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Five-Year Review Report

First Five-Year Review Report
for
Sullivan's Ledge Superfund Site
New Bedford, MA

September 2003

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

EPA
New England

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Date:

9/29/03

FIVE YEAR REVIEW FOR THE SULLIVAN'S LEDGE SUPERFUND SITE

September 2003

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ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
CAA	Clean Air Act
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
ESD	Explanation of Significant Differences
LEL	Lower Explosive Limit
MADEP	Massachusetts Department of Environmental Protection
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU1	Operable Unit 1
OU2	Operable Unit 2
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCCP	Pre-stressed Concrete Cylinder Pipe
RAC	Remedial Action Contract
RAO	Remedial Action Response Objective
RI	Remedial Investigation
RD	Remedial Design
FS	Feasibility Study
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SQCV	Sediment Quality Criteria Values
SVOC	Semivolatile Organic Compound

ACRONYM	DEFINITION
TBC	To Be Considered
TOC	Total Organic Carbon
TSCA	Toxic Substances Control Act
VOC	Volatile Organic Compound
EPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

The Sullivan's Ledge Superfund Site (site), located in New Bedford, Massachusetts, consists of two operable units, Operable Unit 1 (OU1) and Operable Unit 2 (OU2). OU1 consists of a 12-acre disposal area historically used for the disposal of industrial and commercial wastes, and the adjacent unnamed stream. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the unnamed stream (400 feet upstream of the Middle Marsh) referred to as the Adjacent Wetlands.

The selected remedy for OU1 included site preparation, soil excavation/treatment, sediment treatment, construction of an impermeable cap, diversion and lining of the unnamed stream, collection and treatment of on-site groundwater, wetlands restoration/enhancement, long-term environmental monitoring, institutional controls, and five-year reviews.

Three Explanations of Significant Difference (ESDs) have been issued for OU1. The first ESD revised the remedy so that soils in the disposal area would remain in place, untreated, and covered by the cap. Also, excavated soils and sediments from other areas of OU1 that exceeded cleanup standards would remain untreated and would be disposed of beneath the cap within the disposal area. The second ESD revised the remedy to reflect the stream channel's permanent placement in an underground 72-inch pre-stressed concrete cylinder pipe (PCCP), the creation of a new stream channel on the golf course, and the planting of vegetation to recreate the habitat lost. Also, the ESD called for a slurry wall along a portion of the southern boundary and two recovery wells adjacent to the slurry wall. A third ESD incorporates ARARs related to landfill gas migration and describes the actions taken to comply with the ARARs.

The selected remedy for OU2 included site preparation, excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland, dewatering of the excavated sediment/soils, disposal of the treated sediment/soils beneath the cap, wetlands restoration, institutional controls to prevent future residential and restrict commercial use, and long-term environmental monitoring.

The trigger for the OU1 statutory review is the start of actual remedial action on-site construction on March 2, 1998. The start of remedial action on-site construction at OU2 was April 8, 1999, which would place the trigger date for a statutory review at April 8, 1999 (13 months after the trigger date for OU1). However, EPA Region 1 has decided to address both operable units in a single five-year review report because construction is complete for both OUs. Both OU1 and OU2 require a statutory review because contaminants have been left on-site above levels that allow for unlimited use and unrestricted exposure.

At present, the remedies for both OU1 and OU2 protect human health and the environment because there is no current use of the site resulting in an exposure to site media containing contaminant concentrations exceeding applicable criteria. However, in order for the remedy to be protective in the long-term, the following actions need to be taken.

OU1

- Implement institutional controls;
- Continue to evaluate performance of the groundwater extraction and monitoring system with respect to the Remedial Action Response Objectives (RAOs) in the ROD;
- Continue to monitor sediment concentrations and implement corrective actions if necessary;
- Install and operate a full-scale landfill gas collection system to prevent offsite migration of
  landfill gas; and
- Implement the Wetlands Operation and Maintenance (O&M) Plan, including control of invasive and nuisance species in the wetlands.

OU2

- Implement institutional controls; and
- Implement the Wetlands O&M Plan, including control of invasive and nuisance species in the wetlands and monitoring of water table elevations.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name ***(from WasteLAN)***: Sullivan's Ledge

EPA ID ***(from WasteLAN)***: MAD980731343

Region: 01	**State:** MA	**City/County:** New Bedford/Bristol County

SITE STATUS

NPL status: ☒ Final ☐ Deleted ☐ Other (specify) _____

Remediation status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple OUs?* ☒ YES ☐ NO	**Construction completion date:** _3_ / _29_ / _2002_

Has site been put into reuse? ☐ YES ☒ NO

REVIEW STATUS

Lead agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author name: David Lederer (EPA) & Don Dwight (Metcalf & Eddy)

Author title: Remedial Project Manager	**Author affiliation:** US EPA, Region I

Review period:** __11_ / 1_ / _2002_ to _9_ / _30 / _2003_

Date(s) of site inspection: 2 / 19 / 2003 & 2 / 24 / 2003

Type of review:

☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead
☐ Regional Discretion

Review number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _____

Triggering action:

☒ Actual RA Onsite Construction at OU 1____ ☐ Actual RA Start at OU#____
☐ Construction Completion ☐ Previous Five-Year Review Report
☐ Other (specify) _____

Triggering action date ***(from WasteLAN)***: _3_ / _2_ / _1998_

Due date ***(five years after triggering action date)***: _3_ / _2_ / _2003_

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

Five-Year Review Summary Form, cont'd.

Issues, Recommendations and Follow-up Actions:

OU1

- Implement institutional controls (these are in the process of being implemented);
- Continue to evaluate performance of the groundwater extraction, treatment and monitoring system;
- Continue to monitor sediment concentrations and implement corrective actions if necessary;
- Install and operate full-scale landfill gas collection system to prevent offsite migration of landfill gas;
- Implement Wetlands O&M Plan.

OU2

- Implement institutional controls;
- Implement Wetlands O&M Plan, including control of invasive species in the wetlands and monitoring of water table elevations.

Protectiveness Statement(s):

The five-year review concluded that the remedies for both OU1 and OU2 currently protect human health and the environment because there is no current use of or exposure to site media containing contaminant concentrations exceeding applicable criteria. However, in order for the remedy to be protective in the long-term, the aforementioned actions need to be taken.

Other Comments:
None.

SECTION 1.0
INTRODUCTION

This document is a comprehensive and interpretive report on the five-year review conducted for the Sullivan's Ledge Superfund Site in New Bedford, Massachusetts. The document was prepared for the US Environmental Protection Agency's (EPA) Region I office.

The five-year review was conducted to determine whether the remedies for the site are protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this five-year review report. In addition, this report identifies issues found during the review and recommendations to address them.

EPA Region 1 has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). CERCLA § 121(c) states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP at Section 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

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

The site consists of two operable units, OU1 and OU2. This five-year review addresses both operable units.

This is the first five-year review for the site. This review is required by statute as the selected remedies result in contaminants being left on the site above levels that allow for unlimited use and unrestricted exposure. The trigger for the OU1 statutory review is the start of actual remedial action on-site construction on March 2, 1998. The start of remedial action on-site construction at OU2 was April 8, 1999, which would place the trigger date for a statutory review at April 8, 1999 (13 months after the trigger date for OU1). However, EPA Region 1 has decided to address both OUs in a single five-year review report because construction is complete for both

OUs. Both OU1 and OU2 require a statutory review because contaminants have been left on-site above levels that allow for unlimited use and unrestricted exposure. At OU1, contaminated soils were left in place and a groundwater contaminant plume still exists. OU2 requires a statutory review because, although the site was cleaned up to levels that are protective of aquatic organisms, the remedy calls for institutional controls that prohibit residential use of the site and thus disallows unlimited use. The OU2 ROD (Page 20) notes that if EPA had assumed that the future use would be residential, cleanup levels would be lower due to higher frequencies of exposure. Thus, the ROD implies that contaminants could be left in place that are above levels that allow for unlimited use and unrestricted exposure.

SECTION 2.0
SITE CHRONOLOGY

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

Table 1: Chronology of Site Events	
Event	**Date**
Quarrying operations conducted at the site	prior to 1846 through 1921
Land acquired by the City of New Bedford through tax title foreclosure	1935
Pits used for waste disposal	1930's through early 1970's
Fires in quarry pits lead to backfilling of one pit	early 1970's
Geotechnical borings by the Mass. Dep't. of Public Works indicate the presence of capacitors in subsurface	1982
EPA conducted air monitoring program of the Greater New Bedford Area	1982
EPA installed groundwater monitoring wells around the site	1983
NPL Listing	September 21, 1984
OU1 Phase I Remedial Investigation report by NUS Corporation	September 1987
OU2 Final Remedial Investigation/Feasibility Study report by Ebasco Services Inc.	January 1989
ROD issued by EPA for OU1	June 29, 1989
OU2 Final Remedial Investigation - Additional Studies of Middle Marsh report by Metcalf & Eddy, Inc.	April 1991
OU2 Feasibility Study of Middle Marsh report by Metcalf & Eddy, Inc.	May 1991
ROD issued by EPA for OU2	September 27, 1991
Consent Decree for OU2 was lodged in U.S. District Court in Massachusetts	January 25, 1993

Table 1: Chronology of Site Events	
Event	**Date**
ESD issued by EPA modifying the remedy so that treatment would no longer be required for OU1 soils and sediments to be covered by the OU1 landfill cap.	July 26, 1995
100% remedial design approved by EPA for OU1	June 1997
Start of on-site construction at OU1	March 2, 1998
Start of on-site construction at OU2	April 8, 1999
Start up of the OU1 Groundwater Collection and Treatment System	December 10, 1999
ESD issued by EPA substituting a slurry wall for the shallow collection trench along a section of the site boundary and culverting a section of the unnamed stream instead of a concrete lining	September 27, 2000
Final Remedial Construction Report, OU2 by URS Corporation and Certification of Remedial Construction Completion	August 13, 2001
Remedial Construction Report, OU1 by O'Brien & Gere Engineers, Inc. and Certification of Construction Completion	March 8, 2002
Approval of OU2 Construction Completion Report	January 23, 2003
Approval of OU1 Construction Completion Report	January 23, 2003
ESD issued by EPA adding Massachusetts solid waste regulations as ARARs and requiring mitigation of landfill gas.	September 29, 2003

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The site is located in New Bedford, Massachusetts, Bristol County, near the intersection of I-195 and Hathaway Road (see Figure 1, provided in Attachment 1 of this report), and consists of two operable units, OU1 and OU2.

OU1 consists of a 12-acre historic disposal area and the adjacent unnamed stream (see Figure 2, provided in Attachment 1 of this report). The unnamed stream flows from the site underneath Hathaway Road into OU2, which consists of the Middle Marsh and adjacent wetlands. The disposal area is bounded on the south by the highway interchange with Route 140 and I-195, on the east and west by commercial establishments, and on the north by Hathaway Road.

OU2 is located within the Whaling City Golf Course at New Bedford, just north of Hathaway Road. OU2 is bounded on the south by the southern banks of the tributary of the unnamed stream, on the north by the Apponagansett Swamp, and on the east and west by fairways of the golf course. OU2 includes a 13-acre wooded wetland called Middle Marsh, and a 1.5 acre wetland area bordering the unnamed stream (400 feet upstream of the Middle Marsh) referred to as the Adjacent Wetlands.

