RECORD OF DECISION

INDUSTRI-PLEX SUPERFUND SITE OPERABLE UNIT-2
(AND INCLUDING WELLS G&H SUPERFUND SITE OPERABLE UNIT-3,
ABERJONA RIVER STUDY)

CITY OF WOBURN
MIDDLESEX COUNTY, MASSACHUSETTS

Prepared by:

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DECLARATION FOR THE RECORD OF DECISION

PART I: THE DECLARATION

A. SITE NAME AND LOCATION

Industri-plex Superfund Site Operable Unit 2 (and including Wells G&H Superfund Site Operable Unit 3, Aberjona River Study)
Woburn, Massachusetts
Middlesex County
EPA Identification Numbers:
Industri-plex - MAD076580950
Wells G&H - MAD980732168

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Industri-plex Superfund Site Operable Unit 2 (and including the Wells G&H Superfund Site Operable Unit 3, Aberjona River Study) ("Industri-plex OU-2"), in Woburn, Massachusetts, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Woburn Public Library, 45 Pleasant Street, Woburn, Massachusetts and at the United States Environmental Protection Agency (EPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies each of the items comprising the Administrative Record upon insert which the selection of the remedial action is based.

The Commonwealth of Massachusetts concurs with the Selected Remedy.

C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for Industri-plex OU-2, which is the final operable unit for the Industri-plex Superfund Site. Other operable units remain at the Wells G&H Superfund Site. The first phase of Industri-plex, Operable Unit 1, or Industri-plex OU-1, addressed soil, groundwater (interim action only), on-site sediment, and air contamination at Industri-plex OU-1. This final phase, Operable Unit 2, addresses principal and low-level threats at Industri-plex OU-2 in groundwater, soil, sediment and surface water contamination to the extent that such threats exist.

The selected remedy is a comprehensive approach for Industri-plex OU-2 that addresses all current and potential future risks caused by contaminated groundwater, soil, sediment, and surface water. Specifically, this remedial action addresses contamination in:

Groundwater originating at Industri-plex OU-1 and extending to the Halls Brook Holding Area Pond (HBHA Pond);

Sediments in the HBHA Pond, HBHA Wetlands, Wells G&H Wetland, and Cranberry Bog Conservation Area;

Surface and subsurface soil in the vicinity of the former (now buried) Mishawum Lake; and

Surface water in the HBHA Pond.

The remedial measures will prevent future unacceptable risks from sediments and soils, and untreated groundwater and surface water, and will allow for restoration of Industri-plex OU-2 to beneficial uses. Institutional controls will be required to prevent unacceptable exposures to hazardous substances and contaminated materials in groundwater, soils, and deeper wetland sediments in the future. Also, long-term monitoring, operation and maintenance, and periodic five-year remedy reviews will be performed.

The major components of this remedy are:

- Dredging and off-site disposal of contaminated sediments in the southern portion of the HBHA Pond; dredging and off-site disposal of contaminated near shore sediments at the Wells G&H Wetland and Cranberry Bog Conservation Area; and restoration of all disturbed areas. This component will address sediments posing unacceptable human health risks for near shore sediments and unacceptable ecological risks for the southern portion of HBHA Pond.

- Use of the northern portion of HBHA Pond as a sediment retention area (primary and secondary treatment cells) that will intercept contaminated groundwater plumes (including arsenic, benzene, ammonia, 1,2-dichloroethane, trichloroethene, naphthalene) from Industri-plex OU-1, treat/sequester contaminants of concern (including arsenic, benzene, ammonia), and minimize downstream migration of contaminants (including arsenic, benzene, ammonia). The primary treatment cell will intercept the contaminated groundwater plumes discharging in the HBHA Pond. The effluent from northern portion of the HBHA Pond (secondary treatment cell outlet) will serve as the surface water compliance boundary, and achieve National Recommended Water Quality Criteria (NRWQC). Sediments which accumulate in the northern portion of the HBHA Pond will be periodically dredged and sent off-site for disposal. Portions of storm water from Halls Brook, which may interfere with the natural treatment processes occurring within the northern portion of the HBHA Pond, will be diverted to the southern portion of HBHA Pond.

- If necessary, In-situ Enhanced Bioremediation of contaminated groundwater plumes (e.g., benzene) at the West Hide Pile (WHP).

- Construction of an impermeable cap to line stream channels (e.g. New Boston Street Drainway), and to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

- Construction of a permeable cap to prevent contaminated soil erosion (e.g. Area A6), downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

- Establishing institutional controls to restrict contact with soils, groundwater, or deeper interior wetland sediments with concentrations above cleanup standards and protect the remedy.

- Construction of compensatory wetlands for any loss of wetland functions and values associated with the selected remedy (e.g. northern portion of HBHA Pond, Halls Brook storm water by-pass, capped stream channels) nearby in the watershed.

- Long-term monitoring of the groundwater, surface water, and sediments, and periodic Five-year Reviews of the remedy.

The selected response action addresses principal and low-level threat wastes at Industri-plex OU-2. Principal threats to groundwater will be addressed by the management of migration and institutional controls; in soil by institutional controls and capping, in sediment by removal, off-site disposal, institutional controls, and providing an alternate habitat; in surface water by management of migration and providing an alternate habitat. To the extent that contamination remains on-site covered or capped, institutional controls will be put in place to prevent exposure in the future. The selected remedy is consistent with EPA's preferred alternative outlined in the June 2005 Proposed Plan and is consistent with a combination of all or a portion of Alternatives SS-2, SUB-2, GW-2, GW-4 for the West Hide Pile, HBHA-4, NS-4, DS-2, and SW-2, outlined in the June 2005 Feasibility Study. The estimated present worth cost of the remedy, including long-term operation, maintenance and monitoring, is approximately $25.6 million.

E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Based on the size and location of the contaminated soil areas, EPA concluded that it was impracticable to excavate and treat the chemicals of concern in a cost-effective manner. Thus, the selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (and groundwater and/or land use restrictions are necessary), reviews will be conducted every five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

F. SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Regional Administrator pursuant to CERCLA and section 404 of the Clean Water Act, 33 U.S.C. § 1251 et seq., the remedy is the least damaging practicable alternative for protecting aquatic ecosystems at the Industri-plex OU-2 under the standards of 40 CFR Part 230. At the HBHA Pond and the Wells G&H Wetland and Cranberry Bog Conservation Area, EPA expects impacts to wetlands and other waters, including the HBHA Pond and capped channels. EPA cannot identify a less damaging practicable alternative for each area which would avoid impacting the wetland areas while adequately addressing site risks.

Best management practices will be used throughout the clean up of this area of Industri-plex OU-2 to minimize adverse impacts on the wetlands and waters, wildlife and habitat. Damage to these wetlands will be mitigated through erosion control measures and proper re-grading and re-vegetation of the impacted area with indigenous species. Following excavation activities, wetlands will be enlarged, restored or replicated consistent with the requirements of the Federal and State wetlands protection laws.

Executive Order 11988 (Protection of Flood Plains) requires a determination that there is no practical alternative to taking federal actions in a flood plain area. Once that determination is made, the action taken must be designed or modified to minimize potential harm to or within the flood plain with the goal to minimize the impact of floods on human safety, health and welfare, and to restore and preserve natural and beneficial values served by flood plains. Sediments in a portion of the HBHA Pond and the Wells G&H Wetland and Cranberry Bog Conservation Area that pose an unacceptable human health and/or ecological risk are located in a flood plain. Through its analysis of the data collected in the RI as well as evaluations in the human health and ecological risk assessments, EPA has determined that because significant high level contamination exists in a portion of the flood plain in the HBHA Pond and the Wells G&H Wetland and Cranberry Bog Conservation Area, there is no practical alternative to conducting work in the flood plain. Once EPA determines that there is no practical alternative to conducting work in flood plain, the Agency is then required to minimize potential harm to or within the flood plain. The selected remedy for the HBHA Pond and the Wells G&H Wetland and Cranberry Bog Conservation Area requires excavation and removal of sediments that pose an unacceptable risk in the flood plain. Once those sediments have been excavated, the flood plain area will be restored such that there is no lost flood storage capacity.

G. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Industri-plex OU-2, as well as the Industri-plex OU-1 and Wells G&H OU-1 Administrative Record files, which have been incorporated by reference into the Industri-plex OU-2 Administrative Record.

1. Chemicals of concern (COCs) and their respective concentrations.

2. Baseline risk represented by the COCs.

3. Cleanup standards established for COCs and the basis for the levels.

4. Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD.

5. Land and groundwater use that will be available at the Industri-plex OU-2 as a result of the selected remedy.

6. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.

7. Decisive factor(s) that led to selecting the remedy.

H. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for contaminated groundwater, soil, sediment, and surface water at Operable Unit 2 of the Industri-plex Superfund Site (and including Wells G&H Superfund Site Operable Unit 3). This remedy was selected by the EPA with concurrence of the Commonwealth of Massachusetts Department of Environmental Protection (see Appendix A for Commonwealth of Massachusetts' concurrence letter).

Concur and recommended for immediate implementation:

U.S. Environmental Protection Agency

By: Susan Studlien　　　Date: 01/31/06

Susan Studlien
Director
Office of Site Remediation and Restoration
Region 1

PART 2: THE DECISION SUMMARY

A. SITE NAME, LOCATION AND DESCRIPTION

- Site Name: Industri-plex Superfund Site Operable Unit 2 (and including Wells G&H Superfund Site Operable Unit 3, Aberjona River Study), Woburn, Massachusetts, 01801.
- Location: Woburn, Massachusetts
- National Superfund electronic database identification number, e.g., CERCLIS identification number: Industri-plex – MAD076580950, and Wells G&H – MAD980732168
- The current lead entity for Industri-plex Superfund Site Operable Unit 2 (and including Wells G&H Superfund Site Operable Unit 3, Aberjona River Study): EPA
- Site type: Former chemical and glue manufacturing facilities whose operations and waste disposal practices caused releases and downstream migration of contamination within the Aberjona River watershed.

Site Description

In 1983, EPA identified two Superfund sites along the Aberjona River in Woburn, Massachusetts: the Industri-plex and Wells G&H Superfund Sites.

Situated in north Woburn, the Industri-plex Superfund Site is primarily contaminated with metals (e.g., arsenic, lead, and chromium) and buried animal hide wastes. The original 1986 Record of Decision (ROD) and the 1989 Consent Decree governing the implementation of the ROD defined the Industri-plex Superfund Site as being comprised of 245 acres; the Consent Decree included a map which defined the site for its purposes. Under CERCLA and the National Contingency Plan, the parameters of the Industri-plex Superfund Site include any areas where hazardous substances originating from that Site have come to be located. 42 U.S.C. § 9601(9); 40 C.F.R. § 300.5. For purposes of this ROD, the terms "Site" or "Industri-plex Site" includes both operable units at Industri-plex (see Figure A-1 for approximate overall Industri-plex Site boundary and locus map). Where it is appropriate, EPA will refer to the Site as defined by the 1986 ROD and the 1989 Consent Decree as "Industri-plex OU-1" (see Figure A-2 for approximate Industri-plex OU-1 boundary), and to that portion of the Site covered by this ROD as "Industri-plex OU-2" (see Figure A-3 for approximate Industri-plex OU-2 boundary). It should be noted that Industri-plex OU-1 and OU-2 overlap in some areas covered under the original OU-1 ROD.

The original ROD and the Consent Decree for Industri-plex OU-1 required the investigation of the migration and impacts of site-related contamination (e.g., metals) on downstream areas, as well as the evaluation of potential sources of hazardous materials impacting the aquifer This Industri-plex OU-1 investigation is included in the area also referred to herein as the Northern Study Area.

The Wells G&H Superfund Site consists of approximately 330 acres situated in East Woburn, Massachusetts, and is located approximately 1 mile downstream of Industri-plex OU-1 along the Aberjona River (see Figure A-2 for approximate Wells G&H boundary). In 1979, contamination was discovered in two municipal wells, Wells G and H (installed in 1964 and 1967, respectively). The groundwater was contaminated with volatile organic compounds (VOCs), including trichloroethene (TCE) and tetrachloroethene (PCE) and, as a result, the wells were shut down. Contaminants found in site soils included polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyl compounds (PCBs), VOCs, and pesticides. Aberjona River sediments were found to be contaminated with heavy metals, including arsenic, chromium, mercury, and zinc, and some PAHs. The 1989 Wells G&H ROD specified a groundwater cleanup remedy for five source area properties contributing to VOC groundwater contamination (Operable Unit 1 (Wells G&H OU-1)). This Wells G&H ROD, along with a 1991 Explanation of Significant Differences and a 1991 Consent Decree designated two other operable units: the second operable unit (Wells G&H OU-2) is referred to as the Central Area Aquifer Study, and investigates the remaining groundwater; and the third operable unit (Wells G&H OU-3) is referred to as the Aberjona River Study and investigates surface water and sediment contamination along the river and its associated wetlands. This Wells G&H OU-3 investigation is also referred to as the Southern Study Area. Currently, Wells G&H OU-1 groundwater treatment activities are on-going at all five source area properties. Wells G&H OU-2 continues to be investigated.

As a result of the similar sediment contamination (e.g., metals such as arsenic) at the two Superfund sites, EPA merged the Wells G&H OU-3 into Industri-plex OU-2 to establish one comprehensive cleanup plan for the Aberjona River and associated wetlands. This investigation, which resulted in this ROD, is known as Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) Comprehensive Multiple Source Groundwater Response Plan Remedial Investigation (MSGRP RI), as depicted on Figure A-4. This ROD will use the terminology "Industri-plex OU-2" to include Wells G&H OU-3, except as otherwise indicated.

Based upon the baseline risk assessment results and contaminant fate and transport mechanisms, as presented in the March 2005 Comprehensive MSGRP RI, October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data (October 2005 Technical Memorandum), and the Administrative Record, the approximate boundaries of Industri-plex OU-2 are illustrated on Figure A-3.

Heavy metals are the principal contaminants of concern throughout Industri-plex OU-2, with arsenic representing the most significant metal present at elevated concentrations throughout the system. The most significant source of metals contamination has been from Industri-plex OU-1. Although the contaminated soils have been capped as part of the Industri-plex OU-1 remedy, they continue to impact groundwater at OU-1 and discharge inorganics (including dissolved arsenic) to the HBHA Pond, the HBHA Wetlands and the Aberjona River. Once contaminants are discharged from groundwater to the surface water bodies, sediments and surface water are impacted and the contaminants are transported further downstream.

Several organic contaminants (including benzene) were also detected in soils and groundwater in the Northern Study Area. Benzene was the most frequently detected VOC at concentrations exceeding state standards for groundwater. In addition to the inorganic and organic groundwater plumes, these plumes also include high concentrations of ammonia. The ammonia is primarily generated from the buried organic waste at Industri-plex OU-1 (e.g., animal hide waste). The ammonia, along with the inorganic and organic plumes, primarily discharge into the HBHA Pond, and contribute to sediment and surface water impacts in the pond.

Other organic compounds, such as naphthalene and trichloroethene (TCE), were also observed sporadically in groundwater samples in the vicinity of the HBHA Pond. TCE was also observed in another area approximately one half mile south of Industri-plex OU-1, generally located south and southwest of Cabot Road, in the vicinity of former Mishawum Lake. However, based on the available groundwater data, it appears that the source of the TCE south of Cabot Road is not related to Industri-plex OU-2.

A more complete description of Industri-plex OU-2 can be found in Section 1 of the MSGRP RI prepared by Tetra Tech NUS, Inc (TtNUS) for EPA, dated March 2005, and the October 2005 Technical Memorandum.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Site Ownership/Operations

Various manufacturing facilities operated on the Industri-plex OU-1 from 1853 to 1969. Prior to 1853, the Industri-plex OU-1 was undeveloped land, covered forest along the northern, upland border, and wetlands and marshy swampland over the southern two thirds of the property.

SUMMARY OF INDUSTRI-PLEX OU-1 OWNERSHIP (1853 – 1989)

Date	Ownership	Comments
Prior to 1853	Unknown	Natural undeveloped land.
1853 – 1863	Robert B. Eaton	Manufactured Hartshorn, Vitriol, Copperas, Glue, Gums, Nitrates.
1863 – 1929	Merrimac Chemical Co. (New England Manufacturing Co. made munitions from 1915 to 1920)	Manufactured many types of acids, tin crystals, oxy-muriate of antimony, arsenical pesticides. Waste products were arsenic, lead, zinc, copper and mercury.
1929 – 1931	Monsanto Chemical Co.	Similar products to Merrimac Chemical Co.
1931 – 1934	F&L Land Salvage and Improvement Co.	Salvage existing plant equipment.
1934 -1936	New England Chemical Industries, Inc.	Manufacture of animal glues, "technical gelatin"
1936 – 1961	Consolidated Chemicals Industries	Same products as previous owner.
1961 – 1969	Stauffer Chemical Co.	Same as previous owner.
1969 – 1989	Mark-Phillip Trust	Industrial developer.

From 1853 through 1931, Industri-plex OU-1 was home to various chemical manufacturing operations that produced chemicals for the local textile, leather and paper industries; the main products being sulfuric acid and related chemicals. Other chemicals produced at this facility included arsenic insecticides, acetic acid, dry colors, and organic chemicals including phenol, benzene, picric acid, toluene, and trinitrotoluene (TNT). Beginning in 1935, the plant was dedicated to the manufacturing of glue from animal hides until mid-1969 when operations ceased and the property was vacated.

The waste products resulting from 115 years of industrial activities were randomly disposed of on-site. Prior to 1934, it appears that waste materials were disposed of over a wide area, encompassing all of the property owned by Merrimac Chemical Company west of the current location of Commerce Way, including the property west of the railroad tracks. It appears that the wastes were used for two purposes. The first use was to fill lowlands, wetlands and shallow ponds in order to provide more useable land on which to locate new processes. The second use was as a construction material used to build dikes and levees to contain liquid wastes in a particular area. After 1934 and for the remainder of industrial operations, the disposal of waste products was generally limited to areas east and southeast of the main plant. These wastes were deposited directly on top of the existing deposits and reached heights in excess of forty feet above natural grade. The locations of the operations are depicted in the March 2005 MSGRP RI and Industri-plex OU-1 Administrative Record

In December 1968, the Mark-Phillip Trust (MPT or the Trust) purchased approximately 149 acres of the property from Stauffer Chemical Company, while others purchased the remaining 35 acres. The MPT intended to develop the Stauffer land, along with land owned to the south and east, as an industrial park to be called "Industri-plex 128." From early 1970 to 1979, development activities involved filling and excavating portions of the property to facilitate the sale of various parcels. Excavations uncovered chemical and glue manufacturing wastes, including decaying animal hides. In addition to two existing waste stockpiles (i.e., East Central Hide Pile and South Hide Pile), some of these waste deposits were excavated and either trucked off-site, buried on the southern Boston Edison Company (BECO, n/k/a NSTAR) right-of-way, or stockpiled in two new waste piles (i.e., West and East Hide Piles).

<u>Regulatory Enforcement Activities</u>

The Commonwealth of Massachusetts has a long history of enforcement actions against the MPT arising out of its development of the property. These actions began in August of 1969 when the developer began work without the proper permits from the Massachusetts Department of Natural Resources (DNR). In December 1970, the DNR issued a permit to the Trust; the permit acknowledged the existence of the former Stauffer wastewater treatment lagoon and disposal area and required that they be addressed in compliance with current state regulations. In addition, after repeated violations of administrative orders issued by the Department of Environmental Quality Engineering (DEQE, n/k/a DEP), a state court issued an injunction sought by the Commonwealth and the Town of Reading, preventing certain development activities.

Federal involvement began in June 1979 when the United States Attorney's Office, on behalf of the U.S. Army Corps of Engineers (COE) and EPA, filed suit against the MPT alleging violations of § 404 of the Federal Water Pollution Control Act, which regulates the filling of wetlands. An injunction was issued and further development activity stopped. In support of this injunction, EPA provided the results of its soil and water testing at the property, which showed that hazardous substances, primarily arsenic, chromium and lead sludges, had been released. Negotiations between the MPT and the state and federal regulatory agencies began and continued until May 1985, when separate state and federal Consent Decrees were approved by their respective courts. The decrees, similar in scope, required the Trust to undertake a series of steps, including investigations to determine the nature and extent of the hazardous waste problems, cleaning up the hazardous waste problems and resolving the wetland filling issues. In exchange, the MPT would be able to develop certain pieces of the property in order to generate enough revenue to continue with the remedial investigations and clean up. Citing the inability to generate sufficient capital, the MPT has never complied with the terms of the Consent Decrees.

The Industri-plex Site was listed on the Superfund Interim List of 115 Top Priority Hazardous Waste Sites in 1981 and on the Superfund National Priorities List in 1983.

In May, 1982, the DEQE and EPA entered into a Consent Order with Stauffer Chemical Company to undertake a Remedial Investigation/Feasibility Study (RI/FS) and subject to certain conditions to pay for its apportioned share of the remedial actions. Stauffer began implementing the Consent Order in the summer of 1982 with Phase I of a RI and completed the RI/FS process in April 1985 with the submission of the Phase II RI/FS.

Two early response actions were undertaken at Industri-plex OU-1. The first, conducted by the DEQE in November 1980 involved a sprayed latex cover over a large exposed arsenic and lead deposit to minimize air entrainment of arsenic and lead dust. In the summer of 1981, EPA undertook a removal action by installing a chain link fence around Industri-plex OU-1 to prevent unauthorized access. A subsequent action was undertaken in June 1986 to repair the existing fence.

Based upon investigations in the early 1980s, EPA established a 1986 Record of Decision for the first phase of cleanup at Industri-plex OU-1, which included the construction of protective caps over approximately 110 acres of soils contaminated with heavy metals and animal wastes (permeable cap over approximately 105 acres, impermeable cap over approximately 5 acres) to prevent people from coming into contact with the contamination. The installation of the protective caps was completed in 1998, and the industrial park is currently home to retail, commercial and light industry land uses, as well as the Anderson Regional Transportation Center. Industri-plex OU-1 also included a gas collection and treatment system, institutional controls, and interim groundwater remedy, as well as further investigations of site-related contamination at and downstream of Industri-plex OU-1. In addition, as noted above, the 1986 ROD required further investigation to support a second decision regarding the impacts of groundwater and surface water contamination from Industri-plex OU-1. This investigation contributes to the basis for this ROD.

On April 24, 1989, EPA entered into a Consent Decree with 26 Settling Parties to perform the Industri-plex OU-1 Remedial Design/ Remedial Action. The Industri-plex Site Remedial Trust (ISRT) was created as a requirement of the 1989 Consent Decree for the 26 Settling Defendants (current and previous landowners) to form a single entity responsible for funding, managing, and administering the remediation at Industri-plex OU-1 and fulfilling the obligations of the Consent Decree. Since the 1989 Consent Decree, the ISRT has performed many of the investigations to support the RI/FS.

The Settling Parties have been very active in generating data to support the MSGRP RI and MSGRP FS, participating in technical discussions regarding contaminants at the Industri-plex OU-2, and providing technical comments on the baseline risk assessments, MSGRP RI, MSGRP FS and Proposed Plan. Some of their activities are presented above and below in Part 2, Sections B and C, and include extensive review and comment on EPA's March 2003 Wells G&H Superfund Site OU-3 Aberjona River Study Baseline Human Health Risk Assessment and on the May 2003 Wells G&H Superfund Site OU-3 Aberjona River Study Baseline Ecological Risk Assessment. These comments and EPA's responses are included in the Administrative Record. In addition, the Settling Parties collected an extensive amount of environmental data which was incorporated into the MSGRP RI report.

EPA has not yet notified any Potentially Responsible Parties ("PRPs") of their liability for past response costs or future response actions.

Principal Contaminants Discovered During Remedial Investigation Phase

Heavy metals are the principal contaminants of concern throughout Industri-plex OU-2, with arsenic representing the most significant metal present at elevated concentrations throughout the system. The most significant source of metals contamination is Industri-plex OU-1. The presence of buried animal waste, as well as other buried organic materials, has resulted in reducing conditions in groundwater and the release of metals to groundwater in a dissolved form. Ammonia is present primarily as a result of hide waste degradation. The reducing conditions in the groundwater also contribute to ammonia migration in groundwater. Historical releases include releases from groundwater and releases from surface water, sediment, and soil since operations began in 1853 until the protective remedial caps were completed in 1998. Although the contaminated soils have been capped with a permeable cap, they continue to impact groundwater at Industri-plex OU-1 due to the reducing conditions caused by the degradation of buried organic material and to discharge contaminants (e.g., dissolved arsenic) to the HBHA Pond, the HBHA Wetlands and the Aberjona River. Once contaminants are discharged from groundwater to the surface water bodies, sediments and surface water are impacted and the contaminants continue to be transported further downstream as part of the suspended solid load or in the dissolved state through diffusion processes. Current releases include releases from groundwater, sediment, and soil (total suspended solids) and sediment diffusion (dissolved arsenic).

Several organic contaminants were also detected in soils and groundwater in the Northern Study Area. Benzene was the most frequently detected VOC at concentrations exceeding state standards for groundwater. The highest concentrations of benzene were observed in the shallow groundwater in two areas: between the East Central Hide Pile and the South Hide Pile, and within a localized area along the eastern edge of the West Hide Pile. High concentrations of benzene were observed in the deeper groundwater extending from the southern side of Atlantic Avenue to the central portion of the HBHA Pond. In general, the overall benzene plume, extending in both the shallow and deeper groundwater, is located in the vicinity of Atlantic Avenue south to the HBHA Pond. This location is generally consistent with the findings of previous investigations conducted during the earlier Industri-plex OU-1 groundwater investigations and the 1983 RI. These plumes were found to discharge into the HBHA Pond.

In addition to the contaminants described above, these plumes also include elevated concentrations of ammonia. The ammonia is primarily generated through the biological degradation of the buried organic waste at Industri-plex OU-1 (e.g., animal hide waste). The highest concentrations of ammonia correlate with the buried animal/glue waste on Industri-plex OU-1. The reducing conditions in the groundwater contribute to the ammonia presence and migration in groundwater. The ammonia in groundwater, along with the arsenic and benzene plumes, discharge into the HBHA Pond, impacting surface water and sediments in the pond.

In addition to the above, the following activities also contributed to the downstream release of contamination:

- Historical, significant precipitation events and erosion;
- Historical disturbances, mixing, and relocation/distribution of wastes during development activities at Industri-plex OU-1;

A more detailed description of the Site history can be found in Section 1 of the MSGRP RI Report, the October 2005 Technical Memorandum, the Industri-plex Site 1986 Record of Decision, and the Wells G&H Site 1989 Record of Decision.

C. COMMUNITY PARTICIPATION

Throughout the Industri-plex Site's history, there has been a high degree of community involvement. EPA has kept the community and other interested parties apprised of Industri-plex

OU-2 activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of recent public outreach efforts.

- December 27, 2001: EPA Meeting with Woburn Officials at Mayor's office regarding Industri-plex OU-2 and Wells G&H OU-3 merger.

- Spring 2002: EPA released a Fact Sheet and Press Release announcing the merger of the Industri-plex OU-2 with Wells G&H OU-3 to establish one comprehensive cleanup decision for the river and associated wetlands.

- June 4, 2002: EPA meeting with Woburn Residence Environmental Network (WREN) at a private residence regarding Industri-plex OU-2 and Wells G&H OU-3 investigations.

- June 19, 2002: EPA meeting with Woburn Neighborhood Association (WNA) to discuss Industri-plex OU-2 and Wells G&H OU-3 merger at Altavesta Elementary School, Woburn, MA.

- July 15, 2002: EPA meeting with Woburn City Council at the Woburn City Hall regarding Industri-plex OU-2 and Wells G&H OU-3 investigations. At the meeting, EPA provided the Woburn City Council information regarding EPA's Technical Outreach Services for Communities (TOSC) program which provides free access to independent scientific and technical assistance for the evaluation of technical documents.

- August 6, 2002: EPA meeting with Mystic River Watershed Association and Friends of Upper Mystic Lakes at a private residence regarding Industri-plex OU-2 and Wells G&H OU-3 investigations.

- March 2003: EPA released Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment.

- Spring 2003: EPA released a Fact Sheet and Press Release summarizing the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment, dated March 2003.

- April 15, 2003: EPA meeting with City officials presenting the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at City Hall, Woburn, MA.

- May 6, 2003: EPA meeting with Aberjona Study Coalition (ASC) presenting the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at Thompson Library, Woburn, MA.

- May 13, 2003: EPA held an informational Public Meeting presenting the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at the Shamrock Elementary School, Woburn, MA.

- May 19, 2003: EPA meeting with Woburn City Council discussing the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at City Hall.

- May 2003: EPA released Wells G&H OU-3 Aberjona River Study Draft Baseline Ecological Risk Assessment.

- June 2, 2003: EPA meeting with Winchester Selectman discussing the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at Town Hall.

- June 16, 2003: EPA awarded $100,000 Technical Assistant Grant to the Aberjona Study Coalition (ASC) for the Industri-plex and Wells G&H Superfund Sites.

- June 2003: EPA released a Fact Sheet and Press Release summarizing the Wells G&H OU-3 Aberjona River Study Draft Baseline Ecological Risk Assessment, dated May 2003.

- July 23, 2003: EPA meeting with Aberjona Study Coalition (ASC) discussing the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Ecological Risk Assessment at Thompson Library, Woburn, MA.

- July 24, 2003: EPA meeting with Winchester Officials regarding the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Human Health Risk Assessment at Town Hall.

- July 24, 2003: EPA held an informational Public Meeting presenting the results of the Wells G&H OU-3 Aberjona River Study Draft Baseline Ecological Risk Assessment at the Shamrock Elementary School, Woburn, MA.

- Fall 2003: EPA received public comments on EPA's March 2003 and May 2003 Wells G&H OU-3, Aberjona River Study, Draft Baseline Human Health and Ecological Risk Assessments from a number of stakeholders.

- June 28, 2004: EPA released comprehensive responses to public comments received on the Wells G&H OU-3, Aberjona River Study, March 2003 and May 2003 Draft Baseline

Human Health and Ecological Risk Assessments.

- September 2004: EPA released Revised Wells G&H OU-3 Aberjona River Study Baseline Human Health and Ecological Risk Assessment, dated September 2004, based upon the Agency's June 28, 2004 responses to public comments.

- October 2004: EPA released a Fact Sheet and Press Release summarizing the Revised Wells G&H OU-3 Aberjona River Study Baseline Human Health and Ecological Risk Assessment, dated September 2004, based upon the Agency's June 28, 2004 responses to public comments.

- March 2005: EPA released Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) Comprehensive Multiple Source Groundwater Response Plan (MSGRP) Remedial Investigation Report.

- April 2005: EPA released a Fact Sheet summarizing the March 2005 Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) Comprehensive Multiple Source Groundwater Response Plan (MSGRP) Remedial Investigation Report. The Fact Sheet identified the next steps in the schedule as the release of a Proposed Plan in May 2005 or June 2005 which would begin a 30-day public comment period.

- April 15, 2005: EPA released a Press Release announcing EPA's informational Public Meeting scheduled for 7:00 PM, April 28, 2005, at the Shamrock Elementary School, Woburn, MA to discuss the results of the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3 Aberjona River Study) MSGRP RI report.

- April 28, 2005: EPA held an informational Public Meeting presenting the results of the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) comprehensive MSGRP RI report. EPA also announces that a Proposed Plan would be released in May 2005 or June 2005 beginning a 30-day public comment period.

- June 17, 2005: EPA released Press Release announcing June 30, 2005 informational Public Meeting of Proposed Plan for Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) at the Shamrock Elementary School, Woburn, MA.

- June 28, 2005: EPA published a legal notice and brief analysis of the Proposed Plan in the Woburn Daily Times Chronicle.

- June 30, 2005: EPA released the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) Feasibility Study ("MSGRP FS").

- June 30, 2005: EPA released the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) Proposed Plan with the 30-day comment period beginning on July 1, 2005, and ending on July 31, 2005.

- June 30, 2005: EPA held an informational Public Meeting presenting the results of the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3, Aberjona River Study) MSGRP FS and Proposed Plan, and initiates a 30-day public comment period beginning July 1, 2005 and ending July 31, 2005. EPA makes the administrative record available for public review at EPA's offices in Boston, and Woburn Public Library. This is the primary information repository for local residents and will be kept up to date by EPA. In addition, administrative record was made available at the Winchester Public Library, and copies of the administrative record on compact discs were distributed to the public that attend the informational Public Meeting.

- July 15, 2005: EPA Press Release announcing 30-day extension to the 30-day comment period, based upon a request from a community group, with the comment period ending on August 31, 2005.

- July 27, 2005: EPA Public Hearing recording formal verbal public comments on the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3 Aberjona River Study) Proposed Plan, dated June 2005.

- October 19, 2005: After reviewing public comments received by August 31, 2005, EPA releases Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data, Fact Sheet supplementing the June 2005 Proposed Plan, and Supplemental Administrative Record, and re-opens the public comment period from October 20, 2005 to November 18, 2005.

- November 17, 2005: EPA second Public Hearing recording formal verbal comments on the Industri-plex Superfund Site OU-2 (and including Wells G&H Superfund Site OU-3 Aberjona River Study) June 2005 Proposed Plan, October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data, and October 2005 Fact Sheet supplementing the June 2005 Proposed Plan.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at the Industri-plex Superfund Site are complex. EPA has organized the work into two operable units (OUs). Furthermore, considering the hydraulic connection and similar contaminants of concerns (e.g., metals such as arsenic) at Industri-plex OU-1 and downstream low-lying areas along the Aberjona River and associated wetlands, Industri-plex OU-2 incorporates the downstream investigations associated with the Wells G&H Superfund Site OU-3 Aberjona River Study (known as the Southern Study Area for river reaches 1 – 6) as depicted on Figure A-4.

In 1986, EPA signed a Record of Decision for the first phase of cleanup at Industri-plex OU-1 which included the following:

- construction of permeable protective caps over more than 100 acres of soils contaminated with heavy metals (e.g., arsenic, lead, chromium) and animal wastes to prevent people from coming into contact with the contamination;
- construction of an impermeable protective cap, gas (hydrogen sulfide) collection and treatment system over approximately 5 acres;
- establish institutional controls to preserve the continued effectiveness of the Industri-plex OU-1 remedy to protect human health and the environment;
- implement an interim groundwater remedy for groundwater hot spots of benzene and toluene contamination; and
- conduct further investigations (known as the Groundwater/Surface Water Investigation Plan or "GSIP") of site-related contamination at and downstream of Industri-plex OU-1 to support a second operable unit.

The permeable protective caps, impermeable protective cap, and gas collection and treatment system were completed in 1998, though cap certification reports have not yet been completed for Industri-plex OU-1. The Final GSIP investigations were completed between 2002 and 2004. The final design of the institutional controls was completed in March 2005, though the institutional controls have not yet been recorded on the properties at Industri-plex OU-1. The Industri-plex OU-1 Settling Parties did not implement the interim groundwater remedy; hence, EPA will not be issuing a certification of completion for the interim groundwater remedy portion of Industri-plex OU-1, and the permanent groundwater remedy outlined in this ROD supersedes the interim groundwater remedy component of OU-1. During the 1990s and early 2000s, portions of Industri-plex OU-1 were redeveloped and currently house retail, commercial and light industry, as well as an intermodal transportation facility, the Anderson Regional Transportation Center.

In addition, the 1986 ROD required EPA to conduct further investigations, called the Multiple Source Groundwater Response Plan (MSGRP), to support a second operable unit. This investigation serves as the basis for this ROD.

Industri-plex OU-2: This ROD incorporates the current knowledge of the nature and extent of contamination, contaminant fate and transport mechanisms, and baseline risk assessment results as presented in the MSGRP RI report, the October 2005 Technical Memorandum, and the Administrative Record. This ROD establishes a final groundwater remedy for the Industri-plex Site, where the Commonwealth has determined the aquifer is of low use and value (i.e., not for drinking water purposes) at Industri-plex OU-1 north of Interstate 95 within the Northern Study Area. If any final groundwater decisions are necessary for the remaining Wells G&H aquifer within the Southern Study Area, which the Commonwealth determined to be a medium use and value aquifer with the potential to be used as a future drinking water source, then these decisions will be made in the Wells G&H Superfund Site Operable Unit 2, Central Area Aquifer Study.

This ROD addresses the contamination originating from Industri-plex OU-1 and downstream migration of contamination from groundwater contaminant discharges from Industri-plex OU-1. The waste capped under Industri-plex OU-1 continues to serve as a principal threat through the release of contaminants in groundwater. Ingestion of, dermal contact with, and inhalation of volatile compounds released from extracted groundwater within this aquifer poses a potential future risk to human health because EPA's acceptable risk range is exceeded. This ROD also addresses the contamination of soils and sediments. Ingestion of and dermal contact with these soils and sediments poses a potential current and/or future risk to humans because EPA's acceptable risk range is exceeded. Exposure to these sediments also poses an unacceptable ecological risk to the benthic community. Finally, this ROD addresses the contamination of surface water. Exposure to these surface waters poses an unacceptable ecological risk to aquatic life.

This ROD represents the final response action for the Industri-plex Site and addresses the principal threats at Industri-plex OU-2 through interception, treatment and sequestration of contaminated groundwater plumes at the northern portion of the HBHA Pond (primary and secondary treatment cells) and the West Hide Pile (enhanced in-situ bioremediation), periodic removal of sediments accumulating at the northern portion of the HBHA Pond, sediment removal and restoration at the southern portion of the HBHA Pond and near shore sediment areas, capping (impermeable) stream channels impacted by contaminated groundwater plumes discharge (including New Boston Street Drainway), capping contaminated soils adjacent to the HBHA Pond (including Area A6), establishing institutional controls for groundwater, soils, and sediments to prevent exposures to contamination above cleanup standards (outlined in Section L of this ROD) and protect the remedy, compensation for any wetland function and value losses nearby in the watershed, and long-term monitoring of groundwater, surface water, and sediments.

The ROD will serve as the final groundwater, soils, surface water and sediment remedy at the Industri-plex Site.

The principal and low-level threats that this ROD addresses are summarized in the following table:

Principal Threats	Medium	Contaminant(s)	Action To Be Taken
Future Human Health Risk	Groundwater	Arsenic, VOCs, and ammonia	Management of migration and institutional controls
Future Human Health Risk	Soil	Arsenic	Institutional Controls
Current/Future Human Health Risk	Sediment	Arsenic, benzo(a)pyrene	Removal, off-site disposal, and institutional controls
Ecological Risk	Sediment	Arsenic	Partial removal, capping, and management of migration, and compensatory mitigation for wetland and stream losses
Ecological Risk	Surface water	Arsenic, benzene, and ammonia	Management of migration, and compensatory mitigation for wetland and stream losses

E. SITE CHARACTERISTICS

Chapter 1 of the June 2005 MSGRP FS contains an overview of the MSGRP RI. The significant findings of the March 2005 MSGRP RI and October 2005 Technical Memorandum are summarized below. These technical documents can be found in the Administrative Record and contain various figures illustrating the locations of samples collected during the investigation, and media concentrations/detections.

The approximate boundaries of Industri-plex OU-2 are illustrated on Figure A-3, which accounts for fate and transport processes and/or depositional locations where contamination contributes to human health or environmental risks. The Aberjona River flows through the Industri-plex OU-2, and the HBHA is located in the northwest portion of the Industri-plex OU-2 contributing surface water flow to the Aberjona River. Several associated tributaries, drainways, and wetlands also traverse or are situated within Industri-plex OU-2. The Industri-plex OU-2 originates at the Industri-plex OU-1, which is the location of the only significant source of contamination in Industri-plex OU-2.

The disposal of manufacturing wastes at Industri-plex OU-1 from 1853 to 1968 and development activities from 1968 to the early 1970s resulted in the filling of wetlands, diverting the course of the Aberjona River, and the creation of four large waste stockpiles. The Halls Brook Holding Area (HBHA) was created as a storm water management area following the filling of Mishawum Lake in the early 1970s. The northern portion of the HBHA consists of a large rectangular shallow pond (approximately 175 feet by 900 feet and depth up to 20 feet), referred to as the HBHA Pond. Downstream of the HBHA Pond, the southern portion of the HBHA consists of wetlands containing three smaller ponds, referred to as the HBHA Wetland. When the HBHA was constructed, the Aberjona River was diverted from Mishawum Lake to its current course which follows a series of culverts and drainage channels in the middle of the Commerce Way roadway and runs parallel to the HBHA approximately 1,500 feet to the east. Flows from the Aberjona River and the HBHA converge at the outlet of the HBHA at Mishawum Road. The Aberjona River continues to flow south through the Wells G&H Superfund Site wetland north of Salem Street (referred to as the Wells G&H Wetland), and the Cranberry Bog Conservation Area south of Salem Street. The river continues to flow south through southern Woburn and Winchester, and concludes at the Mystic Lakes.

In 1986, EPA completed a Record of Decision (ROD) for Industri-plex OU-1 that selected a soil remedy which consisted of capping arsenic/lead/chromium contaminated soils and animal hide wastes material piles (i.e., East Hide Pile, East Central Hide Pile, West Hide Pile, South Hide Pile, and portions of the NSTAR (Formerly Boston Edison Company) right-of-way Number 9. These soils represent the most significant source of contamination at the Industri-plex OU-2. The contaminants gradually dispersed into the surrounding environmental media and have resulted in the contamination of soil, groundwater, surface water, sediments, and biota at the Industri-plex OU-2. The nature and extent of the contamination along with fate and transport information are summarized in the following sections.

<u>Soil Contamination</u>

The nature and extent of soil contamination was further investigated in areas within, adjacent to, and downgradient of Industri-plex OU-1. These areas included soils along the perimeter of the Industri-plex OU-1 boundary, buried sediments of the former Mishawum Lake bed, benzene and toluene source area soils, and floodplain soils along the HBHA and the Aberjona River. Soils impacted by site-related contaminants are as follows:

- Within the boundaries of Industri-plex OU-1, there are over 150 acres of soils contaminated with heavy metals (specifically, arsenic, lead, chromium, and, to a lesser degree, barium, copper, zinc, and mercury) and animal hide waste materials. Approximately 110 acres exceeded the heavy metals threshold values established in the

1986 ROD and have been capped with either an engineered cover or with existing materials considered to be "equivalent cover" (e.g., asphalt pavement, building slabs, etc.) These capped areas include animal hide waste materials buried at the West Hide Pile, East Hide Pile, East-Central Hide Pile, South Hide Pile and along portions of the NSTAR right-of-way Number 9. Although capped and no longer a threat from erosion, these contaminants remain on-site and represent the most significant source of contamination at Industri-plex OU-2. Some of these chemicals have remained adsorbed to soils while others have been mobilized into deeper soils, into groundwater, and into the adjacent wetlands, HBHA and Aberjona River.

- Four areas located outside and adjacent to the Industri-plex OU-1 boundary were investigated to determine if metals contamination exceeding the Industri-plex OU-1 soil remedy action levels extended beyond the Industri-plex OU-1 boundary. Only the area located between the southern Industri-plex OU-1 boundary and the HBHA Pond (Area 6) was found to contain concentrations of arsenic, chromium, and lead exceeding action levels established for the Industri-plex OU-1 soil remedy.

- Prior to it being filled to create open land for development, Mishawum Lake served as one of the first significant depositional areas for contaminants being discharged from Industri-plex OU-1. Soils exhibiting elevated concentrations of metals exceeding comparative regulatory criteria (i.e., EPA Region 9 Preliminary Remediation Goals (PRGs) and MassDEP Soil Background criteria) were detected in both near-surface and subsurface soils. The highest concentrations of metals and the most frequent exceedances of comparative screening criteria for metals, in particular arsenic, generally occurred in the soil samples collected at a depth representing the former lake bottom.

- An investigation was conducted to locate the source of persistent benzene and toluene groundwater contamination adjacent to the West Hide Pile (benzene) and along Atlantic Avenue (benzene and toluene) at Industri-plex OU-1. This investigation included subsurface geophysical surveys (i.e., ground penetrating radar and electro-magnetic surveys), soil-gas sampling, subsurface soil samples, and groundwater sampling. Although a concentrated source of contamination was not located (e.g., Underground Storage Tanks (UST), drums, etc.), both benzene and toluene were detected in most soil samples. However, these detections were generally low with the majority of samples well below the comparative screening criteria. At sample locations collected along Atlantic Avenue, 4 of 17 samples exceeded the screening criterion for benzene (600 micrograms per kilogram [μg/kg]) and none exceeded the screening criterion for toluene (520,000 μg/kg). In addition, one soil sample collected at the West Hide Pile within the saturated zone, exhibited elevated concentrations of benzene (210,000 μg/kg) exceeding its screening criterion. While toluene and benzene persist in these areas, only benzene exceeded its screening criterion.

- Soil samples were collected in depositional areas along the HBHA and the Aberjona River in order to investigate the presence of heavy metals deposited by floodwaters. Areas investigated included the banks of a drainage channel along/adjacent to the NSTAR right-of-way Number 9 in the southern portion of Industri-plex OU-1, floodplain areas along the eastern and southwestern banks of the HBHA, wetlands by Normac Road (south of Interstate 95 and north of the Wells G&H Wetland), the backyard of a residence located on Salem Street at the southwest edge of the Wells G&H Wetland, the Cranberry Bog Conservation Area, Danielson Park, river bank/wetland areas at Kraft Foods, Davidson Park in Winchester, and the banks of the Aberjona River near the Wedgemere train station in Winchester. Arsenic was the only metal that was detected in all floodplain sample locations at concentrations ranging from 6.1 milligrams per kilogram (mg/kg) to 272 mg/kg. Arsenic concentrations exceeded the screening criterion in all areas (except at the Wedgemere station where the criterion was exceeded in seven of nine samples). Although the screening criterion for arsenic (0.39 mg/kg) is based on residential assumptions, approximately 87 percent of floodplain soil samples exhibited arsenic concentrations that also exceeded the MassDEP Natural Soil Background reference criterion (20 mg/kg).

Groundwater Contamination

Between 1990 and 2002, over 460 groundwater samples were collected, analyzed and quantitatively evaluated to assess area-wide groundwater contamination in the Northern Study Area. Groundwater within the Southern Study Area is scheduled for comprehensive evaluation by EPA as part of the Wells G&H Superfund Site Operable Unit 2, Central Area Aquifer, investigations. The findings of the Northern Study Area investigation are as follows:

- Arsenic was more frequently detected in groundwater than any other metal (i.e., detected in 360 samples out of 467 samples analyzed for metals). Approximately 12 percent of the samples exceeded the arsenic screening criterion of 400 micrograms per liter (μg/L). Arsenic concentrations were generally highest in the groundwater south and west of the East Central Hide Pile and beneath the NSTAR right-of-way, with the maximum observed concentration of 24,400 μg/L located in the NSTAR right-of-way, just northwest of the HBHA.

- Other metals that exceeded the screening criteria included:

  - cadmium: only exceeded in three samples; the highest only slightly exceeding the criterion was located just north of the East Central Hide Pile;

- chromium: only exceeded in two samples collected from the same well located approximately 450 feet south of Atlantic Avenue (likely attributable to high suspended solids in the sample);

- lead: exceeded in 23 samples; all located in the areas north of the HBHA Pond, east of New Boston Road, and west of Atlantic Avenue;

- mercury: exceeded in eight samples sporadically distributed throughout the study area, but the highest concentrations observed were just northwest of the HBHA;

- nickel: exceeded in five samples sporadically distributed throughout the study area but the highest concentrations observed in the area between the East Hide Pile and the East Central Hide Pile; and

- zinc: exceeded in 11 samples sporadically distributed through out the study area but the highest concentration observed in the area of the Anderson Regional Transportation Center.

* Benzene was the most frequently detected VOC at concentrations exceeding the screening criteria. In the shallow groundwater, the highest concentrations of benzene were observed in two areas: between the East Central Hide Pile and the South Hide Pile adjacent to Atlantic Avenue (69,000 μg/L); and within a localized area along the eastern edge of the West Hide Pile (4,100 μg/L). In the deeper groundwater, high concentrations of benzene extended from the southern side of Atlantic Avenue to the southern end of the HBHA Pond. In general, the overall benzene plume, extending in both the shallow and deeper groundwater, is located in the vicinity of Atlantic Avenue south to the HBHA Pond. This current location is generally consistent with the findings of previous investigations conducted during the early GSIP investigations and the 1983 RI.

* Elevated concentrations of ammonia exist in contaminated groundwater plumes at Industri-plex OU-1. The decomposition of the buried animal hide wastes contribute significantly to the generation and release of ammonia in groundwater. In addition, the contaminated groundwater plumes contain strong reducing conditions which contribute to the presence and migration of high ammonia concentrations in the groundwater and its discharge into the HBHA Pond. The fate and transport of ammonia is similar to the fate and transport patterns observed for dissolved arsenic groundwater plumes. The highest concentrations of ammonia in groundwater (up to 2,710 milligrams per liter (mg/L)) were found at locations adjacent to or downgradient of the existing animal hide piles and in other areas where animal wastes have been buried, such as the NSTAR right-of-way (2,370 mg/L) and the West Hide Pile (63.7 mg/L). Consistent with the MSGRP RI, these groundwater plumes, including ammonia, migrate and discharge in the HBHA Pond.

- Although toluene concentrations did not exceed the screening criteria in samples collected during the recent investigations, toluene was detected at elevated concentrations within the center of the plume, just south of the Atlantic Avenue/Commerce Way intersection. Elevated concentrations of toluene (up to 2,500 µg/L) were observed in this area. During previous investigations conducted in 1997 by the ISRT as part of the source area investigation, elevated concentrations of toluene were also detected in this area with a maximum observed concentration of 19,000 µg/L. Elevated concentrations were also detected within the intermediate and deeper overburden beneath and immediately south of the NSTAR right-of-way.

- Trichloroethene (TCE) was observed sporadically in shallow groundwater samples in the vicinity of the NSTAR right-of way and the HBHA Pond. TCE in the shallow groundwater surrounding the HBHA Pond was detected at below screening criteria (< 6 µg/L).

- TCE was also detected at higher concentrations (up to 110 µg/L) in the intermediate to deep overburden in another area approximately one-half mile south of Industri-plex OU-1, south and southwest of Cabot Road, in the vicinity of former Mishawum Lake. TCE degradation by-products (1,1-dichloroethene, cis-1,2-dichlorethene) were also detected, but concentrations did not exceed their respective screening criteria. Based on the available groundwater data, it appears that the source of the TCE along Cabot Road is not related to Industri-plex OU-2 and appears to be isolated. This TCE, located south and southwest of Cabot Road in the vicinity of former Mishawum Lake, will not be addressed as part of this ROD.

- Although detected naphthalene concentrations did not exceed screening criteria, elevated concentrations were observed in shallow groundwater adjacent to and north of the HBHA Pond.

- Samples collected from varying depths at 10 boring locations along the southern perimeter of the Northern Study Area are considered representative of groundwater quality as it leaves the Northern Study Area and enters the Wells G&H aquifer Interim Wellhead Protection Area. These samples were compared to Massachusetts Maximum Contaminant Levels (MMCLs) and MassDEP GW-1 standards. Of the metals detected, only arsenic exceeded its MMCL (10 µg/L). No organic compounds were found to exceed their respective MMCLs or GW-1 standards.

<u>Sediment Contamination</u>

A total of 429 surface sediment samples (0-6 inches in depth) were collected from river, lake, and wetland locations from Industri-plex OU-1 to the Mystic Lakes during several GSIP and MSGRP investigations from 1995 through 2004 (see Figure A-4). In addition, sediment samples were also collected from local and regional reference stations from areas not expected to have been impacted by site-related contaminants. All sediment samples were analyzed for metals and some were also analyzed for VOCs, SVOCs, pesticides, and PCBs. Metals concentrations observed in sediments were compared to concentrations found at the reference stations and to regulatory reference criteria, such as the EPA Region 9 PRGs and the Ontario Ministry of the Environment and Energy (OMEE) Severe-Effects Level (SEL) sediment quality guidelines.

- The highest concentrations of metals and the most exceedances of reference criteria were found in the HBHA, the Wells G&H Wetland, and the Cranberry Bog Conservation Area. The number of metals exceeding reference criteria was highest in the Wells G&H Wetland, the Cranberry Bog Conservation Area, and the HBHA.

- Arsenic was the most prevalent metal that exceeded reference criteria. Other metals where more than 50 percent of the samples exceeded all the reference criteria included iron and lead.

- Twenty VOCs were detected in surface sediment samples. Most compounds were detected infrequently and at low concentrations. Only four compounds (benzene, tetrachloroethene, trichloroethene, and vinyl chloride) exceeded the EPA Region 9 PRGs for residential soil in at least one sample.

- Twenty-three SVOCs, primarily PAHs, were detected in surface sediment samples. Five PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene] exceeded Region 9 PRGs at the Industri-plex OU-2 and the reference stations.

Surface Water Contamination

Beginning in May 2001 and ending in October 2002, an extensive surface water monitoring program was conducted throughout the watershed that included measurements of precipitation, streamflow, suspended sediment, and metals concentrations (dissolved and total), in addition to other physio-chemical parameters at 10 stations located along a 9-mile reach of the Aberjona River. See Figure E-1 for the location of each of the surface water sampling stations. The intensive monitoring period captured monthly baseflow sample data as well as six storm events spanning multiple seasons (spring, summer, and fall).

- Concentrations of metals in surface water only sporadically exceeded National Recommended Water Quality Criteria (NRWQC) during both baseflow and stormflow conditions. The most frequently detected metals exceeding Criterion Continuous

Concentration (CCC) (chronic) criteria included aluminum, copper, lead, and zinc. Although the concentrations of arsenic were below NRWQC criteria, both dissolved and particulate phases of arsenic represent potential impacts to downstream depositional areas. For the majority of the 10 surface water sampling stations, the total arsenic concentrations were highest during stormflow conditions.

- The surface water monitoring data showed that metals transport is highly impacted by total suspended solids (TSS) concentrations. Spikes in metals concentrations are associated with spikes in TSS. Monitoring data collected during baseflow conditions show that arsenic concentrations are higher in the HBHA (including HBHA Pond and HBHA Wetlands). This trend was also observed for the other metals evaluated (chromium, copper, iron, lead, and mercury).

  The highest concentrations for metals were most often observed at the outlet of the HBHA (Station 4). Spikes in metals concentrations at this station were associated with spikes in suspended sediment concentrations indicating that elevated levels of metals at this station are associated with the particulate phase. The total metals concentrations typically decreased downstream of Station 4. During storm events, the highest arsenic concentrations were observed at the outlet of the HBHA Pond (Station 2). A chemocline is present within the HBHA Pond, which generally divides shallow water in the pond from deeper water. The chemocline is created and maintained by the continuing discharges of higher conductivity, greater density, and low oxygen content (anoxic) contaminated groundwater at the deeper portions of the HBHA Pond while the upper layer of the water column in the pond has a lower conductivity, lower density, and higher oxygen content (oxic) sustained by contributions of non-contaminated surface water from Halls Brook. The chemocline within the HBHA Pond becomes unstable during large storm events causing high contaminant concentrations in the deep surface water to mix with shallow water, and higher concentrations of arsenic to be released at the outlet of the pond. See the following fate and transport section for further information on the chemocline in the HBHA Pond.

- The highest concentration of dissolved arsenic in the HBHA Pond was observed in deep surface water at the northern multi-level sample station (5,043 μg/L). High concentrations of dissolved arsenic were also observed in deep surface water at central and south portions of the HBHA Pond with the highest values of 2,170 μg/L (central) and 2,845 μg/L (south). The concentrations of dissolved arsenic in shallow surface water at the HBHA Pond ranged from 2.0 to 27.4 μg/L.

- The reduction of metal concentrations observed during baseflow conditions between Station 4 and Station 5 and subsequent downstream stations indicates that deposition is occurring between stations. Sediment samples were collected at significant depositional areas along the HBHA and Aberjona River from Industri-plex OU-1 to the Mystic Lakes. The distribution of arsenic and other metals along the river shows a clear pattern of metals transport from Industri-plex OU-1 south to the Mystic Lakes, with the greatest area of sediment deposition occurring at the Wells G&H Wetland and Cranberry Bog Conservation Area.

- Benzene was detected in deep surface water in the northern portion of the HBHA Pond with concentrations up to 1,830 μg/L. Concentrations decreased through the water column to the point where benzene was not detected at the pond surface.

- Concentrations of ammonia up to 1,380 mg/L were observed discharging in the northern portion of the HBHA Pond, and concentrations up to 1,270 mg/L were observed in the deep surface water of the HBHA Pond. The concentrations of ammonia in the shallow surface water at the HBHA Pond outlet were slightly elevated and ranged from 4.0 mg/L to 17.9 mg/L.

Fate and Transport of Key Contaminants

Past storage, manufacture, handling and disposal practices of numerous chemicals at Industri-plex OU-1 has resulted in the release to soils of VOCs (aromatic hydrocarbons), SVOCs (including PAHs), and metals. Depending on the combination of contaminants, geologic and hydrogeologic conditions, and surface features, contaminants released to soils have migrated into other environmental media, specifically the underlying groundwater, adjacent surface water bodies, and sediments.

The fate and transport of contaminants involve complicated and interdependent processes that affect the mobilization of contaminants between various media and areas. The principal source of contamination within Industri-plex OU-2 is the capped soils underlying Industri-plex OU-1. These contaminated soils are impacting groundwater, which in turn discharges to the HBHA Pond and wetlands and northern portions of the Aberjona River, subsequently impacting surface water and sediment. The surface water flows from the HBHA and Aberjona River combine at Mishawum Road and represents the primary contaminant transport vehicle for downgradient receptors. While the applicable fate and transport processes are generally the same throughout the MSGRP RI Study Area, the impacted media and contaminants of concern vary from the northern portions of Industri-plex OU-2 to the lower portions of Industri-plex OU-2 and are summarized as follows:

FATE & TRANSPORT MODEL AREA	IMPACTED MEDIA	CONTAMINANTS OF CONCERN
Industri-plex OU-1 and the HBHA	Soils, Groundwater, Sediment, Surface water	Metals, VOCs , SVOCs, Ammonia
Wells G&H Wetland	Sediment, Surface water, Groundwater	Metals, SVOCs
Cranberry Bog Conservation Area	Sediment, Surface water	Metals

- The most significant ongoing transport process for metals in soils underlying Industri-plex OU-1 is leaching to groundwater. Once in groundwater, contaminants continue to migrate. The contaminants most widely detected in groundwater include arsenic, benzene, toluene, ammonia and to a lesser degree, lead and zinc. Contaminants are then transported through groundwater flow paths where they predominantly discharge in the northern portions of the HBHA Pond and migrate downstream impacting sediments and surface water.

- Portions of groundwater at greater depths continues to flow parallel to the main buried valley situated approximately between the MBTA rights-of-way rail road tracks (Lowell Commuter Line) and Commerce Way (See MSGRP RI Figure 3-2). As evidenced by downgradient groundwater sample data, the deeper portion of the aquifer does not appear to be a significant pathway for contaminant migration as contaminant concentrations in deeper groundwater are not being sustained. These contaminants are likely being attenuated by biological and chemical processes.

- Available data indicate that the biological activity occurring primarily from the degradation of buried animal hide waste materials, as well as soils contaminated with aromatic hydrocarbons [benzene and toluene], help produce a reducing environment in groundwater. The abundance of buried animal hide waste at Industri-plex OU-1 significantly contributes to these reducing conditions. In turn, metals, such as arsenic and iron, are being reduced, rendered more soluble, and therefore much more mobile in groundwater. These actions are evidenced by observed groundwater arsenic levels as well as the presence of arsenic in surface water samples collected in the groundwater discharge zones in the HBHA Pond. Also, as discussed below, the reducing conditions assist in the migration of ammonia.

- A fraction of the dissolved arsenic being discharged from groundwater into the HBHA Pond sediments becomes bound to ferric oxides and is effectively removed from the water column and becomes part of the sediment load in the pond. However, a portion of the sediment-bound arsenic is released and migrates through the sediments up into the water column. This arsenic can either be further sequestered from solution or transported downstream. These reactions are dependent upon a fairly stable chemocline that is present at about the mid-water depth.

- The chemocline is the result of the difference in density between oxic surface water and anoxic contaminated groundwater and steady inputs of oxygen, iron, sulfates, and organic carbon. The Halls Brook influent provides steady inputs of oxygen and organic carbon solids, while contaminated groundwater plumes provide steady inputs of iron and sulfates. The relative position of the chemocline fluctuates throughout the year due to seasonal variations in temperature and surface water flow. Below the chemocline in deep surface water, high concentrations of dissolved arsenic (up to 5,043 μg/L), benzene (up to 2,530 μg/L), ammonia (up to 1,270 mg/L) are present in the HBHA Pond. Sudden increases in flows, as seen during storm conditions, mix the water column and destabilize the chemocline thus allowing more arsenic to be "flushed" downstream. However, after such storm events, the chemocline has been shown to be re-established within a period of less than a month.

- Once in the surface water column, as either dissolved or associated with the suspended solid load, arsenic will continue to migrate downstream with the flow of water. Depending on the geochemical and flow conditions, dissolved metals in the water column may adsorb to suspended solids, such as fine grained soil particles or other metal complexes and either settle out and become part of the sediment bed load or be transported within the water column as part of the suspended solid load and be deposited at locations downstream.

- As part of the sediment bed load and depending on the geochemical conditions, metals may dissolve from the sediment particles back into the surface water, whereby the cycle of dissolution and precipitation would continue. This cycling was mostly observed within portions of the HBHA that exhibited significant anoxic/reduced conditions, specifically, within the HBHA Pond. However, this cycling may be occurring at other portions of the HBHA, but likely at a lesser degree than the HBHA Pond due to its geometry and influx of anoxic groundwater.

- Organic compounds in groundwater, such as benzene, discharging into the sediment and deeper portions of the HBHA Pond are generally attenuating to very low concentrations or are not detected in shallow portions of the HBHA Pond surface water. The VOCs in sediments may be biodegraded, partitioned to surface water, or remain bound to the organic matter present in stream sediments. VOCs that enter into surface water can volatilize into the ambient air where they are degraded by photolysis or hydrolysis; they can remain in surface water and undergo degradation processes such as biodegradation, hydrolysis, or reduction-oxidation reactions; or they can become attenuated through dilution, diffusion, and advection. A study conducted by Massachusetts Institute of Technology (MIT) in 2000 concluded that biodegradation at the anoxic/oxic interface was the largest sink for benzene in the HBHA Pond as compared to other fate and transport processes.

- Industri-plex OU-1 has a very large source of organic nitrogen in the form of buried animal hide wastes. As bacteria decompose the waste, some of the nitrogen that was bound up in complex organic molecules can be released to the soil as ammonia. Through leaching processes, the ammonia is converted to ammonium by reacting with water. Ammonia exists in water in two forms: as ammonium ion (NH^{4+}), which is highly soluble, and as ammonia gas (NH_3). In aerobic settings, organic nitrogen may mineralize to ammonium, which plants and microbes can utilize, adsorb to negatively charged particles (e.g., clay), or diffuse to the surface. Ammonium can be absorbed by plants or microbes and incorporated back into the organic matter matrices. It can also become bound to organic soil matrices since the soils have negative charges and the ammonium is positive. However, ammonium is a reduced compound, so if there is no oxygen present, it will not transform or be converted to a more soluble form. Under these reduced conditions, ammonium will be transported conservatively through the aquifer. In the case of Industri-plex OU-2, reduced groundwater conditions have been documented at Industri-plex OU-1 south to Interstate 95 within the Northern Study Area (MSGRP, 2005a). These reduced and anoxic groundwater conditions at Industri-plex OU-2 allow the ammonium to remain in groundwater (up to 2,710 mg/L), migrate with the groundwater flow towards the south, and discharge into the HBHA Pond.

  High concentrations of ammonia, as part of the contaminated groundwater plumes from Industri-plex OU-1, are discharged into HBHA Pond resulting in high concentrations of ammonia in surface water. The presence of the chemocline in the HBHA Pond helps sequester the highest ammonia concentrations at depth (up to 1,762 mg/L) by limiting vertical transport and assisting natural processes available to convert some of the ammonia to nitrates, nitrites, and nitrogen gas. As ammonia migrates to the chemocline, aerobic bacteria can convert the ammonia to nitrite. Through diffusion, the nitrite comes into contact with the more oxygenated zone of the chemocline where it can be partially oxidized to nitrate. Further reductions can also occur through facultative anaerobic bacteria where the nitrate can be reduced to nitrite and nitrogen gas can be released. The shallow surface water (0 – 100 cm) ammonia concentrations were elevated up to 31.1

mg/L. Hence, as described earlier, the chemocline within the HBHA Pond helps keep high concentrations of contaminants, including ammonia, below the chemocline in deeper surface water.

Elevated ammonia concentrations ranging from 10.0 to 12.7 mg/L in upgradient surface water tributaries (East Drainage Ditch, Landfill Creek, and New Boston Street Drainway) also contribute to elevated ammonia surface water concentrations at the outlet of Halls Brook prior to its discharge into HBHA Pond and shallow surface water in HBHA Pond. Halls Brook, upgradient of its confluence with these tributaries, did not exhibit detectable surface water ammonia concentrations and serves to dilute ammonia surface water concentrations from these upgradient tributaries. In addition, elevated levels of ammonia were detected at the NSTAR (formerly Boston Edison Company (BECO)) right-of-way culvert discharging into the HBHA Pond. These elevated levels of ammonia also contribute to ammonia concentrations in shallow surface water in HBHA Pond. However, the contribution of ammonia from these surface water discharges is much less significant than the ammonia concentrations in deep surface water of the HBHA Pond, which originate from the Industri-plex OU-1 contaminated groundwater plumes discharging into the pond.

- Due to its proximity to the Lower South Pond and wetlands, groundwater along the eastern edge of the West Hide Pile, where another source of benzene was detected, is likely discharging to the surface water of the adjacent pond and wetland areas as evidenced by the absence of benzene in groundwater samples downgradient of the West Hide Pile. In addition, similar to groundwater conditions at other areas of Industri-plex OU-1 with buried animal waste materials, the groundwater conditions at the West Hide Pile and possibly the East Hide Pile (see Figure J-4), likely produce elevated levels of ammonia and arsenic in groundwater as evidenced by groundwater sampling location A02-1 at the West Hide Pile which contained elevated ammonia and arsenic concentrations of 79.3 mg/L (October 2005 Technical Memorandum, Appendix A) and 362 ug/L (March 2005 MSGRP RI Report, Appendix 2D), respectively. Once discharged to the sediments and surface water, the benzene is likely being attenuated by biodegradation, chemical degradation, volatilization, and dispersion as seen in the HBHA Pond. No sediment or surface water data were collected in this area to evaluate potential groundwater impacts on the adjacent wetlands. Additional pre-design investigations will be carried out to determine these potential impacts, prior to implementing the West Hide Pile groundwater component of the selected remedy (i.e., In-situ Enhanced Bioremediation).

- Surface water data collected from Halls Brook indicate that during storm events, slightly elevated concentrations of chromium and lead are also flowing into the HBHA Pond. However, only lead exceeded its NRWQC CCC (i.e., chronic) criterion (2.5 μg/L) during both storm event and baseflow conditions. The source for this contamination is likely the New Boston Street Drainway and the East Drainage Ditch based on surface water quality samples collected during construction of the Industri-plex OU-1 remedy and sediment data collected during this investigation. Historically, Olin Chemical Corporation (Olin) has been identified as a source of ammonia, chromium, and N-nitrosodimethylamine (NDMA) in groundwater and chromium in sediments and soils. The Olin site is a potential source of chromium contamination in sediments and ammonia in surface water along the East Drainage Ditch, a small tributary to Halls Brook.

- Based on the surface water data, surface water clearly is the transport mechanism that is facilitating the transport of arsenic (and other metals) through the river system downstream of Industri-plex OU-1. This fate and transport mechanism is demonstrated by the baseflow and stormflow surface water sample data collected during the 18-month investigation and is also evidenced by sediment data collected throughout the Aberjona River. Based on these data, the highest concentrations of arsenic are within Industri-plex OU-2 and steadily decrease as the river flows south to the Mystic Lakes. The highest concentrations of arsenic at Industri-plex OU-2 were found at the HBHA with the highest storm flow concentrations observed at HBHA Pond outlet (MSGRP RI surface water Station 2) and highest baseflow observed at HBHA Wetland outlet (MSGRP RI surface water Station 4). Concentrations of arsenic and other metals in surface water at the furthest downstream monitoring stations, located at the Mystic Lakes, show further reductions in metals concentrations, as well as TSS concentrations, during both baseflow and stormflow conditions.

Conceptual Site Model

The Conceptual Site Model (CSM) for soil, groundwater, sediments, and surface water at Industri-plex OU-2 is provided in Figure E-2. The CSM is a three-dimensional "picture" of Industri-plex OU-2 conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future Industri-plex OU-2 conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response action for the soil, groundwater, sediments, and surface water at Industri-plex OU-2 is based on this CSM.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Various types of land use are found at Industri-plex OU-2. Predominant physical features include highways, streets, paved areas, commercial and industrial properties, and open space. Residential properties are found adjacent to and in surrounding areas in close proximity to the Southern Study Area. Significant development has occurred throughout the MSGRP RI Study

Area. Development and land use in the Northern and the Southern Study Areas are discussed briefly below and in greater detail in the MSGRP RI.

1. Land Use

Current land use in Woburn is mixed, including residential, industrial, and commercial uses, with the majority of the area, including nearly all land immediately surrounding Industri-plex OU-1, developed for industrial and commercial use. Portions of the developed areas not covered by paving or buildings are landscaped and maintained. Land use in areas immediately surrounding the Aberjona River and associated floodplains and wetlands is highly urbanized and includes residential, business, light commercial, and industrial areas. Land abutting the Cranberry Bog Conservation Area and other downstream areas (e.g., Davidson Park) of the Southern Study Area are residential.

Based on a review of "The Directory of New England Manufacturers", the types of manufacturers or businesses that are located in Woburn include:

- Food and Kindred Products
- Apparel and Textile Products (made from fabrics)
- Lumber and Wood Products (excluding furniture)
- Furniture and Fixtures
- Printing, Publishing, and Allied Industries
- Chemicals and Allied Products
- Rubber and Miscellaneous Plastic Products
- Stone, Clay, Glass, and Concrete Products
- Fabricated Metal Products (except machinery and transportation equipment)
- Machinery (except electrical)
- Electrical and Electronic (machinery, equipment, and surplus)
- Transportation Equipment
- Measuring, Analyzing, and Controlling Instruments
- Miscellaneous Manufacturing Industries
- Wholesale Trade - Durable Goods
- Business Services
- Miscellaneous Repair Services
- Engineering Research Management and Related Services

One municipal sanitary landfill, the Woburn Sanitary Landfill, is located within the Northern Study Area. The landfill, a 54-acre solid waste disposal area, officially ceased operating in June 1986. Construction of the landfill cap was completed in 2003. In addition, a regional transportation facility, known as the Anderson Regional Transportation Center (RTC), centered around a commuter rail station and bus transport system is located on Industri-plex OU-1.

The Aberjona River is classified by the MassDEP as a Class B river. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated, Class B waters can be used as a source of public water supply with appropriate treatment. Class B waters are considered suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. The current use of the Aberjona River and its associated wetlands and ponds (including the HBHA and HBHA wetlands) is for recreation. Recreational activities noted as occurring within these surface water bodies are primarily fishing and wading, with swimming occurring at one designated beach area (i.e., Sandy Beach) in Winchester. The river frequently floods low-lying floodplain areas associated with the MSGRP RI Study Area. It is unknown if the Aberjona River is used for industrial purposes such as cooling water or process use.

It is reasonably anticipated that future land use in the Northern Study Area will remain the same as defined by the current zoning laws (i.e., industrial and commercial use). Although recently closed, a child day care center that previously operated in the Northern Study Area indicates that this is a potential future use. In 1997, an "open space" designation was added to the Woburn zoning ordinance. The only significant parcels of land designated as "open space" within the MSGRP RI Study Area are a portion of the HBHA, a portion of the Wells G&H Wetland, and the Cranberry Bog Conservation Area. Future land use in the Southern Study Area is under evaluation by the City of Woburn. Although the most recent version of the City of Woburn's draft redevelopment plan released in February 2005 did not include future reuse plans for the interior wetlands at the Wells G&H site, the City of Woburn has historically had discussions and planning meetings regarding the construction of walking trails adjacent to the Wells G&H wetland. Although this is not a significant deviation from its current use, it would provide increased accessibility to contaminated areas if these walking trails are constructed. It should also be noted that as part of future flood mitigation measures, increased surface water storage capacity may occur within the watershed.

2. Groundwater Classification and Use

MassDEP Bureau of Waste Site Cleanup has developed a groundwater classification system for use in risk characterization at disposal sites. The three classes of groundwater (GW-1, GW-2 and GW-3) and contaminant criteria applying to each classification are established in the state's Massachusetts Contingency Plan (MCP). Groundwater is classified as GW-1 if it is located within a current or potential drinking water source area. The GW-2 classification applies to areas where there is the potential for migration of vapors from the groundwater to the air inside occupied structures and specifically applies to groundwater located within a 30-foot radius of an existing occupied building or structure, where the average annual depth to groundwater in the area is 15 feet or less. The GW-3 classification applies to groundwater that may impact surface water. All groundwater is considered a potential source of discharge to surface water and therefore is, at a minimum, categorized as GW-3 (310 CMR 40.0932).

The groundwater classifications for the MSGRP RI Study Area were identified by MassDEP and documented in their "Groundwater Use and Value Determinations" for the Industri-plex and Wells G&H sites (see below) at the request of EPA. The Use and Value Determinations were used by EPA in developing and evaluating site-specific risk assessment scenarios.

Overall, the purpose of the Use and Value Determination is to identify whether the aquifer at the Site should be considered a "high," "medium," or "low" use and value aquifer based on the balancing of eight factors:

- quantity or potential yield of the aquifer
- quality of the water within the aquifer
- if the aquifer is a current public drinking water supply
- if the aquifer is a current private drinking water supply
- likelihood and identification of future drinking water use
- other current or reasonable expected groundwater uses
- ecological value
- public opinion

<u>Groundwater Use and Value Determination for the Industri-plex Site (Industri-plex OU-1 south to Interstate 95):</u>

The MassDEP "Groundwater Use and Value Determination" for the Industri-plex Superfund Site (MassDEP, 1997 and 2004) concluded that the aquifer at Industri-plex OU-1 south to Interstate 95 within the Northern Study Area was of low use and value (see Figure F-1). MassDEP's Use and Value Determinations have been included as an Appendix C to this ROD.

The Industri-plex area aquifer was classified by MassDEP as a Non-Potential Drinking Water Source Area (NPDWSA) and of low use and value despite the presence of the two potential GW-1 areas (Phillip's Pond and south of the easternmost extension of the NSTAR [formerly BECO] right-of-way) because commercial development and other factors make it unlikely that public drinking water facilities would be developed in the areas.

Due to its designation as a low use and value NPDWSA, the MassDEP concluded that for the purposes of the risk assessment, the groundwater in the Industri-plex area is classified as GW-2 and GW-3. The GW-2 classification applies to any areas where there are occupied structures and the average depth to groundwater is 15 feet or less. At a minimum, the GW-3 classification applies to the entire Northern Study Area. The installation of commercial wells may be associated with non-potable groundwater uses such as irrigation, process water use, and the use of groundwater in a public car wash. Shallow groundwater throughout the Northern Study Area may also be exposed during construction and utility-related excavations.

As indicated in the section below, the edge of the Interim Wellhead Protection Area (IWPA) for Woburn municipal wells G&H is at Interstate 95, the southern boundary of the Northern Study Area. Although the wells are inactive, they are still considered a public water supply and the MCP requires that groundwater flowing into an IWPA must meet drinking water standards. Therefore, although the Northern Study Area groundwater is classified as GW-2 and GW-3, the groundwater at its southern border must meet GW-1 standards before entering the Wells G&H IWPA.

Groundwater Use and Value Determination for the Wells G&H Site:

The MassDEP "Groundwater Use and Value Determination" for the Wells G&H Superfund Site concluded the aquifer in the area of the Wells G&H Site (e.g., the Central Area Aquifer) is of medium use and value. Nearly the entire Wells G&H Site, including the wetlands, lies within the IWPA of municipal wells G&H. Although the wells are inactive, they are still considered a public water supply (see Figure F-2). MassDEP's Use and Value Determinations have been included as an Appendix C to this ROD.

Because the Wells G&H aquifer is within the IWPA and because it is a medium and high yield aquifer, the aquifer is classified under the MCP as a GW-1 area. The 0.5-mile radius of the IWPA takes precedence over areas excluded as non-drinking water source areas under the MCP; therefore, regardless of other designations the whole area within the IWPA is considered a current drinking water source area. Due to the development in the area, the GW-2 classification also potentially applies to areas where there is the potential migration of vapors from groundwater to occupied buildings. Lastly, all groundwater within the Commonwealth is, at a minimum, considered GW-3 which considers the ecological and human health impacts of groundwater discharge to surface water. The aquifer discharges into the Aberjona River and wetlands and must meet all applicable standards. Baseline risk assessment exposures scenarios should consider the above classifications. Groundwater within the Central Area (OU-2) of the Wells G&H Superfund Site is scheduled for comprehensive evaluation by EPA.

Groundwater Users

Based on the information available, there are no current groundwater users within the zone of influence of the contaminant plumes at the Industri-plex Site. The following section provides information on the current groundwater users within the City of Woburn, some of which may be recharged by the Aberjona River, as well as significant historical use.

The City of Woburn has historically withdrawn groundwater from the Horn Pond and Aberjona

River aquifers for its municipal water supply. Production wells installed near Horn Pond have been used since 1931. Production wells G and H were installed in 1964 and 1967, respectively, and used until 1979, when they were closed due to VOC contamination. Since these two wells were shut down in 1979, Woburn has received approximately 60 percent of its water supply from the Horn Pond wells and the remainder from the Massachusetts Water Resource Authority (MWRA). The City of Woburn has the only registered potential groundwater supply source in the study area, and is registered for a total water withdrawal of up to 4.2 million gallons per day (mgd) for use city-wide. The average water withdrawal from the Horn Pond wells is 3.7 mgd.

Groundwater wells used for irrigation, industrial processes, and monitoring exist throughout the MSGRP RI Study Area. Generally, it is assumed that these wells do not consistently withdraw a significant amount of groundwater, and therefore are not expected to have an influence on area-wide groundwater flow direction. However, the Atlantic Gelatin (Kraft Foods) industrial production wells have historically withdrawn significant amounts of groundwater from the Southern Study Area. Atlantic Gelatin has installed and operated a total of seven production wells; three are currently in operation. Presently, the total permitted withdrawal rate is 1 mgd. Approximately 800,000 gallons per day are withdrawn from Atlantic Gelatin wells located in Winchester, adjacent to the Aberjona River. The balance of approximately 200,000 gallons per day is withdrawn from Well No. 7, located in Woburn, near Whittemore Pond. Other historical users of groundwater for industrial process water have included the John J. Riley Leather Company, Johnson Brother's Roses, Independent Tallow, and Stauffer Chemical Company in Woburn; also J.O. Whitten and Parkview Apartments in Winchester (CDM, 1967). One of the two Riley tannery production wells was reported to yield 750 gpm and the Stauffer Chemical Company well(s) reportedly yielded 1 mgd.

G. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with Industri-plex OU-2 assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The public health risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of Industri-plex OU-2, were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the MSGRP RI Study Area, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates.

Separate baseline risk assessments were completed for the Northern Study Area (Appendix 6 of the MSGRP RI) and the Southern Study Area (2004 Wells G&H OU-3 Aberjona River Study) to determine whether contaminated media (surface water, sediment, sediment cores, fish, soil, groundwater, and soil gas) pose risks to human and ecological receptors. These risk assessments were combined and evaluated as part of a comprehensive risk evaluation to support the MSGRP RI. In addition, a supplemental risk evaluation was performed as part of the October 2005 Technical Memorandum. The sampling locations/stations (e.g. WH, CB-03, SC-02, etc.) described below are illustrated in the MSGRP RI and, where appropriate, the October 2005 Technical Memorandum.

A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below followed by a summary of the environmental risk assessment.

1. Human Health Risk Assessment

Fifty-nine of the more than 125 chemicals detected at the MSGRP RI Study Area were selected for evaluation in the human health risk assessment as chemicals of potential concern. The chemicals of potential concern were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Tables 3-2.1 through 3-2.8 of the Southern Study Area risk assessment, Tables 2.1 through 2.13 of the Northern Study Area risk assessment, and in Appendices C.1 (Tables 2.1 through 2.3) and C.3 (Table 1) of the October 2005 Technical Memorandum. From this, a subset of the chemicals were identified in the MSGRP FS as presenting a significant current or future risk and are referred to as the chemicals of concern in this ROD and summarized in Tables G-1 through G-7 for sediment, sediment cores, surface soil, subsurface soil, and groundwater (shallow and all depths combined). These tables contain the exposure point concentrations used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment for the chemicals of concern. Estimates of average or central tendency exposure concentrations for the chemicals of concern and all chemicals of potential concern can be found in Tables 3-3.1 through 3-3.9 of the Southern Study Area risk assessment and Tables 3.1 through 3.11 of the Northern Study Area risk assessment.

Potential human health effects associated with exposure to the chemicals of potential concern were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of Industri-plex OU-2.

Exposure Assessment

Industri-plex OU-2 includes portions of Industri-plex OU-1 in Woburn, the HBHA Pond and HBHA wetland, and the Aberjona River and associated floodplain areas and wetlands between Industri-plex OU-1 and the Cranberry Bog Conservation Area. The Aberjona River flows through the Wells G&H Superfund Site, portions of which are included within Industri-plex OU-2. Interstate 95 crosses Industri-plex OU-2, east to west, and divides Industri-plex OU-2 into Northern and Southern Study Areas. A railroad right-of-way runs along the western boundary of Industri-plex OU-2. Land use in the vicinity of the Northern Study Area is commercial/industrial, while land use in the vicinity of the Southern Study Area is a mixture of commercial, industrial, recreational, and residential properties. There is a high likelihood that commercial/industrial use of the Northern Study Area will continue. The reuse of the Southern Study Area, as indicated by the City, will most likely be recreational. Also refer to Sections E and F of the ROD for more detailed descriptions of Industri-plex OU-2 features and land use.

The Northern Study Area and the surrounding area are served by a municipal drinking water sources that are not affected by Industri-plex OU-1. The municipal drinking water sources include Horn Pond aquifer situated in west Woburn, and Quabbin Reservoir situated in central Massachusetts. The aquifer within the Northern Study Area is classified by the State as both GW-2 (areas where there is a potential for migration of vapors to occupied structures) and GW-3 (considers impacts associated with the discharge of groundwater to surface water).

Groundwater within the Southern Study Area is scheduled for comprehensive evaluation by EPA as part of the Wells G&H Central Area Aquifer investigations and was not evaluated as part of the MSGRP RI. However, an evaluation was performed on the potential impact of river contamination on groundwater in the Wells G&H Central Area Aquifer, which concluded that arsenic in the river and wetland sediments and surface water would not adversely affect the development of large-capacity potable water supply wells in the Wells G&H Central Area Aquifer (see MSGRP RI, Appendix 5A). This conclusion was based on historical water quality data from municipal Wells G and H; information regarding the hydrologic relationship between the aquifer, the river and the wetlands; geochemical conditions existing in the aquifer; recent water quality data from the sampling of various monitoring wells and surface water stations during related investigations; and known and postulated geochemical behavior of the contaminants and associated metals, notably iron and manganese. These results suggest that arsenic in the river and sediments is unlikely to migrate to drinking water supply well(s) above its current drinking water standard (i.e. Maximum Contaminant Level (MCL) of 10 μg/L)).

The following is a brief summary of the exposure pathways that were found to present a significant risk. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 3.3 and on Tables 3.4.1 through 3.4.11 of the Southern Study Area risk assessment, in Section 3 and on

Tables 4.1 through 4.11 of the Northern Study Area risk assessment, and in Section 4 of the October 2005 Technical Memorandum. The following current exposure pathways were found to present a significant risk:

- Recreational user (adult and young child) with exposure to sediment (by ingestion and dermal contact) at Stations WH and CB-03 within the Southern Study Area.[1]

The following exposure pathways were found to present a potential significant risk in the future:

- Recreational user (adult and young child) with exposure to sediment (by ingestion and dermal contact) at Stations 13/TT-27, WH, NT-3, and CB-03 within the Southern Study Area.[2]
- Worker with exposure to sediment (by ingestion and dermal contact while dredging) at sediment core locations SC02, SC05, SC06, and SC08;[3]
- Child with exposure to surface and subsurface soil (by ingestion and dermal contact in a day care setting) within the former Mishawum Lake bed area of the Northern Study Area;[4]
- Construction worker with exposure to subsurface soil (by ingestion and dermal contact) within the former Mishawum Lake bed area and to shallow groundwater (by dermal contact) within the Northern Study Area;[5]
- Industrial worker (adult) with exposure to groundwater used as process water (by ingestion, dermal contact, and inhalation of volatile compounds released to the air during

[1] For current recreational sediment exposures, ingestion of 100 mg/day for 24 years was presumed for an adult. For a young child (age 1 to 6), ingestion of 200 mg/day for 6 years was presumed. Dermal contact was assumed with 5,700 cm^2 of surface area for the adult and 2,800 cm^2 for the child. Current sediment exposures at Stations CB-04 and WH were assumed to occur 104 days/year and 26 days/year, respectively.

[2] For future recreational sediment exposures, the ingestion rates, exposure durations, and surface areas were consistent with those used for current exposures. Future sediment exposures at Station CB-04 were assumed to occur 104 days/year. Future exposures at Stations 13/TT-27, WH, and NT-3 were assumed to occur 78 days/year.

[3] For the worker, exposures were presumed to occur 167 days/year for 2 years during dreding. Sediment ingestion exposures were evaluated using an ingestion rate of 200 mg/day. Dermal contact was assumed with 3,300 cm^2 of surface area.

[4] For child exposures, the ingestion rate, exposure duration, and surface area were consistent with those used for young child sediment exposures in a day care setting. Future day care child exposures were assumed to occur 150 days/year.

[5] For contaminated groundwater, ingestion of 50 mL/day, 125 days/year for 1 year was presumed for a construction worker. Dermal contact was assumed with 3,300 cm^2 of surface area. Soil exposures were evaluated using soil ingestion rate of 200 mg/day.

use) within the Northern Study Area;[6] and

- Car wash worker (adult) with exposure to groundwater used in a warm-water car wash (by inhalation of volatile compounds released to the air during use) within the Northern Study Area.[7]

Volatilization and dispersion models were used to estimate the levels of contaminants released from groundwater to air during process water use and the use of groundwater in a car wash. The Toxchem+ Model was used to model off-gassing of volatile compounds during industrial water usage as process water. The proportional extrapolation of the Foster & Chrostowski Shower Model was used to estimate airborne volatile compound levels inside a warm water car wash.

Toxicity Assessment

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level by the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} or 1E-06 for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" which is the risk in addition to the background cancer risk experienced by all individuals. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Table G-8.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are

[6] For contaminated groundwater, ingestion of 50 mL/day, 250 days/year for 25 years was presumed for an industrial worker. Dermal contact was assumed with 3,300 cm^2 of surface area. Inhalation of vapors released from groundwater was assumed to occur 8 hours/day. Airborne concentrations of volatile compounds were estimated using the Toxchem+ software package.

[7] For contaminated groundwater, inhalation of vapors released from groundwater for 8 hours/day, 250 days/year for 25 years was presumed for a car wash worker. Airborne concentrations of volatile compounds were estimated using a proportional extrapolation of the Foster & Chrostowski Shower Model.

derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ $\leq$ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic non-carcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI $\leq$ 1 indicates that toxic non-carcinogenic effects are unlikely. A summary of the non-carcinogenic toxicity data relevant to the chemicals of concern is presented in Table G-9.

A site-specific sediment arsenic bioavailability study was conducted to more accurately determine the degree to which arsenic is absorbed from sediments following incidental ingestion. The site-specific oral bioavailability estimate was applied to the oral cancer slope factor and oral reference dose to derive site-specific toxicity values applicable to the sediment incidental ingestion pathway only (Tables G-8 and G-9).

