	0.0033	NT		NT		U	0.140	NT		NT		0.01	0.0032	NT		NT		U	0.0027	NT		U	0.0042	NT		U	0.003	NT		0.01	0.003	0.008	0.002	NT		U	0.002	U	0.003	NT	
Ethylbenzene	2,500 / 500	U	0.0033	NT		NT		U	0.140	NT		NT		U	0.0032	NT		NT		U	0.0027	NT		U	0.0042	NT		U	0.003	NT		U	0.003	U	0.002	NT		U	0.002	U	0.003	NT	
Trichloroethene (TCE)	2 / 2,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		U	0.003	U	0.002	NT		U	0.002	U	0.003	NT					
<b>Polycyclic Aromatic Hydrocarbons (PAH)</b>																																											
Acenaphthene	5,000 / 4,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Anthracene	5,000 / 5,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Benzo(a)anthracene	300 / 300	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.19	0.180	U	0.190	NT	
Benzo(b)fluoranthene	300 / 300	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.15J	0.180	U	0.190	NT	
Benzo(k)fluoranthene	3,000 / 3,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.15J	0.180	U	0.190	NT	
Benzo(a,h)perylene	2,500 / 2,500	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Benzo(a)pyrene	30 / 30	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.18J	0.180	U	0.190	NT	
Chrysene	40 / 40	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.18J	0.180	U	0.190	NT	
Dibenzo(a,h)anthracene	30 / 30	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Fluoranthene	5,000 / 5,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.42J	0.180	0.11J	0.190	NT	
Indeno(1,2,3-cd)pyrene	300 / 300	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Naphthalene	40 / 3,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Phenanthrene	2,500 / 100	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		U	0.180	U	0.190	NT	
Pyrene	5,000 / 5,000	U	0.440	NT		U	0.450	U	0.360	NT		U	0.400	NT		NT		NT		U	0.370	NT		U	1.1	NT		U	0.400	NT		U	0.180	U	0.180	NT		0.38J	0.180	0.13J	0.190	NT	
<b>Extractable Petroleum Hydrocarbons (EPH)</b>																																											
C <sub>10</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	4.4	U	4.9	U	4.5	U																																			

Table 2-1 Con't - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1 Standards	Building No. 28																Building No. 6 Transformer / Courtyard Area																
		B-28-1 (0-0.5')	B-28-2 (0-0.5')	B-28-3 (0-0.5')	DUP1 (0-0.5')	B-28-4 (0-0.5')	B-28-5 (0-0.5')	B-28-6 (0-0.5')	DUP2 (0-0.5')	B1-5 (5' bfg)	B1-9.5 (9.5' bfg)	B1-14.5 (14.5' bfg)	B1-19.5 (19.5' bfg)	B1-19.5 DUP1 (19.5' bfg)	B2-6 (5' bfg)	B2-9.5 (9.5' bfg)	B2-14.5 (14.5' bfg)	B2-20 (20' bfg)	B3-5 (5' bfg)	B3-10 (10' bfg)	B3-15 (15' bfg)	B3-19.5 (19.5' bfg)	B4-5 (5' bfg)	B4-9.5 (9.5' bfg)										
Date Sampled	9-3 GW-2/GW-3	7/20/05	7/20/05	7/20/05	7/20/05	7/20/05	7/20/05	7/20/05	7/20/05	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04	9/3/04									
Sampling Company	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W									
Analytes		Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL							
<b>Metals</b>																																		
Arsenic	20 / 20	NT		4.8	1.3	NT		NT		NT		13	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Barium	5,000 / 5,000	NT		20	1.3	NT		NT		NT		1100	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Beryllium	3 / 3	NT		U	0.25	NT		NT		NT		U	0.64	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Cadmium	30 / 30	NT		U	0.25	NT		NT		NT		U	0.84	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Chromium	200 / 200	NT		35J	1.3	NT		NT		NT		14J	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Lead	300 / 300	NT		3.7	1.3	NT		NT		NT		140	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Selenium	800 / 800	NT		U	1.3	NT		NT		NT		U	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Silver	200 / 200	NT		UJ	1.3	NT		NT		NT		UJ	3.2	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Zinc	5,000 / 5,000	NT		17J	6.3	NT		NT		NT		180J	16	NT		NT		NT		NT		NT		NT		NT		NT		NT				
Mercury	30 / 30	NT		U	0.027	NT		NT		NT		0.16	0.16	NT		NT		NT		NT		NT		NT		NT		NT		NT				
<b>Polychlorinated Biphenyls - PCBs</b>																																		
Aroclor-1016	2 / 2	U	0.110	U	0.100	U	0.100	U	0.110	U	0.110	U	0.120	U	0.110	U	0.100	2.4J	0.120	U	540	0.51J	0.110	U	0.110	U	0.100	U	0.230	U	0.120	U	0.110	U
Aroclor-1254	2 / 2	U	0.110	U	0.100	U	0.100	U	0.110	U	0.110	U	0.120	0.74	0.110	0.67	0.100	U	0.120	U	540	U	0.110	U	0.110	U	0.100	U	0.230	U	0.120	U	0.110	U
Aroclor-1260	2 / 2	U	0.110	0.52	0.100	U	0.100	U	0.110	U	0.110	U	0.120	U	0.110	U	0.100	39J	6.0	2900J	540	35J	5.3	0.72J	0.110	1.6J	0.100	2.3J	0.230	U	0.120	0.33J	0.110	U
<b>Volatile Organic Compounds - VOCs</b>																																		
Acetone		NT		UJ	0.260	NT		NT		NT		U	13	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzene	700 / 900	NT		U	0.0026	NT		NT		NT		U	0.130	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Chloroform	10 / 300	NT		U	0.0026	NT		NT		NT		U	0.130	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Ethylbenzene	2,500 / 500	NT		U	0.0026	NT		NT		NT		U	0.130	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Trichloroethene (TCE)	2 / 2,000	NT		U	0.0026	NT		NT		NT		0.46	0.130	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
<b>Polycyclic Aromatic Hydrocarbons (PAH)</b>																																		
Acenaphthene	5,000 / 4,000	NT		U	0.170	NT		NT		NT		U	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Anthracene	5,000 / 5,000	NT		U	0.170	NT		NT		NT		0.25	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(a)anthracene	300 / 300	NT		U	0.170	NT		NT		NT		0.74	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(b)fluoranthene	300 / 300	NT		U	0.170	NT		NT		NT		0.72	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(k)fluoranthene	3,000 / 3,000	NT		U	0.170	NT		NT		NT		0.43	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(g,h,i)perylene	2,500 / 2,500	NT		U	0.170	NT		NT		NT		0.22	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(a)pyrene	30 / 30	NT		U	0.170	NT		NT		NT		0.70	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Chrysene	40 / 40	NT		U	0.170	NT		NT		NT		0.79	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Dibenzo(a,h)anthracene	30 / 30	NT		U	0.170	NT		NT		NT		0.13J	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Fluoranthene	5,000 / 5,000	NT		U	0.170	NT		NT		NT		1.6	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Indeno(1,2,3-cd)pyrene	300 / 300	NT		U	0.170	NT		NT		NT		0.24	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Naphthalene	40 / 3,000	NT		U	0.170	NT		NT		NT		U	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Phenanthrene	2,500 / 100	NT		U	0.170	NT		NT		NT		1.3	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Pyrene	5,000 / 5,000	NT		U	0.170	NT		NT		NT		1.2	0.200	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
<b>Extractable Petroleum Hydrocarbons (EPH)</b>																																		
C <sub>9</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	3.7	U	3.4	U	3.4	U	3.6	5.1J	3.6	U	4.0	U	3.4	U	3.4	NT		NT		NT		NT		NT		NT		NT		NT		
C <sub>14</sub> -C <sub>28</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	3.7	U	3.4	U	3.4	U	3.6	18J	3.6	14	4.0	U	3.4	U	3.4	NT		NT		NT		NT		NT		NT		NT		NT		
C <sub>11</sub> -C <sub>22</sub> Aromatics Hydrocarbons	5,000 / 5,000	52	3.7	7.4	3.4	U	3.4	U	3.6	16	3.6	25	4.0	U	3.4	U	3.4	NT		NT		NT		NT		NT		NT		NT		NT		
Acenaphthene	5,000 / 4,000	U	0.37	U	0.34	U	0.34	U	0.36	U	0.36	U	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Acenaphthylene	2,500 / 1,000	U	0.37	U	0.34	U	0.34	U	0.36	U	0.36	U	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Anthracene	5,000 / 5,000	0.65	0.37	U	0.34	U	0.34	U	0.36	U	0.36	U	0.36	0.53	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		
Benzo(a)anthracene	300 / 300	1.1	0.37	U	0.34	U	0.34	U	0.36	U	0.36	0.97	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(a)pyrene	30 / 30	0.92	0.37	U	0.34	U	0.34	U	0.36	U	0.36	0.71	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(b)fluoranthene	300 / 300	0.71	0.37	U	0.34	U	0.34	U	0.36	U	0.36	0.66	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(g,h,i)perylene	2,500 / 2,500	0.43	0.37	U	0.34	U	0.34	U	0.36	U	0.36	U	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Benzo(k)fluoranthene	3,000 / 3,000	0.89	0.37	U	0.34	U	0.34	U	0.36	U	0.36	0.76	0.4	U	0.34	U	0.34	NT		NT		NT		NT		NT		NT		NT		NT		
Chrysene	40 / 40	1.1	0.37	U	0.34	U	0.34	U	0.36	U	0.3																							



Table 2-1 Cont - Summary of All Remaining Site Soil Analytical Data (Sub-Basement Transformer No. 6 / Courtyard Area)  
 City of Lawrence - 21 Canal Street  
 RTN 3-2691

