Second Five-Year Review Report

for

Baird & McGuire Superfund Site

Holbrook,

Norfolk County, Massachusetts

September 2004

PREPARED BY:

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LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
AAL	Ambient Air Level
ARAR	Applicable or Relevant and Appropriate Requirement
AUL	Activity and Use Limitation
AWQC	Ambient Water Quality Criteria
BOH	Board of Health
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC §§ 9601 *et seq.*
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
CWA	Clean Water Act
DEM	Department of Environmental Management
DEP	Massachusetts Department of Environmental Protection
DEQE	Massachusetts Department of Environmental Quality Engineering
DOT	Department of Transportation
EO	Executive Order
EPA	Environmental Protection Agency (U.S. EPA - Region 1)
ERA	Ecological Risk Assessment
ERED	Environmental Residue Effects Database

ACRONYM	DEFINITION
ESD	Explanation of Significant Differences
EW	Extraction Well
FDA	U.S. Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act of 1947
FS	Feasibility Study
GWTF	Groundwater Treatment Facility
HQ	Hazard Quotient
ICs	Institutional Controls
IS	Incineration and Stabilization
LNAPL	Light Non-Aqueous Phase Liquid
LOAEL	Lowest Observed Adverse Effects Level
LTRA	Long-term Response Action
M&E	Metcalf & Eddy
MCLs	Maximum Contaminant Levels
MEPA	Massachusetts Environmental Policy Act
MGD	Million Gallons Per Day
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan, 40 CFR Part 300
NOAA	National Oceanic and Atmospheric Administation
NOAEL	No Adverse Effects Levels
NPL	National Priority List
O&M	Operation and Maintenance
OMEE	Ontario Ministry of Environment and Energy
OU-1	Operable Unit 1
OU-2	Operable Unit 2
OU-3	Operable Unit 3
OU-4	Operable Unit 4
PAHs	Polycyclic Aromatic Hydrocarbons
PLC	Programmable Logic Controller

ACRONYM	DEFINITION
PRP	potentially responsible party
RAC	Response Action Contract
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 *et seq.*
RfD	Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
RSE	Remedial System Evaluation
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SF	Slope Factor
SQC	Sediment Quality Criteria
SVOCs	Semivolatile Organic Compounds
TBC	To Be Considered
TLV	Threshold Limit Value
TRV	Toxicity Reference Value
UCL	Upper Concentration Limit
USACE	United States Army Corps of Engineers
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

This five-year review report was prepared for the Baird & McGuire Superfund Site located on South Street in Holbrook, MA. The 1986 ROD defines the Site as the area within the EPA security fence constructed in July 1985 and covers approximately 32.5 acres. The Site is not limited to land within the Baird & McGuire property, as it also includes five privately owned lots and two lots co-owned by the towns of Holbrook and Randolph. The site impacts several ecological features including the Cochato River, an unnamed brook, the 100-year floodplain, and wetland areas.

Site contamination occurred during the operations of a chemical manufacturing company (Baird & McGuire) from 1912 to 1983, that produced herbicides, pesticides, disinfectants, soaps, floor waxes and solvents. Waste disposal methods at the site included direct discharge into the soil, a nearby brook and wetlands, a former gravel pit in the eastern portion of the site, and underground disposal systems. VOCs, PAHs, pesticides, and heavy metals including lead and arsenic are the contaminants of concern in site soils, sediment, and groundwater. Additionally, an LNAPL plume has been determined to be the primary source of contamination in groundwater.

The EPA issued three RODs for the site that included four selected operable units. The first ROD, issued in September 1986, specified groundwater extraction and treatment at an on-site treatment plant (OU-1) and soil excavation and treatment at an on-site incinerator (OU-2). The second ROD, issued in September 1989, addressed contamination in the Cochato River sediments (OU-3). EPA issued the final ROD in 1990, which called for reopening the Donna Road well field to replace the lost supply resulting from contamination of the South Street municipal wellfield (OU-4).

The construction of the GWTF (OU-1) was completed in 1991. Treatment of contaminated groundwater is ongoing. Treated water recharges to the groundwater through four infiltration basins. The source control remedy to remove and treat contaminated soils (OU-2) was completed in July 1997. The removal and treatment of contaminated sediments from the Cochato River (OU-3) was completed in June 1995. In 2000, EPA provided funding to assist the towns of Holbrook and Randolph in expanding the existing water supply capacity at the Upper Reservoir/Great Pond. An Explanation of Significant Difference (ESD) document was issued in August 2003 for OU-4 stating that, due to expansion of the water capacity in the Upper Reservoir/Great Pond provided via an ESD document for OU-1, the reactivation of the Donna Rd. wellfield was determined to be not necessary. Consequently, no further action will be taken on OU-4.

The operation and maintenance activities that have been conducted in the past five years include operation of the GWTF; groundwater, surface water, sediment, fish and wetland monitoring; and evaluation of long term protectiveness of the remedies and the need for institutional controls (ICs). A review of the O&M activities and data indicate that the GWTF is fully functional and protective of site groundwater and nearby surface water. Many facility upgrades have improved its performance. Additional upgrades are planned for the near future, such as optimizing the removal of LNAPL from the overburden.

A review of groundwater, surface water, sediment, and fish data collected over the past five years indicates the following:

- contamination in the groundwater at the site is diminishing. The plume of organic contamination has decreased. Some metals, such as arsenic, remain in the groundwater. The highest concentrations of arsenic are found near the LNAPL sources, and are attributed to the presence of LNAPL product containing arsenic, which is also decreasing;
- contaminants in surface water (Cochato River) were not detected above action limits;
- concentrations of contaminants in fish tissue did not clearly demonstrate a decreasing trend and still exhibit levels above FDA levels for ingestion;
- sediment sample data indicate no significant trends of decreasing or increasing contaminant concentrations.

This is the second five-year review for the Site. The first five-year review was completed in September 1999, and that date was the trigger for this second review. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

This five-year review concluded that the remedy is functioning as designed and continues to be protective of human health and the environment. However, in order for the remedy to remain protective in the long term, the institutional controls must be implemented. ICs will be included in an ESD document which is currently being prepared by EPA.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)***: Baird & McGuire		
EPA ID ***(from WasteLAN)***: MAD001041987		
Region: I	**State:** MA	**City/County:** Holbrook/Norfolk

SITE STATUS	
NPL status: ☒ Final ☐ Deleted ☐ Other (specify) ______	
Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete	
Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** 8 / 21 / 2003
Has site been put into reuse? ☐ YES ☒ NO	

REVIEW STATUS	
Lead agency: ☒EPA ☐ State ☐ Tribe ☐ Other Federal Agency ______	
Author name: Elaine Stanley	
Author title: Remedial Project Manager	**Author affiliation:** EPA Region I
Review period:** 9 /15/1999 to 9/28 /2004	
Date(s) of site inspection: 9/14 /2004	
Type of review: ☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion	
Review number: ☐ 1 (first) ☒ 2 (second) ☐ 3 (third) ☐ Other (specify) ______	
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Actual RA Start at OU#____ ☐ Construction Completion ☒ Previous Five-Year Review Report ☐ Other (specify) ______	
Triggering action date ***(from WasteLAN)***: 9/15/1999	
Due date ***(five years after triggering action date)***: 9/30/2004	

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues:

(1) Groundwater at the site contains concentrations of VOCs, SVOCs, metals, and pesticides above action limits. The groundwater is currently treated to concentrations below the action limits.

(2) Sediment along the river contains PAHs above action limits and concentrations of metals and pesticides have not decreased significantly during the past 5 years.

(3) Fish tissue contain PAHs at concentrations above action limits, however fish contamination may not all be site related. Warning signs provide a degree of current protectiveness.

(4) Some sections of replicated wetlands do not appear to be receiving sufficient water; presence non-native and invasive plants is increasing.

(5) Institutional Controls are not complete.

Recommendations and Follow-up Actions:

(1) Continue operating GWTF and groundwater monitoring; develop comprehensive monitoring plan.

(2) Continue monitoring sediments biannually; develop sediment monitoring plan.

(3) Conduct fish sampling once every five years; develop monitoring plan.

(4) Conduct an additional round of wetland monitoring.

(5) Complete the review and implementation of comprehensive institutional controls. This activity is currently being completed by the EPA and the State.

Protectiveness Statement(s):

Comprehensive Protectiveness Statement: The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through continued operation of the GWTF, and sediment cleanup goals, through natural degrading, depositional, and dispersive processes. In the interim, exposure pathways that could result in unacceptable risks are being controlled. All threats at the Site have been addressed through groundwater treatment; removal, incineration, and stabilization of contaminated soil and ash; site fencing; and expansion of an alternate water supply.

Long-term protectiveness of the remedial action will be verified by continued monitoring of groundwater, sediment, fish tissue, and wetlands. However, the State has no monitoring plans in place for MNA, sediments, wetlands, and fish tissue.

Other Comments: None.

SECTION 1.0
INTRODUCTION

This five-year review report is for the remedial actions conducted and on-going at the Baird & McGuire Superfund Site (the site) [Figures 1 and 2]. The purpose of this five-year review is to determine whether the remedies for the site are protective of human health and the environment. The methods, findings, and conclusions of this review are documented in this five-year review report. In addition, five-year review reports identify issues found during the review, if any, and present recommendations to address them.

EPA Region I has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). Section 121(c) of CERCLA 42 USC § 9621(c) states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The Baird & McGuire site consists of four operable units. Operable Unit 1 (OU-1) refers to groundwater extraction and treatment. Operable Unit 2 (OU-2) refers to soil excavation and treatment at an on-site incinerator and on-site disposal. Operable Unit 3 (OU-3) was designated to address the contamination in the Cochato River sediments. Operable Unit 4 (OU-4) was designated for reopening the Donna Road well field to replace the lost supply resulting from contamination of the South Street well field.

This is the second five-year review for the Baird & McGuire Superfund Site. This review is required by statute because the selected remedy will, upon completion, leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. The trigger for this statutory review is the signature date of the previous Five-Year Review report on September 15, 1999.

SECTION 2.0
SITE CHRONOLOGY

The chronology of the Site, including all significant site events and dates is included in Table 1.

Table 1: Chronology of Site Events

Event	Date
Baird & McGuire Inc. operated a chemical mixing and batching company.	1912 - 1983
Commonwealth of Massachusetts becomes involved and fines the company at least thirty-five times for violations of the Federal Insecticide, Fungicide and Rodenticide Act of 1947(FIFRA).	1954 - 1977
Massachusetts Department of Environmental Quality Engineering (DEQE) (currently Department of Environmental Protection, or DEP) documents a number of questionable disposal practices.	1981 - 1982
Baird & McGuire Inc. carries out a number of voluntary remedial actions.	February - April, 1982
South Street municipal well field shut down.	1982
The Board of Selectmen of Holbrook revoke Baird & McGuire's permit to store chemicals at the Site and order the dismantling of existing storage facilities. As a result operations were terminated.	May 2, 1983
The Site is added to the National Priority List (NPL).	September 8, 1983
EPA begins removal actions including removing 1,000 cubic yards of contaminated soil, the constructing of a clay cap, installing a groundwater interception/recirculation system and erecting some fencing.	1983
EPA constructs a security fence to enclose the site.	July 1985
Remedial Investigation (RI) performed by GHR Engineering Associates.	May 1985
Feasibility Study (FS) performed by GHR Engineering Associates.	1986

Table 1: Chronology of Site Events	
Event	**Date**
EPA issues the first ROD which specifies groundwater extraction and treatment via an on-site treatment plant (OU-1) and soil excavation and treatment via an on-site incinerator (OU-2).	September 30, 1986
EPA issues the second ROD to address contamination in the Cochato River sediments (OU-3).	October 9, 1989
EPA issues the final ROD that calls for reopening the Donna Road well field to replace the lost supply resulting from contamination of the South Street wellfield (OU-4).	September 27, 1990
A groundwater treatment facility (GWTF) and extraction/recharge system is built (OU-1) and treatment of groundwater begins.	1991 to present
Removal of contaminated sediments from the Cochato River by the New England Division of the U.S. Army Corps of Engineers (OU-3).	May 1994 - June 1995
Source control remedy to remove and treat contaminated soils (OU-2) and on-site disposal of OU-2 soils and OU-3 sediments.	June 1995 - July 1997
LNAPL recovery system is constructed and becomes operational.	1998
Completion of the first Five-Year Review for the Site	September 1999
A Remedial System Evaluation (RSE) is completed for the GWTF.	January 2002
EPA signed two ESD documents for OU-1 and OU-4, allowing for partial funding of an off-site municipal water supply expansion project.	August 2003
The Massachusetts DEP assumes site-wide O&M responsibility from the EPA.	June 2004
Completion of the second Five-Year Review for the Site	September 2004

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Baird & McGuire Superfund Site is located on South Street in Holbrook, MA (Figure 1). The 1986 ROD defines the Site as the area within the EPA security fence constructed in July 1985. According to the FS, this fence encompasses all known areas of soil contamination related to Baird & McGuire (GHR, 1986a). The Site boundary and coincident fence line are shown on Figure 2, based on a Site survey conducted in May 1988. The Site designated on Figure 2 has been determined to consist of approximately 32.5 acres. For the purpose of increased security and access control measures during remedial actions, additional fencing was constructed in some areas beyond the Site boundary. This includes fencing around the groundwater treatment plant and recharge basins, and fencing beyond the southern Site boundary.

As illustrated on Figure 2, the Site is not limited to land within the former Baird & McGuire properties. Historically, Lots 130, 130-1 and 130-2 have had Baird & McGuire ownership. These lots consist of 9.33 acres, of which approximately 8 acres are within the Site boundaries. The remaining 24.5 acres of the Site consist of portions of five privately owned lots and two lots jointly owned by the towns of Holbrook and Randolph. In addition, four privately owned lots located west of the Cochato River (Lots 6, 12-2 and 12-3) have restricted access to the river due to the presence of the security fence.

Figure 2 also shows significant ecological Site features, including the Cochato River, the unnamed brook, the 100-year floodplain, and wetland areas. Based on a wetland boundary delineation conducted during RI investigations, wetlands occupied approximately 44 percent of the Site. In addition, 66 percent of the Site was determined to be within the 100-year floodplain (GHR, 1986a).

3.2 HISTORY OF CONTAMINATION

Baird & McGuire Inc. operated a chemical mixing and batching company in northwest Holbrook, MA from 1912 to 1983. Manufactured products included herbicides, pesticides, disinfectants, soaps, floor waxes and solvents. Waste disposal methods at the site included direct discharge into the soil, a nearby brook and wetlands, and a former gravel pit in the eastern portion of the site. Underground disposal systems were also used.

The state became involved between 1954 and 1977 and fined the company at least thirty-five times for violations of the Federal Insecticide, Fungicide and Rodenticide Act of 1947 (FIFRA). In 1981 and 1982 the Massachusetts Department of Environmental Quality Engineering (DEQE) documented a number of questionable disposal practices. Baird & McGuire Inc. performed voluntary remedial actions from February to April of 1982. In May 1982, the Board of Selectmen of Holbrook revoked Baird & McGuire's permit to store chemicals at the Site and ordered that existing storage facilities be dismantled. As a result, operations were terminated.

3.3 INITIAL RESPONSE

A hydrological study was completed by the EPA which initiated some remedial actions in 1983. These actions included the removal of 1,020 cubic yards of contaminated soil, 1 ton of waste creosote, 25 gallons of waste coal tar, 155 pounds of solids hazardous waste and 47 drums of flammable liquids and solids, and 2 drums of corrosives. The EPA also oversaw construction of a clay cap, installation of a groundwater interception-recirculation system, and erection of fencing. The Site was added to the National Priority List (NPL) on September 8, 1983. EPA constructed a security fence in July 1985 to enclose the Site.

An RI/FS (1985/1986a, GHR) identified and described the presence of a groundwater contamination plume, originating from the Baird & McGuire property and extending beyond the Cochato River. The EPA issued three RODs for the Site, defining four operable units and describing selected remedial alternatives. The first ROD, issued in September 1986, specified groundwater extraction and treatment at an on-site treatment plant (OU-1) and soil excavation, treatment at an on-site incinerator, and disposal of ash on-site (OU-2). The second ROD, issued in September 1989, addressed contamination in the Cochato River sediments (OU-3). EPA issued the final ROD in 1990, which called for reopening the Donna Road well field to replace the lost supply resulting from contamination of the South Street wellfield (OU-4).

3.4 BASIS FOR TAKING ACTION AT THE SITE

The following summarizes the contaminants detected at the Site, as identified in the RI and during subsequent investigations.

Soil. Contaminants such as volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), other organic compounds, pesticides, dioxin, and heavy metals such as lead and arsenic have been detected in soils across the site. Dioxin also has been detected in area wetland soils. Although the Site was fenced off, both direct contact and accidental human ingestion of site soils posed an imminent threat to human health due to the high levels of pesticides and dioxin, as identified in the RI.

Groundwater. During the RI, VOCs, SVOCs, PAHs, pesticides, and metals (arsenic and lead) were detected in site groundwater and downgradient of the site, beyond the Cochato River. Direct contact or accidental ingestion of groundwater posed an imminent threat to public health. The contaminated groundwater resulted in the shut down of public wells (South Street well field). In a subsequent investigation, conducted by EPA in 1997, it was confirmed that light non-aqueous phase liquids (LNAPL) exist near the center of the plume. LNAPLs, undissolved chemicals that are less dense than water and thus float on top of the groundwater, have been determined to be a continuing source of contamination in groundwater at this site. Groundwater monitoring has continued to indicate the presence of VOCs, SVOCs, pesticides, solvents, arsenic and other inorganic chemicals.

Sediments. Contaminants of concern, detected in Cochato River and Unnamed Brook sediments at the site, include VOCs, PAHs, arsenic, and pesticides including DDT and chlordane. The concentrations detected were greatest in the portions of the river on Site and approximately 500 feet downgradient of the existing site fence. These sediments were determined to be acutely toxic to aquatic life (EPA, 1989); however, human contact with contaminated sediment has been found not to pose a significant health risk.

These conclusions formed the basis of the selected remedies (past and present) for the Site as outlined in the RODs. See Section 4.0 for additional details.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

EPA issued three RODs for the Site, defining four operable units and describing selected remedial alternatives. The first ROD, issued in September 1986, specified groundwater extraction and treatment via an on-site treatment plant (OU-1) and soil excavation and treatment via an on-site incinerator (OU-2). The second ROD, issued in September 1989, addressed contamination in the Cochato River sediments (OU-3). EPA issued the final ROD in 1990, which called for reopening the Donna Road well field to replace the lost supply resulting from contamination of the South Street wellfield (OU-4).

The following sections summarize the selected remedies for Operable Units 1, 2, 3, and 4.

4.1.1 Operable Unit 1

The remedial objectives for OU-1 groundwater are:

- Remediate the contaminated aquifer within a reasonable time period to prevent present or future impacts to groundwater drinking supplies;
- Protect surface waters from future contaminant migration; and
- Minimize long-term damage and/or maintenance requirements.

The selected remedial action for OU-1 includes the following components:

- Groundwater Extraction System;
- On-site Groundwater Treatment Facility;
- Groundwater Recharge System.

The current system consists of eight extraction wells (EW-2, EW-3, EW-4A, EW-5, EW-6, EW-7, EW-8, and EW-9) that pump contaminated groundwater to a groundwater treatment facility, and four recharge basins for discharge of treated groundwater back to the aquifer. Extraction wells EW-1 and EW-4 are currently off-line. The groundwater extraction wells were located to contain the plume. The implementation of this system is described in Section 4.2.1.

4.1.2 Operable Unit 2

The remedial objectives for OU-2 (soil) were:

- Minimize the risk to the human population from direct contact with contaminated soils/sediments;

- Protect surface waters from future contaminant migration; and
- Minimize long-term damage and/or maintenance requirements.

Based on the nature and extent of soil contamination documented in the RI/FS, the 1986 ROD specified the excavation of soil from "hot areas" with subsequent treatment in an on-site incinerator, and on-site disposal of the treated soil (ash). The hot areas were delineated in the ROD based on contamination profiles developed in the RI Addendum (GHR, 1986b). The limits of excavation were established so that contaminant concentrations outside of the hot areas were one to two orders of magnitude lower than the concentrations inside the hot areas. Also considered was the presence of wetlands and the extent of contamination in those wetlands, with the intent of minimizing disruption to wetlands. The ROD notes that although this approach results in residual soil contamination, future health risk for a trespasser scenario would be within an acceptable range.

The selected remedial actions for OU-2 included the following components:

- Excavation with associated dewatering and erosion control;
- Backfilling using treated soil into the excavation area;
- Extraction Well Piping Relocation at the end of the excavation process;
- Temporary relocation of the Unnamed Stream during remediation followed by restoration of its natural course;
- On-Site Incineration and Stabilization (IS) Facility;
- Site Closure upon the completion of soil excavation and treatment;
- Site Restoration;
- Wetlands Restoration;
- Continued Monitoring.

4.1.3 Operable Unit 3

The remedial objectives for OU-3 (sediment in river) were:

- Reduce human exposure to arsenic, DDT, PAHs, and chlordane in sediment by excavating to an average depth of six (6) inches and by achieving the following levels of contaminants: 250 ppm for arsenic; 19 ppm for DDT; 5 ppm for chlordane; and 22 ppm for total PAHs. These concentrations correspond to a 1 x 10^{-5} to 1 x 10^{-6} excess cancer risk level; and

- Reduce environmental exposure to those contaminants of concern to concentrations corresponding to the mean sediment quality criteria (SQC) (EPA, 1989) in the river bed, and to the upper bound SQC in the wetland area north of Ice Pond.

The ROD specified excavation and incineration of approximately 1,500 cubic yards of contaminated sediments for protection of public health and the environment. Sediments were to be excavated on an average of six inches from approximately the center of the fenced Site area downstream to Union Street. Sediments were to be transported to the on-site treatment facility, implemented under OU-2, and subsequently placed as backfill on the Site.

The ROD also required erosion control, wetlands restoration, placement of organic fill in the excavated areas of the river in the vicinity of the groundwater plume and long-term monitoring of downstream portions of the river where sediments were not excavated.

To minimize the disruption of wetlands, sediments were not to be removed from areas of the river where contaminant concentrations were low, calculated risks were low, and no impacts were observed. In accordance with the ROD for OU-3, long term monitoring is to be conducted to evaluate remaining contaminant levels and their behavior over time (EPA, 1989).

4.1.4 Operable Unit 4

The remedial objectives for OU-4 were:

- To identify a candidate water source to replace the 0.31 million gallons per day (MGD) lost supply from the closing of the South Street municipal well field in an environmentally sound, cost effective manner without placing additional stress on the Great Pond Reservoir system or existing water treatment facilities.

The selected remedy for OU-4 consisted of the following components:

- Permitting/Predesign Studies;
- Groundwater Extraction;
- Groundwater treatment;
- Delivery to the Distribution System.
-

On August 21, 2003, an Explanation of Significant Difference document (ESD) was issued for the groundwater remedy (OU-1) specified in the1986 ROD. The ROD was changed to include excavation of soil from the Upper Reservoir/Great Pond located in Braintree and Randolph (approximately 400,000 cubic yards) to provide an additional storage capacity resulting in an estimated additional supply of 0.31 MGD to be used in the interim to supplement the community's drinking water until the groundwater remedial action is complete. On this date, the

EPA also issued an ESD document for OU-4 stating that no further action will be taken under this ROD.

4.2 REMEDY IMPLEMENTATION

This section presents summaries of the remedial actions conducted or being conducted at the site in accordance with the RODs objectives mentioned in Section 4.1.

4.2.1 OU-1 Remedy Implementation

The groundwater remedy at the Site is ongoing. A groundwater treatment facility (GWTF) and extraction/recharge system were built in 1991 and remain in operation, with modifications. The three main components of the groundwater remedy are extraction, on-site treatment, and recharge as specified by the 1986 ROD.

Groundwater Extraction. The groundwater extraction system consists of eight extraction wells (EW 2, EW-3, EW-4A, EW-5, EW-6, EW-7, EW-8, and EW-9) each operating at a flow rate of between 10 and 35 gpm. The extraction well locations are shown on Figure 3. The system was originally designed to pump at a maximum total rate of 200 gpm. The wells pump the groundwater via separate pipes to an extraction well control building, located south of the extraction system, where the water converges to a single header pipe that conveys the water to the GWTF. All extraction system controls (e.g., valves, flow meters, electrical switches) are housed within the extraction system control building. The wells are operated remotely through use of a programmable logic controller (PLC) located at the GWTF.

Figure 3 also shows the locations of the numerous monitoring wells that exist at the Site. At many of the monitored locations, multiple wells have been constructed. These well clusters allow water levels and water quality to be determined at different depths in the stratified drift deposits, in the till deposits and weathered bedrock zone, and in the underlying fractured bedrock. Data gathered from the monitoring wells are used both to determine the area of capture of the extraction well system and to monitor the improvements in water quality resulting from groundwater extraction and treatment.

LNAPL Collection. As an enhancement to the groundwater extraction and treatment systems, LNAPL is pumped directly from 3 wells (EW-8, MW-97-1, and MW-98-1) to a separate collection tank. The recovered LNAPL is disposed off-site. LNAPL is collected at a rate of approximately 5 gallons per day. Until June, 2004, the LNAPL was mixed with an absorbent, crushed corncobs, prior to off-site disposal. The State is currently shipping the LNAPL off-site in liquid form.

Groundwater Treatment. The Groundwater Treatment Facility (GWTF) is located off of South Street as shown on Figure 3. All unit operations are contained in the same building including:

- Metals pretreatment consisting of potassium permanganate to remove heavy metals and arsenic, and the addition of polymer to enhance iron removal;

- Filtration for removing suspended solids carried over from the metals removal process;
- Granular activated carbon adsorption for removing organic compounds;
- Sludge dewatering used for decreasing the water content of the metals hydroxide sludge;
- Metals hydroxide sludge disposal in a RCRA hazardous waste landfill;
- Vapor phase carbon adsorption for treating off-gases from various tanks.

Monitoring points throughout the system allow for in-line instruments to measure flow and indicator parameters, and allow for the collection of samples for off-site laboratory analyses. The GWTF operations is currently staffed 10 hours a day, 7 days per week. Groundwater is treated to meet the SDWA MCLs.

Groundwater Recharge System. Treated water from the GWTF is recharged back to the groundwater through four infiltration basins (each 100 feet by 100 feet). Water is discharged to one basin at a time while the other three basins remain inactive. Discharge is rotated on a weekly basis to other basins to prevent overuse of any one basin and allow maintenance of a particular basin if recharge capacity is diminished.

4.2.2 OU-2 Remedy Implementation

The selected remedy for OU-2 consisted of soil excavation and incineration, erosion control, dewatering, backfilling of incinerated material, relocation of the unnamed stream, site restoration, wetlands restoration and monitoring.

This source control remedy (removal and treatment of contaminated soils) commenced in June 1995 and was completed in July 1997. All soils excavation and treatment facilities have been decommissioned and removed. To summarize the OU-2 remedial activities consisted of:

- Approximately 248,000 tons of soil and sediment were excavated and treated by on-site incineration. Soils were excavated to approximately one foot below the seasonal low water table within the excavation limits, with excavation depths ranging from approximately 3 to 33 feet below grade;
- Approximately 250,000 tons of the treated soil (i.e., ash) were backfilled into the 12.5-acre excavation area;
- TCLP tests were performed on the ash, and approximately 320 tons of ash which failed the leaching criteria were stabilized with cement prior to backfilling to reduce the potential for leaching of contaminants;
- The incinerator building and equipment were demobilized and removed from the site and the incinerator building foundation was crushed and buried on-site;
- Approximately 7.4 acres of forested and scrub/shrub floodplain wetlands underwent on-site restoration, including a small peat bog and 1,000 linear feet of

the unnamed brook.

EPA and M&E concluded from the site visit conducted for the first five-year review that, although the wetland was not restored with the organic soils recommended in the Final Restoration Plan, the mitigative measures required by EPA and USACE were met. The wetland was monitored annually in order to assess the success of the wetland restoration effort.

4.2.3 OU-3 Remedy Implementation

The remedy for OU-3 involved removal of contaminated sediments from the Cochato River. This remedy commenced in May 1994 and was completed in June 1995. Major components of the sediment remedy were site preparation, sediment dredging, placement of organic fill and monitoring.

In preparation for river excavation, the river banks were cleared and grubbed. A detention basin was built in the river just downstream of the Union Street Bridge to trap suspended sediments during dredging and was subsequently removed. Temporary haul roads were constructed and then removed after testing showed no residual contamination. Sediments were dredged from a 2,100-foot reach of river extending from the Baird & McGuire Site to the Union Street bridge. Sediments were dredged to a minimum depth of six inches and a maximum depth of 24 inches in some areas. Dredged material was placed in sealable containers and transported to the Baird & McGuire exclusion zone where it was stored for subsequent incineration. A total of 4,712 cubic yards of material were removed from the river. Dredged material was transported to the IS facility, incinerated and placed as backfill within the OU-2 soil excavation area. Wetlands adversely impacted by the dredging and the installation of haul roads were restored under the OU-2 Final Restoration Plan.

The portion of the river where contaminated groundwater underlies the riverbed was backfilled with approximately 438 cubic yards of clean organic fill. This organic fill acts as a filter which will attenuate contaminated groundwater that may discharge into the river.

Following completion of the remedy, the EPA implemented a long term monitoring plan of the Cochato River downstream of the dredged area including analyses of sediment and fish. The plan includes collection and analysis of sediment samples annually for the first five years and fish samples every 5 years, followed by a review of the data and trends.

4.2.4 OU-4 Remedy Implementation

The ROD for OU-4 was issued to address alternate water supply/replacement of lost supply that resulted from the contamination and subsequent shutdown of the South Street well field, which was part of the water supply for Holbrook in 1982. The reactivation of the Donna Road aquifer was selected as the alternate water supply.

In 2000, EPA provided funding to assist the towns of Holbrook and Randolph in expanding existing water capacity at the Upper Reservoir/Great Pond. This was addressed in an ESD document in August 2003 for the groundwater remedy (OU-1). EPA believes the increase in additional drinking water capacity of the Upper Reservoir/Great Pond as provided by the ESD document for OU-1, should be sufficient to eliminate any interim risk until interim cleanup levels are met for the groundwater remedy. As a result, the reactivation of the Donna Road wellfield was determined to be not necessary. Thus, an ESD document was issued on August 21, 2003 for OU-4, which states that EPA will not implement the selected OU-4 remedy and no further action will be taken under OU-4.

4.3 OPERATION AND MAINTENANCE

The majority of O&M activities at the site include the operations of the GWTF (OU-1). For OU-1, O&M activities include the operation and maintenance of the GWTF, including the groundwater extraction wells, and the LNAPL collection system, and monitoring well sampling and analyses. Operating the GWTF currently requires a staff of six to operate the facility 10 hours per day and provide routine and periodic mechanical maintenance, equipment inspections, and monitoring of the process and data (chemical analyses, flows, vessel pressures). Periodic monitoring activities include sample collection from plant monitoring points, monitoring wells, and extraction wells.

More specifically, operating the GWTF includes the addition of treatment chemicals such as polymer and potassium permanganate used for groundwater treatment, change out of filter media such as activated carbon and filter sand, collecting samples from the process for laboratory analyses, disposal of residuals (sludge), and the collection and disposal of LNAPL.

LNAPL is collected from 3 wells and pumped into a tank in a separate building. The tank is periodically pumped out for off-site disposal of the LNAPL. Other disposal activities include the disposal of sludge from the metals removal process. The sludge is transported off-site in roll-off containers for disposal.

Typical maintenance items include gear lubrication, seal replacement, and pipe cleaning. Other O&M activities include maintaining site security, such as fence repair and change of locks on buildings, and general site maintenance such as mowing and snow removal as needed.

The O&M of the site is documented in a monthly report. Elements of the monthly report include a summary of overall facility performance, monitoring information for the extraction wells, process control summary information (average pH, turbidity, and temperature), treatment process information, and a summary of analytical data for the process, including contaminant removal efficiency. Measuring and meeting discharge criteria is key in determining the facility's performance.

Problems associated with the O&M of the site include typical mechanical and process issues that are addressed as needed. In the past 5 years, the most significant issues have included the need for replacing the Supervisory Control and Data Acquisition (SCADA) system, replacement of holding tanks, and addressing pressure build up in the pressure filters. These issues have been addressed through the installation of an updated SCADA system, installation of new tanks to replace ones with leaks/potential leaks, and modifications to the chemical addition for metals removal to reduce the work load of the pressure filters. These items are additionally discussed in Section 5.0.

Contaminant removal rates for VOCs, SVOCs, metals, and pesticides have continued to exceed 99% removal. GWTF effluent concentrations meet or exceed the discharge criteria for these compounds.

Other O&M activities include periodic monitoring of soils and wetlands (OU- 2) and monitoring of sediment and fish in the Cochato River (OU- 3). More specifically, the O&M activities for these operable units have included the collection of additional data. Discussions of data collection and results are presented in following sections. At this time, however, the State has not submitted any monitoring plans for these operable units.