Regional groundwater flow in the overburden, shallow bedrock, and deep bedrock is to the north. In the absence of the installed groundwater treatment pump and treatment system, local groundwater flow in the overburden and shallow bedrock is from the southwest to the northeast corner of the former disposal area. Flow from the southwest corner of the site entered the quarry pits. A portion of the groundwater discharged out of the pits into the overburden and the unnamed stream and the remainder discharged into the bedrock. Prior to the installation of the OU1 cap, most of the former disposal area was covered by a layer of fill which overlayed the bedrock and quarry pits. The thickness of the fill generally increased to the south and east across the property with the maximum observed thickness of 22.4 feet found in the southwest corner of the site. Shallow bedrock is highly fractured, with fracture planes varying in frequency and orientation, which means that the shallow bedrock exhibits the properties of a porous medium, with groundwater flowing in the direction of the hydraulic gradient. The deep bedrock contains fewer fractures than the shallow bedrock and the fractures follow a regional north/northwest lineament trend. Thus, contaminant migration in the deep bedrock is controlled by the orientation of the fractures.

3.2 HISTORY OF CONTAMINATION

The OU1 disposal area was originally operated as a granite quarry that supplied building stone to the New Bedford area. Quarry operations began in the 1800s and continued until 1921. During that time, as many as four separate quarry pits were in use on the property.

After serving as a local swimming hole, the City of New Bedford assumed ownership of the property in 1935 through a tax title foreclosure. The pits and adjacent areas were operated by the City of New Bedford and used by local industry as a disposal site for wastes such as electrical transformers and capacitors, fuel oil, volatile liquids, old tires, glass, metal, steel tanks, smoke stack soot, and scrap rubber. The site also was used for disposal of other types of debris such as brush and trees, cobblestones, bricks, and demolition materials. The pits and adjacent areas are referred to throughout this report as the disposal area.

In the early 1970s, a major fire erupted on-site, primarily involving the mass of tires disposed of in the quarry pits. This fire was difficult to control due to the presence of the tires, and created a dense, black smoke. Due to concern regarding possible recurrence of such fires, an effort was undertaken to backfill the remainder of the smaller pit and to regrade the site, covering any exposed refuse. In early 1982, Massachusetts Department of Public Works, District 6, conducted test borings on-site in conjunction with a proposal for construction of a commuter parking lot, but recommended cancelling the project when borings indicated the presence of electrical capacitors.

EPA conducted an air monitoring program of the Greater New Bedford area in 1982 and installed groundwater monitoring wells around the site in 1983. Based in part on the results of these studies, the site was included in the National Priorities List (NPL) in September 1984.

3.3 INITIAL RESPONSE

In September 1984, EPA issued the owner and operator of the site, the City of New Bedford, an Administrative Order under Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). In compliance with this order, the City of New Bedford secured the disposal area by installing a perimeter fence and posting signs warning against unauthorized trespassing at the site.

On November 29, 1988, EPA notified parties who owned or operated the facility, generated wastes that were shipped to the facility, or transported wastes to the facility, of their potential liability with respect to the site.

A Remedial Investigation (RI) of the site was completed in two phases. The Phase I RI completed by NUS in September 1987 under subcontract to EBASCO (EBASCO, 1987) provided the data necessary for site characterization. The draft final Phase II RI and Feasibility Study (FS) was completed in March of 1988 by E.C. Jordan under subcontract to EBASCO (EBASCO, 1989).

In June 1989, EPA concluded that additional studies of the Middle Marsh and adjacent wetlands were needed and these areas were grouped into a second OU. The Remedial Investigation - Additional Studies of Middle Marsh report was completed in April 1991 by Metcalf & Eddy, Inc. (M&E, 1991a). The Feasibility Study of Middle Marsh was completed by Metcalf & Eddy, Inc.

on May 29, 1991 (M&E, 1991b).

3.4 BASIS FOR TAKING ACTION

Based on results of the Phase I and Phase II RIs, three source areas of contamination were identified for the site: the quarry pits, site soils, and PCB-contaminated sediments. The RIs also determined that contaminants from the quarry pits had contaminated on- and off-site groundwater and surface water in the unnamed stream.

The following summary describes contamination found at the site:

Soils. The Phase II RI and pre-design sampling confirmed semivolatile organic compound (SVOC) contamination within the disposal area and along the eastern site boundary. Polychlorinated biphenyls (PCBs) were also detected within the disposal area and along the eastern site boundary.

Sediments. PCBs were the only compound of concern in the sediments. PCB contamination was detected in sediments from the unnamed stream, Middle Marsh, golf course water hazards, and Apponagansett Swamp. PCB concentrations occurred at levels above the Sediment Quality Criteria Values (SQCVs) in each of the four habitats.

Groundwater. The majority of on-site groundwater contamination was caused by volatile organic compounds (VOCs); less significant levels of SVOCs and PCBs were also reported. Results from VOCs were identified in the overburden groundwater, shallow bedrock groundwater (less than 100 feet), and deep bedrock groundwater (down to 200 feet below ground surface).

Surface Water. Relatively high concentrations of VOCs, SVOCs, and inorganics were reported in the Phase II RI at groundwater seeps located east and north of the disposal area. For several contaminants, the concentrations exceed the ambient water quality criteria (AWQC). Impacts to the unnamed stream, however, appeared minimal due to the effects of dilution by the large volume of water in the unnamed stream. There was no public health risk associated with surface water.

The human health risk assessment for OU1 estimated potential human health risks associated with exposure to contaminants of concern in surface soils, sediments, air, surface water, and groundwater. The risk assessment assumed that access to the site is restricted and the land is zoned as commercial, but considered a proposed future use of the site as a soccer field. PCBs and total PAHs contributed the majority of the total carcinogenic risk from direct contact with surface soils. Noncarcinogenic risk from incidental ingestion of on-site soils by children was elevated due to the lead concentration in an on-site shallow soil sample. Though groundwater was not a current source of drinking water, carcinogenic and noncarcinogenic risks from future ingestion of groundwater were estimated. Benzene, trichloroethene, vinyl chloride, and PCBs

contributed over 99 percent of the total cancer risk. 1,1-dichloroethene was the major contributor to the noncarcinogenic risk at the site. Direct contact with contaminated sediments in the unnamed stream was the highest carcinogenic risk from exposure to sediments. The ecological risk assessment indicated that a potential risk existed for aquatic organisms due to exposure to contaminants in surface water of the unnamed stream. It was noted that risk to aquatic organisms due to PCB exposure in water could not be accurately evaluated because the detection limit for PCBs (1.0 ug/l) was greater than the water quality criteria concentration (0.014 ug/l).

The human health risk assessment for OU2 concluded that human exposure to contaminants in Middle Marsh and the golf course/wetland area through current and future pathways would not result in significant increases in carcinogenic risk, and that there are no significant risks to human health posed by exposure to noncarcinogenic contaminants under the assumption that the current and future site use would be as a golf course. The OU2 Record of Decision (ROD) notes that if EPA had assumed that future use would be residential, cleanup levels would be lower due to higher frequency of exposure. The OU2 ROD requires the use of institutional controls to prohibit residential use and restrict commercial use, thereby assuring the protectiveness of human health. The ecological risk assessment concluded that aquatic exposures and wetland/terrestrial exposures to PCB-contaminated sediments in portions of the Middle Marsh presented an unacceptable risk to biota present in OU2. This was the primary basis of the remedial action for OU2.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

This section outlines the selected remedies for OU1 and OU2.

4.1.1 Operable Unit 1

The EPA ROD for Sullivan's Ledge OU1 was issued on June 29, 1989. The RAOs listed in the ROD are:

- Prevent or mitigate the continued release of hazardous substances to the unnamed stream, Middle Marsh, and Apponagansett Swamp;
- Reduce risks to human health associated with direct contact with and incidental ingestion of contaminants in the surface and subsurface soils;
- Reduce risks to animal and aquatic life associated with the contaminated surface soils and sediments;
- Reduce the volume, toxicity, or mobility of the hazardous contaminants;
- Maintain air quality at protective levels for on-site workers and nearby residents during site remediation;
- Reduce further migration of groundwater contamination from the quarry pits in the upper 150 feet of the bedrock groundwater flow system;
- Significantly reduce the mass of contaminants in groundwater located in and immediately adjacent to the quarry pits;
- Provide flushing of groundwater through the pits to encourage continued removal of contaminants at the site; and
- Minimize the threat posed to the environment from contaminant migration in the groundwater and surface water.

The selected remedy for OU1, as identified in the ROD, consisted of the following components. Items related to soil/sediment excavation, treatment, and placement are source control measures. Items related to groundwater collection/treatment are management of migration measures.

- Site Preparation
- Soil Excavation/Treatment;
- Sediment Treatment;
- Construction of an Impermeable Cap;
- Diversion and Lining of the Unnamed Stream;
- Collection and Treatment of On-site Groundwater;
- Wetlands Restoration/Enhancement;
- Long-term Environmental Monitoring and Five-Year Reviews; and
- Institutional Controls.

As stated in the ROD, EPA determined that contaminants have contaminated on- and off-site groundwater and surface water in the unnamed stream. Due to technical impractibility, MCLs were not used as cleanup goals. Instead, significant reduction of the contaminant mass and protection of surface water bodies were used as cleanup goals. A two part plan for the cleanup of on-site contaminated groundwater and seeps involved an active extraction system (bedrock extraction wells) and a passive collection system (shallow collection trench).

On July 26, 1995, EPA issued an ESD documenting changes to the remedial action specified in the OU1 ROD. The ROD called for excavation of soils within the disposal area down to the seasonal low water table, de-watering, solidification, and placement back within the disposal area under an impermeable cap. The revised remedy described in the ESD called for soils in the disposal area to remain in place, untreated, and covered by the cap. The ROD also called for soils and sediments from the unnamed stream, water hazards, and other areas of OU1 outside the disposal area that exceed cleanup standards to be excavated, treated, and disposed of under the impermeable cap within the disposal area. Under the revised remedy, excavated soils and sediments from these areas would remain untreated and would be disposed of under the impermeable cap within the disposal area.

Another ESD was issued by EPA on September 27, 2000, documenting additional changes to the remedial action specified in the OU1 ROD. The ROD described the concrete lining of about 750 feet of the unnamed stream in the portion parallel to the eastern boundary of the site. As described, the revised remedy included the permanent placement of the stream channel in an underground 72-inch PCCP, the creation of a new stream channel on the golf course, and the planting of vegetation to recreate the habitat lost. Under the ROD, passive groundwater collection along the eastern and southern boundary of the site consisted of an under drain pipe

within a shallow trench; the ESD substituted this collection system with a slurry wall along a portion of the southern boundary and two recovery wells adjacent to the slurry wall.

A third ESD was issued by EPA on September 29, 2003. It incorporated methane gas collection into the remedy to comply with Massachusetts Solid Waste Management Regulations and to prevent the off-site migration of gas.