Risk Characterization

The following is a summary of the media and exposure pathways that were found to present a significant risk exceeding EPA's cancer risk range and/or non-cancer threshold. Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to Section 3.5 and Tables 3.9.1 through 3.9.104 of the Southern Study Area risk assessment, Section 5 and Tables 9.1 through 9.39 of the Northern Study Area risk assessment, and Section 4 and Appendix C of the October 2005 Technical Memorandum for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

Recreational User – Current and Future

Tables G-10 through G-12 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in sediment evaluated to reflect current and potential future recreational exposure corresponding to the RME scenario. For the current and future young child and adult recreational user, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and HI of 1. The exceedances were due to the presence of arsenic in sediment for both the current (Stations WH and CB-03) and future (Stations 13/TT-27, WH. NT-3, and CB-03) scenarios. Benzo(a)pyrene was also a future risk contributor for Stations 13/TT-27 and WH.

Dredging Worker - Future

Table G-13 depicts the non-carcinogenic risk summary for the chemicals of concern in sediment cores evaluated to reflect potential future exposure for a dredging worker corresponding to the

RME scenario. For the dredging worker, non-carcinogenic risks exceeded the EPA target organ HI of 1. The exceedances were due primarily to the presence of arsenic in sediment cores SC02, SC05, SC06, and SC08.

Day Care Child - Future

Tables G-14 and G-15 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in surface and subsurface soil evaluated to reflect potential future exposure for a child in day care corresponding to the RME scenario. For the day care child, carcinogenic and non-carcinogenic risks for subsurface soil exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and HI of 1. For surface soil, non-carcinogenic risks exceeded the EPA HI of 1. The exceedances were due primarily to the presence of arsenic in surface and subsurface soil. However, carcinogenic risk for surface soil was within the EPA acceptable range of 10^{-4} to 10^{-6}.

Construction Worker - Future

Table G-16 depicts the non-carcinogenic risk summary for the chemicals of concern in subsurface soil and shallow groundwater evaluated to reflect potential future exposure for a construction worker corresponding to the RME scenario. For the construction worker, non-carcinogenic risks exceeded the EPA target organ HI of 1. The exceedance was due primarily to the presence of arsenic in subsurface soil and shallow groundwater.

Industrial Worker - Future

Tables G-17 and G-18, respectively, depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in groundwater evaluated to reflect potential future exposure for an industrial worker corresponding to the RME scenario. For the industrial worker using groundwater as process water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and HI of 1. The exceedances were due primarily to the presence of 1,2-dichloroethane, benzene, trichloroethene, naphthalene, and arsenic in groundwater.

Car Wash Worker - Future

Tables G-19 and G-20 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in groundwater evaluated to reflect potential future exposure for a car wash worker corresponding to the RME scenario. For the worker using groundwater in a car wash, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and HI of 1. The exceedances were due primarily to the presence of 1,2-dichloroethane, ammonia, benzene, trichloroethene, and naphthalene in groundwater. Toluene in groundwater was not identified as contributing an unacceptable human health risk under these scenarios described above.

Even though low-flow sampling techniques were used to collect Northern Study Area groundwater samples, a number of monitoring wells could not be stabilized prior to the collection of groundwater samples. These samples may have contained elevated levels of suspended particulate materials, possibly resulting in an overestimate of the bioavailable contaminant levels in the samples and risk associated with the samples.

For the groundwater dermal contact pathways, risk associated with dermal absorption could not be quantified for all contaminants. Data needed to predict dermal absorption is insufficient for some compounds including pentachlorophenol. This uncertainty may result in an underestimation of carcinogenic risk. This uncertainty will be periodically reviewed and the models updated to address changes in the dermal absorption values during the five-year reviews.

Airborne concentrations of volatile compounds for the process water and car wash scenarios were estimated through the use of volatilization and dispersion models. Parameter values used in these models were selected to represent reasonable maximum exposures that may occur in the future during process water and car wash water usage. The risk associated with future groundwater use may be less than estimated should groundwater uses that result in a lesser degree of worker exposure be considered.

The City of Woburn's February 2005 draft redevelopment plan no longer includes the construction of a boardwalk (Station NT-1) or pier (Station NT-2) into the Wells G&H Wetland. Therefore, the risks and hazards identified for these two stations were not considered further in the ROD. Decisions concerning Stations NT-1 and NT-2 will be further reviewed when the redevelopment plan is finalized, if necessary, as part of the five-year review process.

2. Ecological Risk Assessment

The Comprehensive Ecological Risk Assessment (Chapter 7 of the MSGRP RI) presents a discussion of comprehensive risk results and associated uncertainties applicable to the river as a whole. The Comprehensive Ecological Risk Assessment is based on separate baseline risk assessments completed for the Northern Study Area and the Southern Study Area, and on the risk evaluation completed for the October 2005 Technical Memorandum to determine whether contaminated media (surface water, sediment, soil, and biota) pose risks to ecological receptors. The comprehensive risk assessment provided a refinement of risks, an evaluation of the ecological significance of risks, and determination of unacceptable ecological risks to ecological receptors.

Identification of Chemicals of Concern

Contaminants of potential concern (COPCs) were identified using an effects-based screening comparing the maximum contaminant concentrations to ecological benchmarks for each medium and within each exposure area. The COPCs were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, mobility, and persistence in the environment. Summaries of the initial screening for sediment, soil, and surface water can be found in Tables 4-1 through 4-3, Table E.4-14 (Appendix E), and Table 4-16 of the Southern Study Area risk assessment (M&E, 2004) and Tables 1, 3, and 6 of the Northern Study Area risk assessment. Screening of ammonia in surface water can be found in Tables 4.1 and Appendix D of the October 2005 Technical Memorandum.

Surface water

Data used to identify COPCs in surface water are summarized in Tables G-21 and G-22. Selection of surface water COPCs was initially conducted with a limited data set and subsequently revised based on additional data collection (Aberjona River Study, Appendix E). The inorganic COPCs barium, cadmium, copper, iron, lead, manganese, and silver were initially identified at concentrations above screening values (Table G-21). The additional COPC screening (Table G-22) identified the inorganics barium, cadmium, cobalt, iron, manganese, silver, and zinc as exceeding surface water benchmarks. SVOCs were infrequently detected and represent a low risk to receptors in surface water. Surface water screening indicated a possible risk from exposure to benzene in HBHA Pond. Additional data collected as part of a Natural Attenuation Study (Ford, 2004; Ford, 2005) documented elevated concentrations of benzene and dissolved arsenic at depth in the HBHA Pond in April 2000 and 2001 and September 2004 (maxima of 2,530 μg/L and 5,043 μg/L, respectively). Elevated ammonia in surface water (maximum of 2,110 mg N/L) was also documented in HBHA Pond in the October 2005 Technical Memorandum.

Sediment

Data used to identify COPCs in sediment are summarized in Tables G-23 and G-24. In the Northern and Southern Study Areas respectively, fifty-two and fifty-eight chemicals detected in sediment were selected as COPCs due to exceedances of screening benchmark values or a lack of a screening benchmark value (VOCs, SVOCs, pesticides/PCBs, and inorganics).

Soil

In soils, beryllium, cobalt, and nickel were below screening values. The remaining 17 inorganics were above screening values and were retained as COPCs in soils (Table G-25). Separate samples to represent soils in terrestrial habitats were not collected in the Southern Study Area.

Instead, it was assumed that animals inhabiting the drier areas of the Aberjona River floodplain may also be exposed to COPCs in surficial sediment (*i.e.*, wetland soil during drier periods). Therefore, COPCs selected in sediment screening were used to evaluate receptor exposure to wetland soils in the Southern Study Area.

Exposure Assessment

The Site is located within the Aberjona River Watershed. The Aberjona River is the primary river system in the Aberjona River basin. The river flows through Woburn and Winchester, terminating in Winchester where it discharges into the Mystic Lakes. The primary habitats evaluated at the Site were the river, associated wetlands, and adjacent riparian habitats.

The most significant water bodies located at the MSGRP RI Study Area include: Halls Brook, HBHA and the Aberjona River. Within the Northern Study area, with the exception of Halls Brook, all of the water bodies were either modified or created for flood storage capacity during development of the area. Wetland areas adjacent to the Aberjona River are scattered throughout the MSGRP RI Study Area. The most significant wetland areas include the Wells G&H Wetland and the Cranberry Bog Conservation Area Wetland. The most significant downstream water bodies include the Upper and Lower Mystic Lakes, where the Aberjona River discharges.

The major exposure routes for the ecological receptors were through direct exposure to COPCs in sediment and surface water and through ingestion of contaminants through dietary exposures. In addition, risks to riparian species potentially exposed to COPCs in soils were evaluated. Terrestrial receptors may accumulate COPCs through consumption of contaminated prey and incidental soil ingestion. Aquatic and semi-aquatic receptors may be exposed to COPCs through ingestion of contaminated prey, sediment, and surface water. Exposure pathways, assessment endpoints, and measurement endpoints are summarized in Table G-26.

Receptor species were selected for exposure evaluation to represent various components of the food chain in the river/wetland ecosystem, and included: muskrat, green heron, mallard, short-tailed shrew, benthic invertebrates, and several species of warm water fish. In addition, in the Northern Study Area, a piscivorous mammal, the river otter, was also evaluated. There are no threatened or endangered species known to live within the MSGRP RI Study Area.

The exposure of surface water aquatic receptors was evaluated by a comparison of measured concentrations in each habitat area to surface water quality benchmarks. In addition, exposures of fish were evaluated through the comparison of tissue COPC concentrations of fish collected within the MSGRP RI Study Area to reference locations and tissue residue benchmarks.

The exposure of sediment-dwelling organisms (benthic invertebrates) to sediment COPCs was evaluated by a comparison of measured sediment concentrations to sediment quality benchmarks.

In addition, exposures of sediment invertebrates were evaluated through the comparison of tissue COPC concentrations of invertebrates collected within the MSGRP RI Study Area to reference locations.

To assist in exposure estimation for the wildlife indicator species (muskrat, otter, heron, mallard, and shrew), fish, invertebrates, and plants were collected from the MSGRP RI Study Area and analyzed to provide site-specific estimates of concentrations of food items used in the dietary exposure models. Exposure assumptions and exposure point concentrations for the wildlife models are presented in Appendix 7C of the MSGRP RI for the Northern Study Area and Tables 4-28 to 4-31 and Appendix E.1 for the Southern Study Area.

Ecological Effects Assessment

The potential effects of contaminant exposure on fish populations were evaluated through analysis of fish tissue COPC concentrations. In addition, population studies were conducted in order to document the fish community structure at HBHA Pond and HBHA Wetland Pond No. 3 as compared to two reference ponds.

The effect of sediment contaminants on sediment-dwelling benthic invertebrates was the subject of extensive analysis, including toxicity testing, invertebrate tissue analyses, and benthic invertebrate community studies. Data were used to evaluate the relationship of sediment contaminant concentrations, benthic invertebrate toxicity testing results, and benthic community composition data.

Estimates of dietary exposures for wildlife were quantified for each of the selected receptor species. Dietary exposure models were used to estimate exposure of each receptor species to each of the COPCs identified in the screening of sediment, surface water, and soil data (as applicable). The dietary doses were compared to mammalian and avian toxicity reference values (TRVs) obtained from the literature for each COPC.

Risk Characterization

The risks identified for each receptor were reviewed with consideration of the level of the risk to the population or community, the uncertainty associated with the analysis, and the amount and quality of the affected resource. The results were interpreted further within the context of the magnitude of the effect, the uncertainty of the estimates, and the ecological significance of the effect (Chapter 7 of the MSGRP RI). Summaries of estimated risks are presented for each receptor species or community in Table G-27.

Each endpoint has associated with it a magnitude of risk and a degree of uncertainty. The magnitude of risk incorporates both the degree to which the endpoint was exceeded and also the proportion of the habitat affected. Since the endpoints were population-based, a reasonable probability of risk was determined to be present only when a risk was present throughout the majority of the organism's habitat. The ecological significance related to each receptor/endpoint was evaluated in terms of factors defined by EPA. An evaluation of these factors is used to clarify if risks associated with contamination are present at levels that represent unacceptable ecological risk. Each of the six categories evaluated in Table G-27 were used to support a conclusion about the ecological significance of each endpoint where risk was identified. The magnitude of the potential risk was further considered when evaluating the significance of each factor.

Surface water data collected from the HBHA Pond as part of a Natural Attenuation Study (Ford, 2004) indicated elevated concentrations of dissolved arsenic in the deep water of the HBHA Pond. These values, up to 5,043 $\mu g/L$, greatly exceed the acute NRWQC. EPA (Ford, 2004) data indicate that these elevated values are most likely associated with sediment dissolution of arsenic to the over-lying water column. The concentration of benzene in the deep water of HBHA Pond also exceeded surface water benchmarks and there were exceedances of acute and chronic NRWQC in surface water of HBHA Pond. Additional data and risk evaluation completed for the October 2005 Technical Memorandum documented numerous exceedances of the NRWQC for ammonia throughout the HBHA Pond. The elevated concentrations of benzene, ammonia, and arsenic in the surface water of HBHA Pond represent a risk to aquatic receptors.

An evaluation of the benthic invertebrate measurement endpoints indicates that there were potential impacts from inorganic contaminants on invertebrate communities. There is evidence of severe toxicity to benthic organisms at the HBHA Pond. The toxicity testing results were highly correlated to sediment arsenic concentrations, particularly when the effect of high iron concentrations was taken into account. The summary of risk (Table G-27) indicates a difference in the magnitude of the risk to benthic invertebrates between the HBHA Pond and the remainder of the MSGRP RI Study Area. In the HBHA Pond, there is a high risk and confidence, based on several supporting lines of evidence, that there is severe toxicity and impairment of benthic communities. In the downgradient areas, the evidence indicates a low magnitude of toxicity, although there was a high correlation of effects with distribution of Site contaminants (primarily arsenic). Since benthic invertebrates provide important functions in aquatic ecosystems, the impact on the benthic community in the HBHA Pond, with severe toxicity and impairment of benthic communities, represents a significant ecological effect. Due to the magnitude of the adverse effect on this receptor community, the impact on the benthic community in the HBHA Pond represents an unacceptable ecological risk.

Based on the dietary modeling, there were negligible risks to green heron from exposure to COPCs. In addition, there were negligible risks to river otter from exposure to COPCs through dietary exposure. The majority of the diet for both green heron and river otter was based on consumption of fish.

Food chain modeling based on site-specific data indicated negligible risk to mallard duck from exposure to COPCs. For mallard, chromium, lead, and mercury posed low risk mainly within the Wells G&H Wetland, resulting from high sediment concentrations of these metals. The likelihood that high concentrations of sediment metals in limited areas of the Wells G&H Wetland will have serious population effects on a species with wide foraging ranges, like mallards, is low. Although habitat of the Wells G&H Wetland is considered to be of relatively high quality and local ecological significance, the low probability of impacts on the receptors result in low ecological significance of the effects on waterfowl. Hence, the impact on the mallard population is not considered an unacceptable ecological risk.

Based on the muskrat models, there is potential risk to muskrat (representative of semi-aquatic mammals) from ingestion of arsenic. These risks have been evaluated in the context of the limitations of the data and the models. Within this context the risk to muskrat exceeds levels potentially associated with harm (growth or reproduction), but the uncertainty associated with these estimates is high. The relatively low magnitude of the risk estimates (HQ values less than 10) and the high uncertainty associated with the models leads to a conclusion of low probability of significant population effects on muskrat. Based on the data collected, the risk assessment does not provide sufficient evidence to conclude that arsenic contamination is causing an adverse effect on muskrat populations that is of sufficient magnitude, severity, and extent that the population will not be maintained in an acceptable state. Hence, the impact on the muskrat population is not considered an unacceptable ecological risk.

The analysis of the selected indicators/endpoints indicates the only area of unacceptable ecological risk is in the HBHA Pond, where the potential risk to aquatic receptors is due to arsenic, benzene, and ammonia in surface water. The potential risk to the benthic invertebrate community is due to inorganic COPCs, especially arsenic.

In addition, evidence suggests that there is high exposure to inorganic COPCs, especially arsenic, for semi-aquatic mammals, bottom feeding fish, and small forage fish in several other areas of the MSGRP RI Study Area. However, in general, EPA has determined the resulting level of ecological risk for these receptors is low and not considered an unacceptable risk. COC concentrations expected to provide adequate protection of ecological receptors in the HBHA Pond are provided in Table G-28.

3. Basis for Response Action

Because the baseline human health and ecological risk assessments revealed that potential exposure to compounds of concern in soil, groundwater, surface water, and sediment via ingestion, dermal contact, and/or inhalation by human or ecological receptors may present an unacceptable human health risk (cancer risk greater than 10^{-4} and noncancer Hazard Index of 1), or unacceptable ecological risk (toxicity or exceedances of NRWQC and benchmarks), actual or threatened releases of hazardous substances from Industri-plex OU-2, if not addressed by implementing the response action selected in this ROD, may present an unacceptable risk to human health or the environment. In order to address these risks, the focus of the remedial action is soil within the former Mishawum Lake bed area, groundwater originating from Industri-plex OU-1, surface water in the HBHA Pond, and sediment within the HBHA Pond, Stations WH, NT-3, 13/TT-27, and CB-03, and sediment core locations SC02, SC05, SC06, and SC08.

H. REMEDIATION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for Industri-plex OU-2 are:

- Within the Northern Study Area from (including) Industri-plex OU-1 to Interstate 95, prevent or mitigate the potential future exposure of workers via ingestion, dermal contact, and/or inhalation to concentrations of arsenic, benzene, ammonia, trichloroethene, 1,2-dichloroethane, and naphthalene in groundwater that may present a human health cancer risk in excess of 10^{-4} and target organ Hazard Index >1, so that the excess cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and the non-cancer Hazard Index does not exceed one.

- Within the Wells G&H Wetland and Cranberry Bog Conservation Area, reduce the current and future potential exposure of recreational adults and children via ingestion and dermal contact to concentrations of arsenic and benzo(a)pyrene in near-shore sediment that may present a human health cancer risk in excess of 10^{-4} and target organ Hazard Index >1, so that the excess cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and the non-cancer Hazard Index does not exceed one.

- Within the HBHA Wetland and Wells G&H Wetland, prevent or mitigate the potential future exposure of workers via ingestion and dermal contact to concentrations of arsenic in deeper (interior) sediment that may present a human health target cancer risk in excess of 10^{-4} and target organ Hazard Index >1, so that the excess cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and the non-cancer Hazard Index does not exceed one.

- Within the Former Mishawum Lake bed area, prevent or mitigate the potential future exposure of workers via ingestion and dermal contact to concentrations of arsenic in subsurface soil that may present a human health cancer risk in excess of 10^{-4} and target organ Hazard Index >1, so that the excess cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and the non-cancer Hazard Index does not exceed one.

- Within the Former Mishawum Lake bed area, prevent the potential future exposure of children via ingestion and dermal contact to concentrations of arsenic in surface and subsurface soil that may present a human health cancer risk in excess of 10^{-4} and target organ Hazard Index >1 such that the cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and the non-cancer Hazard Index does not exceed one.

- Prevent or minimize the exposure of benthic invertebrates and aquatic life to levels of arsenic, benzene, and ammonia in surface water, which are present as a result of groundwater discharge, in excess of applicable or relevant and appropriate requirements (ARARs) or benchmarks for the protection of aquatic life.

- Reduce the exposure of benthic invertebrates to levels of arsenic indicative of impairment in HBHA Pond sediment.

- Provide an alternate habitat to replace the lost wetland functions and values associated with portions of the HBHA Pond used as a component of the remedy.

- Minimize, to the extent practicable, the migration of soluble and particulate arsenic during storm events to downstream depositional areas.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for Industri-plex OU-2.

With respect to source control, the MSGRP RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long-term management. This range also included alternatives that treat the principal threats posed by Industri-plex OU-2 but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

With respect to the groundwater response action, the MSGRP RI/FS developed a limited number of remedial alternatives that attain site-specific remediation levels within different time frames using different technologies; and a no action alternative.

As discussed in Section 2 of the FS, soil, sediment, groundwater, and surface water treatment technology options were identified, assessed and screened based on implementability, effectiveness, and cost. These technologies were combined into source control (SC) and management of migration (MM) alternatives. Section 3 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 4 of the FS.

A total of 72 source control and management of migration remedial alternatives were screened in Section 2 of the FS for all impacted media including soil, groundwater, sediment, and surface water. Forty-four alternatives were retained as possible options for the cleanup of Industri-plex OU-2. From this initial screening, remedial options were combined, and a total of 27 alternatives were selected for detailed analysis. Although the alternatives are media-specific, in most cases, the media and alternatives are inter-related such that one alternative for a particular medium may impact the remedial alternative options for other downgradient media. For example, since contaminated groundwater discharges are responsible for sediment contamination in the HBHA Pond, any sediment alternative would be dependent upon the actions taken to eliminate the groundwater sources of contamination otherwise the sediment remedy could become re-contaminated.

With regard to the groundwater response action, based on site-specific conditions, the FS concluded that it is infeasible to eliminate arsenic groundwater contamination since the primary source of groundwater contamination (i.e., soil) addressed under OU-1 was capped and not removed. This large source area at Industri-plex OU-1, representing over 110 acres and potentially several million cubic yards of soil, will continue to impact groundwater. In addition, EPA has determined that groundwater will not be used in the future as a drinking water source (also refer to Section D of the ROD). As a result, alternatives selected for groundwater focused on management of migration rather than elimination of arsenic groundwater contamination.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of the 27 remedial action alternatives that were retained from the screening conducted in Sections 2 and 3 of the FS and were developed to address the RAOs for the specific media of concern and were based on the environmental setting where the specific medium was located. These areas present unique challenges in addressing the contamination problems and typically require different methods and approaches to meet the RAOs. For example, sediments requiring remediation are located in three distinctly different areas that include: a large open water pond (HBHA Pond); shallow wetland areas where the water depth is generally less than 2 feet deep (near shore sediments of the Wells G&H Wetland and the Cranberry Bog Conservation Area); and buried deep sediments in deeper wetland areas of the river or stream channel in the HBHA Wetland and the Wells G&H Wetland. Remedial alternatives developed for one type of sediment may not be practical or feasible for another.

These 27 alternatives were formulated by combining technologies and general response actions retained following a screening evaluation of 72 technologies for effectiveness, implementability, and cost. Although the alternatives are media-specific, in most-cases, the media and alternatives are inter-related such that one alternative for a particular medium may impact the remedial alternative options for other downgradient media. For example, since contaminated groundwater discharges are responsible for sediment contamination in the HBHA Pond, any sediment alternative would be dependent upon the actions taken to eliminate the groundwater sources of contamination, otherwise the sediment remedy could become re-contaminated. In summary, the alternatives by media are as follows:

<u>Surface Soil (0 to 3 feet below grade) in the former Mishawum Lake bed area (SS)</u>:

- Alternative SS-1: No Action
- Alternative SS-2: Institutional Controls with Monitoring
- Alternative SS-3: Permeable Cover and Monitoring with Institutional Controls
- Alternative SS-4: Excavation and Off-Site Disposal
- Alternative SS-5: Excavation , Treatment, and On-Site Reuse

Subsurface Soil (3 to 15 feet below grade) in the former Mishawum Lake bed area (SUB):

- Alternative SUB-1: No Action
- Alternative SUB-2: Institutional Controls with Monitoring
- Alternative SUB-3: Permeable Cover and Monitoring with Institutional Controls

Groundwater (GW):

- Alternative GW-1: No Action
- Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls
- Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls
- Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls

Halls Brook Holding Area Sediment (HBHA)

- Alternative HBHA-1: No Action
- Alternative HBHA-2: Monitoring
- Alternative HBHA-3: Subaqueous Cap
- Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat
- Alternative HBHA-5: Removal and Off-Site Disposal

Near Shore Sediments (NS)

- Alternative NS-1: No Action
- Alternative NS-2: Institutional Controls
- Alternative NS-3: Monitoring with Institutional Controls
- Alternative NS-4: Removal and Off-Site Disposal

Deep Sediments (DS)

- Alternative DS-1: No Action
- Alternative DS-2: Monitoring with Institutional Controls
- Alternative DS-3: Removal and Off-Site Disposal

Surface Water (SW)

- Alternative SW-1: No Action
- Alternative SW-2: Monitoring
- Alternative SW-3: Monitoring and Providing an Alternate Habitat

The individual detailed analysis of each alternative is provided in Section 4 of the Industri-plex MSGRP FS and in supporting Tables 4-1D through 4-27D. A general description and summary of the major components of each alternative is presented below.

SURFACE SOIL ALTERNATIVES (SS)

Alternative SS-1: No Action

Under this alternative, no remedial technologies would be implemented at Industri-plex OU-2 to reduce arsenic concentrations in surface soils in the former Mishawum lakebed area (see Figure J-1). No degradation of arsenic would be anticipated from naturally occurring processes; therefore no reduction in risks to human health would be achieved. Contaminants would remain at Industri-plex OU-2 above levels that allow for unlimited use and unrestricted exposure, therefore a formal review of Industri-plex OU-2 conditions and risks would need to be performed at least once every five years. The estimated cost for this alternative is $0.

Alternative SS-2: Institutional Controls With Monitoring

This is part of the selected remedy (see Section L). Alternative SS-2 (Institutional Controls with Monitoring) does not involve treatment or removal, but provides protection of human health by controlling potential exposures to contaminated soil through the implementation of institutional controls in the former Mishawum lakebed area. Institutional controls that would be implemented under this alternative would include prohibitions on the use of impacted properties for a day care facility and prohibitions on excavation without regulatory oversight and adequate worker health and safety precautions (engineering controls, personal protective equipment (PPE)) to minimize or prevent direct contact with contaminated soil during removal activities and to control the potential spread of contamination. Institutional controls will be developed and established to prevent exposures, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

- No degradation of arsenic is anticipated to occur from naturally occurring processes. Therefore, a groundwater monitoring component is included to ensure that contaminated soils that are left in place in the former Mishawum lakebed area do not impact groundwater and create unacceptable human health risks or hazards in the future. A network of permanent groundwater monitoring wells would be installed to enable groundwater monitoring. The estimated cost for this alternative is $0.6 Million

Alternative SS-3: Permeable Cover and Monitoring with Institutional Controls

Alternative SS-3 (Permeable Cover and Monitoring with Institutional Controls) does not involve treatment or complete removal of contaminated soil, but provides protection of human health by preventing or controlling potential exposures to contaminated soil through the construction of a protective barrier or cap over the contaminated soils in the former Mishawum lakebed area. Under this alternative, a permeable cover would be constructed to prevent future exposures to contaminated surface soil in the former Mishawum Lake bed area. Existing paved surfaces and building foundation and slabs would be evaluated for suitability as equivalent cover so that these surfaces would not have to be removed. Areas unsuitable as equivalent cover would require removal of surface soils (approximately 18 inches) and construction of an engineered permeable cover. In addition, institutional controls would be required to ensure that the cover, including equivalent structures such as asphalt paved areas and building foundations, is adequately protected through use restrictions and maintenance.

No degradation of arsenic is anticipated from naturally occurring processes. Therefore, a groundwater monitoring component is included to ensure that contaminated soils that are left in-place do not impact groundwater and create unacceptable human health risks or hazards in the future. A network of permanent groundwater monitoring wells would be installed to enable groundwater monitoring. The estimated cost for this alternative is $6 Million

<u>Alternative SS-4: Excavation and Off-Site Disposal</u>

Under this alternative, all source area materials exceeding the arsenic cleanup standards (presented in Part 2, Section L.4 of this ROD) in the former Mishawum lakebed area will be excavated and transported for off-site disposal at an approved, licensed facility. This alternative assumes that the soils underlying existing buildings would likely have been imported structural fill placed during construction of the building and will not require remediation. This alternative would provide permanent elimination of risks to human health resulting from future exposures to arsenic in surface soils. Note that if the pre-design investigation conducted to delineate the limits of contamination determine that the soils under a building do exceed the arsenic cleanup standards then institutional controls would be required until such time as the soils could be removed, such as during building demolition (see Alternative SS-2 for the components of institutional controls). The estimated cost for this alternative is $47.2 Million

<u>Alternative SS-5: Excavation, Treatment, and On-Site Reuse</u>

This alternative is identical to Alternative SS-4 (Excavation and Off-Site Disposal) except that the excavated soil contaminated at levels above cleanup standards in the former Mishawum lakebed area would be treated on-site to remove arsenic and then placed back into the excavations. No off-site disposal of wastes would be required except those wastes generated during the treatment process (i.e. contaminated rinsate).

This alternative would provide permanent elimination of risks to human health resulting from future exposures to arsenic in surface soils. Note that if the pre-design investigation conducted to delineate the limits of contamination determine that the soils under a building do exceed the arsenic cleanup standards, then institutional controls would be required until such time as the soils could be removed, such as during building demolition (see Alternative SS-2 for the components of institutional controls). The estimated cost for this alternative is $23 Million.

SUBSURFACE SOIL ALTERNATIVES (SUB)

Alternative SUB-1: No Action

Under this alternative, no remedial technologies would be implemented at Industri-plex OU-2 to reduce arsenic concentrations in subsurface soils in the former Mishawum lakebed area. No degradation of arsenic would be anticipated from naturally occurring processes, therefore no reduction in risks to human health would be achieved. Contaminants would remain at Industri-plex OU-2 above levels that allow for unlimited use and unrestricted exposure, therefore a formal review of Industri-plex OU-2 conditions and risks would need to be performed at least once every five years. The estimated cost for this alternative is $0.

Alternative SUB-2: Institutional Controls with Monitoring

This is part of the selected remedy (see Section L). Alternative SUB-2 (Institutional Controls with Monitoring) addresses soils within the zone of 3 feet to 15 feet below the surface that exceed the arsenic cleanup standards in the former Mishawum lakebed area (see Figure J-2). Human health risks and hazards associated with these contaminated subsurface soils are only present if the soils are excavated, causing a construction worker exposure; or excavated and re-distributed to the ground surface causing a potential exposure to a day care child. Alternative SUB-2 (Institutional Controls with Monitoring) is an alternative that does not involve treatment or removal, but provides protection of human health by preventing or controlling potential exposures to contaminated soil and prohibitions on excavation without regulatory oversight and adequate worker health and safety precautions (engineering controls, PPE) to minimize or prevent direct contact with contaminated soil during removal activities and to control the potential spread of contamination. Institutional controls will be developed and established to prevent exposures, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

No degradation of arsenic is anticipated from naturally occurring processes. Therefore, a groundwater monitoring component is included to ensure that contaminated soils that are left in-place do not impact groundwater and create unacceptable human health risks or hazards in the future. A network of permanent groundwater monitoring wells would be installed to enable groundwater monitoring. The estimated cost for this alternative is $1.3 Million.

Alternative SUB-3: Permeable Cover and Monitoring with Institutional Controls

Alternative SUB-3 (Permeable Cover and Monitoring with Institutional Controls) is similar to Alternative SS-3 (Permeable Cover with Institutional Controls) except that it addresses a considerably larger area, representing the locations with subsurface arsenic cleanup standards exceedances in the former Mishawum lakebed area. This alternative does not involve treatment, but provides protection of human health by preventing or controlling potential exposures to contaminated soil through the construction of a protective barrier or cap over the contaminated soils.

Under this alternative, a permeable cover would be constructed to prevent future exposures to contaminated subsurface soil in the former Mishawum lakebed area. As with Alternative SS-3 (Permeable Cover with Institutional Controls), existing paved surfaces and building foundation and slabs would be evaluated for suitability as equivalent cover, so that these surfaces would not have to be removed.

In order to construct the cap, limited removal of surface soils (approximately 18 inches) must be conducted to install the cover and maintain the existing grades. Since the area of surface soils requiring remediation is contained within the assumed limits of the subsurface soil remediation area, these soils (approximately 6,600 cubic yards) are assumed to exceed the arsenic cleanup standards and will require off-site disposal. All other surface soils within the limits of the subsurface soil remedy area are assumed to be below the arsenic cleanup standards and will be excavated, temporarily stockpiled, and later reused as backfill. In addition, institutional controls would be required to ensure that the cover, including the equivalent cover such as asphalt paved areas and building foundations, is protected through use restrictions and long-term maintenance.

No degradation of arsenic is anticipated from naturally occurring processes. Therefore, a groundwater monitoring component would be included to ensure that contaminated soils left in-place do not impact groundwater and create unacceptable human health risks or hazards in the future. A network of permanent groundwater monitoring wells would be installed to enable groundwater monitoring. The estimated cost for this alternative is $8.1 Million.

GROUNDWATER ALTERNATIVES (GW)

Alternative GW-1: No Action

Under this alternative, no remedial technologies would be implemented at Industri-plex OU-1 south to Interstate 95 within the Industri-plex OU-2 MSGRP RI Northern Study Area to reduce arsenic, ammonia, benzene, trichloroethene (TCE), naphthalene, or 1,2- dichloroethane (DCA) concentrations within groundwater (see Figure J-3 and J-4 for the approximate location of plumes). The alternative would not limit potential human or ecological exposures to contaminated groundwater and would not prevent future discharges of contaminated groundwater to surface water within the HBHA Pond. There would be no measures taken to restrict the future use of groundwater that is contaminated with these contaminants. Groundwater that is contaminated with arsenic would continue to migrate southward with the flow of groundwater and discharge into the HBHA Pond, and continue to provide a source of contamination to surface water and sediments in the HBHA Pond, the downstream HBHA Wetlands, the Aberjona River and adjacent wetlands. No degradation of arsenic is anticipated from naturally occurring processes. The estimated cost for this alternative is $0.

Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls

This is part of the selected remedy (see Section L). Alternative GW-2 (Pond Intercept with Monitoring and Institutional Controls) is an alternative that involves little or no active treatment, but provides protection of human health by preventing or controlling potential exposures to contaminated groundwater (including arsenic, ammonia, benzene, TCE, naphthalene, 1,2-DCA: see Figure J-3 and J-4 for approximate location of contaminated groundwater plumes) through institutional controls. The alternative, in conjunction with HBHA-4 Alternative, also controls the downstream migration of the contaminated groundwater to areas in the HBHA Wetlands and the Aberjona River by intercepting it at the HBHA Pond. Natural processes in the HBHA Pond will degrade or sequester the contaminants of concern such that unacceptable amounts of contaminants will not migrate downstream of HBHA Pond. Alternative GW-2 (Pond Intercept with Monitoring and Institutional Controls) would rely upon other sediment and surface water alternatives to address these contaminants within the HBHA Pond itself. Institutional controls will be developed and established to prevent exposures, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

Although degradation of organics in site-wide groundwater is anticipated over time through natural processes, the degradation of arsenic is not expected. This alternative would not limit potential ecological exposures to contaminated groundwater in the HBHA Pond and would not prevent future discharges of contaminated groundwater to surface water within the HBHA Pond. Although contaminated groundwater would be intercepted at the HBHA Pond and contaminants would be sequestered at the Pond bottom, contaminated groundwater would continue to discharge into the HBHA Pond and continue to provide a source of contamination to surface water and sediments in the HBHA Pond. The estimated cost for this alternative is $3.9 Million.

Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls

Alternative GW-3 (Plume Intercept by Groundwater Extraction, Treatment and Discharge with Institutional Controls and Monitoring) is an active groundwater extraction and treatment alternative. This alternative would consist of installing a groundwater extraction system that would capture groundwater from the overburden aquifer within the contaminant plumes that were delineated based on the results of the human health risk assessment prior to discharge into the HBHA Pond.

The implementation of Alternative GW-3 (Plume Intercept by Groundwater Extraction, Treatment and Discharge with Institutional Controls and Monitoring) would achieve several objectives through the extraction and treatment of contaminated groundwater originating from the Industri-plex OU-1. These include plume containment; prevention of the continued discharge of groundwater contaminants into the HBHA Pond; prevention of the continued migration of groundwater contaminants through surface water and sediments to the HBHA Pond, HBHA Wetlands, Aberjona River, and adjacent wetlands; and reduction of ecological risks observed in the HBHA Pond deep surface water and sediment due to contaminated groundwater discharges.

In addition, GW-3 would incorporate in-situ enhanced bioremediation through oxygen injection to treat the source areas for organic contaminants (benzene) at the West Hide Pile, an area located outside of the capture zone of the proposed groundwater extraction system.

Due to the presence of contaminants in soil throughout the Industri-plex OU-1 area, there will be continued leaching of contamination from the soil source areas that impacts groundwater such that the groundwater extraction system would not be expected to achieve RAOs within a reasonable time period. Therefore, institutional controls to prevent groundwater withdrawals would also be required under Alternative GW-3 (Plume Intercept by Groundwater Extraction, Treatment and Discharge with Institutional Controls and Monitoring) to address potential human health risks and hazards associated with direct contact, inhalation, and ingestion. The estimated cost for this entire alternative is $19.1 Million.

Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls

A portion of this alternative that applies to the West Hide Pile is part of the selected remedy (see Section L). Alternative GW-4 (Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls) is an in-situ groundwater treatment alternative that incorporates two technologies to address both organic and inorganic contaminants in groundwater in the vicinity of the West Hide Pile; in-situ enhanced bioremediation through oxygen injection would be used to treat the source areas for organic contaminants (benzene, TCE, 1,2-DCA, and naphthalene) located between the East-Central Hide Pile and the South Hide Pile in the vicinity of Atlantic Avenue, and at the West Hide Pile for benzene; and a permeable reactive barrier (PRB) located between the southern perimeter of the NSTAR (formerly Boston Edison) right-of-way and the HBHA Pond would be used for the treatment of arsenic in groundwater prior to discharge to the Pond. Figure J-5 presents a conceptual representation of the location of the PRB and the location of the bio-enhancement treatment area at the West Hide Pile.

As with Alternative GW-3 (Plume Intercept by Groundwater Extraction, Treatment and Discharge with Institutional Controls and Monitoring), these two in-situ treatment processes together would achieve several objectives including prevention of continued migration of groundwater contaminants into the HBHA Pond, HBHA, and Aberjona River and reduction of ecological risks observed in the HBHA Pond deep surface water and sediment due to continued contaminated groundwater discharges. However, due to the nature of the PRB treatment (the PRB would intercept groundwater as it flows to the Pond rather than actively treat it throughout the groundwater plume area), concentrations of arsenic in excess of the cleanup standards would remain throughout the human health risk areas. Therefore, institutional controls that prohibit groundwater withdrawals would be required to address potential human health risks and hazards associated with direct contact, inhalation, and ingestion exposures. The estimated cost for this entire alternative is $17.8 Million. The estimated cost for the enhanced bioremediation portion only at the West Hide Pile is $3.8 Million.

HALLS BROOK HOLDING AREA SEDIMENT ALTERNATIVES (HBHA)

Alternative HBHA-1: No Action

Under this alternative, no remedial technologies would be implemented to reduce arsenic concentrations within the sediments of the HBHA Pond (also see Figure J-6 for area to be addressed). No degradation of arsenic is anticipated from naturally occurring processes within the HBHA Pond, therefore no reduction in ecological risk would be achieved. Five-year reviews would be required if this alternative were to be implemented. The estimated cost for this alternative is $0.

Alternative HBHA-2: Monitoring

Alternative HBHA-2 (Monitoring) incorporates long-term monitoring to evaluate possible changes to the nature and extent and migration patterns of contaminated sediments and risks to benthic invertebrates in the HBHA Pond over time. Alternative HBHA-2 (Monitoring) would not address ecological risks or control the migration of contaminated sediments to downstream areas. However, if contaminated groundwater discharges are eliminated (through interception of the groundwater contaminant plumes before it reaches the Pond, as provided by Alternative GW-3 or GW-4), natural processes such as biodegradation of organic contaminants and sedimentation and burial of inorganic contaminants may eventually reduce the exposure risks, toxicity, and mobility of the benzene and arsenic that is currently located in sediments at the Pond bottom. The estimated cost for this alternative is $1.2 Million.

Alternative HBHA-3: Subaqueous Cap

Alternative HBHA-3 (Subaqueous Cap) does not involve treatment or removal, but provides protection of the environment from contaminated sediments by preventing or controlling direct contact exposures to benthic invertebrates and by preventing migration of contaminated sediments from the HBHA Pond to downstream areas. Alternative HBHA-3 (Subaqueous Cap) includes the placement of a subaqueous cap consisting of a geotextile layer covered with clean permeable soil materials over contaminated sediments at the base of the HBHA Pond, creating a new benthic habitat and an effective barrier from existing sediment contaminants. Alternative HBHA-3 (Subaqueous Cap) would address ecological risks, but would not address the source of contamination (i.e. groundwater discharges) which could, over time, result in recontamination of the clean cap materials if a plume intercept alternative is not utilized to address groundwater. The estimated cost for this alternative is $5.3 Million.

<u>Alternative HBHA-4: Storm Water Bypass and Sediment Retention With Partial Dredging and Providing an Alternate Habitat</u>

This is part of the selected remedy (see Section L). Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) involves partial removal of contaminated sediments and reduces the mobility of soluble and particulate arsenic that is released from the HBHA Pond during storm events to downstream depositional areas. In the southern portion of the HBHA Pond where contaminated sediments are dredged and restored, this alternative would protect the environment by preventing exposure of benthic invertebrates to contaminated sediments. In the northern portion of the HBHA Pond where primary and secondary treatment cells/areas will be designed and constructed to sequester/treat contaminants and serve as sediment retention areas, this alternative would not protect the environment.

Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) would involve the construction of two low-head cofferdams designed to divide the HBHA Pond into three main areas (primary treatment area/cell, secondary treatment area/cell, and southern portion of the HBHA Pond area. The northern portion of the HBHA Pond includes the primary and secondary treatment areas/cells. The northern/first low-head cofferdam will be located to intercept all contaminated groundwater plumes (including arsenic, ammonia, benzene, TCE, naphthalene, 1,2-DCA; see Figure J-3 and J-4 for approximate location of contaminated groundwater plumes) discharging into the HBHA Pond. This first low-head cofferdam will establish the boundaries of the primary treatment cell which will sequester/treat contaminants and serve as a sediment retention area reducing contaminant migration. A southern/second low-head cofferdam would be constructed to the south of the first cofferdam to create a secondary treatment area/cell that would further sequester/treat contaminants in surface water that leaves the primary treatment cell through the use of aeration and sedimentation. In the future, contaminated sediments would be periodically dredged from the primary and secondary treatment cells to ensure they remain effective at preventing contaminant migration downstream of the northern portion of the HBHA Pond (effluent from the secondary treatment cell outlet).

A second component of Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) would be the diversion of stormflow from Halls Brook to avoid high flow volumes into the sediment retention area that would break down the chemocline within the primary treatment cell. A portion of the stormwater flow that would otherwise enter the northern portion of the HBHA Pond would instead be diverted to the south of the low-head cofferdams (downstream of the secondary treatment cell) so that baseflow conditions are maintained in the primary treatment cell. It is imperative that these baseflow conditions are continuously provided to the primary treatment cell so that the chemocline within the primary treatment cell is maintained.

Contaminated sediments containing arsenic at concentrations exceeding the cleanup standards would be dredged from the southern portions of the HBHA Pond located downstream of the second low-head cofferdam (south of the primary treatment cell outlet). Hydraulic dredging methods would be utilized to permanently remove contaminated sediments from these areas of the HBHA Pond. Sediments would be dewatered and transported to an approved licensed disposal facility. Periodic dredging in the primary and secondary treatment cells (sediment retention areas) would also be a component of this remedy to prevent excessive accumulation of sediments and maintain the integrity of the chemocline within the primary treatment cell, comply with the surface water cleanup standards at the outlet of the secondary treatment cell, and maintain the function of the sediment retention areas (primary and secondary treatment cells).

As part of Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat), an impermeable liner would be placed along the open channel section of the New Boston Street Drainway to prevent to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy. The contaminated groundwater discharges could contaminate sediments in the channel and ultimately enable the transport of contaminated sediment (arsenic) into the southern portion of the HBHA Pond (the portion of the Pond from which contaminated sediments would be removed) during storm events.

Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) would also involve constructing a permeable cap along the northern banks of the HBHA Pond, located along the southern boundary of the Boston Edison right-of-way (A6 area) and adjacent to the railroad right of-way west of the HBHA Pond. This action would prevent soils contaminated with arsenic exceeding the HBHA Pond sediment cleanup standard from eroding into the northern portion of the Pond and impacting other components of the selected remedy.

Alternative HBHA-4 will receive continuous contaminated groundwater discharges for the foreseeable future, and the remedial design for Alternative HBHA-4 must take into consideration significant storm weather conditions (including hurricanes) to ensure durability, permanence, and long term performance.

In order to compensate for any wetland function and value losses that would occur from the use of the northern portion of the HBHA Pond (primary and secondary treatment cells) as a sediment retention area, Alternative HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) would involve wetland compensation nearby in the watershed.

Figure J-6 presents an approximate location of HBHA-4. Figure J-7 presents a conceptual representation of HBHA-4 (Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat) including the location of the storm water bypass structure, the low-head cofferdams, and the soil/sediment erosion areas of concern.

Institutional controls will be developed and established to prevent exposures and protect the selected remedy, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

The estimated cost for this alternative is $9.2 Million.

Alternative HBHA-5: Removal and Off-Site Disposal

Under this alternative, all contaminated sediments in the HBHA Pond that exceed the arsenic cleanup standard would be removed using hydraulic dredging methods, dewatered, and transported off-site for disposal at an approved licensed facility. This alternative would provide permanent elimination of risks to ecological receptors resulting from exposures to contaminated sediments in the HBHA Pond, but would not address the source of contamination (i.e. groundwater discharges from Industri-plex OU-1) which would likely result in recontamination of the uncontaminated underlying or replacement substrate following dredging. In order for this alternative to be effective in the long-term, a plume intercept alternative would need to be implemented to address contaminated groundwater discharges to the HBHA Pond so that the dredged portions of the Pond are not re-contaminated.

In addition, Alternative HBHA-5 (Removal and Off-Site Disposal) would prevent arsenic-contaminated groundwater from discharging into the New Boston Street Drainway, which eventually discharges to Halls Brook, and would prevent arsenic-contaminated soils located along the southern boundary of the Boston Edison right-of-way (A6 area) from eroding into the northern portion of the HBHA Pond and contributing to the contaminated sediment load in the system.

The estimated cost for this alternative is $3.8 Million.

NEAR SHORE SEDIMENT ALTERNATIVES (NS)

Alternative NS-1: No Action

Under this alternative, no remedial technologies would be implemented to reduce arsenic concentrations in sediments within the near shore areas. These areas are located in the Well G&H Wetland and the Cranberry Bog Conservation Area (see Figure J-8). This alternative would not reduce the risks to human health and would require the five-year reviews to periodically address conditions and risks. The estimated cost for this alternative is $0.

Alternative NS-2: Institutional Controls

Alternative NS-2 (Institutional Controls) is an alternative that does not involve treatment or removal, but provides protection of human health by preventing or controlling potential exposures to contaminated sediment through installation of fencing to restrict access to contaminated sediment and through the imposition of institutional controls on impacted properties to prevent activities that might result in unacceptable exposures to contaminated near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area. Institutional controls will be developed and established to prevent exposures, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

Alternative NS-2 (Institutional Controls) would achieve no risk reduction beyond that which would be provided by restricting access to contaminated near-shore sediments. The estimated cost for this alternative is $0.3 Million.

Alternative NS-3; Monitoring with Institutional Controls

Alternative NS-3 (Monitoring with Institutional Controls) incorporates long-term monitoring to evaluate possible changes to the nature and extent and migration patterns of contaminated sediments in the near-shore areas in the Wells G&H Wetland and the Cranberry Bog Conservation Area, combined with institutional controls as a remedy for near-shore contaminated sediment. Natural processes that may reduce the potential exposures and risks may include burial of the contaminated sediments by accumulation of uncontaminated sediments thus limiting the accessibility and risks due to direct contact exposures. Under this alternative, institutional controls would also be implemented to prevent future exposures to contaminated sediment in the vicinity of sampling stations where potential human health risks and hazards were identified. Finally, installation of a permanent barrier (i.e. chain link fence) would prevent access to contaminated sediments and human health risks associated with recreational exposures through direct contact.

The estimated cost for this alternative is $1.8 Million.

Alternative NS-4: Removal and Off-Site Disposal

This is part of the selected remedy (see Section L). Under this alternative, all near-shore contaminated sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area exceeding the arsenic cleanup standards will be removed using mechanical excavation methods, dewatered, and transported off-site for disposal at an approved licensed facility. This alternative would provide permanent elimination of risks to humans resulting from exposures to contaminated near-shore sediments. As defined in the March 2005, MSGRP RI, near-shore sediments are those sediments which extend perpendicularly from the shoreline to a distance of approximately 30 feet into the wetland.

The estimated cost for this alternative is $3.2 Million.

DEEP SEDIMENT ALTERNATIVES (DS)

Alternative DS-1: No Action

Under this alternative, no remedial technologies would be implemented to reduce arsenic concentrations in sediments located in deeper sediment cores collected in the river channel near the Wells G&H Wetland and the Cranberry Bog Conservation Area (see Figure J-9). This alternative would not reduce the risks to human health and would require the performance of five-year reviews. The estimated cost for this alternative is $0.

Alternative DS-2: Monitoring with Institutional Controls

This is part of the selected remedy (see Section L). Alternative DS-2 (Monitoring with Institutional Controls) would address risks from future exposures to deep sediments near the Wells G&H Wetland and the Cranberry Bog Conservation Area by prohibitions on excavation without regulatory oversight and adequate worker health and safety precautions (engineering controls, PPE) to minimize or prevent direct contact with contaminated sediments during dredging/removal activities and to control the potential spread of contamination. Generally, these sediments are not accessible to humans except for in a dredging scenario, therefore prohibitions or restrictions on dredging would be an effective deterrent to potential future exposures to sediment in the deep sediment human health risk areas. Institutional controls will be developed and established to prevent exposures, where necessary. The form of institutional controls would be determined during pre-design and design in accordance with relevant guidance, policies and regulations.

The estimated cost for this alternative is $0.5 Million.

<u>Alternative DS-3: Removal and Off-Site Disposal</u>

Under this alternative, all deep sediments near the Wells G&H Wetland and the Cranberry Bog Conservation Area associated with sediment core sample locations exceeding the arsenic cleanup standards will be removed using mechanical excavation methods, dewatered, and transported off-site for disposal at an approved licensed facility. This alternative would provide permanent elimination of risks and hazards to humans resulting from exposures to contaminated deep sediment.

The estimated cost for this alternative is $117.4 Million.

SURFACE WATER ALTERNATIVES (SW)

<u>Alternative SW-1: No Action</u>

Under this alternative, no remedial technologies would be implemented to reduce arsenic and benzene concentrations within deep surface water of the HBHA Pond. The alternative would not limit potential ecological exposures to contaminated surface water. This alternative does not reduce ecological risks nor prevent the downstream migration of arsenic contaminated sediments and would require the performance of 5-year reviews. The estimated cost for this alternative is $0.

<u>Alternative SW-2: Monitoring</u>

This is part of the selected remedy (see Section L). Alternative SW-2 (Monitoring) is an alternative that involves no active treatment, but monitors the status of contamination that may or may not be attenuated by natural processes or other selected groundwater and sediment remedial alternatives. Although degradation of organic contaminants in the deeper surface water of the HBHA Pond is anticipated through natural processes, the degradation of arsenic is not expected unless the sources of contamination (i.e. groundwater discharges and arsenic dissolution from contaminated sediments) are eliminated through implementation of a plume intercept alternative and a sediment removal alternative that addresses the northern portion of the Pond. As such, this alternative would not be fully protective of the environment (i.e. aquatic organisms) unless implemented in conjunction with other media-specific alternatives whereby the sources of contamination (i.e. groundwater discharges and arsenic dissolution from contaminated sediments) are eliminated.

The estimated cost for this alternative is $3.2 Million.

Alternative SW-3: Monitoring and Providing an Alternate Habitat

The monitoring component of Alternative SW-3 (Monitoring and Providing an Alternate Habitat) is identical to that which is included in Alternative SW-2. As discussed above, unless the sources of contamination (i.e. contaminated groundwater and sediments) are addressed through other media-specific alternatives, natural processes are not expected to attenuate contaminants to concentrations that do not reflect impairment to aquatic organisms. To mitigate the loss of aquatic habitat within the affected area and meet the RAO, a similar wetland would be constructed to compensate for the loss and to maintain the functions and values of the benthic community and wetland habitat within the watershed.

The estimated cost for this alternative is $10.8 Million.

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a Industri-plex OU-2 remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.

5. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the MSGRP RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and MSGRP RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Tables 4-28A through 4-28G and Table 4-29 of the Industri-plex MSGRP FS, and attached to this ROD as Tables K-1 through K-9.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Only those alternatives which satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria. There were a total of 27 alternatives evaluated to address Surface Soils (SS), Subsurface Soils (SUB), Groundwater (GW), Halls Brook Holding Area Sediments (HBHA), Near Shore Sediments (NS), Deeper Wetland Sediments (DS), and Surface Water (SW). The evaluation of these alternatives for SS, SUB, GW, HBHA, NS, DS and SW are described under the threshold and primary balancing criteria below.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describers how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Surface Soil (SS): The No Action Alternative, SS-1, does not protect human health or the environment. The Preferred Alternative, SS-2, would be protective of human health and the environment through institutional controls in the former Mishawum lakebed prohibiting the use of the property for day care facilities and prohibiting excavation without regulatory oversight and appropriate precautions. Alternative SS-3 would provide enhanced protection, since a permeable cover or barrier would further restrict exposure to contaminated surface soil in the former Mishawum lakebed. Alternatives SS-4 and SS-5 provide the highest level of protection for human health and the environment because all contaminated surface soil in the former Mishawum lakebed exceeding the proposed cleanup standards would either be removed off-site or treated.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, does not protect human health or the environment. The preferred alternative, SUB-2, would provide protection from exposure to contaminated soils in the former Mishawum lakebed through institutional controls prohibiting excavation without regulatory oversight and appropriate precautions. Alternative SUB-3 would provide enhanced protection since a permeable cover or barrier would further restrict exposure to contaminated subsurface soil in the former Mishawum lakebed. This alternative also requires institutional controls and land use restrictions to protect the integrity of the cover.

Groundwater (GW): The No Action Alternative, GW-1, does not protect human health or the environment. The Preferred Alternative, GW-2, would provide protection from exposure to contaminated groundwater through institutional controls. Alternatives GW-3 and GW-4 would provide enhanced protection to human health and the environment through institutional controls restricting groundwater use.

Halls Brook Holding Area Pond Sediments (HBHA): Neither the No Action Alternative, HBHA-1, nor HBHA-2, which calls for monitoring, would be protective of the environment. Alternative HBHA-3, which calls for the installation of a permeable cover or barrier over contaminated sediments in the bottom of the pond, may provide enhanced protection for benthic organisms. However, this alternative requires that groundwater discharges to the pond be eliminated, otherwise the cap materials could become re-contaminated. The preferred alternative, HBHA-4, which calls for the removal of contaminated sediments from the southern portion of HBHA Pond, would provide protection to benthic invertebrates in this area of the pond. Since the northern portion of the pond would be incorporated into the cleanup remedy and used to treat contaminated groundwater discharges, this area would not provide protection to the benthic organisms in the short-term. However, an alternative wetland would be constructed in its place. Alternative HBHA-5 provides the highest level of protection for the environment because all contaminated sediment in the northern and southern portions of HBHA Pond would be removed. However, this alternative also requires that groundwater discharges to HBHA Pond be eliminated so that the pond does not become re-contaminated.

Near Shore Sediments (NS): The No Action Alternative, NS-1, does not protect human health. Alternatives NS-2 and NS-3 would provide protection from exposure to contaminated sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area through institutional controls. NS-3 would also include periodic monitoring. The Preferred Alternative, NS-4, provides the highest level of protection for human health because all contaminated sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area exceeding the cleanup standards would be removed.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, does not protect human health. The Preferred Alternative, DS-2, would provide protection from exposure to deeper contaminated sediments near the Wells G&H Wetland and the Cranberry Bog Conservation Area through institutional controls. Alternative DS-3 provides the highest level of protection for human health because all contaminated sediments exceeding the cleanup standards would be removed. However, the marginal benefit derived from Alternative DS-3 over Alternative DS-2 would be low, since these sediments are inaccessible to humans.

Surface Water (SW): The No Action Alternative, SW-1, does not protect the environment. The Preferred Alternative, SW-2, which includes monitoring, and Alternative SW-3, which includes monitoring and the construction of an alternate wetlands habitat, would be protective if implemented in conjunction with other groundwater cleanup alternatives.

2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL REGULATIONS (ARARS):

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4). Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site. Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statues or provides a basis for invoking a waiver.

Surface Soil (SS): The No Action Alternative, SS-1, does not comply with the ARARs. The Preferred Alternative, SS-2, and Alternatives SS-3, SS-4 and SS-5 would comply with all ARARs. For a detailed analysis, refer to Tables 4-1A-D, 4-2A-D, 4-3A-D, 4-4A-D and 4-5A-D in the Industri-plex OU-2 MSGRP FS.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, does not comply with ARARs. The Preferred Alternative, SUB-2, and Alternative SUB-3 would comply with all ARARs. For a detailed analysis, refer to Tables 4-6A-D, 4-7A-D and 4-8A-D in the Industri-plex OU-2 MSGRP FS.

Groundwater (GW): The No Action Alternative, GW-1, does not comply with ARARs. The Preferred Alternative, GW-2, and Alternatives GW-3 and GW-4 would comply with all ARARs through institutional controls restricting groundwater use. For a detailed analysis, refer to Tables 4-9A-D, 4-10A-D, 4-11A-D and 4-12A-D in the Industri-plex OU-2 MSGRP FS.

Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, and Alternative HBHA-2 do not comply with ARARs. Alternative HBHA-3, the Preferred Alternative, HBHA-4, and HBHA-5 would comply with all ARARs. For a detailed analysis, refer to Tables 4-13A-D, 4-14A-D, 4-15A-D, 4-16A-D and 4-17A-D in the Industri-plex OU-2 MSGRP FS.

Near Shore Sediments (NS): The No Action Alternative, NS-1, does not comply with ARARs. Alternatives NS-2 and NS-3 would comply with some, but not all ARARs. The Preferred

Alternative, NS-4, would comply with all ARARs. For a detailed analysis, refer to Tables 4-18A-D, 4-19A-D, 4-20A-D and 4-21A-D in the Industri-plex OU-2 MSGRP FS.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, does not comply with ARARs. Alternative DS-2, which includes monitoring and institutional controls, would meet the ARARs. Alternative DS-3, which removes and disposes of contaminated sediments off-site, complies with all ARARs. For a detailed analysis, refer to Tables 4-22A-D, 4-23A-D and 4-24A-D in the Industri-plex OU-2 MSGRP FS.

Surface Water (SW): The No Action Alternative, SW-1, would not comply with ARARs. If implemented in conjunction with other groundwater and sediment remedial alternatives, such as Alternative HBHA-4, Alternative SW-2, which provides monitoring, and Alternative SW-3, which provides monitoring and an alternate habitat, would comply with ARARs at the outlet of the northern portion of the HBHA Pond (effluent from the secondary treatment cell) if they were implemented in conjunction with other groundwater and sediment alternatives. For a detailed analysis, refer to Tables 4-25A-D, 4-26A-D and 4-27A-D in the Industri-plex OU-2 MSGRP RI/FS.

3. LONG-TERM EFFECTIVENESS AND PERMANENCE:

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Surface Soil (SS): The No Action Alternative, SS-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SS-2, would provide long-term effectiveness and permanence through institutional controls in the former Mishawum lakebed area. Alternative SS-3 would provide additional long-term effectiveness and permanence through institutional controls prohibiting disturbance of the cover in that area. Alternatives SS-4 and SS-5 provide the highest degree of long-term effectiveness and permanence because the contaminated soil in the former Mishawum lakebed would be removed.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SUB-2, would provide long-term effectiveness and permanence through institutional controls in the former Mishawum lakebed area. Alternative SUB-3 would also provide long-term effectiveness and permanence through institutional controls prohibiting disturbance of the cover in the former Mishawum lakebed.

Groundwater (GW): The No Action Alternative, GW-1, does not provide any long-term effectiveness or permanence. GW-2, the Preferred Alternative, would provide long-term effectiveness and permanence through institutional controls limiting groundwater use. Alternatives GW-3 and GW-4 would also be effective in the long-term, however GW-3 would require more extensive operation and maintenance than GW-4.

Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, does not provide any long-term effectiveness or permanence. Alternative HBHA-2 would provide marginal long-term effectiveness and permanence, and long-term monitoring would be required to evaluate risks associated with contaminants left in place. Alternative HBHA-3 would provide enhanced long-term effectiveness and permanence provided there is no erosion of the permeable cover and contamination from groundwater discharges is eliminated. The Preferred Alternative, HBHA-4, provides a greater level of long-term effectiveness since a majority of contaminated sediments would be removed from the southern portion of HBHA Pond. Alternative HBHA-5 would provide the highest level of long-term effectiveness and permanence because the contaminated sediment would be removed off-site, assuming in conjunction with the GW alternatives that contaminated groundwater plumes no longer discharge into HBHA Pond.

Near Shore Sediments (NS): The No Action Alternative, NS-1, does not provide any long-term effectiveness or permanence. Alternatives NS-2 and NS-3 would provide long-term effectiveness and permanence through institutional controls in the Wells G&H Wetland and the Cranberry Bog Conservation Area. The Preferred Alternative, NS-4, provides the highest degree of long-term effectiveness and permanence because the sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area exceeding the cleanup standards would be excavated.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative DS-2, would provide long-term effectiveness and permanence through institutional controls for the deep river sediments near the Wells G&H Wetland and the Cranberry Bog Conservation Area. Alternative DS -3 provides the highest degree of long-term effectiveness and permanence because the sediments in these areas exceeding the cleanup standards would be excavated.

Surface Water (SW): The No Action Alternative, SW-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SW-2, which includes monitoring, and Alternative SW-3, which also includes monitoring provide greater long-term effectiveness. Alternative SW-3 provides the greatest level of permanence by creating an alternate wetlands habitat.

4. REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT:

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Surface Soil (SS): The No Action Alternative, SS-1, the Preferred Alternative, SS-2, and Alternative SS-3 do not include treatment. Alternative SS-4 may provide limited off-site treatment, if necessary, to qualify for disposal of soils excavated from the former Mishawum lakebed area at a licensed landfill. Alternative SS-5 reduces the toxicity and mobility of the contaminants by using a "soil washing" process to remove arsenic from this soil before using the treated soil as backfill.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, the Preferred Alternative, SUB-2, and Alternative SUB-3 do not reduce toxicity, mobility or volume through treatment or other means.

Groundwater (GW): The No Action Alternative, GW-1, offers no treatment other than long-term natural attenuation processes that may occur with organic contaminants. The Preferred Alternative, GW-2, controls the migration of contaminated groundwater by intercepting contamination at the HBHA Pond, and makes use of the naturally occurring processes in HBHA Pond to precipitate metals and degrade organic contaminants. Alternative GW-2 does not actively treat groundwater prior to discharge to HBHA Pond, except for natural attenuation processes that may occur. When combined with Alternative HBHA-4, as EPA is proposing to do, GW-2 would control or reduce downstream migration of inorganic contaminants during storm events. Both Alternatives GW-3 and GW-4 employ technologies to prevent contaminated groundwater from discharging into HBHA Pond and also destroy or remove target contaminants from the groundwater. Alternative GW-3 is an ex-situ system while Alternative GW-4 is an in-situ design. Both technologies are able to reduce the toxicity, mobility and volume of contaminants in the groundwater and both treatment processes are irreversible.

Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, and Alternatives HBHA-2, and HBHA-3 do not treat contaminants. Alternative HBHA-3 reduces the mobility of contaminated sediments by placing a cap over them. The Preferred Alternative, HBHA-4, and Alternative HBHA-5 may include limited off-site treatment of dredged sediments, if necessary, to qualify for disposal at a licensed landfill. HBHA-4 also reduces the mobility of contaminated sediments by creating a retention area where contaminated sediments are contained and periodically removed.

Near Shore Sediments (NS): The No Action Alternative, NS-1, and Alternatives NS-2 and NS-3 do not treat contaminants. Alternatives NS-2 and NS-3 may reduce mobility in the long-term if contaminated sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area are buried by the accumulation and deposition of uncontaminated sediments. The Preferred Alternative, NS-4, may include limited off-site treatment if necessary to qualify for disposal of excavated sediments at a landfill.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1 and the Preferred Alternative, DS-2, do not treat or reduce the toxicity of the deeper wetland sediments near the Wells G&H Wetland and the Cranberry Bog Conservation Area unless other alternatives are implemented upstream to reduce downstream contaminant migration and clean sediments are given an opportunity to accumulate and deposit on top of contaminated sediments, in essence capping the contaminated sediment. Alternative DS-3 may include limited off-site treatment, if necessary, to qualify for disposal of excavated sediments at a licensed landfill.

Surface Water (SW): The No Action Alternative, SW-1, the Preferred Alternative, SW-2, and Alternative SW-3 do not include treatment.

5. SHORT-TERM EFFECTIVENESS:

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

Surface Soil (SS): The No Action Alternative, SS-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives SS-2 and SS-3, which call for the installation of institutional controls in the former Mishawum lakebed area, will effectively limit risks to human health in the short-term. In addition, the cover required as part of SS-3 will become effective upon its construction. Alternatives SS-4 and SS-5 will become effective once the contaminated soils in this area are excavated and disposed of off-site or treated. The Preferred Alternative, SS-2, would have limited impacts on property owners where institutional controls restrict land use. Alternatives SS-3, SS-4, and SS-5 would have the most short-term impacts on the community, including an increase in traffic during construction activities. Impacts to workers would be minimal since construction activities would be completed in accordance with appropriate health and safety procedures and potential risks and hazards associated with fugitive dust emissions would be addressed with prescribed engineering controls. No adverse environmental impacts are anticipated from any alternative.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives SS-2 and SS-3 which call for the installation of institutional controls in the former Mishawum lakebed area will effectively limit risks to human health in the short-term. In addition, the permeable cover required as part of SS-3 will become effective upon its construction. The Preferred Alternative, SUB-2, would have limited impacts on property owners in this area where institutional controls restrict land use. Alternative SUB-3 would have the most significant short-term impacts on the community including an increase in traffic during construction activities. Impacts to individual property owners would be significant since large portions of property would require a soil cover and the use of parking areas and road ways would be temporarily restricted. Impacts to workers would be minimal since construction activities would be completed in accordance with appropriate health and safety procedures and potential risks and hazards associated with fugitive dust emissions would be addressed with prescribed engineering controls. No adverse environmental impacts are anticipated from any alternative.

Groundwater (GW): The No Action Alternative, GW-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternative GW-2, the Preferred Alternative, and Alternatives GW-3 and GW-4 which call for the installation of institutional controls will effectively limit risks to human health in the short-term. The Preferred Alternative, GW-2, would have limited impacts on property owners since the imposition of institutional controls would restrict groundwater use. Alternatives GW-3 and GW-4 would have limited short-term impacts on the community, including an increase in traffic during construction activities. Fugitive dust emissions would be addressed with engineering controls. Alternatives GW-3 and GW-4 may have limited adverse environmental impacts during construction, however engineering controls and approved construction methods would be used to minimize these risks.

Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, would not be effective in the short-term or cause short-term impacts because the alternative does not require any action. Alternative HBHA-2 would not cause any short-term impacts to the community because the alternative only requires monitoring. Alternative HBHA-3, the Preferred Alternative, HBHA-4, and Alternative HBHA-5 would have the most short-term impacts on the community including an increase in traffic during construction activities. Fugitive dust emissions would be addressed with engineering controls. Alternative HBHA-3 would have potential significant environmental impacts from the displacement and migration of contaminated sediments during the placement of the cap. However, these potential risks could be minimized through engineering controls that minimize and control suspended solids. The Preferred Alternative, HBHA-4, and Alternative HBHA-5 would have the most significant short-term environmental impacts due to the dredging activities. Benthic communities destroyed during the sediment removal would re-establish themselves over time.

Near Shore Sediments (NS): The No Action Alternative, NS-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives NS-2 and NS-3 would have minor impacts on the community and workers installing protective fencing in the Wells G&H Wetland and the Cranberry Bog Conservation Area. The Preferred Alternative, NS-4, would have the most short-term impacts on the community, including an increase in traffic during construction activities as well as an increase in organic odors while excavating along shoreline wetlands. Fugitive dust emissions would be minimized and addressed with engineering controls. Alternative NS-4 would also cause short-term environmental impacts during excavation restoration of the wetland. These impacts would be minimized by engineering controls. Benthic communities destroyed during the sediment removal would re-establish themselves over time.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, and the Preferred Alternative, DS-2, would not cause any short-term impacts to the community or on-site workers because the alternatives do not require any action. Alternative DS-3 would have the most significant short-term impacts on the community and surrounding businesses, including an increase in traffic during construction activities, as well as an increase in organic odors while excavating the deeper sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area. Impacts to individual property owners would be significant since large portions of property would be utilized to implement the alternative. Fugitive dust emissions would be minimized and addressed with engineering controls. Alternative DS-3, which requires constructing haul roads, potential cofferdams and intrusions into the wetland areas to access deep sediments, would cause extensive and severe environmental impacts. These impacts would be minimized by engineering controls during the remediation. Benthic communities and other wetland habitat features that are destroyed during sediment removal would eventually re-establish themselves over time.

Surface Water (SW): The No Action Alternative, SW-1, would not cause any short-term impacts to the community or on-site workers because the alternative does not require any action. The Preferred Alternative, SW-2, would not cause any short-term impact on the community. Alternative SW-3 would have the most short-term impacts to the community due to the construction of an alternate wetlands habitat.

6. IMPLEMENTABILITY:

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Surface Soil (SS): The No Action Alternative, SS-1, would be the easiest to implement because there are no remedial actions required. The Preferred Alternative, SS-2, would be the next easiest to implement. Alternatives SS-3, SS-4 and SS-5 would be more difficult than the other alternatives due to the former Mishawum lakebed area requiring remediation, the proximity to active commercial and light industrial properties, and the additional construction activities associated with these alternatives.

Subsurface Soil (SUB): The No Action Alternative, SUB-1, would be the easiest to implement because there are no remedial actions. The Preferred Alternative, SUB-2, would be the next easiest to implement. Alternative SUB-3 would be more difficult than the other alternatives due to the former Mishawum lakebed area requiring remediation, the proximity to active commercial and light industrial properties, and the additional construction activities associated with this alternative.

Groundwater (GW): The No Action Alternative, GW-1, is the easiest to implement because there are no remedial actions required. The Preferred Alternative, GW-2, would be the next easiest to implement. Alternative GW-3 would be more difficult than Alternative GW-2 due to the complexities involved with a multi-process treatment system and typical construction issues. However, technologies for Alternative GW-3 are reliable and proven. Alternative GW-3 requires more extensive operation and maintenance than any other alternative and would likely require a full-time treatment plant operator. Alternative GW-4 could be the most difficult to implement due to the deep excavations required to install the reactive wall and uncertainties associated with the technology. However, these uncertainties could be addressed during the pre-design investigation.

Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, would be the easiest to implement because there are no remedial actions required. Alternative HBHA-2 would be the next easiest since it only involves collecting sediment samples. Alternative HBHA-3, the Preferred Alternative, HBHA-4, and Alternative HBHA-5 would be more difficult than Alternatives HBHA-1 and HBHA-2 due to the construction activities involved in these alternatives, including dredging, water treatment, sediment dewatering, and the need for specialized equipment and skilled workers. The Preferred Alternative, HBHA-4, is more difficult than Alternative HBHA-5 because it is further compounded by the construction of a sediment retention area and larger compensatory wetland. All alternatives except the Preferred Alternative, HBHA-4, require that contaminated groundwater discharges be eliminated prior to constructing the remedy so that the excavated or capped areas do not become re-contaminated.

Near Shore Sediments (NS): The No Action Alternative, NS-1, would be the easiest to implement because there are no on-site remedial actions required. Alternatives NS-2 and NS-3 would be the next easiest since the only activities required are posting fences and signs in the Wells G&H Wetland and the Cranberry Bog Conservation Area. Alternative NS-3 would also include periodic sampling of surface water and sediment. The Preferred Alternative, NS-4, would be more difficult than the others due to the excavation, dewatering, water treatment and wetlands restoration activities involved in this alternative.

Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, and the Preferred Alternative DS-2 would be the easiest to implement because there are no on-site remedial actions required. Alternative DS-3 would be the most difficult to complete due to the complexities involved in accessing the interior portions of the Wells G&H Wetland and the Cranberry Bog Conservation Area with heavy equipment to conduct the excavation, dewatering, water treatment and wetlands restoration activities involved in this alternative.

Surface Water (SW): The No Action Alternative, SW-1, and the Preferred Alternative, SW-2, would be the easiest to implement because there are no on-site remedial actions required. The Preferred Alternative, SW-2, would require additional effort associated with monitoring. Alternative SW-3 would be the most difficult to implement due to locating and constructing an alternate wetlands habitat.

7. COST:

The estimated present worth costs for each alternative are presented in Table K-8 (same table presented in the Proposed Plan – without the highlight). The estimated present worth costs for the alternatives addressing SS, SUB, GW, HBHA, NS, DS and SW, not including the No Action alternatives, range from $11.0 million to $215.0 million. The selected remedy includes alternatives SS-2, SUB-2, GW-2, a portion of GW-4, HBHA-4, NS-4, DS-2, and SW-2, and has a total estimated present worth cost of $25.7 million.

8. STATE ACCEPTANCE:

The State has expressed its support for the preferred alternatives presented in the Proposed Plan and concurs with the selected remedy outlined in this ROD. See Appendix A for state concurrence letter.

9. COMMUNITY ACCEPTANCE:

EPA held an informational Public Meeting on June 30, 2005, initiating a 30-day public comment period beginning July 1, 2005. In response to public requests, EPA extended this initial public comment period 30-days closing the public comment period on August 31, 2005. After review of the public comments, EPA then reopened the comment period from October 20, 2005 to November 18, 2005. EPA held Public Hearings on July 27, 2005, and November 17, 2005. EPA received extensive written and oral comments from community during this process.

Members of the public, community leaders, and environmental groups neither supported nor advocated against EPA's selected remedy. Specific comments focused on institutional controls, comprehensive long-term monitoring, wetland functions impacts, assurances the selected remedy will work, and participation in the Remedial Design and Remedial Action phases. Many comments also indicated that additional time to review the Proposed Plan and supporting technical documents (e.g. MSGRP RI, FS, technical memoranda, etc.) was needed.

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy is a comprehensive remedy which utilizes source control and management of migration components to address the principal risks at Industri-plex OU-2. The selected remedy serves as a final remedy for the Industri-plex Superfund Site, and addresses the third operable unit (OU-3, Aberjona River Study) for the Wells G&H Superfund Site. If any final groundwater decisions are necessary for the remaining Wells G&H aquifer, these decisions will be made under Wells G&H Operable Unit 2, Central Area Study.

The major components of the remedy include the following:

- Dredging and off-site disposal of contaminated sediments in the southern portion of the HBHA Pond; dredging and off-site disposal of contaminated near shore sediments at the Wells G&H Wetland and Cranberry Bog Conservation Area; and restoration of all disturbed areas. This component will address sediments posing unacceptable human health risks for near shore sediments and unacceptable ecological risks for the southern portion of HBHA Pond.

- Use of the northern portion of HBHA Pond as a sediment retention area (primary and secondary treatment cells) that will intercept contaminated groundwater plumes (including arsenic, benzene, ammonia, 1,2-dichloroethane, trichloroethene, naphthalene) from Industri-plex OU-1, treat/sequester contaminants of concern (including arsenic, benzene, ammonia), and minimize downstream migration of contaminants (including arsenic, benzene, ammonia). The primary treatment cell will intercept the contaminated groundwater plumes discharging in the HBHA Pond. The effluent from northern portion of the HBHA Pond (secondary treatment cell outlet) will serve as the surface water compliance boundary, and achieve National Recommended Water Quality Criteria (NRWQC). Sediments which accumulate in the northern portion of the HBHA Pond will be periodically dredged and sent off-site for disposal. Portions of storm water from Halls Brook, which may interfere with the natural treatment processes occurring within the northern portion of the HBHA Pond, will be diverted to the southern portion of HBHA Pond.

- If necessary, In-situ Enhanced Bioremediation of contaminated groundwater plumes (e.g., benzene) at the West Hide Pile (WHP).

- Construction of an impermeable cap to line stream channels (e.g. New Boston Street Drainway), and to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

• Construction of a permeable cap to prevent contaminated soil erosion (e.g. Area A6), downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

• Establishing institutional controls to restrict contact with soils, groundwater, or deeper interior wetland sediments with concentrations above cleanup standards and protect the remedy.

• Construction of compensatory wetlands for any loss of wetland functions and values associated with the selected remedy (e.g. northern portion of HBHA Pond, Halls Brook storm water by-pass, capped stream channels) nearby in the watershed.

• Long-term monitoring of the groundwater, surface water, and sediments, and periodic Five-year Reviews of the remedy.

2. Description of Remedial Components

The selected remedy is consistent with EPA's preferred alternative outlined in the June 2005 Proposed Plan and is consistent with a combination of all or a portion of Alternatives SS-2, SUB-2, GW-2, GW-4 for WHP, HBHA-4, NS-4, DS-2, and SW-2, outlined in the June 2005 Feasibility Study. The selected remedy is generally depicted in Figure L-1.

Soil Contamination in Former Mishawum Lakebed Area

Risks from contaminated surface and subsurface soils in the former Mishawum lakebed Area, generally depicted in Figures J-1 and J-2 and mostly under buildings and bituminous parking lots and streets for surface soils, will be addressed via Institutional Controls. See "Institutional Controls" Section below for additional details.

Groundwater

Risks from exposure to contaminated groundwater plumes, generally depicted in Figures J-3 and J-4, will be controlled via Institutional Controls. See "Institutional Controls" Section below for additional details. Downstream migration of the contaminated groundwater to areas in the HBHA Wetlands and the Aberjona River will be controlled by intercepting the contaminated groundwater plumes at the HBHA Pond where contaminants of concern will be degraded, sequestered and/or treated such that no unacceptable human health or ecological risks are present downstream of the HBHA Pond. Additional detail on the HBHA Pond remedial component is outlined in the "Halls Brook Holding Area Pond" Section below.

In addition, benzene contamination in groundwater in the area of the West Hide Pile (WHP), generally depicted in Figure J-4 and conceptually depicted in Figure J-5, may be treated via the installation of an in-situ enhanced bioremediation system, including installation of small diameter (e.g. 2 inch) injection wells for the application of oxygenated materials to promote biological degradation. Plumes associated with the West Hide Pile (e.g. benzene, arsenic, ammonia) likely discharge to nearby wetlands (e.g. southern pond). However, additional groundwater and surface water data are required to assess the impact of groundwater discharge, originating from the West Hide Pile, on surface water and sediments. If EPA determines that there are no unacceptable risks from contaminated groundwater discharges after the collection and evaluation of additional data during pre-design studies, and institutional controls have been implemented appropriately on the property restricting human health exposures to the contaminated groundwater, then it may not be necessary to implement this enhanced bioremediation component of the remedy.

Halls Brook Holding Area Pond

There are six important aspects of this component of the selected remedy:

1) The northern portion of the HBHA Pond is incorporated in the selected remedy, and designed to intercept contaminated groundwater plumes from Industri-plex OU-1 and sequester/treat contaminants so that surface water discharge from the northern portion is below surface water cleanup standards (e.g. National Recommended Water Quality Criteria, benchmark criteria) for those contaminants. Sediments that accumulate in the northern portion of the HBHA Pond will be removed periodically and disposed off-site. As described in the conceptual plan below, the northern portion of the HBHA Pond will be divided into a primary and secondary treatment cell to achieve cleanup standards, comply with remedial action objectives, and not impact other components of the selected remedy;

2) Sediments in the southern portion of the HBHA Pond will be removed and restored;

3) Storm water by-pass system will be designed and constructed for storm surface water flows (e.g. Halls Brook) that may disrupt the chemocline (stratification of the heavier (greater density) contaminated deep water and lighter (lower density) shallow water) and sequestering/treatment processes within the northern portion of the HBHA Pond for this component of the selected remedy, and/or cause contamination to migrate downstream;

4) Impermeable caps will be designed and constructed to line stream channels and prevent contaminated groundwater plumes discharge into surface water (e.g. New Boston Street Drainway), downstream migration of contaminants of concern and potential impacts to other components of the selected remedy;

5) Permeable caps will be designed and constructed to prevent contaminated soil erosion (e.g. Area A6), downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy; and

6) Wetland and water function and value losses (e.g. northern portion of the HBHA Pond, stormwater by-pass system, capped areas) will be compensated nearby in the watershed.

The location of this component of the selected remedy is generally depicted in Figure J-6, and some of above aspects of this component are conceptually depicted in Figure J-7.

This component of the selected remedy divides the HBHA Pond into two major portions (i.e. northern and southern portions). While the specific design and layout of this portion of the remedy will be determined during the Remedial Design, the following is EPA's conceptual plan based on the evaluation conducted in the Feasibility Study: Two low-head cofferdams will be constructed in the northern portion of the HBHA Pond which will subdivide the northern portion into two treatment areas or cells (i.e. primary and secondary treatment cells). The northern portion of the HBHA Pond will capture the discharge of the contaminated groundwater plumes (exceeding the groundwater cleanup standards), sequester/treat contaminants to achieve surface water cleanup standards (i.e. surface water component of the remedy), serve as a sediment retention area requiring period dredging, and prevent the migration of contaminated sediment and surface water downstream. The sediments in the southern portion of the HBHA Pond exceeding sediment cleanup standards will be dredged and disposed off-site at a permitted facility, and the southern portion will be restored. Implementation of the dredging measures associated with the southern portion of the HBHA Pond dredging would likely resemble similar measures outlined below under Section L "Aberjona River Sediments", and possibly include mechanical and/or hydraulic dredging measures.

The two low-head cofferdams (northern/first and southern/second cofferdams), which divide the northern portion of the HBHA Pond, will create the primary and secondary treatment cells. The primary treatment cell and the first low-head cofferdam will intercept contaminated groundwater plumes discharging into the HBHA Pond, sequester/treat the discharge of the groundwater plumes through natural processes, maintain the chemocline within the primary treatment cell at least 100 centimeters below the elevation of the top of the first low-head cofferdam, and serve as sediment retention area. The secondary treatment cell and the second low-head cofferdam includes an aeration treatment system designed to treat surface water from the primary treatment cell and further sequester/treat contaminants of concern (including arsenic, ammonia and benzene). The secondary treatment cell will also serve as a sediment retention area. The outlet of the secondary treatment cell (i.e. second low-head cofferdam) will comply with surface water cleanup standards (e.g. National Recommended Water Quality Criteria, surface water benchmarks), and remedial action objectives. Sediments that accumulate in the northern portion of the HBHA Pond (primary and secondary treatment cells) will be removed periodically and disposed off-site at a permitted facility. Periodic removal will be necessary to prevent excessive accumulation of sediments, and maintain the integrity of the chemocline and the function of the primary and secondary treatment cells. The dredging measures associated with the sediment retention areas of the primary and secondary treatment cells may include hydraulic dredging measures.

In addition to other design and performance criteria that will be detailed in the remedial design, EPA is establishing the following conditions that may trigger dredging in the northern portion of the HBHA Pond (primary and/ or secondary treatment cells): 1) if the chemocline rises to within 100 cm of the top of the primary treatment cell low-head cofferdam (first cofferdam) outlet, or 2) concentrations of surface water effluent/ outlet from the second treatment cell low-head cofferdam (second cofferdam) exceed the surface water cleanup standards. However, EPA expects that other cost effective interim measures will be evaluated and possibly implemented prior to implementing dredging activities at the HBHA Pond. These interim steps (for example, actions other than dredging) may temporarily postpone the need for dredging operations, until the interim steps are no longer effective and excessive sediment accumulation within primary and/or secondary treatment cells requires dredging. Frequent long-term monitoring will be necessary to monitor the system.

A portion of the sediments in the HBHA Pond help maintain the supply of ferrous iron that contributes to the capture of arsenic near the chemocline and promote microbial degradation, which suggests that when dredging becomes necessary in the primary treatment cell, only partial dredging should be implemented sufficient to lower the elevation of the chemocline and/ or provide further sediment retention capacity. Also, dredging should only be implemented when necessary to ensure that the remedy is functioning appropriately, achieving the remedial action objectives and standards, and the chemocline remains below a depth of 100 cm in the water column ensuring no elevated releases of contaminants of concerns downstream. Long-term groundwater monitoring will also be included as part of the comprehensive monitoring program to evaluate groundwater conditions upgradient, cross-gradient and downgradient of the HBHA Pond.

This component also includes a storm water by-pass system for Halls Brook, impermeable capping of sediments, and permeable capping of soils that may cause downstream migration of contamination and/or may impact the components of the selected remedy.

A storm water by-pass system will be designed and constructed to divert a portion of storm flow from Halls Brook and avoid disrupting the treatment properties of the northern portion of the HBHA Pond (primary and secondary treatment cells)/sediment retention system, including the chemocline. A portion of stormwater flow that would otherwise enter the northern portion of the HBHA Pond and cause destabilization of the chemocline and/or sediment erosion would instead be diverted to the southern portion of the HBHA Pond (downstream of the secondary treatment cell), so that base flow conditions are maintained in the primary and secondary treatment cells during storm events, and the chemocline remains stabilized in the primary treatment cell. This action will help prevent downstream migration of contaminants of concern and potential impacts to other components of the selected remedy.

An impermeable cap will be placed along stream channels (e.g. portions of the New Boston Street Drainway) to prevent contaminated groundwater plumes (e.g. arsenic) discharge, downstream migration of contaminants of concern and potential impacts to other components of the selected remedy. A permeable cap will be placed along contaminated soils (e.g. the northern banks of the HBHA Pond along the southern boundary of the Boston Edison right-of-way and adjacent to the railroad right of-way west of the HBHA Pond (e.g., Area A6)) to prevent soil erosion (i.e. soils exceeding the sediment cleanup standards), additional loading of contaminated sediments to the primary and secondary treatment cells, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

Any wetland function and value losses associated with the selected remedy will be compensated for within the watershed including the northern portion of the HBHA Pond being used as component of the selected remedy, construction of the storm water bypass system and capping sediment/soil areas.

The components of the selected remedy for the HBHA Pond (i.e. HBHA-4), will receive continuous contaminated groundwater discharges for the foreseeable future, and the remedial design for these components must take into consideration significant storm weather conditions (including hurricanes) to ensure durability, permanence, and long term performance.

The details of this component of the selected remedy will be established during pre-design investigations and remedial design, and many of the components are inter-dependent. For example: The location of the first low-head cofferdam and size of the primary treatment cell will greatly depend upon pre-design investigations to further delineate the extent of the contaminated groundwater plumes' discharge into the HBHA Pond so that the primary treatment cell captures all of the contaminated groundwater plumes. The locations of the first low-head cofferdam, the size of the primary treatment cell and the design of the secondary treatment cell will directly affect other remedy components such as the length/size of the Halls Brook storm water by-pass system, the size of the southern portion of the HBHA Pond requiring dredging and restoration, and the amount of wetlands compensation. Also, the wetland function losses associated with the construction of impermeable and permeable caps will affect the amount of wetlands compensation.

Aberjona River Sediments

This component of the selected remedy addresses risks to humans from exposures to contaminated near-shore sediments in the Wells G & H Wetland and the Cranberry Bog Conservation Area by removing near-shore contaminated sediments exceeding the soil cleanup standards, restoring the near shore area, and dewatering and disposing of the contaminated sediments off-site at an approved licensed facility. The general locations of the near-shore areas requiring excavation are depicted on Figure J-8.

Implementation of this remedy component would likely include measures to prevent downstream migration of sediments during construction; dewatering of area proposed for excavation (as necessary) and excavated materials, and treatment of resulting water; installing low-head cofferdams or other means to hydraulically isolate excavation areas from the open water portions of the wetland; replacing wetland substrate and vegetation that was removed; and restoring all areas impacted during construction. During design, proposed construction methods, access points, and haul routes will be discussed and coordinated with local officials to ensure that adverse impacts on the community during construction are minimized.

