Superfund Records Center
SITE: Nyanza
BREAK: 08.03
OTHER: 555316

Five-Year Review Report

Fifth Five-Year Review
for
Nyanza Chemical Waste Dump Superfund Site
Ashland, Massachusetts

April 2014

Prepared by:

The United States Environmental Protection Agency
Region 1, New England
Boston, Massachusetts

EPA
New England

5/13/14

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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BERA	Baseline Ecological Risk Assessment
CBR	Critical Body Residue
CCC	Criteria Continuous Concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cm	centimeters
CMC	Criteria Maximum Concentrations
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CSF	Cancer Slope Factor
DNAPL	Dense Non-Aqueous Phase Liquid
Eco-SSLs	Ecological Site Screening Levels
EPA	Environmental Protection Agency
EPC	Exposure Point Concentrations
ERM	Effect Range-Median
ESD	Explanation of Significant Differences
FS	Feasibility Study
g/day	grams per day
HHEM	Human Health Evaluation Manual
HHRA	Human Health Risk Assessment
IC	Institutional Controls
IRIS	Integrated Risks Information System
in. WC	Inches of Water Column
LEL	Lowest Effect Level
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
Mg/Kg	milligrams per kilogram

ACRONYMS (cont.)

M&MM	Monitoring and Maintenance Manual
MNR	Monitored Natural Restoration
NOAA	National Ocean and Atmospheric Administration
Nobis	Nobis Engineering, Inc.
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
O&M	Operations and Maintenance
OEME	Office of Environmental Measurement and Evaluation
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated Biphenyl
PEC	Probable Effect Concentration
PPA	Potentially Productive Aquifer
PPE	Personal Protective Equipment
PRP	Potentially Responsible Party
PPRTV	Provisional Peer Reviewed Toxicity Value
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAGs	Risk Assessment Guide for Superfund
RAOs	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RBCs	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RSLs	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act
SBERA	Supplemental Baseline Ecological Risk Assessment

ACRONYMS (cont.)

Shaw	Shaw Environmental, Inc.
Site	Nyanza Chemical Waste Dump Superfund Site
SOP	Standard Operating Procedure
SQV	Sediment Quality Value
STSC	Superfund Health Risk Technical Support Center
SVOC	semi-volatile organic compound
TAL	target analyte list
TBC	To be considered
TCE	Trichloroethene
TEC	Threshold Effect Concentration
TL	Total Length
TLV	Threshold Limit Values
µg/m3	micrograms per meter cubed
µg/Kg	micrograms per kilogram
USACE	United States Army Corps of Engineers
USFWS	United States Fish & Wildlife Service
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
VMS	Vapor Mitigation System
WAC	Worcester Air Conditioning
WOE	Weight of Evidence

EXECUTIVE SUMMARY

This is the fifth Five-Year Review for the Nyanza Chemical Waste Dump Superfund Site (Nyanza or Site) located in Ashland, Massachusetts. The review was conducted in accordance with the United States Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Guidance No. 9355.7-03B-P. This is a *statutory* Five-Year Review because:

- The March 30, 1993 Record of Decision (ROD) for the Site was signed after the Superfund Amendments and Reauthorization Act (SARA) became effective on October 17, 1986; and
- As required in the March 30, 1993 ROD, hazardous substances remain at the Site above levels that allow for unlimited use and unrestricted exposure.

At Nyanza, five-year reviews have been completed as follows:

- First Five-Year Review Report – November 10, 1993
- Second Five-Year Review Report – August 17, 1999
- Third Five-Year Review Report – April 12, 2004
- Third Five-Year Review Report Addendum – November 1, 2006
- Fourth Five-Year Review Report – May 13, 2009
- Fourth Five-Year Review Report Addendum – September 29, 2011

EPA divided the cleanup activities into four Operable Units (OUs). OU1 is the former Nyanza Inc. property and several adjacent upland and wetland areas where soils and sludges were contaminated with heavy metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). OU2 consists of a groundwater plume of organic contamination that extends from the former Nyanza Inc. property in a north/northeasterly direction toward the Sudbury River. OU3 includes the Eastern Wetland, Trolley Brook, Chemical Brook and Outfall Creek/Lower Raceway. These drainageways are located between the former Nyanza Inc. property and the Sudbury River. OU4 includes a 26-mile stretch of the Sudbury River where sediment and fish are contaminated with mercury.

EPA completed OU1 Remedial Action (RA) activities on September 25, 1992 and OU3 RA activities on May 30, 2002. RAs at OU2 and OU4 have not been completed. RA activities are

ongoing for OU2 and remedial design activities are ongoing for OU4. In accordance with Section 104(c)(3)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Massachusetts Department of Environmental Protection (MassDEP) is responsible for Operation and Maintenance (O&M) activities of all RAs.

Following the completion of the 2004 Five-Year Review, EPA further evaluated concerns of vapor mitigation into homes and businesses located above the contaminated groundwater plume. Additional indoor air assessments were performed, and an inhalation risk assessment was completed in October 2005. The risk assessment concluded that a potentially unacceptable risk from continued long-term inhalation of trichloroethene (TCE) vapors existed. These results prompted EPA to issue an Explanation of Significant Differences (ESD) for OU2 in September 2006. The ESD for OU2 describes both the installation of vapor mitigation systems (VMS) and source extraction of dense non-aqueous phase liquid (DNAPL). The installation of VMS was completed at 41 properties between May and October 2007. The MassDEP is responsible for the O&M activities associated with the VMS. In addition, two well head treatment systems were installed in 2013 and, as of the preparation of this FYR, continue to operate.

A Record of Decision (ROD) was issued for OU4 in September 2010. Since the ROD was signed, the US Army Corps of Engineers (USACE) and the EPA have developed the Remedial Action Work Plan (RAWP) (April 2013) for the implementation of the selected remedy, thin-layer sand capping. EPA has also made presentations to the public to communicate information about the implementation of the selected remedy and the ecological considerations related to the capping (December 2012).

Exposure assumptions, toxicity data, cleanup levels, and remedial action objectives were reviewed to determine if the selected remedies are still protective. Some of the exposure assumptions and toxicity data have changed since the time of the remedy selection for OU1, OU2, and OU3. Because the selected remedies reduce human exposures through elimination of pathways, these changes do not impact the protectiveness of the selected remedy. Exposure assumptions and toxicity data used during the remedy selection for OU4 are still valid.

Protectiveness statements for OU1, OU2, and OU3 are included in this Five-Year Review. The remedy for OU4 was not evaluated in this review because the remedial action has not been

implemented. The next Five-Year Review will be conducted in 2019, and is due five years from the date that this Five-Year Review is approved.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Nyanza Chemical Waste Dump		
EPA ID: MAD990685422		
Region: 1	**State:** MA	**City/County:** Ashland/Middlesex County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**		
Author name (Federal or State Project Manager): Daniel Keefe		
Author affiliation: U.S. EPA Region I		
Review period: 9/27/13 – 5/30/14		
Date of site inspection: 11/19/13		
Type of review: Statutory		
Review number: 5		
Triggering action date: May 13, 2009		
Due date *(five years after triggering action date)*: May 13, 2014		

ISSUES AND RECOMMENDATIONS IDENTIFIED IN THE FIVE-YEAR REVIEW:				
OU01	**Issue Category: No Issue**			
	Issue: No issues were identified for this OU.			
	Recommendation: No recommendations were identified for this OU.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	None	None	None
OU02	**Issue Category: Institutional Controls**			
	Issue: Institutional controls mandated by the ESD for OU2 not yet fully implemented			
	Recommendation: Work with Town officials to establish zoning ordinance to prevent consumption of contaminated groundwater and inhalation of vapors at outlying portions of the Town.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA/MassDEP	September 2016
OU03	**Issue Category: No Issue**			
	Issue: No issues were identified for this OU			
	Recommendation: No recommendations were identified for this OU.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	None	None	None

Protectiveness Statement(s)		
Operable Unit: 01	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy for OU1 is protective of human health and the environment. The landfill cap is the predominant element of the OU1 remedy. It is functioning as designed and, other than minor fence repairs, nothing was noted or observed that would reduce or diminish its effectiveness. The MassDEP performs routine O&M.		
Operable Unit: 02	*Protectiveness Determination:* Short-term Protective	*Addendum Due Date (if applicable):*
The remedy for OU2 currently protects human health and the environment because the DNAPL recovery system is operating as designed. In addition, the Vapor Mitigation Systems in structures overlying the dissolved-phase plume are functioning and are inspected regularly by MassDEP. However, in order for the remedy to be protective in the long term, the remaining institutional controls need to be implemented.		

Protectiveness Statement(s)		
Operable Unit: 03	*Protectiveness Determination:* Protective	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy for OU3 is protective of human health and the environment. Contaminated sediments from the Eastern Wetland (and downstream channels) were excavated and disposed within the limits of the on-site landfill (OU1). The wetland has been successfully restored. Meandering inspections of the wetland occur semi-annually by MassDEP in association with the OU1 (Landfill) inspections.		
Operable Unit: 04	*Protectiveness Determination:* Not Applicable	*Addendum Due Date (if applicable):*
Protectiveness Statement: The remedy for OU4 was not evaluated in this review because the remedial action has not been implemented.		

1.0 INTRODUCTION

The purpose of this Five-Year Review is to determine if the remedy selected for the Nyanza Chemical Waste Dump Superfund Site in Ashland, Massachusetts continues to be protective of human health and the environment. This report summarizes the Five-Year Review processes, investigations, and remedial actions undertaken at the Site; evaluates the monitoring data collected; reviews, as appropriate, the Applicable or Relevant and Appropriate Requirements (ARARs) specified in the Record of Decision (ROD) for changes; discusses any issues identified during the review; and presents recommendations to address those issues.

The United States Environmental Protection Agency, Region 1 (EPA) prepared this statutory Five-Year Review consistent with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) §121 and the National Contingency Plan. CERCLA §121 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 judgment 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 EPA interpreted this requirement further in the National Contingency Plan; 40 Code of Federal Regulations (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."

EPA conducted this Five-Year Review of the remedial actions implemented at the Site. Nobis Engineering, Inc. (Nobis) supported EPA in completion of the review under EPA Contract No. EP-S1-06-03. Work on this review was undertaken between September 2013 and April 2014.

This is the fifth Five-Year Review for the Site. Once an initial five-year review is complete, the triggering mechanism for subsequent five-year reviews is the completion date of the immediately preceding five-year review. At Nyanza, five-year reviews and two addenda have been completed as follows:

- First Five-Year Review Report – November 10, 1993
- Second Five-Year Review Report – August 17, 1999
- Third Five-Year Review Report – April 12, 2004
- Third Five-Year Review Report Addendum – November 1, 2006
- Fourth Five-Year Review Report – May 13, 2009
- Fourth Five-Year Review Report Addendum – September 29, 2011

The target completion date for this fifth five-year review is May 13, 2014.

Due to the large and complex nature of the contamination at the Site, EPA divided the cleanup activities into four Operable Units (OUs). OU1 is the former Nyanza Inc. property and several adjacent upland and wetland areas where soils and sludges were contaminated with heavy metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). OU2 consists of a groundwater plume of organic contamination that extends from the former Nyanza Inc. property in a north/northeasterly direction toward the Sudbury River. OU3 includes the Eastern Wetland, Trolley Brook, Chemical Brook and Outfall Creek/Lower Raceway. These drainageways are located between the former Nyanza Inc. property and the Sudbury River, and are referred to as the Continuing Source Areas because they previously acted as continuing sources of mercury contamination to the Sudbury River. OU4 includes a 26-mile stretch of the Sudbury River where sediment and fish are contaminated with mercury.

EPA completed OU1 Remedial Action (RA) activities on September 25, 1992 and OU3 RA activities on May 30, 2002. RAs at OU2 and OU4 are not yet complete. RA activities are ongoing at OU2. With regard to OU4, the Remedial Design is completed and this project is awaiting construction funding. In accordance with Section 104(c)(3)(A) of CERCLA, the Massachusetts

Department of Environmental Protection (MassDEP) is responsible for Operation and Maintenance (O&M) activities of all completed Nyanza RAs at this point in time.

2.0 SITE CHRONOLOGY

Table 2-1
Chronology of Site Events
Nyanza Chemical Waste Dump Superfund Site
Ashland, Massachusetts

Event	Date
Initial discovery of contamination in the Sudbury River.	01/01/70
Site listed on the National Priorities List (NPL)	09/08/83
OU1 Record of Decision (ROD) signed	09/04/85
OU1 Remedial Investigation/Feasibility Study (RI/FS) completed	09/04/85
Removal Action completed	4/30/87
OU1 MassDEP Operation and Maintenance (O&M) Plan finalized	11/87
OU1 Remedial Design (RD) completed	12/11/87
Removal Action completed	06/10/88
Removal Action completed	02/10/89
Removal Action completed	04/21/89
OU1 Remedial Action (RA) construction commenced	01/01/89
Removal Action completed	05/07/90
OU2 Interim ROD signed	09/23/91
OU2 RI/FS completed	09/23/91
Removal Action completed	06/18/92
OU1 Explanation of Significant Differences (ESD) issued	09/21/92
OU1 RA report completed	09/25/92
OU3 ROD signed	03/30/93
OU3 RI/FS completed	03/30/93
First Five-Year Review completed	11/10/93
OU2 Treatability Study completed	10/31/96
OU3 RD completed	09/28/98
OU3 RA construction commenced	03/18/99
Second Five-Year Review completed	08/17/99
OU3 RA construction completed	08/01
OU3 RA report completed	05/30/02
OU1 and OU3 O&M Plan finalized	04/03
Third Five-Year Review completed	04/12/04
Ashland Nyanza Health Study – Final Report – MA Dept. of Public Health	04/06
OU4 Final Human Health Risk Assessment issued	05/06
OU2 Explanation of Significant Differences issued	09/28/06
Addendum to Third Five-Year Review issued	11/01/06
OU2 Final Report, Residential Indoor Air Study, November 2006 issues	03/12/07
OU4 Draft Supplemental Baseline Ecological Risk Assessment issued	04/07
OU2 Commencement of construction of Vapor Mitigation Systems (VMS)	05/21/07
OU2 Final VMS installed	09/28/07

Event	Date
OU2 RA Report for VMS completed	06/30/08
OU2 Monitoring and Maintenance Manual Package for VMS issued	08/08
MassDEP begins O&M of the VMS	12/08
OU4 Final Supplemental Baseline Ecological Risk Assessment issued	12/19/08
Fourth Five-Year Review completed	05/09
OU4 ROD Signed	09/30/10
Addendum to Fourth Five-Year Review issued	09/29/11
OU4 Remedial Action Work Plan issued	04/03/13
OU2 DNAPL Extraction Wells installed	09/13
Fifth Five-Year Review completed	05/14

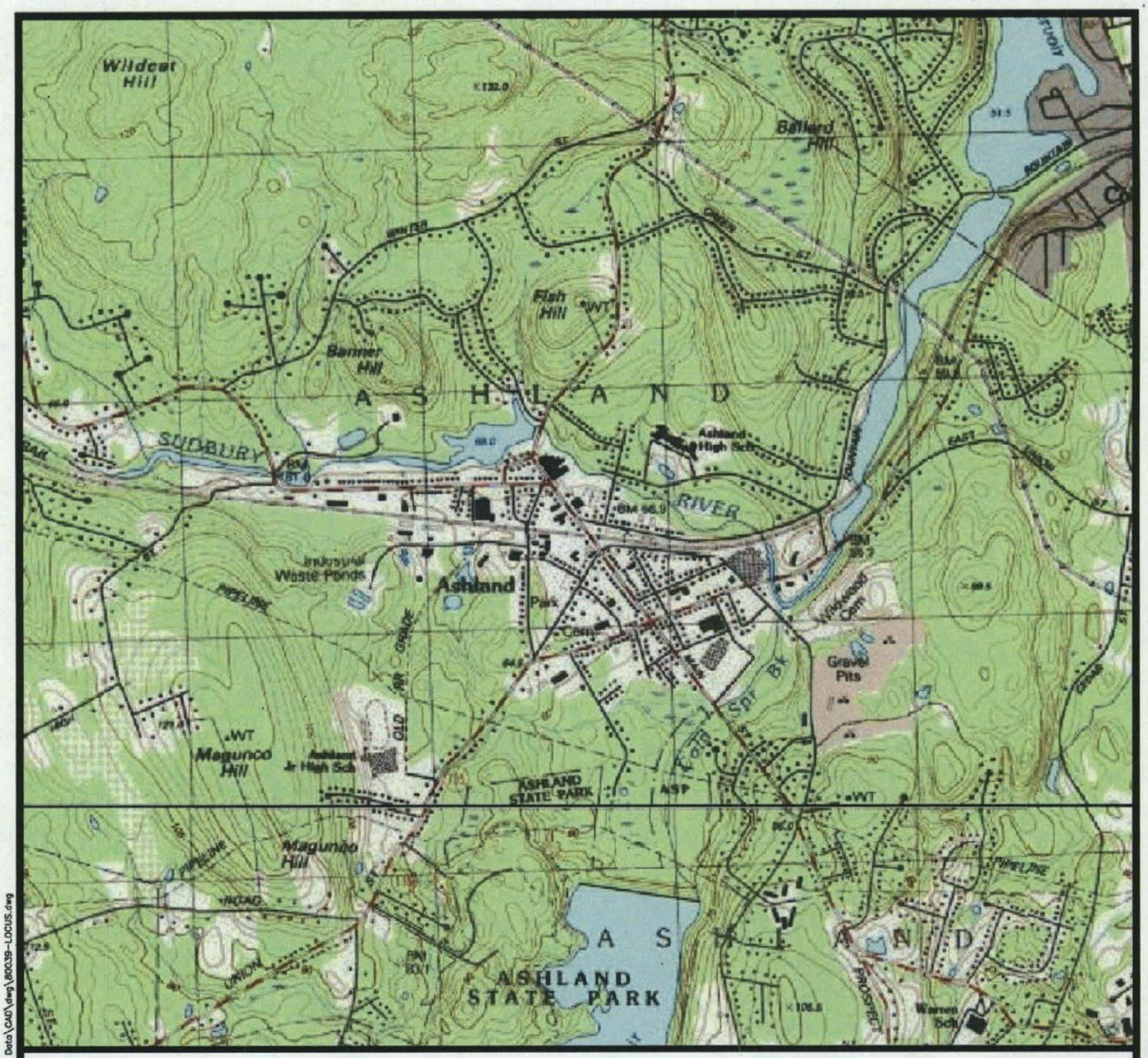
3.0 BACKGROUND

This section contains information pertaining to the Site's physical characteristics, current and prior land use at the property, as well as waste identification and characterization information. This information has been obtained through a review of historical information, previous investigations, zoning and flood maps, and a Site visit.

3.1 Physical Characteristics

The Site is located in the Town of Ashland, Middlesex County, Massachusetts. Ashland is located 25 miles west-southwest of Boston, and 20 miles east-southeast of Worcester. Refer to Figure 1 for a Site Locus Plan. The Site comprises three distinct areas: the 35-acre former Nyanza, Inc. property which currently consists of wetlands, the Megunko Hill area, and an industrial park along Megunko Road; drainageways between the former Nyanza Inc. property and the Sudbury River, consisting of the Eastern Wetland, Trolley Brook, and Outfall Creak/Lower Raceway; and a 26-mile stretch of the Sudbury River down to its confluence with the Assabet River in Concord, Massachusetts.

The primary Site owner currently leases the old plant grounds to various businesses. Approximately 10,000 people live within 3 miles of the Site.



NORTH

USGS TOPOGRAPHIC MAP

FRAMINGHAM, MASSACHUSETTS

1987

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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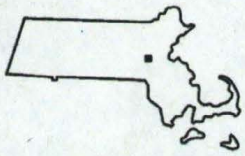


QUADRANGLE LOCATION

FIGURE 1

LOCUS PLAN
NYANZA CHEMICAL WASTE DUMP
SUPERFUND SITE
ASHLAND, MASSACHUSETTS

PROJECT: 80039.06

MARCH 2009

J:\80000 EPA RAC2 Region 1\80000 Task Orders\80039 Nyanza FYR\Technical Data\CAD\dwg\80039-LOCUS.dwg

3.2 Land and Resource Use

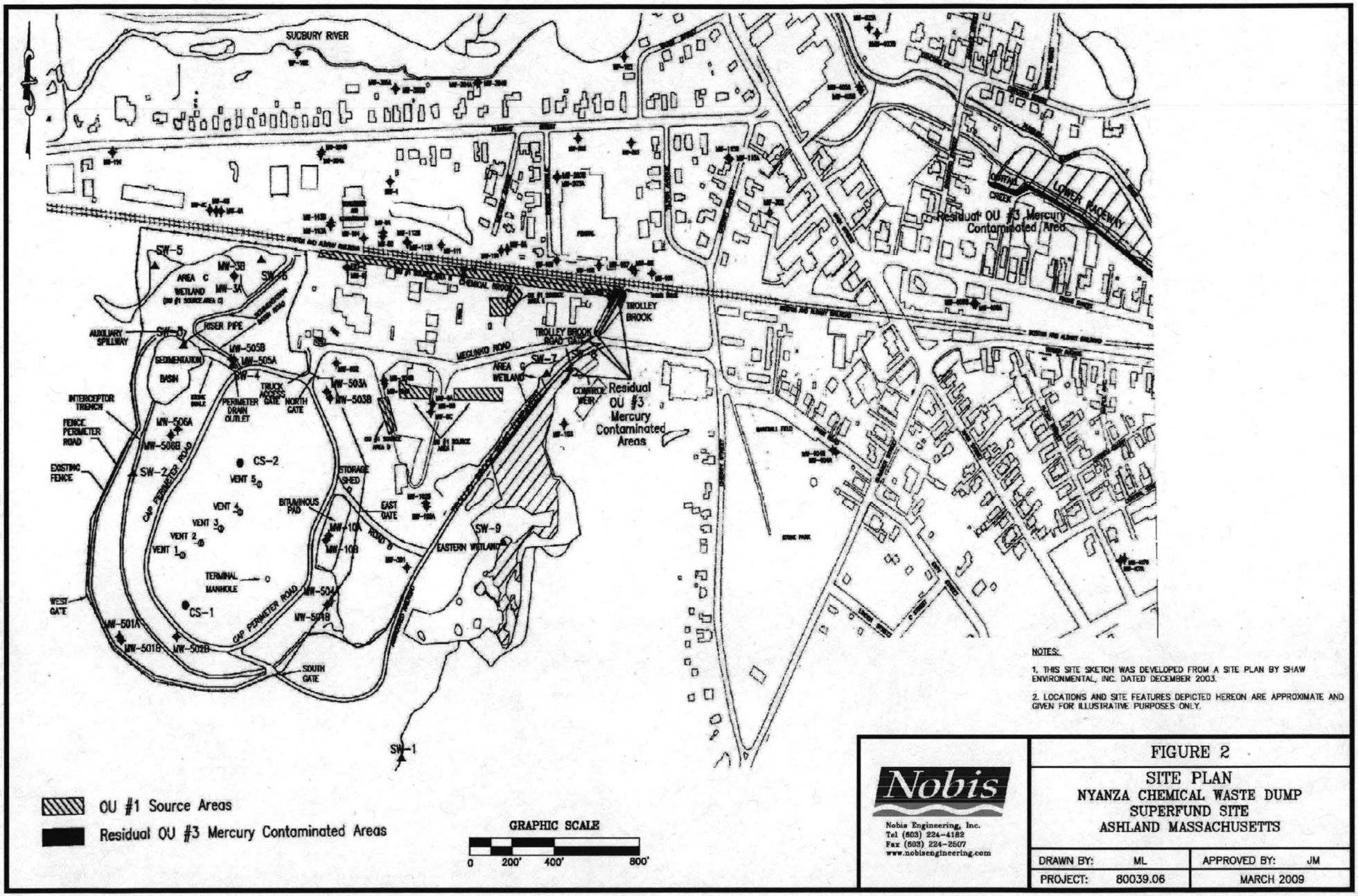
From 1917 to 1978, several companies occupied the Site and manufactured textile dyes and dye intermediates, inorganic colloidal solids, and acrylic polymers. Nyanza, Inc. was the most recent dye manufacturing company to occupy the Site. It operated at the Site from 1965 until 1978. The former plant grounds are currently occupied by several industrial businesses, the largest of which is Nyacol Nano Technologies, Inc.

