Five-Year Review Report

for

Pine Street Barge Canal Superfund Site

Burlington,

Chittenden County, Vermont

October 2006

PREPARED BY:

United States Environmental Protection Agency
Region 1
Boston, Massachusetts

Date:

Susan Studlien 10/03/06

Susan Studlien, Director
Office of Site Remediation and Restoration
United States Environmental Protection Agency, Region 1

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LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYM	DEFINITION
ARAR	Applicable or Relevant and Appropriate Requirement
ARI	Additional Remedial Investigation
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.*
COC	Contaminant of Concern
DNAPL	Dense non-aqueous phase liquid
EPA	Environmental Protection Agency
GE	General Electric Company
ICs	Institutional Controls
JCO	The Johnson Company
LCMM	Lake Champlain Maritime Museum
LNAPL	Light non-aqueous phase liquid
M&E	Metcalf & Eddy
MCLs	Maximum Contaminant Levels
MGP	Manufactured gas plant
MOA	Memorandum of Agreement
μg/kg	Micrograms per kilogram
μg/wipe	Micrograms per wipe
mg/kg	Milligrams per kilogram
NAPL	Non-aqueous phase liquid
NCP	National Contingency Plan, 40 CFR Part 300
NGVD	National geodetic vertical datum
NPL	National Priority List
NRHP	National Register of Historic Places
O&M	Operation and maintenance
ppm	Parts per million

ACRONYM	DEFINITION
PAHs	Polycyclic aromatic hydrocarbons
PRG	Preliminary remediation goal
PRP	Potentially Responsible Party
PSBCCC	Pine Street Barge Canal Coordinating Council
RA	Remedial action
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
SOW	Statement of Work
SVOCs	Semivolatile Organic Compounds
TBC	To Be Considered
TSS	Total Suspended Solids
VOCs	Volatile Organic Compounds
VTAOT	Vermont Agency of Transportation
VTDEC	Vermont Department of Environmental Conservation
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This five-year review report was prepared for the Pine Street Barge Canal Superfund 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 included the capping of contaminated sediments within the canal and turning basin and within 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 from storm sewers at the Site was redirected to control sedimentation. The remedy also includes the establishment of 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 includes the long-term performance monitoring of groundwater, surface water, stormwater, sediments, and the cap. Long-term monitoring is currently being conducted.

This is the first five-year review for the Site. The requirement for conducting five-year reviews is incorporated in Section121 (c) of CERCLA 42 § 9621 (c). Depending on the selected remedial action, the five-year review may be required by statute or conducted as a matter of EPA policy. This review is required by statute because the selected remedy for the Site results in hazardous substances remaining on site above health-based levels. The trigger for this statutory review is the start of actual remedial action (RA) on-site construction at the beginning of October 2001. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

This five-year review concluded that the remedy is currently protective except for the subaqueous cap in portions of Areas 1 and 2 (between T9 and T14) because it does not meet the cap performance standard for isolation of contaminants due to the ongoing release of NAPL; exceeds ecologically-protective sediment benchmarks established in the ROD; exposes fauna living in and around the canal to highly-contaminated waste in the form of free-phase coal tar; and may constitute a loss of benthic habitat. A solution should be implemented to control and eliminate releases of NAPL to the cap and water surface. The lack of a mechanism to determine compliance with institutional controls that have been established to restrict land and groundwater use at the Site will affect remedy protectiveness in the future. The vapor intrusion pathway has not been evaluated and groundwater data indicate the possible presence of subsurface volatile organic compounds in the vicinity of occupied buildings at levels exceeding EPA screening criteria. The indoor air pathway should be evaluated to determine potential risk, if any, to current and future indoor receptors at the Site. Finally, the compliance monitoring program may not be adequate to monitor performance standards for contaminant migration in the future, given new site conditions. This, too, may affect future protectiveness.

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: 1/31/2006 to 10/3/2006		
Date(s) of site inspection: 5/3, 5/4, 5/10, 5/16, and 6/12/2006		
Type of review: ☒ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion		
Review number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)		
Triggering action: ☒ Actual RA Onsite Construction ☐ 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, cont'd.

Issues:

The cap performance standard for isolation of contaminants in the area between T9 and T14 (see Figure 2) is not being met due to the ongoing release of NAPL through the cap. There, the subaqueous cap has not prevented contact between contamination and benthic organisms and fish, and, sediment exceeds benchmarks that are ecologically protective.

Institutional controls to restrict the use of land and groundwater at the Site have been established, however, there is no mechanism in place to determine future compliance with institutional controls.

The subsurface vapor intrusion (i.e. indoor air) pathway was not evaluated in previous risk evaluations. A comparison of historical groundwater data and recently collected groundwater data to generic screening values for the vapor intrusion pathway indicated the possible presence of subsurface VOCs in the vicinity of currently occupied buildings at levels exceeding screening criteria.

An expanded Class IV boundary and new information regarding the location and potential mobility of a significant accumulation of NAPL in the subsurface at the southern portion of the Site call into question the ability of the existing compliance monitoring program to adequately monitor performance standards for contaminant migration.

Recommendations and Follow-up Actions:

Implement a solution to control and eliminate releases of NAPL to the subaqueous cap surfaces. Limit to the extent practicable human exposures to released NAPL and impacted surface water/sediment within the canal until a solution is implemented or the impacts of the NAPL have been assessed.

Develop and implement a plan to monitor compliance with institutional controls.

Evaluate the indoor air pathway to determine potential risk, if any, to current indoor receptors at the Site.

Review and modify, if necessary, the existing compliance monitoring program.

Protectiveness Statement(s):

The remedy is currently protective, except for the subaqueous cap in portions of Areas 1 and 2 between transects T9 and T14 due to the ongoing releases of free-phase coal tar (NAPL).

The remedy will not be protective in the future without a mechanism in place to monitor to determine compliance with institutional controls that have been established to restrict land and groundwater use at the Site.

Two issues that must be evaluated in order to determine protectiveness in the future are:

1. The vapor intrusion to indoor air pathway and the potential to impact current or future indoor receptors.
2. The ability of the existing compliance monitoring program to adequately monitor performance standards for contaminant migration given new site conditions.

Other Comments: None.

SECTION 1.0
INTRODUCTION

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

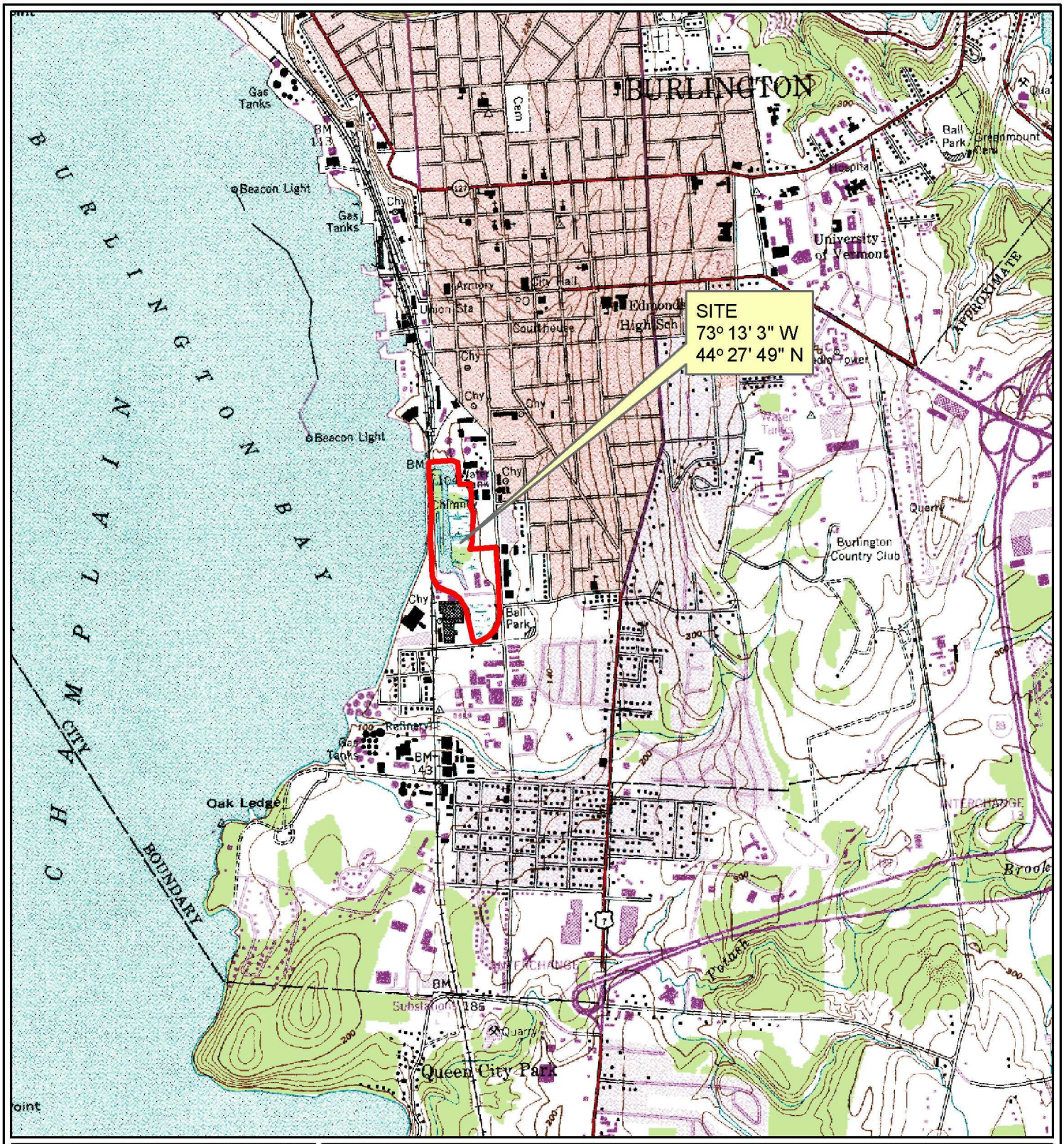
EPA Region I has conducted this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP). Section 121(c) of CERCLA 42 USC § 9621(c) states:

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

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

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

This is the first five-year review for the Pine Street Barge Canal Superfund Site. This review is required by statute because the selected remedy for the Site results in hazardous substances remaining on site above health-based levels. The trigger for this statutory review is the start of actual remedial action (RA) on-site construction at the beginning of October 2001. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.



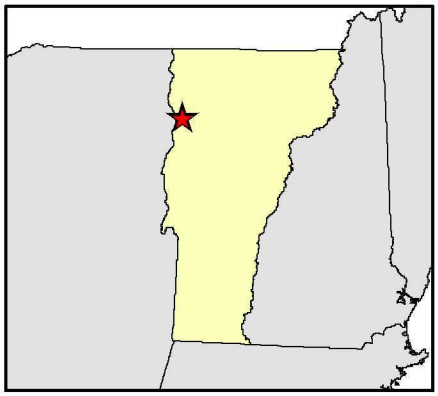


FIGURE 1
SITE LOCUS MAP

Pine Street Canal
Superfund Site
Burlington, Vermont

N
W E
S

1:25,000

0 625 1,250 2,500
Feet

METCALF & EDDY | AECOM

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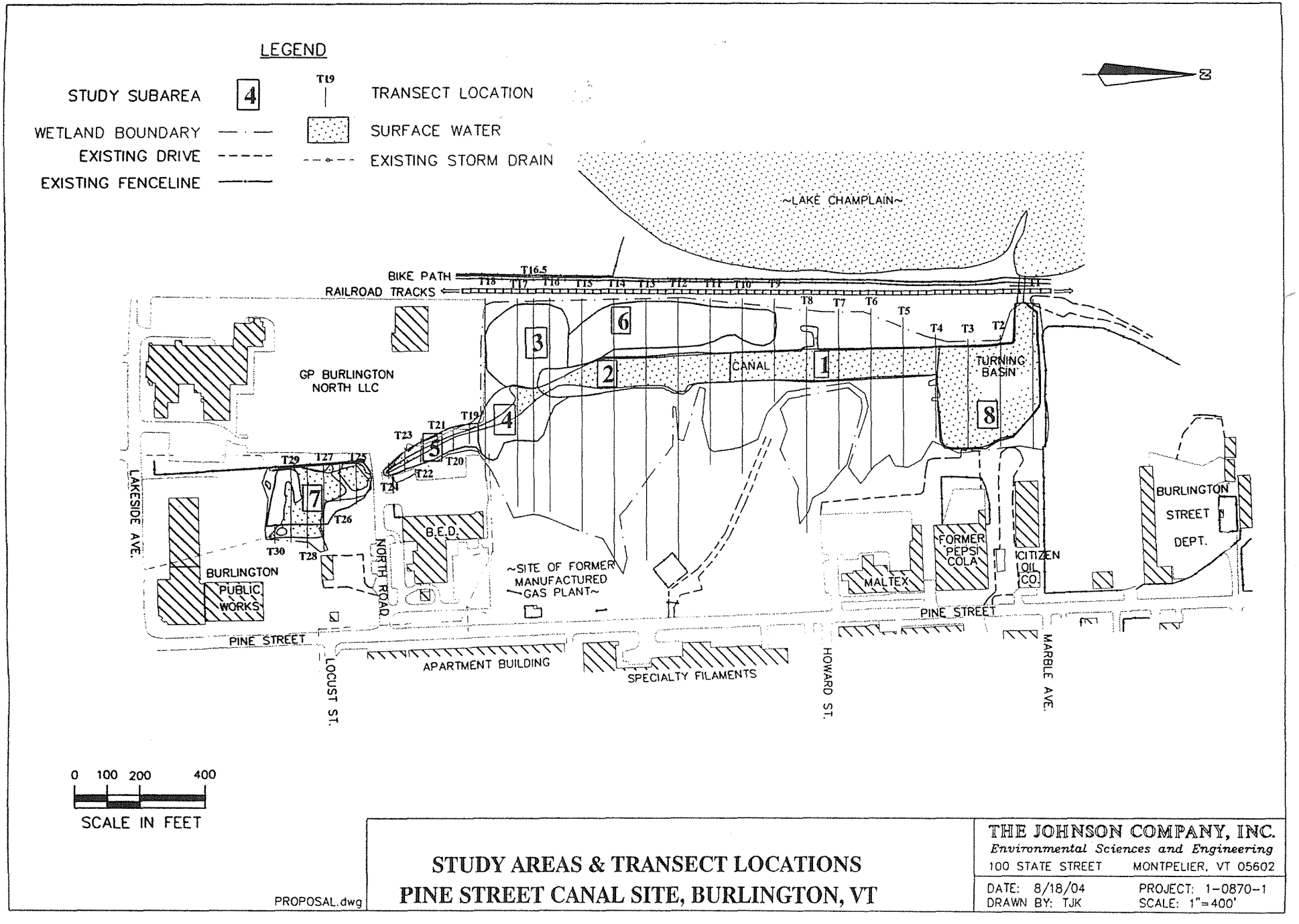

FIGURE 2 (Five-Year Review Report; Source: Johnson Company, 2004b)

SECTION 2.0
SITE CHRONOLOGY

The chronology of the Site, including all significant site events and dates is included in Table 1. Additional events and details are provided in Section 3.0, Background.

TABLE 1. CHRONOLOGY OF SITE EVENTS

DATE	EVENT
Around 1895	Burlington Gas Works moved to a location on Pine Street and began to produce manufactured gas
1944	Large amount of potentially contaminated clay was excavated from the floors of the former General Electric (GE) facility (also the location of the former General Dynamics and Burlington North LLC; currently known as the Gilbane property) and replaced by concrete flooring
1948-1967	GE was disposing of potentially hazardous wastes, in what officials think may be the north end of the study area; Army Corps of Engineers required GE to clean up the area in 1979
April 1967	City permit issued to Vermont Gas Systems to dismantle buildings on manufactured gas plant site
May 1, 1967	Investigation of oil spill took place
July 14, 1967	Burlington Free Press article and picture of fire in the foundation of the gas holder
October 19, 1967	Excavation of Burlington Electric Department headquarters; 20,000 cubic yards of dirt removed, but no records of where it was disposed
December 27, 1967	Western part of former coal gasification plant land sold by the City to G.S. Blodgett
July 13, 1968	State investigated oil spills in the lake from the barge canal; meetings held with landowners to discuss the placement of a dike around the oil and installation of booms across the canal to protect the lake
1968	Drainage ditch that had funneled oils and coal tar from the former gasification plant to the canal plugged
1977-1978	VTAOT conducted soil borings; estimated that 150,000 - 200,000 cubic yards of contaminated material would have to be removed
1978-1980	VTAOT and VTDEC coordinated in developing plans for evaluating and remediating the canal relating to the development of the proposed right-of-way
May 1981	VTDEC sampled water in the canal and turning basin
October 23, 1981	Site proposed for the National Priorities List (NPL)

DATE	EVENT
September 8, 1983	Site listed on the NPL
October to December 1985	Maltex Pond emergency removal action performed by EPA; 444 tons of soil disposed at GSX, Pinewood, SC
May 1990	Draft Remedial Investigation report completed by PEER Consultants on behalf of EPA
March 1992	Supplemental Remedial Investigation Final Report completed by Metcalf & Eddy on behalf of EPA
May 1992	Baseline Risk Assessment Final Report completed by Metcalf & Eddy on behalf of EPA
November 1992	EPA issued proposed plan; Feasibility Study Report completed by Metcalf & Eddy on behalf of EPA
March 1993	State of Vermont implements Class IV Groundwater Classification boundary encompassing portions of the Site
Spring 1993	EPA withdrew cleanup plan proposed in November 1992
Fall 1993	Pine Street Barge Canal Coordinating Council (PSBCCC) formed
July 1997	Supplemental Baseline Ecological Risk Assessment completed by Roy F. Weston on behalf of EPA
July 1997	Additional Remedial Investigation report completed by Johnson Company and submitted to EPA
May 1998	EPA issued second proposed plan; Additional Feasibility Study Report completed by Remediation Technologies, Inc. (RETEC) and submitted to EPA
September 29, 1998	Record of Decision for the Site is signed by EPA
December 23, 1999	Remedial Action design/build team of The Johnson Company and Fleet Environmental approved by EPA
February 11, 2000	Performing Defendants receive notice from the United States District Court for the State of Vermont that the Consent Decree is entered
February 24, 2000	Submittal of the Remedial Design Workplan, Revision 0
August 24, 2000	Submittal of the Remedial Design Workplan, Revision 1
September 28, 2000	EPA conditional approval of Remedial Design Workplan
Fall 2000	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

DATE	EVENT
October 2, 2001	EPA approval of Phase 1A (Outlet Weir) 95%/100% Design Submittal, Revision 1 with revisions dated September 21, 2001
October 2001	Outlet weir construction
November 1, 2001	Outlet weir construction final inspection, EPA and VTDEC
April 10, 2002	EPA final approval of Remedial Design Workplan, Revision 1 dated August 24, 2000
April 10, 2002	EPA approval of Compliance Monitoring Workplan, Final Revision 3, April 3, 2002
June 2002	Memorandum of Agreement for Mitigation of Historic Resources signed
July 8, 2002	EPA conditional approval of the Phase 1B Final Design, May 9, 2002 with revisions June 17, 2002
End of July 2002	Initiate Phase 1B construction
September 19, 2002	EPA approval of the Phase 2 (sub-aqueous capping of canal and turning basin) Conceptual Design
December 3, 2002	EPA approval of Design Change #10 (dewatering of canal and capping sediments in the “dry”), 150 foot test section, followed by the remainder of the canal
January 24, 2003	EPA conditional approval of Design Change #11 (capping of the turning basin sediments in the “dry” and capping of the 100 x 100 foot area)
March 18, 2003	Completion of capping canal and turning basin sediments
March 21, 2003	Re-flooding of canal and turning basin
Spring 2003	Observation of NAPL seeps on the water and cap surface in area of west bank
January 29, 2004	EPA approval of Supplemental West Bank Capping Remedial Action Workplan
June 17 to July 15, 2004	West bank capping and NAPL removal
July 2004	Restrictive easements recorded on parcels listed in Attachment 1
August 6, 2004	EPA and VTDEC Construction Completion Inspection
September 2004	Remedial Action Construction Completion Report completed by The Johnson Company for the Performing Defendants and submitted to EPA and VTDEC; O&M plan for Area 7 and the BED outfall received from City of Burlington, DPW
Fall 2004	Continued observation of NAPL on the canal subaqueous cap
December 30, 2004	EPA conditionally approved Remedial Action Construction Completion Report; outstanding issue is monitoring to determine compliance with institutional controls
November 2005	Draft NAPL Action Plan submitted by BBL/Hart Crowser on behalf of the Performing Defendants

DATE	EVENT
December 2005	Demonstration of Compliance Report completed by The Johnson Company for the Performing Defendants and submitted to EPA and VTDEC
January 2006	State of Vermont expands Class IV boundary; draft NAPL Work Plan submitted by BBL/Hart Crowser on behalf of the Performing Defendants
April 2006	Final NAPL Action Plan and Work Plan approved by EPA
May 2006	NAPL field investigations begin; expected to conclude December 2006

SECTION 3.0
BACKGROUND

3.1 PHYSICAL CHARACTERISTICS AND LAND AND RESOURCE USE

The Pine Street Barge Canal Superfund Site ("the Site") is located in Burlington, Chittenden County, Vermont. The Site is defined in the Record of Decision (ROD) (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 ROD 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. 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.

