Superfund Records Center
SITE: PINE STREET CANAL
BREAK: 8.3
OTHER: 501469

Second Five-Year Review Report

for

Pine Street Barge Canal Superfund Site

Burlington,

Chittenden County, Vermont

December 2011

PREPARED BY:

United States Environmental Protection Agency
Region 1
Boston, Massachusetts

James T. Owens, III, Director
Office of Site Remediation and Restoration
United States Environmental Protection Agency, Region 1

12/22/2011
Date

SDMS DocID 501469

TABLE OF CONTENTS

Page

LIST OF ACRONYMS AND ABBREVIATIONS iii

EXECUTIVE SUMMARY v

Five-Year Review Summary Form vi

SECTION 1.0 INTRODUCTION 1-1

SECTION 2.0 SITE CHRONOLOGY 2-1

SECTION 3.0 BACKGROUND 3-1
- 3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE 3-1
- 3.2 HISTORY OF CONTAMINATION 3-1
- 3.3 INITIAL RESPONSE 3-2
- 3.4 BASIS FOR TAKING ACTION AT THE SITE 3-3

SECTION 4.0 REMEDIAL ACTIONS 4-1
- 4.1 REMEDY SELECTION 4-1
- 4.2 REMEDY IMPLEMENTATION 4-2
  - 4.2.1 Phase 1A – Construction of the Weir 4-3
  - 4.2.2 Phase 1B/2 – Cap Construction 4-3
  - 4.2.3 West Bank Cap 4-3
  - 4.2.4 Wetland Restoration 4-3
  - 4.2.5 Institutional Controls 4-4
  - 4.2.6 Historic Resources 4-4
- 4.3 SYSTEM OPERATIONS/OPERATION AND MAINTENANCE 4-5

SECTON 5.0 PROGRESS SINCE LAST FIVE-YEAR REVIEW 5-1
- 5.1 SUBAQUEOUS CAP IN AREAS 1 AND 2 5-1
- 5.2 INSTITUTIONAL CONTROLS 5-2
- 5.3 VAPOR INTRUSION 5-2
- 5.4 COMPLIANCE MONITORING PROGRAM 5-3

SECTION 6.0 FIVE-YEAR REVIEW PROCESS 6-1
- 6.1 COMMUNITY NOTIFICATION AND INVOLVEMENT 6-1
- 6.2 DOCUMENT REVIEW 6-1
- 6.3 DATA REVIEW 6-1
  - 6.3.1 Groundwater 6-1
    - 6.3.1.1 Groundwater Flow 6-2
    - 6.3.1.2 Groundwater Quality 6-3
  - 6.3.2 Surface Water 6-5
  - 6.3.3 Stormwater Inflow 6-5
  - 6.3.4 Sediment Transport 6-6
  - 6.3.5 Cap Integrity and Chemical Quality 6-6
  - 6.3.6 Review of Habitat Restoration Data and Trends 6-10
    - 6.3.6.1 Aquatic (Open Water) Habitat Restoration 6-10
    - 6.3.6.2 Wetland Habitat Restoration 6-10
  - 6.3.7 Review of Institutional Controls 6-12
- 6.4 SITE INSPECTION 6-12
- 6.5 INTERVIEWS 6-12

SECTION 7.0 TECHNICAL ASSESSMENT 7-1
7.1 QUESTION A: IS THE REMEDY FUNCTIONING AS INTENDED BY THE DECISION DOCUMENTS? 7-1
7.2 QUESTION B: ARE THE EXPOSURE ASSUMPTIONS, TOXICITY DATA, CLEANUP LEVELS, AND REMEDIAL ACTION OBJECTIVES (RAOs) USED AT THE TIME OF REMEDY SELECTION STILL VALID? 7-1
7.2.1 Review of Human Health Risk Assessments and Toxicity Factors Serving as the Basis for the Remedy 7-1
7.2.2 Review of Ecological Risk Assessments and Toxicity Factors Serving as the Basis for the Remedy 7-6
7.2.3 ARARs Review 7-7
7.3 QUESTION C: HAS ANY OTHER INFORMATION COME TO LIGHT THAT COULD CALL INTO QUESTION THE PROTECTIVENESS OF THE REMEDY? 7-8
7.4 TECHNICAL ASSESSMENT SUMMARY 7-8

SECTION 8.0 ISSUES 8-1

SECTION 9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS 9-1

SECTION 10.0 PROTECTIVENESS STATEMENTS 10-1

SECTION 11.0 NEXT REVIEW 11-1

TABLES and FIGURES

Table 1 Groundwater Flow Summary Table for the Northern Portion of the Peninsula
Table 2 Summary of BTEX in Groundwater (2008-2011)
Table 3 Groundwater Level Monitoring (Area 3)

Figure 1 Site Locus Map
Figure 2 Site Boundary
Figure 3 Study Areas and Transect Locations
Figure 4 Location of Wells Used for Compliance Monitoring
Figure 5 Area 3 Observation Well Locations
Figure 6 Fill Groundwater Elevation Monitoring Wells at Gilbane Property
Figure 7 Wells Monitored for NAPL
Figure 8 Groundwater Flow (Spring 2008)
Figure 9 Groundwater Flow (Fall 2009)
Figure 10 Original and Current Class IV Groundwater Areas
Figure 11 Arsenic & Lead Groundwater Concentrations vs Turbidity
Figure 12 Extent of NAPL in Northwestern Corner of Site
Figure 13 Extent of BTEX in Groundwater

ATTACHMENTS

Attachment 1 Parcels Granted Restrictive Easements and Annual Certification Checklist
Attachment 2 List of Documents Reviewed/References
Attachment 3 Site Inspection Form and Interview Records
Attachment 4 Summary of ARARs

LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
BED	Burlington Electrical Department
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CDF	Containment/disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC §§ 9601 *et seq.*
CFR	Code of Federal Regulations
COC	Contaminant of Concern
DOJ	United States Department of Justice
EPA	Environmental Protection Agency
ER-M	Effects Range Median
ESD	Explanation of Significant Differences
GE	General Electric Company
ICs	Institutional Controls
JCO	The Johnson Company
LCMM	Lake Champlain Maritime Museum
M&E	Metcalf & Eddy
MCL(s)	Maximum Contaminant Level(s)
MGP	Manufactured gas plant
MOA	Memorandum of Agreement
μg/L	Micrograms per liter
mg/Kg	Milligrams per kilogram
NAPL	Non-aqueous phase liquid
NCP	National Contingency Plan, 40 CFR Part 300
NGVD	National geodetic vertical datum
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priority List
NRHP	National Register of Historic Places
NTUs	Nephelometric turbidity units

ACRONYM	DEFINITION
O&M	Operation and maintenance
ppb	Parts per billion
PAH(s)	Polycyclic aromatic hydrocarbon(s)
PRP(s)	Potentially Responsible Party(ies)
PSBCCC	Pine Street Barge Canal Coordinating Council
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 *et seq.*
RD/RA SOW	Remedial Design/Remedial Action Statement of Work
RETEC	Remediation Technologies, Inc.
ROD	Record of Decision
SBERA	Supplemental Baseline Ecological Risk Assessment
SEM/AVS	Simultaneously Extracted Metals/Acid Volatile Sulfide
SVOCs	Semivolatile Organic Compounds
TBC	To Be Considered
TCE	Trichloroethylene
TSS	Total Suspended Solids
VOCs	Volatile Organic Compounds
VGES	Vermont Groundwater Enforcement Standard
VTAOT	Vermont Agency of Transportation
VTDEC	Vermont Department of Environmental Conservation
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This *Second Five-Year Review Report* was prepared for the Pine Street Canal Superfund Site (the "Site") located in Burlington, Chittenden County, Vermont. The Site consists of an abandoned barge canal and turning basin, surrounding vegetated wetlands, and upland areas. It is hydraulically connected to Lake Champlain and is subject to flooding from the lake. The Site has been used for various industrial and commercial purposes since the mid-1800s. Around 1895, Burlington Gas Works, a manufactured gas plant, was constructed on Pine Street, just north of what is now the Burlington Electric Department. The plant used a coal gasification process to manufacture gas for the city. Burlington Gas Works reportedly disposed of large quantities of coal gasification wastes, such as coal tar, fuel oil, cyanide, contaminated wood chips, iron oxide, cinders, and metals at its former location along Pine Street and in the wetlands behind the plant. These waste materials are the primary source of contamination at the Site.

The selected remedial action for the Site in the 1998 Record of Decision included capping contaminated sediments within the canal, turning basin and certain emergent wetland areas where an unacceptable ecological risk was found, effectively isolating the contamination below the biologically-active zone. A weir was constructed at the mouth of the turning basin; aquatic and wetland habitat restoration is being conducted; and stormwater management features were enhanced. The remedy also included establishing institutional controls to prevent the use of on-site groundwater for drinking water, prevent or limit the migration of existing contamination, and prevent certain land uses that could result in unacceptable human-health risks. Additionally, the remedy included long-term performance monitoring of groundwater, surface water, stormwater, sediments, as well as the cap.

The requirement for conducting five-year reviews is incorporated in Section121(c) of CERCLA 42 § 9621(c). This review is required by statute because the selected remedy resulted in hazardous substances remaining on site above levels that allow for unlimited use and unrestricted exposure. The trigger for this statutory review was the start of on-site construction of the outlet weir in October 2001. This is the second five-year review for the Site. The first five-year review was prepared in 2006. It concluded that for the remedy to remain protective, coal tar releases in one section of the canal would need to be addressed. In 2009, EPA issued an Explanation of Significant Differences (ESD) that called for modifications to the sand cap; an amended cap was constructed in 2011.

This second five-year review concludes that while the remedy is protective for most pathways of exposure to contaminants, a protectiveness determination of the remedy at the Pine Street Canal Superfund Site cannot be made until further information is obtained to evaluate potential vapor intrusion impacts at the existing Burlington Electric Department building. The vapor instruction study will also examine how to consider the potential for future vapor intrusion on the undeveloped parcels near the Site. Once the data are collected, they will be assessed and a determination will be made whether or not additional measures are necessary to ensure protection of human health. It is expected that these actions will take approximately 12 months to complete at which time a protectiveness determination will be made.

In addition, in order for the remedy to be protective in the long-term, provisions of an ESD issued by EPA in September 2011 must be implemented. The ESD calls for certain enhancements to the containment remedy set forth in the 1998 ROD to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and coal tar left on site.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name ***(from WasteLAN)***: Pine Street Barge Canal Superfund Site		
EPA ID ***(from WasteLAN)***: VTD980523062		
Region: I	**State:** VT	**City/County:** Burlington/Chittenden
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:** 9/30/2004	
Has site been put into reuse? ☐ NO ☒ YES		
REVIEW STATUS		
Lead agency: ☒EPA ☐ State ☐ Tribe ☐ Other Federal Agency		
Author name: Karen Lumino		
Author title: Remedial Project Manager	**Author affiliation:** EPA Region I	
Review period: 3/9/2011 – 12/22/2011		
Date(s) of site inspection: July 12&13, 2011; August 2, 2011		
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) X 2 (second) ☐ 3 (third) ☐ Other (specify)		
Triggering action: ☒ Actual RA Onsite Construction ☐ Actual RA Start ☐ Construction Completion ☐ Previous Five-Year Review Report ☐ Other (specify)		
Triggering action date ***(from WasteLAN)***: 10/3/2001		
Due date ***(five years after triggering action date)***: 10/3/2006		

Five-Year Review Summary Form (continued)

Issues:

The performance standard for benzene in groundwater is exceeded at locations at the northern portions of the site. In September 2011, EPA issued an ESD for enhancements to the containment remedy in the 1998 ROD, including the installation of a 200-300 foot long vertical barrier to contain NAPL and prevent the potential for off-site migration of the groundwater plume; installation of NAPL recovery wells with NAPL removal as necessary; and groundwater monitoring on both sides of the vertical barrier to track flow and extent of contaminants in groundwater.

The subsurface vapor intrusion pathway was not evaluated in previous risk evaluations for the 1998 ROD. A comparison of historical groundwater data and recently collected groundwater data to EPA's generic vapor intrusion screening values indicated the possible presence of subsurface VOCs in the vicinity of a currently-occupied building at levels that exceed screening criteria.

Recommendations and Follow-up Actions:

Implement the provisions of the September 2011 ESD for enhancements to the containment remedy set forth in the 1998 ROD.

Evaluate the vapor intrusion pathway to determine potential risks, if any, to current and future indoor receptors at the Site.

Protectiveness Statement(s):

A protectiveness determination of the remedy at the Pine Street Canal Superfund Site cannot be made at until further information is obtained to evaluate potential vapor intrusion impacts at the existing Burlington Electric Department building. The vapor instruction study will also examine how to consider the potential for future vapor intrusion on the undeveloped parcels near the Site. Once the data are collected, they will be assessed and a determination will be made whether or not additional measures are necessary to ensure protection of human health. It is expected that these actions will take approximately 12 months to complete at which time a protectiveness determination will be made.

In addition, in order for the remedy to be protective in the long-term, provisions of the September 2011 ESD must be implemented.

Other Comments: None

SECTION 1.0
INTRODUCTION

This *Second Five-Year Review Report* is for the remedial actions conducted and ongoing at the Pine Street Canal Superfund Site (the "Site"). The purpose of this five-year review is to determine whether the remedy for the Site remains protective of human health and the environment. The methods, findings, and conclusions of the review are documented in this report. In addition, five-year review reports identify issues found during the review, if any, and present recommendations to address them.

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

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

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

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

This is the second review of the remedial action at the Pine Street site. This review is required by statute because the selected remedy leaves hazardous substances, pollutants or contaminants on site above levels that allow for unlimited use and unrestricted exposure. The first review was completed in October 2006, five years from the start of construction of the outlet weir.

SECTION 2.0
SITE CHRONOLOGY

The chronology of the Site, including all significant events and dates are summarized below. Additional events and details are provided in Section 3.0, Background.

DATE	EVENT
Around 1895	Burlington Gas Works moves to Pine Street and begins producing manufactured gas
1926	Light tar running into Lake Champlain noted in Burlington Gas Works daily log book
1944	Large amount of potentially-contaminated clay is excavated from the floors of the former General Electric facility (a.k.a former General Dynamics and/or Gilbane properties) and replaced by concrete flooring
April 1967	City of Burlington issues permit to Vermont Gas Systems to dismantle buildings on manufactured gas plant site
July 14, 1967	Burlington Free Press article and picture of fire in the foundation of the gas holder
October 1967	20,000 yd^3 of dirt excavated for Burlington Electric Department (BED) building
1968	Drainage ditch that had funneled oil and coal tar from the former gasification plant to the canal is plugged
July 1968	State of Vermont investigates oil spills from the canal into Lake Champlain; holds landowner meetings to discuss installation of dike around the spills and booms across the canal to protect the lake
1977-1978	VTAOT performs exploratory boring; estimates that 150,000 – 200,000 yd^3 of contaminated material would need to be removed for the proposed Southern Connector highway
1979	Army Corps of Engineers requires GE to remediate potentially-hazardous waste they are believed to have disposed on site from 1948 to 1967
October 23, 1981	Site proposed for the National Priorities List
September 8, 1983	Site listed on the National Priorities List
October to December 1985	EPA undertakes emergency removal at Maltex Pond; 444 tons of contaminated soil disposed at GSX, Pinewood, SC
May 1990	*Draft Remedial Investigation Report* completed by PEER Consultants for EPA
March 1992	*Supplemental Remedial Investigation Final Report* completed by Metcalf & Eddy for EPA
May 1992	*Baseline Risk Assessment Final Report* completed by Metcalf & Eddy for EPA

DATE	EVENT
November 1992	EPA issues proposed plan; *Feasibility Study Report* completed by Metcalf & Eddy for EPA
March 1993	State of Vermont designates groundwater at the Site non-potable (Class IV)
Spring 1993	EPA withdraws cleanup plan proposed in November 1992
Fall 1993	Pine Street Barge Canal Coordinating Council forms
July 1997	*Supplemental Baseline Ecological Risk Assessment* completed by Roy F. Weston for EPA
July 1997	Potentially-responsible parties (PRPs) submit *Additional Remedial Investigation Report*
May 1998	EPA issues second proposed plan; PRPs submit *Additional Feasibility Study Report*
September 29, 1998	EPA issues the *Record of Decision* which sets forth the remedy for the Site and will form the basis for all remedial design/remedial action (RD/RA) activities
November 23, 1999	EPA/DOJ lodges RD/RA Consent Decree with the US District Court in Vermont
February 11, 2000	Consent Decree entered by US District Court
February 24, 2000	Performing Defendants submit *Remedial Design Workplan* (RDWP)
September 28, 2000	EPA conditionally approves RDWP
Fall 2000	Performing Defendants begin pre-design investigations and pilot tests
April 2001	Decision to break remedial action into phases due to seasonal constraints, Lake Champlain water level and construction sequence.
October 2, 2001	EPA approves design of outlet weir (Phase 1A)
October 2001	Performing Defendants construct outlet weir (starting clock for five-year reviews)
November 1, 2001	EPA and VTDEC conduct final construction inspection of outlet weir
April 10, 2002	EPA gives final approval of RDWP and *Compliance Monitoring Workplan*
June 2002	*Memorandum of Agreement* for mitigation of adverse effects to historic resources at the Site is fully executed
July 8, 2002	EPA conditionally approves design for capping enhanced stormwater management features (Area 7 and BED outfall), Area 3 and the Area 2 waterway (Phase 1B); Performing Defendants initiate construction
September 19, 2002	EPA approves conceptual design for subaqueous cap in canal (Areas 1 and 2) and turning basin (Area 8) (Phase 2)
December 3, 2002	EPA approves *Design Change #10* – dewatering the canal and capping sediments in the "dry"

DATE	EVENT
January 24, 2003	EPA approves *Design Change #11* – capping sediments in the turning basin in the "dry" and capping a 100 x 100 foot upland area
March 2003	Performing Defendants complete construction on subaqueous cap; re-flood canal and turning basin
Spring 2003	Oily sheens and coal tar (a.k.a "NAPL") is observed on the surface water in the canal and in pools in an uncapped area of the west bank
Fall 2003 to present	Performing Defendants conduct first round of post-construction monitoring; results are presented in bi-annual *Compliance Monitoring Reports*
December 2003	Performing Defendants submit *Supplemental West Bank Capping Remedial Action Workplan*
January 29, 2004	EPA approves workplan for west bank
June to July 2004	Performing Defendants cap west bank and remove NAPL
July 2004	Restrictive easements recorded on parcels listed in Attachment 1
August 6, 2004	EPA and VTDEC conduct final construction inspection for subaqueous cap and west bank cap
September 2004	Performing Defendants submit *Remedial Action Construction Completion Report*; Burlington DPW submits O&M plan for Area 7 and the BED outfall
Fall 2004	Continued observations of accumulations of coal tar on the cap surface in the canal
November 2005	Performing Defendants submit *Draft NAPL Action Plan*
January 2006	State of Vermont expands Class IV boundary; Performing Defendants submit *Draft NAPL Work Plan*
April 2006	EPA approves final NAPL action plan and work plan
May 2006 to February 2007	Performing Defendants complete spring, summer and winter NAPL field investigations
October 2006	EPA completes first five-year review
September 2007	EPA conditionally approves the *Institutional Controls Plan*, which includes a mechanism to monitor and determine compliance with the institutional controls
February 2008	Performing Defendants submit *Final NAPL Investigation Report*
June 2008	Performing Defendants submit *Final NAPL Controls Report*
April 2009	EPA, following a 30-day public comment period, issues an *Explanation of Significant Differences* which outlines modifications to the 1998 remedy to address coal tar migration through the sand cap at the southern end of the Site

DATE	EVENT
July 2010	Performing Defendants submit a memorandum regarding sharp increases in benzene concentrations in groundwater samples collected from monitoring wells outside the Class IV boundary in the northwestern corner of the Site
August 2010	Performing Defendants submit *Design Report* for the amended cap
August 2010 to February 2011	Performing Defendants install amended cap and NAPL monitoring/recovery wells
October 2010	Performing Defendants conduct field investigations to evaluate the feasibility of a vertical barrier to address the potential for off-site migration of the benzene plume
December 2010	Performing Defendants submit *Subsurface Investigation and Evaluation Report* with results of field investigation in the area of the northwestern wells
March 2011	Performing Defendants submit construction completion report for amended cap (currently under agency review)
August 3, 2011	EPA and VTDEC conduct final construction inspection of amended cap
September 19, 2011	EPA, following a 30-day public comment period, issues a second *Explanation of Significant Differences* to the 1998 remedy that calls for additional containment in the northwestern corner of the Site to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and NAPL left on site

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Pine Street Canal Superfund Site is located in Burlington, Chittenden County, Vermont (Figure 1). The Site is defined in the Record of Decision (USEPA, 1998a) as a 38-acre area where contaminants associated with wastes from the manufactured gas plant have been found; although a larger 70- to 80-acre area (the "Study Area"), bordered by Lakeside Avenue, Pine Street, the Vermont Railway property, and Lake Champlain, was the subject of studies conducted prior to the Record of Decision under the direction of EPA. The Site itself is contained within the larger Study Area.

The Site consists of an abandoned barge canal and turning basin, surrounding vegetated wetlands, and upland areas (Figure 2). It is hydraulically connected to Lake Champlain and is subject to flooding from the lake. The canal and turning basin run north-south on the western portion of the Site. Between the Site and Lake Champlain are active train tracks and a well-used bike path.

The majority of the Site itself is currently vacant. Surrounding land uses include industrial, commercial, and residential uses. Groundwater beneath the Site is classified by the State of Vermont as Class IV, which indicates that it is non-potable, suitable only for agricultural or commercial uses. The City of Burlington supplies drinking water to all residences and businesses in the city.

Future land uses are expected to be recreation/open space in the wetland areas along the lakefront, and commercial/industrial in the upland areas along the Pine Street corridor. Stormwater that enters the Site from municipal storm sewers is filtered by the system of wetlands on site before it enters Lake Champlain. Several features located on and surrounding the Site are possible candidates for the National Register of Historic Places (USEPA, 1998a).

3.2 HISTORY OF CONTAMINATION

The Site has been used for various industrial/commercial purposes since the mid-1800s, when the railroad on the western edge of the canal was built. The barge canal and turning basin were first dredged in 1868 to provide access to Lake Champlain for several lumber companies, a coal company, and a boat builder. By 1879, two slips for barges, one running north from the turning basin, the second running east towards Pine Street from the middle of the canal, had also been constructed (USEPA, 1998a).

Around 1895, Burlington Gas Works, a manufactured gas plant (MGP), was constructed on Pine Street, just north of what is now the Burlington Electric Department. The plant used a coal gasification process to manufacture gas for the city. Burlington Gas Works reportedly disposed of large quantities of coal gasification wastes, such as coal tar, fuel oil, contaminated wood chips, iron oxide, cinders, and associated contaminants such as cyanide and metals at its former location along Pine Street and in the wetland areas behind the plant. These waste materials are the primary source of contamination at the Site (USEPA, 1998a).

Disposal practices at the MGP, as well as the operations of other industries at the Site, have resulted in the infilling of wetlands and peaty soils at much of the Site. The gas plant ceased operations in 1966 and was dismantled in 1967. By 1977, both barge slips had been filled in. Naturally-occurring processes, such as deposition, eutrophication, and sediment trapping in large root mats, continued to fill in the canal and turning basin (USEPA, 1998a).

The first observation of visible contamination on surface water was documented in 1926, when a daily log book for the MGP noted that light tar from the plant's tar well was running into Lake Champlain. A series of oily releases to the canal occurred in the late 1960s and early 1970s (USEPA, 1998a).

3.3 INITIAL RESPONSE

In 1977 and 1978, the State of Vermont took exploratory borings for the Southern Connector highway that was proposed to be built across the Site. The borings revealed extensive subsurface contamination. The Site was proposed for the National Priorities List on October 23, 1981 and listed on September 8, 1983.

In 1985, EPA undertook an emergency removal action at the former Maltex Pond (Figure 2) with field oversight provided by the Vermont Department of Environmental Conservation (VTDEC). Soil contaminated with coal tar to a depth of six to 18 inches was removed, solidified with limestone and shipped off site for disposal at an approved facility. A permeable geotextile membrane was placed over the excavated area, and topped with six inches of clean topsoil. Contaminated soil was left in place below the geotextile membrane.

The Vermont Agency of Transportation investigated the Site, primarily along the proposed Southern Connector right-of-way, from 1976 to 1988. In 1988, EPA took the lead and conducted additional remedial investigations through 1992. The results of these activities are contained in the *Draft Remedial Investigation Report* (PEER, 1990); *Supplemental Remedial Investigation Report* (M&E, 1992a); *Baseline Risk Assessment Report* (M&E, 1992b) and *Feasibility Study Report* (M&E, 1992c).

In November 1992, EPA proposed a cleanup plan for the Site that called for (1) construction of a containment/disposal facility (CDF) over the most heavily-contaminated portion of the Site; (2) dredging contaminated sediments from elsewhere on Site and placing them in the CDF; (3) collecting mobile oil and coal tar; (4) on-site restoration or replication of wetlands; and (5) institutional controls to protect the integrity of the CDF and prevent ingestion of groundwater. Public comment on the 1992 proposed plan was overwhelmingly negative. Commenters raised several concerns about the studies, including questions about the nature and extent of ecological risk at the Site, the migration of contaminated groundwater and air quality. Commenters were also concerned about the short-term health effects of excavation and the construction of a large CDF on the shores of Lake Champlain. After a six-month comment period, EPA withdrew the proposed cleanup plan due to community opposition.

In 1993, environmental regulators, the potentially responsible parties (PRPs), and other citizens and groups who had been active in commenting on the 1992 proposed plan formed the Pine Street Barge Canal Coordinating Council (PSBCCC). The PSBCCC's mission was to design and oversee the implementation of additional studies to address questions raised by the public during the comment period, and to recommend to EPA a remedy for the Site. Under the oversight of EPA, VTDEC and PSBCCC, the additional studies were performed in 1994 through 1998. The results of the studies are contained in the

Additional Remedial Investigation Report (JCO, 1997), *Supplemental Baseline Ecological Risk Assessment* (Weston, 1997) and *Additional Feasibility Study Report* (RETEC, 1998).

EPA adopted the recommendations of the PSBCCC, and in May 1998, released a second proposed cleanup plan for public comment. In September 1998, EPA issued the Record of Decision (ROD) for the Site, selecting the remedy recommended by the PSBCCC.

3.4 BASIS FOR TAKING ACTION AT THE SITE

The following summarizes the contaminants found at the Site during the remedial investigations, as summarized in the 1998 ROD.

Surface Soil. Polycyclic aromatic hydrocarbons (PAHs) were identified as the primary contaminant in surface soils (top four to six inches) with other organic chemicals detected infrequently and at low concentrations (M&E, 1992a; JCO 1997). PAH concentrations were highest to the west of the former MGP, particularly in the wetlands. Metals were also prevalent in surface soils at varying concentrations. Chromium, cyanide, lead, barium, iron, and selenium concentrations were elevated in the wetlands areas west of the former MGP and south of the Burlington Electric Department.

