FIVE-YEAR REVIEW REPORT FOR
BURGESS BROTHERS LANDFILL SUPERFUND SITE
BENNINGTON COUNTY, VERMONT

Prepared by

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Date

2015 FIVE-YEAR REVIEW
BURGESS BROTHERS LANDFILL SUPERFUND SITE

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	United States Environmental Protection Agency
CFR	Code of Federal Regulations
DNAPL	Dense, Non-Aqueous Phase Liquids
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GETS	Groundwater extraction and treatment system
ICs	Institutional Controls
ICZ	Institutional Control Zone
ICLs	Interim Cleanup Levels
LTMP	Long-Term Monitoring Plan
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
Mg/kg	Milligrams per Kilogram
MW	Monitoring well
NCP	National Contingency Plan
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
PLs	Performance Levels
PPB	Parts Per Billion
PPM	Parts Per Million
PCE	Tetrachloroethylene
RAO	Remedial Action Objective
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SVE/AS	Soil Vapor Extraction/Air Sparging
SWQC	State Water Quality Criteria
TCA	1,1,1-trichloroethane
TCE	Trichloroethylene
VTDEC	Vermont Department of Environmental Conservation
VOC	Volatile Organic Compound
µg/L	Micrograms per Liter
1,2-DCE	1,2-Dichloroethene

EXECUTIVE SUMMARY

This is the third Five-Year Review (FYR) for the Burgess Brothers Landfill Superfund Site (Site) located in the Towns of Woodford and Bennington, Bennington County, Vermont. The purpose of this FYR is to review information to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the signing of the previous FYR on September 27, 2010.

Starting in the early 1950s, the Site was used as a metal salvage facility and disposal area. Metals, sludge, rejected small appliances, and military specialty batteries were also disposed at the Site. Site investigations and information provided by the former site operator indicate the landfill also received newspaper and building demolition debris. Two lagoon cells (unlined pits) received liquid wastes and sludge from approximately 1967 to 1976. Use of the Site for disposal ended in 1976.

In 1998, the U.S. Environmental Protection Agency (EPA) issued a Record of Decision (ROD) for the Site. The ROD included implementation of a remedy to address landfill waste and impacts to groundwater, surface water and sediment. The ROD also included a provision that if EPA determined that the selected remedy was not effective and that remedial action objectives were not attained within an acceptable timeframe, then an alternate remedial action would be evaluated and implemented.

Pursuant to a Consent Decree signed by EPA, Vermont Department of Environmental Conservation (VTDEC), and the Settling Defendants, the components of the remedy have been implemented. The Settling Defendants installed a cap over the landfill and a portion of the Marshy Area and constructed a Soil Vapor Extraction/Air Sparging system. Long-term monitoring began with a baseline event in 2000 and continued semi-annually through 2012 when the monitoring program was updated to reflect the 2011 remedy (see below). In addition to the required institutional controls that were implemented, the groundwater beneath the Site was reclassified by the State of Vermont to non-potable. EPA issued the first five-year review report in March 2005. In 2007, with contaminant concentrations increasing downgradient of the capped landfill rather than decreasing as projected, the Settling Defendants submitted a draft Focused Feasibility Study to evaluate alternative remedial actions to address the contaminated groundwater. With input from VTDEC, EPA issued a ROD Amendment (Amended ROD) in 2011. The Amended ROD selected a remedy that included two groundwater barriers, one at the edge of the landfill and another farther downgradient. The remedial action objective for the former was to prevent further contaminant migration from beneath the landfill and the remedial action objective for the latter was to address the highly contaminated groundwater beyond the cap.

Pre-design studies indicated groundwater collection trenches would be more cost-efficient and effective than a permeable reactive barrier using zero-valence iron. The Remedial Design was completed in June 2013 and construction of the remedy began in August 2013. Following a suspension for winter conditions, construction resumed in May 2014. A cold startup using clean water was performed in August, baseline sampling took place in October, and actual system startup began in November 2014. Unfortunately, the system experienced multiple shutdowns due to elevated iron concentrations in the pumped water and it has only recently been brought back online.