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 suitable only for agricultural or commercial uses and drinking water use is prohibited. The City of Burlington currently supplies potable water to all residences and businesses in the city.

The ROD indicates that 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. The ROD also indicates that several locations on and surrounding the Site are possible candidates for the National Register of Historic Places (USEPA, 1998a).

Former land uses at the Site are summarized in section 3.2.

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 community. 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 the lake. 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 constructed on the Site. The borings revealed extensive subsurface contamination. The Site was proposed for the National Priorities List (NPL) on October 23, 1981 and listed on September 8, 1983.

In 1985, EPA undertook an emergency removal action at the former Maltex Pond. The Vermont Department of Environmental Conservation (VTDEC) provided field oversight. Six to eighteen inches of coal tar-contaminated soil was removed from the surface, mixed with limestone, solidified, 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 for site investigations and broadened their scope.

Remedial investigation activities were conducted by EPA between 1988 and 1992. The results of these activities are contained in the Draft RI Report (PEER, 1990); Supplemental RI Rpeort (M&E, 1992a); Baseline Risk Assessment Report (M&E, 1992b) and Feasibility Study Study Report (M&E, 1992c).

In November 1992, EPA proposed a cleanup plan for the Site. The plan called for (1) the construction of a containment/disposal facility (CDF) over the most heavily contaminated portion of the Site; (2) dredging contaminated sediments from the canal and turning basin and placing the sediments in the CDF; (3) collecting mobile coal tar and coal oil; (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 fill in data gaps from the prior studies, and to recommend a proposed remedy for the Site to EPA. Under the oversight of EPA and the state of Vermont, and with involvement of the PSBCCC, additional studies of the Site 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 detected at the Site, as identified in the remedial investigations and during subsequent investigations and summarized in the Record of Decision.

Surface Soil. PAHs were identified as the primary contaminant in surface soils (top 6 inches) with other organic chemicals detected infrequently and at low concentrations in surface soils based on the 1992 supplemental remedial investigation. PAH concentrations were highest to the west of the former coal gasification plant, 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 to the west of the former coal gasification plant and south of the Burlington Electric Department. PAHs and metals were also detected in additional shallow surface soil sampling (top 4 inches) conducted during the 1997 additional remedial investigation.

Subsurface Soil. Subsurface soil sampling (deeper than 12 inches), conducted during the 1992 supplemental remedial investigation, 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. 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 NAPL is present within this area. BTEX compounds were also detected in subsurface soils outside the free-phase 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 coal gasification plant; 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/General Electric).

Groundwater. Groundwater sampling conducted during the 1992 supplemental remedial investigation and 1997 additional remedial investigation indicated the presence of PAHs, BTEX, and cyanide in overburden groundwater. The highest PAH concentrations were found in groundwater west of the former MGP but were also detected south of the Burlington Electric Department and 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 (NAPL) is present in the subsurface.

Sediment. Extensive PAH contamination was detected in shallow (top 4 inches) sediments in the canal and wetlands during the 1997 ARI. 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 VOCs and SVOCs were detected in the canal during the 1992 supplemental remedial investigation (M&E, 1992a). Metals concentrations in the canal water were generally less than the concentrations found in groundwater. Surface water samples collected within Lake Champlain, adjacent to the Study Area, 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 sampling conducted during the 1992 supplemental remedial investigation (M&E, 1992a) and 1997 additional remedial investigation (JCO, 1997) indicated that during undisturbed conditions, there are no impacts on local ambient air from contaminated soil and sediments.

Summary of Human Health Risks. The 1992 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 1. Carcinogenic and non-carcinogenic risk estimates were below, within, or close to EPA's target risk range for receptors including swimmers in Lake Champlain, current Site visitors, outdoor workers exposed to soils above a depth of 5 feet, or future visitors (adults and children) to an area which may be 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 1992, 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. Position papers found in Additional Remedial Investigation Report (JCO, 1997) document these additional exposure pathways. The following summarizes the additional evaluations and results for the additional exposure pathways.

- Additional shallow soil samples were collected which confirmed the previous finding regarding shallow soils.
- Additional air sampling confirmed that the Site does not impact local ambient air under undisturbed conditions.
- Use of Site groundwater for agricultural and commercial uses was evaluated and it was concluded that there is no unacceptable risk.
- 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 metals, with the exception of mercury. However, mercury contamination in fish is a regional problem.
- An evaluation of PAHs and fish consumption concluded that there is not likely an unacceptable risk.
- It was concluded that legal controls would be needed to limit potential future exposure to subsurface soils (deeper than 5 feet).
- Additional studies confirmed that there is no unacceptable Site-related human health risk to swimmers in Lake Champlain or persons using it as a drinking water source.

- It was concluded that the 1992 human health risk assessment was conservative enough to accommodate the possibility of some synergistic (i.e., greater than additive) effects between chemicals.
- Zoning ordinances at the time of the ROD did not restrict the placement of a day care center for children on the Site. It was concluded that there is a concern from potential exposures of children to lead and carcinogenic PAHs in Site soils.

Summary of Ecological Risks. COCs identified in the Baseline Risk Assessment (M&E, 1992b) and Supplemental Baseline Ecological Risk Assessment (Weston, 1997) included several PAHs and metals (including mercury). The BRA and SBERA concluded that there was an unacceptable risk to environmental receptors from site-related contaminants. The following summarizes the conclusions of the two ecological risk assessments:

- PAHs and metals in sediments exceeded sediment guidelines published by NOAA and the Ontario Ministry of Environment and Energy indicating possible impacts to sediment-dwelling organisms and benthic species.
- Data collected in the turning basin (Area 8) and the canal exceeded draft EPA sediment quality criteria for certain PAHs.
- 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 selected remedy as outlined in the ROD. See Section 4.0 for additional details.

SECTION 4.0
REMEDIAL ACTIONS

4.1 REMEDY SELECTION

EPA issued the ROD for the Site in September 1998. The remedial action objectives provided in the ROD are summarized as follows:

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 of contaminated sediments in all areas where an unacceptable ecological risk has been found, effectively isolating the contamination below the biologically active zone. This includes subaqueous capping of Areas 1, 2, and 8 (the canal and turning basin) and construction of a cap in the emergent wetlands in Areas 3 and 7. This also includes placement of a soil cover over an approximately 100 x 100 foot area of upland/wetlands, located south of the turning basin and just east of the canal.

- Long-term performance monitoring of groundwater, surface water, stormwater, sediments, and cap.

- Establishment of 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.

As part of construction of the subaqueous cap, the selected remedy included construction of a permanent weir at the mouth of the turning basin, where it enters Lake Champlain; aquatic and wetlands habitat restoration; and the redirection of stormwater from municipal storm sewers at the Site.

4.2 REMEDY IMPLEMENTATION

This section presents summaries of the remedial actions conducted at the Site in accordance with the ROD and as described in the Remedial Action Construction Completion Report (JCO, 2004). Operation & maintenance activities and long-term performance monitoring are ongoing as described in Section 4.3.

A Consent Decree and Statement of Work (agreed to by EPA, the State of Vermont and the Defendants) was entered as an order of 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: Phase 1A – construction of the weir, Phase 1B – cap construction in Areas 3 and 7, and Phase 2 – construction of the subaqueous cap in the canal and turning basin. However, as a result of design changes made during Phase 1B, 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. Phase 1A was conducted first to allow for 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. Construction of the weir took place in October 2001 and received a final construction inspection by EPA on November 1, 2001. 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. The Phase 1A Remedial Action Construction Completion Report was submitted to EPA in January 2002.

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 (BED) 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 was implemented during the winter of 2002/2003 and as an extension of 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 waterways, GeoWeb® was paced on sand and filled with crushed stone to provide erosion protection. Capping of a 100 x 100 foot area south of the turning basin and just east of the canal was done following the winter installation of the cap in the canal and turning basin. The cap in this area consisted of sand and topsoil.

In the spring of 2003, following a high seasonal lake water level, non-aqueous phase liquid (NAPL), both lighter and denser than water (LNAPL and DNAPL), was observed on a portion of the west bank of the canal outside of the cap footprint, and on top of the subaqueous canal cap adjacent to the west bank area. Sheens and globules of NAPL were also observed on the water surface in the canal. During the fall of 2003, a NAPL response strategy was developed which recommended additional capping over the affected portion of the west bank of the canal and removal of DNAPL that had accumulated on the surface of the cap in the canal. Additional investigations of the nature and extent of NAPL contamination on the canal cap and near sub-surface were performed by the Performing Defendants and, based on the results, the West Bank Cap Remedial Action Workplan and Supplemental West Bank Cap Remedial Action Workplan were prepared by Johnson Company, in the late fall of 2003. The west bank cap construction and DNAPL removal were implemented in the summer of 2004.

Wetlands restoration activities were performed in accordance with the Wetland Restoration Plan, contained in the Phase 1B Remedial Action Design Report, and the supplemental restoration plan for the west bank cap, with certain modifications. The initial seeding and planting within the wetland restoration

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

It was determined that sunken barges in the canal and other features at the Site were eligible for the National Register of Historic Places. The Performing Defendants entered into a Memorandum of Agreement for Mitigation of Adverse Effects with EPA and the State of Vermont which was complied with during construction. Under the plan, the Lake Champlain Maritime Museum studied another sunken barge of similar type but located at the bottom of Lake Champlain proper. Field work on the barge, called the Sloop Island Canalboat, was conducted during the summers of 2002 and 2003. A large number of artifacts were collected from the barge and were put on display at the Lake Champlain Maritime Museum in Vergennes, Vermont.

The Remedial Action Construction Completion Report, prepared by The Johnson Company, Inc., was submitted to EPA in September 2004. EPA conditionally approved the Remedial Action Construction Completion Report on December 30, 2004. The outstanding issue is the lack of a mechanism in place to monitor to determine compliance with institutional controls that have been established to restrict the use of land and groundwater.

4.2.3 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 Remedial Design/Remedial Action Statement of Work (RD/RA SOW) (USEPA, 2000), includes the establishment, maintenance, and appropriate enforcement, where necessary, of use restrictions on all parcels for which institutional controls are required.

Institutional controls have been established, as required by the ROD, Consent Decree, and RD/RA SOW, in the form of restrictive easements and the renewal/expansion of the Class IV groundwater boundary. The restrictive easements were recorded in July 2004 on those parcels shown in Attachment 1. The State of Vermont petitioned itself for re-classification of the groundwater beneath the Site as Class IV (non-potable) which went into effect on March 3, 1993. In January 2006, the Class IV boundary was expanded as shown on Figure 3.

4.3 SYSTEM OPERATIONS/OPERATION AND MAINTENANCE

Three monitoring phases were specified in the ROD: pre-construction, construction/post-construction, and long-term monitoring. 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 (O&M), with EPA approval of the Remedial Action Construction Completion Report (JCO, 2004b) in December 2004. In December 2005, the Demonstration of Compliance Report was submitted to EPA and VTDEC (JCO, 2005c). The Demonstration of Compliance Report, and semi-annual Compliance Monitoring Reports, form the basis of this five-year review. 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 the Compliance Monitoring Workplan, Revision 4, which was submitted to EPA and VTDEC on August 3, 2004. 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

Additionally, monitoring has been performed to assess the impact of NAPL seeps which appeared after construction of the cap. Refer to Section 6.3 for a review of documents and monitoring data associated with these monitoring activities.

In 2006, the Performing Defendants expect to spend an estimated $208,500 for operation and maintenance (primarily on the weir), and, site-wide compliance monitoring (Helgason, 2006). This does not include costs associated with maintenance of the stormwater features in Area 7 and the Burlington Electric Department (BED) outfall which is being conducted by the City of Burlington, Department of Public Works pursuant to a monitoring plan dated September 2004.

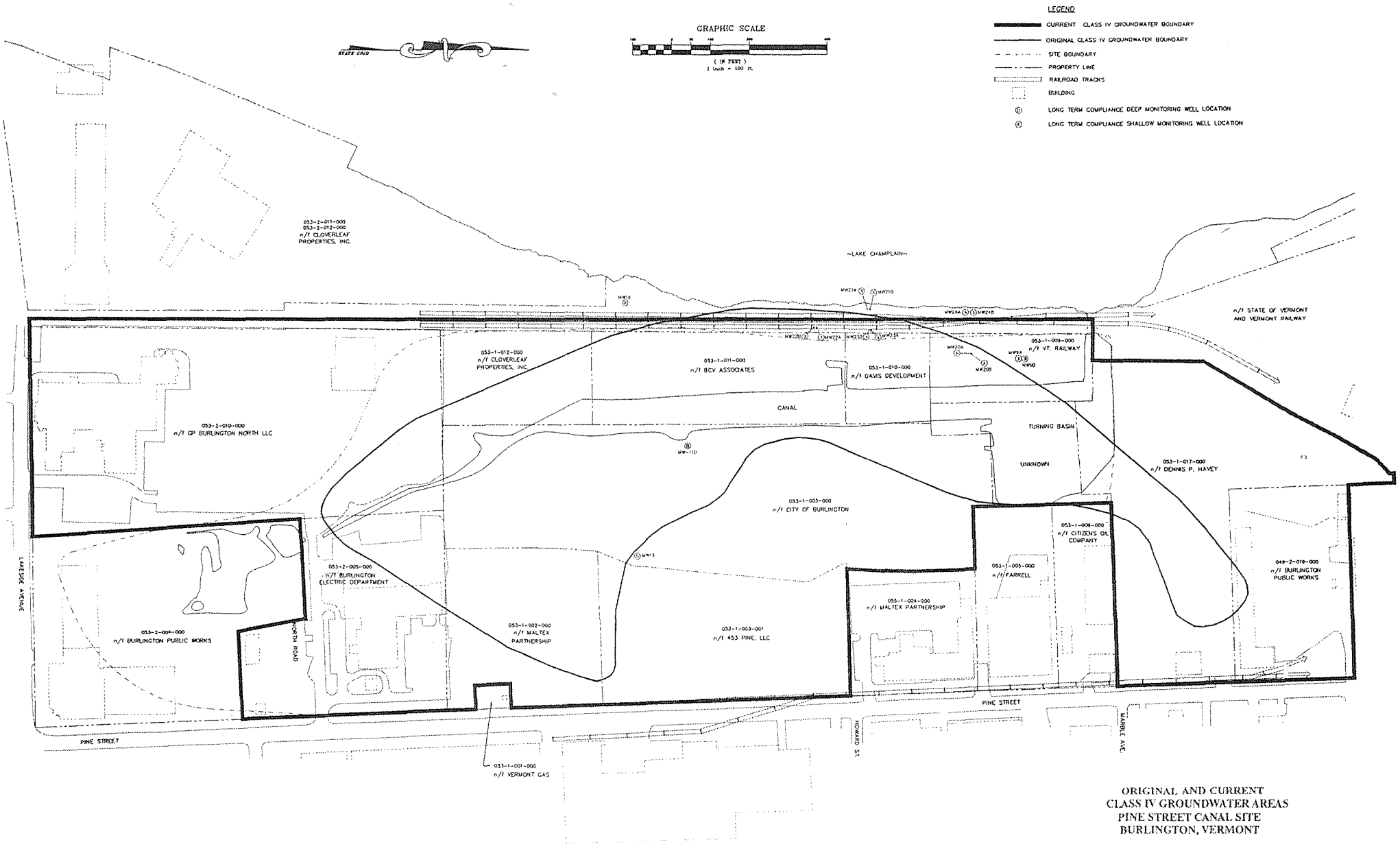

FIGURE 3 (Five-Year Review Report)

SECTION 5.0
PROGRESS SINCE LAST FIVE-YEAR REVIEW

This section is not applicable because this is the first five-year review for the Site.

SECTION 6.0
FIVE-YEAR REVIEW PROCESS

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

6.1 COMMUNITY NOTIFICATION AND INVOLVEMENT

On June 8, 2006, EPA issued a press release to the media outlets and to the Pine Street mailing list announcing that the five-year review was underway. 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 five-year review consisted of a review of relevant documents for the Site. See Attachment 2 for a list of documents that were reviewed.

6.3 DATA REVIEW

Performance standards for the remedy include the requirement that the subaqueous cap must prevent contact between underlying contaminants and benthic organisms and fish in the biologically active part of the benthic habitat at ecologically harmful levels; and 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. Additional monitoring was performed to assess the impact of NAPL seeps which appeared after construction of the cap.

Three monitoring phases were specified in the ROD: preconstruction, construction/post-construction, and long term-monitoring. This report focuses on post-construction and long-term monitoring as appropriate. Additional monitoring was performed to assess the impact of NAPL seeps which appeared after construction of the cap (see section 6.3.2).

6.3.1 Review of Groundwater, Surface Water, Stormwater Inflow, Sediment Transport, and Cap Physical and Chemical Monitoring Data

6.3.1.1 Groundwater Data Review. 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 drinking water Maximum Contaminant Levels (MCLs), and to confirm contaminants are not migrating to Lake Champlain. It should be noted that the Class IV groundwater boundary was recently expanded (January 2006) and some wells that were once outside the boundary are now contained therein. A figure showing the original and new Class IV groundwater boundary is included as Figure 3. Monitoring wells MW-18, MW-21A and B, and MW-24A and B lie outside the Class IV boundary between the Site and Lake Champlain. MW-20 A and B, MW-22A and B, and MW-23A and B are located within

the Class IV boundary. MW-13, and MW-9A and 9B were located outside of the original Class IV boundary but are now inside the boundary (see Figure 4). Monitoring wells MW-21 A and B, MW-24 A and B, and MW-9 A and B act as sentinel wells to indicate the presence of groundwater contamination migration across the Class IV boundary or to Lake Champlain. In general, well pairs identified as "A" and "B" are both considered shallow wells but the "B" wells have deeper screen depth than the "A" wells.