4.1.2 Operable Unit 2

The ROD for OU2 was issued by EPA on September 27, 1991. The RAOs listed in the ROD are:

- Reduce exposure of aquatic organisms to PCB-contaminated pore water and sediments either through direct contact or diet-related bioaccumulation;
- Reduce exposure of terrestrial and wetland species to PCB-contaminated sediment/soils through direct contact or diet-related bio-accumulation;
- Prevent or reduce releases of PCBs to the unnamed stream and the Apponagansett Swamp; and
- Mitigate the impacts of remediation on wetlands.

The selected remedy, as identified in the ROD, consisted of the following components:

- Site preparation;
- Excavation of contaminated sediments and soils from portions of Middle Marsh and the Adjacent Wetland;
- Dewatering of the excavated sediment/soils;
- Disposal of the treated sediment/soils beneath the cap constructed over portions of the disposal area of the site;
- Wetlands restoration;
- Institutional controls to prevent future residential use and restrict commercial use; and
- Long-term environmental monitoring.

4.2 REMEDY IMPLEMENTATION

This section summarizes the implementation of the remedial actions specified in the RODs for OU1 and OU2.

4.2.1 Operable Unit 1

The Settling Parties for OU1 formed the Sullivan's Ledge Site Group led by a project management committee (PMC) and hired a design engineering firm, O'Brien & Gere Engineers, Inc. (OBG) to implement the EPA OU1 Statement of Work. In June 1997, EPA approved the 100% design, initiating the time track for remedial action. The PMC contracted with Harding Lawson and Associates, Inc. (HLA) to implement the remedial actions. On-site construction activities for OU1 were initiated in March 1998 with Phase I mobilization.

Implementation of the remedial action for OU1 is discussed below, by component, as identified in the ROD. The information below is based primarily on the Remedial Construction Report (OBG, 2002d) for OU1.

Site Preparation

Site preparation work included the installation of fencing and gates, clearing of vegetative material and debris and placement on the disposal area, placement of drums of soil and personal protective equipment and various construction debris on the disposal area, demolition of a former car wash located adjacent to the site and placement of the resulting debris on the disposal area, grading of the site to remove high points, abandonment of monitoring wells in the disposal area, proof rolling of the site, and placement of a 12-inch ordinary borrow interim cover on the portion of the site not scheduled for capping until a later phase.

Soil Excavation/Treatment

Soil excavation was conducted in several areas of the site. The approximate total volume of material removed from each area is provided as follows:

- unnamed stream bed and southern tributary soil and sediments - 950 cubic yards plus 50 cubic yards of rock
- East bank soils (south of car wash) - 140 cubic yards
- Soils east of stream channel - 910 cubic yards
- East bank soils (north of car wash) - 40 cubic yards

In each area, post-excavation confirmation samples were collected and compared to the clean-up criteria for soils of 10 ppm PCBs. When necessary, additional excavation was performed until confirmation sampling indicated that the clean-up criteria had been met. The excavated materials

were placed in areas within the limits of the cap system in accordance with construction specifications.

Diversion and Lining of the Unnamed Stream

This component of the remedy involved lining the unnamed stream east of the disposal area with a 72-inch PCCP. The 72-inch PCCP was installed during Phase I of the remedial action.

Collection and Treatment of On-Site Groundwater

This component of the remedy involved the construction of the active groundwater collection system, the passive groundwater collection system, the soil-bentonite groundwater cut-off wall, and the groundwater treatment plant.

The active groundwater collection system was installed during Phase I of the remedial action and consisted of the installation of three bedrock recovery wells, conversion of three existing bedrock wells to recovery wells, installation of two HDPE piping access vaults, installation of HDPE piping from each bedrock recovery well to a manifold in the groundwater treatment plant, and installation of pumps and controls in each of the six bedrock recovery wells.

The passive groundwater collection system was installed during Phase I of the remedial action and consisted of a approximately 660 feet of shallow collection trench (12-inch diameter HDPE perforated collection pipe surrounded by crushed stone backfill), HDPE manholes, a pump station, a valve vault, and associated double-walled piping.

A soil bentonite groundwater cut-off wall was constructed along the northern limits of the landfill cap. The cut-off wall was installed to a depth of 20 to 25 feet and a width of six to 30 feet.
Two recovery wells (called "Interim Wells") with pumps, controls, and associated piping were installed adjacent to the slurry wall.

The groundwater treatment plant was constructed during Phase I of the remedial action. The start-up period and initial operations occurred from December 10, 1999 through October 19, 2000.

Construction of an Impermeable Cap

This component of the remedy involved the following activities:

- installation of the geogrids along the former quarry limits;
- construction of the gas venting system including placement of granular material, installation of gas vent risers and horizontal gas collection pipe, and installation of 22 gas monitoring wells around the perimeter of the landfill cap system;

- installation of the geosythetic clay liner;
- installation of the flexible membrane (LLDPE) cover;
- installation of the synthetic drainage layer;
- placement of the barrier protection material;
- placement of topsoil;
- excavation and construction of the sedimentation basin;
- augmentation of the Hathaway Road culvert;
- construction of run-on/run-off controls including berms, lined swales, and culverts;
- construction of access roads; and
- installation of site security measures including fencing and gates.

Wetlands Restoration/Enhancement

The restoration of affected wetlands in OU1 was conducted concurrently with OU2 wetlands restoration. HLA subcontracted certain wetland restoration tasks (vegetation plantings, invasive control, monitoring, reporting) for both OUs to New England Environmental (NEE) of Amherst, Massachusetts.

Sediment Treatment

Sediment excavation was performed within a tributary of the unnamed stream (Tributary #2), the unnamed stream, and two golf course hazards (Ponds A & B). Post-excavation confirmation samples were collected and compared to the clean-up criteria of 20 µg PCBs/gram carbon. A total of approximately 7,590 cubic yards of sediment was excavated from these areas. Excavated sediments were transferred to the treatment pad, stabilization agents (lime kiln dust and sand) were added and mixed using an excavator, and the material was spread out and moisture conditioned. A total of approximately 9,340 cubic yards of stabilized sediment was placed within the limits of the cap system.

The Sullivan's Ledge Superfund Site, OU1, Remedial Construction Report was completed in March 2002 by OBG (OBG, 2002d). This report included a Certification of Completion of Construction, signed on March 8, 2002. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

Institutional Controls

To date, the institutional controls identified in the OU1 ROD have not been implemented. These include:

- ordinances and zoning restrictions to prevent the use of groundwater for drinking water; and
- deed restrictions regulating land use at the site.

A Grant of Environmental Restriction and Easement (GER) is being drafted by the Commonwealth of Massachusetts in consultation with EPA reflecting the above mentioned restrictions. The GER will be forwarded to the City of New Bedford and other interested parties for review and comment.

4.2.2 Operable Unit 2

On January 25, 1993, EPA gave notice that the Consent Decree (CD) for OU2 had been lodged in United States District Court in Massachusetts. The CD was entered into by AVX Corporation (AVX) as the lead Settling Party, the City of New Bedford, the OU1 Settling Parties, EPA, and the Massachusetts Department of Environmental Protection (MADEP). AVX Corporation hired a design engineering firm, Dames & Moore (now known as URS Corporation) to implement the EPA Statement of Work.

The remedial action at OU2 was conducted between 1998 and 2001. The OU2 Settling Parties contracted with HLA to implement the remedial action.

Activities associated with soil/sediment removal were conducted from April 1999 through September 2000. The calculated volume of soil, sediment, and debris wastes that were removed from Middle Marsh and the adjacent wetland was 25,485 cubic yards. Activities associated with the stabilization of soil/sediment and placement in the disposal area were conducted from June 1999 through June 2000. Activities associated with wetlands restoration were conducted from July 1999 through September 2000.

The Final Remedial Construction Report, Sullivan's Ledge Superfund Site, Second Operable Unit was completed on August 13, 2001 by URS Corporation. The report included a Certification of Remedial Construction Completion, signed on August 13, 2001. This report was approved by EPA on January 23, 2003, which triggered the start of the O&M period.

To date, land use restrictions identified in the OU2 ROD have not been fully implemented. The ROD called for zoning ordinances and/or deed restrictions to ensure that future uses of Middle Marsh and the Adjacent Wetland are limited to existing recreation and conservation purposes, and to prohibit residential and restrict commercial uses.

A GER is being drafted reflecting the above mentioned restrictions by the Commonwealth of Massachusetts in consultation with EPA. The GER will be forwarded to the City of New Bedford and other interested parties for review and comment.

4.3 SYSTEM OPERATIONS/O&M

The Settling Parties for OU1 and OU2 are currently performing O&M as described below.

4.3.1 Operable Unit 1

4.3.1.1 OU1 O&M Activities

An Operations and Maintenance Plan, Post-Construction Environmental Monitoring Plan, and Wetlands Restoration Plan were prepared by OBG and finalized in July 1997.

A Site Operations and Maintenance Manual (OBG, 2002a) was prepared by OBG in February 2002 as an update to the 1997 O&M Plan. The O&M activities that are specified in accordance with the Site Operations and Maintenance Manual include:

- Routine inspections of the landfill cap to look for signs of vegetative stress, burrowing animals, settlement, erosion, slope instability, or any other damage (to be performed monthly throughout the first year and quarterly thereafter);
- Inspections of three surveyed benchmarks for signs of damage at the same frequency as landfill cap inspections;
- Inspections of the access road on the cap system at the same frequency as landfill cap inspections;
- Monthly site security inspections looking for breaches in fence integrity;
- Inspection of the gas vents for signs of damage or obstruction at the same frequency as landfill cap inspections;
- Inspection of run-on/run-off controls, including swales, berms, catchbasins, vaults, headwalls, and the sedimentation basin, at the same frequency as landfill cap inspections; and
- Inspection of the lined portion of the unnamed stream every five years and repairs as necessary.

Activities being conducted in accordance with the Post-Construction Environmental Monitoring Plan include:

- Quarterly groundwater compliance monitoring for the active and passive collection systems (to date, nine quarterly monitoring reports have been submitted);
- Collection and analysis of surface water and sediment samples from four locations within the unnamed stream (results documented in the Wetlands Monitoring Reports (NEE, 2001 and NEE, 2003));

- Monitoring of the perimeter gas monitoring wells for explosive gases and annual monitoring for hydrogen sulfide; and

- Monitoring of representative perimeter gas monitoring wells for VOCs using SUMMA canisters.

The Wetlands Restoration Plan specifies that wetlands monitoring be performed annually for the first three years after completion of the initial restoration, during the fifth year, and once every following five years. Monitoring activities include stream flow and elevation monitoring, groundwater elevation monitoring, and evaluation of percent cover of the restored and created wetlands. To date, two annual wetland monitoring reports have been submitted (NEE, 2001 and 2003).

A Ground Water Treatment Plant (GWTP) Operation and Maintenance Manual, finalized by OBG in August 2000, specifies the following O&M activities:

- Quarterly inspections of the GWTP to determine the total volume of remedial waste water treated since the previous inspection, average flow rate of the system, total volume of non-aqueous phase oil or hazardous materials recovered since the previous inspection, and whether any maintenance activities are necessary;

- Routine monitoring of effluent for various parameters; and

- Routine monitoring of the air discharge from the GAC canister in service with the tank venting system for benzene, trichlorethylene, and vinyl chloride using colorimetric tubes and follow-up laboratory analyses.

The manual also describes recommended maintenance activities that should be performed on the GWTP process equipment. Monthly reports documenting the effluent monitoring and other operating data are submitted by the City of New Bedford.

