

ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES REPORT

**OXFORD PAPER SITE
LAWRENCE, MASSACHUSETTS**

MassDEP Release Tracking Number (RTN) 3-2691

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1. INTRODUCTION

Groundwork Lawrence (GWL) has prepared this Analysis of Brownfields Cleanup Alternatives (ABCA) Report on behalf of the City of Lawrence (the “City”) for the property located at 21 Canal Street (the “Site”) in Lawrence, Massachusetts (Assessor’s Map 67 Lot 6, the upland, and Lot 5, the raceway) as part of the Brownfields Cleanup Program funded by the Merrimack Valley Planning Commission’s United States Environmental Protection Agency (EPA) Brownfields Revolving Loan Fund. The purpose of this ABCA is to present the remedial alternatives chosen to be analyzed as potential response actions.

1.1 Scope of Work

The requirements of an ABCA are to supply the following:

- Information pertaining to the Site background and the potential threats the Site may pose to public health and/or the environment;
- Documentation that the situation at the Site meets the need for an environmental response action;
- Identification of the objectives of the environmental response action, including an analysis of potential cleanup alternatives, enforcement activities, and projected costs; and
- Identification of the most feasible remedial action, with an explanation of the rationale for its selection.

2. SITE LOCATION AND BACKGROUND

The Oxford Paper Mill is located immediately northwest of the intersection of Canal Street and the Spicket River in Lawrence, Massachusetts (Assessor's Map 67 Lot 6, the upland, and Lot 5, the raceway), herein referred to as "the Site". The City of Lawrence took ownership of the Site (Lot 6) in 1983 to advance a redevelopment project known as the Lawrence Gateway. The Gateway project contains a number of transportation and public realm improvements required to help the City of Lawrence reposition the mill district for adaptive reuse. Currently, the raceway (Lot 5) is owned by Essex Hydro Associates, a subsidiary of Enel North America, headquartered in Andover, MA. The City of Lawrence plans to take title to the raceway on September 18, 2012 when City Council votes to accept the property. Figure 1 depicts the location of the site relative to the cities of Methuen and Lawrence. A figure depicting former Site buildings is attached as Figure 2. A survey of the site is attached at Figure 3.

2.1 Previous Site Use(s)

The Site is located on approximately three acres of land 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 site have been demolished. Buildings north of the raceway are believed to have been demolished in the 1970s. 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.

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 (HSO₃). Another pulping process, called the kraft chemical pulping process, uses sodium hydroxide (NaOH) and sodium sulfide (Na₂S), 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. See Figure 2 for more detail on former locations of mill buildings and other Site features.

Currently the Site does not contain any buildings or structures and is unpaved. Vegetation consists mainly of tall grass and shrubs with portions consisting of wooded areas. The Site is bisected by a raceway that divides it into a northern peninsula and a southern parcel. The north and south sides are approximately 20 feet above the raceway. See Figure 3 for a survey depicting Site features as they appeared in April of 2011.

2.2 1989 to 2012 Response Actions

Remediation activities have been undertaken since 1989 when oil was discovered leaking from tanks at the Site into a sewer and the Spicket River and assigned a release tracking number for the site (RTN: 3-2691). After remediating the spill the City identified seven oil storage containers (three 30,000 gallon tanks, one 20,000 gallon tank, one 20,000 gallon tank, two 1,000 gallon tanks). Between 1989 and 2000 all of these tanks were safely removed from the Site.

Stone and Webster (S&W) prepared a Site Investigation Plan on behalf of the City of Lawrence for the Site in 2001 to define the extent and nature of contamination. This plan contained a Sampling and Analysis Plan, QAPP, and a Health and Safety Plan.