According to data reviewed, observations from the inspection of the Site, and interviews, the remedies have generally been implemented in accordance with the requirements of the 1998 ROD and 2011 Amended ROD. The source control portion of the remedy is complete. Implementation of institutional controls has thus far ensured the integrity of the remedial measures conducted at the Site, and prevented exposure to contaminants contained in groundwater. Groundwater, surface water, and sediment monitoring continue in accordance with the long-term monitoring plan as specified in the 2011 Amended ROD and the 2012 Amended Statement of Work.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Burgess Brothers Landfill Superfund Site		
EPA ID: VTD003965415		
Region: 1	**State:** VT	**City/County:** Woodford and Bennington/Bennington
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Terrence Connelly		
Author affiliation: EPA		
Review period: 12/9/2014 – 9/30/2015		
Date of site inspection: June 9, 2015		
Type of review: Statutory		
Review number: 3		
Triggering action date: 9/27/2010		
Due date *(five years after triggering action date)*: 9/27/2015		

Issues and Recommendations Identified in the Five-Year Review

OU(s): *01*	**Issue Category: Remedy Performance**
	Issue: The groundwater extraction system has not operated long enough to assess remedy performance.
	Recommendation: An option for addressing the suspended iron in pumped groundwater has been implemented. Operate groundwater

	extraction and treatment system to assess remedy performance. Conduct performance monitoring to verify operation of GETS and contaminant containment; and compliance monitoring to demonstrate achieving cleanup standards at compliance points. Monitoring will continue to allow assessment of remedy performance.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Settling Defendants	EPA/State	2/26/2016

Protectiveness Statement	
Operable Unit: Sitewide	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at the Burgess Brothers Superfund Site currently protects human health and the environment because exposure pathways for direct contact and groundwater ingestion have been controlled by the Landfill and Marshy Area cap and institutional controls, respectively. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure long-term protectiveness: the groundwater collection trenches have to operate successfully to capture and treat contaminated groundwater to prevent further migration of the contaminant plume from the landfill and to capture the portion of the plume that has already migrated from the landfill.	

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

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

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which 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 actions no less often than every five years after the initiation of the selected remedial action.*"

EPA conducted a FYR of the remedy implemented at the Burgess Brothers Landfill Superfund Site in the Towns of Woodford and Bennington, Bennington County, Vermont. EPA is the lead agency for overseeing the development and implementation of the remedy for the Site by the Settling Defendants. VTDEC, as the support agency representing the State of Vermont, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the third FYR for the Site. The triggering action for this statutory review is the completion date of the previous FYR. The FYR is required because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. The Site consists of one Operable Unit.

II. PROGRESS SINCE THE LAST REVIEW

The second Five-Year Review Report was signed on September 27, 2010. Tables 1 and 2 below present the protectiveness determinations and recommendations from the 2010 FYR.

Table 1: Protectiveness Determinations/Statements from the 2008 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy at the Burgess Brothers Site currently protects human health and the environment because exposure pathways for direct contact and groundwater ingestion have been controlled by the Landfill and Marshy Area cap and institutional controls, respectively. However, in order for the remedy to be protective in the long-term, the source control and groundwater remedies need to be reevaluated and new remedial approaches selected.

Table 2: Status of Recommendations from the 2010 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
1	remedy only partially functioning as intended	Complete the FFS	Settling Defendants	EPA/VTDEC	1/1/2011	Completed	July 26, 2011
1	Groundwater not meeting ICLs[1]	Complete the FFS	Settling Defendants	EPA/VTDEC	1/1/2011	Completed	July 26, 2011
1	Surface water not meeting PLs[2]	Complete the FFS	Settling Defendants	EPA/VTDEC	2011	Completed	July 26, 2011
1	Possible presence of 1,4-dioxane	Add 1,4-dioxane to groundwater monitoring program	Settling Defendants	EPA/VTDEC	1/1/2011	Under Discussion	

[1] Interim Cleanup Levels for groundwater
[2] Performance Levels for surface water

Status of Recommendations from the 2010 FYR

Recommendations 1, 2, and 3

- Completed.