4.3.1.2 Summary of OU1 O&M Issues

The OU1 remedy has generally performed as designed since construction completion. O&M issues/problems that have occurred since construction completion are summarized below.

- The groundwater treatment plant has experienced periods of down time due to various mechanical issues.

  Collection trench pumps and valves. Two variable speed submersible pumps, located in the shallow collection trench pump station have caused several instances of downtime since plant start-up. Another issue has been the shorting out of flow control valves in the

collection trench dry vault due to flooding.

Sulfuric Acid Tank. In July 2001, a leak occurred in the effluent nozzle of the dilution tank resulting in several weeks of plant downtime. Several more leaks to the dilution tank and associated repairs resulted in further downtime. The acid tank was eventually replaced. In March 2003, the acid tank overflowed due to a malfunctioning flow meter. Approximately 2,000 gallons of sulfuric acid spilled on to the floor of the groundwater treatment plant. This spill was cleaned up and there was no release to the environment.

- During summer months of 2002, the GWTP has difficulty maintaining continuous operation reportedly due to low flow delivered by the passive and active collection systems. The cause of the lack of flow was especially dry weather during 2002. The operators have shut-down and restarted the plant under such conditions.

- A single small area of leachate seepage and slope failure have occurred on the southern edge of the landfill cap. The cause of the slope failure was ascertained and the failure was repaired in June 2001. The successful repair has remained intact since that date.

- The OU1 and OU2 restored wetlands have invasive species (primarily cattails and Phragmites) present in varying amounts, depending on the location. Significant effort has been expended by the Settling Parties to control the invasives in accordance with the approved O&M Plan.

- Landfill gas monitoring, conducted in April 2001 in accordance with the Post-Construction Environmental Monitoring Plan (OBG, 1996b), indicated that several gas monitoring wells had methane concentrations that exceeded 25% of the lower explosive limit (LEL) for methane. Additional monitoring of gas monitoring wells during 2001 and 2002 showed similar results. On-site landfill gas vents were also monitored and methane was found to be present. Methane was not detected in explosive gas screenings of subsurface structures and buildings, on and adjacent to the site. Soil gas surveys were performed in spring and summer 2002, indicating that methane was present at greater than 25% LEL at discrete locations east and west of the landfill but was not detected in any adjacent buildings or structures screened.

  A Corrective Action Alternative Analysis was performed to mitigate the migration of explosive gases from the landfill which exceeded the concentrations specified in 310 CMR 19.132(4)(g) and (h). The corrective action chosen was active gas control concurrent with data collection to evaluate the effectiveness in removing landfill gas and reducing off-site migration of landfill gases above 25% LEL. On November 15, 2002, a revised Corrective Action Design was submitted for approval on behalf of the Settling Parties by OBG. The PMC proposed to install a pilot gas extraction system consisting of a trailer mounted 8 horsepower blower with knockout tank and gauges to record stack discharge velocity and temperature. The pilot system was run for an initial three month

period to collect data, and continues to operate at this time.

OBG, on behalf of the OU1 PMC, submitted a conceptual design for a full scale landfill gas collection system dated May 8, 2003. The design is based on the results of the pilot study. The design includes collection from the east, west, and north sides of the landfill via a 200 CFM blower and subsequent release to the atmosphere. The start of implementation of the full scale system is scheduled for 2003.

4.3.1.3 OU1 O&M Costs

Due to agreements between the OU1 Settling Parties and the City of New Bedford, O&M costs are paid separately by both groups. The table below summarizes these costs.

Table 2: Annual Approximate System Operations/O&M Costs for Operable Unit 1

Activity	Annual Cost
Cap Seeding and Maintenance	$26,000/yr
Wetlands Monitoring and Maintenance	$53,000/yr
Groundwater Treatment Plant O&M	$160,000/yr
Environmental Monitoring	$280,000/yr

4.3.2 Operational Unit 2

4.3.2.1 OU2 O&M Activities

Post-construction environmental monitoring and post-construction and long-term wetlands monitoring activities are currently being performed in accordance with the Final Operation and Maintenance Plan for the Second Operable Unit, dated January 13, 1999. The O&M period officially began on January 23, 2003 (the date of approval of the Construction Completion Report). However, some O&M activities did occur prior to that date to maintain the integrity of the restored wetlands. The following post-construction environmental activities are required to be conducted once per year during the first three years, in year five, and then once every five years:

- Collection of four surface water samples from reaches of the unnamed stream and analysis for pH and PCBs;
- Collection of four sediment samples from the reaches of the unnamed stream, within the area of OU2 impacted by remedial action construction and analysis for PCBs and total

organic carbon (TOC);

- Collection of two wetland sediment/soil samples from the adjacent wetland and four sediment/soil samples from the Middle Marsh and analysis for PCBs.

The O&M Plan also specifies that post-construction wetland monitoring be conducted annually, for a period of at least five years. Long-term wetland monitoring will then be conducted to ensure the long-term effectiveness of the wetland restoration program. Wetlands monitoring activities include monitoring of hummocks, wetlands hydrology, soil development, and biological attributes including survival rates of planted trees and shrubs, tree growth, vegetative diversity, plant community, and presence of the Mystic Valley Amphipod.

Annual O&M reports are required to be submitted to EPA.

4.3.2.2 Summary of OU2 O&M Issues

O&M issues/problems that have occurred since construction completion are summarized below.

- The largest issue with regard to OU2 O&M has been the control of invasive species (including cattail and Phragmites) that tend to choke out more desirable wetland species. Significant effort has been expended by the OU2 Settling Parties in controlling invasive species as part of their overall implementation of the O&M Plan.

- Water levels measured in wells and piezometers are lower than pre-remediation conditions by 0.5 feet to 4.0 feet. A Progress Report from URS which contains historic water levels is provided as Attachment 6. It should be noted that most of 2002 was considerably drier than normal. Table 3 compares water levels from August 15, 1997 (pre-remediation) and August 29, 2002 (post-remediation). Ongoing monitoring of the OU2 wetlands will be required to quantify the potential impact of the lower water table elevations and to assess the need for corrective action.

Table 3: Water Level Comparison for Operable Unit 2

Monitoring Point	August 15, 1997 Water Elevation (pre-remediation) (ft)	August 29, 2002 Water Elevation (post-remediation) (ft)	Change in Elevation (ft)
WP-2	63.39	61.18	-2.21
WP-3	62.94	60.53	-2.41
WP-5	64.72	63.89	-0.83
MW-7A	65.42	61.38	-4.04
MW-10A	66.17	64.39	-1.78

4.3.2.3 OU2 O&M Costs

Annual O&M costs are incurred by the OU2 Settling Parties are presented below:

Table 4: Annual Average System Operations/O&M Costs for Operable Unit 2

Activity	Annual Cost
Wetlands Monitoring and Maintenance	$21,600

SECTION 5.0
FIVE-YEAR REVIEW PROCESS

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

5.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

EPA issued a press release informing the public of the availability of this document coincident with its completion.

5.2 DOCUMENT REVIEW

This five-year review consisted of a review of relevant documents for both OUs, including the remedial investigation reports, RODs, remedial construction reports, and O&M and monitoring plans and reports. See Attachment 2 for a list of documents that were reviewed.

5.3 DATA REVIEW

5.3.1 Operable Unit 1

5.3.1.1 Groundwater Treatment Plant Effluent Monitoring

Effluent from the GWTP is discharged to the City of New Bedford publicly-owned treatment works (POTW). The New Bedford POTW has established discharge criteria that must be met by the GWTP for discharge to the municipal sewer system. Treatment plant effluent sample analysis was evaluated to determine if pretreatment discharge limitations were being met. A review of the available data indicates that pretreatment discharge limitations are being met for PCBs, Total Toxic Organics (TTO), SVOCs, and 12 select metals. Table A3-1 (located in Attachment 3) provides a comparison of the most recent effluent data to the pretreatment discharge limitations.

5.3.1.2 Groundwater Monitoring

Monitoring is being conducted while the groundwater treatment plant is operating until the groundwater clean-up standards are achieved in accordance with the requirements of the CD with the OU1 Settling Parties. Once compliance monitoring is completed, performance monitoring will be conducted, for a period of three years, in order to evaluate whether achievement of the cleanup standards is sustained. After performance monitoring, long-term monitoring will be conducted (OBG, 1996b).

The Post-Closure Environmental Monitoring Plan (PCEMP) (OBG, 1996b) describes compliance monitoring requirements for both the active extraction system and the passive

collection system. With regard to the active extraction system, the plan specifies that bedrock and Westbay monitoring wells be sampled on a quarterly basis and that overburden monitoring wells be sampling on a quarterly basis for the first four quarters and annually thereafter. Water level measurements are to be made prior to sampling each well. With regard to the passive collection system, the groundwater must be sampled on a quarterly basis.

The PCEMP requires the sampling of a total of twelve bedrock monitoring wells, eleven overburden monitoring wells, and multiple zones in four Westbay monitoring wells. Due to issues with the integrity of certain wells, however, not all wells have been sampled during each monitoring event. The sampling program has been revised to reflect the sampling of certain subset of wells for certain analytes quarterly, while a larger group of wells are sampled for more analytes on a yearly basis.

To date, a Post-Construction Baseline Groundwater Sampling Event report (OBG, 2000a) and nine quarterly groundwater monitoring reports (OBG, 2001a, 2001b, 2002a, 2002c, 2002e, 2002f, 2002g, 2003a, 2003c) have been submitted.

Active Collection System

The active collection system has been delivering contaminated groundwater to the treatment plant since startup in 1999. The cleanup goal identified in the ROD for the active collection system is the significant reduction in the mass of the bedrock contamination. Two criteria are used to evaluate this goal: (1) a concentration range of 1 to 10 ppm of total VOCs; and/or (2) an asymptotic curve using groundwater monitoring data indicating that significant concentration reductions are no longer being achieved. Several bedrock monitoring wells serve as points of compliance and were established in the PCEMP. A summary of the data is presented in Table A3-2 (located in Attachment 3) and summarized below.

In summary, concentrations of total VOCs are similar to treatment plant startup conditions in 1999 with some apparent increasing and decreasing trends in concentrations. Continuation of the compliance monitoring set forth in the ROD in accordance with the PCEMP should continue. Special attention to any wells manifesting increasing concentrations in total VOCs downgradient of the disposal area is warranted as more data is collected.

Passive Collection System

The objective of the passive collection system is to prevent degradation of the unnamed stream by collecting shallow contaminated groundwater. Cleanup levels are based on AWQC and the designated uses of the receiving waters. Compliance is measured at the influent to the treatment plant. Quarterly groundwater monitoring collects groundwater from the collection system for chemical analysis. Data is presented and summarized in Table A3-3 located in Attachment 3. In general, levels of total VOCs have remained stable since treatment plant startup. Levels of total VOCs and PCBs have generally been below the pretreatment discharge limitations set by the City

of New Bedford even before treatment with the exception of approximately four months which exceeded PCB standards.

In summary, the passive collection system continues to collect shallow contaminated groundwater. Flow from the collection system is providing essential additional flow to the treatment plant to ensure continuous/semi-continuous operation. During dry weather periods and the resultant lower than expected flow rate from the passive collection system vault, the treatment plant has been operating intermittently. In general, the treatment plant has been online Monday through Friday and shut down over the weekend under those conditions.