Subsurface Soil. Subsurface soil sampling (deeper than 12 inches) indicated high concentrations of coal tar, PAHs, BTEX compounds (benzene, toluene, ethylbenzene, xylenes), and cyanide within the wetland areas to the west of the former coal gasification plant (M&E, 1992a). The majority of contamination was determined to be within the peat and fill layers to a depth of 24 feet including beneath the canal. Free-phase coal tar (also referred to as "non-aqueous phase liquid" or NAPL) is present within this area. BTEX compounds were also detected in subsurface soils outside the NAPL area. Metals concentrations varied widely across the Study Area and were highest in the following four areas: wetlands to the west of the former MGP; the filled south barge slip; subsurface sediments of the canal; and near the industrial landfill at the northern property line of General Dynamics (formerly Lockheed-Martin/GE).

Groundwater. Groundwater sampling indicated the presence of PAHs, BTEX, and cyanide in overburden groundwater (M&E, 1992a; JCO, 1997). The highest PAH concentrations were found in groundwater west of the former MGP, south of the Burlington Electric Department and in the former tank farm area north of the turning basin. The extent of BTEX contamination is similar but extends farther in all directions. No contamination was detected in bedrock or water supply wells. Groundwater contamination was found primarily in areas where free-phase coal tar is also present.

Sediment. Extensive PAH contamination was detected in shallow sediments (top four inches) in the canal and wetlands (JCO, 1997). The highest PAH concentrations were detected in the northern part of the canal and turning basin. Concentrations of several metals and cyanide were also elevated in shallow canal and bordering wetland sediments. As noted above, deep soils beneath canal sediments were also impacted.

Surface Water. Relatively low concentrations of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) were detected in the canal (M&E, 1992a). Metals concentrations in the canal water were generally less than the concentrations found in groundwater. Surface water samples collected adjacent to the Study Area in Lake Champlain did not contain elevated concentrations of Site-

related contaminants. Metals concentrations in Lake Champlain samples increased with increasing distance from the Study Area, suggesting other sources.

Air. Air samples indicated that during undisturbed conditions, there are no impacts on local ambient air from contaminated soil and sediments (M&E, 1992a; JCO, 1997).

Summary of Human-Health Risks. The human-health risk assessment (M&E, 1992b) concluded that the most significant human-health risk at the Site was associated with potential residential ingestion of groundwater. The estimated carcinogenic risk for groundwater exceeded EPA's target risk range of 10^{-6} to 10^{-4} and the estimated non-carcinogenic hazard for groundwater ingestion exceeded a hazard index of one. Carcinogenic and non-carcinogenic risk estimates were below, within, or close to EPA's target risk range for receptors including swimmers in Lake Champlain, Site visitors, outdoor workers exposed to soils above a depth of five feet, or future visitors (adults and children) to an area zoned for recreation, conservation, and open space. Contaminants of concern (COCs) that were evaluated included PAHs, cyanide, VOCs, non-PAH SVOCs, pesticides, and metals. In 1993, the PSBCCC identified human-health exposure pathways requiring additional consideration beyond the 1992 baseline risk assessment. Additional studies conducted during the remedial investigation in 1997 were used to evaluate these exposure pathways (JCO, 1997). This evaluation confirmed many of the earlier findings and offered several new ones including:

- No unacceptable risk from agricultural and commercial uses of groundwater.
- An evaluation of metals and fish consumption concluded that it is not likely that fish consumption would occur at a rate high enough to pose an unacceptable risk from PAHs or metals, with the exception of mecury. However, mercury contamination in fish is a regional problem.
- Legal controls would be needed to limit potential future exposure to soils deeper than five feet.
- Legal controls would be needed to prevent children's potential exposure to lead and carcinogenic PAHs in soils (i.e., no day-care facility to be built on site).
- The 1992 human health risk assessment was conservative enough to accommodate the possibility of some synergistic (i.e., greater than additive) effects between chemicals.

Summary of Ecological Risks. Several PAHs and metals (including mercury) were evaluated for ecological risk (M&E, 1992b; Weston, 1997). It was concluded that there was an unacceptable risk to environmental receptors from site-related contaminants, specifically,

- PAHs and metals in sediments exceeded guidelines published by NOAA and the Ontario Ministry of Environment and Energy and draft EPA sediment quality criteria indicating possible impacts to sediment-dwelling organisms and benthic species.
- Brown bullhead fish bile samples contained biochemical biomarker levels and PAH metabolite levels that were statistically significantly higher than corresponding levels for fish collected in the reference area.

- Frog embryos exposed to sediments from the southern section of the canal had 100% mortality and embryo survival was significantly reduced when exposed to sediments from the wetland south of North Road.

The above conclusions regarding Site contamination and risks to human health and the environment formed the basis of the remedy selected in the ROD.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

The remedial action objectives for the remedy selected in 1998 are summarized below.

Ecological

- Eliminate or reduce to acceptable levels the direct exposure of ecological receptors to contaminated soils and sediments posing an unacceptable risk. If not feasible, reduce direct exposures of ecological receptors to COCs to the extent feasible.

- Prevent or minimize long-term adverse effects of remediation activities on the existing aquatic environment and/or wetland habitat and restore wetlands affected by remediation.

Human Health

- Prevent unacceptable exposure (direct contact, ingestion, and inhalation) to contaminated soils located greater than five feet below grade.

- Prevent ingestion and other exposures associated with residential use of contaminated groundwater where contaminated groundwater presents unacceptable risks.

- Prevent exposures associated with residential use (direct contact, ingestion, and inhalation) to contaminated soils, sediments, air, and surface water.

Management of Migration

- Protect Lake Champlain from being impacted by contaminants left on site by ensuring there is not a significant increase in mass flux of contaminants through groundwater or contaminated sediment migration and preventing changes in hydrogeologic conditions that will likely cause migration of contaminated groundwater to Lake Champlain in concentrations above a standard to be developed.

- Protect areas not targeted for remediation (both on- and off-site) by preventing significant migration of contamination from on-site sources. This includes ensuring that contaminated groundwater with concentrations above drinking water standards does not migrate beyond the Class IV boundary, ensuring that contaminated on-site sediments are not significantly mobilized, ensuring that NAPL is not significantly mobilized, preventing degradation of surface water to levels above ambient water quality criteria, and preventing degradation of local (urban) background air quality.

- Protect remediated areas on the Site from becoming recontaminated from on-site and known off-site sources. This includes ensuring that hazardous substances left in place do not mobilize or

create unacceptable risk to ecological receptors and humans in remediated areas, monitoring to provide necessary data to determine if non-CERCLA substances are mobilizing or creating unacceptable risks, and monitoring to provide the necessary data to determine whether stormwater and non-contact cooling water may be creating an unacceptable risk to human and ecological receptors in remediated areas.

Site Uses

- Ensure to the extent practical that the remedy itself does not reduce the suitability of the Site for current and future uses, including a highway.
- Retain or expand current Class IV groundwater classification and boundary.
- Maintain or replace beneficial functions and values of wetlands.

The selected remedial action for the Site included the following components:

- Capping contaminated sediments in all areas where an unacceptable ecological risk has been found, effectively isolating the contamination below the biologically-active zone. This includes a subaqueous cap in the canal and turning basin (Areas 1, 2, 8); construction of a cap in the emergent wetlands in Areas 3 and 7; and placement of a soil cover over a 100 x 100 foot upland area on the east bank of the canal, just below the turning basin.
- Long-term performance monitoring of groundwater, surface water, stormwater, sediments and cap.
- Establishing institutional controls to: (1) prevent the use of on-site groundwater for drinking water, (2) prevent land uses that could result in unacceptable risks to human health, such as residential use, use as a children's day-care center and most excavations below five feet; and (3) prevent or limit the migration of existing contamination.
- Constructing a permanent weir at the outlet of the turning basin to Lake Champlain; aquatic and wetland habitat restoration; and enhanced municipal stormwater management features.

4.2 REMEDY IMPLEMENTATION

This section presents summaries of the remedial actions conducted at the Site in accordance with the 1998 ROD. Operation and maintenance activities and long-term performance monitoring are ongoing as described in Section 4.3.

A Consent Decree and Remedial Design/Remedial Action Statement of Work (RD/RA SOW) agreed to by EPA, the State of Vermont and the Defendants was entered by the United States District Court for the State of Vermont on February 11, 2000. The Consent Decree and Statement of Work required certain defendants, known as the Performing Defendants, to implement the remedial action selected in the ROD. Construction of the remedial action was initially designed to be implemented in three phases:

construction of the outlet weir (Phase 1A), cap construction in Areas 3 and 7 (Phase 1B), and construction of the subaqueous cap in the canal and turning basin (Phase 2). However, as a result of design changes, the cap in the canal and turning basin was constructed as an extension to Phase 1B while the canal was dewatered. This change was made because it was determined that placement of the geotextile and sand could be better controlled in the "dry"; construction in the winter months would take advantage of increased sediment strength due to freezing; and the schedule would be accelerated. The outlet weir was constructed first to allow for better control of the canal water elevation during subsequent phases of construction.

4.2.1 Phase 1A – Construction of the Weir

Phase 1A consisted of the construction of a cast-in-place, broad-crested concrete weir at the canal outlet to Lake Champlain in October 2001 (JCO, 2002a). The weir is approximately 50 feet long and is located beneath the Burlington bike path bridge at the canal outlet. The weir was designed to provide a normal canal stage elevation between 96.0 and 96.5 feet NGVD. Removable stop logs and a six-foot wide sluice were incorporated into the design to allow variation in the canal stage elevation after completion of construction in order to improve wetlands hydrology and optimize wetlands functions at the Site, and to improve access conditions for cap maintenance activities.

4.2.2 Phase 1B/2 – Cap Construction

Phase 1B, which consisted of the capping of Areas 3 and 7; construction of the Burlington Electric Department stormwater outfall and other stormwater management features; and capping and construction of the Area 2 waterway in the southern end of the canal, was implemented in the summer and fall of 2002. Phase 2 construction on the remainder of Areas 2 and 1 (canal) and Area 8 (turning basin) was implemented over the winter of 2002-2003 as an extension to Phase 1B. The cap consists of a geotextile material covered by sand in the canal and turning basin, and sand and topsoil in the upland areas. In the wetland waterway, GeoWeb® was placed on sand and filled with crushed stone to provide erosion protection. The 100 x 100 foot area was capped with sand and topsoil (JCO, 2004b). The canal and turning basin were re-flooded in March 2003, in advance of spring flooding.

4.2.3 West Bank Cap

In the spring of 2003, following completion of the cap, pools of free-phase coal tar were observed outside of the cap footprint on the west bank of the canal and on the surface of the subaqueous cap in the canal. Oily sheens and globules of NAPL were also observed on the surface of the water in the canal. During the fall of 2003, a response strategy was developed which recommended additional capping over the affected portion of the west bank of the canal and removal of NAPL that had accumulated on the surface of the cap in the canal. The west bank cap construction and NAPL removal were implemented in the summer of 2004 (JCO, 2004b).

4.2.4 Wetland Restoration

Wetlands restoration activities were performed in accordance with the Wetland Restoration Plan (JCO, 2002b), as modified to include restoration of the west bank. The initial seeding and planting within the

restoration areas occurred during March and August 2003 and July 2004, and, replacement planting was conducted in October 2004.

4.2.5 Institutional Controls

The ROD specified that certain restrictions be placed on parcels of property within the Site boundary, as well as certain properties outside the boundary of the Site, where restrictions are necessary to ensure that the on-site remedy remains effective. The restrictions include the following:

- The properties will not be used for residential use or for children's day-care centers.
- Groundwater under the properties shall not be used for potable drinking water purposes. No production well (e.g. for industrial use) will be installed at any location where free-phase contamination has been shown to be present.
- No construction activities that will change hydrogeologic conditions and that would cause migration of contaminated groundwater to Lake Champlain will be allowed.
- Excavations to depths greater than five feet (including those below the water table) on the properties will be prohibited unless one or more of the following exceptions apply: (a) excavation is performed to install, repair, maintain, service or remove underground utility components, conduits, installations or channels, which may presently be in place deeper than five feet and which may be below the water table; (b) drilling, driving or boring to install pilings for otherwise allowable construction is permitted; or, (c) the excavation is performed in a location on the property in which current contaminant concentrations at depths greater than five feet are below 140 mg/kg total PAH. In the case of exceptions (a) and (b), workers conducting the excavations and working in the area must use appropriate personal protective equipment as required by the Occupational Health and Safety Administration or its successor agencies, unless a site-specific risk assessment is performed and its results have been approved by EPA prior to the excavation.

The performance standard for institutional controls, as specified in the RD/RA SOW, includes the establishment, maintenance, and appropriate enforcement, where necessary, of land-use restrictions on all parcels for which institutional controls are required. Institutional controls have been established in the form of restrictive easements and the renewal/expansion of the Class IV groundwater boundary.

4.2.6 Historic Resources

It was determined that the capping remedy would adversely affect the canal and other features at the Site that are eligible for the National Register of Historic Places (JMA, 2001). The Performing Defendants entered into a Memorandum of Agreement (MOA) with EPA and the State of Vermont to mitigate those impacts (USEPA, 2002). Under the MOA, researchers from the Lake Champlain Maritime Museum (LCMM) studied a sunken barge of similar type to those in the canal and turning basin, but located at the bottom of Lake Champlain proper. Field work on the barge, called the Sloop Island Canal Boat, was conducted during the summers of 2002 and 2003. A large number of artifacts were collected and are housed at the museum in Vergennes, Vermont. In addition to a detailed technical report, LCMM created

a popular report entitled *The Archaeology of a Champlain Canal Boat and the Pine Street Barge Canal* (available as a link from www.epa.gov/sites/superfund/pinestreet) and signage for the Site chronicling its role in Burlington's booming lumber industry in the late 1800s to its cleanup under Superfund.

4.3 SYSTEM OPERATIONS/OPERATION AND MAINTENANCE

Three monitoring phases were specified in the ROD: pre-construction, construction/post-construction, and long-term. Post-construction for each component of the remedy began once construction on that component was completed. Monitoring moved from post-construction to long-term, including operation and maintenance, with EPA approval of the *Remedial Action Construction Completion Report* (JCO, 2004b) in December 2004. Compliance monitoring is performed in order to comply with the requirements and determine achievement of the performance standards specified in the ROD and RD/RA SOW.

Long-term monitoring is currently performed according to *Compliance Monitoring Workplan, Revision 5*, (JCO, 2006). Long-term monitoring activities include the following:

- Groundwater monitoring
- Surface water monitoring
- Stormwater inflow monitoring
- Sediment transport monitoring
- Physical, chemical, and benthic/biological monitoring of the cap
- Aquatic and wetland habitat restoration monitoring

Long-term monitoring has averaged $150,000 a year over the five years covered by this review.

Operation and maintenance for Area 7 and the outfall at Burlington Electric Department is conducted by Burlington Department of Public Works.

SECTON 5.0
PROGRESS SINCE LAST FIVE-YEAR REVIEW

EPA made the determination during the last five-year review that the remedy is currently protective, except for the subaqueous cap in portions of Areas 1 and 2 (USEPA, 2006). EPA also concluded that the remedy will not be protective in the future without a mechanism in place to determine compliance with the institutional controls that have been established to restrict land and groundwater use at the Site.

Two additional issues that the 2006 *Five-Year Review Report* indicated must be evaluated included:

1. The potential for a vapor intrusion to indoor air pathway, and the potential for this pathway to impact current and future indoor receptors; and

2. The ability of the existing compliance monitoring program to adequately monitor performance standards for contaminant migration given new site conditions.

Each of these topics is addressed in the following sections.

5.1 Subaqueous Cap in Areas 1 and 2

EPA determined that the subaqueous cap in the southern portion of the canal between approximately T9 and T13 (Figure 3) was not protective because it (a) did not meet the performance standard for isolation of contaminants, (b) exceeded the ecologically-sensitive benchmarks established in the ROD, (c) exposed fauna living in and around the canal to highly-contaminated waste in the form of free-phase NAPL and (d) may constitute a loss of benthic habitat. There, coal tar underlying the sand cap was migrating upwards through the cap into the water column, and significant seepage into the canal had occurred.

The Performing Defendants conducted field investigations under the supervision of EPA and VTDEC in 2006 and 2007 to evaluate the rate at which NAPL was being released, its distribution, and mechanism(s) of release. Those studies concluded that the primary mechanism for the release of NAPL in the area between T9 and T13 was gas ebullition (ARCADIS, 2008a). The organic-rich canal sediment and peat beneath the sand cap generates gas, presumed to be methane. As the gas passes through the contaminated sediment, it can become coated with NAPL. Coated bubbles pass through the sand cap and when they hit the water surface and burst, an oily sheen is left behind. The path that the gas takes through the sand can act as a pore through which additional coal tar can migrate. Depending on the density of the coal tar, it either accumulates with the sheens on the water surface, or sinks and accumulates on the cap surface.

In 2008, the Performing Defendants evaluated options that could be implemented as partial replacement for, augmentation of, or addition to the existing cap to prevent NAPL from seeping into the canal (ARCADIS, 2008b). In April 2009, following a 30-day public comment period, EPA issued an Explanation of Significant Differences (ESD) for the modification of the sand cap. Following discussions with EPA and VTDEC, the Performing Defendants designed a modification, referred to as the Amended Cap (ARCADIS, 2010). The Amended Cap was constructed from August 2010 to February 2011, as follows:

- Removal of 800 yd^3 of existing sand cap between approximately T9 and T12+50 via vacuum dredging and off-site disposal.

- Placement of the following cap components, from bottom to top:
  – geocomposite layer
  – reactive core mat (three layers overall, with up to six layers in some areas near the west bank)
  – turf reinforcement mat

- Installation of ten NAPL monitoring and recovery wells, five each on the east and west banks.

- Restoration and seeding.

- Long-term operation, maintenance and monitoring.

Due to the absence of a surface sand layer in the Amended Cap, the cap mid-depth chemical, sediment trap and habitat restoration performance standards established in the RD/RA SOW are no longer applicable. However, the performance standard for the isolation of contaminants that requires that contaminant migration through the cap be minimized is still applicable to the Amended Cap and the long-term monitoring program has been revised to include monitoring for visual sheens, potential gas build-up, and the removal of NAPL from monitoring/recovery wells.

5.2 Institutional Controls

Institutional controls (easements that restrict certain activities on the site) have been placed on parcels on the Site and adjacent to the Site.

In the last five-year review, EPA concluded that the remedy will not be protective in the future without a mechanism in place to determine compliance with the institutional controls that have been established to restrict land and groundwater use at the site.

In September 2007, EPA conditionally approved the *Institutional Controls Plan* (H&W, 2004) which contains a mechanism to monitor and maintain compliance with the institutional controls. Each landowner must submit an annual certification to EPA in form attached in Attachment 1, stating whether they have complied with the institutional controls required in the Consent Decree.

5.3 Vapor Intrusion

The subsurface vapor intrusion to indoor air pathway was not considered in the risk evaluations for the 1998 ROD. EPA concluded in the last five-year review that the potential for this pathway to impact current or future indoor receptors must be evaluated. Per EPA guidance developed after the 1998 ROD was issued (USEPA, 2002), the vapor intrusion pathway should be evaluated at buildings that are within approximately 100 feet laterally or vertically of known or interpolated soil gas or groundwater contaminants. Groundwater data collected from monitoring wells at the Site that are sampled for performance monitoring are not in the vicinity of occupied buildings. However, a review of historical groundwater data indicates that groundwater concentrations in excess of EPA's vapor intrusion screening

levels likely exist in close proximity to one currently-occupied building (Burlington Electric Department) and at least two vacant parcels (453 and 501 Pine Street). A more detailed discussion about the screening will be included in a vapor intrusion assessment currently being drafted by the Performing Defendants, along with a workplan for a vapor intrusion study.

5.4 Compliance Monitoring Program

EPA also recommended re-evaluating the adequacy of the existing compliance monitoring plan given (a) the expansion in January 2006 of the Class IV boundary at the northwestern corner of the Site and (b) new information regarding the location and potential mobility of a significant accumulation of NAPL in the subsurface at the southern portion of the Site.

The existing compliance monitoring program, which began in 2000, requires that semi-annual groundwater monitoring be performed. The monitoring well network includes a series of "sentinel" wells at the northwestern corner of the Site, between the canal and Lake Champlain (Figure 4). Beginning in 2008, the groundwater data collected from monitoring wells outside the expanded Class IV boundary began to show a sharply-increasing trend in benzene concentrations. These data suggest that contamination may be migrating off site. In September 2011, following a 30-day public comment period, EPA issued an Explanation of Significant Differences (USEPA, 2011) that calls for additional containment in the northwestern corner of the Site to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and NAPL left on site. The ESD also calls for an expanded network of monitoring wells that is sufficient to track potential plume migration beyond the Class IV boundary.

Ten new NAPL monitoring wells were installed at the Site (five on the east bank and five on the west) in February 2011 as part of the construction of the Amended Cap. The Performing Defendants are required to check these wells regularly, from early spring to late fall, for accumulations of NAPL, and, remove NAPL for off-site disposal at an approved facility to protect the long-term integrity of the Amended Cap. The frequency of monitoring and removal, proposed by the Performing Defendants in a draft Amended Cap operation, maintenance and monitoring plan, is currently under agency review. EPA believes that the addition of these new NAPL wells to the compliance monitoring network will be sufficient to track potential contaminant migration in the subsurface at the southern end of the Site.

SECTION 6.0
FIVE-YEAR REVIEW PROCESS

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

6.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

On July 13, 2011, EPA issued a press release to the media outlets announcing that the second five-year review was underway. On August 3, 2011, EPA conducted interviews in Burlington with individuals (e.g., PSBCCC) that have historically been involved with the remedial activities at the Site (see section 6.5). A second press release announcing the outcomes and recommendations of the five-year review will be issued once it has been completed.

6.2 DOCUMENT REVIEW

This second five-year review consisted of a review of relevant documents for the Site, compliance monitoring reports submitted biannually by the Performing Defendants. See Attachment 2 for a list of documents that were reviewed.

6.3 DATA REVIEW

Performance standards for the remedy include the requirement that the subaqueous cap prevent contact between underlying contaminants and benthic organisms and fish in the biologically-active part of the benthic habitat at ecologically-harmful levels, and, long-term monitoring of groundwater, surface water, stormwater inflow, sediment transport, and physical and chemical monitoring of the cap to demonstrate compliance with all statutes and regulations identified in the ROD and all requirements of the Consent Decree and RD/RA SOW. The performance standards also include monitoring associated with the aquatic and wetland habitat restoration areas. The performance standard for the institutional controls requires that land use restrictions be established, maintained and, where necessary, enforced.

6.3.1 Groundwater

Groundwater at the Site is monitored to verify hydraulic conditions, to ensure contaminants do not migrate beyond the Class IV groundwater boundary at concentrations above federal drinking water standards (Maximum Contaminant Levels or MCLs), and to confirm contaminants are not migrating to Lake Champlain. The Class IV groundwater boundary was expanded in January 2006 (Figure 10). Monitoring wells MW-18, MW-21(A&B), and MW-24(A&B) lie outside the Class IV boundary between the Site and Lake Champlain. MW-20(A&B), MW-22(A&B), and MW-23(A&B) are located within the Class IV boundary. MW-13 and MW-9(A&B) were outside the original Class IV boundary but are now inside. MW-21, MW-24 and MW-9 act as sentinel wells in that they allow for early detection of groundwater plume migration off site, in the direction of Lake Champlain. In general, well pairs identified as "A" and "B" are both considered shallow wells but the "B" wells have deeper screen depths than the "A" wells.

The groundwater compliance monitoring program includes spring and fall sampling of overburden wells and fall sampling of deep overburden and bedrock wells. All groundwater samples are analyzed for BTEX and PAHs (unfiltered). Overburden groundwater samples are also analyzed for total metals. Groundwater level measurements are also conducted during spring and fall. Locations of wells used for compliance monitoring and water levels are shown in Figure 4. Additional wells used to monitor water levels in Area 3 and the fill on the Gilbane property (formerly owned by General Electric, General Dynamics and GP Burlington North LLC) are shown in Figures 5 and 6, respectively. Ten wells are also monitored for the presence of NAPL, and if NAPL is present, it's removed and shipped off-site to an approved facility. NAPL monitoring was also performed at wells outside the Class IV boundary where MCLs were exceeded. Monitoring wells routinely used to monitor NAPL are shown in Figure 7.

Multiple recovery wells were installed to monitor and remove accumulations of NAPL next to the canal in the area where the Amended Cap was installed in 2010-2011. These wells are not included in the groundwater compliance monitoring program but will be monitored routinely as part of operation, maintenance and monitoring program for the Amended Cap, which is currently under review.

In the event of MCL exceedances, the performance monitoring requirement also includes an assessment of whether there was a statistically significant increase in mass flux migrating beyond the Class IV boundary or in the cross-sectional area of any plume.

6.3.1.1 Groundwater Flow

During the remedial investigation, groundwater was determined to flow generally towards the Site into the area designated as Class IV (non-potable). The exception is along the peninsula between the canal and Lake Champlain at the northern end of the Site where groundwater intermittently flows toward the lake depending on hydraulic and precipitation conditions, such as when canal stage is higher than lake stage.

At the southern end of the Site, groundwater flow is determined by measuring the water level in five shallow wells screened within the surficial fill unit. These wells are located on the northeastern corner of the Gilbane/former General Dynamics property, and all are outside and lakeside of the groundwater plume. A review of data collected from these wells between Oct 2006 and Oct 2010 confirms that typical flow directions are inwards in this portion of the Site, away from the lake and Class IV boundary.

Closer to the outlet weir at the northern end of the Site, groundwater flow is determined by measuring water level in six well clusters located on the peninsula between the canal and Lake Champlain. A review of data collected from these wells between Oct 2006 and Oct 2010 (summarized in Table 1) confirm earlier findings – that flow direction and hydraulic gradients are controlled in large part by the water level in the canal relative to that of the lake. When the lake and canal are at the same elevation above the outlet weir, the hydraulic gradient in the peninsula is very small and there is little to no groundwater flow (Figure 8). However, when the canal stage is higher than that of the lake, significant hydraulic gradients west, towards the lake and Class IV boundary, can result (Figure 9). Groundwater gradients to the lake increased markedly in summer 2007, and intermittently thereafter, due to the repeated construction and demolition (by the Performing Defendants) of beaver dams below the railroad bridge at the canal outlet. While the dams were present, the hydraulic gradient to the lake was seasonally increased beyond its historic levels of less than 0.003 feet/foot. A "beaver baffler" designed to inhibit successful beaver dam

construction was installed at the outlet in October 2010. Its effectiveness at preventing dam construction and therefore reducing beaver-induced elevated canal levels will be evaluated over time.