Starting in 1917, several types of chemical wastes were disposed of in various locations on the Site property with most of these wastes deposited on Megunko Hill, which was used as an unsecured landfill. Wastes included partially treated process wastewater, chemical sludge from the wastewater treatment process, solid process wastes (e.g., chemical precipitate and filter cakes) in drums, solvent recovery distillation residues in drums, and off-specification products. Process chemicals that could not be recycled or reused (including phenol, nitrobenzene, and mercuric sulfate) were also disposed on the Site property. Over 45,000 tons of chemical sludges generated by wastewater treatment processes, along with spent solvents and other chemical wastes, were buried or disposed on the property. The area that contained the largest amount of buried waste and exposed sludge was referred to as "the Hill section".

Chemical wastes were also disposed in the wetland areas. The Area G Wetland and Eastern Wetland received waste effluent discharge from various manufacturing operations. The portion of the Area C Wetland at the headwaters of Chemical Brook contained wastewater treatment sludge and possibly received overflow from an underground concrete wastewater vault that discharged into Chemical Brook (see Figure 2).

3.3 History of Contamination

Nyanza, Inc. and its predecessors originally discharged the dye waste stream to a concrete vault (or settling structure) adjacent to the main process building. The vault was used as a central sump for the collection of wastewater from the entire Nyanza, Inc. operation, as well as from other waste-generating tenants housed nearby. This vault measured approximately 40 x 80 feet and was approximately 10 feet deep. The liquid occasionally overflowed via a pipe into Chemical Brook, which flowed into Trolley Brook and underground through Chemical Brook Culvert into Outfall Creek, and then into the Raceway that entered the wetlands along the Sudbury River. The vault was taken out of service in the 1960s or 1970s, but continued to be a



NOTES:

1. THIS SITE SKETCH WAS DEVELOPED FROM A SITE PLAN BY SHAW ENVIRONMENTAL, INC. DATED DECEMBER 2003.

2. LOCATIONS AND SITE FEATURES DEPICTED HEREON ARE APPROXIMATE AND GIVEN FOR ILLUSTRATIVE PURPOSES ONLY.

Nobis

Nobis Engineering, Inc.
Tel (603) 224-4182
Fax (603) 224-2507
www.nobisengineering.com

FIGURE 2

SITE PLAN
NYANZA CHEMICAL WASTE DUMP
SUPERFUND SITE
ASHLAND MASSACHUSETTS

DRAWN BY:	ML	APPROVED BY:	JM
PROJECT:	80039.06	MARCH 2009	

source of groundwater contamination at the Site until its removal in 1988. Nyanza, Inc. connected to the Metropolitan District Commission sewer collection system in March 1970.

3.4 Initial Response

The following is a summary of the Pre-ROD Removal Actions performed at the Site:

- Removal Action completed on April 30, 1987 by a potentially responsible party (PRP) – one jar (approximately one gallon) of sodium picrate removed by Nyacol Products, Inc.;

- Removal Action completed on June 10, 1988 by EPA – approximately 12,025 tons of sludge were removed from an underground vault and placed into the landfill cell. The contaminants included, but were not limited to, trichloroethene (TCE), chlorobenzene, and nitrobenzene. Inorganic contaminants found in the sludge included heavy metals such as arsenic, cadmium, chromium, mercury, and lead. From October to December 1987, 665 tons of soil adjacent to the vault were removed (309 tons were incinerated and 356 tons were shipped off-site to an approved landfill). In 1988, 2,512 tons of sludge from the vault were solidified on-site and disposed of at an off-site Resource Conservation and Recovery Act (RCRA) landfill facility;

- A Removal Action was completed on February 10, 1989 by a PRP – one 10,000 gallon tank containing sulfuric acid sludge was removed by Edward Camille;

- A Removal Action under the name "Megunco Road" was completed on April 21, 1989 by EPA;

- A Removal Action referred to as Ashland Drum Removal was completed on May 07, 1990 by EPA; and

- A Removal Action was completed on June 18, 1992 by EPA – signs were posted along Sudbury River warning not to eat the fish. Signs were re-posted in 1998 and 2008.

3.5 Basis for Taking Action

The first type of contamination linked to the Site was mercury, first discovered in the Sudbury River in 1970, as part of an overall investigation of mercury problems in Massachusetts. Samples of fish from the river contained levels of methylmercury exceeding US Food and Drug Administration's standard of 1 milligram per kilogram (mg/Kg). A follow-up study in 1972, focusing on Nyanza, Inc., revealed mercury contamination in the Sudbury River was caused by uncontrolled sludge and wastewater disposal at the Nyanza property. The Site was included on the original National Priorities List (NPL) of Superfund Sites in 1981 and was finalized on the NPL in 1983.

The groundwater, soil, sediments, and surface water on and adjacent to the Site were contaminated with heavy metals and chlorinated organics. The groundwater and soil were also contaminated with spent solvents and chemical wastes. Health threats included direct contact with or accidental ingestion of contaminated groundwater or soil. Nearby wetlands and fish in the Sudbury River were contaminated with mercury. In addition, sediments in the Sudbury River also have elevated mercury levels.

4.0 REMEDIAL ACTION

This section describes the RA selected for and implemented at the Site.

4.1 Remedy Selection

The RA objectives for four OUs, as described in their respective RODs, are summarized in the following sections.

4.1.1 Remedial Action Objectives: Source Control and Soil (OU1)

The RA objectives selected in the 1985 OU1 ROD to address contaminated soils and sediments at the Site were as follows:

- Reduce generation of contaminated leachate and thereby mitigate future groundwater contamination;
- Minimize off-site contaminant migration via surface runoff and air transport; and
- Minimize direct human and environmental exposure to contaminated sediments.

To meet these objectives, the OU1 ROD specified that wastes be isolated to minimize contact with groundwater, surface water, and air and to prevent human and animal exposure. Contaminants of concern (COC) for the various media were not identified in the ROD.

On September 21, 1992, an ESD was issued for OU1. Modifications to the actual constructed remedy were documented in the OU1 RA report and the ESD. The most significant modification to the OU1 ROD was to postpone the restoration of the Area G wetland until OU3.

4.1.2 Remedial Action Objectives: Off-Site Groundwater (OU2)

A 1991 OU2 ROD was written as an Interim Remedy, with the intent to further evaluate the effectiveness of groundwater extraction and treatment in meeting drinking water standards after an initial 5-year operational period. The RA objectives selected in the 1991 interim ROD to address groundwater contamination at the Site were as follows:

- Reduce migration of contaminants in groundwater;
- Reduce risks to human health associated with potential future consumption and direct contact with groundwater;
- Reduce risks from present and potential future inhalation of evaporated groundwater contaminants;
- Limit degradation of the Sudbury River and wetlands due to the natural discharge of contaminated groundwater; and
- Comply with Federal and State ARARs, including drinking water standards.

The five-year interim pump and treat remedy was not implemented due to the discovery in early treatability studies of pockets of highly concentrated liquid contamination in the form of a dense, non-aqueous phase liquid (DNAPL).

In September 2006, EPA issued an ESD for OU2. The ESD does not modify the general goals for groundwater remediation established in the 1991 interim ROD, but rather furthers these goals by creating two distinct remedial phases: 1) installation of vapor mitigation systems (VMS) in buildings located over the most-contaminated portions of the groundwater plume, and 2) installation of a DNAPL extraction system. The ESD included the following activities:

- Extraction of DNAPL with off-site treatment and/or disposal;
- Performance of routine groundwater monitoring to assess any changes in plume concentrations and migration;
- The installation, on a voluntary basis, of VMS in approximately 40 to 50 structures (mostly homes) located in the northeast portion of the plume, in an area generally bracketed by Tilton Avenue and Water Street to the west, the Sudbury River to the north and to the east, and the railroad tracks to the south;
- Performance of additional air testing, on a voluntary basis, at approximately 10 to 15 additional homes and businesses located above remaining areas of the plume, generally described as areas immediately west of Forest Street and southeast of the Town Hall along Main Street, as well as the commercial complex to the northeast of the Town Hall along Main Street; and
- Installation of small diameter monitoring wells or piezometers in the areas generally described above to determine the extent of the shallow groundwater plume more accurately.

In addition, the ESD provided clarification on the use of institutional controls to prevent exposure to contaminated groundwater.

4.1.3 Remedial Action Objectives: Wetlands and Drainageways (OU3)

The RA objectives selected in the 1993 OU3 ROD to address mercury-contaminated sediments at the Site were as follows:

Human Health Objectives

- Mitigate mercury contamination in sediment in areas where accidental ingestion and dermal contact with contaminated sediments may result in unacceptable human health risks;

- Mitigate mercury contamination in sediment in order to reduce mercury levels in fish, which may be consumed by fisherman; and

- Mitigate mercury contamination in sediment in the Continuing Source Areas in order to prevent continued migration of contamination to the Sudbury River.

Ecological Objectives

- Mitigate mercury contamination in sediment to achieve an increased level of protection to environmental receptors, approximately equal to that found in background areas, in the Continuing Source Areas;

- Mitigate mercury contamination in sediment in the Continuing Source Areas in order to prevent continued migration of contamination to the Sudbury River; and

- Restore any wetland habitat disturbed during remediation.

4.1.4 Remedial Action Objectives: Sudbury River (OU4)

The RA objectives selected in the 2010 OU4 ROD to address consumption of mercury-contaminated fish at the Site were as follows:

Human Health Objectives

- Prevent the ingestion of mercury-contaminated fish to the extent that such ingestion would results in a non-cancer hazard quotient greater than 1.0 for an individual who consumes fish from the Sudbury River

- Reduce the amount of mercury in sediment and/or surface water to ensure that mercury concentration in fish tissue no longer presents an unacceptable risk (hazard quotient greater than 1.0) except in Reach 8.

4.2 Remedy Implementation

This section describes the completion of the tasks for each OU as required by the RODs.

4.2.1 Operable Unit 1

On September 4, 1985, EPA issued the OU1 ROD. The OU1 ROD called for consolidating sediments and waste from satellite areas onsite in a landfill cell on Megunko Hill, followed by capping the waste under an impermeable cap, and constructing an upgradient interceptor trench to collect and divert groundwater and surface water flows away from the landfill. Specifically, the remedy included excavating all outlying sludge deposits and contaminated soils and sediments associated with these deposits; consolidating this material with the Megunko Hill sediments and waste deposits; capping the Megunko Hill section to prevent water from entering it and spreading contaminants; constructing a groundwater and surface water diversion system on the upgradient side of the Megunko Hill area; backfilling the excavated areas to original grade; establishing a vegetative cover in the wetland areas; and constructing a more extensive groundwater monitoring system to allow for future evaluation of the cap. Approximately 60 percent of the capped Megunko Hill area originally contained surficial contamination, which was not excavated however was a component of the capped landfill cell. The remaining portion of the area to be capped was excavated to bedrock to create a landfill cell for the disposal of contaminated soils and solidified sludges from the on- and off-site cleanup areas. More than 65,000 cubic yards of contaminated soil were excavated and placed in the landfill cell in 1990. Final construction of the cap was completed in 1991. All OU1 cleanup actions were completed in late 1992.

Modifications to the actual constructed remedy were documented in the OU1 RA report and ESD. In particular, the most pertinent modification to the OU1 ROD was to postpone the restoration of the Area G Wetland until OU3. To maintain the effectiveness of the OU1 remedy, MassDEP assumed O&M responsibilities and conducts routine inspections and makes any necessary repairs. O&M was temporarily suspended to allow completion of OU3 RA construction activities. O&M activities resumed in 2003 after the OU3 RA was completed and the O&M Plan updated. Refer to Figure 2 for a depiction of the remedies for OU1 and OU3.

4.2.2 Operable Unit 2

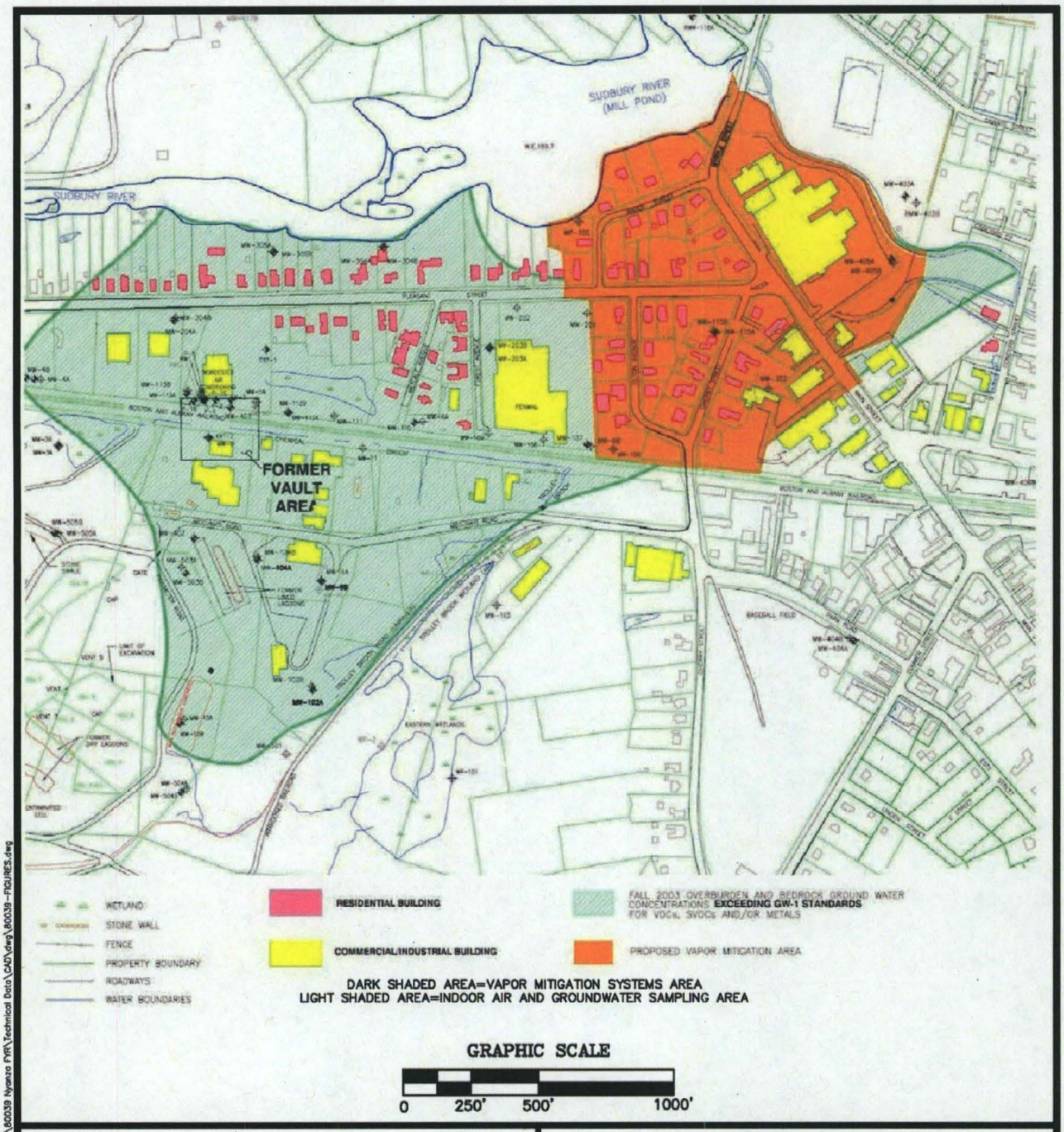
OU2 was originally established to address groundwater contamination. Through the completion of various studies and additional monitoring, the scope of OU2 has expanded to address DNAPL recovery and vapor mitigation. This scope expansion was documented in the 2006 Explanation of Significant Differences.

1991 Interim ROD

In June 1987, EPA authorized the initiation of investigative activities for OU2 to address contaminated groundwater migrating from the Site. An interim ROD was signed on September 23, 1991. The selected remedy included extraction and treatment of groundwater for a minimum of five years and conducting additional studies before adoption of a final remedy. Technical design studies for the selected remedy began in early 1992. A pilot groundwater extraction and treatment system was constructed in 1994. A DNAPL emulsion was discovered during the step test phase of the pilot system pumping test. DNAPL was then observed in the recovery well and the observation well. Additional pumping of the recovery well and one observation well found very slow recovery rates for the DNAPL. However, DNAPL emulsion proved hostile to the pump seals and the pumps ceased to function. In 1994, the pilot test was discontinued, and the groundwater extraction and treatment remedy was postponed indefinitely.

The Interim ROD also required institutional controls in the form of well permit restrictions to prevent the installation of new wells within the plume area. Although a process of formal well permit restrictions has not been established, EPA has established an informal process of communication with the Ashland Board of Health to ensure that property owners are aware of the plume. There are no known production wells located within the plume and the Town of Ashland does not use groundwater from the contaminated plume for their drinking water supply. Refer to Figure 3 for a depiction of the groundwater plume.

Groundwater monitoring was initiated in 1998 on a semi-annual basis until 2004. Initial data indicated that the shallow contaminated groundwater plume extends under numerous homes, businesses and municipal buildings, which prompted EPA to undertake an indoor air sampling



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Nobis

Nobis Engineering, Inc.
Tel (603) 224-4182
Fax (603) 224-2507
www.nobisengineering.com

FIGURE 3

PORTION OF PROPERTIES WITH VAPOR MITIGATION SYSTEMS
NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE
ASHLAND MASSACHUSETTS

DRAWN BY:	ML	APPROVED BY:	JM
PROJECT:	80039.06	MARCH 2009	

program. Indoor air samples were collected from nine residences, the Town Hall, and the police department in late 1998 to determine if contaminants in the groundwater were volatizing and migrating into homes and businesses at levels that might affect public health. Results of the sampling indicated that none of the five targeted compounds exceeded levels deemed safe by EPA and MassDEP.

Between 1999 and 2003, several studies were conducted to evaluate potential ecological risks posed by the groundwater plume discharging into the Sudbury River. Results indicated that aquatic life was affected in one of three areas studied, but any impact on aquatic life could not be tied definitively to the groundwater plume or other existing natural habitat conditions such as storm water runoff, low dissolved oxygen levels, stagnant water, or high amounts of detritus (leaf litter). Additional monitoring was recommended because this affected area is directly upstream of the Lower Raceway, where mercury-contaminated sediments were excavated during OU3.

A final ROD for OU2 will be completed based on additional studies and pending the effectiveness of DNAPL recovery efforts to be performed under the ESD described below.

2006 ESD

A second indoor air monitoring program was conducted in 2004. The volatile organic compound TCE and four other contaminants (vinyl chloride, chlorobenzene, benzene, and 1,4-dichlorobenzene) were detected in five of the seven homes sampled. No sampling was conducted at the Town Hall or the police station. TCE was detected in indoor air at concentrations ranging from 1.3 to 2.9 micrograms per meter cubed (µg/m3), which were all below the existing screening level of 134 $\mu g/m^3$. However, the screening level of 134 $\mu g/m^3$ was based on EPA's withdrawn 1987 toxicity value for a target cancer risk level of 1×10^{-04}.

In 2001, EPA proposed a range of new toxicity values for risk from TCE. As a result, the screening level of 134 $\mu g/m^3$ was recalculated to a proposed screening range of 2 to 43 $\mu g/m^3$ for a target cancer risk level of 1×10^{-04}. Concentrations of TCE in three of the homes exceeded the lower end of the proposed screening range. Exceedance of the new screening level range prompted EPA to perform a risk assessment on all the available air data (i.e., 1998 and 2004 air data) to determine if there were potentially unacceptable inhalation risks. The risk assessment concluded that comparison of the proposed TCE toxicity standard to the TCE vapor results indicated there

was a potentially unacceptable risk from continued long-term inhalation of TCE vapors in seven of the fourteen homes sampled, and in the Town Hall. Based on the results of the risk assessment, EPA signed an ESD for OU2 on September 29, 2006. Refer to Section 4.1.2 for a description of the activities mandated by the ESD.

Inspections of each proposed vapor mitigation property were performed by the United States Army Corps of Engineers (USACE) from October 3 to 28, 2006. Based on the requirements of the ESD and the property inspections, a conceptual design was released by USACE on December 22, 2006. The finalized work plan was issued by USACE on February 12, 2007. The work plan contained a layout for each specific system.

The ESD required that certain pre-construction activities be performed to delineate the vapor mitigation area more accurately. In November 2006, the EPA New England, Office of Environmental Measurement and Evaluation (OEME) performed an indoor air and soil gas sampling study. The goal of the air study was to determine and verify the areal extent where a public health threat existed due to VOCs from contaminated groundwater migrating into buildings and impacting indoor air quality. This goal was accomplished by sampling at properties within or on the edge of the designated GW-1 area for VOCs. The GW-1 area was defined as the area where overburden and bedrock groundwater concentrations exceed the MassDEP GW-1 standards for VOCs. The target VOCs designated for this sampling event were: vinyl chloride, benzene, chlorobenzene, 1,4-dichlorobenzene, and TCE.

During the week of November 13, 2006, an indoor air study was completed at eleven properties and six one-inch diameter groundwater monitoring wells were installed along the previously defined edges of the groundwater plume. The wells were screened across the top of groundwater and subsequently sampled for VOCs in December 2006, along with some nearby existing monitoring wells. Air and groundwater sampling data resulted in the addition of two residential properties to the list of properties where VMS would be offered. The final number of properties to be offered systems was 41. Criteria used in determining the aerial extent that VMS would be offered included: the location of where test results exceed EPA's proposed target risk for the inhalation of vapors; the concentrations of contaminants in groundwater, particularly TCE; and use of models which suggest that structures within this area may be susceptible to inhalation risks from vapor intrusion.