Sample ID	Method 1 Standards	Building No. 6 Transformer / Courtyard Area																				
		SB-10-5 (15' bgs)	SB-10-15 (23' bgs)	SB-10-25 (33' bgs)	SB-11-5 (5' bgs)	SB-11-15 (15' bgs)	DUP (15' bgs)	SB-11-25 (25' bgs)	SB-12-5 (5' bgs)	SB-12-15 (15' bgs)	SB-12-25 (25' bgs)	SB-13-5 (5' bgs)	SB-13-15 (15' bgs)	SB-13-25 (25' bgs)								
Date Sampled	S-3 GW-2/GW-3	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05	5/11/05		
Sampling Company	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W	S&W		
Analytes		Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	Result	QL	
<b>Metals</b>																						
Arsenic	20 / 20	NT		NT		NT		NT		NT		NT		NT		NT		NT		4.4	1.5	
Barium	5,000 / 5,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		18	1.5	
Beryllium	3 / 3	NT		NT		NT		NT		NT		NT		NT		NT		NT		U	0.30	
Cadmium	30 / 30	NT		NT		NT		NT		NT		NT		NT		NT		NT		U	0.30	
Chromium	200 / 200	NT		NT		NT		NT		NT		NT		NT		NT		NT		18	1.5	
Lead	300 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		4.2	1.5	
Selenium	800 / 800	NT		NT		NT		NT		NT		NT		NT		NT		NT		U	1.5	
Silver	200 / 200	NT		NT		NT		NT		NT		NT		NT		NT		NT		U	1.5	
Zinc	5,000 / 5,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		18	7.4	
Mercury	30 / 30	NT		NT		NT		NT		NT		NT		NT		NT		NT		U	0.029	
<b>Polychlorinated Biphenyls - PCBs</b>																						
Aroclor-1016	2 / 2	UJ	0.130	UJ	0.120	UJ	0.110	UJ	0.130	UJ	0.120	UJ	0.110	UJ	0.220	UJ	2.3	UJ	0.570	UJ	0.110	UJ
Aroclor-1254	2 / 2	U	0.130	U	0.120	U	0.110	U	0.130	U	0.120	U	0.110	U	0.220	U	2.3	U	0.570	U	0.110	U
Aroclor-1260	2 / 2	0.90	0.130	0.13	0.120	U	0.110	1.6	0.130	U	0.120	0.25	0.110	3.4	0.220	46	2.3	4.9	0.570	0.8	0.110	10
<b>Volatile Organic Compounds - VOCs</b>																						
Acetone		NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Benzene	700 / 900	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Chloroform	10 / 300	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Ethylbenzene	2,500 / 500	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
Trichloroethene (TCE)	212,000	NT		NT		NT		NT		NT		NT		NT		NT		NT		NT		
<b>Polycyclic Aromatic Hydrocarbons (PAH)</b>																						
Acenaphthene	5,000 / 4,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Anthracene	5,000 / 5,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Benzo(a)anthracene	300 / 300	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Benzo(b)fluoranthene	300 / 300	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Benzo(k)fluoranthene	3,000 / 3,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Benzo(g,h)perylene	2,500 / 2,500	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Benzo(a)pyrene	30 / 30	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Chrysene	40 / 40	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Dibenzo(a,h)anthracene	30 / 30	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Fluoranthene	5,000 / 5,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Indeno(1,2,3-cd)pyrene	300 / 300	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Naphthalene	40 / 3,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Phenanthrene	2,500 / 100	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
Pyrene	5,000 / 5,000	U	0.210	U	0.200	U	0.170	U	0.220	U	0.190	U	0.190	U	0.190	U	0.210	U	0.190	U	0.190	U
<b>Extractable Petroleum Hydrocarbons (EPH)</b>																						
C <sub>9</sub> -C <sub>11</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	4.2	U	4.0	U	3.5	U	4.3	U	3.8	U	3.8	U	3.7	U	4.1	5.6	3.8	U	3.9	6.1J
C <sub>10</sub> -C <sub>14</sub> Aliphatics Hydrocarbons	5,000 / 5,000	U	4.2	U	4.0	U	3.5	6.6	4.3	U	3.8	U	3.8	U	3.7	U	4.1	6.0	3.8	U	3.9	U
C <sub>11</sub> -C <sub>22</sub> Aromatics Hydrocarbons	5,000 / 5,000	U	4.2	U	4.0	U	3.5	8.7	4.3	6.1	3.8	6.5	3.8	5.4	3.7	U	4.1	U	3.8	11	3.9	6.5
Acenaphthene	5,000 / 4,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Acenaphthylene	2,500 / 1,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Anthracene	5,000 / 5,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Benzo(a)anthracene	300 / 300	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Benzo(a)pyrene	30 / 30	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Benzo(b)fluoranthene	300 / 300	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Benzo(k)fluoranthene	2,500 / 2,500	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Benzo(g,h)perylene	3,000 / 3,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Chrysene	40 / 40	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Dibenzo(a,h)anthracene	30 / 30	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Fluoranthene	5,000 / 5,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Fluorene	5,000 / 4,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Indeno(1,2,3-cd)pyrene	300 / 300	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
2-Methylnaphthalene	2,000 / 1,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Naphthalene	40 / 3,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Phenanthrene	2,500 / 100	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U
Pyrene	5,000 / 5,000	U	0.42	U	0.4	U	0.35	U	0.43	U	0.38	U	0.38	U	0.37	U	0.41	U	0.38	U	0.39	U

All concentrations and quantitation limits expressed in mg/kg  
 U = Not Detected  
 UJ = Sample-specific detection limit is approximate  
 J = Quantitation is approximate due to limitations identified in the quality control review  
 NT = Not Tested  
 bgs = below ground surface  
 btg = below transformer pit grade

Table 2-2  
Soil Minimum and Maximum Concentrations for Remaining South Area Soils  
Areas South of the Raceway - City of Lawrence RTN 3-2691

Analytes	South Area (Sub-Basement and Transformer #6 / Courtyard Area)	
	Minimum mg/kg	Maximum mg/kg
<b>Metals</b>		
Arsenic	2.3	67
Barium	16	1100
Beryllium	ND	0.53
Cadmium	ND	1.1
Chromium	12	55
Lead	3.7	540
Selenium	ND	6.2
Silver	ND	3.3
Zinc	17	180
Mercury	ND	6.0
<b>Polychlorinated Biphenyls - PCBs</b>		
Aroclor-1016	ND	2.4
Aroclor-1254	ND	1.07
Aroclor-1260	ND	25,000
<b>Volatile Organic Compounds - VOCs</b>		
Acetone	ND	2.2
Benzene	ND	0.035
Chloroform	ND	0.091
Ethylbenzene	ND	0.003
Trichloroethene (TCE)	ND	0.46
<b>Polyaromatic Hydrocarbons (PAH)</b>		
Acenaphthene	ND	0.21
Anthracene	ND	1.3
Benzo(a)anthracene	ND	3.0
Benzo(b)fluoranthene	ND	2.8
Benzo(k)fluoranthene	ND	3.0
Benzo(g,h,i)perylene	ND	1.1
Benzo(a)pyrene	ND	2.9
Chrysene	ND	3.1
Dibenzo(a,h)anthracene	ND	0.5
Fluoranthene	ND	5.7
Indeno(1,2,3-cd)pyrene	ND	1.2
Naphthalene	ND	0.26
Phenanthrene	ND	4.9
Pyrene	ND	4.5
<b>Extractable Petroleum Hydrocarbons (EPH)</b>		
C <sub>9</sub> -C <sub>16</sub> Aliphatics Hydrocarbons	ND	1400
C <sub>19</sub> -C <sub>36</sub> Aliphatics Hydrocarbons	ND	2900
C <sub>11</sub> -C <sub>22</sub> Aromatics Hydrocarbons	ND	4500
Acenaphthene	ND	1.9
Acenaphthylene	ND	15
Anthracene	ND	16
Benzo(a)anthracene	ND	40
Benzo(a)pyrene	ND	30
Benzo(b)fluoranthene	ND	45
Benzo(g,h,i)perylene	ND	12
Benzo(k)fluoranthene	ND	15
Chrysene	ND	41
Dibenzo(a,h)anthracene	ND	3.9
Fluoranthene	ND	95
Fluorene	ND	8.5
Indeno(1,2,3-cd)pyrene	ND	18
2-Methylnaphthalene	ND	24
Naphthalene	ND	17
Phenanthrene	ND	84
Pyrene	ND	82

ND - Not Detected

Table 2-3  
 South Area Minimum and Maximum Groundwater Concentrations  
 Areas South of the Raceway - City of Lawrence RTN 3-2691

Analytes	South Area (Transformer #6 / Courtyard Area)	
	Minimum µg/L	Maximum µg/L
<b>Polychlorinated Biphenyls - PCBs</b>		
Aroclor-1016	ND	3.1
Aroclor-1260	ND	4.0
<b>Extractable Petroleum Hydrocarbons (EPH)</b>		
C <sub>9</sub> -C <sub>18</sub> Aliphatics Hydrocarbons	130	1400
C <sub>11</sub> -C <sub>22</sub> Aromatics Hydrocarbons	ND	290

ND - Not Detected

**Table 3-1**  
**Initial Screening Matrix of Remedial Action Alternatives**  
**Areas South of the Raceway, Lawrence, MA**  
**City of Lawrence**

REMEDIAL ACTION ALTERNATIVE	DESCRIPTION	LIMITATIONS	FEASIBILITY	CLEANUP TIME	COST	SELECTED FOR DETAILED EVALUATION
<b>IN-SITU TREATMENT</b>						
Enhanced Bioremediation	The activity of naturally occurring microbes is stimulated by circulating water-based solutions through contaminated soils to enhance in situ biological degradation of organic contaminants. Nutrients, oxygen, or other amendments may be used to enhance biodegradation and contaminant desorption from subsurface materials. Typically used for petroleum hydrocarbons.	<ul style="list-style-type: none"> <li>• High concentrations of heavy metals are likely to be toxic to microorganisms.</li> <li>• Cleanup goals may not be attained if the soil matrix prohibits contaminant-microorganism contact.</li> <li>• Bioremediation slows at low temperatures.</li> <li>• The circulation of water-based solutions through the soil may increase contaminant mobility and necessitate treatment of underlying ground water.</li> </ul>	Not feasible for remediation of heavy metals.	1-3 years	Average	No
Phytoremediation	Phytoremediation is a set of processes that use plants to clean contamination in soil, ground water, surface water, sediment, and air.	<ul style="list-style-type: none"> <li>• Depth of treatment zone is determined by plants used in phytoremediation. In most cases, it is limited to shallow soils.</li> <li>• High concentrations of hazardous materials can be toxic to plants.</li> <li>• Seasonal treatment technology.</li> <li>• The technology is still in the demonstration stage.</li> <li>• Transfer of contaminants across media possible (i.e. soil to air)</li> <li>• Requires extensive maintenance (planting, fertilizing, and watering).</li> <li>• May expose ecological habitat.</li> </ul>	Not feasible due to the duration needed to achieve site cleanup levels and maintenance required.	More than 3 years	Average	No
Soil Flushing	Water, or water containing an additive to enhance contaminant solubility, is applied to the soil or injected into the ground water to raise the water table into the contaminated soil zone. Contaminants are leached into the ground water, which is then extracted and treated.	<ul style="list-style-type: none"> <li>• Low permeability or heterogeneous soils are difficult to treat.</li> <li>• Surfactants can adhere to soil and reduce effective soil porosity.</li> <li>• The potential of washing the contaminant beyond the capture zone and the introduction of surfactants to the subsurface concern regulators. The technology should be used only where flushed contaminants and soil-flushing fluid can be contained and recaptured.</li> <li>• Aboveground separation and treatment costs for recovered fluids can drive the economics of the process.</li> </ul>	Not feasible due to high costs and difficulty in containing groundwater at areas south of the raceway at the OPM.	1-3 years	High	No

**Table 3-1**  
**Initial Screening Matrix of Remedial Action Alternatives**  
**Areas South of the Raceway, Lawrence, MA**  
**City of Lawrence**