6.3.1.2 Groundwater Quality

Volatile Organic Compounds. Since 2000, most of the groundwater samples have shown non-detectable or occasional trace detections of the BTEX compounds. The exceptions are located on the peninsula between the canal and lake at the northwestern corner of the Site. Inside the Class IV boundary, BTEX compounds have been detected consistently in MW-23B, with benzene in excess of the federal MCL and Vermont Groundwater Enforcement Standard (VGES) 5 µg/L or 5 parts per billion (ppb). Since April 2008, benzene concentrations in monitoring wells outside the Class IV boundary (MW-21A&B, MW-24A) have been detected at levels that exceed the MCL (Table 2). Prior to 2008, the highest benzene concentration that had ever been recorded in wells outside the Class IV boundary was 1 ppb. Since then, the data have shown a sharply-increasing trend: 11 ppb (spring 2008), 110 (fall 2008), 270 (spring 2009), 390 (fall 2009), 530 (spring 2010), 1100 (fall 2010), and 550 ppb (spring 2011). The appearance of benzene contamination above the MCL in wells MW-24A and MW-21B also indicates that the cross-sectional area of the plume and mass flux of contaminants increased in 2007, and again in 2009.

Polycyclic Aromatic Compounds. Since 2000, most of the groundwater samples have shown non-detectable or occasional trace detections of various PAHs. The exceptions inside the Class IV boundary are MW-22A, MW-23A&B, and MW-20A. Samples from MW-22A and MW-20A have indicated low but relatively consistent concentrations of naphthalene, 2-methylnaphthalene, acenaphthene, fluorene, phenanthrene, and fluoranthene. Samples from MW-23B and MW-23A (not sampled since 2001) have had persistent concentrations of naphthalene and 2-methylnaphthalene approaching or exceeding 1 ppm. All other PAHs analyzed in samples from MW-23B have been detected one or more times, some consistently. Concentration trends over time are not evident in these samples. No MCLs have been established for the detected PAH compounds. VGES have been established for naphthalene (20 ppb), fluorine (280 ppb) and fluoranthene (280 ppb). Outside the Class IV boundary, naphthalene has been detected recently (2010) in two wells (below the VGES) that have also seen increases in benzene concentrations (MW-21A and MW-24A). The detection of naphthalene in these wells where it was not previously detected, also suggests that the cross-section area of the plume and the mass flux of the contaminants may have increased.

Metals. Metals have been detected in all samples. Most are at levels below MCLs. However, since the start of routine monitoring in 2000, arsenic concentrations in samples from MW-21B have ranged from 5.8 to 61.8 ppb and consistently (17 out of 21 times) exceeded the MCL of 10 ppb. Arsenic concentrations in samples from MW-9A have ranged from 2.3 to 84.7 ppb and have exceeded the MCL eight out of 21 times sampled.

Lead concentrations in samples from MW-9A have ranged from less than 0.8 to 474 ppb and have exceeded the 15 ppb federal action level six out of 21 times sampled. Lead concentrations have exceeded the federal action level in one out of 21 samples from MW-20A, in two of 21 samples from MW-20B, and in three of 21 samples from MW-21A.

The elevated metals concentrations in MW-9A and MW-21B are likely attributable to elevated turbidity in the wells (Figure 11). MW-9A has historically been reported with elevated turbidity ranging from 50 to 700 nephelometric turbidity units (NTUs). MW-21B has been reported with sporadic elevated turbidity up to 30 NTUs since its installation in 2000. However, the turbidity levels do not show a consistent increase over time.

The sources of arsenic and lead in MW-21B and MW-9A do not appear to be related to Site releases since they are not detected at similar levels closer to the canal (i.e., in the MW-23 cluster located east of MW-21B) and the primary source of contamination at the Site. Additionally, arsenic and lead are not detected in the MW-24 well cluster, located beyond the Class IV groundwater area west of MW-9A.

Non-aqueous Phase Liquid. Since 2000, ten wells in the compliance monitoring network are monitored only for the presence of NAPL. Seven deep wells (ranging from 50 to 150 feet below ground surface) are monitored annually. Of these, four (MW-1B, MW-3C, MW-8A, and MW-19) have never shown evidence of NAPL. The remaining three have shown evidence of NAPL, but levels have been steadily decreasing: MW-4B – 0.9 to less than 0.01 feet; MW-12 – 0.5 to less than 0.01 feet; and P-106 – few black/brown dots of product in bailer and stains on sorbent pads to no observable NAPL. This indicates that NAPL is not migrating downwards into deeper strata.

Three monitoring wells (MW-17, MW-23A&B) that are screened across the water table and located on the peninsula between the canal and the lake are monitored semi-annually for the presence of NAPL. All three of these wells have historically had measurable thicknesses of NAPL, but levels declined or were stable between 2000 and 2007: MW-17 - 0.5 to 0.03 feet; MW23A - 0.1 feet to no observable NAPL; and MW-23B - 1.85 to less than 0.01 feet. However, beginning with the April 2008 monitoring event, increased thicknesses of NAPL have been observed in MW-17 and MW-23B. Maximum thicknesses of NAPL were reported in October 2010 at 4.15 feet in MW-23B and 0.9 feet in MW-17.

NAPL has not been observed in any of the sentinel well locations (MW-9, MW-21, MW-24). Additional soil coring was performed at thirteen locations in October 2010 to further delineate the extent of NAPL. The coring locations were in a north-south line between the railroad tracks, and between MW-23 and MW-21 (Figure 12). No coal tar was found in any of these cores. These data indicate that NAPL is not migrating beyond the Class IV boundary towards Lake Champlain.

Groundwater Quality Summary. Inside the Class IV boundary, MW-23B has been impacted by PAHs and BTEX, with benzene and naphthalene concentrations consistently exceeding the MCL (for benzene) and VGES (for naphthalene). Directly west of MW-23 and outside the Class IV boundary, samples from the MW-21 cluster exceed the MCL for benzene.

Arsenic was detected in MW-21B, and arsenic and lead were detected in MW-9A at concentrations exceeding MCLs, however the concentrations may be due to elevated turbidity in the samples, which are not filtered prior to analysis. Neither arsenic nor lead are believed to be site-related contaminants.

The NAPL thicknesses in all the deep compliance monitoring wells that historically contained NAPL steadily decreased since 2000, and in some cases, NAPL is no longer observed. All other deep wells in the compliance monitoring network continue to remain free of NAPL. These observations indicate that NAPL is not migrating downwards from the Site towards the bedrock. NAPL thicknesses in shallow

monitoring well MW-17 and the MW-23 well cluster decreased until 2007, but have since increased. NAPL has not been observed in any wells outside the Class IV boundary.

Increases in the hydraulic gradient from the canal to the lake above historic levels have intermittently occurred since 2007, due to increased beaver dam construction across the canal outlet. These increases in gradient pre-date, but may be a factor in, the increases in benzene concentrations in wells outside the Class IV boundary. In fall 2010, an apparatus consisting of steel cage and diverter pipe (a "beaver baffler") was installed at the outlet weir in an attempt to thwart beaver activity, thereby minimizing periods of elevated canal levels that increase groundwater flows towards Lake Champlain.

6.3.2 Surface Water

Surface water quality is monitored to ensure that site-related contaminants are not migrating to Lake Champlain. Grab samples (unfiltered) are collected annually at the outlet of the turning basin to the lake, and analyzed for PAHs. Results are compared to the ambient water quality criteria (AWQC) for protection of human health. Attainment of AWQC is not a performance standard for the remedial action, however, if AWQC are exceeded, those criteria are to be considered, along with other relevant factors, to determine whether additional work will be required.

No PAHs have been detected in any of the annual long-term surface water monitoring events from 2005 through 2010 indicating that site-related contaminants are not migrating to Lake Champlain via surface water.

6.3.3 Stormwater Inflow

As part of the remedy, on-site stormwater management features were enhanced to reduce the potential for runoff that enters the Site through municipal storm sewers to re-contaminate remediated portions of the Site. The goal of the enhancements in Area 7 and BED outfall was to ensure that suitable retention time be provided to remove sediment from stormwater passing through the wetland, before it reached the capped portions of the Site. Performance standards for stormwater inflow management included monitoring to determine whether stormwater may be adversely impacting the quality of the top of the cap in the canal and turning basin.

Stormwater inflow monitoring is conducted through the use of eight sediment traps which are installed in the subaqueous cap in Area 8 (three sediment traps), Area 1 (three sediment traps), and Area 2 (two sediment traps) (JCO, 2006a). Samples have been collected annually since November 2005 and analyzed for PAHs and metals. Although there are no performance standards for the sediment trap data, they are compared to the effects range median (ER-M) for 13 individual PAHs, and for the sum of the 13 PAHs.

All of the sediment trap locations had at least one sample that exceeded at least one individual PAH ER-M and one sum-of-PAHs ER-M. The two highest sum-of-PAHs concentrations were reported from samples taken in or immediately down-gradient of Area 2 prior to installation of the Amended Cap. Settlement of NAPL globules that migrated through the sand cap and into the canal are believed to be the most likely source of these elevated PAH concentrations. The next highest sum-of-PAHs concentrations were reported from samples collected at the southern, upgradient end of the Site where municipal

stormwater enters the canal, and, at the outlet from the canal to Burlington Harbor where there is likely a contribution from off-site sources.

Multiple metals were reported in all sediment trap samples at concentrations that were relatively consistent between samples. Copper concentrations (52 to 165 mg/Kg) were below the ER-M benchmark (270 mg/Kg); the highest concentrations were found near the southern end of the Site, where the stormwater enters the canal. Lead concentrations (46.4 to 177 mg/Kg) were below the ER-M benchmark (218 mg/Kg); the highest concentrations were found in the turning basin near the outlet weir. Mercury detections (0.03 to 0.35 mg/Kg) were all below the ER-M benchmark (0.71 mg/Kg). Selenium was not detected except during the 2010 monitoring event when it was reported in all samples at concentrations ranging from 3.6 to 8.8 mg/Kg. Zinc was reported at concentrations ranging from 296 to 5,130 mg/Kg, with a majority above the 410 mg/Kg ER-M benchmark. Average zinc concentrations for each sample location were all above the zinc ER-M benchmark. There is no readily apparent pattern of distribution to the zinc concentrations and it is not believed to be Site-related.

6.3.4 Sediment Transport

Sediment transport is monitored to verify that the remedy is preventing transport of contaminated sediments to Lake Champlain at levels that would create an unacceptable risk to receptors.

An ISCO sampler has been installed annually in the outlet from the turning basin to Lake Champlain between 2005 and 2010 to collect unfiltered water samples during high flow events. The sampler is controlled by the relative water elevations in the canal and lake as measured with pressure transducers. When the lake level is below the weir, and the canal level rises to a level that exceeds a threshold elevation in response to a rain event (representing a certain flow rate across the weir), the sampler automatically collects water samples. A maximum of three storm events per year that equal or exceed the previous year's peak storm are to be sampled. The initial threshold storm was established as the peak storm measured during remedial investigations (JCO, 1997). The samples collected from the six highest canal stage elevation readings during each storm event are composited and analyzed for PAHs and total suspended solids. The PAH data are compared to the sediment data reported in the Lake Champlain Sediment Toxics Assessment Program report (McIntosh, et al., 1997) and the total suspended solids data are compared to the Vermont Lake Champlain Water Quality Monitoring program data from 1992 through 2006 (ANR, 2007).

There have been two stormwater sampling events since 2005 both of which occurred in October 2007. Two PAHs were detected during the first event, and none during the second. The two PAHs detected were at estimated concentrations of 0.45 ppb fluoranthene and 0.56 ppb pyrene. Burlington Harbor sediment contains 3,820 to 18,950 ppb fluoranthene and 3,170 to 11,239 ppb pyrene. Based on the maximum water level observed during the two sampled storms in 2007, the threshold level was adjusted to 96.96 ft AMSL for the 2008 and subsequent years of the sediment transport monitoring program.

6.3.5 Cap Integrity and Chemical Quality

The cap includes the subaqueous cap (Areas 1, 2, and 8), the emergent wetlands cap in Areas 3 and 7, and a topsoil cover of the scrub/shrub uplands/wetlands south of Area 8 (100 x 100 foot area). The purpose of the cap is to contain and isolate contaminated sediments through the placement of clean

materials over existing substrate and minimize migration of contamination to the surrounding environment. The performance standard for the subaqueous cap is to "*prevent contact between the underlying contaminated sediments and benthic organisms and fish in the biologically active portion of the benthic habitat (1-10cm) at the ecologically harmful levels. It shall be a barrier to the effects of burrowing benthic macroinvertebrate organisms (bioturbation). It shall prevent or minimize the migration of contaminants (by erosion, diffusion, advection, or bioturbation) from the contaminated sediments through the cap. It shall also provide resistance to erosion caused by surface water currents, waves caused by wind, ice scouring, and propeller wash, as well as the effects of bioturbation*".

An additional performance standard for Areas 3 and 7 and for the 100 x 100 foot area is "*to provide suitable substrate for wetland plant species*".

Performance monitoring of subaqueous cap integrity includes physical inspection, chemical monitoring of cap core samples and comparison to benchmark values[1] identified in the RD/RA SOW, and biological monitoring to verify that the cap prevents migration of contaminants from the underlying contaminated sediments through the cap and contact benthic organisms and fish at ecologically harmful levels. Monitoring of the other cap areas includes long term regular inspections to assess physical integrity of the cover and identify erosion or signs of failure.

Bathymetry measurements are to be conducted in year 1, 3, 5, and 10 after construction completion. Seepage measurements are to be conducted in year 1, 3, and 5 after construction completion. Cap core sampling and visual inspection of the cap are to be performed annually.

Physical Monitoring. A cap core thickness assessment was conducted in the canal and turning basin (Areas 1, 2, 8), Area 3, and Area 7 during the post construction period in 2005. Bathymetric surveys of the open water areas (within Areas 1, 2, 5, 8) and topographic surveys of Areas 2, 3, 7, and the 100 x 100 foot area, were conducted in 2003, 2005 and 2007. Topographic surveys of the west bank cap were conducted in 2004 and 2007. Settlement monitoring was conducted during cap construction and monitored during and after construction.

Elevations in the 100 x 100 foot area remained relatively unchanged since construction. The only portion that saw any measureable change was the area near the eastern dry dock which showed less than 0.5 feet of consolidation between 2003 and 2005. The 2007 topographic data indicate that no significant erosion has occurred, including the western portion of the cap adjacent to the canal.

A comparison of 2007 data to previous data sets indicates that no significant erosion, slumps or sloughing of cap material has occurred in the turning basin and northern portion of the canal. A reduction in bottom elevation of less than 0.5 foot was observed in some locations in the turning basin. An elevation increase of approximately one foot was observed near the outlet weir which is consistent with visual observations of a large amount of sediment build up near the weir due to wave action from the lake.

The 2007 data indicate that no significant erosion, slumps or sloughing of cap material has occurred in the southern portion of the canal. There are several localized areas between approximately T9 and T12

[1] Sediment benchmark values established by the 1998 ROD (Appendix B) and determined to be ecologically protective are based on NOAA Sediment Screening Guidelines (ER-Ms, Long, et al 1995) values for total PAHs, individual PAHs, copper, lead, mercury and zinc.

where elevation changes (both gains and losses) of between one and two feet were measured. The areas of the localized elevation changes are discontinuous and the locations of increased versus decreased elevations do not follow a discernible pattern either upstream to downstream or shallow to deeper zones. In addition, the bathymetry between T12 and T13 (where the downstream end of the Area 2 riprap waterway is) where the canal is the shallowest was nearly identical between 2005 and 2007. Therefore the changes do not appear to be the result of erosion. Overall no significant areas of erosion or consolidation were noted and the overall cap surface elevation remains consistent with previous measurements (between 91 and 95 feet NGVD). The maximum predicted consolidation in the northern canal and turning basin (presented in *Design Change #11*, JCO, 2003) was 2.3 feet for a three-foot thick cap. The observed reduction in cap elevations between 2003 and 2007 combined with the earlier consolidation demonstrated by the settlement plates results in a total consolidation of about three feet for a 3-4 foot cap thickness near T8+50. This is reasonably comparable to the predicted consolidation.

Less than 0.2 feet of consolidation occurred below the majority of the West Bank Cap as indicated by a comparison of the 2007 survey data with the July 2004 survey conducted immediately after the cap installation. This is considerably less than the predicted total consolidation of up to 0.9 feet (JCO, 2003b). The peat below most of the West Bank Cap may not have completed primary consolidation by 2007. The top-of-cap elevation directly east of the western cribbing was approximately 96.5 ft NGVD or higher in 2007, as compared with approximately 98 ft NGVD at the end of construction. This consolidation occurred shortly (within three months) after the cap installation and the differential settlement between the portions of cap over the canal and outside the canal was likely due to the significant differences in geotechnical properties between the underlying sediment within the canal and the peat outside the canal. A comparison of the 2007 survey data with measurements performed in 2005 indicates that there has been little change since that time.

The 2007 data indicate that no significant erosion, slumps or sloughing of cap material has occurred in the Area 2 Waterway or in Area 3. The reported ground surface elevations in Area 3 in 2007 are similar to those measured in 2005. These measurements coincide well with design estimates of primary consolidation beneath the Area 3 cap, which were between 0.6 and 1.0 feet. The 2007, 2005, and 2003 survey data indicate that there has been no significant settlement of the coir log structures along the edge of the Area 2 Waterway. The data also confirm that the coir logs are still in their designed alignment.

The 2007 data indicate that no significant erosion, slumps or sloughing of cap material has occurred in Area 7. The reported ground surface elevations in Area 7 in 2007 are generally within 0.5 feet of the end-of-construction elevations reported in 2003 with the exception of an approximate increase of one foot in the bottom elevation of the pond along North Road.

The bathymetric surveys indicate that the minimum water depth maintained by the weir has been sufficient to prevent erosion and scouring. The bathymetric surveys also indicate that erosion and scouring of the subaqueous cap has not occurred.

Chemical Monitoring. Constructed cap core sampling and analysis has been conducted annually from 2003 through 2010 with laboratory chemical analysis performed on the surface (0-10 cm) and mid-cap (circa 30-40 cm) strata. The sediment ER-Ms for copper, lead, mercury, zinc and the sum-of-13-PAHs were designated as performance standards for the mid-cap samples. There are no chemical performance standards for the surface cap samples, only for the mid-cap.

Core sample locations included Areas 1, 2 and 8 (subaqueous cap), and, Areas 3 and 7 (wetland area caps). Samples were also collected in the natural cap Area 4/5, with laboratory chemical analysis performed on the surface (0-10 cm) stratum only. The performance standards for the capped areas are not applicable to Area 4/5. Cap samples were analyzed for PAHs, metals and physical parameters. Cap coring in Area 2 was not conducted during the 2008, 2009 or 2010 monitoring events due to NAPL releases that were being addressed separately (see section 5.1).

No exceedances of the ER-Ms were reported in cap core samples collected in 2006. No PAHs were detected in any of the mid-cap samples. The only top-of-cap samples containing all 13 PAHs were from near the mouth of the canal and the railroad bridge and near the southern end of the canal where stormwater enters the canal.

No PAHs were detected in any of the 2007 mid-cap samples. No reported metals or PAHs in samples from any of the capped areas exceeded the benchmark values. Only one sample (near the mouth of the canal) contained reported PAHs, although all the detections were reported as estimated concentrations below the practical quantitation limit (PQL).

In 2008, no PAHs were detected in any of the mid-cap samples with the exception of one sample taken from the turning basin which contained estimated concentrations of phenanthrene, fluoranthene and pyrene below the laboratory PQL. No reported metals or PAHs from any of the capped areas exceeded the benchmark values. No reported metals or PAHs from any of the capped areas exceeded the benchmark values in the 2009 or the 2010 cap samples.

Cap Compliance Monitoring Summary. Across most of the Site, compliance monitoring data collected indicate that the cap has met the performance standards of containing and isolating the contaminated sediment and is resistant to erosion or bioturbation that would expose contamination to ecological receptors, with the exception of portions of Area 2 which experienced seasonal releases of NAPL through the cap from 2005 to installation of the Amended Cap in 2010.

The sum-of-PAHs and metals in surface sediment samples collected in Area 4/5 are routinely above the ER-M mid-cap benchmark value. As discussed above, there are no chemical performance standards for Area 4/5. The high organic carbon content in the sediments in Area 4/5 limits the bioavailability of PAHs, and the SEM/AVS ratio of less than one indicates that the metals would not be bioavailable. Therefore, the contaminants in Area 4/5 sediments are not likely adversely impacting ecological receptors.

Amended Cap Operation, Maintenance and Monitoring. Due to the absence of a surface sand layer in the Amended Cap, the cap mid-depth chemical, sediment trap and habitat restoration performance standards found in the RD/RA SOW are no longer appropriate for the small portion of the canal covered by the Amended Cap. However, the performance standard for the isolation of contaminants that requires that contaminant migration through the cap be minimized is still applicable and the performance monitoring program has been revised to include monitoring for visual sheens, potential gas build-up, and removal of NAPL from recovery wells.

6.3.6 Review of Habitat Restoration Data and Trends

The performance standard for habitat restoration includes monitoring to verify that suitable habitat is established in both open water and wetland areas affected by the remedy. The performance standard includes the restoration of function and values of wetlands in the habitats affected by the remediation, as well as maintenance of the pre-construction mix of habitat types on the Site (open water, emergent, scrub/shrub and forested wetland). Specific performance standards and monitoring methods were designed for each area, depending on the habitat type.

6.3.6.1 Aquatic (Open water) Habitat Restoration. Compliance monitoring for aquatic habitat restoration consists of benthic macro-invertebrate community sampling and qualitative plant surveys in Areas 1, 2, 4/5 and 8. A pre-construction (2001) baseline macro-invertebrate survey was conducted in Area 4/5 which, since it was not capped as part of the remedial action, is an on-site reference area. Benthic surveys have been conducted annually since 2003 except in Area 2 where sampling was discontinued in 2005 due to NAPL releases and subsequent construction of the Amended Cap.

Benthic macro-invertebrate data collected to date (2003 – 2010) indicate the development of a low-diversity benthic community dominated by oligochaete and tubificid worms, and chironomid midge larvae. The species composition and spatial heterogeneity of the benthic community is consistent with the sediment type found at the Site and is similar to the benthic community in the adjacent Burlington Harbor (Brown, et al., 1992).

Qualitative monitoring (2003 – 2010) along the margins of the turning basin and canal (including the Area 2 Waterway) indicate that the performance standard for the development of a submergent aquatic plant community continues to be met. Some areas are dominated by the invasive Eurasian milfoil (*Myriophyllum spicatum*), but the control of milfoil was not stipulated in the performance standards.

The performance standards for aquatic habitat restoration have been met.

6.3.6.2 Wetland Habitat Restoration. Restoration of habitat functions and values was monitored for five years after restoration in Areas 3 and 7 and the West Bank Cap. Monitoring has included documentation of water levels suitable for each wetland habitat, development of a plant community dominated by wetland plants, and monitoring of soils for a trend toward hydric (saturated wetland conditions) soil morphology by year 10.

Wetland Hydrology. In Area 7, the wetland hydrology is maintained at an elevation of 100 ft by the drop inlet, and wetland conditions have been adequately established meeting the performance standard. Water levels in Area 3 vary seasonally and were monitored in four wells during the spring from 2003 through 2007 in order to demonstrate compliance with the following performance standard:

- *Water table (or saturated soils) ≤ 12 inches from the surface established for three out of five years in the spring.*

As shown in Table 3, the five year monitoring of water levels in Area 3 showed water levels in all observation wells within 12 inches of the ground surface in all years. Since the zone of soil saturation

would extend at least 4 inches above the water table in the topsoil and loamy sand soil types in Area 3 due to capillary action, soil saturation is also demonstrated for three consecutive weeks during the growing season at all four observation well locations. Saturation for three consecutive weeks during the growing season is an indication of wetland hydrology.

Wetland Vegetation. Wetland vegetation monitoring was conducted in Year 1 (2003), Year 3 (2005) and Year 5 (2007), post construction for Areas 3 and 7. Due to the later construction date of the West Bank Cap, monitoring was conducted in Year 1 (2005), Year 3 (2007) and Year 5 (2009). Although part of the wetland restoration, only qualitative monitoring (photographs and visual inspection) was conducted for the 100 x 100 foot area.

The Year 5 monitoring in Areas 3, 7, and the west bank cap demonstrated dominance by wetland plants in all three areas. The 100 x 100 foot area showed wetland plant dominance, although the dominant plant was the invasive *Phragmites*. Strategies to control nuisance plant species in the wetlands have shown limited effectiveness for the control of *Phragmites* and good results for the control of purple loosestrife. *Phragmites* has been treated in Areas 3 and 7. The herbicide treatments may have helped reduce the spread of *Phragmites* in Area 7, although *Phragmites* is dominant on the south side of the channel along the 100-foot elevation in Area 7. The remainder of Area 7 is dominated by other species. *Phragmites* in Area 3 has become well established despite efforts to control it. The west bank cap is not dominated by *Phragmites*. Purple loosestrife has not become dominant in the restored wetlands. The release of the beetle, *Galerucella* sp. appears to be assisting in the control of purple loosestrife, as indicated by the continued presence of the beetles and observed damage to the plants.

Hydric Soil Morphology. The trend toward hydric (wetland) soils is also a performance standard for the wetland areas. Soil morphology changes slowly; therefore the presence of hydric soil indicators was not anticipated to occur within the first 5 years of the habitat restoration. If the water levels in the soil remain saturated at or near the surface for an extended period during the growing season, the soils will show a trend toward hydric indicators. As the water levels in Area 3 and Area 7 are meeting target levels, a trend toward hydric soils is anticipated by year 10. Soil samples to determine the presence of hydric soil indicators were collected from Areas 3 and 7 in late fall 2011 and are currently undergoing analysis and verification. Results will be captured in the next five-year review, along with results from sampling in 2012 for the West Bank Cap.

Wetland Habitat Summary. The performance standards in Area 3, Area 7, and the West Bank Cap have been met, indicating the habitat restoration for the remedy has been successful. The restoration design established the requirement that the mix of habitats present prior to construction be restored post-construction, maintaining each habitat type in approximately the same ratio. The design of the water control structures and the design of the wetland mitigation were interrelated. The water levels have a primary influence on the wetland community types. It was anticipated that if water levels met design criteria, and the capped area met design elevations, the desired wetland mix would be established. Since monitoring data have demonstrated that water levels are generally within design criteria, and wetland vegetation monitoring has shown dominance by wetland indicator species, the restoration has shown an adequate final mix of wetland habitats on Site (open water, emergent, scrub/shrub and forested wetland).

Additional habitat restoration is planned for areas impacted by and during construction of the Amended Cap. This includes restoration of temporary staging areas, and, mitigation for the permanent loss of habitat as a result of a new service road.

6.3.7 Review of Institutional Controls

The performance standard for institutional controls as specified in the RD/RA SOW, includes the establishment, maintenance, and appropriate enforcement, where necessary, of use restrictions on all parcels for which institutional controls are required.

As described in section 4.2.5, restrictive easements have been implemented on all parcels for which easements were required under the Consent Decree and RD/RA SOW. The Class IV boundary was expanded in January 2006, thus satisfying the requirements of the ROD and RD/RA SOW to establish restrictions on the use of groundwater beneath the properties for potable use. In September 2007, EPA approved a mechanism to monitor and maintain compliance with the institutional controls which includes annual landowner certifications. The first certifications were received in 2009 for the previous year. To date, there have been no known landowner activities that violate the conditions of the restrictive easements.