Site mobilization began on May 21, 2007, and actual construction of the VMS began on May 24, 2007. A total of 43 systems were installed in 41 units. Refer to Figure 3 for the locations of the properties where VMS were installed.

However, at the 42nd location, the property owner refused access for the purpose of installing a system, or collecting indoor air and soil gas data. This property houses two apartments. Both tenants were informed of the owner's refusal to install a VMS. A notice was provided to the local Board of Health to ensure that any future tenants are made aware of the possible vapor intrusion concern. EPA determined that deed restrictions are not appropriate for this property since no actual data exist to confirm that an inhalation health risk exists. EPA will continue to periodically ask this homeowner (or any new homeowner pending a property transfer) if they desire a VMS.

A Remedial Action Report for the Vapor Mitigation Phase of OU2 was issued on June 30, 2008. The report documented the activities summarized above, as well as a summary of the project costs. To maintain the effectiveness of the OU2 remedy, MassDEP assumed O&M responsibilities and conducts routine inspections and makes any necessary repairs.

EPA approved a work plan on May 7, 2008 to evaluate DNAPL extraction and off-site treatment and disposal. The Site-specific Quality Assurance Project Plan (QAPP) was approved by EPA in September 2008, and pre-investigation activities occurred in the Fall of 2008. A DNAPL assessment was performed in 2009 using an exploratory drilling program to identify those areas likely to provide the best DNAPL recovery. Based on the results of this assessment, three wells were designated as potential locations for DNAPL removal. Groundwater monitoring, historically conducted twice annually between 1998 and 2004, was reinstated as documented in the 2011 Addendum to the Fourth Five-Year Review. In addition, a DNAPL Extraction System Evaluation Report was prepared in April 2013 to evaluate different mechanisms by which DNAPL could be extracted from the bedrock from two well locations, MW/B-11 on the Nyacol property, and MW-113A on the Worcester Air Conditioning (WAC) property located across the railroad tracks north of the Nyanza property. An evaluation of corrective action technologies was performed, and the preferred remedial alternative was submersible pump technology utilizing a XiTech extraction system. Extraction systems were installed in both wells in September 2013, and the systems have undergone startup and shakedown portions of the remedy implementation.

4.2.3 Operable Unit 3

OU3 addressed wetlands and drainageways between the former Nyanza Inc. property and the Sudbury River that acted as continuing sources of mercury contamination to the Sudbury River. The Continuing Source Areas included the Eastern Wetland, Trolley Brook, and Outfall Creek/Lower Raceway. The remedy provided for:

- Excavation of sediment with mercury levels above 1 mg/Kg from the Continuing Source Areas (this cleanup level is protective of aquatic organisms as well as human health under all exposures scenarios).
- Dewatering of the contaminated sediment.
- Disposal of dewatered sediment under a portion of the cap constructed under OU1.
- Reconstruction of the area of the cap removed during disposal.
- Treatment of water from the dewatering operation with discharge to an on-site surface water body.
- Restoration of impacted wetland areas.
- Institutional controls to limit exposure to contaminants in the Sudbury River.
- Planning and implementation of public awareness activities to increase public knowledge about contamination remaining in the Sudbury River sediments and fish.
- Performing certain pre-design studies to aid in the design of the selected remedy.
- Creation of OU4 to conduct additional investigation of the Sudbury River.

The design of the remedy was completed in 1998. Cleanup activities commenced in March 1999 and were completed in August 2001. The volume of sediment that was relocated from the various waterways and wetlands was 45,000 cubic yards.

4.2.4 Operable Unit 4

OU4 was created as a result of OU3 and the need for additional investigations of the Sudbury River. The Final Remedial Design (Remedial Action Work Plan) was issued in April 2013 to address the scope of the remedy implementation, and the project is currently awaiting construction funding. Figure 4 shows the reaches of the Sudbury River addressed under OU4.

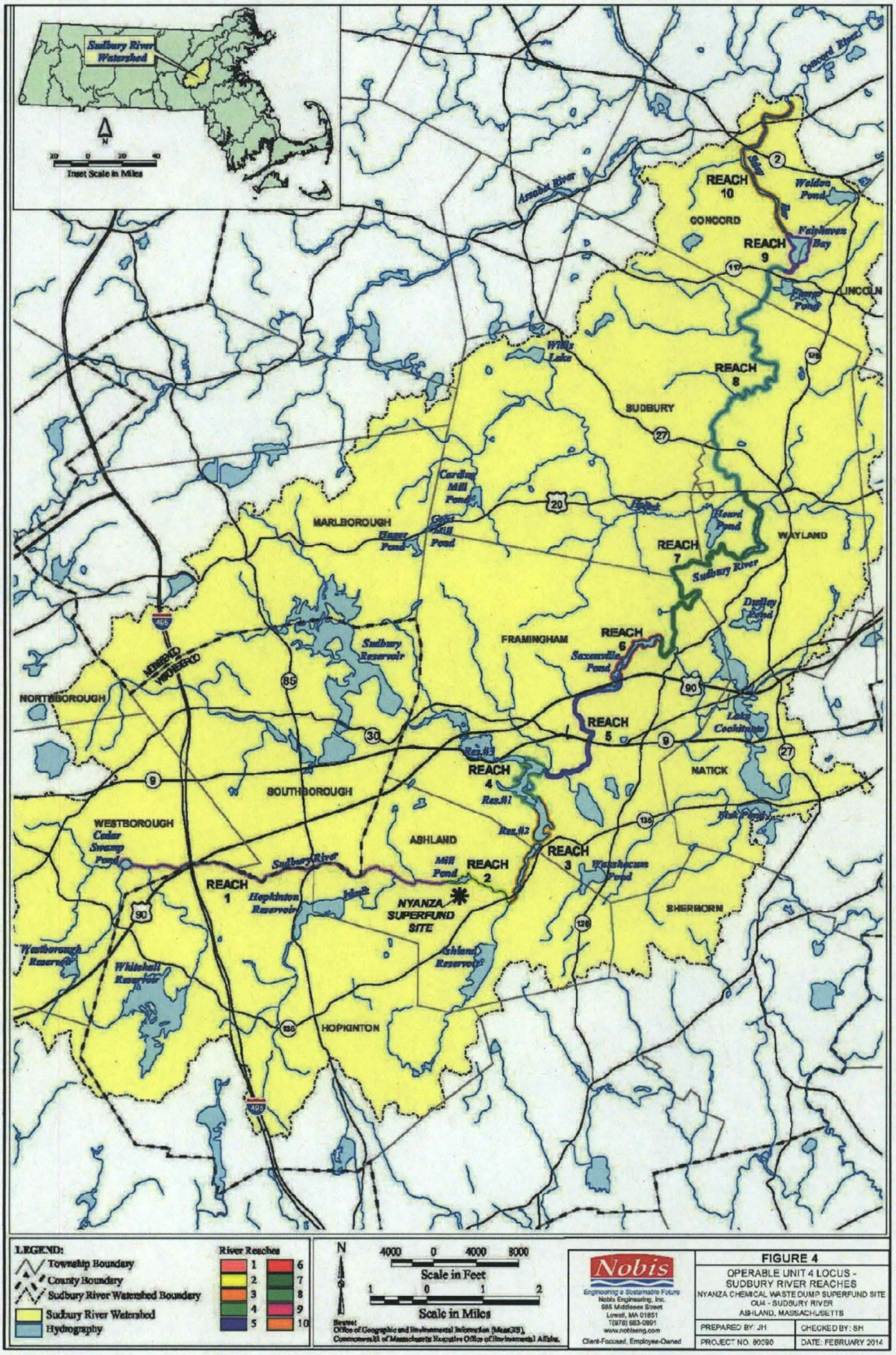
4.3 Operations and Maintenance

In accordance with Section 104(c)(3)(A) of CERCLA, MassDEP is responsible for all O&M activities for the expected life of these remedies. Because OU1 RA activities were completed on November 7, 1991, MassDEP is responsible for OU1 O&M activities through November 6, 2021. Because OU3 activities were completed on November 7, 2001, MassDEP is responsible for OU3 O&M activities through November 6, 2031. Because OU2 activities for VMS were completed on September 28, 2007, MassDEP is responsible for OU2 VMS-related O&M activities through September 2037.

MassDEP OU1 O&M activities began in 1991. OU1 O&M activities were temporarily suspended between 1999 and 2002 to allow OU3 RA construction activities to be completed. OU3 RA was completed in November 2001. OU1 and OU3 O&M activities resumed in 2003 and the O&M Plan was updated.

The O&M Plan provides guidance regarding O&M activities necessary to ensure the OU1 and OU3 remedies remain protective of human health and the environment. To ensure the effectiveness of OU1, MassDEP conducts routine inspections and makes necessary repairs including:

- Maintenance of the cap including vegetation control, liner inspection and repair;
- Maintenance of the diversion trench, removal of obstructions,
- Maintenance of the security fence;
- Sampling and analysis of upgradient and downgradient wells, manhole, and surface water;
- Air sampling and analysis of cap vents, monitoring wells, and terminal manhole to monitor air quality and emissions;
- Soil testing of cap soils every three years or as needed, and
- Air, sediment and leachate sampling, as needed.


Sudbury River Watershed
Inset Scale in Miles
Concord River
Assabet River
REACH 10
Walden Pond
CONCORD
REACH 9
Fairhaven Bay
LINCOLN
Flagg Pond
Willis Lake
REACH 8
SUDBURY
Carding Mill Pond
MARLBOROUGH
Hager Pond
Gibbs Mill Pond
Hoard Pond
WAYLAND
REACH 7
Sudbury River
Dudley Pond
FRAMINGHAM
REACH 6
Saxonville Pond
Sudbury Reservoir
NORTHBOROUGH
REACH 5
Lake Cochituate
Res.#3
REACH 4
NATICK
SOUTHBOROUGH
Res.#1
Res.#2
WESTBOROUGH
Cedar Swamp Pond
ASHLAND
REACH 3
Mill Pond
REACH 2
Hopkinton Reservoir
REACH 1
NYANZA SUPERFUND SITE
SHERBORN
Westborough Reservoir
Whitehall Reservoir
Ashland Reservoir
HOPKINTON
LEGEND:
Township Boundary
County Boundary
Sudbury River Watershed Boundary
Sudbury River Watershed
Hydrography
River Reaches
1 2 3 4 5 6 7 8 9 10
N
4000 0 4000 8000
Scale in Feet
1 0 1 2
Scale in Miles
Source:
Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs.
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Engineering a Sustainable Future
Nobis Engineering, Inc.
585 Middlesex Street
Lowell, MA 01851
T(978) 683-0891
www.nobiseng.com
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FIGURE 4
OPERABLE UNIT 4 LOCUS - SUDBURY RIVER REACHES
NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE
OU4 - SUDBURY RIVER
ASHLAND, MASSACHUSETTS
PREPARED BY: JH
CHECKED BY: SH
PROJECT NO. 80090
DATE: FEBRUARY 2014

The long-term monitoring and maintenance of OU3 includes performing routine inspections to ensure the integrity of the cap and to monitor and maintain former source areas for disturbances that may expose contaminants left in place.

Both the remedies for OU1 and OU3 involved excavating contaminated sediment in wetland areas and extensive wetland restoration activities were performed. Upon the completion of OU3 restoration activities in 2001, USACE conducted long-term wetlands monitoring activities for three years (January 2001 through December 2003). MassDEP continued conducting long-term wetland monitoring activities through 2009. A Quantitative Wetland Restoration Monitoring Report was issued in November 2009 and was the basis for the MassDEP and EPA determination in 2010 that OU3 wetlands restoration was successful, and that inspections to verify the wetlands restoration were no longer necessary. However, where waste exists in discrete areas of the wetlands (e.g., steep embankments) it is under geotextile fabric; this continues to be monitored as part of the semiannual OU1 inspections.

For OU2, a Monitoring and Maintenance Manual (M&MM) for the VMS was issued for the Site in August 2008. EPA and MassDEP do not have any regulatory requirements that dictate how to maintain a vapor mitigation system; however, the M&MM outlined the following schedule for monitoring and maintenance of the vapor mitigation systems:

- Initial inspection of all 43 sub-slab depressurization systems during the winter 2008/2009. Inspection will include visual check of all external and interior system components and monitoring of all pressure points to ensure adequate pressure field;

- A system survey will be conducted every year for each system not inspected, to determine if the fan is running (except Property B, check manometer only). The system survey will be performed by listening and touching the fan casing to determine if it is operating; and

- Complete inspection and monitoring will be conducted during all maintenance calls (unless it is a follow up and a full inspection was recently conducted).

The following documentation forms were included with the M&MM: inspection checklist, property maintenance record, resident contact record, resident notification of visit, and system survey report. Records are updated and maintained by the inspector and the MassDEP.

Between January 12, 2009 and December 4, 2009, 41 (of the 43) vapor mitigation systems were inspected. Two properties had access issues preventing inspections. One property owner did not respond to requests for access, and access for one bank-owned property was not granted. According to the Addendum to the Fourth Five Year Review, systems at 10 properties did not meet the performance guidelines for minimum pressure of -0.004 inches of water column (in. WC) (also expressed as a vacuum of 0.004 in. WC). Additional maintenance and monitoring was performed at each of the 10 properties, resulting in 3 of the 10 properties achieving the minimum pressure of -0.004 in. WC. Corrective measures included physical repair to any visible cracks in the basement slab or walls, enlargement of the VMS suction pit, replacement of the VMS fan with a larger motor, or any combination of these actions as was necessary to achieve the established performance-based pressure. Systems at the remaining 7 properties did not reach the performance standard, however negative pressure was achieved at 4 of the 7 properties. It has been determined that the remaining 3 properties, all located on Water Street, are built over an elevated water table that can rise to the bottom of the slabs and circumvent the pressure field. MassDEP installed two piezometers in the immediate vicinity of these properties to evaluate VOC concentrations in the groundwater. Results indicated the shallow VOC plume does not extend beneath these properties, and mitigation is no longer required. These 3 properties continue to be monitored and evaluated by MassDEP.

As a result of the inspections in 2009, MassDEP and EPA agreed to modify the performance guidelines by allowing detection of a negative pressure field instead of the initial required minimum pressure of -0.004 in. WC for vacuum.

Additional monitoring was performed at several properties during 2010 and 2011, and no systems were monitored during 2012. Beginning in January 2013, monitoring was performed at 37 properties of the 41 properties. Owners could not be contacted for access to 4 of the properties.

The Five-Year Review Site Inspection was conducted on November 19, 2013. The VMS were not inspected as part of the November 2013 Five Year Review Site visit because they are inspected as part of MassDEP's regularly scheduled O&M visits. Refer to Section 6.0 of this report for a summary of the Five-Year Review Site Inspection.

5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW

5.1 Protectiveness Statements from Last Five-Year Review

The fourth Five-Year Review was completed on May 12, 2009, and an Addendum was issued on September 29, 2011. The protectiveness statements from those documents were as follows:

- **Protectiveness of Source Control and Soil (OU1)**
  The remedy for OU1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

- **Protectiveness of Off-Site Groundwater (OU2)**
  In the fourth Five-Year Review, the following statement was made:

  A protectiveness statement of the remedy at OU2 cannot be made at this time until further information is obtained. Further information will be obtained by:

  - *Completing inspections of the 41 VMS units, and*
  - *Implementing modifications and repairs as required to achieve the minimum pressure-based performance standard at all monitoring locations.*

  In the Addendum, it was determined that the MassDEP had inspected all the VMS units and had implemented modifications and repairs as necessary. EPA Region 1 concluded that "*the remedy for OU #2 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.*

- **Protectiveness of Wetlands and Drainageways (OU3)**
  The remedy for OU3 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

- **Protectiveness of The Sudbury River (OU4)**
  A protectiveness statement was not made in the previous Five Year Review because the Remedial Action had not been initiated.

5.2 Status of Recommendations from Previous Five Year Review

In the previous Five-Year Review and associated Addendum, a list of recommended actions for continued O&M of the remedies and associated features was developed. These issues are presented in Table 5-1. Table 5-1 also includes a description of what actions were taken to resolve the issues noted in the previous Five-Year Review.

Table 5-1
Status of Recommendations from Previous Five-Year Review and Addendum
Nyanza Chemical Waste Dump Superfund Site
Ashland, Massachusetts

Issues from Previous Five-Year Review*	Action Taken and Outcome
Rusted drums outside of storage shed.	Drums removed.
Damaged perimeter fence near the South Gate.	Fence repaired.
Groundwater monitoring program for OU2 has not yet been implemented.	Groundwater monitoring program has been implemented for OU2.
Minimum pressure not achieved in eight of the VMS units.	Once access obtained, two more systems identified. Modifications made to 7 of the systems to improve performance. Three systems determined not to be above elevated source concentrations.
DNAPL remedy not yet implemented.	DNAPL recovery system constructed and operational; currently collecting groundwater data and system performance data to evaluate remedy effectiveness
Institutional controls mandated by the ESD for OU2 not yet implemented.	Ongoing efforts to work with Town officials to establish zoning ordinance to prevent consumption of contaminated groundwater and inhalation of vapors.

** Issues from 2009 Five Year Review documented as resolved in the 2011 Addendum.*

5.3 Results of Implemented Actions

Below is a summary of results of the implemented remedial actions since the previous Five-Year Review for each OU.

5.3.1 OU1 Progress

Construction of the RA for OU1 was completed in November 1991. Since that time, the MassDEP has been responsible for O&M of OU1. Quarterly inspections (until 2009 and semiannually thereafter) of the OU1 landfill are conducted and inspection reports are prepared. Corrective actions are performed as needed.

5.3.2 OU2 Progress

As of 2009, the following required elements set forth in the 2006 ESD had been addressed as presented in the Addendum:

- EPA completed the installation of 43 vapor mitigation systems in 41 properties.
- MassDEP continues to perform additional air testing at additional homes.

Since 2009, progress continues to be made to address the remaining requirements.

- EPA continues to perform routine groundwater monitoring to assess any changes in plume concentrations and extent.

- EPA installed additional and replacement monitoring wells or piezometers determine the extent of the shallow overburden and bedrock groundwater plumes.

- Nobis prepared a DNAPL Extraction System Evaluation Report in 2013 that recommended extraction systems using submersible pump technology be installed at two existing monitoring wells.

- Construction of the two DNAPL extraction and storage systems began in June 2013 and the systems began operating in September 2013.

5.3.3 OU3 Progress

Beginning in 2009 inspections and reporting were performed on a semi-annual basis. MassDEP was also responsible for conducting long-term wetland monitoring activities. A Quantitative Wetland Restoration Report was prepared in November of 2009 (Shaw, 2009). The report recommended, based on the wetlands inspections performed to date, that quantitative inspections be replaced with Routine (Meandering) Inspections to be performed in the Spring of 2010. MassDEP performed two routine inspections in 2010, and then continued the Routine Inspections as part of the OU1/OU3 semi-annual inspections with agreement from EPA. Corrective actions for these areas are performed as needed.

5.3.4 OU4 Progress

A Feasibility Study (FS) was conducted and the report issued in June 2010. The FS developed and evaluated a range of cleanup alternatives so that EPA could select a remedial approach. The alternatives were presented in a Proposed Plan in June 2010. Public comments were received and included as part of the ROD issued in September 2010.

The selected remedy includes institutional controls, monitored natural recovery, enhanced natural recovery, long-term monitoring, and five-year reviews to address the risk posed to humans from the consumption of fish contaminated by Nyanza-related mercury. Nine reaches of the river were evaluated and the selected remedy focuses on Reaches 2, 3, 4, 6, 8, 9, and 10. Reach 1 is upstream and not impacted by contamination from the Site. Reaches 5 and 7 do not present unacceptable impacts to human health or the environment.

In April 2013, a Remedial Action Work Plan (RAWP) or Remedial Design was created to address how a portion of the remedy, selected by EPA in the ROD, would be implemented. The Thin Sand Layer Placement component of the remedy was described in detail.

6.0 FIVE-YEAR REVIEW PROCESS

This section provides a summary of the five-year review process and the actions taken by EPA to complete the review.

6.1 Administrative Components

Daniel Keefe (EPA) led the Nyanza Chemical Waste Dump Superfund Site Five-Year Review team. Technical assistance was provided by Nobis. The review was conducted between September 2013 and April 2014. The Scope of Work included the following activities:

- Project Planning and Support
- Document Review
- Standards (ARAR) Review
- Site Interviews
- Site Inspection/Technology Review
- Community Relations

- Five-Year Review Report preparation
- Task Order Close out

6.2 Community Notification and Involvement

EPA issued a News Release on February 13, 2014 announcing EPA review of site clean ups and remedies at 27 Superfund sites across New England this year by doing routine Five-Year Reviews at each site. A link to EPA's website was provided for each of the sites in the News Release, including Nyanza Chemical Waste Dump (http://www.epa.gov/region1/superfund/sites/nyanza). A copy of the News Release is included in Appendix A.

6.3 Document Review

This Five-Year Review consisted of a review of relevant documents including decision documents, monitoring reports, RA reports, Remedial Investigations, FS and Risk Assessment reports. Refer to Appendix B for a complete list of the documents reviewed.

6.4 Data Review

A summary of relevant data regarding the components of the Site remedy is presented below. The results of these sampling events are summarized below by media. These data reviews are related to the completed remedies in place at the Site (i.e., OU1, OU2 – VMS component only and OU3). OU2 – Groundwater and OU4 – Sudbury River are currently in progress and the remedies are not yet complete.

6.4.1 Groundwater

OU1 and OU3

Focused groundwater monitoring as required by the O&M Plan for OU1 and OU3 has continued on a semi-annual basis since 2003. Monitoring wells are gauged for groundwater elevation and groundwater samples are collected using low-flow sampling methodologies from 15 monitoring wells and the terminal manhole. Groundwater flow directions in overburden and bedrock aquifer zones have been determined to be in a general northeastern direction, from Megunko Hill towards the Sudbury River. In accordance with the O&M Plan, the groundwater samples are analyzed for

VOCs via EPA Method 8260B, SVOCs via EPA Method 8270C, target analyte list (TAL) Metals via EPA Method 6010B, and Ultra-Trace Mercury via EPA Method 1631.

The laboratory analytical results are compared to the historical sampling results for each well. As mandated by the 2003 O&M Plan, the contractor performing the sampling notifies MassDEP if concentrations detected exceed two standard deviations of the historical sampling results. Two standard deviations away from the mean is a typical statistical method for determining data trends and locating outliers. Analytical results are then compared to the Massachusetts Contingency Plan (MCP) Category GW-1 Standards, which applies to current or future sources of drinking water. Due to the nature of the Site being classified under the Superfund program, the MCP does not necessarily apply. However, MassDEP and EPA have determined that use of Method 1 standards would be appropriate benchmarks for evaluating Site conditions. These standards are used for preliminary nature and extent evaluation only and are not assumed to be the appropriate cleanup goals for the Site. The 2009 through 2013 data reports were reviewed.