REMEDIAL ACTION ALTERNATIVE	DESCRIPTION	LIMITATIONS	FEASIBILITY	CLEANUP TIME	COST	SELECTED FOR DETAILED EVALUATION
<b>EX-SITU TREATMENT</b>						
Chemical Extraction	Waste contaminated soil and extractant are mixed in an extractor, dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use.	<ul style="list-style-type: none"> <li>Some soil types and moisture content levels will adversely impact process performance.</li> <li>Organically bound metals can be extracted along with the target organic pollutants, which restricts handling of the residuals.</li> <li>Traces of solvent may remain in the treated solids; toxicity of the solvent is an important consideration.</li> <li>Capital costs can be relatively high and the technology may be more economical at larger sites.</li> <li>Meeting highly stringent heavy metals criteria may prove uneconomical.</li> </ul>	Not feasible due to high costs.	1-3 years	High	No
Solidification/Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	<ul style="list-style-type: none"> <li>Depths of contaminants may limit some types of application processes.</li> <li>Certain wastes are incompatible with variations of this process.</li> <li>Treatability studies are generally required.</li> <li>Reagent delivery and effective mixing are more difficult than for ex-situ applications.</li> <li>The solidified material may hinder future site use.</li> <li>Confirmatory sampling can be more difficult than for ex-situ treatment.</li> <li>Eliminates exposure to leachable contaminants but not <u>total</u> concentrations.</li> </ul>	Not feasible due to nature of the use of the site as a protected open space (passive park) and does not prevent exposure to total concentrations.	Less than 1 year	Average	No
Separation	Separation techniques concentrate contaminated solids through physical and chemical means. These processes seek to detach contaminants from their medium (i.e., the soil, sand, and/or binding material that contains them).	<ul style="list-style-type: none"> <li>High clay and moisture content will increase cost.</li> <li>Gravity separation processes rely on a difference in the solids and liquid phase densities. Specific gravity of particles will affect settling rate and process efficiency. Additionally, settling velocity is dependent on the viscosity of the suspending fluid, which must be known to estimate process efficiency and to size equipment.</li> <li>Special measures may be required to mitigate odor problems, resulting from organic sludge that undergoes septic conditions.</li> <li>Successful in treating halogenated SVOCs, pesticides, PCBs, and selected halogenated VOCs.</li> </ul>	Not feasible for remediation of PAHs and heavy metals.	Less than 1 year	Average	No
Soil Washing	Contaminants sorbed onto fine soil particles are separated from bulk soil in an aqueous-based system on the basis of particle size. The wash water may be augmented with a basic leaching agent, surfactant, pH adjustment, or chelating agent to help remove organics and heavy metals.	<ul style="list-style-type: none"> <li>Complex waste mixtures (i.e. metals with organics) make formulating washing fluid difficult.</li> <li>The aqueous stream will require treatment at demobilization.</li> <li>Additional treatment steps may be required to address hazardous levels of washing solvent remaining in the treated residuals.</li> </ul>	Not feasible due to high costs and nature of the use of the site (passive park).	Less than 1 year	High	No
Chemical Reduction/Oxidation	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.	<ul style="list-style-type: none"> <li>Incomplete oxidation or formation of intermediate contaminants may occur depending upon the contaminants and oxidizing agents used.</li> <li>The process is not cost-effective for high contaminant concentration because of the large amounts of oxidizing agent required.</li> <li>Oil and grease in the media should be minimized to optimize process efficiency.</li> </ul>	Not feasible due to high costs.	Less than 1 year	High	No

**Table 3-1  
Initial Screening Matrix of Remedial Action Alternatives  
Areas South of the Raceway, Lawrence, MA  
City of Lawrence**

<b>REMEDIAL ACTION ALTERNATIVE</b>	<b>DESCRIPTION</b>	<b>LIMITATIONS</b>	<b>FEASIBILITY</b>	<b>CLEANUP TIME</b>	<b>COST</b>	<b>SELECTED FOR DETAILED EVALUATION</b>
<b>CONTAINMENT</b>						
Soil Containment Barrier (15 foot or greater barrier between the OHM and the final site ground surface)	Soil Containment barriers are used for contaminant source control.	<ul style="list-style-type: none"> <li>• A Soil Containment Barrier by itself cannot prevent the horizontal and vertical flow of ground water through the waste.</li> <li>• Isolates the ground surface from the OHM to provide no exposure points</li> </ul>	Feasible	1 week	Low, if any at all	Yes
<b>OTHER</b>						
Excavation and Disposal	Contaminated material is removed and transported to permitted off-site treatment and disposal facilities. Pretreatment may be required.	<ul style="list-style-type: none"> <li>• Generation of fugitive emissions and/or asbestos fiber release to the ambient air may be a problem during operations.</li> <li>• The distance from the contaminated site to the nearest disposal facility with the required permit(s) will affect cost.</li> <li>• Depth and composition of the media requiring excavation must be considered.</li> <li>• Disposal options for certain waste may be limited.</li> </ul>	Feasible	1 month	Average	Yes
No Further Action / Institutional Controls	Contaminated material is left in place. Fencing is installed around areas that showed risk.	<ul style="list-style-type: none"> <li>• Existing conditions won't change.</li> <li>• Fences enclose large portions of the park.</li> <li>• Trespassers still exposed to risk.</li> </ul>	Feasible	Less than 3 months	Low	Yes

## **APPENDICES**

## **Appendix A**

### **Conceptual Design for the Areas South of the Raceway**

**CONCEPTUAL DESIGN FOR THE  
AREAS SOUTH OF THE RACEWAY**

**OXFORD PAPER MILL  
21 CANAL STREET  
LAWRENCE, MASSACHUSETTS**

**RTN 3-2691**

*Prepared for:*

Office of Planning & Development  
City of Lawrence  
147 Haverhill Street  
Lawrence, Massachusetts 01840

*Prepared by:*

Stone & Webster Massachusetts, Inc.  
A Shaw Group Company  
100 Technology Center Drive  
Stoughton, MA 02072

August 2006

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**List of Acronyms**

AUL	Activity and Use Limitation
COL	City of Lawrence
COCs	Contaminants of Concern
CSA	Comprehensive Site Assessment
LFR	Levine-Fricke
MADEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MEK	methyl ethyl ketone
MHD	Massachusetts Highway Department
MIBK	methyl isobutyl ketone
msl	mean sea level
NASDI	North American Site Developers
OHM	Oil and/or Hazardous Materials
OPM	Oxford Paper Mill
PCB	polychlorinated biphenyls
RAO	Response Action Outcome
RTN	Release Tracking Number
S&W	Stone & Webster Massachusetts, Inc.
THF	tetrahydrofuran
TSCA	Toxic Substance Control Act

## **1.0 INTRODUCTION**

The Oxford Paper Mill (OPM) in Lawrence, Massachusetts consists of the north side, south side and the raceway. This conceptual design encompasses design information pertaining to the areas south of the raceway at the OPM (the Site). The purpose of this conceptual design is to provide an overview of the Site use once all of the remediation is complete. The general site location is depicted on Figure 1 and the entire site is depicted on Figure 2. Figure 3 shows the area that is covered by this conceptual design (areas south of raceway). This conceptual design for the areas south of the raceway was conducted by Stone & Webster Massachusetts, Inc. (Stone & Webster or S&W), a Shaw Group Company, on behalf of the City of Lawrence (COL), the owner of the OPM property. OPM has been assigned release tracking number (RTN) 3-2691 by the Massachusetts Department of Environmental Protection (MADEP). This conceptual design supports the submittal of the Phase II and Phase III reports for the south side.

The entire site (north and south of the raceway) will be developed into a park and the area south of the raceway will support a newly designed bridge. Canal Street will be relocated to accommodate the new bridge construction. The bridge and passive park is a key part of the revitalization of the downtown area of Lawrence once it is completed. The City of Lawrence is seeking to redevelop this property as part of the Lawrence Gateway Initiative (LGI). The LGI is a comprehensive, coordinated redevelopment plan to help revitalize the City of Lawrence.

Polychlorinated biphenyls (PCBs) are the significant contaminant of concern (COC) for soils found in the former Transformer No. 6 / Courtyard area on the south side of the raceway. S&W has completed environmental investigations and remedial actions for the elevated PCBs found in the Transformer No. 6 / Courtyard area. This area is the focus for the conceptual design on the south side of the raceway. The area contains elevated PCBs that will be located under 15 feet or greater of clean fill in preparation for bridge construction and is also in the vicinity of the bridge abutment in the bridge design.

## **2.0 BACKGROUND**

### **2.1 Site Description and General Information**

The former OPM Site, Release Tracking Number 3-2691, is located on approximately three acres of land in Lawrence, Massachusetts, immediately northwest of the intersection of Canal Street and the Spicket River (refer to the Site Locus Map attached as Figure 1). A small portion of the OPM is also located north of Canal Street on the eastern bank of the Spicket River (an urban surface water body that abuts the OPM). The OPM is transected by a raceway, which discharges to the Spicket River. All nine buildings (Building Nos. 1, 2, 3, 4, 5, 6, 13, 1A, and 28) that once occupied the south side of the OPM have been demolished and removed off-site. The majority of the Site (area south of the raceway) has been backfilled with 15 feet or greater of clean fill (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway) prior to the proposed bridge construction. Buildings north of the raceway were demolished in the 1970s. Oxford Paper ceased operations at the Site in the mid-1970s. The COL took ownership of the property in 1983.

### Conceptual Design Boundaries

The areas south of the raceway (the Site) are in an area of commercial and industrial development within downtown Lawrence, Massachusetts. The areas south of the raceway at one time contained buildings that were once part of a paper mill. The raceway was constructed and used as a power source for generation for some of the Site buildings and it also was used as a means fire protection and as a power source for the Site buildings. Currently, the property does not contain any buildings due to the demolition activities conducted by Massachusetts Highway Department (MHD). The OPM contains vegetation that includes trees around the perimeter. The conceptual design area is bounded to the north by the south raceway wall, to the east by the Spicket River, to the west by a commercial parking lot, and to the south by Canal Street. Access to the property is partially restricted by fencing along the south and west boundaries. A Site Plan for the raceway and the areas south of the raceway is presented in Figure 3.

GenCorp, Inc. (GenCorp), the Everett Mills property, and Union Street are west of the Site. The GenCorp facility, which was formerly occupied by Bolta Products and used for manufacturing rubber and plastic products, is currently vacant. The GenCorp facility was used most recently for manufacturing plastics and vinyl coated fabrics; polyvinyl chloride, resins; methyl isobutyl ketone (MIBK), methyl ethyl ketone (MEK), and tetrahydrofuran (THF) were used as part of these manufacturing operations. The Everett Mills property is currently used for commercial purposes.

Canal Street and the North Canal are south of the OPM beyond where there are other historic mill buildings. The Spicket River is north and east of the Site. The Lawrence General Hospital is beyond the Spicket River to the north.

At the completion of remedial activities, a Class A-4 Response Action Outcome (RAO) and Activity and Use Limitation (AUL) will be implemented for areas south of the raceway in order to maintain a condition of No Significant Risk restricting the use of the Site to a bridge and passive park. GenCorp will complete the remediation of the raceway and S & W on behalf of the COL will provide a design and manage the installation of a geotextile cap on the north side. Since the most significant COC on the north side is asbestos, and the COC on the south side is PCBs, the Phase II and Phase III reports have been separated for each side of the site. S&W will prepare a final RAO report for the entire site.

## **2.2 Previous Response Actions and Assessment Activities**

In order to prepare the Site for construction of a relocated Canal Street and bridge over the Spicket River, MHD has assumed the responsibility to conduct environmental assessment activities associated with the area south of raceway. These activities include the demolition of site buildings, disposal of contaminated and uncontaminated demolition debris associated with these buildings, decontamination of the basements of site buildings and backfill with structural material in anticipation of bridge construction, remove PCB-contaminated transformers and all soils contaminated by PCBs released from various transformers on-site, and final grading for the area south of the raceway.

As part of the preparation for bridge construction, residual soils containing significantly elevated levels of COCs will be covered with at least 15 feet of clean fill throughout the entire south side of the raceway (except for an area of approximately 30 feet from the raceway where the clean fill slopes down to the raceway). As defined in the MCP, these soils are considered to be “isolated” from exposure.

The Transformer No. 6 / Courtyard Area is an area with elevated PCB concentrations regulated by the Toxic and Substance Control Act (TSCA) and is located on the eastern portion of the Site. This area will be covered with at least 15 feet of clean fill as part of bridge construction and according to the MCP, the soils located in this area are considered to be “isolated” from exposure. The site elevations showing the amount of clean fill placed over the environmental boring locations advanced during site investigations are presented in Table 1. At least 15 feet or greater of clean fill will be placed over the Transformer No. 6 / Courtyard in preparation for bridge construction.

### **3.0 CONCEPTUAL DESIGN**

#### **3.1 Areas South of Raceway**

The areas south of the raceway will be developed into an area that will support the placement of a bridge and a passive park. The bridge and passive park will help revitalize the downtown area of Lawrence once it is completed. Canal Street will be relocated to accommodate the new bridge construction. In preparation of these future plans, there are areas that must be fully restored.