Risks from contamination in deeper wetland sediments (in areas generally depicted on Figure J-9) will be addressed via institutional controls and long-term monitoring. See "Institutional Controls" Section below for additional details.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an Explanation of Significant Differences or a Record of Decision Amendment, as appropriate.

Remedial Design and Pre-Design Studies

A number of additional investigations may be necessary to provide additional detailed information required to implement the selected remedy. Pre-design studies may include:

- investigation to delineate the limits of contamination requiring remediation in areas of accessible sediments. Accessible sediments were defined in Appendix 6A of the March 2005 MSGRP RI as areas with mild to moderate vegetation, generally shallow (i.e., less than two feet) and slow moving surface water, and gradual banks with few, if any, physical barriers present (e.g., fencing or other access obstacles). Figure J-8 illustrates the approximate location for accessible near shore sediments exceeding sediment cleanup standards to be removed. Pre-design investigations may be implemented to further estimate the areas requiring removal;

- investigations to further delineate the limits of contamination requiring institutional controls and evaluate background groundwater conditions for ammonia, as well as pre-design groundwater, surface water and sediment investigations at/near the West Hide Pile, East Hide Pile and adjacent wetlands (e.g. benzene, arsenic, ammonia) for assessing potential human health and ecological risks;

- any necessary studies to support the design and implementation of institutional controls approved by EPA;

- studies to locate property suitable for the construction of a compensatory wetlands to mitigate wetland and water function and value losses;

- investigation of the contaminated groundwater plumes and where they discharge into the HBHA Pond so that placement of the first low-head cofferdam for the primary treatment cell can be appropriately located and capture the groundwater plumes (e.g. arsenic, benzene, ammonia); and,

- investigations regarding the design and construction of the primary and/ or secondary treatment cells in the HBHA Pond, including flood storage and mitigation.

Also, as prescribed by EPA guidance, both HHRAs were prepared to evaluate a reasonable maximum exposure (RME) case. The risk assessment was also prepared to account for future potential exposure pathways, as required by EPA guidance, since those hypothetical future exposure pathways may not be completely controllable. Until institutional controls are fully implemented, those future pathways are considered potentially complete, and knowledge of the potential risk findings associated with those pathways are important to the risk management process.

The site-specific arsenic bioavailability study was performed to be specifically applicable to sediment, not soil. Because the soil matrix composition and structure could differ considerably from that of sediment, the arsenic bioavailability estimate developed for sediment was not considered applicable to the soil ingestion pathway. However, during pre-design, additional site-specific, EPA-approved studies/tests may be conducted to determine the relative bioavailability of arsenic from surface soils, or from subsurface soils, if such an approach is deemed beneficial in limiting the extent of institutional controls that may be necessary for individual properties. EPA-approved studies/tests include in-vivo bioavailability studies (e.g. swine bioavailability study) similar to the study conducted by EPA during the MSGRP RI. Future EPA-approved studies may potentially include in-vitro bioavailability studies (not currently approved by EPA).

Individual studies must be conducted for surface soils and subsurface soils (samples from both samples may not be consolidated into one sample because of likely variability in the soil matrix).

The selected remedy is necessary to remove the high concentrations of benzene from the West Hide Pile. Pre-design investigations will be necessary to further evaluate the West Hide Pile and East Hide Pile contaminated groundwater plumes' impact on the nearby wetlands and downgradient groundwater plumes. Institutional controls required under the 1986 Record of Decision have not been recorded on any property to date. However, if 1) appropriate pre-design investigations are implemented for groundwater, surface water and sediment at/near the West Hide Pile, East Hide Pile and adjacent wetlands (e.g. benzene, arsenic, ammonia); 2) EPA further evaluates this data and determines there are no unacceptable ecological or human health risks (exceeding the cleanup standards established for this remedy); and, 3) institutional controls are put in place and eliminate the groundwater human health risks, the implementation of the enhanced bio-remediation remedy for the West Hide Pile may not be necessary.

The specific details of the design and implementation of the selected remedy outlined in this ROD will be finalized during the Remedial Design phase, and will depend on the results of the various pre-design investigations outlined above. The final design of the HBHA Pond remedy may differ somewhat from the conceptual layout of the two low-head cofferdam system described for the HBHA Pond.

<u>Institutional Controls</u>

In order to protect human health by controlling potential exposures to contaminated soils, sediments, and groundwater, the selected remedy relies on the use of Institutional Controls such as limitations on land and groundwater uses and activities. Institutional Controls are also necessary for the protection of the selected remedy. The details of the institutional controls will be resolved during the pre-design and remedial design phase in coordination with the parties performing the Remedial Action, impacted landowners, and local officials. MassDEP participation with the Institutional Controls will be in accordance with Commonwealth of Massachusetts policies, guidance and regulations.

Risks from exposure to contaminated groundwater will be controlled through the implementation of institutional controls. In areas where groundwater contamination exceeds the performance standards outlined in Table L-1, groundwater use restrictions will be required for drinking water, industrial process water, or other purposes (such as waster for a commercial car wash facility and groundwater encountered during excavation activities).

Risks from exposure to contaminated surface (0' - 3' below ground surface) and sub-surface (3' – 15' below ground surface) soils in the former Mishawum lakebed area will be controlled through the implementation of institutional controls. In areas where surface or sub-surface soil contamination exceeds the cleanup standards outlined in Table L-2, land use restrictions will be required to restrict excavations without adequate worker health and safety precautions (e.g. engineering controls, personal protective equipment (PPE), monitoring, etc) to minimize or prevent direct contact with contaminated soil during removal activities, and restrict potential on-site and off-site spread of contamination. Furthermore, on properties where surface soils exceed the cleanup standards, it will also be necessary to restrict land use so that child care facilities are not constructed in those areas.

The selected remedy will address risks to humans from future exposures to sediments situated deeper into the Wells G & H Wetland and the Cranberry Bog Conservation Area wetlands by dredging workers through the use of institutional controls in areas where sediment contamination exceeds the cleanup standards. The details of these institutional controls will be resolved during the remedial design phase. Generally, these sediments are not accessible to humans except in a future dredging scenario. Therefore, prohibitions or restrictions on dredging would be an effective deterrent to potential future exposures to sediment in the deep sediment human health risk areas. Institutional controls would prohibit dredging in areas where sediment contamination exceeds the cleanup standards outlined in Table L-4 unless regulatory oversight and adequate precautions (e.g. engineering controls, PPE, etc.) were taken to minimize or prevent direct contact with contaminated sediment during dredging activities.

Institutional Controls will also be required to ensure that any remedial components constructed as part of the selected remedy, such as covers or caps over contaminated soils areas or low-head cofferdams or other structures constructed in or near the HBHA Pond as part of the remedy are not disturbed or otherwise compromised by any other use or activity.

Long-term Monitoring and Five-year Reviews

Long-term monitoring of groundwater, surface water, and sediments will be required in order to evaluate contaminant status and migration.

Groundwater monitoring is included to ensure that contaminated soils that are left in place do not impact groundwater and do not create unacceptable human health risks in the future. Groundwater monitoring wells will be installed to evaluate contaminant trends and human health and ecological risks or hazards. Details of groundwater monitoring will be resolved during design and the preparation of a long-term monitoring plan. Monitoring scope and frequency could change over time. If contaminant trends show that there have been no impacts to groundwater such that no human health risks or hazards have been created, then groundwater sampling would be suspended or discontinued. If concentrations are shown to increase or persist, then monitoring will continue. Monitoring will also be performed to evaluate the performance of the selected remedy.

Since wastes will be left in place as part of the selected remedy, the NCP requires periodic reviews of the remedy. A comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of this Five-year Review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The Five-year Review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations.

The selected remedy also includes long-term operation, inspections, and maintenance of any systems put in place as part of the remedy, including caps and/or covers over contaminated soils areas, low-head cofferdams, primary and secondary treatment cells, and storm water by-pass structures; periodic removal of accumulated sediments from the sediment retention portion of the HBHA Pond. Long-term inspections and monitoring will also be required to ensure that institutional controls remain effective and are being enforced, and, long-term monitoring of groundwater, surface water, sediments and biota will be necessary to evaluate the effectiveness and re-colonization of biota in the dredged area, as well as the effectiveness of any revegetation, wetland restoration, or wetland replication area.

Long-term monitoring of the northern portion of the HBHA Pond is necessary to evaluate its sequestering/ treatment effectiveness and performance, as well as the chemocline (continued stratification of contaminated water based on higher density water with higher salt content). Although a comprehensive, EPA-approved monitoring program will be developed during the design phase, this monitoring will likely include, at a minimum, the installation and monitoring of sampling stations at discrete sample depths (e.g. sampling intervals 25 cm to 50 cm apart) in the northern portion and monitor for contaminants of concern, specific conductance, dissolved oxygen, ferrous iron (filtered), total iron (unfiltered). The plan will also include sediment accumulation monitoring within the northern portion of the HBHA Pond (primary and secondary treatment cells).

It will also be necessary to monitor the performance of the selected remedy at Industri-plex OU-2 and downstream along the Aberjona River and Mystic Lakes. An EPA-approved monitoring program will be developed during the design phase and will include, at a minimum, surface water monitoring at the HBHA Pond and monitoring along the series of surface water monitoring stations at Industri-plex OU-2, and downstream along the Aberjona River and Mystic Lakes. The monitoring shall also include a component of periodic sediment monitoring within Industri-plex OU-2 boundaries (e.g. wetlands near West Hide Pile, HBHA, Wells G&H Wetlands, Cranberry Bog Conservation Area) and Upper Mystic Lakes including the upper and lower forebays.

The June 2005 Feasibility Study and June 2005 Proposed Plan evaluated monitoring requirements for each alternative to compare costs. However, it is likely that the long-term monitoring requirements of each component of the selected remedy may be consolidated under one Operations and Maintenance Plan for the Remedial Action per this ROD.

3. Summary of the Estimated Remedy Costs

All cost information reported in the ROD is from estimates from the Industri-plex OU-2 MSGRP FS, with an accuracy expectation of +50% to -30%. These estimates will be refined as the remedy is designed and implemented. The original estimated cost of the components of the selected remedy as illustrated in Tables 4-2 (SS), 4-7 (SUB-2), 4-10 (GW-2), 4-12 (portion of GW-4 as highlighted in Table 4-29 of the Proposed Plan), 4-16 (HBHA-4), 4-21 (NS-4), 4-23 (DS-2), and 4-26 (SW-2) is as follows:

SS-2: Institutional Controls with Monitoring	$600,000
SUB-2: Institutional Controls with Monitoring	$1,276,000
GW-2: Pond Intercept with Monitoring and Institutional Controls	$3,918,000
GW-4 (portion representing In-situ Enhanced Bioremediation at the West Hide Pile)	$3,752,000
HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat	$9,187,000
NS-4: Removal and Off-Site Disposal	$3,247,000
DS-2: Monitoring with Institutional Controls	$459,000
SW-2: Monitoring	$3,226,000
Total	$25,665,000

The total cost of the components of the selected remedy is $25,665,000, based upon the present value of 30 years of Operation and Maintenance with a 7% discount rate for calculating total present worth costs. The cost estimate does not forecast beyond the 30 year time period. However, operation and maintenance costs will extend indefinitely beyond the 30 year period.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

4. Expected Outcomes of the Selected Remedy

The expected outcome of the selected remedy is that:

- Contaminated surface soil areas (generally depicted on Figure J-1) will no longer present an unacceptable risk to children or construction workers via dermal contact and ingestion of surface soils (0' – 3' below ground surface);

- Contaminated sub-surface soil areas (generally depicted on Figure J-2) will no longer present an unacceptable risk to construction workers via dermal contact and ingestion of sub-surface soils (3' – 15' below ground surface);

- Areas of contaminated groundwater (generally depicted on Figures J-3 and J-4) will no longer present an unacceptable risk to commercial and construction workers human receptors via dermal contact, ingestion and inhalation of groundwater;

- Sediments in the southern portion of the HBHA Pond (generally depicted on Figure J-6) will no longer present an unacceptable ecological risk to aquatic life;

- near-shore sediment areas (generally depicted on Figure J-8) will no longer present an unacceptable risk to children and adults for ingestion and dermal contact of near shore sediments;

- deep sediment contamination areas (generally depicted on Figure J-9) will no longer present an unacceptable risk to dredging workers for ingestion and dermal contact of deeper wetland sediments; and

- Surface water areas (generally illustrated on Figure J-6) will no longer present an unacceptable risk to aquatic life in the southern portion of the HBHA Pond.

Mitigating these risks will ensure that the areas are suitable for industrial, commercial and recreational land uses. The selected remedy will also intercept contaminated groundwater plumes at the northern portion of the HBHA Pond, treat/sequester contaminants of concerns within the northern portion of the HBHA Pond (primary and secondary treatment cells), reduce migration of contamination downstream of the northern portion of the HBHA Pond, and improve the surface water quality in the watershed downstream of the northern portion of the HBHA Pond (primary and secondary treatment cells).

Based upon the June 2005 Draft Technical Memorandum – Model Simulation of Flow, Suspended Sediment, and Heavy Metal Transport for the Aberjona Watershed, it is anticipated that the contaminant migration from the northern portion of the HBHA Pond will be reduced by

90%. It is estimated that it will take two years to complete construction of the selected remedy, after the completion of pre-design investigations and final designs. The selected remedy will also provide environmental and ecological benefits such as the restoration of wetlands, and the construction of compensatory wetlands in the watershed for loss of habitat, function, and value associated with selected remedy.

a. Cleanup Standards

1. Ground Water Performance Standards

Performance Standards have been established for groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. These standards have been set based on the risk associated with industrial water usage, as described below, because groundwater at Industri-plex OU-1 south to Interstate 95 within the Industri-plex OU-2 MSGRP RI Northern Study Area is considered by MassDEP to be of "low use and value" and not suitable for potable use.

MassDEP completed a Ground Water Use and Value Determination for the Industri-plex aquifer Industri-plex OU-1 south to Interstate 95 within the Industri-plex OU-2 MSGRP RI Northern Study Area. This determination is attached as Appendix F. The Industri-plex aquifer was classified by MassDEP as a Non-Potential Drinking Water Source Area. This finding indicates that the groundwater beneath this portion of the Site is of low use and value as a future drinking water supply because of its concentrated industrial development, and therefore drinking water standards, consistent with the use and value determination, shall not be required to be attained in the groundwater at this portion of the Site.

Because federal and state drinking water standards are not required to be attained at this portion of the Site, a performance standard was derived for each chemical of concern having carcinogenic potential (Classes A, B, and C compounds) to be within the 10^{-4} to 10^{-6} cancer risk range considering the future incidental ingestion of, dermal contact with, and inhalation of volatile compounds released during industrial water usage (i.e., process water or car wash scenarios). Performance Standards for chemicals of concern based on non-carcinogenic effects were established based on a level that represent an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1) considering the future incidental ingestion of, dermal contact with, and inhalation of volatile compounds released during industrial water usage (i.e., process water or car wash scenario) and worker excavation activities.

Table L-1 presents the Performance Standards for carcinogenic and non-carcinogenic chemicals of concern identified in groundwater and are summarized below.

SUMMARY OF GROUNDWATER PERFORMANCE STANDARDS	
Arsenic	150 μg/L
Benzene	4 μg/L
1,2-Dichloroethane	2 μg/L
Trichloroethene	1 μg/L
Naphthalene	5 μg/L
Ammonia	4000 μg/L

Institutional Controls will be required to restrict unacceptable exposures to groundwater that exceeds these Performance Standards.

2. Soil Cleanup Standards

Land use in the vicinity of the former Mishawum lakebed area is commercial/industrial. A day care facility was formerly located in this area and there is a high likelihood that commercial/industrial use of this area will continue, possibly including the future siting of a day care facility. Refer to Sections E and F of the ROD for more detailed descriptions of Site features and land use.

Soil cleanup standards for arsenic in surface and subsurface soil (0 to 15 feet bgs) within the former Mishawum lakebed have been established to be protective for exposure by a future day care child and an excavation worker. The soil cleanup standard for arsenic, a Class A carcinogenic compound, has been set within the 10^{-4} to 10^{-6} cancer risk range considering exposures via dermal contact and incidental ingestion. The cleanup standard for arsenic in soil is based on non-carcinogenic effects, derived for the same exposure pathway(s) and correspond to an acceptable exposure level to which the human population (including sensitive subgroups) may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1). Exposure parameters for the ingestion and dermal contact exposure pathways for the day care child have been described in Section G1.

Table L-2 presents the cleanup standards for arsenic in soil protective of direct contact with soil and are summarized below.

SUMMARY OF SOIL CLEANUP STANDARDS	
Arsenic	50 mg/kg

This soil cleanup standard attains EPA's risk management goal for remedial actions and have been determined by EPA to be protective. Institutional Controls will be required to restrict unacceptable exposure to contaminated soil that exceeds these Cleanup Standards

A site-specific arsenic bioavailability study was performed specifically for depositional sediments, not soil. Because the soil matrix composition and structure could differ considerably from that of sediment, the arsenic bioavailability estimate was not considered applicable to the soil ingestion pathway. However, with EPA approval, during pre-design, additional site-specific bioavailability studies may be conducted to determine the bioavailability of arsenic from surface soils or from subsurface soils, if such an approach is deemed beneficial in limiting the extent of institutional controls that may be necessary for individual properties. Individual studies must be conducted for both surface soils and subsurface soils (samples from both samples may not be consolidated into one sample because of likely variability in the soil matrix). Should a site-specific surface soil and/or subsurface soil arsenic bioavailability study be approved and performed, Table L-3 provides the formula and exposure assumptions that will be used to calculate a surface soil or subsurface soil arsenic cleanup standard, adjusted for the site-specific bioavailability of arsenic.

3. Sediment Cleanup Standards

Sediment cleanup standards protective of human health have been established for arsenic and/or benzo(a)pyrene in near-shore sediments at the Cranberry Bog Conservation Area (e.g. Stations CB-03) and Wells G&H Wetland (e.g. WH, NT-3, and 13/TT-27), generally depicted in Figure F-8, exhibiting an unacceptable cancer risk and hazard index for a future recreational user. A sediment cleanup standard for arsenic in deeper interior wetland sediments at HBHA Wetland (e.g. sediment core SC02) and Wells G&H Wetland (e.g. sediment cores SC05, SC06, and SC08), generally depicted in Figure J-9, exhibiting an unacceptable hazard index for a future dredging worker has been established such that it is protective of human health. Sediment cleanup standards for known and suspect carcinogenic chemicals of concern (Classes A, B, and C compounds) have been set within the 10^{-4} to 10^{-6} cancer risk range considering exposures via dermal contact and incidental ingestion for each receptor. Cleanup standards for chemicals of concern in sediment based on non-carcinogenic effects were derived for the same exposure pathway(s) and correspond to an acceptable exposure level to which the human population (including sensitive subgroups) may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1). Exposure parameters for the ingestion and dermal contact exposure pathways for the recreational user and dredging worker have been described in Section G1. Because the cleanup value described above for benzo(a)pyrene is below a background value for this compound, a background value was used for the sediment cleanup standard.

Table L-4 presents the cleanup standards for carcinogenic and non-carcinogenic chemicals of concern in sediment within the HBHA Wetland, Wells G&H Wetland, and Cranberry Bog Conservation area protective of direct contact with sediment for recreational and worker receptors.

For the HBHA Pond, a sediment cleanup standard for arsenic has been established for ecological protection of the benthic invertebrate population in the portions of the pond where toxicity testing indicated significant adverse impacts on survival and growth, and community impairment. The cleanup standard for the HBHA Pond (273 mg/kg arsenic; see Table G28) is set at a level corresponding to the lowest observed effects level for benthic invertebrates for survival and/or growth exposed to HBHA Pond sediments.

Sediment cleanup standards are summarized below.

SUMMARY OF SEDIMENT CLEANUP STANDARDS	
Near Shore Cranberry Bog Conservation Area (e.g. CB-03)	
Arsenic	230 mg/kg
Near Shore Wells G&H Wetland (e.g. WH, NT-3, 13/TT-27)	
Arsenic	300 mg/kg
Benzo(a)pyrene	4.9 mg/kg
Deeper Interior HBHA Wetland and Wells G&H Wetland (e.g. SC02, SC05, SC06, SC08)	
Arsenic	300 mg/kg
HBHA Pond (ecological)	
Arsenic	273 mg/kg

These sediment cleanup standards must be met at the completion of the remedial action at the points of compliance as follows:

- The compliance point for near shore sediments at the Wells G&H Wetland is identified as the areas targeted for excavation that currently exceed the sediment cleanup standard extending up to 30 feet from the shore line (generally east/west direction) into the wetlands and continuing laterally (generally north/south direction) until the sediment cleanup standard is achieved based upon confirmation samples analyzed for metals and SVOCs using the most recent version of EPA-approved analytical methods.

- The compliance point for near shore sediments at the Cranberry Bog Conservation Area is identified as the areas targeted for excavation that currently exceed the sediment cleanup standard primarily along the drainage swales and continuing until the sediment cleanup standard is achieved based upon confirmation samples analyzed for metals using the most recent version of EPA-approved analytical methods.

- The compliance point for deeper interior wetland sediments at the HBHA Wetlands and Wells G&H Wetlands is identified as the areas targeted for potential future dredging projects that currently exceed the sediment cleanup standard for arsenic. The approximate location of the HBHA Wetlands and Wells G&H Wetlands are presented on Figure J-9 and other figures in the MSGRP RI and FS.

- The compliance point for sediments at the southern portion of the HBHA Pond is identified as the areas for excavation that currently exceed the sediment cleanup standard and continuing until the sediment cleanup standard is achieved based upon confirmation samples analyzed for metals using the most recent version of EPA-approved analytical methods. The approximate boundaries of the HBHA pond are illustrated in Figure J-6 and other figures presented in the MSGRP RI and FS. However, the boundaries of the area of sediment to be remediated in the southern portion of the HBHA Pond will not be determined until the location of the low-head cofferdams is determined.

- The compliance point for the impermeable cap is identified as the area of the stream channel (e.g., New Boston Street Drainway) where contaminated groundwater plumes discharge into the channel, contaminate sediments, and potentially migrate downstream, impacting components of the selected remedy (including the remediated Southern Portion of the HBHA Pond).

- The compliance point for the permeable cap is identified as the area where contaminated soils above the HBHA Pond sediment cleanup standard for arsenic (e.g., Area A6) and may erode and migrate downstream impacting components of the selected remedy (including the Northern Portion of the HBHA Pond)).

The sediment cleanup standards attain EPA's risk management goals for remedial action and are protective of human health and the environment.

4. Surface Water Cleanup Standards

For the HBHA Pond, surface water cleanup standards for arsenic, ammonia, and benzene have been established for ecological protection of aquatic life from direct exposure to surface water based on exceedances of effects-based water quality criteria. These cleanup standards are presented below and in Table G-28.

SUMMARY OF SURFACE WATER CLEANUP STANDARDS	
Arsenic	150 ug/L
Benzene	46 ug/L
Ammonia (temperature and pH dependent)	NRWQC

The surface water cleanup standard for arsenic (150 μg/L) is set at the NRWQC-CCC (chronic criterion) value (EPA 2002). The surface water cleanup standard for ammonia is set at the NRWQC-CCC (chronic criterion) value for Fish Early Life Stages Present and is a 30-day average concentration of total ammonia nitrogen (in mg N/L), not to be exceeded more than once every three years on average. Since the toxicity of ammonia varies depending on water temperature and pH, the ammonia NRWQC-CCC value is adjusted for temperature and pH in accordance with EPA's *1999 Update of Ambient Water Quality Criteria for Ammonia;* dated December 1999 (EPA Document No. EPQ-822-R-99-014). The cleanup standard for benzene (46 ug/l) for the HBHA Pond is set at the Water Quality values calculated using Great Lakes Water Quality Initiative Tier II methodology (Tier II benchmark value).

These surface water cleanup standards must be met at the completion of the remedial action at the point of compliance, which is defined as the discharge point of the final/furthest downstream low-head cofferdam (secondary treatment cell outlet). These cleanup standards are consistent with ARARs for surface water, attain EPA's risk management goals for remedial action, and are protective of the environment.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at Industri-plex Superfund Site Operable Unit 2 (and including Wells G&H Superfund Site Operable Unit 3, Aberjona River Study), is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at Industri-plex OU-2 will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. More specifically:

- Alternatives SS-2 and SUB-2 (Institutional Controls with Monitoring) protect human health by controlling potential exposures to contaminated soil through the implementation of institutional controls, whereby use of the properties for a day care facility would not be allowed (for Alternative SS-2 only), excavations would be restricted, and excavations without adequate worker health and safety precautions would be prohibited. Groundwater monitoring ensures that the contaminated soils left in place do not impact groundwater and create unacceptable human health risks in the future.

- Alternative GW-2 (Pond Intercept with Monitoring and Institutional Controls) protects human health by preventing or controlling potential exposures to contaminated groundwater through institutional controls. In addition, a portion of Alternative GW-4 (In-Situ Groundwater Treatment) addresses benzene contamination at the West Hide Pile by enhanced bioremediation until it meets site-specific cleanup goals protective of human health.

- Alternative NS-4 (Removal and Off-Site Disposal) will protect human health through the removal of near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area containing arsenic in excess of site-specific cleanup goals protective of human health. For the deeper wetland sediments in these areas, Alternative DS-2 (Institutional Controls) will protect human health by controlling potential exposures to contaminated sediments in currently inaccessible areas through the implementation of institutional controls whereby excavations would be restricted and excavations without adequate worker health and safety precautions would be prohibited.

- Alternative HBHA-4 (Storm Water Bypass and Sediment retention with Partial Dredging and Provide an Alternate Habitat) will protect the environment by the removal of contaminated sediments in the southern portion of the pond (i.e., restoration area) to meet clean-up goals protective of the environment and the construction of a compensatory wetland to mitigate the wetlands lost in the northern portion of the pond.

- Alternative HBHA-4 and GW-2 will provide protection of the environment by intercepting contaminated groundwater, maintaining the chemocline to treat and sequester contaminants in the deep portions of the pond (primary treatment cell), and further treating/sequestering contaminants at the secondary treatment cell to achieve surface water cleanup standards at the outlet of the secondary cell. These actions will reduce concentrations of contaminants in surface water entering the southern portion of HBHA Pond and other downstream areas to meet clean-up goals and ARARs protective of the environment.

These alternatives will provide additional protection of human health by controlling the downstream migration of contamination and preventing the recontamination of areas addressed by Alternative NS-4. Alternative SW-2 (Monitoring) provides for long-term monitoring of surface water, sediment, and groundwater to evaluate the effectiveness of the remedy and the long-term protection of human health and the environment afforded by the remedy. In addition, any wetland function losses resulting from implementation of the remedy will be mitigated.

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6} for incremental carcinogenic risk and such that the non-carcinogenic hazard is below a level of concern [i.e., no target organ HI will exceed 1]. It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs and To Be Considered (TBC) criteria. The selected remedy will provide adequate protection of the environment by addressing unacceptable ecological risk to aquatic organisms in HBHA Pond from exposures to sediment through the removal of contaminated sediments in the southern portion of the pond, and the construction of a compensatory wetland to mitigate the wetland functions and values lost in the northern portion of the pond. In addition, risk from exposures of aquatic receptors to surface water contaminants will be reduced to protective levels. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

2. The Selected Remedy Complies With ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to Industri-plex OU-2. See the tables in Appendix D for a list of all ARARs and To Be Considered requirements for the selected remedy.

3. The Selected Remedy is Cost-Effective

In EPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

For groundwater, EPA has determined that the Limited Action Alternative (GW-2: Pond Intercept with Monitoring and Institutional Controls) is the most cost effective alternative as it meets the threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the Limited Action Alternative and the Active remediation alternative, the decisive factors were that 1) the Industri-plex OU-1 source of contamination (i.e. soils and hide piles) will not be removed, consequently the groundwater will remain contaminated indefinitely; 2) the MassDEP has determined that the aquifer is of "low use and value;" 3) institutional controls would still be required by both the Limited Action and the Active Remediation Alternative. Finally, the Limited Action Alternative has fewer short-term impacts than the Active Remediation Alternative on the community.

For the sediment cleanups in near shore sediment areas (Wells G&H Wetland and the Cranberry Bog Conservation Area), EPA has determined that the Active Remediation Alternatives are cost effective as they meet both threshold criteria and are reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the No Action Alternatives and the Active Remediation Alternatives, the decisive factors were that the Active Remediation Alternatives provide greater long-term protectiveness and permanence and unlike the No Action Alternatives, reduce toxicity, mobility, and volume, although not through treatment. Finally, while the No Action Alternatives have no short-term impacts when compared with the Active Remediation Alternatives, the difference is not significant given that the types of impacts from the Active Remediation Alternatives are typical during cleanup operations and can be minimized or eliminated through routine, standard operating procedures.

For sediments in the HBHA Pond, EPA has determined that the Active Remediation Alternative is cost effective as they meet both threshold criteria and are reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the No Action Alternatives and the Active Remediation Alternatives, the decisive factors were that the Active Remediation Alternatives provide greater long-term protectiveness and permanence and unlike the No Action Alternatives, reduce toxicity, mobility, and volume, although not through treatment. Finally, while the No Action Alternatives have no short-term impacts when compared with the Active Remediation Alternatives, the difference is not significant given that the types of impacts from the Active Remediation Alternatives are typical during cleanup operations and can be minimized or eliminated through routine, standard operating procedures.

For sediments in deep, interior portions of the HBHA Wetlands and Wells G&H Wetland, EPA has determined that the Limited Action Alternative is the most cost effective alternative as it meets the threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the Limited Action Alternative and the Active Remediation alternative, the decisive factors were that 1) the exposure pathway is limited to a possible future dredger, which can be protected through safe construction methods, practices, and training; 2) the extent of contamination requiring remediation would impact a larger area (over 35 acres) of wetland habitat; 3) the Active Remediation alternative would be cost prohibitive; and 4) the

Active Remediation Alternative would have significant short-term impacts on the community compared to the Limited Action Alternative.

For surface and subsurface soils in the vicinity of the former Mishawum Lake, EPA has determined that the Limited Action Alternative is the most cost effective alternative as it meets the threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the Limited Action Alternative and the Active Remediation alternative, the decisive factors were that 1) the exposure pathway is limited to a possible construction worker, which can be protected through safe construction methods, practices, and training and a future day care child, which can be protected through land use restrictions; 2) Both Limited Action and Active Remediation would still require institutional controls since some contaminated soils would be left in-place mostly under buildings and bituminous parking lots and streets for surface soils, and 3) the Active Remediation Alternative would have significant short-term impacts on the community compared to the Limited Action Alternative.

For surface water in the HBHA Pond, EPA has determined that, coupled with the Active Remediation for sediments in the HBHA Pond, the Limited Action Alternative is the most cost effective alternative as it meets the threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternative and cost compared to other available options. In evaluating the differences between the Limited Action Alternative and the Active Remediation alternative, the decisive factors were that 1) continued contaminated groundwater discharges will attenuate through natural processes; 2) the Active Remediation alternative would rely on a more extensive and costly groundwater remediation alternative to completely eliminate contaminated groundwater discharges into the HBHA Pond to prevent re-contamination; 3) the creation of an alternate habitat will enhance the ecological diversity in the watershed and may help to mitigate flood storage losses; 4) the Active Remediation alternative would be cost prohibitive, and 5) the Active Remediation Alternative would have significant short-term impacts on the community compared to the Limited Action Alternative.

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: a) long-term effectiveness and permanence; b) reduction of toxicity, mobility or volume through treatment; c) short-term effectiveness; d) implementability; and e) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

a. Long-term Effectiveness and Permanence:

- Surface Soil (SS): The No Action Alternative, SS-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SS-2, would provide long-term effectiveness and permanence through institutional controls. Alternative SS-3 would provide additional long-term effectiveness and permanence through institutional controls prohibiting disturbance of the cover. Alternatives SS-4 and SS-5 provide the highest degree of long-term effectiveness and permanence because the contaminated soil would be removed.

- Subsurface Soil (SUB): The No Action Alternative, SUB-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SUB-2, would provide long-term effectiveness and permanence through institutional controls. Alternative SUB-3 would also provide long-term effectiveness and permanence through institutional controls prohibiting disturbance of the cover.

- Groundwater (GW): The No Action Alternative, GW-1, does not provide any long-term effectiveness or permanence. GW-2, the Preferred Alternative, would provide long-term effectiveness and Alternatives GW-3 and GW-4 would also be effective in the long-term, however GW-3 would require more extensive operation and maintenance then GW-4.

- Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, does not provide any long-term effectiveness or permanence. Alternative HBHA-2 would provide marginal long-term effectiveness and permanence, and long-term monitoring would be required to evaluate risks associated with contaminants left in place. Alternative HBHA-3 would provide enhanced long-term effectiveness and permanence provided there is no erosion of the permeable cover and contamination from groundwater discharges is eliminated. The Preferred Alternative, HBHA-4, provides a greater level of long-term effectiveness since a majority of contaminated sediments would be removed from the southern portion of HBHA Pond. Alternative HBHA-5 provides the highest level of long-term effectiveness and permanence because the contaminated sediment would be removed off-site.

- Near Shore Sediments (NS): The No Action Alternative, NS-1, does not provide any long-term effectiveness or permanence. Alternatives NS-2 and NS-3 would provide long-term effectiveness and permanence through institutional controls. The Preferred

Alternative, NS-4, provides the highest degree of long-term effectiveness and permanence because the sediments exceeding the cleanup standards would be excavated.

- Deeper Wetland Sediments (DS): The No Action Alternative, DS- 1, does not provide any long-term effectiveness or permanence. The Preferred Alternative DS-2, would provide long-term effectiveness and permanence through institutional controls. Alternative DS -3 provides the highest degree of long-term effectiveness and permanence because the sediments exceeding the cleanup standards would be excavated.

- Surface Water (SW): The No Action Alternative, SW-1, does not provide any long-term effectiveness or permanence. The Preferred Alternative, SW-2, which includes monitoring, and Alternative SW-3, which also includes monitoring provides greater long-term effectiveness. Alternative SW-3 provides the greatest level of permanence by creating an alternate wetlands habitat.

b. Reduction of toxicity, mobility or volume through treatment

- Surface Soil (SS): The No Action Alternative, SS-1, the Preferred Alternative, SS-2, and Alternative SS-3 do not include treatment. Alternative SS-4 may provide limited off-site treatment, if necessary, to qualify for disposal at a licensed landfill. Alternative SS-5 reduces the toxicity and mobility of the contaminants by using a "soil washing" process to remove arsenic from the soil before using the treated soil as backfill.

- Subsurface Soil (SUB): The No Action Alternative, SUB-1, the Preferred Alternative, SUB-2, and Alternative SUB-3 do not reduce toxicity, mobility or volume through treatment or other means.

- Groundwater (GW): The No Action Alternative, GW-1, offers no treatment other than long-term natural attenuation processes that may occur with organic contaminants. The Preferred Alternative, GW-2, controls the migration of contaminated groundwater by intercepting contamination at the HBHA Pond, and makes use of the naturally occurring processes in HBHA Pond to precipitate metals and degrade organic contaminants. Alternative GW-2 does not actively treat groundwater prior to discharge to HBHA Pond, except for natural attenuation processes that may occur. When combined with Alternative HBHA-4, as EPA is proposing to do, GW-2 would control or reduce downstream migration of inorganic contaminants during storm events. Both Alternatives GW-3 and GW-4 employ technologies to prevent contaminated groundwater from discharging into HBHA Pond and also destroy or remove target contaminants from the groundwater. Alternative GW-3 is an ex-situ system while Alternative GW-4 is an in-situ design. Both technologies are able to reduce the toxicity, mobility and volume of contaminants in the groundwater and both treatment processes are irreversible.

- Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, HBHA-2, and HBHA-3 do not treat contaminants. Alternative HBHA-3 reduces the mobility of contaminated sediments by placing a cap over them. The Preferred Alternative, HBHA-4, and Alternative HBHA-5 may include limited off-site treatment of dredged sediments, if necessary, to qualify for disposal at a licensed landfill. HBHA-4 also reduces the mobility of contaminated sediments by creating a retention area where contaminated sediments are contained and periodically removed.

- Near Shore Sediments (NS): The No Action Alternative, NS-1, and Alternatives NS-2 and NS-3 do not treat contaminants. Alternatives NS-2 and NS-3 may reduce mobility in the long-term if contaminated sediments are buried by the accumulation and deposition of uncontaminated sediments. The Preferred Alternative, NS-4, may include limited off-site treatment if necessary to qualify for disposal at a landfill.

- Deeper Wetland Sediments (DS): The No Action Alternative, DS-1 and the Preferred Alternative, DS-2, do not treat or reduce the toxicity of the deeper wetland sediments, unless other alternatives are implemented upstream to reduce downstream contaminant migration and clean sediments are given an opportunity to accumulate and deposit on top of contaminated sediments, in essence may include limited off-site treatment, if necessary, to qualify for disposal at a licensed landfill.

- Surface Water (SW): The No Action Alternative, SW-1, the Preferred Alternative, SW-2, and Alternative SW-3 do not include treatment.

c. Short-term effectiveness:

- Surface Soil (SS): The No Action Alternative, SS-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives SS-2 and SS-3, which call for the installation of institutional controls, will effectively limit risks to human health in the short-term. In addition, the cover required as part of SS-3 will become effective upon its construction. Alternatives SS-4 and SS-5 will become effective once the contaminated soils are excavated and disposed of off-site or treated. The Preferred Alternative, SS-2, would have limited impacts on property owners where institutional controls restrict land use. Alternatives SS-3, SS-4, and SS-5 would have the most short-term impacts on the community, including an increase in traffic during construction activities. Impacts to workers would be minimal since construction activities would be completed in accordance with appropriate health and safety procedures and potential risks and hazards associated with fugitive dust emissions would be addressed with prescribed engineering controls. No adverse environmental impacts are anticipated from any alternative.

- Subsurface Soil (SUB): The No Action Alternative, SUB-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives SS-2 and SS-3 which call for the installation of institutional controls will effectively limit risks to human health in the short-term. In addition, the permeable cover required as part of SS-3 will become effective upon its construction. The Preferred Alternative, SUB-2, would have limited impacts on property owners where institutional controls restrict land use. Alternative SUB-3 would have the most significant short-term impacts on the community including an increase in traffic during construction activities. Impacts to individual property owners would be significant since large portions of property would require a soil cover and the use of parking areas and road ways would be temporarily restricted. Impacts to workers would be minimal since construction activities would be completed in accordance with appropriate health and safety procedures and potential risks and hazards associated with fugitive dust emissions would be addressed with prescribed engineering controls. No adverse environmental impacts are anticipated from any alternative.

- Groundwater (GW): The No Action Alternative, GW-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternative GW-2, the Preferred Alternative, and Alternatives GW-3 and GW-4 which call for the installation of institutional controls will effectively limit risks to human health in the short-term. The Preferred Alternative, GW-2, would have limited impacts on property owners since the imposition of institutional controls would restrict groundwater use. Alternatives GW-3 and GW-4 would have limited short-term impacts on the community, including an increase in traffic during construction activities. Fugitive dust emissions would be addressed with engineering controls. Alternatives GW-3 and GW-4 may have limited adverse environmental impacts during construction, however engineering controls and approved construction methods would be used to minimize these risks.

- Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, would not be effective in the short-term or cause short-term impacts because the alternative does not require any action. Alternative HBHA-2 would not cause any short-term impacts to the community because the alternative only requires monitoring. Alternative HBHA-3, the Preferred Alternative, HBHA-4, and

Alternative HBHA-5 would have the most short-term impacts on the community including an increase in traffic during construction activities. Fugitive dust emissions would be addressed with engineering controls. Alternative HBHA-3 would have potential significant environmental impacts from the displacement and migration of contaminated sediments during the placement of the cap. However, these potential risks could be minimized through engineering controls that minimize and control suspended solids. The Preferred Alternative, HBHA-4, and Alternative HBHA-5 would have the most significant short-term environmental impacts due to the dredging activities. Benthic communities destroyed during the sediment removal would re-establish themselves over time.

- Near Shore Sediments (NS): The No Action Alternative, NS-1, would not be effective in the short-term or cause any short-term impacts because the alternative does not require any action. Alternatives NS-2 and NS-3 would have minor impacts on the community and workers installing protective fencing. The Preferred Alternative, NS-4, would have the most short-term impacts on the community, including an increase in traffic during construction activities as well as an increase in organic odors while excavating along shoreline wetlands. Fugitive dust emissions would be minimized and addressed with engineering controls. Alternative NS-4 would also cause short-term environmental impacts during excavation restoration of the wetland. These impacts would be minimized by engineering controls. Benthic communities destroyed during the sediment removal would re-establish themselves over time.

- Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, and the Preferred Alternative, DS-2, would not cause any short-term impacts to the community or on-site workers because the alternatives do not require any action. Alternative DS-3 would have the most significant short-term impacts on the community and surrounding businesses, including an increase in traffic during construction activities, as well as an increase in organic odors while excavating in the wetlands. Impacts to individual property owners would be significant since large portions of property would be utilized to implement the alternative. Fugitive dust emissions would be minimized and addressed with engineering controls. Alternative DS-3, which requires constructing haul roads, potential cofferdams and intrusions into the wetland areas to access deep sediments, would cause extensive and severe environmental impacts. These impacts would be minimized by engineering controls during the remediation. Benthic communities and other wetland habitat features that are destroyed during sediment removal would eventually re-establish themselves over time.

- Surface Water (SW): The No Action Alternative, SW-1, would not cause any short-term impacts to the community or on-site workers because the alternative does not require any action. The Preferred Alternative, SW-2, would not cause any short-term impact on the community. Alternative SW-3 would have the most short-term impacts to the community due to the construction of an alternate wetlands habitat.

d. Implementability:

- Surface Soil (SS): The No Action Alternative, SS-1, would be the easiest to implement because there are no remedial actions required. The Preferred Alternative, SS-2, would be the next easiest to implement. Alternatives SS-3, SS-4 and SS-5 would be more difficult than the other alternatives due to the area requiring remediation, the proximity to active commercial and light industrial properties, and the additional construction activities associated with these alternatives.

- Subsurface Soil (SUB): The No Action Alternative, SUB-1, would be the easiest to implement because there are no remedial actions. The Preferred Alternative, SUB-2, would be the next easiest to implement. Alternative SUB-3 would be more difficult than the other alternatives due to the area requiring remediation, the proximity to active commercial and light industrial properties, and the additional construction activities associated with this alternative.

- Groundwater (GW): The No Action Alternative, GW-1, is the easiest to implement because there are no remedial actions required. The Preferred Alternative, GW-2, would be the next easiest to implement. Alternative GW-3 would be more difficult than Alternative GW-2 due to the complexities involved with a multi-process treatment system and typical construction issues. However, technologies for Alternative GW-3 are reliable and proven. Alternative GW-3 requires more extensive operation and maintenance than any other alternative and would likely require a full-time treatment plant operator. Alternative GW-4 could be the most difficult to implement due to the deep excavations required to install the reactive wall and uncertainties associated with the technology. However, these uncertainties may be addressed during the pre-design investigation.

- Halls Brook Holding Area Pond Sediments (HBHA): The No Action Alternative, HBHA-1, would be the easiest to implement because there are no remedial actions required. Alternative HBHA-2 would be the next easiest since it only involves collecting sediment samples. Alternative HBHA-3, the Preferred Alternative, HBHA-4, and Alternative HBHA-5 would be more difficult than Alternatives HBHA-1 and HBHA-2 due to the construction activities involved in these alternatives, including dredging, water treatment, sediment dewatering, and the need for specialized equipment and skilled workers. The Preferred Alternative, HBHA-4, is more difficult than Alternative HBHA-5 because it is further compounded by the construction of a sediment retention area (primary and secondary treatment cells) and larger compensatory wetlands. All alternatives except the Preferred Alternative, HBHA-4, require that contaminated groundwater discharges be eliminated prior to constructing the remedy so that the excavated or capped areas do not become re-contaminated.

- Near Shore Sediments (NS): The No Action Alternative, NS-1, would be the easiest to implement because there are no on-site remedial actions required. Alternatives NS-2 and NS-3 would be the next easiest since the only activities required are posting fences and signs. Alternative NS-3 would also include periodic sampling of surface water and sediment. The Preferred Alternative, NS-4, would be more difficult than the others due to the excavation, dewatering, water treatment and wetlands restoration activities involved in this alternative.

- Deeper Wetland Sediments (DS): The No Action Alternative, DS-1, and the Preferred Alternative DS-2 would be the easiest to implement because there are no on-site remedial actions required. Alternative DS-3 would be the most difficult to complete due to the complexities involved in accessing the interior portions of the wetlands with heavy equipment to conduct the excavation, dewatering, water treatment and wetlands restoration activities involved in this alternative.

- Surface Water (SW): The No Action Alternative, SW-1, and the Preferred Alternative, SW-2, would be the easiest to implement because there are no on-site remedial actions required. The Preferred Alternative, SW-2, would require additional effort associated with monitoring. Alternative SW-3 would be the most difficult to implement due to locating and constructing an alternate wetlands habitat.

5. The Selected Remedy Does Not Satisfy the Preference for Treatment as a Principal Element

The principal elements of the selected remedy are management of migration of the groundwater, removal and disposal of sediments in near shore sediments (Cranberry Bog Conservation Area and Wells G&H Wetland) and southern portion of the HBHA Pond, source control of sediments in the HBHA Pond, source control of soils, and source control of surface water. These elements address the primary threats at Industri-plex OU-2: risks to human health from groundwater and risks to human health and ecological receptors from sediment, risks to human health from soil, risks to ecological receptors from surface water.

The selected remedy does not satisfy the statutory preference for treatment as a principal element by using treatment to address contaminated media. For groundwater, the previous Operable Unit capped over 105 acres of contaminated soils that are serving as the source of groundwater contamination. Groundwater treatment would be ineffective and impractical given that the source will not be addressed, excluding benzene source at the West Hide Pile (see selected remedy component GW-4 for the West Hide Pile which may implement In-situ Enhanced Bioremediation). For soil, source excavation and treatment was determined to be impractical and impose significant impacts to the local community since the area where the contamination exists is occupied by intensely developed commercial and light industrial properties. For sediments, no effective in-situ remedial technology exists and the extensive volume of material that would require removal for ex-situ treatment would be impractical as well as impacting an extensive area of wetlands and river. For surface water, since contamination is the result of groundwater discharges, extraction and treatment of the entire HBHA Pond would be required and is impractical.

6. Five-Year Reviews of the Selected Remedy are Required.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Performance monitoring data for the selected remedy will be closely monitored to ensure compliance (e.g. contaminated groundwater plumes capture and natural contaminant treatment/ sequestering by the primary treatment cell; further contaminant treatment/sequestering by the southern treatment cell to surface water cleanup limits at the outlet of the secondary cell; reduction of contaminant migration downstream of HBHA Pond so that contaminants do not cause unacceptable human health or ecological risks in the future; etc). In addition, some public comments received during the public comment periods proposed remedial action activities in the HBHA Wetlands. EPA's selected remedy for deeper interior wetlands of the HBHA Wetlands requires the implementation of institutional controls to restrict potential future human exposures to sediments under selected alternative DS-2. Notwithstanding this selected remedy, EPA will closely monitor and evaluate monitoring data from the HBHA Wetland during the Five Year Review process to determine if any further actions may be necessary.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

In accordance with EPA Guidance 540-R-98-031, OSWER 9200.1-23.P, entitled: *A Guide To Preparing Superfund Proposed Plans, Records of Decision and Other Remedy Selection Decision Documents*, dated July 1999, and NCP 300.430(f)(3)(ii) documentation in the ROD is needed for "significant changes that could have been reasonably anticipated based on the information available to the public."

<u>June 2005 Proposed Plan, OU-2</u>

EPA presented a Proposed Plan for remediation contaminated groundwater, sediments, soil, and surface water for Industri-plex OU-2 on June 30, 2005, which included the following components:

- Dredging and off-site disposal of contaminated sediments in the southern portion of the Halls Brook Holding Area (HBHA) Pond and the near shore sediments at the Wells G&H Wetland and Cranberry Bog Conservation Area, and restoration of all disturbed areas. This component will address sediments posing an unacceptable human health risks for near shore sediments and ecological risks for the southern portion of HBHA Pond.

- The northern portion of Halls Brook Holding Area (HBHA) Pond will be incorporated into the cleanup plan and serve as a sediment retention area that will intercept groundwater plumes (e.g. arsenic, benzene, ammonia) originating from Industri-plex OU-1 and minimize downstream migration of contaminants (e.g. arsenic). The northern portion will be separated from the southern portion by various cofferdams (primary and secondary treatment cells), and storm water from Halls Brook will be diverted to the southern portion of HBHA Pond. Natural and aeration treatment processes will be used to reduce and/or settle contaminants within the northern portion. Sediments that accumulate in the northern portion of the HBHA Pond will be dredged periodically and sent off-site for disposal. The most downstream cofferdam (outlet of the secondary treatment cell) will serve as the compliance boundary for the groundwater and surface water captured by the northern portion of the HBHA Pond, and achieve surface water cleanup standards (e.g. National Recommended Water Quality Criteria, benchmarks.

- In-situ Enhanced Bioremediation of groundwater plumes (e.g. benzene) at the West Hide Pile (WHP).

- Capping (impermeable) and stabilizing sediments along New Boston Street Drainway to prevent the discharge of groundwater plumes, the downstream migration of contaminants and erosion, all of which could potentially compromise preferred alternative HBHA-4 and NS-4.

- Capping (permeable) and stabilizing soils adjacent to the NSTAR and MBTA rights-of-way to prevent downstream migration of contaminants, which could potentially compromise the preferred alternatives HBHA-4 and NS-4.

- Establishing institutional controls to ensure that no one comes into contact with soils, groundwater, or deeper wetland sediments above cleanup standards.

- Any loss of wetlands (e.g. northern portion of HBHA Pond, capped sediments) will be compensated for elsewhere in the watershed.

- Long-term monitoring of the groundwater, surface water, and sediments.

After further review of the data and in response to comments from the community and the state, EPA added ammonia as an additional contaminant of concern. The ammonia data was further presented and evaluated in the October 2005 Technical Memorandum and also presented in the October 2005 Fact Sheet, which supplemented the June 2005 Proposed Plan. This additional contaminant will be addressed by the remedial alternatives described in the Proposed Plan and does not require any modification to the selected remedy. EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

O. STATE ROLE

The Commonwealth of Massachusetts Department of Environmental Protection has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the MSGRP RI, Risk Assessment and MSGRP FS to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The Commonwealth of Massachusetts concurs with the selected remedy outlined in this Record of Decision. A copy of the declaration of concurrence is attached as Appendix A.

PART 3: THE RESPONSIVENESS SUMMARY

There has been extensive community participation during the Remedial Investigation/Feasibility Study process for the Industri-plex Superfund Site Operable Unit 2 (including Wells G&H Superfund Site Operable Unit 3, Aberjona River Study), "Industri-plex OU-2." A more detailed summary of community coordination and involvement is outlined in Section C of Part 2 of the ROD, Community Participation.

EPA held a public information meeting on April 28, 2005, describing the results of the March 2005 MSGRP RI Report and schedule for the Proposed Plan. EPA released its Proposed Plan and Administrative Record to the public on June 30, 2005, initiating a 30-day comment period from July 1 - 31, 2005, and published a legal notice of the Proposed Plan in the Woburn Daily Times Chronicle on June 28, 2005. EPA also held a public information session on June 30, 2005 at the Shamrock School in Woburn, Massachusetts. On July 15, 2005, EPA extended the comment period an additional 30 days at the request of the public, concluding the 60 day comment period on August 30, 2005. EPA held a Public Hearing on July 27, 2005 at the Shamrock School. A transcript was created for the July 2005 Public Hearing and has been made part of the Administrative Record for this Record of Decision.

During the comment period, many parties requested additional extensions. After initial review of the comments, EPA reopened the comment period an additional 30 days from October 20, 2005 to November 18, 2005 and released the Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data report, a Fact Sheet supplementing the June 2005 Proposed Plan, and the Supplemental Administrative Record. An additional Public Hearing was held on November 17, 2005 at the Shamrock School. A transcript was created for the November 2005 Public Hearing and has been made part of the Administrative Record for this Record of Decision.

In addition to oral comments provided during the Public Hearings, numerous written comments were provided on the Proposed Plan. The full text of all written and oral comments received during the comment period has been included in the Administrative Record.

Outlined below is a summary of significant comments received from the public and other interested parties during the public comment periods and EPA's response to those comments. Similar comments have been summarized and grouped together and technical and legal issues have been divided into a number of general categories. These general categories are summarized as follows:

A. Questions and Comments Regarding Remedy Section Process
B. Questions and Comments Regarding Institutional Controls
C. Questions and Comments Concerning the Impact of Flooding on the Remedy and Concerning the Upper Mystic Lake
D. Questions and Comments Concerning Human Health and Ecological Risk Assessments
E. Questions and Comments Concerning the Preferred Remedy
F. Questions and Comments Concerning the Scope of Feasibility Study
G. Questions and Comments Concerning Monitoring and Ongoing Review of the Remedy

H. Questions and Comments Concerning ARARs
I. EPA's Response to SMC and Pharmacia's Alternative Proposed Plan
J. Questions and Comments Regarding Liability and Enforcement
K. Questions and Comments Regarding Errors or Omissions in the Feasibility Study

A. Questions and Comments Regarding Remedy Selection Process

A. 1. Multiple requests were made for extensions to the 30-day public comment period.

EPA Response: The comment period, which was originally due to end on July 31, 2005, was extended by 30 days to August 30, 2005, and then reopened for an additional 30 days, from October 20, 2005 to November 18, 2005 in response to requests by the community and other stakeholders.

A. 2. The City and others requested that a "peer review" of the Proposed Plan be conducted.

EPA Response: The City of Woburn was granted assistance via the Technical Outreach Services for Communities (TOSC) program for evaluating and understanding technical documents such as the Remedial Investigation and Proposed Plan. In addition, a $100,000 Technical Assistance Grant (TAG) was issued to the Aberjona Study Coalition (ASC). EPA believes that, with this assistance, the City of Woburn and the ASC have been supplied with sufficient expertise to review the proposal, as evidenced by their comments submitted on the Proposed Plan.

A. 3. Congressman Markey inquired whether the Town of Winchester had been involved in the remedy selection process, and whether the Army Corps of Engineers had been consulted regarding the proposed remedy.

EPA Response: The Town of Winchester has been notified of every report, decision and public meeting which has taken place during the formulation of the Proposed Plan. The Town of Winchester provided written comments on the Proposed Plan expressing appreciation and continued cooperation. With regard to flooding, EPA will coordinate all work that is performed in the Aberjona River floodplain with the Army Corps of Engineers. This work must meet all applicable or relevant and appropriate laws and regulations governing such work, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b).

A. 4. The Industri-plex Custodial Trust ("Custodial Trust") requested a "60 day moratorium on the CERCLA enforcement process. During this time, the beneficiaries of the Custodial Trust could meet in an effort to establish a more collaborative framework for implementing the Aberjona River clean-up." The Custodial Trust also characterized its obligations under the 1989 Consent Decree "...to serve the fiduciary and other needs of the three distinct beneficiaries of the Custodial Trust. They are the City of Woburn, the potentially responsible parties known as the Remedial Trust and the U.S. EPA and the MassDEP. In continued fulfillment of our obligations to these three beneficiaries, the

> Custodial Trust has sought to consider the fiduciary, environmental, regulatory, economic and other impacts that the Proposed Plan for clean-up of the Aberjona River may have on the three beneficiaries of the Custodial Trust. For the record, the Custodial Trust also shares the multi-stakeholder goal of achieving the earliest possible clean-up for the benefit of the public at large."

EPA Response: Comments on the enforcement process are outside the scope of this responsiveness summary, which addresses comments on the Proposed Plan. EPA further notes that it does not agree with the Custodial Trust's characterization of its role with regard to Industri-plex OU-2. The Custodial Trust's fiduciary obligations relate to holding, managing and selling Mark Phillips Trust property, and distributing proceeds from the sale of that property under the 1989 Consent Decree, and to provide EPA access to the property it holds in trust. The Consent Decree does not create any fiduciary obligations for the Custodial Trust relative to the implementation of Industri-plex OU-2.

> A.5 A resident of Wilmington asked where information will be kept and whether the information will be accessible to the public.

EPA Response: The Administrative Record will be kept and maintained at the Woburn Public Library, Woburn, MA, and EPA's Record Center, Boston, MA.

B. Questions and Comments Regarding Institutional Controls

> B. 1. Many commenters expressed concern that institutional controls could create a stigma regarding their property, making it difficult to sell or finance those properties.

EPA Response: EPA identified in the Feasibility Study (FS) and Proposed Plan various alternatives for addressing risks associated with various media. For groundwater (GW-2 and portion of GW-4 for West Hide Pile (WHP)), surface soils (SS), subsurface soils (SUB), and deeper wetland sediments (DS), EPA selected institutional controls. For surface soils (SS) and subsurface soils (SUB), other alternatives were evaluated, such as soil excavation, which if selected may not require institutional controls. However, selecting such an option would significantly increase costs, as well as increase business disruptions during remedy implementation. EPA's selected remedy includes institutional controls that will prevent exposures to contamination above cleanup standards and protect the remedy, where necessary. The selected remedy is also cost effective and causes minimal disruptions to active business operations at the properties requiring action. While EPA appreciates the concerns expressed, the alternatives which incorporate institutional controls will have the most minimal economic impact on the affected properties. EPA is committed to developing minimally-intrusive institutional controls which will attain the remedial action objectives. The form of institutional controls will be determined during pre-design and design in accordance with guidance, policies and regulations. EPA will work closely with state and local officials and impacted landowners on the implementation of institutional controls.

> B. 2. Several landowners questioned whether or not institutional controls could be imposed on their properties if they are not liable for response costs under CERCLA. Several commenters also suggested that EPA rely upon the Activity and Use Limitations ("AULs") or other land use restrictions permitted in Massachusetts under Massachusetts General Laws, Chapter 21E.

EPA Response: EPA has not yet determined the type of institutional controls that may be implemented as part of the remedy. The specific type or types of institutional controls will be determined during the pre-design and design phase. EPA notes that while some landowners may be not be subject to liability under CERCLA, CERCLA does require non-liable parties to cooperate in cleanup efforts, including the implementation of institutional controls. See Section J for responses regarding liability.

> B. 3. The consultant hired by the ASC commented that: "[t]he Massachusetts Contingency Plan specifies that groundwater aquifers are considered State resources and its foreseeable use is therefore determined by the State, not by individual property owners. Institutional controls, therefore, cannot be placed on groundwater unless the State designates these groundwater areas as inappropriate for the uses that pose risk in the human health risk characterization."

EPA Response: The MassDEP conducted a use and value determination of the aquifer within the Northern Study Area (north of Interstate 95), and determined the groundwater to be of "low use and value." The Commonwealth of Massachusetts has worked in consultation with EPA during the preparation of the risk assessments and agrees that the risk assessments are consistent with their Method 3 approach. EPA's baseline risk assessment identified the groundwater plumes as contributing to future risks to commercial/ industrial workers and excavation workers. EPA's selected remedy identifies institutional controls for groundwater to reduce those future human health risks. Under CERCLA, EPA has the authority to take action to limit exposures to groundwater at a site. In this case, institutional controls will be the vehicle to ensure that specified groundwater uses are restricted.

> B. 4. MassDEP commented that: "DEP supports institutional controls (ICs) in concept for the areas outlined in the Proposed Plan because of the future risk these areas present. However, it has not been possible for DEP to fully evaluate the proposed ICs because EPA did not identify the types of ICs with sufficient specificity, nor compare and contrast the efficacy of different types of ICs in the feasibility study (FS). In addition, the FS did not appropriately assess the timing or who will be responsible for securing, maintaining and enforcing the ICs (for example, in the FS Table 4-2D that evaluates ICs for surface soils under the 9 criteria, a time frame is not estimated, and it is incorrectly stated that no coordination among agencies will be required). If these issues are not addressed prior to the ROD, the ROD should then not be limited to a particular type of IC (such as a Grant).
>
> In review of the IC issues for the Proposed Plan, DEP referred in part to EPA's final fact sheet titled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating

and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000 which specifically addresses all the issues mentioned."

The consultant for the Woburn City Council commented that it needed more details concerning monitoring and costs in order to evaluate the proposed institutional controls.

EPA Response: Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. EPA believes that it is appropriate in this case to leave the exact form of institutional controls to the pre-design and design process, so that controls can be developed with the input of stakeholders, and in accordance with relevant guidance, policies and regulations.

B. 5. MassDEP commented that: "[s]ince the decision to place ICs for future dredging on a portion of the HBHA wetland was based on the assessment of a single core, DEP recommends leaving flexibility in the remedy decision for further investigation of that area that may reveal that an alternative remedy (e.g. excavation rather than ICs) may be a better option."

EPA Response: EPA collected four sediment core samples within the HBHA Wetland. The decision for institutional controls was based upon the exposure point concentrations at SC02. The area warranting institutional controls was extended to the next sediment core samples (SC01 and SC03). Pre-design sediment core investigations may be implemented to further define the institutional controls boundaries within the HBHA Wetlands. However, if a responsible party opted for removal of contaminated sediments, then institutional controls may not be required, providing that provisions were implemented to prevent future recontamination from upstream sources.

B. 6. MassDEP commented that because only a few properties will be in need of an additional groundwater restriction under Industri-plex OU-2 and because groundwater is mobile and restrictions on groundwater should be temporary measures, EPA should perform a full evaluation of alternatives to a Grant of Environmental Restriction for those few properties involved.

EPA Response: Considering that waste will remain in place at the Industri-plex site and this waste directly contributes to the contaminated groundwater plumes, EPA does not believe that the institutional controls will be temporary. Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. The form of institutional controls will be determined during the pre-design and design in accordance with relevant guidance, policies and regulations, which will include a review of alternatives to grants of environmental restrictions.

B. 7. MassDEP commented that two alternatives would increase protectiveness immediately, and eliminate the need for ICs on several properties: excavation and removal of surface soil on only vacant properties, or excavation and removal of surface soil in the area indicated in the plan, excluding the sub-surface contaminated area. Subsequently, ICs would only be placed on the subsurface contaminated soil area.

EPA Response: EPA's selected remedy requires institutional controls in the subsurface soil (SUB) area and surface soil (SS) area. The smaller SS area is situated within the boundaries of the SUB area. Removing portions of the SS area will not eliminate the need for institutional controls within that area (SUB area will still require institutional controls). In addition, EPA's selected remedy addresses the remedial action objectives and is cost effective. MassDEP's suggestion to excavate portions of the soils from the SS area will significantly increase costs while not eliminating the need for institutional controls.

B. 8. Cummings Properties (Cummings) inquired as to whether several properties it owns would be subject to institutional controls under the Proposed Plan.

EPA Response: EPA has identified to Cummings which properties owned by Cummings would be subject to institutional controls. EPA's responses are contained in the administrative record.

B. 9. The ASC's consultant asked who would be responsible for overseeing compliance with institutional controls, and further if there were any rules or regulations governing institutional controls. A resident from Wilmington also asked who would be responsible for the controls.

EPA Response: The selected remedy requires further coordination with the state, local officials and impacted landowners, as well as further predesign investigations to determine the extent of institutional controls. While the responsible parties may bear responsibility for monitoring compliance with institutional controls, EPA, the Commonwealth of Massachusetts and/or the City of Woburn will likely enforce and oversee the implementation of the institutional controls. Once designed, the affected current and future property owners will be required to comply with the institutional controls. The implementation of institutional controls is governed in part by the above-mentioned document entitled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000 (EPA IC Guide) and relevant provisions of the Massachusetts Contingency Plan.

B. 10. The MBTA asked EPA to provide details of the institutional controls and monitoring program, whether access to contaminated areas will be limited by fencing, and if so, where the fencing is proposed.

EPA Response: EPA's selected remedy does not include fencing to restrict access to contaminated areas. Institutional controls will be developed and established to prevent exposures to contamination above cleanup standards and protect the selected remedy, where necessary. The form of institutional controls will be determined during the pre-design and design in accordance with relevant guidance, policies and regulations.

B. 11. The Woburn City Council commented that: "EPA makes repeated references to Institutional Controls and we understand that they will be used for Industri-plex. However, the City has never been included in the EPA's discussions and communications about these Institutional Controls, nor has the EPA taken the time to explain what, according to TOSC, will be complex land use restrictions that will necessarily involve local government. When will EPA be explaining these to us? Who will be responsible for regulating, maintaining, and enforcing such controls for decades to come? What will the associated costs be? Who will bear the costs?"

EPA Response: In order to protect human health by controlling potential exposures to contaminated soils, sediments, and groundwater, the selected remedy relies on the use of institutional controls such as land and groundwater use restrictions. Institutional controls are also necessary for the protection of the selected remedy. The details of the institutional controls will be determined during the pre-design and remedial design phase in coordination with the parties performing the remedial action, impacted landowners, and local officials. MassDEP participation with the institutional controls will be in accordance with the Commonwealth of Massachusetts policies, guidance and regulations.

C. Questions and Comments Concerning the Impact of Flooding on the Remedy and Concerning the Upper Mystic Lake

C. 1. The City of Woburn, The Town of Winchester, the Mystic River Watershed Association and the ASC asked EPA to consider the impact of flooding on any proposed remedy. The Woburn City Council asked whether the Preferred Remedy would alter flood storage capacity.

EPA Response: EPA's selected remedy is not expected to reduce flood storage capacity within the watershed. EPA's selected remedy requires the construction of compensatory wetlands to mitigate for any loss of wetland functions and values caused by the remedy, including flood storage. The final compensatory wetland design may actually improve and increase the overall net flood storage capacity within the watershed. EPA's remedy will comply with all regulations and substantive permit requirements, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b). In addition, the surface water control structure (i.e., culvert) at Mishawum Road controls flooding conditions within HBHA and regulates surface water flow downstream. EPA's remedy does not alter this control structure. Limited excavations along the perimeter of the Wells G&H Wetland and Cranberry Bog Conservation Area will be restored to match the existing conditions. EPA's selected remedy is not expected to interfere with or compromise surface water flow conditions downstream in Winchester.

C. 2. The ASC asked EPA to provide a clear delineation of health risks posed by contamination deposited on frequently flooded areas, including several playing fields in Winchester. The ASC's consultant questioned why EPA did not sample in floodplain areas where the ASC had requested sampling during the Remedial Investigation, and stated that sampling results collected to date mandated the need for further sampling.

EPA Response: EPA conducted extensive soil and sediment sampling along frequently flooded areas of the Aberjona River. Extensive sampling was conducted near all of the areas identified in the comment that are prone to flooding including Davidson Park, Wedgemere Station, and Ginn Field. EPA believes that these samples are representative of the conditions affected by episodic flooding and determined there were no unacceptable human health or ecological risks at any of these areas. The collection of surface soil samples within the floodplain, but within 10 and 50 feet of the river or wetland areas, represents a worst-case approach since contaminant levels in soil are likely to display decreasing concentrations with increasing distance from the river channel. This investigation has consistently revealed relatively low concentrations of contamination in these frequently flooded areas, and risk evaluations consistently concluded the areas do not pose a current or future unacceptable human health or ecological risk. These investigation efforts implemented for Industri-plex OU-2 (including Wells G&H OU-3) were significant and sufficient at assessing and evaluating the nature and extent of contamination, fate and transport process, and risks along the river. EPA does not plan on conducting further soil or sediment sampling along the Aberjona River for further risk assessment calculations. EPA's selected remedy will require further surface water monitoring along the Aberjona River, and periodic sediment monitoring at the Upper Mystic Lake and upper and lower forebays (see response to Comment C.8).

C. 3. The ASC's consultant commented that updated floodplain information be used to delineate areas to be sampled and monitored.

EPA Response: EPA targeted sediment and soil sampling in areas of significant deposition and high flood frequency based upon inspection and observations of the river, and discussions with the public. EPA also referenced the 1980 FEMA flood maps relative to our inspections and observations of the river. The frequently flooded areas were sampled.

C. 4. The MBTA asked for the flooding criteria that were considered to assess stream levels during storm events and design of the impermeable cap along stream bed (New Boston Street Drainway) to the west of the MBTA railroad tracks.

EPA Response: The conceptual design for the liner of the stream channels assumes that the stream bed will be excavated in order to install the liner and preserve the current elevations and volume capacity of the existing stream channels. A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

C. 5. The MBTA asked what precautions were being taken to help ensure that stormwater flooding will not cause structural damage to the railroad tracks.

EPA Response: A pre-design investigation will evaluate flood storage issues and serve as part of the design basis for the final remedial design. The design details will be specified in the remedial design.

C. 6. The Town of Winchester requested the opportunity to confer with EPA on the potential impact of the proposed remedy on its flood control projects.

EPA Response: EPA will continue to coordinate with the Town of Winchester regarding the selected remedy, including its impact on flood control.

C. 7. Stauffer Management Company LLC ("SMC"), Pharmacia Corp. ("Pharmacia") and consultants retained by SMC and Pharmacia commented that EPA has proposed to alter significantly the HBHA Pond without regard for flood control in the area, and will exacerbate flooding conditions. The RTC Realty Trust (the "RTC") noted that the proposed alternative has the potential to significantly alter the surface flow regime in the area of the HBHA, and asked for more study or explanation to address the potential for flooding.

The RTC also noted that one of the EPA presentations mentioned that high storm flows into the HBHA "break down the chemocline, stir up the bottom sediments, and "flush" contaminated sediments downstream," and asked if the proposed alternative addresses this transport mechanism, and whether consideration was given to sending some stormwater flow around the upper HBHA retention area and directly into the lower portion of the HBHA.

EPA Response: EPA evaluated the flood storage design which was approved by the United States Army Corps of Engineers ("USACE") in the early 1970s. EPA disagrees with the comment which suggests that the HBHA will be significantly altered by the selected remedy and could have flooding implications as far reaching as Winchester. Storm flows will continue to be mitigated by both the north and south basins of the HBHA Pond. However, the HBHA Pond only represents about 25 percent of the entire HBHA storage area and storm flows will continue to be mitigated by the entire HBHA, not just the HBHA Pond, as was originally designed. Under the selected remedy, no modifications to the HBHA are planned beyond the HBHA Pond. The outlet structure at Mishawum Road will still function as the main control point for retaining storm flows within the HBHA. See also Response to Comment C.1.

The baseflow inputs from Halls Brook and a portion of the storm flow will continue to flow into the primary treatment area/cell (northern/first low-head cofferdam) of the HBHA Pond. Consequently, storm flows will continue to be mitigated by both the north (primary and secondary treatment cells) and south portions (restored area) of the HBHA Pond. It is also important to note that the flood control structure located at the southern tip of the HBHA Wetlands (at Mishawum Road) will not be altered under the selected remedy.

Nonetheless, EPA recognizes that potential flood impacts are an important design consideration for both downstream and upstream areas. These issues will be fully addressed in a pre-design investigation so that these potential impacts can be mitigated by the final remedial design.

The selected remedy for the HBHA Pond will effectively address the contaminated groundwater plumes discharge into the HBHA Pond, and effectively treat/sequester contamination so that the surface water effluent at the outlet of the secondary treatment cell complies with surface water cleanup standards.

C. 8. Friends of Upper Mystic Lake asked for more information/predictions (modeling) on the impact of the proposed remedy on the Upper Mystic Lake, particularly the upper forebay and the sediments in the lake, and a plan for continued monitoring of the Upper Mystic Lake, particularly the upper forebay and the sediments in the lake.

EPA Response: EPA conducted extensive sediment sampling within the upper forebay of the Upper Mystic Lake and determined that no unacceptable human health or ecological risks currently exist in the upper forebay. EPA's selected remedy will require further surface water monitoring along the Aberjona River, and periodic monitoring of sediments in the Upper Mystic Lakes and associated upper and lower forebays. EPA expects the surface water monitoring to be similar to the surface water monitoring conducted during the MSGRP RI, and that these data can be compared to the MSGRP RI results including those for the Upper Mystic Lake. The surface water data will also be applied to June 2005 surface water model to draw further comparisons. Sediment grab samples will also be periodically collected in a manner similar to the MSGRP RI from the Upper Mystic Lakes and upper and lower forebays.

D. Questions and Comments Concerning Human Health and Ecological Risk Assessments

D. 1. The ASC's consultant inquired as to the governing standards for cleanups at properties impacted by the remedy, i.e., Massachusetts Contingency Plan ("MCP") standards versus cleanup standards calculated by EPA. The ASC's consultant further commented that because the acceptable cancer risk set forth in the MCP is ten times more stringent than the acceptable risk relied upon by EPA in setting cleanup goals for the Aberjona River, EPA must work collaboratively with MassDEP to insure that the Commonwealth's interests are furthered with this cleanup, such that additional work will not be required after the federal cleanup is completed.

EPA Response: EPA has coordinated closely with MassDEP throughout the RI/FS process, including the baseline risk assessments. MassDEP considers the risk assessment methods used under this RI/ FS process to be equivalent to the MCP Method 3 risk assessment. MassDEP also considers remedial decisions selected by this ROD, upon their concurrence, to be adequately regulated.

D. 2. The ASC's consultant asked whether the proposed remedy is "safe," and commented that because "EPA has chosen to meet the least stringent level of its range of acceptable risks, there is little room for error in the implementation of its plans if the target risk range is to be truly met. Consequently, every step should be subject to comprehensive evaluation and scrutiny. If the plan goes forward as proposed (or even with minor modifications), the continued process of public participation is crucial to its

> success. In fact, there should be more opportunities for public participation in the remedial design and decision-making process."

EPA Response: The cleanup standards in the Record of Decision correspond to a level of risk that is lower than the "least stringent level of its range of acceptable risks," such that the cumulative risk will be within EPA's overall target risk management range. EPA agrees the public involvement is important to the success of the remedy. Any significant modifications to the remedy will be subject to the public participation processes required by the NCP. The selected remedy is a cost effective solution that will adequately reduce risks identified at the site. Hence, the selected remedy will effectively manage the contamination and risks posed by the site, be constructed in accordance with Federal Occupational Health and Safety Administration (OSHA) requirements, and function in a protective and safe manner. The Superfund process allows for public participation in all aspects of the program. Continued monitoring and evaluation of the remedy implemented will be a necessary part of remedial design, remedial action and long-term monitoring.

In addition, a comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations.

> D. 3. The ASC's consultant commented that "the additional tables and calculations presented by EPA in the September 2004 update to the Baseline Human Health and Ecological Risk Assessment Report are not consistent and suggest potential omissions. Table 3-3.4 lists the exposure point concentrations used in the calculations. Problematically, the sampling locations listed in Table 3-3.4 differ from those mentioned in the text of the report and subsequent tables. The sampling locations included in Table 3-3.4 are NR, WS/WSS, CB-05, DA, KF, and 07/DP. Page ES-3 and other places in the report claim that the residential calculations were performed for locations WS/WSS, CB-05, KF, 07/DP, and AJRW. Thus, the NR and DA locations in Table 3-3.4 were not used in subsequent tables and calculations, and the AJRW location (the only one that represents actual soil data) was evaluated instead (though not included in the exposure point concentration Table 3-3.4)."
>
> The ASC's consultant further commented that the omission of sampling locations DA and NR from the residential evaluation in the Human Health Risk Assessment must be explained, because the residential risk estimates for these stations exceed EPA's acceptable risk management criteria.

EPA Response: EPA established a recreational frequency of exposure for stations NR and DA considering a number of factors, including land use and accessibility, and evaluated potential risks based upon the exposure point concentrations for average and reasonable maximum concentrations. As a result, the human health risk assessment did not identify these areas as associated with an unacceptable risk based on a future recreational scenario. The evaluation of potential residential exposures to surface soil that may have been impacted by flooding was specifically evaluated for locations in Winchester, the locale of concern based on previously provided community comments. Locations in Woburn were also included as considered applicable. Table 3.3-4 is correct in the listing of stations with available surface soil data. The text is correct in identifying which of those stations with available surface soil data have been quantitatively evaluated for this potentially complete residential pathway. Station AJRW exposure point concentrations are provided on Table 3.3-7. It was not an unexpected finding that stations NR and DA had the highest arsenic levels of all the surface soil samples. The surface soil samples from these two stations were collected from areas where the river bank was highly channelized, and a steep drop down to the river bed was present. The soil samples were collected at the very edge of the channel, immediately at the top of the river bank, rather than 10 to 50 feet from the waters edge as noted for surface soil samples collected from the other stations. Because the soil samples collected from stations NR and DA are representative of river bank data rather than floodplain soil data, they were not included in the residential evaluation.

> D. 4. The ASC's consultant commented that: "[i]n many cases, EPA evaluates target-specific hazard indices to gauge the significance of non-cancer health risks. Each chemical is assigned to a specific category of potential adverse health impacts based on the nature of the toxicity data used to derive its reference dose (safe exposure level). However, the target-specific analyses incorrectly assume that each chemical has one and only one endpoint via which it can cause adverse health impacts. In some cases, chemicals can cause multiple adverse health effects at different levels of exposure. In cases where the aggregate hazard index (summed over all chemicals) exceeds one and EPA has developed target-specific analyses for which the disaggregated hazard indices are all smaller than one, EPA should evaluate secondary endpoints for chemicals that might contribute risk to the critical health endpoint . . . By not considering the potential effects of chemicals on non-target organs, EPA has underestimated potential risks."

EPA Response: Each contaminant has one or, in some cases, a small number of target organs, i.e., organs adversely affected by a contaminant at levels slightly above the threshold dose for that compound. It is acknowledged that other organ systems may be affected by specific contaminants; however, the effects on non-target organs occur at higher levels of exposure. In selecting target organs, the most sensitive organ(s) are identified, not all organs that may be affected at all exposure doses. In addition, the hazard posed by two compounds with the same target organ should only be summed if those two compounds also exert toxicity through the same or a similar mechanism of action. The approach used in this risk assessment conforms to the EPA method of estimating target organ hazard indices.

> D. 5. The ASC's consultant commented, regarding the possibility of deep sediment contamination ecological impact, that: "EPA did not justify its decision not to sample sediment depths lower than 6 inches. In the current BERA, this problem has continued. In Appendix E.4 – Baseline Ecological Risk Assessment Supplemental Data of the Baseline Human Health and Ecological Risk Assessment Report – concentrations of

> Contaminants of Potential Concern (COPCs) from 1-2 foot, 2-3 foot and 3-4 foot were not presented nor discussed in the text. The concern of re-suspension of deep sediments that may be contaminated was not addressed. Deeper contamination in sediments may exist beyond Reach 1, but the data have not been provided. Additionally, no remediation is proposed beyond Reach 0. Risk management actions, such as land use restrictions, could be taken to prevent scouring and erosion of contaminated deeper sediments."

EPA Response: The purpose of the baseline ecological risk assessment was to assess risk to organisms exposed to surface sediments. Deep sediment is not a medium typically available for exposure to aquatic organisms; therefore a scenario involving exposure to ecological receptors was not evaluated. None of the scenarios included a pathway for exposure of organisms to deep sediments, and did not require an evaluation of risk to media that is not normally exposed to ecological receptors. In addition, the data collected in the sediment cores did indicate that, in general, there are lower concentrations of sediment contaminants in deeper sediments.

> D. 6. The ASC's consultant commented that: "[t]he exposure model used for the Green Heron (Metcalf & Eddy, 2004; pages 4-55 to 4-56) does not accurately estimate its exposure. Because herons seek favorable foraging areas and do not wander far, exposures should be expressed by reach rather than site-wide. Their foraging areas can be small – for example, a shoreline of a wetland or along a wetland channel; yet, small fish data collected site-wide were used to estimate that fish represent 45% of a heron's diet. Because a value of 55% was used in the exposure model for the invertebrate proportion of a heron's diet, more crayfish data should be collected from reaches not sampled (see Davis and Kushlan, 1994)."

EPA Response: The limited site-specific tissue data utilized in the BERA was sufficient to estimate exposures to avian species. The major COPCs of concern (metals) are not bioaccumulative. The conservative estimate of dietary exposure used the maximum site-wide concentration of each COPC (highest of all the crayfish and fish tissue concentrations). Based on this dose estimate, only iron exceeded the NOAEL level (M&E, 2004, Table 4-194). Although the assessment endpoint is not to determine risk to an individual, this estimate assumes that the exposed individual ate only the most contaminated crayfish and fish in the whole study area every day. Using these data, there is no evidence of potential effects on avian populations. EPA considers the estimates of risk from dietary exposures to be conservative, appropriate, and protective.

> D. 7. The ASC's consultant commented that: "[b]ecause muskrat exposures and risks were calculated on a station-by-station basis (page 4-57), the same comments regarding the Green Heron and the inadequate crayfish data also apply to muskrats."

EPA Response: The limited site-specific tissue data for crayfish was also adequate for muskrat modeling, for different reasons. Muskrats are herbivores, and the dietary dose of animal tissue (represented by crayfish) is only 10% of the diet. Improvements in the estimate of the COPC concentrations in crayfish would not have substantially changed the risk estimates. EPA believes that the estimates of dietary exposures for muskrat were appropriate.

D. 8. Relative to the number of crayfish collected from various reaches, the ASC's consultant commented that: "only two samples were collected from reaches 1 and 2, three from reach 3, one from reach 5, and no samples at all from reaches 4 and 6. These are extremely small crayfish data sets for reaches that measure at least 100 feet each in length. In Table 2-179, the average arsenic concentration in crayfish was 2.7 mg/kg in reach 2, 1.5 mg/kg in reach 3, and 0.24 mg/kg in reach 5. This latter value was the arsenic concentration in a single crayfish. Additionally, the average concentration of contaminants in crayfish is used to assess risk in each reach. Although this provides a best estimate of risk, due to the limited nature of the data, it would be more conservative and more protective of the environment to use the maximum detected concentrations.

Although no crayfish samples were collected from reaches 4 and 6, dietary exposures associated with ingestion of crayfish were calculated for these areas using data from reaches 3 and 5. Using crayfish body burden data from another reach to represent potential crayfish body burdens in reaches 4 and 6 does not provide useful information that can aid in making a risk management decision."

EPA Response: The limited site-specific tissue data for crayfish were adequate for modeling of wildlife exposures, and EPA considers the dietary exposure estimates associated with ingestion of crayfish to be appropriate and protective. The major COPCs of concern (metals) are not bioaccumulative, and the limited tissue data, even using the maximum site-wide concentrations of metals in crayfish tissue, did not result in risk to receptors.

D. 9. The ASC's consultant commented that: "plant uptake factors based on a small number of plant samples were applied to plants in all areas considered in the ecological risk assessment. Six plant samples were collected from stations in the 38-acre wetland of reach 1. Plant tissue data are not available for the other 5 reaches. Using average plant uptake values derived from another reach to represent potential plant tissue concentrations for the other five reaches will not provide useful information that can aid in making a risk management decision."
(The ASC's consultant made this comment with regard to both the September 2004 Ecological Risk Characterization and the MSGRP Ecological Risk Assessments)

EPA Response: Although the data set is not large, EPA did collect site-specific data for concentrations of COPCs in plant tissue. Data were collected in the reach with the highest observed contaminant concentrations, and the potentially largest area of habitat for herbivores (Reach 1). Utilizing these site-specific data for the other reaches is a reasonable estimate of plant uptake, and the uncertainty in these extrapolations was discussed in the BERA.

D. 10. The ASC's consultant commented that: "although the EPA collected media-specific data for the ecological risk assessment, EPA did not necessarily collect the most appropriate data. For example, in evaluating potential dietary risks to the muskrat, EPA sampled cattails, the muskrat's primary food item. Instead of sampling the roots and basal portions of the plants eaten by muskrats (as stated on page 4-38), however, EPA sampled the stems and leaves of the cattails."

EPA Response: Samples of plant tissue were collected to estimate dietary exposure of both muskrat and mallard in food-chain models. It is correct that EPA collected above-ground portions of plants for plant tissue analysis. This was done in part to allow these values to be used as estimates for mallard consumption as well, for which it would not be generally appropriate to use root portions of the plant. As is true for most food-chain modeling, the best available data were used as an estimate in the models. EPA acknowledges that the utilization of stem/leaf samples likely underestimated dietary exposure of muskrat to metal COPCs. However, plant tissue concentrations were not measured at each station, but rather estimated from sediment concentrations. Evaluation of the potential error in this estimate of plant tissue concentrations for sediment concentrations and BCFs, is provided in Table 4-276 of the BERA (M&E, 2004). There is uncertainty involved in each assumption, and EPA attempted to use the data in a consistent and reasonable manner. The issue of above-ground portions of the plant and root tissue was further addressed in the BERA for the Northern Study Area (Appendix 7A, TTNUS, 2005) and in the comprehensive risk assessment (Chapter 7 of the RI, TTNUS, 2005).

> D. 11. The ASC's consultant commented that: "[e]xposure COPC doses for plant ingestion (page 4-58) should not be modeled for the muskrat because the risk assessment should represent realistic and site-specific exposures. The use of plant tissue concentrations that were modeled from average station sediment COPC concentrations for each habitat (pond, wetland, or river) multiplied by site-wide uptake factors is appropriate for a screening-level assessment, but not a baseline risk assessment."

EPA Response: Calculating risk to wildlife using dietary models with site-specific tissue data is standard practice. In the Northern Study Area, additional plant tissue data were collected and utilized to assess dietary dose to muskrat in Reach 0, as well as to assess the uncertainty in the application of uptake factors. Estimates for muskrat were not made using site-wide sediment concentrations; the estimates in reaches 1-6 were based on station-specific sediment concentrations and uptake factors. Utilizing uptake factors, which were based on site-specific data, is a reasonable estimate of plant uptake, and the uncertainty in these extrapolations was discussed in the BERAs.

> D. 12. The ASC's consultant commented that: "eels were caught in the fish survey but were not used in the Risk Assessment. Though eels are a key species in the study area, no justification is provided for the exclusion of eels from the study. Eels have a higher lipid content than the white sucker, a species that was considered in the study, and could therefore contain higher concentrations of lipophilic chemicals. The eel should replace the white sucker in the Risk Assessment. Eels should additionally be used in the small fish tissue data used to calculate dietary fish exposure for the heron."

EPA Response: There were 17 white sucker samples in the Southern Study Area as compared to 5 eel samples (all from reach 6). Only 4 eels were captured in the Northern Study Area and all of them were in Philips Pond, which is a reference pond. No eels were captured in HBHA Pond or HBHA pond No. 3. White sucker was selected as a reasonable receptor to evaluate potential tissue residue effects since more data were available and more tissue residue values were available from similar species. Although eels may have higher lipid content, the major COPCs were metals, which are not lipophilic, and do not generally bioaccumulate through the food web.

D. 13. The ASC's consultant commented that: "[c]opper could be responsible for adverse health effects in benthic invertebrates and perhaps fish as well. The average concentration of 49.7 mg/kg in crayfish is approximately twice the laboratory test concentration at which no effects were observed (page 4-72). The on-site tissue concentration of copper was 2.5 times higher than the reference samples.

Additionally, evaluation of sediment chemistry indicated that high concentrations of arsenic, copper, chromium, mercury, and zinc were correlated with both (a) those sites with evidence of reduced growth of benthic invertebrates in toxicity tests, as well as (b) those stations with evidence of impacted natural communities (page 4-85)."

EPA Response: EPA has acknowledged that the potential impairment of benthic invertebrate communities correlated to arsenic as well as other metals in sediment. However, the potential effects on benthic organisms were most highly correlated to arsenic concentrations. The conclusions regarding the magnitude and significance of the risk to benthic communities is not altered by attributing the risk to one or more metals detected in the sediments.

D. 14. The ASC's consultant commented that: "[t]he text (page 4-88) appears to be incorrect or the calculations are incorrect for the risks to the muskrat. The text states that a test TRV for arsenic is based on a chronic (reproductive) lowest observed adverse effect level (LOAEL) in a mouse of 1.93 mg/kg-day, but a test TRV value of 1.26 mg/kg-day appears in Table 4-142.

In addition, the text states that the 'TRV is based on oral doses of sodium arsenite which is likely to be more toxic than forms found in the muskrat diet on-site. Due to these uncertainties, the confidence in the conclusion of risk to muskrat is reduced.' However, 3.3 % of the diet is associated with ingestion of sediment, either in the pond or wetlands, which may be in arsenite form."