S&W conducted soil sampling for areas south of the raceway to define the extent and characteristics of contamination beneath the basement soils and the Transformer No. 6 / Courtyard Area. Soil sampling was conducted below Buildings Nos. 1, 2, 3, 4, 5, 6, and 28. Groundwater sampling was conducted in the Transformer No. 6 / Courtyard Area. Basement and sub-basement soil samples were collected over a four-year span (May 2001 to July 2005) and in March and May of 2005 for the Transformer No. 6 / Courtyard area.

Soil (surface and subsurface), and groundwater samples were collected over a two-year span (2002 to 2003) by Metcalf & Eddy and S&W for areas north of the raceway. The area north of the raceway is divided into two sections: the wedge and the area north of the wedge area. The wedge area encompasses the portion of land sloping from the raceway wall to the top of the slope. Surface and subsurface samples were collected from twelve different test pit locations and analyzed for PCBs, EPH, priority pollutant metals (including barium and vanadium), and asbestos. North of the wedge area encompasses the northern portion of the area north of the raceway. Surface and subsurface soil samples were collected from ten different soil boring locations in addition to the ten test pits excavated as part of the north area site investigations in 2003.

In 2004, S&W subsequently completed a Phase II Comprehensive Site Assessment (CSA) for Areas North of the Raceway and in 2006 S&W completed a Phase II CSA for Areas South of the Raceway. The CSAs characterized the source, extent, and migration pathways of oil and/or hazardous material, and summarized the risk or harm posed to health, safety, and public welfare. It also developed a field program to fill gaps in data necessary for remedial activities.

The Massachusetts Highway Department (MassHighway, now MassDOT) assumed the responsibility to conduct remediation activities for areas south of the raceway. This included demolition of the mill buildings and removal of the basements in order to develop the property for the relocation of Canal Street and the placement of a bridge over the Spicket River. In general, contamination in subbasement soil consisted of extractable petroleum hydrocarbons, carbon fraction ranges, PAHs, metals, and PCBs. Confirmatory sampling for both of these areas was completed after excavation operations were done to confirm these contaminants were removed. MassHighway was also responsible for partial remediation in the wedge area, which is located immediately north of the raceway, and resulted off-site disposal of 3,377 CY of material. This work was completed between 2000 and 2007.

In 2009, S&W prepared on behalf of the City Phase III Remedial Action Plans (RAP) for both the North and South sides of the Site. The Plans performed an evaluation 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 north and south of the raceway.

In 2011 and 2012, the PCB-contaminated sediment was substantially remediated in the raceway, but additional capping measures are prescribed including the installation of a box culvert over the raceway as a capping technology. The concrete culverts and clean fill will be installed in this area to build up the elevation and to follow the proposed grade of the park spanning the north and south sides. The release tracking number for the raceway is 3-0340.

In 2012, S&W completed the Phase IV Remedy Implementation Plans for the northern and southern sides of the raceway on behalf of the City of Lawrence. These plans presented the design information pertaining to the site.

The information repository for this project, including an index as well as all the environmental reports and plans, and other project information is maintained at: Lawrence Community Development Department, 225 Essex Street, 3rd floor, Lawrence, MA 01840. Some of these documents are also available online at the MA Department of Environmental Protection's website at: <http://public.dep.state.ma.us/SearchableSites/Search.asp>. The release tracking number remains 3-2691.

2.2.1 Nature and Extent of the Contamination for Areas South of the Raceway

In 2009 S&W completed a Phase III RAP that described the nature and extent of the contamination for areas south of the raceway. This report concludes that the Transformer No. 6 / Courtyard Area is the only portion of the Site where significant contamination remains on the south side of the raceway. 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). All soils beneath the basement and sub-basement of the former site buildings and soils below the Building No. 6 / Courtyard Area are considered "isolated" from exposure. The Massachusetts Contingency Plan (MCP) describes soils located at a depth of 15 feet or greater as being "isolated" from exposure.

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 PCB contaminated groundwater is confined to the boundaries of the transformer pit. As determined by S&W's modeling efforts, 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 because the soils are considered to be isolated from exposure by the MCP.