5.3.1.3 Sediment Monitoring

Sediment samples were collected from the unnamed stream, OU1 diversion swale, sedimentation basin and OU1 cap swales in December 2000 and June 2001. Sediment samples were analyzed for PCBs, total combustible organics (TCO), and percent solids. In addition, five sediment samples were analyzed for PAHs and metals. This data was collected as a baseline precursor to the bi-annual sampling specified in the PCEMP (OBG, 1996b). Two sediment samples collected from the unnamed stream exceeded the sediment target level; one sample collected in December 2000 [78 micrograms of PCBs per gram of carbon (ug PCB/gC)] and one sample collected in June 2001 (59 ug PCB/gC). The-1 diversion channel had two exceedances of the sediment target level in December 2000 (32.5 and 47 ug PCB/gC) and one in June 2001 (30 ug PCB/gC). Sedimentation basin sediment samples indicated PCB levels below the sediment target value of 20 ug PCB/gC. OU1 cap swale sediment samples have also shown decreasing levels of PCBs from 1.47 mg/kg (April 2000) to 0.13 mg/kg (June 2001) (OBG, 2001c).

5.3.2 Operable Unit 2

5.3.2.1 Sediment and Soil Monitoring

Sediment samples were collected from four locations along the unnamed stream in October 2001 and analyzed for PCBs and TCO as outlined in the Long Term Environmental Monitoring Section of the OU1 ROD (Section X.A.8), and the PCEMP. PCBs were detected in one of the four sediment samples collected from the unnamed stream, but at a concentration below the sediment target level of 20 ug/gC set forth in the OU1 ROD (Section X.B.2) (NEE, 2001).

Sediment samples were collected from six non-aquatic plot areas in the Middle Marsh and adjacent wetlands in October 2001 as part of the Long Term Environmental Monitoring Plan outlined in the OU2 ROD (Section X.B.1). PCBs were detected in three of the six sediment samples at levels well below the soil cleanup level of 15 mg/kg total PCBs (NEE, 2001).

Sediment samples were also collected in August 2002 from four locations within the unnamed stream, within the area of OU2 impacted by the remedial action construction, and analyzed for PCBs and TCO. Aroclor 1254 was detected in sediment samples from three out of four locations

at levels below the sediment target level. Six wetland soil samples were also collected in August 2002, within the Middle Marsh and adjacent wetlands of OU2, and analyzed for PCBs. Low levels of Aroclor 1254 (well below the 15 mg/kg total PCBs cleanup level) were detected in four out of six soil samples.

5.3.2.2 Surface Water

Surface water samples were collected in October 2001 from the same four locations where sediment was collected in the unnamed stream and analyzed for PCBs and pH. PCBs were not detected above the detection limit in any of the samples collected (NEE, 2001).

Surface water samples were also collected in August 2002 from four locations within the unnamed stream and analyzed for PCBs and pH. Again, PCBs were not detected above the detection limit in any of the samples collected (NEE, 2003).

5.3.2.3 Wetlands

The first full year of wetlands monitoring occurred in 2002 and a report was submitted in 2003 summarizing the results (NEE, 2003). The Executive Summary stated in part:

> During 2002, the performance standard which requires a minimum of 75% areal coverage of non-invasive wetland species has not yet been met for all plant plots. Two of the six OU2 plots, and seven of the thirteen OU1 plots have met or exceeded the performance standard. All of the remaining plant plots are progressing well, and they are expected to meet the 75% areal coverage by the end of the 2003 growing season.
>
> The woody plant survival rate of greater than 80% has been met in the OU1 Mitigation Area East and the OU1 Stream Restoration Area. None of the other areas have met the standard. In response to these findings, additional trees and shrubs were planted in OU1 and OU2 wetlands in the fall of 2002, and additional woody plants are scheduled for planting in the Spring of 2003.
>
> The Vegetative Diversity requirement (one new wetland wood and one new wetland herbaceous species every five years) have been met in almost every plot and in every wetland area. There are new wetland wood stemmed species in five of the six OU2 Middle Marsh plots and nine of the thirteen OU1 plots. There are new wetland herbaceous species in all the OU2 plots and OU1 plots.
>
> The Mystic Valley Amphipod has not been found in the OU2 Middle Marsh. It has been found in the OU1 created wetlands.
>
> All of the Physical Indicators have been met for the 2002 monitoring area. The areal coverage for the hummocks was 25% or greater.

There were hydric soils indicators in all but one plot; the hydrologic criterion (water level within the first 12 inches) was met by the October 2002 sampling, despite the drought conditions).

Wetland maintenance was conducted throughout the year. Invasive plant species were controlled; new woody species were planted; seed was sown; biologs were replaced; silt fences were fixed; new rope fences were places; trespassing signs erected; and trash was removed.

In response to the NEE report (NEE, 2003), M&E wrote extensive review comments on EPA's behalf, particularly commenting on the methodology used by NEE to calculate areal coverages observed in the field during 2002.

5.4 SITE INSPECTION

Site inspections of both OUs are conducted periodically by Metcalf & Eddy. The observations made during these site inspections were used to provide the necessary information for this five-year review.

5.4.1 Operable Unit 1

Groundwater Extraction and Treatment System

The groundwater extraction and treatment system has been inspected by Metcalf & Eddy periodically since start-up in 1999. The most recent inspection was performed on February 19, 2003. The system was operating on the day of inspection.

Outstanding Operational Problems. The following are operational problems encountered at the GWTP since plant start-up in 1999.

- The steel discharge piping from the Groundfos pumps has corroded in well OBG-1. One hundred feet of discharge piping were replaced and a new pump was installed. According to plant operations, OBG-3 is exhibiting similar reduced performance due to corrosion, and will require inspection when weather conditions improve. It is a good possibility that each of the six extraction wells may need new discharge piping.

- **Volume of Groundwater Treated.** The total volume of groundwater treated since start-up is not entirely known at this point. Readings taken from the GWTP effluent totalizer on February 3, 2003 indicate that 22,234,000 gallons of treated groundwater has been treated and discharged to the POTW. However, recent visits to the plant indicate the effluent totalizer was reset (reading 770,000 gallons on February 19, 2003). The plant operators are not aware of how the meter was reset. Therefore, it cannot be determined if

the effluent totalizer was reset at any time prior to February 3, 2003.

GWTP operations acquire all totalizer readings from the GWTP Supervisory Control and Data Acquisition system. The totalizers are manually zeroed approximately every month. Also, influent flow meters from the collection trench and bedrock wells have had operational problems. The collection trench influent flow meter has been cleaned frequently due to a buildup of residue on the piping. The totalizer for the six bedrock extraction wells does not equal the sum of the individual bedrock well totalizers. According to the influent meters on February 3, 2003, 4,380,000 gallons have been pumped from the collection trench and 3,048,000 gallons from the bedrock wells. This results in a 14,806,000 gallon disparity, influent to effluent. A request has been made to the plant operators for the correct GWTP influent and effluent totals.

The accuracy of the GWTP totalizers/flow meters is in question. In order to make sound judgements concerning the effectiveness of the groundwater extraction system in removing contaminant mass, the documented totals of extracted bedrock and overburden groundwater must be recorded accurately. As a result, maintenance and records of the readings of these instruments must be improved.

- The sulfuric acid day tank developed leaks in several areas of the tank over a one year period. The tank was repaired by welding the exterior and re-coating of the interior surface with an epoxy. After further problems with leaks, the acid tank was replaced and there have been no additional problems since. On March 8, 2003, a major leak of sulfuric acid occurred due to a malfunctioning flow meter that caused overflow of the tank. Approximately 2,000 gallons of acid leaked on the floor of the GWTP. The acid tank meter was subsequently repaired. There was no release to the environment and there has been no recurrence of the problem.

- On inspection of the backwash holding tank, plant operations observed sand and gravel similar to the multi-media used in the multi-media filters in the tank. Inspection of the multi-media filters revealed a majority of the multi-media was missing. Plant operations determined that excessive backwash flow rate was the cause of this problem. The backwash flow rate was reduced 5 to 10 gpm to approximately 100 gpm. Also, the filter media was replaced with the appropriate type and amount that was present at GWTP start-up. The problem has not reoccurred.

On-Site Documents and Records

An interview and inspection of site documents and records at the GWTP indicate that many items were not present. The following is a list of missing documents.

1. Site Specific Health and Safety Plan (HASP). The plant operators are using the HASP that

was developed for construction activities during the Phase 1A Remedial Action, prepared by HLA in April 1998. According to Section 22.4 of the Groundwater Treatment Plant O&M Manual (OBG, August 2000), a site specific HASP must be prepared and reviewed and approved by a Certified Industrial Hygienist.

2. OSHA Training Records. Training records for each plant operator should be maintained in accordance with the requirements of OSHA regulations.

3. Discharge compliance records. Vapor-phase carbon effluent and plant effluent analytical records are not located at the GWTP. Originals are located at City of New Bedford main office. These should be located on-site in accordance with Section 18.1 of the Groundwater Treatment Plant O&M Manual (OBG, August 2000) or the manual should be revised.

Landfill Gas Extraction System

The pilot gas extraction system was inspected by Metcalf & Eddy periodically since start-up in December 2002. The most recent inspection was performed on February 24, 2003. The system was operating on the day of inspection and the following observations were made.

The pilot gas extraction system had been operated continuously since January 6, 2003, extracting landfill gas from GV-1 and GV-8 to control the migration of landfill gas to abutting properties. Monitoring was conducted daily for the first three days and weekly thereafter by Mabbett & Associates in accordance with the Corrective Action Design Plan presented in a memo dated November 15, 2002 from OBG to EPA.

Operational issues with the system included water being drawn in from the GV-8 leg of the system. The GV-8 leg was closed in the February 3, 2003 monitoring. Methane was observed to be decreasing in western gas monitoring wells. Methane concentrations along the eastern side of the landfill cap have decreased dramatically to non-detect as of the latest observation on February 24, 2003. The pilot system is still operating.

The Settling Parties' contractors have evaluated the pilot test results (OBG, 2003b) and are currently designing a full-scale landfill gas collection system.

Site Features

Site features identified in the O&M Plan (Sullivan's Ledge Superfund Site, New Bedford, Massachusetts, Site Operations and Maintenance Plan, Feb. 2002) include the landfill cap, surveyed benchmarks, the access road, site security features, the gas venting system, run-on/run-off controls and the lined portion of the unnamed stream. Site features related to OU1 have been periodically inspected by Metcalf & Eddy since their completion during construction phase in 2000. The latest inspection took place on January 24, 2003. The following observations were made during the visit.

- **Landfill cap.** At the time of the inspection, the landfill cap was mowed and erosion control netting and hay was being placed along the steep sections of the southern embankment susceptible to erosion. No areas of erosion were observed in any area of the cap.

- **Surveyed benchmarks.** No signs of damage and were all accounted for.

- **Run-on/run-off controls.** Stormwater channels were minimally vegetated and in good shape. The 30-inch culvert had been cleaned twice of debris that accumulated and caused a reduced flow capacity.

- **Access road.** The landfill cap access road was recently topped with gravel and was in excellent condition.

- **Site security features.** Fencing, barb wire and locks were in good shape. One location along Hathaway Road had a broken cross-brace and was in need of repair. However, the integrity of the fence was intact.