6.4 SITE INSPECTION

An inspection of the areas requiring habitat restoration as a result of the Amended Cap construction was conducted on July 12, 2011. In attendance were Karen Lumino, EPA Remedial Project Manager (RPM); Steve Mangion, EPA Office of Research and Development; Kenneth Munney, US Fish & Wildlife Service; Thor Helgason, *de maximis, inc*; and Sonja Schuyler, The Johnson Company. On July 13, 2011, Steven Goodkind, Director, Burlington Department of Public Works, accompanied Karen Lumino and Steve Mangion on an inspection of the stormwater management features (primarily Area 7). The final construction inspection of the Amended Cap was conducted on August 2, 2011. In attendance were Jean Choi, EPA Region 1; Barry Kellems and Dan Talbot, ARCADIS; Jay Mullowney, Vermont Gas; Don Maynard, The Johnson Company; Karen Lumino, Steve Mangion and Thor Helgason. A completed site inspection form is included in Attachment 3.

6.5 INTERVIEWS

A group interview was conducted between Karen Lumino and Emily Zimmerman, EPA Community Involvement Coordinator; Michael Smith and George Desch, both of VTDEC, and several members of the PSBCCC on August 3, 2011. EPA and VTDEC representatives also met on August 3 with an ad hoc group (with representatives from the City of Burlington, Greater Burlington Industrial Corporation, Vermont Agency of Commerce, etc) working on re-use issues related to a vacant parcel that abuts the Site. Notes from both these meetings are included in Attachment 3. Also attached is a summary of EPA's meeting with the PSBCCC from Marty Feldman, which appeared in a newsletter to the South End Arts + Business Association.

SECTION 7.0
TECHNICAL ASSESSMENT

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

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

Generally, yes. The review of documents indicates that the remedy was constructed in accordance with the ROD and RD/RA SOW and is generally functioning as intended. The exception is the exceedance of the performance standard for benzene at the northern portion of the Site. There, benzene has been detected beyond the Class IV boundary in concentrations that exceed the MCL and VGES which is 5 ppb. The 1998 ROD included the following condition: "A statistically significant increase in the mass flux [of contaminants across the Class IV boundary] shall trigger a detailed data review to determine the cause, significance, and additional measures or monitoring that should be implemented". In September 2011, EPA issued an ESD for additional measures and monitoring to be implemented to enhance the containment remedy set forth in the 1998 ROD. The ESD calls for:

- installation of a 200-300 foot long vertical barrier below the ground surface to contain NAPL and prevent off-site migration of the groundwater plume,
- installation of NAPL recovery wells and NAPL removal, as necessary, to ensure that coal tar and oil do not migrate around or below the vertical barrier, and
- groundwater monitoring on both sides of the vertical barrier to track the flow and extent of contaminants in groundwater (in the dissolved phase).

The conceptual alignment of the barrier is along the train tracks between the canal and bike path (JCO, Dec 2010). The final placement and type of barrier will be determined during remedial design, with installation by the Performing Defendants in 2012.

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

No. The vapor intrusion to indoor air pathway was not evaluated at the time of remedy selection because the 1998 ROD pre-dated EPA's draft vapor intrusion guidance (USEPA, 2002). In addition, as discussed below, toxicity data used in the ROD has been updated for PAHs, benzene and trichloroethylene (TCE).

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

A baseline human-health risk assessment (M&E, 1992b) was performed to evaluate potential human health risks and hazards from exposure to surface water, sediment, soil, and groundwater contaminants from the Site. Supplemental risk assessment position papers prepared by the Pine Street Canal

Coordinating Council (JCO, 1997; Appendix 7) looked at additional exposure pathways. Excavation and maintenance workers exposed to contaminated soil up to five feet in depth; adult residents using impacted groundwater as drinking water; workers using groundwater for industrial/commercial purposes, adult-area residents exposed to surface water and sediment in the canal and Lake Champlain (close to the canal); exposure to fish by recreational fishermen; and adult/young child recreational users exposed to soil and sediment along the waterfront were the receptor populations evaluated. Ambient air data demonstrated comparable levels of compounds in downwind and upwind samples, indicating that the Site is not adversely affecting local air quality.

The following exposure pathways were quantitatively or qualitatively evaluated:

- Incidental ingestion of surface water and dermal contact with surface water and sediment by persons swimming in Lake Champlain or falling into the canal;
- Ingestion of fish from the canal;
- Incidental ingestion of and dermal contact with soil and sediment by site visitors and recreational users;
- Incidental ingestion and dermal contact with soil by workers;
- Ingestion of groundwater used as a source of drinking water and inhalation of volatile compounds released during household water usage; and
- Dermal contact with groundwater and inhalation of volatile compounds during commercial/agricultural water usage.

The greatest potential risk was attributed to the residential ingestion of contaminated groundwater, with benzene, styrene, vinyl chloride, carcinogenic PAHs, dieldrin, arsenic, and beryllium as the contaminants that contributed the most to the carcinogenic risk estimates in excess of the EPA target risk range of 10^{-6} to 10^{-4}. Non-carcinogenic hazard estimates also exceeded the EPA target of one for some additional VOCs, pesticides, and metals, and MCLs were exceeded for a number of contaminants. However, the State of Vermont has reclassified the groundwater under the Site as Class IV, designating it suitable for agricultural or commercial use only and prohibiting its use for drinking. Non-ingestion uses of groundwater were not associated with an unacceptable risk or hazard. Fate and transport studies conclude that contaminants were not reaching Lake Champlain at concentrations exceeding drinking water standards. Therefore, it was concluded that ingestion of water from the lake which is a source of drinking water did not present an unacceptable risk.

The fish ingestion evaluation indicated that consumption of multiple whole fish meals each week of the year would possibly be associated with unacceptable risk and hazard due to metals exposure. However, the canal does not support a sufficient fish population for a person to catch and consume multiple fish meals per week for an entire year.

Risks and hazards associated with exposure to contaminated surface water, sediment, and soil did not exceed EPA's risk management criteria for carcinogenic and non-carcinogenic effects. However, a

concern was noted for young child soil exposures in areas with elevated levels of lead and carcinogenic PAHs, should the Site be developed for uses in which young children are exposed with a higher intensity and frequency than evaluated in the risk assessment (e.g., a residential or day-care scenario). Soil deeper than five feet was not evaluated due to physical limitations and zoning/wetland restrictions at the Site which were determined to make excavations deeper than five feet infeasible.

For the protection of human health, the ROD identified the need for institutional controls to: (1) prevent the ingestion of groundwater within the Class IV boundary; (2) prevent land uses that could result in unacceptable risks to human health, such as residential use, use as a day-care center, and most excavations below five feet; and (3) prevent or limit the migration of existing contamination to Lake Champlain. Performance monitoring for groundwater, surface water, and sediment was also established in the ROD to confirm that contaminant migration was being controlled. Drinking water standards were established as groundwater performance standards.

In this five-year review report, the impact of changes in toxicity values on remedy protectiveness has been evaluated. Any changes in current or potential future exposure pathways or exposure assumptions that may impact remedy protectiveness are also noted. In addition, environmental data have been qualitatively evaluated to determine whether exposure levels existing at the Site present a risk or hazard to current human receptors.

Changes in Toxicity

For groundwater, changes in toxicity values would not affect the long-term protectiveness of the groundwater remedy because groundwater at the Site has been reclassified and ingestion exposures to groundwater within the Class IV boundary are prevented by institutional controls.

For the other media of concern quantitatively evaluated in the risk assessment (soil, sediment, and surface water), toxicity values used in 1992 were consistent with those currently used with the exception of the carcinogenic PAHs, benzene, and TCE. For the carcinogenic PAHs, relative potency factors, developed by EPA in 1993, were not used, resulting in a significant overestimate of the carcinogenic risk associated with the sediment and soil direct contact exposure pathways. EPA's 2005 *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* has identified carcinogenic PAHs as causing cancer risk via a mutagenic mode of action. Applying the potency adjustments for early-life exposure to a child receptor would increase cancer risks from PAHs for that receptor. However, since PAHs are already identified as chemicals of concern to be remediated at the Site, this increased risk would not result in a change of the remedy protectiveness.

Noncarcinogenic toxicity values were not available for benzene and TCE in 1992, resulting in an underestimate of the noncarcinogenic hazard for direct contact with surface water and soil. However, based on the sporadic and low level detections noted for these compounds, the underestimation of the hazard is negligible. Because these media were not associated with a risk in excess of EPA's target risk range and the changes in toxicity values noted would result in a decrease or only a slight increase in risk/hazard estimates, the remedy continues to be protective for soil, sediment, and surface water exposures.

On September 28, 2011, EPA released a final health assessment for TCE with new cancer and non-cancer toxicity values. Although these values are more stringent than those used in the 1992 human-health risk assessment and would result in higher TCE risk from exposure to TCE at the Site, these new values do not affect the remedy selected for the Site because the TCE did not drive the risks at the Site (M&E, 1992b). TCE was detected in four groundwater samples from the study area; only one exceeded the MCL (PEER, 1990). TCE is not a chemical constituent of coal gasification waste which is the source of contamination at the Site (M&E, 1992b).

Changes in Exposure Pathways/Assumptions

The risk evaluations performed for the Site comprehensively evaluated the groundwater, soil, sediment, and surface water pathways and receptors of interest at the Site, except for the following pathways and/or receptors:

- residential/day-care use of the Site;
- exposures to homeless people at the Site;
- direct contact with soils greater than five feet in depth for outdoor workers and future residents;
- direct contact with groundwater by workers excavating into the water table and the inhalation of outdoor air (VOCs and particulates) during trenching activities; and
- inhalation of volatile contaminants in indoor air for indoor workers.

As noted above, future residential land use of the Site was not evaluated because current zoning ordinances and wetlands restrictions greatly reduce the land area available for residential development. Future day-care use of the Site was also not quantitatively evaluated for similar reasons. Institutional controls are currently in place preventing these land uses, assuring current remedy protectiveness. If zoning ordinances and wetlands rules were to change significantly and future development of the Site for residential or day-care use were contemplated, the risk/hazard associated with these uses would have to be evaluated.

There have been documented reports of homeless people living at the Site. Contaminant exposures to this transient population are not expected to exceed those evaluated in the risk assessment for future Site visitors (130 days/year for 30 years). Therefore, it is unlikely that exposures to this receptor population are associated with risk above risk management criteria.

Exposures to soil contaminants present at depths greater than five feet were also not evaluated in the risk assessment. Institutional controls are in place to control exposures to deep soil (i.e., greater than five feet deep), assuring remedy protectiveness. Should excavations at the Site be contemplated that result in the disturbance and movement of the soil currently at depths greater than five feet to a more surficial location, direct contact exposures to deeper soils (up to ten feet or groundwater table) should be evaluated.

Based on contaminant concentrations present in shallow groundwater, exposures to workers via direct contact during excavations, should they occur, may present a risk to human health. In addition, the inhalation of VOCs and particulates released from groundwater and/or soil may potentially present a complete exposure pathway to these receptors. As previously noted, institutional controls are in place to control excavations, including those below the water table. The institutional controls require the use of personal protective equipment to mitigate the worker exposure unless a risk evaluation has been performed to determine the risk associated with these exposure pathways.

One pathway of potential concern that was not evaluated in the previous risk evaluations because they pre-dated EPA guidance (USEPA, 2002) is the subsurface vapor intrusion to indoor air pathway. This pathway may be of concern at sites where soil and/or groundwater contaminated with VOCs exist in close proximity to occupied buildings or locations where buildings may be constructed in the future. Per EPA guidance, the indoor air pathway should be evaluated at buildings that are within approximately 100 feet laterally or vertically of known or interpolated soil gas or groundwater contaminants, and, where the contamination occurs in the unsaturated zone and/or the uppermost saturated zone. The extent of BTEX in groundwater at the Site is Figure 13. Groundwater data collected from monitoring wells sampled for performance monitoring are not in the vicinity of currently occupied buildings. However, historical groundwater data as well as the recently collected groundwater data indicate on-site exceedances of the benzene and/or naphthalene generic screening values for target risk at 1×10^{-6} for the vapor intrusion pathway. Therefore, the vapor intrusion pathway is currently being evaluated to determine the potential risks, if any, to current and future receptors at the Site (e.g., Burlington Electric Department building and vacant parcels at 453 and 501 Pine Street.

Evaluation of Recent Sampling Data

As discussed in Section 6.3.1, selected monitoring wells within and outside the Class IV boundary are sampled for VOCs, PAHs, and metals to confirm that contaminant migration at concentrations above performance standards is not occurring. Performance standards for groundwater are not being met in the northern portion of the canal. Specifically, groundwater samples collected outside the Class IV boundary exceed federal and state drinking water standards for benzene (5 ppb). In the fall of 2007, the highest concentration of benzene that had ever been detected in wells outside the Class IV boundary was 1 ppb. Since then, benzene data have shown a sharply increasing trend to a high of 1100 ppb recorded in fall 2010 (Table 2). Measureable thicknesses of NAPL have also been found intermittently in wells between the canal and the lake. NAPL has not been found in soil borings outside the Class IV boundary however it is unknown if Site groundwater with benzene concentrations exceeding drinking water standards is reaching Lake Champlain. The enhanced containment required by the September 2011 ESD which will be constructed by the Performing Defendants in 2012 will protect the lake from potentially being impacted by the migration of contaminated groundwater and NAPL left on site.

Summary and Conclusions

Changes in toxicity values and exposure pathways that served as the basis for the cleanup levels, as contained in the ROD, have been re-evaluated to determine whether any of the noted changes impact the protectiveness of the remedy. In addition, environmental data have been qualitatively evaluated to determine whether exposure levels existing at the Site present a risk to current human receptors.

The evaluation of 1992 and 2006 toxicity values indicates that the soil, sediment, and surface water risk and hazard estimates calculated in the 1992 risk assessment would be decreased or only slightly increased by the toxicity values changes. On September 28, 2011, EPA released the TCE assessment with new cancer and non-cancer toxicity values. Although these values are more stringent than those used in the 1992 human-health risk assessment and would result in higher TCE risk from exposure to TCE at the Site, this would not affect the remedy selected for the Site.

To continue long-term protectiveness of the remedy, institutional controls should continue to be monitored and maintained to prevent groundwater ingestion exposures within the Class IV boundary, residential and day care use of the Site, and most excavation to depths greater than five feet, including those below the water table. If site conditions change significantly in the future and residential or day-care usage is contemplated, these exposure scenarios, including exposures to media greater than five feet in depth, should be evaluated. Performance monitoring should be continued. The enhanced containment specified in the September 2011 ESD should be implemented to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and NAPL left on site.

Historical groundwater data as well as the recently collected groundwater data indicate on-site exceedances of EPA generic screening values for target risk at 1×10^{-6} for the subsurface vapor to indoor air pathway. Because of the possible presence of subsurface VOCs in the vicinity of the currently-occupied building at levels exceeding EPA screening criteria, the vapor intrusion pathway is currently being evaluated to determine the potential risks, if any, to current and future indoor receptors at the Site.

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

Two ecological risk assessments were conducted at the Site. The first was the 1992 baseline risk assessment; subsequently, a supplemental baseline risk assessment (SBERA, Weston, July 1997) was conducted under a workplan developed by the PSCCC. The PSCCC agreed upon additional studies to supplement ecological risk evaluations and a selected a weight of evidence approach for the SBERA. The additional investigations performed for the SBERA were done in phases, with Phase I including surface soil sampling and screening for PAHs and metals. An area of focus for the SBERA was established using a value of 40 ppm total PAH. The SBERA's conclusions were based on multiple lines of evidence including: comparison of sediment concentrations to published ecological effects benchmarks, evaluation of chemical bioavailability using total organic carbon, SEM/AVS and equilibrium partitioning, sediment toxicity testing, and fish pathology.

The SBERA concluded that, based on the multiple lines of evidence for risks associated with exposure to sediment contaminants, unacceptable ecological risks were found in Areas 1, 2, 3, 7, and 8. While there were findings of adverse effects in Areas 4, 5, and 6, these lines of evidence were not compelling and were not interpreted as an unacceptable ecological risk. Due to the complexity of the contaminants and sediment conditions on the Site, adverse effects and threshold effects levels could not be established for individual contaminants of concern based on the SBERA.

The remedial action objectives (RAOs) were developed for the areas identified to have unacceptable ecological risk (Areas 1, 2, 3, 7 and 8). The RAOs focused on the elimination of direct exposure of ecological receptors to contaminated sediment and soils to reduce exposure to levels representing an

acceptable risk. RAOs also were developed to prevent long-term adverse effects on the existing aquatic environment and/or wetland habitats, and required restoration of wetland and aquatic habitats. No chemical-specific preliminary remediation goals or clean-up levels were identified in the ROD. The remedy selected to address the contamination at the Site provided for capping of contaminated sediments in all areas where an unacceptable ecological risk was identified. The protectiveness of the remedy relies on the effectiveness of the cap to isolate contamination below the biologically active zone, thereby protecting potential ecological receptors from exposure to sediment contaminants.

Performance standards for the physical, chemical, and biological characteristics of the cap were developed during the design phase. These included monitoring the chemical concentrations in the cap to demonstrate effectiveness of the cap as a barrier to ecological exposure. The performance standards of the cap in the RD/RA SOW incorporated an evaluation using a weight of evidence approach to determine if any exceedances of ecologically protective sediment benchmarks in the middle of the cap were caused by failure of the cap. The selected benchmarks were based on NOAA Sediment Screening Guidelines (ER-Ms, Long, et al, 1995) values for total PAHs, individual PAHs, copper, lead, mercury and zinc. These values were also listed in Appendix B of the ROD (USEPA, 1998) as values to be considered in evaluating the effectiveness of the remedy. Although these values are not site-specific, comparison of these sediment benchmarks to values currently used for evaluating potential risk from exposure to sediments indicate they are acceptable and protective.

Due to the date of the SBERA, it was conducted based on the approach outlined in the *Framework for Ecological Risk Assessment* (USEPA, 1992), and not the more current ecological risk assessment guidance (USEPA 1997, 1998b). However, the approach is consistent with the later guidance. The selection of the receptors and endpoints are consistent with current risk assessment approach. The major ecological exposure pathways have not substantially changed and are still valid for the Site. However, the performance standards in the RD/RA SOW are based on the assumption that failure of the cap, if it were to occur, would most likely occur from chemicals of concern penetrating the cap from below via diffusion through the cap. It did not anticipate NAPL releases through channels in the subaqueous cap resulting in the recontamination of the cap from the cap surface downward. The weight of evidence approach in the RD/RA SOW to be used to determine cap failure is not applicable to advective flow through preferential pathways created in the cap. With construction of the Amended Cap to address NAPL releases in the southern portion of the canal, the performance monitoring program has been revised to include monitoring for visual sheens, potential gas build-up and the removal of NAPL from monitoring/recovery wells.

7.2.3 ARARs Review

A review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy due to changes in standards that were identified as ARARs in the RODs, newly promulgated standards for contaminants of concern, and TBCs (to be considered) that may affect the protectiveness of the remedy. The tables in Attachment 4 provide an evaluation of ARARs for the Site using the regulations and requirement synopses listed in the ROD as a basis. The ARARs evaluation also includes a determination of whether each regulation cited in the RODs is currently ARAR or TBC and whether the requirements have been met. The listed ARARs that remain applicable or relevant and appropriate to the Site have been or are currently being complied with. No new ARARs or significant changes to ARARs identified listed in the ROD have been identified as part of this five-year review, although two EPA

guidance documents concerning selection of remedies at site with contaminated sediments were added as "to be considered" in the development of the 2009 and 2011 ESDs. RCRA hazardous waste regulations listed in the ROD as potentially relevant and appropriate are not considered ARAR, with the exception of regulations concerning identification and listing of hazardous wastes, since there is no hazardous waste treatment, storage, or disposal facility at the Site.

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

There is no other information other than that which has been described above that calls into question the protectiveness of the remedy.

7.4 TECHNICAL ASSESSMENT SUMMARY

According to the data reviewed, the site inspection, and the interviews, the remedial actions are functioning as intended by the ROD, except at the northern end of the Site where benzene concentrations in excess of the performance standard (MCL) are found in two wells outside the Class IV boundary. In September 2011, EPA issued an ESD calling for the installation of a 200-300 foot long vertical barrier below the ground surface and NAPL recovery wells to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and NAPL left on site. The conceptual alignment of the barrier is along the train tracks between the canal and bike path. NAPL that accumulates in the recovery wells will be removed periodically and shipped off site for treatment or disposal in an approved facility. The ESD also calls for an expanded groundwater monitoring network that will be sufficient to track potential plume migration beyond the Class IV boundary. The vertical barrier is expected to be installed by the Performing Defendants in 2012.

Historical groundwater data indicate exceedances of EPA generic screening values for target risk at 1×10^{-6} for the subsurface vapor to indoor air pathway. Because of the possible presence of subsurface VOCs in the vicinity of an occupied building at levels exceeding EPA screening criteria, the vapor intrusion pathway is currently being evaluated to determine potential risks, if any, to current and future indoor receptors at the Site.

Most of the ARARs identified in the RODs remain applicable or relevant and appropriate or to be considered and either have been met or are being met.

SECTION 8.0
ISSUES

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

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
The subsurface vapor intrusion (i.e. indoor air) pathway was not evaluated in previous risk evaluations. A comparison of historical and recently collected groundwater data to EPA generic screening values for target risk at 1×10^{-6} for the vapor intrusion pathway indicated the possible presence of subsurface VOCs in the vicinity of a currently-occupied building at levels that exceed screening criteria.	Yes	Yes
The performance standard for benzene in groundwater is exceeded at locations at the northern portions of the site. In September 2011, EPA issued an ESD for enhancements to the containment remedy in the 1998 ROD, including the installation of a 200-300 foot long vertical barrier to contain NAPL and prevent the potential for off-site migration of the groundwater plume; installation of NAPL recovery wells with NAPL removal as necessary; and groundwater monitoring on both sides of the vertical barrier to track flow and extent of contaminants in groundwater.	No	Yes

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Vapor intrusion to indoor air pathway was not evaluated in previous risk evaluations	Evaluate the potential risks, if any, to current and future indoor receptors.	Performing Defendants	EPA	Dec 2012	Yes	Yes
Benzene in excess of federal MCL beyond Class IV boundary	Implement additional containment called for in September 2011 ESD	Performing Defendants	EPA	Dec 2012	No	Yes

SECTION 10.0
PROTECTIVENESS STATEMENTS

A protectiveness determination of the remedy at the Pine Street Canal Superfund Site cannot be made until further information is obtained to evaluate potential vapor intrusion impacts at the existing Burlington Electric Department building. The vapor instruction study will also examine how to consider the potential for future vapor intrusion on the undeveloped parcels near the Site. Once the data are collected, they will be assessed and a determination will be made whether or not additional measures are necessary to ensure protection of human health. It is expected that these actions will take approximately 12 months to complete at which time a protectiveness determination will be made.

In addition, in order for the remedy to be protective in the long-term, provisions of an ESD issued by EPA in September 2011 must be implemented. The ESD calls for certain enhancements to the containment remedy set forth in the 1998 ROD to protect Lake Champlain from potentially being impacted by the migration of contaminated groundwater and coal tar left on site.

SECTION 11.0
NEXT REVIEW

The next five-year review for the Pine Street Canal Superfund Site will be completed by December 2016, five years from the due date of this review. The next five-year review should include:

- Review of any investigations or risk evaluations conducted to determine potential risks, if any, to current and future receptors at the Site from vapor intrusion.

- Review of monitoring data for groundwater, surface water, stormwater inflow, sediment transport, and physical and chemical monitoring of the cap; compliance with institutional controls; and aquatic and wetland habitat monitoring data to confirm that the remedy is protective of human health and the environment.