In the event of MCL exceedances, the performance monitoring requirement also included 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.

The groundwater compliance monitoring program includes spring and fall sampling of overburden wells and fall sampling of deep wells. Groundwater level measurements are conducted during spring and fall, concurrently with groundwater sampling events. 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 GP Burlington North LLC) are shown in Figures 5 and 6. Ten wells are also monitored for the presence of NAPL, and if NAPL is present, it is removed from the well. Monitoring wells used to monitor NAPL are shown in Figure 7. All groundwater samples are analyzed for BTEX and PAHs (unfiltered). Overburden groundwater samples are also analyzed for total metals.

Four recovery wells were installed to monitor and remove accumulations of NAPL during construction of the west bank cap. These wells are not included in the groundwater compliance monitoring program but are discussed in section 6.3.2 of this report.

Groundwater Flow

In the ARI, groundwater was determined to flow generally onto the Site and into the Class IV boundary, except within the northern portion of the peninsula between the canal and the lake where groundwater intermittently flows toward the lake depending on hydraulic and precipitation conditions, such as when the canal stage is higher than the lake stage. Monitoring well clusters MW-9, -20, -21, -22, -23, and -24 are located within this area.

Water levels on the Gilbane property, just south of Area 3, are monitored in five shallow wells screened within the surficial fill unit (Figure 6). Groundwater on this property has generally been shown to be flowing from the south and southwest (into Area 3 of the Site), which is consistent with groundwater flow directions described for this area in the ARI. One exception includes groundwater flow directions generated from water level measurements collected on October 31, 2002, which show groundwater flowing toward the southwest, away from Area 3. No explanation for this presumed anomaly was provided in the Compliance Monitoring Fall 2002 Report (JCO, 2003). Typical flow directions demonstrate that groundwater contaminants are not migrating from the canal toward the Class IV boundary in this portion of the Site.

Groundwater flow direction on the northern portion of the peninsula generally flows either toward the lake or the canal, dependent on hydraulic conditions. The following table summarizes groundwater flow conditions within this area, as gathered from the Compliance Monitoring Reports:

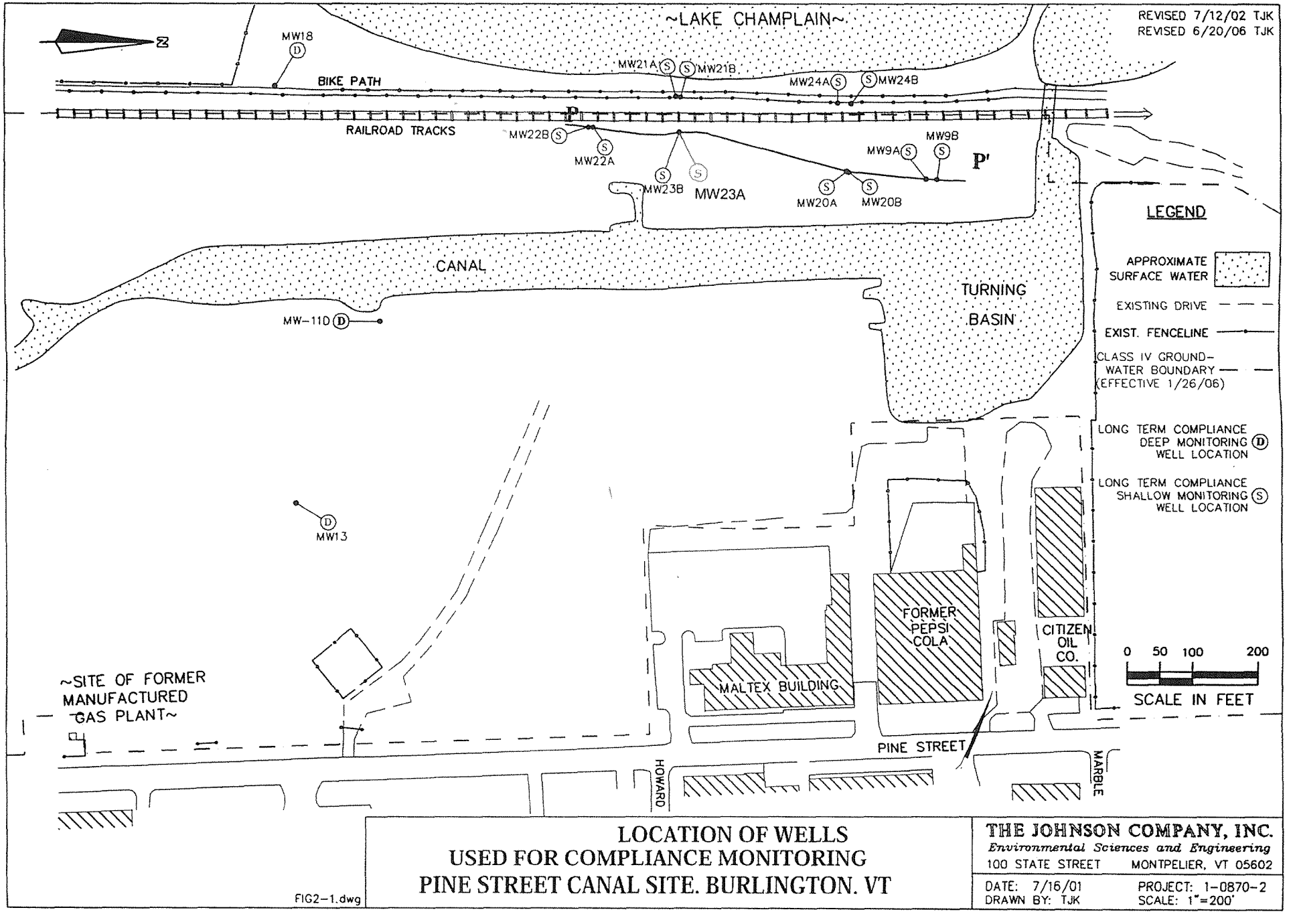

FIGURE 4 (Five-Year Review Report; Source: Johnson Company, 2006b)

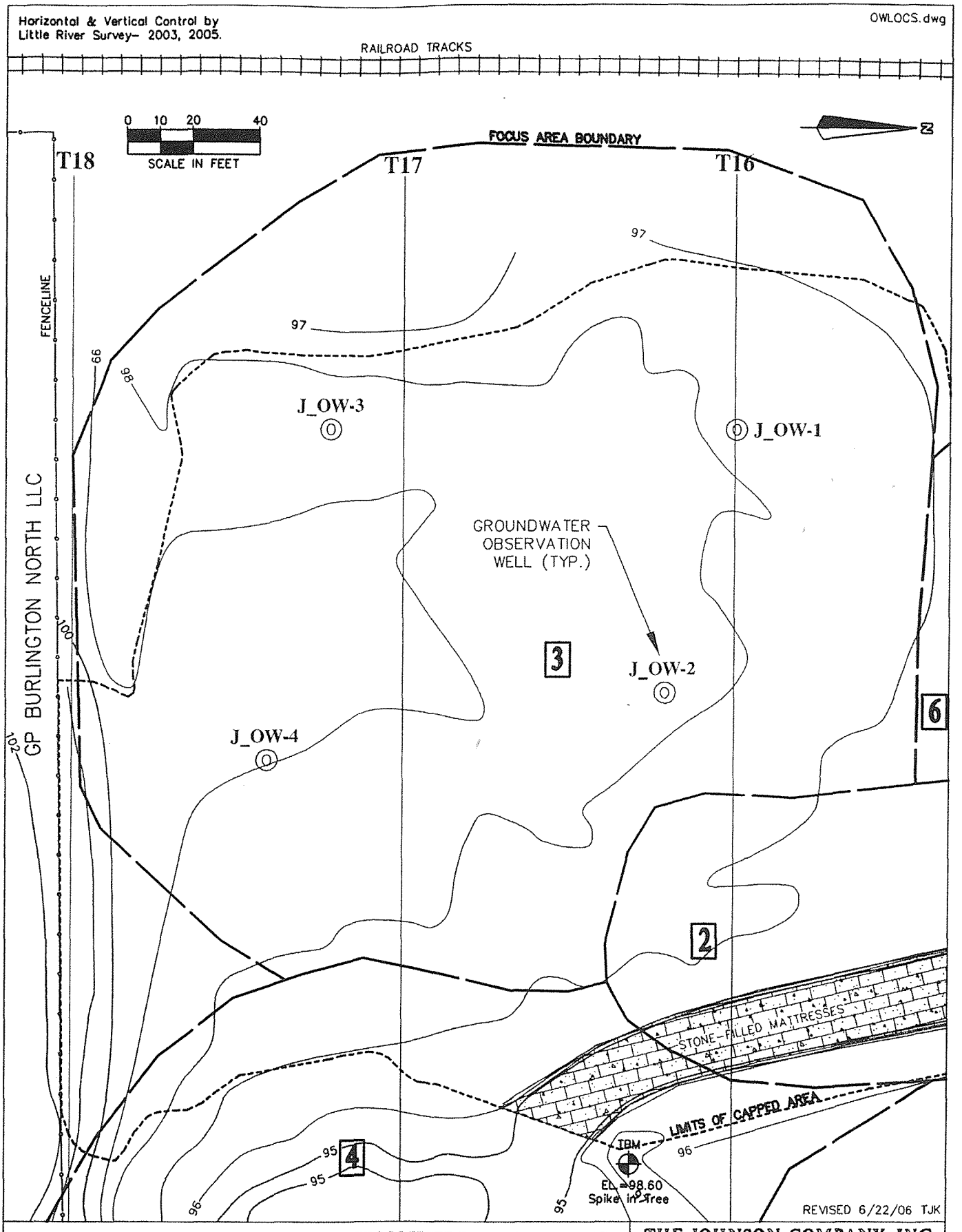

FIGURE 5 (Five-Year Review Report; Source: Johnson Company, 2006b)

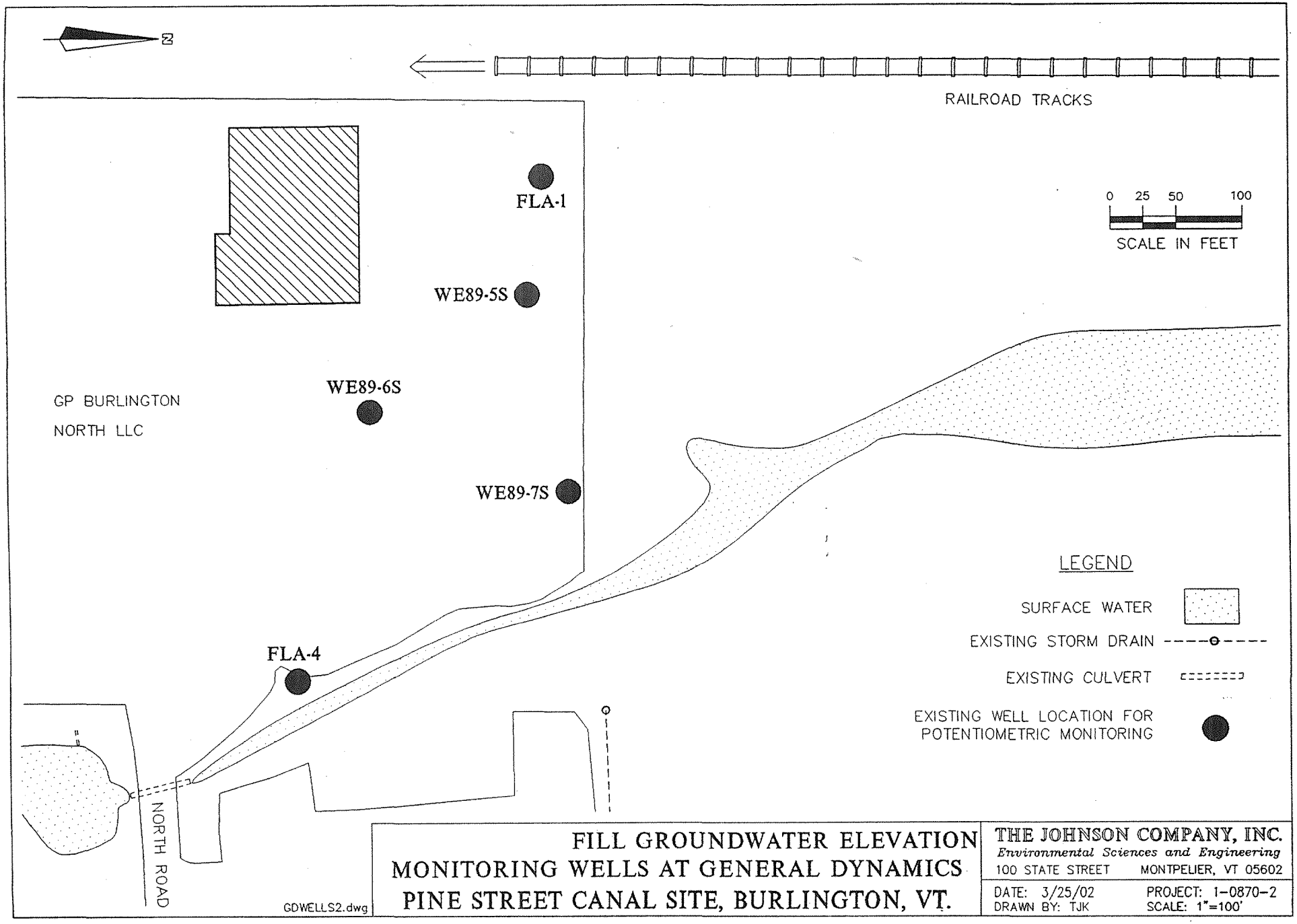

FIGURE 6 (Five-Year Review Report; Source: Johnson Company, 2002)

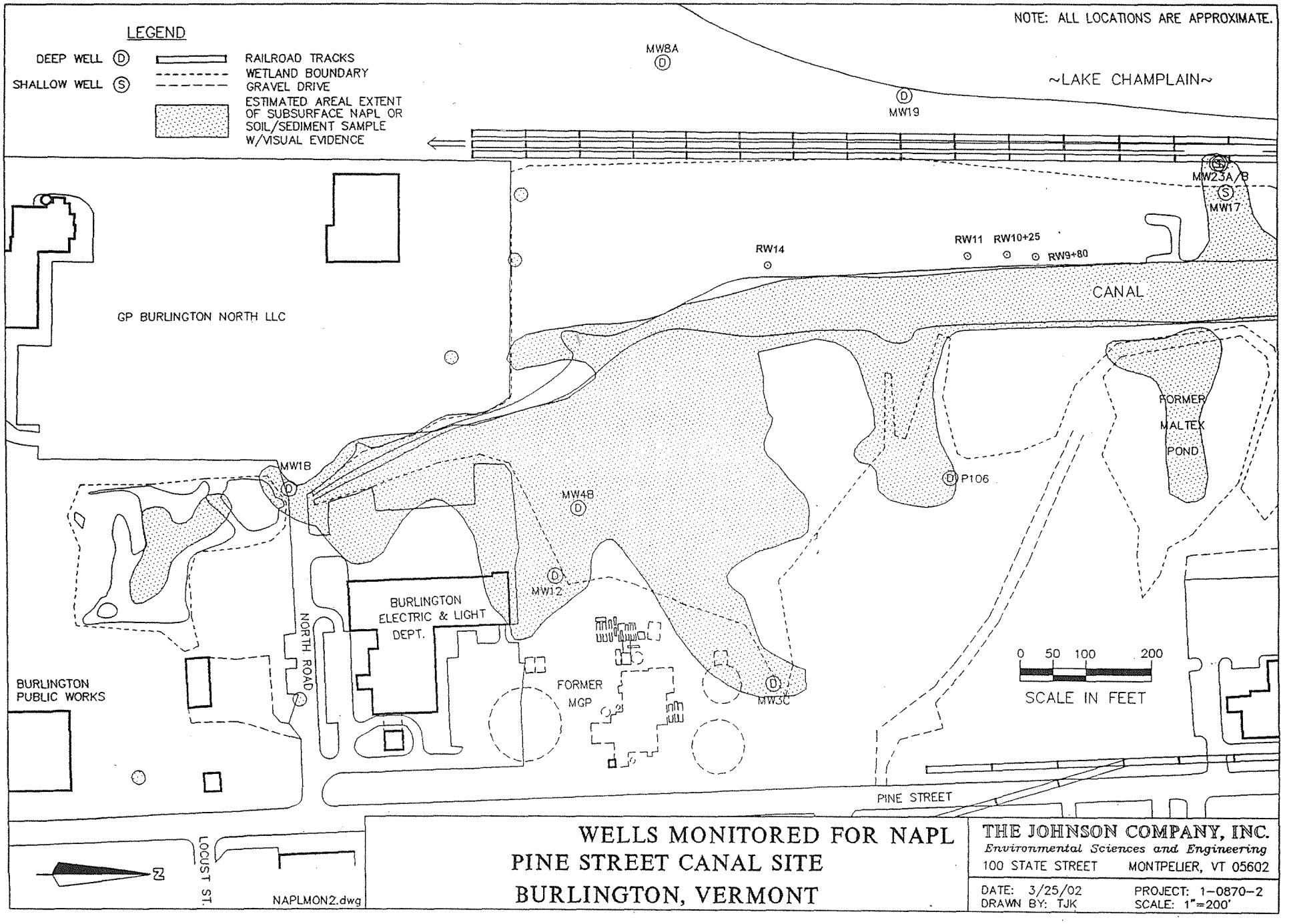

FIGURE 7 (Five-Year Review Report; Source: Johnson Company, 2002)

Table 2. Groundwater Flow Summary Table for the Northern Portion of the Peninsula

Monitoring Round	Date	Groundwater Flow Direction	Groundwater Flow Gradient	Notes
Fall 2005	10/17/05	SE from MW-9B to MW-20B W-SW from MW-23 to MW-21	0.002 0.0014	Canal stage is higher than lake stage
Spring 2005	4/26/05	None – depression in middle	0.0025	Canal and lake stage are equal
Fall 2004	10/11/04	W-SW toward MW-21A	0.0017	Canal stage is higher than lake stage
Spring 2004	4/19/04	SE	0.0001	Canal and lake stage are equal
Fall 2003	10/13/03	W-SW	0.002	Canal stage is higher than lake stage
Spring 2003	4/14/03	S-SE	0.0004 to 0.001	Canal and lake stage are equal
Fall 2002	10/31/02	East	0.015	Lake stage is higher than canal stage due to construction
Spring 2002	4/15/02	None – depression in middle	0.002	Lake stage only slightly higher than canal stage
Fall 2001	10/22/01	West	0.002 to 0.005	Canal stage is higher than lake stage

The groundwater flow summary table indicates that groundwater within this area typically flows to the south, southeast, or east away from the lake when the water levels within the canal and lake are equivalent. However, when the canal stage is higher than the lake stage, such as after a precipitation event which would increase stormwater runoff and baseflow into the canal, groundwater has sometimes been observed to flow to the west or southwest, in the direction of the lake.

Groundwater Quality

NAPL. Ten wells in the compliance monitoring network are checked 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 since 2000: MW-4B – 0.9 to 0.02 feet; MW-12 – 0.5 to 0.05 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 off site.