During the Spring 2013 groundwater monitoring event elevated concentrations (exceeding the MCP GW-1 Standards) for the following VOCs were detected: TCE, cis-1,2-dichloroethene, chlorobenzene, 1,2-dichlorobenzene, nitrobenzene, and the following metals: barium, cadmium, calcium, copper, iron, lead, manganese, magnesium, nickel, potassium, mercury, and thallium. These contaminants were detected in groundwater samples collected from both the overburden and bedrock monitoring wells located hydraulically downgradient of the landfill. In general, the Spring 2013 groundwater monitoring data are relatively consistent with previous sampling events. More contaminants are detected in samples collected from wells located downgradient of the landfill cap. In addition, generally, more contaminants are detected in samples collected from wells screened in the bedrock aquifer zone than in the overburden. The concentrations of contaminants detected in groundwater samples collected from both overburden and bedrock wells continue to fluctuate; however, the overall trend appears to be decreasing.

OU2

Groundwater monitoring was reinstated in 2011 and is performed twice annually to meet the requirements of the OU2 ESD. Synoptic groundwater gauging, sampling, and measurement of DNAPL thickness are performed to provide data on groundwater flow direction, contaminant concentrations, and the potential for contaminants to attenuate. Beginning in 2012, the cumulative

analytical data from eight semi-annual rounds will be evaluated for statistically significant trends in chlorinated ethene and chlorinated benzene degradation and whether the aquifer can sustain any recognized degradation trends.

Samples were analyzed for VOCs, SVOCs, metals and anions. Data from January 2011 and April 2012 were consistent with historic groundwater flow directions and contamination distribution in both overburden and bedrock monitoring wells. Data collected in August 2012 and November 2012 revealed patterns similar to historic data. TCE concentrations indicated a potential contraction in the plume compared to 2003; however, the 2003 data contained additional results along the southern boundary of the site. In addition, TCE concentrations in bedrock wells MW-113A and MW/B5 was at or above TCE solubility.

Monitoring of groundwater in May and November 2013 showed continued high VOC concentrations in both overburden and bedrock monitoring wells. Gauging in May 2013 revealed DNAPL thicknesses similar to the December 2013 sampling event. Evaluation of field parameters and anion and chemical concentrations indicates favorable conditions for reductive dechlorination of chlorinated benzenes and ethenes in localized areas of the plume.

6.4.2 Surface Water

Annual surface water sampling event for OU1 and OU3 was conducted from 2009 through 2013, as dictated in the April 2003 O&M Plan. Surface water samples are collected at nine locations, which based on surface water flow patterns at the Site can be divided into two groups: west and east. The west group includes surface water sampling locations SW-2 through SW-6. In the west group, surface water flow moves from SW-2 and SW-4 towards SW-3 (the sedimentation basin). Surface water flow then moves from SW-3 and SW-5 towards SW-6 (Area C wetland). The east group includes surface water sampling locations SW-1, and SW-7 through SW-9. In the east group, surface water flow moves from SW-1 towards SW-9 (Eastern Wetland). Surface water flow then moves from SW-9 and SW-7 (Area G wetland) towards SW-8. The surface water samples were analyzed for VOCs via EPA Method 8260B, SVOCs via EPA Method 8270C, TAL Metals via EPA Method 6010B, and ultra-trace mercury via EPA Method 1631.

The most recent surface water sampling event was conducted in April 2013. No VOCs or SVOCs were detected during this sampling event. Neither VOC nor SVOC concentrations in previous

sampling events exceeded the Lowest Ecologically Based Criteria developed for the MCP. Metals are detected frequently in surface water samples, and 12 of 20 metals analyzed for in April 2013, including ultra-trace mercury, were detected. Aluminum, iron and zinc all exceeded the National Recommended Water Quality Criteria (NRWQCs) in April 2013 Metals concentrations have exceeded the Lowest Ecologically Based Criteria developed for the MCP as well as the NWRQC. The SW-2 sample collected from the Interceptor Trench contained metals at concentrations exceeding the 2 standard deviation unit notification level. The April 2013 data in combination with historical data do not appear to show increasing or decreasing trends. It is anticipated that potential trends will become more apparent as more data is collected.

6.4.3 Air Monitoring

Air screening at the gas vents, monitoring wells, and the terminal manhole is conducted on a semiannual basis as part of the O&M Site inspection for OU1. Screening for combustible gases, hydrogen sulfide, VOCs, and inorganic mercury is conducted at each point. The most recent reported results were from the Site inspection conducted on April 23-25, 2013. Air screening was conducted at the base, mid-port value and vent opening of the five gas vents, as well as over the monitoring wells and the terminal manhole. All monitoring results were below applicable action levels except for monitoring well headspace air screening in one well where mercury levels exceeded action levels. Elevated mercury levels were detected during three previous sampling events, and as a result, mercury levels will be evaluated further to identify any anomalies or trends in results.

6.4.4 Wetland Monitoring

Inspections of the restored wetlands to ensure final restoration are no longer performed. Recommendations of the Quantitative Wetland Restoration Monitoring Report (Shaw, 2009) included Routine (Meandering) Inspection in 2010. These are performed in conjunction with the semi-annual monitoring for OU1.

6.4.5 Vapor Mitigation Systems Monitoring

Between January 12, 2009 and December 4, 2009, 41 vapor mitigation systems were inspected. Two properties had access issues preventing inspections. One property owner did not respond to requests for access, and access for one bank-owned property was not granted. According to

the Addendum to the Fourth Five Year Review, systems at 10 properties did not meet the performance guidelines for minimum pressure of -0.004 in. WC. Additional maintenance and monitoring was performed at each of the 10 properties, resulting in 3 of the 10 properties achieving the 0.004 in. WC performance standard. Corrective measures included physical repair to any visible cracks in the basement slab or walls, enlargement of the VMS suction pit, replacement of the VMS fan with a larger motor, or any combination of these actions as was necessary to achieve the established performance-based pressure. Systems at the remaining 7 properties did not reach the performance standard, however negative pressure was achieved at 4 of the 7 properties. It has been determined that the remaining 3 properties, all located on Water Street, are built over an elevated water table that can rise to the bottom of the slabs and circumvent the pressure field. MassDEP installed two piezometers in the immediate vicinity of these properties to evaluate VOC concentrations in the groundwater. Results indicated the shallow VOC plume does not extend beneath these properties, and mitigation is no longer required. These 3 properties continue to be monitored and evaluated by MassDEP.

As a result of the inspections in 2009, MassDEP and EPA agreed to modify the performance guidelines by allowing detection of any negative pressure field instead of the minimum pressure of -0.004 in. WC.

Additional monitoring was performed at several properties during 2010 and 2011, and no systems were monitored during 2012. Beginning in January 2013, monitoring was performed at 37 properties of the 41 properties. Owners could not be contacted for access to 4 of the properties. Detection of negative pressure was achieved for at least one monitoring point at all monitored properties. During inspections, corrective actions such as sealing of cracks in floors and areas around sumps, fan replacement, fuse replacement, and installation of additional measurement points were performed.

6.5 Site Inspection

The Five-Year Review Site Inspection to assess the protectiveness of the remedies was conducted on November 19, 2013. The inspection was conducted by Daniel Keefe of EPA, Dave Buckley of MassDEP, accompanied by Boyd Allen and Deb Chisholm of Nobis. A Site-specific checklist was used to document the observations made during the inspection. The components of the OU1 and OU3 remedies were inspected. Because MassDEP was actively inspecting all of

the VMS installed as part of their annual O&M of OU2, these systems were not observed during this inspection.

Issues and recommendations identified during the inspection are further discussed in Section 8.0. A copy of the Site Inspection Checklist is included in Appendix C. Photographs documenting the Site conditions are included in Appendix D. A summary of the observations made during the 2013 Site Inspection is provided below:

- **Landfill Surface** – The landfill surface was generally in good condition with healthy vegetation that appeared to be well maintained and no obvious signs of settlement, erosion, bulges, or cracks. No evidence of damage to the landfill side slopes was observed during the 2014 Site inspection.

- **Cover Penetrations** – There did not appear to be any problems with the cover penetrations, which include the terminal manhole and passive gas vent structures.

- **Roadways and Ditches** – The cap perimeter road appeared to be in good condition with no signs of erosion. Evidence of trespassing was not observed. The ditches and the Interceptor Trench appeared to be in good condition with well-maintained vegetation that had recently been cut back. No evidence of sedimentation was observed in the ditches.

- **Perimeter Drain Outlet** – The perimeter drain outlet was observed to be in good condition.

- **Site Fences and Signage** – The perimeter fence around the landfill cap was observed to be in good condition. Slight damage was observed to a small section of the fence near the East Gate; however, the damage does not affect the overall integrity of the fence. MassDEP is aware of the damage and is planning to make repairs by July 2014. A small section of fence near the East Gate had sagging barbed wire, was observed to be intact along the entire length of the perimeter fence. The four fence gates were observed to be locked and in good condition on the day of the Site inspection. No trespassing signs were posted at 20-foot intervals along the perimeter fence. All signs were observed to be in good condition. Some signage was missing on a newly added section of fence near the East Gate.

- **Monitoring Wells** – The monitoring wells located within the boundary of the perimeter fence were observed to be properly secured and in good condition.

- **Eastern Wetland** – The Eastern Wetland was observed from Trolley Brook Road on the day of the Site inspection. The wetland area appeared to be in good condition.

- **Trolley Brook and Chemical Brook** – A buildup of debris was not observed at the confluence of Trolley Brook and Chemical Brook as has been noted in previous inspections.

- **Control Weir** – The structure appeared to be good condition. Minimal debris consisting of leaves and small branches was observed on the water surface at the weir gate.

6.6 Interviews

Interviews of property and business owners adjacent to the Site, home owners with VMS installed at their properties, and of local and State officials were conducted. The objectives of the interviews were to obtain general information and update current understanding of activities at the Site. Summaries of these interviews are included in Appendix E.

Interview Record forms were mailed to 8 people. The following people provided responses:

Mr. Dave Buckley (MassDEP Project Manager)
Mr. Mark Oram (Town of Ashland Board of Health)
Mr. Bob Gayner (Property owner)
Mr. Mike Brogin (Facilities manager of the Ashland House)
Mr. Ted McGarry (Vice President, Nyacol Nano Technologies)
Mr. Don Rushford (Homeowner with VMS installed)

No significant issues were raised in response to the questions asked on the Interview Record forms. For the most part respondents were satisfied with the efforts of the MassDEP and EPA. Most respondents felt well informed about progress at the Site. There were only two topics of concern expressed. Mr. Oram indicated his concern about OU4 and the controversy that has

arisen in the community over the selected remedy. Some residents don't agree with the selected remedy.

Mr. Oram and Mr. Gayner also indicated that sporadic dumping of refuse around the perimeter of the Site had become a problem. However, the dumping no longer appears to be an issue. There were no other issues brought up by the respondents as part of the interviews.

7.0 TECHNICAL ASSESSMENT

This section provides a technical assessment of the remedies implemented at the Site, as outlined in the Comprehensive Five-Year Review Guidance (EPA, 2001a). The remedies have been evaluated based on their function in accordance with decision documents, their adherence to valid risk data and scenarios, as well as any other information that could have affected the remedy's protectiveness.

7.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

OU1

Yes. The results of the monitoring data review and the Site inspection indicate that the remedy is functioning as designed. Overall, the Site was well maintained and appeared to be in good condition. The issues identified during the Site inspection do not affect the overall protectiveness of the remedy. The cap is functioning as designed and is in good overall condition. The cap remains as a protective barrier to prevent exposure to human trespassers and burrowing mammals. The groundwater diversion trench and associated drainage ways are being actively maintained and appear to be functioning as designed. The results of the groundwater monitoring data indicate that the concentrations of contaminants detected in samples collected from both overburden and bedrock wells continue to fluctuate; however, the overall trend appears to be decreasing. The most recent surface water monitoring data did not detect VOC or SVOC contaminant concentrations above levels of concern. Metals continue to be detected in surface water at consistent concentrations over the last five years. Air monitoring data indicates that no contaminants are being transported off-site. The potential for direct human contact to contaminated sediments has been mitigated by excavation and containment within the Site security fences.

OU2

Yes. The ESD issued in September 2006 created two remedial phases: 1) installation of VMS in buildings located over the contaminated groundwater plume, and 2) installation of a DNAPL extraction system. The first phase of the remedy has been implemented and the MassDEP is currently performing the O&M of the VMS. The second phase (i.e., DNAPL extraction systems) have been constructed and are currently operating and being maintained.

MassDEP is performing inspections of the 43 VMS concurrent with the preparation of this Five-Year Review. During earlier inspections (during this five-year review period), it was determined that a negative pressure equal to 0.004 in WC was not evident with all systems. Since the initial inspections, MassDEP and EPA agreed that the presence of any negative pressure was sufficient to determine the systems are working. Based on this revised criteria, the VMS remedy remains protective of human health and the environment.

The groundwater monitoring program mandated by the ESD has been implemented, and groundwater sampling of off-site groundwater is performed semiannually. In January 2011, groundwater samples were collected from 31 groundwater monitoring wells. This is the first comprehensive groundwater monitoring to be performed since 2003. Additional samples were collected from 17 wells in August 2012, 40 wells in November 2012, 18 wells in May 2013, and 43 wells in November 2013. Four more semiannual rounds of groundwater sampling are scheduled and the data will be reviewed collectively to assess whether natural degradation processes are sufficient to reduce contamination levels to where they might be protective of human health in the future.

Finally, the institutional controls mandated by the interim ROD have not yet been implemented fully. In order to insure that the remedy remains protective in the long-term, institutional controls need to be implemented to prevent exposure to contaminated groundwater. There is a Grant of Environmental Restriction and Easement (GERE) for large portion of the Nyanza site that have been executed, as required by 2001 Consent Decree with the Nyanza property owner. Consent Degrees were also entered with smaller parcel owners along Megunko Road requiring institutional controls; these restrictions are currently being negotiated. With regard to the outlying area (beyond Megunko Road), there currently are no formal controls in place to prevent the installation

of drinking water wells or contact with contaminated groundwater. As described in the ESD, an informal notification process has been used whereby the Town of Ashland seeks EPA's input on any construction projects located within the extent of the known groundwater plume. EPA will request that the Town of Ashland establish a zoning ordinance to provide the necessary controls. These controls will be formalized in the pending final ROD for OU2.

OU3

Yes. The results of the monitoring data review and the Site inspection indicate that the remedy is functioning as designed. Overall, the Site was well maintained and appeared to be in good condition. The issues identified during the Site inspection do not affect the overall protectiveness of the remedy. The cap is functioning as designed and is in good overall condition. The cap remains as a protective barrier to prevent exposure to human trespassers and burrowing mammals. The results of the groundwater monitoring data indicate that the concentrations of contaminants detected in samples collected from both overburden and bedrock wells continue to fluctuate; however, the overall trend appears to be decreasing. The most recent surface water monitoring data did not detect any contaminant concentrations above the applicable EPA and MCP standards. Metals detected in the sample from the interceptor trench upgradient of the cap are likely because of the sediment in the sample and not impacts from the landfill. Air monitoring data indicates that no contaminants are being transported off-site.

The restored wetland areas had been actively maintained, resulting in an established, functioning habitat containing extensive coverage of wetland native species.

The potential for direct human contact to contaminated sediments has been mitigated by excavation and containment within the Site security fences.

OU4

Not Applicable. The selected remedial action has not been implemented yet.

7.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives (RAOs) Used at the Time of the Remedy Selection Still Valid?

OU1

No. Some of the exposure assumptions (pathways and risk assessment methods) and toxicity data used at the time of the OU1 remedy selection (1985) are no longer valid since the RI/FS supporting the ROD was completed in 1985, prior to the existence of current EPA risk guidances. However, excavation and consolidation of contaminated soil, sediment, and sludge in the former on-site sludge disposal area and capping of the Hill area have essentially eliminated the potential for human and environmental exposure to hazardous substances at OU1. Therefore, the remedy is still protective of human health and the environment. The ROD did not establish clean-up standards beyond achieving background levels. Soil background levels used in the 1985 Remedial Investigation Report were as follows: Chromium 29.9 mg/Kg; Mercury 1.0 mg/Kg; Cadmium 0.1 mg/Kg and Lead 8.2 mg/Kg. The RAOs used at the time of the remedy selection are still valid.

Changes in Standards or TBCs

Since the ROD did not specify any chemical-specific ARARs or To-Be Considered materials (TBCs) there were no standards to review, except for the human health and ecological risk assessment guidance described below.

Changes in Exposure Pathways

The human health exposure pathways considered in the 1985 Health Risk Assessment performed during the RI/FS included ingestion of groundwater as drinking water, exposures to dust and vapors from soil, sediment, and sludges, exposures to surface water during recreation, and ingestion of contaminated fish. Ecological exposure pathways included effects on the aquatic ecosystem, exposures to wildlife, and vegetative stress. Dermal contact with groundwater and inhalation of vapors during household water use were not considered. Direct contact (ingestion and dermal contact) with soil, sediment, and sludges were not considered. However, excavation and consolidation of contaminated soil, sediment, and sludge in the former on-site sludge disposal area and capping of the Hill area have essentially eliminated the potential for human and

environmental exposure to hazardous substances in soil, sediment, and sludges at OU1. Groundwater, surface water, and fish exposures are considered further under OUs 2, 3, and 4.

No changes in land use or the physical conditions of the property have occurred since the 2009 five-year review. The Site remains vacant, capped, and fenced. A residential development adjacent to the western end of the Site was approved by the Town of Ashland in 2008; however, construction has been postponed. The Town of Ashland continues to support the use of renewable energy, and two areas, including the OU1 cap, have been zoned for large-scale photovoltaic installation.

Changes in Toxicity and Other Contaminant Characteristics

The health risk assessment within the 1985 RI/FS relied on a comparison of sampling data to criteria including Maximum Contaminant Levels (MCLs), Ambient Water Quality Criteria (AWQC), and adjusted Threshold Limit Values (TLVs), rather than providing risk calculations based on toxicity values. Since the time of the 1985 RI/FS, new toxicological studies and information have become available for many chemicals. EPA has developed toxicity values for contaminants evaluated for the Site. Although the ROD did not identify COCs, the OU1 RI/FS identified aniline, benzene, TCE, vinyl chloride, mercury, lead, arsenic, and chromium as "critical contaminants." Current human health toxicity values are available in EPA's Integrated Risks Information System (IRIS) database (EPA, 2013g), and Table 7-1 lists these values for OU1 critical contaminants. Updated ecologically based soil and sediment toxicity values are available from multiple sources (e.g., EPA Ecological Site Screening Levels (Eco-SSLs), MacDonald *et al.*, 2000).

Table 7-1
Summary of Current Toxicity Factors for Critical Contaminants
Nyanza Chemical Waste Dump Site – OU1
Ashland, Massachusetts

Chemical	Current Applicable Oral Reference Dose	Current Applicable Oral Cancer Slope Factor	Current Applicable Inhalation Reference Concentration	Current Applicable Inhalation Unit Risk Factor
	mg/Kg-day	$(mg/Kg\text{-}day)^{-1}$	$\mu g/m^3$	$(\mu g/m^3)^{-1}$
Aniline	7.0E-3 P	5.7E-3	1.0 E+0	1.6E-6 C
Benzene	4.0E-3	5.5E-2	3.0E+1	7.8E-6
Trichloroethene	5.0E-4	4.6E-2 M	2.0E+0	4.1E-6 M
Vinyl chloride[a]	3.0E-3	7.2E-1 M	1.0E+2	8.8E-6 M
Arsenic	3.0E-4	1.5 E+0	1.5E-2 C	4.3E-3

Chemical	Current Applicable Oral Reference Dose	Current Applicable Oral Cancer Slope Factor	Current Applicable Inhalation Reference Concentration	Current Applicable Inhalation Unit Risk Factor
	mg/Kg-day	$(mg/Kg\text{-}day)^{-1}$	$\mu g/m^3$	$(\mu g/m^3)^{-1}$
Chromium	1.5 E+0	NA	NA	NA
Lead	NA	NA	NA	NA
Mercury	3.0E-4	NA	3.0E-1	NA

Notes and Abbreviations:

1. Current toxicity factors were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] Cancer values for "Continuous lifetime exposure from birth".

NA = Not available.
M = Mutagenic Mode of Action.
P = Provisional Peer Reviewed Toxicity Value (PPRTV).
C = California EPA.

Because the selected remedy reduces human and environmental exposures through elimination of exposure, even though there have been changes in toxicity data since the time of the 1985 RI/FS that could result in changes in total risks due to exposures to site-related contaminants, these changes do not impact the protectiveness of the selected remedy.

Changes in Risk Assessment Methods

Since the RI/FS was completed in 1985, EPA has issued the following human health and ecological risk guidance documents and resources, which would change the methods used to develop risk estimates supporting the OU1 ROD (with potential impacts to exposure pathways, exposure assumptions, and formulas for estimating risks):

- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part A* (EPA, 1989a);
- *Supplemental Guidance to RAGS: Calculating the Concentration Term,* (EPA, 1992b);
- *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA, 1994);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part D* (EPA, 2001b);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a);

- *Guidelines for Carcinogenic Risk Assessment: Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens* (EPA, 2005);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA, 2009a);
- *Exposure Factors Handbook* (EPA, 2011b);
- *Vapor Intrusion Screening Level (VISL) Calculator, (EPA, 2013d);*
- *Vapor Intrusion Screening Level (VISL) Calculator User's Guide, (EPA, 2013d);*
- ProUCL software (EPA, 2013a);
- *ProUCL Technical Guide* (EPA, 2013b);
- *ProUCL User's Guide* (EPA, 2013c).
- *Guidelines for Ecological Risk Assessment* (EPA, 1998).
- *Framework for Ecological Risk Assessment* (EPA, 1992a).
- *Wildlife Exposure Factors Handbook, Volumes I and II* (EPA 600R-93/187a and 187b) (EPA, 1993b).
- *Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual (EPA 540/1-89/001)* (EPA, 1989a).
- *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document (EPA 600/3-89/013)* (Suter II, 1989).
- *Ecological Risk Assessment Issue Papers (EPA/630R-94/009)* (Suter II *et al.*, 1994).
- ECO Updates, Volumes 1-4 (EPA Office of Solid Waste and Emergency Response) (EPA, 1991-1994).
- *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 530-D-99-001A) (EPA, 1999b).
- *Eco SSL Guidance Documents and SOPs* (EPA, 2003 through 2007).

The human health risk assessment in the 1985 RI/FS did not calculate risks. Instead, it relied on a comparison of sampling data to various criteria and a discussion of adverse health effects of the primary COCs. As noted above, excavation and consolidation of contaminated soil, sediment, and sludge in the former on-site sludge disposal area and capping of the Hill area have essentially eliminated the potential for human and environmental exposure to hazardous substances in these media at OU1. Therefore, changes in risk assessment methods, which have occurred since the time of the RI/FS and ROD, do not affect the protectiveness of the selected remedy.

New/Emerging Contaminants and/or Contaminant Sources

No new contaminants or contaminant sources have been identified since the 2009 five-year review. The presence of DNAPL with its potential as an on-going source was discovered in 1994 following the 1991 OU2 ROD. This new source is addressed under the OU2 ESD.