TABLES and FIGURES

Table 1 Groundwater Flow Summary Table for the Northern Portion of the Peninsula
Table 2 Summary of BTEX in Groundwater (2008-2011)
Table 3 Groundwater Level Monitoring (Area 3)

Figure 1 Site Locus Map
Figure 2 Site Boundary
Figure 3 Study Areas and Transect Locations
Figure 4 Location of Wells Used for Compliance Monitoring
Figure 5 Area 3 Observation Well Locations
Figure 6 Fill Groundwater Elevation Monitoring Wells at Gilbane Property
Figure 7 Wells Monitored for NAPL
Figure 8 Groundwater Flow (Spring 2008)
Figure 9 Groundwater Flow (Fall 2009)
Figure 10 Original and Current Class IV Groundwater Areas
Figure 11 Arsenic & Lead Groundwater Concentrations vs Turbidity
Figure 12 Extent of NAPL in Northwestern Corner of Site
Figure 13 Extent of BTEX in Groundwater

Table 1: Groundwater Flow Summary Table for the Northern Portion of the Peninsula

Monitoring Round	Measurement Date(s)	Groundwater Flow Direction	Groundwater Flow Gradient (feet/foot)	Notes
October 2010	10/20/10			beaver dam removed; beaver "baffler" apparatus installed
October 2010	10/1/10	Away from MW-20 in all directions, and towards MW-22 and MW-23	0.008	canal and lake stage were equal
April 2010	4/19/10	Away in all directions from MW-20	0.008	canal and lake stage were equal
November 2009	Various (automated data logger)	West[1]	0.013[1] before removal	beaver dam removed
October 2009	10/19/09	West, southwest and northwest from MW-20	0.01	canal stage was higher than lake stage
September 2009	Various (automated data logger)	West[1]	Increasing through September, October and November [1]	beaver dam rebuilt
April 2009	4/20/09	East, west and south from MW-20, and towards MW-22 and MW-23	0.01	canal and lake stage were equal
November 2008	11/14/08	West[1]	0.04[1] before removal	beaver dam removed
October 2008	10/6/08	West, southwest and northwest from MW-20	0.017	canal stage was higher than lake stage
September 2008	Various (automated data logger)	West[1]	Increasing through September & October[1]	beaver dam rebuilt
July 2008	7/6 to 7/8/08	West[1]	0.04* before removal	beaver dam removed
April 2008	4/22/08	East, west and south from MW-20, and towards MW-22 and MW-23	0.007	canal and lake stage were equal
October 2007	10/16/07	West	0.016	canal stage was higher than lake stage

Monitoring Round	Measurement Date(s)	Groundwater Flow Direction	Groundwater Flow Gradient (feet/foot)	Notes
July 2007	7/13/07	West[1]	0.008[1]	beaver dam constructed circa 7/7/07 at canal outlet
April 2007	4/17/07	South	0.0004	canal and Lake stage were equal
October 2006	10/23/06	South-Southwest from MW-20 to MW-21	0.0025	canal stage was higher than lake stage
April 2006	4/10/06	Towards depression at center of peninsula	0.002	canal and lake stage were equal
October 2005	10/17/05	Southeast from MW-9B to MW-20B West-southwest from MW-23 to MW-21	0.002 0.0014	canal stage was higher than lake stage
April 2005	4/26/05	None – depression in middle	0.0025	canal and lake stage were equal
October 2004	10/11/04	West-southwest toward MW-21A	0.0017	canal stage was higher than lake stage
April 2004	4/19/04	Southeast	0.0001	canal and lake stage were equal
October 2003	10/13/03	West-southwest	0.002	canal stage were higher than lake stage
April 2003	4/14/03	South-Southeast	0.0004 to 0.001	canal and lake stage were equal
October 2002	10/31/02	East	0.015	lake stage was higher than canal stage due to construction
April 2002	4/15/02	None – depression in middle	0.002	lake stage was only slightly higher than canal stage
October 2001	10/22/01	West	0.002 to 0.005	canal stage was higher than lake stage

[1] Indicates data interpolated from canal and lake automated water level loggers

Table 2: Summary of BTEX in Groundwater (2008-2011)

TABLE 2
Summary of BTEX in Groundwater (2008-2011)
Pine Street Canal Site
(All concentrations in parts per billion (ppb)

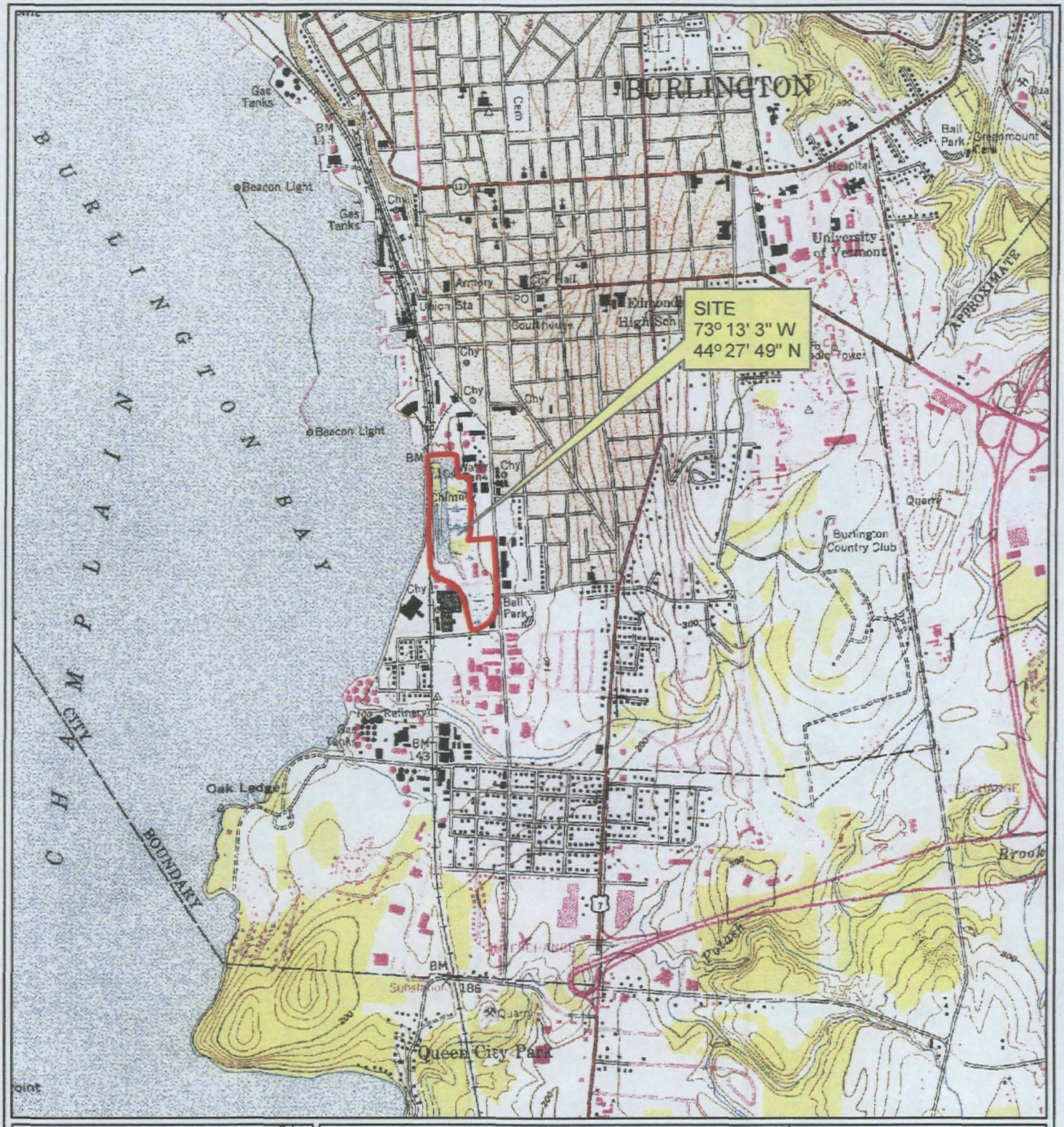
Compound	Sample Date	J_MW-21A	J_MW-21B	J_MW-23B	J_MW-24A	VGES/MCL
Benzene	April 2008	7.4	U1	89	11	**5**
	Oct 2008	110	U1	160	6.1	
	March 2009	270	U1	180	9.3	
	April 2009	230	J0.88	150	11	
	July 2009	270	J0.78	180	7.9	
	Oct 2009	390	11	260	6.8	
	April 2010	530	210	260	9.8	
	Oct 2010	1,100	200	360	8.7	
	April 2011	550	640	380	12	
Toluene	April 2008	U1	U1	53	U1	**1,000**
	Oct 2008	U3.7	U1	180	U1	
	March 2009	U7.9	U1	140	J0.2	
	April 2009	U6.3	U1	110	J0.2	
	July 2009	U7.9	U1	200	U1	
	Oct 2009	U11	U1	260	U1	
	April 2010	U16	U1	190	U1	
	Oct 2010	U15	U2.6	400	U1	
	April 2011	U6	U8.8	400	U1	
Ethylbenzene	April 2008	U1	U1	400	J0.84	**700**
	Oct 2008	U3.7	U1	490	U1	
	March 2009	U7.9	U1	440	U1	
	April 2009	U6.3	U1	390	U1	
	July 2009	U7.9	U1	510	U1	
	Oct 2009	U11	U1	490	U1	
	April 2010	U16	U6.8	480	U1	
	Oct 2010	J12	U2.6	620	U1	
	April 2011	J1.1	U8.8	680	U1	
Total Xylenes	April 2008	U1	U1	530	2.3	**10,000**
	Oct 2008	U3.7	U1	680	1.1	
	March 2009	U7.9	U1	700	8.5	
	April 2009	U6.3	U1	600	11	
	July 2009	U7.9	U1	750	5.4	
	Oct 2009	U11	U1	690	5.1	
	April 2010	U16	U6.8	700	12	
	Oct 2010	97	U2.6	870	10	
	April 2011	6.6	U8.8	970	14	

VGES = Vermont Groundwater Enforcement Standard
MCL= EPA Maximum Contaminant Level
U=Undetected at the listed limit of detection
J=Estimated concentration

Table 3: Groundwater Level Monitoring (Area 3)

Table 3 Groundwater Level Monitoring (Area 3) Pine Street Canal Superfund Site				
Date	**J_OW-1 (ftBGS)**	**J_OW-2 (ftBGS)**	**J_OW-3 (ftBGS)**	**J_OW-4 (ftBGS)**
3/29/07	**0.23**	**0.34**	**0.96**	1.12
4/6/07	**0.37**	**0.01**	**0.53**	**0.49**
4/17/07	**+0.5**	**+0.5**	**0.25**	**0.32**
4/24/07	**+1.87**	**+1.45**	**+0.69**	**+0.61**
4/30/07	**+2.0**	**+1.55**	**+0.78**	**+0.52**
5/11/07	**+0.1**	**+0.8**	**0.40**	**0.50**
5/19/07	**+0.52**	**+0.015**	**0.48**	**0.55**
4/10/06	**0.58**	1.22	1.03	**0.84**
4/17/06	**0.70**	1.09	1.01	1.11
4/24/06	**0.59**	**0.61**	**0.94**	**0.67**
5/1/06	Dry (>1.29)	Dry (>1.52)	Dry (>1.03)	1.38
5/8/06	Dry (>1.29)	1.31	Dry (>1.03)	1.16
5/15/06	**0.36**	**0.55**	**0.65**	**0.63**
5/22/06	**0.33**	**0.31**	**0.64**	**0.05**
4/5/05	**0.66**	**0.35**	**0.73**	**0.49**
4/14/05	**0.35**	**+ 0.02**	**0.92**	**0.96**
4/20/05	**0.65**	**0.23**	Dry (>1.07)	**0.99**
4/25/05	**0.25**	**+ 0.19**	**0.68**	**0.70**
5/3/05	**+ 0.20**	**+ 0.60**	**0.35**	**0.47**
3/12/04	NM[1]	NM[2]	NM[1]	NM[1]
3/29/04	NM[1]	NM[2]	NM[1]	+0.09
4/1/04	**0.22**	NM[2]	**0.93**	**0.49**
4/15/04	**0.09**	**0.23**	**0.77**	**0.42**
5/3/04	**0.3**	**0.6**	**1.0**	**0.55**
4/21/03	dry	dry	dry	dry
4/23/03	**0.12**	**0.80**	**0.96**	**0.48**
4/25/03	**0.26**	**0.99**	1.08	**0.63**
4/28/03	**0.27**	**0.83**	1.14	**0.60**
4/30/03	**0.37**	**0.79**	1.22	1.09
5/1/03	**0.13**	**0.69**	**0.94**	**0.70**
5/3/03	**+0.10**	**0.48**	1.00	**0.38**
5/5/03	**0.20**	**0.70**	1.10	**0.86**
5/12/03	**+0.20**	**0.49**	**0.60**	**0.19**

Numbers in bold indicate water levels within 1 foot of ground surface
Note: ftBGS – feet below ground surface
"+" before value indicates water elevation above ground surface
NM[1] = Not Measured – frozen
NM[2] = Not measured until 4/15 because frost had heaved the casing, casing re-set on 4/15/04



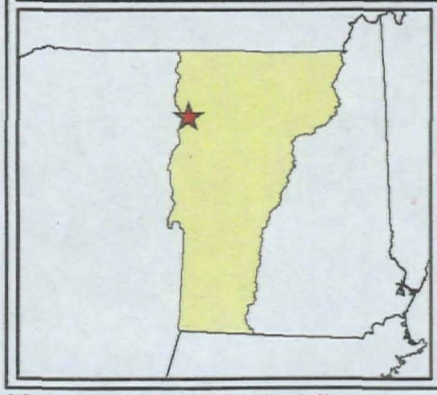


FIGURE 1
SITE LOCUS MAP

Pine Street Canal
Superfund Site
Burlington, Vermont

N
W E
S

1:25,000

0 625 1,250 2,500
Feet

METCALF & EDDY | AECOM

G:\Projects\HAZWASTE\60004828PSC\Maps\LocationMap.mxd

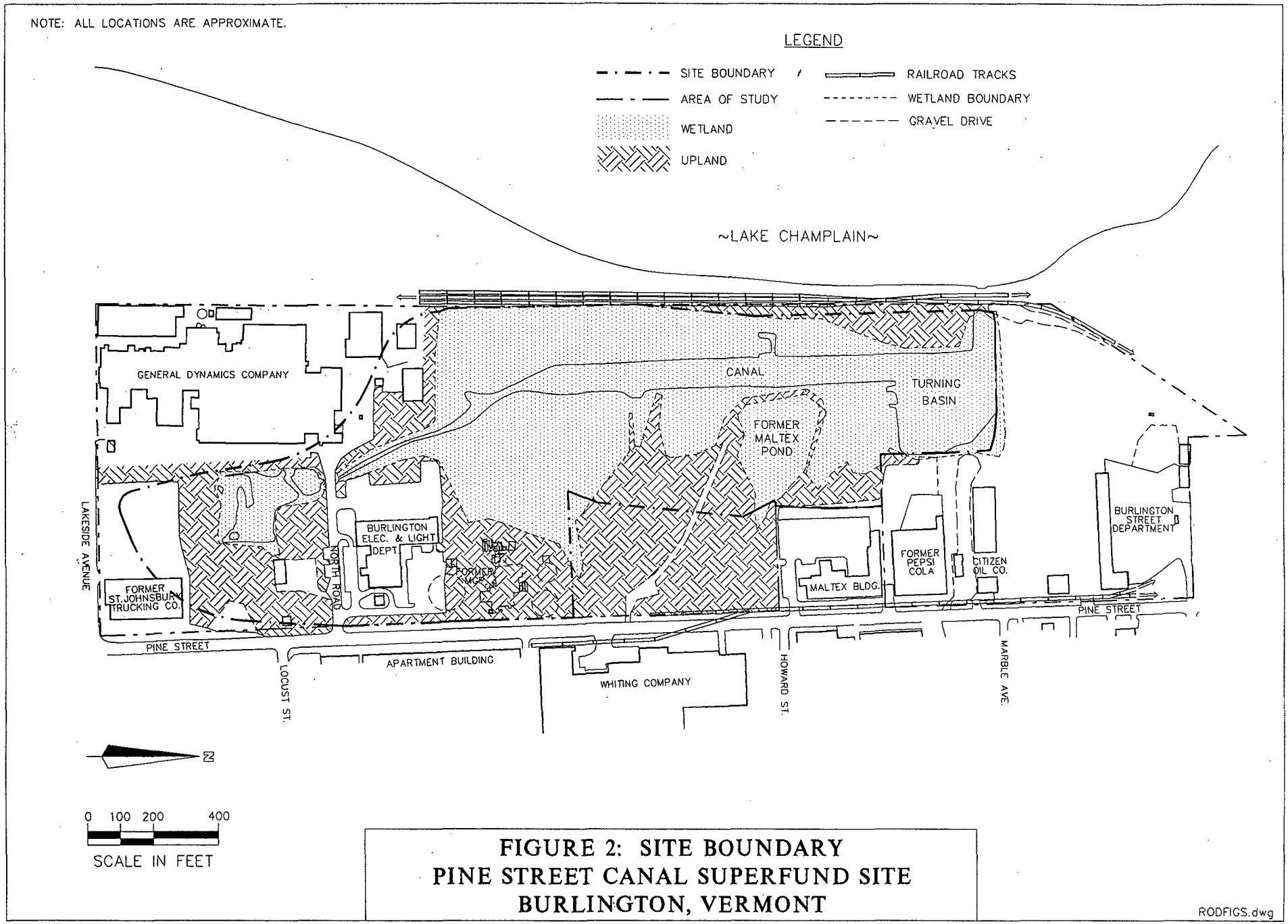
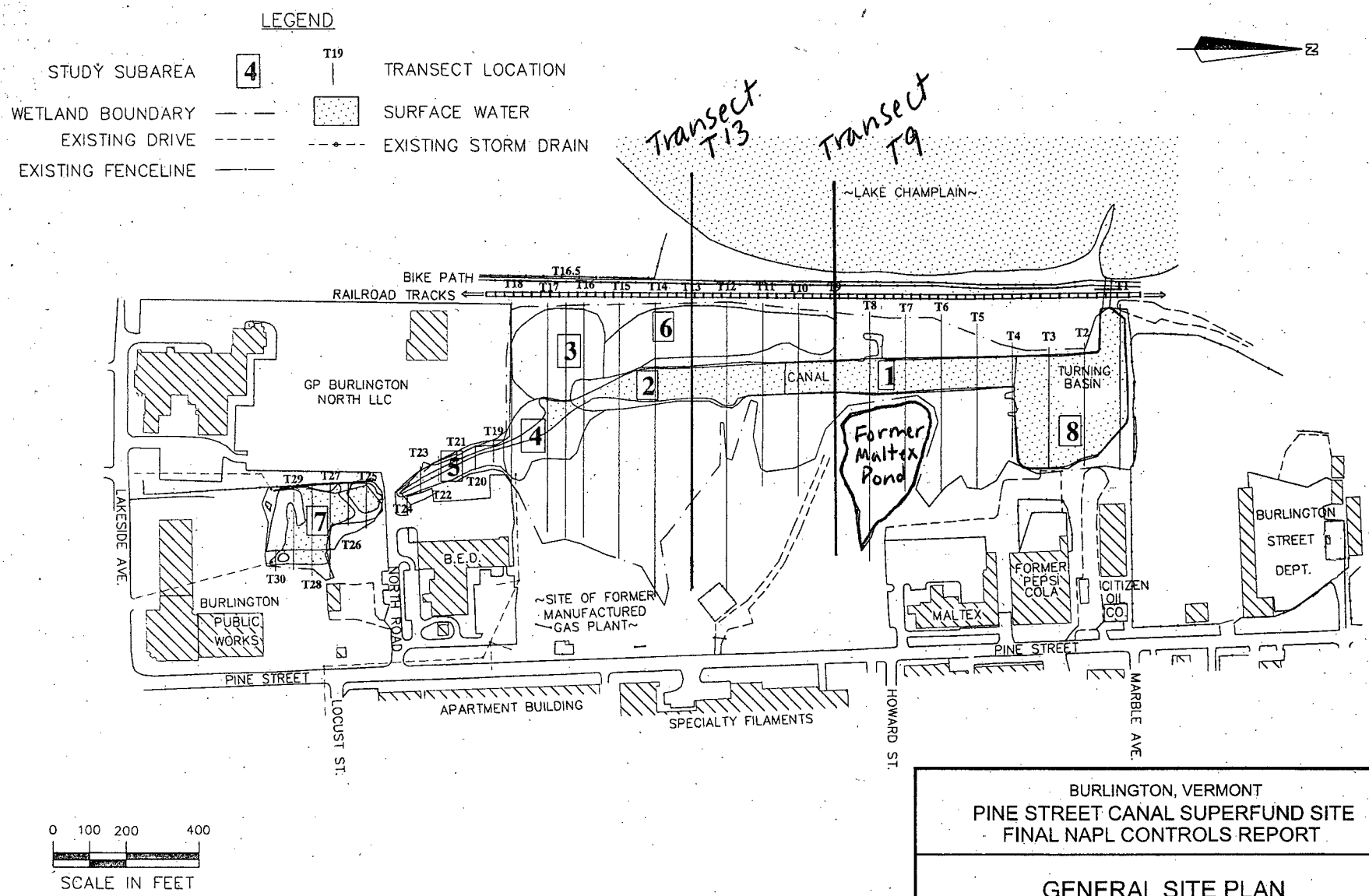


FIGURE 2: SITE BOUNDARY
PINE STREET CANAL SUPERFUND SITE
BURLINGTON, VERMONT



Note: Map provided by The Johnson Company.

BURLINGTON, VERMONT
PINE STREET CANAL SUPERFUND SITE
FINAL NAPL CONTROLS REPORT

GENERAL SITE PLAN

ARCADIS BBL

FIGURE 3

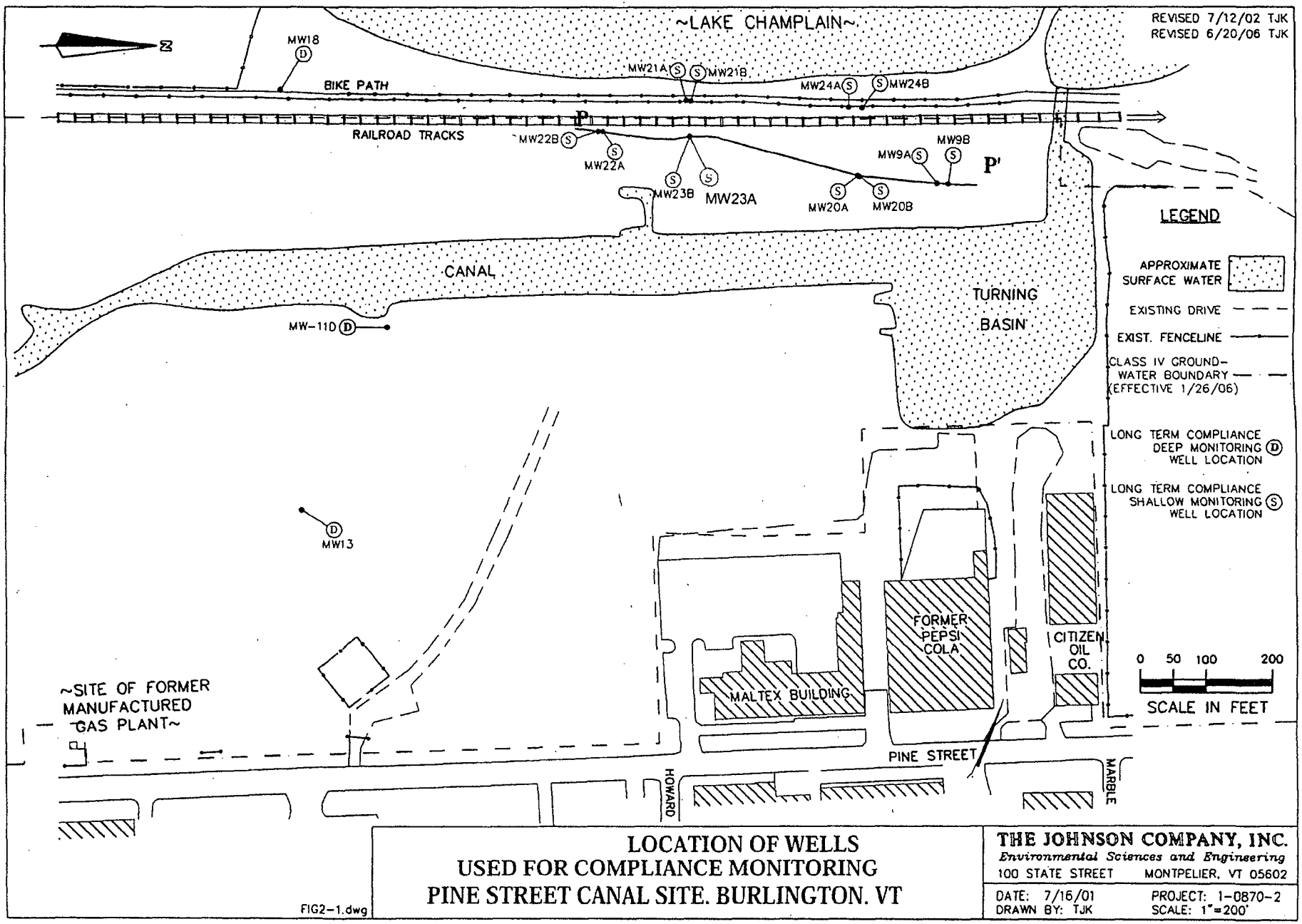


FIGURE 4 (Five-Year Review Report; Source: Johnson Company, 2006b)

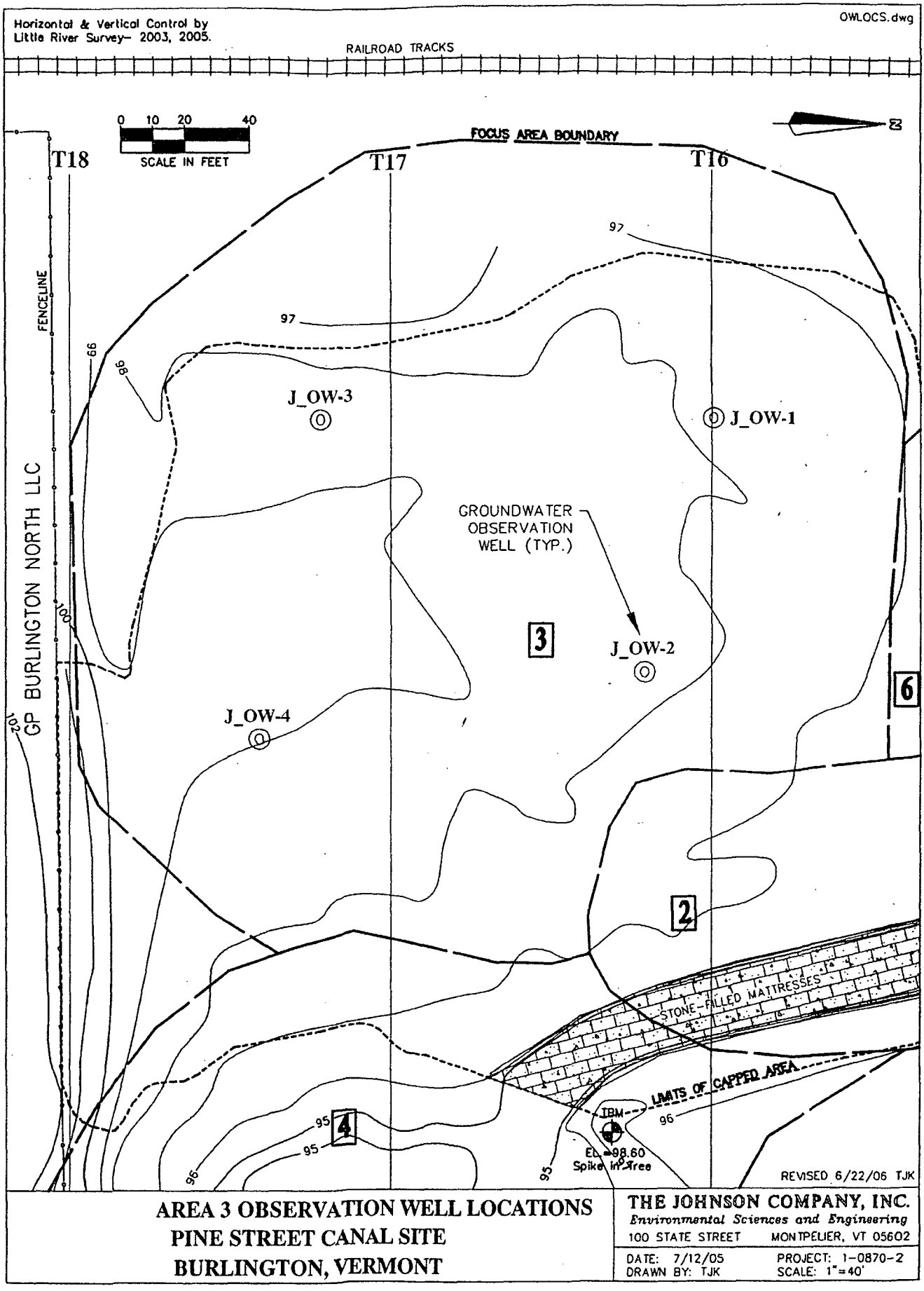


FIGURE 5 (Five-Year Review Report; Source: Johnson Company, 2006b)