Three monitoring wells that are screened across the water table and located between the canal and Lake Champlain (MW-17, MW-23A, and MW-23B) are monitored semi-annually for the presence of NAPL. All three of these wells have had measurable levels of NAPL, but levels have been steadily decreasing since 2000: MW-17 - 0.5 to 0.05 feet; MW23A - 0.1 feet to no observable NAPL; and MW-23B - 1.85 to 0.05

feet. NAPL has not been observed in any of the sentinel wells (MW-9, -21 and -24 clusters). This indicates that NAPL is not migrating off site across the Class IV boundary or into Lake Champlain.

Volatile Organic Compounds. Since 2000, most of the groundwater samples have shown non-detect or occasional trace detections of benzene, toluene, ethylbenzene or xylenes (BTEX compounds). The exceptions are MW-23B which has had consistently detected concentrations of BTEX, and 23A (not sampled since 2001) which also had detected concentrations of BTEX. The concentration of benzene in samples from MW-23B consistently exceeds the MCL. A concentration trend over time is not evident in samples from MW-23B. The lack of reported contamination in wells to the north, west and south, and the lack of a concentration trend over time, indicate that the cross-section area and mass flux of plume is not increasing.

PAHs. Since 2000, most of the groundwater samples have shown non-detect or occasional trace detections of various PAHs. The exceptions are MW-22A, MW23A, MW23B, and MW20A. No MCLs have been established for the detected PAH compounds. Samples from MW-22A and MW-20A have had low (below the sample quantitation limit) but relatively consistent concentrations of naphthalene, 2-methylnaphthalene, acenapthene, fluorene, phenanthrene, and fluoranthene. Samples from MW-23B and MW-23A (not sampled since 2001) have had consistent concentrations of naphthalene and 2-methylnaphthalene approaching or exceeding 1 ppm. All other PAHs analyzed for in samples from MW-23B have been detected one or more times, some consistently. Concentration trends over time are not evident in these samples. The lack of reported contamination in wells to the north, west and south, and the lack of a concentration trend over time, indicate that the cross-section area and mass flux of plume is not increasing.

Metals. Metals have been detected in all samples. Most are at levels below MCLs. Since the start of routine monitoring in 2000, arsenic concentrations of samples from MW-21B have ranged from 5.8 to 36.1 ppb and consistently (eight out of 12 times) exceeded the MCL of 10 ppb. Arsenic concentrations in samples from MW-9A have ranged from 2.3 to 16.2 ppb and have exceeded the MCL three out of 12 times sampled. Lead concentrations in samples from MW-9A have ranged from less than 0.8 to 29.1 ppb and have exceeded the MCL two out of 12 times sampled. Lead concentrations have exceeded the MCL in only one out of 12 samples each from MW-20A and 20B, and MW-21A and so may not be representative of the sampled groundwater.

The sources of arsenic and lead in MW-21B and MW-9A wells are unknown but do not appear to be related to Site releases since they are not detected at similar levels closer to the canal and the primary source of contamination at the Site. Concentration trends over time are not evident in these samples. Since there is not a concentration trend over time, there is no indication that there is contaminant migration across the Class IV boundary or that the cross-section area and mass flux of the plume is increasing in the area.

Groundwater Quality Summary. MW-23B, located within the Class IV boundary shows significant impacts by PAHs and BTEX, and benzene consistently exceeds MCLs. Based on results from the MW-21and MW-24 clusters, which are outside the Class IV boundary, west of the MW-23 cluster, and are non-detect for PAHs and BTEX, there is no evidence of migration across the Class IV boundary or into Lake Champlain.

Arsenic was detected in MW-21B and arsenic and lead were detected in MW-9A at concentrations exceeding MCLs. There is no evidence that contamination in these wells is the result of migration across the pre-2006 Class IV boundary since wells within the boundary and closer to the source do not show elevated concentrations.

The levels of NAPL in compliance monitoring wells that historically contained NAPL have steadily decreased since 2000, and in some cases, NAPL is no longer detectable. All other wells in the compliance monitoring network continue to remain clear of NAPL. These observations indicate that NAPL is not migrating from the Site.

The existing compliance monitoring program should be evaluated to determine whether the performance standard for contaminant migration across an expanded Class IV boundary can be adequately monitored, particularly in the northwest corner of the Site near cluster MW-9.

6.3.1.2 Surface Water Data Review. Surface water was monitored during the construction and post-construction periods to ensure that the engineering controls at the outlet to Lake Champlain are functioning as intended to protect surface water from cap construction impacts. For long-term monitoring, samples are collected and PAH 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. If AWQC are exceeded, however, those criteria are to be considered, along with other relevant factors, to determine whether additional work will be required.

Two Hydrolab water quality meters were installed between the canal and turning basin (near transect T4) on either side of a silt curtain prior to Phase 1B construction. These meters were used to monitor pH, dissolved oxygen, specific conductance, and turbidity prior to, during, and after construction. Surface water samples were also collected from the turning basin for analysis of PAHs, metals, and total suspended solids (TSS) during eleven monthly sampling events during construction.

During the post-construction period, dissolved oxygen, pH, turbidity, specific conductance, and temperature were monitored on either side of the silt curtain between the turning basin and Lake Champlain from April through August 2003. Surface water samples were collected on October 26, 2004 and November 29, 2004 from two monitoring locations for the analysis of PAHs, metals, and TSS during the post-construction period. Following the post-construction period, long-term surface water monitoring, consisting of the collection of grab samples (unfiltered) from the outlet channel to the lake for the analysis of PAHs, was conducted on July 5, 2005.

During construction, all detected analyte/compound concentrations were below the AWQC, with the exception of zinc detected in a sample collected directly from the end of the discharge hose to Lake Champlain from the de-watering pump at the turning basin. Within the two sets of surface water samples collected during the post-construction phase, PAHs and most metals were reported as non-detect and barium, copper, and zinc concentrations were estimated at concentrations an order of magnitude or more below AWQC. For the first long-term surface water monitoring event, no PAHs were detected.

Environmental controls (i.e., booms) in the southern portion of the canal prevent ongoing releases of NAPL from migrating towards Lake Champlain. Based on surface water results, additional work to control surface water contamination is not required at this time.

6.3.1.3 Stormwater Inflow Data Review. As part of the remedy, stormwater management features were enhanced to reduce the potential for stormwater entering the Site from the south and east through the municipal storm sewers to recontaminate remediated portions of the Site. The remedy 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 included monitoring to determine whether stormwater may be creating an unacceptable risk to ecological receptors in remediated areas.

Stormwater inflow monitoring is conducted through the use of eight sediment traps, which were installed on the subaqueous cap in Area 8 (three sediment traps), Area 1 (three sediment traps), and Area 2 (two sediment traps) on March 2, 2005 (JCO, 2006a) (Figure 8). The first sample collection event was conducted on November 16 and 17, 2005. Samples were analyzed for PAHs and metals.

Two trap samples (SD11+70 E35 in Area 2 and SD9+08E in Area 1) had relatively high concentrations of PAHs compared to other trap samples. NAPL droplets were observed on the sample taken from SD11+70E35. The elevated PAH concentrations are attributed to the fact that the samples were taken from the area of ongoing NAPL releases. Samples from the remaining traps had reported concentrations of total PAHs ranging from 18 to 45 ppm with the two highest concentrations found at T12+68, near the ongoing NAPL releases.

Metals were reported in all samples and concentrations were relatively consistent between samples: Arsenic (13.8 to 38.6 ppm), Barium (220 to 392 ppm), Chromium (40.2 to 381 ppm), Copper (52 to 92 ppm), Lead (45 to 70 ppm), Mercury (0.1 to 0.2 ppm), Selenium (Not detected), Silver (less than 0.3 to 3.3 ppm), and Zinc (581 to 1610 ppm).

The contaminant concentrations in the sediment trap samples exceed cap monitoring benchmarks established in Appendix B of the 1998 ROD for total PAHs, individual PAHs, and zinc. The concentrations of arsenic and chromium also exceeded ecological benchmarks in one sample each, although these metals did not have benchmarks identified as performance standards. The levels of PAHs and metals, particularly in the three samples collected in the area of ongoing NAPL releases, exceed concentrations that correspond to probable risk for aquatic organisms exposed to sediments. Deposition of particulates with the concentrations observed could create an unacceptable risk to ecological receptors in remediated areas as these materials accumulate on the surface of the sediment in the canal and turning basin. The impact of the ongoing NAPL releases on data collected from sediments traps has not been quantified, but is likely significant and will continue to be significant until such time as the releases are addressed.

6.3.1.4 Sediment Transport Data Review. The performance standard for sediment transport includes monitoring to verify that the remedy is preventing sediment transport to Lake Champlain at levels that would create an unacceptable risk to receptors in Lake Champlain.

An ISCO sampler was installed in the outlet from the turning basin to Lake Champlain on July 26, 2005 to collect unfiltered water samples. Samples are to be collected during a maximum of three storm events per year that equal or exceed the previous year's peak storm that yielded detectable concentrations of contaminants. For the first year of monitoring (2005/2006), the threshold storm was the peak storm measured during the Additional Remedial Investigation (ARI), completed in 1995.

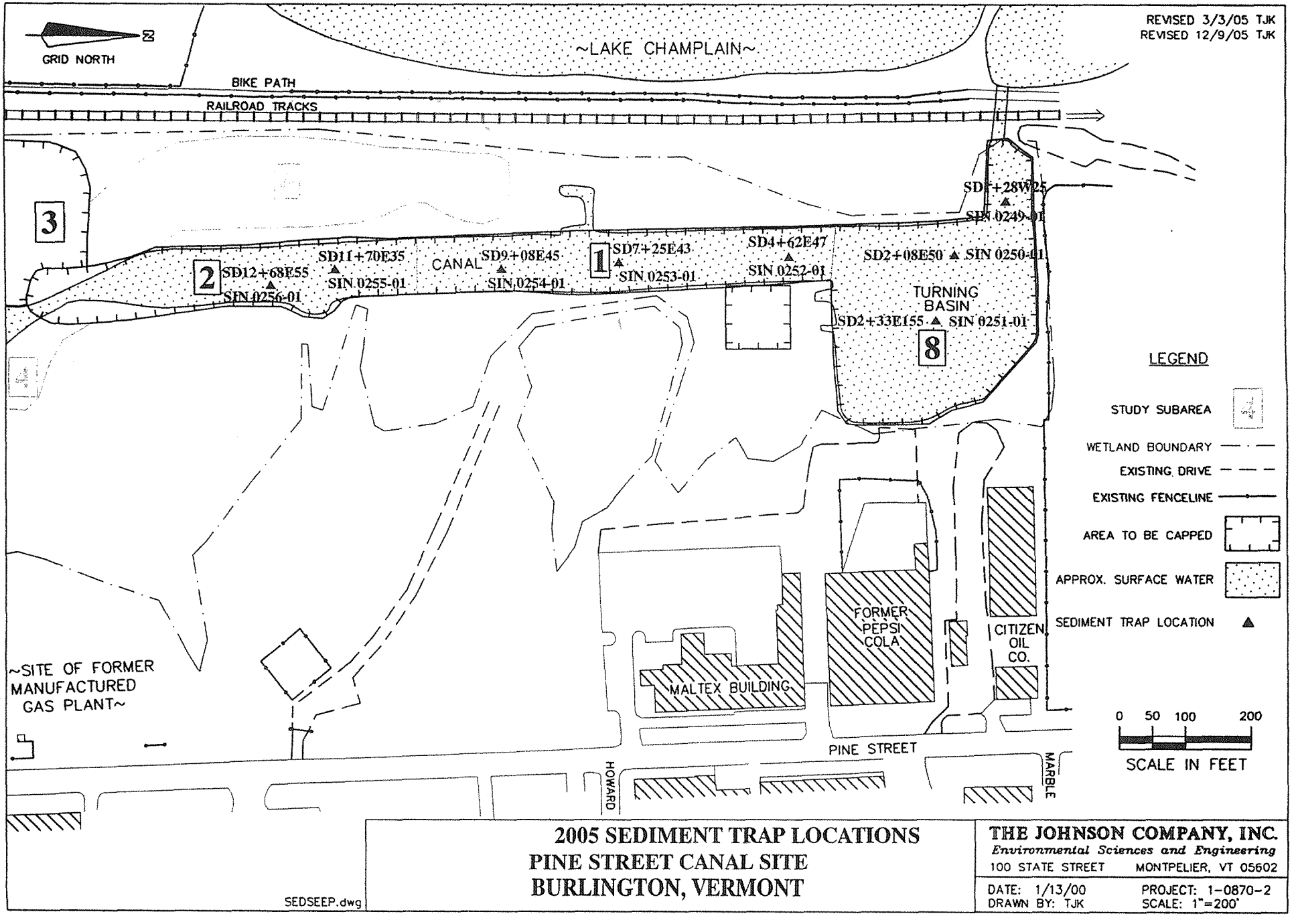

FIGURE 8 (Five-Year Review Report; Source: Johnson Company, 2006a)

Since the installation of the ISCO sampler, there was only one storm event that exceeded the ARI peak storm through late December 2005. However, no samples were collected due to an incorrect application of the modeled trigger stage to the data logger program.

No conclusion can be drawn at this time regarding whether this performance standard is being met. Peak storm events will continue to be monitored and a conclusion regarding protectiveness will be drawn in the next five-year review.

6.3.1.5 Cap Physical and Chemical Data Review. 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*".

The additional performance standard for Areas 3 and 7 is "*to provide a suitable substrate for wetland plant species*" 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 with benthic organisms and fish at ecologically harmful levels. The performance standard for the other cap areas includes long term regular inspections to assess physical integrity of the cover and identify erosion or signs of failure (USEPA, 2000).

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. Cap core thickness assessment was conducted in the canal and turning basin (Areas 1, 2, and 8), Area 3 and Area 7 during the post construction period in 2005 (JCO, 2005c). Bathymetric surveys of the open water areas (within Areas 1, 2, 5, and 8) were conducted in 2003 and four times during the post-construction period in 2005 (JCO, 2005c). Topographic surveys of Areas 2, 3, 7, the 100 x 100 foot area, and the west bank cap were conducted in November 2005 (JCO, 2005c).

[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.

Settlement monitoring was conducted during cap construction and monitored during and after construction.

Based on these assessments, cap thickness in Areas 1 and 2 is 1.5 feet to 3 feet or more, and in Area 8 is 2 to 4 feet thick, and achieve a minimum thickness of 18 inches following settlement, and is consistent with the approved design. Geotextile and geogrid have been placed below the capping material, providing further protection. In Areas 3, 7, and the 100 x 100 foot area, thicknesses of sand and/or topsoil achieved a minimum thickness of 14.7, 18.2, and 17.2 inches, respectively, consistent with the approved design. Consistent with the performance standard, it provides an adequate barrier to bioturbation which is not expected to exceed 10 cm (JCO, 2005c).

The bathymetric survey indicates that a minimum water depth has been maintained by the weir to prevent erosion and scouring. The bathymetric survey indicated that erosion and scouring of the subaqueous cap has not occurred (JCO, 2005c).

Subaqueous cap video inspections were conducted in 2003 to assess the condition of the subaqueous cap (JCO, 2005c). Due to the turbidity of the canal water and subsequent limited visibility, it was concluded to be impractical to provide complete video coverage of the cap (JCO, 2004a).

Chemical Monitoring. Seepage meters were installed in the subaqueous cap area (Areas 1, 2, and 8) for the purpose of monitoring groundwater flux and interstitial water quality in the cap in 2003. Monitoring efforts concluded that insufficient groundwater flux through the cap exists to allow chemical analysis of interstitial groundwater (JCO, 2005c).

Constructed cap core sampling and analysis was conducted with laboratory chemical analysis performed on the surface (0-10 cm) and mid-cap (30-40 cm) strata. Samples were analyzed for PAHs by EPA Method 8270, for metals by EPA Method 6010, and physical parameters. Constructed cap core sampling was conducted in 2003 in randomly selected locations from the subaqueous cap (Areas 1, 2 and 8) and Areas 3 and 7. Concentrations of metals and PAHs were below benchmark values in both mid-cap and top-cap samples (JCO, 2004a).

Cap core sampling and analysis was conducted in 2004 from twelve locations in Areas 1, 2, 3, and 8. Concentrations of PAHs exceeded sediment benchmark values in one mid-cap sample (resulting in the Area 2 average also exceeding the benchmark) and two top-cap samples. The two top-cap samples were located at T10+00 E20 in Area 1, and T12+00 E80 in Area 2. The elevated PAH findings in the two top-cap samples were attributed to their proximity to NAPL releases adjacent to the west bank cap (discussed below in section 6.3.2) although there was no visual evidence of NAPL noted in the sample (JCO, 2005c). Based on resampling in 2005, the mid-cap result was attributed to a NAPL layer resulting from a seep during construction which was later covered by capping material. It is therefore considered a relict of construction rather than migration through the cap.

Constructed cap core sampling and analysis was conducted in 2005 in twelve locations in Areas 1, 2, 3, and 8 as well as four additional locations between T9 and T13 (JCO, 2006a). Concentrations of PAHs exceeded benchmark values in one top-cap sample at T11+00 E40 in Area 2 and was attributed to the NAPL droplets reported on the top of the core.

Core sampling and analysis was conducted in 2005 in the natural cap Areas 4 and 5, with laboratory chemical analysis performed on the surface (0-10 cm) stratum. Samples were analyzed for PAHs by EPA Method 8270, for metals by EPA Method 6010, and physical parameters. Concentrations of PAHs exceeded benchmark values in three of the four top-cap samples and metals exceeded benchmark values in one of the top-cap samples. The performance standard for the capped areas is not applicable to this area.

Cap Compliance Monitoring Summary. Across much of the Site, compliance monitoring data collected to date indicates that the cap has met the performance standards in that it contains and isolates the contaminated sediment and is resistant to erosion or bioturbation that would expose contamination, with the following qualifications:

Cap interstitial water has not been directly assessed as seepage collection devices did not collect sufficient water to analyze. Modeling and seepage meter tests indicate that upward flow of groundwater through the cap is negligible and that recontamination of the cap via contaminated groundwater would be insignificant. Surface water monitoring results also indicate that there is no significant contaminated groundwater migration through the cap. It is possible, however, that benthic organisms may be exposed to contaminated cap interstitial water if it exists.

Some top-cap core samples taken from Areas 1 and 2 exceed ecologically-protective sediment benchmarks for PAHs. Elevated PAHs are attributed to NAPL droplets observed in the sample or, in those instances were NAPL droplets were not observed in the sample, the proximity of the sample to the area of NAPL releases. Free-phase coal tar (NAPL) continues to seep through discrete channels in the subaqueous cap in the southern portion of the Site, and is being deposited on the water and cap surface. This is discussed further in the following section of this report.

6.3.2 Review of NAPL Release Data

The ROD did not envision that contamination in the form of free-phase NAPL would migrate through the cap. Therefore, there is not a cap performance standard specifically addressing NAPL or NAPL migration mechanisms. However, NAPL is a component of the performance standard that requires isolation of sediment contamination from benthic organisms and fish.

Following completion of the cap and subsequent re-flooding of the canal in spring of 2003, NAPL releases appeared on the water and cap surface in the southern portion of the Site (JCO, 2004b). Releases were initially associated with the west cribbing wall on the west bank of the canal and west of the capped area and were identified between T11+20 and T9+75 and between T10+50 and T11+30. Extensive monitoring has continued since that time to assess the nature and extent of the releases and the migration mechanism(s) and consist of the following efforts. The extent of NAPL releases observed prior to field investigations conducted in 2006 is shown on Figure 9.

Winter 2003-2004: Assessment of NAPL location and thickness on the cap by swabbing with a sorbent pad. NAPL thicknesses of more than a foot were observed in some locations (JCO, 2005c).