Expected Progress towards Meeting RAOs

The 1985 ROD established the following RAOs:

- Reduce the generation of contaminated leachate and thereby mitigate future groundwater contamination.
- Minimize off-site contaminant migration via surface runoff and air transport.
- Minimize direct human and environmental exposure to contaminated sediments.

The remedial actions at this Site address these RAOs by excavation and consolidation of wastes; installation and maintenance of a RCRA cap; installation of a groundwater/surface water diversion system eliminating human and environmental direct contact with contaminated soil, sediments, and sludge; eliminating surface runoff of contaminants and air emissions; and reducing leachate production by permanently lowering the groundwater table below the depth of waste deposits.

OU2

No. Some of the human exposure assumptions (pathways and risk assessment methods) and toxicity data used at the time of the 1991 interim remedy selection are no longer valid since the RI/FS was completed in 1991, prior to the existence of several current pertinent EPA risk guidances. The remedy selected under the OU2 interim ROD (1991) was superseded by the 2006 ESD. A focused indoor air risk assessment in 2005 addressing vapor migration into indoor air supported the ESD. The majority of exposure assumptions (pathways and risk assessment methods) and toxicity data used at the time of the focused risk assessment are still valid; however, a few have changed, including the inhalation toxicity values for TCE as described below. Action levels developed following Massachusetts Department of Environmental Protection (MassDEP) methods to protect against imminent hazards, vapor intrusion screening levels (VISLs), and target indoor air concentrations have changed based on changes to the toxicity values. The prior action level for TCE in indoor air was 2 to 43 $\mu g/m^3$. Currently, MassDEP considers TCE concentrations

exceeding 6 μg/m^3 in a residential setting where pregnant women or those who may become pregnant are present to be an imminent hazard requiring immediate response action (MassDEP, 2014a). The focused indoor air risk assessment did not re-evaluate other pathways included in the 1991 RI/FS. Although there have been changes in human exposure assumptions (pathways and risk assessment methods) and toxicity data since the time of the 1991 Human Health Risk Assessment (HHRA) and the 2005 focused indoor air risk assessment, because the selected remedy reduces human exposures through elimination of pathways, these changes do not impact the protectiveness of the selected remedy.

A preliminary ecological assessment of groundwater impacts to surface water was included in the 1991 RI/FS. Further assessment of ecological risks was deferred to OU3.

Neither the OU2 interim ROD (1991) nor the 2006 ESD set specific groundwater cleanup goals. However, MCLs are federal ARARs. There are no changes in MCLs for the Site COPCs since the 2006 ESD.

The RAOs used at the time of the 1991 ROD are still valid. The 2006 ESD did not modify the general goals for groundwater remediation established in the 1991 ROD, but furthered those goals through modification of the selected remedy.

Changes in Standards or TBCs

MCLs are federal ARARs. There are no changes in MCLs.

Changes in Exposure Pathways

The human health exposure pathways considered in the 1991 HHRA performed during the RI/FS included potential future ingestion of groundwater as drinking water, dermal contact with groundwater during washing, and inhalation of groundwater VOCs while showering; inhalation of VOCs and dermal contact with groundwater in basements; dermal contact and ingestion of surface water; and dermal contact and ingestion of sediment. Although appropriate in 1991, exposure assumptions used in support of the 1991 ROD to evaluate drinking water risks and direct exposures to groundwater in basements are out dated. Currently, groundwater is not used as a drinking water source. Potential use of groundwater as a drinking water resource remains a valid pathway; however, MCLs used as interim clean-up criteria are protective of this pathway

and the ESD requires institutional controls (environmental restrictions) to be placed on the Site and surrounding properties overlying the plume prohibiting use of groundwater as drinking water. Formal deed restrictions have not yet been placed on the Site or surrounding residential properties. Instead, EPA has established an informal process of communication with the Ashland Board of Health whereby the Town of Ashland seeks EPA's input into construction projects located within the extent of the known groundwater plume to ensure that property owners are aware of the plume. The Town of Ashland does not use groundwater from the contaminated plume for their drinking water supply. A Grant of Environmental Restrictions and Easements has been signed for one former industrial property off Megunko Road and three others are being negotiated. Direct exposures to groundwater in basements or exposures to surface water and sediments remain valid pathways. Installation of DNAPL extraction wells will serve to reduce migration of contaminants into basements, thus reducing exposures via this pathway.

The focused indoor air HHRA in 2005 addressed vapor migration into indoor air and subsequent inhalation of volatiles. This pathway remains valid; however, vapor intrusion mitigation systems installed in 2008 have reduced exposure via this pathway.

No changes in land use or the physical conditions of the property have occurred since the ESD. The landfill itself remains vacant, capped, and fenced. No new development has occurred in areas above the groundwater plume.

Although there have been changes in exposure assumptions since the time of the 1991 HHRA and the 2005 focused indoor air risk assessment, because the selected remedy reduces human exposures through elimination of pathways these changes do not impact the protectiveness of the selected remedy.

Changes in Toxicity and Other Contaminant Characteristics

Toxicity values for most chemicals have been updated since the time of the 1991 HHRA and ROD, as shown on Tables 7-2 and 7-3 below.

Table 7-2
Summary of Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU2 1991 HHRA
Ashland, Massachusetts

Chemical	Oral Cancer Slope Factor in 1991 HHRA	Current Applicable Oral Cancer Slope Factor	Inhalation Unit Risk Factor in 1991 HHRA[a]	Current Applicable Inhalation Unit Risk Factor	Dermal Cancer Slope Factor in 1991 HHRA	Current Applicable Dermal Cancer Slope Factor
	(mg/Kg-day)$^{-1}$	(mg/Kg-day)$^{-1}$	(mg/Kg-day)$^{-1}$	(µg/m^3)$^{-1}$	(mg/Kg-day)$^{-1}$	(mg/Kg-day)$^{-1}$
Benzene	2.9E-2	**5.5E-2**	8.3E-6	*7.8E-6*	2.9E-2	**5.5E-2**
2-Butanone	NE	NA	NE	NA	NE	NA
Chlorobenzene	NE	NA	NE	NA	NE	NA
1,2-Dichloroethene	NE	NA	NE	NA	NE	NA
Methylene chloride	7.5E-3	*2.0E-3* M	4.0E-6	*1.0E-8*	7.5E-3	*2.0E-3 M*
Tetrachloroethylene	5.1E-2	*2.1E-3*	9.4E-8	**2.6E-7**	5.1E-2	*2.1E-3*
Toluene	NE	NA	NE	NA	NE	NA
Trichloroethene	1.1E-2	**4.6E-2 M**	4.9E-6	*4.1E-6*	1.1E-2	**4.6E-2 M**
Vinyl chloride[b]	1.9E+0	*7.2E-1* M	5.4E-4	*4.4E-6*	1.9E+0	*7.2E-1 M*
Aniline	5.7E-3	5.7E-3	7.4E-6	*1.6E-6 C*	5.7E-3	5.7E-3
Benzidine	2.3E+2	2.3E+2 M	6.6E-2	**6.7E-2**	2.3E+2	2.3E+2 M
4-Chloroaniline	NE	**2.0E-1 P**	NE	NA	NE	**2.0E-1**
2-Chlorophenol	NE	NA	NE	NA	NE	NA
1,2-Dichlorobenzene	NE	NA	NE	NA	NE	NA
1,3-Dichlorobenzene	NE	NA	NE	NA	NE	NA
1,4-Dichlorobenzene	2.4E-2	*5.4E-3 C*	6.9E-6	**1.1E-5 C**	2.4E-2	*5.4E-3*
3,3'-Dimethylbenzidine	9.2E 0	**1.1E+1 P**	2.6E-3	*NA*	9.2E 0	**1.1E+1**
Bis(2-ethylhexyl)phthalate	1.4E-2	1.4E-2	4.0E-6	*2.4E-6 C*	1.4E-2	1.4E-2
Naphthalene	NE	NA	NE	**3.4E-5 C**	NE	NA
Nitrobenzene	NE	NA	NE	**4.0E-5**	NE	NA
N-Nitrosodiphenylamine	NE	**4.9E-3**	NE	**2.6E-6 C**	NE	**4.9E-3**
N-Nitrosodi-n-propylamine	7.0E+0	7.0E+0	2.0E-3	2.0E-3 C	7.0E+0	7.0E+0
Pentachlorophenol	1.2E-1	**4.0E-1**	NE	**5.1E-6 C**	1.2E-1	**4.0E-1**
1,2,4- Trichlorobenzene	NE	**2.9E-2 P**	NE	NA	NE	**2.9E-2**
Dieldrin	1.6E+1	1.6E+1	4.6E-3	4.6E-3	1.6E+1	1.6E+1
Heptachlor	4.5E+0	4.5E+0	1.3E-3	1.3E-3	4.5E+0	4.5E+0
Antimony	NE	NA	NE	NA	NE	NA
Arsenic	1.75E+0	*1.5E+0*	NE	**4.3E-3**	1.75E+0	*1.5E+0*

Chemical	Oral Cancer Slope Factor in 1991 HHRA	Current Applicable Oral Cancer Slope Factor	Inhalation Unit Risk Factor in 1991 HHRA[a]	Current Applicable Inhalation Unit Risk Factor	Dermal Cancer Slope Factor in 1991 HHRA	Current Applicable Dermal Cancer Slope Factor
	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	$(\mu g/m^3)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$
Beryllium	4.3E+0	*NA*	NE	**2.4E-3**	4.3E+0	*NA*
Cadmium	NE	NA	NE	**1.8E-3**	NE	NA
Chromium	NE	NA	NE	NA	NE	NA
Copper	NE	NA	NE	NA	NE	NA
Lead	NE	NA	NE	NA	NE	NA
Manganese	NE	NA	NE	NA	NE	NA
Mercury	NE	NA	NE	NA	NE	NA
Nickel	NE	NA	NE	**2.6E-4 C**	NE	NA

Notes and Abbreviations:

1. Current cancer slope factors were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] The 1991 inhalation CSF $(mg/Kg\text{-}day)^{-1}$ converted to unit risk $(\mu g/m^3)^{-1}$.

[b] "Continuous lifetime exposure from birth".

NE = Not evaluated in the HHRA.

M = Mutagenic Mode of Action. Consideration of the mutagenic mode of action results in increased risks to children and adolescents.

C = California EPA.

H = Health Effects Assessment Summary Tables (HEAST)

P = PPRTV

Bold print indicates change in toxicity value (or newly available) would increase risk.

Italic print indicates change in toxicity value (or withdrawn value) would decrease risk.

Table 7-3
Summary of Non-Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU2 1991 HHRA
Ashland, Massachusetts

Chemical	Oral Reference Dose in 1991 RI HHRA	Current Applicable Oral Reference Dose	Inhalation Reference Concentration in 1991 RI HHRA[a]	Current Applicable Inhalation Reference Concentration	Dermal Reference Dose in 1991 RI HHRA	Current Applicable Dermal Reference Dose
	mg/Kg-day	mg/Kg-day	mg/Kg-day	mg/m^3	mg/Kg-day	mg/Kg-day
Benzene	NE	**4.0E-3**	NE	**3.0E-2**	NE	**4.0E+0**
2-Butanone	5.0E-2	*6.0E-1*	3.15E-1	*5.0E+0*	5.0E-2	*6.0E-1*
Chlorobenzene	2.0E-2	2.0E-2	1.75E-2	*5.0E-2* P	2.0E-2	2.0E-2
1,2-Dichloroethene (Mixed Isomers)[b]	1.0E-2	***9.0E-3 H***	3.5E-2	NA	1.0E-2	**9.0E-3**
1,2-Dichloroethene –cis-	NE	***2.0E-3***	NE	*NA*	NE	**2.0E-3**
1,2-Dichloroethene –trans-	NE	*2.0E-2*	NE	*6.0E-2 P*	NE	*2.0E-2*
Methylene chloride	6.0E-2	**6.0E-3**	2.1E-1	*6.0E-1*	6.0E-2	**6.0E-3**
Tetrachloroethylene	1.0E-2	**6.0E-3**	3.5E-2	*4.0E-2*	1.0E-2	**6.0E-3**
Toluene	2.0E-1	**8.0E-2**	2.0E+0	*5.0E+0*	2.0E-1	**8.0E-2**
Trichloroethene	NE	**5.0E-4**	NE	**2.0E-3**	NE	**5.0E-4**
Vinyl chloride	NE	**3.0E-3**	NE	**1.0E-1**	NE	**3.0E-3**
Aniline	NE	**7.0E-3 P**	NE	**1.0E-3**	NE	**7.0E-3**
Benzidine	1.0E-1	**3.0E-3**	1.05E-2	*NA*	1.0E-1	**3.0E-3**
4-Chloroaniline	4.0E-3	4.0E-3	1.4E-2	*NA*	4.0E-3	4.0E-3
2-Chlorophenol	5.0E-3	5.0E-3	1.75E-2	*NA*	5.0E-3	5.0E-3
1,2-Dichlorobenzene	9.0E-2	9.0E-2	1.4E-1	*2.0E-1 H*	9.0E-2	9.0E-2
1,3-Dichlorobenzene	NE	NA	NE	NA	NE	NA
1,4-Dichlorobenzene	NE	**7.0E-2 A**	NE	**8.0E-1**	NE	**7.0E-2**
3,3'-Dimethylbenzidine	NE	NA	NE	NA	NE	NA
Bis(2-ethylhexyl)phthalate	2.0E-2	2.0E-2	7.0E-2	*NA*	2.0E-2	2.0E-2
Naphthalene	4.0E-3	*2.0E-2*	1.4E-2	**3.0E-3**	4.0E-3	*2.0E-2*
Nitrobenzene	5.0E-4	*2.0E-3*	2.1E-3	*9.0E-3*	5.0E-4	*2.0E-3*
N-Nitrosodiphenylamine	NE	NA	NE	NA	NE	NA
N-Nitrosodipropylamine	NE	NA	NE	NA	NE	NA
Pentachlorophenol	3.0E-2	**5.0E-3**	1.05E-1	*NA*	3.0E-2	**5.0E-3**
1,2,4- Trichlorobenzene	1.3E-3	*1.0E-2*	1.05E-2	*2.0E-3 P*	1.3E-3	*1.0E-2*
Dieldrin	5.0E-5	5.0E-5	1.75E-4	*NA*	5.0E-5	5.0E-5

Chemical	Oral Reference Dose in 1991 RI HHRA	Current Applicable Oral Reference Dose	Inhalation Reference Concentration in 1991 RI HHRA[a]	Current Applicable Inhalation Reference Concentration	Dermal Reference Dose in 1991 RI HHRA	Current Applicable Dermal Reference Dose
	mg/Kg-day	mg/Kg-day	mg/Kg-day	mg/m^3	mg/Kg-day	mg/Kg-day
Heptachlor	5.0E-4	5.0E-4	1.75E-3	*NA*	5.0E-4	5.0E-4
Antimony	4.0E-4	4.0E-4	NE	NA	4.0E-4	**6.0E-5**
Arsenic	1.0E-3	**3.0E-4**	NE	**1.5E-5 C**	1.0E-3	**3.0E-4**
Beryllium	5.0E-3	**2.0E-3**	NE	**2.0E-5**	5.0E-3	**1.4E-5**
Cadmium	5.0E-4	5.0E-4	NE	**1.0E-5 A**	5.0E-4	**2.5E-5**
Chromium III	1.0E+0	*1.5E+0*	NE	NA	1.0E+0	**1.95E-2**
Chromium VI	5.0E-3	**3.0E-3**	NE	1.0E-4	5.0E-3	**7.5E-5**
Copper	3.7E-2	*4.0E-2 H*	NE	NA	3.7E-2	*4.0E-2*
Lead	4.0E-4	***NA***	NE	NA	4.0E-4	*NA*
Manganese	1.0E-1	*1.4E-1*	NE	**5.0E-5**	1.0E-1	*1.4E-1*
Mercury	3.0E-4	3.0E-4	NE	**3.0E-4**	3.0E-4	**2.1E-5**
Nickel	2.0E-2	2.0E-2	NE	**9.0E-5**	2.0E-2	**8.0E-4**

Notes and Abbreviations:

1. Current reference doses were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] The 1991 inhalation RfD (mg/Kg-day) converted to RfC (mg/m^3).

[b] 1,2-Dichloroethene was evaluated in the HHRA as cis-1,2-dichloroethene, considered to be the more toxic isomer in 1991. Current applicable toxicity values for both isomers are shown.

NE = Not evaluated in the HHRA.
NA = Not currently available
A = ATSDR
C = California EPA.
H = HEAST
P = PPRTV
Bold print indicates change in toxicity value would increase risk.
Italic print indicates change in toxicity value would decrease risk.

As shown on the above tables, impacts to calculated risks of toxicity value changes vary by contaminant. Since oral exposures to benzidine and nitrobenzene in drinking water have been identified as the greatest concern for potential groundwater exposures, the impacts of changes to benzidine and nitrobenzene toxicity values are of greatest interest. Cancer risks from benzidine are likely to be greater than those calculated in the 1991 risk assessment were, only because a current evaluation of benzidine would utilize a revised method of evaluating risk to children and adolescents from carcinogens with a mutagenic mode of action. Non-cancer health hazards of nitrobenzene are likely to be less than those calculated in the 1991 risk assessment.

The 2005 indoor air HHRA utilized a tiered approach to evaluation of potential indoor air risks.

The Tier 1 evaluation included a determination that vapor intrusion may be a concern based on groundwater data and that TCE was present in indoor air at concentrations above action levels developed following MassDEP methods to protect against imminent hazards and based on $1x10^{-3}$ cancer risk levels and hazard quotients of 10. The report used the screening range of 2 to 43 $\mu g/m^3$ for TCE in indoor air. Currently, based on changes to the EPA TCE toxicity values and information on TCE developmental toxicity, MassDEP considers TCE concentrations exceeding 6 $\mu g/m^3$ in a residential setting where pregnant women or those who may become pregnant are present to be an imminent hazard requiring immediate response action (MassDEP, 2014a). Air sampling results from 1998 exceeded this level; however, air sampling results from the more recent 2004 indoor air sampling round did not. Although the screening level has changed, the conclusion of the Tier 1 evaluation that further evaluation was needed remains valid.

The Tier 2 evaluation included a comparison of groundwater concentrations to VISLs and comparison of indoor air data to target indoor air concentrations obtained from the EPA's 2002 Vapor Intrusion Guidance (EPA, 2002) based on $1x10^{-6}$ cancer risk levels and hazard quotients of 0.1. VISLs and EPA target indoor air concentrations have changed to reflect the latest toxicity values and are available in the *VISL Calculator* (EPA, 2013d) and the *VISL Calculator User's Guide* (EPA, 2013d). Although the screening levels have changed, the conclusion of the Tier 2 evaluation that further evaluation was needed remains valid.

The Tier 3 evaluation included site-specific risk calculations using 1) groundwater data to model indoor air concentrations and 2) measured indoor air concentrations. The 2005 indoor air HHRA identified twelve COPCs for evaluation of indoor air modeled from shallow groundwater

concentrations and five COPCs (TCE, vinyl chloride, chlorobenzene, benzene, and 1,4-dichlorobenzene) for the evaluation of indoor air sampling results.

Toxicity values for the COPCs identified for groundwater and/or indoor air are shown on Tables 7-4 and 7-5 below. Several have been updated since the time of the 2005 indoor air HHRA and the 2006 ESD. Impacts of those changes on the indoor air risk results are shown to the right.

Table 7-4
Summary of Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU2 2005 Indoor Air HHRA
Ashland, Massachusetts

Chemical	Inhalation Unit Risk Factor in 2005 HHRA/ESD	Current Applicable Inhalation Unit Risk Factor	Impacts on Risk
	$(\mu g/m^3)^{-1}$	$(\mu g/m^3)^{-1}$	
1,2,4- Trichlorobenzene	NE	--	NC
1,2-Dichlorobenzene	NE	--	NC
1,4-Dichlorobenzene	NE	1.1E-5	increase
Naphthalene	NE	3.4E-5	increase
Nitrobenzene	NE	4.0E-5	increase
1,1-Dichloroethene	NE	--	NC
1,2-Dichloroethene, total	NE	--	NC
Cis-1,2-Dichloroethene	NE	--	NC
Benzene	7.8E-6	7.8E-6	NC
Chlorobenzene	NE	--	NC
Methylene chloride	4.7E-7	1.0E-8	decrease
Trichloroethene	1.7E-6[a]	4.1E-6 M	increase
Trichloroethene	1.1E-4[b]	4.1E-6 M	decrease
Vinyl chloride[c]	8.8E-6	8.8E-6 M	NC

Notes and Abbreviations:

1. Current inhalation unit risk factors were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] The 1987 inhalation CSF 6.0E-3 $(mg/Kg\text{-}day)^{-1}$ converted to unit risk.
[b] The 2001 draft CSF 0.4 $(mg/Kg\text{-}day)^{-1}$ converted to unit risk.
[c] "Continuous lifetime exposure from birth".
NE = Not evaluated in the HHRA.
NC = No change.
M = Mutagenic Mode of Action.

Table 7-5
Summary of Non-Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU2 2005 Indoor Air HHRA
Ashland, Massachusetts

Chemical	Inhalation Reference Concentration in 2005 HHRA/ESD	Current Applicable Inhalation Reference Concentration	Impacts on Risk
	µg/m³	µg/m³	
1,2,4- Trichlorobenzene	4.0E+0	2.0E+0[a]	decrease
1,2-Dichlorobenzene	3.15E+2	2.0E+2	increase
1,4-Dichlorobenzene	8.0E+2	8.0E+2	NC
Naphthalene	3.0E+0	3.0E+0	NC
Nitrobenzene	2.0E+0	9.0E+0	decrease
1,1-Dichloroethene	2.0E+2	2.0E+2	NC
1,2-Dichloroethene, total	NE	--	NC
Cis-1,2-Dichloroethene	NE	--	NC
Benzene	3.0E+1	3.0E+1	NC
Chlorobenzene	2.0E+1	5.0E+1[a]	decrease
Methylene chloride	3.0E+3	6.0E+2	increase
Trichloroethene	4.0E+1	2.0E+0	increase
Vinyl chloride	1.0E+2	1.0E+2	NC

Notes and Abbreviations:

1. Current inhalation reference concentrations were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] The Provisional Peer Reviewed Toxicity Values (PPRTVs) derived by EPA's Superfund Health Risk Technical Support Center (STSC) for the EPA Superfund program.

NC = No change.

As shown on the above tables, impacts to calculated risks of toxicity value changes vary by contaminant. Since TCE has been identified as the greatest concern for groundwater contaminant inhalation exposures, the increased impacts of changes to TCE toxicity values are of greatest interest. Non-cancer health hazards of TCE are likely to be 20 times those calculated in the 2005 focused indoor air risk assessment. Cancer risks from TCE were calculated using two different inhalation unit risk values in the 2005 focused indoor air risk assessment. Since the updated TCE unit risk value is between the two values used in 2005, the current cancer risk estimate would lie within the range of those calculated in 2005. Among the other indoor air COPCs, current availability of the 1,4-dichlorobenzene unit risk value results in an increase in total cancer risk and changes to the chlorobenzene reference concentration decrease non-cancer health hazards.