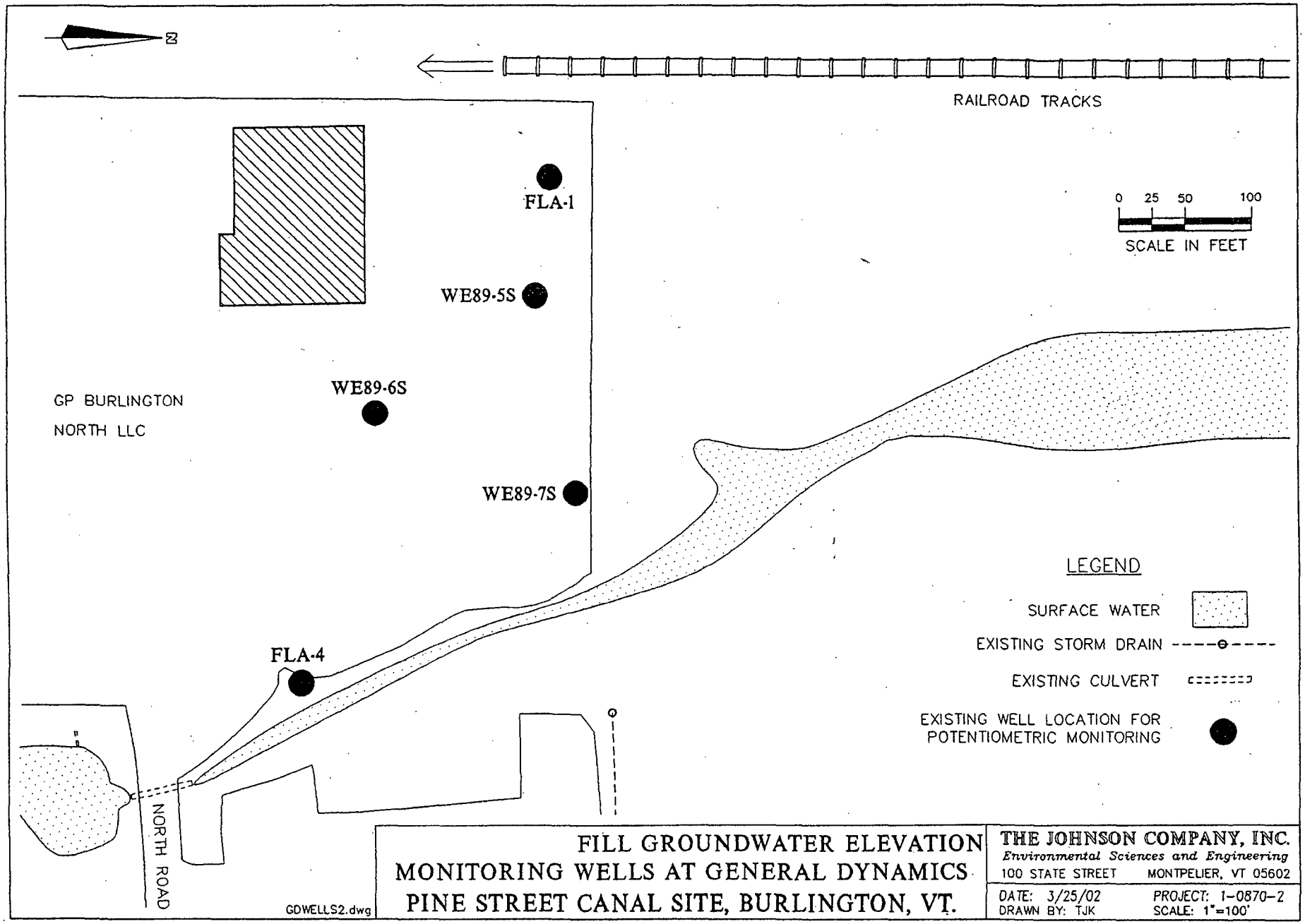


FIGURE 6 (Five-Year Review Report; Source: Johnson Company, 2002)

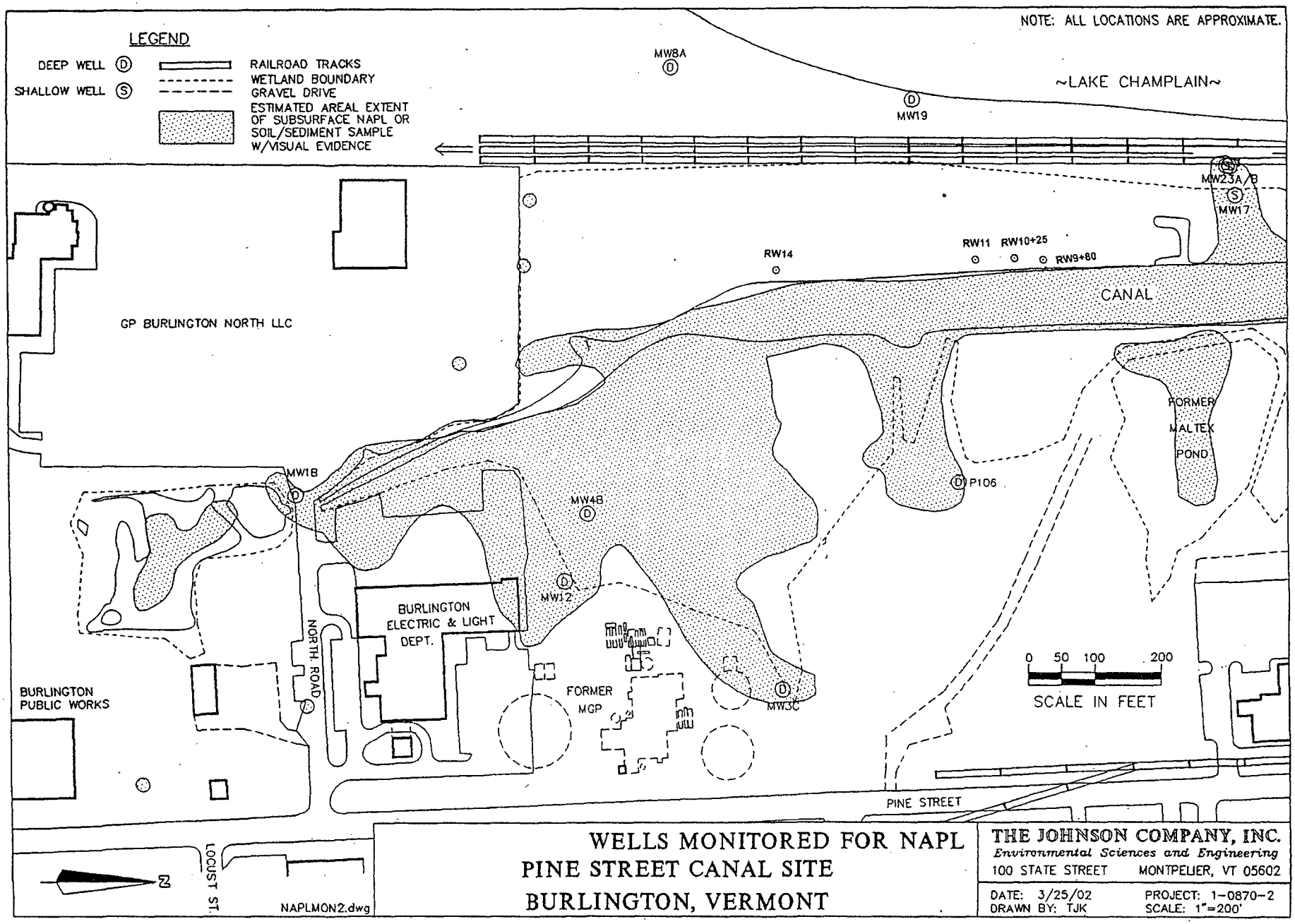


FIGURE 7 (Five-Year Review Report; Source: Johnson Company, 2002)

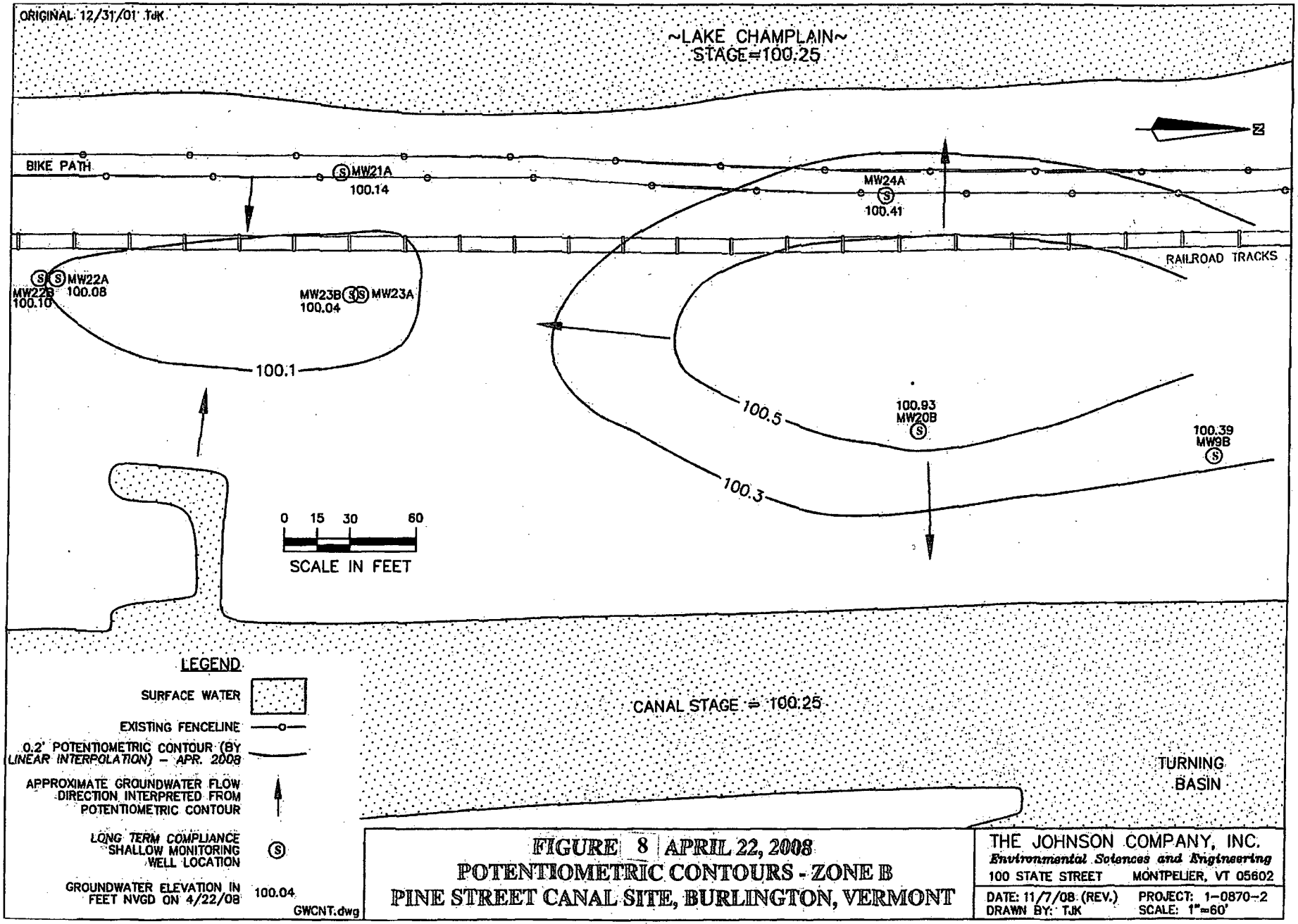


FIGURE 8 | APRIL 22, 2008
POTENTIOMETRIC CONTOURS - ZONE B
PINE STREET CANAL SITE, BURLINGTON, VERMONT

THE JOHNSON COMPANY, INC.
Environmental Sciences and Engineering
100 STATE STREET MONTPELIER, VT 05602

DATE: 11/7/08 (REV.) PROJECT: 1-0870-2
DRAWN BY: TJK SCALE: 1"=60'

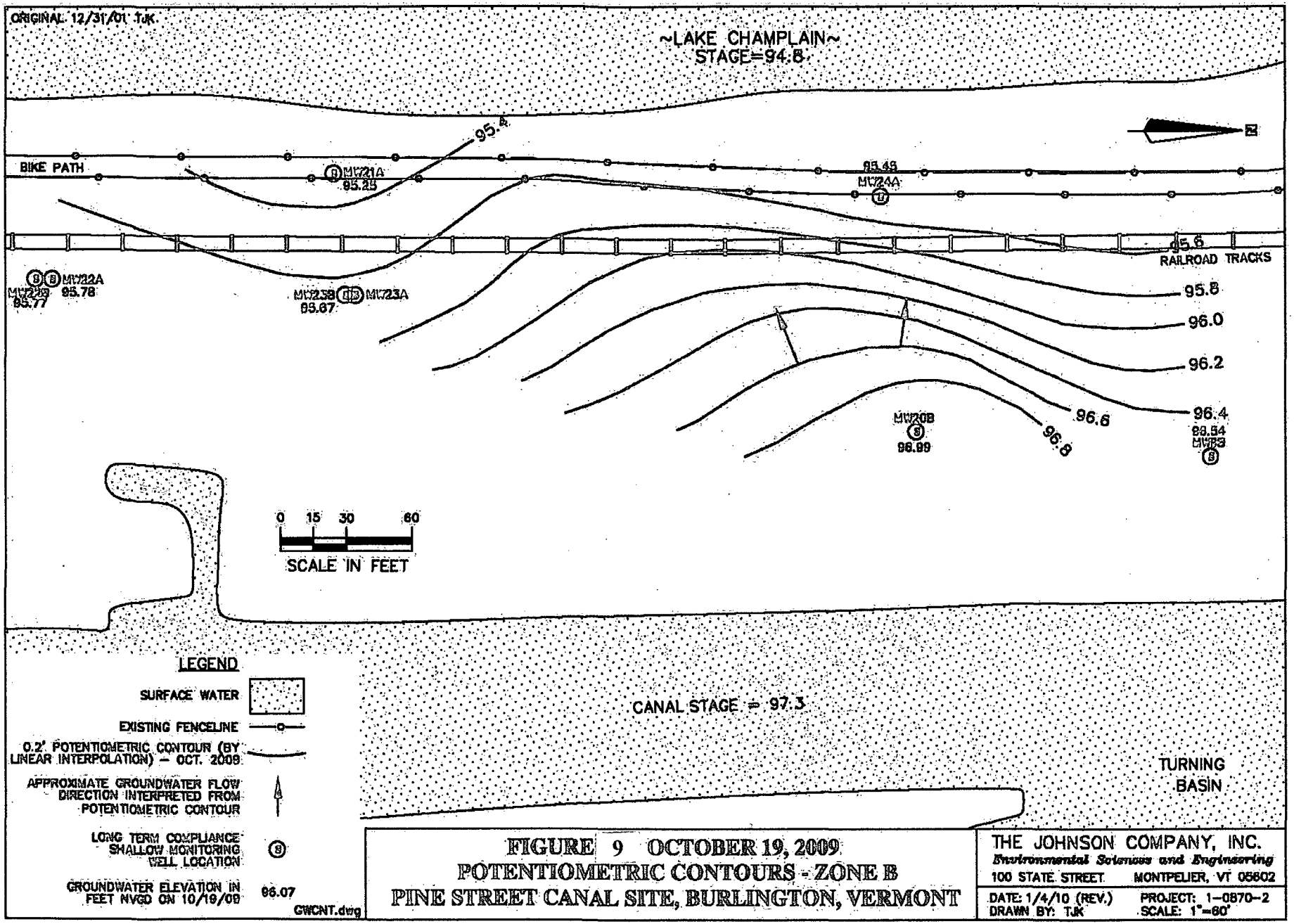
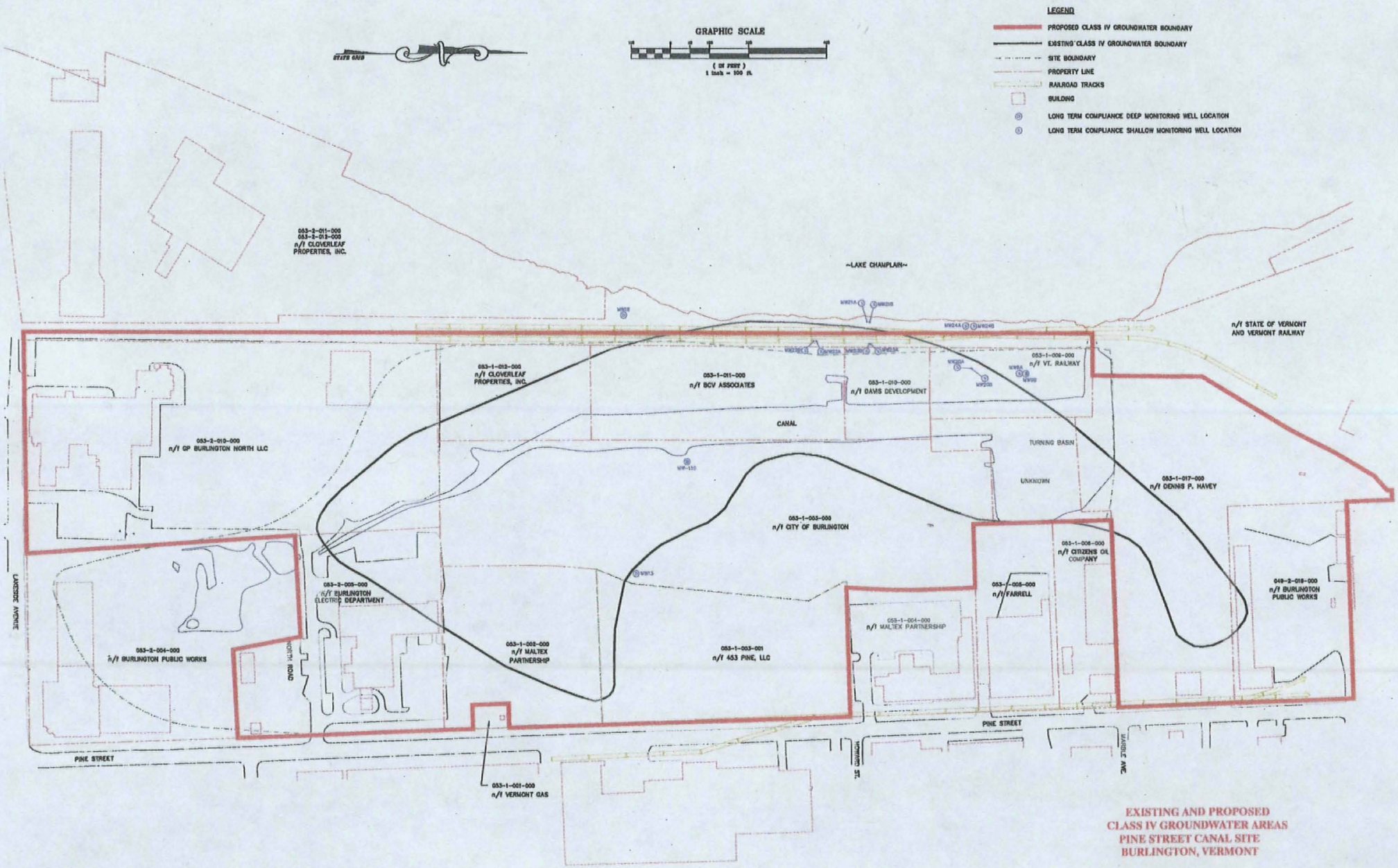


FIGURE 9 OCTOBER 19, 2009
POTENTIOMETRIC CONTOURS - ZONE B
PINE STREET CANAL SITE, BURLINGTON, VERMONT

THE JOHNSON COMPANY, INC.
Environmental Sciences and Engineering
100 STATE STREET MONTPELIER, VT 05602

DATE: 1/4/10 (REV.) PROJECT: 1-0870-2
DRAWN BY: TJK SCALE: 1"=60'

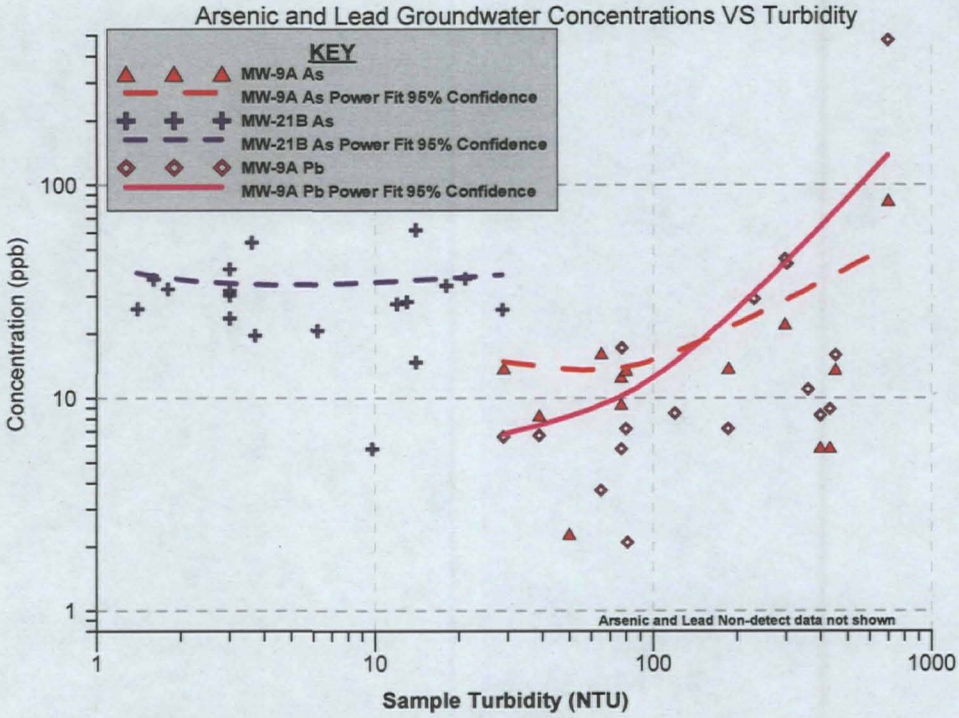


EXISTING AND PROPOSED
CLASS IV GROUNDWATER AREAS
PINE STREET CANAL SITE
BURLINGTON, VERMONT

Finalized by VTDEC
Jan 23, 2006

Figure 10 Original and Current Class IV Boundaries

Figure 11



1-0870-2_2011 five-year review__MW-21B -9A As Pb vs turbidity 061011

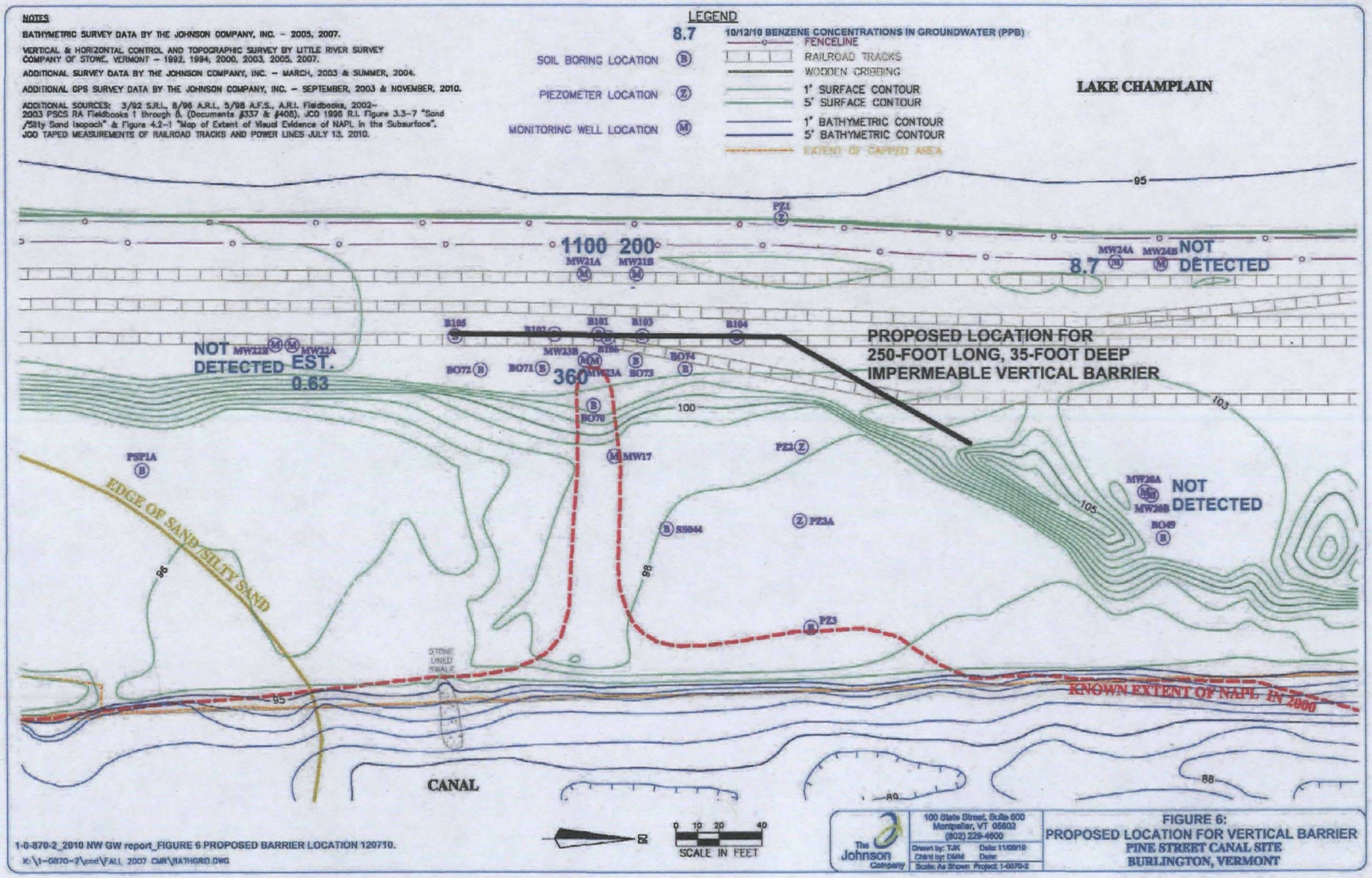


Figure 12 Extent of NAPL in Northwestern Corner of Site

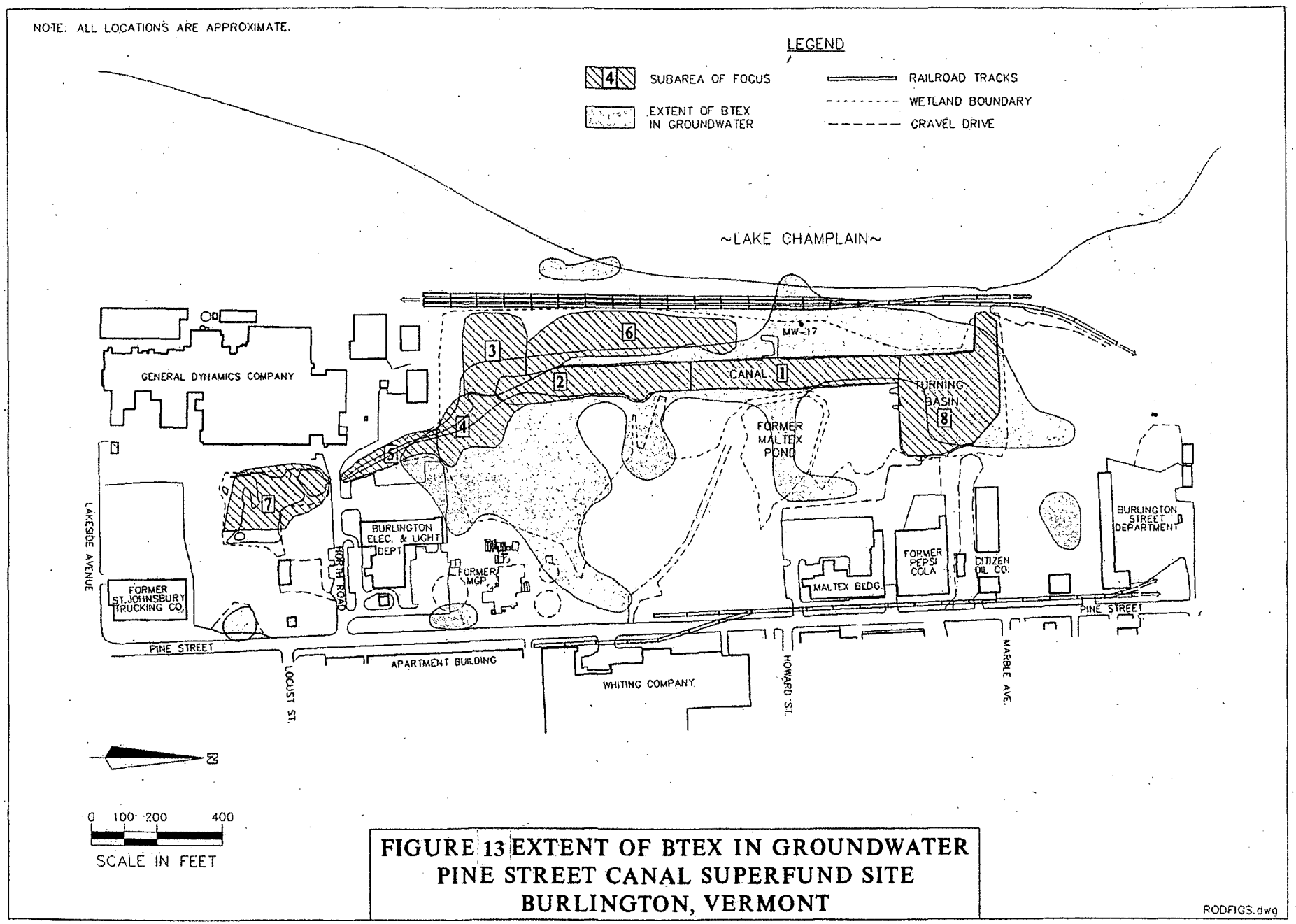


FIGURE 13 EXTENT OF BTEX IN GROUNDWATER
PINE STREET CANAL SUPERFUND SITE
BURLINGTON, VERMONT

RODFIGS.dwg

ATTACHMENT 1
PARCELS GRANTED RESTRICTIVE EASEMENTS AND ANNUAL CERTIFICATION CHECKLIST

List of Affected Properties Identified by the Consent Decree

I. On-site properties:

OLD TAX MAP NUMBER	CURRENT OWNER	NEW TAX MAP NUMBER
55-0-3-0	City of Burlington	053-2-004-000
55-0-4-0		
55-0-5-0		
55-0-6-0		053-2-005-000
53-0-3-0	Vermont Gas Systems, Inc.	053-1-001-000
53-0-9-0	The Maltex Partnership	053-1-002-000
53-0-8-0	City of Burlington	053-1-003-000
53-0-5-0		
52-0-2-0		
52-0-3-0		
52-0-15-0	[unknown]	no new tax number
52-0-13-0	[turning basin]	053-1-007-000
52-0-11-0	Vermont Railway, Inc.	053-1-009-000
52-0-12-0	Davis Development Corporation	053-1-010-000
53-0-1-0	BCV Associates, Inc.	053-1-011-000
53-0-2-0	Cloverleaf Properties, Inc.	053-1-012-000
55-0-1-0	Gilbane Properties, Inc.	053-2-010-000