MHD has assumed the responsibility to conduct environmental assessment activities associated with the areas south of raceway. North American Site Developers (NASDI), was the contractor hired by the MHD to excavate any PCB and/or other Oil and/or Hazardous Materials (OHM) that was present onsite. After NASDI completed the south side excavations, they backfilled and resloped the area to the current elevations as shown in the cross sections Figures 4 and 5. As determined by the confirmatory sampling conducted by S&W, the Transformer No. 6 / Courtyard area is the only portion of the Site where significant contamination exists. The total volume of impacted soil in the Transformer No. 6 / Courtyard Area is approximately 1,000 cubic yards. This impacted area is regulated by EPA’s TSCA.

Once bridge construction is underway, five feet of additional soil will be placed on top of the existing site grade (elevation 45) to bring the south side elevation to approximately 50 feet above mean sea level (msl) in this area. Refer to Figures 4 and 5.

##### **3.1.1 Transformer No. 6 / Courtyard Area**

The Transformer No. 6 / Courtyard area is located on the southeastern portion of Building No. 6 (refer to Figure 3). A release from a transformer in the Building No. 6 Courtyard Area is the source of PCB contamination for this area. As part of the Phase II Comprehensive Site Assessment (CSA) and site remediation goals, additional assessment activities (monitoring well construction / soil borings) in the Transformer No. 6 / Courtyard area were conducted to

determine the nature and extent of PCB contamination in this area. These activities were done based on sampling results from S&W and Levine-Fricke (LFR) sampling event on September 3, 2004. This sampling event was conducted by advancing into transformer pit / courtyard soils to target depths with hollow stem augering. Additional assessment activities conducted by S&W (March and May 2005) included PCB soil sampling from soil borings that were advanced by using an ATV drilling rig with hollow stemmed augers and a sonic drilling rig mounted on a truck. A detailed description of the nature and extent of site contamination is presented in Section 6.0 of the Phase II CSA prepared by Stone & Webster.

### **3.1.2 Results**

In general, PCB contamination exists below the eastern portion of Building No. 6 and throughout the Transformer No. 6 / Courtyard area. In the former Transformer No. 6 Courtyard Area, several soil borings were advanced and analyzed for PCB contamination. With the exception of soil borings SB-6, SB-11, and SB-12, PCB contaminated soils are either below the concentration limit of 1.0 ppm or there will be at least 15 feet of clean fill on top of PCB contaminated soil greater than 1 ppm. According to MCP regulations, soils that have 15 feet of clean soil placed over the top are considered “isolated” from any exposure and can be left in place. Additional soil / fill will be placed over areas of concern which are where SB-6, SB-11, and SB-12 are located in to meet MADEP requirements. A North-South Cross Section as well as a West-East Cross Section displays locations of SB-6, SB-12, and SB-11 as well as approximate amount of fill that needs to be placed over these areas to meet MCP regulations (See Figures 4 and 5). Figure 6 shows the profile transect line for each of the cross sections. The results of PCB concentrations along with current elevations before bridge design as well as new elevations after bridge design are shown in Table 1.

To satisfy MADEP requirements, the method of remediation and also the most cost effective means chosen is to place at least five feet of additional clean fill on top of the areas of concern that are already covered with 15 feet of clean fill and hence the contaminated soil in the area will be “isolated” from any potential exposure.

### **3.1.3 Erosion Control**

Presently, the area has been graded and sloped 2:1. With the addition of more soil near the abutment of the bridge, a retaining wall or some other means may be needed to help stabilize the slope. A physical barrier like a retaining wall would prevent soil from transporting away from this area, thus preventing ongoing maintenance requirements.

## **3.2 Bridge Design**

In an effort to help revitalize the City of Lawrence, the OPM will be converted into a passive park to enhance the quality of the Canal Street area. Along with the park, a newly designed bridge will be constructed by the MHD. This bridge will cross over former Building No.28, over the Spicket River and onto the south side of the OPM where it will meet the relocated Canal Street.

This bridge will be erected in order to provide a link between I-495S and Lawrence's downtown industrial and commercial centers.

As needed in typical bridge construction, structural supports will be placed in order to help support the weight of the overlying bridge. Two abutments will be constructed underneath the bridge. One abutment will be located where former Building No. 28 was located (approximately 105 feet in length) and the other will be placed on the south side west of the Spicket River, approximately 80 feet in length (See Figure 7).

#### **4.0 FUTURE PLANS FOR ENTIRE SITE**

##### **4.1 North Side**

Once the bridge is constructed and Canal Street is relocated, the entire north side will be turned into a passive park. The wedge area, which is part of the north side, contained contaminated soils there were recently removed down to elevation 18 as part of the remediation goals for the site. Remediation efforts for the remainder of the north side of the site are ongoing. S&W plans to place an additional three feet of clean fill over the north side as part of the construction of a geotextile cap to remediate the site. This will ensure that the asbestos contaminated soil beneath the cap is isolated from the public and the potential exposure pathway is minimized.

##### **4.2 Potential Raceway Design**

The site is divided into two sections, the south side and the north side. Cutting through these two areas is a raceway that flows west to east and empties into the Spicket River that flows north to south (Figure 2). The raceway is located at an elevation of approximately 18 feet above msl. It was constructed to supply water for power generation and manufacturing purposes for a number of the Site buildings and used secondary as a means of fire protection.

Sediments in the raceway are presently PCB contaminated. GenCorp is responsible for remediating the material that is located in the raceway including but not limited to sediment that may or may not be PCB contaminated.

Once the cleanup of the raceway is completed, it is anticipated that clean fill will be backfilled in this area to build up the elevation and to follow the current topography of the north and south sides, 50 feet above msl. The backfilled area is anticipated to span from the top of slope of the wedge area on the north side to the top of slope of the final site grade (elevation 50) on the south side. It is anticipated that at least 2 inches of top soil and hydro-seed be put down to stimulate the growth of vegetation. Trees and shrubs will also be planted to further restore the site into a future passive park.

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ENSR Corporation 2002. *Spicket River Sediment Screening Report GenCorp Inc., Lawrence Location*. March 2002.

Massachusetts Department of Environmental Protection (DEP), 1997. *Massachusetts Contingency Plan, 310 CMR 40.0000*.

Stone & Webster Massachusetts, Inc. (S&W), 2004. *Release Abatement Measure Plan for Oxford Paper Mill, Lawrence, MA*. Prepared for the City of Lawrence, April 2001.

Stone & Webster Massachusetts, Inc. (S&W), 2005. *Release Abatement Measure Status Report for Areas South of the Raceway, Lawrence, MA*. Prepared for the City of Lawrence, August 2005.

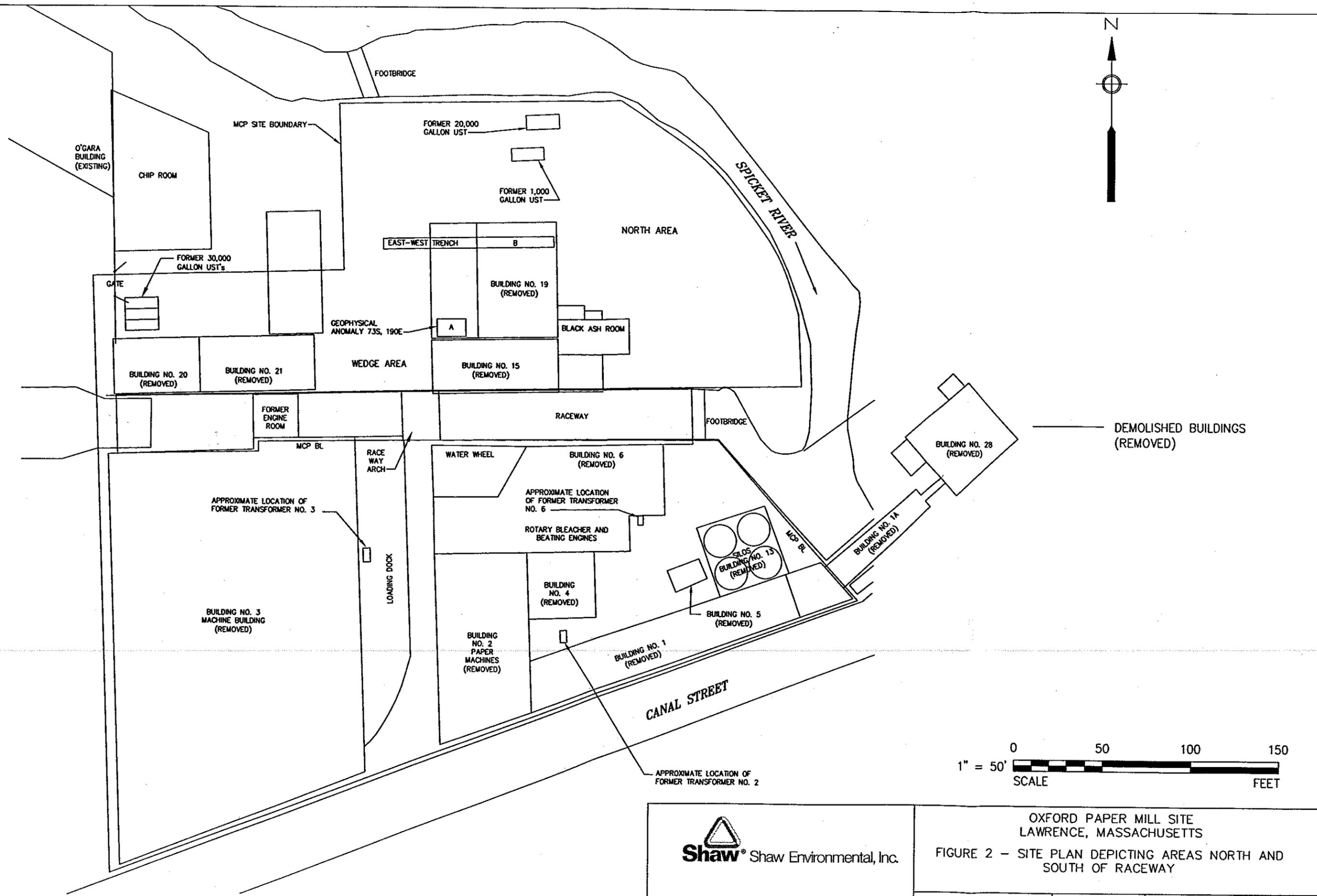
Stone & Webster Massachusetts, Inc. (S&W), 2006. *Phase II Comprehensive Site Assessment for Areas South of the Raceway*.

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Massachusetts Agricultural Experiment Station. 1981. *Soil Survey of Essex County, Massachusetts Northern Part*.