Summer/Fall 2004: Residual NAPL was vacuumed and swabbed from the canal cap surface. Residual NAPL was also removed from the ground surface west of the canal. Four NAPL recovery wells were

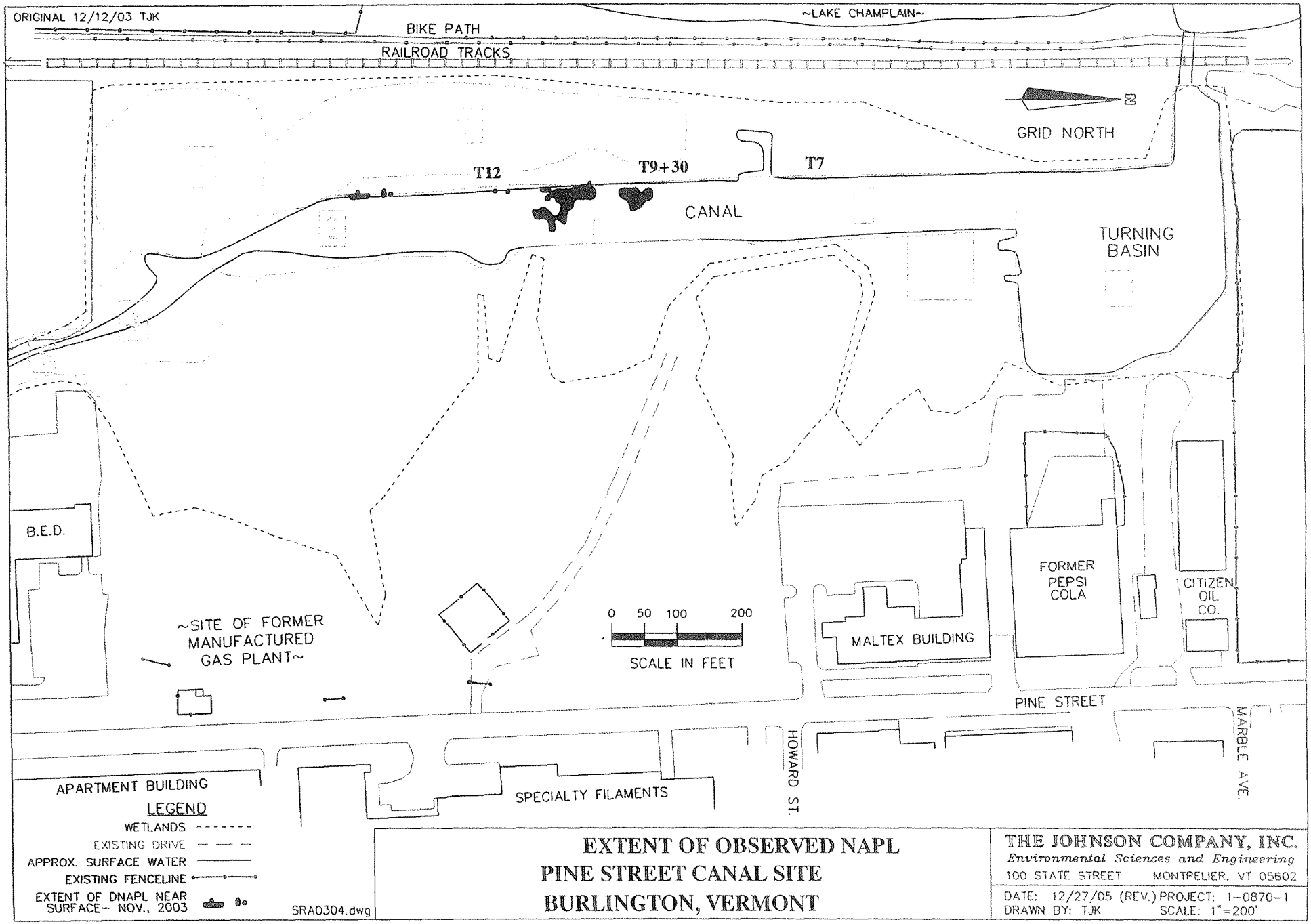

FIGURE 9 (Five Year Review Report; Source: USEPA, 1998a)

installed in the area of the west bank cap at T9+77 ("RW 9+80"), T10+23 ("RW10+25"), T10+90 ("RW-11"), and T14+04 ("RW-14") to facilitate the removal of NAPL accumulations during construction of the west bank cap. NAPL recovery wells located on the west bank cap are shown on Figure 7. During construction of the west bank cap, a total of 800 gallons of NAPL were removed from the RW series wells for off-site disposal.

The west bank cap was constructed in June and July 2004 to address releases emanating from this area. Following construction of the west bank cap, the canal cap area between T9+30 and T14+20 was probed with a ten-foot pole topped with a sorbent pad in 68 locations. The pad was visually inspected to identify the presence of NAPL on the cap surface (JCO, 2005a and 2005c). Probes indicated the presence of NAPL droplets.

NAPL probes were located in 28 locations west of the west bank cap in October 2004 to monitor NAPL movement towards the lake during construction. No evidence of NAPL was observed on these probes (JCO, 2005a).

Cap cores were collected from the west bank cap above the western cribbing wall and five to ten feet west of the western cribbing wall between transects T9+50 and T14+00. No evidence of NAPL was observed in the top one and a half feet of the cores. Sheens, odors, and NAPL were detected below one and a half feet below ground surface in various locations (JCO, 2005a).

Following construction of the west bank cap, the Performing Defendants continued to monitor (but not remove) NAPL accumulations in RW series wells on the west bank. NAPL was observed in two of the four wells (JCO, 2005a). NAPL thicknesses in RW-10+25 varied between 0.1 and 0.5 feet. NAPL thicknesses in RW-14 varied between 0.4 and 1.6 feet, with the thickness inversely proportional to water levels in the canal.

Observations of gas bubbles (presumed to be methane), sheens, and NAPL were made multiple times in Fall 2004. NAPL and sheens were not observed west of the west bank cap. In the canal, it was observed that sheens and NAPL were brought to the water surface by gas bubbles emanating from the cap, generally between 15 and 50 feet east of the western cribbing wall between T9+80 to T11+25. NAPL and a sheen were observed emanating from the west bank cap at T10+50E3. The contamination appeared to be isolated and located in the surface of the cap, and was removed.

Summer/Fall 2005: NAPL probes were located in 28 locations west of the west bank cap in June 2005. No evidence of NAPL was observed on these probes (JCO, 2005b).

The west bank cap was monitored for sheens and odors. No evidence of NAPL was observed on the cap, however, some settlement occurred which exposed sand beneath the topsoil.

The RW series monitoring wells in the west bank cap continued to be monitored for the presence of NAPL. As before, two of the four had accumulations of NAPL. RW-10+25 had 0.33 feet, which is similar to levels recorded in 2004. RW-14 had 1.83 feet of NAPL in August 2005, and 0.21 feet in November 2005 (JCO, 2006a).

Observations of gas bubbles, sheens, and NAPL on the surface of the cap were observed between June and November 2005 (JCO, 2006a). Observations indicated that NAPL and sheens were found in a localized area of approximately 8000 square feet and appeared to be associated with gas bubbles emanating from the cap surface (JCO, 2005c). NAPL zones of measurable thickness were not observed.

Twenty-two cores from the subaqueous canal cap were collected and observed for the presence of NAPL between T10+80 and T12. NAPL stains or droplets were observed in 14 of the samples from 0.5 to 6 inches below the top of the core (JCO, 2006a).

Spring/Summer 2006: The Performing Defendants implemented a NAPL action plan with the goal of addressing ongoing NAPL releases at the southern end of the Site, specifically between transects T9 and T14. The action plan includes additional field investigations to confirm the mechanism(s) responsible for the appearance of NAPL and an approach to address the NAPL. Three separate phases of data collection and field work will have been conducted between May and December 2006. Data analysis and evaluation will be completed by February 2007.

Samples from a variety of media were collected during the May 2006 field event and analyzed for total PAHs (BBL/Hart Crowser, 2006). Total PAH concentrations taken from samples of NAPL collected from wells MW-11B and RW-14 had concentrations of 135,500 and 147,000 mg/kg, respectively. Cap swab samples were collected by divers in seep locations. Total PAH concentrations on the surface of the cap in an area of one square meter ranged from 523,200 to 1,118,000 μg/wipe. Total PAH concentrations from samples of free-phase NAPL taken from the water column ranged from 2,411 to 18,140 μg/wipe. Total PAH concentrations in cap core samples (up to a depth of approximately 15 inches into the cap) ranged from not detected to about 2,279,000 μg/kg. Total PAH concentrations in the cap cores were generally greatest at the upper-most portions of the cap, decreasing with depth.

NAPL Release Summary. The cap performance standard has not been met for the subaqueous cap between T9 and T14. In this area, the cap has not isolated or prevented the migration of contamination, specifically NAPL, to the water and cap surface. In this area, the cap has not prevented contact between the contamination and benthic organisms and fish in the biologically active portion of the benthic habitat. Cores taken from the NAPL release area have concentrations of PAHs that exceed sediment benchmark values selected in the ROD for ecological protection. Fish, frogs, turtles, waterfowl, muskrat, and other fauna that live in and around the canal are exposed to free-phase NAPL with total PAH concentrations as high as 147,000 ppm. In addition to presenting a potential ecological risk, the presence of NAPL may also constitute a loss of habitat. Benthos have not been observed where free-phase NAPL is present (M&E, 1992b). For these reasons, EPA is making the determination that the subaqueous cap between transects T9 and T14 is not protective.

Information collected during and since the extension of the cap over the west bank in 2004 suggests that there is a significant accumulation of NAPL in the subsurface in the southern portion of the Site. In at least one location (RW-14) the NAPL appears to be quite mobile, moving perhaps in response to water levels in the canal. Probes in 28 locations between the west bank cap and Lake Champlain taken in 2004 and 2005 show no evidence of NAPL migrating towards the Class IV boundary or Lake Champlain. However, unlike the northern portion of the Site, there are no shallow monitoring wells between the contamination and the Class IV boundary or Lake Champlain in this area. The current compliance

monitoring program should be evaluated to determine whether the performance standard for contaminant migration across an expanded Class IV boundary or into Lake Champlain can be adequately monitored at the southern portion of the Site.

6.3.3 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.

6.3.3.1 Aquatic (Open water) Habitat Restoration. Compliance monitoring for aquatic habitat restoration consists of benthic invertebrate community sampling in Areas 1, 2, 4/5 and 8, and qualitative plant surveys in these same areas. Following the cap construction in 2003, baseline benthic macroinvertebrate sampling was conducted in the canal and turning basin annually at four locations.

Benthic macroinvertebrate data collected to date indicates the development of a low-diversity benthic community dominated by oligochaete and tubificid worms, and chironomid midge larvae. The 2003 - 2005 sampling in Areas 1, 4/5 and 8 shows the presence of a benthic macroinvertebrate community consistent with sediment type, meeting performance standards.

Prior to 2004, no specific sample was collected from the portion of Area 2 potentially impacted by NAPL release. In 2005, the abundance of invertebrates in Area 2 was reduced from previous years (JCO, 2006a). There are not sufficient data to determine the potential impact of the NAPL release on the benthic invertebrates in Area 2. It is recommended that there be further evaluation of the macroinvertebrate community development in the portion of Area 2 affected by NAPL release to the surface of the cap.

Qualitative monitoring for the presence of a submergent vegetative community was conducted annually from 2003 – 2005. Data collected along the margins of the turning basin and in the canal, indicate the performance standard for the development of a submergent aquatic plant community after three years has been met. Data indicate the presence of vegetation in the canal, turning basin and Area 2 Waterway. Some areas are dominated by the invasive Eurasian milfoil (*Myriophyllum spicatum*), but the control of milfoil in the canal was not stipulated in the performance standards.

Aquatic Habitat Summary. Areas 1, 4/5 and 8 performance standards for habitat restoration have generally been met. In Area 2, additional data are needed to determine the full extent of the impact NAPL releases have had on habitat quality.

6.3.3.2 Wetland Habitat Restoration. Restoration of habitat functions and values was monitored 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.

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. Water levels in Area 3 have been monitored in four wells (Figure 5), during the spring from 2003 through 2006. The Demonstration of Compliance Report (JCO, 2005c) reported that all of the wells in Area 3 indicated wetlands hydrology had been established. However, the monitoring data showed that Well J_OW-3 met the criterion (water ≤ 12 inches below the ground surface) in just under 50% of the measurements, even using the early spring values. Data from 2006 monitoring are similar, with both water levels at both J_OW-2 and J_OW-3 within 12 inches of the ground surface at fewer than 50% of the measurements, and never for three consecutive weeks. This indicates that areas at the higher elevations in Area 3 do not clearly demonstrate wetland hydrology.

Wetland vegetation monitoring was conducted in Year 1 (2003) and Year 3 (2005), post-construction for Areas 3 and 7. The Year 5 monitoring will be performed in 2007. Due to the later construction date of the west bank cap, Year 1 monitoring was completed in 2005. Although part of the wetland restoration, only qualitative monitoring (photographs and visual inspection) was conducted for the 100 ft x 100 ft area.

Based on the fall 2005 monitoring and the June 2006 Site inspection, Areas 3 and 7 and the 100 ft x 100 ft area all showed vegetation to be well established with a trend toward a stable vegetative community. After the first year (2005), the west bank cap was well vegetated.

To meet restoration goals, the wetland vegetation performance standard requires demonstration of a plant community dominated by wetland species. A transect sampling method was used that records the wetland indicator status of plants, to determine if >50% of the plants present are wetland species. Wetland monitoring results in 2003 for the transect monitoring showed a dominance of wetland vegetation in Area 7, but not Area 3. Transect data from 2005 (Year 3) showed a trend toward improved wetland community development in Area 3. One transect in Area 3, and one transect in Area 7 did not meet the criteria for wetland vegetation in 2005. However, the majority of both capped areas showed development of wetland vegetation. A small portion of Area 3, above elevation 99 ft (between wells J_OW-4 and J_OW-3), has not clearly established wetland hydrology or a plant community dominated by wetland species. Visual inspection during the Site inspection in June 2006 indicated that the majority of Area 3 appeared to be covered with wetland vegetation, except the area above and near elevation 100 feet, between Well J_OW-4 and the parking lot bordering the south side of Area 3. The transect monitoring will be continued in 2007 (Year 5 for wetland restoration) to verify the trend toward wetland community development.

Transect data were collected only in Year 1 (2005) post-construction for the west bank cap. However, these data showed the dominance of wetland species after one year.

Strategies to control nuisance plant species in the wetlands have shown some positive results. *Phragmites* has been treated in Areas 3 & 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 was more abundant in 2005; however, it is not notably dominant throughout the capped area. Purple loosestrife is another invasive species present on the Site. It 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. The presence of the beetles and damage to the plants has been verified. The biocontrol by the beetles helps keep the density of the plants low enough to avoid it becoming a nuisance.

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 most of Area 3 and Area 7 are meeting target levels, a trend toward hydric soils is anticipated by year 10.

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, the restoration is anticipated to show a trend toward achieving an adequate final mix of wetland habitat on Site (open water, emergent, scrub/shrub and forested wetland). This is supported by vegetative monitoring data documenting a trend toward the development of the target wetland communities in most of Areas 3 and 7.

Wetland Habitat Summary. The performance standards in Area 7 have generally been met, indicating the habitat restoration for the remedy has been successful. Assuming the trends toward habitat conditions are confirmed in the 2007 monitoring of Area 3, it is anticipated that performance standards will be met there as well.

6.3.4 Review of Institutional Controls

The performance standard for institutional controls as specified in the RD/RA SOW (USEPA, 2000), 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 4.2.3, 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 re-established and expanded as of 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. However, there is no currently no mechanism in place to determine compliance with the restrictions, which is necessary to meet the performance standard for institutional controls. The lack of a plan for monitoring to determine compliance calls into question the future protectiveness of the remedy.

6.3.5 Review of Historic Resources

An historic resources study of the Pine Street barge canal determined that there were a number of features present at the Site that were eligible for the National Register of Historic Places (NRHP), and, that the remedy would have adverse effects on these features (John Milner Associates, 2001). These

features include five sunken canalboats; the remains of a marine railway and boathouse(s); cribbing along the sides of the canal and turning basin; and a drawbridge. In June 2002, a Memorandum of Agreement (MOA) for Mitigation of Adverse Effects was entered into by EPA, Vermont State Historic Preservation Officer, VTDEC, Performing Defendants and the Lake Champlain Maritime Museum. Per the MOA, the Performing Defendants transferred to the Lake Champlain Maritime Museum (LCMM) a sum in the amount of $150,000 to accomplish the following tasks:

Archaeological Study of the Sloop Island Canalboat. Nearly 400 archaeological dives were conducted safely during ten weeks over the 2002 and 2003 field seasons. At the conclusion of the study, two documents will be generated. The first will be a comprehensive technical report, and the second will be a short (6-10 page) non-technical publication for the general public. While the study is complete, work continues on both reports. The current schedule calls for a draft of the technical report and the final popular report to be completed in October 2006.

Interpretation of Standard Canalboats and the Pine Street Site for the Public. Artifacts collected from the Sloop Island Canalboat were treated so that they remain chemically stable and retain as many diagnostic features as possible. They were then described in detail, drawn and photographed. Many of the artifacts are on permanent display at the museum in Vergennes, Vermont. The Sloop Island Canalboat was opened as part of the Lake Champlain Underwater Historic Preserve in 2005. The LCMM maintains a link from their website to information about the archaeological study and the Pine Street Barge Canal site. Talks given by museum staff in neighboring communities provide additional opportunities for education and outreach on canalboats. In addition, the LCMM designed and installed an outdoor wayside exhibit at the Site depicting Burlington's rise in the mid-1800's to one of the nation's most important lumber ports.

NRHP Nomination Forms. LCMM has prepared and submitted draft nomination forms to the VT Division for Historic Preservation the following: 1) NRHP nomination for the Sloop Island Canalboat, and 2) NRHP multiple property documentation form for Lake Champlain Standard Canalboats.

6.4 SITE INSPECTION

An inspection of the condition of on-site monitoring wells was performed on May 3 and 4, 2006 by Laurie O'Connor, Metcalf & Eddy. An inspection of the condition of the caps and weir was performed on May 10 and 16, 2006 by Hasan Abedi, Metcalf & Eddy. An inspection of the habitat restoration areas was performed on June 12, 2006. The following personnel were in attendance for the June 12 Site inspection: Karen Lumino, EPA Remedial Project Manager (RPM) and Steve Mangion, EPA Office of Research and Development; Thor Helgason, de maximis, inc.; George Desch and Michael Smith, VTDEC; Sonja Schuyler, The Johnson Company; and Deborah Roberts, Metcalf & Eddy. A completed site inspection form is included in Attachment 3.

Monitoring wells have minor issues that may require maintenance. Habitat observations are discussed further elsewhere in this report.

In general the cap, waterway, weir and inlets were in good physical condition and functioning. Minor erosion and animal burrowing was evident in a few areas. Sedimentation structures including the Area 7

forebay and the BED outlet in Area 4 are filling with sediment and will need maintenance to continue their effectiveness. Extensive sediment deposition was observed on both the canal and the lake side of the outlet weir. Currently, the buildup of sediment at the weir is not likely to impact the operation of the weir or effectiveness of the remedy as long as the canal and turning basin bottom elevations are generally maintained. The bathymetry surveys in 2003 and 2005 do not indicate an in increase in elevation in the turning basin or weir area.