EPA Response: It is acknowledged that the text on page 4-88 is incorrect. The muskrat arsenic TRVs used in calculations were not based on a TRV of 1.93 mg/kg-day but in fact were based on a LOAEL of 1.26 mg/kg-day as indicated in Table 1-142 and the muskrat food chain models. Since the TRV which was used in the calculations is lower than the TRV mistakenly printed in the text, risk conclusions would not change.

The TRV is based on oral does of sodium arsenite, which is a more toxic form of arsenic. By using sodium arsenite, rather than another form of arsenic, the model ensures that risk from arsenic will not be underestimated.

D. 15. The ASC's consultant commented that: "[t]he derived Wildlife TRV value of 7 mg/kg-day for chromium (page 4-89) does not appear to be the most conservative value. A test TRV of 5 mg/kg-day for a mouse is listed in Table E.3.1 and represents a reproductive endpoint. Using this value, a wildlife TRV would be 2 mg/kg-day and would be a more reasonable estimate to use for the muskrat. It is likely that chromium could be a risk driver for the muskrat because the 3-fold difference between the two wildlife TRVs would elevate the hazard index by a factor of 3."

EPA Response: As stated in the text on page 4-60 of the subject document, a TRV based on a LOAEL was used only if a suitable NOAEL was unavailable. The derived Wildlife TRV value of 7 mg/kg-day was obtained from a NOAEL study 20 weeks in duration. The 2 mg/kg-day value was obtained from a LOAEL study of shorter duration (12 weeks), and thus required a downward adjustment correction factor of 10. The original 7 mg/kg-day TRV was, therefore, more suitable.

D. 16. The ASC's consultant commented that: "EPA's conclusion that there is no evidence of negative impacts on the survival, growth, or reproduction of green heron populations or other piscivorous birds resulting from the exposure to COPCs in the study area (page 4-92) is flawed.

EPA's conclusion may be inaccurate for the following reasons:

- Exposure calculations do not adequately reflect realistic exposures for green herons.
- Table 4-251 indicates that the average arsenic concentration of 0.3 mg/kg in blue gills for the study area is 3-fold higher than the reference, but the concentrations detected in each reach are not presented.
- Table E.2-2 shows that arsenic concentrations in brown bullhead tissue are significantly greater than the reference concentrations.
    - The average arsenic concentration of 0.14 mg/kg in brown bullhead fillets from Reach 3 was 3-fold higher than the reference concentration of 0.042 mg/kg.
    - The average arsenic concentration of 1.2 mg/kg in brown bullhead offal from Reach 3 was 27-fold larger than the reference concentration of 0.046 mg/kg.
    - The average arsenic concentration of 0.17 mg/kg in brown bullhead fillets from Reach 6 was 4-fold higher than the reference concentration.
    - The average arsenic concentration of 0.096 mg/g in brown bullhead offal from Reach 6 showed a 2-fold increase relative to the reference.

In addition, differences in COPC concentrations in crayfish, small fish, and bottom feeding fish within reaches should be compared because risk management decisions will need to be made by reach. Some areas may not be suitable for aquaculture."

EPA Response: EPA used consistent and conservative exposure assumptions. When the maximum case exposure scenario was calculated for heron (Table 4-194 in M&E, 2004), the only COPC with an HQ above 1 was iron. This conservative exposure scenario assumes that the heron feeds exclusively on fish and crayfish with maximum observed concentrations of each COPC observed in the study area. Based on this dose estimate, only iron exceeded the NOAEL level (M&E, 2004, Table 4-194). Although the assessment endpoint is not to determine risk to an individual, this estimate assumes that the exposed individual ate only the most contaminated crayfish and fish in the whole study area every day. Using these data, there is no evidence of potential effects on avian populations. EPA considers the estimates of dietary exposures to be conservative, appropriate, and protective.

Elevated concentrations of COPCs in tissue of fish on site as compared to reference locations may lead to a conclusion of increased exposure to arsenic, but not necessarily the presence of an ecological effect. The ecological effects endpoint was a comparison to tissue residue concentrations that are indicative of toxicity or impairment to fish.

A comparison of tissue concentrations for crayfish and fish among reaches was not part of an assessment endpoint that would assist in the determination of risk to aquatic receptors. The tissue data collected were used to address the assessment endpoints identified in the risk assessment.

> D. 17. The ASC's consultant commented that: "EPA is incorrect in concluding that 'there is relatively high confidence in the mallard TRV used for arsenic since it is based on the same species for a chronic exposure (page 4-93).
>
> The test TRV of 5.14 mg/kg-day for arsenic selected for the mallard and heron was derived from a mortality endpoint, not a chronic endpoint such as reproduction or growth. A lower test TRV of 3 mg/kg-day is cited in Table E.3.2 and is from a recent study (Camardese et al., 1990).
>
> It is a flawed rationale to conclude, 'The exposure analysis indicates that a portion of the potential mallard habitat may be impacted within the Wells G&H wetland. However, the limited area of arsenic above 1,000 mg/kg is not sufficient to represent a threat to mallard populations within the wetland, even if the ducks limited foraging to this wetland exclusively.' The exposure and risk model for the mallard only examines the exposure and risks to the adults, not fledglings which limit their foraging to the immediate vicinity of the nest. If fledglings from the nests in the Wells G&H wetland don't survive due to the effects caused by arsenic, this could have a dramatic effect on the local mallard population.
>
> Feathers could easily be collected from nests in nearby heron colonies or mallard nests in the HBHA wetlands or the Wells G&H wetland, and they could subsequently be analyzed for arsenic to assess their exposure and risk."

EPA Response: The test TRV of 5.14 mg/kg-day for arsenic selected for the mallard and heron was derived from a mortality endpoint for a 128-day test. Whereas, the Camardese et al., (1990) TRV is based on 70-day tests. Using either value for the TRV, the assessment endpoint for mallards would not be exceeded. The Camardese et al., (1990) reference is based on ducklings, so this TRV incorporates the concern for protecting fledglings.

Based on the nature of the COPCs, and level of risk to avian species, EPA did not consider that additional studies on exposures of herons were necessary. In addition, unless there are TRVs in the literature relating arsenic concentrations in feathers to effects on reproduction, growth, or mortality in avian species, collecting these types of data would not assist in determining effects, only in assessing exposure.

> D. 18. The ASC's consultant commented that: "only sediment samples beneath less than three feet of water were used to evaluate exposure of mallard ducks to sediment. The justification and references for this threshold should be elucidated. Also, many species of ducks live on Mystic Lake for at least a portion of the year. Because it is the largest open water body in the Aberjona River watershed, exposures for mallards in Mystic Lake should be calculated separately. Sediment sampling location SD-02-01 was used to evaluate exposure of a muskrat to sediment, but was not used to evaluate mallard exposure."

EPA Response: Mallards are dabbling ducks. Water depth for feeding and brooding is typically listed as from 1 foot to up to 3 feet deep (Johnson et al., 1987). Up to 2.0 to 2.5 feet deep may be more typical for mallards; however, since water levels may vary annually, EPA considered less than 3 feet a reasonable estimate of forage depth for a dabbling duck. (This response was provided previously in the response to Zemba, et al. (2003)).

Mallard use of Mystic Lakes was included in the site-wide model. Based on the depth, sediment sample SD-02-01 should have been used for mallard exposure calculation, and was corrected in Table 4-32 (M&E, 2004). The sitewide model was re-calculated with this sample; and the revised results were presented inTables E.1-51, E.1-52, 4-198 and 4-199 of the 2004 BERA (M&E, 2004). Table 4-197 (M&E, 2004), which summarized HQs for mallard, did not require revision, as none of the HQs, rounded to whole numbers, differed from the previously reported values.

EPA used consistent and conservative exposure assumptions. Modeling potential risk to mallard in a subbasin (Mystic Lakes) of the study area would not alter the risk conclusions.

> D. 19. The ASC's consultant commented that: "EPA may be incorrect to state that 'the survival or reproduction of shrew may be impaired in the study area due to exposure to inorganics in diet, but the results are associated with moderate level of uncertainty' (page 4-96). A screening level risk assessment was performed for the shrew, not a baseline risk assessment that uses site-specific dietary data. Because earthworms were not collected, there is high degree of uncertainty with associated risk estimates. More accurate risk estimates to small mammals such as shrews are desirable because shrews can be found in areas similar to those frequented by pets that roam into the drier wetland areas. In addition, Figure 4-37, Comparison of Arsenic in Sediment to Ecological Thresholds, shows that 7 areas/locations in Reach 2 exceed the shrew threshold and muskrat threshold."

EPA Response: The risk assessments acknowledge and evaluated the uncertainty associated with the risk estimates for shrew. The use of soil-to-earthworm bioconcentration factors represents a conservative estimate of risk.

D. 20. The ASC's consultant commented that: "because benchmarks are not available for some chemicals of concern and because the ecological effects of exceeding the benchmarks are not well defined, another measurement endpoint should be used to evaluate the potential effect of chemicals on the fish populations in the Aberjona River and Mystic Lake. This endpoint should be an assessment of the fish community to evaluate the biological integrity of the Aberjona River.

One such endpoint could be the Index of Biotic Integrity, which is an aggregation of 12 biological metrics that are based on the fish community's taxonomic and trophic composition and the abundance and condition of fish. These metrics assess the species richness component of diversity and the health of resident taxonomic groupings and habitat guilds of fish. Two of the metrics assess the community composition in terms of tolerant or intolerant species. Fish protocols are described in U.S. EPA (1999). [Note: Reference provided in ASC's Reference section: *1999 Update of Ambient Water Quality Criteria for Ammonia*. Office of Water. Office of Science and Technology. Washington, DC. December 1999. EPA-822-R-99-014]

EPA's conclusion (Page 4-98) that 'the assessment did not indicate any impacts on the local populations of predatory fish, bottom feeding fish, and small foraging fish populations' is flawed.

The evaluation does not directly address the ecological effects of COPCs but merely compares tissue concentration to tissue residue benchmarks. An evaluation of the age structure of a fish population for each of the different feeding classes would be indicated if existing fish populations have been affected."

EPA Response: Following EPA guidance, an assessment endpoint was established for assessing fish populations. The measurement endpoint associated with the assessment endpoint was the comparison of fish tissue concentrations to tissue residue benchmarks, as an indication of potential population effects. Based on this endpoint there was no evidence of ecological effects in the Southern Study Area. Fish community studies were conducted by U.S. Fish and Wildlife Service in the Northern Study Area. The population data from the Northern Study Area indicated impairment of fisheries; however, the relative influence of poor quality habitat conditions could not be distinguished from impacts associated with toxicity from contaminants. EPA's goal was to focus data collection on areas, pathways, and receptors that represented highest exposures. Although the fish data from Reach 0 indicated elevated exposures to arsenic, tissue residue and community data did not document significant community impairment in Reach 0. Due to habitat conditions, fish sampling in the upper reaches of the Southern Study Area did not result in sufficient sample sizes to conduct population studies. However, if no significant effects on fish populations were able to be documented in Reach 0, the potential for risk in downstream habitats with lower exposures is unlikely to be significant.

D. 21. ASC's consultant commented that the drinking water ingestion pathway should be explicitly considered in the human health risk assessment.

EPA Response: The groundwater evaluation of the Northern Study Area (from (including) Industri-plex OU-1 to Interstate 95) is based on the Groundwater Use and Value Determination, prepared by MassDEP. The groundwater determination classifies groundwater in this aquifer of "low" use and value, and specifically identifies exposure pathways of relevance to be included in the risk assessment. The groundwater determination further specifies the requirement that MCLs must be met before groundwater enters the Interim Wellhead Protection Area to the south of the Northern Study Area. The risk assessment for the Northern Study Area is consistent with the MassDEP Groundwater Use and Value Determination and, therefore, does not include a residential drinking water scenario. In the March 2005 RI and June 2005 FS, EPA identifies groundwater plumes originating from Industri-plex OU-1 and discharging into the HBHA. The Remedial Investigation did not show that groundwater plumes migrate downstream and impact the Wells G&H site. However, EPA did identify and evaluated the potential concern that sediments deposited in the Wells G&H wetland could release dissolved forms of metals contamination (e.g. arsenic) into the aquifer and impact the future supply wells within the Wells G&H site aquifer. EPA prepared a January 2005 Technical Memorandum (Appendix 5A in the March 2005 MSGRP RI) which concluded this was unlikely. Note that under the Wells G&H Superfund Site Operable Unit 2, additional data will be collected from the Wells G&H aquifer and any remaining site-relate aquifer issues will be addressed under that operable unit. The conclusions of the January 2005 Technical Memorandum will be reviewed as new information gathered as part of the Wells G&H OU-2 investigation data becomes available.

D. 22. The ASC's consultant commented that: "MSGRP pg. 6-10 ascribes considerable uncertainties associated with some exposure point concentrations that are influenced by highly variable data. The precise purpose of using an upper confidence limit on the mean is to account for such uncertainty, which typically results from insufficient numbers of samples to characterize the data distribution. Default risk assessment techniques substitute the maximum detected concentrations within reasonable maximum exposure calculations in cases in which upper confidence limits exceed the maximum values. In these situations, EPA should conduct sensitivity calculations on the risk estimates based on the upper confidence limits (even though they would be higher than the maximum concentrations). If the risk estimates of the sensitivity estimates exceed risk management criteria, EPA should consider further sampling in these areas to better characterize exposure point concentrations and reduce uncertainties.

Additionally, examples of singularly high concentrations such as the 1,600 mg/kg detected at location SC02 suggest the presence of "hot spots" that, if contacted even on occasion, might present excessive risks to human health. EPA should evaluate the potential need for the evaluation of health risks due to acute or short-term exposures. The ATSDR has established an acute Minimum Risk Level (MRL) of 0.005 mg/kg-d for arsenic. A 70 kg dredger ingesting an elevated level of 500 mg/kg per day of soil with an arsenic concentration of 1,600 mg/kg would receive a daily dose of 0.01 mg/kg-d, a value twice the acute MRL. EPA should evaluate acute exposure levels of potential concerns and consider the need for appropriate measures to protect individuals (such as dredgers) against short-term hazards.

The car wash scenario is likely a conservative estimate of the degree of exposure that a worker might receive from exposure to volatile chemicals emanating from groundwater used as industrial process water. As noted on p. 6-10 of the MSGRP, other groundwater use scenarios might be associated with much lower risk. As constructed, the risk assessment provides only the car wash scenario as a basis for developing potential restrictions on groundwater use. We suggest that additional scenarios be added to the risk assessment to provide a broader basis for determining guidelines for using groundwater for industrial or commercial (or other non-contact) uses."

EPA Response: The areas with uncertain exposure point concentrations (SC02 and SO-13) influenced by highly variable data have been identified as requiring action as part of this remedy. EPA agrees that further sampling in these areas is necessary. Therefore, a pre-design investigation will be conducted to more closely delineate the extent of contamination exceeding the sediment cleanup standards and requiring action. Because there are no current exposures occurring to sediment core location SC02, an evaluation of the acute effects of arsenic at this location is not necessary. Note that exposures at this location will be controlled in the future through institutional controls, ensuring that future dredging workers implement appropriate health and safety measures to protect themselves from both acute and long-term health affects associated with arsenic. Regarding groundwater use scenarios, the remedy will also restrict groundwater usage at the Northern Study Area. The risk assessment evaluated groundwater exposures related to a car wash worker, an industrial worker exposed to process water, and an on-site construction worker. EPA considers the groundwater exposure pathways to be reasonable, appropriate and protective.

D. 23. The ASC's consultant commented that: "[a]lthough current exposure to buried sediment from the former Mishawum Lake bottom is unlikely, it is necessary to consider future use of these areas. EPA appropriately sampled these soils and included the data in the risk assessment."

EPA Response: Comment noted.

D. 24. The ASC's consultant commented that ammonia should be considered as a contaminant of concern in the ecological risk assessment.

EPA Response: EPA agrees that ammonia was detected at high concentrations in groundwater and surface water, and should be a contaminant of concern. The March 2005 MSGRP RI presents a detailed discussion of all groundwater sampling events conducted at the site and identifies high concentrations of ammonia within the contaminated groundwater plumes. The highest concentrations in groundwater (up to 2,710 mg/L) are observed at sample locations adjacent to or downgradient of the hide piles or where animal waste have been buried, such as the NSTAR right-of-way.
EPA's June 2005 Administrative Record contains a report (cited by the commenter) entitled "Ammonia Data For Water Quality Samples," dated June 24, 2005, authored by Robert Ford (EPA), which includes groundwater and surface water data. The data identify high concentrations of groundwater discharging into the northern portion of the HBHA Pond up to 2349.7 mg/L, and high ammonia concentrations in deeper portions of the HBHA Pond up to

1762.2 mg/L. The concentration of ammonia in shallow surface water of the HBHA Pond outlet is elevated, ranging from 4.0 mg/L to 17.9 mg/L.

The Industri-plex OU-1 has a very large source of organic nitrogen in the form of buried animal hide wastes. As bacteria decompose the waste, some of the nitrogen that was bound up in complex organic molecules is released to the soil as ammonia. Through leaching processes, the ammonia is converted to ammonium by reacting with water. The fate and transport of ammonia contamination in groundwater is consistent with the contaminated groundwater plumes fate and transport presented in the MSGRP RI, where the contaminated groundwater plumes discharge into the HBHA Pond and impacts aquatic life. The presence of the chemocline serves to sequester the highest concentrations of ammonia at depth while assisting in the processes that decrease ammonia concentrations in the more oxic zones of the water column. EPA's selected remedy will adequately address the ammonia concentrations.

EPA has prepared the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data and October 2005 Fact Sheet supplementing the June 2005 Proposed Plan, which further presents, assesses and explains ammonia's impact on groundwater and surface water. Cleanup goals for the protection of human health and the environment have been developed for groundwater and surface water, respectively, and are presented in the October 2005 Technical Memorandum. This October 2005 Technical Memorandum was included in the Administrative Record for this Record of Decision and was available for review and comment during the reopened public comment period from October 20, 2005 to November 18, 2005. The selected remedy will identify ammonia as a contaminant of concern, and comply with National Recommended Water Quality Criteria (NRWQC).

> D. 25. The ASC's consultant commented that there is still too much uncertainty in the shrew calculations.

EPA Response: The risk assessments acknowledge and evaluate the uncertainty associated with the risk estimates for shrew. The use of soil-to-earthworm bioconcentration factors represents a conservative estimate of risk. The selected remedy includes strategies to reduce transport and further deposition of COPCs, including arsenic, from upstream sources.

> D. 26. The ASC's consultant commented that: "[w]e disagree with the statement on Page 7-4, 'The resulting level of ecological risk for the receptors is low except for the benthic invertebrates in the HBHA Pond.' Arsenic frequently is detected above reference criteria in areas other than the HBHA Pond.

EPA Response: It is clearly documented in the BERA that arsenic concentrations exceeding reference concentrations are found outside of HBHA Pond, however, the presence of arsenic in the sediment did not correspond to significant ecological effects. This has been attributed largely to the variation in the bioavailability of arsenic, depending on sediment chemistry and other factors.

> D. 27. The ASC's consultant commented that: "because no population measurements were taken, one could state that the risk assessment does not provide sufficient evidence

to conclude that arsenic contamination in the study areas *is not causing* an adverse effect on muskrat populations. The density of individual muskrats in the HBHA wetlands and 38-acre wetland was not measured. This measurement would be beneficial to estimate the frequency of muskrat use as well as the habitat value to the muskrat. In addition, if individual muskrats were captured, their fur could be analyzed for arsenic to determine if exposure to arsenic had occurred."

EPA Response: Conducting population studies, with the associated high uncertainty, would not likely provide conclusive evidence to show significant effects on muskrat population as compared to reference areas. The baseline ecological risk assessment's level of analysis conducted for the evaluation of potential effects on muskrat was adequate, and based on these data, the risk assessment does not provide sufficient evidence to conclude that arsenic contamination in the study areas is causing a significant adverse effect on muskrat populations. EPA has acknowledged the uncertainty in the risk evaluation. In addition, unless there are TRVs in the literature relating arsenic concentrations in mammalian fur to effects on reproduction, growth, or mortality, collecting these types of data would not assist in determining effects, only in assessing exposure.

D. 28. A resident of Wilmington commented that in some instances, the human health risk assessments were based only on food and did not include the breathing, drinking water, and skin absorption of receptors to contamination sources.

EPA Response: All human health exposure scenarios were developed appropriately for this site in accordance with EPA risk assessment guidelines. All appropriate exposure pathways were evaluated in the quantitative evaluation including skin absorption and inhalation exposures. The drinking water pathway was not included because groundwater within the Northern Study Area (north of Interstate 95) is not considered a drinking water source area by MassDEP (see MassDEP's Use and Value Determination for the Industri-plex study area)..

D. 29. A resident of Wilmington commented that wildlife is dead and yet EPA found no link to the contamination.

EPA Response: The baseline ecological risk assessment was conducted in accordance with EPA risk assessment guidelines. Unacceptable ecological risks related to the site were only identified in the HBHA Pond. EPA studies did not show unacceptable risk to wildlife for site contaminants in other areas.

D. 30. A resident of Wilmington commented that complete hydrocarbons should be evaluated as part of the risk assessment. She further commented that the use of metals as risk assessment markers is not appropriate nor based upon currently available technology.

EPA Response: EPA disagrees with the comment suggesting that the risk assessments were incomplete or only evaluated certain "marker" contaminants or incomplete exposure pathways. The baseline risk assessments were prepared in accordance with EPA risk assessment guidelines and accepted technology. Sampling was conducted for the full suite of contaminants including volatile and semi-volatile organic compounds, pesticides, polychlorinated biphenyls, metals and water quality parameters. All contaminants detected were evaluated in the risk assessments.

> D. 31. SMC, Pharmacia and the consultant retained by SMC and Pharmacia and SMC comment that the sediment ingestion scenarios relied upon by EPA in determining a current human health risk in two locations are not credible, as the locations are difficult to access.

EPA Response: The exposure scenarios are reasonable and appropriate, consistent with EPA risk assessment guidance, factor in future land use considerations, and are health-protective. In addition, these exposure scenarios are supported by the MassDEP. Only samples determined to be reasonably accessible, based on field observations, were applied to the human health risk assessment. Samples located in areas overgrown with reeds, vines, brambles or with excessively soft sediments, and considered inaccessible, were not quantitatively evaluated for human exposures. The Cranberry Bog and Wells G&H wetland are well utilized areas by the neighborhood and community. Future plans by the City of Woburn include development of the Wells G&H wetland into a passive recreational area. The Cranberry Bog is surrounded by residences, making it plausible that young children living in these residences may contact sediments and soils in areas adjacent to their yards. EPA visited each of the sediment exposure areas on a number of occasions. During each of these visits, adults and children were observed utilizing these areas (e.g., walking dogs, playing in groups, sliding down the embankments). Therefore, it is reasonable and health-protective to consider that residential children and adults living immediately adjacent to the former cranberry bog may come into direct contact with contaminants in sediment at an exposure frequency of 104 days/year. This exposure frequency approaches that used to evaluated a residential scenario (150 days/year) but also considers that each of the visits may not result in direct contact with sediments. Future plans by the City of Woburn include development of the Wells G&H wetland into a passive recreational area. The 78 day/year-exposure frequency for the Wells G&H wetland area is for future exposures. It is likely that children and adults would visit this area more frequently than 78 days per year. In fact, residents have stated to EPA that they currently go to this area nearly every day. The 78 days/year exposure frequency is intended to provide a reasonable maximum estimate of the number of days of sediment and surface water contact per year for future site use in the Wells G&H wetland area. The total number of visits per year, which may include visits without sediment and surface water contact, is acknowledged as likely to exceed 78 days per year.

Note: Because responses to the October 13, 2003 comments provided by Gradient Corporation (consultant for SMC) on the Aberjona River Study were prepared by EPA and are contained as part of the Administrative Record for the Site, no additional responses to the resubmitted October 13, 2003 Gradient comments attached to this August 29, 2005 comment letter have been provided.

> D. 32. The consultant retained by Pharmacia and SMC commented that because the proposed nature trail in the Wells G & H wetland is located in the upland area and does not extend in the wetland where the contaminated sediments are located, the exposure pathway should be considered incomplete.

EPA Response: EPA considers the areas accessible and determined that unacceptable human health risks exist at the areas. The construction of the nature trail in the upland area near station WH would attract recreational users to the Wells G&H 38-acre wetland and be an invitation for those visitors to explore the passive recreational space. Recreational visitors would not be restricted or limited in their ability to explore the area beyond the nature trail, including the near shore wetland areas. Therefore, the presence of the nature trail would potentially increase the frequency with which a recreational visitor may access near shore sediment at station WH. The evaluation of this potential future sediment exposure pathway using exposure assumptions inappropriate for a reasonable maximum exposure scenario would not be health-protective or consistent with EPA risk assessment guidance.

D. 33. Pharmacia and SMC and the consultant retained by Pharmacia and SMC commented that the MSGRP Human Health Risk Assessment was not conducted consistent with EPA guidelines and used unrealistic exposure scenarios and overly conservative exposure parameters.

EPA Response: The MSGRP RI baseline risk assessment was prepared consistent with EPA risk assessment guidance and the Wells G&H OU-3 Aberjona River Study HHRA, and to conform to the requirements of the Final GSIP work plan, prepared by the Industri-plex PRPs and commented on by EPA and MassDEP. Note that the Aberjona River Study HHRA, upon which the MSGRP HHRA was based, was reviewed and commented on by the PRPs, the public, and the MassDEP, and was revised to address those comments and to be transparent, clear, consistent, and reasonable, given the many diverse opinions on where the "zone of reasonableness" might lie.

Furthermore, as prescribed by EPA guidance, both HHRAs were prepared to evaluate a reasonable maximum exposure (RME) case which is a combination of upper-bound variables and average variables either recommended by EPA or assumed based on site-specific information, as available. As defined by EPA, the RME case should use a combination of variables, some at the maximum (95th percentile) and others are the average (50th percentile). Specifically, RAGS Part A recommends a 95% UCL for the EPC, 95th percentile values for contact rates (e.g., a soil ingestion rate), 90th or 95th percentile values for exposure frequency and exposure duration variables, and average (50th percentile) values for body weights. This EPA recommended approach of combining upper bound with average variables was used in the preparation of the risk assessment. The selected exposure variables used in the risk assessment were values recommended in EPA guidance documents or based on site-specific information, as available. The RME exposure estimates were combined with EPA-recommended toxicity information to estimate RME cancer risks and non-cancer hazards. The sources of these values were clearly explained and documented in the report, leading to a transparent and clear evaluation. The use of EPA-recommended exposure and toxicity values to the maximum extent possible results in estimated risks and hazards with a consistent basis across this Site and a basis that is comparable to other regional sites, exclusive of site-specific information.

The risk assessment was also prepared to account for future potential exposure pathways, as required by EPA guidance, since those hypothetical future exposure pathways may not be completely controllable. Until institutional controls are fully implemented at the Site, those future pathways are considered potentially complete, and knowledge of the potential risk findings associated with those pathways are important to the risk management process. Additional detail on each of these general topic comments is provided below under responses to specific comments.

> D. 34. The consultant retained by Pharmacia and SMC commented that a tiered approach to risk assessment should have been used.

EPA Response: A sequence of steps was used in performing the MSGRP and Aberjona River Study risk assessments. Screening level evaluations were performed on the initial rounds of data collected (e.g., 1995/1997 and 1999 rounds). The initial screening of these samples, many collected in inaccessible areas, indicated that additional data were required to adequately evaluate potential human health risks and hazards in accessible areas. In 2001 - 2002, additional data in upland and near-shore areas were collected in support of the HHRAs. Following the collection of these data and a second screening-level evaluation, the arsenic bioavailability study was performed to more accurately characterize the human health risks and hazards associated with elevated arsenic levels in accessible sediments. This study represents a significant step in the reasonable evaluation of arsenic hazard and risk at this Site.

Following release of the draft Aberjona River Study HHRA, comments on the report indicated the need to conduct additional sampling in upland areas potentially impacted by flooding and to evaluate dredging within the watershed based on a specific scenario being considered for flood abatement. After the gathering of site-specific information for current exposure scenarios (e.g., flooding frequency, dredging project duration) and the selection of exposure assumptions to characterize future RME scenarios according to EPA guidance, the reports were prepared in final draft form. The process used to prepare the final draft reports fulfills the intent of the Tiered Approach by incorporating site-specific information for exposure pathways, as appropriate, and after identifying the primary risk-contributing chemical (i.e., arsenic), developing an approach to estimate the risk and hazard associated with this analyte using site-specific information.

The result is a risk assessment where the conclusions are based on contaminant distributions appropriately identified by multiple rounds of sampling, state-of-the-art scientific methods, and reasonable, yet health-protective, exposure assumptions.

> D. 35. The consultant retained by Pharmacia and SMC commented that "the use of multiple upper bound assumptions . . . substantially overestimates the "average" level and even the reasonable maximum level of potential risk. Having used the 95% upper bound (or sometimes the maximum) environmental medium concentration as the exposure point concentration (EPC) for all of the risk calculations and having used the USEPA derived toxicity values, which are all upper-bound conservative values, means that all the risk results, regardless of whether the other exposure parameters are averages or upper bounds, will result in exceeding the level of protectiveness sought under USEPA guidance."

EPA Response: The risk assessment was prepared using EPA guidance relative to the evaluation of reasonable maximum exposure (RME) risk and hazards estimates. As defined by EPA and stated above, the RME scenario should use a combination of variables, some at the maximum (95th percentile) and others are the average (50th percentile). This EPA recommended approach of combining upper bound variable with average variables was used in the preparation of the risk assessment. Exposure variables used in the risk assessment were recommended by EPA or based on site-specific information, as available. The RME exposure estimates were combined with EPA-recommended toxicity information to estimate RME cancer risks and non-cancer hazards. The resulting evaluation is reasonable, yet health-protective.

> D. 36. The consultant retained by Pharmacia and SMC commented that "it is entirely unlikely and unreasonable to assume that well water would be used for any purpose with in the Industri-Plex Site and the MSGRP study area. Therefore, the future groundwater use scenarios (industrial worker process water use and car wash worker) should not be included in the MSGRP HHRA as exposure to groundwater used for industrial or commercial purposes is not a complete exposure pathway."

EPA Response: The risk assessment included an evaluation of potential future non-potable groundwater uses that are not currently restricted by any regulation. The risk assessment scenarios are consistent with the Groundwater Use and Value Determination for the Industri-plex aquifer within the Northern Study Area prepared by MassDEP. In addition, their inclusion complies with the EPA mandate to evaluate potential future land use scenarios.

> D. 37. The consultant retained by Pharmacia and SMC commented that the "use of groundwater in a car wash scenario should not have been included in the risk assessment as a complete exposure pathway based on City of Woburn zoning and groundwater use restrictions. However, even if it was included, it should only have been applied to the B-I zoning areas, and only using data from wells located in these areas, not using the summarized data for the Site and study area as a whole. If this had been done, risks for this receptor would be zero in the B-I #1 area (as no constituents were detected) and would not have exceeded the regulatory guidelines in the B-I #2 area. Moreover, if the shower model had been correctly applied to the data, whether in the B-I areas or erroneously for site-wide groundwater, it is likely that no regulatory guidelines would have been exceeded."

EPA Response: The zoning classifications represent current land use and do not represent future land use, which is considered in the risk assessments. Because zoning laws and classifications may be changed, the future car wash scenario was included based on the "low" use and value determination for the entire Industri-plex aquifer within the Northern Study Area. Portions of this aquifer were identified as not being associated with risk and/or hazard above risk management guidelines for this scenario. The car wash scenario was chosen to represent a conservative non-potable groundwater use scenario focused on the inhalation of volatile compounds. A 95th percentile exposure duration (25 years) was used as recommended by EPA guidance for the RME scenario. Since most car washes do not have a separate enclosed area for workers which may limit worker exposures to impacted air, the typical length of a work day (8 hours) was used for the exposure time. Because car wash facilities vary in size and the types of equipment used, the modeled car wash was assumed to be proportionately similar to a shower. This approach acknowledges that a car wash uses a larger volume of water than a shower, but the car wash also allows the volatile compounds to distribute into a proportionately larger space. A higher degree of ventilation was not factored into the modeling because there is no requirement that a car wash will be constructed with a specific dryer, if any. This approach and assumptions are reasonable and allowed for the use of an EPA-approved model to generate volatile compound airborne concentrations during water usage.

D. 38. The consultant retained by Pharmacia and SMC commented that if the groundwater as industrial process water scenario is included in the MSGRP HHRA, the ingestion pathway should be designated as incomplete.

EPA Response: The process water scenario was chosen to capture a conservative non-potable groundwater use scenario which included all three exposure pathways (incidental ingestion, dermal contact, and inhalation) and to comply with the EPA requirement to evaluate potential future use scenarios. This scenario assumes that an individual would dermally contact extracted groundwater for one hour of the workday. Gloves, long sleeves, or other impediments to dermal contact were assumed to be in place for the remainder of the day. The water ingestion rate of 50 mL/day (approximately one mouthful over the course of a typical work day) accounts for the accidental splashing of water into the mouth. It can not be assumed that workers would be health and safety trained or even be aware that the process water in use may be contaminated.

D. 39. The consultant retained by Pharmacia and SMC commented that ingestion of shallow groundwater during excavation activities should not be identified as a complete exposure pathway, and no risks or hazards should be calculated for this pathway; this commenter further stated that dermal contact with groundwater during excavation did not result in risks above regulatory guidelines.

EPA Response: The groundwater ingestion rate of 50 mL/day (approximately one mouthful over the course of a typical work day) was used to account for the accidental splashing of water into the mouth during excavation activities. This value is within the range of reasonable professional judgment values used to evaluate this pathway.

D. 40. The consultant retained by Pharmacia and SMC commented that "[u]se of the relative bioavailability (RBA) for soils would result in an almost 2-fold decrease in risks calculated for ingestion of arsenic in soils pathway – ingestion of arsenic in soils is the risk-driver for both the construction worker and day care child scenarios."

EPA Response: The site-specific arsenic bioavailability study was performed specifically for depositional sediments, not soil. Because the soil matrix composition and structure could differ considerably from that of sediment, the arsenic bioavailability estimate was not considered applicable to the soil ingestion pathway. However, during pre-design, additional site-specific, EPA-approved studies/tests may be conducted to determine the relative bioavailability of arsenic from surface soils, or from subsurface soils, if such an approach is deemed beneficial in limiting the extent of institutional controls that may be necessary for individual properties. EPA-approved studies/tests include in-vivo bioavailability studies (e.g. swine bioavailability study) similar to the study conducted by EPA during the MSGRP RI. Future EPA-approved studies may potentially include in-vitro bioavailability studies (not currently approved by EPA).

Individual studies must be conducted for surface soils and subsurface soils (samples from both samples may not be consolidated into one sample because of likely variability in the soil matrix).

> D. 41. The consultant retained by Pharmacia and SMC commented that if EPA used the upper-bound soil ingestion rate of 100 mg/day for the construction worker, the site-specific sediment arsenic bioavailability factor for soil ingestion, and eliminated the shallow groundwater ingestion pathway, the resulting potentially carcinogenic risks would not exceed the regulatory guidelines for the construction worker, and the hazard index would be only slightly above the regulatory guideline of 1 for the SO (former Mishawum Lake and associated wetlands) subsurface soil exposure area, and would be below the regulatory guideline for the SO surface soil exposure area.

EPA Response: Exposure assumptions used for the construction worker scenario were obtained from the most current EPA guidance sources available. The evaluation of two distinct exposure intervals is consistent with EPA Region I guidance and prevents the dilution of an exposure point concentration for one interval containing higher levels of contaminants through the addition of data points from a different interval which contains lower contaminant concentrations. This mathematical dilution of an exposure point concentration might result in the lack of identification of a soil interval requiring action. Conversely, the evaluation of each interval as a distinct exposure interval prevents the possible false conclusion that both intervals require action to the same degree. The sediment arsenic bioavailability study is not applicable to soils and EPA does not believe that a 100 mg/kg soil ingestion rate is health-protective for a construction worker.

> D. 42. The consultant retained by Pharmacia and SMC commented that "use of more realistic, yet still conservative exposure factors results in PRGs for arsenic in soil for the day care child scenario that are higher than the USEPA-derived values."

EPA Response: The day care scenario was chosen to evaluate potential day care exposures. Note that children not only attend day care during their preschool years, but also after their preschool years for before-school and after-school care, and also during school vacation periods. The first six years of life were selected for evaluation to account for this continuous period of care until a child goes to preschool, but also to account for the additional time a child may attend a day care facility after the preschool years. The exposure frequency (150 days/year relative to a possible 250 days/year of day care) accounts for adverse temperature and weather conditions during periods of the year within the New England area. As prescribed for the RME scenario, the 95th percentile value for soil ingestion, 50th percentile surface areas, and a dermal adherence factor for a reasonable upper-bound activity were used. The 95% UCL was used as the exposure point concentration, as recommended by EPA guidance for the RME scenario. The sediment arsenic bioavailability study is not applicable to soils. EPA does not believe that the exposure assumptions recommended in this comment are health-protective for a day care scenario.

> D. 43. The consultant retained by Pharmacia and SMC commented that "[i]t is likely that if the more realistic exposure assumptions and EPCs are used in the MSGRP HHRA, risks for this hypothetical future dredger receptor would not exceed regulatory guidelines."

EPA Response: The exposure frequency and exposure duration for the dredging worker is based on site-specific information obtained for a flood-control project being contemplated for the watershed. Other exposure assumptions used for the dredging worker scenario were obtained from the most current EPA sources available for excavation workers.

D. 44. The consultant retained by Pharmacia and SMC commented that "based on [their] review of the available scientific data [for arsenic] (including numerous studies that have been published since the RfD was last revised), use of a diet -adjusted NOAEL of 0.0024 mg/kg-day (reflecting a NOAEL of 0.0015 mg/kg-day and a dietary intake of 0.0009 mg/kg-day) together with an MOE of 1 represents a conservative (i.e., health-protective) toxicity benchmark (RfD = 0.0024 mg/kg-day) for assessing potential non-cancer health risks associated with long-term exposures. This RfD is 8-fold higher that that developed by USEPA. Use of this value would result in an 8-fold decrease in the calculated hazards in the MSGRP and would result in an 8-fold increase in the noncancer-based PRGs."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents. The current EPA-recommended oral reference dose for arsenic was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents the most defensible estimate of the noncarcinogenic toxicity of this compound.

D. 45. The consultant retained by Pharmacia and SMC commented that "[t]he uncertainties and high degree of conservatism in the cancer potency estimates [for arsenic] provide an additional reason why the MSGRP HHRA should have been refined with more realistic exposure assumptions prior to using it as the basis for remedy decisions."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents with exposure assumptions which EPA considers reasonable, as explained above. The current EPA-recommended oral slope factor for arsenic was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents the most defensible estimate of the carcinogenic potency of this compound.

D. 46. The consultant retained by Pharmacia and SMC commented that "[b]ecause the Anttila et al. [TCE carcinogenicity] values represent a more scientifically defensible starting point for characterizing TCE's carcinogenic potency, the MSGRP HHRA overstates the risks from ingestion of TCE in groundwater and inhalation of TCE in indoor air, notwithstanding that neither of these exposure pathways should be identified as complete within the study area."

EPA Response: The baseline risk assessments were prepared in accordance with EPA guidance documents. The carcinogenic potency of trichloroethylene is currently under review by EPA. Once the review is completed and revised potency estimates are released, the impact of the potential changes will be reviewed as part of the five-year review process.

D. 47. The consultant retained by Pharmacia and SMC commented that "t]he result of using the most conservative toxicity value for benzene is to overstate the risks from exposure to benzene."

EPA Response: The high-end of the range of values provided for benzene was used in the quantitative evaluation. To account for the conservative selection of benzene cancer toxicity values, a 10^{-5} cancer risk was selected as the target risk level for PRG calculation. Therefore, this uncertainty has been adequately addressed and accounted for by the selection of a target cancer risk level one order of magnitude higher than the recommended point of departure (i.e., 10^{-6}).

D. 48. The consultant retained by Pharmacia and SMC commented that EPA "did not take the limited benthic invertebrate habitat of HBHA Pond into account in their analysis. Even under the best of conditions, HBHA Pond is a stormwater retention basin and not a quality ecological habitat. Remediation to be conducted under USEPA's -Proposed Plan will not improve the quality of the benthic invertebrate habitat in HBHA Pond."

The consultant retained by Pharmacia and SMC commented that no remedial action was recommended for sediment below the thermocline at a similar pond at the W.R. Grace Site in Acton, Massachusetts.

Pharmacia added that because of anoxic conditions, the benthic invertebrate community in the hypolimnion of stratified lakes and ponds such as the HBHA Pond is typically impoverished and, in persistent anoxic conditions, can be completely absent.

EPA Response: EPA has made a site-specific determination based upon the data, fate and transport, and risk assessment results at the Industri-plex OU-2, including Wells G&H OU-3.

The conditions, risk evaluations, and cleanup decisions associated with the HBHA Pond are site specific and not applicable to the W.R. Grace Superfund Site, Acton, MA. It is the policy of EPA to determine cleanup goals on a site-specific basis. It is also essential to do so with respect to the HBHA Pond and Sinking Pond because these systems are entirely different in their habitats, sources of contamination, and fate and transport of contaminants.

The HBHA Pond is less than 20 feet deep and continuously receives contaminated groundwater plumes discharges in deeper portions of the pond. The HBHA Pond also receives surface water discharges at the surface of the pond. These discharges produce the chemocline within the HBHA Pond which helps keep the highest concentrations of contamination in surface water below the chemocline. This chemocline is an unnatural condition within the HBHA Pond. The sediments in the HBHA Pond contain high concentrations of contaminants and are severely toxic (i.e., associated with significant mortality). The surface water in the HBHA Pond contains high concentrations of contaminants and exceed NRWQC. The HBHA Pond contains various fish species and benthic invertebrates, and these fish and invertebrates contain elevated levels of contaminants in their tissues. EPA considered all the data and the uniqueness associated with the

HBHA Pond, and determined that surface water and sediment in the HBHA Pond posed an unacceptable ecological risk.

Sinking Pond at the WR Grace Site, Acton, MA, is a kettle pond approximately 45 feet deep with no surface water outlet. The primary source of contamination at Sinking Pond is attributed to the surface water discharge directly to the pond from a groundwater treatment system. Also, the hypolimnion present at the Sinking Pond is associated with the kettle pond's natural conditions, while the chemocline at the HBHA Pond is associated with contaminated groundwater plumes discharge and unnatural conditions. Only one sample in the sediments from the deep water of Sinking Pond showed any effect in toxicity testing, and the effect was marginal in significance.

The severe toxicity (i.e., significant mortality) of the sediments in the laboratory at all locations tested in HBHA Pond clearly indicates toxicity of the sediments, independent of other habitat conditions. The toxicity observed in the laboratory was not related to anoxic conditions, since the overlying water in the laboratory was aerated.

The toxicity testing results and tissue concentrations of fish and invertebrates differentiate the benthic invertebrate results in HBHA Pond from the pond reference (Phillips Pond – which also exhibited low oxygen in deep water during stratification) and downstream locations. In addition, the surface water concentrations exceed NRWQC and contribute to aquatic life impacts. EPA determined the surface water and sediments in the HBHA Pond pose an unacceptable ecological risk and warrant action.

EPA believes that remediation of sediments in the southern portion of HBHA Pond will improve and provide additional habitat for aquatic life (e.g., benthic community and fish). The remediation of the southern portion of the HBHA Pond will also reduce downstream migration of contamination.

> D. 49. The consultant retained by Pharmacia and SMC commented that EPA "arbitrarily selected a Preliminary Remediation Goal (PRG) for the protection of benthic invertebrates from a limited amount of data. In selecting the PRG of 273 mg/kg for arsenic in HBHA sediments, USEPA ignored data showing no effects on benthic invertebrates at arsenic concentrations over 1,000 mg/kg. They also ignored their own analyses showing that effects on benthic invertebrates were more highly correlated to habitat conditions (dissolved oxygen concentration, acid volatile sulfide concentrations, water depth, and flow) than sediment arsenic concentrations."
>
> Pharmacia reiterated this comment in a separate submission.
>
> The Pharmacia and SMC's consultant also commented that ".... body burdens of arsenic in benthic invertebrates were similar in the deep water stations in HBHA Pond and downstream in the wetlands. This supports the analyses that demonstrate the toxicity to benthic invertebrates in deep water Pond locations is due to causes other than arsenic."

EPA Response: EPA evaluated all the relevant data and stands behind its nature and extent, fate and transport, and risk evaluations. While not recognized in the comment, fate and transport processes of the groundwater plumes, including but not limited to high arsenic, benzene, ammonia, conductivity, reducing conditions and low DO, and migration and discharge into the HBHA Pond, have contributed to contamination and risks in the HBHA Pond, as well as downstream areas.

EPA utilized data reported in the BERA, as appropriate, when developing site cleanup goals. For data collected outside of the HBHA Pond, the greatest correlations were found between benthic community and habitat quality measurements (acid volatile sulfide concentration in the sediment, water depth, dissolved oxygen content of the overlying water, flow regime, and total organic carbon (TOC)). The data within the HBHA Pond differed dramatically from the rest of the community data observed outside the pond, highlighting the uniqueness of the HBHA Pond. This uniqueness relates to the fact that the HBHA Pond receives a continuous source of contaminated groundwater in the deeper portions of the pond, surface water discharges at the surface of the pond, the presence of the chemocline which helps keep high concentrations of contaminants in surface water below the chemocline, high concentrations of contaminated surface water above NRWQC in the HBHA Pond, high concentrations of contaminated sediments in the HBHA Pond, sediments with extreme toxicity (e.g., significant mortality) in the HBHA Pond, fish and benthic communities presence in the HBHA Pond, fish and benthic communities tissues from the HBHA Pond containing elevated levels of contamination (e.g. arsenic), etc. EPA considered all the data and determined that the surface water and sediment in the HBHA Pond pose an unacceptable ecological risk.

With regard to arsenic in HBHA Pond benthic invertebrates, Appendix Table 7B.6.1 summarizes benthic invertebrate tissue data. Benthic invertebrate tissue data exist for SED-07, 2.3 mg/kg arsenic. There are no tissue data for SED-05, because no organisms were collected. Although an indication of elevated arsenic in tissue, this value from SED-07 has some uncertainty, since it is based on a limited sample size and is not replicated at another deep location. As indicated in the comment, this value is lower than tissue samples collected outside of the HBHA Pond. This could be a result of a number of factors, including that the sample may represent an early instar which did not have a very long exposure to the sediment before it was collected. Contrary to what is stated in the comment, this single value does not prove that arsenic does not contribute to the toxicity observed in the sediments from deep water in HBHA Pond. The highest invertebrate tissue concentration was measured at location MC-06 in the shallow sediments of HBHA Pond of 26 mg/kg.

Based on the analyses in the BERA, EPA concluded the benthic invertebrate data outside of the HBHA Pond indicated a low level of effects on community composition and toxicity correlated to arsenic (even accounting for all of the other environmental variables mentioned above). EPA also concluded these effects were not severe enough to represent an ecological effect that warranted an action. Based on this assessment, a PRG was developed, only for HBHA Pond, using data only from HBHA Pond. With three data points from HBHA Pond, EPA selected the lowest observed concentration of arsenic associated with adverse effects, found at Station SED-06.

It is correct that in Appendix 7D of the BERA, EPA performed multivariate analyses of the benthic invertebrate data. These results indicated that the two deep water locations in HBHA

Pond were dissimilar with regard to benthic community in comparison to any other site or reference sampling location outside of the HBHA Pond. Hence, as mentioned above, the HBHA Pond is unique, containing sediments with severe toxicity and surface water exceeding NRWQC, which EPA determined to be an unacceptable ecological risk.

> D. 50. The consultant retained by Pharmacia and SMC commented that "National Recommended Water Quality Criteria (NRWQC) for dissolved arsenic were not exceeded in outflow from HBHA Pond under baseflow or storm conditions." Pharmacia reiterated this comment in a separate submission.

EPA Response: See above responses. EPA collectively considered nature and extent, fate and transport, and risk evaluations. Contaminated groundwater plumes (including arsenic and ammonia) discharge into the HBHA Pond and contribute to contaminations and risks at the HBHA Pond and downstream areas. EPA has documented and acknowledged that the NRWQC for arsenic is not exceeded in the surface water outflow from HBHA Pond. However, EPA has documented high concentrations of dissolved arsenic in deep water of the pond at concentrations well above the NRWQC. EPA has also documented in the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data that the concentration of ammonia, which is very toxic to aquatic life, also exceeds the NRWQC in both the deep water as well as the shallow water (above the chemocline) in the HBHA Pond on a frequent basis. These concentrations of both arsenic and ammonia represent an exceedance of an ARAR, and a risk to aquatic life.

> D. 51. The consultant retained by Pharmacia and SMC commented that "[t]he HBHA Pond in its current condition is currently providing the wetland functions listed in the Massachusetts Wetlands Regulations (310 CMR 10.01(2)) and does not require wetland replication to provide those functions." Pharmacia reiterated this comment in a separate submission.

EPA Response: The sediments throughout the HBHA Pond were extremely toxic and are associated with contaminated groundwater discharges originating from the Industri-plex site. EPA's ecological risk assessment identified these sediments as presenting an unacceptable ecological risk to benthic organisms. Due to the sediment toxicity and surface water quality exceedances of the NRWQC, EPA does not concur that the wetland functions and values are being protected in the HBHA Pond under current conditions.

Due to sediment contaminant concentrations in both deep and shallow water and the periodic exceedances of the NRWQCs for arsenic and ammonia in surface water, the ability of the HBHA Pond to perform functions of providing wildlife habitat, fisheries habitat and pollution prevention are impaired. The selected remedy includes dredging contaminated sediments from the southern portion of HBHA Pond and restoring the impacted area. A compensatory wetland will be constructed to make up for the lost wetland functions and values in the northern portion of the Pond and capped drainways. The lost functions and values of the southern portion will be restored in place. The degraded functions and values of the northern portion and capped drainways will be mitigated through the construction of compensatory wetlands nearby in the watershed. This mitigation will be consistent with ARARs

The selected remedy incorporates the northern portion of the HBHA Pond into the treatment process, which periodically requires sediments to be removed. Considering these contaminated sediments and future accumulated contaminated sediments will be retained, impact benthic community, and periodically be removed from the northern portion, EPA's selected remedy identified the northern portion as a habitat loss requiring compensation through the construction of alternative habitat within the watershed. EPA's selected remedy for the southern portion of the HBHA Pond requires contaminated sediment removal and restoration. Hence, compensatory mitigation is not necessary for the southern portion.

> D. 52. The consultant retained by Pharmacia and SMC commented that: "the absence of unacceptable ecological risks associated with benzene in groundwater at the West Hide Pile demonstrates that there was no need for USEPA to include enhanced in-situ bioremediation for the West Hide Pile in its Proposed Plan."

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater. EPA's RI identifies that plumes associated with the West Hide Pile (e.g., benzene, arsenic, ammonia) likely discharge to nearby wetlands (e.g. southern pond). Insufficient groundwater data and no surface water data were available to assess the extent of the impact of the West Hide Piles groundwater plumes on surface water and sediments. Further predesign investigation will be necessary for the area to evaluate West Hide Pile and East Hide Pile groundwater impacts on the surface water and sediments and impacts to the downgradient plumes.

> D. 53. The MBTA commented that "EPA should assess the risk associated with potential ammonia contamination and should specifically address the risk posed to a construction worker (for example working within a trench) who could be exposed to ammonia contaminated soil and groundwater/surface water…."

EPA Response: EPA evaluated the potential risk and hazard associated with construction worker contaminant exposures (ingestion, dermal contact, and inhalation exposure routes) in the MSGRP RI human health risk assessment. Arsenic was the only contaminant associated with risk management exceedances. Ammonia was not included as part of the MSGRP RI risk assessment. However, the maximum detected concentration of ammonia in groundwater (2,710 mg/L) was evaluated as part of the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data. Because the potential contribution from ammonia was four orders of magnitude less than conservative screening criteria, ammonia was not selected as a contaminant of concern for the construction worker scenario. Therefore, additional risk characterization information was not included for this receptor.

> D. 54. The ASC's consultant stated that: "the last-minute nature of ammonia's inclusion has prevented EPA from evaluating the potential effects of ammonia, particularly as a contributing source to overall eutrophication of the Aberjona River watershed….We encourage EPA to further consider the role of ammonia as a nutrient source potentially detrimental to the health of the Aberjona's ecosystems."

EPA Response: See EPA Response to Comment F.15, below.

D. 55. The ASC's consultant stated that: "[c]omments made by others erroneously calculate – and greatly exaggerate – the effects of combining upper-bound assumptions in the human health risk characterization."

EPA Response: See EPA response to comment D.35, above.

D. 56. The ASC's consultant states that: [o]n page 3-5 of the October 2005 "Evaluation of Ammonia and Supplemental Soil Data," EPA states that arsenic was not detected in any of the twelve soil samples collected at the Rifle Range. The detection limits of these samples, however, ranged from 19 to 32 mg/kg. These detection limits are too high to judge whether these soil may have been impacted above background levels, as the "natural" concentration of arsenic in soils in Massachusetts averages about 5 mg/kg. These samples should be re-analyzed to obtain better detection limits."

EPA Response: The goal of the soil sampling in this area was not to determine whether upland soil arsenic levels were consistent with background but rather to determine whether arsenic was present at levels associated with a risk management exceedance. Soil arsenic detection limits were adequate to determine whether arsenic was present at levels associated with risk or hazard in excess of risk management criteria.

D. 57. The ASC's consultant questioned: "Has EPA tested for the presence of H_2S in groundwater, and evaluated the possibility that H_2S off-gassing might present potential human health risks to receptors such as the car wash workers (and other potential users of groundwater), especially since the Reference Concentration for H_2S is quite small (about 2 ug/m^3)? If H_2S is potentially present, it should be added as a contaminant of potential concern."

EPA Response: EPA's Office of Research and Development conducted limited analyses of groundwater samples for hydrogen sulfide including conducting field measurements at 18 groundwater sample locations along with vertical profile sampling within the north and central portions of the HBHA Pond water column. Hydrogen sulfide was not detected within the HBHA Pond water column. Although low detections of hydrogen sulfide were sporadically observed in groundwater, EPA does not believe that the low concentrations of hydrogen sulfide would be sustained due to the geochemical conditions observed (and previously reported) in groundwater throughout the Industri-plex site. Specifically, the presence of hydrogen sulfide in groundwater is limited by the elevated concentrations of ferrous iron throughout the site, which results in rapid precipitation of iron sulfides within the aquifer and sediments of the HBHA Pond. Evidence for this process is documented for sediments collected from the northern portion of the HBHA Pond within the zone of plume discharge (Wilkin and Ford, 2002). Based on these data, EPA does not believe that hydrogen sulfide would be present at concentrations that would contribute significantly to human health risk and therefore, is not considered a contaminant of concern.

D. 58. The consultant retained by Pharmacia and SMC commented that: "USEPA used a 95% upper confidence limit (UCL) of ammonia in groundwater of 316 mg/L in their risk calculations. If only data from the B-1 zoned areas (all of which are from the B-1 #1 area) are used, the resulting 95% UCL concentration is 6.54 mg/L..."

EPA Response: See EPA response to comment D.35.

D. 59. The consultant retained by Pharmacia and SMC commented that: "USEPA must also consider the form of ammonia that is in groundwater. USEPA's modeling does not account for the fact that below pH 9.25, ammonia exists largely as the ammonium ion (NH_4^+) in solution (Snoeyink and Jenkins, 1980)....This is a critical distinction because ammonium is not volatile and therefore would not be present in the air due to volatilization."

EPA Response: The form of ammonia in water is both pH and temperature dependent with both higher temperature and pH favoring the unionized (volatile) form. Should groundwater be withdrawn and used as process water or in a warm water car wash, the pH and temperature of the groundwater may be altered such that a higher percentage of volatile ammonia is present than exists natively. In addition, as volatile ammonia is released, there will be equilibrium partitioning that will result in the further conversion of ionized ammonium into volatile ammonia in a time-dependent manner. Because a car wash scenario may involve the warming of groundwater, the mixing of groundwater with soap solutions with basic properties, and the used water may remain in the washing area for a period of time allowing for extended volatilization time, EPA conservatively assumed that future conditions may exist that result in the near complete volatilization of ammonia from groundwater.

D. 60. The consultant retained by Pharmacia and SMC commented that: "USEPA should emphasize the conservatism inherent in the ammonia RfC. The ammonia RfC is based on relatively mild, reversible respiratory effects such as respiratory irritation, and on a single NOAEL exposure level. These observations, coupled with the use of an uncertainty factor of 30, reflect the conservatism inherent in the ammonia RfC."

EPA Response: The current EPA-recommended inhalation reference concentration for ammonia was used in the evaluation. The data upon which this toxicity value is based has been extensively reviewed within the scientific community and the recommended value represents that most defensible estimate of the non-carcinogenic hazard of this compound.

D. 61. The consultant retained by Pharmacia and SMC commented that: "ammonia concentrations at or below 37 mg/m^3 (USEPA's estimated exposure concentration) for extended durations are well below levels that cause serious or permanent adverse effects....There are no reported cumulative effects from repeated exposure to ammonia at the concentrations modeled by USEPA..."

EPA Response: The baseline risk assessment was prepared in accordance with EPA guidance documents. The selection of toxicity values and the evaluation of receptor-specific hazard are to protect against both serious/permanent and less serious/transient health effects. The EPA-recommended ammonia toxicity value is protective of both types of health effects.

D. 62. The consultant retained by Pharmacia and SMC commented that: "USEPA should also compare the estimated ammonia exposure concentrations to occupational exposure guidelines, to provide additional perspective on the likelihood of adverse health effects."

EPA Response: The baseline risk assessment was prepared in accordance with EPA guidance documents and adequately evaluated the potential hazard to a commercial worker.

D. 63. The consultant retained by Pharmacia and SMC commented that: "EPA relies upon an evaluation of ammonia concentration data collected primarily between 1999 and 2001 in the Halls Brook Holding Area Pond (HBHA Pond). No data are presented or analyzed by USEPA for locations further downstream in the Aberjona River watershed. Therefore, the USEPA analysis does not address potential impacts to aquatic life in those portions of the Aberjona River watershed that are appropriate for aquatic life....Measured instantaneous ammonia concentrations [presented in a recent Master of Science Thesis by M. Cutrofello in August 2005] exceeded the applicable 30-day average CCC in amounts that were statistically significant only during 1 of 7 sampling events at HBHA Pond Outlet and 1 of 8 sampling events at HBHA Wetland Outlet. Of 23 samples collected from the Aberjona River at Route 128, immediately downstream of the HBHA Wetland, none exceeded the applicable 30-day average CCC for ammonia. Further downstream on the Aberjona River, there were no instantaneous measurements of total ammonia that exceeded the calculated CCC at any of the stations sampled."

EPA response: EPA used ammonia data collected between 1999 and 2001 due to the intensive studies carried out in HBHA Pond to evaluate temporal and spatial distributions in chemical gradients. However, EPA also collected additional ammonia data in HBHA Pond and tributaries to HBHA Pond in 2004 and 2005. Based on EPA's data, most exceedances of the CCC and CMC for ammonia were in deeper water of HBHA Pond, although exceedances of up to 4-fold the CCC were observed in the HBHA Pond outlet in 3 out of 5 samples collected. These data appear to be generally consistent with the data presented by Cutrofello (2005).

E. Questions and Comments Concerning the Preferred Remedy

E. 1. The ASC inquired whether the type of remedy proposed had been utilized elsewhere and if so, if there is any statistical analysis demonstrating its effectiveness. The ASC's consultant commented that it is unaware of similar remedies being implemented elsewhere, and whether or not the utilization of a system like the HBHA Pond to contain contamination is a "tried and true process."

EPA Response: The components of the remedial action have been widely and successfully implemented at other sites around the country such as in-situ enhanced bioremediation, permeable cap to prevent contaminated soil erosion and downstream migration of contaminants of concern, impermeable cap to prevent contaminated groundwater infiltration and downstream migration of contaminants of concern, dredging and off-site disposal of contaminated sediments,

etc. The principal treatment mechanisms associated with the selected remedy for HBHA Pond involve aeration, precipitation and biological degradation which are commonly used at groundwater and waste water treatment plants throughout the country. Constructed wetlands have also been used as a method of treating contamination using natural processes occurring in a wetland system. In addition, EPA's Office of Research and Development has monitored the conditions within the HBHA Pond which demonstrate the selected remedy will work and achieve the cleanup standards. Please refer to EPA publication EPA832-R-93-005 where 17 case studies were evaluated for constructed treatment wetlands.
The problems at the Industri-plex site are unique and EPA is unaware if a similar system using all of these various components exists elsewhere in the country. However, we note that the natural processes that exist in the HBHA Pond have been shown to be somewhat effective in sequestering arsenic and reducing other COCs. EPA's goal is to assist and enhance these processes while restoring as much of the HBHA Pond and wetland as possible. Notwithstanding the above, at least every five years, EPA will evaluate the conditions at the site and determine if the selected remedy is protective of human health and the environment.

E. 2. One commenter associated with the Woburn Conservation Commission noted that there was nothing in the Proposed Plan detailing the following: management of contaminated soils, the location and design of replicated areas for wetlands mitigation, and treatment of any archaeological findings, and also requested that EPA coordinate its work in wetlands with the Woburn Conservation Commission.

EPA Response: The specific details of the selected remedy as mentioned in the comment (i.e., planting schemes, waste handling procedures, monitoring, etc) will be provided in the remedial design. EPA will continue to coordinate with all stakeholders regarding the selected remedy. EPA notes that remedial actions under the Superfund program are generally exempt from local permits.

E. 3. One Woburn City Alderman asked what will happen to the waste causing the groundwater contamination (upstream of the HBHA Pond).

EPA Response: The capped and buried organic waste (animal hide residues) and soils contribute to groundwater plumes. These capped and buried organic waste and soils will remain in place serving as a long-term source to the contaminated groundwater plumes. Hence, the contaminated groundwater plumes are expected to persist indefinitely.

E. 4. One Woburn City Councilor asked if there was a backup plan in place should the cofferdam system fail. The ASC's consultant commented that EPA should be prepared to deal with unexpected findings and consequences, and asked if there was a backup plan.

EPA Response: Long-term monitoring will ensure that the remedy remains effective and that the conditions that the remedial design is based upon do not change or alter the performance of the remedy. In addition, a comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls, and conducting additional studies and investigations. For example, if under the selected remedy, the NRWQC values cannot be achieved at the HBHA Pond compliance point, then additional actions may be required. If different remedial actions are necessary, then other remedial alternatives, such as GW-3 Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls coupled with HBHA-5 Removal and Off-Site Disposal, outlined in the June 2005 FS, may be considered.

> E. 5. The ASC asked if there were more detailed designs plans available beyond that which is contained in the Proposed Plan. The ASC's consultant commented that there is almost no detailed design information to comment upon.

EPA Response: The design stage of the process will occur after the Record of Decision is issued, and will be available for public review.

> E. 6. The ASC's consultant commented that because a large amount of waste will be left in place, it depends strongly on continued risk and land management.

EPA Response: The comment is noted. EPA recognizes that waste will remain in place and require long-term monitoring. The Feasibility Study evaluated all alternatives based upon 30 years. However, some aspects of the remedial action and monitoring will extend beyond 30 years due to the waste remaining in place.

> E. 7. The ASC's consultant commented that because monitoring is a crucial aspect of the proposed remedy, it should be given the opportunity to review and comment upon the specific details of the monitoring program.

EPA Response: Monitoring is an important component of the selected remedy, and is generally described in the description of alternatives in Section 3, Section 4, and Appendix B of the FS. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during remedial design process.

> E. 8. The ASC's consultant asked who is going to oversee the capping and the construction, who will be responsible for giving permits for construction on these sites, and whether the City of Woburn would be responsible for those matters.

EPA Response: EPA, in consultation with the Commonwealth of Massachusetts, will oversee the remedial design and remedial action. Under the Superfund program, remedial actions are generally exempt from local permitting requirements. As indicated in the above responses, EPA believes public participation is an important aspect of the Superfund process that will continue at this site and encourages involvement of the local authorities during the design and construction phases of the project.

E. 9. The ASC's consultant commented that: "Alternative HBHA-4 involves significant physical disturbance of the Halls Brook Holding Area (HBHA) pond, which raises a concern about whether the existing chemical stratification and the predominant redox chemistry of the pond can be maintained."

EPA Response: An important aspect of the selected remedy for HBHA Pond is ensuring that baseflow surface water from Halls Brook continues to discharge into the northern portion of the HBHA Pond, which helps to maintain the chemocline at a depth of approximately 150 – 200 cm below the pond's surface. The selected remedy re-directs Halls Brook storm surface water flow to the southern portion, but maintains baseflow conditions in the northern portion. EPA agrees that significant, frequent, and careful monitoring of the water quality and redox parameters in the HBHA Pond is an important aspect of the remedy. The specific details of the monitoring program will be provided in the Remedial Design.

E. 10. The ASC's consultant commented that: "t]he Proposed Plan suggests that EPA's proposed Alternative GW-2 for groundwater, when combined with HBHA-4, 'also controls the downstream migration of contaminated groundwater by intercepting it at the northern portion of the HBHA pond' – however, the cofferdam will not intercept arsenic in groundwater discharging directly to the south basin."

EPA Response: The location of the low-head cofferdams presented in the Proposed Plan and selected remedy is conceptual and approximate based on the available groundwater data. The final location of the low-head cofferdams will be determined during the pre-design field investigations and will intercept the contaminated groundwater plumes being released from the Industri-plex site (e.g., arsenic, benzene, ammonia). Also, the presence of arsenic at the bottom of the HBHA Pond does not necessarily correlate directly to the presence of the arsenic groundwater plume. The chemocline within the HBHA Pond keeps contamination at depth, and the dissolution and precipitation cycling processes below the chemocline contribute to the broad distribution of high arsenic concentrations throughout the bottom of the pond.

E. 11. The ASC's consultant commented that: "[t]he proposed remedial plan does not address high concentrations of dissolved total ammonia (NH_4^+ plus NH_3) entering the north basin in groundwater."

EPA Response: Consistent with the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data, EPA agrees that ammonia concentrations in groundwater and surface water are high and ammonia is a contaminant of concern. See EPA's previous response above regarding ammonia as a contaminant of concern. EPA's selected remedy will address the ammonia in surface water and groundwater above the cleanup standards. It should be noted that while ammonia may be competing with arsenic for available oxygen in surface water at HBHA Pond as suggested in the comment, the current levels of oxygen have been adequate to support the reactions necessary to significantly decrease the concentrations of both dissolved arsenic and ammonia. The aeration treatment system will provide an additional source of oxygen that will further enhance those reactions. The complex chemistry associated with the ammonia and other compounds will be evaluated further during the pre-design stage to ensure the remedy is most effectively and efficiently designed.

> E. 12. The ASC's consultant commented that: "[t]he Feasibility Study does not describe the plans for reducing risks posed by the sediments and chemolimnion in the north basin after the PRGs for GW-2 have been reached."

EPA Response: The selected remedy requires institutional controls to reduce the risk associated with human exposure to contaminated groundwater. Groundwater treatment is not specified. Since the source of groundwater contamination (buried wastes and animal hides) is to remain in-place, groundwater is not expected to achieve the groundwater cleanup standards through natural attenuation processes in the foreseeable future. The low-head cofferdams will be maintained and the northern portion of the HBHA Pond will require periodic dredging. In the unlikely event groundwater cleanup standards are achieved and the low-head cofferdams are no longer required, then sediments remaining that exceed the sediment cleanup standard would be dredged at the time the cofferdams are removed and the impacted area would be restored.

> E. 13. The ASC's consultant commented that: "[t]he justification for the 30-year design-life of the chemolimnion/retention pond system has not been provided in the Feasibility Study. "

EPA Response: The 30-year design-life is a consistent standard used for comparing all alternatives, and does not represent how long a remedial alternative will be required to operate. Due to the interactions between GW and HBHA alternatives (groundwater plumes discharge into and impact sediments and surface water in the HBHA Pond), these alternatives were considered together. While all of the GW alternatives (and the HBHA-4 alternative) have a consistent 30-year design life, the designed systems for the remedy are expected to be operated and maintained beyond 30 years because buried waste remains in place at the Industri-plex site. It is impossible to accurately estimate how long these systems will need to function, hence, EPA assumes with the waste remaining in place that the systems will need to function for the foreseeable future.

> E. 14. The ASC's consultant commented that: "[e]stimates of the volume of contaminated sediment to be removed in proposed Alternative NS-4 are based on the analyses of a very limited number of samples."

EPA Response: The estimated areas requiring remediation were based on samples spaced approximately 50 to 75 feet apart. As stated in the Feasibility Study, a pre-design investigation will be conducted to more closely delineate the extent of sediment contamination exceeding the sediment PRG and requiring removal. The results of this investigation will serve as the basis of the Remedial Design. In addition, confirmatory samples will be collected during sediment removal activities to ensure that contaminated sediments exceeding the sediment cleanup standards have been removed from the targeted areas defined in the FS.

E. 15. The ASC's consultant commented that: "[r]egardless of which alternative is implemented for surface water, automated sampling stations should be established at several locations for ongoing monitoring of remedial progress."

EPA Response: A surface water monitoring program similar to the one implemented during the MSGRP RI will be conducted as part of the remedy. The specific details of the monitoring program will be developed during the remedial design phase. This approach will provide surface water data that can be compared to the existing surface water data set. This approach will also satisfy community concerns regarding monitoring downstream of the remedy.

E. 16. The ASC's consultant asked whether the design of the storm water bypass considered dense storm water during cold weather.

EPA Response: EPA has monitored the geochemical conditions of the HBHA Pond during summer periods and has not identified this as a concern. See Robert Ford's September 2004 Natural Attenuation Study (Appendix 2D in the MSGRP RI). EPA also wishes to clarify that the Proposed Plan and the selected remedy are not intended to be detailed technical designs. Remedial Design will occur in the future. In addition, pre-design investigations will be necessary to complete the final design of the system. The impacts of colder storm water on the system is one of the design parameters that will be evaluated further. Long-term monitoring will also be a necessary component of the overall system, and will be addressed during the remedial design phase.

E. 17. The ASC's consultant commented that: "EPA should require that the cofferdams be designed to withstand the effects of ice."

EPA Response: The low-head cofferdams that are constructed in the HBHA Pond will be designed to resist the impacts of ice or any other natural forces to which they would be exposed (e.g. hurricanes, significant flooding, heavy debris from storm events). The specific design details, including the actual location and orientation of the low-head cofferdams and the type of material utilized to construct the cofferdams, will be developed during the Remedial Design process.

E. 18. The ASC's consultant commented that: "Sediment Retention Area at Northern Portion of the HBHA Pond: on page 3-31, paragraph 1 of the Feasibility Study (Section 3.4.5.2) it is written that 'construction of baffles/flow deflectors or installation of floating silt curtains around which surface water flow would be directed, resulting in lower flow velocities as surface water moves toward the southern end of the pond.'

This statement is not correct. Since $Q_{in} = Q_{out}$ in the north basin, flow velocities around baffles and curtains will increase. Travel distances (and hence hydraulic residence times) will increase, which may enhance particle settling, but velocities will not be reduced. Two related questions: (1) what size particles will be removed by the proposed retention basin, and (2) what are the hydraulic residence and particle settling times in the north basin? Because the answers to these questions will impact the effectiveness of the retention basin to remove particulate arsenic, in the absence of this data it is not possible to judge the feasibility of the proposed retention basin to meet the PRG for surface water flowing to the south basin."

EPA Response: The above-mentioned phrase should read: "*...construction of baffles/flow deflectors or installation of floating silt curtains around which surface water flow would be directed, to* promote the settling of particulate arsenic." The last sentence of the first paragraph on Page 3-31 can be ignored.

In reference to the two additional questions, the proposed location of the low-head /s is presented as preliminary and conceptual, based on the discharge of contaminated groundwater. The actual location of the low-head cofferdams is subject to change based on further evaluation of the groundwater and residence time required to provide adequate removal of suspended sediment to achieve the remedial action objectives. Pre-design investigations will also be conducted to optimize the sediment retention system. It is important to note that the primary compliance aspects of the northern portion of the HBHA Pond and its low-head cofferdams system (including the northern/first low-head cofferdam (primary treatment area/cell) and southern/second low-head cofferdam (secondary treatment area/cell)) are three fold: 1) the first low-head cofferdam (primary treatment cell) is located to intercept the contaminated groundwater plumes discharging in the HBHA Pond; 2) the chemocline within the primary treatment cell will be maintained (e.g., storms flows from Halls Brook be diverted from the northern portion of the HBHA Pond to the southern portion (downstream of the primary and secondary treatment cells), periodic dredging within the primary treatment cells); and 3) the effluent from the second low-head cofferdam (secondary treatment cell) comply with surface water cleanup standards (including NRWQC), and periodic dredging within the secondary treatment cell to maintain compliance with the cleanup standards/remove accumulated sediment.

E. 19. The ASC's consultant commented that: "by not allowing chemolimnion to spill over from the north basin to the south, the volume of the chemolimnion will increase, and the chemolimnion level will rise up in the north basin impacting more of the pond."

EPA Response: The chemolimnion/chemocline is not expected to increase in volume as stated in the comment. A scenario that may cause the chemocline to "spill over" the coffer dam may be the result of accumulated sediment that effectively decreases the depth of water and increases the elevation of the chemocline. Accumulated sediment depth will be monitored and periodically dredged to ensure spill over does not occur. This question will need to be evaluated further during predesign investigations.

EPA's selected remedy also requires the construction of compensatory wetlands for any wetland function and value losses associated with the remedy, including any loss flood storage capacity.

E. 20. The ASC's consultant asked how the frequency of sediment dredging will be determined.

EPA Response: The initial frequency of dredging will be determined during remedial design and will be closely monitored during the life of the remedy including the primary and secondary treatment cells in the northern portion of the HBHA Pond. As indicated above, the dredging frequency will be determined by closely monitoring the chemocline, surface water conditions in the northern portion, and sediment accumulation.

EPA anticipates that, in addition to other design and performance criteria that will be detailed in the remedial design, conditions that may trigger dredging in the northern portion of the HBHA Pond will be: 1) if the chemocline rises to within 100 cm of the northern/first low-head cofferdam outlet (primary treatment cell); or 2) concentrations of surface water effluent from the southern/second low-head cofferdam (secondary treatment cell outlet) exceeds the surface water performance standards (e.g., NRWQC). EPA expects that other interim measures will be evaluated and possibly implemented prior to dredging in order to protect the integrity of the chemocline and ensuring compliance with the performance standards. Frequent long-term monitoring will be necessary to monitor the system. These interim steps (for example, actions other than dredging) may temporarily postpone the need for dredging operations, until the interim steps are no longer effective and excessive sediment accumulation within primary and/or secondary treatment cells requires dredging.

It should be noted that a portion of the sediments helps to release some iron-oxides and promote microbial degradation, which suggests that when dredging becomes necessary, only partial dredging should be implemented sufficient to lower the elevation of the chemocline and provide further sediment retention capacity. Also, dredging should only be implemented when necessary to ensure the selected remedy is functioning appropriately, achieving the remedial action objectives and standards, and the chemocline remains low in the water column ensuring no elevated releases of contaminants of concerns downstream of the HBHA Pond.

EPA anticipates that hydraulic dredging will be implemented in the northern portion of the HBHA Pond, and dewatering the northern portion will not be necessary. Water generated during dredging would require testing and, if necessary treatment, prior to discharge. As stated in the FS, specific methods for dredging, materials handling, treatment of water, etc. will be addressed in the remedial design.

> E. 21. The ASC's consultant commented that it is not clear if the aeration system between the two cofferdams will be effective. "... The water will contain very high levels of ammonia, sulfides, and reduced iron, which will all compete with arsenic for oxygen. It is likely that advanced oxidation process – e.g., UV-peroxide oxidation – will be required to effectively oxidize the arsenic moving downstream from the first cofferdam to the second. Also, it is not clear if the aeration system will be operated all year long or if it will be shut off periodically (e.g., during the winter months). Lastly, it is written that 'Periodically, the secondary sediment retention area may also require dredging,' but it is not clear how the frequency of dredging will be determined. EPA should address these questions in the Feasibility Study."

EPA Response: Based on the available surface water data, the shallow water does not contain "very high levels of ammonia" as stated in the comment. It is currently anticipated that aeration will assist the existing natural attenuation processes occurring in the HBHA Pond in achieving the Remedial Action Objectives (RAOs) and surface water cleanup standards at the point of compliance (i.e., the outlet of the southern/second low-head cofferdam (secondary treatment cell)). A pre-design investigation will be required in the ROD to further evaluate the water chemistry and provide the basis for the actual full scale remedial design of the low-head cofferdams and aeration system. In addition, once installed, a comprehensive monitoring program will be implemented to evaluate the effectiveness of the system in meeting the RAO and cleanup standards. Currently it is assumed that the aeration system will be operated year-round. Regarding dredging, accumulated sediment within the secondary treatment cell will be monitored for depth as well as contaminants of concern. The frequency of dredging the secondary treatment cell will be determined based on the accumulated depth of sediments and concentrations of surface water effluent exceeding the surface water performance standards (e.g., NRWQC). Dredging of the secondary treatment cell could also be based on other factors such as the dredging frequency of the primary treatment cell (the sediment retention area for the Northern Portion of the HBHA Pond include the primary and secondary treatment cells). For example, for purposes of cost efficiencies, it is possible that the secondary treatment cell will be dredged at the same time the primary treatment cell. It is also possible that the secondary treatment cell may need to be dredged more frequently then the primary treatment cell.

> E. 22. The ASC's consultant commented that: "EPA does not adequately describe the long-term monitoring and maintenance program for Alternative HBHA-4."

EPA Response: The specific details of the comprehensive monitoring program will be developed in the Remedial Design.

> E. 23. The ASC's consultant commented that: "Section 3.4.5.2 (Sediment Retention Area at Northern Portion of the HBHA Pond), on page 3-31, paragraph 2, describes "construction of a dual low-head cofferdam system starting at the approximate location of the mouth of the Halls Brook and continuing west across HBHA Pond... with the northern portion serving as the sediment retention and secondary polishing area." It should be noted that Hall Brook enters HBHA on the western shore; thus, if the cofferdam is constructed from the brook outlet across the pond, construction will proceed to the east and not the west."

EPA Response: The comment is acknowledged and EPA agrees with the comment. However, since the error does not change the outcome of the FS, the document will not be revised.

> E. 24. The ASC's consultant commented that: "Page 3-31, paragraph 3, makes reference to 'diffusion from accumulated sediments and subsequent chemocline precipitation.' It is not clear what is meant by these statements and what they refer to. It appears that this phrase was inadvertently appended to the sentence in which it appeared."

EPA Response: The comment is acknowledged and the phrase should be ignored. However, since the error does not change the outcome of the FS, the document will not be revised.

> E. 25. The ASC's consultant commented that: "[o]n page 3-31, paragraph 3, sentence 3, it is not clear how the sediment storage figure of '2,000 yd^3 of in-place sediment per

vertical foot' is arrived at. Is this an estimate arrived at from carefully performed measurements and calculations, or is this simply a rough estimate? EPA should describe how the sediment storage volume was estimated."

EPA Response: This estimate provided is a rough estimate of the in-place volume of sediment that would accumulate over the estimated area of the settling basin that is presented in the FS report. The surface area of the sediment retention basin that is depicted in the FS is approximately 56,000 square feet. One foot of sediment depth represents an average estimate of sediment depth assuming that the sediment thickness will be greater towards the center of the pond and lesser near the shores.

56,000 SF x 1 Vertical Foot = 56,000 Cubic Feet (CF)
56,000 CF x 1 CY/27 CF = 2,074 CY

E. 26. MassDEP recommended "dredging the entire pond including the proposed groundwater treatment area [Northern Portion of the HBHA Pond containing the primary and secondary treatment areas/cells] prior to installing the cofferdam. Dredging the entire pond would immediately increase the remedial capacity of the northern section of the pond, potentially ensure that Responsible Party funds would be used to do the dredging, and extend the time period that will be needed before the next dredging will have to take place."

EPA Response: While EPA agrees that dredging the northern section of the pond would create additional sediment retention capacity, EPA is concerned about upsetting the current balance of conditions that assist in sustaining the chemocline and processes accounting for the removal of contaminants. The current in-place sediments represent an arsenic sink and can account for some limited removal of arsenic discharging into the pond from groundwater. The sediment layer, which hosts iron- and sulfate-reducing bacteria, impact arsenic removal within the HBHA Pond in two ways: 1) by supplementing the concentration of ferrous iron (provided primarily by groundwater discharge) that is transported to the chemocline through reductive dissolution of settling iron oxides; and 2) by contributing to the formation of reduced Fe-bearing minerals such as ferrous iron sulfides that sequester a fraction of the dissolved arsenic that accumulates at the bottom of the water column. Complete removal of these sediments and the associated microbial community that has evolved over the life of the HBHA Pond may result in a decrease in the concentration of dissolved ferrous iron in the water column and possibly an increase the concentration of dissolved arsenic. The efficiency of arsenic removal observed near the chemocline is dependent on the relative concentrations of dissolved ferrous iron and arsenic. A significant change to this balance, i.e., a decrease in the ratio of ferrous iron to arsenic, could negatively impact the effectiveness of the selected remedy.

E. 27. MassDEP "questions the need for a cap along the northern bank of the HBHA (which will need long term maintenance, inspections and possibly institutional controls—see Figure 4-3 of the Proposed Plan). Since the bank do not pose an ecological or human health risk, why not continue to let any soil that dislodges from this area end up in the northern treatment area [primary and secondary treatment cells] and settle out? This sediment will eventually be dredged along with the accumulated groundwater treatment sediment in the northern section of the HBHA anyway. If EPA believes that this sediment won't settle within the northern basin and will instead pose a risk by suspending and washing downstream during storm events, then DEP recommends dredging that northern bank along with the sediment of the HBHA in the initial dredging operation."

EPA Response: EPA identified soils along the northern bank of the HBHA Pond (i.e. Area A6) that contain arsenic concentrations greater than the HBHA Pond sediment cleanup standard (273 ppm). The selected remedy requires a permeable cap be placed along contaminated soils (e.g. the northern banks of the HBHA Pond along the southern boundary of the Boston Edison right-of-way and adjacent to the railroad right of-way west of the HBHA Pond (e.g., Area A6)) to prevent soil erosion (i.e. soils exceeding the sediment cleanup standards), additional loading of contaminated sediments to the primary and secondary treatment cells, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy. EPA's selected remedy addresses the remedial action objectives, and is cost effective. MassDEP suggests excavating/ dredging the soils and off-site disposal along with sediments dredged with HBHA Pond. EPA believes the soil removal/excavation, off-site disposal, and restoration could adequately address the remedial action objectives, but believes the option would be more costly.

E. 28. MassDEP recommended "that EPA alter the plan for capping of the New Boston Street Drainway to reduce the need for maintenance and possible ICs. The benefits of the capping are not sufficiently substantiated. For example, if the groundwater is prevented from entering the NBSD (which is the purpose of the impermeable cap) there is not an evaluation as to the alternative endpoint of that groundwater. DEP requests that the NBSD not be capped, and instead culvert the NBSD to confluence with the Atlantic Ave Drainway, the northern treatment area [primary and secondary treatment cells] of the HBHA, or the aeration section between the coffer dams. This will ensure that the flow from the NBSD will end up in the treatment area of the HBHA. The Remedial Investigation concluded that most of the increased flow into the HBHA during storm events is from Hall's Brook, so presumably the diversion will not upset the chemocline in the northern section of the HBHA."

EPA Response: EPA determined that contaminated groundwater may discharge into drainage channels (e.g. New Boston Street Drainway) and contribute to contaminant migration downstream. Some sediment within the New Boston Street Drainway exceed sediment cleanup standards for the HBHA Pond (e.g., arsenic above 273 mg/kg). The selected remedy requires the design and construction of impermeable caps to line stream channels (e.g. New Boston Street Drainway), and to prevent contaminated groundwater plumes discharge into surface water, downstream migration of contaminants of concern and potential impacts to other components of the selected remedy. EPA's selected remedy addresses the remedial action objectives, and is cost effective.

Based on geologic and hydrogeologic studies conducted during the GSIP and MSGRP investigations, EPA believes that groundwater would flow under the capped portion of the New Boston Street Drainway (NBSD) and discharge into the northern portion of the HBHA Pond and would not reduce the need for institutional controls for groundwater use restrictions. Culverting the NBSD so that the flows discharge directly into Atlantic Avenue Drainway or the Northern

Portion of the HBHA (primary and secondary treatment cells referenced in MassDEP's comment as "northern treatment area" and "aeration section", respectively) as suggested would present significant construction issues and costs resulting from crossing the active commuter rail line, crossing through areas of known soil contamination creating soil management and disposal issues, creating additional costs resulting from the management of potentially significant quantities of contaminated groundwater generated during dewatering activities, and result in significantly greater costs in construction materials. In addition, a portion of the NBSD would still require filling or capping to prevent contaminated groundwater discharges thus possibly requiring long-term maintenance issues that would still trigger the need for ICs. Also, if the NBSD is filled-in to prevent groundwater from discharging into the existing stream channel and flowing to Halls Brook, then additional mitigation would be required further adding to the costs.

Under EPA's selected remedy, increased flows associated with storm events contributed by the Halls Brook (including flows from the NBSD) would bypass the Northern Portion of the HBHA Pond (primary and secondary treatment cells). The MassDEP suggests that their proposed diversion will not upset the chemocline if the NBSD is allowed to directly discharge into the "treatment area of the HBHA" Pond. However, the increased flows and velocities contributed by the NBSD under storm conditions is unknown and may cause scouring, mixing, or destabilization of the chemocline.

E. 29. MassDEP commented that: "[t]he Feasibility Study does not evaluate a remedy for the soil that would involve partial excavation of the soil in the Mishawum lakebed area; rather EPA chose only to excavate everything, or put ICs on all properties. DEP urges EPA to evaluate the potential benefit of excavating a portion of the contaminated surface soil. DEP thought the following two alternatives would increase protectiveness immediately, and eliminate the need for ICs on several properties:

1. excavate and remove surface soil on only vacant properties,
2. excavate and remove surface soil in the area indicated in the plan, excluding the sub-surface contaminated area. Subsequently, place ICs only on the subsurface contaminated soil area."

EPA Response: EPA's selected remedy requires institutional controls in subsurface soil (SUB) area and surface soil (SS) area. The smaller SS area is situated within the boundaries of the SUB area. Removing portions of the SS area will not eliminate the need for institution controls within that area (SUB area will still require institutional controls). In addition, EPA's selected remedy addresses the remedial action objectives and is cost effective. MassDEP's suggestion to excavate portions of the soils from the SS area will significantly increase costs while not eliminating institutional controls.

E. 30. MassDEP noted "that an aerator will be a component of the groundwater/surface water remedy south of the upper cofferdam. Apparently the aerator is needed to increase oxygen levels and increase the precipitation of arsenic. This is potentially a part of the remedy requiring frequent maintenance. Therefore, the DEP recommends a method of aeration requiring the lowest-maintenance possible, and enough flexibility in design to allow for the use of a non-polluting energy source for the aerator (e.g., solar panels)."

EPA Response: The specific design of the aeration or oxygenation part of the remedial alternative will be developed as part of the pre-design investigation and the final remedial design. Maintenance and energy efficiencies will be important factors when evaluating aeration treatment technologies and system configurations. MassDEP will have an opportunity to comment on the design during this period.

> E. 31. The consultant for DEK commented that: "[a] reactive barrier installed as part of proposed remedy GW-4 along the NSTAR Easement to the north of the DEK property should be re-considered to protect the DEK property, the HBHA and the downstream sediments in the Aberjona River in the long term, while still retaining remedy GW-2 combined with sediment remedy HBHA-4 to eliminate downstream migration of arsenic bearing sediment in the short term.
> . . . if groundwater impact to the HBHA could be eliminated through upgradient treatment or control of the plume through installation of a reactive barrier as part of remedial alternative GW-4, then the long term impacts of operation and maintenance of HBHA-4 could also be eliminated."