OLD TAX MAP NUMBER	CURRENT OWNER	NEW TAX MAP NUMBER
53-0-1-0	BCV Associates, Inc.	053-1-011-000
53-0-2-0	Cloverleaf Properties, Inc.	053-1-012-000
55-0-1-0	Gilbane Properties, Inc.	053-2-010-000

II. Off-site properties:

OLD TAX MAP NUMBER	CURRENT OWNER	NEW TAX MAP NUMBER
53-0-7-0	453 Pine, LLC	053-1-003-001
52-0-1-0	The Maltex Partnership	053-1-004-000
52-0-4-0	S&S Vending Co.	053-1-005-000
52-0-5-0		
52-0-6-0	Citizens Properties, Inc.	053-1-006-000
52-0-8-0	Dennis P. Havey	053-1-017-000
52-0-10-0		
52-0-9-0	City of Burlington	049-2-019-000
56-0-6-0		
56-0-7-0	Cloverleaf Properties, Inc.	053-2-012-000
56-0-9-0		

ANNUAL CERTIFICATION OF COMPLIANCE WITH EASEMENT
PINE STREET BARGE CANAL SUPERFUND SITE

THIS ANNUAL CERTIFICATION OF COMPLIANCE FOR THE CALENDAR YEAR ____ (hereinafter the "Year") is made this ____ day of _____,____ by _____ , (hereinafter referred to as "Grantor"), concerning the following property (hereinafter referred to as the "Property"):

[Address of Property]

[New Tax Map # from Attachment 1

WHEREAS, the United States Environmental Protection Agency (hereinafter "EPA") has, pursuant to Section 105 of the Comprehensive Response, Compensation and Liability Act ("CERCLA"), placed on the National Priorities List certain lands and premises in the vicinity of Pine Street in Burlington, Vermont, such lands and premises being known as "the Pine Street Canal Superfund Site" (the "Site");

WHEREAS, EPA has selected a "remedial action" for the Site and has defined the extent of the Pine Street Canal Superfund Site in a Record of Decision ("ROD") dated September 29, 1998;

WHEREAS, EPA has determined in the ROD that certain easements, rights, obligations, covenants and restrictions, are necessary at certain portions of the Site and adjoining properties to ensure that future activities on these properties do not interfere with the remedial actions, or substantially increase the ecological, human, or environmental risks at the Site;

WHEREAS, the undersigned Grantor is the owner of certain lands and premises described in Exhibit A hereto (the "Property") which property is either adjacent, nearby or partially or totally within the Site;

WHEREAS, under the terms of a Consent Decree entered on February 11, 2000 in the case of United States of America and the State of Vermont v. Green Mountain Power Corporation et. al, Civil Action No. 1:99-CV-366 (D.Vt.) (the "Consent Decree"), by, and between Settling Defendants, the United States, and the State, Grantor or Grantor's predecessor in interest signatory Owner Settling Defendant has caused to be imposed on the Property an easement (the "Easement") which defines the use restrictions on the Property necessary to implement the ROD for the purpose of protecting human health and the environment;

NOW, THEREFORE,

Based on a site visit to the Property during the Year within 60 days of the date of this Certification and upon diligent review of information describing activities on the Property, I HEREBY CERTIFY, WITH RESPECT TO ACTIVITIES OR USES IN, ON, UPON, THROUGH, OVER OR UNDER THE PROPERTY ("ACTIVITIES OR USES"), WITHIN THE YEAR IDENTIFIED ABOVE, THE FOLLOWING:

	YES	NO	CERTIFICATION STATEMENT
1.	☐	☐	I, or my authorized representative, visited the Property within 60 days of this Certification Statement, and have diligently reviewed information describing activities on the Property. IF NO, EXPLAIN:
2.	☐	☐	Did any Activities or Uses (as defined above) at the Property cause or allow recontamination of the Site? (See attached list of parcels on the Site.) IF YES, EXPLAIN:
3.	☐	☐	Did any Activities or Uses cause contamination of off-site properties? IF YES, EXPLAIN:
4.	☐	☐	Did any Activities or Uses include use of the Property for residential use or for day care centers for the care of children? IF YES, EXPLAIN:
5.	☐	☐	Did any Activities or Uses include use of the groundwater on the Property for potable drinking water purposes? IF YES, EXPLAIN:

	YES	NO	CERTIFICATION STATEMENT
6.	☐	☐	Did any Activities or Uses include the installation of wells at any location where free phase contamination has been shown to be present? IF YES, EXPLAIN:
7.	☐	☐	Did any Activities or Uses include any construction activities that will change hydrogeologic conditions and will likely cause migration of contaminated groundwater to Lake Champlain? IF YES, EXPLAIN:
8.	☐	☐	Did any Activities and Uses on the Property include excavation(s) to depths greater than five feet (including but not limited to excavations which extend below the water table)? IF YES, RESPOND TO CERTIFICATION 9.
9.	☐	☐	Concerning the excavations to depths greater than five feet on the Property, do any of the following exceptions apply? If YES, CHECK ALL OF EXCEPTIONS IN 9A, 9B, and 9C THAT APPLY.
9A.	☐	☐	The excavation was performed to install, repair, maintain, service, or remove underground utility components, conduits, installations, or channels, which were already in place deeper than five feet. IF THE ANSWER IS YES, did workers conducting the excavation and working in the area use appropriate personal protective equipment as required by the Occupational Health and Safety Administration or similar federal or state worker safety agency?

	YES	NO	CERTIFICATION STATEMENT
9B.	☐	☐	The excavation consisted of drilling, driving, or boring to install pilings or utility poles for otherwise allowable construction. IF THE ANSWER IS YES, did workers conducting the excavation and working in the area use appropriate personal protective equipment as required by the Occupational Health and Safety Administration or similar federal or state worker safety agency?
9C.	☐	☐	The excavation was performed in a location on the property in which current contaminant concentrations at depths greater than five feet are less than 140 mg/kg total polycyclic aromatic hydrocarbons. IF THE ANSWER IS YES, provide relevant sampling and analysis data as an attachment to this checklist.
9D.	☐	☐	Concerning the excavations to depths greater than five feet on the Property, IF NONE OF THE ABOVE EXCEPTIONS IN 9A, 9B or 9C APPLY, EXPLAIN:
9E.	☐	☐	Was coal tar encountered during the excavation(s)? IF YES, EXPLAIN HOW THE CONTAMINATED SOIL AND/OR OTHER CONTAMINATED MATERIAL WAS HANDLED:
10.	☐	☐	Did all leases, licenses, occupancy agreements, deed restrictions or other instruments of transfer that were executed during the Year, if any, by which a right to use the Property, or any portion thereof, was conveyed incorporate the terms of the Easement in full or by reference? IF NO, EXPLAIN:

	YES	NO	CERTIFICATION STATEMENT
11.	☐	☐	Did all leases, licenses, occupancy agreements, deed restrictions or other instruments of transfer that were executed during the Year, if any, by which a right to use the Property, or any portion thereof, was conveyed require the grantee (including but not limited to any lessee) to agree that it will comply with the obligations to provide access and/or Institutional Controls to the Property, as set forth in Section IX of the Consent Decree and the Easement? IF NO, EXPLAIN:
12.	☐	☐	Were building permits for construction or any other permits concerning altering the use of the Property obtained during the Year? IF YES, ATTACH COPIES OF ALL SUCH PERMITS.

The Grantor hereby acknowledges its ongoing obligation to comply with the terms of the Easement. By executing this Certification, the Grantor hereby represents and certifies that any and all of its activities during the Year complied in full with the terms of the Easement, except as indicated above.

IN WITNESS WHEREOF, GRANTOR as record title-holder of the above described Property, hereby submits this ANNUAL CERTIFICATION OF COMPLIANCE WITH EASEMENT, which shall be provided to EPA and the State.

Witness: Grantor

_____ By: _____

Name:

Its Duly Authorized Agent

State of Vermont
County of Chittenden

On this _____ day of _____,____, personally appeared _____, signer and sealer of the foregoing written conveyance and acknowledged the same to be _____ own free act and deed and the free act and deed of the Grantor.

Before me, _____

Notary Public

My Commission Expires: _____

ATTACHMENT 2
LIST OF DOCUMENTS REVIEWED / REFERENCES

ARCADIS, 2008a. *Final NAPL Investigation Report, Pine St. Canal Superfund Site, Burlington Vermont.* Prepared for the Performing Defendants. February 2008.

ARCADIS, 2008b. *Final NAPL Controls Report, Pine St. Canal Superfund Site, Burlington Vermont.* Prepared for the Performing Defendants. June 2008.

ARCADIS, 2010. *Design Report, Pine St. Canal Superfund Site, Burlington Vermont.* Prepared for the Performing Defendants. August 6, 2010.

Blasland, Bouck, and Lee, Inc. (BBL) and Hart Crowser, Inc. 2006a. *Action Plan, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for the Performing Defendants. April 2006.

Blasland, Bouck, and Lee, Inc. (BBL) and Hart Crowser, Inc. 2006b. *Work Plan, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for the Performing Defendants. April 2006.

Blasland, Bouck, and Lee, Inc. (BBL) and Hart Crowser, Inc. 2006c. *Interim Data Report for Spring Investigation, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for the Performing Defendants. July 2006.

Brown, E., A. Duchovnay, A. Shambaugh, and A. Williams. 1992. 1991 Lake Champlain Biomonitoring Program. Vermont Water Resources and Lake Studies Center. School of Natural Resources, University of Vermont.

Helgason, Thor, *de maximis, inc.*, 2006. Personal correspondence with Karen Lumino, EPA. September 25, 2006.

Hunton & Williams. 2004. *Institutional Controls Plan. Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for the Performing Defendants. November 29, 2000; amended April 2, 2004.

John Milner Associates (JMA). 2001. *Historic Resources Study, Pine Street Canal Superfund Site, Burlington, Chittenden County, Vermont.* Prepared for the Performing Defendants. Revised May 2001.

Johnson Company, The (JCO). 1997. *Additional Remedial Investigation.* Submitted to the United States Environmental Protection Agency. July 1997.

Johnson Company, The (JCO). 2000. *Final Remedial Design Work Plan, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. August 2000.

Johnson Company, The (JCO). 2002a. *Phase 1A Remedial Action Construction Completion Report.* Prepared for Performing Defendants. January 2002.

Johnson Company, The (JCO). 2002b. *Wetland Restoration Plan Summary, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared on behalf of the Performing Defendants for the Pine Street Canal Coordinating Council Members. April 2002.

Johnson Company, The (JCO). 2002c. *Design Change Request #10, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. November 2002.

Johnson Company, The (JCO). 2003a. *Compliance Monitoring Report, Fall 2002, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2003.

Johnson Company, The (JCO). 2003b. *Design Change Request #11, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2003.

Johnson Company, The (JCO). 2003c. *Compliance Monitoring Report, Spring 2003, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2003.

Johnson Company, The (JCO). 2003d. *Supplemental West Bank Cap Remedial Action Work Plan, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. December 2003.

Johnson Company, The (JCO). 2004a. *Compliance Monitoring Report, Fall 2003, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2004.

Johnson Company, The (JCO). 2004b. *Compliance Monitoring Report, Spring 2004, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2004.

Johnson Company, The (JCO). 2004c. *Remedial Action Construction Completion Report, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. September 2004; reprinted November 2006.

Johnson Company, The (JCO). 2005a. *Compliance Monitoring Report, Fall 2004, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2005.

Johnson Company, The (JCO). 2005b. *Compliance Monitoring Report, Spring 2005, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2005.

Johnson Company, The (JCO). 2005c. *Cost and Performance Report, Isolation of Contaminated Sediments at the Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. December 2005.

Johnson Company, The (JCO). 2005d. *Demonstration of Compliance Report, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. December 2005.

Johnson Company, The (JCO). 2006a. *Compliance Monitoring Report, Fall 2005, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2006.

Johnson Company, The (JCO). 2006b. *Compliance Monitoring Report, Spring 2006, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2006.

Johnson Company, The (JCO). 2006c. *Compliance Monitoring Work Plan, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. April 2002; revised December 2006.

Johnson Company, The (JCO). 2006b. *Compliance Monitoring Report, Spring 2006, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2006.

Johnson Company, The (JCO). 2007a. *Compliance Monitoring Report, Fall 2006, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2007.

Johnson Company, The (JCO). 2007b. *Compliance Monitoring Report, Spring 2007, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2007.

Johnson Company, The (JCO). 2008a. *Compliance Monitoring Report, Fall 2007, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2008.

Johnson Company, The (JCO). 2008b. *Compliance Monitoring Report, Spring 2008, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2008.

Johnson Company, The (JCO). 2009a. *Compliance Monitoring Report, Fall 2008, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2009.

Johnson Company, The (JCO). 2009b. *Compliance Monitoring Report, Spring 2009, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2009.

Johnson Company, The (JCO). 2010a. *Compliance Monitoring Report, Fall 2009, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2010.

Johnson Company, The (JCO). 2010b. *Compliance Monitoring Report, Spring 2010, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2010.

Johnson Company, The (JCO), Don Maynard. 2010c. *Memorandum: Pine Street Canal Superfund Site, Shallow Overburden Groundwater Quality Data.* Prepared for Thor Helgason, *de maximis, inc.* July 2010.

Johnson Company, The (JCO), Don Maynard. 2010d. *Memorandum: Pine Street Canal Superfund Site, Burlington, Vermont, Report of October 2010 Soil Data, Subsurface Investigation and Evaluation – Northwestern Well Area.* Prepared for Thor Helgason, *de maximis, inc.* and Norm Terreri, GMP. December 2010.

Johnson Company, The (JCO). 2011a. *Fall 2010 Compliance Monitoring Report. Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. January 2010.

Johnson Company, The (JCO). 2011b. *Spring 2011 Compliance Monitoring Report. Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for Performing Defendants. July 2011.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. *Environmental Management* 19(1):81-97.

McIntosh, A., M. Watzin, 1997. Table 8, An Assessment of Sediment – Associated Contaminants in Lake Champlain – Phase II. Lake Champlain Basin Program Technical Report No. 23B.

Metcalf & Eddy, Inc. (M&E). 1992a. *Supplemental Remedial Investigation Final Report, Pine Street Canal Superfund Site.* March 1992.

Metcalf & Eddy, Inc. (M&E). 1992b. *Baseline Risk Assessment Final Report.* Prepared for the United States Environmental Protection Agency. May 1992.

Metcalf & Eddy, Inc. (M&E). 1992c. *Feasibility Study Report.* Prepared for the United States Environmental Protection Agency. November 1992.

PEER Consultants (PEER). 1990. *Draft Remedial Investigation Report for Pine Street Canal Site.* Prepared for the United States Environmental Protection Agency. May 1990.

Remediation Technologies (RETEC), Inc. 1998. *Additional Feasibility Study.* Submitted to the United States Environmental Protection Agency. May 1998.

United States Environmental Protection Agency (USEPA). 1992. *Framework for Ecological Risk Assessment. EPA/630/R-92/001.* February 1992.

United States Environmental Protection Agency (USEPA). 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-006.* June 1997.

United States Environmental Protection Agency (USEPA). 1998a. *Record of Decision, Pine Street Canal Superfund Site, Burlington, Vermont.* September 1998.

United States Environmental Protection Agency (USEPA). 1998b. *Guidelines for Ecological Risk Assessment. Risk Assessment Forum. Washington, D.C. EPA/630/R-95/002F.* April 1998.

United States Environmental Protection Agency (USEPA). 2000. *Remedial Design/Remedial Action Statement of Work. Pine Street Canal Superfund Site.* February 2000.

United States Environmental Protection Agency (USEPA), et al. 2002a. *Memorandum of Agreement for Mitigation of Adverse Effects.* June 2002.

ATTACHMENT 3
SITE INSPECTION FORM AND INTERVIEW RECORDS

Pine Street Canal Superfund Site
Second Five-Year Review Inspection Checklist

I. SITE INFORMATION	
Site Name: Pine Street Canal Superfund Site	Date of Inspections: July 12&13, 2011; August 2, 2011
Location and Region: Burlington, VT/Region 1	EPA ID: VTD980523062
Agency leading the five-year review: USEPA Region 1	Weather/temperature: Various

Remedy Includes:
☒ Capping
☒ Aquatic and Wetland Habitat Restoration
☒ Stormwater Inflow and Non-Contact Cooling Water Management
☒ Long-Term Compliance Monitoring
☒ Institutional Controls

Attachments: ☒ Inspection Team Rosters ☒ Site Map

II. INTERVIEWS		
1. Manager responsible for site monitoring Name: Thor Helgason, *de maximis, inc* Title: Project Manager Date: August 2, 2011		
2. Local Regulatory Authorities and Agencies Agency: Burlington DPW Name: Steven Goodkind Title: Director Date: July 13, 2011		
3. Other interviews (optional) ☒ Attached		
III. ON-SITE DOCUMENTS AND RECORDS VERIFIED ☒ NA		
IV. O&M COST RECORDS ☒ Funding Mechanism/Agreement in Place (2000 Consent Decree)		
V. ACCESS AND INSTITUTIONAL CONTROLS		
A. Fencing ☒ NA		
B. Other Access Restrictions ☒ NA		
C. Institutional Controls (ICs)		
1. Implementation and Enforcement: Landowner Defendants submit annual certifications to EPA		
D. General ☒ NA		
1. Vandalism/trespassing ☐ Shown on Site Map Remarks: Evidence of homeless intermittently camping on site (sleeping bags, trash, etc)		
2. Land Use changes on Site ☒ NA		
3. Land Use changes off-Site ☒ NA		
VI. GENERAL SITE CONDITIONS		
A. Roads ☒ NA		
B. Other Site Conditions ☒ NA		
VII. REMEDY COMPONENTS		
A. Capped Areas excluding Amended Cap		
1. Settlement (Low Spots)	☒ Settlement not evident	
2. Cracks	☒ Cracking not evident	
3. Erosion	☒ Erosion not evident	
4. Holes	☒ Holes not evident	
5. Vegetative Cover	☒ Cover properly established	

6. Bulges	☒ Bulges not evident
7. Wet Areas/Water Damage	☒ Wet areas/water damage not evident
8. Slope Instability	☒ Minor sloughing along shoreline
B. Amended Cap (approx T9 to T12+50)	
1. Settlement (Low Spots)	☒ Settlement not evident
2. Cracks	☒ Cracking not evident
3. Erosion	☒ Minor erosion around controlled fill area (T9-T9.75)
4. Holes	☒ Holes not evident
5. Vegetative Cover	☒ Habitat restoration plan still under discussion
6. Bulges/Folding	☒ Minor bulging/folding along cap terminus; punchlist includes replacement of anchor pins
7. Wet Areas/Water Damage	☒ NA
8. Slope Instability	☒ No evidence of slope instability
C. BED Outfall	
1. Settlement (Low Spots)	☒ Settlement not evident
2. Cracks	☒ Cracking not evident
3. Erosion	☒ Erosion not evident
4. Holes	☒ Holes not evident
5. Vegetative Cover	☒ No signs of stress
6. Bulges	☒ Bulges not evident
7. Wet Areas/Water Damage Remarks: Natural ponding – high turbidity water	☒ Wet areas/water damage not evident
8. Slope Instability	☒ No evidence of slope instability
D. North Road Culvert and Drop Inlet	
1. Outlet Pipes Inspected	☒ Functioning
2. Outlet Rock Inspected	☒ Functioning
E. Area 7 Detention/Sedimentation Ponds and Outlet	
1. Siltation	☒ Silt removed periodically by Burlington DPW
2. Erosion	☒ Erosion not evident
3. Outlet Works	☒ Functioning
F. Outlet Weir	
1. Deformations Remarks: Siltation on canal and lake side	☒ Deformation not evident
2. Degradation	☒ Degradation not evident
VIII. GROUNDWATER/SURFACE WATER REMEDIES	
A. Monitoring Data	
1. Monitoring data	☒ is routinely submitted on time ☒ is of acceptable quality
2. Monitoring data suggests: ☒ Groundwater plume is not contained at northwestern corner of Site	
IX. Aquatic and Wetland Habitat Restoration	
A. Areas 3&7 and West Bank	
1. Wetland Hydrology	☒ Evidence of saturation/inundation
2. Vegetative Cover	☒ Cover properly established
3. Wetland Vegetation	☒ Wetland species appear dominant
4. Planted Species	☒ Appear in good health; no obvious signs of stress
5. Invasive Species Control	☒ Required monitoring/mitigation program has been reasonably successful at minimizing inundation from unremediated areas of the Site
6. Erosion	☒ Erosion not evident

B. Canal and Turning Basin (except in Amended Cap area) D. Canal and Turning Basin Bank condition: Good Submergent aquatic vegetation present in Canal: ☒ Yes
C. Amended Cap Area – habitat restoration efforts here incomplete; plan is still under review
X. OVERALL OBSERVATIONS
A. Implementation of the Remedy: At the time of this review, the Amended Cap has been in for less than one year. Early indications from inspections over the summer are positive.
B. Adequacy of O&M: Only minor punchlist items for Amended Cap, and, need for more frequent removal of vegetation on drop inlet in Area 7 to ensure North Road doesn't experience seasonal flooding
C. Early Indicators of Potential Remedy Problems: None observed during inspections
D. Opportunities for Optimization: Review compliance monitoring program for potential to reduce frequencies and parameters, as appropriate, based on data collected over past 10 years

Pine Street Canal Superfund Site

5 Year Review Notes

August 3, 2011

Pine Street Barge Canal Coordinating Council Meeting:

- *Michael Smith: email Free Press announcement of ESD and 5 year review*
- *Marty: email text of press release with link to press release*
- *Bill Howland: passing the baton to Lori Fisher b/c he is no longer on the LCC*
- Purpose of meeting: check in with the community: does the remedy still protect human health and the environment
- Karen to update:
    - Last time we met, a portion of the cap didn't seem to be working. In order to resolve that there was an Explanation of Significant Differences to start work to fix the cap.
    - Construction was done last fall. We removed some of the sand cap and put in a reactive core mat (RCM). The idea is that the coal tar will react with the mat which sequesters it.
    - Inspection was completed yesterday, August 2, 2011, on the latest construction.
- How much of sand was removed? Why wasn't mat placed on top of the sand?
    - We removed the sand because it was contaminated and important to keep bathymetry of canal the same (e.g., not to fill it in)
- Do engineers feel it was successful?
        - The cap just went in but we haven't seen contamination (sheens or coal tar globules) at all in this hot summer. Nor have we smelled any odors.
- Will the mat need to be replaced at any point?
    - Yes it will need to be replaced eventually. The design is meant to have a life span of about 30 years.
    - There is a monitoring program in place to make sure we know when the RCM needs to be changed out or fails.
- Are the coal tar collection recovery wells new?
    - We put in 10 over this past winter.
- Could we call the recovery wells and the RCM newer technology?
    - Certainly true of RCM.
    - Coal tar collection is not a new technology but a newer approach to these kinds of sites. Pine Street's original remedy (sand cap) was constructed almost ten years ago.
- Isn't there a finite amount of contamination in this place? By removing some of this contamination and some of it coming out through bubbles? How much contamination is still there? Will it ever be clean?
    - Difficult to tell you about how much contamination is still there. We can make a calculated prediction, but there would be a lot of room for error.
    - The Pine Street Barge Canal site is most likely to stay how it is for the foreseeable future.