6.5 INTERVIEWS

A group interview was conducted between Jim Murphy, EPA Community Involvement Coordinator, and Karen Lumino, EPA RPM, and several members of the Pine Street Barge Canal Coordinating Council on July 27, 2006. In a separate interview on July 27, Jim Murphy and Karen Lumino met with David White, City Planner for the City of Burlington Department of Planning and Zoning. Jim Murphy conducted a separate interview on July 26, 2006 with Nick Warner, Special Projects Manager for the City of Burlington Community and Economic Development Office. In addition, Steve Goodkind, Director of the City of Burlington Department of Public Works, provided written responses to questions posed by EPA in a letter dated July 12, 2006. Documentation of these interviews is included in Attachment 5.

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 performance of the subaqueous cap in portions of Areas 1 and 2, specifically the area between transects T9 and T14.

The cap performance standard has not been met for the subaqueous cap between T9 and T14. In this area, the cap has not isolated or prevented the migration of contamination, specifically NAPL, to the water and cap surface. In this area, the cap has not prevented contact between the contamination and benthic organisms and fish in the biologically active portion of the benthic habitat. Cores taken from the NAPL release area have concentrations of PAHs that exceed sediment benchmark values selected in the ROD for ecological protection. Fish, frogs, turtles, waterfowl, muskrat, and other fauna that live in and around the canal are exposed to free-phase NAPL with total PAH concentrations as high as 147,000 ppm. In addition to presenting a potential ecological risk, the presence of NAPL may also constitute a loss of habitat. Benthos have not been observed where free-phase NAPL is present (M&E, 1992b). For these reasons, EPA is making the determination that the subaqueous cap between transects T9 and T14 is not protective.

Sediment trap samples collected in 2005 to monitor stormwater inflow exceeded cap monitoring benchmarks for total PAHs, individual PAHs, and zinc. The levels of PAHs and metals, particularly in the three samples collected in the area of ongoing NAPL releases, exceed concentrations that correspond to probable risk for aquatic organisms exposed to sediments. These results may indicate that the sedimentation basins in Areas 7 and 4 are not completely effective or require maintenance. However, the impact of ongoing NAPL releases on data collected from sediment traps has not been quantified, but is likely significant and will continue to be significant until such time as the releases are addressed.

Groundwater data indicate that contamination is not moving off site, across the Class IV boundary or into Lake Champlain. However, the current compliance monitoring must be re-evaluated to determine if the performance standards for contaminant migration can be adequately monitored in light of two recent developments: 1) the expansion of the Class IV boundary in January 2006 and 2) new information regarding the location and potential mobility of a significant accumulation of NAPL in the subsurface at the southern portion of the Site.

Surface water data indicate that contamination is not moving off site into Lake Champlain. Environmental controls (e.g., booms) across the middle of the canal prevent NAPL from the area of ongoing releases from migrating. It is unknown how the surface water going into Lake Champlain would be impacted if these booms were to be removed.

Monitoring of aquatic and wetland habitat monitoring areas is ongoing. The data indicate that the performance standards for habitat restoration in Areas 1, 4/5, 7 and 8, the west bank cap and the 100 x 100 foot area have generally been met. Assuming the trends toward habitat conditions are confirmed in the 2007 monitoring of Area 3, it is anticipated that performance standards will be meet there as well. Prior to 2004, no specific sample was collected from the portion of Area 2 potentially impacted by NAPL release. In 2005, the abundance of invertebrates in Area 2 was reduced from previous years. The presence of free-phase coal tar on the surface of the subaqueous cap is presumed by EPA to have a significant impact on the quality of habitat for the benthic invertebrates. Further evaluation in the portions of the canal where NAPL has accumulated on the surface of the subaqueous cap is needed if a different conclusion regarding its impacts on the benthic community is to be drawn.

Finally, until a mechanism to determine compliance with institutional controls is in place, the remedy will not be functioning as intended by the ROD.

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?

Yes. However, four years after the Pine Street ROD was signed, EPA issued guidance for evaluating vapor intrusion into indoor air (USEPA, 2002). This pathway has not been evaluated for the Site.

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 were also prepared by the Pine Street Canal Coordinating Council (Appendix 7 of the 1997 ARI). 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 concluded that contaminants were not reaching Lake Champlain water at concentrations exceeding drinking water standards. Therefore, it was concluded that ingestion of water from Lake Champlain, used as a drinking water source, 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 noncarcinogenic 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 trichloroethene. 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. Noncarcinogenic toxicity values were not available for benzene and trichloroethene 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.

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;
- 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.

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. Institutional controls are currently in place preventing these land uses, assuring current remedy protectiveness. However, there is no mechanism in place to determine compliance with the institutional controls. Implementation of an institutional control monitoring plan is needed to assure future protectiveness of the remedy, particularly to ensure that the restrictions are effective in continuing to limit excavations below five feet, prohibit use of groundwater for drinking and prohibit the use of the Site for residences or day care. 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 deep soils should be evaluated.

Based on contaminant concentrations present in shallow groundwater, direct worker 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 be potentially complete exposure pathways contributing to work risk and hazard. 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 subsurface NAPL, PAHs in soil/sediment and BTEX in groundwater at the Site are shown in Figures 7, 10 and 11, respectively. 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 risk = 1×10^{-6} for the indoor air pathway (5 ug/L and 150 ug/L, respectively; USEPA, 2002). Because of the possible presence of subsurface VOCs in the vicinity of currently occupied buildings (e.g., Burlington Electric Department) at levels exceeding EPA screening criteria, the potential exists for indoor air impacts. Therefore, the indoor air pathway should be further evaluated to determine the potential risk, if any, to current and future (e.g., vacant parcels at 453 and 501 Pine Street) receptors at the Site.

Evaluation of Recent Sampling Data

As discussed in Section 6.3.1.1, 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. Two wells located within the boundary (MW-23B and MW-9A) and one well located outside the boundary (MW-21B) show concentrations in excess of drinking water standards. However, there is no evidence that the contamination in MW-21B or MW-9A (which until January 2006 was located outside the Class IV boundary) is the result of migration across the Class IV boundary or is related to site releases. Based on available information, there is no evidence of significant migration beyond the Class IV boundary and the remedy currently is protective of the groundwater ingestion exposure pathway. Institutional controls implemented at the Site ensure that drinking water

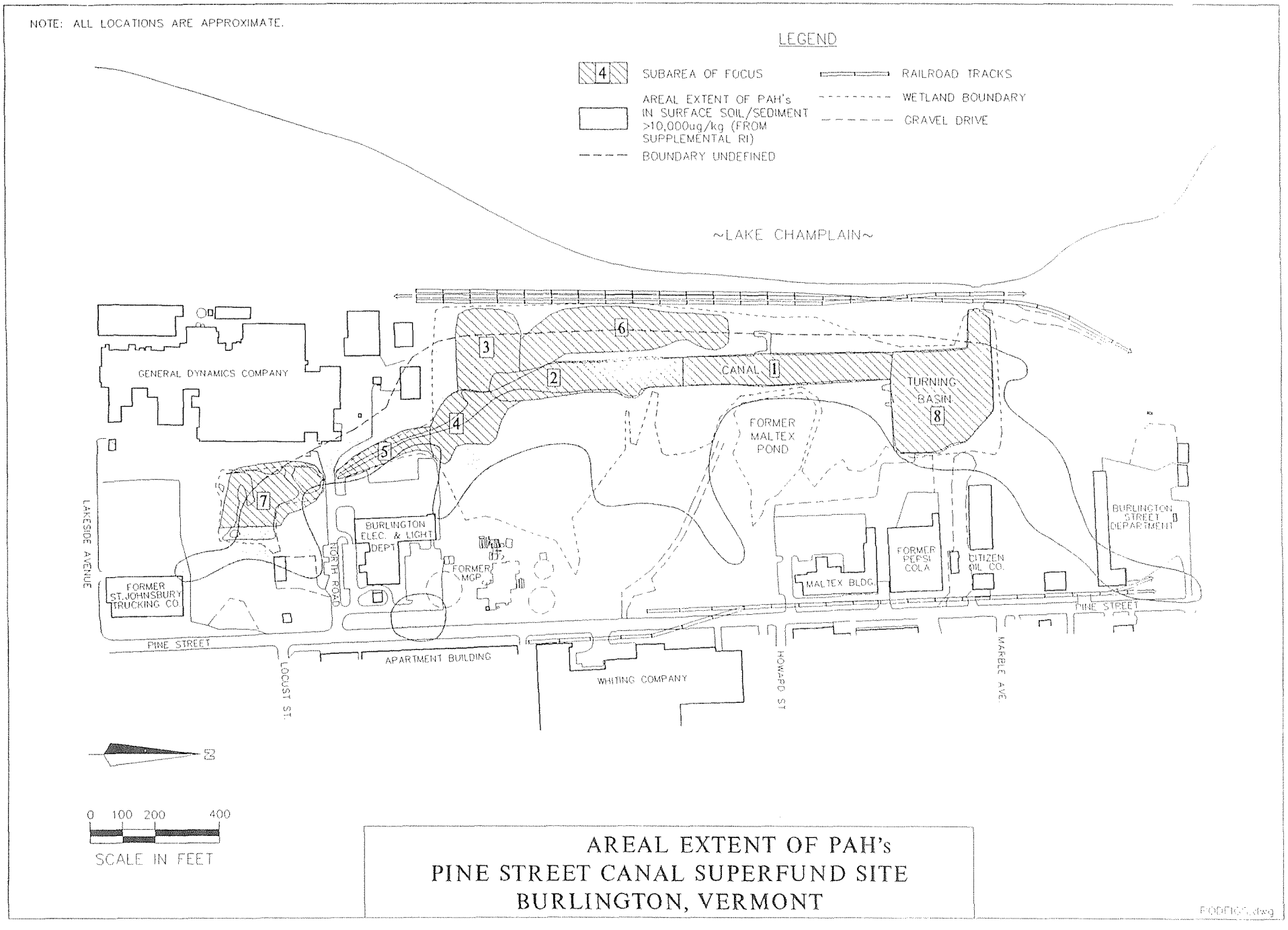

FIGURE 10 (Five Year Review Report; Source: USEPA, 1998a)

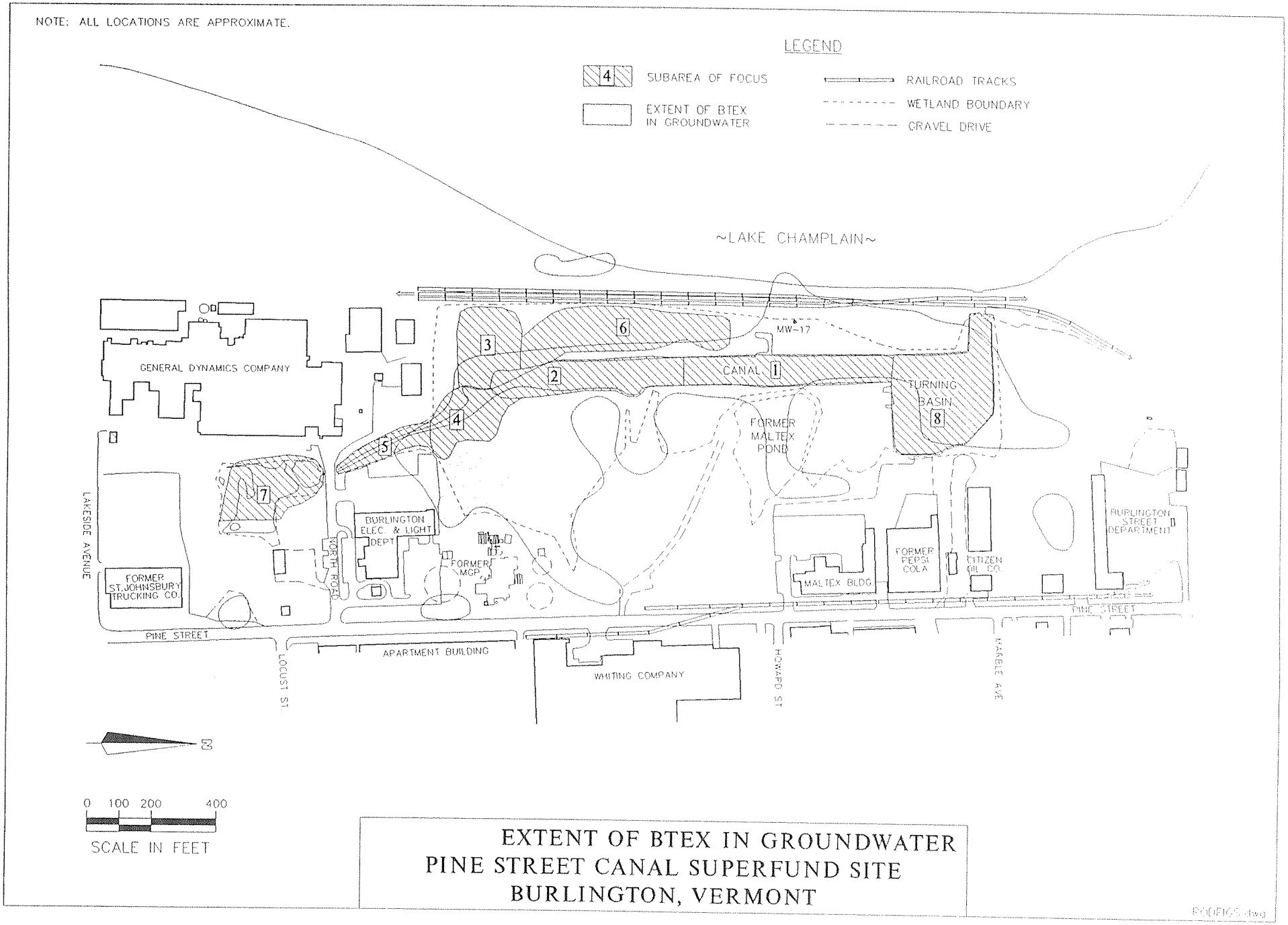

FIGURE 11 (Five Year Review Report; Source: USEPA, 1998a)

wells will not be installed within the Class IV boundary. Because groundwater contaminant concentrations within the Class IV boundary continue to be present at levels indicative of risk management exceedances, institutional controls and performance monitoring should be continued to assure that drinking water wells are not installed within the Class IV boundary and the migration of Site-related contamination beyond the compliance boundary is controlled.

Groundwater data indicate that contamination is not moving off site, across the Class IV boundary or into Lake Champlain. However, the current compliance monitoring must be re-evaluated to determine if the performance standards for contaminant migration can be adequately monitored in light of two recent developments: 1) the expansion of the Class IV boundary in January 2006 and 2) new information regarding the location and potential mobility of a significant accumulation of NAPL in the subsurface at the southern portion of the Site.

Post-construction surface water monitoring grab samples were collected in July 2005 from the outlet to Lake Champlain and analyzed for PAHs. No PAHs were detected. Therefore, these recent data confirm the conclusion that the surface water exposure pathway in Lake Champlain is not of concern for human receptors. Due to a lack of sediment transport data for the lake, no definitive conclusion can be drawn regarding the sediment exposure pathway. However, this exposure pathway to humans was not considered to be of concern prior to remedy implementation.

Failure of portions of the subaqueous cap to contain the release of NAPL may result in the further release and migration of contamination to sediment and surface water within the canal. Human exposures to released NAPL and impacted surface water/sediment within the canal should be limited to the extent practicable until a solution is implemented or the impacts of the NAPL have been assessed.

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. In addition, post-remediation surface water samples at the outlet to Lake Champlain indicate non-detectable concentrations of PAHs. Because these media were associated with risks and hazards below regulatory criteria, the remedy continues to be protective for on-site soil exposures and sediment/surface water exposures in Lake Champlain.

To continue long-term protectiveness of the remedy, institutional controls should 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. Performance monitoring should be continued and the current compliance monitoring program re-evaluated to assure that the migration of site-related contamination beyond the compliance boundary and into Lake Champlain is controlled. 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.

Historical groundwater data as well as the recently collected groundwater data indicate on-site exceedances of EPA generic screening values for risk = 1 x 10^{-6} for the subsurface vapor to indoor air pathway. Because of the possible presence of subsurface VOCs in the vicinity of currently occupied buildings at levels exceeding EPA screening criteria, the indoor air pathway should be further evaluated to determine the potential risk, if any, to current or future indoor receptors at the Site.

Due to failure of portions of the subaqueous cap to contain the release of NAPL, human exposures to released NAPL and impacted surface water/sediment within the canal should be limited to the extent practicable until a solution is implemented or the impacts of the NAPL have been assessed.

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 focus area was subdivided into eight subareas (see Figure 2). 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 (PRGs) 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. Cores taken from the NAPL release area per the compliance monitoring program have concentrations of PAHs that exceed sediment benchmark values in the top-cap segment, but not in the mid-cap segment of the core. 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.

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. 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, which the exception of the performance of the subaqueous cap in portions of Areas 1 and 2, specifically the area between transects T9 and T14. There, the cap performance standard has not been met in that certain portions of the cap have not isolated or prevented the migration of contamination, specifically NAPL, to the cap surface and surface water. The cap has not prevented contact between the contamination and benthic organisms and fish in the biologically active portion of the benthic habitat. Cores taken from the NAPL release area have concentrations of PAHs that exceed sediment benchmark values selected in the ROD for ecological protection. Fish, frogs, turtles, waterfowl, muskrat and other fauna that live in and around the canal are exposed to free-phase NAPL with total PAH concentrations as high as 147,000 ppm. In addition to presenting a potential ecological risk, the presence of NAPL may also constitute a loss of habitat. Benthos have not been observed where free-phase NAPL is present (M&E, 1992b). For these reasons, EPA is making the determination that the subaqueous cap between transects T9 and T14 is not protective.

The Performing Defendants have implemented a NAPL action plan with the goal of addressing ongoing NAPL releases at the Site. The action plan includes additional field investigation(s) to identify the mechanism(s) responsible for the appearance of NAPL and an approach to address the NAPL. Human exposures to released NAPL and impacted surface water/sediment within the canal should be limited to the extent practicable until a solution is implemented or the impacts of the NAPL have been assessed.

Historical groundwater data as well as the recently collected groundwater data indicate on-site exceedances of EPA generic screening values for risk = 1×10^{-6} for the subsurface vapor to indoor air pathway. Because of the possible presence of subsurface VOCs in the vicinity of currently occupied buildings at levels exceeding EPA screening criteria, the indoor air pathway should be further evaluated to determine the potential risk, if any, to current or 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 issues identified in the following table have been noted.