A summary of historic GWTF O&M costs are listed below:

Fiscal Year	Costs of O&M*
2000	$3.0 million
2001	$2.9 million
2002	$2.9 million
2003	$2.8 million
2004	$3.2 million
*The costs shown include all work conducted at the site, including improvements made to the GWTF. Costs for separate studies and evaluations are not included.	

SECTION 5.0
PROGRESS SINCE LAST FIVE-YEAR REVIEW

The last five year review for the Site was completed in September 1999. The 1999 five-year review included several recommendations for each operable unit, and are summarized below. In the past 5 years, several of these recommendations have been addressed. In addition, several other site activities and studies have been conducted to enhance the site remedy (particularly for groundwater treatment [OU-1]). The site progress is described below for each operable unit, with additional details relating to groundwater treatment improvements and evaluations summarized in Table 2.

Table 2: Summary of GWTF Improvements (OU-1) and Process Evaluations	
1. Summary of GWTF System Improvements	
Extraction System	Additional extraction wells have been constructed to enhance groundwater extraction. Wells EW-4A and EW-9 were added.
LNAPL extraction	An inefficient oil water separator was replaced with a newer, more effective system. There are plans to add self contained (drum) collection systems for easy mobilization to various wells when/if LNAPL appears. As part of the RSE (see below) and follow-up study by M&E, reductions in disposal costs for LNAPL are possible. These are being implemented by the current O&M team.
System Controls	At the request of the GWTF operators and as recommended in the RSE, the SCADA system was upgraded to include updated software/hardware and increase system automation. The new system enhances the ability to monitor and control the processes and to store data, and has allowed the plant to be staffed for 10 hours per day versus 24 hours per day previously. The current O&M team is evaluating additional improvements to automation.
GWTF:	
Metals removal	As part of the metals removal process, a polymer delivery system was improved to maintain more consistent addition of polymer to the treated groundwater. Also, the addition of hydroxide and ferric chloride were eliminated. Instead, a potassium permanganate feed system was installed to improve metals removal and decrease sludge production.
Biotreatment	The biounits (activated sludge tanks) have not performed as activated sludge tanks. Instead, they have been used for aeration purposes and as settling tanks behind the metals removal process. Based on more recent analyses (pilot study – see below), it was demonstrated that the aerating does not provide benefit to the removal of organics. An annual cost savings over $10K will be realized if the aeration step can be eliminated. The RSE recommendation for adding tray aerators was not implemented

Table 2: Summary of GWTF Improvements (OU-1) and Process Evaluations	
	because the pilot study indicated that aeration is not needed to effectively remove organic compounds (removed in the GAC units).
Filtration	Filter run times were improved with the modified dosing system and concentrations of polymer added to the metals removal system. It was also determined that use of the biounits for additional settling time post-metals removal improves the filter run times.
GAC	There have been no changes to the two GAC units.
VGAC	The use of the VGAC units will decrease and less costs will be associated with the up keep of these (less filter change outs required) should the aerating step be eliminated.
Sludge dewatering	Replaced sludge tank with two new tanks.
Sludge disposal	No changes. A memorandum from M&E recommended reviewing the current disposal method to reduce costs. Based on analytical data, it may be possible to dispose of the sludge as a non-hazardous waste, which would be less costly.
Discharge basins	No changes
Process Monitoring / Laboratory	The previous GWTF operators submitted a value engineering proposal (VECP) in March 2001 (see below), which was evaluated by the USACE. As a result, the on-site laboratory analyses were replaced with less costly off-site analyses. The frequency of analyses and the number of sample locations within the GWTF were reduced also as a result of the VECP. The RSE report included a recommendation for additional reductions, which was further supported in a memorandum by M&E. Additional reductions in the quantity and frequency of sample analyses are possible. The current O&M team is reviewing possible reductions in monitoring.
2. Summary of O&M Studies and Evaluations	
VECP (PSG; March 2001)	A valued engineering cost proposal (VECP) was submitted to the USACE by the previous GWTF operators to support the reduction in process monitoring costs. A reduction in costs was obtained by reducing the number of sampling points within the treatment process and reducing the frequency of analyses. The VECP supported this effort by demonstrating trends in historical data, which indicated that less data was needed to efficiently operate the plant and still meet clean up goals. Costs were reduced from about \$500K to about \$50K per year as a result of the VECP.
RSE (EPA TOI; January 2002)	A Remedial System Evaluation (RSE) was completed for the GWTF in January 2002. Recommendations included organics removal upgrade

Table 2: Summary of GWTF Improvements (OU-1) and Process Evaluations	
	(aeration), improved plant automation, improved filter media, reduced monitoring, and reduced security. Additional studies have demonstrated that the organics removal upgrade is not necessary, and that the system can be optimized by eliminating the aeration step in lieu of activated carbon filtration. Improvements have been accomplished for the plant automation (updated SCADA system); however, additional automation possibilities are being evaluated. A reduction in process monitoring has been further evaluated. And lastly, efforts to reduce security costs are being evaluated.
Technical Memorandum – Waste Disposal (M&E; November 2003)	On the behalf of the EPA, in a technical memorandum, M&E provided a basis for the reduction in waste disposal costs. The reduction would be realized with a more direct disposal method for the LNAPL and recharacterizing the sludge for solid waste disposal. It was estimated that about $50K per year could be saved. These approaches are being evaluated by the current operators.
Technical Memorandum – Evaluation of Organics Removal (M&E; December 2002)	On behalf of the EPA, M&E reviewed the organic removal process and evaluated the need for upgrading to a separate aeration system (tray aerator proposed in the RSE). It was concluded that a separate aeration system was not needed and that the current aeration step could be avoided in lieu of the activated carbon filters. The implementation of this recommendation could save over $10K in energy costs.
Technical Memorandum – Evaluation of Process Monitoring (M&E; May 2003)	On behalf of the EPA, M&E prepared an evaluation of the current approach to process monitoring (GWTF sampling and analyses). It was determined that the frequency of laboratory analyses could be reduced based on historical data and by using in-line analyzers for certain analyses. A reduction of over $10K per year could be realized.
Record drawing update	On behalf of the EPA, M&E completed an update of the facility record drawings. The record drawings were produced to assist with the change over to State O&M and document significant changes to the GWTF implemented in the past 10 years.
Pilot test	The previous operators and the USACE completed a pilot test to demonstrate that organic compounds are removed without the need for the aeration process (aerators located within the biounits). In addition, PSG evaluated fouling problems with the pressure filters. It was determined that without the aerators, the plant still achieved over 99% removal of organic compounds (exceeded cleanup goals). It was also determined that with less polymer, there was less pressure build up at the filters. This resulted in the procurement of an improved polymer delivery system, which will improve filter run times. Additional studies are on-going by the current operators for improvements to the pressure filter step and the GAC polishing.

GROUNDWATER (OU-1)

Recommendations from previous five-year review:

1. Continue operation of the groundwater extraction and treatment system. Continue to evaluate extraction well performance and modify operation as necessary to maximize flow rate and optimize groundwater recovery.

2. Continue to operate the LNAPL remediation system and optimize LNAPL recovery. The success of the LNAPL remediation system in removing a significant source of groundwater contamination should be assessed. Depending on the success of remediation, the use of other technologies for removing LNAPL sources or enhancing groundwater remediation may be necessary.

3. Evaluate the groundwater extraction and treatment system after the LNAPL remediation system is operational in order to determine how much of the contaminant sources the LNAPL system can feasibly remove.

4. Continue groundwater monitoring and yearly comprehensive evaluation of plume configuration to track progress in plume remediation. The performance of the system should be evaluated in terms of plume size and containment by comparing plume maps and observing trends in Site contaminants.

5. Evaluate the extent to which natural attenuation is occurring in groundwater and predict impact on plume restoration. Future groundwater monitoring should be tailored to collect pertinent data necessary for evaluation of natural attenuation. The process of biodegradation may be a significant factor in total plume remediation once LNAPLs are removed from the groundwater.

6. Restrict future land and water use consistent with the recommendations of the Site Reuse Study (M&E, 1998).

Progress made on the recommendations listed above are summarized as follows:

Groundwater Treatment. The GWTF has continued to operate near the optimal rate and performance. Several modifications and potential improvements to the GWTF have been evaluated and several were implemented within the last 5 years. These are summarized on Table 2.

LNAPL Remediation. The removal of LNAPL has continued with the operation of the LNAPL treatment system. Three wells (EW-8, MW-97-1, and MW-98-1) are used to remove LNAPL from the groundwater at a rate of about 5 gallons per day. Additional wells have been installed within the LNAPL plume and these wells will be used to enhance the removal of LNAPL over the next several years. Since the system began operating, 10,980 gallons of LNAPL have been removed. Other changes to the LNAPL removal system have been evaluated and implemented as shown on Table 2.

System Evaluation. A formal system evaluation has not yet been completed. However, a report on the groundwater and LNAPL plume migration through 2003 has been drafted (M&E, 2004a). In addition, a report on groundwater data trends has been drafted using data from the previous 5 years (M&E, 2004b). The information presented in these reports indicates the need for long-term operation of the groundwater treatment system, with duration depending mostly on the removal of the LNAPL from the overburden.

Groundwater Monitoring and Plume Evaluation. Groundwater monitoring is conducted each quarter for the extraction wells, and yearly for all monitoring wells. The plume of groundwater contamination is evaluated each year based on the groundwater data. To date, the plume has continued to decrease in size, demonstrating the effectiveness of the remedy. A trend report has also been prepared and this report further demonstrates the downward trend of site contaminants (M&E, 2004b). Refer also to Section 6.3 for additional details on site data.

Natural Attenuation. Data required to evaluate and implement natural attenuation is collected as part of the groundwater monitoring program. Currently, due to the presence of LNAPL, natural attention is not likely occurring at a significant rate. It is recommended that the overburden wells which were recommended for continued VOC and SVOC analysis also be sampled for monitored natural attenuation (MNA) parameters at a frequency of every five years until LNAPL thicknesses have dissipated to less than two inches, at which time, the frequency of sampling should be increased to every two years (see Attachment 5). This recommendation will require further evaluation as the presence of LNAPL diminishes.

Site Use Restrictions. The EPA is currently evaluating the best method to continue notifications and restrictions, or institutional controls, to be protective of public health and the environment during continued operations of the GWTF. Current restrictions include existing land use ordinances enforced by the Town (wetland conservation and well permitting), access agreements, and use restrictions on responsible party owned land. Further evaluation is on-going and the comprehensive implementation of institutional controls is expected to be finalized before the next five-year review.

<u>SOILS (OU-2)</u>

Recommendations from previous five-year review:

1. Trends in wetlands restoration should be evaluated to determine if a viable wetlands has developed or will develop in a reasonable time frame. Evaluate compliance with restoration requirements based on three years of monitoring data.

2. Assess the adequacy of legally-binding institutional controls. Evaluate site use to confirm that only commercial and industrial activities have been performed at the site, consistent with recommendations of the Site Reuse Report (M&E, 1998).

Progress made on the recommendations listed above are summarized as follows:

Wetlands Restoration. In 1997 and 1998 the final site restoration plan was amended to improve water retention capability in wetland areas and therefore improve the success of the wetland replication efforts. As reported by ENSR (2002), the improvements included installing three gabion basket/coir log weirs and levee systems to increase hydraulic residence time in the "no-name brook" (an intermittent tributary to the Cochato River), and installation of a spreader levee designed to direct outflow from a ponding along the no-name brook over a wider area of replicated wetland. In December 2002, ENSR reported the results of four years of wetland monitoring which occurred from 1998 to 2001 (ENSR, 2002). The report noted that wetland species had become established along the "no-name brook", although the presence of the non-native and invasive purple loosestrife increased in abundance over the monitoring period. The report also noted that some small sections of the replicated area do not appear to be receiving sufficient water to retain wetland communities. Refer also to Section 6.3.4 for additional information on the wetland monitoring.

Institutional Controls. EPA is currently evaluating institutional controls (ICs) for 11 parcels of land on and abutting the Baird & McGuire Site. Possible ICs have been proposed, which include the use of the Grant of Environmental Restrictions on five parcels that include the GWTF, the extraction wells and piping, and the recharge basins to control groundwater pumping that would impact the effectiveness of the GWTF. On the remaining six properties, deed notices, in the form of the MADEP Notice of Activity and Use Limitations (AUL), to inform current and future property owners of risks associated with the use of groundwater and contact with soil are possible. Further evaluation is on-going and the comprehensive implementation of institutional controls is expected to be finalized before the next five-year review.

In addition, existing governmental controls are in place which will discourage use of the site for certain activities. A local Board of Health (BOH) ordinance requires that property owners obtain BOH and Department of Public Works approval prior to installing wells. The Town of Holbrook zoning by-laws (as amended March 25, 1996), which have established use restrictions in the Flood Plain Protection District, along with the Massachusetts Wetlands Protection regulations, provide an added degree of protection. Much of the site is located within wetlands (approximately 44%) or within the 100 year flood plain and is part of the Flood Plan Protection District (approximately 66%).

<u>**SEDIMENTS (OU-3)**</u>

Recommendations from previous five-year review:

1. Evaluate the success of natural degrading, depositional, and dispersive processes in reducing contaminant concentrations in sediment after the site remedies have stabilized and a sufficient amount of sediment and fish data have been collected. The long-term monitoring program will be supplemented to provide all necessary information needed to demonstrate the effectiveness of the natural attenuation assumption in the ROD (Section X, Subsection A, para.1).

2. The ROD assumed that the Cochato River would not be used for a public water supply. There has been a recommendation by the town of Holbrook to consider using the Cochato River as input to a public water supply. The risks associated with use of this water should

be evaluated carefully before implementation of this proposal. Sampling of Cochato River Water will be required to check that levels are protective of human health was recommended.

Progress made on the recommendations listed above are summarized as follows:

Natural Attenuation. Based on the review of the data trends (M&E, 2004b), no significant trends in data have occurred that indicate progress in natural attenuation. See Section 6.3.3 for additional information.

Use of Cochato River. Based on the review of the latest sampling data, river surface water meets the action limits (see Section 6.3.3). The latest fish tissue data for the Cochato River indicates that PAHs still exceed the action limit at some locations (see Section 6.3.3). Warning signs have been installed along the river cautioning recreational users about the potential dangers associated with the ingestion of fish caught from the river.

REPLACEMENT OF LOST SUPPLY (OU-4)

The previous five-year review indicated that an evaluation of this remedy would be performed after its implementation. It should be noted that the replacement of lost supply at Donna Road is no longer necessary. In 2000, the EPA provided funding to assist the Towns of Holbrook and Randolph in expanding existing water capacity at the Upper Reservoir/Great Pond. This modification has been addressed in an ESD document to OU-4 and an ESD document to OU-1, both dated August 23, 2004.

SECTION 6.0
FIVE-YEAR REVIEW PROCESS

This section describes the activities performed during the five-year review process and provides a summary of findings.

6.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

Over the past five years, notifications to the public have included two fact sheets, one Citizens' Task Force Meeting, and two public meetings.

A fact sheet was issued on October 12, 1999 and a public meeting was held on October 13, 1999 to update the public on clean-up progress at the site and progress on an alternate water supply.

A fact sheet was issued in late 2000, providing a Cochato River monitoring update.

On February 27, 2001, a Community Task Force meeting was held, during which EPA provided an update on progress on groundwater remediation and alternate water supply.

Prior to conducting this five-year review, a fact sheet was issued and a public meeting was held on May 12, 2004 to present an overview of site progress and present the details regarding transfer of the long-term response action to the State of Massachusetts DEP for O&M.

6.2 DOCUMENT REVIEW

This five-year review consisted of a review of relevant documents for the Site. See Attachment 2 for a list of documents that were reviewed.

6.3 DATA REVIEW

6.3.1 Treatment Plant Effluent Monitoring

The effluent from the groundwater treatment plant is monitored on a regular basis to observe contaminant removal efficiencies. Also, a pilot test was conducted to evaluate potential improvements to the treatment process in the summer and fall of 2003. As part of the pilot test, final effluent from the plant was tested on a weekly to biweekly (every other week) basis for VOCs, SVOCs, arsenic, iron, manganese, total solids, and total suspended solids and on a more frequent basis for turbidity and pH.

On every occasion over the period from June 23, 2003 to November 3, 2003, the final effluent contained no detectable concentrations of VOCs or SVOCs indicating 100% removal. Influent concentrations ranged from 283 to 1,234 ug/L for total VOCs and 903 to 1,444 ug/L for total SVOCs.

Concentrations of arsenic in effluent samples were nondetect on all but one occasion during the period from June 23, 2003 to September 8, 2003. The arsenic concentration from that sample

(6.2 ug/L on July 21, 2003) was below the MCL (10 ug/L). Iron was not detected in any effluent samples. Manganese was detected at concentrations above the secondary MCL (0.05 mg/L) in all effluent samples; however, the presence of manganese is attributed to the use of potassium permanganate and is not a primary drinking water concern. Lastly, is should be noted that turbidity readings were often greater than the project action limit of 5 NTU during the pilot test, possibly due to changes in equipment use during the pilot test. Monthly process reports from January through May 2004 (PSG, 2004a through 2004e) indicated that average turbidity levels in plant effluent were less than 1 NTU. Turbidity is not a primary drinking water contaminant.

6.3.2 Groundwater Monitoring

Summary. Groundwater extraction wells at the site are sampled on a quarterly basis. A comprehensive round of groundwater monitoring, including most of the site monitoring wells, has been conducted by the GWTF operator on an annual basis since 2000, with prior monitoring events occurring in 1988 (pre-extraction system), 1994 (2 events), 1995 (2 events), 1997, and 1998. Groundwater samples are analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, metals, and wet chemistry parameters.

Annual evaluations of extraction system performance in regard to contaminated groundwater remediation and containment have been performed. These evaluations generally involve creating contour maps ("plume maps") of total VOCs and SVOCs in overburden and bedrock for a comprehensive round of groundwater sampling performed by the GWTF operator. The 1997 and 1998 plume maps were included in the previous five-year review report (M&E, 1999). Plume maps for 2000, 2001, 2002, and 2003 are documented in annual reports entitled *Evaluation of Groundwater Remediation Progress at the Baird & McGuire Superfund Site* (M&E, 2001, 2002, 2003, and 2004a). Additionally, a report entitled *Trend Evaluation Report for the Baird & McGuire Superfund Site* has been drafted for the site (M&E, 2004b).

As an example of data evaluation, plume maps for 2000 and 2003, showing total VOCs and total SVOCs in overburden are included in Attachment 3. A comparison of these maps indicates that the plumes of VOCs and SVOCs have continued to decrease in size over the past four years. Comparison of 2003 maps with 2000 maps indicates that the edge of the plume (i.e., 5 ppb contour line) has moved inward toward the source since the 2000 sampling event. For VOCs and SVOCs, decreases in contaminant concentrations at the center of the plume area are apparent.

The following table shows compounds which were detected in the 2003 comprehensive sampling round at concentrations above the MCLs. Only the exceedances from the most recent sampling round are presented.

Table 3. Groundwater MCL Exceedances in 2003

Contaminant	Location	SDWA MCL (ug/L)	Concentration (ug/L) in 2003
Benzene	MW-97-21	5	7.9 J

Contaminant	Location	SDWA MCL (ug/L)	Concentration (ug/L) in 2003
Benzene	MW-97-3	5	6.7 J
Benzene	M-3SD	5	6 J/5.2 J (FD)
Benzene	MW-97-1	5	20 J
Benzene	MW-97-28	5	5.1 J
Benzene	MW-98-1	5	14 J
Benzene	EW-6	5	7.6 J
Vinyl chloride	MW-97-13	2	2.1
Pentachlorophenol	M-3SD	1	ND/13 (FD)
Pentachlorophenol	MW-97-28	1	350
Lindane (gamma-BHC)	MW-97-3	0.2	0.24 J
Lindane (gamma-BHC)	MW-97-1	0.2	1.5 J
Lindane (gamma-BHC)	MW-97-28	0.2	1.9
Lindane (gamma-BHC)	MW-98-1	0.2	0.96
Lindane (gamma-BHC)	MW-97-23	0.2	0.33 J
Alpha-chlordane	MW-97-23	2[1]	2.6 J
Gamma-chlordane	MW-97-23	2[1]	3.1 J
Arsenic	22 overburden monitoring wells and all extraction wells	10	13.1 - 2,420
Iron	48 overburden and bedrock monitoring wells and all extraction wells	300 (SMCL)	429 - 81,200

[1] - MCL is for total chlordane
ND - Not detected
FD - Field duplicate result
J - Estimated value
SMCL - Secondary MCL

VOCs and SVOCs. Total VOC and SVOC concentrations over time for Site groundwater are provided in Table A4-1 of Attachment 4. It should be noted that several site wells were replaced after being destroyed by source control remediation. The original well name and the replacement well name are listed in Table A4-1 for clarity. The trend evaluation report concluded that significant decreasing trends in VOC and SVOC concentrations exist for the majority of overburden and bedrock wells monitored at the Site. VOC and SVOC concentrations in monitoring wells on the east side of the Cochato River have primarily been nondetect or very low, indicating that continued migration of the plume beneath and beyond the river is not occurring. As shown in Table 3, benzene, vinyl chloride, and pentachlorophenol were detected above MCLs in overburden groundwater in 2003.

Metals. Arsenic has generally been detected in the majority of overburden wells within the plume and surrounding areas. Within the plume area, several overburden wells have shown continual decreases in arsenic concentrations over the past four or more sampling rounds. Other wells have not exhibited consistent increasing or decreasing trends. Historical arsenic concentrations are provided in Table A4-2 of Attachment 4. As shown in Table 3, arsenic was detected above the SDWA MCL at all of the extraction wells sampled and at 22 other overburden monitoring wells across the site in 2003. Iron was also detected at concentrations above the secondary MCL in groundwater from all of the extraction wells and at 48 overburden and bedrock monitoring wells in 2003. As described in the most recent Groundwater Evaluation Report for the site (M&E, 2004a), the aquifer is in a reduced state, and therefore arsenic is soluble and mobile. The extraction system is containing the arsenic plume along with the organic plume by removing the dissolved phase plume. Once all organics are removed and the aquifer returns to an oxidized state, arsenic may become immobile in the aquifer.

Pesticides. Over the past four years, pesticides have generally been detected in fewer monitoring wells and at lower concentrations each year. In the latest 2003 round of sampling, pesticides were detected primarily in overburden wells within the plume area and in a few overburden wells north of the plume. In previous years, pesticides had also been detected in some bedrock wells and in more overburden wells located north and south of the plume area and east of the Cochato River. As shown in Table 3, SDWA MCLs were exceeded for lindane (gamma-BHC) in five overburden wells and alpha- and gamma-chlordane in one overburden well within the plume area in 2003.

LNAPL. LNAPL continues to be a major source of dissolved contaminants in groundwater. A remediation system has been in place since March 1999 to remove LNAPL. Monitoring of LNAPL thickness has occurred since that time. LNAPL samples, analyzed during June 2003 and July 2003, were found to contain significant concentrations of the same contaminants found in the groundwater (i.e., iron, arsenic, VOCs, SVOCs, and pesticides) (M&E, 2004a). The location of LNAPL is coincident with the hot spot of the plume. Therefore, it has been concluded that LNAPL is the primary source of the contaminants found in the groundwater. The groundwater evaluation reports for the site have concluded that, because a significant amount of pure phase product (LNAPL) still exists in groundwater at the site, biodegradation will have relatively little impact on contaminant destruction. If the LNAPL can be removed such that only the dissolved phase remains, biodegradation could be a significant factor in attaining cleanup goals. Biodegradation may be beneficial at the present time in stabilizing the edges of the plume away from the plume source, such as across the river and to the north of the extraction system. However, hydraulic containment achieved by the groundwater extraction system is likely the primary reason for the stable or shrinking plume size. From March 1999 through April 2004, approximately 10,980 gallons of LNAPL have been recovered.

MNA Parameters. It is recommended that the overburden wells which were recommended for continued VOC and SVOC analysis also be sampled for natural attenuation (NA) parameters at a frequency of every five years until LNAPL thicknesses have dissipated to less than two inches, at which time, the frequency of sampling should be increased to every two years (see Table 13). The reasoning is that while there is evidence of biodegradation occurring (M&E, 2003a), it will have relatively little impact on contaminant destruction as long as a significant amount of pure phase product (LNAPL) still exists in the groundwater. If the LNAPL can be removed to the point that the source strength is significantly reduced, biodegradation could be a significant factor in attaining cleanup goals at the plume boundaries.

Conclusions. Overall, the data shows that the groundwater extraction system has been effective in containing the dissolved phase plumes and decreasing the concentrations of contaminants in groundwater. Underlying groundwater contamination remains, however, and continued treatment is required to achieve state and federal drinking water standards, RCRA groundwater protection standards, and other federal and state groundwater protection standards. Constituents in Site groundwater still exceed interim cleanup criteria for arsenic, alpha- and gamma-chlordane, gamma-BHC, VOCs, and SVOCs, and iron (secondary MCL). Identified as applicable or relevant and appropriate, the requirements under the Safe Drinking Water Act, RCRA Subpart F, Massachusetts Groundwater Quality Standards, and Massachusetts Drinking Water Requirements remain to be met. Groundwater requires continued remediation under these rules.

The trend evaluation report for the site included recommendations with regard to future groundwater monitoring. A table summarizing the recommendations for future monitoring is provided as Table A5 in Attachment 5. The report recommended that the groundwater extraction wells continue to be sampled on a quarterly basis for VOCs, SVOCs, arsenic, and iron.

It was additionally recommended that monitoring wells where VOCs or SVOCs have been detected above MCLs within the past four years be sampled on an annnual basis for the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes) and SVOCs. Also, a small set of additional wells should be sampled annually for BTEX compounds and SVOCs to aid in defining the plume edges each year. It was proposed that wells where no VOCs or SVOCs have been detected over the past four years be eliminated from the monitoring program and that the remaining overburden and bedrock wells be sampled once every five years for VOCs and SVOCs. The report also recommended that pesticide analysis be performed once every five years at the same locations to be sampled for VOCs and SVOCs.

A smaller set of overburden wells was recommended for arsenic and iron analysis on an annual basis. A larger set of wells were specified for analysis of inorganics, in addition to arsenic and iron, to be performed once every five years.

The trend evaluation report also recommended that measurements of LNAPL thickness be made on a monthly basis at all site wells where measurable thicknesses of LNAPL have been observed in 2001 to 2003. It is recommended that monitored natural attenuation (MNA) parameters be analyzed for every 5 years until LNAPL thickness is reduced to less than 2 inches on a consistent basis. At that time, the frequency of MNA analysis should be increased to every 2 years.

MADEP will be reviewing the M&E reports (2004a and 2004b), the second Five Year Review Report, and DEP's assessment of the data collected in the summer 2004. Based on these evaluations the state will finalize the site groundwater monitoring plan prior to the first round of annual sampling set for the summer of 2005.

6.3.3 Cochato River Sediment, Surface Water, and Fish Tissue Monitoring

Long-term monitoring of sediments in the Cochato River was performed on an annual basis from 1996 to 2002. The OU-3 ROD called for long-term monitoring of sediments in portions of the Cochato River downstream of the portion of the Cochato River where sediments were excavated as part of the remedy. Long-term monitoring has also included analysis of fish tissue in order to monitor the impact of the sediments on the fish population. Fish sampling was conducted in 1992, 1996, and annually from 1999 through 2002. Surface water samples were collected from the Cochato River in 2000 in order to establish baseline surface water quality for the project.

Sediment samples have been collected from the following areas along the river (see Figure 4):

Site A:	Upstream of the project area (control)
Site B:	Between the Union Street Bridge and Center Street
Site C:	Ice Pond (two areas)
Site D:	Mary Lee Wetlands (two areas)
Site E:	Adjacent to on-site well EW-7

At Sites C and D, samples have been collected of both the river sediments and soil from the river bank. Fish samples have been collected from Sites A, B, C, and D and from Sylvan Lake (see Figure 4). Surface water samples were collected from Sites A, B, C, D, and E in 2000.

A trend analysis report (M&E, 2004b) has been drafted which evaluates trends in sediment/soil and fish tissue data collected to date as part of long-term monitoring. The report also provides a comparison of the data to action limits for the site and provides recommendations for future monitoring. A summary of the report conclusions and preliminary recommendations is provided below.

River Sediment/Bank Soil. Total PAH, total DDT, total chlordane, and arsenic data for Cochato River sediment and bank soil were evaluated for significant increasing or decreasing trends. For the most part, no significant increasing or decreasing trends were noted at the sampling locations for any of the contaminants evaluated.

With regard to the total DDT results, no significant increasing or decreasing trends were noted for the period from 1996 to 2002. For the most part though, the total DDT results from 1996 through

1998 are higher than the subsequent results for 1999 to 2002. The exception is for Site D river sediment, which showed a significant increase in 2001 as compared to the previous few years (1998-2000) and the subsequent year (2002).

Significant decreasing trends were noted for total chlordane in bank and river locations at Site C. Total chlordane concentrations at Site A (the control location) have remained fairly constant and low relative to the other stations. The results for Station D at the river locations showed a significant increase in 2001 as compared to the previous few years (1998-2000) and the subsequent year (2002). This peak was similar to the peak for total DDT seen at the same location in 2001. Excluding the 1996 results, the Site D bank locations do show a decreasing trend for total chlordane.

No significant trends were noted for total PAHs at any of the sampling locations, with the exception of Site A (the upstream, control location) which showed an increasing trend. Total PAH concentrations at Site A were still low relative to the other stations. The PAH concentrations at Site D bank locations have shown a decrease since 1998, though using all of the data from 1996 through 2002, no significant trend was noted.

Site C bank and river locations and the Site D river locations have seen the most fluctuations in arsenic concentrations with no overall increasing or decreasing trend. Arsenic concentrations at Sites A, B, and E have remained fairly constant over time.

Total DDT, total chlordane, and arsenic concentrations for all bank and river locations from 1996 to 2002 were below the action limits established for cleanup. The total PAH concentration in Site E sediment in 2000 far exceeded the action limit for river locations. The concentration in 2000 was also much higher than the total PAH concentrations in 1999, 2001, and 2002 at Station E.

As stated in the Final Interpretive Report prepared by Battelle (Battelle, 2000), the long-term monitoring plan requires five years of annual sediment monitoring followed by a 25-year sampling regime with gradually decreasing intensity of monitoring, provided that contaminant levels in sediment show signs of decreasing.

To summarize, there have been no increasing or decreasing trends for most contaminants at most sampling locations during the last five years, with an exceedance of the action limit for total PAHs in 2000 at one location. It is recommended that long-term sediment monitoring continue at a reduced frequency. Based on the downward trends in groundwater contaminants concentrations, the frequency of sampling could be reduced to every five years.

Fish Tissue. Over the past three sampling rounds (2000 - 2002), total DDT concentrations in fish samples from Site A and Sylvan Lake have exceeded the action limit, established by the FDA, on one or more occasion. Total chlordane concentrations in fish samples were below the action limit in 2000 to 2002, with the exception of an American Eel sample caught at Site C in 2000. This result was substantially higher than the total chlordane results for other fish species from Site C, collected in 1999, 2001, and 2002. From 2000 to 2002, total PAH concentrations in fish samples from Site B, Site C, and Sylvan Lake exceeded the action limit on one or more occasion. Because the types of fish collected at each site have generally not been consistent from year to year, it is difficult to demonstrate trends over time for the entire study area.

Based on these results, it is recommended that fish sampling continue, however, the frequency could be reduced to once every five years to coincide with the sediment monitoring. It is also recommended that future sampling events focus on one or two types of species (such as the brown bullhead) throughout the study area, if feasible. Though this may be difficult, it would make it easier to evaluate changes in fish tissue contaminant tissue levels throughout the study area and between sampling events.

Surface Water. Surface water samples were collected from the Cochato River in 2000 and analyzed for PAHs, pesticides, and arsenic. In-situ water quality measurements were also conducted. PAHs were not detected at any location. Arsenic was detected at Sites B, C, and D and total chlordane was detected at Site D, however, all concentrations were well below the action limits established for the site. Based on these results, future surface water monitoring is not necessary.

6.3.4 Wetland Monitoring. Monitoring data presented in the ENSR Final Vegetative Monitoring Report (ENSR, 2002) suggest that improvements installed in 1997/98, including the gabions and level spreader levee, have had a positive impact on the restored wetlands. Wetland replication has been most effective in the herbaceous layer. Plant communities dominated by wetland species have become established along the "no-name brook", although many of the species identified in the 2001 survey were not among those originally planted. Although not dominant in any of the plots, the presence of the non-native and invasive purple loosestrife (*Lythrum salicaria*) increased in abundance over the monitoring period and could potentially dominate the wetland over time, creating a wetland with little habitat value. Wetland replication has been less successful in the overstory, which may need more time to become fully established. Measures may need to be taken to control the purple loosestrife population.

Some small sections of the replicated area adjacent to the river do not appear to be receiving sufficient water to retain wetland communities. Wood sheeting along the Cochato River as well as groundwater extracted as part of the site remedy may be preventing the natural flow of water to these areas. However, monitoring of groundwater levels is needed to establish this relationship.

In the next five year period, it is recommended that an additional round of wetland monitoring be performed to evaluate whether purple loose strife has dominated the wetland and whether measures should be implemented to control it. It is also recommended that the gabion, spreader, and levee structures be inspected to identify any maintenance which should be performed to ensure its continued successful performance.