## **FIGURES**

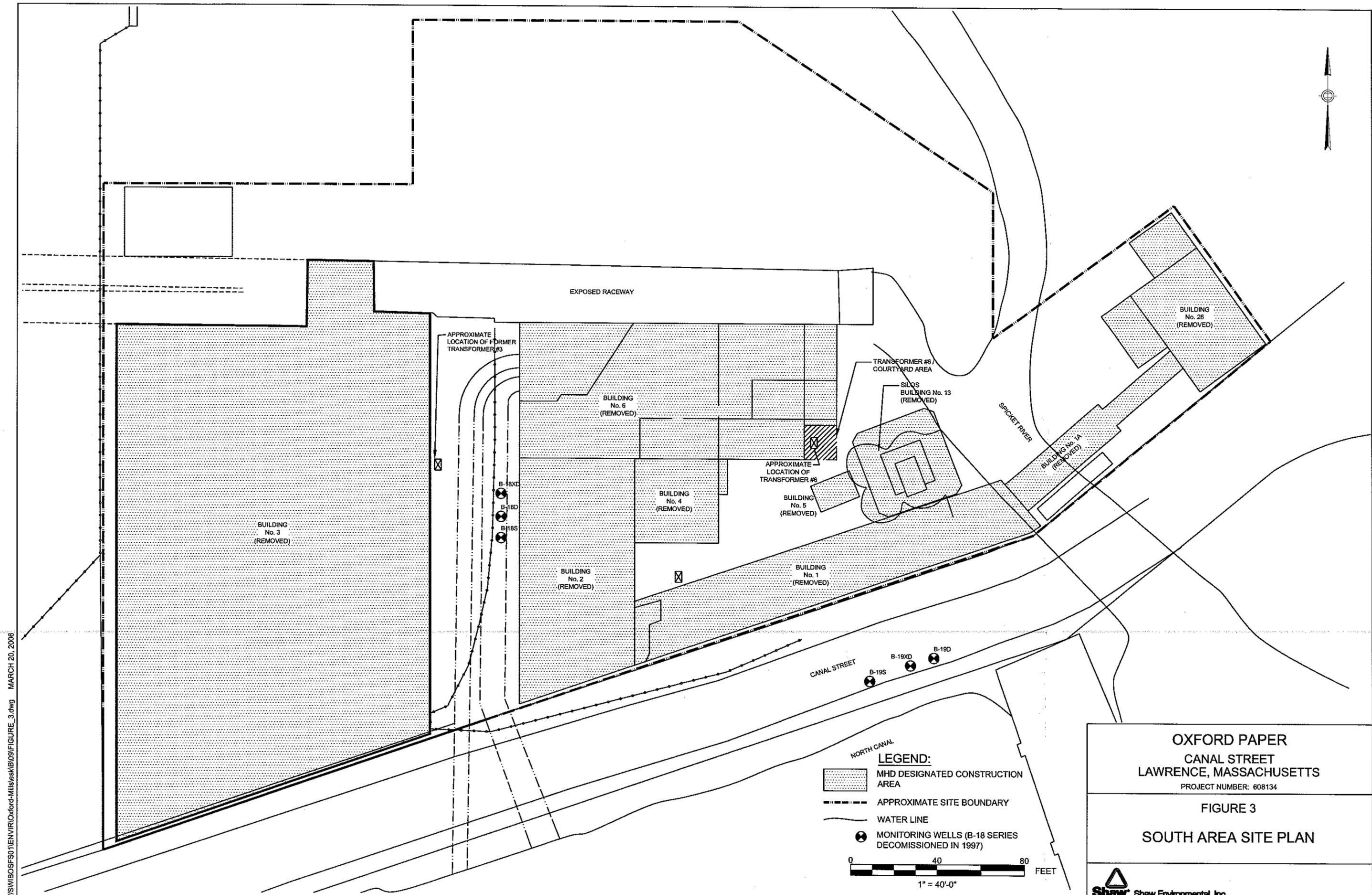


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**Shaw**® Shaw Environmental, Inc.

OXFORD PAPER MILL SITE  
 LAWRENCE, MASSACHUSETTS  
 FIGURE 2 - SITE PLAN DEPICTING AREAS NORTH AND SOUTH OF RACEWAY  
 SCALE: AS NOTED    02\_16\_06    JWR



/S:\BIBS\01ENV\Oxford-Mills\sk\BIBS\FIGURE\_3.dwg MARCH 20, 2006

**LEGEND:**

- MHD DESIGNATED CONSTRUCTION AREA
- APPROXIMATE SITE BOUNDARY
- WATER LINE
- MONITORING WELLS (B-18 SERIES DECOMMISSIONED IN 1997)

0 40 80 FEET  
1" = 40'-0"

**OXFORD PAPER**  
CANAL STREET  
LAWRENCE, MASSACHUSETTS  
PROJECT NUMBER: 608134

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FIGURE 3

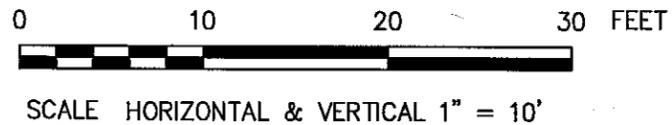
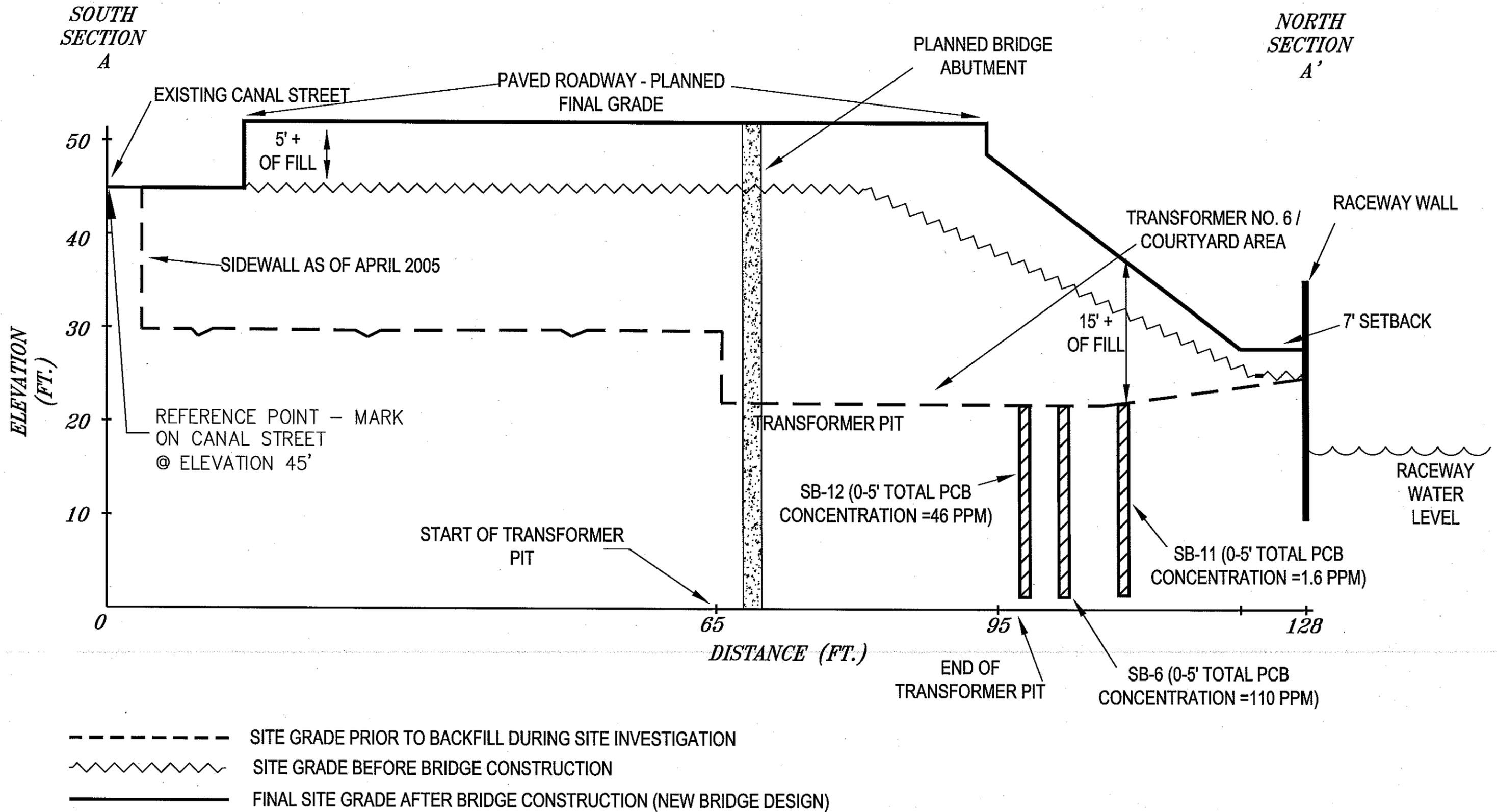
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SOUTH AREA SITE PLAN

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Shaw Environmental, Inc.

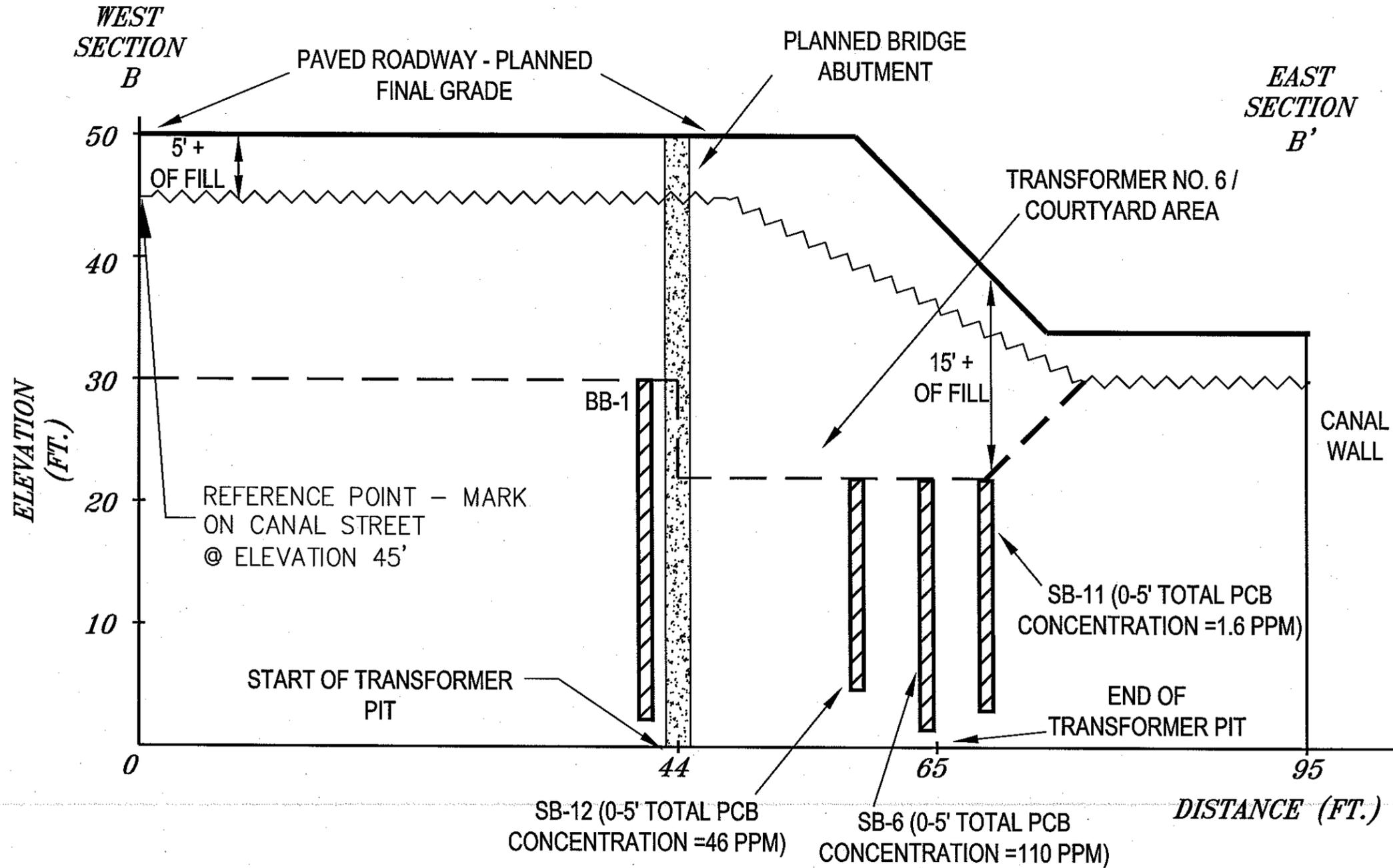
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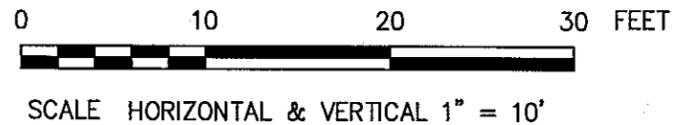
SHAW ENVIRONMENTAL OXFORD PAPER MILL SITE  
 FORMER TRANSFORMER No. 6 COURTYARD AREA  
 LAWRENCE, MASSACHUSETTS  
 FIGURE 4 - PROFILE SHOWING SITE GRADES  
 BEFORE AND AFTER BRIDGE CONSTRUCTION FOR THE  
 TRANSFORMER NO. 6 / COURTYARD AREA (NORTH-SOUTH)