TABLE 3. ISSUES

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Between transects T9 and T14, the cap performance standard for isolation of contaminants has not been met in the subaqueous cap and ecologically-protective sediment benchmarks have been exceeded.	Yes	Yes
There is no mechanism in place to determine future compliance with institutional controls (ICs) that have been established to restrict land and groundwater use at the Site.	No	Yes
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 risk = 1×10^{-6} for the vapor intrusion pathway indicated the possible presence of subsurface VOCs in the vicinity of currently occupied buildings at levels exceeding screening criteria.	Unknown	Unknown
The compliance monitoring program should be re-evaluated to determine if the performance standards for contaminant migration can be adequately monitored in light of the following: 1) the expansion of the Class IV boundary in January 2006 and 2) new information regarding the location and potential mobility of a significant accumulation of NAPL in the subsurface at the southern portion of the Site.	No	Yes

SECTION 9.0
RECOMMENDATIONS AND FOLLOW-UP ACTIONS

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

TABLE 4. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Cap performance standard for isolation of contaminants has not been met and sediment benchmarks have been exceeded in the subaqueous cap between T9 and T14.	Develop a plan to control and eliminate ongoing NAPL releases. Reduce human exposure in the short-term. Construction additional remedial measures for NAPL releases.	Performing Defendants Performing Defendants	EPA EPA	Feb 2007 2008 Field Season	Yes	Yes
Lack of mechanism to determine future compliance with ICs.	Develop and implement a plan to monitor ICs to determine compliance.	Performing Defendants	EPA	Oct 2007	No	Yes
Vapor intrusion to indoor air pathway was not evaluated in previous risk evaluations.	Evaluate the potential risk, if any, to current and future indoor receptors.	Performing Defendants	EPA	Oct 2007	Un-known	Un-known
Compliance monitoring program may not adequately assess contaminant migration off site.	Review and modify, as needed, compliance monitoring program.	Performing Defendants	EPA	Oct 2007	No	Yes

SECTION 10.0
PROTECTIVENESS STATEMENTS

The remedy is currently protective, except for the subaqueous cap in portions of Areas 1 and 2, specifically between transects T9 and T14, because it does not meet the cap performance standard for isolation of contaminants; exceeds ecologically-protective sediment benchmarks established in the ROD; exposes fauna living in and around the canal to highly-contaminated waste in the form of free-phase coal tar (NAPL); and may constitute a loss of benthic habitat.

The remedy will not be protective in the future without a mechanism in place to determine compliance with institutional controls that have been established to restrict land and groundwater use at the Site.

Two issues that must be evaluated in order to determine protectiveness in the future are:

1. The vapor intrusion to indoor air pathway and the potential to impact current or future indoor receptors.

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

SECTION 11.0
NEXT REVIEW

The next Five-Year Review for the Pine Street Canal Superfund Site will be completed by October 2011, five years from the due date of this review. The next Five-Year Review should include:

- Evaluate investigations related to mobilization of NAPL or actions taken to control and mitigate the NAPL releases.

- Review of any investigations or risk evaluations conducted to evaluate the vapor intrusion (indoor air) pathway, which has not been previously evaluated.

- 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.

ATTACHMENT 1
PARCELS GRANTED RESTRICTIVE EASEMENTS

Attachment 1

Grant of Environmental Restrictions and Right of Access
Pursuant to Consent Decree, Section IX, ¶¶ 34-38

Record Owner	Address	Old Tax Map #	New Tax Map #
Cloverleaf Properties, Inc.	44 Lakeside Avenue 501 Pine St. (rear)	56-0-6-0, 56-0-7-0, 56-0-9-0 53-0-2-0	053-2-012-000 053-1-012-000
The Maltex Partnership	501 Pine Street	53-0-9-0	053-1-002-000
City of Burlington	339 Pine Street	52-0-9-0	049-2-019-000
City of Burlington	645 Pine Street	55-0-3-0, 55-0-4-0, 55-0-5-0	053-2-004-000
City of Burlington	585 Pine Street	55-0-6-0	053-2-005-000
Vermont Gas Systems, Inc.	501 Pine Street	53-0-3-0	053-1-001-000
GP Burlington North, L.L.C.	128 Lakeside Avenue (n/s)	55-0-1-0	053-2-010-000
BCV Associates, Inc.	Pine Street (btwn canal & RR bed)	53-0-1-0	053-1-011-000
City of Burlington	Pine Street	52-0-2-0, 52-0-3-0, 53-0-5-0, 53-0-8-0	053-1-003-000
Derrick H. Davis and Susan M. Conley, Trustees of the Derrick H. Davis Charitable Remainder Trust II	453 Pine Street	53-0-7-0	053-1-003-001
Dennis P. Havey	345 Pine Street	52-0-8-0 52-0-10-0	053-1-017-000
The Maltex Partnership	431 Pine Street	52-0-1-0	053-1-004-000
Davis Development Corporation	431 Pine Street (rear)	52-0-12-0	053-1-010-000
Vermont Railway, Inc.	Maple Street (approx. 1.21 acres)	52-0-11-0	053-1-009-000
Citizens Oil Company nka Citizens Properties, Inc.	377 Pine Street	52-0-6-0	053-1-006-000
S & S Vending Co.	405 Pine Street	52-0-5-0 52-0-4-0	053-1-005-000

ATTACHMENT 2
LIST OF DOCUMENTS REVIEWED/REFERENCES

ATTACHMENT 2
LIST OF DOCUMENTS REVIEWED / REFERENCES

Blasland, Bouck, and Lee, Inc. (BBL) and Hart Crowser, Inc. 2006. *Interim Data Report for Spring Investigation, Pine Street Canal Superfund Site, Burlington, Vermont.* Prepared for the Performing Defendants. Submitted to USEPA and VTDEC. July 20, 2006.

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ATTACHMENT 3
SITE INSPECTION FORM

I. Site Information

Site Name: Pine Street Barge Canal Superfund Site	Date of Inspection: 5/3/06 & 5/4/06 – Monitoring wells only (L. O'Connor) 5/10/06&5/16/06- Geotechnical (H. Abedi) 6/12/06-Habitat Restoration (D. Roberts)
Location and Region: Burlington, Vermont/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 Roster ☒ Site Map ☒ Monitoring Well Inspection Sheet

II. Interviews Note: Interviews conducted by EPA, See attached summaries

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED ☒ NA
IV. O&M Costs ☒ NA
V. ACCESS AND INSTITUTIONAL CONTROLS
A. Fencing ☒ NA
B. Other Access Restrictions ☒ NA
C. Institutional Controls (ICs)
Implementation and Enforcement-☒ NA
D. General
1. Vandalism/trespassing ☐ Shown on Site Map Remarks: Homeless people sleep east of canal (several sleeping bags and pillows observed)
2. Land Use changes on Site ☒ NA Remarks:
3. Land Use changes off-Site ☒ NA Remarks:
VI. GENERAL SITE CONDITIONS
A. Roads 1. Roads damaged ☐ Location shown on site map ☐ Roads adequate ☒ NA Remarks:
B. Other Site Conditions Remarks:
VII. REMEDY COMPONENTS
A. West Bank
1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident Areal extent: Depth: Remarks:
2. Cracks ☐ Location shown on map ☒ Cracking not evident Lengths: Widths: Depths:

Remarks:

3. Erosion ☐ Location shown on map ☐ Erosion not evident
Areal Extent: Depth:
Remarks: Minor Erosion and sloughing along the shoreline

4. Holes ☐ Location shown on map ☒ Holes not evident
Areal extent: Depth:
Remarks:

5. Vegetative Cover ☐ Grass ☒ Cover properly established ☐ No signs of stress
☐ Trees/shrubs (Size and locations indicated on diagram)
Remarks:

6. Bulges ☐ Location shown on map ☒ Bulges not evident
Areal extent: Height:
Remarks:

7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident
☐Wet areas ☐ Location shown on map Areal extent:
☐Ponding ☐ Location shown on map Areal extent:
☐Seeps ☐ Location shown on map Areal extent:
☐Soft subgrade ☐ Location shown on map Areal extent:
Remarks:

8. Slope Instability ☐Slides ☐ Location shown on map ☒ No evidence of slope instability
Areal extent:
Remarks: Minor sloughing along shoreline.

B. East Bank

1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident
Areal extent: Depth:
Remarks:

2. Cracks ☐ Location shown on map ☒ Cracking not evident
Lengths: Widths: Depths:
Remarks:

3. Erosion ☐ Location shown on map ☒ Erosion not evident
Areal Extent: Depth:
Remarks:

4. Holes ☐ Location shown on map ☒ Holes not evident
Areal extent: Depth:
Remarks:

5. Vegetative Cover ☐ Grass ☐ Cover properly established ☒ No signs of stress
☐ Trees/shrubs (Size and locations indicated on diagram)
Remarks:

6. Bulges ☐ Location shown on map ☒ Bulges not evident
Areal extent: Height:
Remarks:

7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident
☐Wet areas ☐ Location shown on map Areal extent:
☐Ponding ☐ Location shown on map Areal extent:
☐Seeps ☐ Location shown on map Areal extent:
☐Soft subgrade ☐ Location shown on map Areal extent:
Remarks: Natural wet areas evident

8. Slope Instability ☐Slides ☐ Location shown on map ☒ No evidence of slope instability
Areal extent:
Remarks:

C. Area 7

1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident
Areal extent: Depth:
Remarks:

2. Cracks ☐ Location shown on map ☒ Cracking not evident
Lengths: Widths: Depths:
Remarks:

3. Erosion ☐ Location shown on map ☒ Erosion not evident
Areal Extent: Depth:
Remarks:

4. Holes ☐ Location shown on map ☐ Holes not evident
Areal extent: Depth:
Remarks: Several animal burrows

5. Vegetative Cover ☐ Grass ☒ Cover properly established ☐ No signs of stress
☐ Trees/shrubs (Size and locations indicated on diagram)
Remarks:

6. Bulges ☐ Location shown on map ☒ Bulges not evident
Areal extent: Height:
Remarks:

7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on map Areal extent:
☐ Ponding ☐ Location shown on map Areal extent:
☐ Seeps ☐ Location shown on map Areal extent:
☐ Soft subgrade ☐ Location shown on map Areal extent:
Remarks:

8. Slope Instability ☐ Slides ☐ Location shown on map ☒ No evidence of slope instability
Areal extent:
Remarks:

D. Area 2/3

1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident
Areal extent: Depth:
Remarks:

2. Cracks ☐ Location shown on map ☒ Cracking not evident
Lengths: Widths: Depths:
Remarks:

3. Erosion ☐ Location shown on map ☒ Erosion not evident
Areal Extent: Depth:
Remarks:

4. Holes ☐ Location shown on map ☒ Holes not evident
Areal extent: Depth:
Remarks:

5. Vegetative Cover ☐ Grass ☐ Cover properly established ☒ No signs of stress
☐ Trees/shrubs (Size and locations indicated on diagram)
Remarks:

6. Bulges ☐ Location shown on map ☒ Bulges not evident
Areal extent: Height:
Remarks:

7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on map Areal extent:
☐ Ponding ☐ Location shown on map Areal extent:

☐Seeps ☐ Location shown on map Areal extent: ☐Soft subgrade ☐ Location shown on map Areal extent: Remarks: Some areas naturally wet
8. Slope Instability ☐Slides ☐ Location shown on map ☒ No evidence of slope instability Areal extent: Remarks:
E. BED Outfall
1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident Areal extent: Depth: Remarks:
2. Cracks ☐ Location shown on map ☒ Cracking not evident Lengths: Widths: Depths: Remarks:
3. Erosion ☐ Location shown on map ☒ Erosion not evident Areal Extent: Depth: Remarks:
4. Holes ☐ Location shown on map ☒ Holes not evident Areal extent: Depth: Remarks:
5. Vegetative Cover ☐ Grass ☐ Cover properly established ☒ No signs of stress ☐ Trees/shrubs (Size and locations indicated on diagram) Remarks:
6. Bulges ☐ Location shown on map ☒ Bulges not evident Areal extent: Height: Remarks:
7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident ☐Wet areas ☐ Location shown on map Areal extent: ☐Ponding ☐ Location shown on map Areal extent: ☐Seeps ☐ Location shown on map Areal extent: ☐Soft subgrade ☐ Location shown on map Areal extent: Remarks: Natural ponding – high turbidity water
8. Slope Instability ☐Slides ☐ Location shown on map ☒ No evidence of slope instability Areal extent: Remarks:
F. 100' x 100' Area
1. Settlement (Low Spots) ☐ Location shown on map ☒ Settlement not evident Areal extent: Depth: Remarks:
2. Cracks ☐ Location shown on map ☒ Cracking not evident Lengths: Widths: Depths: Remarks:
3. Erosion ☐ Location shown on map ☒ Erosion not evident Areal Extent: Depth: Remarks: Minor erosion and sloughing along the shoreline
4. Holes ☐ Location shown on map ☐ Holes not evident Areal extent: Depth: Remarks: Several animal burrows within the area
5. Vegetative Cover ☐ Grass ☒ Cover properly established ☒ No signs of stress ☐ Trees/shrubs (Size and locations indicated on diagram) Remarks:

6. Bulges ☐ Location shown on map ☒ Bulges not evident Areal extent: Height: Remarks:
7. Wet Areas/Water Damage ☒ Wet areas/water damage not evident ☐ Wet areas ☐ Location shown on map Areal extent: ☐ Ponding ☐ Location shown on map Areal extent: ☐ Seeps ☐ Location shown on map Areal extent: ☐ Soft subgrade ☐ Location shown on map Areal extent: Remarks:
8. Slope Instability ☐ Slides ☐ Location shown on map ☒ No evidence of slope instability Areal extent: Remarks: Minor sloughing along the shoreline
G. Canal
1. Settlement ☐ Location shown on map ☒ No evidence of settlement Areal extent: Depth: Remarks:
2. Material Degradation ☐ Location shown on map ☒ No evidence of degradation Material type: Areal extent: Remarks:
3. Erosion ☐ Location shown on map ☒ No evidence of erosion Areal Extent: Depth: Remarks:
4. Undercutting ☐ Location shown on map ☒ No evidence of undercutting Areal extent: Depth: Remarks:
5. Obstructions Type: ☒ No obstructions ☐ Location shown on map Areal extent: Size: Remarks:
6. Excessive Vegetative Growth Type: ☒ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on map Areal extent: Remarks:
7. Additional Remarks: NAPL sheen and odor were present between T9 to T12 area during BBL's field investigation during May 2006.
H. Turning Basin
1. Settlement ☐ Location shown on map ☒ No evidence of settlement Areal extent: Depth: Remarks:
2. Material Degradation ☐ Location shown on map ☒ No evidence of degradation Material type: Areal extent: Remarks:
3. Erosion ☐ Location shown on map ☒ No evidence of erosion Areal Extent: Depth: Remarks:
4. Undercutting ☐ Location shown on map ☒ No evidence of undercutting Areal extent: Depth:

Remarks:

5. Obstructions Type: ☒ No obstructions
☐ Location shown on map
Areal extent: Size:
Remarks:

6. Excessive Vegetative Growth Type:
☒ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on map
Areal extent:
Remarks:

I. North Road Culvert and Drop Inlet

1. Outlet Pipes Inspected ☒ Functioning ☐ N/A
Remarks:

2. Outlet Rock Inspected ☒ Functioning ☐ N/A
Remarks:

J. Area 7 Detention/Sedimentation Ponds

1. Siltation ☐ N/A ☐ Siltation not evident
Areal extent: Depth:
Remarks: Siltation observed in Forebay

2. Erosion ☒ Erosion not evident
Areal extent: Depth:
Remarks:

3. Outlet Works ☒ Functioning ☐ N/A
Remarks:

4. Dam ☐ Functioning ☒ N/A
Remarks:

K. Outlet Weir

1. Deformations ☐ Location shown on map ☒ Deformation not evident
Horizontal displacement: Vertical displacement:
Rotational displacement:
Remarks: Siltation on canal and lake side (silt deposit of one to two feet)

2. Degradation ☐ Location shown on map ☒ Degradation not evident
Remarks:

L. Perimeter Ditches/Off-Site Discharge ☒ N/A

VIII. GROUNDWATER/SURFACE WATER REMEDIES

A. Monitoring Data

1. Monitoring well conditions: See attached Monitoring Well Inspection Sheet

IX. Aquatic and Wetland Habitat Restoration

A. West Bank

1. Wetland Hydrology ☒ Evidence of saturation/inundation ☐ Wetland Hydrology not evident
Areal extent: 100% Depth: 3-4 in.
Remarks: Unusually high water levels for June. Water level over top of most of the bank.

2. Vegetative Cover ☒ Cover properly established ☐ No signs of stress
☐ Bare Areas (Size and locations indicated on diagram)

Remarks: Buckthorn seedlings and Timothy on top of cap. Burreed and cattails at edge of bank. Vegetation sparse 20 ft from edge of bank. Probably due to inundation.

3. Wetland Vegetation ☐ Wetland Species Appear Dominant
☒ Areas of Upland Species Dominant

Areal Extent: 80% total cover, predominately upland.
Remarks:

4. Planted Species — Trees/shrubs Survival: ☐ Good ☐ Fair ☐ Poor
Trees/shrubs Condition: ☐ Good ☐ Fair ☐ Poor
N/A Herb Survival: ☐ Good ☐ Fair ☐ Poor
Herb Condition: ☐ Good ☐ Fair ☐ Poor
Remarks: No plantings were installed on West Bank.

5. Invasive Species Control ☐ Invasive Species Absent
☒ Invasive Species Prevalent

Areal Extent: Buckthorn seedlings and reed canary grass prevalent.
Remarks:

6. Erosion ☐ Location shown on map ☒ Erosion not evident
Areal Extent: Depth:
Remarks:

B. Area 7

1. Wetland Hydrology ☒ Evidence of saturation/inundation ☐ Wetland Hydrology not evident
Areal extent: above elevation 100 ft Depth:
Remarks: Hydrology consistent with design elevations. Pockets of inundation up to base of the bank (approx. 101 ft).

2. Vegetative Cover ☒ Cover properly established ☒ No signs of stress
☐ Bare Areas

Remarks: Cover established throughout most of Area 7. Two small bare areas (approx. 20 ft x 30 ft) were noted, likely due to inundation and herbicide treatment for invasive species.

3. Wetland Vegetation ☒ Wetland Species Appear Dominant
☐ Areas of Upland Species Dominant
Areal Extent: Emergent vegetation established around the detention pond and channel.
Remarks:

4. Planted Species — Trees/shrubs Survival: ☒ Good ☐ Fair ☐ Poor
Trees/shrubs Condition: ☒ Good ☐ Fair ☐ Poor
Herb Survival: ☒ Good ☐ Fair ☐ Poor
Herb Condition: ☒ Good ☐ Fair ☐ Poor
Remarks: Shrubs, particularly speckled alder are doing well in Area 7. Red maple and cottonwood trees that were planted are surviving. A large number of black locust seedlings are present on the north bank.

5. Invasive Species Control ☐ Invasive Species Absent
☒ Invasive Species Prevalent

Areal Extent: *Phragmites* is dominant on the south side of the channel along the 100-foot elevation in Area 7, where it is 50 – 100% of the vegetative cover. The remainder of Area 7 is dominated by other species.
Remarks: Herbicide treatment appears to be aiding in the control of *Phragmites*, keeping it from dominating all of the area.

6. Erosion ☐ Location shown on map ☒ Erosion not evident

Areal Extent: Depth:
Remarks: Forebay, at the discharge of the 48 in. DPW culvert is filling with sediment.

C. Area 2/3

1. Wetland Hydrology ☒ Evidence of saturation/inundation ☐ Wetland Hydrology not evident
Areal extent: Soil Saturated to the surface up to approx. elevation 99 ft. Depth: Surface
Remarks:

2. Vegetative Cover ☒ Cover properly established ☒ No signs of stress
☐ Bare Areas (Size and locations indicated on diagram)

Remarks:

3. Wetland Vegetation ☒ Wetland Species Appear Dominant
☐ Areas of Upland Species Dominant
Areal Extent: Majority of the area appeared to be covered with wetland vegetation, except area above and near elevation 100 feet, between Well J_OW-4 and the parking lot bordering the south side of Area 3.
Remarks:

4. Planted Species
Trees/shrubs Survival: ☒ Good ☐ Fair ☐ Poor
Trees/shrubs Condition: ☒ Good ☐ Fair ☐ Poor
Herb Survival: ☒ Good ☐ Fair ☐ Poor
Herb Condition: ☒ Good ☐ Fair ☐ Poor
Remarks:

5. Invasive Species Control ☐ Invasive Species Absent
☒ Invasive Species Prevalent

Areal Extent:
Remarks: Both purple loosestrife and *Phragmites* are present, but not dominant.