6.4 SITE INSPECTIONS

A site inspection of the groundwater treatment plant was performed on September 14, 2004. A completed site inspection form is attached. The following personnel were in attendance: Maggie Delegorete, Chief Operator; Jason Bierly - Project Manager (Clean Harbors Incorporated); Neil Thurber, Metcalf & Eddy; and Cinthia McLane, Metcalf & Eddy.

6.5 INTERVIEWS

In accordance with the EPA guidance for five-year reviews (EPA, 2001), several personnel involved with the operation and maintenance of the site were interviewed. The interviews took place on September 14, 2004 with various follow up phone conversations. The interview forms are attached. Key points of discussion are provided in applicable sections of this report.

SECTION 7.0
TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy and provides answers to the three questions posed in the EPA guidance for five-year reviews (EPA, 2001).

7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS?

The review of documents, ARARs, and risk assumptions indicates that the remedy was constructed in accordance with the ROD and ESDs and is currently protective.

7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOs) USED AT THE TIME OF REMEDY SELECTION STILL VALID?

7.2.1 Review of Human Health Risk Assessments and Toxicity Factors Serving as the Basis for the Remedy

The risk assessment performed for the 1986 Feasibility Study (FS) report (GHR, 1986a) concluded that there would be significant risk to human health if groundwater from the site containing VOCs, SVOCs, and metals was ingested in the future. The risk assessment further determined that trespasser exposures to site soil containing arsenic, chlordane, and dioxins exceeded EPA risk management guidelines. Direct contact recreational exposures to Cochato River sediments containing elevated levels of arsenic, DDT, PAHs, and chlordane also exceeded regulatory limits. MCLs were selected as interim cleanup levels for groundwater. The results of the risk assessment were used to determine the lateral and vertical limits of soil excavation, and to establish cleanup levels for sediment.

In 1997, a supplemental risk evaluation was performed by M&E as part of the Site Reuse Study (M&E, 1998) to determine the potential risk associated with future commercial/industrial site re-use. Child trespasser risks were also evaluated. Because soils had been excavated, incinerated, and backfilled on-site, the risk evaluation focused on residual risks associated with backfilled ash, contaminated soils remaining below the bottom depth of excavation, and 20 acres of soil remaining outside the limits of excavation. The study concluded that, based on the results of the qualitative risk evaluation, the site could be developed for commercial or industrial use and would not pose harm to children periodically trespassing onto the site.

In this five-year review report, the toxicity values that served as the basis for the sediment cleanup levels, as contained in the ROD, have been re-evaluated to determine whether any changes in toxicity impact the protectiveness of the remedy. Changes in toxicity values since the 1997 risk evaluation are also discussed to determine whether reuse decisions remain valid. Any changes in current or potential future exposure pathways or exposure assumptions that may impact remedy protectiveness are also noted. In addition, environmental data, available since the last five year review, have been qualitatively evaluated to determine whether exposure levels existing at the Site present a risk to current human receptors.

Changes in Toxicity

Table 4 presents a summary of the changes in toxicity values (oral reference doses and oral cancer slope factors) for compounds selected as Contaminants of Potential Concern (COPCs) as identified in the 1989 risk assessment. Updated toxicity information was obtained from the *Integrated Risk Information System* (IRIS; EPA, 2004) and other current EPA sources (e.g., the National Center for Environmental Assessment). Toxicity values for contaminants identified as COPCs during the 1997 risk evaluation, performed as part of the Site Reuse Study, have also been listed.

For most contaminants, changes to toxicity information have been minimal. Changes in toxicity values for groundwater COPCs (e.g., trichloroethene, tetrachloroethene, and vinyl chloride) would not affect remedy protectiveness since cleanup levels for groundwater are based on federal Maximum Contaminant Levels (MCLs). The only change between 1997 and 2004 toxicity values is for chlordane, a significant contaminant in residual soils remaining at the site. The oral slope factor for chlordane has been decreased overall by a factor of approximately three, which results in a decrease in the estimation of cancer risk associated with chlordane in residual soil. Therefore, the conclusions of the 1997 risk evaluation remain valid.

Institutional controls should be implemented to assure that future use of the site is consistent with the assumptions used in the Site Reuse Study risk evaluation. Appropriate fencing should also be maintained to minimize the presence of children on-site at a greater frequency than would occur during trespassing. The implementation of comprehensive institutional controls is on-going, and when complete, will provide long-term protectiveness for all site remedies.

TABLE 4: Comparison of 1989 and 2004 Oral Reference Doses and Oral Cancer Slope Factors for Compounds of Potential Concern

Contaminant of Potential Concern	Oral Reference Dose (RfD) (mg/kg-day)			Oral Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$		
	1989	1997 [e]	2004	1989	1997 [e]	2004
1,1-Dichloroethene	N/A		0.05	1.16		N/A
1,2-Dichloroethane	N/A		0.02	0.092		0.091
2,3,7,8-TCDD (Dioxin)	1.00E-09 a		N/A	1.56E+05		1.50E+05
4,4'-DDD	N/A	N/A	N/A	0.34	0.24	0.24
4,4'-DDE	N/A		0.0003	0.34		0.34
4,4'-DDT	N/A		0.0005	0.34		0.34
Aldrin	N/A		0.00003	11.4		17
Arsenic	N/A	0.0003	0.0003	15	1.5	1.5
Benzene	N/A		0.004	0.029		0.055
Benzidene	N/A		0.003	234		230
Benzo(a)pyrene	N/A	N/A	0.02	11.5	7.3	7.3
Beryllium	N/A		0.002	2.6		N/A
alpha-BHC	N/A		N/A	11.1		6.3
beta-BHC	N/A		N/A	1.84		1.8
delta-BHC	N/A		N/A	4.75		N/A
gamma-BHC	N/A		0.0003	1.33		N/A
Cadmium (food)	N/A		0.001	6.1		N/A
Cadmium (water)	N/A		0.0005	6.1		N/A
Chlordane	N/A	0.0005	0.0005	1.61	1.3	0.35

Contaminant of Potential Concern	Oral Reference Dose (RfD) (mg/kg-day)			Oral Slope Factor (SF) $(mg/kg\text{-}day)^{-1}$		
	1989	1997 [e]	2004	1989	1997 [e]	2004
Chloroform	N/A		0.01	0.081		N/A
Dieldrin	N/A	0.00005	0.00005	30.4	16	16
Heptachlor	N/A		0.0005	3.37		4.5
Heptachlor epoxide	N/A		0.000013	3.37		9.1
Nickel	0.01 b		0.02	1.05		N/A
Tetrachloroethene	N/A		0.01	0.051		0.54
Trichloroethene	N/A		0.0003	0.011		0.4
Vinyl chloride	N/A		0.003	0.0175		1.5
trans-1,2-Dichloroethene	0.01 c		0.02	N/A		N/A
trans-1,3-Dichloropropylene	0.0026 a		0.03	N/A		0.05/0.1
2-Butanone	0.024 c		0.6	N/A		N/A
Barium	0.00029 b		0.07	N/A		N/A
Ethylbenzene	0.097 b		0.1	N/A		N/A
Fluoranthene	0.006 a		0.04	N/A		N/A
Lead (d)	0.0014 b		N/A	N/A		N/A
Silver	0.0014 a		0.005	N/A		N/A
Toluene	0.29 b		0.2	N/A		N/A
Xylenes	0.01 b		0.2	N/A		N/A
Zinc	0.21 b		0.3	N/A		N/A
Dibenzofuran	N/A		0.004	N/A		N/A
2-Methylnaphthalene	N/A		0.004	N/A		N/A
Acenapthene	N/A		0.06	N/A		N/A
Acenaphthylene	N/A		0.02	N/A		N/A
Anthracene	N/A		0.3	N/A		N/A
Benzo(a)anthracene	N/A		0.02	N/A		0.73
Benzo(b)fluoranthene	N/A		0.02	N/A		0.73
Benzo(g,h,i)perylene	N/A		0.02	N/A		N/A
Benzo(k)fluoranthene	N/A		0.02	N/A		0.073
Chrysene	N/A		0.02	N/A		0.0073
Dibenz(a,h)anthracene	N/A		0.02	N/A		7.3
Fluorene	N/A		0.4	N/A		N/A
Indeno(1,2,3-cd)pyrene	N/A		0.04	N/A		0.73
Naphthalene	N/A		0.02	N/A		N/A
Phenanthrene	N/A		0.02	N/A		N/A
Pyrene	N/A		0.03	N/A		N/A

N/A = Not Applicable or Not Available

a. Derived from Acceptable Daily Intake (mg/day) divided by assumed body weight of 70 kg.
b. Derived from Acceptable Intake Chronic (mg/day) divided by assumed body weight of 70 kg.
c. Derived from Risk Reference Dose (mg/day) divided by assumed body weight of 70 kg.
d. Lead is currently evaluated through the use of exposure modeling for adults and children.
e. 1997 evaluation only looked at the analytes noted.

Changes in Exposure Pathways/Assumptions

There have been no changes in soil or groundwater exposure pathways since the last five-year review.

One pathway of potential concern that was not evaluated in the 1989 risk assessment was the vapor intrusion pathway. This pathway may be of concern at sites where shallow groundwater contaminated with VOCs exists in close proximity to occupied buildings. There are currently no occupied buildings located above the shallow groundwater VOC plume. However, should shallow groundwater VOC contamination continue to exist coincident with future site development involving building construction, the indoor air pathway should be further evaluated to determine the potential risk to on-site workers.

Recommended exposure assumptions and risk assessment methods have changed significantly since the 1989 risk assessment was completed. Because sediment cleanup levels were based on 1989 exposure assumptions and methods, a re-evaluation of the cleanup levels has been performed to determine whether changes in exposure assumptions or methods affect remedy protectiveness. A comparison of sediment cleanup levels, developed using 2004 EPA methods and assumptions, to the sediment cleanup levels presented in the ROD are provided below. Target risk levels identified in the ROD were used for this evaluation:

Compound	ROD Cleanup Level	2004 Cleanup Level	Risk-Level (established in the ROD)
Arsenic	250 mg/kg	4.5 mg/kg	10^{-6}
PAHs	22 mg/kg	7.2 mg/kg	10^{-5}
DDT	19 mg/kg	20 mg/kg	10^{-6}
Chlordane	5 mg/kg	19 mg/kg	10^{-6}

The sediment cleanup levels for chlordane and DDT remain protective of human recreational exposures because the 2004 values are higher than the ROD values. The PAH cleanup level would correspond to approximately a 3×10^{-5} cancer risk, which is within the EPA target risk range. It should be noted that the PAH cleanup level assumes that all PAHs present are the most toxic chemical in the group, benzo(a)pyrene. Because this is an overly conservative assumption, the PAH cleanup level also remains protective of human health and likely corresponds to a significantly lower cancer risk. The arsenic sediment cleanup level of 250 mg/kg corresponds to approximately a 6×10^{-5} cancer risk. Because the total risk associated with sediment contaminant exposure at the cleanup levels is within the EPA target risk range of 10^{-6} to 10^{-4}, the overall sediment remedy action limits remain protective.

Action limits were also developed for the fish tissue ingestion pathway for total DDT, total PAHs, and total chlordane. The action limits are developed by the Food and Drug Administration, designed to protect the average individual from potential adverse effects. The action limits for fish ingestion continue to be protective of human health.

Evaluation of Recent Sampling Data

As discussed in Section 6.3.2, arsenic, benzene, chlordane, lindane, vinyl chloride, and pentachlorophenol in select monitoring wells continue to exceed MCLs. Continued exceedances of MCLs indicate that completion of the drinking water ingestion pathway would present a risk to residents. Since groundwater from the site is not currently used by area residents as a source of potable water, the drinking water exposure pathway is incomplete. Until groundwater concentrations meet interim cleanup levels (MCLs), institutional controls should be implemented at the Site to ensure that no private wells are installed at or near the Site.

Contaminants in groundwater may potentially discharge to nearby surface water bodies where direct contact human exposures could occur. Surface water samples were collected from the Cochato River in 2000 and analyzed for PAHs, pesticides, and arsenic at Sites A through E. PAHs were not detected at any location. Arsenic was detected at Sites B, C, and D with concentrations ranging from 0.21 µg/L to 0.75 µg/L. Total chlordane was detected at Site D (0.0062 µg/L). The detected surface water concentrations of PAHs and chlordane were evaluated for potential risk to human recreational receptors by comparison to the dermal component of the Region 9 tap water PRG. The results of the comparison demonstrate that the concentrations do not exceed the risk-based PRG. Therefore, there is likely to be negligible risk to human recreational receptors exposed to surface water impacted by the Site.

Sediment from the Cochato River sampling Sites A through E were most recently sampled in 2002 and analyzed for PAHs, DDT, chlordane, and arsenic. The maximum detected concentration of all compounds were significantly below the compound-specific sediment cleanup levels discussed above. Because the cleanup levels overall remain protective of human recreational exposures and contaminant levels are significantly below the cleanup levels, direct contact recreational exposure to sediments would not exceed EPA risk management guidelines. Therefore, the sediment remedy continues to be protective with respect to human health.

Fish sampling was most recently conducted in 2002 from Sites A through D and Sylvan Lake. Fish fillet tissue from collected fish were analyzed for PAHs, DDT, and chlordane. The maximum detected concentration of total DDT and total chlordane were below their compound-specific action limits discussed above. However, the maximum detected concentration of total PAHs in fish fillet tissue from Sylan Lake and Site B exceeded the total PAH action limit. Because of this exceedance, recreational fishing from the surface water bodies adjacent to the site should be limited and fish sampling should continue. Warning signs have been installed along the river cautioning recreational users about the potential dangers associated with the ingestion of fish caught from the river.

Summary and Conclusions

Toxicity values that served as the basis for the cleanup levels, as contained in the ROD, have been re-evaluated to determine whether any changes in toxicity impact the protectiveness of the remedy along with any changes in current or potential future exposure pathways or exposure assumptions. In addition, environmental data, available since the last five year review, have been qualitatively evaluated to determine whether exposure levels existing at the Site present a risk to current human receptors.

Based on the evaluation of changes in toxicity values, the decrease in the cancer toxicity value for chlordane results in a decrease in the estimation of cancer risk estimates associated with chlordane in residual on-site soils. Therefore, the conclusions of the 1997 risk evaluation remain valid as long as site reuse is limited to commercial/industrial use. Institutional controls should be implemented to assure that future uses of the site are consistent with the assumptions used in the Site Reuse Study risk evaluation. Appropriate fencing should be maintained to limit trespassing. Until groundwater remediation is completed, future site development involving the construction of a building near the shallow groundwater VOC plume should include consideration of the potential for risk to on-site workers via inhalation of VOCs in indoor air.

Because the total risk associated with the sediment cleanup levels is within the EPA target risk range of 10^{-6} to 10^{-4} and the maximum detected concentrations in sediment are below cleanup levels, the remedy remains protective for sediment. Surface water concentrations are less than risk-based PRGs. However, the maximum detected concentration of total PAHs in fish fillet tissue from Sylvan Lake and Site B exceed the total PAH action limit. Because of this exceedance, recreational fishing from the surface water bodies impacted by the site should be limited and fish sampling should continue. Warning signs have been installed along the river cautioning recreational users about the potential dangers associated with the ingestion of fish caught in the river.

Continued exceedances of MCLs indicate that completion of the drinking water ingestion pathway would present a risk to human receptors. Since groundwater from the site is not currently used by area residents as a source of potable water, the drinking water exposure pathway is incomplete. Until groundwater concentrations meet MCLs, institutional controls should be implemented at the Site to ensure that no private wells are installed at or near the Site.

7.2.2 Review of Ecological Risk Assessments and Toxicity Factors Serving as the Basis for the Remedy

The ecological risk assessment (ERA) performed for the 1986 Feasibility Study (FS) Report (GHR, 1986a) was conducted using the best science, methodologies, and professional judgement available at the time. However, the approach would not comply with contemporary guidelines (EPA, 1997). Since the ERA was written in 1986, EPA has promulgated guidelines to address screening out chemicals, selecting contaminants of concern, and performing risk calculations. Furthermore, many of the tools available today had not yet been created, such as benchmark screening values, toxicity data, or improved laboratory detection levels.

7.2.2.1 Soil Excavation. The ERA concluded that there would be significant risk to ecological receptors from pesticides, SVOCs, and dioxin, although the ERA did not recommend site specific clean-up levels derived from ecological endpoints (as would be done using current guidelines). The limits of cleanup were based on the nature and extent of soil contamination documented in the RI/FS; the ROD specified the excavation of soil from "hot areas" based on contamination profiles developed in the RI Addendum (GHR, 1986b). The limits of excavation were established so that contaminant concentrations outside of the hot areas were one to two orders of magnitude lower than the concentrations inside the hot areas. Excavated soil and sediment were treated by on-site incineration and backfilled in upland areas. Limits of excavation were established to minimize disruption to wetlands.

Although the limits of excavation were not determined using ecologically based risk criteria, the remedy likely eliminated risk to ecological receptors from pesticides and other organic contaminants in soil within the excavated area. Using the maximum analyte concentrations in quarterly ash samples reported in Table A-1 of the Evaluation of Potential Future Reuse Opportunities of the Baird & McGuire Site report (M&E, 1998), a preliminary model was run to estimate exposure of selected SVOCs and inorganics to a shrew living in the remediated area. Typically, mean concentrations and upper confidence limits (UCLs) on the mean concentrations are used in exposure models. However, maximum concentrations were used in the model because they were readily available and represent a worst case scenario.

The preliminary model assumed that a shrew's diet consists of vegetation (12.8%), earthworms (78.6%), and incidental soil (8.6%) (Sample, 1993). Concentrations of contaminants in dietary components were estimated using equations described in Sample *et al.* (1997), Baes *et al.* (1984), Sample *et al.* (1998), Markwell *et al.* (1989), and Travis and Arms (1988). It was assumed that shrew drink from intermittent sources of water which do not equilibrate with soil contaminant concentrations, thus exposure from drinking water was negligible. The model also used an oral bioavailability factor of 1, and thus assumed that 100% of the chemical is bioavailable once it becomes ingested. The home range of a shrew is estimated to be 0.07 acres (USEPA, 1993), which corresponds to an area that could be contained entirely within the excavated area (ASUF=1). The model assumed that shrew stay within their home ranges throughout the year (TSUF=1). Soil was conservatively assumed to have a 2.0 % total organic carbon (TOC) content. Calculated doses and equations are presented in Attachment 6 (Tables A-1 though A-6).

Modeled COC daily dose estimates were compared to toxicity reference values obtained from the literature in order to calculate a hazard quotient (HQ). An HQ is a ratio of exposure levels to toxicity reference values (TRVs,) as shown:

$$\text{Hazard Quotient} = \frac{\text{Modeled COC Dose}}{\text{TRV}}$$

An HQ less than or equal to 1.0 indicates harm is unlikely, while an HQ greater than 1.0 suggests that a COC is present at concentrations which may affect the survival or reproductive capacity of an exposed individual. HQs are shown in Attachment 6.

Mammalian TRVs for COCs were obtained from the literature. If available and appropriate, TRVs which were associated with chronic exposures (i.e., long duration exposures) and which reported no-adverse-effects levels (NOAELs) relating to reproduction or mortality were selected. When a suitable NOAEL was unavailable, studies which reported lowest-observed-adverse-effects-levels (LOAELs) were used and adjusted downward with an uncertainty factor of 10. The LOAEL to NOAEL adjustment was the only calculation in which an uncertainty factor was used.

Based on assumptions of the preliminary model which used selected contaminants and maximum ash concentrations, HQs for most contaminants were below 1.0, and only a few exceeded 2.0. Since HQs were based on maximum concentrations, HQs calculated based on average concentrations and UCLs (i.e. more realistic exposure scenarios) would likely be below 1.0.

The preliminary model therefore indicates that the remedy implemented for upland soils was protective for ecological receptors, although a more thorough model which uses UCLs and average concentrations, and evaluates risk from all site contaminants would be needed to confirm this conclusion with greater certainty.

Reports which present confirmatory samples collected during soil excavation were not available during this 5 Year Review, thus it could not be determined whether or not the limits of excavation were sufficient to remove concentrations of contaminants to levels which are protective to ecological receptors under contemporary ARARs.

7.2.2.2 River Sediments. Action limits for river sediments and river bank soils were based on human health criteria, thus the top six inches of sediment were removed from the excavation area, and riverbanks were restored with clean material. Because action limits were not based on ecological criteria, it could not be determined with certainty whether or not the action limits were sufficient to remove concentrations of contaminants to levels which are protective of ecological receptors under contemporary ARARs. However, because the zone of biological activity in sediments (i.e. the oxidized zone) typically consists of the top six inches (Rosenberg and Resh, 1993), and because the oxidized zone is where most species concentrate their interaction with their environment (USEPA, 2000), removal of the top six inches of sediment and replacement with clean material likely mitigates the risk of contaminants to benthic and aquatic ecological receptors.

Reports which present confirmatory samples collected during soil excavation were not available during this 5 Year Review, thus it could not be determined whether or not the limits of excavation were sufficient to remove concentrations of contaminants to levels which are protective to ecological receptors under contemporary ARARs.

The remedy also included conducting long-term fish tissue monitoring in the river. Table 5 compares maximum fish body burden data collected during the September/October 2002 round of sampling (M&E, 2003) to toxicity reference values (TRVs). TRVs were obtained from the Environmental Residue Effects Database (ERED) (USACE, 2004). TRVs were selected from chronic no-observed effects-dose (NOED) studies with reproductive endpoints. Because a TRV for total PAHs could not be found, the TRV for phenanthrene was selected as a surrogate because it is the lowest value from available individual PAHs. The comparison indicates that because fish body burdens are below TRVs, there is negligible risk to fish, thus the remedy is protective of fish.

Table 5. Comparison of Maximum Fish Body Burdens to TRVs

Contaminant of Concern	Max Fish Body Burden (mg/kg wet weight)[1]	TRV[2] (mg/kg wet weight)	ERED Reference[3]
Total PAHs[4]	0.229	17	JA234
DDT	2.427	3.8	JAW4
Chlordane	0.190	1.38	SEQ97-4

1. Maximum reported the highest whole body or reconstructed whole body tissue concentration among all of the species identified and sampled from the monitoring area
2. ERED database records of several freshwater fish were queried - members of Ictaluridae, Centrachidae, Cyprinadeae, Percidae, and Esocidae to represent the warm water species captured and sampled onsite.
3. Citations for primary references are provided in the ERED database.
4. TRV for phenanthrene was selected as a surrogate value for Total PAHs because it is the lowest value from available individual PAHs

7.2.3 ARARs Review

Review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy due to changes in standards that were identified as ARARs in the three RODs and in the previous Five-Year Review Report (EPA, 1999), newly promulgated standards for chemicals of potential concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. The results of the 1999 ARARs review, which was conducted consistent with the most recent five-year review guidance (EPA, 2001), were used as a basis for this review. The tables in Attachment 7 provide the ARARs review. The review is summarized below.

The following ARARs were identified for the selected remedy:

Location-specific:

- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act (CWA)
- Fish and Wildlife Coordination Act (16 U.S.C. 661)
- Wetlands Executive Order (EO 11990)
- Executive Order (EO 11988)
- Massachusetts Wetlands Protection Regulations
- Massachusetts Hazardous Waste Facility Location Regulations
- Massachusetts Environmental Policy Act (MEPA) Regulations
- Massachusetts Certification for Dredging, Dredged Material Disposal and Filling in Waters
- Department of Environmental Management (DEM) Inland Wetland Orders

Chemical-specific:

- Safe Drinking Water Act (SDWA)
- Resource Conservation and Recovery Act (RCRA)
- Federal Ambient Water Quality Criteria (AWQC)
- EPA Office of Water Guidance - Water-related Fate of 129 Priority Pollutants (1979)
- Health Advisories (EPA Office of Drinking Water)
- Threshold Limit Values (TLVs)
- National Oceanic Atmospheric Administration (NOAA)
- Ontario Ministry of Environment and Energy (OMEE)
- Massachusetts Drinking Water Requirements
- Massachusetts Surface Water Quality Standards
- Massachusetts Surface Water Discharge Permit Program Regulations
- Massachusetts Air Quality/Air Pollution Regulations
- Massachusetts Guidance on Acceptable Ambient Air Levels (AALs)

Action-Specific:

- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act (CWA)

- Clean Air Act (CAA)
- Department of Transportation (DOT) Rules for Transportation of Hazardous Materials
- Massachusetts Hazardous Waste Regulations, Phase I and II
- Massachusetts General Laws
- Massachusetts Solid Waste Management Regulations
- Massachusetts Wetlands Protection Regulations
- Massachusetts Surface Water Discharge Permit Program Regulations
- Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters
- Massachusetts Employee and Community "Right to Know" Regulations
- OSHA General Industry Standards, Recordkeeping and Reporting, and Standards for Hazardous Waste Site Operations

Tables A7-1, A7-2, and A7-4 of Attachment 7 provide an evaluation of ARARs for the first two operable units (OU-1, OU-2) using the regulations and requirement synopses listed in the RODs as a basis. Tables A7-5, A7-6, and A7-7 provide an evaluation of ARARs for OU-3 likewise using the regulations and requirement synopses listed in the ROD as a basis. Location specific ARARs applicable to all operable units are summarized in Table A7-3. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met. Most of the listed ARARs remain applicable or relevant and appropriate to the site. Some of the listed ARARs were for the soil remediation phase of the remedy, which was completed in 1997, and hence they are listed as formerly applicable or formerly relevant and appropriate. Those that are still applicable or relevant and appropriate are being complied with.

7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY?

There is no other information that calls into question the protectiveness of the remedy.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the RODs, as modified by the two ESD documents. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. Most of the ARARs identified in the RODs remain applicable or relevant and appropriate and either have been met or are being complied with.

SECTION 8.0
ISSUES

Based on the activities conducted during this five-year review, the issues identified in the following table have been noted.

Table 6: Issues		
Issues	**Affects Current Protectiveness (Y/N)**	**Affects Future Protectiveness (Y/N)**
Groundwater at the site contains concentrations of VOCs, SVOCs, metals, and pesticides above action limits. The groundwater is currently treated to concentrations below the action limits.	N	Y*
Sediment along the river contains PAHs above action limits and concentrations of metals and pesticides have not decreased significantly during the past 5 years.	N	Y*
Fish tissue contain PAHs at concentrations above action limits, however fish contamination may not all be site related. Warning signs provide a degree of current protectiveness.	N	Y*
The final implementation of comprehensive institutional controls has not been realized.	N	Y*

*Future protectiveness is dependent upon continued GWTF operation until contaminant concentrations no longer exceed the action limits.

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted above, it is recommended that the actions listed in the following table be taken:

Table 7: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Groundwater at the site contains contaminants above action limits	Continue operations of GWTF	State	State/EPA	2009	N	Y*
Sediments along the river contain concentrations of contaminants above action limits	Continue monitoring program; continue operations of the GWTF; maintain site fencing	State	State/EPA	2009	N	Y*
Some sections of replicated wetlands do not appear to be receiving sufficient water; presence non-native and invasive plants is increasing	Perform additional monitoring to evaluate whether invasive plants require control; monitor groundwater levels; inspect gabion, spreader, and levee structures.	State	State/EPA	2009	N	Y
Fish tissue contains PAHs above action limits	Continue monitoring program; maintain warning signs	State	State/EPA	2009	N	Y*
Institutional controls are not complete.	Complete the review and implementation of comprehensive institutional controls. This activity is currently being completed by the EPA and the State.	State/EPA	State/EPA	2005	N	Y

*Future protectiveness is dependent upon continued GWTF operation until contaminant concentrations no longer exceed the action limits (interim groundwater cleanup levels, sediment cleanup levels, and FDA action levels for fish).

SECTION 10.0
PROTECTIVENESS STATEMENTS

OU-1 The current pathway for human health exposures has been eliminated as the contaminated aquifer is no longer being used as a drinking water source. The aquifer is being remediated to mitigate a future human health exposure pathway and data indicates that the plume of organic contamination is shrinking. There is, however, a continuing hot spot source of contamination and high concentrations continue to be observed in the overburden. Monitoring data have indicated that groundwater discharges to the Cochato River do not occur during periods of full plume containment. For this reason, groundwater remedial actions need to continue.

For continued protection, the groundwater treatment plant, recharge basins, monitoring wells, extraction wells, LNAPL recovery system, and piping network must remain operable and undisturbed. Groundwater should not be used for any purpose, due to its contamination and to the negative impact pumping could have on the effectiveness of the extraction and treatment system. It is important to complete the implementation of comprehensive institutional controls at the site to maintain a complete level of protectiveness for future activities in and around the site. The State has indicated that the groundwater monitoring plan will be finalized prior to the first round of annual sampling set for summer of 2005, however has indicated that they will not include MNA in the plan.

OU-2 The ROD limited the excavation and treatment of soils to hot areas, and limited the depth of the excavation due to complications of excavation into the water table. Residual soil contamination is present on site, in terms of both areas beyond and below the excavation limits and in terms of the backfilled ash. Protectiveness to human health is attained through controls of potential on-site use activities. As long as the Site is not used for residential purposes and the appropriate fencing is maintained to prohibit trespassing by children, human health protectiveness will be within the risk-based concentrations established by EPA.

Protectiveness is achieved for future workers in a commercial or industrial use scenario. Contaminants present at depths greater than 15 feet below grade are considered unlikely to be contacted directly by individuals during future Site development activities, including construction and utility work. Continued monitoring of wetlands is needed to confirm that the wetlands remain viable, and therefore protected. However, the State currently has no monitoring plan in place.

Completion of comprehensive institutional controls will help achieve long term protectiveness of the remaining soil exposure issues mentioned above.

OU-3

Sediment with a high degree of contaminants was excavated and treated, and clean fill was used to replace materials excavated. To minimize disruption to wetlands, sediments were not removed from areas of the river where contaminant concentrations were low. Although contaminated sediments remain, it is expected that natural degradative, depositional, and dispersal processes will gradually reduce remaining concentrations in the sediment. It is recommended that long-term monitoring continue to evaluate contaminant levels and their behavior over time. However, the State currently has no monitoring plan in place.

OU-4

There is no protectiveness statement required for OU-4.

Comprehensive Protectiveness Statement

The remedy is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals, through continued operation of the GWTF, and sediment cleanup goals, through natural degrading, depositional, and dispersive processes. In the interim, exposure pathways that could result in unacceptable risks are being controlled. All threats at the Site have been addressed through groundwater treatment; removal, incineration, and stabilization of contaminated soil and ash; site fencing; and expansion of an alternate water supply.

Long-term protectiveness of the remedial action will be verified by continued monitoring of groundwater, sediment, and fish tissue. However, the State has no monitoring plans in place for MNA, sediments, wetlands, and fish tissue.

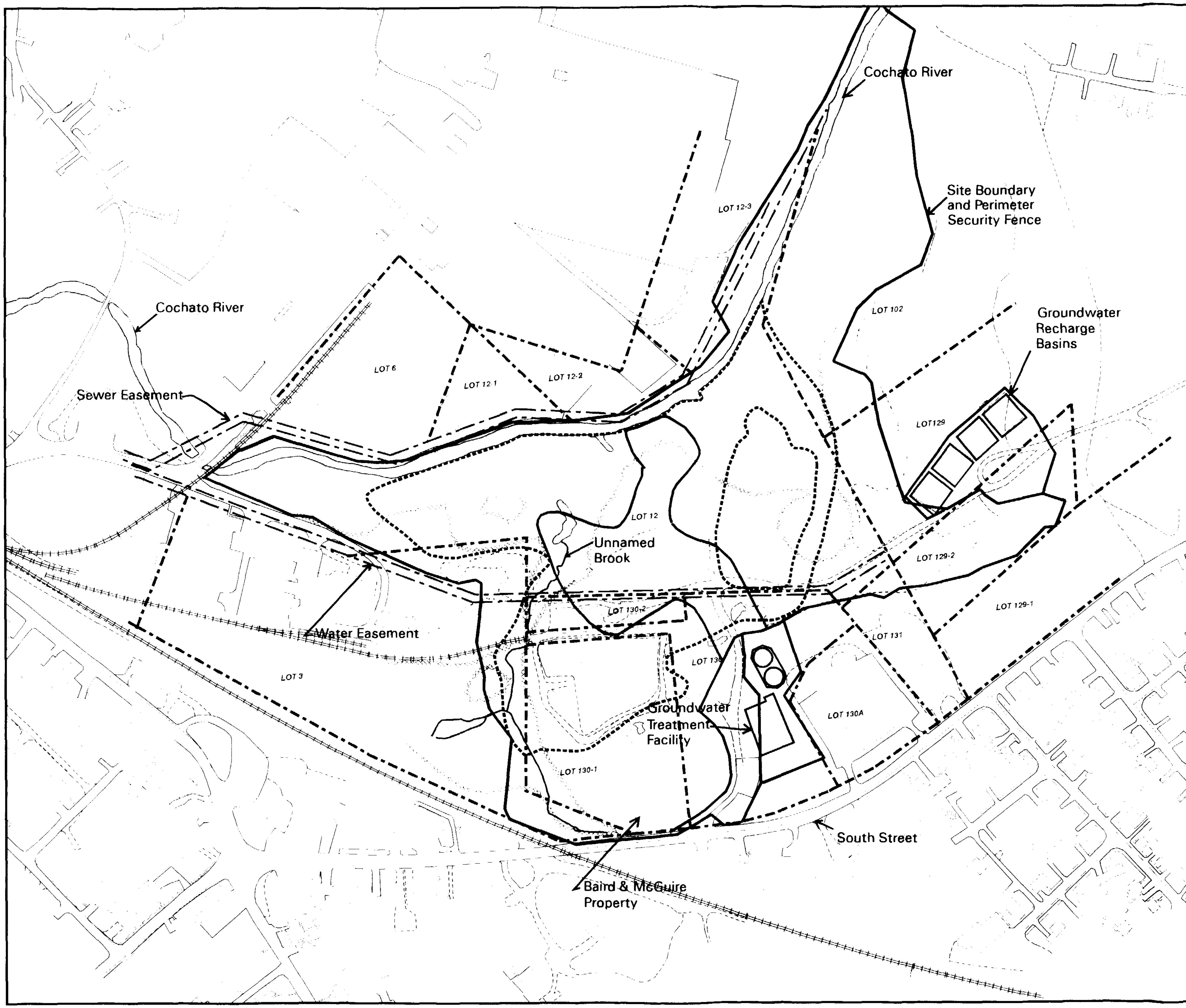
SECTION 11.0
NEXT REVIEW

Five-year reviews are done every five years at sites where contaminant levels remain at concentrations that prevent unlimited, unrestricted use of the Site. Since remedial actions have not been completed for all operable units, and since the remedy does not allow for unrestricted use of the Site, a follow-up five-year review will be required. Five-year reviews are triggered by the date remedial actions are initiated at any operable unit. When a five-year review is conducted at a time other than when it is due, the next five-year review is due within five years of the time when it was originally required (U.S. EPA, 1994). Each five-year review is to cover all operable units, whether or not remediation at that unit is complete (EPA, 1994). The next five-year review for the Baird & McGuire Site should be conducted in 2009.