- **Gas venting system.** All gas vents were in good shape. Gas monitoring well GM-8 had a broken roadbox cover and needed replacement. All other GM wells were in good condition.

Unnamed Stream/Ponds

An inspection checklist, which describes the conditions of wetland restoration areas, is provided as Attachment 5. The most recent inspection of wetland restoration areas within OU1 and OU2 was conducted on July 9, 2003 by Metcalf & Eddy. The following observations of OU1 areas were made during this site visit.

Fencing consisting of yellow rope with wooden posts was installed in 2002 along the unnamed stream (except within Middle Marsh) and along the northern border of the OU1 Ponds. The fencing was designed to keep the golfers out of the areas as well as to demarcate the no-mow zones. Signs along the fence also alert golfers that they are not allowed past the fence. These fences have successfully reduced destruction of the mitigation/restored wetland areas, specifically along the north bank of the OU1 Ponds, and along the unnamed stream immediately before the Middle Marsh. In addition, the no-mow zones have been successful at maintaining a buffer around the restoration areas, including the Ponds.

The northern bank of the OU1 Ponds has been re-seeded and vegetation has been established since the exclusion of golfers by the permanent fencing.

No significant erosion was noted and the water within the unnamed stream was very clear. No silty discharge was noted from Tributary #2.

The permanent vegetation sampling plots appeared intact.

5.4.2 Operable Unit 2

The following observations of OU2 wetland areas were made during the site visit on October 5, 2002. Refer also to the inspection checklist for OU2 wetland areas which is provided in Attachment 5. In particular, it was noted that the Phragmites population had increased in the Adjacent Wetland and Middle Marsh, and to a lesser extent in mitigative areas east and west. This population should be controlled during spring activities at the time that cattail and purple loosestrife populations are addressed. The permanent vegetation sampling plots appeared intact.

In May of 2003, Metcalf & Eddy performed oversight of NEE performing a bi-annual vegetation plot survey. On June 10, 2003, Metcalf & Eddy conducted independent monitoring of the permanent vegetation sampling plots. Conclusions drawn from the spring 2003 monitoring of the OU2 wetlands areas included:

> The number of wetland species within each plot greatly exceeded the number of upland species. A few species were not identifiable, however, the late summer monitoring round should yield fewer unidentifiable species. The actual percent areal coverage of non-invasive wetland species, as averaged over six plots, was determined to be between 52% and 77%, depending on whether the unknown species would be classified as wetland or upland. It was concluded that the results of the late summer monitoring round would be used to determine whether performance standards have been met. However, it was observed that the current vegetation plots may not represent areas inundated with invasive species. It was recommended by Metcalf & Eddy that vegetation plots representing these areas be added and monitored.

The following observations of OU2 wetland areas were made during the site visit on July 9, 2003. Refer also to the inspection checklist for OU2 wetland areas which is provided in Attachment 5:

> The Phragmites population had increased in the Adjacent Wetland and Middle Marsh. The Settling Parties' contractor has been cutting and spraying invasive species approximately once a week since early June 2003. This effort should be continued throughout the 2003 growing season. The purple loosestrife population has begun to flower and should be eradicated prior to the development and drop of seed. The permanent vegetation sampling plots appeared intact.

5.5 INTERVIEWS

5.5.1 Operable Unit 1

A series of interview questions were developed for the PMC, the City of New Bedford, and OBG. Answers to several of the questions were obtained during an interview conducted with Steve Wood of the PMC on June 2, 2003. Additional responses were obtained from Steve Wood by e-mail on June 16, 2003. Answers to most of the questions are provided below and others are provided in the appropriate sections of this report.

When asked about their overall impression of the project, the PMC responded by saying that overall the project was a good experience and that much time and money were saved by coordinating with the OU2 Settling Parties. Also, the City of New Bedford "stepped up" to take responsibility for their share of the remedy. When asked if there have been any unexpected O&M difficulties or cost at the site in the last five years, the PMC responded by saying that unexpected issues included the landfill gas migration issues and the difficulties and subsequent repair and replacement of the sulfuric acid day tank (see Section 4.3.1.2 for a detailed discussion of these issues). The PMC indicated that O&M activities are being performed in accordance with the approved O&M and monitoring plans. It was indicated that O&M of the landfill gas system will eventually be the responsibility of the City of New Bedford.

The PMC was asked for their assessment and plans to address certain O&M issues that were identified during this five-year review. With regard to invasive species within OU1 wetlands, the PMC indicated that they will continue to control invasive species in accordance with the O&M plan. With regard to the landfill gas migration issue, the PMC indicated that the problem would be addressed by implementation of a full-scale landfill gas collection system as proposed in the May 8, 2003 pilot test report (OBG, 2003b).

When asked why monitoring well MW-12 has not been repaired and sampled since it is currently blocked, the PMC responded by saying that there are no plans to replace MW-12, since well GCA-1, which is also a shallow bedrock well, is located immediately adjacent and can be sampled. The PMC also indicated that monitoring well MW-4 was apparently destroyed by construction of the new storage facility on an abutting property. The PMC indicated that based on correspondence from the Veritas Group, the abutting property owner, to EPA dated December 4, 2002, the Veritas Group has agreed to either modify other monitoring wells on their property by adding a stick-up and lock box, if necessary, or to replace any well destroyed.

When asked whether a post site construction elevation survey has been conducted and how much settling has occurred, the PMC indicated that a post-construction elevation survey was conducted. When asked whether the casings on OBG-3 is scheduled to be repaired, the PMC

indicated that the casing is intact and that the only problem is stretched piping and wiring. The PMC indicated that the PMC and the City of New Bedford are looking into the replumbing of well OBG-3 in conjuction with work to allow the shallow collection trench to discharge directly to the City POTW. At the same time, interim flow meters, which are currently located in a vault and periodically experience water damage, may be moved to a more protected location.

5.5.2 Operable Unit 2

A series of interview questions were developed for AVX, the OU2 lead Settling Party, and its contractor (URS). Answers to several of these questions were obtained during an interview conducted with Marilyn Wade of URS on June 4, 2003 and additional responses were obtained in a follow-up e-mail dated June 4, 2003. Answers to most of the questions are provided below and others are provided in the appropriate sections of this report.

When asked about its overall impression of the project, URS responded by saying that overall, wetland restoration has a good foundation and is proceeding along a trajectory to achieve a forested wetlands. When asked whether there have been any unexpected O&M difficulties or costs at the site in the last five years, URS stated that the degree of maintenance required to control invasive species in the wetlands was unexpected. URS indicated that O&M activities are being performed in accordance with the approved O&M and monitoring plans.

URS was asked for its assessment and plans to address certain O&M issues that were identified during this five-year review. With regard to the invasive species, URS indicated that a plan is in place to address invasives by cutting and spraying with herbicides. With regard to the lower post-remediation water levels as compared to the pre-remediation water levels, URS indicated that it will continue to monitor four times per year. However, URS's primary concern is the establishment of a forested wetlands. If the wetlands continually progress towards achieving performance standards, however, URS opined that the water level issue will be moot. With regard to golfers treading over wetland species due to unauthorized access, URS indicated that additional fencing to restrict golfer access is in place and will be maintained.

SECTION 6.0
TECHNICAL ASSESSMENT

This section discusses the technical assessment of the remedy and provides answers to the three questions posed in EPA's Comprehensive Five-Year Review Guidance (June 2001).

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

6.1.1 OU1

Institutional controls are in the process of being finalized for the site. EPA is working with MADEP to finalize the draft GER for presentation to the City of New Bedford and other interested parties later in 2003.

A review of documents, ARARs, risk assumptions, and site inspection results indicates that the remedy has been constructed as intended by the ROD as modified by the ESDs.

The excavation of sediments and soils has been performed to comply with soil and sediment cleanup standards set in the ROD and the ESD, thus removing the source of contamination to sediment and surface water and reducing risk to human health and aquatic organisms. However, there were exceedances of sediment clean-up criteria identified in a limited number of sampling points during follow-up sampling performed in OU1. Therefore, continued sediment sampling is necessary to monitor the effectiveness of the remedy.

The landfill cap has been constructed in accordance with the ROD. The groundwater extraction and treatment system has been constructed and is operating. Further monitoring of the system's effectiveness in meeting the OU1 ROD RAO concerning groundwater is required. The Settling Parties' consultants are preparing a report on the results of recent extraction system performance testing. This document and future performance data should be reviewed in the next five-year review to determine if the extraction system is meeting the OU1 ROD RAO.

Wetlands excavation and subsequent replantings were completed in accordance with the ROD and ESDs. Continued monitoring, maintenance, and replantings are necessary to ensure that the wetlands restoration effort satisfies the requirements of the site Wetlands Operation and Maintenance Plan. OU1 and OU2 wetlands O&M activities have emphasized the control of invasive species to ensure the survival of wetlands plantings. In addition, it is important that data collected from plant plots be representative of the areas restored as a whole, particularly data collected concerning the Middle Marsh.

Operation and maintenance of the cap, GWTP and extraction system has been effective. Cap issues such as erosion and slope failure have been addressed by the OU1 Settling Parties. When there have been operating issues in the groundwater treatment plant such as the issue with the sulfuric acid day tank, they have been addressed by the Settling Parties and the City of New

Bedford. The results of the performance testing will need to be incorporated into the GWTP O&M manual so that the operator may optimize the operation of the extraction system and groundwater treatment system.

The migration of landfill gas in soil is being addressed. The OU1 Settling Parties installed a pilot landfill gas collection system as an interim measure to prevent migration of landfill gas to offsite receptors and to gather data for possible design of a long term system. A pilot test report dated May 8, 2003, documenting the effectiveness of the pilot system has been submitted to EPA (OBG, 2003b). The Settling Parties have committed to submitting a detailed design of a full-scale system with subsequent implementation in the fall of 2003. The Settling Parties have also installed methane monitoring equipment inside the groundwater treatment plant and the hotel adjacent to the site. Continued monitoring of soil gas, perimeter gas monitoring wells, and nearby structures is necessary as a human health protectiveness measure.

6.1.2 OU2

Institutional controls are in the process of being finalized for the site. Because there are no current uses of the site that violate the intent of the institutional controls, the protectiveness of the remedy is not impacted. However, if the institutional controls are not finalized, the remedy may not be protective in the future.

A review of documents, ARARs, risk assumptions, and site inspection results indicates that the remedy is functioning as intended by the ROD. Sediment excavation and treatment have been performed to meet site performance standards, thereby minimizing the risk to aquatic organisms.

As stated above, there are issues with both OU1 and OU2 with respect to the control of invasive species and the survival of wetlands plantings. Cattails and Phragmites have been found in some parts of the wetlands that are intended to be forested and/or scrub shrub wetlands. Continued control is presently required to allow wetlands to develop in compliance with the approved Wetlands Operation and Maintenance Plan. A wetlands monitoring report from the OU1 and OU2 Settling Parties documenting the first full year of wetlands monitoring has been submitted to EPA.

Water level monitoring of wells and piezometers in the OU2 wetlands indicates that water levels are 0.5 feet to, in some cases, 3.0 feet lower than pre-remediation conditions. Some of the observations may be due to drought conditions during 2002. So far 2003 has however been a much wetter year. If the lowered water table interferes with progress towards meeting Wetlands Operations and Maintenance Plan requirements, corrective action may be necessary.