The sample results were used to perform an MCP Method 3 Risk Characterization, which identifies potential exposures and risk levels to current and potential future users of the Site. The risk characterization concluded that:

- 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 and roadway built over the Site as part of the Lawrence Gateway project.

- An AUL will not be required for the south side of the raceway because the residual soils containing elevated levels of PCBs will be isolated because they are covered with at least 15 feet of clean fill.

2.2.2 Nature and extent of the Contamination for Areas North of the Raceway

In 2009 S&W completed a Phase III Remedial Action Plan that describes the nature and extent of the contamination for areas north of the raceway. In general, contamination in surface (0 to 3 feet below ground surface) and subsurface (greater than 3 feet below ground surface) north area soils consists of extractable petroleum hydrocarbon (EPH) carbon fraction ranges, PAHs, metals (namely arsenic, arsenic, beryllium, and lead), PCBs, and asbestos. The Phase II and Phase III determined that Asbestos Containing Material (ACM) is the significant contaminant of concern (COC) for soils found on the north side. It is believed that the presence of ACM on the north side is due to the demolition of the mill buildings without conducting an asbestos abatement removal program, whereas demolition on the south side was conducted using an asbestos abatement removal program.

The total volume of impacted wedge area soil removed from the Site by MassHighway is 3,377 CY. The total volume of impacted soil in the North area is approximately 16,900 CY.

For screening purposes, the groundwater analytical results were compared to applicable MCP reportable concentration GW-2 Standards. Results of the Phase II CSA groundwater analyses revealed that only metals (selenium and vanadium) were detected exceeding the GW-2 Standards.

The sample results were used to perform an MCP Method 3 Risk Characterization, which identifies potential exposures and risk levels to current uses of the Site. The risk characterization identified no significant risk to human health exists for current site activities. The Risk Characterization concluded the following:

- A condition of no significant risk to human health does exist for current site activities (construction or trespassing).
- A condition of no significant risk to human health does not exist for future activities (park).
- A condition of no significant risk has not been achieved for future activities and therefore additional remediation must occur or an AUL must be placed on the property for restricted future use.

The Stage I Environmental Screening concluded the surface water exposure point concentrations modeled from groundwater contaminant concentrations do not exceed ambient water quality criteria for aquatic receptors, it is concluded that the Site does not pose a significant risk to the environment.

2.3 Conceptual Site Model

The Site will be redeveloped as a 3 acre passive park and is part of a broader effort to create a new Gateway to Lawrence. Portions of soil at the south area of the Site are impacted by PCBs and portions of the north area of the Site are contaminated by ACM. A risk assessment has concluded that the potential exposure of future park users of the Site to concentrations of asbestos must be

mitigated in order to achieve a condition of No Significant Risk under the MCP. Exposure routes for asbestos include airborne friable asbestos. Inhaling fugitive dusts containing asbestos may result in a potential health risk because persons may breathe in asbestos fibers. A risk assessment has concluded that the potential exposure of future park users of the Site to concentrations of PCBs does not exist because the contaminant is under 15 feet of soil and is considered isolated from exposure. The selected remedial alternative must mitigate potential exposures to contaminants by either removing the drivers of the risk or by providing a barrier to exposure of future users to the ACM.

3. EVALUATION OF CLEANUP ALTERNATIVES

3.1 Remedial Action Objective and Cleanup Goals

The objective of remediation at the Site is to achieve MCP Site closure by demonstrating that a condition of No Significant Risk has been achieved for current and future users of the property. To achieve a condition of No Significant Risk and subsequent Response Action Outcome (RAO), exposure to concentrations of chemicals of concern in accessible soil must be prevented. If impacted soil will remain on the Site, the implementation of an Activity and Use Limitation (AUL) will be required unless it is considered isolated from exposure under the MCP.