ATTACHMENT 1
SITE MAPS AND FIGURES

FIGURE 1
BAIRD AND McGUIRE SURPERFUND SITE
HOLBROOK, MASSACHUSETTS

g:\projects\massachusetts\bairdmcguire\BairdMcGuire Locus Map.mxd



LEGEND

- Limit of Excavation
- Property Lines
- Easement
- Site Boundary and Perimeter Fenceline
- Additional Fencing
- Roads
- Streams
- Wetland Delineation
- 100 Year Floodplain
- Ponds and Waterbodies
- Baird & McGuire Property

MAP SOURCE:
Base Map is from Eastern Topographics (May 4, 1988).
Site features are compiled from numerous project plans and documents. All locations are approximate.

M&E Metcalf & Eddy

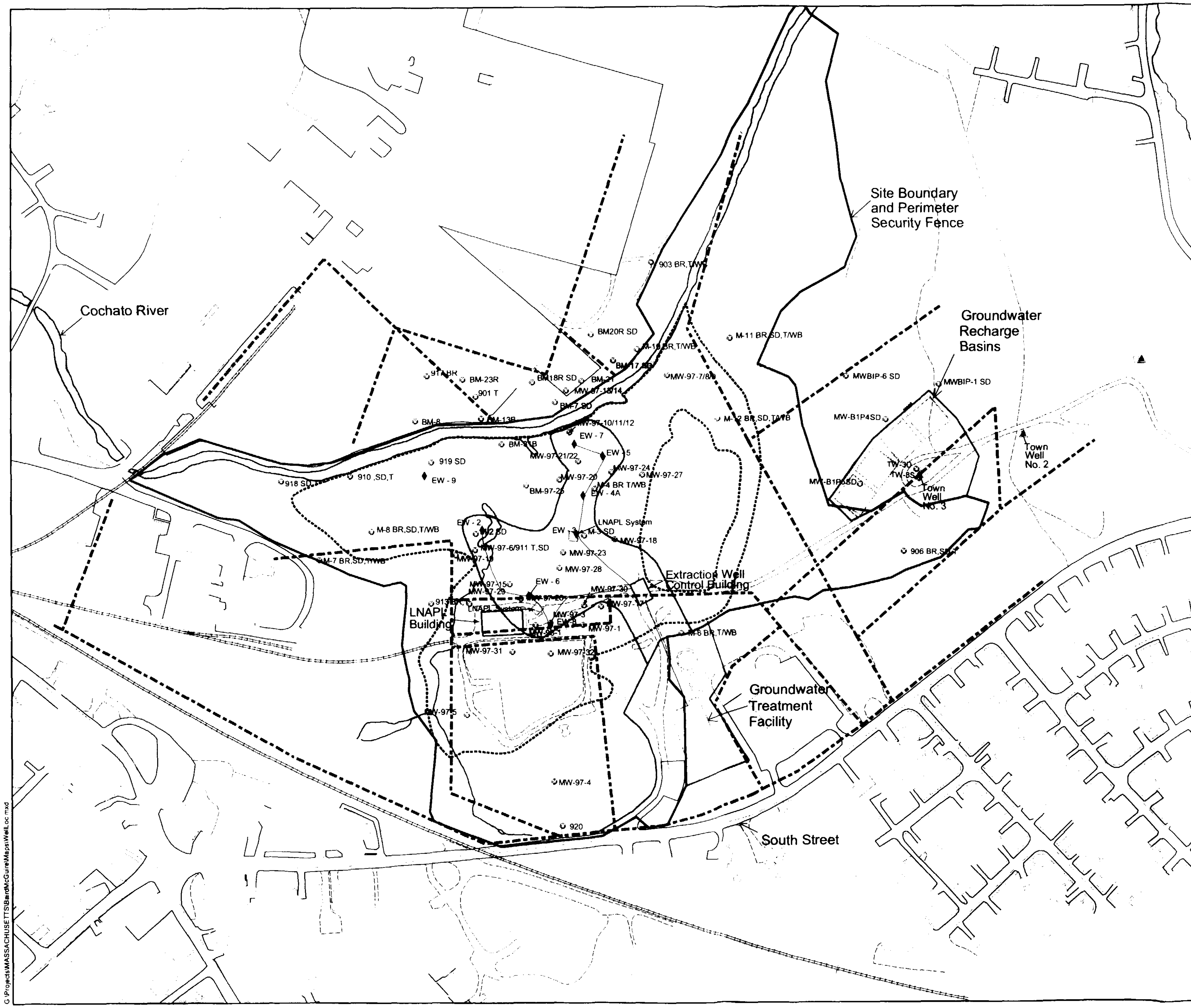
Original includes color coding.

N

250 0 250
SCALE IN FEET

Figure 2.
BAIRD & McGUIRE
SITE FEATURES.

BAIRD & McGUIRE SUPERFUND SITE
M&E Print Date: September 28, 2004



LEGEND

- Limits of Excavation
- Property Lines
- Site Boundary
- Additional Fencing
- Roads
- Streams
- Extraction Piping
- EW — Extraction Well
- Town Well
- MW — Monitoring Well
- Ponds and Waterbodies

MAP SOURCE:
Base Map is from Eastern Topographics (May 4, 1988).
Site features are compiled from numerous project plans and documents. All locations are approximate.

M&E Metcalf & Eddy

N

125 62.5 0 125 250 375 500
SCALE IN FEET

Figure 3.

BAIRD & McGUIRE SUPERFUND SITE SITE PLAN AND WELL LOCATION PLAN.

HOLBROOK, MASSACHUSETTS

G:\Projects\MASSACHUSETTS\BairdMcGuire\Maps\WellLoc.mxd

Originals in color.

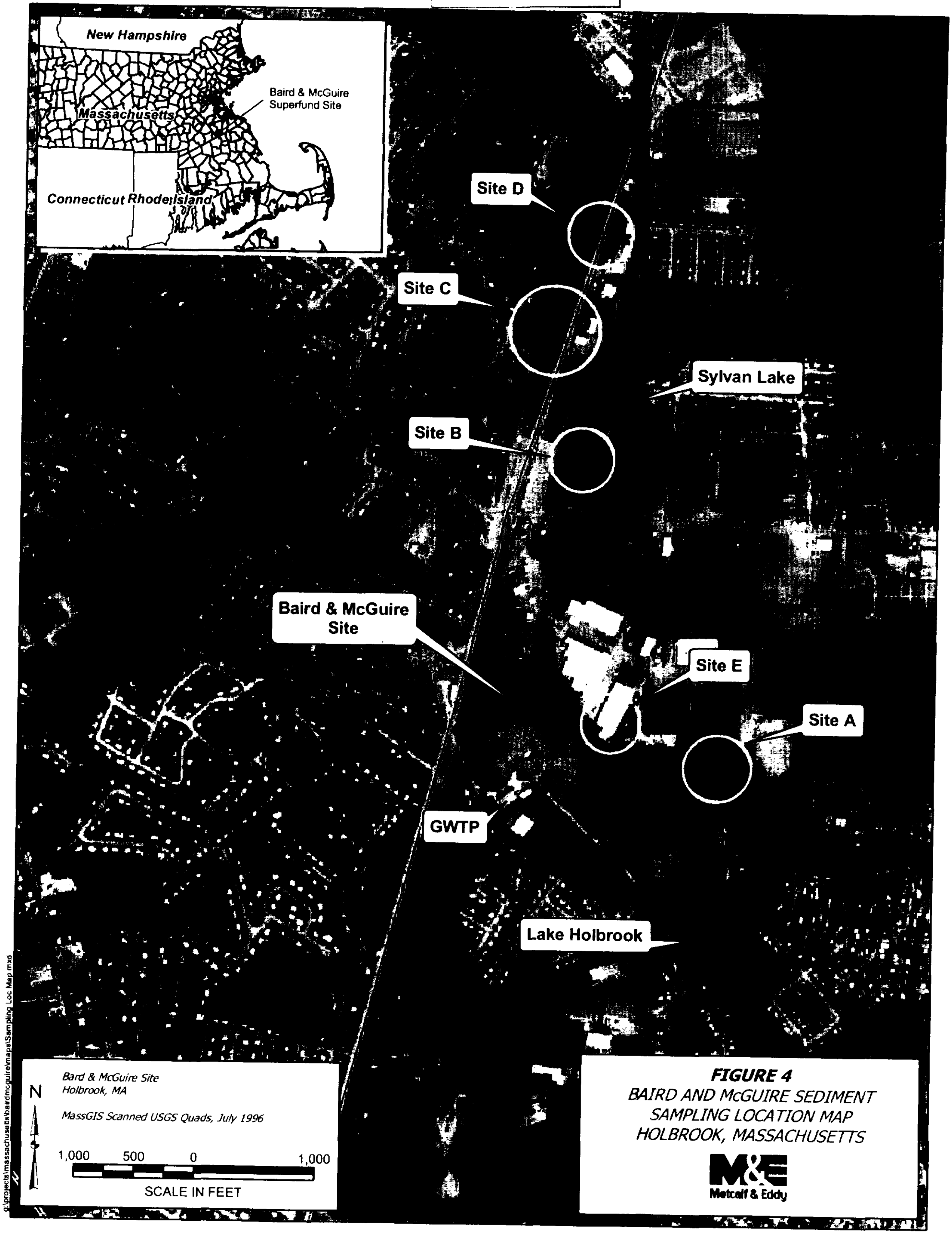


FIGURE 4
BAIRD AND McGUIRE SEDIMENT SAMPLING LOCATION MAP HOLBROOK, MASSACHUSETTS

ATTACHMENT 2
LIST OF DOCUMENTS REVIEWED / REFERENCES

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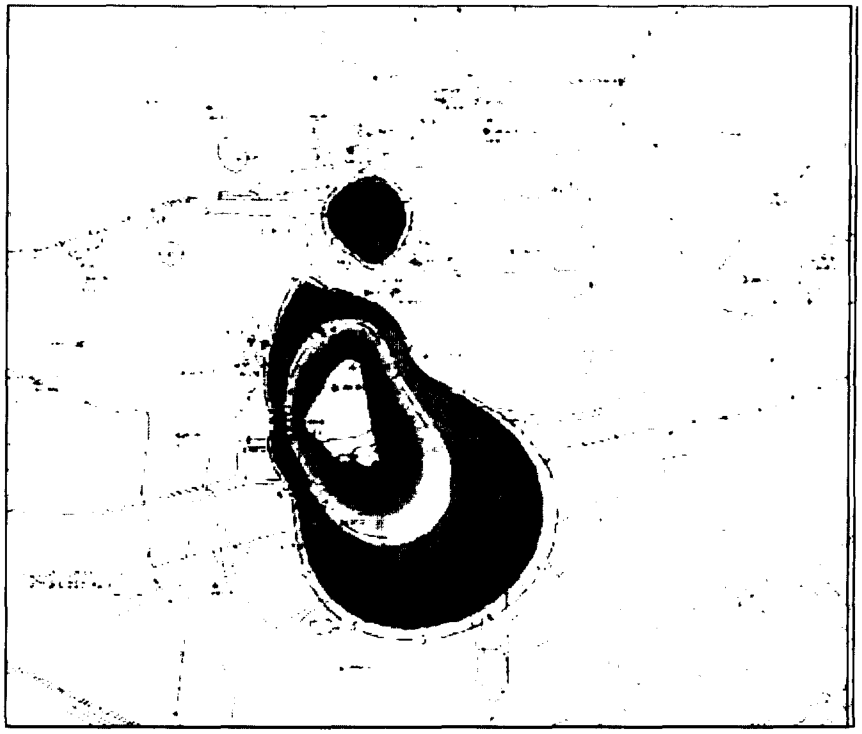
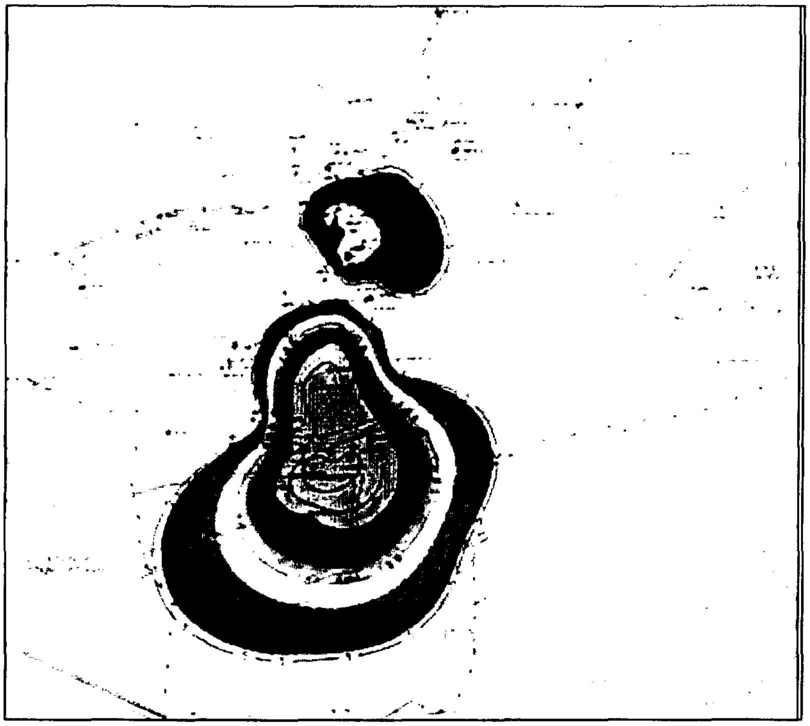
ATTACHMENT 3
PLUME MAPS OF TOTAL VOC AND TOTAL SVOC CONCENTRATIONS IN OVERBURDEN GROUNDWATER - 2000 AND 2003



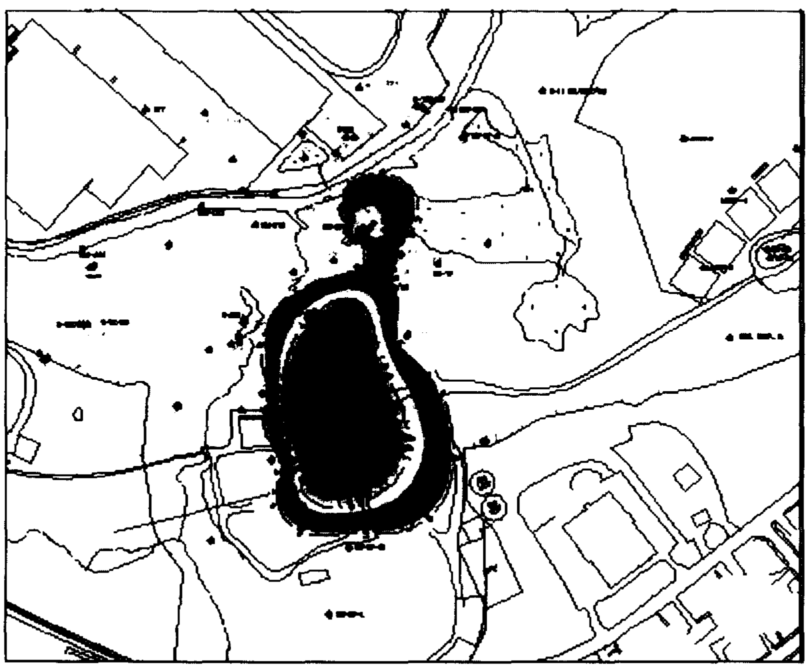
Total VOCs Contours in the Overburden – 2000

Originals in color

Total VOCs Contours in the Overburden – 2003



Total SVOCs Contours in the Overburden – 2000



Total SVOCs Contours in the Overburden – 2003

ATTACHMENT 4
VOC, SVOC, AND ARSENIC CONCENTRATIONS IN GROUNDWATER

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	8/88,9/88 Total VOCs (ppb)	4/94 Total VOCs (ppb)	10/94 Total VOCs (ppb)	3/95 Total VOCs (ppb)	4/95 Total VOCs (ppb)	8/97,9/97,10/97 Total VOCs (ppb)	8/98,9/98,10/98 Total VOCs (ppb)	02/00 - 05/00 Total VOCs (ppb)	04/01 - 07/01 Total VOCs (ppb)	04/02 - 07/02 Total VOCs (ppb)	04/03 - 06/03 Total VOCs (ppb)
Area A (east side of river)													
BM-7		SD						1.55	ND	0.16	ND	ND	ND
BM-8		SD	13.7					18	4.1	2.15	0.58	ND	0.71
BM-13B		SD	787					44.93	6.7	3.81	5.1	2.85	1.1
BM-17		SD	7420		1224		24.9	28.24	ND	ND	ND	ND	ND
BM-18R		SD	2293				736	8.66	ND	ND	ND	ND	ND
BM-20R		SD	1.4	ND			ND	0.057	ND	ND	0.41	ND	ND
BM-21		SD						10.32	ND	ND	ND	ND	ND
BM-23R		SD	660				ND	0.87	7.5	4.71	1.46	1.05	0.77
901A		SD						7.71	2.51	6	1.73	ND	1.06
903B		SD	ND				ND	ND	ND	ND			ND
915A	MW-97-13	T						8.37	3.97	1.17	3.21	1.32	4.42
915B	MW-97-14	SD						759.6	0.61	ND	ND	ND	ND
M-10T/WB		T/WB						1.07	ND	ND			
Area B (plume wells)													
BM-2	MW-97-17	SD						655	238		63.3	40.29	69.26
BM-4A		SD	14590										
BM-10	MW-97-18	SD						ND	ND	ND	ND	ND	ND
BM-30		SD	140.2				11.4						
BM-32B	MW-97-20	SD							0.54	ND	ND	ND	ND
BM-34A	MW-97-21	SD						3925	2303	1129.2	1014	412.8	208.1
BM-34B	MW-97-22	SD					5630	1476	6.05	2.78	2.58	4.02	ND
BM-35	MW-97-23	SD	13490					3317	6470	4894	4770.5	2573	1250
BM-37	MW-97-24	SD	124.9					0.44	ND	ND	ND	ND	ND
BM-38	MW-97-25	SD						34	4.52	6.94	4.67	3.69	4.61
902A	MW-97-3	SD	11540					10120	4870	2209	1722	531.6	288.8
902B		SD	7319										
904B		SD	490										
914C	MW-97-12	SD	10169				9045	5005	1918	95.06	107.47	111	3.08
914B	MW-97-11	SD	7860				11725	1245	8.15	17.54	5.665	5.3	5.9
914A	MW-97-10	T							1938	9.66	8.65	9.17	0.99
M-1T/WB	MW-97-15	T/WB					148.6	7.4	9.4	3.03	1.83	ND	0.49
M-9T/WB	MW-97-16	T						5.65			ND	ND	ND
M-3SD		SD						630.2	935	308.4	569.7	629.8	683.3
M-5SD	MW-97-27	SD						ND	ND	ND	ND		ND
MW-97-1		SD								3700	2857	2300	2348

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	8/88,9/88 Total VOCs (ppb)	4/94 Total VOCs (ppb)	10/94 Total VOCs (ppb)	3/95 Total VOCs (ppb)	4/95 Total VOCs (ppb)	8/97,9/97,10/97 Total VOCs (ppb)	8/98,9/98,10/98 Total VOCs (ppb)	02/00 - 05/00 Total VOCs (ppb)	04/01 - 07/01 Total VOCs (ppb)	04/02 - 07/02 Total VOCs (ppb)	04/03 - 06/03 Total VOCs (ppb)
MW-97-2		SD											2.67
MW-97-28		SD								5525	7282	2069	644.9
MW-97-29		SD									0.83	ND	ND
MW-97-30		SD									1364	620.6	269
MW-97-31		SD								0.48	ND	ND	ND
MW-97-32		SD								62.49	177.8	216.9	26.96
MW-98-1		SD								1427.1	1051.2	1886.9	1412.2
EW-1		T/WB		38	48.9	49.2	27.6						
EW-3		SD		4467	4260	2785	11870	1104	785	521.8	191.6	221	198.4
EW-4		T/WB		377	375	229	435	10.97	2.52	0.84	ND	ND	
EW-5		SD		653	780	575	726.8	19.9	6.34	1.28	1.1	ND	0.29
EW-6		SD		2829	4683	2767	3061.5	2254	1956	3484	3024.8	1552.4	1145.8
EW-7		SD							142.7	39.1	23.5	11.89	4.98
EW-8		SD								2668	1637.3	388	329
Area C (north of plume)													
BM-14	MW-97-19	SD	355.9				23.9	12.3	1.93	0.29	0.38	ND	ND
BM-31B		SD			2.4		1.6	1.81	1.53	ND			11.14
909A		SD	180	ND	.		ND						
910A		T		11			18.3		1.1	0.31	0.33	ND	ND
910B		SD		6			18	15.6	1.36	0.31			
911A		T									ND	ND	0.42
911B		SD	28				14.9	10.81	2.15	0.29	ND	ND	ND
912A	MW-97-8	SD	9.4	5	5		2	1.6	ND	ND			
913A		SD						9.47	1.79	ND	2.49	ND	ND
919		SD						9.35	3.8	6.88	6.74	5.25	2.55
M-2SD		SD						15.04	5.45	0.86			
M-7SD		SD			5.4		11.9	1.79	ND	0.36	0.8	ND	ND
M-7T/WB		T/WB						3.92	0.76	1.37	2.02	1.78	1.11
M-8SD		SD		5	5		18.5	11.64	ND	0.39			ND
M-8T/WB		T/WB						10.4	ND				0.28
EW-2		SD		146	62.5	10	19	21.15	4.32	4.58	2	ND	0.64
Area D (south of plume)													
BM-15B		T									ND	ND	ND
912B	MW-97-9	SD	38	ND	1.4		4	1.4	ND	ND	ND	1.87	ND
M-6T/WB		T/WB						ND	ND		ND	ND	ND
M-11SD		SD		7	0.8		ND						

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	8/88,9/88 Total VOCs (ppb)	4/94 Total VOCs (ppb)	10/94 Total VOCs (ppb)	3/95 Total VOCs (ppb)	4/95 Total VOCs (ppb)	8/97,9/97,10/97 Total VOCs (ppb)	8/98,9/98,10/98 Total VOCs (ppb)	02/00 - 05/00 Total VOCs (ppb)	04/01 - 07/01 Total VOCs (ppb)	04/02 - 07/02 Total VOCs (ppb)	04/03 - 06/03 Total VOCs (ppb)
M-12SD		SD					ND			ND	ND	ND	ND
M-12T/WB		T/WB								ND	ND	ND	ND
Area E (west of plume - upgradient)													
920		SD								ND	0.85	1.48	
Bedrock Wells	**Replacement Well**												
Area A (east side of river)													
901		BR					3.7						
903		BR	0										
BM-13		BR	198.8				50.7						
M-10BR		BR		ND	2.7		0.8	2.18	0.58	ND	4.95	ND	ND
Area B (plume wells)													
902-1		BR	1811										
902-2		BR	590										
904		BR	1200										
M-4BR		BR					25.7			5.71	3.09	2.18	1.72
Area C (north of plume)													
909	MW-97-5	BR	180	ND			ND	ND	ND	ND	ND	ND	ND
910		BR	24.9	10	10		15.4						
911	MW-97-6	BR	768.2				10.5	2.9	1.2	0.14		ND	ND
913		BR	25.1				19	14.9	10.28	3.26	2.28	ND	0.78
M-7BR		BR			5.4		8.3	6.96	7.65	4.96		5.97	3.56
M-8BR		BR		4	18		16.7	10.1	3.62	2.86	2.57	2.69	2.7
Area D (south of plume)													
905		BR	1360				ND						
912	MW-97-7	BR	13.1	ND	3.8		2.5	1.63	1.73	1.33	1.98	ND	1.1
M-6BR		BR					ND	4.2	ND		ND	ND	ND
M-12BR		BR			2.7		13.1			0.51	1.52	ND	ND
Area E (west of plume - upgradient)													
908	MW-97-4	BR	ND	ND									

Notes

SD: stratified drift

T: till

BR: bedrock

T/WB: till and weathered bedrock

ND: non-detect

Blank Space: not sampled

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	8/88,9/88 Total SVOCs (ppb)	4/94 Total SVOCs (ppb)	10/94 Total SVOCs (ppb)	3/95 Total SVOCs (ppb)	4/95 Total SVOCs (ppb)	8/97,9/97,10/97 Total SVOCs (ppb)	8/98,9/98,10/98 Total SVOCs (ppb)	02/00 - 05/00 Total SVOCs (ppb)	04/01 - 07/01 Total SVOCs (ppb)	04/02 - 07/02 Total SVOCs (ppb)	04/03 - 06/03 Total SVOCs (ppb)
Area A (east side of river)												
BM-7							16.2	4.3	ND	ND	ND	ND
BM-8		ND					ND	ND	ND	ND	ND	ND
BM-13B		ND					3	4.2	ND	ND	ND	ND
BM-17		6570		1938		62	31.7	14.6	3.5	14.1	ND	ND
BM-18R		840				97	ND	ND	ND	ND	ND	ND
BM-20R		13	ND			110	ND	ND	ND	ND	ND	ND
BM-21							23.4	2.7	ND	ND	ND	ND
BM-23R		65				ND	ND	ND	ND	ND	ND	ND
901A							5.2	ND	ND	ND	ND	ND
903B		ND				6	ND	ND	ND			ND
915A	MW-97-13						2.8	3	ND	ND	ND	ND
915B	MW-97-14						3115	9.1	2.6	ND	ND	ND
M-10T/WB							2.7	ND	ND			
Area B (plume wells)												
BM-2	MW-97-17						6452	2652		957	616	421
BM-4A		15440										
BM-10	MW-97-18						ND	ND	ND	ND	ND	ND
BM-30		27				ND						
BM-32B	MW-97-20							5.7	ND	ND	ND	ND
BM-34A	MW-97-21						7284	6113	4056	2679	1484	285
BM-34B	MW-97-22					9098	3482	46.9	4.6	4.2	ND	ND
BM-35	MW-97-23	22320					686900	42620	20690	18398	29560	6950
BM-37	MW-97-24	94					573.3	66	38.9	8.9	ND	ND
BM-38	MW-97-25						74.6	6.7	ND	ND	ND	ND
902A	MW-97-3	49200					4578	2049	4545000	6239	17740	4520
902B		8520										
904B		ND										
914C	MW-97-12	11500				734	7141	6032	510	834.2	171	70
914B	MW-97-11	10440				855	2937	46.7	57.9	3.2	ND	ND
914A	MW-97-10							5286	ND	4.3	ND	ND
M-1T/WB	MW-97-15					132	ND	ND	ND	ND	ND	ND
M-9T/WB	MW-97-16						8.3			ND	ND	ND
M-3SD							3030	2593	1969	2108.7	922	1060.8
M-5SD	MW-97-27						5	10.1	ND	2.3		ND
MW-97-1									263600	9350	59470	11850

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	8/88,9/88 Total SVOCs (ppb)	4/94 Total SVOCs (ppb)	10/94 Total SVOCs (ppb)	3/95 Total SVOCs (ppb)	4/95 Total SVOCs (ppb)	8/97,9/97,10/97 Total SVOCs (ppb)	8/98,9/98,10/98 Total SVOCs (ppb)	02/00 - 05/00 Total SVOCs (ppb)	04/01 - 07/01 Total SVOCs (ppb)	04/02 - 07/02 Total SVOCs (ppb)	04/03 - 06/03 Total SVOCs (ppb)
MW-97-2												6.1
MW-97-28									37750	7725	3254	2931
MW-97-29										15.5	ND	ND
MW-97-30										5371	657	972.8
MW-97-31									790	ND	ND	ND
MW-97-32									2498	3977	1752	1272
MW-98-1									9660	3766	9610	7790
EW-1			78	62	34	46						
EW-3			12127	581	10230	7967	5166	3455	1643	1409.6	637	730
EW-4			1119	1915	681	267	26.4	6.4	ND	ND	ND	
EW-5			2516	4884	1859	531	327.6	178.9	85.7	60.7	26.33	30.3
EW-6			4073	ND	4400	4511	4800	2885	655.8	3715	3139	2202
EW-7								471.8	120.7	66.7	18	23.1
EW-8									9534	7667	3190	3613
Area C (north of plume)												
BM-14	MW-97-19	250				ND	ND	ND	ND	ND	ND	ND
BM-31B				ND		ND	ND	ND	ND			2.4
909A		ND	ND			ND						
910A			ND			ND		ND	ND	ND	ND	ND
910B			2			ND	ND	ND	ND			
911A										ND	ND	ND
911B		34				ND	ND	3.6	ND	ND	ND	ND
912A	MW-97-8	27	ND	ND		ND	ND	ND	ND			
913A							ND	ND	ND	ND	ND	ND
919							ND	ND	ND	ND	ND	ND
M-2SD							5.4	ND	ND			
M-7SD				ND		ND	ND	ND	ND	ND	ND	ND
M-7T/WB							ND	ND	ND	ND	ND	ND
M-8SD			4	ND		ND	ND	ND	ND			ND
M-8T/WB							ND					ND
EW-2			91	8870	ND	79	76.8	ND	ND	7.5	ND	ND
Area D (south of plume)												
BM-15B											ND	ND
912B	MW-97-9	ND	ND	ND		ND	ND	123.1	ND	ND	ND	ND
M-6T/WB							5.5	ND		ND	ND	ND
M-11SD			7	ND		ND						

TABLE A4-1. HISTORICAL VOC AND SVOC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	8/88,9/88 Total SVOCs (ppb)	4/94 Total SVOCs (ppb)	10/94 Total SVOCs (ppb)	3/95 Total SVOCs (ppb)	4/95 Total SVOCs (ppb)	8/97,9/97,10/97 Total SVOCs (ppb)	8/98,9/98,10/98 Total SVOCs (ppb)	02/00 - 05/00 Total SVOCs (ppb)	04/01 - 07/01 Total SVOCs (ppb)	04/02 - 07/02 Total SVOCs (ppb)	04/03 - 06/03 Total SVOCs (ppb)
M-12SD						ND			ND	ND	ND	ND
M-12T/WB									ND	ND	ND	ND
Area E (west of plume - upgr												
920									ND	ND	ND	
Bedrock Wells	**Replacement Well**											
Area A (east side of river)												
901						23						
903		0										
BM-13		122				9						
M-10BR			1	67		2	ND	ND	ND	ND	ND	ND
Area B (plume wells)												
902-1		6180										
902-2		590										
904		0										
M-4BR						ND			ND	ND	ND	ND
Area C (north of plume)												
909	MW-97-5	ND	3			ND	ND	ND	ND	ND	ND	ND
910		ND	ND	ND		ND						
911	MW-97-6	159				ND	15	2.8	ND		ND	ND
913		75				ND	ND	ND	ND	ND	ND	ND
M-7BR				ND		ND	ND	ND	ND		ND	ND
M-8BR			ND	2		ND	ND	ND	ND	ND	ND	ND
Area D (south of plume)												
905		33				ND						
912	MW-97-7	32	ND	ND		ND	ND	ND	ND	ND	ND	ND
M-6BR						ND	4.2	3.3		ND	ND	ND
M-12BR				ND		2			ND	ND	ND	ND
Area E (west of plume - upgr												
908	MW-97-4	20	10									