Although there have been changes in toxicity data since the time of the 1991 HHRA and the 2005 focused indoor air risk assessment, because the selected remedy reduces exposures through elimination of pathways these changes do not impact the protectiveness of the selected remedy.

Changes in Risk Assessment Methods

Since the HHRA was completed in 1991, EPA issued the following pertinent risk guidance documents and resources, which would change the methods used to develop human health risk estimates supporting the 1991 OU2 ROD (with potential impacts to exposure pathways, exposure assumptions, and formulas for estimating risks), including:

- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part D* (EPA, 2001b);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a);
- *Guidelines for Carcinogenic Risk Assessment: Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens* (EPA, 2005);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA, 2009a);
- *Exposure Factors Handbook* (EPA, 2011b);
- *Vapor Intrusion Screening Level (VISL) Calculator, (EPA, 2013d); and*
- *Vapor Intrusion Screening Level (VISL) Calculator User's Guide, (EPA, 2013d).*

Several of the above were also issued after the 2006 focused risk assessment. In 2009, EPA finalized the *Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)* (EPA, 2009a) recommending the use of inhalation unit risk factors and reference concentrations in conjunction with average daily concentration estimates for evaluating inhalation exposures. This guidance addressing methods of evaluating inhalation risks, the *VISL Calculator* (EPA, 2013d), and the *VISL Calculator User's Guide* (EPA, 2013d) are pertinent to the 2006 focused risk assessment were issued after 2006.

Although there have been changes in risk assessment methods since the time of the 1991 HHRA and the 2005 focused indoor air risk assessment, because the selected remedy reduces

exposures through elimination of pathways these changes do not impact the protectiveness of the selected remedy.

New/Emerging Contaminants and/or Contaminant Sources

The presence of dense non-aqueous phase liquid (DNAPL) and its potential to act as an on-going source to the down gradient (dissolved) groundwater plume was discovered in 1994 subsequent to the 1991 OU2 ROD. This new source is addressed under the OU2 ESD signed in 2006. A significant component of the DNAPL is TCE. Since 2006 (i.e., the signing of the ESD), 1,4-dioxane has been identified as an emerging contaminant in groundwater at a number of sites with TCE. There are no MCLs for 1,4-dioxane. EPA has sampled for 1,4-dioxane at Nyanza since 2011 and has not detected it. However, as a result of dilutions and/or traditional VOC methods employed, the detection limits do exceed the EPA RSL for tap water of 0.67 μg/L. However, the 2014 MassDEP Groundwater Use and Value Determination for Nyanza did not consider the review area as a current drinking water source which mitigates the elevated detection limits.

Expected Progress towards Meeting RAOs

The 1991 ROD established the following RAOs:

- Reduce migration of contaminants in groundwater.
- Reduce risks to human health associated with potential future consumption and direct contact with groundwater.
- Reduce risks from present and potential future inhalation of evaporated groundwater contaminants.
- Limit degradation of the Sudbury River and wetlands due to the natural discharge of contaminated groundwater.
- Comply with state and federal ARARs, including drinking water standards.

The 2006 ESD did not modify the general goals for groundwater remediation established in the 1991 ROD, but furthered those goals through source extraction, an expanded groundwater, requirements for institutional controls prohibiting future use of groundwater as drinking water, installation of vapor migration systems, and indoor air monitoring program.

The remedial actions at this Site as modified by the ESD address or will address the RAOs by extraction and disposal of DNAPL; performance of routine groundwater monitoring; installation of additional groundwater monitoring wells; implementation of environmental use restrictions; installation of 43 vapor intrusion mitigation systems in 41 structures; and performance of indoor air monitoring in structures located above the plume beyond the area where vapor mitigation systems were proposed. Installation of one DNAPL extraction well was completed in September 2013 on the Nyacol property and an existing monitoring well was converted to a DNAPL extraction well on the WAC property. The DNAPL extraction and subsequent off-site treatment and disposal of extracted DNAPL are intended to reduce the DNAPL as a continuing source of groundwater contamination. Groundwater monitoring is on-going, and serves to monitor the extent of groundwater contamination and progress in reducing the plume. The additional monitoring well is intended to help clarify the extent of the plume.

Groundwater is not used currently as a drinking water source. In 2014, MassDEP issued a Groundwater Use and Value Determination for Nyanza (MassDEP, 2014b) that covered an area within a half mile radius centered on the Nyacol property. The Groundwater Use and Value Determination did not consider the review area to be a current drinking water source but identified four distinct areas (PPA1 through PPA4 on Figure 1 in Appendix F) as "potentially productive aquifers" for future water supplies based on hydrogeological characteristics. All but one of the areas (PPA4) were eliminated based on existing site uses (density of housing, lot size, proximity of commercial/industrial properties, etc.). PPA4 covers only a small portion of the known plume area north of Pleasant Street and adjacent to the Sudbury River.

The ROD required institutional controls (environmental restrictions) to be placed on the Site and adjacent properties overlying the plume to prohibit use of groundwater as drinking water. A Grant of Environmental Restrictions and Easements has been signed for one former industrial property off Megunko Road and three others are being negotiated. The environmental use restrictions are designed to be protective of human health by eliminating future exposures to groundwater as drinking water. Formal deed restrictions have not been placed on surrounding residential properties. Instead, EPA has established an informal process of communication with the Ashland Board of Health whereby the Town of Ashland seeks EPA's input into construction projects located within the extent of the known groundwater plume to ensure that property owners are aware of the plume. The installation of vapor migration systems was completed in 2007. Vapor mitigation systems are intended to eliminate the potential for vapor intrusion into homes.

Additional indoor air sampling is intended to determine whether additional vapor mitigation systems are needed based on future changes in toxicity, plume migration, or changes in property use. Testing is being conducted presently (at 60 Pleasant Street) because of a property use change. The installation of vapor intrusion mitigation systems is designed to be protective of human health by eliminating the vapor intrusion exposure pathway.

OU3

No, some human health exposure assumptions (pathways and risk assessment methods) and toxicity data used at the time of the OU3 remedy selection (1993) are no longer valid, since the RI/FS was completed in 1992, which was prior to the existence of several current pertinent EPA human health risk guidances. Changes in toxicity values and risk assessment methods have occurred since the remedy selection; however, changes do not impact the protectiveness of the remedy. An ecological risk assessment was included in the 1992 RI/FS. As for human health, ecological screening benchmarks, exposure assumptions, and toxicity values have changed since the RI/FS was completed. However, the remedy is still protective of human health and the environment. The ROD established a mercury clean-up goal of 1 mg/Kg for sediments in the continuing source areas. The RAOs used at the time of the remedy selection are still valid.

Changes in Standards or TBCs

The OU3 ROD identifies AWQCs as ARARs. AWQCs protect aquatic life and human health. The AWQC (now known as National Recommended Water Quality Criteria (NRWQC)) that are applicable to the Site include fresh water Criteria Maximum Concentrations (CMC), fresh water Criteria Continuous Concentration (CCC), and human health criteria based on the consumption of fish. There have been no changes to the AWQC for mercury since the current value was published in 1995.

The 1 mg/Kg clean-up goal for mercury was selected to be protective of aquatic organisms as well as human health and is based on the National Oceanic and Atmospheric Administration's (NOAA) Effect Range – Median (ER-M) (Long & Morgan, 1991). More recent consensus values are available from MacDonald *et al.* (2000). However, the mercury probable effects concentration (PEC), which is analogous to the 1 mg/Kg NOAA ER-M selected as the clean-up goal, is essentially the same at 1.06 mg/Kg.

Changes in Exposure Pathways

The 1992 Human Health Risk Assessment evaluated recreational exposures including swimming, wading, and fishing. Exposure scenarios included exposure through accidental ingestion of and dermal contact with surface water and sediment. In addition to the recreational scenario, a residential scenario, which assumed more frequent exposure to contaminated sediment, was evaluated in bordering wetland areas. Fish ingestion exposure scenarios for the Sudbury River were evaluated for sports and subsistence fishermen. These scenarios and pathways remain valid. EPA does not publish default exposure assumptions for recreational exposures to sediment or surface water or for ingestion of fish. Therefore, standard practice involves site-specific selection of the exposure assumptions. The assumptions used are reasonable, and therefore can be considered still valid. Therefore, no changes in exposure pathways and exposure assumptions impact the protectiveness of the selected remedy.

An ecological risk assessment was also performed as part of the 1992 RI/FS. That ecological risk assessment evaluated the following pathways:

- effects on plants and animals that live in the surface water;
- effects on animals that live in the sediment; and
- effects on animals that feed on fish or river animals.

These pathways remain valid.

No changes in land use or the physical conditions of the property have occurred since the 2009 five-year review.

Changes in Toxicity and Other Contaminant Characteristics

Toxicity values are updated on an on-going basis by EPA. Since the time of the remedy selection, toxicity values for many of the contaminants evaluated in the HHRA have been updated. Current toxicity values for the COPCs are available in EPA's IRIS database (EPA, 2013g) and shown on Tables 7-6 and 7-7 below.

Toxicity values for several COPCs have been updated since the time of the 1992 HHRA, as shown on Tables 7-6 and 7-7 below. The 1992 HHRA presented oral cancer slope factors and reference

doses only. Current practice is to develop dermal toxicity values by adjusting oral toxicity values with an absorption factor. The tables below present current oral toxicity values for comparison purposes. Footnotes indicate those contaminants where current applicable dermal toxicity value would differ from the oral values presented.

Table 7-6
Summary of Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU3
Ashland, Massachusetts

Chemical	Oral Cancer Slope Factor in 1992 RI HHRA/ROD	Current Applicable Oral Cancer Slope Factor	Impacts on Risk
	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	
Acenaphthene	NE	NA	NC
Acenaphthylene	NE	NA	NC
Anthracene	NE	NA	NC
Benzo(a)anthracene	5.8E+0	7.3E-1 M	decrease
Benzo(a)pyrene	5.8E+0	7.3E+0 M	increase
Benzo(b)fluoranthene	5.8E+0	7.3E-1 M	decrease
Benzo(g,h,i)perylene	NE	NA	NC
Benzo(k)fluoranthene	5.8E+0	7.3E-2 M	decrease
Benzoic Acid	NE	NA	NC
Benzyl Alcohol	NE	NA	NC
Bis(2-chloroethyl)ether	1.1E+0	1.1E+0	NC
Bis(2-ethylhexyl)phthalate	1.4E-2	1.4E-2	NC
Butylbenzylphthalate	NE	NA	NC
2-Chlorophenol	NE	NA	NC
Chrysene	5.8E+0	7.3E-3 M	decrease
Dibenz(a,h)anthracene	5.8E+0	7.3E+0 M	increase
Dibenzofuran	NE	NA	NC
1,2-Dichlorobenzene	NE	NA	NC
1,3-Dichlorobenzene	NE	NA	NC
1,4-Dichlorobenzene	2.4E-2	5.4E-3 C	decrease
Diethylphthalate	NE	NA	NC
Di-n-butylphthalate	NE	NA	NC
Di-n-octylphthalate	NE	NA	NC
Fluoranthene	NE	NA	NC
Fluorene	NE	NA	NC
Indeno(1,2,3-cd)pyrene	5.8E+0	7.3E-1 M	decrease
2-Methylnaphthalene	NE	NA	NC
2-Methylphenol	NE	NA	NC
3-/4-Methylphenol	NE	NA	NC
Naphthalene	NE	NA	NC
Nitrobenzene	NE	NA	NC
N-Nitrosodiphenylamine	4.9E-3	4.9E-3	NC
Phenanthrene	NE	NA	NC

Chemical	Oral Cancer Slope Factor in 1992 RI HHRA/ROD	Current Applicable Oral Cancer Slope Factor	Impacts on Risk
	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	
Phenol	NE	NA	NC
Pyrene	NE	NA	NC
Aldrin	1.7E+1	1.7E+1	NC
Chlordane	1.3E+0	3.5E-1	decrease
4,4'-DDD	2.4E-1	2.4E-1	NC
4,4'-DDE	3.4E-1	3.4E-1	NC
4,4'-DDT	3.4E-1	3.4E-1	NC
Dieldrin	NE	1.6E+1	increase
Endosulfan	NE	NA	NC
Endrin	NE	NA	NC
Endrin Ketone	NE	NA	NC
Heptachlor	4.5E+0	4.5E+0	NC
Heptachlor Epoxide	9.1E+0	9.1E+0	NC
Lindane	1.3E+0	1.1E+0 C	decrease
Methoxychlor	NE	NA	NC
Polychlorinated Biphenyls	7.7E+0	2.0E+0	decrease
1,2,4- Trichlorobenzene	NE	2.9E-2 P	NC
Acetone	NE	NA	NC
Benzene	2.9E-2	5.5E-2	increase
2-Butanone	NE	NA	NC
Chlorobenzene	NE	NA	NC
Chloromethane	1.3E-2	NA	decrease
1,1-Dichloroethene	6.0E-1	NA	decrease
1,2-Dichloroethene	NE	NA	NC
Ethylbenzene	NE	1.1E-2 C	increase
Methylene chloride	7.5E-3	2.0E-3 M	decrease
Styrene	3.0E-2	NA	decrease
Tetrachloroethylene	5.1E-2	2.1E-3	decrease
Toluene	NE	NA	NC
Trichloroethene	1.1E-2	4.6E-2 M	increase
Vinyl chloride[a]	1.9E+0	7.2E-1 M	decrease
Xylenes	NE	NA	NC
Aluminum	NE	NA	NC
Antimony	NE	NA	NC
Arsenic	1.8E+0	1.5E+0	decrease
Barium	NE	NA	NC
Beryllium	4.3E+0	NA	decrease
Cadmium	NE	NA	NC
Calcium	NE	NA	NC
Chromium	NE	NA	NC
Cobalt	NE	NA	NC
Copper	NE	NA	NC
Iron	NE	NA	NC
Lead	NE	NA	NC

Chemical	Oral Cancer Slope Factor in 1992 RI HHRA/ROD	Current Applicable Oral Cancer Slope Factor	Impacts on Risk
	$(mg/Kg\text{-}day)^{-1}$	$(mg/Kg\text{-}day)^{-1}$	
Magnesium	NE	NA	NC
Manganese	NE	NA	NC
Mercury	NE	NA	NC
Methylmercury	NE	NA	NC
Nickel	NE	NA	NC
Potassium	NE	NA	NC
Selenium	NE	NA	NC
Silver	NE	NA	NC
Sodium	NE	NA	NC
Vanadium	NE	NA	NC
Zinc	NE	NA	NC
Thallium	NE	NA	NC

Notes and Abbreviations:

1. Current cancer slope factors were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

[a] "Continuous lifetime exposure from birth".

NA = Not applicable

NE = Not evaluated in the HHRA.
NC = No change.
M = Mutagenic Mode of Action.
P = Provisional Peer Reviewed Toxicity Value (PPRTV).
C = California EPA.

Table 7-7
Summary of Non-Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU3
Ashland, Massachusetts

Chemical	Oral Reference Dose in 1992 RI HHRA/ROD	Current Applicable Oral Reference Dose	Impacts on Risk
	mg/Kg-day	mg/Kg-day	
Acenaphthene	6.0E-2	6.0E-2	NC
Acenaphthylene	4.0E-3	NA	decrease
Anthracene	3.0E-1	3.0E-1	NC
Benzo(a)anthracene	NE	NA	NC
Benzo(a)pyrene	NE	NA	NC
Benzo(b)fluoranthene	NE	NA	NC
Benzo(g,h,i)perylene	4.0E-3	NA	decrease
Benzo(k)fluoranthene	NE	NA	NC
Benzoic Acid	4.0E+0	4.0E+0	NC
Benzyl Alcohol	3.0E-1	1.0E-1 P	increase
Bis(2-chloroethyl)ether	NE	NA	NC
Bis(2-ethylhexyl)phthalate	2.0E-2	2.0E-2	NC
Butylbenzylphthalate	2.0E-1	2.0E-1	NC
2-Chlorophenol	5.0E-3	5.0E-3	NC
Chrysene	NE	NA	NC

Chemical	Oral Reference Dose in 1992 RI HHRA/ROD	Current Applicable Oral Reference Dose	Impacts on Risk
	mg/Kg-day	mg/Kg-day	
Dibenz(a,h)anthracene	NE	NA	NC
Dibenzofuran	4.0E-3	1.0E-3 PA	increase
1,2-Dichlorobenzene	9.0E-2	9.0E-2	NC
1,3-Dichlorobenzene	3.0E-2	NA	decrease
1,4-Dichlorobenzene	NE	7.0E-2	increase
Diethylphthalate	8.0E-1	8.0E-1	NC
Di-n-butylphthalate	1.0E-1	1.0E-1	NC
Di-n-octylphthalate	2.0E-2	2.0E-2	NC
Fluoranthene	4.0E-2	4.0E-2	NC
Fluorene	4.0E-2	4.0E-2	NC
Indeno(1,2,3-cd)pyrene	NE	NA	NC
2-Methylnaphthalene	NE	4.0E-3	increase
2-Methylphenol	5.0E-2	5.0E-2	NC
3-/4-Methylphenol	5.0E-2	5.0E-2	NC
Naphthalene	4.0E-3	2.0E-2	decrease
Nitrobenzene	5.0E-4	2.0E-3	decrease
N-Nitrosodiphenylamine	NE	NA	NC
Phenanthrene	4.0E-3	NA	decrease
Phenol	6.0E-1	3.0E-1	increase
Pyrene	3.0E-2	3.0E-2	NC
1,2,4- Trichlorobenzene	1.31E-3	1.0E-2	decrease
Aldrin	3.0E-5	3.0E-5	NC
Chlordane	6.0E-5	5.0E-4	decrease
4,4'-DDD	NE	NA	NC
4,4'-DDE	NE	NA	NC
4,4'-DDT	5.0E-4	5.0E-4	NC
Dieldrin	5.0E-5	5.0E-5	NC
Endosulfan	5.0E-5	6.0E-3	decrease
Endrin	3.0E-4	3.0E-4	NC
Endrin Ketone	NE	NA	NC
Heptachlor	5.0E-4	5.0E-4	NC
Heptachlor Epoxide	1.3E-5	1.3E-5	NC
Lindane	3.0E-4	3.0E-4	NC
Methoxychlor	5.0E-3	5.0E-3	NC
Polychlorinated Biphenyls	NE	NA	NC
Acetone	1.0E-1	9.0E-1	decrease
Benzene	NE	4.0E-3	increase
2-Butanone	5.0E-2	6.0E-1	decrease
Chlorobenzene	2.0E-2	2.0E-2	NC
Chloromethane	NE	NA	NC
1,1-Dichloroethene	9.0E-3	5.0E-2	decrease
1,2-Dichloroethene	1.0E-2	9.0E-3	decrease
Ethylbenzene	1.0E-1	1.0E-1	NC
Methylene chloride	6.0E-2	6.0E-3	increase

Chemical	Oral Reference Dose in 1992 RI HHRA/ROD	Current Applicable Oral Reference Dose	Impacts on Risk
	mg/Kg-day	mg/Kg-day	
Styrene	2.0E-1	2.0E-1	NC
Tetrachloroethylene	1.0E-2	6.0E-3	increase
Toluene	2.0E-1	8.0E-2	increase
Trichloroethene	NE	5.0E-4	increase
Vinyl chloride	NE	3.0E-3	increase
Xylenes	2.0E+0	2.0E-1	increase
Aluminum	NE	1.0 E+0 P	increase
Antimony	4.0E-4	4.0E-4 D	NC
Arsenic	3.0E-4	3.0E-4	NC
Barium	5.0E-2	2.0E-1	decrease
Beryllium	5.0E-3	2.0E-3	increase
Cadmium	5.0E-4	5.0E-4 D	NC
Calcium	NE	NA	NC
Chromium	1.0 E+0	1.5E+0 D	decrease
Cobalt	NE	3.0E-4 P	NC
Copper	NE	4.0E-2 H	NC
Iron	NE	7.0E-1 P	NC
Lead	NE	NA	NC
Magnesium	NE	NA	NC
Manganese	1.0E-1	1.4E-1	decrease
Mercury	3.0E-4	3.0E-4 D	NC
Methylmercury	3.0E-4	1.0E-4	increase
Nickel	2.0E-2	2.0E-2 D	NC
Potassium	NE	NA	NC
Selenium	5.0E-3	5.0E-3	NC
Silver	3.0E-3	5.0E-3 D	decrease
Sodium	NE	NA	NC
Vanadium	7.0E-3	5.0E-3 R D	increase
Zinc	2.0E-1	3.0E-1	decrease
Thallium	7.0E-5	1.0E-5 PA	increase

Notes and Abbreviations:

1. Current reference doses were obtained from EPA's Integrated Risks Information System database (IRIS), 2013 unless otherwise noted.

NE = Not evaluated in the HHRA.
NA = Not currently available
NC = No change.
D = Current applicable dermal toxicity value would differ from the oral value.
P = Provisional Peer Reviewed Toxicity Value (PPRTV).
PA = PPRTV Appendix.
C = California EPA.
H = HEAST
R = EPA Regional Screening Levels User's Guide

As shown on the above tables, impacts of changes vary by contaminant. Since mercury was identified as the greatest concern for OU3 exposures, the impacts of changes to mercury (or methylmercury) toxicity values are of greatest interest. The toxicity value for mercury remains

unchanged since the 1992 OU3 HHRA. However, the toxicity value (oral reference dose) for methylmercury slightly decreased since the 1992 OU3 HHRA. The impact of this change is a slight increase in risk from exposures to methylmercury.

Additional wildlife toxicity values have become available since the time of the remedy selection. Piscivore toxicity-based fish concentrations and toxicity reference values for the evaluated chemicals of potential ecological concern (COPECs) in biota are shown on Tables 7-8 and 7-9 below.

Table 7-8
Summary of Piscivore Toxicity-based Fish Concentrations
Nyanza Chemical Waste Dump Site – OU3
Ashland, Massachusetts

Chemical	Fish Benchmark Concentration in 1992 RI ERA/ROD (µg/Kg wet weight)	More Recent Fish Benchmark Concentration (µg/Kg wet weight)	Overall Impacts on Risk
DDT	150	6[a]	Increase
PCB	640	79[b]	Increase
Chlordane	300	500[c]	NC, benchmark still below concentrations
Dieldrin	300	81[b]	NC, benchmark still below concentrations
Mercury	100	13[a]	Increase

Notes and Abbreviations:
[a] Belted kingfisher; Sample *et al*,. 1996.
[b] River otter; Sample *et al*,. 1996.
[c] NYDEC, 2000.