EPA Response: The capped and buried organic waste (animal hide residues) contribute to groundwater plumes. This buried organic waste will remain in place serving as a long-term source of the contaminated groundwater plumes. Hence, the contaminated groundwater plumes are expected to exist for the foreseeable future. EPA evaluated several remedial alternatives to address the risks associated with groundwater including remedies to intercept the groundwater at the current Industri-plex site boundary. Those risks were the result of potential future use of the groundwater as process water or in a car wash scenario. Other technologies and remedial alternatives were extensively evaluated in the FS including the reactive barrier as suggested in the comment. EPA believes that the selected alternative is the best alternative that balances all required evaluation criteria while still addressing the risks.

> E. 32. The MBTA asked why a 16-inch cap is being proposed for elevated metal levels along the Northern Portion of the HBHA Pond, and for the rationale for using a relatively thin soil cap.

EPA Response: The Industri-plex (OU-1) ROD originally required a cap consisting of 30 inches of cover soils. This design requirement was later re-evaluated and revised to include the use of engineered geotextile materials to lessen the cap thickness while maintaining the cap's effectiveness. A similar engineered cap is proposed for the referenced soils.

> E. 33. The MBTA asked for the rationale for only placing 4 inches of topsoil on the cap proposed as part of Alternative HBHA-4 and comments that this is a relatively thin topsoil layer which will require significant monitoring and maintenance to prevent erosion damage.

EPA Response: The required topsoil layer has been sufficient to establish and maintain vegetation in order to prevent erosion throughout the site. See above response to comment.

E. 34. The MBTA asked EPA to describe the cap monitoring and maintenance programs.

EPA Response: The proposed design for the cap is consistent with the cap designs previously designed and installed under Industri-plex OU-1, including those previously installed by the MBTA at the Industri-plex site. The specific details of these designs are included in the <u>100% Design Report, Industri-plex Site, Woburn, Massachusetts, Remedial Work for Soil, Sediments and Air</u>, dated April 25, 1992, and prepared by Golder Associates, Inc. Regarding caps for Industri-plex OU-2, specific design details and monitoring and maintenance requirements will be specified in the remedial design.

E. 35. The MBTA commented that a "component of Alternative HBHA-4 requires the lining of a portion of the streambed located west of the MBTA railroad tracks with a 40-mil High Density Polyethylene (HDPE) Liner overlain with a 16-inch thick layer of gravel/cobble . . . Please provide the flooding criteria that were considered to assess stream levels during storm events."

EPA Response: The conceptual design for the liner of the stream channel assumes that the stream bed will be excavated in order to install the liner and preserve the current volume capacity of the existing stream channel. A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

E. 36. The MBTA asked whether the EPA considered the potential for structural damage to the railroad tracks, along with the potential for contaminated stormwater to discharge to the right of way (ROW).

EPA Response: The purpose of the liner is to eliminate potential contaminated groundwater from discharging to the stream, which is likely presently occurring, and ultimately discharge to the HBHA. The remedy will not cause contaminated water to discharge to the ROW.

Although not specified in the comment, EPA assumes that "the potential for structural damage to the railroad tracks" referred to in the comment would be the result of construction activities during liner installation. Construction methods and procedure will be specified in the remedial design to prevent structural damage as was the case when approximately 350 linear feet of the NBSD along the ROW was previously capped with a permeable liner during the execution of Industri-plex OU-1 remedy. AMTRAK and MBTA will have an opportunity to review and comment on these designs.

E. 37. The MBTA asked EPA to show the location of the streambed and proposed limit of work in relation to the MBTA ROW, and to explain why only a portion of the streambed is being lined.

EPA Response: Please refer to Figure 4-3 of the FS and the Proposed Plan, and Figure J-7 of this ROD for the estimated location of the proposed stream channels requiring the impermeable cap liner.

As stated above, the purpose of the impermeable cap is to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy.

> E. 38. The MBTA commented that: "[i]f Alternative HBHA-4 is implemented, a geotextile cushion should be provided between the HDPE liner and the gravel cobble, to help prevent damage and punctures to the liner, which could be caused by the gravel/cobble layer."

EPA Response: Details will be resolved during the predesign and design stage of the selected remedy. MBTA will have an opportunity to review and comment on these designs at that time.

> E. 39. The MBTA asked EPA to "explain how contaminated sediments that will enter the southern portion of the HBHA Pond via the stormwater by-pass structure during storm events will be managed. The Feasibility Study indicates that sediment will be periodically dredged from the sediment retention area, but it is not clear if periodic dredging is also proposed in the southern portions of the HBHA Pond."

EPA Response: The selected remedy for HBHA Pond requires the design and construction of an impermeable cap to line stream channels (e.g. New Boston Street Drainway), and to prevent the discharge of contaminated groundwater plumes, contamination of stream sediments, downstream migration of contaminants of concern, and potential impacts to other components of the selected remedy. Therefore, once the upgradient portions of the selected remedy are constructed and the southern portion of the HBHA Pond is dredged and restored, EPA does not believe the southern portion of the pond will become re-contaminated and require additional dredging. EPA will evaluate the conclusion during the five-year reviews.

> E. 40. The MBTA asked EPA to "explain how the chemo-cline will be maintained in the southern portion of the HBHA Pond during and following storm events. As indicated on page E-6 of the Feasibility Study, the chemo-cline is destabilized during storm events and the amount of metals entering the water column and being transported further downstream is much greater."

EPA Response: Under the selected remedy for the HBHA Pond, a chemocline is not expected to be present within the restored southern portion of the HBHA Pond. The selected remedy intercepts the contaminated groundwater plumes at the primary treatment cell within the northern portion of the HBHA Pond, and prevents the plumes from discharging into the secondary treatment cell and southern portion of the HBHA Pond. Low-head cofferdams will be constructed to help form the primary and secondary treatment cells. After construction of the low-head cofferdams, construction of the primary and secondary treatment cells, and sediment removal and restoration of the southern portion of the HBHA Pond, a chemocline should no longer be present in the restored southern portion.

However, as part of the selected remedy, the chemocline within the primary treatment cell of the northern portion of the HBHA Pond must be maintained. An important aspect of maintaining the chemocline within the primary treatment cell is the construction of a storm water by-pass system at Halls Brook. The by-pass system will divert significant Halls Brook storm surface water flows from the primary treatment cell to the southern portion of the HBHA Pond, which could disturb the chemocline within the primary treatment cell, while maintaining Halls Brook base flow surface water conditions into the primary treatment cell during storm events. EPA's selected remedy will achieve surface water cleanup standards at the outlet of the northern portion of the HBHA Pond (secondary treatment cell outlet).

> E. 41. The MBTA asked EPA to "provide the flooding criteria that are being considered for the implementation of Alternative HBHA-4."

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 42. The MBTA asked EPA whether precautions would be taken to help ensure that contaminated stormwater does not discharge to the MBTA ROW.

EPA Response: Under the selected remedy, arsenic contaminated groundwater would be prevented from discharging into the NBSD.

> E. 43. The MBTA asked EPA whether precautions would be taken to help ensure that stormwater flooding will not cause structural damage to the railroad tracks.

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 44. The MBTA asked EPA to provide details regarding the proposed dredging work, which will demonstrate that this activity will not cause structural damage to the MBTA railroad tracks and/or ROW.

EPA Response: A pre-design investigation is intended to evaluate flood storage issues and serve as part of the design basis for the final remedial design. The specific design details will be specified in the remedial design.

> E. 45. The MBTA asked EPA to provide a complete set of design documents for each of the preferred alternatives when completed to review them and provide comments.

EPA Response: The remedial design documents will be available to all interested parties, once completed.

> E. 46. The City of Woburn, Mayor's Office, commented that: it "does not question the ultimate goal of the remedy the Environmental Protection Agency has proposed. The concept and premise of the design seem sound. However, one area of concern is the amount of dredging proposed within the Halls Brook Holding Area. There appear to be

two schools of thought. One being that the best remedy involves the complete removal of all contaminated sediments and the other being that the very act of removal may cause a greater risk for release of sediments downstream."

EPA Response: The selected remedy will address remedial action objectives and cleanup standards. We agree that it is critical to ensure that dredging does not itself cause further adverse impact. The remedial design will specify construction methods, materials, and performance goals to ensure that implementation of the plan will not cause downstream migration of contamination.

E. 47. The Woburn City Council commented that: "EPA has not fully explained whether or not there are current/ongoing releases of COC'S into the Aberjona Watershed, particularly from points north, and if so, does the plan attempt to arrest the migration of such contaminants? Our understanding of the plan is that it principally reduces exposure to COC's and does not necessarily stop migration of COC's at the source or sources."

EPA Response: The March 2005 MSGRP RI, the June 2005 MSGRP FS and Proposed Plan, and the selected remedy clearly state that there are current ongoing releases of contaminants into the environment that are originating from the Industri-plex site. These contaminants are impacting groundwater that in turn discharge into the HBHA, which discharges into the Aberjona River. The RI/FS also identified unacceptable human health and ecological risks associated with these contaminants of concern (COCs). To reduce those risks, remedial action objectives (RAOs) were established as the cleanup goals for any future remedial action and also to serve as the guideline for developing remedial alternatives that would accomplish these goals. Following a comprehensive evaluation process, the selected remedy represents the best set of remedial alternatives to achieve the RAOs for all affected media while balancing all of the required evaluation criteria.

The principal source of groundwater contamination is contaminated soils at the Industri-plex site that could be as much as several million cubic yards in volume. It is not cost-feasible to remove these wastes as was determined during the OU-1 FS. EPA's selected remedy will intercept contaminated groundwater plumes and reduce their migration downstream. A remedial strategy to manage the migration of these contaminants and associated risks is more appropriate.

E. 48. The Woburn City Council asked EPA whether any of the Preferred Alternatives, such as pond or plume intercept methods, inadvertently increase health risks by altering the migration of COC's onto currently "clean" properties within the City, and whether any of the Preferred Alternatives could actually interfere with the natural attenuation process that is currently occurring within the sediments of the pond and increase the downstream migration of contaminants.

EPA Response: EPA's selected remedy addresses the remedial action objectives and cleanup standards, as well as complies with all state and federal regulations. EPA's selected remedy will not cause the migration of COCs onto "clean" properties as suggested in the comment, but is expected to reduce the migration of contaminants of concern downstream and reduce health and environmental risks. Also, EPA's selected remedy utilizes and improves upon the treatment properties of the HBHA Pond.

> E. 49. The Woburn City Council asked EPA for the specific proposed dredging methods and guidelines, and for assurances that the most careful methods of removing chemicals had been selected.

EPA Response: EPA's selected remedy addresses the remedial action objectives and cleanup standards, as well as complies with all state and federal regulations, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b). EPA's selected remedy includes sediment removal/dredging which will comply with all relevant and appropriate state and federal regulations. EPA's selected remedy envisioned hydraulic dredging for the deep sediments in the HBHA Pond and mechanical dredging for other sediments. The details of the sediment removal design will occur during remedial design. The Woburn City Council will have an opportunity to review and comment on specific design elements during the remedial design phase.

> E. 50. The Woburn City Council asked EPA whether there has been or will there be any on-site study of the effectiveness of the proposed bioremediation for groundwater before full-scale treatment begins.

EPA Response: EPA believes that the selected bioremediation technology that was selected to address groundwater contamination at the West Hide Pile, if necessary, will be effective. As stated in the FS, a pre-design investigation will be conducted to develop the specific design details of the treatment application process as suggested.

> E. 51. The consultant for the Woburn City Council commented that: "there may not be adequate protection for downstream receptors during the removal of the contaminated sediments from the HBHA pond. This concern primarily relates to the use of a hydraulic excavator, rather than a hydraulic dredge, to remove those sediments. Two possible site preparation methods (and the nebulous "other") are listed to help mitigate for sediment transport."

EPA Response: EPA's selected remedy includes sediment removal/dredging which will comply with all relevant and appropriate state and federal regulations. EPA's selected remedy anticipated hydraulic dredging for the deep sediments in the HBHA Pond and mechanical dredging or excavation for other near-shore sediments. The details of the sediment removal methods and protections will occur during remedial design. EPA's remedy will comply with all regulations and substantive permit requirements.

> E. 52. The consultant for the Woburn City Council asked whether Alternative HBHA-4 will be effective in mitigating the mobilization of contaminants during storm and high water events.

EPA Response: A pre-design investigation will be conducted to evaluate storm water management concerns and provide a design basis for the final location and design components of the selected remedy. This design will be available to the City for review. At the northern portion of the HBHA Pond, the selected remedy will intercept contaminated groundwater plumes at the primary treatment cell, sequester/treat groundwater contamination at the primary and secondary treatment cells so that surface water effluent from the secondary treatment cell outlet achieves surface water cleanup standards. EPA believes that the selected remedy for the HBHA Pond will be effective at controlling the migration of contaminants above surface water cleanup standards downstream of the secondary treatment cell during base and storm flow events.

> E. 53. A resident of Wilmington commented that: "GW-1 (drinking water source areas) must be given the highest priority for cleanup. Better intervention is needed and should be updated for GW-1 to include only the newest and best technology available to identify and address the "actual break-down products and risks (contaminants imposed (forced on our environment) by the PRPs at possibly GW-2 or GW-3 locations if not at the source, or holding areas. Applying newer technologies along with "treatment trains" will further enhance removal."

EPA Response: The aquifer near the Industri-plex site within the Northern Study Area is not considered GW-1 by MassDEP. MassDEP's Use and Value Determination identified this area of the aquifer by Industri-plex to be of "low use and value."

> E. 54. A resident of Wilmington commented that: "[t]he most up-to-date technology should be made available and used to be most protective of public health and the environment where there is a complete exposure pathway."

EPA Response: EPA believes that the selected remedy utilizes appropriate technologies and addresses the remedial action objectives and cleanup standards. During the remedial design of the selected remedy, all appropriate technologies and methods to design the selected remedy will be evaluated for use at the Site.

> E. 55. SMC, Pharmacia and the consultant for SMC and Pharmacia commented that EPA's Proposed Remedy for the HBHA Pond will disrupt the natural ability of the pond to sequester arsenic.

EPA Response: The selected remedy for the HBHA Pond and its periodic dredging will not negatively impair the chemocline or increase downstream contaminant migration. See previous responses.

> E. 56. SMC commented that EPA's sediment remedy is needlessly invasive, and would create greater human health risk than capping and institutional controls.

EPA Response: The selected remedy for near shore sediments is more effective at reducing risk when compared with other alternatives is implementable, and its short-term effectiveness can be ensured through proper controls. EPA evaluated capping as an alternative in the FS, but it was eliminated from further consideration since in-situ caps may enhance accessibility to interior portions of the wetlands, which were previously considered inaccessible and typically have higher concentrations of contamination. In addition, capping would also require long-term inspections, maintenance, and institutional controls to ensure that the cap remained intact and protective and that the biological barriers mentioned in the comment remained effective in preventing access. Institutional controls would also be required where land use restrictions would be imposed and would require periodic inspection and enforcement to remain effective. All of these factors would also increase the cost of the capping alternative. Please also refer to EPA's responses to SMC's consultant's comments.

E. 57. SMC commented that benzene beneath the West Hide Pile is attenuating naturally, and may be addressed adequately with existing institutional controls.

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater during the 1980s and 1990s. Also, elevated levels of benzene were detected in soils at the West Hide Pile (MSGRP RI). EPA conducted a baseline risk assessment based upon existing conditions that identified human health risks associated with potential future groundwater exposures to commercial/ industrial workers and excavation workers.

EPA's RI identifies that plumes associated with the West Hide Pile (e.g., benzene, arsenic, ammonia) likely discharge to nearby wetlands (e.g., southern pond). Insufficient groundwater data and no surface water data were available to assess the extent of the West Hide Piles groundwater plume's impact to surface water and sediments. Further pre-design investigation will be necessary for the area to evaluate West Hide Pile and East Hide Pile groundwater impacts on the near surface water and sediments and impacts to the downgradient plumes.

EPA's selected remedy is necessary to remove the high concentrations of benzene from the West Hide Pile. Institutional controls required under the 1986 Record of Decision have not been recorded on any property to date. If institutional controls are implemented that eliminate exposures, and predesign investigation do not identify these plumes contributing to human health risks and hazards or an ecological risk (exceeding the cleanup levels established for this remedy), then EPA agrees that implementation of Alternative GW-4 for the West Hide Pile may not be necessary.

E. 58. SMC commented that the proposed remedy is overly costly.

EPA Response: EPA's selected remedy is estimated at $25.7 million, and does not represent the most expensive options that were evaluated under the Feasibility Study. The most expensive remedial alternatives could have exceeded a total cost of over $210 million as illustrated on Table 4-29 of the Proposed Plan, and Table K-8 of this ROD.

E. 59. SMC and Pharmacia's consultant commented that: "USEPA has used the site-specific PRGs calculated in the FS as screening levels to identify locations that have a PRG exceedance, and thus areas that require additional action. Use of PRGs in this manner exaggerates the areas that may need to be addressed in the FS. The PRGs are EPC surrogates, just as the EPCs take into account the distribution of the data and ideally represent the 95% upper bound on the arithmetic mean concentration, so too should the PRGs."

EPA Response: The areas requiring remediation presented in the Feasibility Study were based on samples spaced approximately 50 to 75 feet apart and an estimation of areas exceeding the sediment PRG. Application of the sediment PRG in this manner was appropriate in developing a cost estimate to support the Feasibility Study within an expected accuracy of -30 percent to +50 percent based on the available data. However, as stated in the Feasibility Study, a pre-design investigation will be conducted to more closely delineate the extent of sediment contamination exceeding the sediment cleanup standards which requires remediation. The results of this investigation will serve as the basis of the Remedial Design.

> E. 60. SMC and Pharmacia's consultant commented that: "Wetland functions are being protected in the HBHA Pond under current conditions and would be also under USEPA's Proposed Plan. Therefore, wetland replication is not needed as part of any proposed remediation."

EPA Response: The sediments throughout the HBHA Pond were extremely toxic and are associated with contaminated groundwater discharges originating from the Industri-plex site. EPA's ecological risk assessment identified these sediments as presenting an unacceptable ecological risk to benthic organisms. Due to the sediment toxicity and surface water quality exceedances of the NRWQC, EPA does not concur that the wetland functions and values are being protected in the HBHA Pond under current conditions.

Due to sediment contaminant concentrations in both deep and shallow water and the periodic exceedances of the NRWQCs for arsenic and ammonia in surface water, the ability of the HBHA Pond to perform functions of providing wildlife habitat, fisheries habitat and pollution prevention are impaired. The selected remedy includes dredging contaminated sediments from the southern portion of HBHA Pond and restoring the impacted area. A compensatory wetland will be constructed to make up for any lost wetland functions and values in the northern portion of the pond and capped drainways. The lost functions and values of the southern portion will be restored in place. The degraded functions and values of the northern portion and capped drainways will be mitigated through the construction of compensatory wetlands nearby in the watershed. This mitigation will be consistent with ARARs.

The selected remedy incorporates the northern portion of the HBHA Pond into the treatment process, which periodically requires sediments to be removed. Considering these contaminated sediments and future accumulated contaminated sediments will be retained, impact benthic community, and periodically be removed from the northern portion, EPA's selected remedy identified the northern portion as a habitat loss requiring compensation through the construction of alternative habitat within the watershed. EPA's selected remedy for the southern portion of the HBHA Pond requires contaminated sediment removal and restoration. Hence, habitat compensation is not necessary for the southern portion.

> E. 61. SMC and Pharmacia's consultant commented that after a storm event, the chemocline is not broken down in the northern end of the pond, and that EPA's conclusions regarding the impact of storm events on the chemocline are based upon incomplete data.

EPA Response: EPA disagrees with the comment and the above analysis. EPA evaluated all the data associated with the HBHA Pond, not a limited data set as described by the commenter. EPA considered the nature and extent, fate and transport, and risks associated with all the data. Contrary to the comment, conductivity profiles collected throughout the water column by EPA indicate that during and following a storm event, the chemocline does destabilize. The HBHA Pond under baseflow conditions consistently illustrated that the depth of the chemocline throughout the pond ranged between approximately 150 centimeters (cm) to 250 cm below the surface of the pond. After a significant storm event, the chemocline was no longer observed at the central and southern stations. In addition, hourly surface water monitoring data collected from the most downstream surface water monitoring stations during the storm events revealed higher arsenic concentrations during first flush effects from upstream sources. This information correlates with storm water releases from the HBHA Pond.

E. 62. SMC and Pharmacia's consultant commented that: "construction of a stormwater bypass and the Sediment Retention Cell, as proposed in USEPA's Proposed Plan, is not necessary to maintain the chemocline and associated arsenic removal processes."

EPA Response: The secondary treatment cell (referred by the commenter as a polishing cell) will further reduce contaminant concentrations (e.g., precipitate metals, degrade organics, volatilization) during baseflow and storm flow conditions, as well as address any potential episodic releases from the primary treatment cell. The secondary treatment cell will also further reduce ammonia concentrations associated with the contaminated groundwater plume discharge. The objective of the northern portion of the HBHA Pond, serving as a treatment component of the remedy (primary and secondary treatment cells), is to intercept contaminated groundwater plumes that discharge into the HBHA Pond at the primary treatment cell, sequester/treat contaminated groundwater plumes at the primary and secondary treatment cells, periodically remove the accumulated contaminated sediments from the primary and secondary treatment cells, and ensure that effluent from the secondary treatment cell outlet do not exceed surface water cleanup standards. .

E. 63. SMC and Pharmacia's consultant commented that: "[s]ediments in the HBHA provide a second important arsenic removal process in the HBHA Pond. This process should be maintained and not disturbed by dredging."

EPA Response: The in-place sediments represent a partial arsenic sink for contaminated groundwater. However, EPA disagrees with the comment and reiterates that these sediments only remove a fraction of the arsenic as evidenced by the surface water data collected during the Natural Attenuation Study and the MSGRP investigations. Arsenic is continuing to migrate through the water column.

EPA's selected remedy for Northern Portion of the HBHA Pond (primary and secondary treatment cells) requires sediments that accumulate in the northern portion of the HBHA Pond to be removed periodically and disposed off-site. The selected remedy for the HBHA Pond takes into account that a portion of the sediments in the HBHA Pond help maintain the supply of ferrous iron that contributes to the capture of arsenic near the chemocline and promote microbial degradation, which suggests that when dredging becomes necessary in the primary treatment cell, only partial dredging should be implemented sufficient to lower the elevation of the chemocline and/or provide further sediment retention capacity. Also, dredging should only be implemented when necessary to ensure that the remedy is functioning appropriately, achieving the remedial action objectives and cleanup standards, and the chemocline remains below a depth of 100 cm in the water column ensuring no elevated releases of contaminants of concerns downstream.

EPA's selected remedy established the following conditions that may trigger dredging in the Northern Portion of the HBHA Pond (primary and/or secondary treatment cells): 1) if the chemocline rises to within 100 cm of the top of the primary treatment cell's low-head cofferdam (northern/first low-head cofferdam) outlet, or 2) concentrations of surface water effluent/outlet from the second treatment cell's low-head cofferdam (southern/second low-head cofferdam) exceed the surface water cleanup standards. However, EPA expects that other cost effective interim measures will be evaluated and possibly implemented prior to implementing dredging activities at the HBHA Pond. These interim steps (for example, actions other than dredging) may temporarily postpone the need for dredging operations, until the interim steps are no longer effective and excessive sediment accumulation within primary and/or secondary treatment cells requires dredging. Frequent long-term monitoring will be necessary to monitor the system.

The selected remedy for the Southern Portion of the HBHA Pond, which is not impacted by contaminated groundwater plume discharges, requires contaminated sediments be removed and the southern portion restored. In addition, EPA's selected remedy minimizes impacts to the HBHA Pond and maximizes the pond's restoration. EPA's selected remedy also requires the construction of compensatory wetlands to mitigate any wetland function and value losses.

The commenter appears to not understand the concept of the storm water bypass system. All of the storm water from Halls Brook will not be diverted from the northern portion of the HBHA Pond (primary and secondary treatment cells). Halls Brook is the predominant source providing steady inputs of low conductivity, oxygenated water, while contaminated groundwater plumes provide steady inputs of iron and sulfates. Hence, surface water baseflow conditions from Halls Brook will continue to flow into the primary treatment cell during storm events to sustain the chemocline. A portion of the storm water flows from Halls Brook which could potentially disrupt the chemocline will be diverted/by-passed to the southern portion of the HBHA Pond.

The purpose of the drainway liner is to prevent contaminated groundwater plumes from discharging to the drainway and contaminating sediments, which could migrate downstream and impact the selected remedy for HBHA Pond and contribute to further downstream migration during storm events. Surface water flow from the drainway will continue to flow into Halls Brook and the northern portion of the HBHA Pond. The drainway liner will not impact the functions of the selected remedy. Also, the primary source of iron to the HBHA Pond is from the discharge of contaminated groundwater plumes (not Halls Brook as the comment suggests).

E. 64. SMC and Pharmacia's consultant commented that pond partitioning will adversely affect arsenic removal. In particular, the comment suggests that the selected remedy may significantly affect the settling capacity within the HBHA Pond.

EPA Response: The principal component associated with sequestering arsenic in the existing HBHA Pond are the chemocline, which is caused by groundwater plumes discharge to the pond and baseflow surface water discharge to the pond, the shape of the HBHA Pond, and its very shallow outlet elevation. EPA's selected remedy enhances these properties, and achieves the remedial action objectives. The selected remedy is expected to treat/sequester the contaminated groundwater plumes discharging into the HBHA Pond (including but not limited to arsenic, benzene and ammonia contamination), and reduce contamination migration downstream.

Groundwater discharge to the HBHA Pond, surface water discharge to the HBHA Pond, soil erosion, and contaminant fate and transport processes contribute to the distribution of the sediments in the HBHA Pond. EPA's selected remedy utilizes the northern portion of the HBHA Pond to intercept (via primary treatment cell) and sequester/treat groundwater plumes discharge to the pond (via primary and secondary treatment cells), and periodic removal of sediment (all sediment grains sizes, including fine grain) from the primary and secondary treatment cells . The comment points out the reduced settling area resulting from the installation of the low-head cofferdams but fails to acknowledge the reduced volume of water passing through the retention area during a storm event. Monitoring will be an important part of the design and remedy to ensure that the surface water cleanup standards are not exceeded. As noted in the FS and Proposed Plan and in previous responses, this portion of the selected remedy will also require further pre-design investigations.

The purpose of the primary treatment cell (northern/first low-head cofferdam), is to intercept contaminated groundwater plumes. The purpose of the primary and secondary treatment cells are to treat/sequester contaminants, retain sediments for periodical removal, and achieve surface water cleanup criteria (e.g., NRWQC) at the outlet of the secondary treatment cell. These contaminated groundwater discharges are occurring in the northern portion of the HBHA Pond. Investigations conducted as part of the MSGRP RI and acknowledged by the comment demonstrate that a portion of the contaminated sediments are transported to downstream areas due to "interim natural forces" (i.e., storm events). Halls Brook represents the largest contribution of storm flow to the HBHA Pond. Diverting the high flows associated with storm flows from Halls Brook away from areas where contaminated sediments are concentrated will reduce the downstream migration of these contaminants. The final design of the low-head cofferdams system will be developed following a pre-design investigation.

E. 65. SMC and Pharmacia's consultant commented that: "the arsenic mitigation strategy incorporated in the USEPA's Proposed Plan will likely be subject to periodic up-set and flushing via stormwater inflows from the Atlantic Avenue Drainway and the NSTAR ROW No. 9 drainage culvert. Similarly, re-suspended hydroxide floc transported to the Southern Basin will be flushed downstream by flows from the Halls Brook bypass. The intensity of these flushing flows will increase as development within the Pond's contributing drainage basin increases. Consequently, USEPA's Proposed Plan will remain susceptible to periodic flushing events and hence will continue to export sediment from the HBHA system . . . The new North Basin (Sediment Retention Cell) will be subjected to direct inflows from the Atlantic Avenue Drainway and the ephemeral stream draining NSTAR ROW No. 9. Collectively, these two inflow points drain approximately 45 percent of the area discharging to the Pond (MSGRP RI, 2005). During major storm events, runoff entering the basin from these sources will be significant and unmitigated. As evidenced by runoff hydrographs generated from the 5.31-inch precipitation event that occurred on March 22-24, 2001, peak inflows from the Atlantic Avenue Drainway approached 90 cubic feet per second (cfs), while the NSTAR ROW No. 9 culvert peaked at over 20 cfs (Roux Associates, 2002). The 5.31-inch event, while significant, corresponded to a design storm with a recurrent frequency of only 10 years (NCRS, 1986). Peak inflows from a 100-year event would be substantially greater. Ultimately, the flushing effects associated with large design storms would significantly and adversely affect the performance of the USEPA's Proposed Plan."

EPA Response: EPA disagrees with the comment. The flows from the identified tributaries during storm conditions were relatively minor compared with the storm flows from Halls Brook. Flows similar to these smaller storm flows have been experienced from the Halls Brook under baseflow conditions and no disruptions of the chemocline were observed. The data do not support the comment. EPA does not consider these tributary storm flows significant and does not believe they will disrupt the chemocline. As noted in the FS, Proposed Plan and this ROD, this portion of the selected remedy will also require further predesign investigations.

The comment is speculative in suggesting that: "The intensity of these flushing flows will increase as development within the Pond's contributing drainage basin increases." This suggests that future area development will go unchecked with regards to storm water management. Recent large-scale development in the immediate area of the Industri-plex site contradicts the comment's claim. In the case of the Anderson Regional Transportation Center, Target, and National Development's development of the northern Commerce Way extension and Presidential Way, significant storm water management structures have been incorporated into the construction design.

The comment is also speculative as far as predicting the failure of EPA's selected remedy, especially since the system has not yet been designed. As presented in the comment, the contributing flows of the Atlantic Avenue Drainway during the March 2001 storm event discussed in the comment are misleading in that the duration of the peak flow (90 cfs) was not presented nor was it discussed how the data was collected. This specific measurement was not presented in the Downgradient Transport Draft Report prepared by Roux Associates, dated April 1, 2002. The flow measurement presented in the report for this station on March 22, 2001 only showed a flow of 37.86 cfs. Again, this was a snapshot of the flow and the duration was not presented. However, it does illustrate the variability of flows during a storm event. As stated in a response to previous comments, the final design of the low-head cofferdams system will be developed following a pre-design investigation which will identify major design components of the cofferdams and storm water bypass system that are important to maximize its sediment retention capabilities.

E. 66. SMC and Pharmacia's consultant commented that: "[a]rsenic-containing iron hydroxide floc will form when reduced water in the bottom of the Sediment Retention Cell encounters the oxic/anoxic transition zone. Hydrous ferric oxides will form at the oxic/anoxic transition zone as reduced ferrous (Fe^{+2}) iron encounters oxygenated water, oxidizes to ferric Fe^{+3}) iron and precipitates as hydrous ferric oxide (HFO) floc (Skousen and Ziemkiewicz, 1995). Arsenic sorbs to the HFO floc, which would accumulate in the bottom of the Sediment Retention Cell.

Flushing flows into the Sediment Retention Cell from the Atlantic Avenue Drainway (90 cfs) and the ephemeral stream draining NSTAR ROW No. 9 (20 cfs) during major storm events would likely disrupt the chemocline and flush arsenic-bearing HFO floc to downgradient locations. The shortened length to width ratios created by the partitioning Coffer dams and the bypass of Halls Brook would significantly reduce TSS settling efficiency in the Southern Basin thereby increasing the export of the low density floc materials to downstream locations. The length to width ratios will shorten the amount of time and distance fine grained sediments will have to effectively settle out of the water columns. Similarly, the loss of the Northern pond area to Halls Brook inflows during stormwater runoff periods will eliminate the hydraulic buffering capacity, shorten available sediment settling time and convey higher sediment loads directly to the pond outlet from a re-directed Halls Brook (i.e., the by –pass option).

Perhaps more importantly, storms of lesser intensity occurring immediately after spring and fall turnover would export the re-entrained floc to the South Basin and similarly transport the arsenic bearing TSS downstream via the mechanisms discussed above. Turnover occurs in lakes and ponds deep enough to thermally stratify. In essence, as water cools in the fall, density differentials in the water column cause the cooler surface water to sink displacing warmer bottom water. This "turnover effect" results in a completely mixed water column that reintroduces low-density sediments present in the bottom of the Pond uniformly throughout the water column. The water will thermally re-stratify during the colder winter periods. During late winter ice-out conditions, the surface water warms to maximum density (i.e. 4oC), subsequently sinks to the bottom resulting in a spring turnover event. Similar complete water column mixing occurs until thermal stratification is re-established and water column stability returns (Wetzel, 1975, Tchobanogious and Schroeder, 1987). Even in the event that some of this material is re-deposited in the South Basin, it would be subject to re-entrainment and flushing during storm events via the high velocity inflows from the Halls Brook bypass option."

EPA Response: The comment suggests that the chemocline in the primary treatment cell and the sediment retention areas within the primary and secondary treatment cells of the northern portion of the HBHA Pond will be ineffective during spring and fall turnover periods even though no site-specific data are presented to support this claim. EPA has evaluated a significant amount of surface water data collected during various seasons from the HBHA Pond. EPA has not observed any turn-over conditions that would impact the performance of the chemocline such that the remedial action objectives as stated in the FS, Proposed Plan and this ROD would not be achieved. Increases in arsenic concentrations migrating from the HBHA Pond have consistently been shown to correlate with storm events.

Also, see above comment regarding tributary storm water flows. As noted in the FS, Proposed Plan, and this ROD, this portion of the selected remedy will also require further pre-design investigations. The actual size and location of the low-head cofferdams, which determines the size and location of the selected remedy for the northern portion of the HBHA Pond (primary and secondary treatment cells), will be determined during pre-design and design.

> E. 67. SMC and Pharmacia's consultant commented that a: "significant flaw in USEPA's Proposed Plan is the loss of future iron-rich sediment delivery to the proposed North Basin (Sediment Retention Cell). The elimination of the continuous supply of iron-rich organic materials from Halls Brook inflows during storm events could adversely impact the arsenic sequestration and attenuation processes in the Sediment Retention Cell . . .
>
> Another negative effect of the proposed Halls Brook stormwater bypass would be the elimination of a continuously oxygenated water supply to the proposed Sediment Retention Basin. As the sole perennial stream entering the Pond, Halls Brook is the major source of dissolved oxygen delivery to the water body. Given the importance of maintaining aerobic conditions in the Sediment Retention Cell for arsenic removal, the proposed bypass of stormwater inflows to the southern basin of the Pond could significantly effect the long-term maintenance of aerobic conditions within the proposed basin. Ultimately, this could result in the periodic development of anaerobic conditions within the basin and significantly effect arsenic removal performance."
>
> Pharmacia commented that partitioning the HBHA will reduce the pond's arsenic reduction potential.

EPA Response: EPA disagrees with these comments. The commenters misunderstand the conceptual design of the storm water bypass discussed in the Proposed Plan. EPA's selected remedy only diverts a portion of storm water flows from Halls Brook away from the northern portion of the HBHA Pond. It does not divert Halls Brook base flow component of surface water, which is an essential part of creating and maintaining the chemocline within the primary treatment cell. Only a portion of the storm water flows from Halls Brook, which could potential disrupt the chemoline, will be diverted downstream of the secondary treatment cell. As noted above, EPA will not be eliminating iron-rich organic materials. Contaminated groundwater, the primary source of iron in the HBHA Pond, will continue to discharge in the northern portion of the HBHA Pond. In addition, baseflow surface water discharge, as well as a portion of the storm water flows, will continue to contribute iron-rich sediments and dissolved iron.

> E. 68. SMC and Pharmacia's consultant commented that: "while dredging can remove sediment mass, it is not necessarily an effective technology when it comes to risk reduction; in fact, at a number of sediment sites, dredging has resulted in higher concentrations of the constituent of concern in surface sediments after implementation. As a result, the risks are increased as opposed to decreased."

EPA Response: EPA has successfully implemented sediment dredging at many Superfund sites. The success of the dredging project in minimizing sediment resuspension, migration, and downstream migration is dependent upon the dredging method selected and other engineering controls installed during dredging (e.g., silt curtains). For the FS, EPA assumed that hydraulic dredging methods would be used since this particular method is best suited for low-specific gravity sediments in the HBHA Pond and minimizes sediment resuspension in the pond during dredging. Details of the dredging will be refined during the design process. All dredging requirements will comply with all applicable state and federal regulations.

> E. 69. SMC and Pharmacia's consultant commented that: "although one of USEPA's goals of Alternative HBHA-4 is to provide an improved benthic habitat in a portion of the pond, dredging, no matter how effective, will never contribute to this end. The HBHA Pond is a man-made structure designed to retain stormwater, and its bottom is prone to anoxic conditions. Even if all the arsenic-containing sediments were removed, anoxia would likely continue, preventing the development of thriving communities."

EPA Response: The dimensions of the HBHA Pond do not cause the atypical anoxic conditions present at the deep surface water of the HBHA Pond. Contaminated groundwater plumes that discharge into the HBHA Pond cause the chemocline and severe contamination in the sediments and surface water of the HBHA Pond, as well as the high conductivity, anoxic and reducing conditions in the deep surface water of the HBHA Pond. The selected remedy will remove the discharge of contaminated groundwater plumes from the southern portion of the HBHA Pond, and EPA believes the sediment remediation and restoration of the southern portion of HBHA Pond will improve and provide additional habitat for aquatic life (e.g., benthic community and fish). The remediation of the southern portion of the HBHA Pond will also reduce downstream migration of contamination.

> E. 70. SMC and Pharmacia's consultant commented that: "the primary transport mechanism assumed in the Feasibility Study (FS) is scouring of the arsenic containing sediment from the bottom of the pond and downstream migration of these sediments. This, however, is not the case. Rather, the sediments in the HBHA Pond sorb arsenic entrained in groundwater as the groundwater discharges to the surface water. Further, hundreds of years of sorptive capacity remain in the sediments. Dredging these sediments would actually destroy an effective, functioning arsenic removal mechanism. In addition, since surface water velocities in the pond are quite low (a result of the pond's design as a retention basin), sediments are not scoured and transported downstream with any regularity."
>
> Pharmacia commented that the HBHA is sequestering and preventing downstream migration of contaminants.

EPA Response: EPA refers the commenters to the March 2005 RI and June 2005 Surface Water Modeling Report which identify transport mechanisms along surface water and clearly associates downstream migration of contaminated sediments from the HBHA Pond to increased storm flows during storm events. EPA's selected remedy dredges and restores sediments from the southern portion of the HBHA Pond, while the northern portion serves to sequester/treat contaminated groundwater discharging in the northern portion. The selected remedy for the northern portion of the HBHA Pond (primary and secondary treatment cells) requires sediments to be periodically dredged.

> E. 71. SMC and Pharmacia's consultant commented that: EPA "significantly underestimated the volume of sediments that would be dredged from the southern portion

> of HBHA Pond if its Proposed Plan is implemented. USEPA's 6,700 cubic yard estimate of sediment volume was derived by multiplying the areal extent of the HBHA Pond south of the proposed northern cofferdam (135,000 square feet) by an assumed average sediment thickness of 1.33 feet (roughly equivalent to the 41-centimeter average sediment thickness of the 1991 GSIP Phase 2 Remedial Investigation data set). During implementation of the Final GSIP Scope of Work (SOW) in 2001, sediment thickness was measured at 22 locations throughout the HBHA Pond. Using this sediment thickness data, the portion of HBHA Pond to be dredged under USEPA's Proposed Plan contains approximately 10,000 cubic yards of sediments, almost 50 percent more than the sediment volume (6,700 cubic yards) used in the Proposed Plan to determine the costs for performance of this remedial action. Since sediment removal costs constitute a substantial proportion of the total capital costs for the HBHA Pond remedial action, USEPA significantly underestimated the cost of implementing its Proposed Plan."

EPA Response: EPA utilized reasonable information to estimate the volume of sediments requiring removal. The actual volume of sediments may increase or decrease depending upon actual field conditions at the time of implementation. When developing the FS estimate, EPA considered several sources of information including the Final GSIP data referenced in the comment, and applied sediment core data from Robert Ford's September 2004 Natural Attenuation Study (Appendix 2D of the March 2005 MSGRP RI), which was considered to be the most reliable data set to estimate sediment volumes.

The methods employed to measure sediment thickness in the HBHA Pond during the Final GSIP performed by the Industri-plex Site Remedial Trust (i.e. pushing a perforated disk through the water column and "feeling" the differences in resistance between the water and sediment) were subjective with considerable uncertainty. No confirmation cores were collected to verify the accuracy of this method.

> E. 72. SMC and Pharmacia's consultant commented that: the "Wells G & H Wetland near shore sediments targeted for remediation are not easily accessible. The existing dense vegetation and adjoining rifle range make this wetland both difficult and potentially dangerous to access. Existing potential physical hazards pose far greater impediments to accessing deeper areas within the Wells G & H Wetland than potential access facilitated by above-grade *in situ* capping."

EPA Response: EPA disagrees with the comment and considers the identified near shore sediment areas to be accessible.

> E. 73. SMC and Pharmacia's consultant commented that "caps can be designed to provide dermal barriers to exposure without excessive thickness (e.g., incorporation of geotextiles). Because the proposed remedial areas are relatively confined, caps placed over wetland sediments would likely settle, keeping increases to the existing grade elevation to a minimum.
>
> . . . USEPA's concerns regarding potential access to deeper sediments as a result of capping could be effectively addressed through use of additional biological barriers to

supplement the existing dense vegetation (i.e., planting vegetation containing briars/thorns while avoiding those that produce edible fruits [e.g., blackberry])."

EPA Response: The selected remedy for near shore sediments is more effective at reducing risk when compared with other alternatives. EPA evaluated capping as an alternative in the FS, but it was eliminated from further consideration since in-situ caps may enhance accessibility to interior portions of the wetlands, which were previously considered inaccessible and typically have higher concentrations of contamination. In addition, capping would also require long-term inspections, maintenance, and institutional controls to ensure that the cap remained intact and protective and that the biological barriers mentioned in the comment remained effective in preventing access. Institutional controls would also be required where land use restrictions would be imposed and would require periodic inspection and enforcement to remain effective. All of these factors would also increase the cost of the capping alternative.

E. 74. SMC and Pharmacia's consultant commented that future human exposures to groundwater at the West Hide Pile can be prevented or controlled through the use of institutional controls. In addition, SMC and Pharmacia's consultant commented that: "[g]iven the absence of any chemical-specific ARARs for Site groundwater . . . or any other regulatory driver for groundwater cleanup at the West Hide Pile, ...there was no need for USEPA to include enhanced in-situ bioremediation for the West Hide Pile in its Proposed Plan."

EPA Response: Benzene concentrations in groundwater remain elevated at the West Hide Pile, similar to concentrations previously detected in groundwater. EPA conducted a baseline risk assessment based upon existing conditions resulting in the identification of human health risks associated with potential future groundwater exposures to commercial/ industrial workers.

EPA's selected remedy is necessary to remove the high concentrations of benzene from the West Hide Pile. Predesign investigations will be necessary to further evaluate the West Hide Pile and East Hide Pile contaminated groundwater plumes impact on the nearby wetlands and downgradient groundwater plumes. Institutional controls required under the 1986 Record of Decision have not been recorded on any property to date. If institutional controls that eliminate human health risks are implemented and maintained, and predesign investigation do not identify these plumes contributing to human health risks and hazards or an ecological risk (exceeding the cleanup standards established for this remedy), then EPA agrees that implementation of Alternative GW-4 for the West Hide Pile may not be necessary.

E. 75. SMC and Pharmacia's consultant commented that: "further reductions in the concentration of benzene in West Hide Pile groundwater will likely require the injection of oxygen in quantities designed to cause the complete degradation of the soluble organic carbon from the hides. Consequently, enhanced *in-situ* bioremediation cannot feasibly be implemented to treat benzene in groundwater at the West Hide Pile as proposed in USEPA's Proposed Plan is technically infeasible."

EPA Response: Injection of oxygen enriching compounds will stimulate biodegradation of organic compounds such as benzene. A pre-design investigation will be required to define the target area of application and the specific oxygen formula composition and application rates. In addition, with regards to arsenic, application of this technology may have a secondary benefit in that injection of oxygen-releasing compounds may actually reverse the reducing conditions at the hide pile that are driving the mobilization and migration of arsenic.

E. 76. The ASC consultant commented that: "• In designing the cofferdam system EPA should carefully consider likely changes (*e.g.*, due to inputs of salts to the hypolimnion, seasonal effects, and large storms) in the physical and chemical constraints that govern the reactions that are hoped will occur in the north basin (i.e., nitrification, oxidation of arsenic and sorption onto ferric iron, biodegradation of benzene). • EPA should consider adopting concentration-based standards for contaminants of concern in waters discharging from the cofferdams. In setting the standards, EPA should mandate both regular and event monitoring to capture the range of anticipated flow conditions and pollutant discharges. • EPA should also answer the following questions regarding the treatment system and cofferdam/aeration system. • How long will it take for the treatment system to achieve the ammonia PRG of 4 mg/L in groundwater entering the north basin? • What is the design life of the cofferdam and aeration system? • If the PRGs for arsenic and benzene are achieved before that of ammonia, will the treatment system be maintained and operated until the ammonia PRG is achieved?

EPA Response: Predesign investigations will be implemented to determine the design of northern portion of the HBHA Pond (primary and secondary treatment cells, storm water by-pass system, etc). The outlet of the northern portion of the HBHA Pond (secondary treatment cell effluent) will serve as the surface water compliance boundary and must achieve surface water cleanup standards. Due to waste remaining in place at the Industri-plex site (e.g. animal hide wastes), cleanup standards for ammonia in groundwater are not expected to be achieved for the foreseeable future. The selected remedy will be required as long as there are exceedances of the cleanup standards.

F. Questions and Comments Concerning Scope of the Feasibility Study

F. 1. A resident of Wilmington commented that while Olin Chemical is mentioned, the report does not include source discharges to Halls Brook from Olin Chemical Industry/Wilmington under EPA NPDES permits.

EPA Response: Sediment data collected from the East Drainage Ditch and the New Boston Street Drainway were presented in the 2005 MSGRP RI. In addition surface water data from the East Drainage Ditch and the New Boston Street Drainway were presented in the October 2005 Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report.

F. 2. A resident of Wilmington asked whether there were any NPDES discharge permits to Halls Brook or the Study Area not mentioned in the FS.

EPA Response: Information regarding current NPDES permits was presented in the 2005 MSGRP RI.

> F. 3. A resident of Wilmington asked where Woburn's current town drinking-water sources are in relation to the study area, whether there is there any possible impact to the drinking water sources, and whether the best technology has been employed to protect the sources beyond drinking water standards.

EPA Response: Drinking water sources for Woburn were identified in the 2005 MSGRP RI. Currently, Woburn obtains its drinking water from two sources 1) Horn Pond aquifer located in West Woburn, and 2) Quabbin Reservoir located in Central Massachusetts and provided by Massachusetts Water Resource Authority. The Horn Pond aquifer is situated west of the study area in West Woburn. As presented in the MSGRP RI and FS, EPA does not believe that contamination addressed under Industri-plex OU-2 impacts any of Woburn's current drinking water sources.

> F. 4. A resident of Wilmington asked whether there is a listing of any and all private wells within the Study Area and whether receptors within 5001 (or other required footage) were notified and updated on the conditions. Ms. Duggan also commented that if private well owners were not notified, they should be and receive assistance as part of the process.

EPA Response: Private wells in the vicinity of the Industri-plex Site were identified in the 2005 MSGRP RI. There are no private wells currently located within the groundwater plume areas requiring remediation.

> F. 5. The MBTA asked EPA to provide the report reference that indicates the depth to groundwater and location of contaminated surface water (if any) within the MBTA ROW.

EPA Response: Monitoring wells installed within the MBTA ROW are identified on Figure 2-4 of the RI. The depths to groundwater observed during sample collection are presented in Appendix 2 of the RI, and elevations are presented in Appendix 3A of the RI.

The comment is somewhat vague in requesting the location of "contaminated surface water". All surface water in the HBHA has some degree of contamination. However, surface water did not present an unacceptable human heath risk for the exposure scenarios evaluated for the contaminants of concern. Please refer to Section 6.0 of the RI for a more thorough discussion of human health risks.

> F. 6. One commenter stated that Kraft Foods has applied to increase the amount of water they are permitted to pump from Walkers Pond a/k/a Whittemore Pond on Montvale Avenue, and asked EPA whether or not an increase in pumping could draw contaminants into the pond or into their plant.

EPA Response: EPA is unaware of any contamination issue at Whittemore Pond that may present water quality issues for Kraft Foods. The commenter's letter does not specify how much more water Kraft is intending on withdrawing from wells located near the pond in addition to the approximate 200,000 gallons per day that they are currently permitted.

The MSGRP RI investigations did not extend to the area of Whittemore Pond, but was concentrated along the Aberjona River. The impacts of additional withdrawals on the pond are unknown. EPA is unaware of any geochemical or hydrogeologic information presently available for the area between the Aberjona River and Whittemore Pond. However, based on the evaluation of data from the Wells G&H wetland and their potential impact under a drinking water withdrawal (see Appendix 5A of the RI), EPA does not believe that dissolved arsenic present in surface water of the Aberjona River will impact Whittemore Pond. EPA suggests however, that if these additional withdrawals are of concern, the City should request that Kraft Foods conduct a hydrogeologic investigation that models the impacts of the proposed withdrawal increases, specifically with regard to seasonal pond elevations.

> F. 7. The consultant for the City Council commented that: "[w]e were unable to determine if a site specific treatability study was performed using the proposed oxygenates (which were not detailed) to determine if this treatment method would be applicable for this site. Since there are many factors that influence in-situ oxidation, a careful evaluation of the site-specific parameters and the extent of contamination is crucial to the proper application and success of this remedial technology. There is a need to understand the interaction between native soil and oxidants, determine soil oxidant demand (SOD), and to determine efficacy of oxidants on target compounds. Conducting this study and analyzing and subsequently reporting the data could go a long way to determine if this proposed remediation method will be effective.

EPA Response: EPA believes that this technology will be effective at this site. As stated in the FS, a pre-design investigation will be conducted to develop the specific design details of the treatment application process as suggested.

> F. 8. EPA received a telephone message from Ms. Theresa Murphy, Woburn Conservation Commission. Ms. Murphy understands that EPA has identified contamination in the Aberjona River, and asked the following question: She was informed that a business in Woburn may be withdrawing surface water from the Aberjona River for use in its commercial products such as hydro-seeding mixtures. If surface water were being withdrawn from the river, then what would EPA's position be on the matter, and does it violate any federal laws?

EPA Response: EPA is unaware of any federal laws that would prohibit the withdrawal of surface water in the estimated quantities stated. The Massachusetts Water Management Act (Act) requires a permit for surface water withdrawals over 100,000 gallons per day. The Act does give MassDEP the authority to regulate withdrawals below 100,000 gallon per day, but MassDEP has not yet exercised this authority.

> F. 9. MBTA expressed a concern regarding the nature and extent of ammonia contamination in groundwater west of the Lower South Pond and north of the intersection of Merrimac and New Boston Streets: "It does not appear that the EPA characterized soil

and groundwater in this area. Due to the likely presence if high ammonia concentrations in this area, which is located west of three hide piles (hide piles are the known source of ammonia), our comments/concerns are as follows:

- The EPA should collect additional ammonia data in this area."

MBTA further stated that:
"The chosen remedial measure by the EPA should take into account the depth of the hide piles, which was reported to be over 40 feet deep in areas."

EPA Response: EPA did collect three groundwater samples for ammonia analysis in the vicinity of the area identified in the comment. Soil sampling was not required since the soils in this area were addressed under OU-1. Other groundwater samples analyzed for ammonia were collected west and southwest of the East Central Hide Pile and South Hide Pile. The ammonia sampling was sufficient to address site risks related to ammonia contaminated groundwater. EPA has included the subject area within the boundaries of Industri-plex OU-2. It should be noted that the concentrations of ammonia exceeding the ammonia PRG were found to be within the limits of the arsenic/benzene plume (see Figure 2-4, June 2005 Feasibility Study) that will also be addressed under Alternative GW-2. Also, as stated in the MSGRP RI and the FS, EPA did consider the depth of the buried wastes at the hide piles and the impacts on the fate and transport of contaminants in soil and groundwater. Remedial measures for these buried wastes have already been completed under OU-1.

F. 10. The Custodial Trust asked:

"1) Do you know why no elevated ammonia shows up around the West and East Hide Piles?

2) And, did EPA look at the most recent work being done at Tufts regarding ammonia?"

EPA Response: Samples for ammonia analysis were collected near the West Hide Pile at groundwater sampling location A01 and A02 (see Appendix A, October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report). Ammonia concentrations of 63.7 mg/L and 79.3 mg/L were detected at A01 and A02, respectively. Also, EPA did review the Tufts MS thesis prepared by M. Cutrofello (Tufts).

F. 11. The concerned Citizens Network expressed an interest that the scope of the source investigation for the Industri-plex RI should extend to the Olin Chemical site in Wilmington, MA: "The ammonia contamination on the Olin site and the site's contamination migratory pathway into the Aberjona watershed, are both well documented. In our opinion it is more than reasonable to investigate this site as a potential source contributor of the high ammonia levels found in the northern areas of the Industrial-Plex (sic)."

Other comments also expressed extending/ expanding investigations to Olin Chemical, as well as the Woburn Landfill, relative to their potential contribution of ammonia.

EPA Response: Sediment data collected from the East Drainage Ditch and the New Boston Street Drainway were presented in the 2005 MSGRP RI. In addition surface water data from the East Drainage Ditch and the New Boston Street Drainway were presented in the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report. Concentrations of ammonia were detected in these streams. Further pre-design investigations will be implemented to evaluate the background concentrations of ammonia. Please be advised that the Olin Chemical facility was proposed on EPA's National Priority List (NPL) on September 14, 2005, and will be the subject of a separate Remedial Investigation. Olin's contribution to groundwater contamination will be addressed as part of the investigations at the Olin facility.

> F. 12. National Development's consultant stated that they believe the interpreted groundwater plume requiring remediation does not extend onto MetroNorth Business Center's property. "According to Figure 2-4 of the Report, four monitoring wells were installed within the MNBC property, or on the northern border of the MNBC property - B7-02, B7-04, B7-05, and B7-07. Well B7-02 is in the tail area; the other wells are on the main portion of the property or at the northern border of the property. Only one of these wells B7-02, at the tail of the property, is included among the monitoring wells with contaminant concentrations that pose future human health risk."

EPA Response: Based upon available data and hydrogeology, EPA maintains that contaminated groundwater exceeding the groundwater cleanup standards for arsenic, benzene, naphthalene, etc., does extend onto the subject property and will require remediation in accordance with the selected remedy (i.e. GW-2 Institutional Controls). Monitoring well locations on the property, immediately upgradient of the property (including B7-03), and immediately downgradient of the property all exhibit concentrations exceeding the groundwater cleanup standards. As presented in the MSGRP RI, groundwater flows in a general south to southwesterly direction. These concentrations and aquifer hydrological conditions were modeled to determine the boundaries of the groundwater plumes. Further pre-design investigations may be implemented to determine the extent of groundwater institutional controls.

> F. 13. The consultant for ASC commented that: "Conversion of ammonia to gaseous nitrogen is not likely to occur at significant rates and EPA's conjecture that it may occur is misleading and unsupported." ASC includes a specific quote from the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report, describing the fate and transport of the ammonia in surface water.

EPA Response: EPA's discussion of the fate and transport of ammonia presented in the Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data – October 2005, does not suggest or imply that all ammonia is converted to nitrogen gas. The discussion presents the fate and transport processes affecting ammonia which are part of the nitrogen cycle, and includes the conversion of some ammonia to nitrogen gas, thus "completing the nitrogen cycle". The fate and transport discussion recognizes that the nitrogen cycle may be incomplete for some of the ammonia within the HBHA.

Specifically, the technical memorandum states, "As ammonia migrates to the chemocline, aerobic bacteria can convert the ammonia to nitrite. Through diffusion, the nitrite comes into contact with the more oxygenated zone of the chemocline where it can be further oxidized to nitrate. Further reductions can also occur through facultative anaerobic bacteria where the nitrate can be reduced to nitrite and nitrogen gas can be released."

F. 14. The consultant for ASC indicated that the groundwater data was insufficient to contour ammonia plumes. Specifically, the consultant commented that: "EPA did not collect sufficient data to assess ammonia transport, and the available groundwater data are not sufficient to justify contouring."

EPA Response: EPA did not present an ammonia contour map as suggested in the comment. Figure 3-1 presents groundwater sample locations that were sampled for ammonia and presents the results of the sample analyses at each of those locations. The contour line that is shown on Figure 3-1 represents the approximate boundary of the contaminated groundwater plume area that would be addressed by the preferred alternatives presented in the Proposed Plan, as indicated in the figure legend. As highlighted in Figure 3-1, monitoring wells containing concentrations of ammonia above 4 mg/L were situated within the contaminated groundwater plume area. The ammonia data was sufficient to understand the nature and extent of significant ammonia concentrations, fate and transport processes, and address site groundwater risks. As outlined in the October 2005 Draft Final Technical Memorandum – Evaluation of Ammonia and Supplemental Soil Data Report, 1) ammonia concentrations are greatest closer to areas with buried animal hides (e.g. hide piles); 2) buried animal hides present a significant source of organic nitrogen; 3) site-wide reducing conditions in groundwater favor the production and mobilization of ammonia in groundwater; and 4) based on the site hydrogeology, ammonia in groundwater would follow the same migration pathways as other site groundwater contaminants previously documented.

F. 15. The consultant for ASC commented that: "EPA should consider the requirements of the Clean Water Act as Applicable or Relevant and Appropriate Requirements (ARARs) and should demonstrate that the proposed plan complies. As required by the Clean Water Act, EPA should perform an assessment of nitrogen loading to the Aberjona River including contamination from the Industri-plex and Wells G&H Superfund sites."

EPA Response: EPA conducted a baseline risk assessment and identified various compounds contributing to unacceptable human health and/or ecological risks in groundwater, surface water, sediments and soils. At the Industri-plex site, contaminated groundwater discharges into the HBHA Pond causing elevated levels of arsenic, ammonia and benzene in surface water above surface water cleanup standards. The selected remedy for HBHA Pond will adequately address the unacceptable risks posed by these compounds, and prevent the downstream migration of these compounds from the northern portion of the HBHA Pond above the surface water cleanup standards, which are based on the freshwater chronic (CCC) NRWQC and consistent with the Massachusetts Water Quality Standards. The Commonwealth of Massachusetts, will continue assessing the Aberjona River and other rivers within the Commonwealth, and will develop a total mximum daily load (TMDL) for certain pollutants in the Aberjona. Any TMDLs will be considered in the five-year review process. EPA will require implementation of a comprehensive monitoring program to evaluate the effectiveness and protectiveness of the selected remedy. The details of the monitoring program will be developed during the remedial design phase.

G. Questions and Comments Concerning Monitoring and Ongoing Review of the Remedy

G. 1. The Woburn City Council asked EPA how frequently clean-up methods will be re-evaluated, and how frequently and in what format will EPA communicate with the public and public officials about the efficacy of the methods. The consultant for the ASC also commented that "EPA should consider mandating that contingency plans be developed in the event that the cofferdam system does not meet the concentration-based standards."

EPA Response: A comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The findings of the five-year review will be presented in a report which will be made available to the public and will be included in the Administrative Record. The purpose of the five-year review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations. For example, if under the selected remedy the NRWQC values cannot be achieved at the HBHA Pond compliance point, then additional actions may be required. If different remedial actions are necessary, then other remedial alternatives, such as GW-3 Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls coupled with HBHA-5 Removal and Off-Site Disposal, outlined in the June 2005 FS, may be considered.

G. 2. The consultant for the Woburn City Council commented that: "[s]ince there is a heavy reliance on institutional controls and some *in-situ* remediation activities rather than removal actions, we believe that it would be in the best interest to have annual reviews of the monitoring data generated with an accompanying public meeting."

EPA Response: The five-year review process is not the only process whereby the effectiveness of the proposed remedy will be evaluated. An EPA-approved comprehensive monitoring program will be developed during remedial design and instituted as part of the selected remedy. This EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migration patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process. The results of the monitoring program will be made available to the public.

G. 3. The consultant for SMC and Pharmacia commented that: "During the feasibility study process, long-term monitoring evolved from a multi-medium approach to a medium-specific approach that is contrary to the USEPA's own Conceptual Site Model approach and framework for monitoring plan development, and is not integrated to the extent warranted by the interdependent nature of the preferred remedial alternatives; and [t]his medium-specific approach results in an inappropriately extensive sampling program."

EPA Response: EPA identifies monitoring as a necessary component of the selected remedy. The monitoring program described in the Proposed Plan is the result of combining individual alternatives from the FS, which presented monitoring programs specific to the medium and remedial alternative selected. EPA recognizes that monitoring efficiencies can be realized when a multi-medium approach is taken. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process.

G. 4. The consultant for SMC and Pharmacia commented that: "The objective of long-term monitoring for the Site is to monitor the effectiveness and protectiveness of the proposed remedial actions. However, due to the non-integrated nature of the long-term monitoring program proposed by USEPA, most of the data generated can not be used to meet this objective. For example, groundwater and surface water data will be developed for many areas of the Site where changes in contaminant concentrations will have little or no impact on the effectiveness or protectiveness of the proposed remedial actions, since there are no current risks in these areas and potential future risks will be managed by institutional controls. Also, some of the analytical parameters (e.g., semivolatile organic compounds) are proposed for media and locations where they don't exist or where their presence has little or no effect on overall Site risks. Lastly, sampling frequencies proposed in the various medium-specific long-term monitoring plans, which range from quarterly to semi-annually, are also inappropriate.

Typically, quarterly or semi-annual sampling is performed to identify seasonal trends, such as fluctuations in contaminant concentrations associated with higher or lower water levels. However, seasonal monitoring is clearly not needed for the duration of long-term monitoring."

EPA Response: An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during the remedial design process.

G. 5. The MBTA commented that: "The EPA should require that post-remediation monitoring for ammonia be conducted, to ensure that levels are maintained within acceptable limits."

EPA Response: Ammonia is a contaminant of concern that will be monitored to ensure compliance with the cleanup standards.

G. 6. The consultant for DEK commented that the proposed pre-design investigations/studies and long-term monitoring should also consider the ammonia by-products from the selected remedy for HBHA Pond.

EPA Response: The selected remedy addresses the unacceptable risks identified at the Industri-plex site. The details associated with long-term monitoring will be addressed during remedial design.

H. Questions and Comments Concerning Applicable or Relevant and Appropriate Requirements ("ARARs")

H. 1. SMC commented that: "EPA acknowledges that the subaqueous cap complies with all applicable ARARs more effectively than does the partial dredging remedy. *Id.* tbl. 4-28D; *see also* Proposed Plan tbl. 4-29. Unlike dredging, a Subaqueous Permeable Reactive cap complies completely with chemical-specific ARARs for the Pond, because the cap would ensure that the discharge of arsenic from the groundwater does not make its way into the surface water of the Pond. A Subaqueous Permeable Reactive cap, proposed in SMC's Alternative Remedial Action Plan, achieves complete compliance with identified ARARs, while the dredging remedy does not."

EPA Response: The comment states that the subaqueous cap alternative performs slightly better than the HBHA-4; Storm Water Bypass and Sediment retention with Partial Dredging and Providing and Alternate Habitat. As referenced in the comment, this is graphically shown on Table 4-29 of the Proposed Plan. However, this slightly better performance in complying with ARARs is based on the fact that, under the Subaqueous Cap scenario (Alternative HBHA-3), contaminated groundwater discharges are assumed to be completely eliminated through another groundwater alternative (e.g. GW-3 pump and treatment system). The remedy selected in this ROD does not include a pump and treat system. EPA does not believe that a subaqueous cap alone will be effective in eliminating contaminated groundwater discharges. HBHA-4 allows contaminated groundwater to discharge into a controlled northern part of the HBHA Pond sediment retention area (primary treatment area/cell) where natural processes decrease the arsenic concentrations in surface water. When the cost of a groundwater pump and treat system, along with measures needed to avoid recontamination, are taken into account, the partial dredging remedy is a more cost-effective means to achieve remedial action objectives, and it minimizes impacts to the aquatic environment.

EPA's Response to the Alternative Remedial Action Plan is contained in Section I, below.

H. 2. SMC commented that: "EPA's dredging will contravene an action-specific ARAR identified by EPA for the Pond, namely a Massachusetts water pollution control regulation, which states that 'No discharge of dredged or fill material shall be permitted if

> there is a practicable alternative to the proposed discharge which would have less adverse impact on aquatic ecosystem. . ."

EPA Response: See Response to Comment H. 1, above.

> H. 3. SMC commented that the preferred alternative HBHA-4 may not be cost-effective "as required" by the Massachusetts Contingency Plan ("MCP"), Mass. Regs. Code 310, § 40.0860(7).

EPA Response: The cited provision of the MCP is not applicable or relevant and appropriate under CERCLA. EPA and MassDEP rely on the provision of the MCP that provides that "(t)he Department shall deem response actions at a disposal site subject to CERCLA adequately regulated for purposes of compliance with 310 CMR 40.0000, provided: (a) the Department concurs with the ROD and/or other EPA decisions for remedial actions at such site in accordance with 40 CFR 300.515(e)." Massachusetts has concurred with the ROD, and, therefore, the site is "adequately regulated" for purposes of state law.

> H. 4. SMC commented that EPA's assumptions regarding exposure to near-shore sediments in the Wells G & H Wetland and Cranberry Bog Conservation Area is unrealistic, and stated that "EPA has dropped from its list of future areas of concern locations NT- 1 and NT-2, precisely because the City of Woburn has decided not to build a boardwalk in that location, . . .thus acknowledging implicitly the sufficiency of institutional controls. In fact, the City's Redevelopment Plan actually includes observation decks to *prevent* exposure to sediments, not facilitate it as EPA says."
>
> SMC goes on to comment that institutional controls and monitoring would be sufficient to remedy the unacceptable risk in the Wells G & H Wetland and Cranberry Bog Wetlands, further stating that: "[t]o the extent a waiver of ARARs is necessary with respect to the near-shore sediments of the Wells G&H Wetlands and the Former Cranberry Bog, EPA may consider capping and institutional controls to be an "interim measure" as part of a "total remedial action" that will satisfy ARARs, 40 C.F.R. § 300.430(f)(1)(ii)(C)(1), or an alternative that will attain an "equivalent" standard of performance to that required under the ARARs, *id.* § 300.430(f)(1)(ii)(C)(4). EPA should also consider whether the drastic remedy of excavation and off-site removal of sediments, the scope of which is inadequately defined, see footnote 5, may pose a greater risk to human health than institutional controls and monitoring, thus warranting a waiver of ARARs under 40 C.F.R. § 300.430(f)(1)(ii)(C)(2). Under any of these provisions, a waiver of ARARs would be appropriate, to the extent a waiver is necessary."

EPA Response: The commenter's description of accessibility is overstated. EPA and MassDEP have had little trouble accessing the areas for sample collection and in fact have observed evidence of activity by others (trash, fire pits, etc.). Please also refer to previous responses regarding exposure scenarios.

If the City of Woburn recommends nature trail options NT-1 and NT-2, which constructs trails deeper into the wetlands, then those nature trail options will need to be considered in the remedy since the boardwalks would actually provide an avenue to more easily access areas deeper into the wetlands where contamination may present a human health risk.

No waiver of ARARs under 40 C.F.R. § 300.430(f)(1)(ii)(C)(2) is necessary. The selected remedy is more effective at reducing risk when compared with institutional controls and monitoring. The current volume estimate of sediments requiring removal may actually be overestimated since the proposed limits are bounded only by limited samples shown not to exceed the sediment cleanup standards. Pre-design investigation sampling could in fact more closely delineate the remediation area and reduce the overall area and volume of sediments requiring excavation.

> H. 5. SMC commented that: "[r]emedial option GW-4 is unnecessary to achieve compliance with ARARs for groundwater at the MSGRP Study Area. Remedial option GW-2, which combines a pond intercept mechanism with monitoring and institutional controls, already achieves compliance with ARARs, reduces the toxicity, mobility, and volume of contaminants, is less costly, and is significantly easier to implement than the in-situ groundwater treatment option. Proposed Plan tbl. 4-29. Moreover, injecting oxygen-rich compounds into the groundwater beneath the West Hide Pile is not likely to diminish the size of the benzene plume, because other organic compounds will compete for the oxygenated material, thus preventing the material from targeting the benzene effectively. This proposal is therefore not only unnecessary, but fails to recognize that it is technologically impracticable to devise a system that will diminish the benzene plume by injecting oxygen into the groundwater beneath the West Hide Pile. In fact, injecting oxidizing material will lock up the iron in the groundwater, even though iron is needed to make the Pond work as an arsenic sink. Although SMC does not believe that injecting oxygenated compounds into the benzene plume is necessary to satisfy ARARs not already met by GW-2, if EPA disagrees, it should waive ARARs pursuant to 40 C.F.R. § 300.430(f)(1)(ii)(C)(3)."

EPA Response: Both GW-2 and GW-4 comply with ARARs. However, implementation of GW-4 may also be necessary if the groundwater discharge from the West Hide Pile is having an unacceptable impact on surface water and sediments. EPA disagrees with the stated opinion that "injecting oxygen-rich compounds into the groundwater beneath the West Hide Pile is not likely to diminish the size of the benzene plume". Injection of oxygen-enriching compounds will stimulate biodegradation of organic compounds such as benzene. A pre-design investigation will be required to define the target area of application and the specific oxygen formula composition and application rates. Regarding arsenic, application of this technology may have a secondary benefit in that injection of oxygen-releasing compounds may actually reverse the reducing conditions at the hide pile that are driving the mobilization and migration of arsenic.

> H. 6. SMC commented that: "institutional controls and monitoring may be considered an 'interim measure' that, along with the natural attenuation of benzene beneath the West Hide Pile, will become part of 'total remedial action' that will meet ARARs. *Id.* §300.430(f)(1)(ii)(C)(1). Or institutional controls and monitoring, along with natural attenuation, may be considered a remedial alternative that 'will attain a standard of

performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach.'"

EPA Response: See Response to Comment H. 5, above.

H. 7. MassDEP requested "specifically listing 314 CMR 3.00 – the Surface Water Discharge Permit Program as a Chemical-Specific and an Action-Specific State ARAR because there may be instances where discharge to surface water may be necessary during the sediment remedy (right now it is only mentioned for consideration under the listing for their Federal NPDES program)."

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised. However, this ARAR will be included in the ROD.

H. 8. MassDEP recommended "removing the MCP Method 1 Groundwater Standards from the State Regulatory Requirements section and placing it instead in the Criteria, Advisories, and Guidance section as a To Be Considered. In addition, the listing is a little confusing as the requirement column only lists the Groundwater Standards, whereas the Consideration for FS column states that the standards will be considered for developing both soil and groundwater PRGs. The Method 1 Standards are only required at state sites that choose to conduct a Method 1-type risk assessment (not for Method 3 risk assessments which are roughly equivalent to the EPA risk method), therefore the standards are not used consistently at all sites. However, EPA is of course free to consider and use these numbers at any time during the Superfund process.

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised. However, this ARAR will be re-located in the ROD as suggested.

H. 9. MassDEP requested "listing 310 CMR 19.000 – Solid Waste Management as an Action-Specific ARAR because some of the remedy involves the capping of sediment and the surrounding banks, therefore some of the landfill capping requirements may be relevant and appropriate."

EPA Response: EPA does not believe that the cited provision is relevant and appropriate for the capping of sediment and surrounding banks.

H. 10. MassDEP commented regarding page 78, Section 2.1.4 of the MSGRP FS: "This section cites the MassDEP Method 1 standards as 'to be considered,' then states that the standards are relevant. The standards should solely be cited as 'to be considered' because the standards are not applied at every site (just those that choose to use Method 1). In addition, the section states that the soil categories are 'established based on a site-specific risk/exposure analysis.' Since the soil categories are already established and are only selected by the environmental professional for use after evaluating their site-specific exposure scenario, it would be more accurate to state the following: '...the category of standards used are selected based on a site-specific risk and exposure analysis.' "

EPA Response: The comment is acknowledged. Since the comment does not change the outcome of the FS, the document will not be revised.

I. EPA's Response to SMC and Pharmacia's Alternative Proposed Plan

SMC and Pharmacia submitted an Alternative Proposed Plan which varied in certain respects from EPA's Proposed Plan; EPA responds herein to that plan. No responses are provided for soil media (EPA's selected remedy SS-2 and SUB-2) due to SMC and Pharmacia's general agreement with EPA's selected remedy (i.e., institutional controls). Also, no response is provided for deep wetlands sediments (EPA's selected remedy DS-2) due to SMC and Pharmacia's general agreement with EPA's selected remedy (i.e., institutional controls), with the exception of SMC and Pharmacia's alternative remedial action for HBHA Wetland proposing the installation of various dikes, et. al.

I. 1. SMC and Pharmacia's "Alternative Remedial Action treats sediments in the HBHA Pond through placement of the subaqueous cap designed to treat groundwater in situ, addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes)."

SMC and Pharmacia commented that: the "subaqueous permeable reactive cap proposed for treating groundwater in the HBHA Pond would more effectively reduce the toxicity, mobility and volume of arsenic in groundwater entering the HBHA Pond and discharging to surface water than USEPA's Proposed Plan. The capping of HBHA Pond sediments would also more effectively reduce the mobility of arsenic in sediments through treatment than USEPA's proposed hydraulic dredging. Enhancing sedimentation in the HBHA Wetland through construction of low-head dikes would reduce the mobility of arsenic in sediments through burial of existing sediments by increasingly cleaner suspended particles. Specifically, the reactive cap would reduce release of arsenic into HBHA Pond surface water, where it can coprecipitate on iron hydroxide floe and suspended sediments entering and flowing through the HBHA Pond. Capping sediments in the HBHA Pond and the Wells G&H and Cranberry Bog Conservation Area wetlands would not constitute treatment. Conversely, potential stabilization of dewatered sediments hydraulically dredged from the HBHA Pond and excavated from near-shore wetlands areas would provide some reduction of mobility through treatment. In total, the Alternative Remedial Action would provide greater reduction of toxicity, mobility or volume through treatment, as summarized below."

EPA Response: EPA disagrees with the suggestion that a subaqueous cap is a better, more effective alternative than the selected remedy component HBHA-4. EPA's selected remedy will intercept all contaminated groundwater plumes from Industri-plex at the primary treatment area/cell (final location of low-head cofferdams will be determined during predesign), treats/sequesters contaminated groundwater, surface water and sediments in the northern portion of the HBHA Pond (primary and secondary treatment cells), periodically removes accumulated contaminated sediments from the bottom of the northern portion (primary and secondary treatment cells), constructs compensatory wetlands to mitigate any wetland function and value losses (including flood storage losses) associated with the selected remedy, removes contaminated sediment from the southern portion of HBHA Pond, and restores the southern portion of the HBHA Pond. The chemocline will be closely monitored and maintained and the aeration system will be designed to treat contaminants (including ammonia) to meet the surface water cleanup standards. EPA's selected remedy for the southern portion of the HBHA Pond requires off-site disposal of excavated sediments that complies with all federal and state transportation regulations. This portion of the selected remedy is a permanent solution for the southern portion of the HBHA Pond that permanently removes contaminated sediments and restores the wetland. Any traffic impacts during implementation of the selected remedy would be temporary and controlled through traffic control planning, resulting in a permanent solution for the sediments.

EPA's selected remedy will be implemented in accordance with federal and state regulation, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b), and control any releases during sediment removal and construction activities. This component of the remedy (contaminated sediment removal via dredging) is a common and proven technology. This component of the selected remedy reduces toxicity, mobility or volume of contaminants, is implementable, and results in a permanent solution (via contaminated sediment removal).

EPA's selected remedy incorporates portions of existing sequestering properties occurring in the HBHA Pond through the maintenance of the chemocline within the northern part of the HBHA Pond sediment retention area (primary treatment cell). Also, EPA's selected remedy intercepts the contaminated groundwater plumes (primary treatment cell) which provide the most significant source of iron to the pond. Baseflow surface water discharges from the Halls Brook, and baseflow and storm flow surface water discharges from minor tributaries will continue to provide suspended solids containing iron as well.

The existing sediments at the bottom of the HBHA Pond are not effectively removing arsenic from groundwater, as evident with the high concentrations of contamination in the surface water exceeding the NRWQC.

It is unlikely that the sediments at the bottom of the HBHA Pond possess "hundreds of years of remaining sorptive capacity", due to the ISRT contractor's application of inappropriate collection and test methods. Specifically, sediment collection procedures and batch sorption tests documented in the Supplemental Site Investigation Report, Industri-Plex Site (pp. 15-18, September 1997), prepared by the ISRT indicate that no precautions were taken to prevent oxidation of sediments from sampling locations SED-1 and SED-2 within the HBHA Pond. These procedures lead to oxidation of poorly crystalline iron sulfides that are produced within the sediments. Weight percent concentrations of acid volatile sulfides such as FeS have been identified in these sediments (R. T. Wilkin and R. G. Ford, 2002, Use of hydrochloric acid for determining solid-phase arsenic partitioning in sulfidic sediments. Environmental Science & Technology, 36(22): 4921-4927). Sampling procedures used by Wilkin and Ford (2002) to prevent sediment oxidation during collection and processing included: 1) capping and immediately freezing sediment cores upon retrieval; and 2) sectioning and drying frozen sediments within a glove box under an inert gas mixture (97% N_2:3% H_2). Dried sediments were stored in the glove box prior to extraction with hydrochloric acid to determine the fraction of acid volatile sulfides. Upon oxidation, FeS is converted to hydrous ferric oxide, which has a much higher sorption capacity for arsenic. Thus, the apparent sorption capacity based on ISRT batch sorption test data is not reflective of the actual sorption capacity of the intact sediments.

The current sediments at the bottom of the HBHA Pond are not stable or irreversible, as evident with the diffusion of contaminants from the sediment to the surface water, and the high concentrations of contamination in the surface water. The ability of the proposed alternative to convert these bottom sediments to stable and irreversible conditions is uncertain, and the sorption of capacity of the subaqueous cap is limited and reversible.

EPA did not choose a subaqueous cap as a component of the selected remedy due to poor reduction of toxicity, mobility, or volume through treatment, poor implementability, and unlikely success. The contaminated sediments at the bottom of the HBHA Pond are greater than 90% water and have a specific gravity very similar to water. This condition presents significant construction issues and concerns relative to displacement, entrainment, re-suspension and downstream migration during placement of cap materials. In addition, the deep surface water has very high concentrations of the contaminants of concern. Placing a cap with geogrid/geosynthetics on top of the deep surface water and sediment will likely cause the release of contaminated surface water and sediments that could re-contaminate the cap itself and downstream depositional areas.

The proposed subaqueous cap does not take into consideration that the source of the contaminated groundwater plumes discharging into the HBHA Pond are the buried and capped wastes at the Industri-plex site that will remain in place and continue to discharge into the pond in the future. The subaqueous cap has a limited capacity and will require periodic replacement which is not discussed in the proposed alternative. The replacement warrants previous cap materials to be removed and disposed off-site. The periodic removal of this cap material would be similar to dredging but would be further complicated by the installed geosynthetics. In addition, similar to reasons specified in the FS, the reliability of ZVI to effectively remove arsenic over a long period of time is uncertain given the chemical constituents of the contaminated groundwater. The high concentrations of dissolved solids present in groundwater will compete with the arsenic for binding sites of the ZVI and could cause contaminated groundwater to break through the cap and discharge unchecked into the water column. Another concern is that the cap materials could become clogged as a result of chemical reactions with the groundwater. In this situation, contaminated groundwater could migrate and discharge further downstream, beyond the treatment zone. In addition, the clogging and limited capacity of ZVI will require the subaqueous cap to be periodically removed and replaced.

The subaqueous cap will not address all contaminants of concerns, such as ammonia.

The proposed cap thickness is not discussed. In order to accomplish the goal of capturing all arsenic discharging from groundwater as stated, the cap thickness may be substantial. In this case the flood storage capacity of the HBHA Pond would be severely impacted, a condition of concern noted throughout SMC's and Pharmacia's comment documents. Mitigation of these flood storage losses do not appear to have been accounted for in SMC/Pharmacia's cost estimates.

Placing a cap over the contaminated sediments does not address the unacceptable ecological risks to the sediments, and does not mitigate for wetland function and value losses. Contrary to the proposed alternative, placing a cap over sediments impacts wetland functions and values.

The proposed alternative does not address contaminated surface water which exceeds NRWQC.

The proposed alternative would construct low head dikes in the HBHA Pond and HBHA Wetlands and attempts to control surface water flows in the HBHA Pond system. Under this aspect of the alternative proposal, the HBHA Pond and HBHA Wetland is incorporated into the treatment process and allows contamination to release and migrate downstream of the HBHA Pond and deposit throughout the HBHA wetlands. The release, downstream migration and deposition, and accumulation of contamination in sediments may cause future unacceptable ecological risks to the environment, as well as reduce wetland functions and values downstream, including flood storage. The proposal does not account for these impacts, and incorrectly suggests these impacts will improve habitat equivalent to mitigation.

The proposed alternative would result in greater impacts to the wetlands considering the intrusive construction activities associated with a cap are similar to dredging (both the selected remedy and proposed alternative disturb existing wetlands), the proposed alternative calls for greater intrusive activities over a broader area of wetlands (throughout the entire HBHA Wetlands), and the proposed alternative does not compensate for wetland function and value losses.

The dimensions of the HBHA Pond do not cause the atypical anoxic conditions present at the deep surface water of the HBHA Pond. Contaminated groundwater plumes that discharge into the HBHA Pond cause the chemocline and severe contamination in the sediments and surface water of the HBHA Pond, as well as the high conductivity, anoxic and reducing conditions in the deep surface water of the HBHA Pond.

The MSGRP RI documented the impacts of significant storm events on the HBHA Pond. The proposed alternative plan does not adequately account for these impacts.

> I. 2. Under SMC and Pharmacia's Alternative Remedial Action, "[i]nstitutional controls, which are ready to be inaugurated, would be used to restrict groundwater use at the West Hide Pile. MCP AULs would be used to restrict groundwater use on those other portions of the Study Area where arsenic and benzene are migrating in groundwater toward and discharging to HBHA Pond."
>
> SMC and Pharmacia commented that "[w]hile not necessary to achieve the RAOs, USEPA's Proposed Plan includes in situ bioremediation of groundwater at the West Hide Pile. Although bioremediation would generally be considered to provide greater overall

protection of human health and the environment than institutional controls, the in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable overall protection of human health and the environment.

The in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable compliance with ARARs.

The in situ bioremediation as described in USEPA's Proposed Plan will not achieve greater reduction of benzene concentrations than ongoing natural attenuation. Therefore, the institutional controls proposed as part of the Alternative Remedial Action are considered to provide comparable long-term effectiveness.

USEPA's Proposed Plan for in situ bioremediation of groundwater at the West Hide Pile will not provide any greater reduction of benzene toxicity, mobility or volume through treatment than ongoing natural attenuation processes. As a result, the institutional controls proposed as part of the Alternative Remedial Action, which do not include "treatment" per se, are considered comparable to USEPA's preferred alternative under this evaluation criterion."

EPA Response: Groundwater contamination at the West Hide Pile has been shown to present a risk to human health exceeding the remedial action objectives and cleanup standards, and has been a consistent source of benzene contamination to the groundwater at the Industri-plex site. Limited groundwater data were available at the West Hide Pile, and no surface water or sediment data were collected by the West Hide Pile to assess the extent of contaminated groundwater plume discharges and potential impacts to the adjacent wetlands. The 2002 groundwater data were not collected from the same location (vertical and horizontal position) or interval as previous groundwater data samples as suggested in the comment and can not be directly compared to determine a degree or percent reduction. EPA's selected remedy for the West Hide Pile will rapidly address the high concentrations of benzene in the groundwater and addresses the remedial action objectives and cleanup standards, as well as address any arsenic and ammonia contaminants in groundwater at the West Hide Pile.

Notwithstanding the above, if the following items can be adequately addressed during pre-design and remedial design activities, then implementation of the in-situ enhanced bioremediation system at the West Hide Pile may not be necessary: 1) Predesign investigations are adequately implemented for groundwater surface water and sediment near the West Hide Pile, East Hide Pile, and adjacent wetlands; 2) EPA further evaluates this data and determines there are no unacceptable human health risks or hazards or ecological risks; and 3) If Industri-plex OU-1 institutional controls are recorded on the properties with human health groundwater risks and adequately remove/reduce human health risks.

I. 3. SMC and Pharmacia's Alternative Remedial Action "addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes), addresses migration of sediments in the HBHA Pond and Wetland through construction of surface water flow controls (low-head dikes), and prevents exposure to deep wetland sediments through institutional controls."

SMC and Pharmacia commented that: "[t]he construction of flow control structures and devices in the HBHA Pond and HBHA Wetland would pose considerably fewer short-term impacts to the community than the hydraulic dredging of HBHA Pond sediments proposed in USEPA's Proposed Plan, which involves hazardous material processing on land, then offsite transport for disposal. Similarly, the construction of flow control structures would pose less risk of worker exposure to hazardous materials. Increased sedimentation from the flow control structures should not cause any adverse environmental impacts. The combination of capping and construction of flow control structures will immediately present an improved benthic habitat upon construction completion. However, anoxic conditions will to continue for HBHA Pond sediments under this or USEPA's Proposed Plan, since the pond was designed as a stormwater detention basin rather than aquatic habitat, and its very design is what creates the anoxic conditions."

EPA Response: EPA's selected remedy does not require action within the HBHA Wetlands, except for institutional controls to control future dredging activities within the wetland. EPA's selected remedy for the HBHA Pond (HBHA-4) will intercept all contaminated groundwater plumes from Industri-plex (final location of low-head cofferdams will be determined during predesign) at the primary treatment cell, treats/sequesters contaminated groundwater, surface water and sediments in the northern portion of the HBHA Pond (primary and secondary treatment cells), periodically removes accumulated contaminated sediments from the primary and secondary treatment cells, constructs compensatory wetlands to mitigate any wetland function and value losses (including flood storage losses) associated with the selected remedy, removes contaminated sediment from the southern portion of the HBHA Pond, and restores the southern portion of the HBHA Pond. Surface water releases from the northern portion of the HBHA Pond (outlet of the secondary treatment cell) must comply with surface water cleanup standards. EPA expects that the selected remedy will improve habitat and flood storage capacity in the watershed.

Placing cap materials within the pond will impact the HBHA Pond's wetland functions and values, and decrease the existing flood storage capacity.

Placing a cap over the contaminated sediments does not address the unacceptable ecological risks associated with the sediments, and does not mitigate wetland function and value losses. Contrary to the proposed alternative, placing a cap over sediments impacts wetland and value functions.

The proposed alternative would construct low head dikes in the HBHA Pond and HBHA Wetlands and attempts to control surface water flows in the HBHA system. Under this aspect of the alternative proposal, the HBHA Pond and HBHA Wetland are incorporated into the treatment process and allow contaminated groundwater and sediments to be released, migrate downstream, and deposit and accumulate in the HBHA Pond and HBHA Wetlands. The release, downstream migration and deposition, and accumulation of contaminated sediments may cause future unacceptable ecological risks to the environment, as well as reduce wetland functions and values downstream, including flood storage. The proposal does not account for these impacts, and does not properly mitigate for these lost wetland functions and values.

The proposed alternative would result in greater impacts to the wetlands considering that a broader area of wetlands will require disturbance and construction activities (i.e., throughout the HBHA Wetlands, the proposed alternative does not construct wetlands to compensate for wetland function and value losses (e.g. proposed alternative suggests deposited contaminated solids/sediments serves as the basis for creating new benthic invertebrate habitats)) nor does it make provisions for mitigating flood storage losses.

The proposed alternative does not address all of the contaminants of concern, specifically benzene and ammonia.