<u>Notes</u>

SD: stratified drift

T: till

BR: bedrock

T/WB: till and weathered bedroc

ND: non-detect

Blank Space: not sampled

TABLE A4-2. HISTORICAL ARSENIC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	1988 Arsenic (mg/L)	Q1/93 Arsenic (mg/L)	Q2/93 Arsenic (mg/L)	Q3/93 Arsenic (mg/L)	Q4/93 Arsenic (mg/L)	Q1/94 Arsenic (mg/L)	Q2/94 Arsenic (mg/L)	Q3/94 Arsenic (mg/L)	Q4/94 Arsenic (mg/L)	Q1/95 Arsenic (mg/L)	Q2/95 Arsenic (mg/L)	Q3/95 Arsenic (mg/L)	Q4/95 Arsenic (mg/L)	8/97 - 10/97 Arsenic (mg/L)	8/98 - 10/98 Arsenic (mg/L)	Q1/00 Arsenic (mg/L)	4/01 - 7/01 Arsenic (mg/L)	4/02 - 7/02 Arsenic (mg/L)	4/03 - 6/03 Arsenic (mg/L)
Area A (east side of river)																					
BM-7		SD								0.0053						0.012	0.0040	ND	ND	ND	ND
BM-8		SD	ND	ND	0.073	ND	0.0040	ND	ND	ND			ND			0.0016	ND	ND	ND	ND	ND
BM-13B		SD		0.0060	0.11	0.017	0.010	0.0023	0.0022	0.0074		0.0055	ND		0.0030	0.0044	0.022	ND	ND	ND	ND
BM-17		SD	0.019									0.014				0.0085	0.035	0.070	0.10	0.19	0.206
BM-18R		SD	0.0030													0.014	0.013	0.0080	ND	ND	ND
BM-20R		SD	ND	0.0070	0.17	0.011	0.040	0.0056	0.0044			0.0065	ND		0.0056	0.0028	0.0091	0.0090	0.64	ND	ND
BM-21		SD														0.0060	0.0032	ND	ND	ND	ND
BM-23R		SD	ND													0.0031	ND	ND	ND	ND	ND
901A		SD														0.0016	ND	ND	ND	ND	ND
903B		SD	0.017									0.053			0.28	0.0048	0.090	0.016			0.0043
915A	MW-97-13	T														0.0048	ND	ND	ND	ND	ND
915B	MW-97-14	SD													0.026	0.074	0.041	0.022	0.010	ND	0.010
M-10T/WB		T/WB		0.0050	0.020	0.020	0.020	0.031	0.012	0.0085		0.0072	ND			0.0016	0.0081	0.011			
Area B (plume wells)																					
BM-2	MW-97-17	SD														0.61	0.82		0.55	0.47	0.451
BM-4A		SD	2.8																		
BM-10	MW-97-18	SD															0.26	0.46	0.072	0.019	0.0215
BM-30		SD	0.10									0.042			0.059						
BM-32B	MW-97-20	SD															0.36	0.10	0.008	ND	ND
BM-34A	MW-97-21	SD														2.6	2.1	1.6	2.1	2.2	1.96
BM-34B	MW-97-22	SD														1.8	0.62	0.40	0.35	0.32	0.224
BM-35	MW-97-23	SD														1.1	2.1	1.1	0.96	0.82	0.619
BM-37	MW-97-24	SD	ND													2.8	6.8	1.2	0.51	0.53	0.280
BM-38	MW-97-25	SD								0.040		0.074				0.014	0.014	0.0070	0.011	ND	0.0056
902A	MW-97-3	SD	0.0032														0.37	0.70	0.27	0.25	0.181
902B		SD	0.0020																		
904B		SD	ND																		
914C	MW-97-12	SD	0.0039													2.7	1.6	0.60	0.42	0.33	0.365
914B	MW-97-11	SD	0.0036													1.4	0.54	0.36	0.22	0.17	0.138
914A	MW-97-10	T														0.029	1.6	0.0090	0.014	ND	0.0131
M-1T/WB	MW-97-15	T/WB														0.032	0.024	0.0060	ND	ND	ND
M-9T/WB	MW-97-16	T								ND		ND	ND			1.4			ND	ND	0.0063
M-3SD		SD														2.0	1.4	1.0	ND	0.7	0.462
M-5SD	MW-97-27	SD														0.56	0.63	0.39	0.41		0.229

TABLE A4-2. HISTORICAL ARSENIC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	1988 Arsenic (mg/L)	Q1/93 Arsenic (mg/L)	Q2/93 Arsenic (mg/L)	Q3/93 Arsenic (mg/L)	Q4/93 Arsenic (mg/L)	Q1/94 Arsenic (mg/L)	Q2/94 Arsenic (mg/L)	Q3/94 Arsenic (mg/L)	Q4/94 Arsenic (mg/L)	Q1/95 Arsenic (mg/L)	Q2/95 Arsenic (mg/L)	Q3/95 Arsenic (mg/L)	Q4/95 Arsenic (mg/L)	8/97 - 10/97 Arsenic (mg/L)	8/98 - 10/98 Arsenic (mg/L)	Q1/00 Arsenic (mg/L)	4/01 - 7/01 Arsenic (mg/L)	4/02 - 7/02 Arsenic (mg/L)	4/03 - 6/03 Arsenic (mg/L)
MW-97-1		SD																0.36	0.86	0.66	1.18
MW-97-2		SD																			0.255
MW-97-28		SD																2.0	0.79	1.50	2.42
MW-97-29		SD																	0.061	0.054	0.0467
MW-97-30		SD																	0.42	1.20	0.791
MW-97-31		SD																0.088	ND	ND	ND
MW-97-32		SD																0.071	0.080	0.028	0.0346
MW-98-1		SD																0.24	0.27	0.28	0.250
EW-1		T/WB						0.063		0.061	0.086	0.036	0.046	0.028							
EW-3		SD						2.4		2.5	1.9	1.8	1.4	1.6	1.6		1.3	1.1	0.94	0.83	0.796
EW-4		T/WB						0.19		0.23	0.27	0.22	0.15	0.19	0.20		0.27	0.19	0.18	0.17	
EW-5		SD						1.1		0.97	0.75	0.84	0.67	0.68	0.66		0.60	0.39	0.31	0.29	0.282
EW-6		SD						1.1		1.4	0.93	1.4	0.68	0.79	0.31		0.73	0.82	0.65	0.6	0.604
EW-7		SD															1.3	0.76	0.63	0.55	0.458
EW-8		SD																0.79	0.62	0.52	0.488
Area C (north of plume)																					
BM-14	MW-97-19	SD	0.012									0.0060				0.0061	0.0036	ND	ND	ND	ND
BM-31B		SD								2.0		1.6			1.9		2.0	0.21			1.18
909A		SD	0.0040	0.0060	0.062	0.013	0.0090	0.0025	0.014			ND									
910A		T		0.010	0.011	0.0050	ND	ND	0.0027	ND		ND	ND		ND		0.021	ND	ND	ND	ND
910B		SD		0.0060	0.011	0.0080	ND	ND	0.0096	0.0023		ND			ND	0.0071	0.011	ND			
911A		T																	ND	ND	ND
911B		SD	0.090													0.46	0.064	0.038	ND	ND	0.0081
912A	MW-97-8	SD	ND	0.0020	0.0010	ND	ND	ND	ND	ND		ND			ND	0.0031	ND	ND			
913A		SD	0.0030							0.0044		ND				0.0016	0.0036	ND	ND	ND	ND
919		SD								3.1						3.5	3.8	1.9	1.7	2.5	1.79
M-2SD		SD															0.041	0.038			
M-7SD		SD		0.0050	0.028	0.011	0.0050	ND	ND	0.0024		ND	0.0040		0.0038	0.0031	ND	ND	ND	ND	ND
M-7T/WB		T/WB		0.0040	0.0080	0.0040	ND	ND	ND	0.0028			ND			0.0035	ND	ND	ND	ND	ND
M-8SD		SD		0.0030	0.0010	0.0040	0.0030	ND	ND	0.0034		ND			ND	0.0079	ND	ND			ND
M-8T/WB		T/WB		ND	0.0080	0.0040	ND	ND	ND	ND			ND			0.0031					ND
EW-2		SD						0.062		0.057	0.034	0.039	0.043	0.048	0.070		0.025	0.085	0.042	0.16	0.144
Area D (south of plume)																					
BM-15B		T																	ND	ND	ND
912B	MW-97-9	SD	ND	0.0080	0.026	0.035	0.093	0.015	0.021	0.0070		0.0078			2.1	0.0033	0.0034	ND	ND	ND	ND
M-6T/WB		T/WB														0.0016	ND		ND	ND	ND
M-11SD		SD																			

TABLE A4-2. HISTORICAL ARSENIC CONCENTRATIONS AT SITE WELLS

Overburden Wells	Replacement Well	Well Type	1988 Arsenic (mg/L)	Q1/93 Arsenic (mg/L)	Q2/93 Arsenic (mg/L)	Q3/93 Arsenic (mg/L)	Q4/93 Arsenic (mg/L)	Q1/94 Arsenic (mg/L)	Q2/94 Arsenic (mg/L)	Q3/94 Arsenic (mg/L)	Q4/94 Arsenic (mg/L)	Q1/95 Arsenic (mg/L)	Q2/95 Arsenic (mg/L)	Q3/95 Arsenic (mg/L)	Q4/95 Arsenic (mg/L)	8/97 - 10/97 Arsenic (mg/L)	8/98 - 10/98 Arsenic (mg/L)	Q1/00 Arsenic (mg/L)	4/01 - 7/01 Arsenic (mg/L)	4/02 - 7/02 Arsenic (mg/L)	4/03 - 6/03 Arsenic (mg/L)
M-12SD		SD							0.10									ND	ND	ND	ND
M-12T/WB		T/WB																ND	ND	ND	ND
Area E (west of plume - upgradient)																					
920		SD																0.0060	ND	ND	
Bedrock Wells	Replacement Well																				
Area A (east side of river)																					
901		BR										0.0061			ND						
903		BR																			
BM-13		BR																			
M-10BR		BR		0.0040	ND	ND	0.0050	ND	ND	ND		ND	ND		ND	0.0016	0.0061	ND	ND	ND	ND
Area B (plume wells)																					
902-1		BR																			
902-2		BR																			
904		BR	ND																		
M-4BR		BR																ND	ND	ND	ND
Area C (north of plume)																					
909	MW-97-5	BR	ND	ND	0.0040	0.0050	ND	ND	ND			ND				0.0031	ND	ND	ND	ND	ND
910		BR	ND	0.0030	0.011	0.0060	ND	ND	0.0036	ND		ND	0.0040		0.0058						
911	MW-97-6	BR														0.0077	0.0076	ND		ND	0.0076
913		BR	0.0070							0.0036		ND		ND		0.0027	ND	ND	ND	ND	ND
M-7BR		BR		0.0030	0.0010	ND	0.0050	ND	ND	ND		ND	ND		ND	0.0031	ND	ND		ND	ND
M-8BR		BR		0.0010	0.0080	ND	ND		ND	0.0024		ND	ND		ND	0.0031	ND	ND	ND	ND	ND
Area D (south of plume)																					
905		BR	ND									0.011			0.0053						
912	MW-97-7	BR	ND	ND	0.0010	ND	ND	ND	ND	ND		ND				0.0048	0.0046	ND	ND	ND	ND
M-6BR		BR							0.0023							0.0095			ND	ND	ND
M-12BR		BR																ND	ND	ND	ND
Area E (west of plume - upgradient)																					
908	MW-97-4	BR		0.012	0.0010			ND													

Notes

SD: stratified drift

T: till

BR: bedrock

T/WB: till and weathered bedrock

ND: non-detect

Blank Space: not sampled

ATTACHMENT 5
RECOMMENDATIONS FOR FUTURE MONITORING

Table A5. Recommendations for For Future Monitoring

Frequency:			Monthly			Quarterly			Annually			Every 5 Years			
	Activity/Analysis:	LNAPL Measurement	Water Levels	VOCs	SVOCs	Arsenic and Iron	BTEX compounds	SVOCs	Arsenic and Iron	VOCs	SVOCs	Inorganics	Pesticides	MNA Param. [1]	
GROUNDWATER															
Overburden Wells	**Replacement Wells**														
Area A (east side of river)															
BM-7			●							●	●		●	●	
BM-8			●							●	●		●	●	
BM-13B			●							●	●		●	●	
BM-17			●				●	●	●	●	●	●	●	●	
BM-18R			●												
BM-20R			●							●	●		●	●	
BM-21			●												
BM-23R			●							●	●		●	●	
901A			●							●	●		●	●	
903B			●												
915A	MW-97-13		●				●	●		●	●		●	●	
915B	MW-97-14		●							●	●		●	●	
M-10T/WB			●												
Area B (plume wells)															
BM-2	MW-97-17		●						●	●	●	●	●	●	
BM-10	MW-97-18		●						●			●			
BM-32B	MW-97-20		●						●			●			
BM-34A	MW-97-21		●				●	●	●	●	●	●	●	●	
BM-34B	MW-97-22		●						●	●	●	●	●	●	
BM-35	MW-97-23	●	●				●	●	●	●	●	●	●	●	
BM-37	MW-97-24		●						●	●	●	●	●	●	
BM-38	MW-97-25		●				●	●	●	●	●	●	●	●	
902A	MW-97-3	●	●				●	●	●	●	●	●	●	●	
914C	MW-97-12		●				●	●	●	●	●	●	●	●	
914B	MW-97-11		●						●	●	●	●	●	●	

Table A5. Recommendations for For Future Monitoring

Frequency:			Monthly		Quarterly				Annually			Every 5 Years			
	Activity/Analysis:	LNAPL Measurement	Water Levels	VOCs	SVOCs	Arsenic and Iron	BTEX compounds	SVOCs	Arsenic and Iron	VOCs	SVOCs	Inorganics	Pesticides	MNA Param.	
914A	MW-97-10		●						●	●	●	●	●	●	
M-1T/WB	MW-97-15		●				●	●	●	●	●	●	●	●	
M-9T/WB	MW-97-16		●						●			●			
M-3SD			●				●	●	●	●	●	●	●	●	
M-5SD	MW-97-27		●						●	●	●	●	●	●	
MW-97-1		●	●				●	●	●	●	●	●	●	●	
MW-97-28		●	●				●	●	●	●	●	●	●	●	
MW-97-29			●				●	●	●	●	●	●	●	●	
MW-97-30			●				●	●	●	●	●	●	●	●	
MW-97-31			●						●	●	●	●	●	●	
MW-97-32			●						●	●	●	●	●	●	
MW-98-1		●	●				●	●	●	●	●	●	●	●	
EW-3		●	●	●	●	●	●	●	●	●	●	●	●	●	
EW-4			●	●	●	●	●	●	●	●	●	●	●	●	
EW-5			●	●	●	●	●	●	●	●	●	●	●	●	
EW-6		●	●	●	●	●	●	●	●	●	●	●	●	●	
EW-7			●	●	●	●	●	●	●	●	●	●	●	●	
EW-8		●	●	●	●	●	●	●	●	●	●	●	●	●	
Area C (north of plume)															
BM-14	MW-97-19		●							●	●		●	●	
BM-31B			●				●	●		●	●	●	●	●	
910A			●							●	●		●	●	
910B			●												
911A			●												
911B			●							●	●		●	●	
912A	MW-97-8		●												
913A			●							●	●		●	●	
919			●				●	●		●	●	●	●	●	

Table A5. Recommendations for For Future Monitoring

Frequency:			Monthly		Quarterly				Annually			Every 5 Years			
Activity/Analysis:		LNAPL Measurement	Water Levels	VOCs	SVOCs	Arsenic and Iron	BTEX compounds	SVOCs	Arsenic and Iron	VOCs	SVOCs	Inorganics	Pesticides	MNA Param. [1]	
M-2SD			●												
M-7SD			●							●	●		●	●	
M-7T/WB			●				●	●		●	●		●	●	
M-8SD			●							●	●		●	●	
M-8T/WB			●							●	●		●	●	
EW-2			●	●	●	●	●	●	●	●	●	●	●	●	
Area D (south of plume)															
BM-15B			●												
912B	MW-97-9		●				●	●		●	●		●	●	
M-6T/WB			●												
M-12SD			●												
M-12T/WB			●												
Area E (west of plume - upgradient)															
920			●							●	●		●	●	
Bedrock Wells	**Replacement Well**														
Area A (east side of river)															
M-10BR			●							●	●			●	
Area B (plume wells)															
M-4BR			●							●	●			●	
Area C (north of plume)															
909	MW-97-5		●												
911	MW-97-6		●							●	●	●		●	
913			●							●	●			●	
M-7BR			●							●	●			●	
M-8BR			●							●	●			●	

Table A5. Recommendations for For Future Monitoring

	Frequency:		Monthly		Quarterly				Annually			Every 5 Years			
	Activity/Analysis:	LNAPL Measurement	Water Levels	VOCs	SVOCs	Arsenic and Iron	BTEX compounds	SVOCs	Arsenic and Iron	VOCs	SVOCs	Inorganics	Pesticides	MNA Param. [1]	
Area D (south of plume)															
912	MW-97-7		●							●	●			●	
M-6BR			●												
M-12BR			●							●	●			●	
	Total Number of Wells:	8	73	7	7	7	25	25	31	56	56	34	48	56	

1. It is recommended that MNA analyses be performed every 5 years until LNAPL thicknesses have dissipated to continuously less than 2 inches. At that point, MNA analyses should be performed every 2 years.

MNA Param. - Monitored natural attenuation parameters (including chloride, sulfate, nitrate/nitrite N, ammonia N, total Kjedahal N, phosphate, chemical oxygen demand, total suspended solids, nitrate as N, sulfide, ferrous iron, methane, ethane, ethene)

BTEX compounds - Benzene, Toluene, Ethylbenzene, Xylenes

Table A6-1. Recommendations for For Future Monitoring

Frequency:			Every 2 Years					Every 5 Years		
Activity/Analysis:	VOCs	PAHs	Pesticides	TOC/TCO	Grain Size	PAHs	Pesticides	Lipid Content	Fish Scales	
COCHATO RIVER SEDIMENT/BANK SOIL										
River Locations:										
Station A		●	●	●	●					
Station B		●	●	●	●					
Station C		●	●	●	●					
Station D		●	●	●	●					
Station E	●	●	●	●	●					
Bank Locations:										
Station C		●	●	●	●					
Station D		●	●	●	●					
FISH TISSUE										
Station A						●	●	●	●	
Station B						●	●	●	●	
Station C						●	●	●	●	
Station D						●	●	●	●	
Sylvan Lake						●	●	●	●	

ATTACHMENT 6
SHREW MODEL CALCULATIONS

TABLE A6-1
MAXIMUM CONCENTRATIONS OF SELECTED CONTAMINANTS IN ASH SAMPLES[1]
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

Selected Chemical of Concern	Maximum Concentration (mg/kg)
SVOCs	
2-Methylnaphthalene	2.0
Acenaphthylene	0.06
Anthracene	0.47
Benzo(a)anthracene	0.47
Benzo(a)pyrene	0.44
Benzo(g,h,i)perylene	0.46
bis(2-Ethylhexyl)phthalate	0.53
Carbazole	0.03
Chrysene	0.78
Dibenz(a,h)anthracene	0.20
Di-n-butylphthalate	0.26
Fluoranthene	0.77
Indeno(1,2,3-cd)pyrene	0.39
Naphthalene	5.3
Phenanthrene	1.0
Pyrene	0.39
Pesticides/PCBs	
4,4'-DDD	0.38
4,4'-DDE	0.77
4,4'-DDT	0.05
alpha-Chlordane	0.04
Aroclor-1248	0.02
Aroclor-1254	0.02
Aroclor-1260	0.02
Endosulfan sulfate	0.02
Endrin	0.005
Endrin aldehyde	0.01
Endrin ketone	0.005
gamma-Chlordane	0.03
Heptachlor epoxide	0.01
Methoxychlor	0.01
Inorganics	
Aluminum	22,500
Antimony	4.7
Arsenic	823
Barium	164
Beryllium	1.6
Cadmium	4.6
Chromium	37
Cobalt	13
Copper	38
Lead	83
Manganese	651
Mercury	0.25
Nickel	36
Selenium	0.99
Silver	0.57
Thallium	2.2
Vanadium	52
Zinc	163

1. Data from selected chemicals of concern summarized from Table A-1 in M&E. 1998. *Evaluation of Potential Future Reuse Opportunities for the Baird & McGuire Site*. June 5, 1998.

TABLE A6-2
ESTIMATION OF MAXIMUM CONCENTRATIONS IN PLANT TISSUE
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

Selected Chemical of Concern	$C_{ash\ max}$ mg/kg dry	Log K_{ow} [1]	B_{veg} [2,3]	F[5]	$C_{veg\ max}$ [5] mg/kg wet
Semivolatile Organics					
2-Methylnaphthalene	2.0	3.86	0.23	0.1	0.045
Acenaphthylene	0.06	3.94	0.20	0.1	0.001
Anthracene	0.47	4.45	0.10	0.1	0.005
Benzo(a)anthracene	0.47	5.76	0.02	0.1	0.001
Benzo(a)pyrene	0.44	6.13	0.06	0.1	0.002
Benzo(g,h,i)perylene	0.46	6.63	0.01	0.1	0.0003
bis(2-Ethylhexyl)phthalate	0.53	7.6	0.002	0.1	0.0001
Carbazole	0.03	3.72	0.27	0.1	0.001
Chrysene	0.78	5.81	0.02	0.1	0.001
Dibenz(a,h)anthracene	0.20	6.54	0.01	0.1	0.0001
Di-n-butylphthalate	0.26	4.57	0.09	0.1	0.002
Fluoranthene	0.77	5.16	0.04	0.1	0.003
Indeno(1,2,3-cd)pyrene	0.39	6.7	0.01	0.1	0.0002
Naphthalene	5.25	3.3	0.48	0.1	0.25
Phenanthrene	1.01	4.46	0.10	0.1	0.01
Pyrene	0.39	1.46	5.55	0.1	0.22
Pesticides and PCBs					
4,4'-DDD	0.38	6.02	0.01	0.1	0.00049
4,4'-DDE	0.77	6.51	0.10	0.1	0.008
4,4'-DDT	0.05	6.91	0.02	0.1	0.00009
alpha-Chlordane	0.04	6.22	0.02	0.1	0.00006
Aroclor-1248	0.02	6.34	0.01	0.1	0.00002
Aroclor-1254	0.02	6.79	0.02	0.1	0.00004
Aroclor-1260	0.02	8.27	0.001	0.1	0.000002
Endosulfan sulfate	0.02	3.83	1.00	0.1	0.002
Endrin	0.01	5.2	0.02	0.1	0.00001
Endrin aldehyde	0.01	5.6	0.02	0.1	0.00003
Endrin ketone	0.00	5.02	0.05	0.1	0.00002
gamma-Chlordane	0.03	6.22	0.02	0.1	0.0001
Heptachlor epoxide	0.01	4.98	0.02	0.1	0.00002
Methoxychlor	0.01	5.08	0.04	0.1	0.00003
Inorganics					
Aluminum	22,500		0.004	0.1	9.0
Antimony	4.7		0.2	0.1	0.09
Arsenic	823		0.04	0.1	3.3
Barium	164		0.15	0.1	2.5
Beryllium	1.6		0.01	0.1	0.002
Cadmium	4.6		0.55	0.1	0.25
Chromium	37		0.0075	0.1	0.03
Cobalt	13		0.02	0.1	0.03
Copper	38		0.4	0.1	1.5
Lead	83		0.045	0.1	0.37
Manganese	651		0.25	0.1	16
Mercury	0.25		0.9	0.1	0.02
Nickel	36		0.06	0.1	0.21
Selenium	0.99		0.025	0.1	0.002
Silver	0.57		0.4	0.1	0.02
Thallium	2.2		0.004	0.1	0.0009
Vanadium	52		0.0055	0.1	0.03
Zinc	163		1.5	0.1	24

$C_{ash\ max}$ = maximum ash concentration
K_{ow} = Octanol/Water Partitioning Coefficient (unitless)
B_{veg} = Bioconcentration factor in vegetation
F = conversion factor dry weight to wet weight
$C_{veg\ max}$ = maximum vegetation concentration

1. Log K_{ow} values as reported in RAIS, 2004 except for endrin aldehyde (Montgomery, 1996), and di-n-butylphthalate and endrin ketone (Schwarzenbch et al., 1993). Inorganics do not have K_{ow} values so cells are left blank.
2. B_{veg} for organic COCs were derived using the following regression equation: $\log B_{veg} = 1.588 - 0.578 \log K_{ow}$ (Travis & Arms, 1988). B_{veg} for benzo(a)pyrene, Aroclor-1254, chlordane, DDD, DDE, DDT, endrin, and heptachlor epoxide were based on empirical values presented in Travis & Arms, 1988.
3. B_{veg} values for inorganic COCs are from Baes, et al., 1984.
4. Plant concentrations were converted from dry weight to wet weight because the food ingestion rates used in models are based on wet weight. A conversion factor of 0.1 was used based on plants containing 90 percent water (Baes, et al., 1984).
5. $C_{veg} = C_{ash} * B_{veg} * F$

TABLE A6-3
ESTIMATION OF MAXIMUM CONCENTRATIONS IN EARTHWORM TISSUE
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

Selected Chemical of Concern	$C_{ash\ max}$ mg/kg dry	log K_{ow} [1]	log K_{oc} [2]	K_d [3]	C_{wat} [4]	K_{bw} [5]	$C_{worm\ max}$ [6,7] mg/kg wet
Semivolatile Organics							
2-Methylnaphthalene	2.0	3.9	3.8	125	0.016	1.82E+03	29
Acenaphthylene	0.06	3.9	3.9	149	0.00	2.19E+03	0.82
Anthracene	0.47	4.5	4.4	474	0.001	7.08E+03	7.0
Benzo(a)anthracene	0.47	5.8	5.7	9,192	0.000	1.45E+05	7.4
Benzo(a)pyrene	0.44	6.1	6.0	21,237	0.0000	3.39E+05	7.0
Benzo(g,h,i)perylene	0.46	6.6	6.5	65,857	0.00001	1.07E+06	7.5
bis(2-Ethylhexyl)phthalate	0.53	7.6	7.5	591,711	0.000001	1.00E+07	9.0
Carbazole	0.03	3.7	3.7	91	0.00	1.32E+03	0.46
Chrysene	0.78	5.8	5.7	10,293	0.000	1.62E+05	12
Dibenz(a,h)anthracene	0.20	6.5	6.4	53,719	0.00000	8.71E+05	3.2
Di-n-butylphthalate	0.26	4.6	4.5	622	0.000	9.33E+03	3.9
Fluoranthene	0.77	5.2	5.1	2,364	0.000	3.63E+04	12
Indeno(1,2,3-cd)pyrene	0.39	6.7	6.6	77,163	0.00001	1.26E+06	6.4
Naphthalene	5.3	3.3	3.2	35	0.15	5.01E+02	75
Phenanthrene	1.0	4.5	4.4	485	0.00	7.24E+03	15
Pyrene	0.39	1.5	1.4	0.5	0.72	7.24E+00	5.2
Pesticides and PCBs							
4,4'-DDD	0.38	6.0	5.9	16,557	0.000023	2.63E+05	6.0
4,4'-DDE	0.77	6.5	6.4	50,193	0.000015	8.13E+05	13
4,4'-DDT	0.05	6.9	6.8	124,119	0.0000004	2.04E+06	0.89
alpha-Chlordane	0.04	6.2	6.1	26,036	0.0000015	4.17E+05	0.64
Aroclor-1248	0.02	6.3	6.2	34,161	0.00000	5.50E+05	0.4
Aroclor-1254	0.02	6.8	6.7	94,598	0.0000	1.55E+06	0
Aroclor-1260	0.02	8.3	8.1	2,696,001	0.0000000	4.68E+07	0.4
Endosulfan sulfate	0.02	3.8	3.8	116	0.00015	1.70E+03	0.25
Endrin	0.01	5.2	5.1	2,588	0.000002	3.98E+04	0.08
Endrin aldehyde	0.01	5.6	5.5	6,399	0.00000	1.00E+05	0.2
Endrin ketone	0.005	5.0	4.9	1,722	0.000003	2.63E+04	0.07
gamma-Chlordane	0.03	6.2	6.1	26,036	0.000001	4.17E+05	0.5
Heptachlor epoxide	0.01	5.0	4.9	1,573	0.000004	2.40E+04	0.11
Methoxychlor	0.01	5.1	5.0	1,972	0.00000	3.02E+04	0.11
Inorganics							
Aluminum	22,500						421
Antimony	4.7						0.37
Arsenic	823						4.4
Barium	164						4.2
Beryllium	1.6						0.30
Cadmium	4.6						4.4
Chromium	37						1.5
Cobalt	13						0.62
Copper	38						2.2
Lead	83						4.5
Manganese	651						5.9
Mercury	0.25						0.07
Nickel	36						2.5
Selenium	0.99						0.15
Silver	0.57						1.4
Thallium	2.2						0.17
Vanadium	52						0.72
Zinc	163						72

1. log K_{ow} values taken from RAIS, 2004.
2. log K_{oc} = (0.983 log K_{ow}) + 0.00028 (equations in footnotes 2-6 from Sample *et al.,* 1997)
3. $K_d = f_{oc} \times K_{oc}$, average f_{oc} = 4.1%
4. $C_{wat} = C_{sdt}/K_d$
5. log K_{bw} = (log K_{ow}) - 0.6
6. $C_{worm\ max} = K_{bw} \times C_{soil}$ (for organic COCs only)
7. Values for As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, and Zn based on regression analyses on literature derived soil-biota uptake data provided in Sample *et al*.,1998. Values for Al, Ba, Be, Co, Ag, and V are uptake factors provided by Sample,*et al.*, 1998. An uptake factor of 0.5 was conservatively assumed for antimony and thallium.