Table 7-9
Summary of Wildlife TRVs
Nyanza Chemical Waste Dump Site – OU3
Ashland, Massachusetts

Chemical	Wildlife NOAEL-/LOAEL[a] -based TRVs (mg/Kg-day)		Risk Estimate
	Avian	Mammalian	
DDT	0.0227/0.227[b]	0.147/0.735[b]	Raccoon – EDIs < TRVs Heron – Max EDI > NOAEL-based TRV Osprey – Mean and Max EDIs > NOAEL-based TRV
PCB	0.144/0.72[c]	0.137/0.685[d]	Raccoon – EDIs ≈ NOAEL-based TRV Birds – All EDIs < TRVs
Mercury	0.0128/0.064[c]	0.032/0.16[c]	All EDIs > TRVs

Notes and Abbreviations:

1. Estimated daily intakes but not TRVs provided in original risk assessment.

[a] NOAEL/LOAEL– No-observed-adverse-effect level/Lowest-observed-adverse-effect level

[b] EPA, 2007

[c] Values used in OU4 SBERA (2008).

[d] Sample *et al.*, 1996

Although there have been changes in toxicity data since the time of the 1992 HHRA and ERA, because the selected remedy reduces exposures through removal of contaminated sediments and restoration of wetlands, these changes do not impact the protectiveness of the selected remedy.

Changes in Risk Assessment Methods

Since the HHRA and ERA were completed in 1992, EPA has issued human health and ecological risk guidance documents and resources that have changed the methods used to develop human health and ecological risk estimates (with potential impacts to exposure pathways, exposure assumptions, and formulas for estimating risks). Pertinent documents and resources include:

- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part D* (EPA, 2001b);
- *Risks Assessment Guidance for Superfund, Human Health Evaluation Manual, (RAGS HHEM) Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a); and
- *Guidelines for Carcinogenic Risk Assessment: Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens* (EPA, 2005).
- *Guidelines for Ecological Risk Assessment* (EPA, 1998).
- *Framework for Ecological Risk Assessment* (EPA, 1992a).
- *Wildlife Exposure Factors Handbook, Volumes I and II* (EPA 600R-93/187a and 187b) (EPA, 1993b).
- *Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual (EPA 540/1-89/001)* (EPA, 1989a).
- *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document (EPA 600/3-89/013)* (Suter II, 1989).
- *Ecological Risk Assessment Issue Papers (EPA/630R-94/009)* (Suter II *et al.*, 1994).

- ECO Updates, Volumes 1-4 (EPA Office of Solid Waste and Emergency Response) (EPA, 1991-1994).
- *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (EPA 530-D-99-001A) (EPA, 1999b).

The March 2005 *Guidelines for Carcinogen Risk Assessment, Supplemental Guidance for Assessing Susceptibility from Early-Life Exposures to Carcinogens* provides a revised method of evaluating risk to children and adolescents from carcinogens with a mutagenic mode of action, including polycyclic aromatic hydrocarbons (PAHs). PAHs were detected in sediments; however, they were not considered Site-related. The methodology used in the baseline risk assessment followed standard practice of the time. Although it differs in some aspects from accepted practices used today in risk assessment, changes do not impact the protectiveness of the remedy.

New/Emerging Contaminants and/or Contaminant Sources

No new contaminants or contaminant sources have been identified since the remedy.

Expected Progress towards Meeting RAOs

The 1993 ROD established the following RAOs:

- Mitigate mercury contamination in sediment in areas where accidental ingestion and dermal contact with contaminated sediments may result in unacceptable human health risks.

- Mitigate mercury contamination in sediment in order to reduce mercury levels in fish, which may be consumed by fishermen.

- Mitigate mercury contamination in sediment in the Continuing Source Areas in order to prevent continued migration of contamination to the Sudbury River.

- Mitigate mercury contamination in sediment to achieve an increased level of protection to environmental receptors in the Continuing Source Areas; one that is approximately equal to that found in background areas.

- Restore and wetland habitat that is destroyed during remediation.

The remedial actions at this Site addressed these RAOs by excavating contaminated sediments from the Continuing Source Areas, consolidating the excavated sediment beneath the OU1 RCRA cap, and restoring the affected wetland areas.

OU4

Yes, human health and ecological exposure assumptions (pathways and risk assessment methods) and toxicity data used at the time of the OU4 remedy selection (2010) are still valid. The 1999 and 2006 OU4 HHRAs and the 1999 OU4 Baseline Ecological Risk Assessment (BERA) (Weston, 1999) and 2008 OU4 Supplemental Baseline Ecological Risk Assessments (SBERA) (Avatar, 2008) supported the 2010 ROD.

The selected clean-up goal of 0.48 mg/Kg for fish tissue mercury concentration remains protective for the recreational scenario evaluated.

The RAOs used at the time of the remedy selection are still valid.

Changes in Standards or TBCs

The 2010 OU4 ROD listed no chemical-specific ARARs. Typically the NRWQC and the state analog would be the main chemical-specific ARARs, but these were determined to be not relevant and appropriate because the NRWQC and the state analog are at concentrations below the background concentration of mercury and below the risk-based figure calculated for the river. No changes to the NRWQC for mercury have occurred since the 2010 ROD.

The 2010 ROD mercury clean-up goal of 0.48 mg/Kg for fish tissue concentrations was based on child recreational fishermen, assuming an average consumption rate of 4.7 g/day (ten 4 ounce meals per year). There are no federal ARARs and no TBCs for methyl mercury in fish tissue. The selected clean-up goal remains protective for the recreational scenario evaluated.

Overall, the results of the SBERA did not indicate that mercury from past Site discharges resulted in population-level risk to ecological receptors residing in or using the Sudbury River. The

conservative assumptions built into this approach supported this conclusion, even though there was an acknowledged amount of uncertainty with several of the lines of evidence used to evaluate the six assessment endpoints. Given that no new surface water or sediment benchmarks for mercury have been promulgated and no significant new data regarding mercury methylation, bioaccumulation, or toxicity have been published, the results of the SBERA are still valid.

Changes in Exposure Pathways

The 1999 OU4 HHRA (Weston, 1999) provided 1) a qualitative evaluation of recreational exposures to mercury in the river (swimming) and exposures to mercury in surface water used as a drinking water source and 2) a quantitative evaluation of fish ingestion exposures to mercury for sports and subsistence fishermen. Qualitative evaluations in the OU4 HHRA included comparison of site exposure point concentrations (EPCs) updated with data collected after the OU3 RI to toxicological benchmarks or EPCs from the 1992 OU3 HHRA within the OU3 RI (NUS, 1992) that had not demonstrated significant risk. Exposure scenarios in the 1992 OU3 HHRA that had not demonstrated significant risk included exposure through accidental ingestion of and dermal contact with surface water and sediment. As noted above, the exposure assumptions used in the 1992 OU3 HHRA are reasonable and still valid. Since the updated EPCs were lower than those evaluated in the 1992 OU3 HHRA, the 1999 OU4 HHRA concluded that risks from recreational exposures to mercury in surface water and sediment were insignificant. This conclusion remains valid. The 1999 OU4 HHRA comparison of surface water mercury concentrations to tap water risk-based screening levels and MCLs indicates potential risks from exposure to mercury in surface water used as drinking water are also insignificant. Since surface water is not used as drinking water source, this comparison remains a conservative and protective approach.

The 2006 OU4 HHRA (Avatar, 2006) further evaluated risks to fishermen from consumption of mercury in fish in 10 separate reaches of the river, supplementing the 1999 OU4 quantitative evaluation of exposures to mercury through fish ingestion (Weston, 1999). The scenarios included recreational fishermen, subsistence fishermen, and ethnic fishermen who may eat whole fish, rather than just the fillets. The scenarios and pathways remain valid. EPA does not publish default exposure assumptions for ingestion of fish, so standard practice involves selecting Site-specific exposure assumptions. The assumptions used were reasonable, and can be considered still valid.

Therefore, no changes in exposure pathways and exposure assumptions impact the protectiveness of the selected remedy.

The 1999 OU4 BERA (Weston, 1999) evaluated risks to environmental receptors in 10 reaches of the Sudbury River. The 2008 OU4 SBERA (Avatar, 2008) further evaluated risks to environmental receptors, supplementing the earlier assessment with more recent data and reach-specific abiotic and biotic concentration data to estimate exposure. Six assessment endpoints were developed for evaluation in the SBERA (see Table 7-10 below).

Table 7-10
Summary of Assessment Endpoints
Nyanza Chemical Waste Dump Site – OU4
Ashland, Massachusetts

Assessment Endpoint		Measurement Endpoint
Receptor	**Ecological Attribute**	
Benthic Invertebrate Community	Community structure, survival, and reproduction	In situ mussel bioaccumulation, growth and toxicity testing using the freshwater mussel.
		Comparison of sediment chemistry with sediment quality values (SQVs) and values from other literature sources.
		Mercury bioaccumulation study using *Hexagenia*.
		Comparison of mercury concentrations in crayfish tissue with reference area concentrations and with residue effect levels from the literature.
Fish Population	Survival and reproduction	Comparison of surface water chemistry with Federal Ambient Water Quality Criteria (AWQC) and values from other literature sources.
		Comparison of mercury concentrations in fish tissue with reference area concentrations and with residue effect levels from the literature.
Herbivorous Birds (as represented by wood duck)	Survival, reproduction, and neurological effects	Comparison of site-specific egg, blood, and feather concentrations in waterfowl with reference area concentrations and residue effect levels from the literature.
Insectivorous Birds (as represented by tree swallows, eastern kingbirds, and marsh birds)	Reproduction, survival, and neurological effects	Comparison of site-specific egg, blood, and feather concentrations in tree swallows, eastern kingbirds, and marsh birds with reference area concentrations, residue effect levels from literature, and effect levels developed by USFWS as part of their tree swallow egg injection study.
		Quantitative comparison of daily intakes based on dietary intake of mercury by tree swallows from site-specific invertebrates with literature-based values.
Piscivorous Birds (as represented by belted kingfisher, great blue heron,	Survival, reproduction, and neurological effects	Quantitative comparison of daily intakes based on dietary intake of mercury using site-specific fish tissue concentrations and site-specific mercury levels in other aquatic-related food items (e.g., crayfish) with literature-based values.

Assessment Endpoint		Measurement Endpoint
Receptor	Ecological Attribute	
and hooded merganser)		Comparison of site-specific egg, blood, and feather concentrations in waterfowl with reference area concentrations and residue effect levels from the literature.
Piscivorous Mammals (as represented by the mink)	Survival, reproduction, and neurological effects	Comparison of site-specific blood and fur concentrations in mink and otter with reference area concentrations, and residue effect levels from the literature.
		Quantitative comparison of daily intakes based on dietary intake of mercury in fish and crayfish with literature-based values.

Most of the 10 reaches had two or more lines of evidence to assess risk. Using a systematic weight-of-evidence (WOE) process, the quality of the assessment and the magnitude of response for each line of evidence were integrated. Based on the WOE process, risk criteria, and comparing to concentrations at local reference areas and from regional data sources, only four lines of evidence showed a likelihood of adverse ecological effects above baseline:

- Sediment mercury concentrations compared to benthic community Threshold Effect Concentration (TEC) and PEC benchmarks;
- Mercury levels in total length (TL) >20 centimeters (cm) fish compared with lowest effect level (LEL) reproductive critical body residues (CBRs);
- Mercury levels in Reach 8 red-winged blackbird blood (collected in 2005) compared to a generic avian blood effect level; and
- Mercury levels in hooded merganser eggs from Reaches 4 and 8 in 2005.

The following discussion evaluates the confidence and uncertainty with these four lines of evidence and assesses the risks associated with the assessment endpoints related to these lines of evidence.

Overall, the results of this SBERA did not indicate that mercury contamination resulting from the Site discharges are likely to result in population-level risk to ecological receptors residing in or using the Sudbury River. The conservative assumptions built into this approach support this conclusion, even though there is an acknowledged amount of uncertainty with several of the lines of evidence used to evaluate the six assessment endpoints.

No changes in the pathways have occurred so the results of the SBERA are still valid.

No changes in land use or the physical conditions of the property have occurred since the 2010 ROD.

Changes in Toxicity and Other Contaminant Characteristics

The toxicity value for mercury remains unchanged since the 1992 OU3 HHRA. The toxicity value (oral reference dose [RfD]) for methylmercury increased between the 1992 OU3 HHRA and the 1999 OU4 HHRA. The oral RfD for methyl mercury increased since the 1992 OU3 HHRA. The impact of these changes is that health hazards in the 1999 qualitative comparison of 1999 EPCs to the EPCs from the 1992 HHRA are still protective.

Since the time of the OU4 remedy selection, oral toxicity values for mercury and methylmercury used in the 2006 OU4 HHRA and the 1999 OU4 HHRA have not changed as shown in the table below.

Table 7-11
Summary of Non-Cancer Toxicity Factor Changes
Nyanza Chemical Waste Dump Site – OU4
Ashland, Massachusetts

Chemical	Oral Reference Dose in 1999 & 2006 HHRA/ROD	Current Applicable Oral Reference Dose	Impacts on Risk
	mg/Kg-day	mg/Kg-day	
Mercury	3.0E-4[a]	3.0E-4[a]	NC
Methylmercury	1.0E-4	1.0E-4	NC

Notes and Abbreviations:
1. Current oral reference doses were obtained from EPA's Integrated Risks Information System database (IRIS), 2013.
[a] Mercuric chloride values used for inorganic mercury.
NC = No change.

Changes in Risk Assessment Methods

The 1999 HHRA was conducted prior to the publication of current EPA risk assessment guidance Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Parts D) (EPA, 2001b), requiring use of RAGS D table formats to present HHRA results. The

methodology used in the 1999 baseline risk assessment, while following standard practice of the time, differs in some aspects from these tables; however, the 2006 HHRA was conducted using the RAGS D table formats. Use of earlier methods in the 1999 HHRA does not affect the protectiveness of the remedy.

No changes in human health risk assessment methods affecting the fish ingestion pathway have occurred since the 2006 HHRA.

The 2008 SBERA followed the same methods as the 1999 BERA. No changes in ecological risk assessment methods have occurred since these assessments were conducted.

New/Emerging Contaminants and/or Contaminant Sources

No new contaminants or contaminant sources have been identified since the remedy.

Expected Progress towards Meeting RAOs

The 2010 ROD established the following RAOs:

- Prevent the ingestion of mercury-contaminated fish to the extent that such ingestion would result in a non-cancer hazard quotient greater than 1.0 for an individual who consumes fish from the Sudbury River.
- Reduce the amount of mercury in sediment and/or surface water to ensure that mercury concentration in fish tissue no longer presents an unacceptable risk (hazard quotient greater than 1.0) except in Reach 8.

The selected remedy for OU4 has not yet been implemented.

7.3 Question C: Has Any Other Information Come To Light That Could Call Into Question the Protectiveness of the Remedy?

OU1

No. There are no new human health or ecological risks that have been identified. The proposed development that was to be located upgradient of the landfill was put on hold, but there has been a recent renewal of interest in the project. The Site inspection and data review did not identify any new information that would call into question the protectiveness of the remedy.

OU2

No. There are no new human health or ecological risks that have been identified. The DNAPL extraction system as well as VMS are operating as designed. EPA is in the process of generating long-term groundwater data of sufficient quality and quantity (8 rounds) to evaluate trends in the dissolved-phase plume. Pending this evaluation, discussion with MassDEP should commence regarding the final Groundwater remedy.

OU3

No. There are no new human health or ecological risks that have been identified. The proposed development that was to be located upgradient of the landfill was put on hold, but there has been a recent renewal of interest in the project. The Site inspection and data review did not identify any new information that would call into question the protectiveness of the remedy.

OU4

The remedy for OU4 was not evaluated in this review because the remedial action has not been implemented.

7.4 Technical Assessment Summary

OU1

According to the data review, the Site inspection and interviews, the remedy is currently functioning as intended by the ROD. The landfill cap area is maintained properly and institutional controls are in place to prevent access to the OU1 Site. Groundwater data indicate a primarily

downward trend and surface water data indicates all detected VOCs and SVOCs are at concentrations below EPA and MCP criteria, thus, preventing a risk from exposure. Metals concentrations in surface water have exceeded the Lowest Ecologically Based Criteria developed for the MCP as well as the NWRQC. The April 2013 data in combination with historical data do not appear to show increasing or decreasing trends. It is anticipated that potential trends will become more apparent as more data are collected.

OU2

According to the data review, the Site inspection and interviews, portions of the remedy are not completed (i.e., DNAPL remedy); therefore, a determination of its functionality cannot yet be determined. Groundwater monitoring continues on an annual basis in order to evaluate the current status of groundwater contaminant plume and its potential impact to receptors. Institutional controls have not yet been established.

Regarding the vapor intrusion mitigation portion of the OU2 remedy, the 43 systems are fully operational, and are inspected by MassDEP to ensure they are operational based on presence of a negative pressure measurement.

OU3

According to the data review, the Site inspection and interviews, the remedy is currently functioning as intended by the ROD. The wetland areas and drainageways are maintained properly. Wetlands vegetation growth is restored and monitoring and maintenance is no longer necessary. Periodic Site visits and maintenance are performed to ensure the integrity of the cap and to monitor and maintain the former source areas for disturbances that may expose contaminants left in place. Groundwater data collected in the vicinity of the cap indicate a primarily downward trend and surface water data indicates all detected VOCs and SVOCs are at concentrations below EPA and MCP criteria, thus, preventing a risk from exposure. Metals concentrations in surface water around the cap have exceeded the Lowest Ecologically Based Criteria developed for the MCP as well as the NWRQC. The April 2013 data in combination with historical data do not appear to show increasing or decreasing trends. It is anticipated that potential trends will become more apparent as more data are collected.

OU4

A technical assessment of the remedy cannot be performed at this time because the selected remedy has not been implemented.

8.0 ISSUES

This section provides a summary of the issues identified during this fifth five-year review. Recommendations and follow-up actions are presented in Section 9.0.

Table 8-1
Issues
Nyanza Chemical Waste Dump Superfund Site
Ashland, Massachusetts

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Institutional controls mandated by the ROD for OU2 have not yet been implemented.	N	Y

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The following is a summary of recommendations and follow-up actions that are proposed for the Site.

Table 9-1
Recommendations and Follow-Up Actions
Nyanza Chemical Waste Dump Superfund Site
Ashland, Massachusetts

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
Institutional controls mandated by the ROD for OU2 not yet implemented.	Complete negotiation of Grants of Environmental Restrictions and Easements with three remaining private property owners on Megunko Road.	EPA/MassDEP	None	9/30/16
Institutional controls mandated by the ROD for OU2 not yet implemented.	Work with Town officials to establish zoning ordinance to prevent consumption of contaminated groundwater and inhalation of vapors.	EPA/MassDEP	None	9/30/16

10.0 PROTECTIVENESS STATEMENTS

10.1 Protectiveness of Source Control and Soil (OU1)

The remedy for OU1 is protective of human health and the environment. The landfill cap is the predominant element of the OU1 remedy. It is functioning as designed and, other than minor fence repairs, nothing was noted or observed that would reduce or diminish its effectiveness. The MassDEP performs routine O&M and is intending to make minor fence repairs in July 2014.

10.2 Protectiveness of Off-Site Groundwater (OU2)

The remedy for OU2 currently protects human health and the environment because the DNAPL recovery system is operating as designed. In addition, the Vapor Mitigation Systems in structures overlying the dissolved-phase plume are functioning and are inspected regularly by MassDEP. However, in order for the remedy to be protective in the long term, the remaining institutional controls need to be implemented.

10.3 Protectiveness of Wetlands and Drainageways (OU3)

The remedy for OU3 is protective of human health and the environment. Contaminated sediments from the Eastern Wetland (and downstream channels) were excavated and disposed within the limits of the on-site landfill (OU1). The wetland has been successfully restored. Meandering inspections of the wetland occur semi-annual by MassDEP in association with the OU1 (Landfill) inspections.

10.4 Protectiveness of the Sudbury River (OU4)

The remedy for OU4 was not evaluated in this review because the remedial action has not been implemented.

11.0 NEXT REVIEW

A sixth five-year review for the Nyanza Chemical Waste Dump Superfund Site will be conducted in 2019. The target completion date is five years from the approval of this fifth five-year review.

APPENDIX A

PUBLIC NOTICE

NEWS RELEASE

U.S. Environmental Protection Agency
New England Regional Office
February 13, 2014

Contact: Emily Zimmerman, 617-918-1037

EPA Will Review 27 Superfund Site Clean Ups This Year

Boston, Mass. – (February 13, 2014) – EPA will review site clean ups and remedies at 27 Superfund Sites across New England this year by doing routine Five-Year Reviews at each site.

EPA conducts evaluations every five years on previously-completed clean up and remediation work performed at Superfund sites and Federal Facilities listed on the "National Priorities List" (aka Superfund sites) to determine whether the implemented remedies at the sites continue to be protective of human health and the environment. Further, five-year review evaluations identify any deficiencies to the previous work and, if called for, recommend action(s) necessary to address them.

In addition to a careful evaluation of technical work at the sites, during the Five Year Review process EPA also provides the public with an opportunity to evaluate preliminary findings and to provide input on potential follow up activity that may be required following the review process.

The Superfund Sites at which EPA is performing Five Year Reviews over the following several months include the following sites. Please note: the Web link provided after each site provides detailed information on site status and past assessment and cleanup activity.