The Oxford Site is being redeveloped as part of a broad revitalization project called the Lawrence Gateway Project. The Gateway includes the Oxford Site as well as an adjacent Brownfield site that has been redeveloped as a well landscaped 865 space municipal parking lot. The Oxford Site is proposed to be redeveloped as a 3 acre passive park adjacent to the Lawrence General Hospital and the Spicket River. The new park is part of the Spicket River Greenway providing a vital link for residents to access the Merrimack River and the amenities along the North Canal.

3.2 Cleanup Alternatives Considered

Several potential alternatives were evaluated for addressing the contaminated soil at the Site. From that evaluation, S&W identified a limited number of practicable remedial alternatives that could be implemented at the Site based on available Site data and S&W experience. The “No Action” alternative was also included as part of the evaluation to establish a basis for conducting remedial actions at the Site. All scenarios will require applicable MCP regulatory submittals and shall be performed in accordance with applicable MCP deadlines. The remedial alternatives identified for consideration under this alternatives analysis include:

1. No action
2. Soil excavation and off-site disposal,
3. Geotextile capping combined with excavation and transportation and disposal off-site and geotextile capping combined with excavation and relocation of soils on-site.

3.3 Evaluation and Comparison of Remedial Alternatives

Each remedial alternative identified above was first evaluated to determine whether it could achieve a condition of No Significant Risk at the Site as required by the MCP. Those alternatives that were deemed capable of achieving no significant risk were further evaluated utilizing the comparative evaluation criteria specified at 310 CMR 40.0858 of the MCP. These criteria include: effectiveness, short-and long-term reliability, difficulty of implementation, cost, potential risks and timeliness. The cost estimates presented in this document are rough estimates that were prepared solely for the relative comparison of the identified alternatives and should not be used as design-level estimates. A table comparing the estimated costs for each alternative is provided as Table 1. A description of each alternative and the results of the comparative analysis are presented in the following subsections.

3.3.1 Conceptual Remedial Scenario No. 1 -No Action

This scenario involves no additional remedial actions. Currently, access to the Site is restricted by a fence; however, there is potential for future exposure to the contaminated soil on Site if the fence is not maintained. This alternative does not provide a Permanent Solution for the Site. Under this alternative, conditions at the Site do not meet the remedial action objectives nor would it meet the broader redevelopment goals of the Lawrence Gateway project of creating a 3 acre passive park. The No Action alternative would not achieve a condition of No Significant Risk as required by the MCP, nor would it prevent exposures to Site contaminants, and it is therefore not evaluated further with respect to the comparative evaluation criteria.

3.3.2 Soil Excavation and Off-Site Disposal (meets standards for unrestricted use)

This alternative proposes the remediation of the Site to meet standards for unrestricted use. Prior to site work, erosion controls would be installed to protect the surrounding streets, parking lots, the raceway and the Spicket River from siltation. Chain link fencing currently exists at the site and would be utilized during the earth moving process. Due to the impact of contaminants to soil, the concentrations of dust generated by the earthwork will be monitored using portable equipment and dust control measures implemented if risk-based dust levels are exceeded. All excavated soil will be stockpiled and characterized prior to off-site disposal. Backfill will be characterized to verify suitability for use on-Site as backfill. Imported clean soil will be used to restore the area to meet the grades as the currently exist on the site (see Figure 3, Site Survey). Table 1 provides comparative costs for the alternatives.

3.3.3 Geotextile capping combined with excavation and transportation and disposal off-site and geotextile capping combined with excavation and relocation of soils on-site

Due to the level and characteristics of contamination of the wedge area soil (the soil on the slope to the raceway), the best remedial alternative is excavation and disposal since it would achieve a permanent solution for this heavily contaminated area. This work was completed by MassDOT. The best remedial alternative for the north area for future use as a passive park, based on the screening provided in Phase III, is the geotextile capping alternative combined with excavation of approximately 2675 CY of asbestos contaminated soil and relocation of approximately 2175 CY on site and disposal of the remaining 500 CY off-site. The capping of the north areas with the relocation of the excavated soils on site the north side of the site will save the project significant costs. Box culverts will be used as an additional capping technology for the raceway. This enables the redevelopment of the site as a 3 acre passive park linking the north and south sides (see figure 4) . The significant cost savings are due largely to the elimination of the disposal costs and the reduction of backfill needed to bring the North area back up to site grade. Based on cost and risk reduction, this was found to be the best remedial alternative for the entire site.