$C_{sdt\ max}$ - COC concentration in soil

K_{ow} - Octanol/Water Partitioning Coefficient (Unitless)

K_{oc} - Water/Soil Organic Carbon Partitioning Coefficient (L/kg)

f_{oc} - Fraction of Organic Carbon in Soil (Unitless)

K_d - Soil/Water Partitioning Coefficient (L/kg Sediment)

C_{wat} - Pore Water Concentration (mg/L)

K_{bw} - Biota/Water Partitioning Coefficient (L/kg Organism)

C_{worm} - Concentration in Worms (mg/kg - body weight wet)

TABLE A6-4
TOXICITY REFERENCE VALUES FOR SHREW
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

Chemical of Concern[1]	Test Species	Body Weight (kg)[2]	Exposure Route and Duration Class	Duration	System	Test TRV[5] (mg/kg - d)	Test TRV Type	NOAEL[6]	Source	Wildlife TRV (mg/kg-d)[7]
Semivolatile Organics										
2-Methylnaphthalene	mouse	0.03	oral in diet	81 wk	reproductive	113.8	NOAEL	113.8	Maruta et al., 1997 (in ATSDR, 2003c)	135.3
Acenaphthylene[3]	mouse	0.03	oral in food (intermediate)	19-29 d	reproductive	133.3	NOAEL	133.3	ATSDR, 1995	158.5
Anthracene[3]	mouse	0.03	oral gavage (intermediate)	13 wk	reproductive	1000	NOAEL	1000	EPA, 1989d (in ATSDR, 1995)	1189.2
Benzo(a)anthracene[4]	mouse	0.03	oral in food (intermediate)	30-197 d	cancer	1.30	NOAEL	1.30	ATSDR, 1995	1.5
Benzo(a)pyrene[3]	mouse	0.03	oral in food (intermediate)	30-197 d	cancer	1.30	NOAEL	1.30	Neal & Rigdon, 1967 (in ATSDR, 1995)	1.5
Benzo(g,h,i)perylene[3]	mouse	0.03	oral in food (intermediate)	19-29 d	reproductive	133.3	NOAEL	133.3	ATSDR, 1995	158.5
bis(2-Ethylhexyl)phthalate	mouse	0.03	oral in diet	105 d	reproductive	183.30	LOAEL	18.33	Lamb, et al., 1987 (in Sample, et al., 1996)	21.8
Carbazole	mouse	0.03	oral in food (intermediate)	19-29 d	reproductive	133.3	NOAEL	133.3	ATSDR, 1995	158.5
Chrysene[4]	mouse	0.03	oral in food (intermediate)	30-197 d	cancer	1.30	NOAEL	1.30	ATSDR, 1995	1.5
Dibenz(a,h)anthracene[4]	mouse	0.03	oral in food (intermediate)	30-197 d	cancer	1.30	NOAEL	1.30	ATSDR, 1995	1.5
Di-n-butylphthalate	mouse	0.03	oral in food (chronic)	105 d	reproductive	550	NOAEL	550	Lamb, et al., 1987 (in Sample, et al., 1996)	654.1
Fluoranthene[3]	mouse	0.03	oral gavage (intermediate)	13 wk	hepatic	125	NOAEL	125	EPA, 1988e (in ATSDR, 1995)	148.7
Indeno(1,2,3-cd)pyrene[4]	mouse	0.03	oral in food (intermediate)	30-197 d	cancer	1.30	NOAEL	1.30	ATSDR, 1995	1.5
Naphthalene	mouse	0.03	oral gavage (intermediate)	13 wk	reproductive	200	NOAEL	200	NTP, 1980a (ATSDR, 2003)	237.8
Phenanthrene[3]	mouse	0.03	oral in food (intermediate)	19-29 d	reproductive	133.3	NOAEL	133.3	ATSDR, 1995	158.5
Pyrene[3]	mouse	0.03	oral in food (intermediate)	19-29 d	reproductive	133.3	NOAEL	133.3	ATSDR, 1995	158.5
Pesticides/PCBs										
4,4'-DDD	mouse	0.03	oral in food (chronic)	130 wk	cancer	42.6	LOAEL	4.26	Tomatis, et al., 1974 (in ATSDR, 2002)	5.1
4,4'-DDE	mouse	0.03	oral in food (chronic)	78 wk	cancer	27	LOAEL	2.7	NCI, 1978 (in ATSDR, 2002c)	3.2
4,4'-DDT	rat	0.35	oral in diet (chronic)	2 year	reproductive	0.80	NOAEL	0.80	Fitzhugh, 1948 (in Sample, et al., 1996)	1.8
Aroclor-1248	rabbit	1.20	oral in diet (intermediate)	11 wk	developmental	28.00	LOAEL	2.80	Thomas & Hinsdill, 1980 (in ATSDR, 2000d)	8.4
Aroclor-1254[8]	mouse	0.01	oral in diet (chronic)	12 mo	reproductive	0.68	LOAEL	0.07	McCoy et al (in Sample, et al., 1996)	0.07
Aroclor-1260	rat	0.35	oral in diet (chronic)	24 mo	reproductive	4.10	NOAEL	4.10	Mayes, et al., 1998 (in ATSDR, 2002d)	9.0
alpha-Chlordane	mouse	0.03	oral in diet (chronic)	6 gen	reproductive	4.58	NOAEL	4.58	WHO, 1984 (in Sample, et al., 1996)	5.4
gamma-Chlordane	mouse	0.03	oral in diet (chronic)	6 gen	reproductive	4.58	NOAEL	4.58	WHO, 1984 (in Sample, et al., 1996)	5.4
Endosulfan sulfate	rat	0.35	oral in diet (intermediate)	4 wk	reproductive	0.15	NOAEL	0.15	Dikshith et a., 1984 (in Sample et al., 1996)	0.3
Endrin	mice	0.03	oral in diet (chronic)	120 d	reproductive	0.92	LOAEL	0.09	Good & Ware, 1969 (in Sample et al., 1996)	0.11
Endrin Aldehyde	NA									NA
Endrin Ketone	NA									NA
Heptachlor Epoxide	NA									NA
Methoxychlor	rat	0.35	oral in diet (chronic)	11 mo	reproductive	4.00	NOAEL	4.00	Gray et al, 1988 (in Sample, et al., 1996)	8.79

TABLE A6-4 (Con't)
TOXICITY REFERENCE VALUES FOR SHREW
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

Chemical of Concern[1]	Test Species	Body Weight (kg)[2]	Exposure Route and Duration Class	Duration	System	Test TRV[5] (mg/kg - d)	Test TRV Type	NOAEL[6]	Source	Wildlife TRV (mg/kg-d)[7]
Metals										
Aluminum	mouse	0.03	oral in water (chronic)	390 d	reproductive	49	NOAEL	49	Ondreicka, et al., 1966 (in ATSDR, 1999b)	58.3
Antimony	mouse	*0.03*	oral in water (chronic)	*lifetime, >1 yr*	lifespan	*1.25*	*LOAEL*	*0.125*	*Schroeder, et al., 1968b (in Sample, et al., 1996)*	0.1
Arsenic	mouse	0.03	oral in water (chronic)	3 gen	reproductive	1.26	LOAEL	0.12	Schroeder & Mitchner, 1971 (in Sample, et al., 1996)	0.1
Barium	rat	0.435	oral in water (chronic)	16 mo	growth	5.1	NOAEL	5.1	Perry, et al., 1983 (in Sample, et al., 1996)	11.8
Beryllium	rat	0.35	oral in water (chronic)	lifetime, >1 yr	longevity	0.66	NOAEL	0.66	Schroeder & Mitchner, 1975 (in Sample, et al., 1996)	1.5
Cadmium	rat	0.30	oral gavage (chronic)	6 wk	reproductive	1.0	NOAEL	1.0	Sutou, et al., 1980b (in Sample, et al., 1996)	2.1
Chromium	rat	0.35	oral in food (subchronic)	20 wk	systemic	9	NOAEL	9	Anderson, et al., 1997b (in ATSDR, 2000b)	19.8
Cobalt	rat	0.35	oral in food (intermediate)	69 d	reproductive	5	NOAEL	5	Nation, et al., 1985 (in ATSDR, 1992)	11.0
Copper	mink	1.0	oral in diet (chronic)	357 d	reproductive	11.7	NOAEL	11.7	Aulerich, et al., 1982 (in Sample, et al., 1996)	33.4
Lead	rat	0.35	oral in diet (chronic)	3 gen	reproductive	8.0	NOAEL	8.0	Azar, et al., 1973 (in Sample, et al., 1996)	17.6
Manganese	rat	0.35	oral in diet (chronic)	224 d	reproductive	88	NOAEL	88	Laskey, et al., 1982 (in Sample, et al., 1996)	193.4
Mercury	rat	0.35	oral in diet (chronic)	3 gen	reproductive	0.032	NOAEL	0.032	Verschuuren, et al., 1976 (in Sample, et al., 1996)	0.1
Nickel	rat	0.35	oral in diet (chronic)	3 gen	reproductive	40	NOAEL	40	Ambrose, et al., 1976 (in Sample, et al., 1996)	87.9
Selenium	rat	0.35	oral in water (chronic)	1 yr	reproductive	0.2	NOAEL	0.2	Rosenfeld & Beath, 1954 (in Sample, et al., 1996)	0.4
Silver	rat	0.35	oral in water (acute)	2 wk	mortality	181.2	NOAEL	181.2	Walker, 1971 (in ATSDR, 1990)	398.2
Thallium	rat	0.37	oral in water (subchronic)	60 d	reproductive	0.74	LOAEL	0.074	Formigli, et al., 1986 (in Sample, et al., 1996)	0.164
Vanadium	rat	0.26	oral intubation (chronic)	60 d +	reproductive	2.1	LOAEL	0.21	Domingo, et al., 1986 (in Sample, et al., 1996)	0.4
Zinc	rat	*0.35*	oral in diet (chronic)	*d 1-16 of gestation*	reproductive	*160*	NOAEL	*160*	Schlicker & Cox, 1968 (in *Sample, et al., 1996*)	*351.7*

Notes:

d - day(s)

wk - week(s)

mo - month(s)

yr -year(s)

gen - generations

COC - Chemical of Concern

TRV - Toxicity Reference Value

NOAEL - No Observed Adverse Effect Level

LOAEL - Lowest Observed Adverse Effect Level

NA - TRV not available

1 COC or COC and analyte/compound used in toxicological testing.

2 Body weight for test species based on USEPA 1985b (cited in Sample, et al., 1996), other body weights are actual body weights of animals used in test.

3 Lowest non-carcinogenic NOAEL from PAH toxicological data summarized in ATSDR, 1995; test used benzo(a)pyrene. USEPA has indicated that acenaphthylene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, phenanthrene and pyrene are not classifiable as carcinogens (ATSDR, 1995). Carbazole was included in this group for the development of HQs.

4 Lowest carcinogenic NOAEL from PAH toxicological data summarized in ATSDR, 1995; test used benzo(a)pyrene. USEPA has classified benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene as carcinogens (ATSDR, 1995).

5 TRVs for studies in which dose was administered five times per week were multiplied for a factor of 0.7.

6 *LOAELs were divided by an uncertainty factor of 10 to obtain NOAELs.*

7 Test NOAELs were adjusted for wildlife species body weight using the following equation: NOAELwildlife = NOAELtest * (BW test/BW wildlife) ^ 0.25 (Sample, et al., 1996).

8. Body weight from individual study.

TABLE A6-5
HAZARD QUOTIENTS FOR SHREW
MAXIMUM CONCENTRATIONS
BAIRD & MCGUIRE SUPERFUND SITE 5 YEAR REVIEW

	Selected Chemical of Concern	Total Dose (mg/kg-day)	TRV (mg/kg-day)	Total HQ	Percent Soil HQ	Percent Prey HQ	Percent Veg HQ	Percent Surface Water HQ
	Semivolatile Organics							
	2-Methylnaphthalene	1.1E+01	135.3	<0.1	0.1	99.9	0.0	NA
	Acenaphthylene	3.2E-01	158.5	<0.1	0.1	99.9	0.0	NA
	Anthracene	2.7E+00	1189.2	<0.1	0.1	99.9	0.0	NA
X	Benzo(a)anthracene	2.9E+00	1.5	1.9	0.1	99.9	0.0	NA
X	Benzo(a)pyrene	2.7E+00	1.5	1.8	0.1	99.9	0.0	NA
	Benzo(g,h,i)perylene	2.9E+00	158.5	<0.1	0.1	99.9	0.0	NA
	bis(2-Ethylhexyl)phthalate	3.5E+00	21.8	0.2	0.1	99.9	0.0	NA
	Carbazole	1.8E-01	158.5	<0.1	0.1	99.9	0.0	NA
X	Chrysene	4.8E+00	1.5	3.1	0.1	99.9	0.0	NA
	Dibenz(a,h)anthracene	1.2E+00	1.5	0.8	0.1	99.9	0.0	NA
	Di-n-butylphthalate	1.5E+00	654.1	<0.1	0.1	99.9	0.0	NA
	Fluoranthene	4.6E+00	148.7	<0.1	0.1	99.9	0.0	NA
X	Indeno(1,2,3-cd)pyrene	2.5E+00	1.5	1.6	0.1	99.9	0.0	NA
	Naphthalene	2.9E+01	237.8	0.1	0.1	99.8	0.1	NA
	Phenanthrene	5.9E+00	158.5	<0.1	0.1	99.9	0.0	NA
	Pyrene	2.0E+00	158.5	<0.1	0.1	99.2	0.7	NA
	HAZARD INDEX			*9.4*				
	Pesticides and PCBs							
	4,4'-DDD	2.4E+00	5.1	0.5	0.1	99.9	0.0	NA
X	4,4'-DDE	4.9E+00	3.2	1.5	0.1	99.9	0.0	NA
	4,4'-DDT	3.5E-01	1.8	0.2	0.1	99.9	0.0	NA
	Aroclor-1248	1.5E-01	8.4	<0.1	0.1	99.9	0.0	NA
X	Aroclor-1254	1.5E-01	0.1	2.3	0.1	99.9	0.0	NA
	Aroclor-1260	1.6E-01	9.0	<0.1	0.1	99.9	0.0	NA
	alpha-Chlordane	2.5E-01	5.4	<0.1	0.1	99.9	0.0	NA
	gamma-Chlordane	2.1E-01	5.4	<0.1	0.1	99.9	0.0	NA
	Endosulfan sulfate	9.7E-02	0.3	0.3	0.1	99.8	0.1	NA
	Endrin	3.0E-02	0.1	0.3	0.1	99.9	0.0	NA
	Endrin Aldehyde	8.5E-02	NA	NA	NA	NA	NA	NA
	Endrin Ketone	2.9E-02	NA	NA	NA	NA	NA	NA
	Heptachlor Epoxide	4.2E-02	NA	NA	NA	NA	NA	NA
	Methoxychlor	4.5E-02	8.8	<0.1	0.1	99.9	0.0	NA
X	*HAZARD INDEX*			*5.0*				
	Inorganics							
X	Aluminum	3.1E+02	58.3	5.4	47.1	52.7	0.2	NA
X	Antimony	1.8E-01	0.1	1.2	16.9	79.9	3.3	NA
X	Arsenic	7.3E+00	1.3	5.8	73.7	23.4	2.9	NA
	Barium	2.9E+00	11.8	0.2	37.6	56.9	5.5	NA
	Beryllium	1.3E-01	1.5	<0.1	8.2	91.7	0.1	NA
	Cadmium	1.8E+00	2.1	0.8	1.7	97.4	0.9	NA
	Chromium	8.2E-01	19.8	<0.1	29.3	70.4	0.2	NA
	Cobalt	3.3E-01	11.0	<0.1	26.5	73.0	0.5	NA
	Copper	1.2E+00	33.4	<0.1	20.5	71.6	8.0	NA
	Lead	2.3E+00	17.6	0.1	23.3	75.7	1.0	NA
	Manganese	7.6E+00	193.4	<0.1	56.2	30.2	13.6	NA
	Mercury	3.0E-02	0.1	0.4	5.5	89.6	4.8	NA
	Nickel	1.2E+00	87.9	<0.1	19.2	79.6	1.1	NA
	Selenium	6.4E-02	0.4	0.1	10.2	89.6	0.2	NA
	Silver	5.5E-01	398.2	<0.1	0.7	99.1	0.3	NA
	Thallium	8.3E-02	0.2	0.5	17.4	82.5	0.1	NA
X	Vanadium	6.2E-01	0.4	1.4	54.4	45.3	0.3	NA
	Zinc	3.1E+01	351.7	<0.1	3.5	91.5	5.0	NA
X	*HAZARD INDEX*			*16.1*				

HQ = Hazard quotient
TRV = Toxicity Reference Value
X = Indicates a COPC with a HQ ≥ 1.
0.0 = Indicates COPC was not detected in medium, or that the detected concentration was low, contributing less than 0.05% of the Total HQ.
Total Dose = Sum of exposure from ingestion of food (plant and animal) and soil.

Table A6-6

BAIRD & MCGUIRE - Shrew Model - Maximum Exposures - Remediated Upland Soils

Soil Organism Ingestion (1 trophic level)

Organism	Shrew		Date/Time	9/27/2004 14:33
Prey	Earthworm			
Organismal Parameters				
Food Intake Rate, wet (FIW)	0.62	kg $food_{wet}$ / kg BW_{wet} * day		
Food Intake Rate, dry (FID)	0.095	kg $food_{dry}$ / kg BW_{wet} * day		
Inadvertent soil or sediment ingested ($SI_{soil/sed}$)	0.086	unitless (fraction of diet)		
Animal Food Source Dietary Percentage (P_a)	0.786	fraction on a wet weight basis, 10% on a dry weight basis		
Vegetation Food Source Dietary Percentage	0.128	fraction on a wet weight basis, 90% on a dry weight basis		
Surface water ingested (SI_{water})	NA	L_{water} / kg BW_{wet} * day		
Areal Site Use Factor	0.8			
Temporal Site Use Factor	1			
Soil/Sed bioavailability factor (SBAF)	100%			

NOTES:

$Dose_{prey}$ = FIW * Food Source Dietary Percentage * C_{prey} * ASUF * TSUF

HQ = Dose/TRV

$Dose_{ash}$ = $SI_{soil/sed}$ * FID * C_{ash} * ASUF * TSUF * SBAF

$Dose_{water}$ = SI_{water} * C_{water} * ASUF * TSUF

$Dose_{veg}$ = FIW * Vegetation Food Source Dietary Percentage * Cveg * ASUF * TSUF

3.20E-01

Max Concentrations

	Selected Compound	C_{ash} (mg/Kg)	C_{Prey} (mg/Kg)	C_{veg} (mg/kg)	C_{Water} (ug/L)	TRV mg/Kg day	DOSE ash (mg/Kg BW day)	DOSE prey (mg/Kg BW day)	DOSE veg (mg/Kg BW day)	DOSE water (mg/Kg)	Total Dose (mg/Kg BW day)	HQ ash	HQ prey	HQ veg	HQ water	TOTAL HQ	% HQ ash	% HQ prey	% HQ veg	% HQ water
	Datasource:	Ash Max	Earthworm Max	Plant Max	Negligible	NOAEL														
	Semivolatile Organics																			
	Acenaphthylene	0.056	0.820	0.001145165	NA	158.52	0.000366016	0.319714442	7.27042E-05	NA	3.20E-01	2.31E-06	2.02E-03	4.59E-07	NA	*2.02E-03*	0.1%	99.9%	0.0%	NA
	2-Methylnaphthalene	2	29.197	0.045493568	NA	136.33	0.013072	11.38267203	0.002888296	NA	1.14E+01	9.66E-05	8.41E-02	2.13E-05	NA	*8.42E-02*	0.1%	99.9%	0.0%	NA
	Acenaphthylene	0.056	0.820	0.001145165	NA	158.52	0.000366016	0.319714442	7.27042E-05	NA	3.20E-01	2.31E-06	2.02E-03	4.59E-07	NA	*2.02E-03*	0.1%	99.9%	0.0%	NA
	Anthracene	0.467	6.977	0.004844142	NA	1189.21	0.003052312	2.71995117	0.000307545	NA	2.72E+00	2.57E-06	2.29E-03	2.59E-07	NA	*2.29E-03*	0.1%	99.9%	0.0%	NA
X	Benzo(a)anthracene	0.471	7.407	0.000854567	NA	1.55	0.003078456	2.887587373	5.42541E-05	NA	2.89E+00	1.99E-03	1.87E+00	3.51E-05	NA	*1.87E+00*	0.1%	99.9%	0.0%	NA
X	Benzo(a)pyrene	0.441	7.036	0.002479925	NA	1.55	0.002882376	2.743107429	0.000157445	NA	2.75E+00	1.86E-03	1.77E+00	1.02E-04	NA	*1.78E+00*	0.1%	99.9%	0.0%	NA
	Benzo(g,h,i)perylene	0.463	7.533	0.000263901	NA	158.52	0.003026168	2.936873347	1.67546E-05	NA	2.94E+00	1.91E-05	1.85E-02	1.06E-07	NA	*1.85E-02*	0.1%	99.9%	0.0%	NA
	bis(2-Ethylhexyl)phthalate	0.53	8.957	8.30761E-05	NA	21.80	0.00346408	3.491966723	5.27433E-06	NA	3.50E+00	1.59E-04	1.60E-01	2.42E-07	NA	*1.60E-01*	0.1%	99.9%	0.0%	NA
	Carbazole	0.032	0.465	0.000876901	NA	158.52	0.000209152	0.181127422	5.56777E-05	NA	1.81E-01	1.32E-06	1.14E-03	3.51E-07	NA	*1.14E-03*	0.1%	99.9%	0.0%	NA
X	Chrysene	0.777	12.243	0.001318989	NA	1.55	0.005078472	4.772931985	8.37399E-05	NA	4.78E+00	3.28E-03	3.09E+00	5.42E-05	NA	*3.09E+00*	0.1%	99.9%	0.0%	NA
	Dibenz(a,h)anthracene	0.197	3.194	0.000126575	NA	1.55	0.001287592	1.245203845	8.03596E-06	NA	1.25E+00	8.33E-04	8.05E-01	5.20E-06	NA	*8.06E-01*	0.1%	99.9%	0.0%	NA
	Di-n-butylphthalate	0.26	3.903	0.002298864	NA	654.06	0.00169936	1.521449616	0.00014595	NA	1.52E+00	2.60E-06	2.33E-03	2.23E-07	NA	*2.33E-03*	0.1%	99.9%	0.0%	NA
	Fluoranthene	0.77	11.828	0.003104636	NA	148.65	0.00503272	4.611104367	0.000197107	NA	4.62E+00	3.39E-06	3.10E-02	1.33E-06	NA	*3.11E-02*	0.1%	99.9%	0.0%	NA
X	Indeno(1,2,3-cd)pyrene	0.39	6.363	0.000202518	NA	1.55	0.00254904	2.480511964	1.28576E-05	NA	2.48E+00	1.65E-03	1.60E+00	8.32E-06	NA	*1.61E+00*	0.1%	99.9%	0.0%	NA
	Naphthalene	5.25	74.981	0.251628196	NA	237.84	0.034314	29.23166347	0.015975371	NA	2.93E+01	1.44E-04	1.23E-01	6.72E-05	NA	*1.23E-01*	0.1%	99.8%	0.1%	NA
	Phenanthrene	1.01	15.095	0.010338116	NA	158.52	0.00660136	5.884862753	0.000656346	NA	5.89E+00	4.16E-05	3.71E-02	4.14E-06	NA	*3.72E-02*	0.1%	99.9%	0.0%	NA
	Pyrene	0.39	5.183	0.216363803	NA	158.52	0.00254904	2.020592952	0.013736505	NA	2.04E+00	1.61E-06	1.27E-02	8.67E-05	NA	*1.28E-02*	0.1%	99.2%	0.7%	NA
	Pesticides and PCBs																			
	4,4'-DDD	0.38	6.037	0.00048778	NA	5.07	0.00248368	2.353519622	3.09681E-05	NA	2.36E+00	4.90E-04	4.65E-01	6.11E-06	NA	*4.65E-01*	0.1%	99.9%	0.0%	NA
X	4,4'-DDE	0.773	12.519	0.000094304	NA	3.21	0.005052328	4.880288649	0.000513891	NA	4.89E+00	1.57E-03	1.52E+00	1.60E-04	NA	*1.52E+00*	0.1%	99.9%	0.0%	NA
	4,4'-DDT	0.054	0.888	8.55842E-05	NA	1.76	0.000352944	0.346304382	5.43357E-06	NA	3.47E-01	2.01E-04	1.97E-01	3.09E-06	NA	*1.97E-01*	0.1%	99.9%	0.0%	NA
	Aroclor-1248	0.024	0.386	2.01229E-05	NA	8.37	0.000156864	0.150516971	1.27756E-06	NA	1.51E-01	1.87E-05	1.80E-02	1.53E-07	NA	*1.80E-02*	0.1%	99.9%	0.0%	NA
X	Aroclor-1254	0.024	0.393	4.07578E-05	NA	0.07	0.000156864	0.153191782	2.58763E-06	NA	1.53E-01	2.35E-03	2.29E+00	3.87E-05	NA	*2.29E+00*	0.1%	99.9%	0.0%	NA
	Aroclor-1260	0.024	0.416	1.54224E-06	NA	9.01	0.000156864	0.162320759	9.79136E-08	NA	1.62E-01	1.74E-05	1.80E-02	1.09E-08	NA	*1.80E-02*	0.1%	99.9%	0.0%	NA
	alpha-Chlordane	0.04	0.640	6.19527E-05	NA	5.45	0.00026144	0.249686015	3.93325E-06	NA	2.50E-01	4.80E-05	4.58E-02	7.22E-07	NA	*4.59E-02*	0.1%	99.9%	0.0%	NA
	gamma-Chlordane	0.033	0.528	5.11109E-05	NA	5.45	0.000215688	0.205990962	3.24493E-06	NA	2.06E-01	3.96E-05	3.78E-02	5.96E-07	NA	*3.79E-02*	0.1%	99.9%	0.0%	NA
	Endosulfan sulfate	0.017	0.248	0.0017	NA	0.33	0.000111112	0.09663916	0.00010793	NA	9.69E-02	3.37E-04	2.93E-01	3.27E-04	NA	*2.94E-01*	0.1%	99.8%	0.1%	NA
	Endrin	0.005	0.077	7.56781E-06	NA	0.11	0.00003268	0.029969155	4.80466E-07	NA	3.00E-02	2.99E-04	2.74E-01	4.39E-06	NA	*2.74E-01*	0.1%	99.9%	0.0%	NA
	Endrin Aldehyde	0.014	0.219	3.14288E-05	NA	NA	0.000091504	0.086294743	1.99535E-06	NA	8.54E-02	NA	NA	NA	NA	*NA*	NA	NA	NA	NA
	Endrin Ketone	0.0048	0.073	2.33175E-05	NA	NA	3.13728E-05	0.028587453	1.48038E-06	NA	2.86E-02	NA	NA	NA	NA	*NA*	NA	NA	NA	NA
	Heptachlor Epoxide	0.007	0.107	1.67918E-05	NA	NA	0.000045752	0.04162481	1.06608E-06	NA	4.17E-02	NA	NA	NA	NA	*NA*	NA	NA	NA	NA
	Methoxychlor	0.0075	0.115	3.36373E-05	NA	8.79	0.00004902	0.044772927	2.13557E-06	NA	4.48E-02	5.58E-06	5.09E-03	2.43E-07	NA	*5.10E-03*	0.1%	99.9%	0.0%	NA

BAIRD & MCGUIRE - Shrew Model - Maximum Exposures - Remediated Upland Soils

Soil Organism Ingestion (1 trophic level)				
Organism	Shrew		Date/Time	9/27/2004 14:33
Prey	Earthworm			
Organismal Parameters				
Food Intake Rate, wet (FIW)	0.62	kg food$_{wet}$ / kg BW$_{wet}$ * day		
Food Intake Rate, dry (FID)	0.095	kg food$_{dry}$ / kg BW$_{wet}$ * day		
Inadvertent soil or sediment ingested (SI $_{soil/sed}$)	0.066	unitless (fraction of diet)		
Animal Food Source Dietary Percentage (P$_a$)	0.786	fraction on a wet weight basis, 10% on a dry weight basis		
Vegetation Food Source Dietary Percentage	0.128	fraction on a wet weight basis, 90% on a dry weight basis		
Surface water ingested (SI $_{water}$)	NA	L $_{water}$ / kg BW $_{wet}$ * day		
Areal Site Use Factor	0.8			
Temporal Site Use Factor	1			
Soil/Sed bioavailability factor (SBAF)	100%			

NOTES:
Dose $_{prey}$ = FIW * Food Source Dietary Percentage * C$_{prey}$ * ASUF * TSUF
HQ = Dose/TRV
Dose$_{s/s}$ = SI $_{soil/sed}$ * FID * C$_{sed}$ * ASUF * TSUF * SBAF
Dose$_{water}$ = SI $_{water}$ * C$_{water}$ * ASUF * TSUF
Dose $_{veg}$ = FIW * Vegetation Food Source Dietary Percentage * Cveg * ASUF * TSUF

3.20E-01

Max Concentrations

	Selected Compound	C_{ash} (mg/Kg)	C_{Prey} (mg/Kg)	C_{veg} (mg/kg)	C_{Water} (ug/L)	TRV mg/Kg day	DOSE ash (mg/Kg BW day)	DOSE prey (mg/Kg BW day)	DOSE veg (mg/Kg BW day)	DOSE water (mg/Kg)	Total Dose (mg/Kg BW day)	HQ ash	HQ prey	HQ veg	HQ water	TOTAL HQ	% HQ ash	% HQ prey	% HQ veg	% HQ water
	Datasource:	Ash Max	Earthworm Max	Plant Max	Negligible	NOAEL														
	Inorganics																			
X	Aluminum	22600	421.429	9	NA	58.27	147.08	164.2964671	0.571392	NA	3.12E+02	2.52E+00	2.82E+00	9.81E-03	NA	5.35E+00	47.1%	52.7%	0.2%	NA
X	Antimony	4.7	0.373	0.094	NA	0.15	0.0307192	0.145422476	0.005967872	NA	1.82E-01	2.07E-01	9.78E-01	4.01E-02	NA	1.23E+00	16.9%	79.9%	3.3%	NA
X	Arsenic	823	4.383	3.292	NA	1.26	5.379128	1.70884819	0.209002496	NA	7.30E+00	4.27E+00	1.36E+00	1.66E-01	NA	5.79E+00	73.7%	23.4%	2.9%	NA
	Barium	164	4.185	2.46	NA	11.84	1.071904	1.623781181	0.15618048	NA	2.85E+00	9.05E-02	1.37E-01	1.32E-02	NA	2.41E-01	37.6%	56.9%	5.5%	NA
	Beryllium	1.6	0.300	0.0016	NA	1.45	0.0104576	0.117031068	0.000101581	NA	1.28E-01	7.21E-03	8.07E-02	7.00E-05	NA	8.80E-02	8.2%	91.7%	0.1%	NA
	Cadmium	4.6	4.406	0.253	NA	2.12	0.0300656	1.717186601	0.016062464	NA	1.76E+00	1.42E-02	8.10E-01	7.58E-03	NA	8.32E-01	1.7%	97.4%	0.9%	NA
	Chromium	37	1.490	0.02776	NA	19.78	0.241832	0.580736011	0.001761792	NA	8.24E-01	1.22E-02	2.94E-02	8.91E-05	NA	4.17E-02	29.3%	70.4%	0.2%	NA
	Cobalt	13.4	0.619	0.0268	NA	10.99	0.0875824	0.241302299	0.001701478	NA	3.31E-01	7.97E-03	2.20E-02	1.55E-04	NA	3.01E-02	26.5%	73.0%	0.5%	NA
	Copper	37.7	2.209	1.508	NA	33.43	0.2464072	0.861313066	0.095739904	NA	1.20E+00	7.37E-03	2.58E-02	2.86E-03	NA	3.60E-02	20.5%	71.6%	8.0%	NA
	Lead	82.7	4.502	0.37216	NA	17.58	0.5405272	1.755150881	0.023627069	NA	2.32E+00	3.07E-02	9.98E-02	1.34E-03	NA	1.32E-01	23.3%	75.7%	1.0%	NA
	Manganese	651	5.864	16.275	NA	183.41	4.254936	2.286028677	1.0332672	NA	7.57E+00	2.20E-02	1.18E-02	5.34E-03	NA	3.92E-02	56.2%	30.2%	13.6%	NA
	Mercury	0.25	0.068	0.0225	NA	0.07	0.001634	0.026513263	0.00142848	NA	2.96E-02	2.32E-02	3.77E-01	2.03E-02	NA	4.21E-01	5.5%	89.6%	4.8%	NA
	Nickel	35.7	2.477	0.2142	NA	87.91	0.2333352	0.965641032	0.01359913	NA	1.21E+00	2.65E-03	1.10E-02	1.55E-04	NA	1.38E-02	19.2%	79.6%	1.1%	NA
	Selenium	0.99	0.146	0.002475	NA	0.44	0.00647064	0.056959151	0.000157133	NA	6.36E-02	1.47E-02	1.30E-01	3.57E-04	NA	1.45E-01	10.2%	89.6%	0.2%	NA
	Silver	0.57	1.388	0.0228	NA	398.25	0.00372552	0.541012453	0.001447526	NA	5.45E-01	9.35E-06	1.36E-03	3.63E-06	NA	1.37E-03	0.7%	99.1%	0.3%	NA
	Thallium	2.2	0.175	0.00088	NA	0.16	0.0143792	0.068070095	5.58694E-05	NA	8.25E-02	8.75E-02	4.14E-01	3.40E-04	NA	5.02E-01	17.4%	82.5%	0.1%	NA
X	Vanadium	51.7	0.722	0.029435	NA	0.43	0.3379112	0.281637914	0.001806281	NA	6.21E-01	7.89E-01	6.57E-01	4.21E-03	NA	1.45E+00	54.4%	45.3%	0.3%	NA
	Zinc	163	72.183	24.45	NA	361.65	1.065368	28.14085786	1.5522816	NA	3.00E+01	3.03E-03	8.00E-02	4.41E-03	NA	8.75E-02	3.5%	91.5%	5.0%	NA

ATTACHMENT 7
ARARS REVIEW

TABLE A7-1. POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SUPERFUND SITE – OPERABLE UNITS 1 AND 2, HOLBROOK, MASSACHUSETTS

Media and Authority	Requirement	ROD Status	ROD requirements synopsis and consideration in RI/FS	Five-Year Review
Groundwater Federal Regulatory Requirements	SDWA – Maximum Contaminant Levels (MCLs) (40 CFR 141.11 – 141.16)	Applicable	Maximum Contaminant Levels (MCLs) have been promulgated for a number of common organic and inorganic analytes. These levels regulate the concentration of analytes in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water. The Holbrook Municipal South Street well field was closed due to Baird & McGuire Site contamination. Private drinking water wells exist in the vicinity.	Although the municipal wells have been closed, the Site is located in a state-designated interim wellhead protection area. Drinking water rules are therefore relevant and appropriate. MCLs and non-zero MCLGs have the status of ARARs for areas surrounding the Baird & McGuire Site boundaries. Many of the MCLs and MCLGs have changed since ROD completion. MCLs/MCLGs for OU-1 are provided in Table A7-2. Since the last five-year review in 1999, the MCL for arsenic was lowered from 50 ug/L to 10 ug/L. Constituents in Site groundwater still exceed criteria for arsenic, lindane (gamma-BHC), alpha- and gamma-chlordane, VOCs, SVOCs, and the secondary MCL for iron. Groundwater treatment is currently being conducted. The treated groundwater is being discharged back to groundwater and meets the standards for this rule. Groundwater contamination remains, however, and treatment is expected to continue for several years. Groundwater requires continued remediation under this rule.