There have been some issues with access by golfers to restored areas. In some instances, golfers have trampled wetlands species, thus inhibiting the success of restoration in some areas. EPA and the Settling Parties have met with golf course personnel to address this issue, and signs and additional fencing have been installed. These measures have met with considerable success. Continued access controls will be required going forward.

6.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND RAOs USED AT THE TIME OF REMEDY SELECTION STILL VALID?

In order to answer this question, OU1 and OU2 ROD ARARs were reviewed and the OU1 and OU2 risk assessments were revisited to evaluate the impact of any changes in standards, toxicity factors, exposure assumptions, and site conditions on remedy protectiveness.

6.2.1 Review of OU1/OU2 Risk Assessments and Toxicity Factors Serving as the Basis for the Remedies

An evaluation of changes in toxicity values and other contaminant characteristics, changes to the risk assessment methodology, and changes to exposure assumptions used in the human health and ecological risk assessments for the site was performed. The overall conclusion of this evaluation was that the OU1/OU2 remedies as implemented, are protective of human health and the environment. A discussion of the results and conclusions of the evaluation is provided below.

6.2.1.1 Review of Human Health Risk Assessments

The Phase I and Phase II human health risk assessments (OU1; Ebasco 1987; 1989) and the human health risk assessment for Middle Marsh (OU2; M&E, 1991) were conducted using methodology which would partially comply with current EPA risk assessment guidance. The primary discrepancies between current guidance and previous guidance exist in the areas of toxicity values, which have been significantly refined since 1989, and exposure assumptions selected to model exposure doses. In addition, the risk assessments characterized risks based on maximum detected concentrations. Current guidance prescribes the use of the 95% upper confidence limit for risk characterization. Use of the maximum detected concentration results in an overestimate of risk in all cases. The following provides an evaluation of these discrepancies and their impact on the protectiveness of the remedy.

Changes in Exposure Pathways/Assumptions

OU1

The Phase I and Phase II human health risk assessments (Ebasco, 1987; 1989) evaluated an older child exposure scenario for the area south of Hathaway Road and the unnamed stream extending north of Hathaway Road (OU1). This scenario assumes that the site will be used, to some degree, for recreational purposes. No changes in land use have occurred on or near the site, and no changes are anticipated in the near future. On the landfill cap in the portion south of Hathaway Road, the construction of residential buildings is prohibited by zoning already in place and the construction of commercial buildings is highly unlikely. Construction of facilities will also be limited by the GER to be placed on the deed. The area south of Hathaway Road is not

highly utilized as recreational space currently, but its recreational use may be increased in the future through the construction of passive recreational areas (e.g., athletic fields). Therefore, the land use assumptions used in the risk assessments continue to be valid for OU1.

Future residential groundwater use was also evaluated in the risk assessment. The risk assessment assumed that groundwater was not currently used as a source of potable water, but may be used as a future resource. Unacceptable risk was estimated for this future exposure scenario using methods and exposure assumptions largely consistent with current guidance. This was the primary basis for the groundwater containment and institutional control components of the remedy. The groundwater collection and treatment system and the soil-bentonite groundwater cut-off wall are in place. Once institutional controls are in place, these components of the remedy should prevent the completion of an exposure pathway between future human receptors and groundwater contaminants.

In the 1991 risk assessment, the older child receptor was evaluated for exposures in a manner consistent with current EPA guidance. The exposure pathways evaluated include ingestion and dermal contact with soil and sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The method used to estimate dermal doses differs from the current method, but overall, resulted in an overestimate of dermal risk. The largest difference for the dermal pathway was the use of skin-soil adherence factors that were more than an order of magnitude higher than those currently recommended (e.g., 2.77 mg/cm^2 vs. 0.2 mg/cm^2). The exposure assumptions selected were, in general, lower than current recommended values. For example, an exposed skin surface area of 2,400 cm^2 was used for older child soil exposures compared to a currently accepted value of 4,700 cm^2. An exposure frequency of 12 days/year was used. Current guidance would likely result in the selection of a higher exposure frequency to characterize future exposures (e.g., 52 days/year). It should be noted that an exposure frequency of 48 days/year was used in the development of site-specific cleanup levels. Overall, the use of the lower exposure assumptions resulted in an underestimate of risk. However as described in the "Summary and Conclusions" sub-section below, implementation of the remedy has resulted in a determination that the remedy can be considered protective of human health for OU1.

OU2

The Phase I and Phase II human health risk assessments (completed in 1987 and 1989, respectively) which evaluated portions of Middle Marsh, and the OU2 human health risk assessment (completed in 1991) evaluated an older child trespasser and adult golfer scenarios for the area north of Hathaway Road. This area is currently part of or adjacent to the Whaling City Golf Course. This portion of the site will continue to be used as a golf course or for other recreational purposes in the foreseeable future. Therefore, the land use assumptions used in the risk assessments continue to be valid for OU2.

The older child receptor was evaluated for exposures in a manner consistent with current EPA guidance. The exposure pathways evaluated include ingestion and dermal contact with soil and

sediment, dermal contact with surface water while wading, and inhalation of volatile compounds and particulates. The same exposure assumptions used for the older child receptors at OU1 were applied to OU2. The adult receptor was evaluated for dermal contact with soil, sediment and surface water along with inhalation of volatile compounds and particulates. Contrary to current guidance, incidental ingestion of soil and sediment was not evaluated, resulting in an underestimate of risk. Consistent with OU1, the method used to estimate dermal doses differed from the current method, resulting in an overestimate of dermal risk. The exposure assumptions selected for the adult were, in general, slightly different than current recommended values. For example, an exposed skin surface area of 2,940 cm^2 was used for adult soil exposures compared to a currently accepted value of 5,700 cm^2. An adult exposure frequency of 260 days/year was used for soil and 130 days/year for sediment and surface water. Current guidance would likely result in the selection of a lower exposure frequency to characterize future exposures (e.g., 100 days/year). Overall, the use of these variable exposure assumptions would have resulted in both conservative and non-conservative effects on the calculation of risk if current methods were used.

Changes in Toxicity

Toxicity values (reference doses and cancer slope factors) have changed significantly since the human health risk assessments were prepared. At the site, however, a complete exposure pathway does not exist between groundwater and human receptors for current site use, and the soil-bentonite groundwater cut-off wall, the groundwater collection system, and the institutional controls which will be implemented should prevent future exposure. As a result, changes in toxicity values of groundwater contaminants have not been evaluated for protectiveness.

OU1

Significant differences were noted in the cancer slope factors used in the human health risk assessments for PCBs, PAHs, and vinyl chloride. In all cases, the toxicity value used in the OU1 risk assessment was at least two-fold more conservative than the current value. These differences result in an overestimate of risk. Other differences between historical and current toxicity values tended to be minimal.

Lead was identified as a contaminant potentially contributing to soil risk at OU1. The average of detected lead concentrations in soil was 423 mg/kg during Phase I. Lower levels were documented during Phase II sampling. Based on a review of the risk calculations, use of current risk assessment methods would not result in an unacceptable risk associated with the average detected lead concentration based on a recreational scenario. In addition, much of the affected area has been capped, resulting in an incomplete exposure pathway between soil contaminants and human receptors.

PCBs and PAHs were identified as risk-drivers for soils and sediments. The risk associated with both classes of compounds was likely overestimated due to the use of conservative toxicity values. The area containing elevated PAH levels has been capped, preventing a complete

exposure pathway between contaminants and human receptors. As long as the cap remains intact, the remedy is protective of human health. PCB-contaminated soil and sediment were excavated from the stream bed. PCB levels remaining on-site, based on confirmatory results, range up to 29.3 mg/kg total PCBs. The highest concentration would correspond to a human health risk slightly greater than 1E-04, based on a residential exposure scenario. Levels remaining in excess of 10 mg/kg are confined to one location where it was infeasible to remove additional material. In this area, material left in place was covered with a concrete cradle, preventing human exposures. Exposed soils contain less than 10 mg/kg total PCBs. This concentration corresponds to a risk of approximately 5E-05, based on a residential exposure scenario. Since recreational exposures are expected for this area, and recreational exposures occur with less intensity and frequency than residential exposures, recreational risks are expected to be less than 5E-05. Based on these exposure scenarios, the remedy can be considered protective of human health for OU1.

OU2

As noted above, significant differences were identified in the cancer slope factors used in the 1991 human health risk assessment for PCBs, PAHs, and vinyl chloride. Since the toxicity values used in the risk assessment were more conservative than the current values, risk was overestimated for these compounds. Other differences between historical and current toxicity values tended to be minimal.

No contaminants were identified as human health risk-drivers for sediments. Because of potential ecological risks, PCB-contaminated sediments were excavated from the area north of Hathaway Road. PCB levels remaining in this area, based on confirmatory results, do not exceed 2.0 mg/kg total PCBs. This concentration would correspond to a human health risk of 1E-05, based on a residential exposure scenario. Since recreational exposures are expected for this area, and recreational exposures occur with less intensity and frequency than residential exposures, recreational risks are expected to be less than 1E-05 (possibly closer to 1E-06). Therefore, the remedy is considered protective of human health for OU2.

Summary and Conclusions Relative to Human Health Risks

A number of differences were noted between the OU1 and OU2 human health risk assessments and current risk assessment practices. Because of the variable nature of the differences, some tending to underestimate risk and others tending to overestimate risk, the estimated risks are not likely to be different from risks estimated using current guidance.

However, because OU1 soils are capped and groundwater extraction and treatment is underway, the remedy is protective of human health as long as the cap is maintained, migration of the groundwater plume is controlled, and institutional controls are implemented (i.e., exposure to contaminated media is prevented). Because PCB-contaminated sediments were removed and levels remaining are not of a concern for human health, the remedy is also protective for sediments within the stream bed (OU1) and the area north of Hathaway Road (OU2). Overall,

the remedy is considered to be protective of human health and the environment.

6.2.1.2 Review of Ecological Risk Assessments

The Phase I and Phase II ecological risk assessments (Ebasco 1987; 1989) and the ecological risk assessment for Middle Marsh (OU2; M&E, 1991) were reviewed. As with the human health risk assessment, there are differences in the methodology used to conduct these risk assessments in comparison to current guidance. Also, many of the benchmark screening values and toxicity data existing today did not exist when these risk assessments were performed. In addition, present day laboratory detection limits are consistently lower than those at the time the risk assessment was proposed.

OU1

In order to evaluate whether the remedial action objectives and target cleanup level for sediment are still appropriate and protective of ecological health, a comparison of the post-remediation confirmatory sediment samples, collected to verify that cleanup target levels had been achieved, to current ecological screening benchmarks was conducted.

Table 1 shows that confirmatory samples from Tributary #2, Pond A, and Pond B sediments are all below screening values. Table 1 also indicates that one location of the unnamed stream exceeded the screening criterion. However, this location was excavated to a depth of 6.0 feet. The backfilled wetland soils act as a barrier between remaining contaminants, thus creating an incomplete exposure pathway to benthic organisms.

The backfilled wetland soils acts as a barrier between remaining contaminants (including PAHs and PCBs) and potential aquatic and benthic receptors, thus creating an incomplete exposure pathway to aquatic and semi-aquatic organisms.