3.3.4 Comparison to Comparative Evaluation Criteria

This Section presents a relative comparison of the selected remedial alternatives (Alternatives #2 and #3). A remedial alternative evaluation matrix that compares each alternative based on these criteria is provided as Table 2.

Effectiveness – Both remedial alternatives will be equally effective at achieving a Permanent Solution under the MCP, 310 CMR 40.1000 as both alternatives will protect against contaminant exposure to users of the passive park at the site.

Reliability – Remedial Alternative #2 is more reliable in preventing exposure to future users of the Site because more of the contaminated material will be removed, although the limitation of use proposed in Alternative #3 has proven a reliable way to prevent exposures in the past. Because of the similarity between the two alternatives there is very low potential for failure associated with either scenario.

Difficulty of Implementation – The implementation of an AUL is substantially less difficult than Soil Excavation and Disposal as no additional characterization, earthwork, oversight and work plans that would be required for Off-Site Excavation and Disposal are necessary for implementation an AUL.

Cost-Benefit – The cost to implement Alternative #3 (AUL) is the lower of the two alternatives. The benefit of the high cost of Alternative #2 (Soil Excavation and Off-Site Disposal) is that the future use of the Site would not be limited. Considering the cost to the City for redevelopment that allows for unrestricted use does not outweigh the high costs.

Potential Risks -The potential short-term and long-term risks associated with each of the alternatives are considered low to moderate. Potential short-term risks associated with soil excavation/disposal (Alternative #2) include: 1) soil spilled during excavation, handling or transport could result in short-term exposure of surrounding human populations to contaminated soil and 2) dust generated during soil excavation and loading could expose area residents, site workers, and passers-by to possible inhalation of contaminated dust.

Timeliness – An RAO with an AUL can be completed more quickly than soil excavation and off-site disposal which will require pre-characterization of the soil, regulatory reporting (i.e. Quality Assurance Project Plans, Release Abatement Measure Plan and status reports or MCP Phase reports), earthwork and submittal of a closure report.

3.4 Selection of Remedial Alternative

The No Action Alternative (Remedial Alternative #1) was included in this analysis for comparative purposes only and is not a feasible alternative because it does not meet the remedial action objectives.

The recommended cleanup alternative is Alternative #3: Activity and Use Limitation. This alternative allows for more rapid redevelopment, and the City has indicated that, based on the decades long planning for the new Lawrence Gateway, a 3 acre passive park that links the south and north sides is the desired redevelopment alternative. The benefits of cleaning up the Site for unrestricted use does not merit the additional costs. Therefore Alternative #3 is the recommended alternative.