The proposed alternative does not address contaminants in surface water which exceed surface water cleanup standards, such as ammonia.

> I. 4. SMC and Pharmacia's Alternative Proposed Plan proposes capping near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area. SMC and Pharmacia commented that: "[c]apping near-shore sediments in the Wells G&H Wetland and the Cranberry Bog Conservation Area would isolate these sediments in place in a manner that would prevent human exposure. Installation of these caps would create upland islands that would increase habitat diversity within the existing wetland systems. Capped areas would be re-vegetated with plants inhospitable to humans to create natural biological barriers to the capped areas and deter access to deep sediments in the interior of the wetland. Capping would add to the mosaic of habitats present in this riparian system, providing new habitat types and increased habitat edges and assure long-term protection of human health and the wetland ecosystem."

EPA Response: EPA disagrees with the suggestion that capping near shore sediments is a better, more effective alternative than the selected remedy component NS-4. EPA's selected remedy will remove the contaminated near shore sediments, dispose of the contaminated sediments off-site, and restore the area. The selected remedy is a permanent solution for the near shore sediments contributing to unacceptable risks. Any traffic impacts during implementation of the selected remedy would be temporary and controlled through traffic control planning. Off-site disposal will comply with all federal and state transportation requirements.

EPA's selected remedy will be implemented in accordance with federal and state regulation, including Section 404 of the Clean Water Act and the Executive Order for Floodplain Management, Exec. Order 11988 (1977), codified at 40 C.F.R. Part 6, App. A., 40 CFR 6.302(b), and control any releases during sediment removal construction activities. This component of the remedy (contaminated sediment removal via dredging) is a common and proven technology.

This component of the selected remedy reduces toxicity, mobility or volume of contaminants, is implementable, and results in a permanent solution (via contaminated sediment removal).

Unless dredging is incorporated into the design, the proposed capping alternative will increase the elevation over the sediments and increase accessibility to deeper/interior wetlands and generally higher concentrations of contaminated sediments.

The proposed alternative does not account for contamination desorption impacts or long-term erosion impacts. Sediment desorption impacts may re-contaminate the cap, while long-term erosion impacts may impact long-term effectiveness and permanence of the cap.

The proposed alternative, if compared with EPA's selected remedy, would provide less long-term effectiveness and permanence, and poorer reduction of toxicity, mobility and volume of contaminated sediments.

The proposed alternative inappropriately mitigates for lost wetland functions and values through the use of its cap by considering the change in elevation as providing "new habitat types and increased ecotones", and by HBHA Wetland mitigations by allowing contaminated sediments to deposit and accumulate and considering these elevated contaminated sediment new habitat with supplemental vegetation plantings.

Placing cap material over the sediments will impact wetland functions and values, including decreased flood storage capacity, which are not addressed.

The degree of impacts on the wetlands during construction would be similar to EPA's selected remedy. However, the proposed alternative when compared with EPA's selected remedy would result in greater impacts to the wetlands considering it does not construct wetlands to compensate for wetland function and value losses and will reduce flood storage capacity within the watershed.

The proposed installation of vegetation that would be inhospitable to humans to create biological barriers would not adequately protect human health, provide long-term permanence, or reduce toxicity, mobility, or volume of contamination to future accessible deeper/interior wetland sediments.

Biological barriers would be inconsistent with the land use of the property which includes open space (including recreational use, e.g. periodic paint ball games) and future recreational reuse.

Costs to implement and maintain institutional controls were not accounted for in the evaluation of the sediment capping alternative for near-shore sediments.

I. 5. SMC and Pharmacia commented that: "[b]y adapting an integrated approach to site monitoring, monitoring efforts could be focused on arsenic-containing and benzene-containing groundwater discharging from the Industri-plex Superfund Site to surface water in Halls Brook Holding Area Pond, arsenic accumulation in HBHA Pond sediments, the potential for arsenic-containing groundwater from Former Lake

Mishawum to discharge into HBHA Wetland and arsenic flux from Hall Brook Holding area wetland via the surface water pathway (Figure 2). Groundwater discharge from the site would be monitored by installing three well clusters at the north end of HBHA Pond to determine whether or not arsenic concentrations were increasing, decreasing or steady state. Sampling would be conducted quarterly for two years, semiannually for three years and annually thereafter. Sediment sampling would be performed annually at three locations in HBHA Pond (upstream end, center and downstream end) to determine the amount of arsenic sorbed to the sediments and the amount of sorption capacity remaining. Three monitoring well clusters would be installed on the eastern edge of HBHA Wetland to determine if arsenic was mobilized from buried lake bottom sediment and migrating to the wetland. One well cluster would be located at the north end of HBHA Wetland, one well cluster would be located in the center of the wetland and the other well cluster would be located at the south end of the wetland. Sampling would be conducted semiannually for five years, annually for five years and discontinued if arsenic is not discharging to surface water at concentrations that would cause an adverse impact on public health or the environment. To determine arsenic flux from HBHA Wetland, a surface water sampling station would be maintained at the outlet of the wetland to sample monthly baseflow and storms with greater than 0.5 inches of precipitation. Samples would be analyzed for TSS and Total and Dissolved Arsenic."

EPA Response: The monitoring program generally described in EPA's Proposed Plan is the result of combining individual alternatives from the FS, which presented monitoring programs specific to the medium and remedial alternative selected. EPA recognizes that monitoring efficiencies can be realized when a multi-media approach is taken. An EPA-approved monitoring program will be performed consistent with previous RI monitoring methods and procedures so that on-site and off-site contaminant trends and migrations patterns can be adequately evaluated and compared to previous RI data. Monitoring will also be performed to evaluate the performance of the selected remedy. Specific details of the monitoring program will be developed during remedial design process.

J. Questions and Comments Regarding Liability and Enforcement

J. 1. SMC and Pharmacia made repeated claims that EPA's decision-making was "arbitrary and capricious and otherwise not in accordance with law." SMC and Pharmacia further challenge the constitutionality of CERCLA both as drafted and applied, and claim that any effort to compel them to perform or pay for the remedy would constitute a taking without just compensation.

EPA Response: Legal challenges to EPA's decision-making process or to EPA's legal authority are not considered comments on the remedy, but rather comments on the enforcement process and thus are not addressed in this responsiveness summary.

J. 2. SMC and Pharmacia claim that components of the Proposed Alternative are governed by the Consent Decree they entered in 1989 and any attempts to alter the Consent Decree must be approved by the United States District Court for the District of Massachusetts.

EPA Response: Comments regarding the 1989 Consent Decree are not considered comments on the remedy, but rather comments on the enforcement process. However, it should be noted that EPA has carefully reviewed the terms of that settlement and has determined that the selected remedy is fully consistent with that Consent Decree.

J. 3. Several commenters expressed concern that they would be forced to expend funds on actions such as the implementation of institutional controls despite having alleged defenses to liability. One commenter noted that under Massachusetts state law and regulation, parties with defenses to liability have a reduced burden with regard to institutional controls. One commenter suggested that non-liable parties should be granted covenants not to sue or other forms of contribution protection in exchange for implementing institutional controls.

EPA Response: Comments regarding liability are not considered comments on the remedy, but rather comments on the enforcement process and thus are not addressed in this responsiveness summary. See Section B for response to comments re: institutional controls.

J. 4. One commenter asked who would be liable if they incurred damages resulting from response actions on their property.

EPA Response: Comments regarding potential liability from response actions are not addressed in this responsiveness summary. However, whether the response actions are undertaken by EPA or by private parties, EPA will ensure that all contractors are fully insured.

J. 5. One commenter asked how much money has been spent on studies and litigation.

EPA Response: EPA estimates that the various studies supporting this Record of Decisions have cost approximately $10 million. Currently, no litigation costs have been incurred regarding the selected remedy.

K. Questions and Comments Regarding Errors or Omissions in the Feasibility Study

K. 1. The consultant for ASC commented that: "Section 3.4.5.2 (Sediment Retention Area at Northern Portion of the HBHA Pond), on page 3-31, paragraph 2, describes 'construction of a dual low-head cofferdam system starting at the approximate location of the mouth of the Halls Brook and continuing west across HBHA Pond… with the northern portion serving as the sediment retention and secondary polishing area.' It should be noted that Hall Brook enters HBHA on the western shore; thus, if the cofferdam is constructed from the brook outlet across the pond, construction will proceed to the east and not the west.

Page 3-31, paragraph 3, makes reference to 'diffusion from accumulated sediments and subsequent chemocline precipitation.' It is not clear what is meant by these statements and what they refer to. It appears that this phrase was inadvertently appended to the sentence in which it appeared."

EPA response: The comments are acknowledged. However, since the errors do not change the outcome of the FS, the document will not be revised.

K. 2. The consultant for ASC commented that: "[o]n page 3-31, paragraph 3, sentence 3, it is not clear how the sediment storage figure of '2,000 yd^3 of in-place sediment per vertical foot' is arrived at. Is this an estimate arrived at from carefully performed measurements and calculations, or is this simply a rough estimate? EPA should describe how the sediment storage volume was estimated."

EPA Response: The estimate provided is a rough estimate of the in-place volume of sediment that would accumulate over the estimated area of the settling basin that is presented in the FS report. The surface area of the sediment retention basin that is depicted in the FS is approximately 56,000 square feet. One foot of sediment depth represents an average estimate of sediment depth assuming that the sediment thickness will be greater towards the center of the pond and lesser near the shores.

56,000 SF x 1 LF = 56,000 CF
56,000 CF x 1 CY/27 CF = 2,074 CY

K. 3. MassDEP commented that: it "would prefer that the term 'concur' not be used in [Section 2.1.4, on page 78] with reference to the findings of the risk assessment primarily because DEP has a formal concurrence process in relation with the ROD that has not yet occurred. DEP has evaluated the federal and the state risk assessment methodologies and views the EPA risk assessment procedures as equivalent to those that are conducted under the MCP (Method 3), and we in this case consider the remedial goals developed from that process adequate."

EPA Response: The comment is acknowledged. However, since the comment does not change the outcome of the FS, the document will not be revised.

K. 4. MassDEP recommended that: "the last sentence in [Section 2.1.4, on page 78] which refers to institutional controls be moved to another section because arguing the reasonableness of one of the remedial alternatives seems out of place within the ARARs section."

EPA Response: The comment is acknowledged. However, since the comment does not change the outcome of the FS, the document will not be revised.

K. 5. SMC and Pharmacia's consultant commented that: "the PRG equations provided in Appendix A of the FS (USEPA, 2005b), are incorrect on both the risk assessment and simple arithmetic levels."

EPA Response: As noted in the comment, the PRG equations presented in the MSGRP FS are incorrect. However, the numerical PRGs were calculated utilizing the original spreadsheets from the human health risk assessment and are therefore, not impacted. The correct equation will be incorporated into the Record of Decision.

TABLES AND FIGURES

Table G-1

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Current
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
Station WH								
	Arsenic	4.7	3230	mg/kg	12 / 12	1910	mg/kg	95% UCL - T
Station CB-03								
	Arsenic	9.1	1410	mg/kg	12 / 12	595	mg/kg	95% UCL - G

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP);
95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the current chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at each station), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in sediment at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-2

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Station 13/TT-27								
	Benzo(a)pyrene	0.15	1.7	mg/kg	6 / 6	1.3	mg/kg	95% UCL - N
	Arsenic	15.9	4210	mg/kg	9 / 9	3635	mg/kg	95% UCL - G
Station WH								
	Benzo(a)pyrene	1	1	mg/kg	1 / 1	1	mg/kg	Max
	Arsenic	4.7	3230	mg/kg	12 / 12	1910	mg/kg	95% UCL - T
Station NT-3								
	Arsenic	6.6	3230	mg/kg	22 / 22	496	mg/kg	95% UCL - T
Station CB-03								
	Arsenic	9.1	1410	mg/kg	12 / 12	595	mg/kg	95% UCL - G

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP);
95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the most frequently detected COC in sediment at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic, and for the organic chemical benzo(a)pyrene at Station 13/TT-27. Due to the limited amount of sample data for benzo(a)pyrene at Station WH, the maximum detected concentration was used as the default EPC

Table G-3

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment Cores

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
SC02								
	Arsenic	27	1600	mg/kg	4 / 4	1600	mg/kg	Max
SC05								
	Arsenic	210	900	mg/kg	4 / 4	900	mg/kg	Max
SC06								
	Arsenic	66	1700	mg/kg	4 / 4	1700	mg/kg	Max
SC08								
	Arsenic	140	1250	mg/kg	2 / 4	1250	mg/kg	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in sediment cores (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in sediment cores). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC detected in sediment cores at the site. Due to the limited amount of sample data available for arsenic, the maximum detected concentration was used as the default EPC.

Table G-4

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
SO (Former Mishawum Lake Bed Area)	Arsenic	5.7	192	mg/kg	20 / 20	92	mg/kg	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP);
95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in surface soil (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in surface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in surface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-5

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
SO (Former Mishawum								
Lake Bed Area)	Arsenic	1.6	2680	mg/kg	14 / 14	1900	mg/kg	95% UCL - T

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in subsurface soil (i.e., the concentration that will be used to estimate the exposure and risk for each COC in subsurface soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in subsurface soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic.

Table G-6

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Shallow Groundwater

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
Study Area								
	Arsenic	0.252	24432.5	ug/L	93 / 107	3427	ug/L	95% UCL - NP

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in shallow groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in shallow groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that arsenic is the only COC in shallow groundwater at the site. The 95% UCL on the arithmetic mean was used as the EPC for arsenic in shallow groundwater.

Table G-7

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater (All Depths)

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
Study Area								
	1,2-Dichloroethane	0.17	48	ug/L	2 / 153	2.1	ug/L	95% UCL - NP
	Ammonia	49	2710000	ug/L	67 / 92	320000	ug/L	95% UCL - NP
	Benzene	0.1	69000	ug/L	126 / 445	2389	ug/L	95% UCL - NP
	Trichloroethene	0.15	110	ug/L	31 / 153	9.5	ug/L	95% UCL - NP
	Naphthalene	3	220	ug/L	12 / 68	28	ug/L	95% UCL - NP
	Arsenic	0.161	24432.5	ug/L	288 / 357	1130	ug/L	95% UCL - NP

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T); 95% UCL of Normal Data (95% UCL - N); 95% UCL of Non-parametric Data (95% UCL - NP); 95% UCL of Gamma Distributed Data (95% UCL - G); Arithmetic Mean (Mean)

The table represents the chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the inorganic chemical, arsenic, is the most frequently detected COC in groundwater at the site. The 95% UCL on the arithmetic mean was used as the EPC for all COCs detected in groundwater.

Table G-8

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Trichloroethene	4.0E-01	4.0E-01	$(mg/kg\text{-}day)^{-1}$	C-B2	NCEA	01/05/05
Benzo(a)pyrene	7.3E+00	7.3E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	01/05/05
Arsenic (other media)	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	01/05/05
Arsenic (sediment)	7.7E-01	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	Site-specific (1)	

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,2-Dichloroethane	2.6E-05	$(ug/m^3)^{-1}$	N/A	B2	IRIS	01/05/05
Ammonia	N/A	$(ug/m^3)^{-1}$	N/A	D	IRIS	08/01/05
Benzene	7.8E-06	$(ug/m^3)^{-1}$	N/A	A	IRIS	01/05/05
Trichloroethene	1.1E-04	$(ug/m^3)^{-1}$	N/A	C-B2	NCEA	01/05/05
Naphthalene	N/A	$(ug/m^3)^{-1}$	N/A	C	IRIS	01/05/05

Key

N/A: Not applicable

IRIS: Integrated Risk Information System, U.S. EPA

NCEA: National Center for Environmental Assessment, U.S. EPA

CalEPA = California Environmental Protection Agency

(1) The IRIS oral cancer slope factor was adjusted based on the results of a site-specific sediment arsenic bioavailability study.

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - Indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

This table provides the carcinogenic risk information which is relevant to the contaminants of concern in sediment, soil, and groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in this assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants. Three of the COCs are also considered carcinogenic via the inhalation route. Benzo(a)pyrene and arsenic, as non-volatile contaminants, were not included in the evaluation of inhalation exposures.

Table G-9

Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of Rfd: Target Organ (MM/DD/YYYY)
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Immune System	300	IRIS	01/05/05
Trichloroethene	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Liver	3000	NCEA	01/05/05
Benzo(a)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (other media)	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	IRIS	01/05/05
Arsenic (sediment)	Chronic	5.9E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	Site-specific (1)	
Arsenic (other media)	Subchronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	IRIS	01/05/05
Arsenic (sediment)	Subchronic	5.9E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	Site-specific (1)	

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: RfD: Target Organ	Dates (MM/DD/YYYY)
1,2-Dichloroethane	Chronic	5	ug/m^3	N/A	N/A	Liver/Kidney/GI System	3000	NCEA	01/05/05
Ammonia	Chronic	100	ug/m^3	N/A	N/A	Respiratory	30	IRIS	08/01/05
Benzene	Chronic	30	ug/m^3	N/A	N/A	Immune System	300	IRIS	01/05/05
Trichloroethene	Chronic	40	ug/m^3	N/A	N/A	Liver/CNS	3000	NCEA	01/05/05
Naphthalene	Chronic	3	ug/m^3	N/A	N/A	Respiratory	3000	IRIS	01/05/05

Key

N/A - No information available

IRIS - Integrated Risk Information System, U.S. EPA

NCEA - National Center for Environmental Assessment, U.S. EPA

(1) The IRIS oral reference dose was adjusted based on the results of a site-specific sediment arsenic bioavailability study.

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in soil, sediment, and groundwater. Three of the COCs have oral toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. Chronic and subchronic toxicity data available for the three COCs for oral exposures have been used to develop chronic and subchronic oral reference doses (RfDs), provided in this table. The available chronic and subchronic toxicty data indicate that benzene affects the immune system, trichloroethene affects the liver, and arsenic affects the skin. Reference doses are not available for the carcinogenic polycyclic aromatic hydrocarbon, benzo(a)pyrene. Dermal RfDs are not available for any of the COCs. As was the case for the carcinogenic data, dermal RfDs can be extrapolated from oral RfDs by applying an adjustment factor as appropriate. However, no adjustment is necessary for any of the COCs, and the oral RfDs discussed were used as the dermal RfDs for all COCs. Inhalation reference concentrations (RfCs) are available for the five volatile COCs evaluated for the inhalation pathway. Benzo(a)pyrene and arsenic, as a non-volatile contaminants, were not included in the evaluation of inhalation exposures.

Table G-10

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station WH	Arsenic	Skin	2E+00	- -	5E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment	Station CB-03	Arsenic	Skin	2E+00	- -	6E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the current child and adult recreational user exposed to sediment. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 2 for Station WH and 3 for Station CB-03 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated sediment containing arsenic.

Table G-11

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station 13/TT-27	Benzo(a)pyrene	2E-06	- -	1E-06	3E-06
			Arsenic	5E-04	- -	2E-04	7E-04
						Sediment Risk Total =	7E-04
Sediment	Sediment	Station WH	Benzo(a)pyrene	1E-06	- -	1E-06	2E-06
			Arsenic	3E-04	- -	9E-05	4E-04
						Sediment Risk Total =	4E-04
						Total Risk =	N/A

Key

-- Route of exposure is not applicable to this medium.

N/A - Not applicable. Summing of sediment risks across exposure points is not applicable since risks were estimated assuming all of a receptor's exposure occurred at each station.

This table provides risk estimates for the significant routes of exposure for the future child and adult recreational user. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to sediment, as well as the toxicity of the COCs (benzo(a)pyrene and arsenic). The total risk from direct exposure to contaminated sediment at this site to a future child and adult recreational user is estimated to be 7×10^{-4} for Station 13/TT-27 and 4×10^{-4} for Station WH. The COC contributing most to this risk level is arsenic in sediment. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 7 in 10,000 and 4 in 10,000 of developing cancer as a result of site-related exposure to the COCs at Stations 13/TT-27 and WH, respectively.

Table G-12

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Recreational User
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment	Station 13/TT-27	Arsenic	Skin	9E+00	- -	3E+00	1E+01
							Sediment Hazard Index Total =	1E+01
							Skin Hazard Index =	1E+01
Sediment	Sediment	Station WH	Arsenic	Skin	5E+00	- -	2E+00	6E+00
							Sediment Hazard Index Total =	6E+00
							Skin Hazard Index =	6E+00
Sediment	Sediment	Station NT-3	Arsenic	Skin	1E+00	- -	4E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment	Station CB-03	Arsenic	Skin	2E+00	- -	6E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future child and adult recreational user. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 10, 6, 2, and 3 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated sediment containing arsenic at Stations 13/TT-27, WH, NT-3, and CB-03, respectively.

Table G-13

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Dredger
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Sediment	Sediment Cores	SC02	Arsenic	Skin	4E+00	- -	7E-01	4E+00
							Sediment Hazard Index Total =	4E+00
							Skin Hazard Index =	4E+00
Sediment	Sediment Cores	SC05	Arsenic	Skin	2E+00	- -	4E-01	2E+00
							Sediment Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Sediment	Sediment Cores	SC06	Arsenic	Skin	4E+00	- -	7E-01	4E+00
							Sediment Hazard Index Total =	4E+00
							Skin Hazard Index =	4E+00
Sediment	Sediment Cores	SC08	Arsenic	Skin	3E+00	- -	5E-01	3E+00
							Sediment Hazard Index Total =	3E+00
							Skin Hazard Index =	3E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future dredging worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 4, 2, 4, and 3 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated sediment cores containing arsenic at locations SC02, SC05, SC06, and SC08, respectively.

Table G-14

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Day Care Child
Receptor Age: Young Child (ages 1-6)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	1E-03	- -	1E-04	1E-03
						Soil Risk Total =	1E-03
						Total Risk =	1E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future day care child. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an child's exposure to subsurface soil, as well as the toxicity of the COC (arsenic). The total risk from direct exposure to contaminated subsurface soil at this site to a future day care child is estimated to be 1×10^{-3}. The only COC contributing to this risk level is arsenic in subsurface soil. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 1 in 1,000 of developing cancer as a result of site-related exposure to arsenic.

Table G-15

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Day Care Child
Receptor Age: Young Child (ages 1-6)

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	2E+00	- -	1E-01	2E+00
							Soil Hazard Index Total =	2E+00
							Skin Hazard Index =	2E+00
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	3E+01	- -	3E+00	4E+01
							Soil Hazard Index Total =	4E+01
							Skin Hazard Index =	4E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future day care child. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 2 and 40 indicate that the potential for adverse noncancer effects could occur from exposure to contaminated surface and subsurface soil, respectively, containing arsenic.

Table G-16

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	SO (Former Mishawum Lake Bed Area)	Arsenic	Skin	6E+00	2E-01	6E-01	7E+00
							Soil Hazard Index Total =	7E+00
Groundwater	Shallow Groundwater	Study Area	Arsenic	Skin	3E+00	- -	2E-01	3E+00
							Groundwater Hazard Index Total =	3E+00
							Receptor Hazard Index =	1E+01
							Skin Hazard Index =	1E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future construction worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 10 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated subsurface soil and shallow groundwater containing arsenic.

Table G-17

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Study Area					
			1,2-Dichloroethane	- -	1E-05	- -	1E-05
			Benzene	2E-05	4E-03	4E-05	4E-03
			Trichloroethene	7E-07	2E-04	1E-06	2E-04
			Arsenic	3E-04	- -	2E-05	3E-04
						Groundwater Risk Total =	5E-03
						Total Risk =	5E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future industrial worker exposed to groundwater used as process water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an industrial worker's exposure to groundwater, as well as the toxicity of the COCs (1,2-dichloroethane, benzene, trichloroethene, and arsenic). The total risk from direct exposure to contaminated groundwater at this site to a future industrial worker is estimated to be 5×10^{-3}. The COCs contributing most to this risk level are benzene, trichloroethene, and arsenic in groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 5 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-18

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Study Area	Benzene	Immune System	- -	5E+01	- -	5E+01
			Naphthalene	Respiratory	- -	6E+00	- -	6E+00
			Arsenic	Skin	2E+00	- -	1E-01	2E+00
							Groundwater Hazard Index Total =	6E+01
							Immune System Hazard Index =	5E+01
							Respiratory Hazard Index =	6E+00
							Skin Hazard Index =	2E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future industrial worker exposed to groundwater used as process water. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 50 and 2 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing benzene, naphthalene, and arsenic.

Table G-19

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Car Wash Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	Study Area	1,2-Dichloroethane	- -	1E-05	- -	1E-05
			Benzene	- -	6E-03	- -	6E-03
			Trichloroethene	- -	3E-04	- -	3E-04
						Groundwater Risk Total =	6E-03
						Total Risk =	6E-03

Key

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future car wash worker. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a car wash worker's exposure to groundwater, as well as the toxicity of the COCs (1,2-dichloroethene, benzene, and trichloroethene). The total risk from direct exposure to contaminated groundwater at this site to a future car wash worker is estimated to be 6×10^{-3}. The COCs contributing most to this risk level are benzene and trichloroethene. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 6 in 1,000 of developing cancer as a result of site-related exposure to the COCs.

Table G-20

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Car Wash Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	Study Area						
			Ammonia	Respiratory	- -	9E+01	- -	9E+01
			Benzene	Immune System	- -	7E+01	- -	7E+01
			Naphthalene	Respiratory	- -	5E+00	- -	5E+00
							Groundwater Hazard Index Total =	2E+02
							Immune System Hazard Index =	7E+01
							Respiratory Hazard Index =	9E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future car wash worker. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs of 90 and 5 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing ammonia, benzene, and naphthalene.

Table G-21

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Surface Water

Chemical	Frequency of Detection	Maximum Detected Concentration[1] (u g/L)	Location of Maximum Detected Conc.	Screening Criterion (u g/L)	Type	COPC? [2]	Reason for Exclusion
Aluminum	6 / 133	37	IPSW-08-00-051602FT	87	Freshwater Chronic NAWQC	No	DF, BSV
Antimony	10 / 133	4	IPSW-09-051502FT	30	SCV	No	BSV
Arsenic	63 / 133	13	IPSW-05-051502FT	150	Freshwater Chronic NAWQC [3]	No	BSV
Barium	132 / 133	**63**	IPSW-08-091002FT	4	Tier II	Yes	
Beryllium	6 / 133	0.25	IPSW-08-00-072502FT	5.3	Tier II	No	DF, BSV
Cadmium	7 / 133	**0.31**	IPSW-09-042602FT	0.27	Freshwater Chronic NAWQC [4]	Yes	
Calcium	133 / 133	58,100	IPSW-05-111901FT	NA	NA	No	Nutrient
Chromium	62 / 133	2.9	IPSW-06-042602FT	83.7	Freshwater Chronic NAWQC [4,5]	No	BSV
Cobalt	29 / 133	2.1	IPSW-05-102502FT	3	Tier II	No	BSV
Copper	56 / 133	**52**	IPSW-06-042602FT	10.2	Freshwater Chronic NAWQC [4]	Yes	
Iron	69 / 133	**1,480**	IPSW-05-071401FT	1,000	Freshwater Chronic NAWQC	Yes	
Lead	8 / 133	**3.8**	IPSW-08-00-083102FT	3.0	Freshwater Chronic NAWQC [4]	Yes	
Magnesium	133 / 133	9,280	IPSW-05-111901FT	NA	NA	No	Nutrient
Manganese	118 / 133	**770**	SW-MC-13-0	80	Tier II	Yes	
Mercury	10 / 133	0.17	IPSW-06-080602FT	0.77	Freshwater Chronic NAWQC	No	BSV
Nickel	67 / 133	2.7	IPSW-09-071401FT	59	Freshwater Chronic NAWQC [4]	No	BSV
Potassium	132 / 132	7,690	IPSW-05-021502FT	NA	NA	No	Nutrient
Selenium	8 / 133	2.7	IPSW-05-062002FT	4.61	Freshwater Chronic NAWQC	No	BSV
Silver	7 / 133	**0.55**	IPSW-10-051502FT	0.12	Tier II	Yes	
Sodium	132 / 132	144,000	IPSW-06-021502FT	NA	NA	No	Nutrient
Thallium	7 / 133	3.6	IPSW-06-102502FT	12	SCV	No	BSV
Vanadium	14 / 133	2.0	IPSW-09-071401FT	19	Tier II	No	BSV
Zinc	105 / 133	121	IPSW-05-121701FT	134	Freshwater Chronic NAWQC [4]	No	BSV

Notes:

[1] Dissolved (filtered) concentrations.

[2] Analytes with maximum detected concentrations exceeding screening criteria were included as Chemicals of Potential Concern (COPCs).

[3] Value reported for arsenic $^{3+}$.

[4] Metals criteria were adjusted to a site-specific hardness value 116 mg/L as $CaCO_3$ using equations provided in USEPA, 2002.

[5] Value reported for chromium $^{3+}$, it is assumed that chromium in surface water is present in reduced form.

COPC - Chemical of Potential Concern

NAWQC - National Ambient Water Quality Criterion (USEPA 1986a,b; 1987; 1992a, 1998, 2002).

SCV - Secondary Chronic Value as presented in Suter and Tsao (1996).

Tier II - Ecotox Thresholds Great Lakes Water Quality Initiative Tier II Methodology (USEPA, 1996).

NA - Screening criterion Not Available

BSV - Below Screening Value

DF - Detection Frequency < 5%

A bolded value indicates that a maximum detected concentration exceeds screening benchmarks.

Table G-22

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Surface Water

Chemical	Frequency of Detection	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Conc.	Screening Criterion (ug/L)	Type	COPC?	Reason for Exclusion
Benzene	2 / 10	190	SW-MC-05-10.8-D	46	Tier II	Yes	
Chlorobenzene	2 / 10	4.0	SW-MC-05-10.8-D	130	Tier II	No	BSV
cis-1,2-Dichloroethene	7 / 10	13	SW-MC-05-10.8-D	590	SCV	No	BSV
Toluene	1 / 10	4.0	SW-MC-06-0	130	Tier II	No	BSV
Trichloroethene	6 / 10	4.0	SW-MC-05-10.8-D	350	Tier II	No	BSV
Vinyl Chloride	2 / 10	3.0	SW-MC-05-10.8-D	NA	NA	Yes	
Xylene, m/p-	1 / 10	2.0	SW-MC-05-10.8-D	13	SCV	No	BSV
Anthracene	1 / 28	0.1	SW-09-IP	0.73	SCV	No	BSV/DF
Benzoic acid	3 / 9	69	SW-04-IP	42	SCV	Yes	
bis(2-Ethylhexyl)phthalate	1 / 28	120	SW-09-IP	32	Tier II	Yes	
Cyclohexanone	6 / 18	290	SW-04-IP	NA	NA	Yes	
Diethylphthalate	5 / 28	0.3	SW-09-IP	220	Tier II	No	BSV
Di-n-Butylphthalate	2 / 28	0.2	SW-04-IP	33	Tier II	No	BSV
Di-n-octylphthalate	1 / 28	0.3	SW-09-IP	NA	NA	No	DF
Fluoranthene	2 / 28	0.6	SW-09-IP	NA	NA	Yes	
Phenol	3 / 28	7	SW-04-IP	NA	NA	Yes	
Pyrene	2 / 28	0.4	SW-09-IP	NA	NA	Yes	
Aluminum	6 / 75	82	IPSW-02-010402FT	87	Freshwater Chronic NAWQC	No	BSV
Antimony	10 / 75	4.4	IPSW-02-111901FT	30	SCV	No	BSV
Arsenic	73 / 93	120	SW-MC-05-10.8-D	150	Freshwater Chronic NAWQC[2]	No	BSV
Barium	73 / 75	44.2	IPSW-02-111901FT	4	Tier II	Yes	
Beryllium	5 / 75	0.37	IPSW-04-00-072502FT	5.3	Tier II	No	BSV
Cadmium	6 / 75	0.84	IPSW-02-062002FT	0.34	Freshwater Chronic NAWQC[3]	Yes	
Chromium	44 / 75	10	SW-MC-05-10.8-D	109.5	Freshwater Chronic NAWQC[3,4]	No	BSV
Cobalt	28 / 75	5.0	SW-MC-07-9.8-D	3	Tier II	Yes	
Copper	38 / 75	7.4	IPSW-02-111901FT	13.5	Freshwater Chronic NAWQC[3]	No	BSV
Iron	61 / 75	27,000	SW-MC-05-10.8-D	1,000	Freshwater Chronic NAWQC	Yes	
Lead	9 / 75	1.4	IPSW-04-00-051602FT	4.2	Freshwater Chronic NAWQC[3]	No	BSV
Manganese	75 / 75	1,500	SW-MC-05-10.8-D	80	Tier II	Yes	
Mercury	6 / 75	0.10	IPSW-03-092502FT	0.77	Freshwater Chronic NAWQC	No	BSV
Nickel	52 / 75	7.0	SW-MC-05-10.8-D	78	Freshwater Chronic NAWQC[3]	No	BSV
Selenium	5 / 75	1.6	IPSW-04-00-092502FT	4.61	Freshwater Chronic NAWQC	No	BSV
Silver	5 / 75	0.40	IPSW-04-00-101802FT	0.36	SCV	Yes	
Thallium	6 / 75	2.7	IPSW-02-072502FT	12	SCV	No	BSV
Vanadium	12 / 75	19	SW-MC-05-10.8-D	19	Tier II	No	BSV
Zinc	73 / 75	380	SW-MC-05-0-S	177	Freshwater Chronic NAWQC[3]	Yes	
Supplemental Data Set							
Benzene[5]	54 / 67	2530	NML-8-09/04	46	Tier II	Yes	
Arsenic[5]	47 / 51	5043	NML-8-09/01	150	Freshwater Chronic NAWQC[2]	Yes	
Ammonia[6]	85 / 127	2110	NML-10-09/01	2.9	Freshwater Chronic NAWQC[7]	Yes	

Notes:

[1] Analytes with maximum detected concentrations exceeding screening criteria were included as Chemicals of Potential Concern (COPCs).

[2] Value reported for arsenic $^{3+}$.

[3] Metals criteria adjusted for hardness (161 mg/L as $CaCO_3$) using equations provided in USEPA, 2002.

[4] Value reported for chromium $^{3+}$, it is assumed that chromium in surface water is present in reduced form.

[5] Data set compiled for natural attenuation report presented in Appendix 2D of RI report. Benzene data from Tables 1 to 3 of Appendix G of natural attenuation report; Arsenic data from Tables D.4 and D.5 of natural attenuation report.

[6] Data set compiled for Technical Memorandum, Evaluation of Supplemental Data (TtNUS, 2005c). Ammonia data from Table 4.1 of the Technical Memorandum.

[7] Ammonia criterion adjusted for pH and temperature using equations provided in USEPA, 2002.

COPC - Chemical of Potential Concern

NAWQC - National Ambient Water Quality Criterion (USEPA 1986a,b; 1987; 1992a, 1998, 2002).

SCV - Secondary Chronic Value as presented in Suter and Tsao (1996).

Tier II - Ecotox Thresholds Great Lakes Water Quality Initiative Tier II Methodology (USEPA, 1996).

NA - Screening criterion Not Available

BSV - Below Screening Value

DF - Detection Frequency < 5%

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion [3]
				Conc. (mg/kg)	Type [1]		
1,1,1-Trichloroethane	3 / 100	110	SD-TT-30-01-TR	na	na	No	DF
1,1,2-Trichloro-1,2,2-trifluoroethane	1 / 5	37.5	SD-UF-02-TR	na	na	No	LC
1,1-Dichloroethane	1 / 87	3	SD-18-01-FW	27	SCV	No	BSV/DF
1,2-Dichloroethene(total)	8 / 65	59	SD-18-01-FW	400	SCV	No	BSV
2-Butanone	22 / 71	290	SD-19-01-FW	270	SCV	Yes	
Acetone	22 / 81	7300	SD-TT-30-01-TR	8.7	SCV	Yes	
Benzene	8 / 87	22	SD-21-01-ME	57	SQB	No	BSV
Carbon Disulfide	3 / 63	29	SD-10-02-TR	0.85	SCV	No	DF
cis -1,2-Dichloroethene	18 / 28	562	SD-20-01-ME	400	SCV	Yes	
Ethylbenzene	4 / 87	9	SD-06-03-ME	3600	SQB	No	BSV/DF
Methyl Acetate	4 / 6	530	SD-TT-30-01-TR	na	na	No	LC
Methylene chloride	2 / 101	100	SD-22-03-FW	370	SCV	No	BSV/DF
Naphthalene	3 / 26	208	SD-21-01-ME	480	ERL	No	BSV
Tetrachloroethene	5 / 90	3164	SD-22-02-ME	530	SQB	Yes	
Toluene	3 / 63	22	SD-TT-30-01-TR	670	SQB	No	BSV/DF
trans -1,2-Dichloroethene	1 / 28	387	SD-11-01-ME	400	SCV	No	BSV/DF
Trichloroethene	18 / 91	2025	SD-20-01-ME	1600	SQB	Yes	
Vinyl chloride	2 / 87	255	SD-11-01-ME	na	na	No	DF
Xylene, m/p-	2 / 28	25	SD-06-03-ME	25	SQB	No	BSV
2-Methylnaphthalene	28 / 98	220	SD-09-06-FW	70	ERL	Yes	
Acenaphthene	39 / 99	520	SD-09-06-FW	620	SQC	No	BSV
Acenaphthylene	38 / 98	480	SD-07-10-FW	44	ERL	Yes	
Anthracene	55 / 99	1300	SD-06-03-FW	220	LEL	Yes	
Benzo(a)anthracene	85 / 109	9600	SD-07-10-ME	320	LEL	Yes	
Benzo(a)pyrene	84 / 106	10000	SD-07-10-ME	430	ERL	Yes	
Benzo(b)fluoranthene	95 / 116	16000	SD-07-10-ME	240	LEL [4]	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Benzo(g,h,i)perylene	62 / 103	5300	SD-07-10-ME	170	LEL	Yes	
Benzo(k)fluoranthene	84 / 109	14000	SD-07-05-FW	240	LEL	Yes	
bis(2-ethylhexyl)phthalate	49 / 89	13000	SD-07-05-FW	890000	SCV	No	BSV
Butylbenzylphthalate	9 / 74	620	SD-07-05-FW	11000	SQB	No	BSV
Carbazole	19 / 74	680	SD-07-09-FW	na	na	Yes	
Chrysene	88 / 110	10000	SD-07-10-ME	340	LEL	Yes	
Di-n-octylphthalate	3 / 73	430	SD-07-05-FW	na	na	No	DF
Dibenz(a,h)anthracene	42 / 100	2000	SD-07-10-ME	60	LEL	Yes	
Dibenzofuran	8 / 72	500	SD-09-06-FW	2000	SQB [5]	Yes	
Diethylphthalate	1 / 72	240	SD-07-04-FW	567	SQB [6]	No	BSV/DF
Fluoranthene	102 / 116	23000	SD-07-10-ME	2900	SQC	Yes	
Fluorene	46 / 99	810	SD-09-06-FW	540	SQB	Yes	
Indeno(1,2,3-cd)pyrene	69 / 106	6900	SD-07-10-ME	200	LEL	Yes	
N-nitrosodiphenylamine	7 / 75	560	SD-10-01-FW	na	na	Yes	
Naphthalene	36 / 99	2500	SD-21-02-FW	480	SQB	Yes	
Phenanthrene	81 / 106	12000	SD-07-10-ME	850	SQC	Yes	
Pyrene	100 / 114	15000	SD-07-10-ME	660	ERL	Yes	
4,4'-DDD	74 / 111	310	SD-13-03-ME	8	LEL	Yes	
4,4'-DDE	91 / 115	160	SD-10-01-ME	5	LEL	Yes	
4,4'-DDT	62 / 104	47	SD-07-10-FW	1.6	ERL	Yes	
Aldrin	23 / 96	18	SD-10-01-ME	2	LEL	Yes	
alpha-BHC	14 / 98	2.7	SD-07-02-FW	6	LEL	No	BSV
alpha-Chlordane	71 / 111	93	SD-13-03-ME	7	LEL	Yes	
Aroclor-1248	26 / 103	560	SD-10-01-ME	30	LEL	Yes	
Aroclor 1254	10 / 103	2600	SD-JY-07	60	LEL	Yes	
Aroclor-1260	38 / 105	2400	SD-JY-07	5	LEL	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion		COPC?[2]	Reason for Exclusion[3]
				Conc. (mg/kg)	Type[1]		
beta-BHC	19 / 101	6.6	SD-07-07-FW	5	LEL	Yes	
delta-BHC	21 / 95	25	SD-06-03-FW	3	LEL[7]	Yes	
Dieldrin	54 / 103	20	SD-14-03-FW	52	SQC	No	BSV
Endosulfan I	23 / 105	68	SD-21-01-FW	2.9	SQB	Yes	
Endosulfan II	23 / 96	8.4	SD-07-09-FW	14	SQB	No	BSV
Endosulfan Sulfate	9 / 94	3.9	SD-07-04-FW	na	na	Yes	
Endrin	43 / 101	17	SD-06-03-ME	20	SQC	No	BSV
Endrin Aldehyde	34 / 97	27	SD-07-02-ME	na	na	Yes	
Endrin Ketone	4 / 93	2.9	SD-08-02-FW	na	na	No	DF
gamma-BHC (Lindane)	4 / 93	1.4	SD-07-02-FW	3.7	SQB	No	BSV/DF
gamma-Chlordane	66 / 108	650	SD-13-03-ME	0.5	ERL	Yes	
Heptachlor	12 / 93	1.6	SD-07-06-FW	68	SCV	No	BSV
Heptachlor Epoxide	21 / 96	4.9	SD-22-01-FW	5	LEL	No	BSV
Methoxychlor	3 / 93	12	SD-07-10-FW	19	SQB	No	BSV/DF
Aluminum	341 / 355	34400	SD-13-02-FW	25500	TEL	Yes	
Antimony	196 / 317	329	SD-TT-22-01	2	ERL	Yes	
Arsenic	338 / 353	4550	SD-12-03-ME	8.2	ERL	Yes	
Barium	339 / 355	3420	SD-WW-11	na	na	Yes	
Beryllium	280 / 351	2.9	SD-19-01-ME	na	na	Yes	
Cadmium	302 / 354	37.7	SD-01-06-FW	1.2	ERL	Yes	
Chromium	351 / 355	24600	SD-WW-08	81	ERL	Yes	
Cobalt	351 / 355	130	SD-CB-03-06	50	LEL*	Yes	
Copper	351 / 355	3760	SD-TT-30-03	34	ERL	Yes	
Cyanide	57 / 122	12.1	SD-WS-08	0.1	LEL*	Yes	
Iron	351 / 355	258000	SD-19-01-TR	20000	LEL	Yes	
Lead	351 / 355	41000	SD-TT-22-01	47	ERL	Yes	

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Manganese	351 / 355	3060	SD-UM-02	460	LEL	Yes	
Mercury	300 / 344	89.2	SD-TT-30-03	0.15	ERL	Yes	
Nickel	338 / 355	177	SD-CB-04-03	21	ERL	Yes	
Selenium	223 / 351	30.3	SD-12-03-ME	na	na	Yes	
Silver	104 / 320	11.5	SD-CB-04-02	0.5	LEL*	Yes	
Thallium	148 / 331	18.1	SD-BW-03	na	na	Yes	
Vanadium	341 / 355	180	SD-UM-02	na	na	Yes	
Zinc	350 / 355	8750	SD-CB-04-03	120	LEL	Yes	

Notes:

[1] SCV, SQB, and SQCs based on 1% sediment organic carbon content; where SCV, SQBs and SQCs are used, sediment organic carbon content was greater than 1%, unless indicated otherwise

[2] Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.

[3] Reasons for exclusion were that the maximum level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).

[4] Screening value for benzo(k)fluoranthene

[5] Organic carbon content at SD-09-06-FW was 0.1%; if the SQB were adjusted based on 0.1% organic carbon content, the maximum level of dibenzofuran would be greater than the screening criterion.

[6] SQB was adjusted downward for organic carbon content at SD-01-07-FW (0.9%)

[7] Value for BHC in Persaud *et al.* (1993)

DF - detection frequency
BSV - below screening value
LC - laboratory contaminant
ERL - NOAA Effects Range-Low (Long *et al*., 1995; Long and Morgan, 1990)
SCV - Secondary Chronic Value (Jones *et al*., 1997)
SQC - USEPA Sediment Quality Criterion (USEPA, 1993 b,c) - used for endrin and dieldrin only
SQB - USEPA Office of Solid Waste and Emergency Response Sediment Quality Benchmark (USEPA, 1996)

Table G-23							
Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)							
Study Area: Wells G&H Superfund Site - Aberjona River Study - OU3 - Aberjona River Study Area **Medium: Sediment**							
Chemical	**Frequency of Detection**	**Maximum Detected Concentration (mg/kg)**	**Location of Maximum Detected Conc.**	**Screening Criterion**		**COPC?[2]**	**Reason for Exclusion [3]**
				Conc. (mg/kg)	**Type [1]**		

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al*., 1993)

LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)

TEL - Threshold Effects Level (Buchman, 1999)

na - not available

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
1,1-Dichloroethane	2 / 8	0.045	SD-MC-07	0.027	SCV	Yes	
2-Butanone	3 / 8	0.52	SD-MC-05	0.27	SCV	Yes	
Acetone	8 / 8	2.3	SD-MC-05	0.0087	SCV	Yes	
Benzene	4 / 8	46	SD-MC-05	0.057	SQB	Yes	
Carbon Disulfide	4 / 8	0.060	SD-MC-05	0.00085	SCV	Yes	
Chlorobenzene	1 / 8	0.026	SD-MC-05	0.82	SQB	No	BSV
cis-1,2-Dichloroethene	3 / 8	0.036	SD-MC-05	0.40	SCV	No	BSV
Ethylbenzene	1 / 8	0.50	SD-MC-05	3.6	SQB	No	BSV
Toluene	1 / 8	0.093	SD-MC-05	0.67	SQB	No	BSV
Trichloroethene	2 / 8	0.016	SD-MC-05	1.6	SQB	No	BSV
Vinyl Chloride	1 / 8	0.013	SD-MC-05	na	na	Yes	
Xylene, m/p-	1 / 8	2.4	SD-MC-05	0.025	SQB	Yes	
Xylene, o-	1 / 8	0.30	SD-MC-05	0.16	SCV	Yes	
2-Methylphenol	1 / 8	0.38	SD-MC-05	0.012	SCV	Yes	
Acenaphthene	5 / 8	0.80	SD-MC-05	0.62	SQC	Yes	
Acenaphthylene	3 / 8	0.11	SD-MC-13	0.044	ERL	Yes	
Anthracene	6 / 8	1.2	SD-MC-05	0.22	LEL	Yes	
Benzo(a)anthracene	8 / 8	4.9	SD-MC-05	0.32	LEL	Yes	
Benzo(a)pyrene	8 / 8	7.2	SD-MC-11	0.43	ERL	Yes	
Benzo(b)fluoranthene	8 / 8	10	SD-MC-05	0.24	LEL [4]	Yes	
Benzo(g,h,i)perylene	8 / 8	4.1	SD-MC-05	0.17	LEL	Yes	
Benzo(k)fluoranthene	8 / 8	8.3	SD-MC-05	0.24	LEL	Yes	
bis(2-Ethylhexyl)phthalate	8 / 8	37	SD-MC-06	890	SCV	No	BSV
Butylbenzylphthalate	1 / 8	0.14	SD-MC-13	11	SQB	No	BSV
Carbazole	6 / 8	2.1	SD-MC-05	na	na	Yes	
Chrysene	8 / 8	10	SD-MC-05	0.34	LEL	Yes	

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Dibenz(a,h)anthracene	8 / 8	1.2	SD-MC-11	0.060	LEL	Yes	
Dibenzofuran	4 / 8	0.83	SD-MC-05	2.0	SQB	No	BSV
Diethylphthalate	2 / 8	0.46	SD-MC-11	0.63	SQB	No	BSV
Fluoranthene	8 / 8	19	SD-MC-05	2.9	SQC	Yes	
Fluorene	5 / 8	1.3	SD-MC-05	0.54	SQB	Yes	
Indeno(1,2,3-cd)pyrene	8 / 8	5.2	SD-MC-05	0.20	LEL	Yes	
Naphthalene	5 / 8	0.83	SD-MC-05	0.48	SQB	Yes	
N-Nitrosodiphenylamine	4 / 8	0.17	SD-MC-11	na	na	Yes	
Phenanthrene	8 / 8	10	SD-MC-05	0.85	SQC	Yes	
Phenol	2 / 8	0.55	SD-MC-05	na	na	Yes	
Pyrene	8 / 8	14	SD-MC-11	0.66	ERL	Yes	
4,4'-DDD	3 / 8	0.022	SD-MC-06	0.0080	LEL	Yes	
4,4'-DDE	2 / 8	0.017	SD-MC-13	0.0050	LEL	Yes	
4,4'-DDT	1 / 8	0.013	SD-MC-13	0.0016	ERL	Yes	
alpha-Chlordane	1 / 8	0.092	SD-MC-06	0.0070	LEL	Yes	
gamma-Chlordane	1 / 8	0.093	SD-MC-06	0.00050	ERL	Yes	
Aluminum	68 / 68	19,900	AR04	25,500	TEL	No	BSV
Antimony	37 / 51	20	AR04	2	ERL	Yes	
Arsenic	68 / 68	2,390	SD-MC-07	8.2	ERL	Yes	
Barium	68 / 68	227	HB02-12	na	na	Yes	
Beryllium	52 / 68	2.0	HB02-03	na	na	Yes	
Cadmium	67 / 68	45	HB02-10	1.2	ERL	Yes	
Chromium	68 / 68	1,120	AR04	81	ERL	Yes	
Cobalt	68 / 68	136	HB02-03	50	LEL*	Yes	
Copper	68 / 68	2,000	HB01-05	34	ERL	Yes	

Table G-24

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - Sitewide
Medium: Sediment

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Iron	68 / 68	233,000	HB02-11	20000	LEL	Yes	
Lead	68 / 68	672	HB01-04	47	ERL	Yes	
Manganese	68 / 68	3,900	HB02-11	460	LEL	Yes	
Mercury	59 / 65	3.8	SD-MC-09	0.15	ERL	Yes	
Nickel	68 / 68	55	HB02-03	21	ERL	Yes	
Selenium	65 / 68	20	AR04	na	na	Yes	
Silver	55 / 68	19	AR05	0.5	LEL*	Yes	
Thallium	31 / 51	18	HB02-11	na	na	Yes	
Vanadium	68 / 68	84	HB02-17	na	na	Yes	
Zinc	68 / 68	12,900	HB01-08	150	ERL	Yes	
Chromium VI	68 / 68	12	AR04	na	na	Yes	

Notes:

[1] SCVs, SQBs, and SQCs based on 1% sediment organic carbon content; actual sediment organic carbon content is greater than 1% at all sample locations.

[2] Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.

[3] Reasons for exclusion were that the maximum detected level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).

[4] Screening value for benzo(k)fluoranthene

DF - detection frequency
BSV - below screening value
COPC - Contaminant of potential ecological concern
ERL - NOAA Effects Range-Low (Long *et al*., 1995; Long and Morgan, 1990)
SCV - Secondary Chronic Value (Jones *et al*., 1997)
SQC - USEPA Sediment Quality Criterion (USEPA, 1996)
SQB - USEPA Office of Solid Waste and Emergency Response Sediment Quality Benchmark (USEPA, 1996)

Table G-24							
Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)							
Study Area: Industri-Plex Superfund Site - Sitewide							
Medium: Sediment							
Chemical	**Frequency of Detection**	**Maximum Detected Concentration (mg/kg)**	**Location of Maximum Detected Conc.**	**Screening Criterion**		**COPC?[2]**	**Reason for Exclusion [3]**
				Conc. (mg/kg)	**Type [1]**		

LEL - Ontario Ministry of Environment and Energy Lowest Effect Level (Persaud *et al*., 1993)

LEL*- Ontario Ministry of Environment and Energy Lowest Effect Level (OME, 1996)

TEL - Threshold Effects Level (Buchman, 1999)

na - not available

Table G-25

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Industri-Plex Superfund Site - A6 and HB03 areas
Medium: Soil

Chemical	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Criterion Conc. (mg/kg)	Screening Criterion Type [1]	COPC?[2]	Reason for Exclusion [3]
Aluminum	23 / 23	6530	A612 (0-1)	na	na	Yes	pH[4]
Antimony	14 / 23	50	A608 (0-1)	0.248	Mammal	Yes	
Arsenic	23 / 23	719	A608 (0-1)	0.25	Mammal	Yes	
Barium	23 / 23	535	A608 (0-1)	17.2	Avian	Yes	
Beryllium	10 / 23	0.30	HB04-02 (0-0.5)	2.42	Mammal	No	BSV
Cadmium	17 / 19	2.3	A607 (0-1)	0.38	SSL (Mammal	Yes	
Chromium	23 / 23	2680	A610 (0-1)	0.4	Mammal	Yes	
Cobalt	23 / 23	11	A608 (0-1)	13	SSL (Phyto)	No	BSV
Copper	23 / 23	611	A608 (0-1)	38.9	Avian	Yes	
Iron	23 / 23	66900	A608 (0-1)	na	na	Yes	pH[5]
Lead	23 / 23	5200	A608 (0-1)	0.94	Avian	Yes	
Manganese	23 / 23	353	A606 (0-1)	322	Mammal	Yes	
Mercury	21 / 23	9.6	A608 (0-1)	0.1	Earthworm	Yes	
Nickel	23 / 23	17	A611 (0-1)	30	Phyto	No	BSV
Selenium	12 / 23	7.6	A608 (0-1)	0.331	Avian	Yes	
Silver	8 / 23	17	A608 (0-1)	2	Phyto	Yes	
Thallium	19 / 23	42	A608 (0-1)	0.027	Mammal	Yes	
Vanadium	23 / 23	37	A611 (0-1)	0.714	Mammal	Yes	
Zinc	23 / 23	901	A610 (0-1)	12	Mammal	Yes	
Chromium VI	15 / 23	45	A610 (0-1)	12	Mammal	Yes	

Notes:
[1] Value in parentheses indicates the depth interval of soil core.
[2] Analytes with maximum detected concentrations exceeding screening criteria were included in the BERA.
[3] Reasons for exclusion were that the maximum detected level was below the screening value (BSV) and/or the frequency of detection was less than or equal to 5% (DF).
[4] Aluminum is identified as a COPC only for soils with a pH <5.5 (EPA, 2003b). Because soil pH data was not available for this location, aluminum was retained as a COPC.
[5] At soil pH values between 5 and 8, iron is generally not toxic (EPA, 2003b). Because soil pH data was not available for this location, iron was retained as a COPC.

DF - detection frequency
BSV - below screening value
COPC - Contaminant of potential ecological concern
SSL - EPA Interim Final Ecological Soil Screening Level (EPA 2003b)
Mammal - benchmark based on lowest mammalian value (Sample, Opresko, & Suter, 1996)
Avian - benchmark based on lowest avian value (Sample et al., 1996)
Earthworm - benchmark based on toxicity concentrations for earthworm (Efroymson, et al., 1997a)
Phyto - benchmark based on phytoxicity value (Efroymson, et al. 1997b)
na - not available

Table G-26

Ecological Exposure Pathways of Concern

Exposure Medium	Sensitive Environment Flag Y or N	Receptor	Endangered/ Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment	N	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates	- Comparison of sediment COPC concentrations to benchmarks - Toxicity of sediment to *Hyallela azteca* and *Chironomus tentans* - Comparison of tissue COPC concentration of invertebrates to reference locations - Multivariate analysis of benthic invertebrate community compositon
Surface Water	N	Aquatic invertebrates and warmwater fish populations	N	Ingestion and direct contact with chemicals in surface water	Sustainability (survival, growth, reproduction) of aquatic life	- Comparison of surface water COPC concentrations to criteria/benchmarks
				Direct and dietary exposures of COPCs in surface water	Sustainability (survival, growth, reproduction) of warmwater fish populations	- Comparison of tissue COPC concentration of fish to reference locations - Comparison of tissue concentrations with fish tissue benchmarks - Evaluation of population statistics to reference locations
Soil	N	Small terrestrial mammals	N	Ingestion of chemicals in soil	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of soil COPC concentrations to benchmarks - Comparison of estimated dietary doses in insectivorous wildlife with TRVs
Surface Water/Sediment/ Biota	N	Muskrat	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of semi-aquatic mammals	- Comparison of estimated dietary doses in herbivorous mammals with TRVs
Surface Water/Sediment/ Biota	N	River Otter[1]	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in piscivorous mammals with TRVs
Surface Water/Sediment/ Biota	N	Mallard	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in omnivorous waterfowl with TRVs
Surface Water/Sediment/ Biota	N	Green Heron	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of small terrestrial mammals	- Comparison of estimated dietary doses in predatory birds with TRVs

Notes:

(1) River otter evaluated for the Norther Study Area, only.

COPC - Chemical of Potential Concern

TRVs - Toxicity reference values

Table G-27

SUMMMARY OF RISK CONCLUSIONS FOR COMBINED STUDY AREAS

	INCREASING LEVEL OF RISK FROM NEGLIGIBLE TO HIGH → → → → → → →					Ecological Significance [1]						Unacceptable Ecological Risk[15]
Receptor/ Endpoint	Negligible Risk Potential Low Uncertainty	Low Risk Potential Increased Uncertainty	Moderate Risk High Uncertainty	Moderate/High Risk Decreased Uncertainty	High Level of Impacts Low Uncertainty	Endangered or sensitive species[2]	Magnitude of the effect and level of biological organization affected[3]	Likelihood the effect will occur or continue[4]	Relative importance of the affected area to the surrounding habitat[5]	Extent to which the affected area is highly sensitive or ecologically unique[6]	Recovery potential of the affected receptor and chemical persistence[7]	
Muskrat			Moderate risk - arsenic in diet in Reaches 0, 1 & 2. Modeling with high uncertainty. Uncertain population effects.			No	U / L [8, 9]	L	U / M [10]	U / M	U / M [11]	No
River Otter		Low risk. Modeling with moderate uncertainty.				No	n / a	n / a	n / a	n / a	n / a	No
Green Heron	Negligible Risk Potential Low Uncertainty.					No	n / a	n / a	n / a	n / a	n / a	No
Mallard		Low risk due to metals in limited area of Reach 1. Modeling with moderate uncertainty.				No	U / L [8, 9]	L	U / L [10]	U / L	U / L [11]	No
Northern Short-tailed Shrew		Low risk - arsenic in diet. Modeling with high uncertainty. Uncertain population effects.				No	U / L [8, 9]	L	U / L [10]	L	U / L [11]	No
Warmwater fish populations	Reaches 2 to 6 with low risk based on tissue data. Uncertain risk in Reach 1.	HBHA Pond and HBHA Wetlands with low risk based on tissue arsenic data. Some exceedences of tissue benchmarks. Uncertain population effects.				No	L [9, 12]	L	U / L [10]	L	L [13]	No
Benthic Invertebrate Communities		HBHA wetland and Reaches 1 & 2 with Low/uncertain toxicity and communtiy impairment.		HBHA Pond with high risk based on severe toxicity and community impairment. High tissue metals.		No	U / M [9, 14]	L	L	L	L [13]	Yes

RATING: L = LOW, M = MODERATE, H = HIGH , U = UNCERTAIN , n / a = NEGLIGIBLE RISK, or not applicable

NOTES:

1 Ecological significance is defined in USEPA (1997) or OSWER Directive 9285.7-28, "Ecological Risk Assessment and Risk Management Principles for Superfund Sites," dated October 7, 1999. The six categories address the factors recommended in the OSWER guidance to be considered in evaluating the significance of ecological effects. The magnitude of the potential risk was considered in evaluating the significance of each factor; a low risk to the receptor generally equates to low ecological significance.

2 No endangered species were identified. The affected populations do not represent other known species with sensitivity to the chemical of potential concern (arsenic).

3 The magnitude of the observed or predicted ecological effects and level of biological organization affected (individual, local population, or community).

4 The likelihood that effects will occur or continue in terms of bioaccumulation or biomagnification into the food chain.

5 The extent to which the affected area is important to the functioning of the surrounding habitat (e.g., wildlife migration corridor, overwintering habitat, etc.).

6 The degree to which the affected area itself (directly) represents highly sensitive or ecologically unique (essential) habitat to the receptor population (e.g., nursery habitat).

7 The likelihood an affected receptor will not recover from the effect of site releases (i.e., species has long generation time or limited foraging range, chemical persistance in the environment).

8 There is high uncertainty in the magnitude of risk because it was estimated using modeling methods without any direct measure of effect (no model verification).

9 Loss of individuals or effects on reproduction may be mitigated in the affected area by immigration from nearby habitats (recruitment from the regional population).

10 Halls Brook and the Aberjona River could function as migration corridors to wildlife and fish, however, it is uncertain whether they are used for this purpose.

11 Receptor has generation time that is moderately short, sediment arsenic is persistent in the affected area, but not fully bioavailable because of chelation to iron.

12 No population effect was detected in Reaches 1 to 6 based on tissue data, however, no fish tissue samples were collected in Reach 1. Tissue concentrations of arsenic exceeded benchmarks in Reach 0. Population effects uncertain in Reach 0.

13 Receptor has generation time that is short (invertebrates) or moderately short (fish), sediment arsenic is persistent in the affected area, but not fully bioavailable because of chelation to iron.

14 Triad analysis (chemical, biological, and ecological field sampling) identified a high magnitude of effect in the HBHA Pond, however, downgradient of the pond there was lower community effects associated with higher uncertainty.

15 Unacceptable Risk is defined in USEPA (see footnote 1) as a predicted impact to a local population or community of sufficient magnitude, severity, areal extent, and duration that they will not be able to recover and/or maintain themselves in a healthy state. Additionally, these effects are predicted to exceed the natural variation in similar reference areas.

Table G-28

COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment Endpoint
HBHA Pond	Sediment	Arsenic	273	mg/kg	Site-Specific LOAEL	Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates
	Surface Water	Arsenic	150	ug/L	NRWQC[1]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish
		Benzene	46	ug/L	Tier II Benchmark[2]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish
		Ammonia	NRWQC, pH and temperature dependent	ug/L	NRWQC[3]	Sustainability (survival, growth, reproduction) of populations of aquatic organisms including invertebrates and fish

Notes:

(1) The NRWQC value is selected as the surface water PRG
(2) The TIER II value is selected as the surface water PRG
(3) The NRWQC value is selected as the surface water PRG for ammonia and is calculated based on an adjustment for pH and temperature; tables and formulas provided in EPA (2002) should be used to calculate the appropriate value.

COC - Chemical of Concern
LOAEL - Lowest Observable Adverse Effect Level
NRWQC - National Recommended Water Quality Criterion (EPA, 2002)
Tier II - Great Lakes Water Quality Initiave Tier II methodology (Suter and Tsao, 1996)

TABLE K-1
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE SOILS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SS-1: No Action	Alternative SS-2: Monitoring with Institutional Controls	Alternative SS-3: Permeable Cover and Monitoring with Institutional Controls	Alternative SS-4: Excavation and Off-Site Disposal	Alternative SS-5: Excavation, Treatment, and On-Site Reuse
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	☐	◘	■	■	■
Ecological Protection	NA	NA	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	NA	NA	NA	NA	NA
Location-Specific ARARs	NA	■	■	■	■
Action-Specific ARARs	NA	■	■	■	■
Other Criteria, Advisories, Guidance	☐	■	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	☐	■	■	■	■
Magnitude of Residual Risk - Ecological:	■	■	■	■	■
Adequacy and Reliability of Controls	☐	◘	◘	■	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible				
Treatment/Recycling Processes Utilized	☐	☐	☐	☐	■
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	☐	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	☐	■
Irreversibility	☐	☐	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	■	■	■	■	■
Environmental Impacts	■	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	☐	■	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	☐	☐	☐
Reliability of the Technology	☐	☐	◘	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐	■	■
Ability to Monitor Effectiveness of the Remedy	☐	◘	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	■	☐
Availability of Prospective Technologies	■	■	■	■	☐
COST					
Capital	$0	$185,000	$5,329,000	$47,172,000	$22,993,000
O&M	$0	$30,000/yr	$48,000/yr	$0	$0
Present Worth	$0	$600,000	$5,992,000	$47,172,000	$22,993,000

TABLE K-2
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SUBSURFACE SOILS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SUB-1: No Action	Alternative SUB-2: Monitoring with Institutional Controls	Alternative SUB-3: Permeable Cover and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	☐	■	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	NA	NA	NA
Location-Specific ARARs	NA	■	■
Action-Specific ARARs	NA	■	■
Other Criteria, Advisories, Guidance	☐	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	☐	■	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	☐	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	☐
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐
Irreversibility	☐	☐	☐
Type and Quantity of [Process] Residuals	☐	☐	☐
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	☐
Time Until Remedial Action Objectives are Achieved	☐	■	◘
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	☐
Reliability of the Technology	☐	■	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐
Ability to Monitor Effectiveness of the Remedy	☐	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$315,000	$6,495,000
O&M	$0	$108,000 (Years 1-10) $30,000 (Years 11-30)	$159,000 (Years 1-10) $81,000 (Years 11-30)
Present Worth	$0	$1,276,000	$8,070,000

TABLE K-3
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR GROUNDWATER
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative GW-1: No Action	Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment and Monitoring with Institutional Controls
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	☐	◘	■	■
Ecological Protection	☐	☐	■	■
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	NA	◘	■	■
Location-Specific ARARs	NA	■	■	■
Action-Specific ARARs	NA	■	■	■
Other Criteria, Advisories, Guidance	☐	■	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	☐	◘	◘	◘
Magnitude of Residual Risk - Ecological:	☐	◘	■	■
Adequacy and Reliability of Controls	☐	◘	■	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible			
Treatment/Recycling Processes Utilized	☐	◘	■	■
Amount of Hazardous Materials Destroyed or Treated	☐	◘	■	■
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	◘	■	■
Irreversibility	☐	◘	■	◘
Type and Quantity of [Process] Residuals	☐	◘	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	◘	◘	◘
Time Until Remedial Action Objectives are Achieved	☐	◘	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	☐	☐
Reliability of the Technology	☐	■	■	☐
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘	☐
Ability to Monitor Effectiveness of the Remedy	☐	■	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	☐
Availability of Prospective Technologies	■	■	■	☐
COST				
Capital	$0	$432,000	$4,739,000	$13,089,000
O&M	$0	$410,000 (yr 1-5) $205,500 (yr 6-30)	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$444,000 (yr 1-5) $222,000 (yr 6-30)
Present Worth	$0	$3,918,000	$19,137,000	$17,792,000

TABLE K-4
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR HBHA POND SEDIMENTS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative HBHA-1: No Action	Alternative HBHA-2: Monitoring	Alternative HBHA-3: Subaqueous Cap	Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing Alternate Habitat	Alternative HBHA-5: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Protection of Human Health	☐	☐	◘	■	■
Ecological Protection	☐	☐	◘	■	■
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets				
Chemical-Specific ARARs	☐	☐	■	◘	■
Location-Specific ARARs	NA	NA	■	■	■
Action-Specific ARARs	NA	NA	■	■	■
Other Criteria, Advisories, Guidance	☐	☐	■	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective				
Magnitude of Residual Risk - Human Health:	☐	☐	■	■	■
Magnitude of Residual Risk - Ecological:	☐	☐	◘	◘	■
Adequacy and Reliability of Controls	☐	☐	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible				
Treatment/Recycling Processes Utilized	☐	☐	☐	◘	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	◘	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	◘	◘
Irreversibility	☐	☐	☐	■	■
Type and Quantity of [Process] Residuals	☐	☐	☐	◘	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts				
Protection of Community and Workers During Remedial Actions	☐	■	■	■	■
Environmental Impacts	■	◘	☐	☐	☐
Time Until Remedial Action Objectives are Achieved	☐	☐	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability				
Ability to Construct and Operate the Technology	■	■	☐	◘	◘
Reliability of the Technology	☐	☐	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	☐	◘	■
Ability to Monitor Effectiveness of the Remedy	☐	■	◘	■	■
Ability to Obtain Approvals from Other Agencies	■	■	■	■	■
Coordination with Other Agencies	■	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	☐	◘	◘
Availability of Prospective Technologies	■	■	☐	■	■
COST					
Capital	$0	$0	$3,160,000	$4,833,000	$3,560,000
O&M	$0	$144,000/yr 1-2 $70,000 yr 3-30	$144,000/yr	$144,000/yr $1,136,500 (every 5 yrs)	$95,000/yrs 1-3 only
Present Worth	$0	$1,201,000	$5,291,000	$8,237,000	$3,810,000

NOTE: The effectiveness of HBHA-2, HBHA-3, and HBHA-5 assume that contaminated groundwater discharges to the HBHA Pond will be eliminated. This assumption is not necessary for HBHA-4.

TABLE K-5
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR NEAR-SHORE SEDIMENTS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative NS-1: No Action	Alternative NS-2: Institutional Controls	Alternative NS-3: Monitoring with Institutional Controls	Alternative NS-4: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Protection of Human Health	☐	◘	◘	■
Ecological Protection	NA	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets			
Chemical-Specific ARARs	☐	☐	☐	■
Location-Specific ARARs	NA	NA	NA	■
Action-Specific ARARs	☐	☐	☐	■
Other Criteria, Advisories, Guidance	☐	◘	◘	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective			
Magnitude of Residual Risk - Human Health:	☐	◘	◘	■
Magnitude of Residual Risk - Ecological:	☐	■	■	■
Adequacy and Reliability of Controls	☐	◘	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible			
Treatment/Recycling Processes Utilized	☐	☐	☐	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐	◘
Irreversibility	☐	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts			
Protection of Community and Workers During Remedial Actions	■	■	■	■
Environmental Impacts	■	■	■	◘
Time Until Remedial Action Objectives are Achieved	☐	■	■	■
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability			
Ability to Construct and Operate the Technology	■	■	■	◘
Reliability of the Technology	☐	◘	◘	■
Ease of Undertaking Additional Remedial Actions, if Necessary	◘	■	■	■
Ability to Monitor Effectiveness of the Remedy	☐	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■	■
Coordination with Other Agencies	■	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■	■
Availability of Necessary Equipment and Specialists	■	■	■	◘
Availability of Prospective Technologies	■	■	■	■
COST				
Capital	$0	$70,000	$70,000	$2,997,000
O&M	$0	$16,000 /yr	$135,000 /yr	$95,000 yrs 1-3 only
Present Worth	$0	$338,000	$1,807,000	$3,247,000

☐ **Low rating in comparison to other alternatives for specified criterion**

◘ **Mid-range rating in comparison to other alternatives for specified criterion**

■ **High rating in comparison to other alternatives for specified criterion**

TABLE K-6
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR DEEP SEDIMENTS CORES LOCATIONS
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative DS-1: No Action	Alternative DS-2: Institutional Controls	Alternative DS-3: Removal and Off-Site Disposal
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	☐	◘	■
Ecological Protection	NA	NA	NA
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	☐	☐	■
Location-Specific ARARs	NA	NA	■
Action-Specific ARARs	☐	☐	■
Other Criteria, Advisories, Guidance	☐	■	■
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	☐	☐	■
Magnitude of Residual Risk - Ecological:	■	■	■
Adequacy and Reliability of Controls	☐	◘	■
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	◘
Amount of Hazardous Materials Destroyed or Treated	☐	☐	◘
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	◘
Irreversibility	☐	☐	■
Type and Quantity of [Process] Residuals	☐	☐	◘
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	◘
Environmental Impacts	■	■	☐
Time Until Remedial Action Objectives are Achieved	■	■	☐
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	◘	☐
Reliability of the Technology	☐	◘	☐
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	■
Ability to Monitor Effectiveness of the Remedy	☐	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	◘
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	◘
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	◘
COST			
Capital	$0	$44,000	$116,968,000
O&M	$0	$30,000 /yr	$100,000 yrs 1-3 only
Present Worth	$0	$459,000	$117,378,000

TABLE K-7
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR SURFACE WATER
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

	Alternative SW-1: No Action	Alternative SW-2: Monitoring	Alternative SW-3: Monitoring and Providing an Alternate Habitat
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Protection of Human Health	NA	NA	NA
Ecological Protection	☐	☐	◘
COMPLIANCE WITH ARARs	☐ - Does Not Meet, ◘ - May Not Meet/Partially Meets, ■ - Meets		
Chemical-Specific ARARs	☐	☐	☐
Location-Specific ARARs	■	■	■
Action-Specific ARARs	■	■	◘
Other Criteria, Advisories, Guidance	☐	☐	◘
LONG-TERM EFFECTIVENESS AND PERMANENCE	☐ - No Protection, ◘ - Partially Protective, ■ - Protective		
Magnitude of Residual Risk - Human Health:	■	■	■
Magnitude of Residual Risk - Ecological:	☐	☐	◘
Adequacy and Reliability of Controls	☐	☐	◘
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT	☐ - Low or Reversible, ◘ - Moderate or Moderately Reversible, ■ - High or Irrreversible		
Treatment/Recycling Processes Utilized	☐	☐	☐
Amount of Hazardous Materials Destroyed or Treated	☐	☐	☐
Degree of Expected Reductions in Toxicity, Mobility or Volume:	☐	☐	☐
Irreversibility	☐	☐	☐
Type and Quantity of [Process] Residuals	☐	☐	☐
SHORT-TERM EFFECTIVENESS	☐ - High Impacts, ◘ - Moderate Impacts, ■ - Low Impacts		
Protection of Community and Workers During Remedial Actions	■	■	■
Environmental Impacts	■	■	◘
Time Until Remedial Action Objectives are Achieved	☐	☐	◘
IMPLEMENTABILITY	☐ - High Effort or Low Reliability, ◘ - Moderate Effort or Moderate Reliability, ■ - Low Effort or High Reliability		
Ability to Construct and Operate the Technology	■	■	◘
Reliability of the Technology	☐	■	◘
Ease of Undertaking Additional Remedial Actions, if Necessary	■	■	◘
Ability to Monitor Effectiveness of the Remedy	■	■	◘
Ability to Obtain Approvals from Other Agencies	■	■	■
Coordination with Other Agencies	■	■	■
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	■	■	■
Availability of Necessary Equipment and Specialists	■	■	◘
Availability of Prospective Technologies	■	■	■
COST			
Capital	$0	$0	$7,807,000
O&M	$0	$236,000 /yr	$236,000 /yr
Present Worth	$0	$3,226,000	$10,797,000

TABLE K-8
SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES
RECORD OF DECISION
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

MEDIUM	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	COSTS		
							Capital Costs	Annual O&M Costs	Present Worth
SURFACE SOIL (SS)									
Alternative SS-1: No Action	□	□	□	□	■	■	$0	$0	$0
Alternative SS-2: Institutional Controls	◘	■	◘	□	■	■	$185,000	$30,000	$600,000
Alternative SS-3: Permeable Cover with Institutional Controls	■	■	◘	□	◘	◘	$5,329,000	$48,000	$5,992,000
Alternative SS-4: Excavation and Off-Site Disposal	■	■	■	□	◘	■	$47,172,000	$0	$47,172,000
Alternative SS-5: Excavation, Treatment, and On-Site Reuse	■	■	■	■	◘	◘	$22,993,000	$0	$22,993,000
SUBSURFACE SOIL (SUB)									
Alternative SUB-1: No Action	□	□	□	□	◘	■	$0	$0	$0
Alternative SUB-2: Institutional Controls	■	■	◘	□	■	■	$315,000	$108,000 (yr 1-10) $30,000 (yr 11-30)	$1,276,000
Alternative SUB-3: Permeable Cover with Institutional Controls	■	■	■	□	◘	◘	$6,495,000	$159,000 (yr 1-10) $81,000 (yr 11-30)	$8,070,000
GROUNDWATER (GW)									
Alternative GW-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative GW-2: Pond Intercept with Monitoring and Institutional Controls	◘	■	◘	◘	◘	■	$432,000	$410,000 (yr 1-5) $205,500 (yr 6-30)	$3,918,000
Alternative GW-3: Plume Intercept by Groundwater Extraction, Treatment and Discharge and Monitoring with Institutional Controls	■	■	■	■	◘	◘	$4,739,000	$1,297,500 (yr 1-2) $1,040,000 (yr 3-30)	$19,137,000
Alternative GW-4: Plume Intercept by In-Situ Groundwater Treatment, and Monitoring with Institutional Controls	■	■	◘	◘	◘	□	$13,089,000	$444,000 (yr 1-5) $222,000 (yr 6-30)	$17,792,000
HBHA POND SEDIMENTS (HBHA)									
Alternative HBHA-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative HBHA-2: Monitoring	□	□	□	□	◘	■	$0	$144,000/yr 1-2 $70,000/yr 3-30	$1,201,000
Alternative HBHA-3: Subaqueous Cap	■	■	◘	□	◘	□	$3,160,000	$144,000	$5,291,000
Alternative HBHA-4: Storm Water Bypass and Sediment Retention with Partial Dredging and Providing an Alternate Habitat	■	◘	◘	◘	◘	◘	$5,419,000	$176,000/yr 1-3 $100,000/yr 4-30 $1,136,500 (every 5yrs)	$9,187,000
Alternative HBHA-5: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$3,560,000	$95,000/yr 1-3 only	$3,810,000
NEAR SHORE SEDIMENTS (NS)									
Alternative NS-1: No Action	□	□	□	□	◘	◘	$0	$0	$0
Alternative NS-2: Institutional Controls	◘	◘	◘	□	■	■	$70,000	$16,300	$338,000
Alternative NS-3: Monitored Natural Recovery	◘	◘	◘	□	■	■	$70,000	$135,000	$1,807,000
Alternative NS-4: Removal and Off-Site Disposal	■	■	■	◘	◘	◘	$2,997,000	$95,000/yr 1-3 only	$3,247,000
DEEP SEDIMENTS (DS)									
Alternative DS-1: No Action	□	□	□	□	■	◘	$0	$0	$0
Alternative DS-2: Institutional Controls	◘	◘	◘	□	■	■	$44,000	$30,000	$459,000
Alternative DS-3: Removal and Off-Dite Disposal	■	■	■	◘	□	◘	$116,968,000	$100,000/yr 1-3 only	$117,378,000
SURFACE WATER (SW)									
Alternative SW-1: No Action	□	◘	□	□	■	◘	$0	$0	$0
Alternative SW-2: Monitoring	□	◘	◘	□	■	■	$0	$236,000	$3,226,000
Alternative SW-3: Monitoring and Providing an Alternate Habitat	◘	◘	■	□	■	◘	$7,807,000	$236,000	$10,797,000

□ Low rating in comparison to other alternatives for specificed criterion

◘ Mid-range rating in comparison to other alternatives for specificed criterion

■ High rating in comparison to other alternatives for specificed criterion

Table L-1: Groundwater Performance Standards

Carcinogenic Chemical of Concern	Cancer Classification	Performance Standards (ug/L)	Basis	RME Risk
Benzene	A	4	risk	1E-05
1,2-Dichloroethane	B2	2	risk	1E-05
Trichloroethene	C-B2	1	risk	3E-05
Arsenic	A	150	risk	4E-05
			Sum of Carcinogenic Risk:	9E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Performance Standards (ug/L)**	**Basis**	**RME Hazard Quotient**
Benzene	immune system	4	risk	0.1
Ammonia	respiratory	4000	HQ	1
1,2-Dichloroethane	kidney	2	risk	0.3
Trichloroethene	liver	1	risk	0.02
Naphthalene	general toxicity	5	HQ	1
Arsenic	skin	150	risk	0.3
			General Toxicity Hazard Index:	1
			Liver Hazard Index:	0.02
			Kidney Hazard Index:	0.3
			Immune System Hazard Index:	0.1
			Respiratory Hazard Index	1
			Skin Hazard Index:	0.3

Key

HQ = Hazard Quotient

Table L-2: Soil Cleanup Standards for the Protection of Day Care Child Direct Contact Exposures

Former Mishawum Lake Bed Area

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Standard (mg/kg)	Basis	RME Risk
Arsenic	A	50	HQ	4E-05
			Sum of Carcinogenic Risk:	4E-05

Non-Carcinogenic Chemical of Concern	Target Endpoint	Cleanup Standard (mg/kg)	Basis	RME Hazard Quotient
Arsenic	skin	50	HQ	1
			Liver Hazard Index:	1

Key

HQ = Hazard Quotient

Table L-3: FORMULA AND ASSUMPTIONS

ARSENIC SOIL CLEANUP STANDARD GOAL

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion/Dermal	Day Care Child	Young Child (ages 1-6)	Former Mishawum Lake Bed Area	IR	Ingestion Rate of Soil	200	mg/day	USEPA, 1997	Preliminary Remediation Goal (PRG) non-cancer =
				FI	Fraction Ingested	1	unitless	Prof. Judgement	$\frac{\text{THI x RfD/RBA x BW x AT-N}}{\text{ED x EF x CF x [IR + (SA x AF x DAF)]}}$
				EF	Exposure Frequency	150	days/year	USEPA, 1994	
				ED	Exposure Duration	6	years	USEPA, 1994	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
				CF	Conversion Factor	0.000001	kg/mg	- -	
				SA	Skin Surface Area Available for Contact	2,800	cm^2	USEPA, 2004	
				AF	Skin Adherence Factor	0.2	mg/cm^2-day	USEPA, 2004	
				DAF	Arsenic Dermal Absorption Factor	0.03	- -	- -	
				RfD	Arsenic Oral Reference Dose	3E-04	mg/kg-day	- -	
				THI	Target Hazard Index	1	- -	- -	
				RBA (1)	Relative Bioavailability of Arsenic	site-specific	- -	- -	

References:

USEPA, 1989 - *Risk assessment guidance for Superfund. Volume I: Human health evaluation manual. Part A.* Interim Final. EPA/540/1-89/002. December 1989.

USEPA, 1994 - *Risk updates, no. 2.* USEPA Region I. August 1994.

USEPA, 1997 - *Exposure factors handbook.* Office of Research and Development. Washington, D.C. August 1997.

USEPA, 2004 - *Risk assessment guidance for Superfund Volume I: Human health evaluation manual (Part E, Supplemental guidance for dermal risk assessment), Final.* Office of Superfund Remediation and Technology Innovation. Washington, D.C. EPA/540/R/99/005

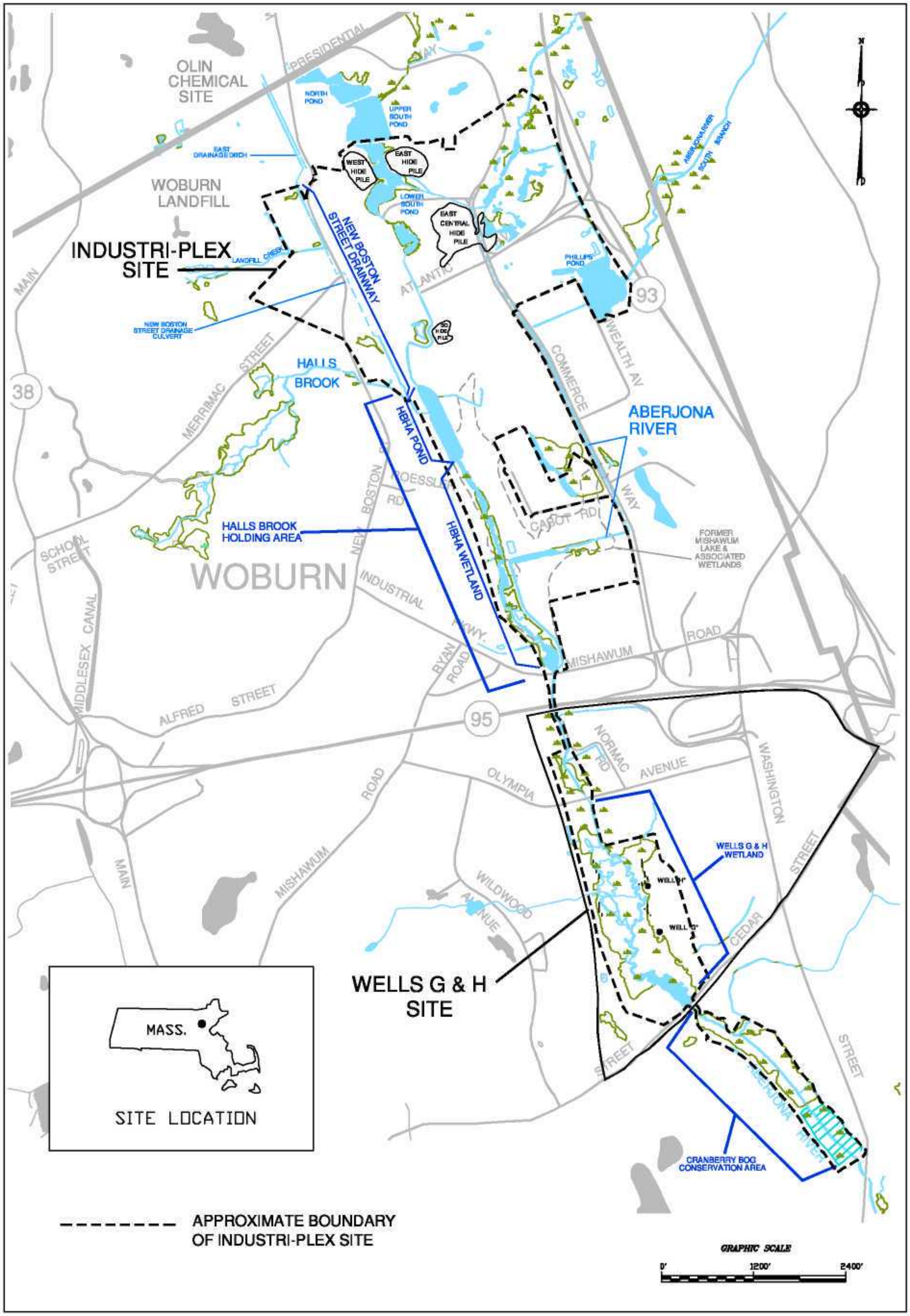
(1) Two different site-specific RBAs would be experimentally determined; one for surface soils and one for surface soils.