6. Erosion ☐ Location shown on map ☐ Erosion not evident
Areal Extent: Depth:
Remarks:

D. 100' x 100' Area

1. Wetland Hydrology ☒ Evidence of saturation/inundation ☐ Wetland Hydrology not evident
Areal extent: Depth:
Remarks:

2. Vegetative Cover ☒ Cover properly established ☐ No signs of stress
☐ Bare Areas (Size and locations indicated on diagram)

Remarks:

3. Wetland Vegetation ☐ Wetland Species Appear Dominant
☒ Areas of Upland Species Dominant
Areal Extent: Some areas of wetland-dominated vegetation, majority appears upland.
Remarks: Although intended to meet wetland criteria for scrub-shrub wetland, according to wetland restoration plan, the 100x100 ft area was not included in monitoring.

4. Planted Species **N/A**
Trees/shrubs Survival: ☐ Good ☐ Fair ☐ Poor
Trees/shrubs Condition: ☐ Good ☐ Fair ☐ Poor
Herb Survival: ☐ Good ☐ Fair ☐ Poor
Herb Condition: ☐ Good ☐ Fair ☐ Poor

Remarks: No plantings.

5. Invasive Species Control ☐ Invasive Species Absent
☒ Invasive Species Prevalent

Areal Extent: Approximately 75% of the site is dominated (about 50%) *Phragmites*. No treatment/control is done at 100x100 ft area.
Remarks:

6. Erosion ☐ Location shown on map ☐ Erosion not evident
Areal Extent: Depth:
Remarks: Bank not visible due to high water.

D. Canal and Turning Basin
Bank condition: Bank not visible due to high water.
Submergent aquatic vegetation present in Canal: ☒ Yes ☐ No

Remarks: Areas of submergent aquatic vegetation dense along the south end of the West Bank Cap area, dominated by Elodea and water milfoil.

X. OTHER REMEDIES

See attached inspection sheets

Attachment C. Monitoring Well Inspection Sheet
Pine St. Canal Superfund Site 5 YR Review

Inspector: L. O'Connor (Metcalf and Eddy)

Date of Inspection: 5/3/06 and 5/4/06

Monitoring Well Location	Well ID Mark Present (Y/N)	Well Lock Present (Y/N)	Well Plumb/ Level (Y/N)	Outer Casing Good Condition (Y/N)	Concrete Pad Good Condition (Y/N)	Additional Notes
MW-20A	Y	NV	Y	Y	Y	flush mount - can not see lock
MW-20B	N	NV	Y	Y	N	flush mount - can not see lock; no well ID, but right next to MW-20A; pad broken
MW-21A	N	NV	Y	Y	NV	flush mount - can not see lock
MW-21B	N	NV	Y	Y	NV	flush mount - can not see lock
MW-22A	Y	NV	Y	Y	Y	flush mount - can not see lock
MW-22B	Y	NV	Y	Y	Y	flush mount - can not see lock
MW-23A	Y	NV	Y	Y	Y	flush mount - can not see lock
MW-23B	Y	NV	Y	Y	NV	flush mount - can not see lock
MW-24A	N	NV	Y	Y	NV	flush mount - can not see lock
MW-24B	N	NV	Y	Y	NV	flush mount - can not see lock
MW-9A	Y	Y	Y	Y	NV	
MW-9B	Y	Y	Y	Y	NV	
MW-1B	Y	Y	Y	Y	NV	
MW-3C	Y	Y*	Y	Y	N	lock present but not engaged (locked by L.O.); pad broken
MW-4B	Y	Y*	Y	Y	N	lock present but not engaged (locked by L.O.); outer casing filled w/water; no plug on PVC; pad broken
MW-8A	Y	Y	Y	Y	NV	could not walk right up to well due to fence - inspected from 15 feet away
MW-11D	Y	Y	Y	Y	NV	
MW-12	Y	Y*	Y	Y	N	lock present but not engaged (locked by L.O.); outer casing filled w/water; a lot of algae on plug on PVC; pad broken
MW-13	Y	Y	Y	Y	NV	
MW-17	Y	Y*	Y	Y	NV	PVC & cap too high to close outer casing top; not locked and can not be locked as is
MW-18	Y	Y	Y	Y	NV	could not walk right up to well due to fence - inspected from 15 feet away
MW-19	Y	Y	Y	Y	N	pad 1/4 broken
P-106	Y	Y	Y	Y	NV	
WE 89-5S	N	NV	Y	Y	Y	flush mount
WE 89-6S	N	NV	Y	Y	Y	flush mount; asphalt around outer casing is crumbling; outer casing exposed
WE 89-7S	Y	Y	Y	Y	NV	
FLA-1	N	NV	Y	Y	N	flush mount
FLA-4	Y	Y	N	Y	NV	well not straight - approx. 10° off vertical

NV = Not Visible

* - Lock present but not engaged

ATTACHMENT 4
SUMMARY OF ARARs

TABLE A3-1. SUMMARY OF ARARs
PINE STREET BARGE 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.	TBC	No action necessary; sediments currently meet this criteria.	The soil used to cap the Canal and Turning Basin met these criteria.
Ontario Ministry of the Environment and Energy (OMEE) Sediment Quality Guidelines	Guidelines derived specifically for freshwater sediments that define three levels of chronic effects on benthic organisms: no-effect level; lowest-effect level (LEL) which indicates level of sediment contamination that can be tolerated by most benthic organisms; severe-effects level (SEL) level at which pronounced disturbances of sediment-dwelling organisms 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 and 7 and the Canal and Turning Basin were capped with clean material (sand/soil) providing a barrier between benthic organisms and contaminated sediments. However, in certain portions of the cap (between transects T9 and T12), the cap has not been effective in isolating contamination from the contaminated sediments beneath the cap and preventing ecological exposures. The values are still 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 10^{th} and 50^{th} 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 and 7 and the Canal and Turning Basin were capped with clean material (sand/soil) in order to provide a barrier between benthic organisms and contaminated sediments. However, in certain portions of the cap, the cap has not been effective in isolating contamination from the contaminated sediments beneath the cap and preventing ecological exposures. The values are still TBC in evaluating the effectiveness of the

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
BURLINGTON, VERMONT

REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
				cap in preventing harmful ecological exposures.
Clean Water Act (CWA) 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 (AWQC).	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 are still to be considered in evaluating the results of long-term monitoring of 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	Substantiative 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, 40 CFR 6, Subpart A	Actions by federal agencies taking place within floodplains must be done to avoid adverse impacts and preserve beneficial values in floodplains.	Applicable	Substantiative 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 from pre-existing conditions.The placement of the cap reduces the flood storage capacity of the site, however Lake Champlain provides practically unlimited storage. Therefore, no adverse effects are expected.
Executive Order	Actions by federal agencies taking place within wetlands must be	Applicable	All remedial actions will be designed to minimize wetlands areas to be	Engineering controls were used during remedy construction to

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
BURLINGTON, VERMONT

REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
11990 Protection of Wetlands, 40 CFR 6, Subpart A	planned to limit adverse impacts.		impacted during implementation of the remedy and all remediated areas will have wetlands restoration activities.	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 (CWA) 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	Substantiative portions of this Act will be met through the design of these alternatives. In particular, actions which minimize impacts to non-remediation 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. Steps to prevent this occurrence may include, but are not limited to silt curtains, weirs, subaqueous cap placement, and specialized 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. Planting of cap material in wetlands in Areas 3 and 7 and the movement of excess soil from Area 7 to Area 3 resulted in a net loss of less than 0.1 acre of wetlands. Alternatives with lesser effects were evaluated and found to not be practicable. No loss of wetlands resulted from capping the Canal, Turning Basin, and 100-foot by 100-foot area.
National Historic Preservation Act Regulations Preservation of Historic Properties Controlled by Federal Agency, 36 CFR 800	Actions by federal agencies must be planned to preserve historic properties and minimize harm to National Historic Landmarks. Statues include requirements that actions must be taken to recover and preserve artifacts, preserve historic properties 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 design. Appropriate steps to record and document the structures will be conducted following consultation with the state and prior to construction of the cap.	This ARAR has been met. A Historic Resources Study was completed on behalf of the Performing Defendants prior to construction. The Performing Defendants entered into a Memorandum of Agreement for Mitigation of Adverse Effects with EPA and the State of Vermont which was complied with during construction. Historical artifacts were identified prior to construction. Barges and marine railways were left in place and cap material was

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
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REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
				carefully placed to avoid harm to the historic resources. Remnants of marine railways outside of the cap footprint were identified and surrounded with construction fencing during construction to protect them. Additionally, as part of a mitigation agreement, the Lake Champlain Maritime Museum studied another sunken barge at the bottom of Lake Champlain, and a large number of artifiacts were collected and put on display at the Lake Champlain Maritime Museum.
Archaeologic and Historical Preservation Act Regulations, 36 CFR Part 65	Actions by federal agencies must be done to preserve and recover any historical/archeological artifacts found.	Applicable	A full assessment of the status of the historical submerged structures will be conducted prior to remedial design. Appropriate steps to record and document the structures will be conducted following consultation with the state and prior to construction of the cap.	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	A full assessment of the status of the historical submerged structures will be conducted prior to remedial design. Appropriate steps to record and document the structures will be conducted following consultation with the state and prior to construction of the cap.	Same as above
Fish and Wildlife Coordination Act Modification to Waterway that Affects Fish or Wildlife, 50 CFR	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 U.S. Fish and Wildlife Service and Vermont fish and Wildlife Dept. 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

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
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REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
Part 297				were used to protect wetlands and water quality during construction.
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 impact wetland habitat areas 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 Vermont Agency of Natural Resources designated most of the groundwater under the site as a Class IV groundwater, which is not suitable for potable use but suitable for some agricultural, industrial and commercial uses. Existing Class IV designation establishes a measure of protection from consumption of groundwater exceeding federal drinking water standards (MCLs). As a Class IV groundwater, appropriate management practices must be used to prevent violation of groundwater quality standards in adjacent Class III groundwaters.	This ARAR remains applicable. The Class IV boundary was recently expanded from the original boundary established in 1993. Long-term groundwater monitoring is conducted to ensure that groundwater contaminants do not migrate across the Class IV boundary at concentrations above federal MCLs. Monitoring has indicated arsenic concentrations above the current MCL of 10 ug/l in one well located outside of the Class IV boundary; however, there is no indication the arsenic contamination is the result of migration across the Class IV boundary or that the area of contamination is increasing.

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
BURLINGTON, VERMONT

REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
Action-Specific				
RCRA – Identification and Listing of Hazardous Wastes 40 CFR 261	Criteria for determining if a waste is a hazardous waste and is subject to regulation.	Potentially ARAR	If a contaminated media exhibits the characteristic of a hazardous waste, these regulations are applicable. If a contaminated media 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.
RCRA – Treatment, Storage and Disposal Facilities, 40 CFR Part 268	Regulations concerning land disposal of listed or characteristically hazardous waste.	Not ARAR	No RCRA hazardous wastes would be generated under this alternative. *In Situ* capping activities will involve consolidation of materials within an area of existing contamination, which does not implicate RCRA standards [55 Fed. Reg. 8666, 8760 (March 8, 1990)].	Hazardous wastes generated during construction were disposed of at a RCRA disposal facility. The consolidation of soils 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 these 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. However, there is no mechanism in place to determine future compliance with institutional controls.
RCRA General Facility Standards and Security 40 CFR 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	Requirements for the design, construction and operation of	Potentially Relevant and	These standards will be considered during the Remedial Design/Remedial	This ARAR is not considered relevant and appropriate since there

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
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REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
and Prevention, 40 CFR 264, Subpart C	hazardous waste facilities to maintain equipment to prevent an unplanned release.	Appropriate	Action Phases.	is no hazardous waste treatment, storage, or disposal facility at the Site.
Contingency Plan and Emergency Procedures, 40 CFR 264, Subpart D	Regulations pertaining to hazardous waste facilities requiring a contingency plan and emergency procedures.	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.
Releases from Solid Waste Management Units, 40 CFR 264, Subpart F	Regulations pertaining to hazardous waste facilities requiring monitoring and corrective action for units that manage solid waste.	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.
Closure and Post-Closure 40 CFR 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 ARAR	If a contaminated media exhibits the characteristic of a hazardous waste, these regulations are applicable. If a contaminated media is sufficient 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	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

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
PINE STREET BARGE CANAL SUPERFUND SITE
BURLINGTON, VERMONT

REQUIREMENTS/ CRITERIA	DESCRIPTION	EVALUATION DECISION	ACTION TO BE TAKEN TO ATTAIN ARAR (FROM ROD)	FIVE-YEAR REVIEW
	discharge of wastes to the waters of the state, prevent degradation of high quality waters and prevent, abate, or control all activities harmful to water quality.			performed during and following construction has indicated that there were no short-term or long-term impacts to 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 Regulations, 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 was 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 were 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. This alternative includes measures to manage stormwater runoff.	This ARAR was met during construction. Stormwater runoff from construction areas was controlled prior to discharge downstream with silt curtains and sorbent booms.
Vermont Wetland	Procedures to identify and protect	Applicable	Wetlands functions and values will be	This ARAR is being complied with

TABLE A3-1. SUMMARY OF ARARs (CONTINUED)
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Regulations, 10 VSA Ch. 37	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.		restored by implementation of these measures. Alternative 3a most completely addresses this ARAR.	through restoration of impacted wetland habitat areas and continued monitoring.
Vermont Dam Regulations 10 VSA 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 Vermont DEC Facilities Engineering Division requirements and the City of Burlington was notified of the project.

ATTACHMENT 5
INTERVIEW RECORDS

Pine Street Barge Canal Superfund Site
Five Year Review community interview conducted by Jim Murphy, July 26, 2006
Nick Warner, Special Projects Manger
City of Burlington Community and Economic Development Office

Nick's primary concern is the difficulty that a local real estate developer has currently been experiencing in completing the various requirements necessary to redevelop a parcel of several acres that abuts the Pine Street Barge Canal site. The parcel was initially included as part of the superfund site, but after further investigation had been completed, the property was carved out as a clean parcel. The city is interested in the appropriate redevelopment of the parcel since there is limited land available for further economic development in Burlington.

While several previous attempts to redevelop the property have been abandoned primarily due to the numerous environmental studies and assessments required, Nick felt that the current developer clearly understood the various restrictions and requirements associated with property and is willing and able to complete the necessary work. The final hurtle to overcome is to resolve the uncertainty of any future superfund liability associated with potential redevelopment. Nick believes that appropriate contact people at EPA have been available and cooperative dealing with the developer, but unfortunately the liability remains an issue. I offered to speak to the developer if Nick thought that could help in any way.

Other than the issue described above, Nick felt that the experience of the Pine Street Canal Coordinating Council had been a very positive one for participants and the overall community and that the community had been stabilized by becoming a partner in the decision-making at the site.

While Nick had received a few telephone calls following the EPA press release and subsequent media coverage which noted that limited coal tar contamination is seeping into the canal, there was no overall concern with the site or the remedy at this point in time.

Nick further noted that the city is particularly interested in EPA's Brownfields program, sees the need for the development and understanding of new insurance products related to contaminated sites, and also sees the need for a large revolving loan fund to support brownfields development in Burlington.

Pine Street Barge Canal Superfund Site
Five-yr review community interviews – written comments dated July 17, 2006
Steve Goodkind, Director
City of Burlington Department of Public Works

Mr. Goodkind provided written responses (below in bold, italics) to questions posed by EPA in a letter dated July 12, 2006.

Q1. What is your overall impression of the Pine Street project?

The project appears to have gone well with two exceptions. a) The plantings on the southern portion of the project leave a lot to be desired, and, b) The plans never considered amenities and/or design features that would facilitate the cleaning of the pond.

Q2. How has the remedial action at the Pine Street site impacted the surrounding community?

No

Q3. Are you aware of any community concerns regarding the implementation or administration of the remedial action at Pine Street?

No

Q4. Are you aware of any events, incidents or activities at the site such as vandalism, trespassing or emergency responses from local authorities?

No

Q5. Do you feel well informed about the activities, issues and/or progress? How do you find out about issues, if any?

No. I only learned of the ongoing seepage issue through the newspaper.

Q6. Do you have any comments, suggestions or recommendation regarding management or operation of the Pine Street site?

We should be getting regular update reports.

Q7. Are you aware of any City actions/activities that have impacted by the remedy?

I remain concerned about the maintenance of the pond. We were not informed prior to the design that the city would be involved in the maintenance of the pond. Therefore we took no interest in the design from that perspective. As noted above, the design does not appear to have taken maintenance needs into account. I suspect that the periodic dredging of the pond will be a difficult procedure that may involve the replacement/repair of the pond that will be damaged by the process.

Pine Street Barge Canal Superfund Site
5-yr review community interview conducted by Jim Murphy and Karen Lumino, July 27, 2006
David White, City Planner
City of Burlington Department of Planning and Zoning

The City has a preference to develop the remaining vacant lots (453 and 501 Pine St) which abut the Superfund site and which have had deed restrictions imposed on them through the remedy. But if that were not to happen, the City would embrace the area for what it is – recreational open space – perhaps a "gateway" for some sort of public access to the open water and wetlands that make up the Superfund site.

David feels the community's involvement in changing the remedy for the site was a very powerful and positive thing. He thinks a there are probably opportunities for making basic information available about the Pine Street site and the deed restrictions that EPA hasn't explored, such as linking from City of Burlington's websites.

Pine Street Barge Canal Superfund Site
5-yr review community interviews conducted by Jim Murphy and Karen Lumino, July 27, 2006
Group interview with members of the Pine Street Barge Canal Coordinating Council

Lori Fisher, Director, Lake Champlain Committee

> Lori feels comfortable knowing that although coal tar is being released in some portions of the site, there is a culture of responsiveness on the part of EPA, VT DEC and the Performing Defendants and the issue will be resolved. She would like us to explore aggressive options for addressing the releases in the canal if what we are seeing is a pattern of releases, believing that in the long run it would be the most cost effective course of action.
>
> As an advocacy organization, LCMM would like EPA to provide an opportunity for public involvement in the decision regarding supplemental remedial actions, and offered to co-sponsor a meeting with EPA around the time of the focused feasibility study. She also felt that a fact sheet, in addition to the routine press release, transmitting the results of the five-yr review would be a good idea.

John Akey, Ward 5 Neighborhood Planning Assembly

> John feels the capping remedy was still the right remedy, even with the ongoing releases which he views as more an issue of maintenance than anything else. The capping remedy saved a lot of money.

Marty Feldman, Pine Str Arts and Business Association

> Marty believes with respect to the Superfund site, people in the community have "moved on". People think the problem in the canal has been fixed, and that the situation is in capable hands. Marty expressed the opinion that the community has confidence that EPA, VT DEC and the Performing Defendants are working on the issue of ongoing releases and will address them.

Joe Kwasnik, National Grid

> The Performing Defendants are taking the current releases to the canal very seriously and have hired a firm (BB&L) with experience with national experience with capped contaminated sediment sites. Joe stated that he would pass along to his company and other Performing Defendants any recommendations expressed during the interview.

Also sitting in on the group interview were George Desch, VT DEC, and Chris Crandell, President, the Johnson Company (for the last few minutes). Invited but not in attendance were Norm Tererri, Gary Kjelleren, Bill Howland, Bill Ellis and Ken Munney.