4. FIGURES

Figure 1: Site Location Map

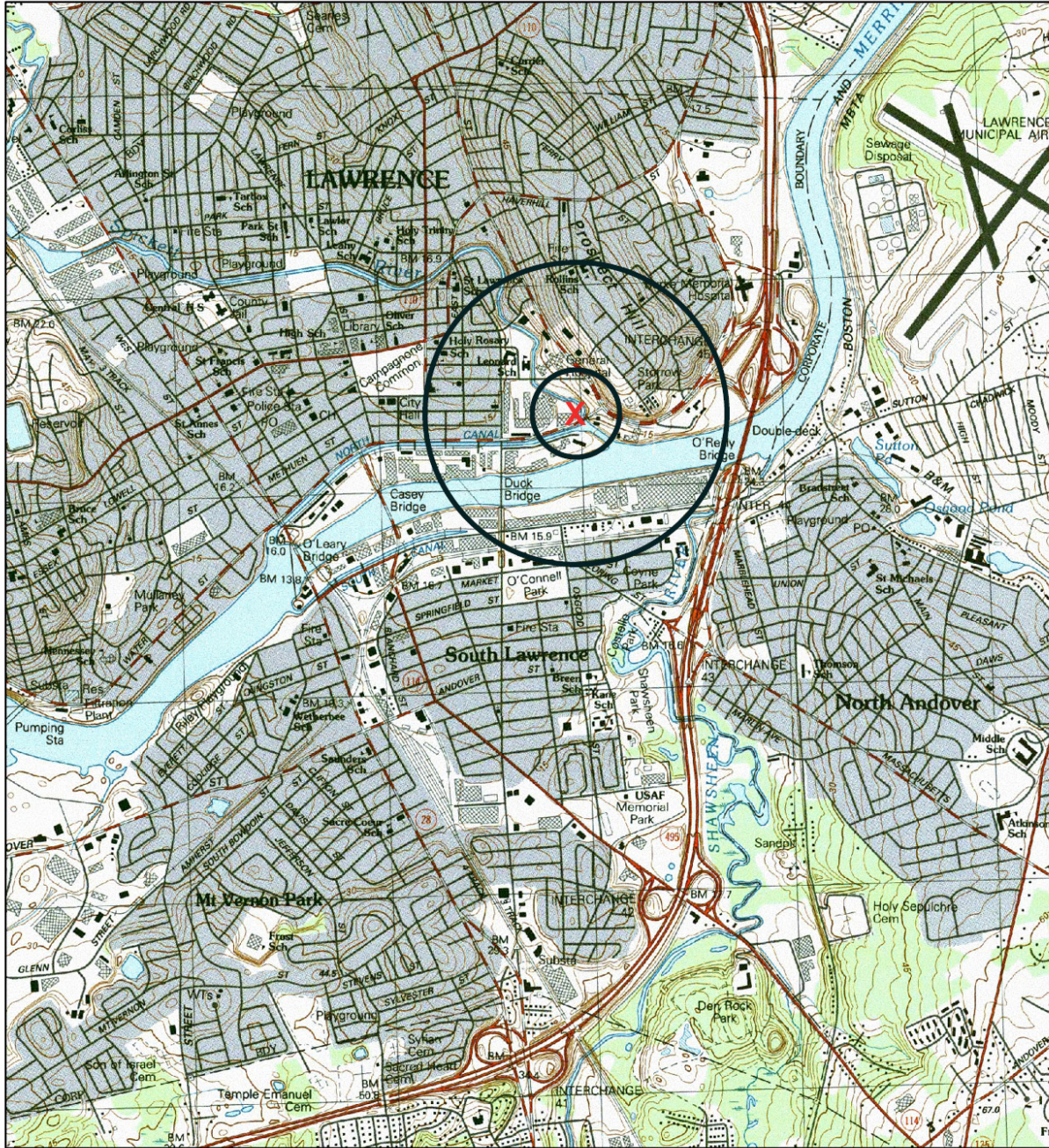


Figure 1: Site Location Map

Oxford Paper Site
 21 Canal Street
 Lawrence, Massachusetts
 RTN: 3-2691

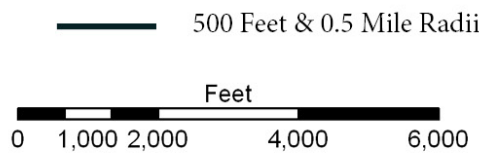
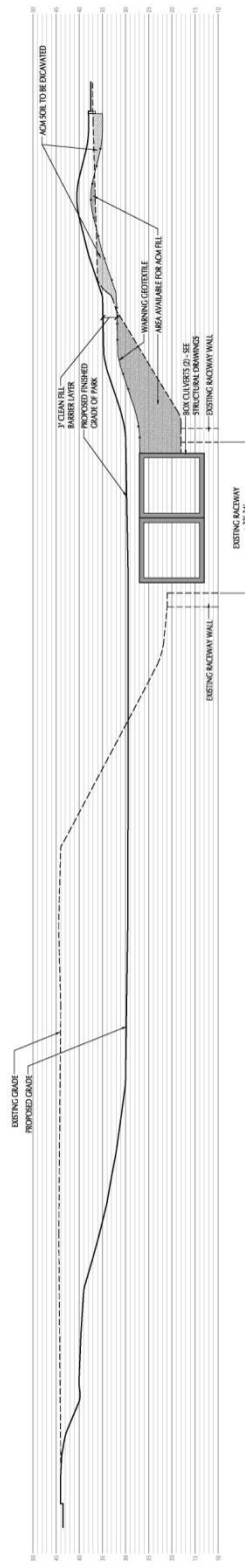
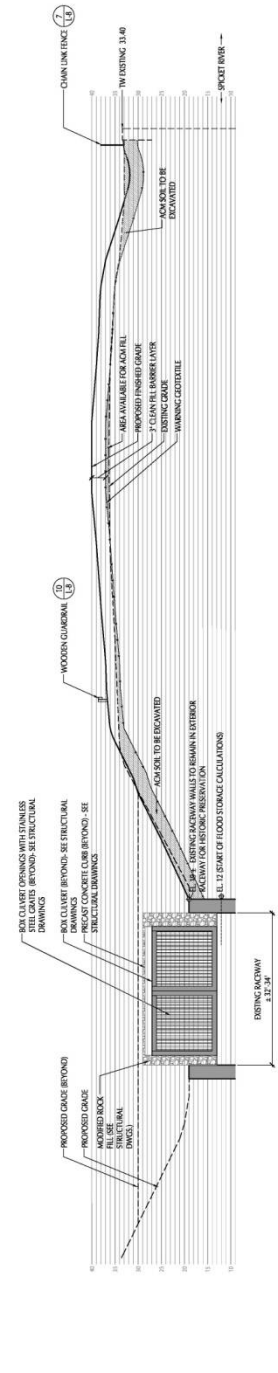


Figure 4: Cross Section of Proposed Park



1 SECTION A-A
SCALE 1" = 10'-0"



2 SECTION B-B
SCALE 1" = 10'-0"

5. TABLES

Table 1

**Cost Summary of the Remedial Alternatives Proposed in the ABCA
Oxford Paper Site, 21 Canal Street, Lawrence, Massachusetts**

Remedial Alternative	Approximate Estimated Cost
#1 No Action	\$35,000
#2 Soil Excavation and Off-Site Disposal (meets standards for unrestricted use)	\$4,160,000
#3 Geotextile capping combined with excavation and transportation and disposal off-site and geotextile capping combined with excavation and relocation of soils on-site.	\$1,205,000

General Assumptions and Notes:

- 1) Costs are based on estimates provided by S&W in the Phase III.
- 2) Cost estimates are for comparative purposes only, and should not be used as design-level estimates.

Table 2

**Remedial Alternative Evaluation Matrix
Oxford Paper Site, 21 Canal Street, Lawrence, Massachusetts**

COMPARATIVE	REMEDIAL ALTERNATIVE		
	#1 No Action	#2 Soil Excavation and Off-Site Disposal (meets standards for unrestricted use)	#3 Geotextile capping combined with excavation & transportation and disposal off-site plus geotextile capping combined with excavation & relocation of soils on-site
Comparative Effectiveness	Low	High	High
Comparative Reliability	Low	High	High
Comparative Difficulty of Implementation	Low	High	Moderate
Comparative Cost	Low	High	Low
Comparative Implementation Risks	High	High	Low
Comparative Benefits	Low	Moderate	Moderate
Comparative Timeliness	Long	Moderate	Short