    - There was a significant amount of contamination left in the ground there, which was decided to be left there under the original remedy selected in 1998. The contamination will, therefore, be around for a long period of time.
- Is coal tar more or less mobile when it's capped underground?
    - We are still learning a lot about the mobility of coal tar (a.k.a non-aqueous phase liquid, or, NAPL). It still seems to be mobile.
- What was the weir for?
    - The weir was to protect the cap; it replaced the beaver dam at the outlet of the canal to Lake Champlain.
- Is there contamination getting into the lake?
    - The latest ESD is for this concern.
    - We saw spikes in benzene and NAPL. It appears that this contamination has moved onto the other side of the canal. We are looking at putting in some kind of vertical barrier in order to prevent the contamination from getting into the lake.
    - Karen's guess is that the timeline for this will be next winter or spring. They are still working on the design. Need to coordinate with the railroad.
- Where are we at right now?
    - We issued the ESD in draft, and we are in the comment period for the work plan.
    - Comment period ends on August 15th.
- What about the flooding? Did that have an impact?
    - We think that the RCM worked. We didn't see much change with the flooding.
- What is the response if we do start seeing sheens and smelling odors?
    - Recommendation at that point would be that the original remedy isn't working and we need to really re-assess the remedy as a whole.
- Who takes all of the expenses?
    - The Performing Defendants
- How often is the site checked?
    - We are finalizing the details of the monitoring plan. But we have people coming out ever two weeks-every month.
        - Doing inspections, taking samples..etc
- Who is doing the sampling and monitoring efforts?
    - Johnson Company
- Can we go out on an inspection?
    - We can try to figure out how to walk you down the middle access road
- From the LCC perspective: part of our interest was telling the story of what happened at the Pine Street Barge Canal. To help think about what kinds of things we are doing today that are causing the superfund sites of tomorrow. It was an amazing community involvement feat.
- It was significant for EPA to take on this kind of project with this kind of involvement. Pine Street Canal was a pilot.
    - Do we want to capture the story through a sign on the bike path?
    - Do we want to do some sort of website?

- Could this kind of signage be considered as part of the ESD? Could we construct an area off of the bike path to put up signs to tell the Pine Street story?
    - Not sure it's possible to find that kind of money.
- South End Business Association might be interested in this kind of effort.
- Original plan was to put in some kind of board walk across the site.
- Coordinating Council does not think the internet takes the place of the physical signage.
- Someone would have to take the lead on maintaining the signage. It would need to be a collaborative project.
- Concerns from the business community on the remedy
    - There is some chatter that the remedy didn't work, but it is very minor.
    - There is a more generalized concern about possible development or preservation.
        - Equal amounts of people who like it the way it is
        - Other voices that want to be able to see brownfields idea through: can we get funding to build..etc
        - People want more information
        - There was such intense focus on this project for so long, and now there is less focus and therefore less news stories. People are interested in an update.

Sign-In: Pine Street Coordinating Council (10am)

Name	Organization	Email / Phone
Marty Feldman	SEBAA	marty@lightworksvt.com 658-6815
GEORGE DESCH	VT DEC	george.desch@state.vt.us
Michael Smith	VT DEC	michael.b.smith@state.vt.us
Stephen Marion	EPA	marion.steve@EPA.Gov
JOHN AKEY	Community Rep.	jpakey@hotmail.com 802-233-4039
Lori Fisher	Lake Champlain Committee	lori@lakechamplaincommittee.org
Karen Cumino	USEPA	

To:
Cc:
Bcc:
Subject: Fw: barge canal article

Begin forwarded message:

From: SEABA <info@seaba.com>
Date: September 9, 2011 1:40:09 PM EDT
To: Marty Feldman <marty@lightworksvt.com>
Subject: Art Hop is Here!

south end arts + business association

What's Up With the Barge Canal

by Marty Feldman

On August 3rd, the EPA convened a 5-year update meeting at the Lake Champlain Committee headquarters on Flynn Avenue. The clean-up remedy was chosen and employed close to 13 years ago after several years of meeting and negotiations. Some of the original committee members were present at this meeting, including myself, representing SEABA. There's a lengthy history of the site, its contamination, and the clean-up. I've listed a useful web link for those interested in this infamous litany.

Here's the short story: Back in Pine Street's industrial period, a coal gasification plant operated on this site to convert coal (brought in on barges) into gas. A by-product of this process was coal tar, which is buried in the ground in and around the canal. A while after the plant shut down, the decision was made to clean up to site and it was eventually classified as a Superfund site. The EPA decided on a clean up solution that would cap it in concrete, becoming one of the largest concrete structures in the region. The community fought this decision, and eventually the EPA smartly withdrew its plan and supported a community-focused process to come up with an alternate strategy.

The finale of this process was a remedy to carefully install a sub-aqueous cap, using sand, in the canal waters, hopefully to cover and seal the waterway and its surrounding wetlands from the coal tar buried in the peat layer below. In addition, the plan called for monitoring wells, a barrier at the entrance to the lake to help isolate the canal from the lake dynamics, as well as other preventatives and repairs. An interesting result of the community based function of the plan, was that a special fund was set up to support projects that would help mitigate the environmental and commercial loss to the local community. The special project fund supported Engelsby Brook restoration work conducted by the City, research on Burlington Harbor done by the UVM Rubenstein Science Lab next to the ECHO center, and stormwater sediment removal work and an urban revitalization project administered by the City. Another

side-note of interest was the discovery of sunken ships in the canal of historic value.
All this work, has been and continues to be paid for by the "Responsible Parties," made up primarily of local and regional utilities.
Over time, the cap has apparently pushed down on the contaminated peat layer and some coal tar has emerged in the form of oily bubbles, sheen, and odor. This past year, the remedy was modified, and a new type of cap, call a Reactive Core Mat was installed over the sand cap, which has proven effective in other coal tar site nationwide. Several passive recovery wells have also been installed around the site to handle any escaping contaminant. The summer's bizarre weather certainly would have produced more effluent without the modification, but so far, so good…nada coal tar. In the near future, a larger vertical barrier will be installed with collecting wells to prevent contaminates from making there way into the lake.
EPA is taking comments on this additional remedy work through August 15, 2011, so if you'd like to comment, please visit this site: www.epa.gov/region1/newsevents/index.html.
Plenty of addition information is available at: www.epa.gov/region1/newsevents/index.html

©2011 SEABA | 404 Pine Street | Burlington, VT | 05401 | www.seaba.com | (802) 859-9222

This email was sent to marty@lightworksvt.com. To ensure that you continue receiving our emails, please add us to your address friend.
Unsubscribe

Powered by Mad Mimi
®

Pine Street Canal

5 Year Review: Meeting Notes

August 3, 2011 (12:30-2:00pm)

- Need for parking in the South End.
- Company called dealer.com across the street from the Pine Street Canal Superfund Site
- Looking to do a ground level parking lot
- Group is focused on 453 parcel for a potential parking lot to satisfy parking needs in the South End
- City is working to redevelop there with Brownfields money
    - We are 0 for 4 on redevelopment on this site
- Question: the parcel in question is not actually part of the site boundary. Therefore, the question is can the city use brownfields money to redevelop that particular parcel?
- Proposing to design a parking lot that can help the remedy and become part of the remedy. We are unclear about the institutional controls? It's difficult to find precedent on this because of the multi party ownership.
- What the group sees as a liability issue:
    - Liability to the regulatory community—both state and EPA. What are the responsibilities now in terms of monitoring and access?
    - Third Party liability—gas station owners...etc. Third party is looking to put more responsibility for impact to the site in terms of covering problems (prp issues).
- EPA: there is uncertainty about NAPL at that area because our original decision was not to go after the source. Therefore, there were issues we didn't need to tackle in that area. There would need to be additional testing to figure out the contamination picture there.
- Is there a path through EPA where a design for this sort of thing can begin moving forward? Can the design of this parking lot become implemented into the remedy?
    - This proposal is not really part of the remedy anymore.
    - We would need to pull in the brownfields program to assess possibilities.
- Problem about prospective purchaser agreement: this area is outside of the drawn site, but it is still tied up with the Superfund site because of the institutional controls. This won't prevent the gas plant parties from taking action towards responsibility for site.
- One Liability Model that came up:
    - Working with specialty liability transport groups. The idea is to buy contaminated property and own the liability, then ground lease to someone interested in taking on the property.
    - This starts to get into financial issues
    - Not the cheapest model, but it does address some of the Third Party Liability problems.
- In the end, who has the regulatory authority over this particular parcel?
    - Based on PAH, groundwater..etc, is that parcel a VT State site

        - How the institutional controls effects the parcel has to be run in more detail through the attorneys.
- Seems the concern is third party law suits...
    - This parcel is redefined as not part of NPL. It is a state site, so there is some liability protection through the state program.
    - VT DEC can see it possibly working under the brella program: with liability protection.
        - Brella program offers protection against reworkers...requirements for state to compensate: it's basically an insurance policy
- Need to find out if EPA is willing to negotiate a purchaser's agreement to include liability protection.
- VT DEC: seems for 453 we can overcome technical hurdles.
- State should check in with the AG's office to look over the settlement and double check any red flags there.
- EPA is the keeper of the deed restriction/institutional controls
- Phase 1 would be mandatory
- Need an attorney to go over the settlement agreement complications on property boundaries
- Is EPA willing to do a Protective Purchasers Agreement in this case?
- Does Brella cover off-site impacts?
    - Brella is a state program with a state action.
- What does the institutional control actually say?
- Conclusions:
    - This site is probably eligible to be a brownfields site. It is not part of the Pine Street Canal Superfund site.
    - Could we consider a PPA?
- Stormwater issues: under new MS4 permit there is more potential for collecting stormwater

Sign In - Pine Street Canal 5 yr. Review

Name	Organization	Email/Phone
Kiersten Bourgeois	Vermont Agency of Commerce	kiersten.bourgeois@state.vt.us 802/828.5220
David Weinstein	Senator Bernie Sanders	david_weinstein@sanders.senate.gov
Frank Cioffi	GBIC	frank@vermont.org 8028625726
SETH BOWDEN	GBIC	seth@vermont.org 8625726
Steve MAngion	EPA	MAngion.Steve@EPA.ca
Nick Warner	Burlington CEDO	nwarner@ci.burlington.vt.us
CHAD FARRELL	ENCORE REDEVELOPMENT	chad@encoreredevelopment.com 802-861-3023
Michael Smith	VT DEC	michael.b.smith@state.vt.us
GEORGE DESCH	VT DEC	george.desch@state.vt.us
Patricia Coppolino	VT DEC	patricia.coppolino@state.vt.us

ATTACHMENT 4
SUMMARY OF ARARs

SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
PINE STREET CANAL SUPERFUND SITE
BURLINGTON, VERMONT

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
			Chemical-specific	
Draft Sediment Quality Criteria	Criteria developed by the USEPA for certain hydrophobic organic compounds to protect benthic organisms.	To Be Considered (TBC)	No action necessary; sediments currently meet these criteria.	The soil used to cap the canal and turning basin met these criteria.
Ontario Ministry of the Environment and Energy Sediment Quality Guidelines	Guideline derived for freshwater sediments that define three levels of chronic effects on benthic organisms: no-effect level; lowest-effect level (LEL) which indicates a level of sediment contamination that can be tolerated by most benthic organisms; and severe-effects level (SEL) at which pronounced disturbances will occur for a majority of the benthic species.	TBC	Capping sediment areas that currently exceed these criteria will attain compliance with the guidance criteria. Alternative 3a, capping all subareas with ecological concern, will address this ARAR most completely.	Areas 3, 7 and the canal/turning basin were capped with clean material (sand/soil) providing a barrier between benthic organisms and contaminated sediments. In one area of the canal, the original sand cap was replaced with a cap with a reactive core to better isolate contamination in sediments, preventing ecological exposures. The values continue to be considered in evaluating the effectiveness of the cap in preventing harmful ecological exposures.
NOAA Sediment Screening Guidelines	Used to identify concentration levels associated with deleterious effects on estuarine and marine species and environments. Based on a database compiled from 89 publications, lowest (ER-L) and median (ER-M) effects ranges (corresponding to the 10th and 50th percentiles, respectively) of observed biological effects were developed.	TBC	Capping sediment areas that currently exceed these criteria will attain compliance with the guidance criteria. Alternative 3a, capping all subareas with ecological concern, will address this ARAR most completely.	Areas 3, 7 and the canal/turning basin were capped with clean material (sand/soil) providing a barrier between benthic organisms and contaminated sediments. In one area of the canal, the original sand cap was replaced with a cap with a reactive core to better isolate contamination in sediments, preventing ecological exposures. The values continue to be considered in evaluating the effectiveness of the cap in preventing harmful ecological exposures.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Clean Water Act Ambient Water Quality Criteria Guidelines (40 CFR Part 131)	Establishes policy of user-based surface water quality criteria for protection of aquatic organisms and human health.	TBC	No action necessary; surface water quality presently meets Ambient Water Quality Criteria.	Engineering controls were used during construction to prevent impacts. Surface water sampling was performed during construction and it was concluded that there were no short-term or long-term impacts to surface water quality. These criteria continue to be considered in evaluating the results of long-term monitoring of the surface water.
			Location-Specific	
Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility Located on 100-year Floodplain (40 CFR 264.18(b))	Facility must be designed and operated to avoid washout.	Applicable	Substantive portions of this requirement will be considered during design of the capped areas to minimize washout effects from flood events.	This ARAR has been met. The cap was designed to withstand a 100-year flood event.
Executive Order 11988 Floodplains Management (incorporated by reference in 33 CFR 320.4)	Actions by federal agencies taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	Applicable	Substantive portions of this requirement will be considered during design of the capped areas to minimize washout effects from flood events.	This ARAR has been met. The weir was designed to not significantly change flood conditions upstream. The placement of a cap reduces flood storage capacity of the site; however, Lake Champlain provides practically unlimited storage. Therefore, no adverse effects are expected.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Executive Order 11990 Protection of Wetlands (incorporated by reference in 33 CFR 320.4)	Actions by federal agencies taking place within wetlands must be planned to limit adverse impacts.	Applicable	All remedial actions will be designed to minimize wetlands areas to be impacted during implementation of the remedy and all remediated areas will have wetlands restoration activities.	Engineering controls were used during remedy construction to prevent impacts to adjacent wetlands. Disturbed wetlands were restored by placing topsoil and planting wetland vegetation. This regulation is being complied with through ongoing monitoring of the wetland habitat restoration areas.
Clean Water Act Section 404 Dredge and Fill in Wetlands (40 CFR Part 230)	Dredging or filling activities in wetlands are regulated. Appropriate and practicable steps must be taken to minimize and address impacts of any discharges occurring as a result of the selected remedial alternative. No activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available.	Applicable	Substantive portions of this Act will be addressed during remedial design and implementation of the remedy. Actions that minimize impacts to non-remediated areas of the Site will be taken and every effort will be made to prevent migration of either contaminated sediments or cap material during placement (e.g., silt curtains, weirs, specialized cap placement techniques). Alternative 3a is the least environmentally-damaging practicable alternative. Restoration and mitigation measures will be taken following placement of the cap.	This ARAR was complied with during construction and through restoration of disturbed wetland habitat areas. Wetland plantings in Areas 3 and 7 and moving excess soil from Area 7 to Area 3 resulted in a net loss less than 1/10th acre of wetlands. (Alternatives with lesser effects were evaluated and found not practicable.) No loss of wetlands resulted from capping the canal, turning basis and 100 x 100 foot area. Actions have been taken to control invasive species. A mitigation plan for the loss of wetland habitat along the eastern bank of the Amended Cap (to maintain a service road) is under development.
National Historic Preservation Act Preservation of Historic Properties Controlled by	Actions by federal agencies must be take to preserve historic properties; recover and preserve artifacts; and minimize harm to National Historic Landmarks.	Applicable	A full assessment of the status of the historical submerged structures will be conducted prior to remedial action. Appropriate steps to record and document the structures will be conducted following consultation with the Vermont State Historic Preservation Officer and prior to construction of the cap.	This ARAR has been met. A study that identified historic resources on site was completed prior to construction. The Performing Defendants entered into a Memorandum of Agreement for the Mitigation of Adverse Effects with EPA and the State of Vermont. Barges and marine railways were left in place and cap material was carefully placed to avoid

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Federal Agency (36 CFR 800)				harm. Remnants of marine railways outside of the area to be capped were marked off with fencing to protect them during construction. Mitigation for the loss of the barges due to their being capped permanently included a study of another sunken barge in Lake Champlain proper, conducted by the Lake Champlain Maritime Museum which curated and has on display artifacts recovered from the barge.
Archaeologic and Historic Preservation Regulations (36 CFR Part 65)	Actions by federal agencies must be done to preserve and recover any historical or archaeological artifacts found.	Applicable	Same as above.	Same as above.
Vermont Historic Preservation Law (22 VSA Ch. 14, §§ 743(4) and 767	Places controls on actions conducted by the State of Vermont that may impact historic, scientific or archaeological data.	Applicable	Same as above.	Same as above.
Fish and Wildlife Coordination Act Modification to Waterway that Affects Fish and Wildlife (50 CFR Part 297)	Actions by federal agencies must be taken to protect fish or wildlife when diverting channeling or otherwise modifying a stream or river.	Applicable	The requirements of this Act will be considered during design of the remedy. Consultation with USF&WS and Vermont Fish and Wildlife is required.	The weir was designed and constructed so as to not adversely impact spring spawning or fish migration. The capped areas were designed to protect fish and wildlife from exposure to contaminated sediments. Engineering controls were used to protect wetlands and water quality during construction.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Vermont Wetlands Rules (10 VSA Ch. 37, §§ 905)	Identification and protection of significant wetlands and their values and functions.	Applicable	The wetland functions and values will be restored by implementation of these alternatives. Alternative 3a most completely addresses this ARAR by restoration of all stressed wetlands identified at the Site.	This ARAR is being complied with through restoration of impacted wetland habitat areas, invasive species control and continued monitoring.
Vermont Groundwater Protection Law (10 VSA Ch. 48, §§ 1340)	Establishes classifications for groundwater to protect the existing and potential future use of each groundwater source.	Applicable	In 1993, the State of Vermont designated most of the groundwater at the Site as Class IV – non-potable, suitable for only some agricultural, industrial and commercial uses. Class IV designation establishes a measure of protection from consumption of groundwater exceeding federal drinking water standards (MCLs), and, appropriate management practices must be used to prevent violation of groundwater quality standards in adjacent Class III groundwater.	This ARAR remains applicable. Long-term groundwater is conducted to ensure that contaminants do not migrate across the Class IV boundary at concentrations above federal MCLs. Benzene concentrations in excess of the MCL have been detected outside the Class IV boundary in one area of the Site. An ESD issued in September 2011 calls for certain enhancements to the 1998 ROD to protect Lake Champlain from potentially being impacted by migration of contaminated groundwater and coal tar left on site.
RCRA Identification and Listing of Hazardous Wastes (40 CFR Part 261)	Criteria for determining if a waste is a hazardous waste and is subject to regulation.	Potentially ARAR	If a contaminated medium exhibits the characteristic of a hazardous waste, these regulations are applicable. If a contaminated medium is sufficiently similar to listed RCRA hazardous wastes, these regulations are potentially relevant and appropriate.	Contaminated soil moved to Area 3 during weir construction was tested and found to be non-hazardous. Some waste materials were identified during construction as hazardous and were disposed of at a RCRA disposal facility. Some soil consolidated under the Area 3 and Area 2 cap may be characteristic hazardous waste.
			Action-specific	
RCRA Treatment, Storage and	Regulations concerning land disposal of listed or characteristically hazardous	Not ARAR	No RCRA hazardous wastes would be generated. *In-situ* capping activities will involve consolidation of materials	Hazardous wastes generated during construction were disposed of at a RCRA disposal facility. The consolidation of soils

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Disposal Facilities (40 CFR Part 268)	waste.		within an area of existing contamination, which does not implicate RCRA standards [55 Fed. Reg. 8666, 8760 (March 8, 1990)].	beneath the cap does not implicate RCRA standards.
RCRA Land Disposal Facility Notice in Deed (40 CFR 264.116, 264.119(b)(1)	Establishes provisions for a deed notation for closed hazardous waste disposal units, to prevent land disturbance by future owner.	Potentially Relevant and Appropriate	Purpose of deed restrictions or other institutional controls for the alternatives is sufficiently similar to the purpose of RCRA deed notations to consider the RCRA restriction language.	Institutional controls have been implemented and include deed restrictions limiting land disturbance for properties on and adjacent to the Site. A mechanism is in place to determine future compliance with institutional controls.
RCRA General Facility Standards and Security (40 CFR Part 264, Subpart B)	General standards and security provisions for facilities that treat, store or dispose of hazardous waste.	Potentially Relevant and Appropriate	Criteria will be considered during remedial design/remedial action phases.	This ARAR is not considered relevant and appropriate since there is no hazardous waste treatment, storage or disposal facility at the Site.
RCRA Preparedness and Prevention (40 CFR Part 264, Subpart C)	Requirements for the design, construction and operation of hazardous waste facilities to maintain equipment to prevent an unplanned release.	Potentially Relevant and Appropriate	These standards will be considered during the remedial design/remedial action phases.	This ARAR is not considered relevant and appropriate since there is no hazardous waste treatment, storage or disposal facility at the Site.
RCRA Contingency Plan and Emergency Procedures (40 CFR Part 264, Subpart D)	Regulations pertaining to hazardous waste facilities requiring monitoring and corrective action for units that manage solid waste.	Potentially Relevant and Appropriate	Same as above.	Same as above.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
RCRA Releases from Solid Waste Management Units (40 CFR Part 264, Subpart F)	Regulations pertaining to hazardous waste facilities requiring monitoring and corrective action for units that manage solid waste.	Potentially Relevant and Appropriate	Same as above.	Same as above.
RCRA Closure and Post-Closure (40 CFR Part 264, Subpart G)	Regulations pertaining to closure and post-closure activities for regulated units.	Potentially Relevant and Appropriate	These standards for groundwater monitoring will be considered during development of long-term monitoring plans.	This ARAR is not considered relevant and appropriate since there is no hazardous waste treatment, storage or disposal facility at the Site.
Vermont Hazardous Waste Management Regulations (10 VSA Ch. 159)	Requirements for the management, treatment and disposal of hazardous wastes.	Potentially Relevant and Appropriate	If a contaminated medium exhibits the characteristic of a hazardous waste, these regulations are applicable. If a contaminated medium is sufficiently similar to hazardous wastes regulated by the State of Vermont, these regulations are relevant and appropriate. The requirements for storing hazardous wastes and designing, constructing and operating hazardous waste facilities will be considered during remedial design and remedial action.	Contaminated soil moved to Area 3 during weir construction was tested and found to be non-hazardous. Some waste materials were identified during construction as hazardous and were disposed of at a RCRA disposal facility. Some soil consolidated under the Area 3 and Area 2 cap may be characteristic hazardous waste.
State Water Quality Policy (10 VSA § 1250)	Establishes policy to protect and enhance the quality, character and usefulness of surface water and to assure the public health; control the discharge of wastes to the waters of the State;	Applicable	These criteria will be considered during design of cap placement techniques.	The criteria were applicable. Engineering controls were used during construction to prevent impacts. Surface water sampling performed during and following construction has indicated that there were no short-term or long-term impacts to

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
	prevent degradation of high quality waters; and prevent, abate or control all activities harmful to water quality.			surface water quality. Long-term monitoring of surface water is conducted.
Vermont Water Quality Standards (10 VSA Ch. 47, EPR Ch. 1) and Vermont NPDES Permit Program (10 VSA Ch. 47)	Establishes requirements for surface water quality, effluent standards and/or limitations for discharges to surface water.	Applicable	Surface water quality presently meets Ambient Water Quality Criteria (AWQC). However, these standards will be considered during design and construction of the cap.	Engineering controls were used during construction to prevent impacts. Surface water sampling was performed during construction and it concluded that there were no short-term or long-term impacts to surface water quality. Long-term monitoring of surface water is conducted and the results are compared to AWQC.
Vermont Air Pollution Control Regulations (10 VSA Ch. 23 § 554)	Lists hazardous contaminants and sets Hazard Limiting Values and Action Limits for numerous compounds. Identifies source registration and pollution control requirements.	Applicable	These values and action limits will be considered during design of cap placement techniques.	Generation of dust during construction was not an issue because the soils/sediments were generally moist. The size of the sand stockpiles was minimized to reduce dust generation during construction. Air monitoring was conducted during construction.
Vermont Primary and Secondary Ambient Air Quality Standards (5-304, 5-305)	Establishes maximum 24-hour concentrations and annual geometric mean ambient air quality standards for particulate matter.	Relevant and Appropriate	These standards will be considered during design of cap placement techniques.	Same as above.
Stormwater Discharge Permit (10 VSA § 4152)	Limits stormwater runoff off the Site.	Relevant and Appropriate	No stormwater from the Site has been identified to exceed pertinent standards. Alternative 3a has measures to manage runoff.	This ARAR was met during construction. Stormwater runoff from construction areas was controlled prior to discharge downstream with silt curtains and booms.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
Vermont Wetland Regulations (10 VSA Ch. 37)	Procedures to identify and protect significant wetlands and the values and functions which they serve in such a manner that the goal of no net loss of such wetlands and their functions is achieved.	Applicable	Wetlands functions and values will be restored by implementation of these measures. Alternative 3a most completely addresses this ARAR.	This ARAR is being complied with through restoration of impacted wetland habitat areas, invasive species control and continued monitoring.
Vermont Dam Regulations (10 VSA Ch. 43)	This law governs all dams that are constructed in the State impounding more than 500,000 cubic feet of water and sediment, except those dams relating to the generation of electrical power for public use.	Potentially Applicable	If design calculations indicate that the volume of impounded water may exceed 500,000 cubic feet, these regulations would apply to the design of the weir. The requirements of this law include: 1) proper notification of state and local offices; 2) preparation of plans and specifications for the project by an engineer; 3) determination of public good; and 4) oversight of the construction of the project by an engineer.	This ARAR was applicable to the construction of the weir, since the volume of impounded water was determined to be greater than 500,000 cubic feet, and has been met. The design and construction was conducted according to VT DEC Facilities Engineering Division requirements and the City of Burlington was notified of the project.
EPA OSWER Directive 9285.6-08 (2002) Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites	Provides for an iterative approach at sites with contaminated sediments to address risks, and calls for early control of contaminated sources.	TBC	Consider the use of planned actions to address complex contaminated sediment sites.	Although directive was issued after the 1998 ROD, the remedial approach has been phased, as seen in the 1998 ROD, the ESD in 2009 that resulted in placing a reactive core cap in a 250 foot section of the canal, and an ESD in 2011 that provides for installation of a barrier to protect Lake Champlain from groundwater contamination that could migrate from the Site.

SUMMARY OF ARARs FOR PINE STREET CANAL SUPERFUND SITE (continued)

Requirements/ Criteria	Description	Evaluation Decision	Action to be Taken to Attain ARAR (from ROD)	Five-Year Review
EPA OSWER Directive 9355.0-85 (2005) Contaminated Sediment Remediation Guidance for Hazardous Waste Sites	Guidance for remedy selection at sites with contaminated sediments.	TBC	Consider factors in guidance when making remedial decision. When capping contaminated sediments, consider the physical environment, sediment characteristics, waterway uses, habitat alterations, materials, geotechnical and other design issues, placement methods and performance monitoring.	This guidance was issued after the 1998 ROD, but was considered in development of the 2009 and 2011 ESDs.