Table L-4: Sediment Cleanup Standards for the Protection of Recreational and Dredging Worker Direct Contact Exposures

Cranberry Bog Conservation Area: CB-03				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Risk**
Arsenic	A	230	HQ	6E-05
			Sum of Carcinogenic Risk:	6E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	230	HQ	1
			Skin Hazard Index:	1
Wells G&H Wetland: WH, NT-3, 13/TT-27				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standards (mg/kg)**	**Basis**	**RME Risk**
Benzo(a)pyrene	B2	4.9	background	1E-05
Arsenic	A	300	HQ	6E-05
			Sum of Carcinogenic Risk:	7E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	300	HQ	1
			Skin Hazard Index:	1
Sediment Cores: SC02, SC05, SC06, and SC08				
Carcinogenic Chemical of Concern	**Cancer Classification**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Risk**
Arsenic	A	300	risk	1E-05
			Sum of Carcinogenic Risk:	1E-05
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Standard (mg/kg)**	**Basis**	**RME Hazard Quotient**
Arsenic	skin	300	risk	0.8
			Skin Hazard Index:	0.8

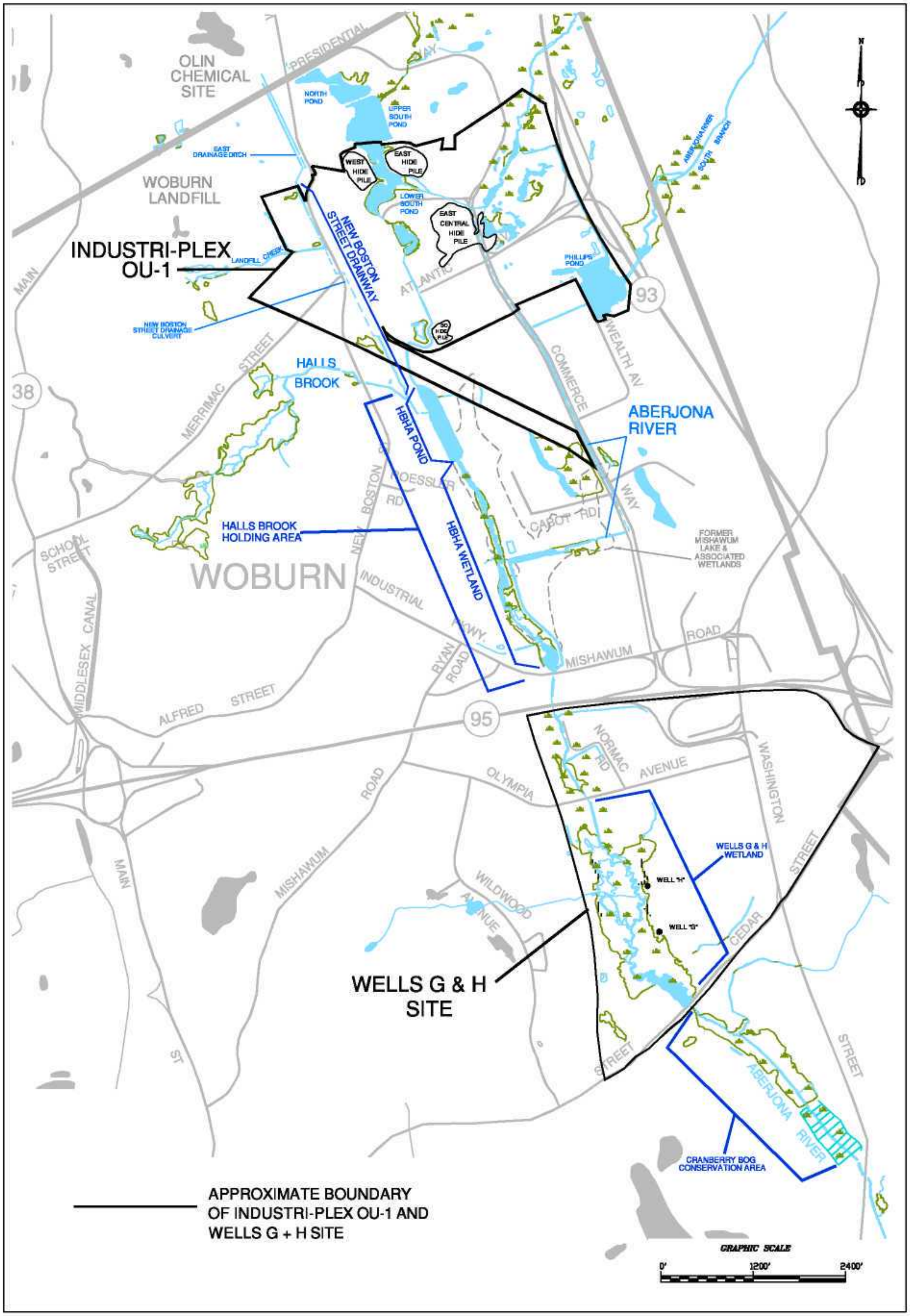
Key

HQ = Hazard Quotient



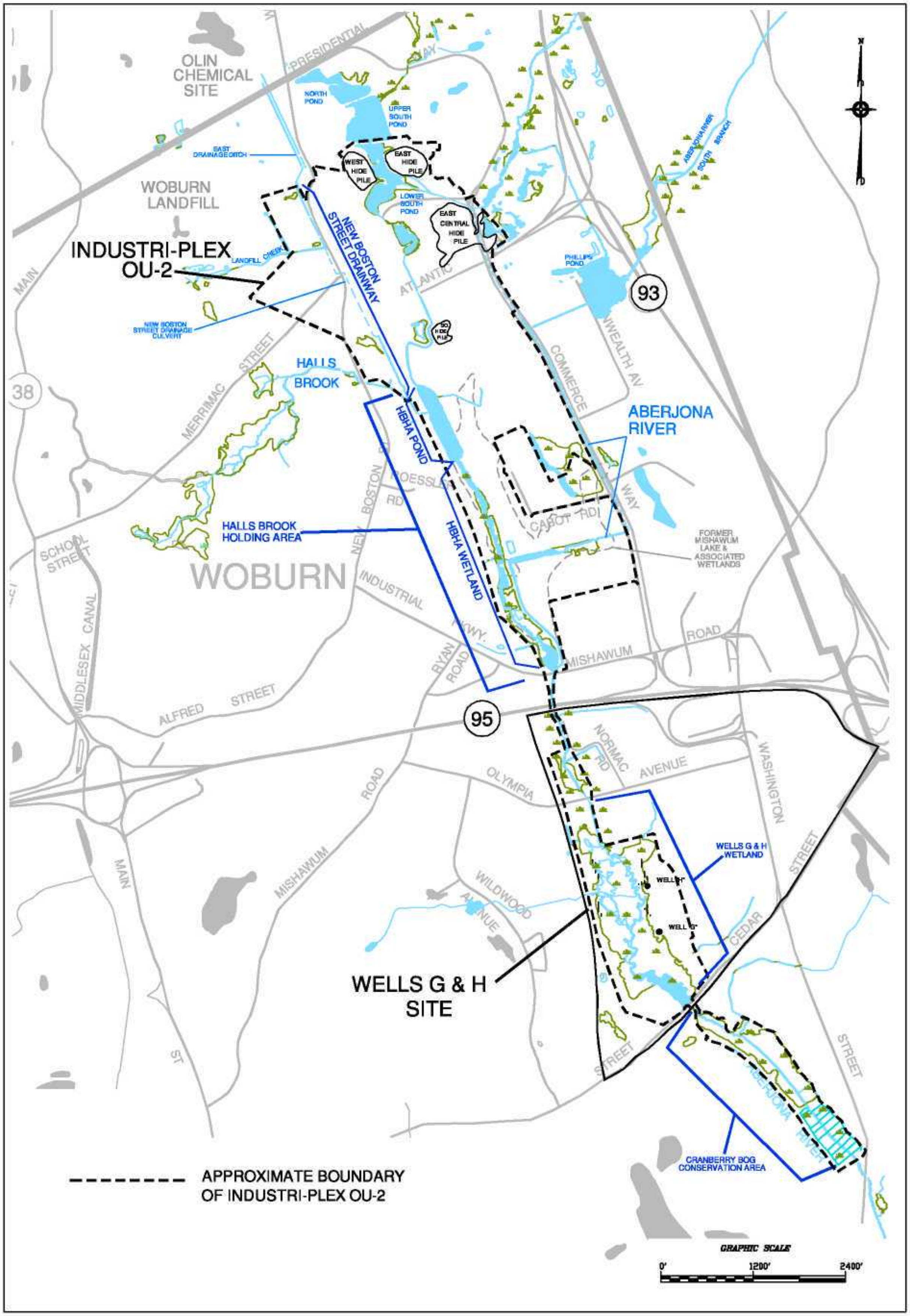
OLIN CHEMICAL SITE
PRESIDENTIAL WAY
NORTH POND
UPPER SOUTH POND
EAST DRAINAGE DITCH
WEST HIDE PILE
EAST HIDE PILE
LOWER SOUTH POND
EAST CENTRAL HIDE PILE
WOBURN LANDFILL
INDUSTRI-PLEX SITE
LANDFILL CREEK
NEW BOSTON STREET DRAINWAY
NEW BOSTON STREET DRAINAGE CULVERT
ATLANTIC
PHILLIPS POND
93
ABERJONA RIVER SOUTH BRANCH
MAIN
STREET
MERRIMAC
38
HALLS BROOK
COMMERCE
WEALTH AV
ABERJONA RIVER
HBHA POND
BOSTON
ROESSLER RD
CABOT RD
WAY
FORMER MISHAWUM LAKE & ASSOCIATED WETLANDS
HALLS BROOK HOLDING AREA
HBHA WETLAND
SCHOOL STREET
WOBURN
NEW
INDUSTRIAL PKWY.
MIDDLESEX CANAL
RYAN ROAD
MISHAWUM ROAD
ALFRED STREET
95
NORMAC RD
AVENUE
WASHINGTON
OLYMPIA
ROAD
MAIN
MISHAWUM
WILDWOOD AVENUE
WELLS G & H WETLAND
WELL "H"
WELL "G"
CEDAR
STREET
WELLS G & H SITE
MASS.
SITE LOCATION
ABERJONA RIVER
CRANBERRY BOG CONSERVATION AREA
APPROXIMATE BOUNDARY OF INDUSTRI-PLEX SITE
GRAPHIC SCALE
0'
1200'
2400'

FIGURE A-1



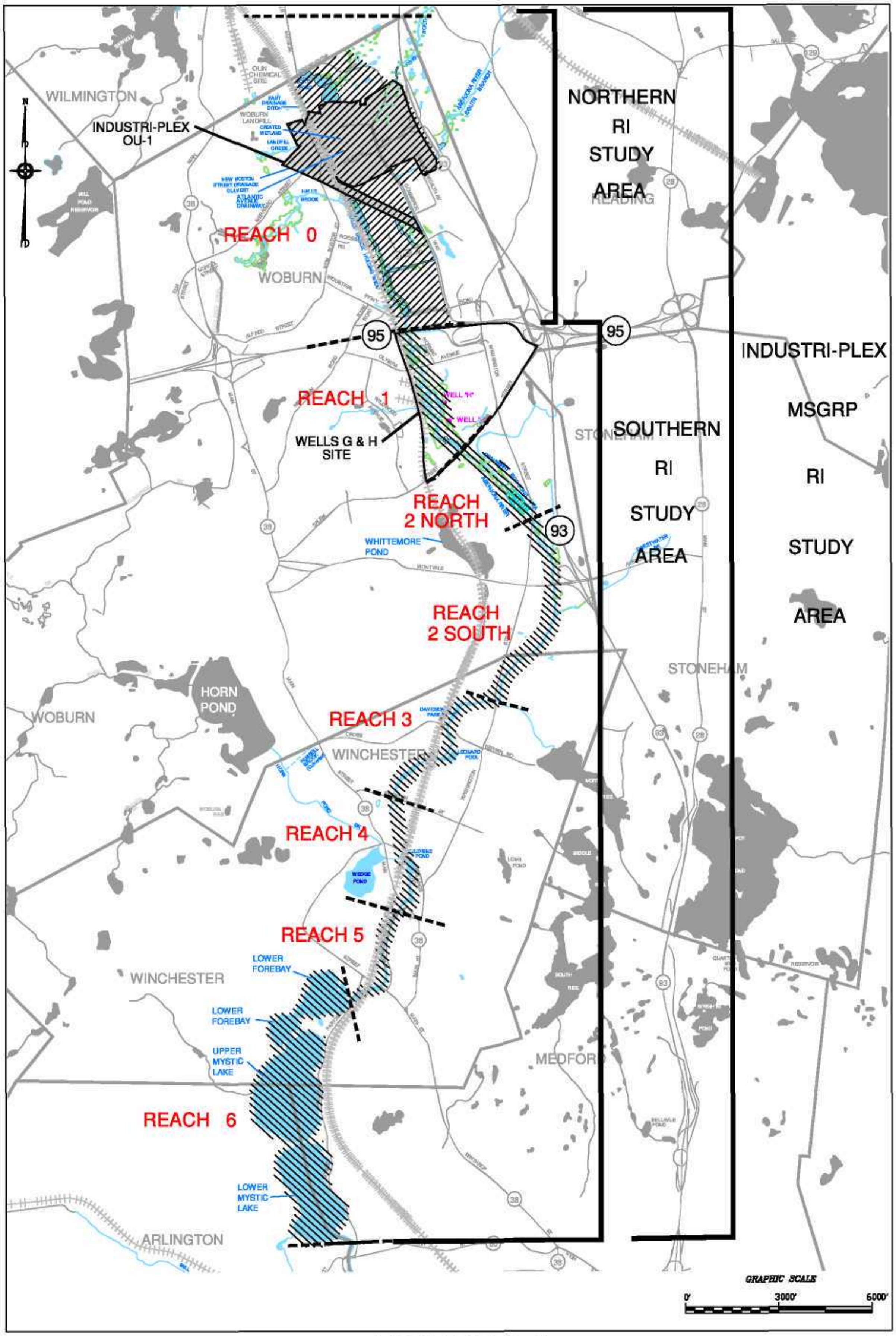
OLIN CHEMICAL SITE
WOBURN LANDFILL
INDUSTRI-PLEX OU-1
HALLS BROOK
ABERJONA RIVER
HALLS BROOK HOLDING AREA
HBHA POND
HBHA WETLAND
NEW BOSTON STREET DRAINWAY
WOBURN
WELLS G & H SITE
WELLS G & H WETLAND
CRANBERRY BOG CONSERVATION AREA
FORMER MISHAWUM LAKE & ASSOCIATED WETLANDS
APPROXIMATE BOUNDARY OF INDUSTRI-PLEX OU-1 AND WELLS G + H SITE
GRAPHIC SCALE
0'
1200'
2400'

FIGURE A-2



OLIN CHEMICAL SITE
WOBURN LANDFILL
INDUSTRI-PLEX OU-2
NEW BOSTON STREET DRAINWAY
HALLS BROOK
HBHA POND
HBHA WETLAND
HALLS BROOK HOLDING AREA
WOBURN
ABERJONA RIVER
FORMER MISHAWUM LAKE & ASSOCIATED WETLANDS
WELLS G & H WETLAND
WELLS G & H SITE
CRANBERRY BOG CONSERVATION AREA
APPROXIMATE BOUNDARY OF INDUSTRI-PLEX OU-2
GRAPHIC SCALE
0'
1200'
2400'

FIGURE A-3



NORTHERN RI STUDY AREA
INDUSTRI-PLEX OU-1
WILMINGTON
OLIN CHEMICAL SITE
WOBURN LANDFILL
REACH 0
WOBURN
95
REACH 1
WELLS G & H SITE
SOUTHERN RI STUDY AREA
INDUSTRI-PLEX MSGRP RI STUDY AREA
REACH 2 NORTH
93
WHITTEMORE POND
REACH 2 SOUTH
STONEHAM
HORN POND
WOBURN
REACH 3
WINCHESTER
REACH 4
WEDGE POND
REACH 5
LOWER FOREBAY
WINCHESTER
LOWER FOREBAY
UPPER MYSTIC LAKE
MEDFORD
REACH 6
LOWER MYSTIC LAKE
ARLINGTON
GRAPHIC SCALE
0'
3000'
6000'

FIGURE A-4

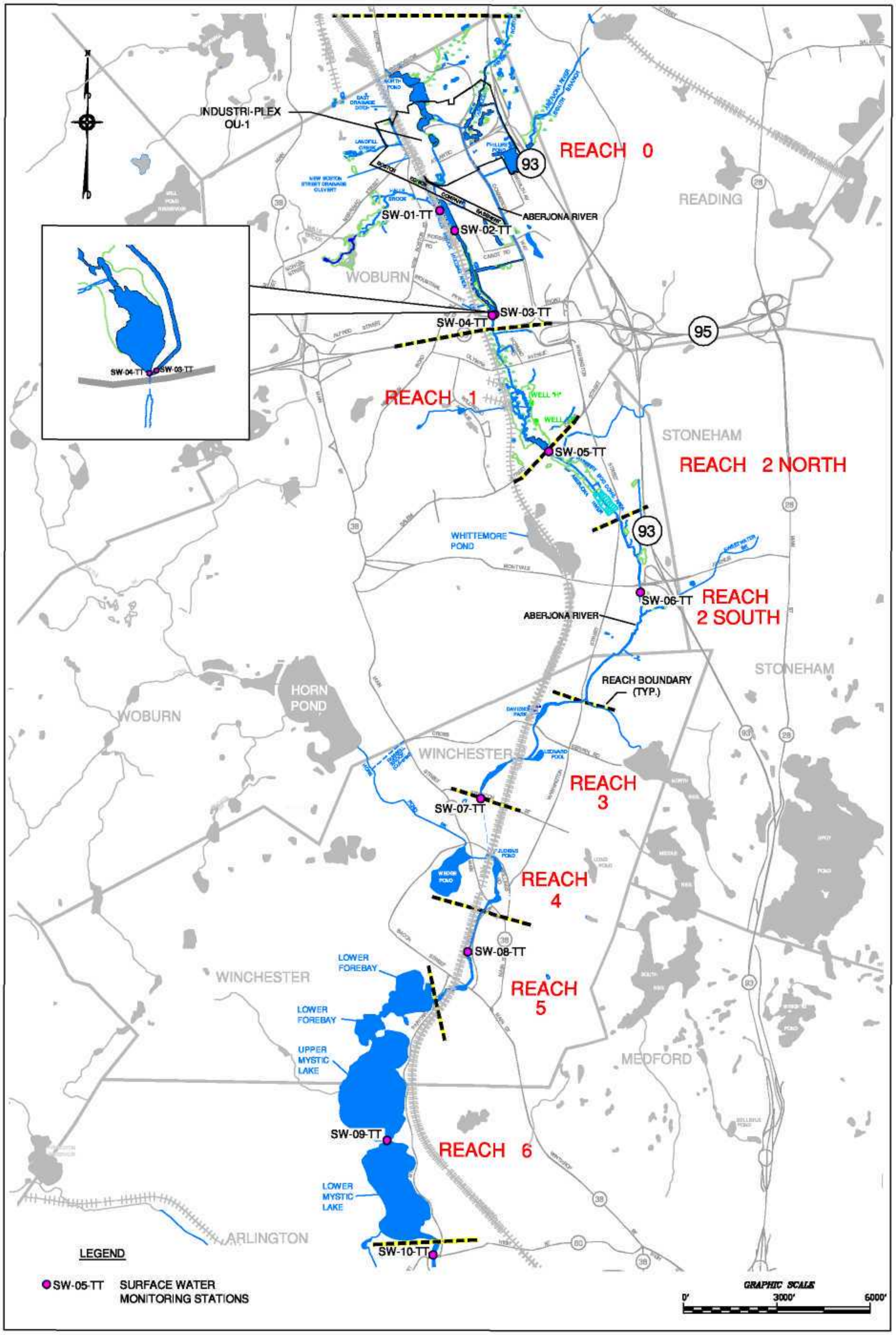
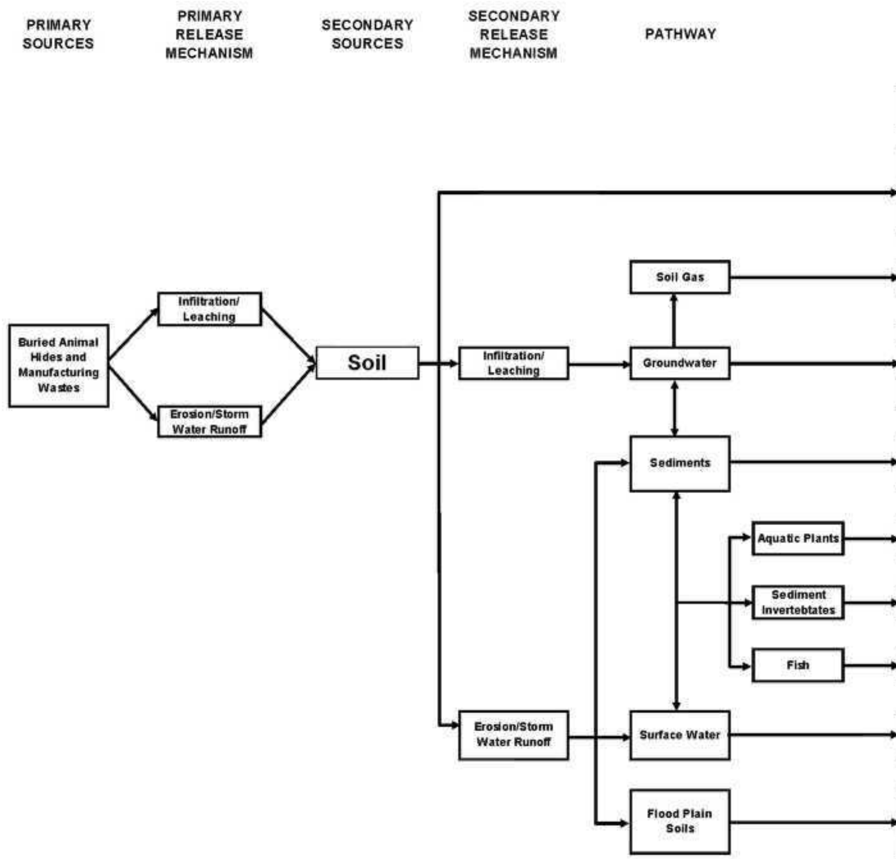

INDUSTRI-PLEX
OU-1
REACH 0
93
READING
ABERJONA RIVER
SW-01-TT
SW-02-TT
WOBURN
SW-03-TT
SW-04-TT
95
REACH 1
STONEHAM
SW-05-TT
REACH 2 NORTH
93
WHITTEMORE
POND
SW-06-TT
REACH
2 SOUTH
ABERJONA RIVER
STONEHAM
REACH BOUNDARY
(TYP.)
HORN
POND
WOBURN
WINCHESTER
REACH
3
SW-07-TT
REACH
4
SW-08-TT
LOWER
FOREBAY
WINCHESTER
REACH
5
LOWER
FOREBAY
UPPER
MYSTIC
LAKE
MEDFORD
SW-09-TT
REACH 6
LOWER
MYSTIC
LAKE
ARLINGTON
SW-10-TT
LEGEND
SW-05-TT SURFACE WATER
MONITORING STATIONS
GRAPHIC SCALE
0'
3000'
6000'

FIGURE E-1

FIGURE E-2



RECEPTOR

EXPOSURE ROUTE	HUMAN							BIOTA	
	Industrial Worker	Excavation Worker	Car Wash Worker	Dredging Worker	Groundskeeper	Recreational User	Day Care Child	Terrestrial	Aquatic
Ingestion		●			●	●	●	●	
Inhalation		●							
Dermal Contact		●			●	●	●		
Inhalation		●					●		
Ingestion	●	●							
Inhalation	●		●						
Dermal Contact	●	●							
Ingestion				●		●			●
Dermal Contact				●		●			●
Ingestion								●	●
Ingestion								●	●
Ingestion						●		●	●
Ingestion								●	●
Dermal Contact						●			●
Ingestion						●		●	
Dermal Contact						●			

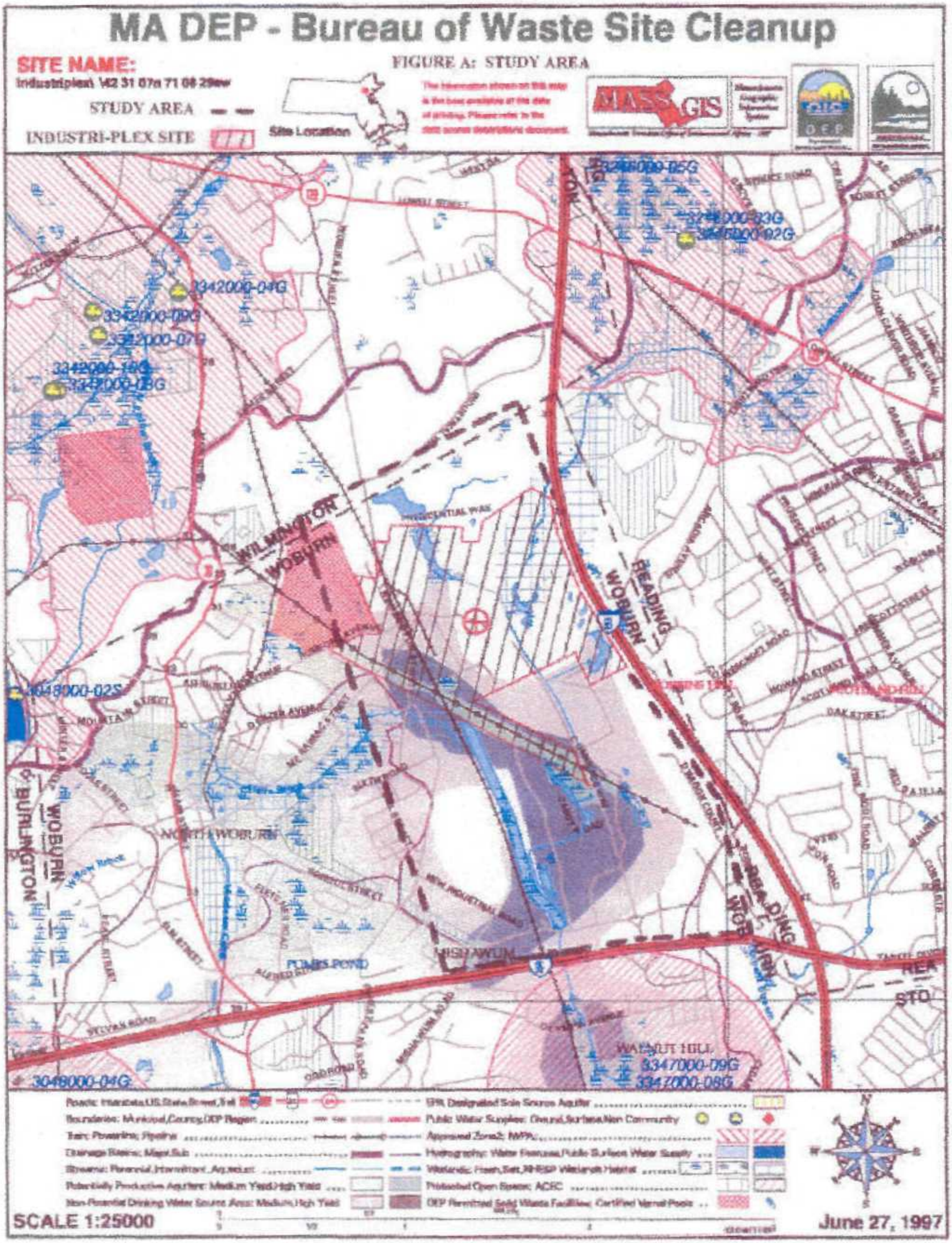

MA DEP - Bureau of Waste Site Cleanup
SITE NAME:
FIGURE A: STUDY AREA
STUDY AREA
INDUSTRI-PLEX SITE
Site Location
WILMINGTON
WOBURN
READING
BURLINGTON
NORTH WOBURN
WALNUT HILL
3342000-04G
3348000-02S
3048000-04G
3347000-09G
3347000-08G
SCALE 1:25000
June 27, 1997

FIGURE F-1

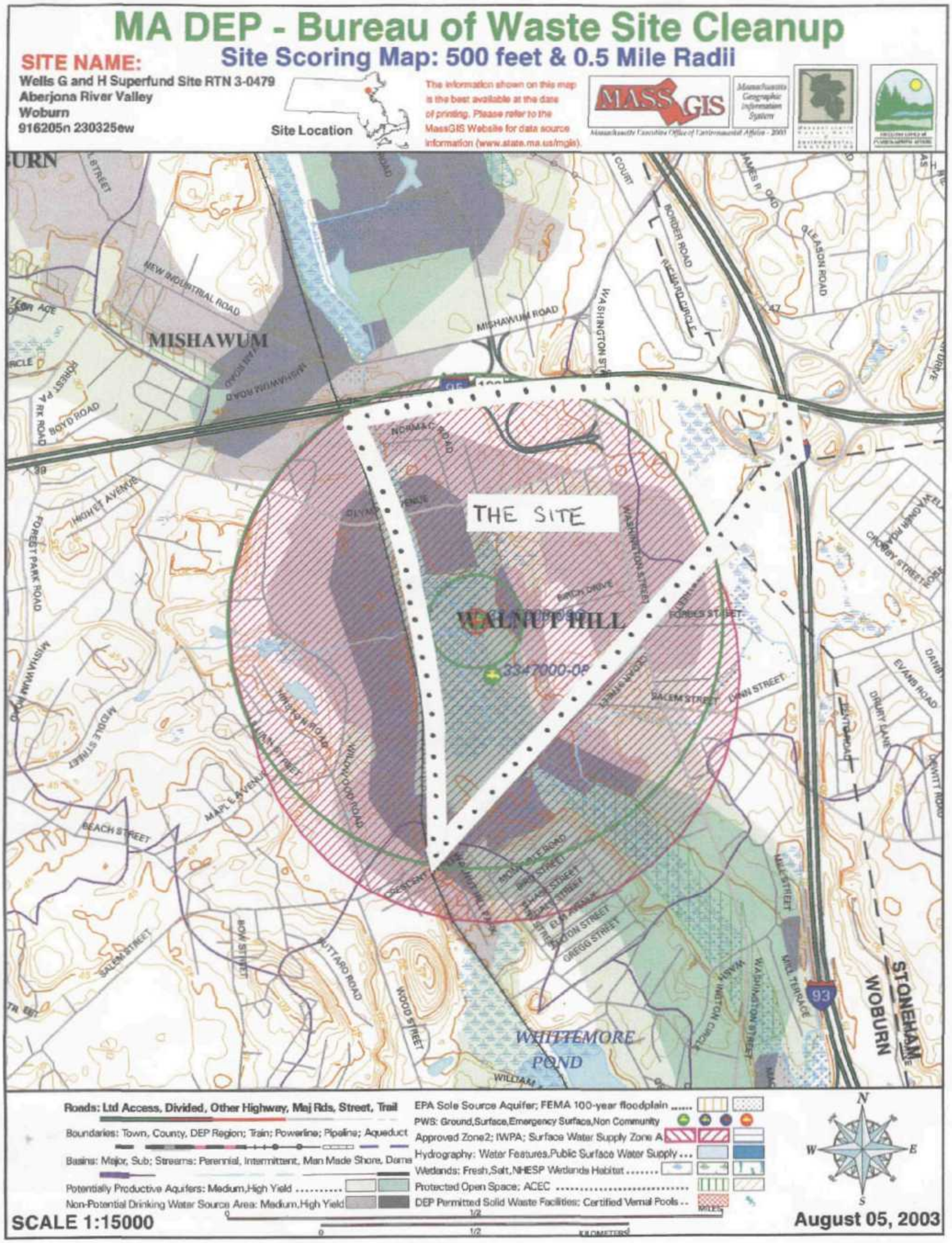

MA DEP - Bureau of Waste Site Cleanup
Site Scoring Map: 500 feet & 0.5 Mile Radii
SITE NAME:
Wells G and H Superfund Site RTN 3-0479
Aberjona River Valley
Woburn
916205n 230325ew
Site Location
The information shown on this map is the best available at the date of printing. Please refer to the MassGIS Website for data source information (www.state.ma.us/mgis).
MASS GIS
MISHAWUM
THE SITE
WALNUT HILL
3347000-0P
WHITTEMORE POND
STONEHAM
WOBURN
NEW INDUSTRIAL ROAD
MISHAWUM ROAD
WASHINGTON STREET
BORDER ROAD
GLEASON ROAD
FOREST PARK ROAD
BOYD ROAD
BEACH STREET
SALEM STREET
MAPLE AVENUE
WILDWOOD ROAD
SALEM STREET
FORBES STREET
EVANS ROAD
DRURY LANE
GREGG STREET
WOOD STREET
Roads: Ltd Access, Divided, Other Highway, Maj Rds, Street, 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
PWS: Ground,Surface,Emergency Surface,Non Community
Approved Zone2; IWPA; 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
August 05, 2003
N
S
E
W

FIGURE F-2

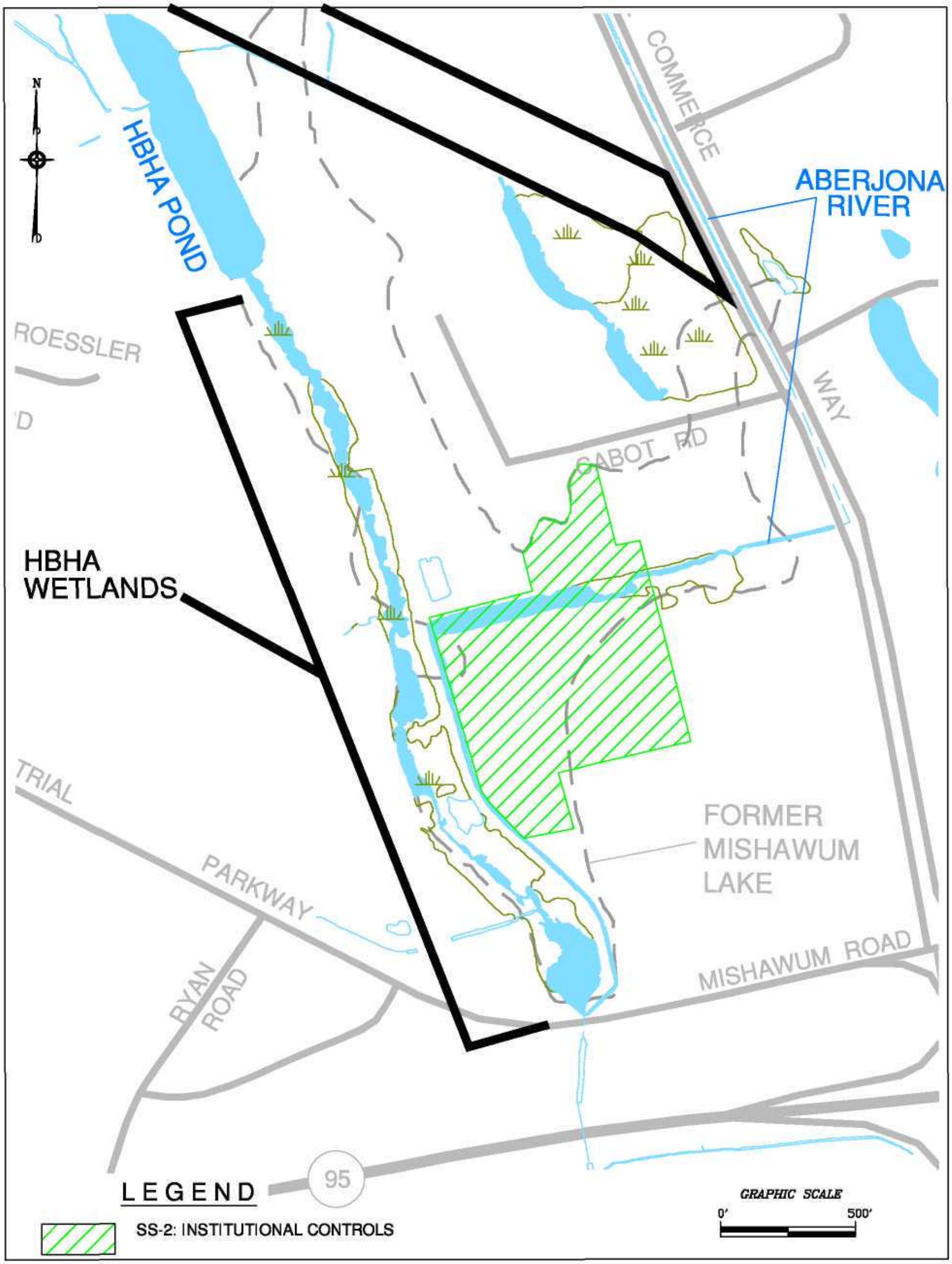

HBHA POND
ABERJONA RIVER
COMMERCE
WAY
ROESSLER
CABOT RD
HBHA WETLANDS
TRIAL
PARKWAY
RYAN ROAD
FORMER MISHAWUM LAKE
MISHAWUM ROAD
95
LEGEND
SS-2: INSTITUTIONAL CONTROLS
GRAPHIC SCALE
0'
500'
N

FIGURE J-1

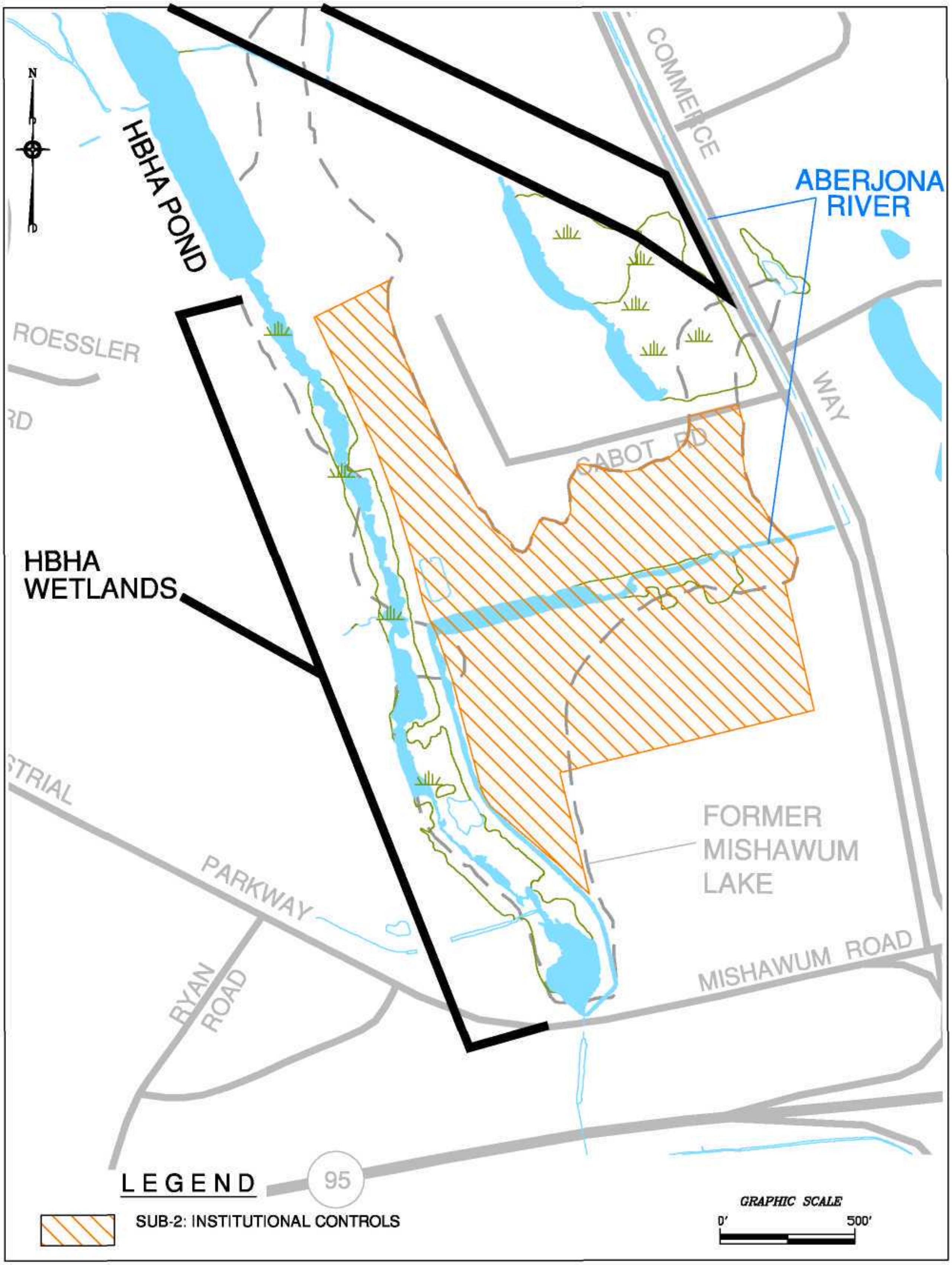

HBHA POND
COMMERCE
WAY
ABERJONA RIVER
ROESSLER
RD
CABOT RD
HBHA WETLANDS
TRIAL
PARKWAY
FORMER MISHAWUM LAKE
MISHAWUM ROAD
RYAN ROAD
95
LEGEND
SUB-2: INSTITUTIONAL CONTROLS
GRAPHIC SCALE
0'
500'

FIGURE J-2

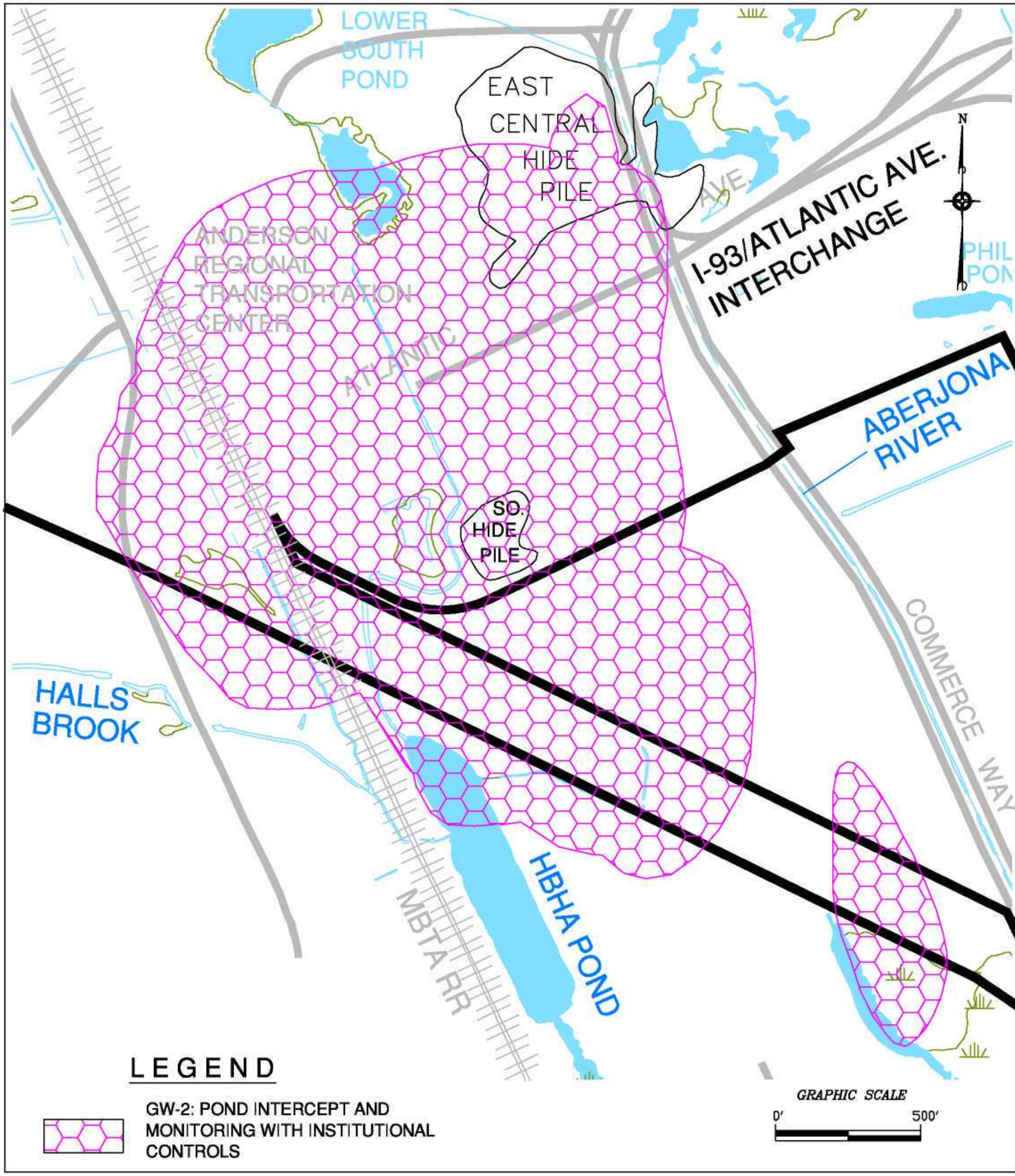

LOWER SOUTH POND
EAST CENTRAL HIDE PILE
ANDERSON REGIONAL TRANSPORTATION CENTER
ATLANTIC
AVE.
I-93/ATLANTIC AVE. INTERCHANGE
PHIL PON
ABERJONA RIVER
SO. HIDE PILE
COMMERCE WAY
HALLS BROOK
HBHA POND
MBTA RR
LEGEND
GW-2: POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS
GRAPHIC SCALE
0'
500'
N

FIGURE J-3

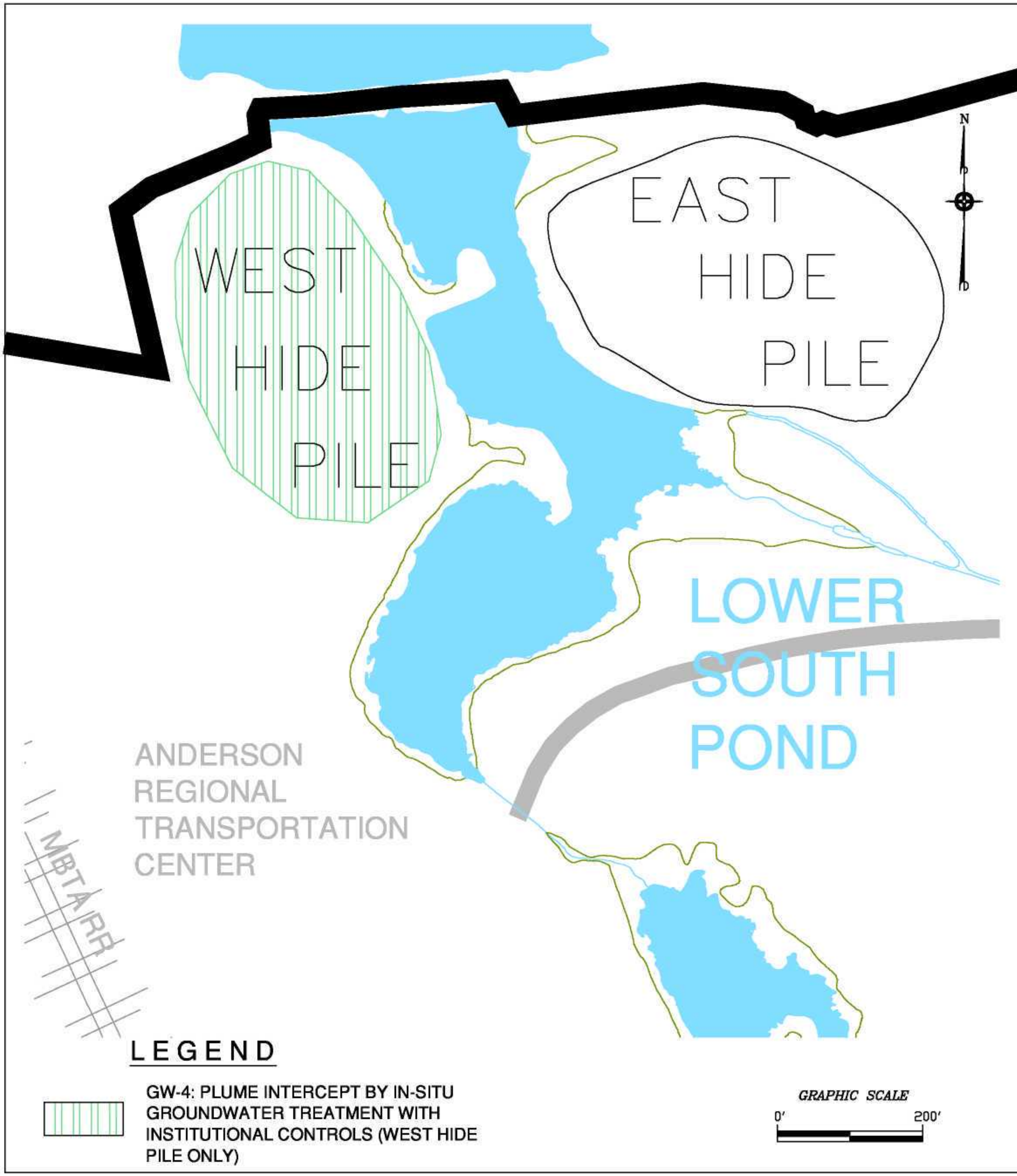
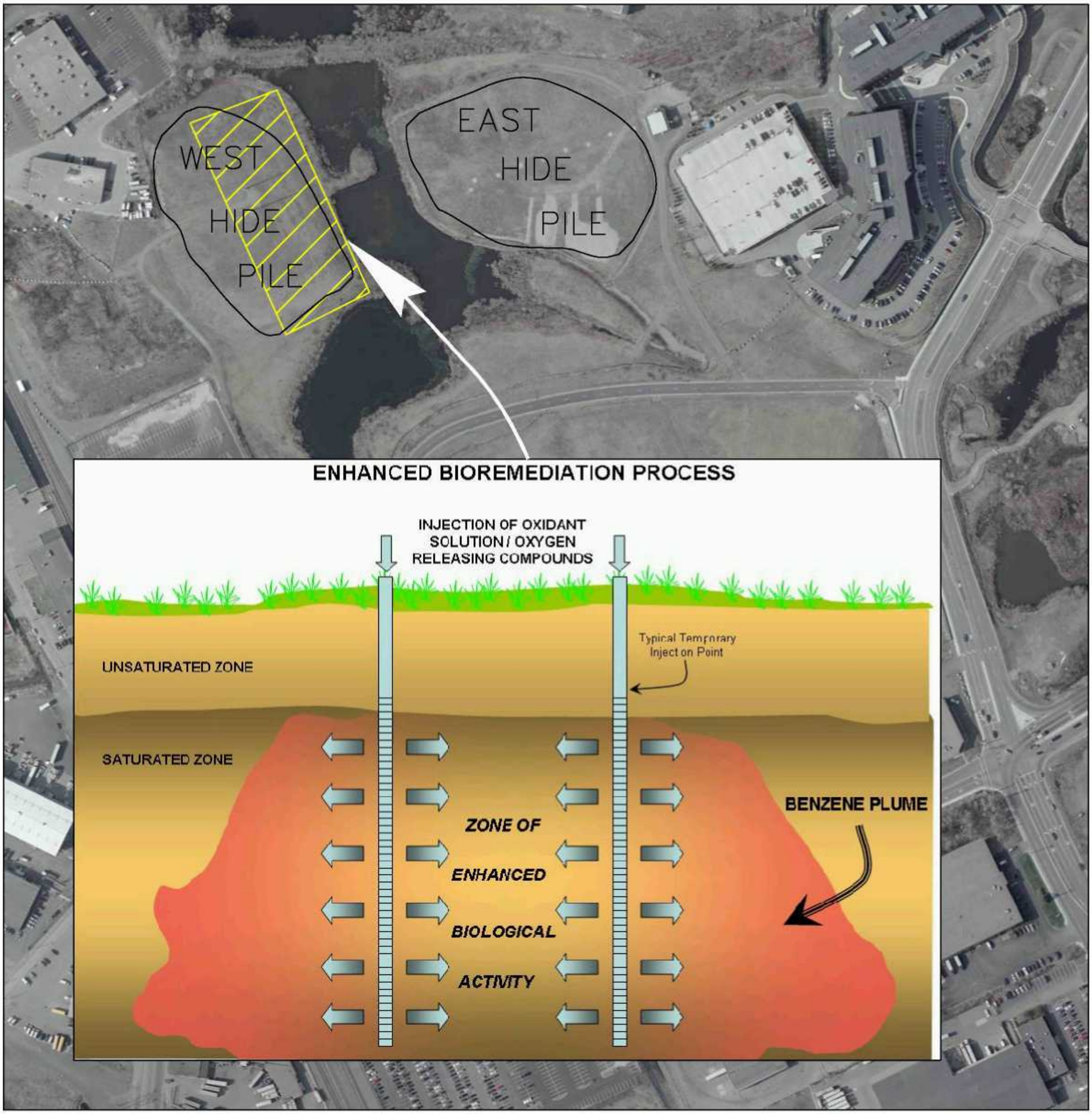
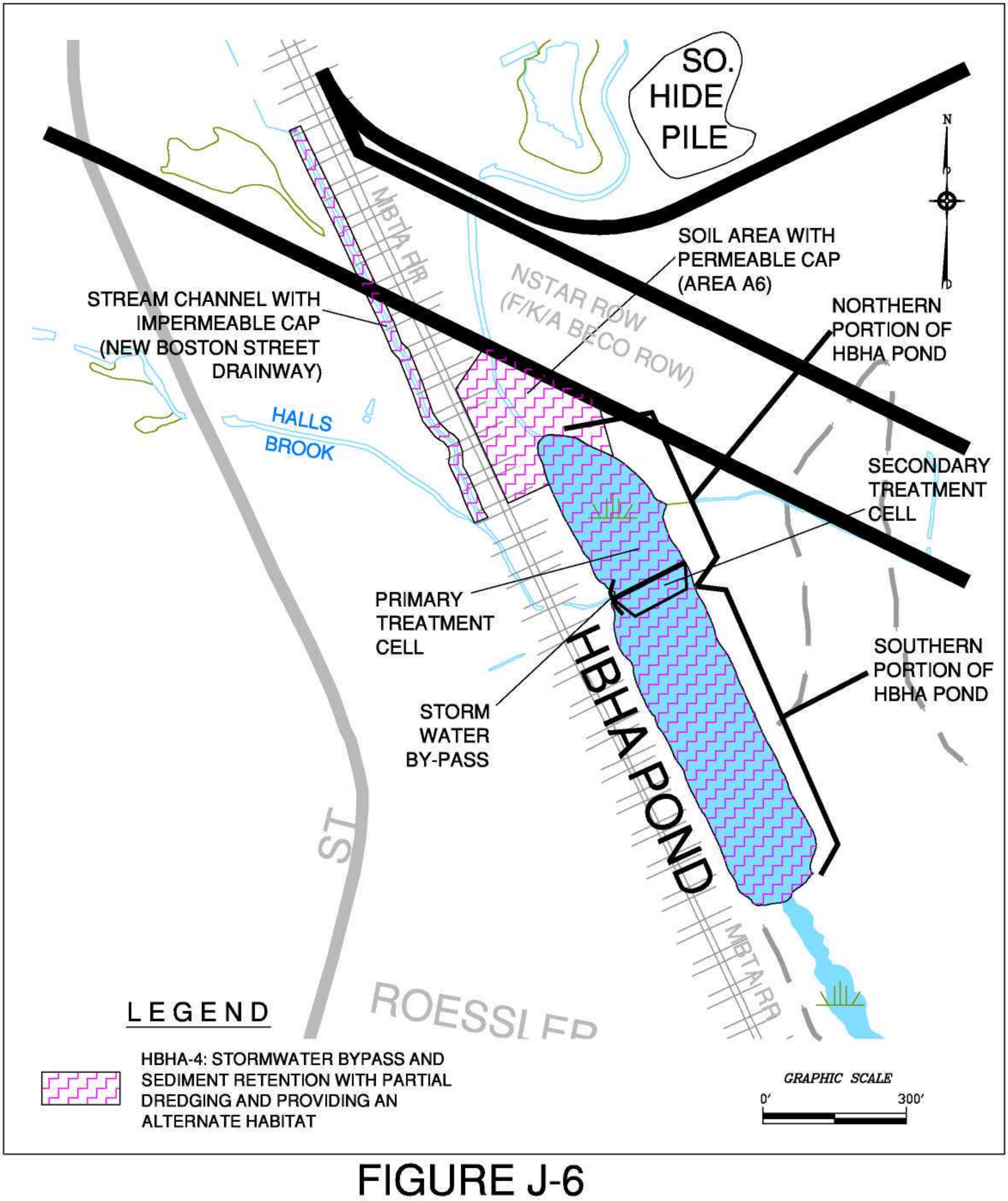

EAST
HIDE
PILE
WEST
HIDE
PILE
N
LOWER
SOUTH
POND
ANDERSON
REGIONAL
TRANSPORTATION
CENTER
MBTA RR
LEGEND
GW-4: PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT WITH INSTITUTIONAL CONTROLS (WEST HIDE PILE ONLY)
GRAPHIC SCALE
0'
200'

FIGURE J-4



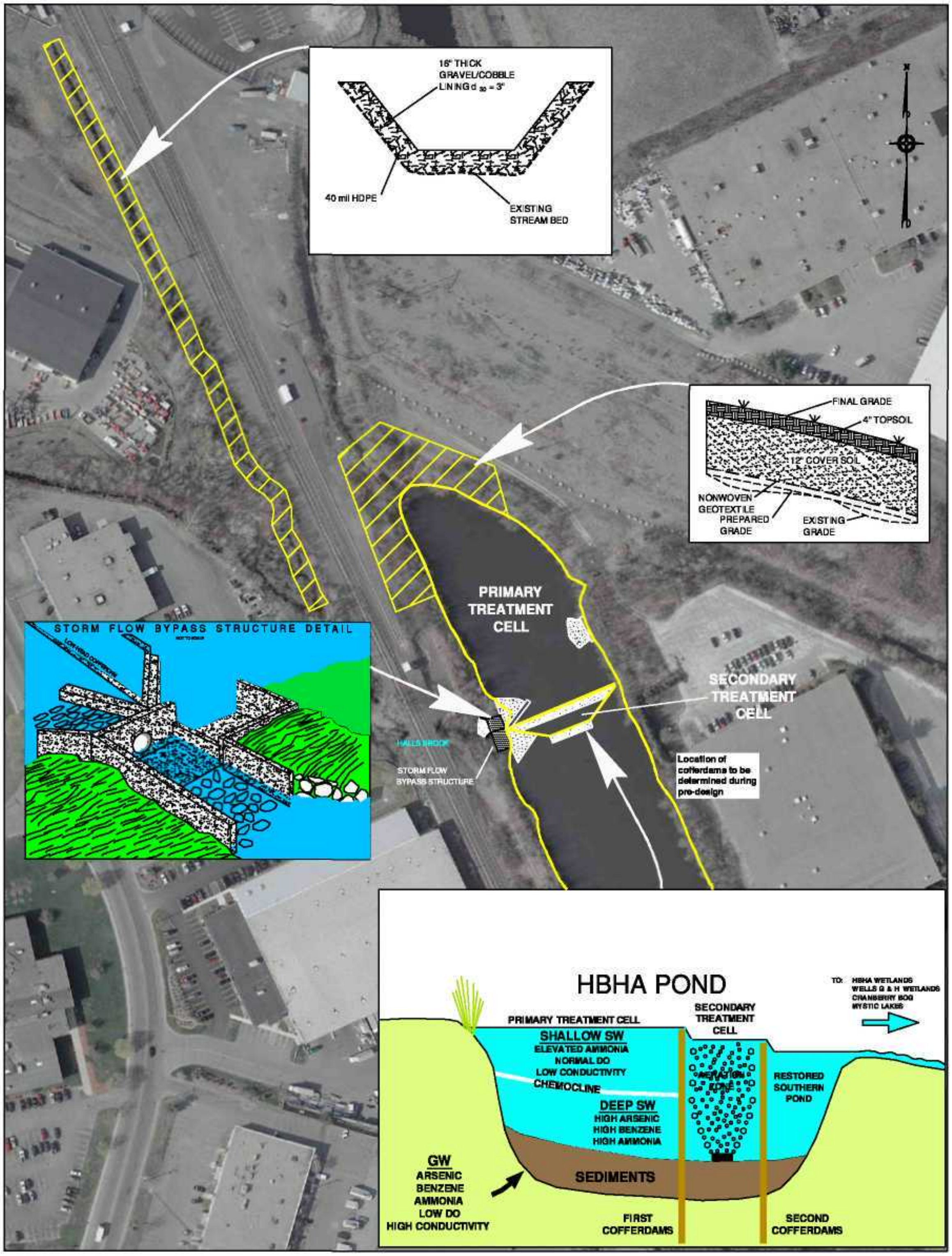
WEST
HIDE
PILE
EAST
HIDE
PILE
ENHANCED BIOREMEDIATION PROCESS
INJECTION OF OXIDANT
SOLUTION / OXYGEN
RELEASING COMPOUNDS
Typical Temporary
Injection Point
UNSATURATED ZONE
SATURATED ZONE
ZONE OF
ENHANCED
BIOLOGICAL
ACTIVITY
BENZENE PLUME

FIGURE J-5



SO. HIDE PILE
MBTA RR
NSTAR ROW (F/K/A BECO ROW)
SOIL AREA WITH PERMEABLE CAP (AREA A6)
STREAM CHANNEL WITH IMPERMEABLE CAP (NEW BOSTON STREET DRAINWAY)
NORTHERN PORTION OF HBHA POND
HALLS BROOK
SECONDARY TREATMENT CELL
PRIMARY TREATMENT CELL
STORM WATER BY-PASS
HBHA POND
SOUTHERN PORTION OF HBHA POND
ST
ROESSLER
MBTA RR
LEGEND
HBHA-4: STORMWATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT
GRAPHIC SCALE
0'
300'
N

FIGURE J-6



NOTES:

1. BACKGROUND IMAGE PROVEDED BY CITY OF WOBURN AS A MrSID FILE.
2. COORDINATE SYSTEM OF FIGURE: NAD 83 FEET.
3. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE.
4. GRAPHIC SCALE SHOWN TO BE CONSIDERED APPROXIMATE.

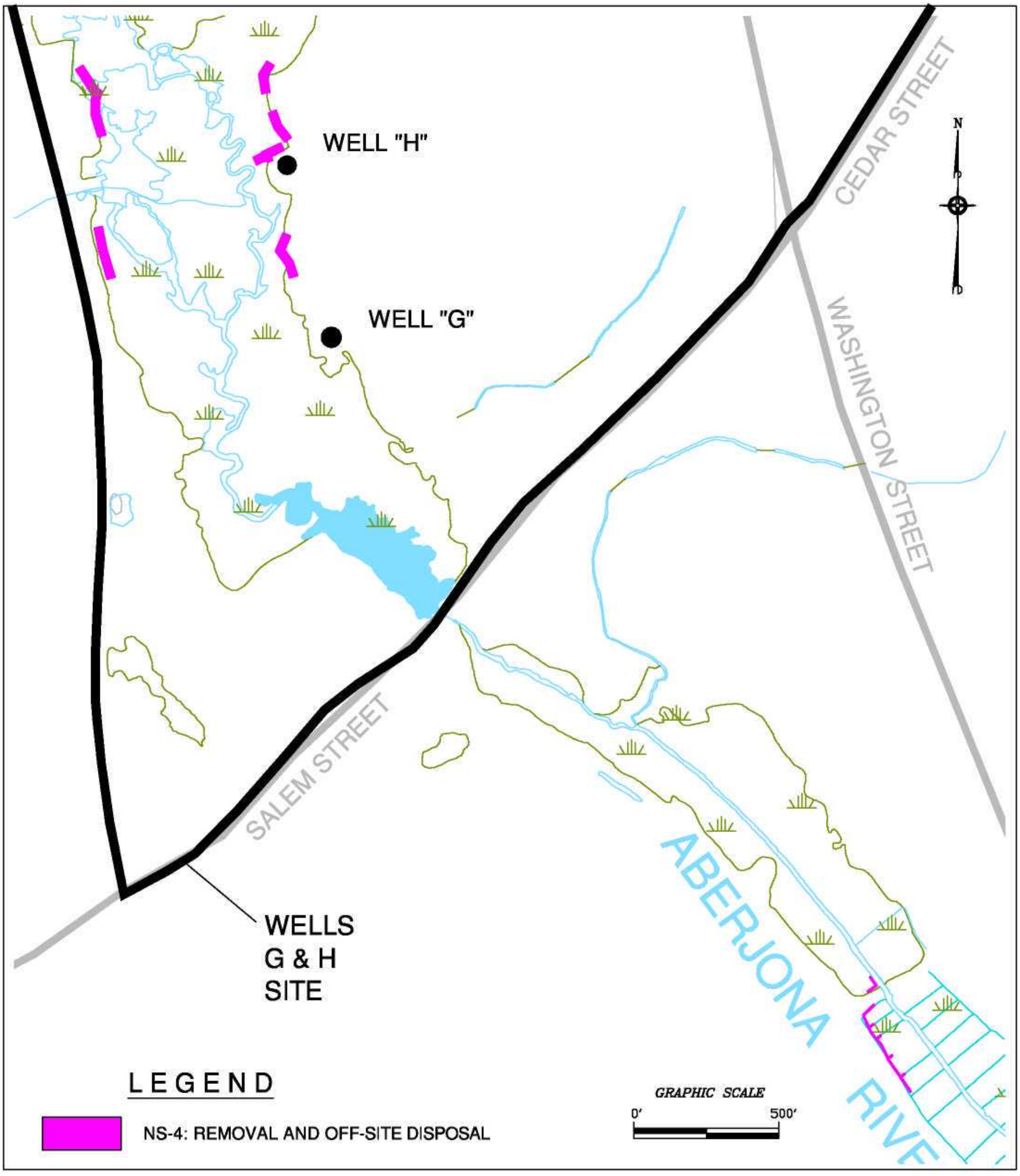
LEGEND

SOIL/SEDIMENT CAP

GRAPHIC SCALE

0' 100' 200'

FIGURE J-7



WELL "H"
WELL "G"
CEDAR STREET
WASHINGTON STREET
SALEM STREET
ABERJONA RIVE
WELLS
G & H
SITE
N
LEGEND
NS-4: REMOVAL AND OFF-SITE DISPOSAL
GRAPHIC SCALE
0'
500'

FIGURE J-8

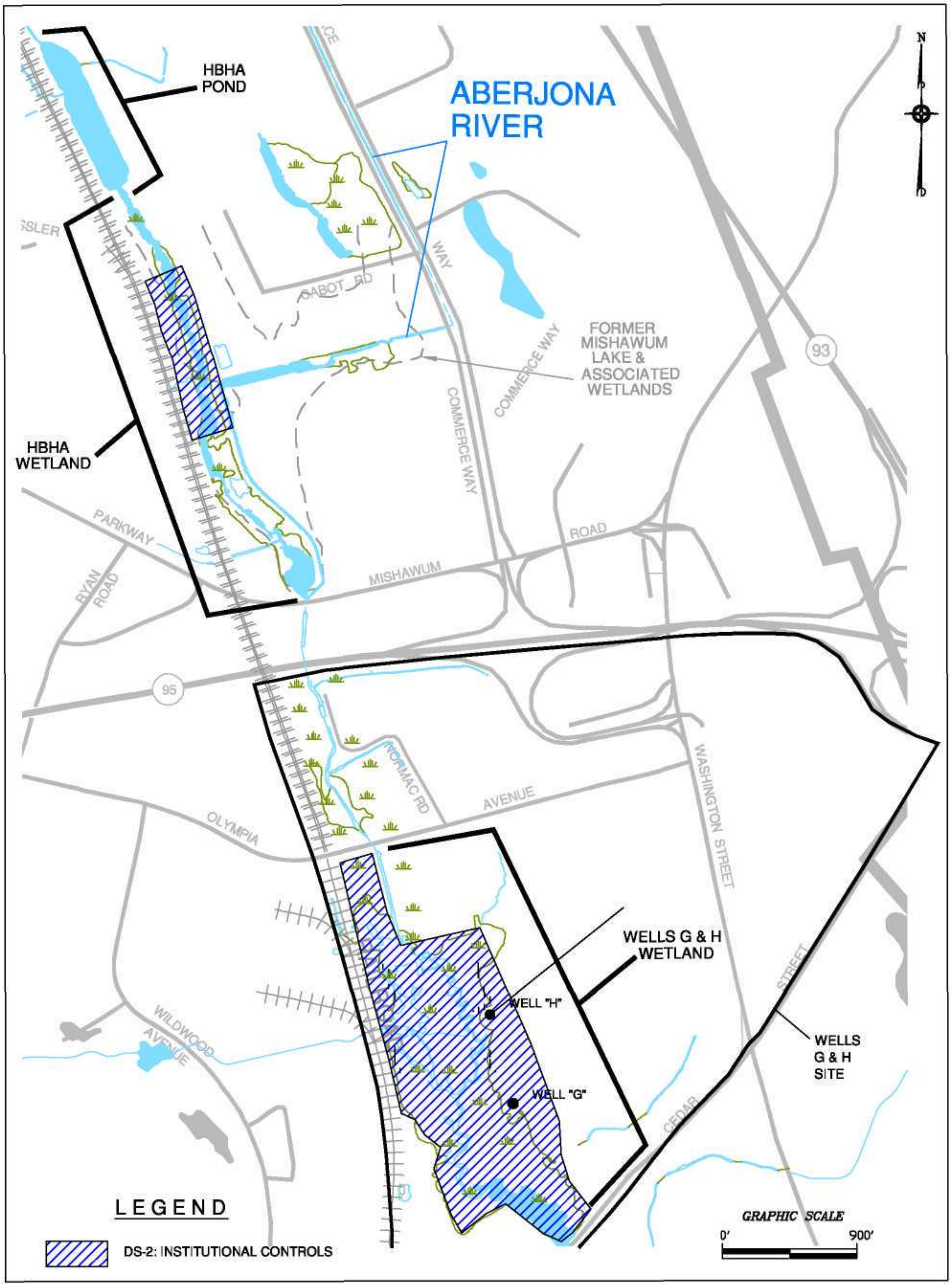
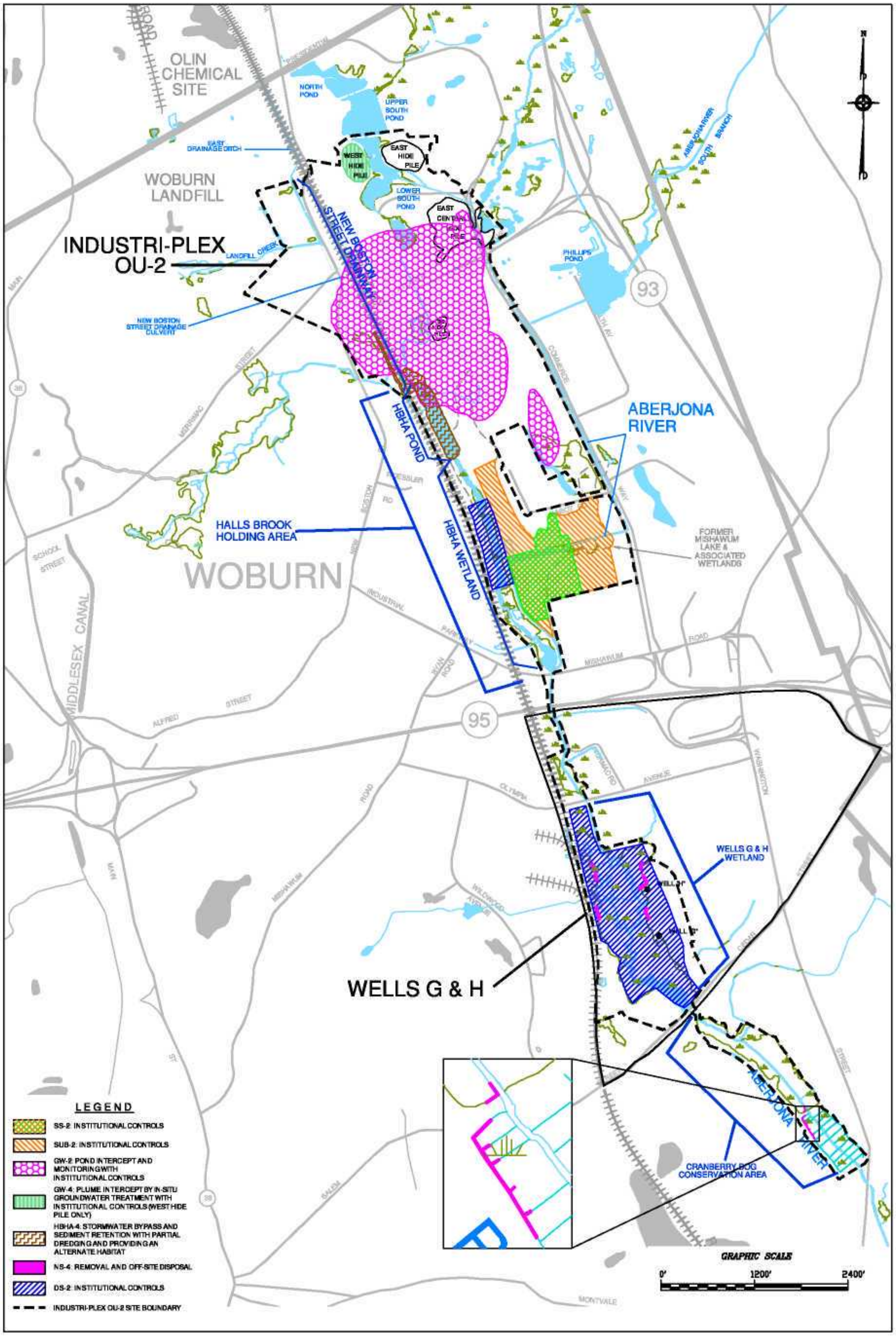

HBHA
POND
ABERJONA
RIVER
HBHA
WETLAND
FORMER
MISHAWUM
LAKE &
ASSOCIATED
WETLANDS
CABOT RD
COMMERCE WAY
MISHAWUM
ROAD
PARKWAY
RYAN
ROAD
93
95
OLYMPIA
AVENUE
NORMAC RD
WASHINGTON STREET
WELLS G & H
WETLAND
WELL "H"
WELL "G"
WILDWOOD
AVENUE
CEDAR
STREET
WELLS
G & H
SITE
LEGEND
DS-2: INSTITUTIONAL CONTROLS
GRAPHIC SCALE
0'
900'

FIGURE J-9



OLIN CHEMICAL SITE
WOBURN LANDFILL
INDUSTRI-PLEX OU-2
NORTH POND
UPPER SOUTH POND
EAST DRAINAGE DITCH
WEST HIDE PILE
EAST HIDE PILE
LOWER SOUTH POND
EAST CENTRAL HIDE PILE
LANDFILL CREEK
NEW BOSTON STREET DRAINAGE CULVERT
NEW BOSTON STREET DRAINWAY
PHILLIPS POND
93
ABERJONA RIVER
HBHA POND
HALLS BROOK HOLDING AREA
HBHA WETLAND
FORMER MISHAWUM LAKE & ASSOCIATED WETLANDS
WOBURN
MIDDLESEX CANAL
95
WELLS G & H WETLAND
WELLS G & H
ABERJONA RIVER
CRANBERRY BOG CONSERVATION AREA
LEGEND
SS-2: INSTITUTIONAL CONTROLS
SUB-2: INSTITUTIONAL CONTROLS
GW-2: POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS
GW-4: PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT WITH INSTITUTIONAL CONTROLS (WEST HIDE PILE ONLY)
HBHA-4: STORMWATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT
NS-4: REMOVAL AND OFF-SITE DISPOSAL
DS-2: INSTITUTIONAL CONTROLS
INDUSTRI-PLEX OU-2 SITE BOUNDARY
GRAPHIC SCALE
0'
1200'
2400'

FIGURE L-1

APPENDICES

Appendix A

Massachusetts Department of Environmental Protection Letter of Concurrence

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

STEPHEN R. PRITCHARD
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

30 January 2006

Ms. Susan Studlien
Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region 1
One Congress Street, Suite 1100
Boston, MA 02114-2023

Re: State Concurrence Determination
Record of Decision – Industri-plex Superfund Site Operable Unit 2 (including Wells G&H Superfund Site Operable Unit 3)
Wobum, Massachusetts

Dear Ms. Studlien:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Record of Decision (ROD) and the selected remedy recommended by the U.S. Environmental Protection Agency (EPA) for Operable Unit 2 of the Industri-plex Superfund Site. This ROD and selected remedy also incorporate Operable Unit 3 of the Wells G&H Superfund Site. Subject to the matters set forth, below, MassDEP concurs with the selected remedy documented in the ROD.

Industri-plex is located in Wobum, north of Route 95 in a commercial/industrial area. The Industri-plex OU 2 ROD addresses groundwater, soil, sediment, and surface water impacts from past waste disposal practices at the site. This ROD also incorporates OU3 from the Wells G&H Superfund Site in Wobum, which extends from the Aberjona River near Route 95 to the Mystic Lakes in Arlington.

The selected remedy involves excavation of shallow, near-shore sediments, interception and treatment of groundwater, and the establishment of institutional controls. Specifically, the selected remedy involves the following:

- Removal of contaminated sediments from portions of the Halls Brook Holding Area (HBHA) Pond, near shore sediments at the Wells G&H Wetland, and from the Cranberry Bog Conservation Area. Wetlands impacted by the proposed remedy will be restored or replaced.

- Interception and treatment of a groundwater plume contaminated with arsenic, benzene, and ammonia at the northern portion of the HBHA Pond. The Pond will treat and sequester groundwater contaminants and minimize downstream migration of contaminants. Sediments that accumulate in the northern portion of the HBHA Pond will be periodically dredged and sent off-site for disposal.

- If necessary, in-situ enhanced bioremediation of a smaller groundwater plume contaminated with benzene near the West Hide Pile (WHP). The WHP was capped under the Industri-Plex OU1 ROD. This decision will be made during the pre-design phase after additional groundwater information is collected.

- Construction of an impermeable cap to line a nearby stream channel known as the New Boston Street Drainway to prevent contaminated groundwater from discharging into it.

- Construction of a permeable cap to prevent contaminated soil erosion and downstream migration adjacent to the NSTAR and MBTA right-of-way.

- Institutional controls to restrict contact with soils, groundwater and deeper interior wetland sediments with concentrations above performance standards.

- Long-term monitoring of the groundwater, surface water, and sediments, and periodic Five-year Reviews of the remedy.

We noted in our prior comments MassDEP's conceptual agreement with the use of institutional controls for those areas generally identified in the selected remedy as needing institutional controls, because of the future risk those areas present. We further noted that it was not possible for MassDEP to evaluate fully different types of institutional controls to determine what would be most appropriate for the site, due to a lack of information then available, and that certain EPA guidance addresses the development of such information. In EPA's summary of the selected remedy in the ROD, EPA indicates that additional studies during the pre-design and remedial design phase may be necessary to support the design and implementation of institutional controls.

MassDEP agrees that EPA should ensure that such studies are done during the pre-design and design phase to evaluate specific types and other details of institutional controls for the site. MassDEP requests that EPA, in determining what studies and other steps are needed to accomplish this purpose, and in selecting appropriate institutional controls for the selected remedy, give due consideration to its final fact sheet titled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups"

EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000", among any other relevant guidance or policies.

Under the circumstances, until EPA determines, during the pre-design and design phase, what institutional controls would be most appropriate for areas outlined in the selected remedy, MassDEP fully reserves all rights to evaluate and comment upon specific institutional controls that EPA may propose, and to determine MassDEP's participation, if any, in the development, implementation, administration and enforcement of such institutional controls as EPA may select or approve for the selected remedy. MassDEP will evaluate and comment upon specific institutional control proposals once EPA identifies them pursuant to the additional studies mentioned, above.

We believe that with proper design and construction the selected remedy will address the remaining contamination in a manner that is protective of public health and the environment.

If you have any questions regarding this letter, please contact Mr. Jay Naparstek, Deputy Division Director at (617) 292-5697.

Very truly yours,

Robert W. Golledge, Jr.
Commissioner
Department of Environmental Protection

Appendix B

Glossary of Terms and Acronyms

APPENDIX B - ACRONYMS

21E	310 Code of Massachusetts Regulations (CMR) Chapter 21E
ARAR	Applicable or Relevant and Appropriate Requirements
ASC	Aberjona Study Coalition
AST	above ground storage tank
As	arsenic
ATSDR	Agency for Toxic Substances and Disease Registry
AUL	Activity and Use Limitation
AVS	acid volatile sulfide
B&M	Boston and Maine
BECO	Boston Edison Company
BERA	baseline ecological risk assessment
BTEX	benzene, toluene, ethyl benzene, xylene
CBCA	Cranberry Bog Conservation Area
CCC	Criterion Continuous Concentration (chronic)
CMC	Criterion Maximum Concentration (acute)
Cr	chromium
CT	central tendency
CD	Consent Decree
CDM	Camp, Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System

CF	cubic foot
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMC	Criterion Maximum Concentration (acute)
CMR	Code of Massachusetts Regulations
COC	chemical/contaminant(s) of concern
COD	chemical oxygen demand
COE	U.S. Army Corps of Engineers
COPC	contaminant of potential concern
CPAH	carcinogenic polynuclear aromatic hydrocarbons
Cr	chromium
CSM	Conceptual Site Model
CT	central tendency
CWA	Clean Water Act
CVOC	chlorinated volatile organic compounds
CY	cubic yard
DCA	dichloroethane
DCE	dichloroethene
DDT	p,p'-Dichlorodiphenyltrichloroethane
MassDEP	Massachusetts Department of Environmental Protection
DEQE	Department of Environmental Quality Engineering
DNAPL	dense non-aqueous phase liquid
DNR	Department of Natural Resources

DO	dissolved oxygen
DOC	dissolved organic carbon
DPS	downgradient property status
DPT	direct push technology
DPW	Department of Public Works
DS	deeper (interior) wetland sediments
EHP	East Hide Pile
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
Fe	iron
FS	Feasibility Study
gpd	gallons per day
g/hr	grams per hour
gpm	gallons per minute
GPR	ground penetrating radar
GSIP	Groundwater/Surface Water Investigation Plan
GW	groundwater
HBHA	Halls Brook Holding Area
Hg	mercury
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient

I-95	Interstate 95
I-93	Interstate 93
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
ISRT	Industri-plex Site Remedial Trust
IRA	Immediate Response Action
IWPA	Interim Wellhead Protection Area
J	Estimated value based on data QC
lb	pound
LEDPA	Least Environmentally Damaging Practicable Alternative
LF	linear foot
LLC	limited liability corporation
LOAEL	lowest observed adverse effect level
LNAPL	Light Non-Aqueous Phase Liquid
MA	Massachusetts
MADEP	Massachusetts Department of Environmental Protection
MAPC	Metropolitan Area Planning Council
MBTA	Massachusetts Bay Transportation Authority
MCL	maximum contaminant level
MCP	Massachusetts Contingency Plan
MDC	Metropolitan District Commission
M&E	Metcalf & Eddy, Inc
mgd	million gallons per day

mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MIT	Massachusetts Institute of Technology
MM	Management of Migration
MMCL	Massachusetts Maximum Contaminant Levels
MOA	Memorandum of Agreement
MPT	Mark Phillip Trust
MRA	Massachusetts Rifle Association
MSGRP	Multiple Source Groundwater Response Plan
MSGRP RI	Multiple Source Groundwater Response Plan Remedial Investigation
MSMA	Monosodium Methane Arsenate
MRWA	Mystic River Watershed Association
MWRA	Massachusetts Water Resources Authority
NA	Not analyzed
NAPL	Non-aqueous phase liquid
NAS	Natural Attenuation Study
NAWQC	National Ambient Water Quality Criteria
NBSD	New Boston Street Drainway
NCDC	National Climatic Data Center
NCP	National Contingency Plan
ND	Not detected
NDS	Not a Disposal Site
NDMA	N-nitrosodimethylamine

NERL	(EPA) New England Regional Laboratory
NFA	no further action
NGVD	National Geodetic Vertical Datum
NML	northern multi-level (sampler)
NOAA	National Oceanic Atmospheric Admistration
NPDES	National Pollutant Discharge Elimination System
NPDWSA	Non-Potential Drinking Water Source Area
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
NS	near shore sediments
NSTAR	NSTAR Electric & Gas Company
NWS	National Weather Service
O&M	operation and maintenance
OMEE	Ontario Ministry of the Environment and Energy
ORD	(EPA) Office of Research and Development
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OSRR	Office of Site Remediation and Restoration
OU	Operable Unit
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyl compounds
PCE	tetrachloroethene

PID	photo-ionization detector
PPA	Prospective Purchaser Agreement
ppb	part per billion
PPE	personal protective equipment
ppm	part per million
PQL	Practical Quantitation Limit
PRB	permeable reactive barrier
PRG	Preliminary Remediation Goal
PRP	Potentially Responsible Parties
RAO	response action outcome
RAM	Release Abatement Measure
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RME	reasonable maximum exposure
ROD	Record of Decision
RTC	(Anderson) Regional Transportation Center
RTN	Release Tracking Number
SARA	Superfund Amendments and Reauthorization Act
SC	Source Control
SEL	severe effects level
SEM	selective extractable metals

SIC	Standard Industrial Code
SP	Settling Parties
SS	Surface Soil
SUB	Subsurface Soil
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SW	surface water
SWAP	Source Water Assessment Program
SY	square yard
TAG	Technical Assistance Grant
TBC	To Be Considered
TCA	trichloroethane
TCE	trichloroethene / trichloroethylene
TCLP	Toxicity Characteristic Leachate Procedure
TCO	total combustible organics
TDS	total dissolved solids
TNT	trinitro-toluene
TOC	total organic carbon
TOSC	Technical Outreach Services for Communities
TPH	total petroleum hydrocarbons
TRC	TRC Environmental Corporation
TRV	toxicity reference value
TRI	toxic release inventory

Trust	Mark Phillip Trust
TSP	trisodium phosphate
TSS	total suspended solids
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper Confidence Limit
μg/kg	microgram per kilogram
μg/L	microgram per liter
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
UV	ultraviolet
VOC	volatile organic compound
WHP	West Hide Pile
WNA	Woburn Neighborhood Association
WREN	Woburn Resident Environmental Network
XRF	X-ray Fluorescence (Spectroscopy)
ZVI	zero valent iron

Appendix C

Massachusetts Department of Environmental Protection
Ground Water Use and Value Determinations

APPENDIX C-1
INDUSTRI-PLEX SITE
GROUNDWATER USE AND VALUE DETERMINATION

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

SITE 3-1731-02
5 11

ARGEO PAUL CELLUCCI
Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

August 26, 1997

Mr. Daniel Coughlin, Chief
Massachusetts Superfund Section
USEPA
JFK Federal Building, HBO
Boston, MA 02203

Dear Dan:

Enclosed please find the Groundwater Use and Value Determination prepared by DEP for the Industri-Plex site. This first Use and Value Determination conducted by DEP, pursuant to the recently finalized Guidance developed by EPA, was done as a pilot in anticipation of the signing of a Memorandum of Agreement between the two agencies.

In determining the use and value of the groundwater in the vicinity of the Industri-Plex site, we referred to the aquifer classification contained in the Massachusetts Contingency Plan. As we have discussed, the classification in the MCP gives consideration to all of the eight factors contained in the Use and Value Guidance. Enclosed with the Use and Value Determination is a copy of the GIS map used to determine the aquifer classification. This map provides a variety of information, including the USGS yield classification, the presence of public water supplies and zones of protection, surface water bodies, wetlands and protected open space areas.

I trust you will find this example of how we will conduct Use and Value Determinations under the MOA acceptable. If so, I believe we are ready to finalize the MOA and begin implementing these determinations on other NPL sites. The most recent version of the MOA was drafted by Bill Walsh-Rogalski of your office. I have included a copy of the comments we submitted on that draft. If you are satisfied with the Industri-Plex example, please send us a final version of the MOA for review and signature.

If I can be of any further assistance on this, please do not hesitate to call me at 292-5697.

Very truly yours,

Jay Naparstek

Jay Naparstek, Chief
Federal Sites Section

GROUNDWATER USE AND VALUE DETERMINATION PILOT
Industri-Plex Superfund Site

August, 1997

Consistent with the Environmental Protection Agency's (EPA) 1996 Final Ground Water Use and Value Determination Guidance, the Department has developed a "Use and Value Determination" of the groundwater impacted by the Industri-Plex Superfund Site (the "Site"). The purpose of the Use and Value Determination is to identify whether the aquifer at the site should be considered of "High, Medium", or "Low" use and value. In the development of its Determination, the Department has applied the criteria for groundwater classification as promulgated in the Massachusetts Contingency Plan (MCP). The classification contained in the MCP considers criteria similar to those recommended in the Use and Value Guidance. The Department's recommendation supports a low use and value for the Study Area groundwater. An explanation for the determination is outlined below.

The Industri-Plex Superfund Site (the "Site") covers approximately 245 acres of land in Woburn, Massachusetts. Contamination at the Site includes soils containing arsenic, chromium, lead, and odorous tannery wastes; and groundwater and surface water containing heavy metals and volatile organics. The soil remedy is nearly complete, but the groundwater and surface water at the site are still under investigation. For the purposes of this Determination, the groundwater under evaluation is defined as the extent of the Groundwater/Surface Water Investigation Plan (GSIP), which includes and expands upon the boundaries for the soil remedy (See Figure A, the "Study Area").

The aquifer underlying much of the Study Area is classified as medium or high yield by the United States Geological Survey (USGS). Portions of the north, southeast and southwest regions of the Area are classified as low yield. Despite the medium/high yield classification of a significant portion of the aquifer, the Department has classified the Study Area as a Non-Potential Drinking Water Source Area because of its concentrated industrial development. More specifically, the Study Area aquifer is classified as both GW-2 and GW-3 (see description below). Table 1 reviews the Study Area with respect to the eight factors contained in the Use and Value guidance.

There are no public or private wells in the Study Area. However, the southern border at Route 128 is the edge of the Wells G + H Interim Wellhead Protection Area (IWPA). Wells G + H are inactive, but are still considered a public drinking water supply. The medium and low yield portions of the Area aquifer flow into this IWPA. Study Area groundwater must meet drinking water standards (the GW-1 classification) before entering the IWPA.