Therefore, the selected remedy is considered protective with regard to sediment.

Table 1. Comparison of Confirmatory Sediment PCBs Values to Benchmark Screening Values at OU-1.

Location	Total PCB[1] mg/Kg	TOC %	Benchmark[2] mg/Kg	Potential Risk?
Tributary #2	0.08	0.7	0.21	No
	0.08	1.4	0.42	No
	0.091	18	5.4	No
Unnamed Stream	0.35	1.3	0.39	No
	0.87	0.7	0.3	No[3]

Location	Total PCB[1] mg/Kg	TOC %	Benchmark[2] mg/Kg	Potential Risk?
Pond A	0.69	13	3.9	No
	0.56	6.7	2.01	No
	0.24	1.9	0.57	No
	0.4	3.5	1.05	No
	2	14	4.2	No
	0.24	2.4	0.72	No
Pond B	1.1	22	6.6	No
	0.8	22	6.6	No
	1.1	27	8.1	No
	0.75	26	7.8	No
	0.1	15	4.5	No
	1.5	25	7.5	No
	1	15	4.5	No

1. O'Brien & Gere Engineers, Inc., 2002. Sullivan's Ledge Superfund Site, New Bedford, MA, Remediation Construction Report, March 2002. Section 3.0
2. Benchmark assumes Aroclor 1254 is the dominant cogener, and has been adjusted for sample specific TOC values. Value taken from Persaud et al. 1993 as cited in Jones, Sutter, & Hull, 1997.
3. Though confirmatory PCB level exceeds screening benchmark, the sample depth is 6.0 feet, below the biological zone, therefore no ecological risk.

Soils east of the stream channel were generally excavated to a depth of two to six feet and capped. East bank soils (both north and south of the former car wash) were excavated to a depth of several feet and capped. Because the cap creates a barrier to the contaminated layer, the exposure pathway in soil is incomplete. Thus, the potential risk to terrestrial receptors is minimal.

Because contaminated sediment and soil have been removed or isolated, and the disposal area capped, the exposure pathway to surface water has also been eliminated. Thus, the potential risk to aquatic or semi-aquatic receptors is minimal.

Although the method used to perform the ecological risk assessments differs significantly from current methods and guidance, target clean-up levels and the selected remedy for OU1 appears to still be valid.

OU2

A review of detection limits for VOC and SVOC data used in the risk assessment indicate that they are generally below screening values and that the ecological risk assessment correctly eliminated them as contaminants of concern.

Furthermore, the Phase I and Phase II investigations demonstrated that the primary source of contamination was the OU1 disposal area. Before the implementation of the remedial action, flood waters from the disposal area could transport contaminants downstream. Because the remedy at OU1 consisted of capping the upstream disposal area, and the remedy at OU2 consisted of excavating sediment from the Middle Marsh to the edge of the flood plain and restoring wetlands, the source of contaminants have been eliminated. Thus, flood water will no longer transport contaminants via surface water or sediment. Furthermore, the clean fill and wetland soil used to reconstruct the Middle Marsh and the Adjacent Wetland would act as a barrier to any residual contaminants (including VOCs, SVOCs, and PCBs) below the excavation area, effectively eliminating the exposure pathway into sediment pore water. Therefore, the selected remedy is protective of benthic organisms as well as aquatic and semi-aquatic organisms.

Summary and Conclusions Relative to Ecological Risks

In conclusion, although the method used to perform the Ecological Risk Assessment differs from current methods and guidance, target clean-up levels and the selected remedy for OU2 appear to still be valid.

As a general conclusion, changes in guidance have occurred since the OU1 and OU2 risk assessments that could, if performed today, change some of the risk conclusions. However, despite the changes, the remedies as implemented sufficiently address these risks.

6.2.2 ARARs Review

A review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy of changes in standards that were identified as ARARs in the ROD, newly promulgated standards for chemicals of potential concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. The tables in Attachment 4 provide the ARARs review. The review is summarized below.

OU1

The 1989 ROD for OU1 (USEPA, 1989) set forth the following ARARs for the selected remedy:

- Safe Drinking Water Act
- Toxic Substances Control Act (TSCA)
- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act (CWA)
- Clean Air Act (CAA)
- Occupational Safety and Health Administration (OSHA)
- U.S. Department of Transportation
- 310 CMR 22.00 - Massachusetts Drinking Water Regulations
- 314 CMR 6.00 - Massachusetts Groundwater Quality Standards

- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 454 CMR 21.000 - Massachusetts Right to Know Regulations
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

In addition, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Interim Sediment Quality Criteria were identified in the ROD as To Be Considered (TBC).

Table A4-1 of Attachment 4 provides an evaluation of ARARs for OU1 using the regulations and requirement synopses listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met.

The Massachusetts Solid Waste Management Regulations (310 CMR 19.117, 19.118, 19.132, and 19.150) were not included in the ROD but are now considered applicable because they provide a means to detect, monitor, and address landfill gas at property boundaries at concentrations greater than 25% LEL. These regulations require that MADEP be notified when concentrations of landfill gases at the property boundary are measured above 25% LEL. They also mandate the control of landfill gases to concentrations less than 25% LEL to prevent public health and safety concerns. These ARARs were the topic of the September 29, 2003. ESD recently finalized by EPA.

The requirements of many of the ARARs identified in the ROD were met during remedy construction and are no longer ARAR or TBC.

OU2

The 1991 ROD for OU2 (USEPA, 1991) set forth the following ARARs for the selected remedy:

Location-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Resource Conservation and Recovery Act (RCRA)
- 990 CMR 1.00 - Hazardous Waste Facility Siting Regulations
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 10.00 - Massachusetts Endangered Species Act Regulations

Action-specific:

- Clean Water Act (CWA)
- Executive Order 11988 (Floodplain Management)
- Executive Order 11990 (Protection of Wetlands)
- Fish and Wildlife Coordination Act
- Toxic Substances Control Act (TSCA)
- Clean Air Act (CAA)
- Federal Noise Control Act
- 314 CMR 4.00 - Massachusetts Surface Water Quality Standards
- 310 CMR 10.00 - Massachusetts Wetlands Protection Act Regulations
- 321 CMR 9.00 - Massachusetts Endangered Wildlife and Wild Plants Regulations
- 314 CMR 9.00 - Massachusetts Certification for Dredging, Dredged Material Disposal, and Filling in Waters
- 314 CMR 8.00 - Massachusetts Supplemental Requirements for Hazardous Waste Management Facilities
- 310 CMR 30.00 - Massachusetts Hazardous Waste Management Regulations
- 310 CMR 6.00 - Massachusetts Ambient Air Quality Standards
- 310 CMR 7.00 - Massachusetts Air Pollution Control Regulations

Additional policies, criteria, and guidance were identified in the ROD as TBC, including:

- Massachusetts Wetlands Protection Policy 90-2
- TSCA Subpart G PCB Spill Cleanup Policy
- Interim Sediment Quality Criteria, Massachusetts Allowable Ambient Air Limits - Annual (AALs) and Massachusetts Threshold Effects Exposure Levels (TELs)
- Guidance on Remedial Actions for Superfund Sites with PCB Contamination
- EPA Interim Policy for Planning and Implementing CERCLA Response Actions

Tables A4-2 and A4-3 of Attachment 4 provide an evaluation of location-specific and action-specific ARARs for OU2 using the regulations, requirement synopses, and descriptions of actions to be taken that were listed in the ROD as a basis. The evaluation includes a determination of whether the regulation is currently ARAR or TBC and whether the requirements have been met. In some cases, the description of actions to be taken to attain the location-specific ARARs differed for the selected and contingency remedies. In these cases, both descriptions were provided in Table A4-3.

6.2.3 Overall Answer to Question B

In general, a review of ARARs and risk information that were the bases of the OU1 and OU2 remedies indicates that there were no changes that would impact the protectiveness of the remedies.

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

6.3.1 OU1

The presence of elevated methane gas in the landfill gas monitoring wells was not addressed by the remedial action that was described in the OU1 ROD. The OU1 Settling Parties are currently working to address landfill gas to protect public health through the installation of an active gas collection and extraction system. EPA issued an ESD on September 29, 2003 to require mitigation of the landfill gas issue and to add Massachusetts Solid Waste Landfill Regulations (310 CMR 19.117, 19.118, 19.132, and 19.150) to the list of ARARs.

6.3.2 OU2

No information has come to light that could call into question the protectiveness of the remedy.

SECTION 7.0
ISSUES

Based on the activities conducted during this five-year review, the issues identified in Table 5 have been noted.

Table 5: Issues

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
OU1 Institutional controls are in process of being finalized.	N	Y
Monitoring of groundwater pump and treat operation effectiveness on controlling contaminant migration must be documented and comply with OU1 RAOs.	N	Y
Landfill gas has been discovered at the site. A pilot gas collection system is in place. A full-scale active system is to be installed.	N	Y
Compliance with Wetlands Operation and Maintenance Plans, including control of invasive and nuisance species.	N	Y
Monitoring sediment concentrations to ensure they meet clean-up levels.	N	Y
OU2 Institutional controls are in process of being finalized.	N	Y
Compliance with Wetlands Operation and Maintenance Plans, control of invasive and nuisance species. Further monitoring of groundwater elevations in restored areas should be performed to quantify any effects on wetlands restoration.	N	Y

SECTION 8.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

In response to the issues noted above, it is recommended that the actions listed in Table 6 be taken:

Table 6: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
OU1 Institutional controls	Finalization of institutional controls.	MADEP, EPA, & the City of New Bedford	EPA/MADEP	2003-4	N	Y
Performance of groundwater extraction system	Evaluate and demonstrate compliance with RAOs	Sullivan's Ledge Site Group and the City of New Bedford	EPA/MADEP	continued	N	Y
Landfill gas migration	Continue to monitor. Design and implement long-term corrective action.	Sullivan's Ledge Site Group	EPA/MADEP	2003	N	Y
OU2 Institutional controls	Finalization of institutional controls.	MADEP, EPA, & the City of New Bedford	EPA/MADEP	2003-4	N	Y
Implement Wetland O&M Plan	Nuisance and invasive species control and monitoring and evaluation of the groundwater table depth's effect on restored wetlands.	AVX Corporation (OU2 Settling Parties)	EPA/MADEP	continued	N	Y

SECTION 9.0
PROTECTIVENESS STATEMENTS

OU1 and OU2

The remedies for both OU1 and OU2 currently protect human health and the environment because there is no current use of the site resulting in an exposure to media containing contaminant concentrations exceeding applicable criteria. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness.

OU1

- Implement institutional controls;
- Evaluate performance of the groundwater extraction and treatment system in terms of RAOs;
- Continue to monitor sediment concentrations and implement corrective actions if necessary;
- Design and install a long-term gas extraction system; and
- Implement the Wetlands Operation and Maintenance Plan, including controlling invasive and nuisance species in the wetlands.

OU2

- Implement institutional controls;
- Implement the Wetlands Operation and Maintenance Plan, including the control of invasive and nuisance species in the wetlands. Monitor and evaluate the impact of lower groundwater levels and implement corrective action if necessary.

SECTION 10.0
NEXT REVIEW

The next five-year review for the site is scheduled for March 30, 2008.