SCALE: AS NOTED	08_23_06	JWR
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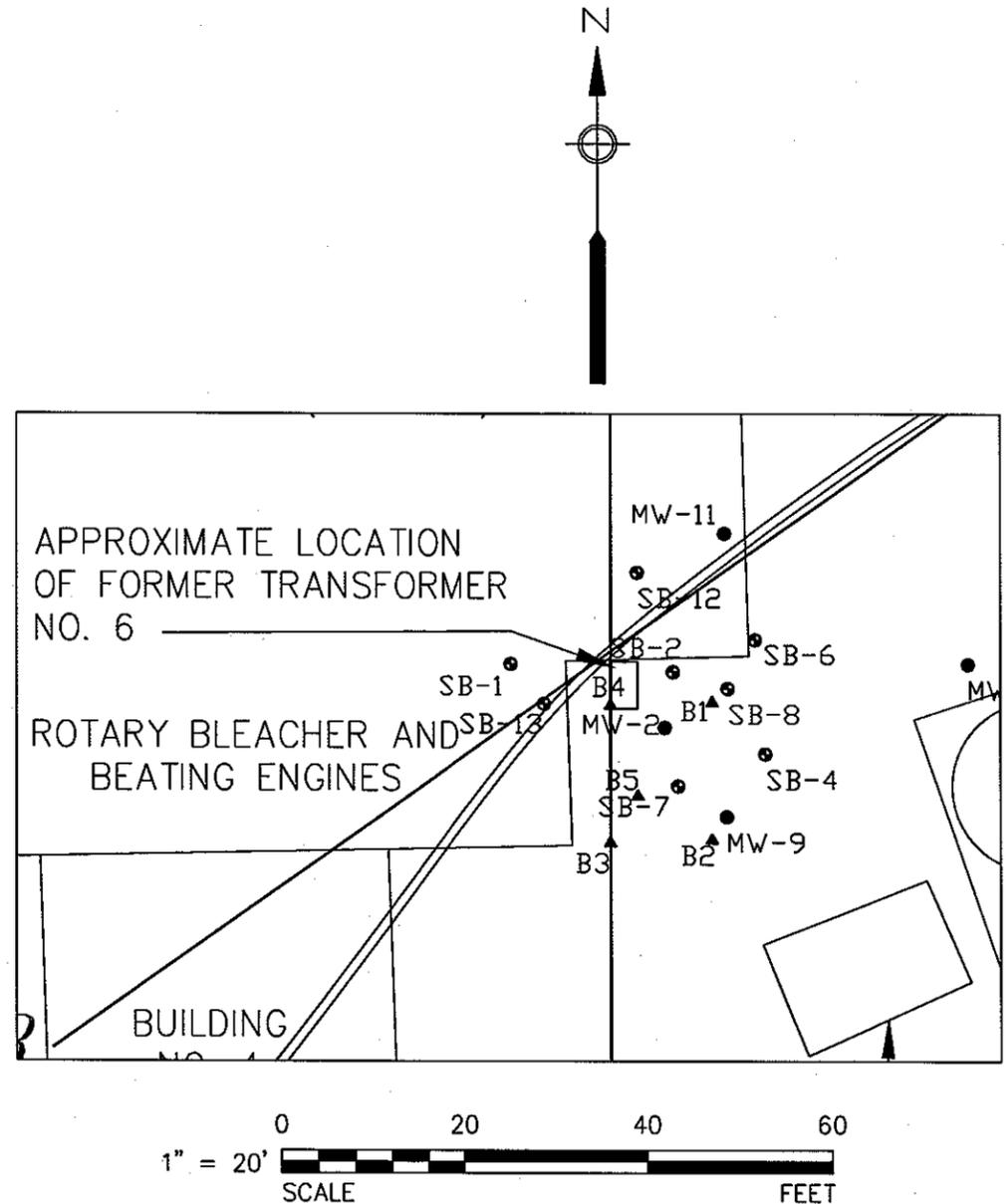
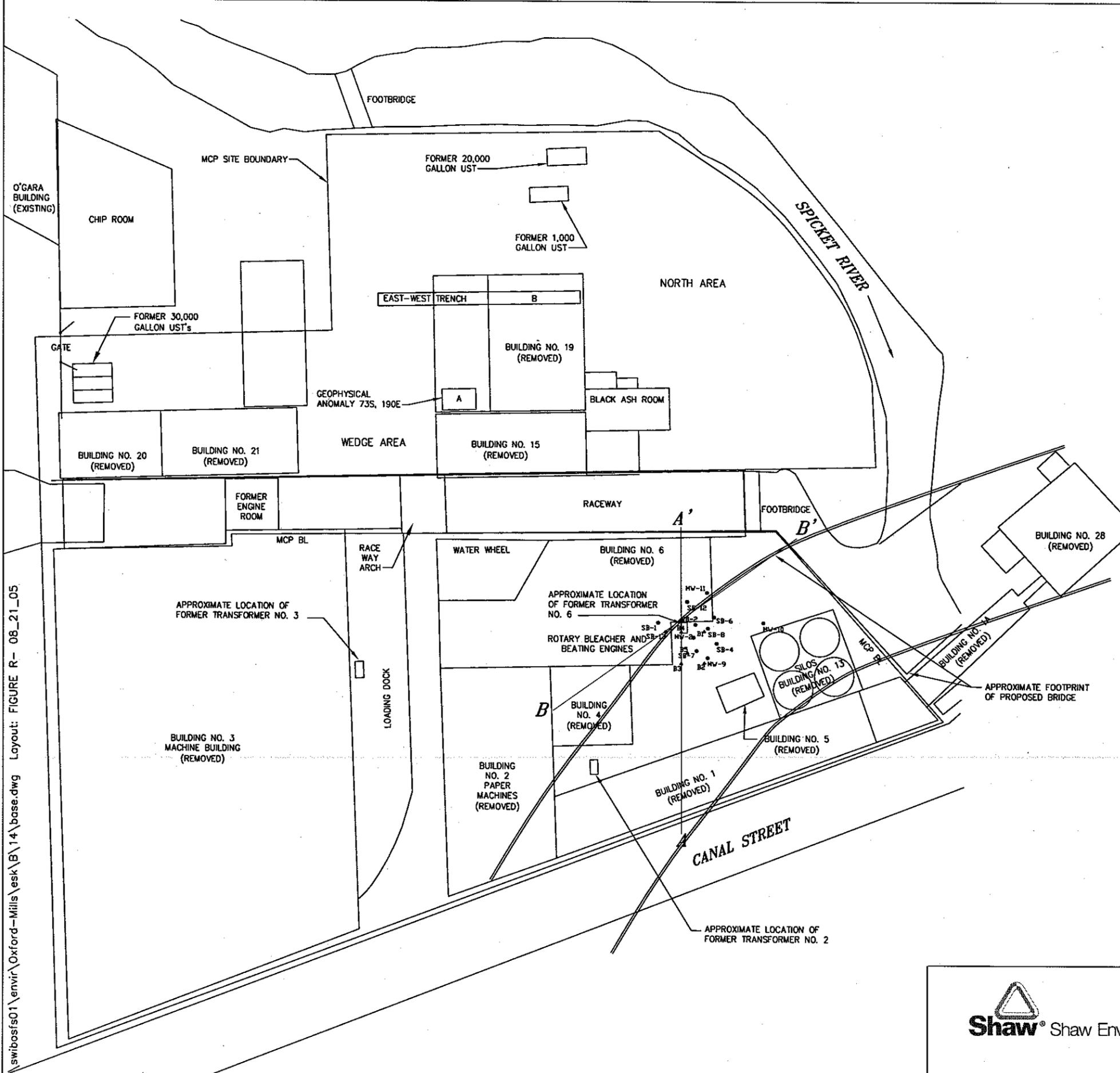