For the purposes of the risk assessment of the Study Area groundwater, the Department defines a GW-2 classification as areas where there is a potential for migration of vapors from groundwater to occupied structures. The classification applies to locations where groundwater has an average annual depth of 15 feet or less and where there is an occupied building or structure within a 30 foot surface radius of that groundwater. The GW-3 designation considers the impacts and risks associated with the discharge of groundwater to surface water and therefore applies to all groundwater. Considering these classifications, the groundwater risk evaluation for the Industri-Plex site should include, but is not limited to, the following:

Human Health: a) vapor seepage into buildings,
b) use of the water in industrial processes,
c) excavation into groundwater (i.e., worker exposure),
d) discharge into surface water (and the consequential effects of the discharge--i.e., wading scenarios, recreation, fishing).

Ecological: a) effects on the biota that make up the benthic community,
b) effects on the biota that feed on or in the benthic community, and on up the food chain, as determined by the substance's persistence and ability to bioaccumulate.

In light of the use and value factors and similar criteria established in the MCP that were examined in this determination, the Department supports a low use and value for the Study Area aquifer. The Department welcomes the opportunity to participate in this new approach to evaluating groundwater, which furthers the goal of making more consistent and realistic remedial groundwater decisions at Superfund sites.

TABLE 1
INDUSTRI-PLEX SITE GROUNDWATER USE AND VALUE DETERMINATION PILOT
August, 1997

USE AND VALUE FACTORS	INDUSTRI-PLEX SITE: #3-1731 SITE-SPECIFIC DETERMINATION
Quantity	-Medium/High Yield, small portions Low Yield -Medium/High Yield covers entire south-western portion of the OU-1 portion of the site, and three quarters of the Groundwater/ Surface Water Study Area down to Route 128.
Quality	-Elevated levels of total magnesium, calcium, sodium, and iron and other metals in Study Area groundwater. Site groundwater contaminants include volatile organics (primarily benzene and toluene), and metals (primarily arsenic and chromium).
Current Public Drinking Water Supply	-No Wellhead Protection Area within the Study Area, but the study area borders the Wells G & H IWPA to the south. -Horne Pond wells supplemented by MWRA water are supplied by town for drinking water. -It is not a sole Source Aquifer.
Current Private Drinking Water Supply	-No known private drinking water supplies in the Study Area.
Likelihood and Identification of Future Drinking Water Use	-Study Area groundwater is designated by the State as a Non-Potential Drinking Water Source Area. -Study Area is highly urbanized: industrial and commercial development, with some residential at southeast. -Not designated by the Town as an area for future drinking. -No known Activity and Use Limitations on the Study Area properties.
Other Current or Reasonable Expected Ground Water Use(s) in Review Area	-Several groundwater wells in the area are used for non-potable activities such as irrigation. -In the future, possible increase in production well use, and use of well water for irrigation.
Ecological Value	-Groundwater discharge to Halls Brook, Halls Brook Holding Area, and the Aberjona River.
Public Opinion	-Public comment occurs during the promulgation of MCP regulations, and under CERCLA will occur during the Record of Decision process. -No known petition in process for a change in groundwater classification in the Study Area. Would expect substantial opposition to possible use as a water supply.

MA DEP - Bureau of Waste Site Cleanup

SITE NAME:
Industriplex\ \42 31 07n 71 08 29ew

STUDY AREA

INDUSTRI-PLEX SITE

Site Location

FIGURE A: STUDY AREA

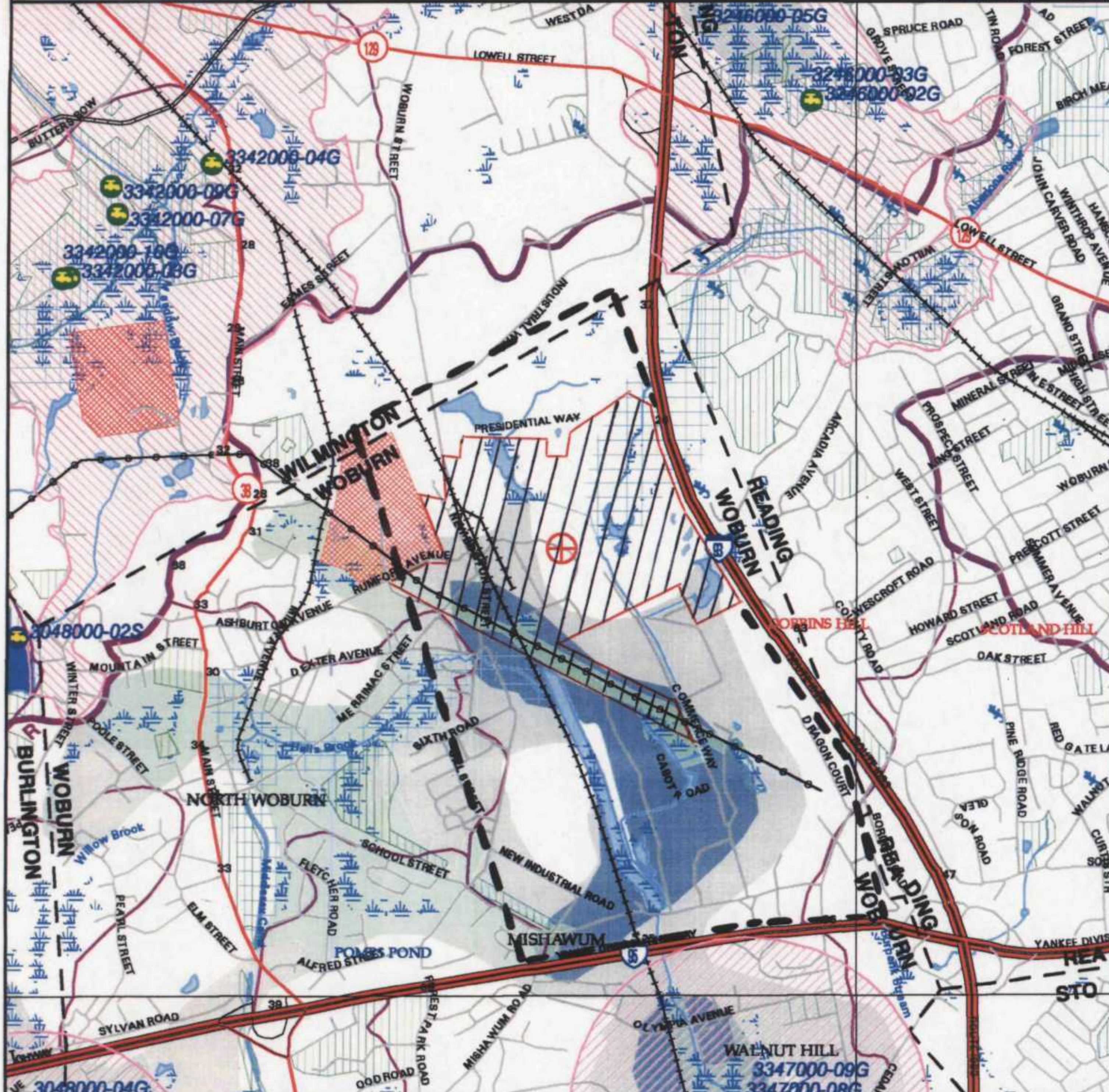
The information shown on this map is the best available at the date of printing. Please refer to the data source descriptions document.

MASS GIS

Massachusetts Geographic Information System

Massachusetts Executive Office of Environmental Affairs - 1997

DEP



Roads: Interstate, US, State, Street, Trail

Boundaries: Municipal, County, DEP Region

Train; Powerline; Pipeline

Drainage Basins: Major, Sub

Streams: Perennial, Intermittent, Aqueduct

Potentially Productive Aquifers: Medium Yield, High Yield

Non-Potential Drinking Water Source Area: Medium, High Yield

EPA Designated Sole Source Aquifer

Public Water Supplies: Ground, Surface, Non Community

Approved Zone2; IWPA;

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

N S E W

SCALE 1:25000

MILES 0 1/2 1

KILOMETERS 0 1/2 1 2 3

June 27, 1997

APPENDIX C-2
WELL G&H SITE
GROUNDWATER USE AND VALUE DETERMINATION

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

ELLEN ROY HERZFELDER
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

MEMORANDUM

Date: July 8, 2004

To: Robert Cianciarulo, Chief, EPA Mass Superfund Section

From: Anna Mayor, MADEP

CC: Joe LeMay, EPA
Gordon Bullard, TTNUS

Re: Wells G + H Groundwater Use and Value Determination

Enclosed is a newly signed original of the DEP's Wells G + H Groundwater Use and Value Determination. I am sending the revised version in response to a request made by Joe LeMay of your office to resubmit the Determination with our Assistant Commissioner's signature, rather than the Deputy Division Director's signature as in the November 24, 2003 version. Outside of the date, the signatory, the change in the EPA Section Chief, and the addition of Gordon Bullard to the cc list; no other changes were made to cover letter or the document. If there is anything else you need, please let me know.

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

June 21, 2004

Robert Cianciarulo, Chief
Massachusetts Superfund Section
U.S. EPA Region I
JFK Federal Building
Boston, MA 02203

RE: Groundwater Use and Value Determination
Wells G + H Superfund Site (MAD #980732168, RTN#3-0479)

Dear Mr. Cianciarulo:

Enclosed please find the Groundwater Use and Value Determination prepared by the Department (DEP) for the Wells G + H Superfund Site (the Site). This Determination was conducted by the DEP pursuant to the Memorandum of Agreement (1998) between the U.S. Environmental Protection Agency and the DEP.

In determining the use and value of the groundwater in the vicinity of the Wells G + H Site, we referred to the aquifer classification system in the Massachusetts Contingency Plan (MCP). The classification in the MCP gives consideration to all of the factors in the Use and Value Guidance. Enclosed with the Use and Value Determination is a copy of the GIS map used to determine the aquifer classification. This map provides a variety of information, including the USGS yield classification, the presence of public water supplies and zones of protection, surface water bodies, wetlands, protected open space areas, and drainage basin boundaries.

If you have any questions regarding this letter, please don't hesitate to contact me at 617-654-6651.

Sincerely,

Richard Chalpin
Assistant Commissioner, Bureau of Waste Site Cleanup

cc. Joe LeMay, EPA
Anna Mayor, MADEP
Gordon Bullard, TTNUS

enclosure

GROUNDWATER USE AND VALUE DETERMINATION
Wells G + H Superfund Site
Woburn, MA

June 2004

Consistent with the Environmental Protection Agency's (EPA) 1996 Final Ground Water Use and Value Determination Guidance, the Department has developed a "Use and Value Determination" of the groundwater beneath the Wells G + H Superfund Site (the "Site"). The purpose of the Use and Value Determination is to identify whether the aquifer at the site should be considered of "High", "Medium", or "Low" use and value. In the development of its Determination, the Department has applied the criteria for groundwater classification as promulgated in the Massachusetts Contingency Plan (MCP). The classification contained in the MCP considers criteria similar to those recommended in the Use and Value Guidance as agreed to in the Memorandum of Agreement (MOA) between EPA and DEP. The Department's recommendation supports a medium use and value for the Site Area groundwater. A brief background of the Site, an explanation for the determination, and a table listing the criteria that facilitated the determination are outlined below.

The Site covers approximately 330 acres in eastern Woburn, Massachusetts. The Site is bounded by Route 128/95 to the north, Route 93 to the east, the Boston and Maine railroad to the west, and Salem Street to the south. The groundwater under evaluation for this determination is within the boundaries of the Site as shown on the attached Figure.

The Site is almost entirely within the Interim Wellhead Protection Area (IWPA) of the two municipal wells G + H. The two wells reside near the center of the Site as shown on the Figure. The aquifer within the Site is classified as medium and high yield by the United States Geological Survey (USGS). Combined, the wells had a pumping capacity of approximately 1.73 million gallons of water per day (MGD). Wells G + H were shut down in May of 1979 when high levels of chlorinated organics were discovered in both wells. Since that date the wells have not been used. However, the City has not formally abandoned the wells in accordance with the DEP's regulations; therefore, at this time the DEP Drinking Water Program has classified the wells as inactive.

Approximately two thirds of the water currently used by the City is from seven groundwater wells in a separate aquifer under Horn Pond, and the remainder is supplied by the Massachusetts Water Resources Authority. There have been problems with TCE contamination from an unknown source in the aquifer at Horn Pond, as well as bacterial contamination from a nearby Combined Sewage Overflow (CSO), but these have been stabilized and controlled. City engineers have indicated to the DEP's Drinking Water Program that the stability of the current water supply and the expression of public opinion against the use of the G + H wells for drinking has meant that the likelihood of using the inactive wells in the near future is very low. However, they have also expressed to DEP that they do not want to eliminate the possible future use of the resource. Water usage has increased tenfold since the City's water system became operational in 1873, and is now at least 6 million gallons of water per day.

With regard to the cleanup of the Site, an intensive remedial investigation was conducted through the 1980s following the shut down of the wells. A Record of Decision issued by EPA in September of 1989 required the remediation of the sources of the contamination to the wells, and the investigation of the Central Area groundwater and the Aberjona River. To date, contaminated soil at the Site has been remediated at three of the source areas known as Wildwood Conservation Trust (also known as Beatrice Food Corporation), New England Plastics, Inc., and W.R. Grace. Contaminated soils remain at the Unifirst Corporation and the Olympia Nominee Trust properties. The remaining contaminants include chlorinated organics, heavy metals, polychlorinated biphenyls (PCBs), and other wastes.

The investigation of the Aberjona River, which flows through the center of the site, has indicated that contaminants are present in both sediment and surface water. The sediment of the Aberjona River contains elevated levels of metals including arsenic, chromium, mercury, copper and lead, volatile and semi-volatile organics, pesticides, and PCBs. The surface water contains volatile organics, pesticides, semi-volatile organics, and metals. The groundwater within the Central Area, i.e., the area downgradient of the source area properties, contains a broad mix of inorganic and organic contaminants, including nitrates, sodium, chloride, barium, arsenic, chromium and lead, chlorinated organics consisting primarily of trichloroethylene and tetrachloroethylene, other volatile organics, poly-aromatic hydrocarbons (PAHs), and other semi-volatile organic compounds.

Because the Site is within the IWPA of a current drinking water supply, and also because the aquifer is medium and high yield, the Site Area aquifer is classified under the MCP as GW-1 meaning a current or potential drinking water source area. The one-mile diameter IWPA default zone supercedes any of the areas excluded as non-drinking water source areas under the MCP. The GW-2 classification applies to areas where there is potential migration of vapors from groundwater to occupied structures; specifically, where groundwater has an average annual depth of 15 feet or less and where the structure is within a 30 foot surface radius of that groundwater. Since much of the site is developed with commercial, industrial and residential structures, GW-2 potentially applies to the majority of the aquifer. An exception to the developed areas is the land surrounding the wells owned by the City that is vacant. Potential uses for this land are being examined under a Superfund Redevelopment Grant by the EPA. So far all of the plans created under the grant have included various scenarios of recreational use.

Lastly, at a minimum, all groundwater is considered as GW-3, which considers the ecological and human health impacts and risks associated with the discharge of groundwater to surface water. The aquifer discharges into the Aberjona River and its associated wetlands.

Considering these classifications, exposure scenarios for the groundwater risk evaluation should include, but not be limited to: ingestion and exposures from other domestic uses; inhalation of vapors from seepage into buildings; use of the water in industrial processes and other potential exposures to the use of the water in industrial and residential activities; worker exposure during excavation into groundwater; and exposures resulting from discharge to surface water.

Overall, the aquifer has significant current ecological value for its contribution to the River and the associated wetlands; however, the groundwater and the sediment of the River and its wetlands are contaminated. The full ecological value of the groundwater won't be realized until it and the sediment of the area have been remediated, which is most likely several years away. Its potential human value is significant, but only in the far future. In light of these and other criteria established in the MCP that were examined in this determination, the Department supports a medium use and value for the Site Area aquifer.

Groundwater Use and Value Considerations				
Factors	High	Medium	Low	Comments
1. Quantity	X			Aquifer is high-yield (1.75 million gal/day) The aquifer is alluvial, highly porous sand and gravel.
2. Quality			X	Aquifer is contaminated throughout (upper aquifer into the bedrock) with a broad variety of contaminants above drinking water standards. Many of the contaminants are organic and volatile and therefore are expected to eventually breakdown or volatilize upon eventually reaching surface water. Main sources of anthropogenic contamination of the aquifer appear to have been identified, and most are being or have been removed.
3. Current Public Water Supply Systems		X		There are two public supply wells on site. Both are inactive due to the presence of contamination. The City uses groundwater from another aquifer (Horn Pond Aquifer) and supplements the lost supply from Wells G&H with MWRA water. The City experiences regular water shortages and voluntary and required reduction efforts during the summer months.
4. Current Private Drinking Water Supply Wells			X	No known private drinking water wells within the study area. The City does not allow private wells to be tied into the municipal drinking water system at any point.
5. Likelihood and I.D. of Future Drinking Water Use		X		There are no other potential water supply development areas in the City that we are aware of. It is unlikely that the Wells G&H will be used in the near future, but possibly in the longer term as demand increases.
6. Other Current or reasonable Expected Groundwater Use(s) in Review Area		X		There are industrial wells used for processing and irrigation, and commercial wells also used for irrigation in the area. It is reasonable to expect similar uses to continue.
7. Ecological Value	X			Groundwater in the study area discharges directly to the Aberjona River.
8. Public Opinion		X		Public opinion has been opposed to utilizing the Wells G&H for water supply. The City has expressed an interest in having the source available for the future.

MA DEP - Bureau of Waste Site Cleanup

Site Scoring Map: 500 feet & 0.5 Mile Radii

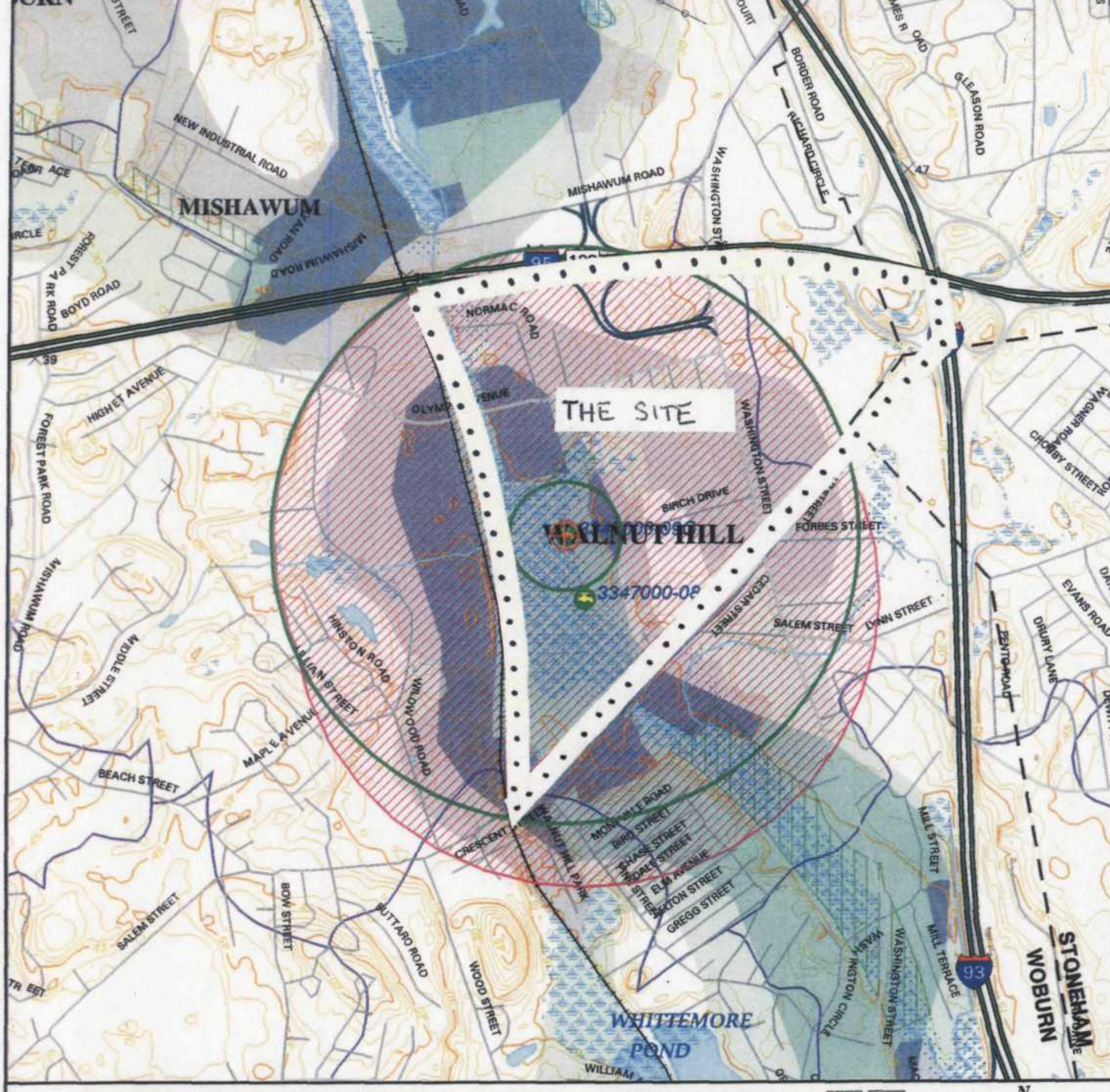
SITE NAME:

Wells G and H Superfund Site RTN 3-0479
Aberjona River Valley
Woburn
916205n 230325ew

Site Location

The information shown on this map is the best available at the date of printing. Please refer to the MassGIS Website for data source information (www.state.ma.us/mgis).

MASS GIS — Massachusetts Geographic Information System — Massachusetts Executive Office of Environmental Affairs - 2003



Roads: Ltd Access, Divided, Other Highway, Maj Rds, Street, Trail	EPA Sole Source Aquifer; FEMA 100-year floodplain
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct	PWS: Ground, Surface, Emergency Surface, Non Community
Basins: Major, Sub; Streams: Perennial, Intermittent, Man Made Shore, Dams	Approved Zone2; IWPA; Surface Water Supply Zone A
Potentially Productive Aquifers: Medium, High Yield	Hydrography: Water Features, Public Surface Water Supply
Non-Potential Drinking Water Source Area: Medium, High Yield	Wetlands: Fresh, Salt, NHESP Wetlands Habitat
	Protected Open Space; ACEC
	DEP Permitted Solid Waste Facilities; Certified Vernal Pools

SCALE 1:15000 — 0 — 1/2 MILES — 0 — 1/2 KILOMETERS

N S E W

August 05, 2003

Appendix D

Applicable or Relevant and Appropriate Requirements (ARARs) Tables

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-1 ARARS AND TBCs FOR SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practical alternative method to work in wetland buffer zones (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation controls would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation controls would be adopted during construction and restoration activities.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated soils using this criteria to determine whether they should be managed as hazardous waste.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure with surface soils, and groundwater monitoring would ensure that there is no migration of contamination from the soil.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-1 ARARS AND TBCs FOR SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no *significant net increase in flood storage or velocities*; and (f) disturbed vegetation, river, and riverbank would be restored.

LOCATION-SPECIFIC ARARS

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practical alternative method to work within wetland buffer zones (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.

TABLE D-1 ARARS AND TBCs FOR SS-2 (INSTITUTIONAL CONTROLS WITH MONITORING) (cont.)

LOCATION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based cleanup standards developed for this Site. The cleanup standards are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-2 ARARs and TBCs FOR SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact, and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated soil constitutes characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	The imposition of institutional controls would prevent exposure with subsurface soils, and groundwater monitoring would be used to ensure that there is no migration of contamination from the soil.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts on wetlands.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-2 ARARs and TBCs FOR SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING) (cont.)

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because there is no practicable alternative that would be less damaging to resource areas and all practical measures would be taken to minimize adverse impacts to wetlands.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-2 ARARs and TBCs FOR SUB-2 (INSTITUTIONAL CONTROLS WITH MONITORING) (cont.)

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based cleanup standards developed for this Site. The cleanup standards are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-3 GW-2 (POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	Alternative GW-2 would comply with this ARAR. Groundwater monitoring would be required to evaluate the natural attenuation processes and contaminant migration into HBHA Pond.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-3 GW-2 (POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS) (cont.)

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work within a wetland buffer zone (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains (i.e., installation of monitoring wells) with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond would be required to replace lost and impaired functions and values.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-3 GW-2 (POND INTERCEPT AND MONITORING WITH INSTITUTIONAL CONTROLS) (cont.)

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 150 ug/L Benzene: 46 ug/L Ammonia: NRWQC-CCC for Fish Early Life Stages Present (value to be adjusted for temperature & pH in accordance with EPA's *1999 Update of Ambient Water Quality Criteria for Ammonia;* dated December 1999;EPA Document No. EPQ-822-R-99-014)	NRWQC for arsenic and other site-related constituents would be achieved at the point of compliance (south of the HBHA cofferdam) and in the river downstream of the cofferdam.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based cleanup standards developed for this Site. The cleanup standards are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-4 GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. If it is determined that in-situ treatment is required, there would be no practicable alternative method to work within a wetland buffer zone that would achieve the remedial action objective but would have less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. If it is determined that in-situ treatment is required, there would be no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA – Groundwater Monitoring (40 CFR 264, Subpart F)	Relevant and Appropriate	This regulation details the requirements for groundwater monitoring and responding to releases from solid waste management units.	GW-4 would comply with this ARAR. Groundwater monitoring would be required to evaluate the performance of in-situ groundwater technologies and contaminant migration into HBHA Pond.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained if it is determined that in-situ treatment is required, there would be no practicable alternative method that would achieve the remedial action objective but would have less damaging impacts to resource areas. All practical measures would be taken to minimize adverse impacts to wetlands.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-4 GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS) (cont.)

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. If it is determined that in-situ treatment is required, there would be no practicable alternative method to work within a wetland buffer zone with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. If it is determined that in-situ treatment is required, there would be no practical alternative method to work in floodplains with less adverse impact. All practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	The design specifications and required construction procedures would ensure that Alternative GW-4 will comply with this ARAR for all areas within the 100-year floodplain.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	The design specifications and required construction procedures would ensure that Alternative GW-4 will comply with this ARAR for all work areas within the 100-foot buffer zone of a wetland to minimize impacts to wetlands and mitigate if necessary.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-4 GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS) (cont.)

CHEMICAL SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 150 ug/L Benzene: 46 ug/L Ammonia: NRWQC-CCC for Fish Early Life Stages Present (value to be adjusted for temperature & pH in accordance with EPA's *1999 Update of Ambient Water Quality Criteria for Ammonia;* dated December 1999;EPA Document No. EPQ-822-R-99-014)	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Ground Water Discharge Permit Program (314 CMR 5.00)	Relevant and Appropriate	Groundwater discharges shall not result in a violation of Massachusetts Surface Water Quality Standards (314 CMR 4.00) or Massachusetts Ground Water Quality Standards (314 CMR 6.00).	Will be attained. Alternative GW-4 would comply with this ARAR. Design of the treatment system would ensure that treated groundwater would comply with these standards.
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards designate and assign uses for which groundwater in the Commonwealth shall be managed and protected, and set forth water quality criteria necessary to maintain the designated areas.	Will be attained. GW-3 standards apply to the site. This aleternative provide in-situ treatment of organic contamination to the north of the West Hide Pile until these standards are achieved.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-4 GW-4 (PLUME INTERCEPT BY IN-SITU GROUNDWATER TREATMENT AND MONITORING WITH INSTITUTIONAL CONTROLS) (cont.)

CHEMICAL SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Massachusetts Ambient Air Quality Standards (310 CMR 6.0) and Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation also contains standards for fugitive emissions, dust, and particulates during construction.	The design specifications and required construction procedures will ensure that GW-4 will comply with this ARAR to minimize fugitive dust and particulate emissions during construction.
	Massachusetts Contingency Plan (MCP – 310 CMR 40.000)	To Be Considered	The MCP has established a set of risk-based threshold concentrations (UCLs) that must be attained in order to achieve a condition of no significant risk for groundwater or soil within a particular groundwater classification area.	UCLs were used to compare the risk-based cleanup standards developed for this Site. The cleanup standards are below the UCLs.
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR Part 230	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained because (a) there is no practical alternative that will achieve the cleanup objective with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there is no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved. Appropriate mitigation would be included to compensate for the continuing deposition of contaminants into the northern portion of HBHA Pond and to compensate for the portions of the New Boston Street Drainway (that were not accounted for in the original 1986 remedy decision) where an impermeable cap would be installed. These actions would be required to replace lost and impaired functions and values.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J	Applicable	Subpart A of Part 262 provides that a generator who treats, stores, or disposes of hazardous waste on-site must determine whether or not he has a hazardous waste, obtain an EPA identification number for any hazardous waste and comply with the regulations regarding accumulation of hazardous waste and recordkeeping. Subparts I and J of Part 264 identify design, operating, monitoring, closure, and post-closure care requirements for long-term storage of RCRA hazardous waste in containers and tank systems, respectively. However, Section 262.34(a) allows accumulation of RCRA hazardous wastes for up to 90 days in containers or tanks provided generator complies with requirements of Subparts I and J of Part 265.	Will be attained. Any hazardous wastes, free product, drums, or contaminated equipment would be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations would also be complied with for any off-site disposal.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criteria to determine whether they should be managed as hazardous waste.
	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated sediments constitute characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	Contaminated sediments in the HBHA Pond are the result of the discharge of contaminated groundwater. Periodic dredging of the sediments north of the cofferdam will remove unacceptable risks to human health and the environment beyond the point of compliance, south of the cofferdam.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative HBHA-4 will comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-4 will comply with applicable standards.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-4 would comply with this ARAR. Consultations with the USFWS will be made during the design phase.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored. Appropriate mitigation to compensate the continuing deposition of contaminants into the northern portion of HBHA Pond will be required to replace lost and impaired functions and values.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont.)	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of NPDES requirements and federal water quality criteria.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.
	Massachusetts Surface Water Discharge Permit Regulations, 314 CMR 3.00	Applicable	Regulates the discharge of water into public surface waters, allows Commonwealth to establish state standards under federal NPDES program.	See above discussion of federal NPDES requirements.
	Mass. Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Applicable	Section 30.300 identifies the requirements for disposal of hazardous waste; Sections 30.680 and 30.690 identify requirements for long-term storage of RCRA hazardous waste in containers and tank systems similar to federal RCRA storage requirements identified above. Section 30.340 allows on-site accumulation of hazardous waste for up to 90 days and is also similar to federal RCRA storage requirements identified above.	Will be attained. See discussion of federal RCRA Hazardous Waste Regulations above.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative HBHA-4 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities 40 CFR 264.18(b)	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required construction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative HBHA-4 will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative HBHA-4 will comply with this ARAR. Consultations with the USFWS will be made during the design phase.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

LOCATION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-5 HBHA-4 (STORM WATER BYPASS AND SEDIMENT RETENTION WITH PARTIAL DREDGING AND PROVIDING AN ALTERNATE HABITAT) (cont.)

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Applicable	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	HBHA-4 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that HBHA-4 would comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Relevant and Appropriate	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 150 ug/L Benzene: 46 ug/L Ammonia: NRWQC-CCC for Fish Early Life Stages Present (value to be adjusted for temperature & pH in accordance with EPA's *1999 Update of Ambient Water Quality Criteria for Ammonia;* dated December 1999;EPA Document No. EPQ-822-R-99-014)	AWQC for arsenic and other site-related constituents would be achieved at the point of compliance (south of the HBHA cofferdam) and in the river downstream of the cofferdam.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal NPDES requirements and federal water quality criteria.
	Massachusetts Surface Water Discharge Permit Regulations, 314 CMR 3.00	Applicable	Regulates the discharge of water into public surface waters, allows Commonwealth to establish state standards under federal NPDES program.	See above discussion of federal NPDES requirements.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection, 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Clean Water Act §404, and regulations, 33 USC 1344, 40 CFR, 230,	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity.	Will be attained in part because (a) there is no practical alternative method that will achieve cleanup objectives with less adverse impact; (b) all practical measures would be taken to minimize and mitigate any adverse impacts from the work; (c) there would be no likely impact on T&E species; (d) actions would be taken to minimize impact of hydrologic changes during the work; (e) after completion of the work, there would be no significant net loss of flood storage capacity, and no significant net increase in flood stage or velocities; and (f) river and riverbanks would be restored and habitat will be improved.
	RCRA Identification and Listing of Hazardous Wastes, 40 CFR 261.3	Applicable or Relevant and Appropriate	Criteria for determining if a waste or contaminated media is a hazardous waste subject to regulation. If a contaminated media exhibits the characteristics of a hazardous waste, RCRA hazardous waste regulations are applicable. If a contaminated media is sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate.	EPA will assess the contaminated sediments using this criteria to determine whether they should be managed as hazardous waste.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont)	RCRA Closure and Post-Closure Requirements, 40 CFR, Subpart G	Relevant and Appropriate	If contaminated sediments constitute characteristic hazardous waste or are sufficiently similar to listed RCRA hazardous wastes, these regulations are relevant and appropriate. Closure must be completed in a manner that minimizes the need for further maintenance, and controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.	Closure of units which contain sediments which are characteristic hazardous wastes, or which are sufficiently similar to hazardous wastes, would attain compliance with this standard.
	RCRA Hazardous Waste Regulations (Storage and Disposal of Hazardous Waste) 40 CFR Part 262, Subpart A, 40 CFR Part 264, Subparts I and J.	Applicable	Subpart A of Part 262 provides that a generator who treats, stores, or disposes of hazardous waste on-site must determine whether or not he has a hazardous waste, obtain an EPA identification number for any hazardous waste and comply with the regulations regarding accumulation of hazardous waste and recordkeeping. Subparts I and J of Part 264 identify design, operating, monitoring, closure, and post-closure care requirements for long-term storage of RCRA hazardous waste in containers and tank systems, respectively. However, Section 262.34(a) allows accumulation of RCRA hazardous wastes for up to 90 days in containers or tanks provided generator complies with requirements of Subparts I and J of Part 265.	Will be attained. Any contaminated media which is characterized as a hazardous waste, free product, drums, or contaminated equipment will be managed and stored in accordance with the substantive requirements of the cited regulations prior to being sent off-site for disposal. Disposal regulations will also be complied with for any off-site disposal.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative NS-4 would comply with this ARAR. Consultations with the USFWS would be made during the design phase.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements (cont.)	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative NS-4 would comply with this ARAR. Design specifications for the removal methods and procedures and design of the dewatering treatment system would ensure that NS-4 would comply with applicable standards.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative method that would be less damaging to resource areas; (b) all practical measures would be taken to minimize adverse impacts on wetlands; (c) stormwater discharges would be controlled through best management practices (BMPs); (d) actions would be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there would be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank would be restored.
	Massachusetts Surface Water Quality Standards 314 CMR 4.00	Applicable	These standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained, or protected. Minimum water quality criteria required to sustain the designated uses are established. Federal AWQC are to be considered in determining effluent discharge limits. Where recommended limits are not available, site-specific limits shall be developed.	Alternative NS-4 would comply with this ARAR through the use of engineering controls and protective construction methods and procedures that will be specified during the pre-design and design phase of remediation. Treatment standards and methods would be instituted for sediment dewatering effluent.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

ACTION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements (cont)	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.
	Massachusetts Surface Water Discharge Permit Regulations, 314 CMR 3.00	Applicable	Regulates the discharge of water into public surface waters, allows Commonwealth to establish state standards under federal NPDES program.	See above discussion of federal NPDES requirements.
	Mass. Hazardous Waste Regulations (Storage of Hazardous Waste), 310 CMR 30.300, 30.680, 30.690 310 CMR 30.340	Relevant and Appropriate	Requirements for long-term storage, transport and disposal of RCRA hazardous waste in containers and tank systems	See discussion of federal RCRA Hazardous Waste Regulations above.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	Statement of Procedures on Wetlands Protection 40 CFR Part 6, App. A, Exec. Order 11990 (1977) 40 CFR 6.302(a)	Applicable	Federal agencies shall avoid, whenever possible, the long and short term impacts associated with the destruction of wetlands, and wetlands development wherever there is a practicable alternative in accordance with Executive Order 11990.	Will be attained. There is no practicable alternative method to work in wetlands with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	Executive Order for Floodplain Management Exec. Order 11988 (1977) 40 CFR Part 6, App. A. 40 CFR 6.302(b)	Applicable	Federal agencies are required to reduce the risk of flood loss, minimize impact of floods, and restore and preserve the natural and beneficial values of floodplains.	Will be attained. There is no practical alternative method to work in floodplains with less adverse impact and all practicable measures would be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures would be adopted during construction and restoration activities.
	RCRA Floodplain Restrictions for Solid Waste Disposal Facilities and Practices 40 CFR 257.3-1	Relevant and Appropriate	Solid waste practices must not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain or result in washout of solid waste, so as to pose a hazard to human life, wildlife, or land or water resources.	Will be attained. The design specifications and required construction procedures would ensure that the implementation of Alternative NS-4 will comply with this ARAR for all areas within the 100-year floodplain.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	A hazardous waste treatment, storage, or disposal facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or to result in no adverse effects on human health or the environment if washout were to occur.	Will be attained. The design specifications and required constuction procedures would ensure that any treatment, storage or disposal of hazardous waste undertaken pursuant to Alternative NS-4 will comply with this ARAR.
	Fish and Wildlife Coordination Act and regulations, 16 USC 662, 663 40 CFR 6.302(g)	Applicable	Requires consultation with appropriate agencies to protect fish and wildlife when federal actions may alter waterways. Must develop measures to prevent and mitigate potential loss to the maximum extent possible.	Alternative NS-4 will comply with this ARAR. Consultations with the USFWS will be made during the design phase.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

LOCATION-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, MGL c. 131 § 40, 310 CMR 10.00	Applicable	Regulations restrict dredging, filling, altering, or polluting inland wetland resource areas and impose performance standards for work in such areas. Protected resource areas include: 10.54 (Bank); 10.55 (Bordering Vegetated Wetlands); 10.56 (Land under Water); 10.57 (Bordering Land subject to Flooding); and 10.58 (Riverfront Area).	Will be attained because (a) there is no practicable alternative that would be less damaging to resource areas; (b) all practical measures will be taken to minimize adverse impacts on wetlands; (c) stormwater discharges will be controlled through best management practices (BMPs); (d) actions will be taken to minimize impact of hydrologic changes during the work to the extent practicable; (e) after completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood storage or velocities; and (f) disturbed vegetation, river, and riverbank will be restored.
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.06	Applicable	For discharge of dredged or fill material, there must be no practicable alternative with less adverse impact on aquatic ecosystem; must take practicable steps to minimize adverse impacts on wetlands or land under water; stormwater discharges must be controlled with BMPs; must be no substantial adverse impact to physical, chemical, or biological integrity of surface waters.	Will be attained because (a) there is no practicable alternative method with less adverse impact on the aquatic ecosystem; (b) all practical measures would be taken to minimize adverse impacts on wetlands and land under water; (c) stormwater discharges would be controlled through BMPs; and (d) there would be no substantial long-term adverse impacts to integrity of river waters
	Water Quality Certification for Discharge of Dredged or Fill Material, Dredging and Dredged Material Disposal in Waters of the United States within the Commonwealth, 314 CMR 9.07	Applicable	Hydraulic or mechanical dredging allowed; must avoid fisheries impacts.	Will be attained. There are no significant fisheries in area at present and aquatic habitat will be restored.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-6 NS-4 (REMOVAL AND OFF-SITE DISPOSAL) (cont.)

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Pollutant Discharge Elimination System (NPDES),40 CFR 122	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Major requirements include the following: • Use of best available technology economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. • Applicable federally-approved state water quality standards must be complied with. These standards may be in addition to or more stringent than other federal standards under the CWA.	Alternative NS-4 would comply with this ARAR. Design specifications for the dredging methods and procedures and design of the dewatering treatment system would ensure that NS-4 will comply with applicable standards.
	Clean Water Act, Ambient Water Quality Criteria, 33 U.S.C. § 1314, 40 CFR 131.36(b)(1)	Applicable	National recommended criteria for surface water quality. Arsenic Criteria: For protection of freshwater aquatic life due to chronic exposure: 150 ug/L	Will be attained once contaminated sediments are removed. Design of the temporary sediment dewatering treatment system would also ensure that treated effluent will comply with applicable standards.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	See above discussion of federal water quality criteria.
	Massachusetts Surface Water Discharge Permit Regulations, 314 CMR 3.00	Applicable	Regulates the discharge of water into public surface waters, allows Commonwealth to establish state standards under federal NPDES program.	See above discussion of federal NPDES requirements.
Criteria, Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-7 DS-2 (INSTITUTIONAL CONTROLS)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Alternative DS-2.	There are no actions that would be performed that would invoke a location-specific ARAR.

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Applicable	Provides surface water quality standards for a number of organic and inorganic contaminants.	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics	Will be attained. Surface water monitoring would be conducted to confirm that sediment contamination that is left in place does not impact surface water.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-7 DS-2 (INSTITUTIONAL CONTROLS)

CHEMICAL-SPECIFIC ARARs (cont.)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Criteria, Advisories, and Guidance	Cancer Slope Factors (CSFs)	To Be Considered	Guidance values used to evaluate the potential carcinogenic risk caused by exposure to contaminants.	CSFs were used to evaluate health risks associated with site-related contaminants.
	Reference Doses (RfDs)	To Be Considered	Guidance values used to evaluate the potential non-carcinogenic hazard caused by exposure to contaminants.	RfDs were used to evaluate health risks associated with site-related contaminants.
	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE D-8 SW-2 (MONITORING)

ACTION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR will be attained because other media-specific alternatives are selected in conjunction with this altemative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR will be attained because other media-specific alternatives are selected in conjunction with this altemative to address groundwater and sediment contaminant sources.

LOCATION-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
NA	None	NA	There are no location-specific ARARs applicable for Altemative SW-2 (Monitoring).	There are no actions that would be performed that would invoke a location-specific ARAR.

CHEMICAL-SPECIFIC ARARs

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Regulatory Requirements	National Recommended Water Quality Criteria Clean Water Act-Section 304(a)(1)	Relevant and Appropriate	Provides surface water quality standards for a number of organic and inorganic contaminants.	This ARAR will be attained because other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.
State Regulatory Requirements	Massachusetts Surface Water Quality Standards 314 CMR 4.05(5)(e)	Relevant and Appropriate	Establishes federal water quality criteria as allowable water quality concentrations. Allows for site-specific criteria where federal criteria are invalid due to site-specific characteristics.	This ARAR will be attained because unless other media-specific alternatives are selected in conjunction with this alternative to address groundwater and sediment contaminant sources.

APPENDIX D – APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTIONS TO BE TAKEN TO ATTAIN REQUIREMENT
Advisories, and Guidance	EPA Health Advisories, Human Health Risk Assessment Guidance, and Ecological Risk Assessment Guidance	To Be Considered	These advisories and guidance documents provide guidance for developing health risk information and environmental assessments at Superfund sites.	Risk guidance documents were used to evaluate human health and ecological risks associated with site-related contaminants and to develop cleanup standards.

Appendix E

Administrative Record Index and Guidance Documents

Industri-Plex, MAD076580950
Operable Unit 02
Woburn, MA
and Including
Wells G & H, MAD980732168
Operable Unit 03
Woburn, MA

Record of Decision (ROD)
Administrative Record File

January 31, 2006

Instruction on Viewing Administrative Record Documents

The following index, and the administrative record (AR) documents that it links to, are provided here as a courtesy to the public in a convenience copy format. Official copies of the AR can be viewed at the US EPA Region 1 Superfund Record Center. The AR is available on CD-ROM for viewing at the Woburn Public Library repository, Woburn, MA.

To view the documents as described in the following index, click on the desired entry and the linked Adobe Acrobat© PDF file will open in a separate window. When viewing each document, use the PDF bookmarks provided in some documents, or look for red, boxed instructions to navigate through the document.

Prepared by
EPA New England
Office of Site Remediation & Restoration

Introduction to the Collection

This is the administrative record file for the Industri-Plex Superfund Site, Woburn, US, Operable Unit 02, Record of Decision (ROD), dated January 31, 2006. The file contains site-specific documents and a list of guidance documents used by EPA staff in selecting a response action at the site.

This file includes, by reference, the administrative record file for the Proposed Plan, issued June 30, 2005 and the administrative record file for the Supplemental Proposed Plan, issued October 20, 2005.

The administrative record file is available for review at:

EPA New England Superfund Records and Information Center
1 Congress Street, Suite 1100 (HSC)
Boston, MA 02114
(by appointment)
617-918-1440 (phone)
617-918-1223 (fax)
www.epa.gov/region01/superfund/resource/records.htm

Woburn Public Library
45 Pleasant Street
Woburn, MA 01801
781-933-0148 (phone)
781-938-7860 (fax)
http://www.woburnpubliclibrary.org/

Questions about this administrative record file should be directed to the EPA New England site manager.

An administrative record file is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

03: REMEDIAL INVESTIGATION (RI)

214535 **WOBURN ENVIRONMENTAL STUDIES, PHASE 1 REPORT, REMEDIAL INVESTIGATION (RI), VOLUME 1 OF 3, ENVIRONMENTAL ASSESSMENT**

Author: ROUX ASSOCIATES
Addressee: STAUFFER CHEMICAL CO
Doc Type: REPORT
Doc Date: 04/01/1983 **# of Pages:** 294
File Break: 03.06

14984 **WOBURN ENVIRONMENTAL STUDIES, PHASE 2 REPORT, VOLUME 1 OF 3, REMEDIAL INVESTIGATION (RI)**

Author: STAUFFER CHEMICAL CO
Addressee:
Doc Type: REPORT
Doc Date: 08/01/1984 **# of Pages:** 185
File Break: 03.06

32791 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 1 OF 5**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 06/07/1991 **# of Pages:** 386
File Break: 03.06

32792 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 2 OF 5, PLATES**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 06/07/1991 **# of Pages:** 26
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

32793 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 3 OF 5, APPENDICES A AND B**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/07/1991 **# of Pages:** 401
File Break: 03.06
Doc Type: REPORT

32794 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 4 OF 5, APPENDIX C [PART 1 OF 2: APPENDIX C, SECTIONS 1 THROUGH 2]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/07/1991 **# of Pages:** 363
File Break: 03.06
Doc Type: REPORT

32795 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 5 OF 5, APPENDICES D THROUGH G [PART 1 OF 2: APPENDIX D]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/07/1991 **# of Pages:** 294
File Break: 03.06
Doc Type: REPORT

34147 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 4 OF 5, APPENDIX C [PART 2 OF 2: APPENDIX C, SECTIONS 3 THROUGH 6]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/07/1991 **# of Pages:** 378
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

34148 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 1 REMEDIAL INVESTIGATION FINAL REPORT, VOLUME 5 OF 5, APPENDICES D THROUGH G [PART 2 OF 2: APPENDICES E THROUGH G]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/07/1991 **# of Pages:** 130
File Break: 03.06
Doc Type: REPORT

32796 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 2 REMEDIAL INVESTIGATION DRAFT REPORT, VOLUME 1 OF 3**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/29/1992 **# of Pages:** 235
File Break: 03.06
Doc Type: REPORT

32797 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 2 REMEDIAL INVESTIGATION DRAFT REPORT, VOLUME 2 OF 3, APPENDICES A THROUGH C [PART 1 OF 2: APPENDICES A THROUGH B]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/29/1992 **# of Pages:** 198
File Break: 03.06
Doc Type: REPORT

32798 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 2 REMEDIAL INVESTIGATION DRAFT REPORT, VOLUME 3 OF 3, APPENDIX D [PART 1 OF 2: APPENDICES D1 THROUGH D2]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/29/1992 **# of Pages:** 455
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

34149 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 2 REMEDIAL INVESTIGATION DRAFT REPORT, VOLUME 2 OF 3, APPENDICES A THROUGH C [PART 2 OF 2: APPENDIX C]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/29/1992 **# of Pages:** 241
File Break: 03.06
Doc Type: REPORT

34150 **GROUND-WATER/SURFACE WATER INVESTIGATION PLAN, PHASE 2 REMEDIAL INVESTIGATION DRAFT REPORT, VOLUME 3 OF 3, APPENDIX D [PART 2 OF 2: APPENDICES D3 THROUGH D6]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/29/1992 **# of Pages:** 296
File Break: 03.06
Doc Type: REPORT

32754 **EPA COMMENTS ON GSIP PHASE 2**

Author: JOSEPH F LEMAY US EPA REGION 1
Addressee: MICHAEL LIGHT MONSANTO
Doc Date: 12/13/1996 **# of Pages:** 23
File Break: 03.06
Doc Type: LETTER

35251 **DRAFT PRELIMINARY MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN REPORT**

Author: HALLIBURTON NUS ENVIRONMENTAL CORP
Addressee: US EPA
Doc Date: 08/01/1997 **# of Pages:** 92
File Break: 03.02
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

230913 **GROUNDWATER USE AND VALUE DETERMINATION PILOT (08/26/97 TRANSMITTAL LETTER IS ATTACHED)**

Author: MA DEPT OF ENVIRONMENTAL PROTECTION
Doc Date: 08/01/1997 **# of Pages:** 0
Addressee:
File Break: 03.06
Doc Type: REPORT

237454 **SOURCE AND CHEMODYNAMIC BEHAVIOR OF DIPHENYL SULFONE AND ORTHO- AND PARA-HYDROXYBIPHENYL IN SMALL LAKE RECEIVING DISCHARGES FROM ADJACENT SUPERFUND SITE**

Author: PHILIP M GSCHWEND MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
Doc Date: 01/01/1998 **# of Pages:** 0
Addressee: LUKAS Y WICK MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT)
File Break: 03.06
Doc Type: REPORT

35268 **TOXICOLOGICAL SURFACE WATER, SEDIMENTS SAMPLING AND FISH SAMPLING WORK PLAN AND QUALITY ASSURANCE PROJECT PLAN [PART 1 OF 2].**

Author: MENZIE-CURA & ASSOCIATES INC
Doc Date: 07/07/1999 **# of Pages:** 250
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
File Break: 03.07
Doc Type: REPORT

35269 **TOXICOLOGICAL SURFACE WATER, SEDIMENTS SAMPLING AND FISH SAMPLING WORK PLAN AND QUALITY ASSURANCE PROJECT PLAN [PART 2 OF 2].**

Author: MENZIE-CURA & ASSOCIATES INC
Doc Date: 07/07/1999 **# of Pages:** 177
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
File Break: 03.07
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

35249 ECOLOGICAL SAMPLING DATA REPORT [PART 1 OF 2].

Author: MENZIE-CURA & ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 02/01/2000 **# of Pages:** 340
File Break: 03.02
Doc Type: REPORT

35250 ECOLOGICAL SAMPLING DATA REPORT [PART 2 OF 2].

Author: MENZIE-CURA & ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 02/01/2000 **# of Pages:** 348
File Break: 03.02
Doc Type: REPORT

230867 FISHERY SURVEY

Author: US DEPT OF INTERIOR - FISH & WILDLIFE SERVICE
Addressee:
Doc Date: 04/01/2001 **# of Pages:** 0
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

230915 **INTERIM LETTER REPORT FINAL GSIP SOW SOURCE AREA INVESTIGATION**

Author: LAWRENCE MCTIERNAN ROUX ASSOCIATES
Addressee: HEATHER A TRENT ROUX ASSOCIATES
D. MICHAEL LIGHT INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT

Doc Date: 10/31/2001 **# of Pages:** 0
File Break: 03.06

237455 **USE OF HYDROCHLORIC ACID FOR DETERMINING SOLID-PHASE ARSENIC PARTITIONING IN SULFIDIC SEDIMENTS**

Author: ROBERT FORD US EPA
Addressee: RICHARD T WILKIN US EPA
Doc Type: REPORT

Doc Date: 01/01/2002 **# of Pages:** 0
File Break: 03.06

35260 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 1 OF 3, TEXT, TABLES, AND FIGURES**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT

Doc Date: 04/01/2002 **# of Pages:** 90
File Break: 03.03

03: REMEDIAL INVESTIGATION (RI)

35262 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 2 OF 3, APPENDICES A THROUGH F [PART 1 OF 3]**

Author: ROUX ASSOCIATES **Doc Date:** 04/01/2002 **# of Pages:** 383
Addressee: INDUSTRI-PLEX REMEDIAL TRUST **File Break:** 03.03
Doc Type: REPORT

35263 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 2 OF 3, APPENDICES A THROUGH F [PART 2 OF 3]**

Author: ROUX ASSOCIATES **Doc Date:** 04/01/2002 **# of Pages:** 355
Addressee: INDUSTRI-PLEX REMEDIAL TRUST **File Break:** 03.03
Doc Type: REPORT

35264 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 2 OF 3, APPENDICES A THROUGH F [PART 3 OF 3]**

Author: ROUX ASSOCIATES **Doc Date:** 04/01/2002 **# of Pages:** 361
Addressee: INDUSTRI-PLEX REMEDIAL TRUST **File Break:** 03.03
Doc Type: REPORT

35265 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 3 OF 3, APPENDICES F (CONT'D) THROUGH I [PART 1 OF 3]**

Author: ROUX ASSOCIATES **Doc Date:** 04/01/2002 **# of Pages:** 348
Addressee: INDUSTRI-PLEX REMEDIAL TRUST **File Break:** 03.03
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

35266 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 3 OF 3, APPENDICES F (CONT'D) THROUGH I [PART 2 OF 3]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/2002 **# of Pages:** 362
File Break: 03.03
Doc Type: REPORT

35267 **FINAL GSIP SCOPE OF WORK, VOLUME 4, DOWNGRADIENT TRANSPORT DRAFT REPORT, PART 3 OF 3, APPENDICES F (CONT'D) THROUGH I [PART 3 OF 3]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/2002 **# of Pages:** 401
File Break: 03.03
Doc Type: REPORT

35252 **FINAL GSIP SCOPE OF WORK, VOLUME 2, GROUNDWATER AND SOIL INVESTIGATION DRAFT REPORT, PART 1 OF 3 [PART 1 OF 2]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/05/2002 **# of Pages:** 350
File Break: 03.03
Doc Type: REPORT

35253 **FINAL GSIP SCOPE OF WORK, VOLUME 2, GROUNDWATER AND SOIL INVESTIGATION DRAFT REPORT, PART 1 OF 3 [PART 2 OF 2]**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/05/2002 **# of Pages:** 182
File Break: 03.03
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

42722 **SOURCE AREA INVESTIGATION**

Author: ANNE GUIMONT ROUX ASSOCIATES
Addressee: LAWRENCE MCTIERNAN ROUX ASSOCIATES
D. MICHAEL LIGHT INDUSTRI-PLEX REMEDIAL TRUST

Doc Date: 05/24/2002 **# of Pages:** 45
File Break: 03.04

Doc Type: LETTER

42724 **FINAL GSIP SCOPE OF WORK (SOW), SOURCE AREA INVESTIGATION**

Author: LAWRENCE MCTIERNAN ROUX ASSOCIATES
Addressee: CHRISTOPHER J MILONE ROUX ASSOCIATES
JOSEPH F LEMAY US EPA REGION I

Doc Date: 02/25/2003 **# of Pages:** 205
File Break: 03.07

Doc Type: LETTER

65315 **DRAFT PRELIMINARY MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN (MSGRP) SUPPLEMENTAL REPORT - SOUTHERN AREA**

Author:
Addressee:

Doc Date: 06/01/2003 **# of Pages:** 0
File Break: 03.04

Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

230914 **GROUNDWATER USE AND VALUE DETERMINATION (06/21/04 TRANSMITTAL LETTER IS ATTACHED)**

Author: MA DEPT OF ENVIRONMENTAL PROTECTION
Addressee:
Doc Type: REPORT

Doc Date: 06/01/2004 **# of Pages:** 0
File Break: 03.06

65233 **EPA RESPONSES TO COMMENTS ON THE MAY 2003 ABERJONA RIVER STUDY BASELINE HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT**

Author: JOSEPH F LEMAY US EPA REGION 1
Addressee: BARBARA D BECK GRADIENT CORPORATION
PAUL B GALVANI ROPES & GRAY
STEPHEN R HANSEN S R HANSEN & ASSOCIATES
PAUL MEDEIROS WOBURN CITY COUNCIL
LUKE METTE STAUFFER MANAGEMENT COMPANY
CHRIS PERKINS UNIVERSITY OF CONNECTICUT
JERRY RINALDI SOLUTIA INC
MARK TWOGOOD WINCHESTER (MA) TOWN OF
Doc Type: LETTER

Doc Date: 06/28/2004 **# of Pages:** 229
File Break: 03.10

230916 **SUB-SLAB SOIL GAS SAMPLING**

Author: LAWRENCE MCTIERNAN ROUX ASSOCIATES
Addressee: GERALD RINALDI INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT

Doc Date: 07/19/2004 **# of Pages:** 0
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

213053 BASELINE HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT REPORT, ABERJONA RIVER STUDY, VOLUME 1 OF 6, TEXT AND FIGURES

Author: METCALF & EDDY
Doc Date: 09/01/2004
# of Pages: 492
Addressee:
File Break: 03.10
Doc Type: REPORT

230912 FINAL PROJECT REPORT: NATURAL ATTENUATION STUDY; GROUNDWATER, SURFACE WATER, SOIL AND SEDIMENT INVESTIGATION

Author: ROBERT FORD US EPA
Doc Date: 09/02/2004
# of Pages: 0
Addressee:
File Break: 03.06
Doc Type: REPORT

230917 TECHNICAL MEMORANDUM - POSSIBLE EFFECTS OF ARSENIC AND HEAVY METALS IN SEDIMENT AND SURFACE WATER ON FUTURE POTABLE WATER SUPPLY DEVELOPMENT IN THE CENTRAL AREA AQUIFER

Author: TRC ENVIRONMENTAL CORP
Doc Date: 01/01/2005
# of Pages: 0
Addressee: US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

230918 DRAFT EVALUATION OF FLOW, SUSPENDED SEDIMENT, AND HEAVY METALS IN ABERJONA RIVER

Author: TRC ENVIRONMENTAL CORP
Doc Date: 01/01/2005
# of Pages: 0
Addressee: US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

230868 **DRAFT FINAL MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN (MSGRP) REMEDIAL INVESTIGATION REPORT (RI), APPENDIX 4H - SUB-SLAB SOIL GAS**

Author: TETRA TECH NUS INC **Doc Date:** 03/01/2005 **# of Pages:** 0
Addressee: US EPA REGION I **File Break:** 03.06
Doc Type: REPORT

237446 **DRAFT FINAL TECHNICAL MEMORANDUM - EVALUATION OF AMMONIA AND SUPPLEMENTAL DATA**

Author: TETRA TECH NUS INC **Doc Date:** 10/01/2005 **# of Pages:** 238
Addressee: **File Break:** 03.04
Doc Type: REPORT

04: FEASIBILITY STUDY (FS)

14994 **WOBURN ENVIRONMENTAL STUDIES, PHASE 2 REPORT, VOLUME 2 OF 3, FEASIBILITY STUDY (FS) [PART 1 OF 2, REPORT]**

Author: STAUFFER CHEMICAL CO **Doc Date:** 04/01/1985 **# of Pages:** 204
Addressee: **File Break:** 04.06
Doc Type: REPORT

04: FEASIBILITY STUDY (FS)

16627 **WOBURN ENVIRONMENTAL STUDIES, PHASE 2 REPORT, VOLUME 2 OF 3, FEASIBILITY STUDY [PART 2 OF 2, APPENDICES]**

Author: STAUFFER CHEMICAL CO
Addressee:
Doc Type: REPORT
Doc Date: 04/01/1985 **# of Pages:** 229
File Break: 04.06

233375 **PROPOSED PLAN**

Author: US EPA REGION 1
Addressee:
Doc Type: REPORT
Doc Date: 06/01/2005 **# of Pages:** 0
File Break: 04.09

233377 **DRAFT MODEL SIMULATION OF FLOW, SUSPENDED SEDIMENT, AND HEAVY METAL TRANSPORT FOR ABERJONA RIVER WATERSHED**

Author: TETRA TECH NUS INC
Addressee: US EPA
US EPA REGION 1
Doc Type: REPORT
Doc Date: 06/01/2005 **# of Pages:** 0
File Break: 04.02

04: FEASIBILITY STUDY (FS)

233379 DRAFT FINAL FEASIBILITY STUDY (FS) REPORT

Author: TETRA TECH NUS INC
Addressee: US EPA
Doc Type: REPORT
Doc Date: 06/01/2005 **# of Pages:** 0
File Break: 04.06

233378 AMMONIA DATA FOR WATER QUALITY SAMPLES

Author: ROBERT FORD US EPA
Addressee: JOSEPH F LEMAY US EPA REGION I
Doc Type: REPORT
Doc Date: 06/24/2005 **# of Pages:** 0
File Break: 04.02

70331 PUBLIC COMMENTS FROM 07/2005-09/2005 ON JUNE 2005 PROPOSED PLAN

Author: US EPA REGION 1
Addressee:
Doc Type: LETTER
Doc Date: 09/01/2005 **# of Pages:** 0
File Break: 04.09

237453 FACT SHEET SUPPLEMENTING JUNE 2005 PROPOSED PLAN

Author: US EPA REGION I
Addressee:
Doc Type: FACT SHEET
Doc Date: 10/01/2005 **# of Pages:** 8
File Break: 04.09

05: RECORD OF DECISION (ROD)

14846 **RECORD OF DECISION (ROD) (A TECHNICAL REPORT DATA SHEET IS ATTACHED)**

Author: US EPA REGION 1
Addressee:
Doc Date: 09/30/1986 **# of Pages:** 249
File Break: 05.04
Doc Type: REPORT

16796 **RECORD OF DECISION**

Author: US EPA REGION 1
Addressee:
Doc Date: 09/14/1989 **# of Pages:** 226
File Break: 05.04
Doc Type: REPORT

42284 **EXPLANATION OF SIGNIFICANT DIFFFERENCES (ESD)**

Author: US EPA REGION 1
Addressee:
Doc Date: 04/25/1991 **# of Pages:** 6
File Break: 05.04
Doc Type: REPORT

70375 **PUBLIC HEARING TRANSCRIPT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY SUPPLEMENTAL PROPOSED PLAN**

Author:
Addressee:
Doc Date: 11/17/2005 **# of Pages:** 0
File Break: 05.03
Doc Type: REPORT

05: RECORD OF DECISION (ROD)

70374 **PUBLIC COMMENTS FROM 10/2005-11/2005 ON SUPPLEMENTAL ADMINISTRATIVE RECORD (AR) FOR 10/20/05 PROPOSED PLAN**

Author: US EPA REGION I
Addressee:
Doc Date: 11/18/2005 **# of Pages:** 0
File Break: 05.03
Doc Type: LETTER

70376 **RECORD OF DECISION**

Author:
Addressee:
Doc Date: 01/31/2006 **# of Pages:** 0
File Break: 05.04
Doc Type: REPORT
Doc Type: RECORD OF DECISION

06: REMEDIAL DESIGN (RD)

230846 **FINAL REPORT, INTERIM CAP MATERIALS REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: MONSANTO CHEMICAL CO
Doc Date: 03/01/1990 **# of Pages:** 50
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230856 **HAZARDOUS SUBSTANCES IN SOIL, PRE-DESIGN INVESTIGATION TASK S-1**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 06/01/1990 **# of Pages:** 54
File Break: 06.04
Doc Type: REPORT

230861 **INTERIM REPORT NO 1, BASELINE AIR SURVEY PRE-DESIGN INVESTIGATION TASK A-1**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 07/01/1990 **# of Pages:** 130
File Break: 06.04
Doc Type: REPORT

230840 **PRE-DESIGN INVESTIGATION TASK SW-1 EXTENT OF HAZARDOUS SUBSTANCES IN WETLANDS AND SURFACE WATER SEDIMENTS, INTERIM REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 08/01/1990 **# of Pages:** 126
File Break: 06.04
Doc Type: REPORT

230850 **PRE-DESIGN INVESTIGATION TASK GW-1 PLUME DELINEATION, PHASE 1 INTERIM REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 08/01/1990 **# of Pages:** 262
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230857 **REMEDIAL RESIGN, CONCEPTUAL GROUNDWATER REMEDIATION SYSTEM REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 08/01/1990 **# of Pages:** 23
File Break: 06.04
Doc Type: REPORT

230841 **PRE-DESIGN INVESTIGATION TASK S-3 IDENTIFY SOURCES OF CAP MATERIALS, INTERIM FINALS REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 175
File Break: 06.04
Doc Type: REPORT

230842 **PRE-DESIGN INVESTIGATION TASK S-1 EXTENT OF HAZARDOUS SUBSTANCES IN SOILS, INTERIM FINAL REPORT, VOLUME 1 OF 2**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 129
File Break: 06.04
Doc Type: REPORT

230843 **PRE-DESIGN INVESTIGATION TASK S-1 EXTENT OF HAZARDOUS SUBSTANCES IN SOILS, INTERIM FINAL REPORT, VOLUME 2 OF 2**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 428
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230845 **PRE-DESIGN INVESTIGATION TASK S-4 FOUNDATION DATA INTERIM, FINAL REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 155
File Break: 06.04
Doc Type: REPORT

230852 **PRE-DESIGN INVESTIGATION TASK SW-1 EXTENT OF HAZARDOUS SUBSTANCES IN WETLANDS AND SURFACE WATER SEDIMENTS, INTERIM FINAL REPORT, VOLUME 1 OF 2**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 122
File Break: 06.04
Doc Type: REPORT

230853 **PRE-DESIGN INVESTIGATION TASK SW-1 EXTENT OF HAZARDOUS SUBSTANCES IN WETLANDS AND SURFACE WATER SEDIMENTS, INTERIM FINAL REPORT, VOLUME 2 OF 2**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 417
File Break: 06.04
Doc Type: REPORT

230854 **PRE-DESIGN INVESTIGATION TASK S-2 STABILITY OF HIDE PILES, INTERIM FINAL REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 182
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230859 **INTERIM REPORT NO 2, BASELINE AIR SURVEY PRE-DESIGN INVESTIGATION TASK A-1**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1990 **# of Pages:** 105
File Break: 06.04
Doc Type: REPORT

230849 **PRE-DESIGN INVESTIGATION TASK A-2 GAS TREATABILITY, INTERIM FINAL REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 10/01/1990 **# of Pages:** 173
File Break: 06.04
Doc Type: REPORT

230848 **INTERIM REPORT NO 3, BASELINE AIR SURVEY PRE-DESIGN INVESTIGATION TASK A-1**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 12/01/1990 **# of Pages:** 114
File Break: 06.04
Doc Type: REPORT

230922 **PRE-DESIGN INVESTIGATION TASK GW-2 HYDROGEOLOGIC CHARACTERIZATION FOR EXTRACTION/RECHARGE SYSTEM INTERIM FINAL REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 12/01/1990 **# of Pages:** 282
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230844 PRE-DESIGN INVESTIGATION TASK S-1 EXTENT OF HAZARDOUS SUBSTANCES IN SOILS, SUPPLEMENTAL REPORT

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 01/01/1991 **# of Pages:** 138
File Break: 06.04
Doc Type: REPORT

230869 PRE-DESIGN INVESTIGATION SLUG TEST REPORT

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 01/01/1991 **# of Pages:** 310
File Break: 06.04
Doc Type: REPORT

230920 PRE-DESIGN INVESTIGATION TASK GW-2 PLUME DELINEATION INTERIM FINAL REPORT, VOLUME 2 OF 2

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 01/01/1991 **# of Pages:** 484
File Break: 06.04
Doc Type: REPORT

230921 PRE-DESIGN INVESTIGATION TASK GW-2 PLUME DELINEATION INTERIM FINAL REPORT, VOLUME 1 OF 2

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 01/01/1991 **# of Pages:** 298
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230847 **PRE-DESIGN INVESTIGATION TASK A-1 BASELINE AIR SURVEY, INTERIM FINAL REPORT**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 05/01/1991 **# of Pages:** 175
File Break: 06.04
Doc Type: REPORT

230851 **SUPPLEMENTAL PRE-DESIGN INVESTIGATION OF ARSENIC PIT AND CHROMIUM LAGOONS**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 08/01/1991 **# of Pages:** 297
File Break: 06.04
Doc Type: REPORT

230855 **PRE-DESIGN INVESTIGATION SITE MONITORING PLAN INTERIM FINAL REPORT, VOLUME 1 OF 2**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 09/01/1991 **# of Pages:** 393
File Break: 06.04
Doc Type: REPORT

230923 **AQUIFER PUMPING TEST, HARD COPY OF MANUAL AND DIGITAL WATER LEVEL MEASUREMENT DATA**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 12/01/1991 **# of Pages:** 551
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

230924 AQUIFER PUMPING TEST, VOLUME 2 OF 2

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 12/01/1991 **# of Pages:** 210
File Break: 06.04
Doc Type: REPORT

230925 AQUIFER PUMPING TEST, VOLUME 1 OF 2

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 12/01/1991 **# of Pages:** 95
File Break: 06.04
Doc Type: REPORT

32790 INTERIM DESIGN REPORT, GROUNDWATER REMEDY, 100% DESIGN REPORT, PART II.

Author: GOLDER ASSOCIATES INC
Addressee:
Doc Date: 03/01/1992 **# of Pages:** 198
File Break: 06.04
Doc Type: REPORT

32782 100% DESIGN REPORT, PART 1, VOLUME 1 OF 8 [PART 1 OF 2]

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 349
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

32783 **100% DESIGN REPORT, PART 1, VOLUME 2 OF 8 [PART 1 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 354
File Break: 06.04
Doc Type: REPORT

32784 **100% DESIGN REPORT, PART 1, VOLUME 3 OF 8 [PART 1 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee:
Doc Date: 04/01/1992 **# of Pages:** 309
File Break: 06.04
Doc Type: REPORT

32785 **100% DESIGN REPORT, PART 1, VOLUME 4 OF 8 [PART 1 OF 2]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 261
File Break: 06.04
Doc Type: REPORT

32786 **100% DESIGN REPORT, PART 1, VOLUME 5 OF 8**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 334
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

32787 **100% DESIGN REPORT, PART 1, VOLUME 6 OF 8 [PART 1 OF 2]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 330
File Break: 06.04

32788 **100% DESIGN REPORT, PART 1, VOLUME 7 OF 8**

Author: GOLDER ASSOCIATES INC
Addressee:
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 1
File Break: 06.04

32789 **100% DESIGN REPORT, PART 1, VOLUME 8 OF 8**

Author: GOLDER ASSOCIATES INC
Addressee:
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 1
File Break: 06.04

33591 **100% DESIGN REPORT, PART 1, VOLUME 1 OF 8 [PART 2 OF 2]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 34
File Break: 06.04

06: REMEDIAL DESIGN (RD)

33592 **100% DESIGN REPORT, PART 1, VOLUME 2 OF 8 [PART 2 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 313
File Break: 06.04
Doc Type: REPORT

33594 **100% DESIGN REPORT, PART 1, VOLUME 2 OF 8 [PART 3 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 369
File Break: 06.04
Doc Type: REPORT

33595 **100% DESIGN REPORT, PART 1, VOLUME 3 OF 8 [PART 2 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 292
File Break: 06.04
Doc Type: REPORT

33596 **100% DESIGN REPORT, PART 1, VOLUME 3 OF 8 [PART 3 OF 3]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Date: 04/01/1992 **# of Pages:** 252
File Break: 06.04
Doc Type: REPORT

06: REMEDIAL DESIGN (RD)

33640 **100% DESIGN REPORT, PART 1, VOLUME 4 OF 8 [PART 2 OF 2]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 283
File Break: 06.04

33650 **100% DESIGN REPORT, PART 1, VOLUME 6 OF 8 [PART 2 OF 2]**

Author: GOLDER ASSOCIATES INC
Addressee: INDUSTRI-PLEX REMEDIAL TRUST
Doc Type: REPORT
Doc Date: 04/01/1992 **# of Pages:** 109
File Break: 06.04

230911 **IMPACT OF GROUND-WATER/SURFACE-WATER INTERACTIONS ON CONTAMINANT TRANSPORT WITH APPLICATION TO ARSENIC CONTAMINATED SITE**

Author: ROBERT FORD US EPA
Addressee:
Doc Type: REPORT
Doc Date: 01/01/2005 **# of Pages:** 0
File Break: 06.04

07: REMEDIAL ACTION (RA)

230909 **SUPPLEMENTAL SITE INVESTIGATION REPORT**

Author: CAMP DRESSER & MCKEE INC
Addressee: ENVIROGEN INC
ENVIRONMENTAL SCIENCE & ENGINEERING INC
ROUX ASSOCIATES

Doc Date: 09/01/1997 **# of Pages:** 389
File Break: 07.05

Doc Type: REPORT

48549 **BENZENE AND TOLUENE SOURCE AREA INVESTIGATION**

Author: ROUX ASSOCIATES
Addressee: INDUSTRI-PLEX REMEDIAL TRUST

Doc Date: 01/08/1998 **# of Pages:** 118
File Break: 07.05

Doc Type: REPORT

230919 **EPA COMMENTS ON VOLUNTARY SUPPLEMENTAL SITE INVESTIGATION (SSI) REPORT**

Author: JOSEPH F LEMAY US EPA REGION 1
Addressee: D MICHAEL LIGHT SOLUTIA INC

Doc Date: 04/07/1998 **# of Pages:** 31
File Break: 07.05

Doc Type: LETTER

07: REMEDIAL ACTION (RA)

230910 FINAL GROUNDWATER/SURFACE WATER INVESTIGATION PLAN (GSIP) STATEMENT OF WORK (SOW)

Author: US EPA REGION I
Addressee:
Doc Type: REPORT

Doc Date: 08/25/1998 # of Pages: 26
File Break: 07.03

10: ENFORCEMENT/NEGOTIATION

44323 CONSENT DECREE FOR REMEDIAL DESIGN/REMEDIAL ACTION AT REFERRAL, UNITED STATES DISTRICT COURT OF MASSACHUSETTS CIVIL ACTION NO 89-0195-MC AND 89-0196-MC

Author: US DEPT OF JUSTICE
Addressee: US EPA REGION I
Doc Date: 09/22/1988 **# of Pages:** 362
File Break: 10.08
Doc Type: LITIGATION
Organization: AERO REALTY TRUST
Organization: ATLANTIC AVENUE ASSOCIATES INC
Organization: ATLANTIC AVENUE TRUST
Organization: BOSTON EDISON CO
Organization: BOYD CORPORATION
Organization: ZENECA INC
Organization: LIPTON INDUSTRIES, INC
Organization: MARK PHILIP TRUST
Organization: MASSACHUSETTS BAY TRANSPORTATION AUTHORI'
Organization: MONSANTO CO
Organization: NODRAER REALTY TRUST
Organization: P X REALTY TRUST
Organization: PEBCO COMPANY
Organization: POSITIVE START REALTY, INC
Organization: STAUFFER CHEMICAL CO
Organization: STAUFFER MANAGEMENT COMPANY
Organization: WELLES COMPANY
Organization: WINTER HILL STOREHOUSE, INC
Organization: WOBURN (MA) CITY OF
Organization: WOODCRAFT SUPPLY CORPORATION

16982 CONSENT DECREE, CIVIL ACTION 91-11807 MA

Author: US EPA REGION I
Addressee:
Doc Date: 09/28/1990 **# of Pages:** 250
File Break: 10.08
Doc Type: LITIGATION

13: COMMUNITY RELATIONS

32531 FACTSHEET: EPA MERGES TWO ABERJONA RIVER STUDIES

Author: US EPA REGION I
Addressee:
Doc Type: FACT SHEET
Doc Date: 05/01/2002 **# of Pages:** 7
File Break: 13.05

213095 FACT SHEET: ABERJONA RIVER STUDY COMPREHENSIVE MULTIPLE SOURCE GROUNDWATER RESPONSE PLAN (MSGRP) REMEDIAL INVESTIGATION (RI)

Author: US EPA REGION I
Addressee:
Doc Type: FACT SHEET
Doc Date: 04/01/2005 **# of Pages:** 0
File Break: 13.05

17: SITE MANAGEMENT RECORDS

25854 SITE ANALYSIS, VOLUME 2 OF 2

Author: US EPA - ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CTR (EPIC)
Addressee: US EPA REGION I
Doc Type: PHOTOGRAPH
Doc Date: 11/01/1988 **# of Pages:** 0
File Break: 17.04

17: SITE MANAGEMENT RECORDS

25700 AERIAL PHOTOGRAPHIC ANALYSIS, VOLUME 2 OF 2

Author: US EPA - ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CTR (EPIC)
Addressee: US EPA REGION 1
Doc Date: 08/01/1998
# of Pages: 1
File Break: 17.04
Doc Type: PHOTOGRAPH

25872 AERIAL PHOTOGRAPHIC ANALYSIS, VOLUME 1 OF 2

Author: US EPA - ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CTR (EPIC)
Addressee: US EPA REGION 1
Doc Date: 08/01/1998
# of Pages: 59
File Break: 17.04
Doc Type: REPORT

41767 AERIAL PHOTOGRAPHIC ANALYSIS OF ABERJONA RIVER STUDY AREA, VOLUME 1 OF 2

Author: US EPA - ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CTR (EPIC)
Addressee: US EPA REGION 1
Doc Date: 10/01/2002
# of Pages: 42
File Break: 17.04
Doc Type: REPORT

17: SITE MANAGEMENT RECORDS

41769 **AERIAL PHOTOGRAPHIC ANALYSIS OF ABERJONA RIVER STUDY AREA, VOLUME 2 OF 2**

Author: US EPA - ENVIRONMENTAL PHOTOGRAPHIC INTERPRETATION CTR (EPIC) **Doc Date:** 10/01/2002 **# of Pages:** 1

Addressee: US EPA REGION 1 **File Break:** 17.04

Doc Type: PHOTOGRAPH

Number of Documents in Collection:117

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
QUALITY CRITERIA FOR WATER 1986

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1987	EPA/440/5-86-001	4003

TITLE
INTEGRATED RISK INFORMATION SYSTEM (IRIS) [A COMPUTER-BASED HEALTH RISK INFORMATION SYSTEM AVAILABLE THROUGH E-MAIL--BROCHURE ON ACCESS IS INCLUDED]

DOCDATE	OSWER/EPA ID	DOCNUMBER
		5009

TITLE
LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1988		2114

TITLE
LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING INORGANICS ANALYSES (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1988		2113

TITLE
INTERIM FINAL GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA.

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/1988	OSWER #9355.3-01	2002

TITLE
ATSDR HEALTH ASSESSMENTS ON NPL SITES (DRAFT)

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/16/1986		5000

TITLE
CHEMICAL, PHYSICAL & BIOLOGICAL PROPERTIES OF COMPOUNDS PRESENT AT HAZARDOUS WASTE SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/27/1985	OSWER #9850.3	5001

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME I, HUMAN HEALTH EVALUATION MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/29/1989	OSWER #9285.7-01a	5023

TITLE
EXPOSURE FACTORS HANDBOOK

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1989	EPA/600/8-89/043	5020

TITLE
PROTECTION OF WETLANDS: EXECUTIVE ORDER 11990. 42 FED. REG. 26961 (1977).

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/24/1977		C003

TITLE
ECOLOGICAL ASSESSMENT OF HAZARDOUS WASTE SITES: A FIELD AND LABORATORY REFERENCE.

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	EPA 600/3-89/013	C251

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
RAPID BIOASSESSMENT PROTOCOLS FOR USE IN STREAMS AND RIVERS. BENTHIC MACROINVERTEBRATES AND FISH.

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1989	EPA 444/4-89-001	C253

TITLE
ECO UPDATE. ECOTOX THRESHOLDS. INTERMITTENT BULLETIN VOLUME 3, NUMBER 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1996	OSWER 9345.0-12FSI	C269

TITLE
ROLE OF THE BASELINE RISK ASSESSMENT IN SUPERFUND REMEDY SELECTION DECISIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/22/1991	OSWER 9355.0-30	C276

TITLE
FINAL GROUND WATER USE AND VALUE DETERMINATION GUIDANCE

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/4/1996		C278

TITLE
RISK UPDATE ISSUE NO. 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1994		C288

TITLE
EXPOSURE FACTORS HANDBOOK; GENERAL FACTORS, VOLUME I

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1997	EPA 600/P-95/002FA	C356

TITLE
ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS (EPA 540-R-97-006)

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/2/1997		C361

TITLE
DRAFT FINAL GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/18/1997		C366

TITLE
WATER-RELATED ENVIRONMENTAL FATE OF 129 PRIORITY POLLUTANTS (VOLUME I) (EPA-440/4-79-029A)

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1979		C393

TITLE
HEALTH EFFECTS ASSESSMENT SUMMARY TABLES - FY 1997 UPDATE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1997	EPA 540/R-97-036	C468

TITLE
COMMUNITY RELATIONS IN SUPERFUND: A HANDBOOK

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992	EPA 540/R-92/009	C488

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME 1, HUMAN HEALTH EVALUATION MANUAL, INTERIM

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1998	OSWER 9285.7-01D	C530

TITLE
INSTITUTIONAL CONTROLS: A SITE MANAGER'S GUIDE TO IDENTIFYING, EVALUATING AND SELECTING INSTITUTIONAL CONTROLS AT SUPERFUND AND RCRA CORRECTIVE ACTION CLEANUPS.

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/2000	OSWER 9355.0-74 FS-P	C531

TITLE
COMPREHENSIVE FIVE-YEAR REVIEW GUIDANCE

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/2003	OSWER 9355.7-03B-P	C539

TITLE
ECOLOGICAL RISK ASSESSMENT AND RISK MANAGEMENT PRINCIPLES FOR SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/7/1999	OSWER 9285.7-28 P	C563

TITLE
WILDLIFE EXPOSURE FACTORS HANDBOOK, VOLUME 1 OF 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1993	EPA 600/R-93/187	C566

TITLE
FINAL GUIDANCE ON ADMINISTRATIVE RECORDS FOR SELECTING CERCLA RESPONSE ACTIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	OSWER NO. 9833.3A-1	C576

TITLE
SOIL SCREENING GUIDANCE: USER'S GUIDE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1996	OSWER NO. 9355.4-23	C577

TITLE
EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/24/1977	EO 11988	C578

TITLE
A GUIDE TO DEVELOPING AND DOCUMENTING COST ESTIMATES DURING THE FEASIBILITY STUDY

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/2000	OSWER 9355.0-75	C582

TITLE
METHODS FOR MEASURING THE MEASURING THE TOXICITY AND BIOACCUMULATION OF SEDIMENT-ASSOCIATED CONTAMINANTS WITH FRESHWATER INVERTEBRATES

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1994		C583

TITLE
REGION I, EPA-NE DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ENVIRONMENTAL ANALYSES

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1996		C584

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
METHODS FOR MEASURING THE TOXICITY AND BIOACCUMULATION OF SEDIMENT-ASSOCIATED CONTAMINANTS WITH FRESHWATER INVERTEBRATES

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/2000		C585

TITLE
DRINKING WATER STANDARS

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/2003		C586

TITLE
SUPPLEMENTAL GUIDANCE TO RAGS: CALCULATIING THE CONCENTRATION TERM

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1992		C587

TITLE
PROVISIONAL GUIDANCE FOR QUANTITATIVE RISK ASSESSMENT OF POLYCYCLIC AROMATIC HYDROCARBONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1993		C588

TITLE
REVISED INTERIM SOIL LEAD GUIDANCE FOR CERCLA SITES AND RCRA CORRECTIVE ACTION FACILITIES

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1994		C589

TITLE
GUIDANCE MANUAL FOR THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL FOR LEAD IN CHILDREN

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1994		C590

TITLE
RISK UPDATES NO 3

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1995		C591

TITLE
RISK UPDATES NO 4

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/1/1996		C592

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL. PART D. STANDARDIZED PLANNING, REPORTING, AND REVIEW OF SUPERFUND RISK ASSESSMENTS. FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/2001		C593

TITLE
PRELIMINARY REMEDIATION GOALS TABLE REGION 9 TECHNICAL SUPPORT TEAM

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/2002		C594

TITLE
USERS GUIDE FOR THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL FOR LEAD IN CHILDREN

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/2002		C595

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
CALCULATING UPPER CONFIDENCE LIMITS FOR EXPOSURE POINT CONCENTRATIONS AT HAZARDOUS WASTE SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/2002		C596

TITLE
NATIONAL RECOMMENDED WATER QUALITY CRITERIA

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/27/2002		C597

TITLE
RECOMMENDATIONS OF THE TECHNICAL REVIEW WORKGROUP FOR LEAD FOR AN APPROACH TO ASSESSING RISK ASSOCIATED WITH ADULT EXPOSURES TO LEAD IN SOIL

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/2003		C598

TITLE
DRINKING WATER STANDARDS

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/2003		C599

TITLE
RISK-BASED CONCENTRATION TABLE REGION III TECHNICAL GUIDANCE MANUAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/14/2004		C600

TITLE
PRO-UCL VERSION 3.0 STATISTICAL SOFTWARE TO COMPUTE UPPER CONFIDENCE LIMITS ON THE UNKNOWN POPULATION MEAN

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/2004		C601

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL (PART E SUPPLEMENTAL GUIDANCE FOR DERMAL RISK ASSESSMENT) FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/2004		C602

TITLE
AMBIENT WATER QUALITY CRITERIA FOR DDT

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1980		C603

TITLE
HEALTH EFFECTS ASSESSMENT FOR IRON (AND COMPOUNDS)

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1994		C604

TITLE
UPDATE NUMBER 1 TO QUALITY CRITERIA FOR WATER

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1986		C605

TITLE
UPDATE NUMBER 2 TO QUALITY CRITERIA FOR WATER

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1987		C606

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
WATER QUALITY STANDARDS: ESTABLISHMENT OF NUMERIC CRITERIA FOR PRIORITY TOXIC POLLUTANTS STATES COMPLIANCE

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992		C607

TITLE
SUPPLEMENTAL GUIDANCE TO RAGS CALCULATING THE CONCENTRATION TERM

DOCDATE	OSWER/EPA ID	DOCNUMBER
5/1/1992		C608

TITLE
WATER QUALITY GUIDANCE FOR THE GREAT LAKES SYSTEM AND CORRECTION: PROPOSED RULES

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1993		C609

TITLE
SEDIMENT QUALITY CRITERIA FOR THE PROTECTION OF BENTHIC ORGANISMS: DIELDRIN

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1993		C610

TITLE
SEDIMENT QUALITY CRITERIA FOR THE PROTECTION OF BENTHIC ORGANISMS: ENDRIN

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1993		C611

TITLE
GUIDANCE MANUAL FOR THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL FOR LEAD IN CHILDREN

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1994		C612

TITLE
GREAT LAKES WATER QUALITY INITIATIVE CRITERIA DOCUMENTS FOR THE PROTECTION OF WILDLIFE

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1995		C613

TITLE
GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1998		C614

TITLE
NATIONAL RECOMMENDED WATER QUALITY CRITERIA

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/10/1998		C615

TITLE
AQUIRE - AQUATIC TOXICITY INFORMATION RETRIEVAL DATABASE

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/29/1998		C616

TITLE
DRAFT EQUILIBRIUM-PARTITIONING SEDIMENT GUIDELINES (ESGS) FOR THE PROTECTION OF BENTHIC ORGANISMS: METAL MIXTURES (CADMIUM, COPPER, LEAD, NICKEL, SILVER AND ZINC)

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1999		C617

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
METHODS FOR MEASURING THE TOXICITY AND BIOACCUMULATION OF SEDIMENT-ASSOCIATED CONTAMINANTS WITH FRESHWATER INVERTEBRATES

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/2000		C618

TITLE
INDUSTRI-PLEX SUPERFUND SITE SUB-SLAB SAMPLING GUIDELINE

DOCDATE	OSWER/EPA ID	DOCNUMBER
11/2/2003		C619

TITLE
EPA REGION 9 PRELIMINARY REMEDIATION GOALS TABLE

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/2004		C620