TABLE A7-1. POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
BAIRD & MCGUIRE SUPERFUND SITE – OPERABLE UNITS 1 AND 2, HOLBROOK, MASSACHUSETTS

Media and Authority	Requirement	ROD Status	ROD requirements synopsis and consideration in RI/FS	Five-Year Review
	RCRA – Subpart F, Groundwater Protection Standards, Concentration Limits (40 CFR 264.94(a))	Relevant and Appropriate	Standards for 14 toxic compounds have been adopted as part of RCRA groundwater protection standards. These limits were originally set at MCLs. The groundwater protection regulations require the setting of groundwater protection standards which must be protective of the public health and the environment. During the design of the groundwater interception and treatment system, restoration target levels were proposed based on existing data.	RCRA sets the limit for organic constituents at background levels. Constituents in Site groundwater exceed RCRA MCLs for arsenic and exceed background concentrations for all organic COCs. Groundwater treatment is currently being conducted. The treated groundwater is being discharged back to groundwater and meets the standards for this rule. Groundwater contamination remains, however, and treatment is expected to continue for several years. Groundwater still requires remediation under this rule.
	Massachusetts Drinking Water Requirements (310 CMR 22.05 to 22.09)	Applicable	The Massachusetts Drinking Water Standards and Guidelines list Massachusetts Maximum Contaminant Levels (MMCLs) that apply to water delivered to any user of a public water supply system as defined by the rule.	The Site is located in a designated Mass. Wellhead Protection Area. Drinking water standards are applicable to groundwater supplies surrounding the Baird & McGuire Site. MMCLs for OU-1 are provided in Table A7-2. Constituents in Site groundwater still exceed criteria for arsenic, lindane (gamma-BHC), alpha- and gamma-chlordane, VOCs, and SVOCs. Groundwater treatment is currently being conducted. The treated groundwater is being discharged back to groundwater and meets the standards for this rule. Groundwater contamination remains, however, and treatment is expected to continue. Site groundwater requires continued remediation to protect outlying groundwater supplies.

TABLE A7-1. POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SUPERFUND SITE – OPERABLE UNITS 1 AND 2, HOLBROOK, MASSACHUSETTS

Media and Authority	Requirement	ROD Status	ROD requirements synopsis and consideration in RI/FS	Five-Year Review
Federal Criteria, Advisories, and Guidance	SDWA – Maximum Contaminant Level Goals (MCLGs)	Relevant and Appropriate/ To Be Considered	Maximum contaminant level goals (MCLGs) are health-based criteria that are to be considered for drinking water sources as a result of SARA. These goals are available for a number of organic and inorganic contaminants. Projected groundwater concentrations were compared to their MCLGs in documents supporting the ROD.	MCLs and non-zero MCLGs have the status of ARARs for areas outside of the Baird & McGuire Site boundaries. Zero MCLGs are criteria to be considered. Many of the MCLs and MCLGs have changed since ROD completion. MCLs/MCLGs for OU-1 are provided in Table A7-2. Groundwater requires continued remediation under this rule to protect outlying resources.
Discharge to Surface Water Massachusetts Regulatory Requirements	Massachusetts Surface Water Quality Standards (314 CMR 4.05)	Applicable	DEP Surface Water Quality Standards are given for dissolved oxygen, temperature increase, pH, and total coliform and there is a narrative requirement for toxicants in toxic amounts. In the absence of a state standard for a compound, federal AWQC would be appropriate. Requirements were considered; however, no numerical standards exist for contaminants found in Site groundwater which would be discharged to surface water. Federal AWQC will be used in the absence of narrative standards.	These regulations classify the surface waters of the Commonwealth according to the uses of those waters. The wetland has a Class A waterway classification. Class A waters are designated as habitat for fish, other aquatic and wildlife, and for primary and secondary contact recreation. The state surface water minimum criteria for Class A waters are consistent with federal AWQC. These rules are applicable to the Cochato River and unnamed brook.

TABLE A7-1. POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SUPERFUND SITE – OPERABLE UNITS 1 AND 2, HOLBROOK, MASSACHUSETTS

Media and Authority	Requirement	ROD Status	ROD requirements synopsis and consideration in RI/FS	Five-Year Review
Federal Criteria, Advisories, and Guidance	Federal Ambient Water Quality Criteria (AWQC)	Relevant and Appropriate	Federal AWQC are health-based and ecologically based criteria which have been developed for 95 carcinogenic and non-carcinogenic compounds. AWQC were considered in characterizing public health risks to aquatic organisms due to contaminant concentrations in surface water at Cochato River. Because this water is not used as a drinking water source, the criteria developed for aquatic organisms protection and ingestion of contaminated aquatic organisms were considered.	CERCLA Sec. 121 (d)(2)(A) Specifically states that remedial actions shall at least attain federal AWQC established under the Clean Water Act if they are relevant and appropriate. AWQC for both protection of human health from ingestion of water and aquatic organisms are relevant and appropriate. Current AWQC are listed in Table A7-6.
Air Massachusetts Regulatory Requirements	Massachusetts – Air Quality, Air Pollution (310 CMR 6.00-8.00)	Formerly Applicable now Not ARAR	These standards were primarily developed to regulate stack and automobile emissions.	310 CMR 6.00 provide ambient air quality standards for the Commonwealth, standards for dust are contained in 310 CMR 7.09, and 310 CMR 7.08 provides incinerator standards. These standards were used in establishing discharge limits from the incinerator. The incinerator has been dismantled and these requirements are no longer applicable, relevant or appropriate. Should excavation occur in the future, dust control standards would need to be reconsidered.
Federal Criteria, Advisories, and Guidance	Threshold Limit Values (TLVs)	Formerly To Be Considered now Not ARAR	These standards were issued as consensus standards for controlling air quality in workplace environments. TLVs could be used to assess Site inhalation risks for soil removal operations.	The incinerator has been dismantled and these requirements are no longer applicable, relevant or appropriate. Should excavation be considered in the future, these values would need to be reconsidered.

TABLE A7-1. POTENTIAL CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SUPERFUND SITE – OPERABLE UNITS 1 AND 2, HOLBROOK, MASSACHUSETTS

Media and Authority	Requirement	ROD Status	ROD requirements synopsis and consideration in RI/FS	Five-Year Review
Massachusetts Criteria, Advisories, and Guidance	Massachusetts Guidance on Acceptable Ambient Air Levels (AALs)	Formerly To Be Considered now Not ARAR	AALs were considered when assessing the significance of monitored and modeled residential contamination from air emissions.	The incinerator has been dismantled and these requirements are no longer applicable, relevant or appropriate.

TABLE A7-2. NUMERICAL STANDARDS FOR BAIRD & MCGUIRE GROUNDWATER

CHEMICAL [1]	SDWA MCL[2] (mg/L)	SDWA MCLG[3] (mg/L)	RCRA MCL[4] (mg/L)	Mass. Drinking Water Stds.[5] (mg/L)
Organics, Pesticides, PCBs				
Acenapthalene*, **	--	--	--	--
Aldrin	--	--	--	[8]
Benzene*	0.005	0	--	0.005
Benzidine	--	--	--	--
Benzo(a)pyrene	0.0002	0	--	0.0002
Butanone, 2-	--	--	--	--
Chlordane*	0.002	0	--	0.002
Chloroform	--	--	--	[8]
DDD, 4, 4-	--	--	--	--
DDE, 4, 4-	--	--	--	--
DDT, 4, 4-	--	--	--	--
Dibenzofuran*	--	--	--	--
Dichloroethane, 1, 2-	0.005	0	--	0.005
Dichloroethylene, 1,2-trans*	0.1	0.1	--	0.1
Dichloropropylene, 1,3-trans	--	--	--	--
Dieldrin*	--	--	--	[8]
Dimethylphenol, 2,4-*	--	--	--	--
Dioxin (2, 3, 7, 8-TCDD)	$3x10^{-8}$	0	--	$3x10^{-8}$
Ethylbenzene*	0.7	0.7	--	0.7
Fluoranthene	--	--	--	--
Fluorene*, **	--	--	--	--
Heptachlor	0.0004	0	--	0.0004
Heptachlor epoxide	0.0002	0	--	0.0002
Lindane (gamma-BHC)	0.0002	0.0002	0.004	0.0002
Methylnaphthalene, 2-*, **	--	--	--	--

TABLE A7-2. NUMERICAL STANDARDS FOR BAIRD & MCGUIRE GROUNDWATER

CHEMICAL [1]	SDWA MCL[2] (mg/L)	SDWA MCLG[3] (mg/L)	RCRA MCL[4] (mg/L)	Mass. Drinking Water Stds.[5] (mg/L)
Naphthalene*, **	--	--	--	[8]
Phenanthrene*, **	--	--	--	--
Total Other PAHs (**)	--	--	--	--
Tetrachloroethylene	0.005	0	--	0.005
Toluene*	1	1	--	1
Trichloroethane, 1,1,1-	0.20	0.20	--	0.2
Vinyl chloride	0.002	0	--	0.002
Xylenes (total)*	10	10	--	10
Inorganics				
Antimony	0.006	0.006	--	0.006
Arsenic*	0.010	--	0.05	0.010
Barium	2.0	2	1.0	2
Beryllium	0.004	0.004	--	0.004
Cadmium	0.005	0.005	0.01	0.005
Iron	--	0.3 (SMCL)	--	--
Lead*	Treatment technique [6]	0	0.05	Treatment technique[6]
Nickel	--	--	--	--
Silver	--	0.10 (SMCL)	0.05	0.10 (SMCL)
Zinc	--	5 (SMCL)	--	5 (SMCL)
Dimethylphenol, 2,4-*	--	--	--	--
Methylphenol, 4-*	--	--	--	--

TABLE A7-2. NUMERICAL STANDARDS FOR BAIRD & MCGUIRE GROUNDWATER

CHEMICAL [1]	SDWA MCL[2] (mg/L)	SDWA MCLG[3] (mg/L)	RCRA MCL[4] (mg/L)	Mass. Drinking Water Stds.[5] (mg/L)
Trichloroethylene (TCE)	0.005	0	--	0.005

Notes

1. Chemical listed in this table include selected critical contaminants identified in Table 1 of the 9/30/86 ROD, indicator compounds as defined in the Site Maintenance Plan (see * below), and other compounds detected at levels exceeding SDWA MCLs during 2003 groundwater monitoring.
2. National Primary Drinking Water Regulations under Safe Drinking Water Act, 40 CFR Part 141, Subpart G, Maximum Contaminant Levels (MCLs)
3. National Primary Drinking Water Regulations under Safe Drinking Water Act, 40 CFR Part 141, Subpart F, Maximum Contaminant Level Goals (MCLGs)
4. Federal Resource Conservation and Recovery Act Maximum concentration of Constituents for Groundwater Protection, 40 CFR 264.94, Table 1.
5. Massachusetts Drinking Water Regulations, 310 CMR 22.00
6. The MCL for lead was replaced by an action level of 15 ppb (0.015 mg/L) at the tap, 0.005 mg/L in the system. Public water systems exceeding the action level must for further treatment; b) undertake a public education program to inform consumers about how to reduce exposure to lead in drinking level continues, replace all lead service pipes.
7. These compounds are identified as "unregulated inorganic and organic chemicals" requiring special monitoring (310 CMR 22.07C).

*These compounds are contamination indicator compounds as defined in the Site Maintenance Plan for the Baird & McGuire Groundwater Treatment Plant and Extraction/Recharge System" prepared by Metcalf & Eddy, April 25, 1989, for the U.S. Army Engineer District, Omaha.

**PAH compounds listed in Table 2 of 9/30/86 Record of Decision: 2-methylnapthalene, acenapthene, acenapthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluorene, indeno(1, 2, 3-cd)pyrene, napthalene, phenanthrene, and pyrene.

TABLE A7-3. POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SITE (ALL OPERABLE UNITS), HOLBROOK, MASSACHUSETTS

SITE FEATURE AND AUTHORITY	REQUIREMENTS	ROD STATUS	REQUIREMENT SYNOPSIS AND CONSIDERATION IN RI/FS	FIVE-YEAR REVIEW
<u>Wetlands</u> Federal Regulatory Requirements	Clean Water Act (CWA) Section 404 – (40 CFR Part 230)	Applicable	Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. Permits are required to be obtained from the US Army Corps of Engineers for dredge and fill activities in off-site wetlands. During identification, screening, and evaluation of alternatives, the effects on wetlands are evaluated. Wetland impacts must be avoided, minimized, mitigated.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed that requires the restoration of approximately 7.4 acres of forested and scrub/shrub floodplain wetlands, including a small peat bog and 1,000 linear feet of intermittent stream, impacted by the remedial action. The plan required restoring the wetland to the approximate original grades and elevations, backfilling with organic topsoil (at least 20 percent organic matter by weight) and seeding and planting with appropriate herbaceous, shrub, and tree species. The wetland was monitored for four years in order to assess the success of the wetland restoration effort. The final monitoring report was completed in 2002.
	Executive Order, 11990; Wetlands Protection; Clean Water Act (40 CFR 6, Appendix A)	Applicable	Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative that has less effect is available. All operable units include wetlands.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002.

TABLE A7-3. POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SITE (ALL OPERABLE UNITS), HOLBROOK, MASSACHUSETTS

SITE FEATURE AND AUTHORITY	REQUIREMENTS	ROD STATUS	REQUIREMENT SYNOPSIS AND CONSIDERATION IN RI/FS	FIVE-YEAR REVIEW
	Fish and Wildlife Coordination Act (16 U.S.C. 661)	Applicable	The Fish and Wildlife Coordination Act (16 USC 661 *et. seq.*) requires that, before issuing a federal permit or undertaking any federal action that causes the impoundment (with certain exemptions), diversion, or other control or modification of any body of water, the applicable federal agency must consult with (1) the appropriate state agency exercising jurisdictions over wildlife resources; (2) the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service, within the Department of Interior; and (3) the National Marine Fisheries Service, within the Department of Commerce. The Baird & McGuire Site includes significant wetlands. This requirement is addressed under CWA Section 404.	Consultation occurred as part of the RI/FS process.
State Regulatory Requirements	Massachusetts – Wetlands Protection (310 CMR 10.00)	Applicable	These requirements are promulgated under Wetlands Protection Laws, which regulate dredging, filling, altering, or polluting wetlands. Work within 100 feet of a wetland is also regulated under this requirement. The requirement defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. If alternatives require that work be completed within 100 feet of a defined wetland, these regulations are to be considered. Mitigation of impacts on wetlands are addressed under CWA 404.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002.

TABLE A7-3. POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
BAIRD & MCGUIRE SITE (ALL OPERABLE UNITS), HOLBROOK, MASSACHUSETTS

SITE FEATURE AND AUTHORITY	REQUIREMENTS	ROD STATUS	REQUIREMENT SYNOPSIS AND CONSIDERATION IN RI/FS	FIVE-YEAR REVIEW
	Massachusetts Environmental Policy Act (MEPA) Regulations (301 CMR 11.00)	Formerly Applicable, Now not ARAR	These regulations require that all actions exceeding specified threshold established under MEPA, requiring funding, or requiring a major permit, prepare and file an Environmental Notification Form (ENF). MEPA has determined that the reports generated during Baird & McGuire investigations essentially constitute an Environmental Impact Report. During development of alternatives, impacts to wetlands and floodplains were evaluated.	The CERCLA process generates evaluations and reports that are equivalent to those requires by MEPA. To eliminate redundancy, these rules are no longer considered ARAR.
	Department of Environmental Management (DEM) Inland Wetland Orders (302 CMR 6.00)	Applicable	Pursuant to these regulations, DEM has authority to adopt orders restricting activities or uses of inland wetlands in order to preserve and promote public safety, property, wildlife and water resources, and floodplain areas. DEM was appraised of remedial actions which may impact inland wetlands.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002.
Floodplains Federal Regulatory Requirements	RCRA Location Standards 40 CFR 264.18(b)	Relevant and Appropriate	RCRA-defined listed or characteristic hazardous waste (40 CFR 261) facility must be designed, constructed, operated, and maintained to prevent washout by 100-year flood.	This ARAR has been met. All hazardous waste facilities are outside of the 100-year flood plain.

TABLE A7-3. POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SITE (ALL OPERABLE UNITS), HOLBROOK, MASSACHUSETTS

SITE FEATURE AND AUTHORITY	REQUIREMENTS	ROD STATUS	REQUIREMENT SYNOPSIS AND CONSIDERATION IN RI/FS	FIVE-YEAR REVIEW
	Floodplains Protection Executive Order 11988; Clean Water Act (40 CFR 6.302(b), Appendix A)	Applicable	Federal agencies shall take action to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of floodplains. Federal agencies shall also evaluate potential effects of actions in floodplains and ensure consideration of flood hazards and floodplain management. If action is taken in floodplains, alternatives to avoid adverse effects, and minimize potential harm must be taken.	This ARAR has been met. The Site was regraded according to plan and according to former floodplain delineation.
State Regulatory Requirements	Massachusetts Wetlands Protection (310 CMR 10.57 (2), 10.04)	Applicable	Actions in "bordering land subject to flooding" shall provide compensatory storage for flood storage volume lost as a result of the project, shall not restrict flows so as to cause an increase in flood stage or velocity, and shall not impair its capacity to provide important wildlife habitat functions or alter vernal pool habitat. Actions in "isolated land subject to flooding" shall not result in flood damage because of lateral displacement of water that would otherwise be confined within the area, adverse effects on water supply, adverse effects on the capacity of the area to prevent groundwater pollution, or adverse effects on vernal pool habitat.	This ARAR has been met. The site was regraded according to plan and according to former floodplain delineation.

TABLE A7-3. POTENTIAL LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE BAIRD & MCGUIRE SITE (ALL OPERABLE UNITS), HOLBROOK, MASSACHUSETTS

SITE FEATURE AND AUTHORITY	REQUIREMENTS	ROD STATUS	REQUIREMENT SYNOPSIS AND CONSIDERATION IN RI/FS	FIVE-YEAR REVIEW
	Massachusetts Hazardous Waste Management Rules, Facility Location Regulations (310 CMR 30.700-30.707)	Relevant and Appropriate	No new facility may be located in an area subject to flooding, within the watershed of class A or class SA segment of a surface water body (unless DEP determines these is no feasible alternative), on land overlying an actual planned, or potential public or private drinking water source, or in the flow path of groundwater supplying water to an existing well. Variances and exceptions are noted in the regulations. The impact of the construction and operation of an on-site hazardous waste treatment, storage or disposal facility on the floodplain must be considered during the development of remedial alternatives.	As there was no feasible alternative, the groundwater treatment facility was constructed at this Site. The groundwater treatment facility treats materials that may be classified as RCRA hazardous by toxicity. While these rules may be relevant, they are not appropriate based on the nature of the treatment (remediation).
	Massachusetts Certification for Dredging, Dredged Material Disposal and Filling in Waters (314 CMR 9.00)	Applicable	A water quality certification is required for any activity that involves dredging in a waterway or wetland in Massachusetts that is also subject to a U.S. Army Corps of Engineers CWA Permit, a EPA NPDES permit, or a Massachusetts Wetlands or Waterways Order of Conditions or License. Application must be made to DEP to certify that a proposed project will attain or maintain the Massachusetts Water Quality Standards and minimize adverse impacts to water quality.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002. This work has been completed and substantive requirement have been attained.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
Federal Regulatory Requirements			
RCRA – Generator Standards (40 CFR 261, 265.170 – 265.174, 262.10 – 262.34)	If contaminated substances meet the definition of RCRA-hazardous under 40 CFR 261, RCRA requirements are applicable. If contaminated substances at CERCLA sites are determined to be sufficiently similar to RCRA hazardous wastes, technical aspects of RCRA requirements are considered relevant and appropriate. If removed from their existing locations, hazardous substances should be handled, transported, and treated as RCRA hazardous waste. General generator requirements outline waste characterization, management of containers, packaging, labeling and manifesting. **ROD Status: ARAR** **5-Year Status: Relevant and Appropriate**	Treatment residuals from wastewater treatment will be disposed of according to RCRA. Waste containers will be handled and managed in accordance with RCRA.	These requirements are relevant and appropriate to operations at the groundwater treatment facility. Although the GWTP does not treat RCRA-designated hazardous waste, it does generate a treatment residual that may, at times, meet the definition of a RCRA hazardous waste. Generator requirements are therefore being complied with at the facility.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
RCRA – Standards for Owners and Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10 – 264.18)	If a facility operated pursuant to RCRA regulations, RCRA requirements are applicable. If contaminated substances at CERCLA sites are determined to be sufficiently similar to RCRA hazardous wastes, technical aspects of RCRA requirements are considered relevant and appropriate. If removed from their existing locations, hazardous substances should be handled, transported, and treated as RCRA hazardous waste. General facility requirements outline general waste analysis, security measures, inspections, and training requirements – **ROD Status: ARAR** **5-Year Status: Not ARAR**	All facilities on-site will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained. Process wastes will be evaluated for the characteristics of hazardous wastes to assess further requirements. Treatment residuals from wastewater treatment will be disposed of according to RCRA.	These requirements were relevant and appropriate to the incinerator. The incinerator has been dismantled. The groundwater treatment facility does not treat hazardous waste and does not meet the standards for being sufficiently similar to a hazardous waste treatment facility. These rules are no longer considered applicable, relevant or appropriate.
RCRA – Preparedness and Prevention (40 CFR 265.30-265.37)	This regulation outlines safety equipment and spill control requirements for hazardous waste facilities. Part of the regulation includes a requirement that facilities be designed, maintained, constructed, and operated so that the possibility of an unplanned release which could threaten public health or the environment is minimized – **ROD Status: ARAR** **5-Year Status: Relevant and Appropriate**	Safety and communication equipment will be installed at the Site; local authorities will be familiarized with Site operations.	These requirements are relevant and appropriate to operations at the groundwater treatment facility. Although the GWTP does not treat RCRA-designated hazardous waste, it does generate a treatment residual that may, at times, meet the definition of a RCRA hazardous waste. Generator requirements are therefore being complied with at the facility. Local authorities are familiar with Site operations and safety equipment is in place.
RCRA – Contingency Plan and Emergency Procedures (40 CFR 265.50-265.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc. This regulation also requires that threats to	Plans will be developed and implemented during Site work including installation of monitoring wells, and implementation of Site	These requirements are relevant and appropriate to operations at the groundwater treatment facility. Although the GWTP does not treat RCRA-designated hazardous waste, it does generate a treatment residual that may, at

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
	public health and the environment be minimized – **ROD Status: ARAR** **5-Year Status: Relevant and Appropriate**	remedies. Copies of the plans will be kept on-site.	times, meet the definition of a RCRA hazardous waste. Generator requirements are therefore being complied with at the facility. A contingency plan is available at the Site.
RCRA Subpart F – Groundwater Protection (40 CFR 264.90-264.109)	This regulation details requirements for a groundwater monitoring program to be installed at the Site. **ROD Status: ARAR** **5-Year Status: Relevant and Appropriate**	A groundwater monitoring system must be installed as part of any alternative. During Site characterization, the location and depth of monitoring wells will be evaluated for use in this monitoring program.	Groundwater corrective action rules have changed significantly since the ROD was issued. A groundwater monitoring program has been implemented at the Site. Monthly water level monitoring and quarterly groundwater sampling is performed under this plan. These requirements are relevant and appropriate to the Site due to its former use. Substantive rules are being complied with.
RCRA Subpart G – Closure and Post-Closure (40 CFR 264.110-264.120)	This regulation details specific requirements for closure and post-closure of hazardous waste facilities – **ROD Status: ARAR** **5-Year Status: Not ARAR**	Those parts of the regulations concerned with long-term monitoring and maintenance of the Site will be considered during remedial design. A post-closure plan will be developed.	These requirements were relevant and appropriate to the incinerator. The incinerator has been dismantled. The groundwater treatment facility does not treat hazardous waste and does not meet the standards for being sufficiently similar to a hazardous waste treatment facility. These rules are no longer considered applicable, relevant or appropriate.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
RCRA Subpart K – Surface Impoundments (264.220 – 264.232)	This regulation specifies design, operation and closure requirements for surface impoundments containing hazardous waste. **ROD Status: ARAR** **5-Year Status: Not ARAR**	Design and operating requirements for a liner, leachate collection and removal system and closure are detailed.	There are no waste impoundments on-site. These rules are not applicable, relevant or appropriate.
RCRA Subpart N – Landfills (40 CFR (264.300 – 264.317)	This regulation details design and operating, monitoring, closure and post-closure requirements for hazardous waste landfills. **ROD Status: ARAR** **5-Year Status: Not ARAR**	Landfills must be designed with a liner leachate collection and monitoring, and a specific cap. In addition, long-term monitoring and a post-closure plan must be developed.	As RCRA Subtitle C hazardous wastes were not land disposed on-site, these rules are not applicable, relevant or appropriate.
RCRA Subpart O – Incinerators (40 CFR 264.340 – 264.351)	This regulation details specific requirements for the design, operation and closure of a hazardous waste incinerator. **ROD Status: ARAR** **5-Year Status: Not ARAR**	Performance standards, waste analysis, operating requirements, monitoring, inspection and closure are specified.	These requirements were relevant and appropriate to the incinerator. The incinerator has been dismantled. The groundwater treatment facility does not treat hazardous waste and does not meet the standards for being sufficiently similar to a hazardous waste treatment facility. These rules are no longer considered applicable, relevant or appropriate.
Clean Water Act – Surface Water Discharges (40 CFR Parts 122, 125)	Any point source discharges must meet NPDES permitting requirements, which include compliance with applicable water quality standards; establishment of a discharge monitoring system; and routine completion of discharge monitoring records. **ROD Status: ARAR** **5-Year Status: Not ARAR**	If groundwater that has been treated by on-site treatment processes is discharged to surface waters on-site, treated groundwater must be in compliance with applicable water quality standards. In addition, a discharge monitoring program must be implemented. Routine discharge monitoring records must be completed.	Treated groundwater is being discharged back to groundwater. No direct, point-source surface water discharge is occurring.
CWA – 40 CFR Part 230	This regulation outlines requirements for discharges of dredged or fill material. Under this requirement no activity that impacts a wetland will be permitted if a	During the identification, screening, and evaluation of alternatives, the effects on wetlands must be evaluated.	A Wetlands Restoration Plan has been implemented at the Site.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
	practicable alternative that has less impact on the wetland is available. If there is no other practicable alternative, impacts must be mitigated **ROD Status: ARAR** **5-Year Status: Applicable**		
CAA – NAAQS for Total Suspended Particulates (40 CFR 129.105, 50)	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter **ROD Status: ARAR** **5-Year Status: Not ARAR**	Fugitive dust emissions from Site excavation activities will be maintained below 260 $\mu g/m^3$ (primary standard) by dust suppressants, if necessary.	These requirements were applicable to the excavation and incineration of debris. These activities are completed. These requirements are only applicable if further land disturbing activities are conducted. None are currently planned.
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-171.5)	This regulation outlines procedures for the packaging, labeling, manifesting, and transportation of hazardous materials **ROD Status: ARAR** **5-Year Status: Not ARAR**	Contaminated materials shipped off-site will be packaged, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.	Shipping of hazardous materials has been in compliance. EPA no longer considers DOT rules an ARAR as they are not environmental rules and must always be complied with for all off-site shipments.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
State Regulatory Requirements			
Massachusetts Hazardous Waste Regulations (310 CMR 30.000, MGL Ch. 21C)	These regulations provide a comprehensive program for the handling, storage, and recordkeeping at hazardous waste facilities. They implement federal RCRA regulations **ROD Status: ARAR** **5-Year Status: Relevant and Appropriate**	Because these requirements supplement RCRA hazardous waste regulations, they must also be considered at the Site.	These requirements are relevant and appropriate to operations at the groundwater treatment facility. Although the GWTP does not treat RCRA-designated hazardous waste, it does generate a treatment residual that may, at times, meet the definition of an RCRA hazardous waste. Generator requirements are therefore being complied with at the facility.
Massachusetts Solid Waste Management regulations (310 CMR 19.141)	This regulation requires that notice be recorded in the Registry of Deeds whenever certain types of solid or hazardous waste activity occur on property **ROD Status: ARAR** **5-Year Status: Applicable**	Notification of remedial actions will be given to the County Registry of Deeds.	This has not been completed to date.
Massachusetts Wetlands Protection (310 CMR 10.00)	This regulation outlines the requirements necessary to work within 100 feet of a coastal or inland wetland. The act sets forth a public review and decision-making process by which activities affecting waters of the state are to be regulated to contribute to their protection **ROD Status: ARAR** **5-Year Status: Applicable**	Wetland remediation will comply with the substantive but not the administrative requirements for wetland protection.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002.
Massachusetts Surface Water Discharge	This section outlines the requirements for obtaining an NPDES permit in	Pollutant discharges to surface water must comply with NPDES permit	No direct point-source discharges to surface water are occurring.

TABLE A7-4. POTENTIAL ACTION-SPECIFIC ARARS FOR OPERABLE UNITS 1 AND 2 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	REQUIREMENT SYNOPSIS AND STATUS	ACTION TAKEN TO ATTAIN ARARS	FIVE-YEAR REVIEW
Permit Program (314 CMR 2.00-4.00)	Massachusetts **ROD Status: ARAR** **5-Year Status: Not ARAR**	requirements. Permit conditions and standards for different classes of water are specified.	
Certification for Dredging, Dredged Material Disposal, and Filling Waters (314 CMR 9.00, MGL Ch. 21, ss. 26-53)	This regulation is promulgated to establish procedures, criteria, and standards for the water quality certification of dredging and dredged material disposal **ROD Status: ARAR** **5-Year Status: Applicable**	Applications for proposed dredging/fill work need to be submitted and approved before work commences. Three categories have been established for dredge or fill material based on the chemical constituents. Approved methods for dredging, handling, and disposal options for the three categories must be met.	To mitigate unavoidable wetland impacts, a Final Site Restoration Plan was developed. The plan required the restoration of forested and scrub/shrub floodplain wetlands, including a small peat bog, and an intermittent stream impacted by the remedial action. The plan also required annual monitoring of the wetlands for at least three years following completion of the restoration efforts. Four years of monitoring data were collected and the final monitoring report was completed in 2002.

TABLE A7-5. POTENTIAL CHEMICAL-SPECIFIC CRITERIA, ADVISORIES, AND GUIDANCE FOR OU-3. BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

MEDIA AND AUTHORITY	REQUIREMENT	ROD STATUS	ROD REQUIREMENT SYNOPSIS AND CONSIDERATION IN THE FFS	FIVE-YEAR REVIEW
Surface Water Federal Regulatory Requirements	SDWA – MCLs (40 CFR 141.11 – 141.16)	Relevant and Appropriate	Maximum contaminant levels (MCLs) have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for surface water bodies used for drinking water. When the risks to public health due to consumption of surface water were assessed, concentrations of contaminants of concern were compared to federal MCLs.	MCLs and non-zero MCLGs have the status of ARARs for surface water downgradient of the Baird & McGuire Site boundaries. Many of the MCLs and MCLGs have changed since ROD completion. MCLs/MCLGs for site contaminants are provided in Table A7-2. Contaminated sediments have been removed and are no longer expected to leach contamination to the Cochato River. This requirement has been attained for OU-3. These criteria are not currently ARAR; however, they may become relevant and appropriate if the Cochato River is considered for a potential public water supply.
	SDWA – MCLGs (40 CFR 141.50 – 141.51)	Relevant and Appropriate	MCLGs are health-based criteria that are used for the protection of drinking water sources as a result of SARA. These unenforceable goals are available for a number of organic and inorganic contaminants. MCLGs will be used when an extraordinary risk is associated with contaminants in the Cochato River surface water and sediment.	MCLs and non-zero MCLGs have the status of ARARs for surface water downgradient of the Baird & McGuire Site boundaries. Zero MCLGs are criteria to be considered. Many of the MCLs and MCLGs have changed since ROD completion. MCLs/MCLGs for site contaminants are provided in Table A7-2. Contaminated sediments have been removed and are no longer expected to leach contamination to the Cochato River. This requirement has been attained for OU-3. It would be relevant and appropriate if the Cochato River is considered for a potential public water supply.
	Federal Ambient Water Quality Criteria (AWQC) under the Clean Water Act	Relevant and Appropriate	Remedial actions involving contaminated surface water or groundwater must consider the uses of the water and the circumstances of the release or threatened release; this determines the relevance and appropriateness.	CERCLA Sec. 121 (d)(2)(A) Specifically states that remedial actions shall at least attain federal AWQC established under the Clean Water Act if they are relevant and appropriate. These criteria are not currently ARAR; however, they may

TABLE A7-5. POTENTIAL CHEMICAL-SPECIFIC CRITERIA, ADVISORIES, AND GUIDANCE FOR OU-3.
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

MEDIA AND AUTHORITY	REQUIREMENT	ROD STATUS	ROD REQUIREMENT SYNOPSIS AND CONSIDERATION IN THE FFS	FIVE-YEAR REVIEW
			This requirement will be considered when determining clean-up levels or potential discharge limits.	become relevant and appropriate if the Cochato River is considered for a potential public water supply. Current AWQC are listed in Table A7-6.
State Regulatory Requirements	Massachusetts Drinking Water Standards (310 CMR 22.00)	Relevant and Appropriate	Massachusetts adopted the federal SDWA Maximum Contaminant Levels (MCLs) as its drinking water standards. MCLs regulate the concentration of contaminants in public drinking water supplies. When risks to public health due to consumption of surface water were assessed, concentrations of contaminants of concern were compared to Massachusetts MCLs.	The Site is located in a designated Mass. Wellhead Protection Area. Drinking water standards are applicable to drinking water sources surrounding the Baird & McGuire Site. MMCLs for site contaminants are provided in Table A7-2. Contaminated sediments have been removed and are no longer expected to leach contamination to the Cochato River. This requirement has been attained for OU-3. It does, however, remain relevant and appropriate.
	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	Surface water quality standards are specified for the major surface water bodies of the Commonwealth. Surface waters were classified with respect to designated uses. Each class of surface water has a criteria associated with it (e.g., dissolved oxygen, temperature, pH, total coliform). The Cochato River is designated as a Class B River. Actions will take into account the designated use(s) and will comply with specified water quality standards.	These regulations classify the surface waters of the Commonwealth according to the uses of those waters. The wetland has a Class A waterway classification. Class A waters are designated as habitat for fish, other aquatic and wildlife, and for primary and secondary contact recreation. The state surface water minimum criteria for Class A waters are consistent with federal AWQC. These rules are applicable to the Cochato River and unnamed brook.
<u>Air</u> State Regulatory Requirements	Massachusetts Air Pollution Control Regulations (310 CMR 6.04)	Relevant and Appropriate	Massachusetts has promulgated ambient air quality standards for six pollutants (e.g., sulfur oxides, particulate matter, carbon, ozone, nitrogen, and lead). During excavation activities these standards will be complied with.	310 CMR 6.00 provide ambient air quality standards for the Commonwealth, standards for dust are contained in 310 CMR 7.09, and 310 CMR 7.08 provides incinerator standards. These standards were used in establishing discharge limits from the incinerator. The incinerator has been dismantled and these requirements are no longer applicable, relevant or appropriate.