- SITE GRADE PRIOR TO BACKFILL DURING SITE INVESTIGATION
- ~~~~~ SITE GRADE BEFORE BRIDGE CONSTRUCTION
- \_\_\_\_\_ FINAL SITE GRADE AFTER BRIDGE CONSTRUCTION (NEW BRIDGE DESIGN)



SHAW ENVIRONMENTAL OXFORD PAPER MILL SITE  
 FORMER TRANSFORMER No. 6 COURTYARD AREA  
 LAWRENCE, MASSACHUSETTS  
 FIGURE 5 - PROFILE SHOWING SITE GRADES  
 BEFORE AND AFTER BRIDGE CONSTRUCTION FOR THE  
 TRANSFORMER NO. 6 / COURTYARD AREA (WEST - EAST)

SCALE: AS NOTED	08_23_06	JWR
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\\swibof01\envr\Oxford-Mills\esk\B\14\base.dwg Layout: FIGURE R- 08\_21\_05



OXFORD PAPER MILL SITE  
LAWRENCE, MASSACHUSETTS  
FIGURE 6 - SITE PLAN DEPICTING PROFILE LOCATION  
AND APPROXIMATE FOOTPRINT OF PROPOSED BRIDGE

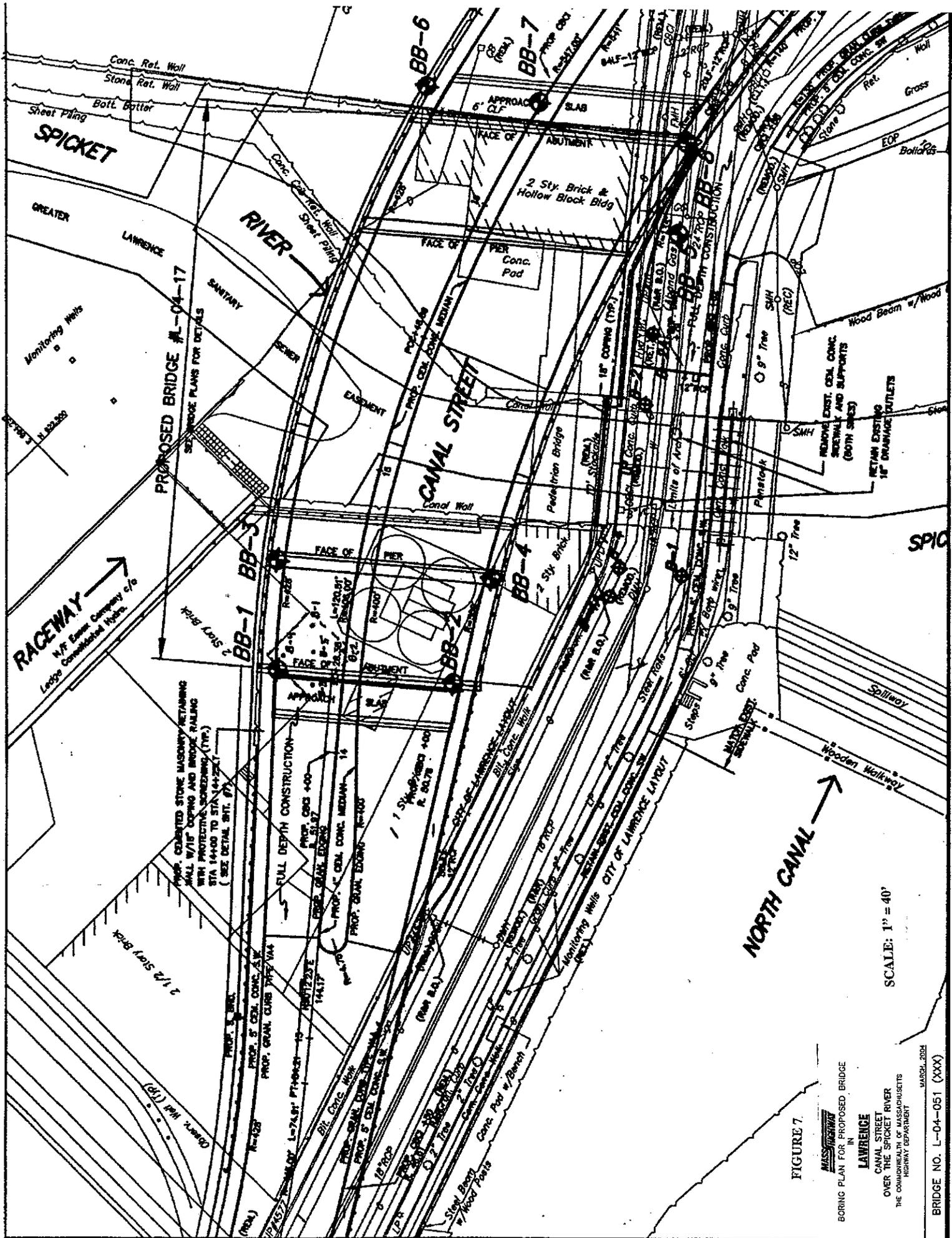


FIGURE 7


  
 BORING PLAN FOR PROPOSED BRIDGE
   
 IN
   
**LAWRENCE**
  
 CANAL STREET RIVER
   
 OVER THE SPICKET RIVER
   
 THE COMMONWEALTH OF MASSACHUSETTS
   
 HIGHWAY DEPARTMENT

SCALE: 1" = 40'

BRIDGE NO. L-04-051 (XXX)

## **TABLES**

Table 1 - Fill Placed Over Borings Located In and Around the Transformer No. 6 / Courtyard Area Prior to Bridge Construction

Boring Location	Elevation @ Boring (ft)	Elevation Below Fill (ft) Original Bridge Design	Elevation Below Fill (ft) New Bridge Design	Total PCB Concentration (ppm)
B-1	0-5	17	22	41.4
	5-9.5	21.5	26.5	2,900
	9.5-14.5	26.5	31.5	35.5
B-2	14.5-19.5	31.5	36.5	1.6
	0-5	22.6	28.6	2.3
	5-9.5	27.1	33.1	ND
B-3	9.5-14.5	32.1	38.1	0.33
	14.5-20	37.6	43.6	ND
	0-5	22.6	28.6	ND
B-4	5-10	27.6	33.6	1.2
	10-15	32.6	38.6	1.5
	15-19.5	37.1	43.1	ND
B-5	0-5	19.2	28.2	27.8
	5-9.5	23.7	32.7	29.4
	9.5-15	29.2	38.2	25,000
SB-1	15-19.5	33.7	42.7	22.3
	0-4.5	22.7	28.7	0.23
	4.5-9	27.2	33.2	0.68
SB-2	9-14	32.2	38.2	121.8
	14-19	37.2	43.2	610
	0-5	18.8	24.8	15
SB-4	5-15	28.8	34.8	11
	0-5	19.2	26.2	1.5
	5-15	29.2	38.2	360
SB-6	15-25	39.2	48.2	2.1
	0-5	18.3	28.3	610
	5-15	22.7	28.7	11
SB-7	0-5	13.5	18.5	110
	5-15	32.7	38.7	0.49
	0-5	17	22	1.6
SB-8	5-15	27	32	1.1
	0-5	22.6	28.6	0.36
	5-15	32.6	38.6	2.6
SB-9	15-25	42.6	48.6	0.13
	0-5	0	2	0.9
	5-15	10	12	0.13
SB-10	15-25	20	22	ND
	0-5	9.4	14.4	1.6
	5-15	19.4	24.4	0.25
SB-11	15-25	29.4	34.4	3.4
	0-5	13.9	18.9	4.6
	5-15	23.9	28.9	4.9
SB-12	15-25	33.9	38.9	0.6
	0-5	20.1	25.1	10
	5-15	30.1	35.1	3.3
SB-13	15-25	40.1	45.1	7.8

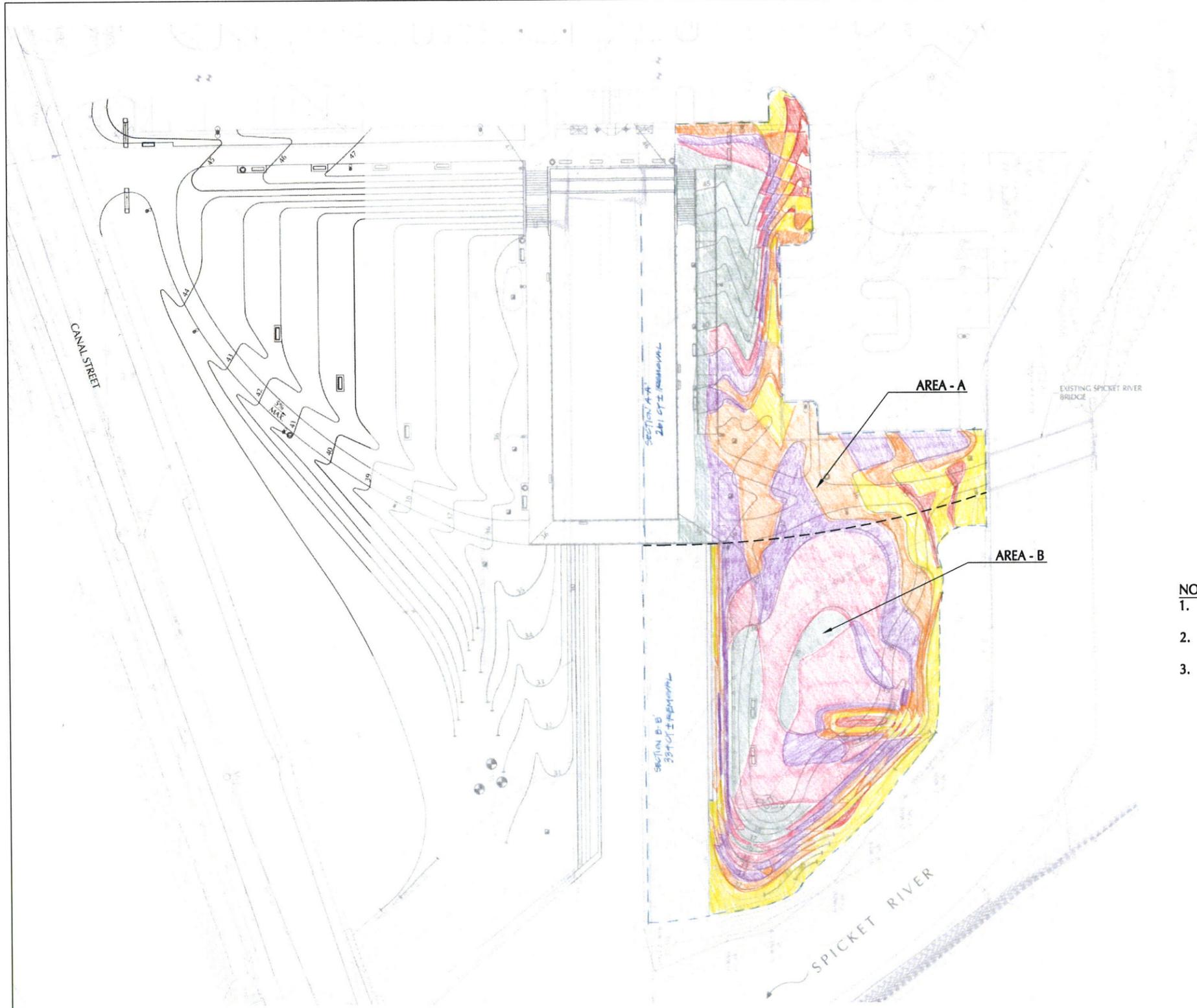
Highlighted areas would have less than 15 feet of fill according to original bridge design

**LABORATORY ANALYTICAL REPORTS FOR THE PHASE III – AREAS  
SOUTH OF THE RACEWAY ARE PROVIDED IN THE PHASE II REPORT**

**LABORATORY ANALYTICAL REPORTS FOR THE PHASE III REPORT  
WERE PROVIDED FOR THE MADEP AND EPA SUBMITTALS**

## **Appendix B**

### **Shadley Associates; Lawrence Gateway Park, Contaminated Soil Relocation Grading Plan and Volume Calculation**



SYMBOL	DESCRIPTION
[Yellow]	DIFFERENCE = 0'
[Orange]	REMOVE 3"
[Light Orange]	DIFFERENCE = 1'
[Light Purple]	REMOVE 2"
[Purple]	DIFFERENCE = 2'
[Pink]	REMOVE 1"
[Light Green]	DIFFERENCE = 3'
[Green]	REMOVE 0'
[Dark Green]	DIFFERENCE > 3'
[Red]	CUT = 1'
[Dark Red]	REMOVE 4"
[Dark Purple]	CUT > 2'
[Dark Blue]	REMOVE 6"

**AKRIA**  
 Massachusetts Regional Transit Authority  
 85 Railroad Avenue  
 Haverhill, MA  
 01835

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 Lowell, MA 02429 • F 781.852.2667  
 www.shadleyassociates.com

**Lawrence Gateway Park**

**NOT FOR CONSTRUCTION**

SA PROJECT NUMBER:  
2007.31

SCALE: AS SHOWN  
 DRAWN BY: WC  
 REVIEWED BY: PS

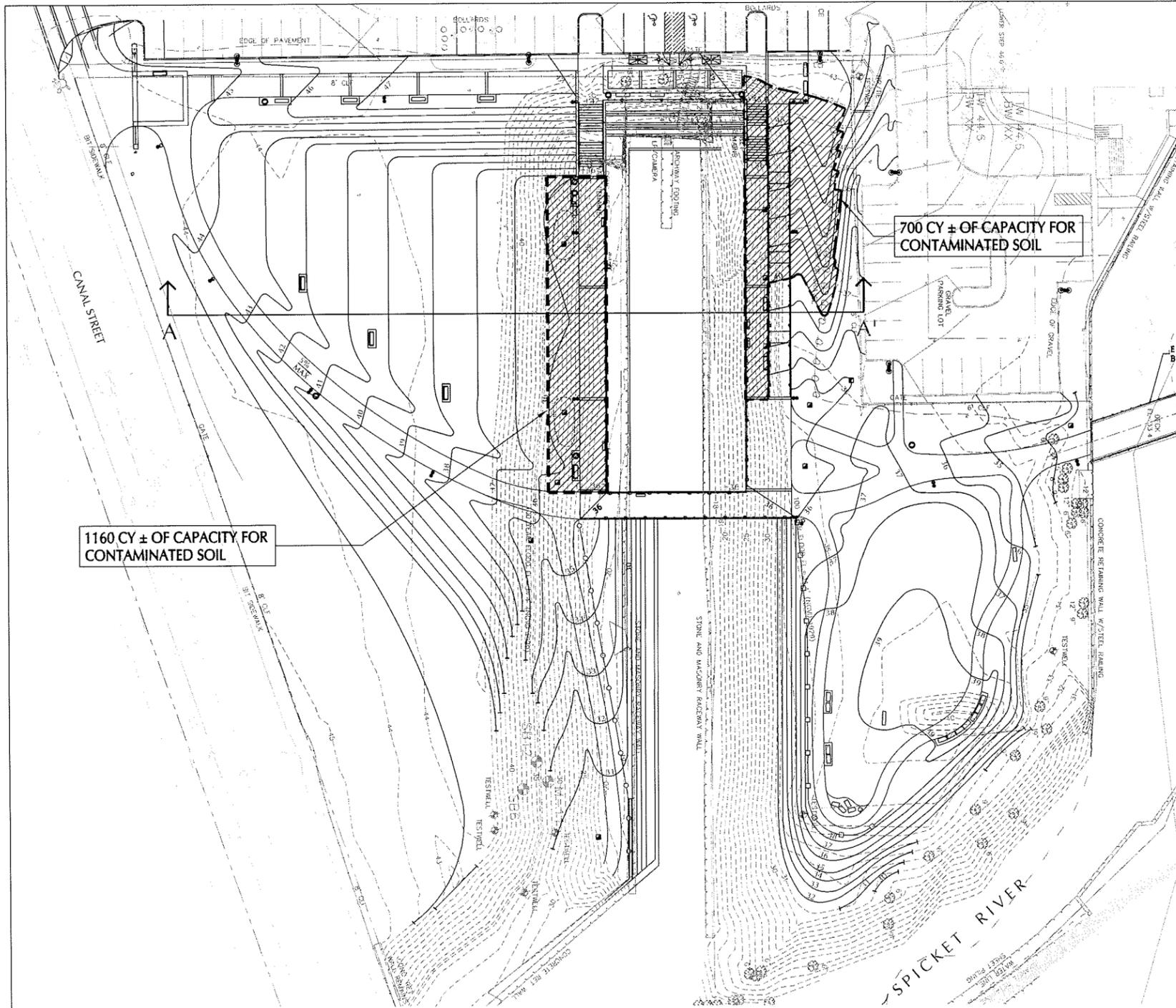
DATE:  
JANUARY 6, 2009

SHEET TITLE:  
**CONTAMINATED SOIL RELOCATION**

- NOTES:**
1. ASSUME ALL EXISTING ON-SITE MATERIAL NORTH OF THE RACEWAY IS CONTAMINATED.
  2. CALCULATIONS BASED ON GRADING PLAN DATED SEPTEMBER 25, 2009.
  3. THE REMOVAL DEPTHS SHOWN IN THE LEGEND ARE WHAT WOULD BE REQUIRED TO ACHIEVE THE FINISHED GRADES ON THE GRADING PLAN UP TO THE BOTTOM OF THE CAP (CAP DEPTH IS 3' UNDER LANDSCAPED AREAS AND 1' UNDER PAVEMENT).

CONTAMINATED SOIL RELOCATION		
	APPROXIMATE TOTAL CONTAMINATED SOIL RELOCATION AREA "A" (NORTH OF RACEWAY)	944 CY
	APPROXIMATE TOTAL CONTAMINATED SOIL RELOCATION AREA "B" ("PENINSULA")	911 CY
	<b>TOTAL</b>	<b>1855 CY</b>





- NOTES:
1. ASSUME ALL EXISTING ON-SITE MATERIAL NORTH OF THE RACEWAY IS CONTAMINATED.
  2. CALCULATIONS BASED ON GRADING PLAN DATED SEPTEMBER 25, 2009.
  3. THE REMOVAL DEPTHS SHOWN IN THE LEGEND ARE WHAT WOULD BE REQUIRED TO ACHIEVE THE FINISHED GRADES ON THE GRADING PLAN UP TO THE BOTTOM OF THE CAP (CAP DEPTH IS 3' UNDER LANDSCAPED AREAS AND 1' UNDER PAVEMENT).

CAPACITY TO CONTAIN CONTAMINATED SOIL ON-SITE	
APPROXIMATE STORAGE CAPACITY (NORTH OF RACEWAY)	700 CY