Connecticut

Linemaster, Woodstock, CT
http://www.epa.gov/region1/superfund/sites/linemaster

Nutmeg Valley, Wolcott, CT
http://www.epa.gov/region1/superfund/sites/nutmeg

Maine

Saco Tannery Waste Pits, Saco
http://www.epa.gov/region1/superfund/sites/sacotannery

Massachusetts

Nyanza Chemical Waste Dump, Ashland
http://www.epa.gov/region1/superfund/sites/nyanza

Baird & McGuire, Holbrook
http://www.epa.gov/region1/superfund/sites/baird

Hatheway & Patterson, Mansfield
http://www.epa.gov/region1/superfund/sites/hatheway

Hocomonco Pond, Westborough
http://www.epa.gov/region1/superfund/sites/hocomonco

Rose Disposal, Lanesborough
http://www.epa.gov/region1/superfund/sites/ftrose

Silresim, Lowell
http://www.epa.gov/region1/superfund/sites/silresim

W.R. Grace, Acton
http://www.epa.gov/region1/superfund/sites/graceacton

Wells G&H, Woburn
http://www.epa.gov/region1/superfund/sites/wellsgh

Norwood PCBs, Norwood
http://www.epa.gov/region1/superfund/sites/norwood

South Weymouth Naval, Weymouth, MA
http://www.epa.gov/region1/superfund/sites/sweymouth

New Hampshire

Ottati & Goss, Kingston
http://www.epa.gov/region1/superfund/sites/og

Tinkham Garage, Londonderry
http://www.epa.gov/region1/superfund/sites/tinkham

Sylvester, Hillsborough County
http://www.epa.gov/region1/superfund/sites/sylvester

Town Garage/Radio Beacon, Rockingham
http://www.epa.gov/region1/superfund/sites/towngarage

New Hampshire Plating, Hillsborough County
http://www.epa.gov/region1/superfund/sites/nhplating

Pease Air Force Base, Portsmouth, Newington and Greenland, NH
http://www.epa.gov/region1/superfund/sites/pease

Rhode Island

Landfill Resource & Recovery, North Smithfield
http://www.epa.gov/region1/superfund/sites/lrr

Vermont

Elizabeth Mine, Strafford
http://www.epa.gov/region1/superfund/sites/elizmine

Parker Sanitary Landfill, Lyndonville
http://www.epa.gov/region1/superfund/sites/parker

Pownal, North Pownal
http://www.epa.gov/region1/superfund/sites/pownal

Bennington Municipal Landfill, Bennington
http://www.epa.gov/region1/superfund/sites/bennington

BFI Sanitary Landfill, Rockingham
http://www.epa.gov/region1/superfund/sites/bfi

Tansitor Electronics, Inc., Bennington County
http://www.epa.gov/region1/superfund/sites/tansitor

Pine Street Canal, Burlington
http://www.epa.gov/region1/superfund/sites/pinestreet

Learn more about the Latest EPA News & Events in New England
(http://www.epa.gov/region1/newsevents/index.html)

Follow EPA New England on Twitter (http://twitter.com/epanewengland)

More info on EPA's Environmental Results in New England
(http://www.epa.gov/region1/results/index.html)

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U.S. EPA, Region 1, 5 Post Office Square, Suite 100, Boston, MA 02109-3912 United States

APPENDIX B

DOCUMENTS REVIEWED/REFERENCES

DOCUMENTS REVIEWED/REFERENCES CITED

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APPENDIX C

SITE INSPECTION CHECKLIST

SITE INSPECTION CHECKLIST

I. SITE INFORMATION	
Site name: Nyanza Chemical Waste Dump	**Date of inspection:** November 19, 2013
Location and Region: Ashland, MA – Region 1	**EPA ID:** MAD990685422
Agency, office, or company leading the five-year review: EPA	**Weather/temperature:** 42°, sunny, windy

Remedy Includes: (Check all that apply)

- ☑ Landfill cover/containment
- ☑ Access controls
- ☑ Institutional controls
- ☐ 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 ☐ Site photographs

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M Staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

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: Town of Ashland Board of Health
   Contact: Mark Oram — Town Health Agent — 11/19/2013 — (508) 881-0100
   Name — Title — Date — Phone no.
   Problems; suggestions; ☐ Report attached _____

   Agency: MassDEP
   Contact: Dave Buckley — Project Manager — 11/19/2013 — (617) 566-1184
   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 _____

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

1. **O&M Documents**

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

Remarks: O&M Manual was not reviewed prior to site inspection.

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

   Remarks:

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

   Remarks:

4. **Permits and Service Agreements**

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

   Remarks:

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

   Remarks:

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

   Remarks:

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

   Remarks:

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

   Remarks:

9. **Discharge Compliance Records**

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

   Remarks:

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

    Remarks:

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house	☑ Contractor for State
☐ PRP in-house	☐ Contractor for PRP
☐ Federal Facility in-house	☐ Contractor for Federal Facility

☐ Other

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ 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: _____

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

A. Fencing

1. **Fencing damaged** ☐ Location shown on Site map ☑ Gates secured ☐ N/A
Remarks: Slight fence damage and missing barbed wire observed near the East Gate.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks: "Do Not Enter" signs were not observed along the new section of perimeter landfill fence near the East Gate.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☑ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☑ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

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

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☑ N/A

Remarks:

D. General

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

Remarks: Evidence of trespassing and hunting in the Eastern Wetland was observed.

2. **Land use changes on site** ☑ N/A

Remarks:

3. **Land use changes off site** ☐ N/A

Remarks: A residential development had been proposed on the hill behind the landfill. Construction has been postponed.

VI. GENERAL SITE CONDITIONS

A. Roads ☑ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☑ Roads adequate ☐ N/A

Remarks: Roads were observed to be in good condition.

B. Other Site Conditions

Remarks:

VII. LANDFILL COVERS ☑ Applicable ☐ 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: Vegetation sprayed with herbicides in September 2013. Owner mows cap, but no specific schedule in place.

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 the steep side slope of the cover and will allow the runoff water collected by the benches to move off 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: Gas vents were during cap inspection.

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: Perimeter ditches were in good condition.		
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 ☑ 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:_____

C. Treatment System ☐ Applicable ☑ N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks:_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks:_____

3. **Tanks, Vaults, Storage Vessels**
   ☐ N/A ☐ Good condition ☑ Proper secondary containment ☐ Needs Maintenance
   Remarks:_____

4. **Discharge Structure and Appurtenances**
   ☐ N/A ☐ Good condition ☐ Needs Maintenance
   Remarks:_____

5. **Treatment Building(s)**
   ☐ N/A ☑ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks: DNAPL extraction wells for OU2 contained in sheds for weather protection. Installed in 2013.

6. **Monitoring Wells** (pump and treatment remedy)
   ☑ Properly secured/locked ☑ Functioning ☑ Routinely sampled ☑ Good condition
   ☐ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks: OU2 monitoring wells for monitoring and DNAPL extraction not all viewed during site visit. Conditions inferred from monitoring reports

D. Monitoring Data

1. Monitoring Data
   ☑ Is routinely submitted on time ☑ Is of acceptable quality

2. Monitoring data suggests:
☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

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:_____

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 OU2 VMS systems are actively being inspected by MassDEP under the M&MM. All systems have been inspected by MassDEP and are functioning as designed. All systems meet the revised pressure testing standards put in place by MassDEP And agreed to by EPA in March 2010.

B. Adequacy of O&M

The O&M activities are properly maintaining the site, and the remedy is functioning as designed.

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, which suggest that the protectiveness of the remedy may be compromised in the future.

D. Opportunities for Optimization

None observed at this time.

APPENDIX D

PHOTOS DOCUMENTING SITE CONDITIONS

Photo Number 1 – Cap and vents. Date: November 19, 2013

Photo Number 2 – French Drain system collection and clean out. Date: November 19, 2013

Photo Number 3 – Drainage run on east side of cap. Date: November 19, 2013

Photo Number 4 – Perimeter Fence East side of cap, barbed wire disrepair. Date: November 19, 2013

Photo Number 5 – DNAPL recovery shed at Nyacol. SB-600 at right. Date: November 19, 2013

Photo Number 6 – DNAPL recovery shed at Worcester Air Conditioning. Date: November 19, 2013

Photo Number 7 – Confluence of Eastern wetland and Trolley Brook. Date: November 19, 2013

Photo Number 8 – Close up of riprap on west edge of the Eastern Wetland. Date: November 19, 2013

Photo Number 9 – Looking across Eastern Wetland to capped northeast bank. Date: November 19, 2013

Photo Number 10 – View of Trolley Brook. Date: November 19, 2013

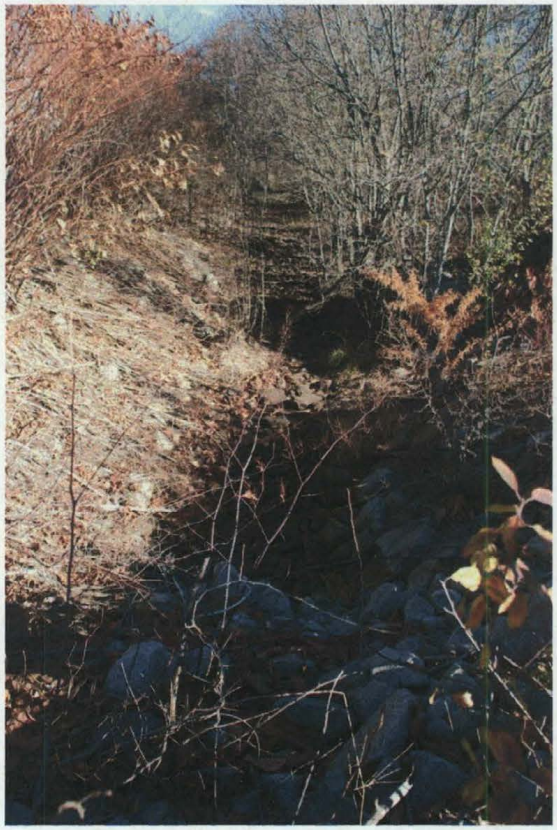


Photo Number 11 – View of the weir at north end of Eastern Wetland.Date: November 19, 2013

Photo Number 12 – View of Eastern Wetland, Trolley embankment upper left. Date: November 19, 2013

Photo Number 13 – View of Mill Pond and fish consumption warning signs.Date: November 19, 2013

Photo Number 14 – Proposed OU4 staging area, Fountain Rd. Date: November 19, 2013

Photo Number 15– View of warning signs posted at Reservoir 2. Date: November 19, 2013

APPENDIX E

INTERVIEW NOTES

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	EPA ID No.: MAD990685422
Subject: Fifth Five-Year Review (2014)	Time: / Date: x/xx/2013
Type: Telephone Visit Other Location of Visit:	Incoming Outgoing

Contact Made By:

Name:	Title:	Organization:

Individual Contacted:

Name: Mike Brogin BROGAN	Title: Facilities Manager	Organization: Ashland House

Telephone No: 508-397-2352 Fax No: 508-881-6836 E-Mail Address: AFOMDD@AOL.COM	Street Address: Main Street City, State, Zip: Ashland, MA 01721

Summary Of Conversation

Q1: What is your overall impression of the project?

A1: I thinx it's good, I haven't heard of any issues.

Q2: What effects have Site operations had on the surrounding community?

A2: Before the cleanup there was great concern regarding property values. I believe now that the site remediation is complete, those concerns have gone away.

Q3: Are you aware of any community concerns regarding the Site or its operation and administration? If so, please give details.

A3: Not at the site. I do hear concern from people regarding the Sand capping of the Sudbury River & Reservoir #3

Q4: Are you aware of any events, incidents, or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

A4: No

Q5: Do you feel well informed about the Site's activities and progress?

A5: Reasonably so.

Q6: Do you have any comments or recommendations for EPA regarding this Site?

A6: No.

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	EPA ID No.: MAD990685422
Subject: Fifth Five-Year Review (2014)	Time: Date: x/xx/2013
Type: Telephone Visit Other Location of Visit:	Incoming Outgoing

Contact Made By:

Name:	Title:	Organization:

Individual Contacted:

Name: Jed McGarry	Title: VP & CFO	Organization: Nyacol

Telephone No: 508-881-2220 Fax No: E-Mail Address:	Street Address: Megunko Road P.O. Box 349 City, State, Zip: Ashland, MA 01721

Summary Of Conversation

Q1: What is your overall impression of the project?

A1: The contractors and ongoing activities always worked with Nyacol to assure their activities would not disrupt business operations. We have had a very good relationship.

Q2: What effects have Site operations had on the surrounding community?

A2: N/A

Q3: Are you aware of any community concerns regarding the Site or its operation and administration? If so, please give details.

A3: No

Q4: Are you aware of any events, incidents, or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

A4: No

Q5: Do you feel well informed about the Site's activities and progress?

A5: No

Q6: Do you have any comments, suggestions, or recommendations regarding the Site's management or operation?

A6: No

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	EPA ID No.: MAD990685422
Subject: Fifth Five-Year Review (2014)	Time: Date: x/xx/2013
Type: Telephone Visit Other Location of Visit: 48 Cherry St. Ashland	Incoming Outgoing

Contact Made By:

Name:	Title:	Organization:

Individual Contacted:

Name: Don Rushford	Title: Resident	Organization:

Telephone No: 508-881-6726 Fax No: E-Mail Address: D.Rushford@Hotmail	Street Address: 48 Cherry Street City, State, Zip: Ashland, MA 01721

Summary Of Conversation

Q1: What is your overall impression of the project?
A1: Good

Q2: Are you aware of any community concerns regarding the Site or its operation and administration? If so, please give details.
A2: No.

Q3: Are you aware of any events, incidents, or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
A3: No

Q4: Do you feel well informed about the Site's activities and progress?
A4: Yes

Q5: Do you have any comments or recommendations for EPA regarding this Site?
A5: No

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	**EPA ID No.:** MAD990685422
Subject: Fifth Five-Year Review (2014)	**Time:** **Date:** x/xx/2013
Type: Telephone Visit Other **Location of Visit:**	Incoming Outgoing

Contact Made By:

Name:	**Title:**	**Organization:**

Individual Contacted:

Name: Dave Buckley	**Title:** Project Manager	**Organization:** MassDEP

Telephone No: 617-556-1184 **Fax No:** **E-Mail Address:** david.buckley@state.ma.us	**Street Address:** One Winter Street **City, State, Zip:** Boston, MA 02108

Summary Of Conversation

Q1: What is your overall impression of the project?
A1: *The implemented components of the site remedy for OU1, OU2, and OU3 are fuctioning and protective of public health and the environment.*

Q2: Are there changes to State laws/regulations that could impact the remedy's protectiveness?
A2: *Recent ARAR changes were not identified. However, careful future consideration to changes in TCE toxicity values (particularly acute) should be monitored.*

Q3: Please describe any complaints or violations or other event requiring Departmental response. Has communication with those responsible for O&M been responsive?
A3: *Chemical Brook which parellels private property has had several instances where abutter activities have resulted debris filling in the brook. MassDEP and local Conservation Commission have responded with requirements to remedy. Periodic tresspassing within the capped area has occurred but appears currently under control. Police have been contacted.*

Q4: Is the remedy functioning as intended?
A4: *Yes*

Q5: Have there been any problems encountered with the remedy or deviations from established plans?
A5: *The OU2 vapor instrusion remedy has experienced prior performance problems. MassDEP has effected system modifications to remedy with some success. EPA and DEP have modified performance standards.*

Q6: Could you please describe any significant changes in O&M activities or sampling processes in the previous 5 years?
A6: *The frequency of maintenance and monitoring activities of the OU2 vapor intrusion remedy has been increased to be consistent with MassDEP guidelines. Change from system reviews every 5 years to annually.*

Q7: Has the Department been informed of any issues or problems associated with the Site?
A7: *Not beyond what has been identified in previous responses.*

Q8: Does the Department feel well informed about the Site's activities and progress?
A8: *Yes*

Q9: Does the Department have any comments, suggestions, or recommendations to EPA regarding the project?
A9: *Not at this time*

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	EPA ID No.: MAD990685422
Subject: Fifth Five-Year Review (2014)	16:05 Date: 1/22/2014
Type: Telephone Visit Other Location of Visit:	Incoming Outgoing

Contact Made By:

Name: Deb Chisholm	Title: Project Scientist	Organization: Nobis Engineering

Individual Contacted:

Name: Bob Gayner	Title: Property Owner	Organization:

Telephone No: 603-998-1008 Fax No: E-Mail Address:	Street Address: Box 300, 62 Temple Drive City, State, Zip: Alton, NH 03809

Summary Of Conversation

Q1: What is your overall impression of the project?

A1: Mr. Gayner has owned the site since 1980 and has seen all the work and expense go in to cleaning it up. He believes this is probably one of the safest sites in Superfund.

Q2: What effects have Site operations had on the surrounding community?

A2: Nyanza was a blight on the community. The cleanup has had a very positive effect on the community. Health risks were taken away and there are no more issues coming up.

Q3: Are you aware of any community concerns regarding the Site or its operation and administration? If so, please give details.

A3: No. The community has no concerns because they understand it is being monitored. They've put the site behind them.

Q4: Are you aware of any events, incidents, or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

A4: No, the gates and locks have taken care of any issues with tresspassing or vandalism. There was a problem with dumping, but cameras were put in place and it seems to have worked.

Q5: Do you feel well informed about the Site's activities and progress?

A5: Yes. Mr. Gayner has been integrally involved and has a great relationship with both EPA and MassDEP. They keep him fully informed.

Q6: Do you have any comments or recommendations for EPA regarding this Site?

A6: No. Mr. Gayner has a good rapport with Dan and Dave and they are doing a great job.

INTERVIEW RECORD

Site Name: Nyanza Chemical Waste Dump Superfund Site	EPA ID No.: MAD990685422
Subject: Fifth Five-Year Review (2014)	Time: 0930 Date: 1/07/2014
Type: Telephone Visit Other Location of Visit: via phone	Incoming Outgoing

Contact Made By:

Name: Deb Chisholm	Title: Project Scientist	Organization: Nobis Engineering

Individual Contacted:

Name: Mark Oram	Title: Member	Organization: Ashland Board of Health

Telephone No: 508-881-0100 x681 (Ashland Town Hall) Fax No: 508-881-0102 E-Mail Address: moram@ashlandmass.com	Street Address: 101 Main Street City, State, Zip: Ashland, MA 01721

Summary Of Conversation

Q1: What is your overall impression of the project?

A1: The whole project is moving in the right direction, and Mr. Oram has a good overall impression. The latest work, OU4, is controversial and unfortunate how some of the community is reacting. EPA is excellent at keeping the Town in the loop.

Q2: What effects have Site operations had on the surrounding community?

A2: OUs 1, 2, and 3 went great as far as how the neighborhoods were impacted. The wetlands work went well and EPA did a good job of making sure the trucks weren't leaking material all over the roadways during cleanup. The vapor system installations went well. There was a lot of notification to the property owners and everyone seemed happy with the results.

Q3: Are you aware of any community concerns regarding the Site or its operation and administration? If so, please give details.

A3: OU4 is a concern of the community, particularly those neighbors who border the MDC property that will be impacted during the work in the Sudbury River. However, some land use changes may be coming as a result of a recently awarded grant. The creation of recreation trails along the Sudbury River may impact the same people who are concerned about the OU4 cleanup work.

Q4: Are you aware of any events, incidents, or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.

A4: Mr. Oram was aware of some breaks in the fencing areound portions of the Site as well as dumping that has taken place outside the fencing on the south side of the site. Cameras were installed at one point to catch who was dumping, however, the cameras were stolen. MassDEP does a great job keeping him informed of activities at the Site.

Q5: Do you feel well informed about the Site's activities and progress?

A5: Definitely. EPA and MassDEP have been great at keeping the Town informed. Mr. Oram feels he can always get questions answered.

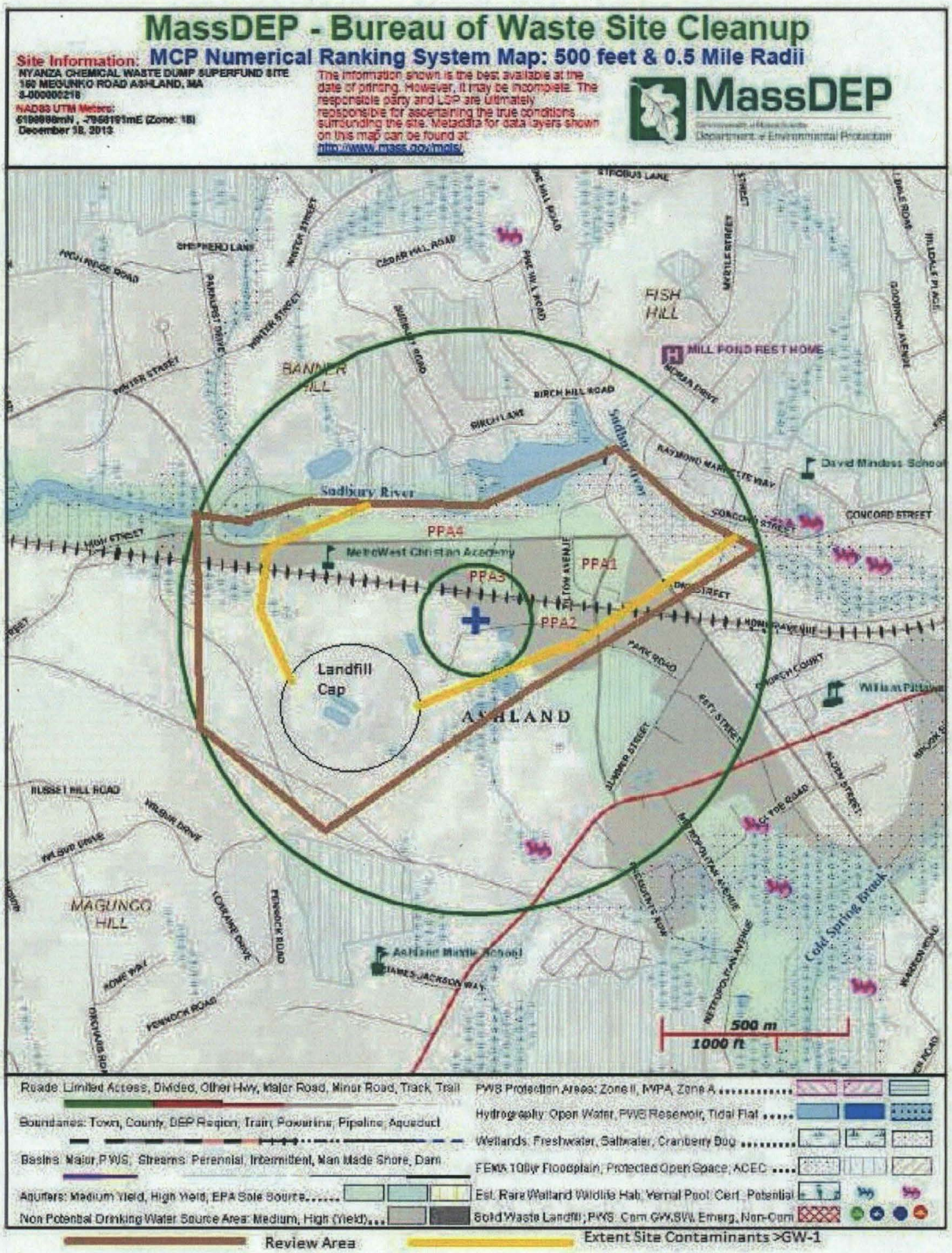
Q6: Do you have any comments, suggestions, or recommendations regarding the Site's management or operation?

A6: Mr. Oram is satisfied with the operations of the completed OUs. OU4 is concerning. Mr. Oram suggested getting people who aren't on board with the OU4 cleanup to be part of the solution.

APPENDIX F

POTENTIALLY PRODUCTIVE AQUIFER FIGURE

FIGURE 1


MassDEP - Bureau of Waste Site Cleanup
Site Information: MCP Numerical Ranking System Map: 500 feet & 0.5 Mile Radii
NYANZA CHEMICAL WASTE DUMP SUPERFUND SITE
160 MEGUNKO ROAD ASHLAND, MA
3-000000218
NAD83 UTM Meters:
6190888mN , -7968191mE (Zone: 18)
December 18, 2013
The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.
MassDEP
Department of Environmental Protection
FISH HILL
MILL POND REST HOME
BANNER HILL
Sudbury River
PPA4
PPA3
PPA1
PPA2
Landfill Cap
ASHLAND
MetroWest Christian Academy
David Mindess School
William Pitaluga
Ashland Middle School
MAGUNCO HILL
Cold Spring Brook
500 m
1000 ft
Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region, Train, Powerline, Pipeline, Aqueduct
Basins: Major,PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)
PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain, Protected Open Space, ACEC
Est. Rare Wetland Wildlife Hab, Vernal Pool: Cert, Potential
Solid Waste Landfill; PWS: Com GW,SW, Emerg, Non-Com
Review Area
Extent Site Contaminants >GW-1