TABLE A7-5. POTENTIAL CHEMICAL-SPECIFIC CRITERIA, ADVISORIES, AND GUIDANCE FOR OU-3. BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

MEDIA AND AUTHORITY	REQUIREMENT	ROD STATUS	ROD REQUIREMENT SYNOPSIS AND CONSIDERATION IN THE FFS	FIVE-YEAR REVIEW
				Should excavation occur in the future, dust control standards would need to be reconsidered.
Federal Criteria, Advisories, and Guidance	EPA Office of Water Guidance, Water-Related Fate of 129 Priority Pollutants (1979).	To Be Considered	This guidance manual gives transport and fate information for 129 priority pollutants. These criteria were considered during the risk assessment.	There is no change from the ROD presentation for this ARAR.
State Criteria, Advisories and Guidance	Massachusetts Guidance on Allowable Ambient Levels (AALs), cited in Chemical Health Effects Assessment Methodology and Methodology to Derive Allowable Ambient Levels. Draft, DEQE, 1987.	To Be Considered	This guidance evaluates acute and chronic toxicity and sets draft AALs for 106 chemicals. Final AALs will be issued in 1989. These levels will be considered when evaluating excavation and treatment technologies that have potential hazardous air emissions.	These requirements are no longer to be considered for this operable unit. The incinerator has been dismantled.

TABLE A7-5. POTENTIAL CHEMICAL-SPECIFIC CRITERIA, ADVISORIES, AND GUIDANCE FOR OU-3. BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

MEDIA AND AUTHORITY	REQUIREMENT	ROD STATUS	ROD REQUIREMENT SYNOPSIS AND CONSIDERATION IN THE FFS	FIVE-YEAR REVIEW
Soil/Sediment Federal Criteria, Advisors and Guidance	EPA Future Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants (SCD No. 17; May 1988)	To Be Considered	These criteria have been recently developed by EPA for 16 organic compounds. These criteria represent levels protective of aquatic life. These criteria were used to generate sediment quality criteria values during the risk assessment.	These criteria were never finalized and are no longer used, having been replaced by other, more appropriate criteria such as EPA *Ecotox Thresholds and Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. These criteria are no longer to be considered.
State Regulatory Requirements	Soil Standards for S-3 (310 CMR 40.0975(6)(c)	Applicable	The MCP establishes requirements and procedures for the discovery, notification, assessment of, and responses to, releases and threats of release of oil or hazardous materials. Pursuant to MCL c21E and the MCP, the Commonwealth of Massachusetts publishes a list of confirmed oil or hazardous material to be investigated. Because the Baird & McGuire Site is a confirmed state hazardous material Site and listed on the National Priorities List, joint federal and state jurisdiction exists. Cooperative agreements and contracts with the federal government shall incorporate, to the extent possible, the deadlines and specifications of MCL c21E and the MCP.	The MCP includes a specific reference to remediation at CERCLA sites (40.0111) where it is stated that the MCP does not apply to sites adequately regulated under CERCLA, provided that DEP concurs with the ROD and that CERCLA addresses all contaminants. DEP concurred with the ROD for this site. Therefore, these rules are no longer considered ARARS.

TABLE A7-6. NUMERICAL CHEMICAL-SPECIFIC ARARS CRITERIA, ADVISORIES, AND GUIDANCE FOR CONTAMINANTS OF CONCERN FOR OU-3 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

	Surface Water		Sediment	
CHEMICAL OF CONCERN	**Water Quality Guideline (µg/l)**	**Source[1]**	**Sediment Quality Guideline (mg/kg)**	**Source[2]**
Organic Compounds:				
Acenapthalene	--	--	0.044	ER-L
Benzene	46	ET Tier II	0.057	SQB
Chlordane	0.0043	AWQC	0.005	ER-L
DDT (4,4'-)	0.001	AWQC	0.00158	ER-L
Di(2-ethylhexyl)phthalate (DEHP)	32	ET Tier II	--	--
Dibenzofuran	20	ET Tier II	2	SQB
Dichloroethylene, 1,2-trans	590	SCV	--	--
Dichloromethane (Methylene chloride)	2200	SCV	--	--
Dieldrin	0.056	AWQC	0.052	SQC
Dimethylphenol, 2,4-	---	--	--	--
Ethylbenzene	290	ET Tier II	3.6	SQC
Fluorene	3.9	ET Tier II	0.54	SQB
Methylnaphthalene, 2-	--	--	0.070	ER-L
Methylphenol, 4-	--	--	--	--
Monochlorobenzene	130	ET Tier II	0.82	SQB
Naphthalene	24	ET Tier II	0.160	ER-L
PAHs[(3)]	--	--	4.02	ER-L
Toluene	130	ET Tier II	0.67	SQB
Trichloroethane, 1,1,1-	62	ET Tier II	0.17	SQB
Trichloroethylene (TCE)	350	ET Tier II	1.6	SQB
Xylenes (total)	13	SCV	0.025 [4]	SQB
Inorganics:				
Arsenic	150 [5]	AWQC	8.2	ER-L
Lead	1.4 [5]	AWQC	46.7	ER-L

NOTES:

1 Current surface water quality guidelines are screened in the order presented:

1) EPA Ambient Water Quality Criteria (AWQC) (EPA, 2002)

2) EPA Ecotox Thresholds (ET) for Surface Water (EPA, 1996)

3) Secondary Chronic Values (SCVs) for aquatic biota developed by Oak Ridge National

TABLE A7-6. NUMERICAL CHEMICAL-SPECIFIC ARARS CRITERIA, ADVISORIES, AND GUIDANCE FOR CONTAMINANTS OF CONCERN FOR OU-3 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

Laboratory (Suter and Tsao, 1996)

2 Current sediment quality guidelines are screened in the order presented:

1) EPA Ecotox Thresholds for Sediment (EPA, 1996)

2) National Oceanic and Atmospheric Administration (NOAA) Effects Range –Low (ER-L) for sediments (Long & Morgan, 1990; Long *et al.* 1995; *respectively cited in* Jones, Suter & Hull, 1997)

3) Ontario Ministry of the Environmental Lowest Effects Levels (*cited in* Jones, Suter & Hull, 1997)

4) Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) for freshwater sediments (MacDonald, *et al.*, 1994). Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, Lowest Effect Level, August 1993. Ontario Ministry of Environment and Energy (Persaud, 1994).

3 Polycyclic Aromatic Hydrocarbons. Sediment quality guidelines are for total PAH; EPA ecotox thresholds are for phenanthrene only.

4 Sediment quality criteria for Xylenes is for m-Xylene

5 Hardness dependent

TABLE A7-7. POTENTIAL ACTION-SPECIFIC ARARs FOR OU-3
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	ROD REQUIREMENT SYNOPIS AND STATUS	ACTION TO BE TAKEN TO ATTAIN ARAR	FIVE-YEAR REVIEW
Federal Regulatory Requirements			
RCRA – Generator Standards (40 CFR 261, 265.170 – 265.174, 262.10 – 262.34)	If contaminated substances meet the definition of RCRA-hazardous under 40 CFR 261, RCRA requirements are applicable. If contaminated substances at CERCLA sites are determined to be sufficiently similar to RCRA hazardous wastes, technical aspects of RCRA requirements are considered relevant and appropriate. If removed from their existing location, hazardous substances should be handled, transported, and treated as RCRA hazardous waste. General generator requirements outline waste characterization, management of containers, packaging, labeling and manifesting. **ROD Status: Applicable** **5-Year Status: Not ARAR**	Treatment residuals from wastewater treatment will be disposed of according to RCRA. Waste containers will be handled and managed in accordance with RCRA.	These requirements were relevant and appropriate to the incinerator. Sediments have been remediated and may no longer be considered a hazardous material. These rules are no longer considered applicable, relevant or appropriate to OU-3.

TABLE A7-7. POTENTIAL ACTION-SPECIFIC ARARs FOR OU-3 BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	ROD REQUIREMENT SYNOPIS AND STATUS	ACTION TO BE TAKEN TO ATTAIN ARAR	FIVE-YEAR REVIEW
RCRA – Standards for Owners and Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10 – 264.18)	If a facility operated pursuant to RCRA regulations, RCRA requirements are applicable. If contaminated substances at CERCLA sites are determined to be sufficiently similar to RCRA hazardous wastes, technical aspects of RCRA requirements are considered relevant and appropriate. If removed from their existing location, hazardous substances should be handled, transported, and treated as RCRA hazardous waste. General generator requirements outline general waste analysis, security measures, inspections, and training requirements. **ROD Status: Applicable** **5-Year Status: Not ARAR**	All facilities on-site will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained. Process wastes will be evaluated for the characteristics of hazardous wastes to assess further requirements. Treatment residuals from wastewater treatment will be disposed of according to RCRA.	These requirements were relevant and appropriate to the incinerator. The incinerator has been dismantled. The groundwater treatment facility does not treat hazardous waste and does not meet the standards for being sufficiently similar to a hazardous waste treatment facility. These rules are no longer considered applicable, relevant or appropriate to OU-3.
RCRA Land Disposal Restrictions (40 CFR 268)	If contaminated substances that meet the definition of RCRA-hazardous, or are sufficiently similar to RCRA hazardous wastes, and are land disposed, RCRA LDR rules are ARAR. **ROD Status: Applicable** **5-Year Status: Not ARAR**	RCRA land disposal requirements, including treatment standards and landfill requirements, must be followed.	No materials meeting the definition of RCRA-hazardous under 40 CFR Part 261 were land disposed on site. These rules are not applicable or appropriate.

TABLE A7-7. POTENTIAL ACTION-SPECIFIC ARARs FOR OU-3
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	ROD REQUIREMENT SYNOPIS AND STATUS	ACTION TO BE TAKEN TO ATTAIN ARAR	FIVE-YEAR REVIEW
Clean Air Act (CAA) Regulations, NAAQs for Particulates (40 CFR 50)	Site remediation activities, including excavation and treatment, must comply with NAAQS. The most relevant pollutant standard at remedial response sites is for particulate matter. **ROD Status: ARAR** **5-Year Status: Not ARAR**	This regulation specifies maximum primary and secondary 24-hour concentrations for fugitive dust. Fugitive dust emissions from Site activities must be maintained below 260 $\mu g/m^3$ (primary standard) by dust suppressants if necessary.	These requirements were applicable to excavation and incineration activities, which are now complete. No further land disturbing activities are planned, thus these rules are no longer ARAR.
OSHA General Industry Standards, Recordkeeping and Reporting, and Standards for Hazardous Waste Site Operations 1926, 1904, 1910 (29 CFR)	These standards specify the type of safety equipment and other worker safety procedures to be followed during all remedial activities. **ROD Status: Applicable** **5-Year Status: Not ARAR**	Worker safety rules are to be adhered to an all workplace risks are to be communicated to employees.	OSHA requirements have been followed. EPA no longer considers OSHA rules ARAR as they are worker safety rules that must always be complied with.
State Regulatory Requirements			
Massachusetts Hazardous Waste Management Rules (MHWMR) (310 CMR 30.00)	Massachusetts is authorized by EPA to administer substantial portions of the federal RCRA program. If a facility operated pursuant to RCRA regulations, RCRA requirements are applicable. Similar to the RCRA regulations, these rules will be considered relevant and appropriate at CERCLA sites where the hazardous contaminants have been determined to be sufficiently similar to the designated hazardous wastes, and proposed remedial actions are similar to hazardous waste treatment, storage, and/or disposal. **ROD Status: Applicable** **5-Year Status: Relevant and Appropriate**	Because these regulations supplement RCRA hazardous waste regulations, they must also be considered at the Site.	These requirements are relevant and appropriate to operations at the groundwater treatment facility. Although the GWTP does not treat RCRA-designated hazardous waste, it does generate a treatment residual that may, at times, meet the definition of an RCRA hazardous waste. Generator requirements are therefore being complied with at the facility.

TABLE A7-7. POTENTIAL ACTION-SPECIFIC ARARs FOR OU-3
BAIRD & MCGUIRE SITE, HOLBROOK, MASSACHUSETTS

ARAR	ROD REQUIREMENT SYNOPIS AND STATUS	ACTION TO BE TAKEN TO ATTAIN ARAR	FIVE-YEAR REVIEW
Massachusetts Contingency Plan (MCP) (310 CMR 40.0000)	The MCP establishes requirements and procedures for the discovery, notification, assessment of, and response to, releases and threats of release of oil or hazardous materials. Pursuant to MCL c. 21E and the MCP, the Commonwealth of Massachusetts publishes a list of confirmed oil or hazardous material to be investigated. Because the Baird & McGuire Site is a confirmed state hazardous material Site and listed on the National Priorities List, joint federal and state jurisdiction exists. Cooperative agreements and contracts with the federal government shall incorporate, to the extent possible, the deadlines and specifications of MGL c21E and the MCP. **ROD Status: Applicable** **5-Year Status: Not ARAR**	The revised MCP sets applicable standards in soil. The MCP method 1 soil standards consider both the potential risk of harm resulting from direct exposure to the contaminated soil and potential impacts at the Site via leaching. On-site soils are classified according to the frequency and intensity to which human contact may occur.	The MCP includes a specific reference to remediation at CERCLA sites (40.0111) where it is stated that the MCP does not apply to sites adequately regulated under CERCLA, provided that DEP concurs with the ROD and that CERCLA addresses all contaminants. DEP concurred with the ROD for this site, therefore, these rules are no longer considered ARARs.
Massachusetts Air Pollution Control Regulations (310 CMR 6.00 through 8.00)	These regulations outline the standards and requirements for air pollution control in Massachusetts. Specific regulations generally considered ARARs at CERCLA sites include the particulate matter standard (for excavation and treatment activities), and plan approval and emission limitations (for treatment activities, such as incineration, generating pollutant emissions). **ROD Status: Applicable** **5-Year Status: Not ARAR**	310 CMR 6.00 provide ambient air quality standards for the Commonwealth. 310 CMR 7.09 provides dust standards and 310 CMR 7.08 provides incinerator standards for establishing discharge limits.	These requirements were applicable to the excavation and incineration of debris. These activities are completed, and no further land disturbing activities are planned. There are no air emission sources on site. These rules are no longer ARAR.

ATTACHMENT 8
INTERVIEW RECORDS AND SITE INSPECTION CHECKLIST

INTERVIEW RECORD

Site Name: Baird & McGuire	**EPA ID No.:** MAD001041987	
Subject: Groundwater treatment (OU-1)	**Time:** 0800	**Date:** 9/14/04
Type: ☐ Telephone X Visit ☐ Other **Location of Visit:** Site	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Neil Thurber	**Title: Project Engineer**	**Organization: M&E**

Individual Contacted:

Name: Jack Connolly	**Title: former Site Manager**	**Organization: USACE**

Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**

Summary Of Conversation

Is the remedy functioning as expected? How well is the remedy performing?

The remedy (OU-1) is functioning as expected. The performance of the treatment plant is good. There have been several recent improvements. [see below]

1. What does the monitoring data show? Are there any data trends that appear unusual? What is the current monitoring program for the GWTF, LNAPL collection, wells?

The data indicates that the GWTF meets the goals established in the ROD.

2. Please describe the O&M staff and activities, including frequency of site inspections and O&M activities.

The staff operates and maintains the GWTF, including daily routine maintenance. Reports of O&M activities have been historically prepared on a monthly basis up to June 2004.

3. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? Please describe changes and impacts.

Significant changes include the reduction in the frequency of sampling within the GWTF. Less samples are now collected and the former on-site lab is no longer in operation, decreasing costs associated with laboratory analyses.

4. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No. Typical O&M activities have been implemented. The costs of O&M have been roughly the same each year, with a slight increase in year 5 in order to make final improvements (new SCADA, new tanks) prior to State lead operations.

5. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

There have been several improvements intiated by the USACE including: additonal extraction wells, changes to metals removal system, replacement of tanks, and new SCADA system.

There have also been tests at the GWTF to look at other possible improvements. The most recent pilot test (2003) resulted in a change in polymer addition. It also indicated that organics are being removed from the groundwater without the need for a separate aeration step. It was also hypothesized that biofouling was effecting the filtration steps, although there were no improvements noticed with the addition of a biocide. Additional studies regarding the post-metals removal filtration step may be warranted.

6. Any security issues in the last five years?

No

7. Do you have any comments, suggestions, or recommendations regarding the project?

Recommendation made in previous studies should be further evaluated, such as reviewing the use of aerators in the biounits and looking into upgrades for the post-metals filter process.

INTERVIEW RECORD

Site Name: Baird & McGuire Superfund Site	**EPA ID No.:**MAD001041987	
Subject: Five Year Review	**Time:** 2:00 PM Follow-up 9:00 AM	**Date:**9/14/04 9/15/04
Type: ☒ Telephone ☐ Visit ☒ Other **Location of Visit:** Ms. Allen provided input by email on September 7, 2004. Follow-up clarification phone calls were made on September 14 and 15, 2004.	☐ Incoming ☐ Outgoing	

Contact Made By:

Name: Cinthia McLane/Neil Thurber	**Title: Metcalf & Eddy Project Manager/Project Engineer**	**Organization: Metcalf & Eddy**

Individual Contacted:

Name: Dorothy Allen	**Title: Project Manager**	**Organization: MADEP, Bureau of Waste Site Cleanup**
Telephone No: (617) 292-5785 **Fax No: 617-292-5530** **E-Mail Address: dorothy.t.allen@state.ma.us**	**Street Address:** **One Winter Street** **City, State, Zip: Boston, MA 02108**	

Summary Of Conversation

There have been no changes in State regulations that would impact remedy protectiveness.

There have been no permits issued at the site. The O&M contractor has been complying with waste disposal reporting requirements.

The site has been successfully turned over for O&M to the State, which is currently providing O&M via the use of a state support contractor. The State will be modifying the treatment operation and maintenance to further optimize the remedy and the treatment system. Optimization may include an energy assessment to check pump sizing, alternate energy sources, such as solar panels, use of heat pumps to heat the groundwater to improve stripping efficiency. Ms. Allen would like to look at alternatives to the existing granular activated carbon system for removal of naphthalene. She expressed concern that the system is not being used as designed, with the carbon being replaced based on headloss rather than breakthrough.

Modifications to the existing LNAPL system will also be examined, including whether putting the aqueous phase back into the wells to be collected by downgradient extraction wells is the best way to operate.

There have been no complaints, violations or incidents related to the site that required a state response.

The state is becoming more aware of issues and problems at the site than it was previously.

The remedy is removing VOCs and arsenic from groundwater. Arsenic groundwater concentrations, however, are remaining the same. This is unexpected.

Well monitoring data show that VOC plume is decreasing but not the arsenic plume. This is unusual. The monitoring plan for the plant is to assure compliance with effluent discharge limits and allow for sludge disposal. LNAPL thickness is measured monthly along with well groundwater elevations. Groundwater contaminant concentrations are measured annually.

There is a need at the site to investigation the potential arsenic mobilization as well as further plant and remedy optimization. Strategy for monitoring of wells and pumping rates needs to be developed.

The State will further refine the monitoring strategy at the site. Possible modifications to the groundwater monitoring program include eliminating wells that have had nothing in them for a number of years, eliminating all metals except arsenic, and eliminating monitored natural attenuation parameters until LNAPL has been removed.

Ms. Allen indicated that the state has no plans to sample Cochato River sediments or fish, as this is not part of Operable Unit 1. She said that the MADEP has only assumed responsibility for groundwater treatment, not the other operable units.

There have been no institutional controls implemented with respect to this site. Access for remedy implementation has been obtained through Access Agreements with property owners.

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Baird & McGuire Superfund Site	**Date of inspection:** September 14, 2004
Location and Region: Holbrook, MA/Region I	**EPA ID:** MAD001041987
Agency, office, or company leading the five-year review: USEPA Region I	**Weather/temperature:** Clear, sunny, 70° F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- X Access controls
- X Institutional controls
- X Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other__________
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Jason Bierly - Project Manager (Clean Harbors Incorporated)
   Name Title
   Interviewed X at site ☐ at office ☐ by phone Phone no. ________
   Problems, suggestions; ☐ Report attached - Mr. Bierly had recently been assigned the role of project manager for the O&M of the groundwater treatment facility (OU-1). In general, Mr. Bierly indicated that the facility is operating in good condition and that maintenance and improvements to the facility are being considered. Additional details are provided below.

2. **O&M staff** Maggie Delegorete - Chief Operator (CHI)
   Name Title
   Interviewed X at site ☐ at office ☐ by phone Phone no. ________
   Problems, suggestions; ☐ Report attached - Ms. Delegorete has been part of the GWTF operating team for several years. She indicated the plant is operational daily and that regular maintenance and inspections are required to maintain efficient operations. Many older system components may need upgrading in order to achieve the most efficient operating status.

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________________

Agency ______________________
Contact ______________________ ______________ ______ ________
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______________________

4. **Other interviews** (optional) X Report attached.

USACE - manager of O&M activities during period from September 1999 to June 2004. See interview form for Jack Connolly.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

X O&M manual	X Readily available	☐ Up to date	☐ N/A
X As-built drawings	X Readily available	☐ Up to date	☐ N/A
X Maintenance logs	X Readily available	☐ Up to date	☐ N/A

Remarks - All documents are available at the site and with the project manager at his office in Braintree. The O&M manual consists of several components due to its size and the complexities of the facility. CHI is currently working to revise the O&M plan.

2.

Site-Specific Health and Safety Plan	X Readily available	X Up to date	☐ N/A
☐ Contingency plan/emergency response plan	X Readily available	X Up to date	☐ N/A

Remarks____________________

3. **O&M and OSHA Training Records** X Readily available X Up to date ☐ N/A

Remarks____________________

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	X N/A
☐ Effluent discharge	☐ Readily available	☐ Up to date	X N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	X N/A
☐ Other permits________	☐ Readily available	☐ Up to date	X N/A

Remarks____________________

5. **Gas Generation Records** ☐ Readily available ☐ Up to date X N/A

Remarks____________________

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date X N/A

Remarks____________________

7. **Groundwater Monitoring Records** X Readily available X Up to date ☐ N/A

Remarks - groundwater monitoring reports are completed yearly.

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date X N/A

Remarks____________________

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	X N/A
☐ Water (effluent)	☐ Readily available	☐ Up to date	X N/A

Remarks____________________

10. **Daily Access/Security Logs** X Readily available X Up to date ☐ N/A

Remarks____________________

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house | X Contractor for State
☐ PRP in-house | ☐ Contractor for PRP
☐ Federal Facility in-house | ☐ Contractor for Federal Facility

☐ Other - It should be noted that an EPA/USACE contractor has operated the facility for the previous 4½ years; a State contractor has operated that facility for the previous 3 months.

2. **O&M Cost Records**

☐ Readily available X Up to date
X Funding mechanism/agreement in place
Original O&M cost estimate__________________ ☐ Breakdown attached

Total annual cost by year for review period if available

From__________ To__________ __________________ ☐ Breakdown attached
Date Date Total cost
From__________ To__________ __________________ ☐ Breakdown attached
Date Date Total cost
From__________ To__________ __________________ ☐ Breakdown attached
Date Date Total cost
From__________ To__________ __________________ ☐ Breakdown attached
Date Date Total cost
From__________ To__________ __________________ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: See interview form for USACE representative.

V. ACCESS AND INSTITUTIONAL CONTROLS X Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** X Location shown on site map X Gates secured ☐ N/A

Remarks - fencing is checked weekly and repaired as needed.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks - There are currently security personnel at the site 24 hours per day.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes X No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No X N/A

Type of monitoring (*e.g.*, self-reporting, drive by) Weekly check of fence; daily checks around the site by security personnel
Frequency ______
Responsible party/agency ______
Contact ______ (Name) ______ (Title) ______ (Date) ______ (Phone no.)

Reporting is up-to-date ☐ Yes ☐ No X N/A
Reports are verified by the lead agency ☐ Yes ☐ No X N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No X N/A
Violations have been reported ☐ Yes ☐ No X N/A
Other problems or suggestions: ☐ Report attached
Site access has been granted for the protection and use of all monitoring wells and extraction wells, with the exception of one property owner. The State is currently working on access to this property although this property does not have much of an impact on the remedy (one monitoring well).

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate X N/A
Remarks - See discussion in report text.

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map X No vandalism evident
Remarks ______

2. **Land use changes on site** X N/A
Remarks ______

3. **Land use changes off site** X N/A
Remarks ______

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable X N/A

1. **Roads damaged** ☐ Location shown on site map X Roads adequate ☐ N/A
Remarks ______

B. Other Site Conditions

Remarks - The site conditions are adequate for the operation and maintenance of the groundwater treatment facility and LNAPL recovery system. The site conditions also indicate that the protectiveness of the soil and sediment meet the requirements of the RODs.

VII. LANDFILL COVERS ☐ Applicable X N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths____________ Widths___________ Depths__________
   Remarks____
   ____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent______________ Depth____________
   Remarks____
   ____

5. **Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks____
   ____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
   Remarks____
   ____

7. **Bulges** ☐ Location shown on site map ☐ Bulges not evident
   Areal extent______________ Height____________
   Remarks____
   ____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent______________
   ☐ Ponding ☐ Location shown on site map Areal extent______________
   ☐ Seeps ☐ Location shown on site map Areal extent______________
   ☐ Soft subgrade ☐ Location shown on site map Areal extent______________
   Remarks____
   ____

9.	**Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability Areal extent______________ Remarks____ ____
B. Benches	☐ Applicable ☐ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)
1.	**Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
2.	**Bench Breached** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
3.	**Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay Remarks____ ____
C. Letdown Channels	☐ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)
1.	**Settlement** ☐ Location shown on site map ☐ No evidence of settlement Areal extent______________ Depth____________ Remarks____ ____
2.	**Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation Material type______________ Areal extent______________ Remarks____ ____
3.	**Erosion** ☐ Location shown on site map ☐ No evidence of erosion Areal extent______________ Depth____________ Remarks____ ____
4.	**Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting Areal extent______________ Depth____________ Remarks____ ____
5.	**Obstructions** Type_____________________ ☐ No obstructions ☐ Location shown on site map Areal extent______________ Size____________ Remarks____ ____

6.	**Excessive Vegetative Growth** Type___________ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent___________ Remarks___________
D. Cover Penetrations ☐ Applicable ☐ N/A	
1.	**Gas Vents** ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks___________
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks___________
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks___________
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks___________
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks___________

E. Gas Collection and Treatment ☐ Applicable ☐ N/A			
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks______________________________		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks______________________________		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks______________________________		
F. Cover Drainage Layer	☐ Applicable	☐ N/A	
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks______________________________		
2.	**Outlet Rock Inspected** ☐ Functioning ☐ N/A Remarks______________________________		
G. Detention/Sedimentation Ponds	☐ Applicable	☐ N/A	
1.	**Siltation** Areal extent______________ Depth____________ ☐ N/A ☐ Siltation not evident Remarks______________________________		
2.	**Erosion** Areal extent______________ Depth____________ ☐ Erosion not evident Remarks______________________________		
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks______________________________		
4.	**Dam** ☐ Functioning ☐ N/A Remarks______________________________		

H. Retaining Walls ☐ Applicable ☐ N/A	
1.	**Deformations** ☐ Location shown on site map ☐ Deformation not evident Horizontal displacement________ Vertical displacement________ Rotational displacement________ Remarks________
2.	**Degradation** ☐ Location shown on site map ☐ Degradation not evident Remarks________
I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A	
1.	**Siltation** ☐ Location shown on site map ☐ Siltation not evident Areal extent________ Depth________ Remarks________
2.	**Vegetative Growth** ☐ Location shown on site map ☐ N/A ☐ Vegetation does not impede flow Areal extent________ Type________ Remarks________
3.	**Erosion** ☐ Location shown on site map ☐ Erosion not evident Areal extent________ Depth________ Remarks________
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks________
VIII. VERTICAL BARRIER WALLS ☐ Applicable X N/A	
1.	**Settlement** ☐ Location shown on site map ☐ Settlement not evident Areal extent________ Depth________ Remarks________
2.	**Performance Monitoring** Type of monitoring________ ☐ Performance not monitored Frequency________ ☐ Evidence of breaching Head differential________ Remarks________

IX. GROUNDWATER/SURFACE WATER REMEDIES X Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines X Applicable ☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** X Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks - routine maintenance is required for several components.
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** X Good condition ☐ Needs Maintenance Remarks - routine maintenance is required for several components.
3. **Spare Parts and Equipment** X Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable X N/A
1. **Collection Structures, Pumps, and Electrical** ☐ Good condition ☐ Needs Maintenance Remarks
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks
3. **Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks

C. Treatment System X Applicable ☐ N/A	
1.	**Treatment Train** (Check components that apply) X Metals removal X Oil/water separation ☐ Bioremediation ☐ Air stripping X Carbon adsorbers X Filters - sand filters X Additive (*e.g.*, chelation agent, flocculent) - potassium permanganate and polymer ☐ Others ______ X Good condition ☐ Needs Maintenance X Sampling ports properly marked and functional X Sampling/maintenance log displayed and up to date X Equipment properly identified X Quantity of groundwater treated annually - about 130 gpm; or 68MG per year ☐ Quantity of surface water treated annually ______ Remarks - upgrades to the pressure (sand) filters may be required to enhance their efficiency. Channeling has been observed according to the operators. A small leak was noted at the carbon filter (GAC A) that may require repair in the near future.
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A X Good condition ☐ Needs Maintenance Remarks ______
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A X Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks ______
4.	**Discharge Structure and Appurtenances** ☐ N/A X Good condition ☐ Needs Maintenance Remarks ______
5.	**Treatment Building(s)** ☐ N/A X Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks ______
6.	**Monitoring Wells** (pump and treatment remedy) X Properly secured/locked ☐ Functioning X Routinely sampled X Good condition ☐ All required wells located ☐ Needs Maintenance ☐ N/A Remarks - the pumps in several extraction wells may need replacement according to the operators.
D. Monitoring Data	
1.	Monitoring Data X Is routinely submitted on time ☐ Is of acceptable quality
2.	Monitoring data suggests: X Groundwater plume is effectively contained X Contaminant concentrations are declining (with the exception of arsenic - see report text)

D. Monitored Natural Attenuation				
1. **Monitoring Wells** (natural attenuation remedy)				
☐ Properly secured/locked	☐ Functioning	☐ Routinely sampled	☐ Good condition	
☐ All required wells located	☐ Needs Maintenance		☐ N/A	
Remarks: The state currently does not have an MNA plan in place.				

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy for OU-1 (groundwater) appears effective in treating groundwater and containing the plume. As reported by the O&M team, decreasing trends for many contaminants are evident

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The current protectiveness for OU-1 appears in tact due to the continual operation of the GWTF. Long-term protectiveness will be met with the operation of the GWTF. Additional data is needed to determine when the GWTF can be taken off-line. For instance, there appears to be a very slow extraction rate of LNAPL. Arsenic in the groundwater does not appear the be decreasing. The State currently does not have MNA, sediment, and fish tissue monitoring plan in place. It is recommended that a schedule be submitted for implementation of these requirements.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. There are several needs for routine maintenance within the GWTF; however, the remedy's protectiveness (OU-1) is being met. There have been no unexpected significant changes in cost or scope. According to the O&M team, there appears to be an unexpected high frequency of carbon change out (carbon filters). The current operating company is evaluating solutions to this.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Several opportunities to optimize the GWTF have been implemented during the transition from Federal lead to State lead operations. A new SCADA system has been implemented for improved monitoring and automation of the plant. In addition, the staffing has been reduced from 24 hours per day to 10 hours per day. New alarms and autodialers with the SCADA system allow for less manned operations. Additional oppotunities to optimize the plant are being reviewed by the current O&M team. These include using less aeration, improving groundwater extraction wells, and improving LNAPL extraction, and upgrading the $KMnO4$ feed system.