APPROXIMATE STORAGE CAPACITY (SOUTH OF RACEWAY)	1160 CY
TOTAL	1860 CY

**WKPA**  
 Merrimack Valley Regional Transit Authority  
 85 Railroad Avenue  
 Haverhill, MA  
 01835

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 Georgetown, MA 01439 • P: 978.463.2657  
 www.shadleyassociates.com

Lawrence  
 Gateway Park

NOT FOR  
 CONSTRUCTION

SA PROJECT NUMBER:  
 2007.31

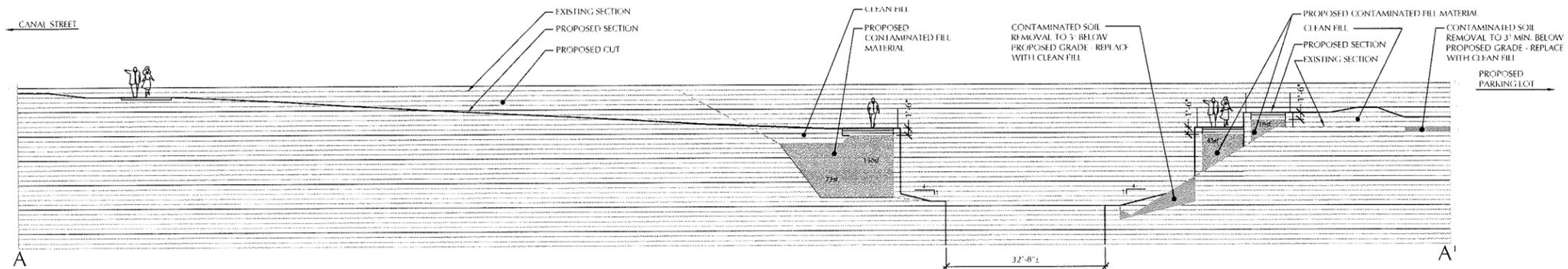
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DRAWN BY: WC

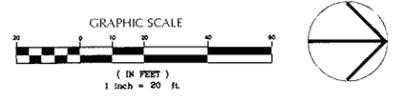
REVIEWED BY: PS

DATE:  
 JANUARY 6, 2009

SHEET TITLE:  
 CONTAMINATED  
 SOIL  
 ONSITE  
 CAPACITY



Section A-A' Scale: 1"=10'-0"



**Shadley Associates, P.C.**

1730 Massachusetts Avenue  
 Lexington, MA 02420  
 TEL: (781) 652-8809  
 FAX: (781) 862-2687

**EARTHWORK CALCULATIONS**

Project: Lawrence Gateway Park  
 Status: Design Development  
 Date: 1/6/2009

**SUMMARY**

Project Earthwork: 2,776 CY NET FILL (existing contours to proposed contours less surface treatments)

Estimated volume of contaminated soil to be relocated onsite: 1,854 CY

Capacity of site for contaminated soil: 1,860 CY

*Contaminated soil calculations are included within the Project Earthwork figure above*

Existing grade to finished grade, not including surface treatment sections (depths)	CY			
Net Earthwork Elevation 35 and above (FILL)	947			
Net Earthwork Below Elevation 35 (FILL)	4,707			
<b>Total Project Earthwork (NET FILL)</b>	<b>5,654</b>			
Finished Surface Treatment Depths	SF	Depth In Feet	CF	CY
Bituminous Concrete	7,348	1.25	9,185.00	340.19
Cement Concrete	2,304	1.00	2,304.00	85.33
Unit Pavers	9,451	2.00	18,902.00	700.07
Seeded Areas	77,202	0.50	38,601.00	1,429.67
Planted Areas	3,730	2.00	7,460.00	276.30
Steps	628	2.00	1,256.00	46.52
<b>Total Surface Treatment Depths</b>				<b>2,878.07</b>
<b>Total Project Earthwork Less Surface Treatments (NET FILL)</b>	<b>2,776</b>			

**Shadley Associates, P.C.**

1730 Massachusetts Avenue

Lexington, MA 02420

TEL: (781) 652-8809

FAX: (781) 862-2687

**EARTHWORK CALCULATIONS FOR CONTAMINATED SOIL**

Project: Lawrence Gateway Park

Status: Design Development

Date: 1/6/2009

**SUMMARY**

CONTAMINATED SOIL RELOCATION		QTY	UNIT
Approximate Contaminated Soil Removal Area "A" (north of raceway)		944	CY
Approximate Contaminated Soil Removal Area "B" ("peninsula")		911	CY
<b>Total Contaminated Removal</b>		<b>1,855</b>	<b>CY</b>
CAPACITY TO CONTAIN CONTAMINATED SOIL			
Approximate Storage Capacity North of Raceway		700	CY
Approximate Storage Capacity South of Raceway		1,160	CY
<b>Total Contaminated Soil Capacity</b>		<b>1,860</b>	<b>CY</b>
SUMMARY			
<b>Need to Find Additional Capacity for Contaminated Soil</b>		<b>-5</b>	<b>CY</b>

**EARTHWORK CALCULATIONS**

Shadley Associates

Project: Lawrence Gateway Park

Status: Design Development

Date: 1/6/2009

Note: Calculations below are based on the difference between the existing contours and proposed contours per the Grading Plan dated 9/29/08.

	Cut (SF)	Fill (SF)	Net (SF)	Net CF	Net CY
Contour Number 47	0	1,852	1,852	1,852	69
Contour Number 46	0	4,639	4,639	4,639	172
Contour Number 45	170	8,058	7,888	7,888	292
Contour Number 44	24,549	3,958	20,591	20,591	763
Contour Number 43.5	0	19,081	19,081	9,541	353
Contour Number 43	18,036	3,938	14,098	14,098	522
Contour Number 42	15,534	3,943	11,591	11,591	429
Contour Number 41	12,849	4,594	8,255	8,255	306
Contour Number 40	10,165	4,761	5,404	5,404	200
Contour Number 39	6,984	6,835	149	149	6
Contour Number 38	3,994	13,065	9,071	9,071	336
Contour Number 37	1,410	15,327	13,917	13,917	515
Contour Number 36	102	23,903	23,801	23,801	882
Contour Number 35	154	15,109	14,955	14,955	554
Contour Number 34	199	11,254	11,055	11,055	409
Contour Number 33	213	10,244	10,031	10,031	372
Contour Number 32	184	10,045	9,861	9,861	365
Contour Number 31	106	9,659	9,553	9,553	354
Contour Number 30	100	10,843	10,743	10,743	398
Contour Number 29	47	9,968	9,921	9,921	367
Contour Number 28	265	9,220	8,955	8,955	332
Contour Number 27	339	8,618	8,279	8,279	307
Contour Number 26	437	8,496	8,059	8,059	298
Contour Number 25	395	7,904	7,509	7,509	278
Contour Number 24	374	7,112	6,738	6,738	250
Contour Number 23	327	6,739	6,412	6,412	237
Contour Number 22	292	6,527	6,235	6,235	231
Contour Number 21	0	5,797	5,797	5,797	215
Contour Number 20	0	4,739	4,739	4,739	176
Contour Number 19	0	3,099	3,099	3,099	115
Contour Number 18	0	90	90	90	3

Total Fill 7,876  
 Total Cut 2,225  
 Net Fill 5,650

Fill 35 and above 3,173  
 Cut 35 and above 2,225  
 Net Fill 35 and above 947

Fill 34 and below 4,707  
 Cut 34 and below 0  
 Net Fill 34 and below 4,707

Contaminated Cut 1,759 65  
 Non contaminated cut 2,160