Recommendation 4

- This recommendation was pushed forward to be addressed in the revised Long-Term Monitoring Plan following the completion of the FFS, Amended ROD and Amended Statement of Work. Sampling for 1,4-dioxane will be included in 2016.

Remedy Implementation Activities

The FFS was approved by EPA in July 2011. The Proposed Plan was released on July 19, 2011 and the Amended ROD selecting a remedy to address these issues was signed September 30, 2011.

System Operation/Operation and Maintenance Activities

Operation of the Soil Vapor Extraction (SVE) system continued until October 2012 when EPA formally approved the decommissioning of the SVE system (operation of the complimentary Air Sparging (AS) component ceased in 2002). Operation of the groundwater collection trenches and *ex-situ* treatment system began November 4, 2014, but as discussed in Section 3.0 below, operated only sporadically through January 2015 because of iron precipitation clogging the treatment system components. Following the addition of two settling tanks to the treatment system, operation of the pumping and treatment resumed on May 28, 2015.

III. FIVE-YEAR REVIEW PROCESS

Administrative Components

The Settling Defendants were notified of the initiation of the five-year review on January 30, 2015. The Burgess Brothers Landfill Superfund Site Five-Year Review was led by Terrence Connelly, the EPA Remedial Project Manager. Gerold Noyes assisted in the review as the VTDEC representative.

The review which began with an update to EPA's site team on December 10, 2014, consisted of the following components:

- Community Involvement;
- Document Review;
- Data Review;
- Site Inspection; and
- Five-Year Review Report Development and Review.

Community Notification and Involvement

Activities to involve the community in the five-year review process were initiated with a discussion in December 2014 between the Remedial Project Manager and Community Involvement Coordinator for the Site. Per Region 1 policy, a region-wide press release announcing all upcoming five-year reviews in New England was sent to all regional newspapers including the Bennington Banner. The press release was sent on January 5, 2015 and is attached in Appendix B. The results of the review and the report will be made available at the Site information repository located at

Bennington Free Library
101 Silver Street
Bennington, Vermont 05201

and at

U.S. Environmental Protection Agency
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Document Review

This five-year review consisted of a review of relevant documents including decision documents, monitoring data, and the institutional controls. Groundwater and surface water cleanup standards, as listed in the September 2011 Amended ROD, were also reviewed.

Data Review

Groundwater and Surface Water

Prior to the 2011 Amended ROD, the Settling Defendants conducted routine groundwater and surface water monitoring in accordance with the April 2000 Demonstration of Compliance Plan. At the time of the 2010 FYR, nineteen monitoring events had been conducted since the capping of the landfill. As described in more detail in the 2010 FYR, the salient points from these monitoring events are the following:

- Contamination is primarily VOCs with manganese being the only metal that appears to be migrating from the landfill;
- Groundwater contamination is limited to the upper thirty feet of overburden;
- An extensive, unsaturated lodgement till separates the contaminated overburden from the bedrock;
- VOC concentrations both upgradient and downgradient of the landfill compliance boundary are suggestive of DNAPL; and
- The extent of the plume has not changed substantially during the period the monitoring has occurred.

There have been five groundwater sampling events since the 2010 FYR. Following the 2011 Amended ROD, the focus of the monitoring shifted to obtaining information to assist in the Pre-Design Investigation and selection of the type of barrier systems to be constructed to address groundwater contamination. Overall, these six sampling events refined the width of the contaminant plume, bounding it on both eastern and western sides, and marked the slow southerly downgradient movement of the plume core. Maximum concentrations at the compliance boundary were 33,000 and 5,000 ppb with typical ranges of 500 – 5000 and 500 – 2,500 ppb for PCE and TCE, respectively. Maximum concentrations at the downgradient boundary were 1,000 and 910 ppb with typical ranges of 10 – 600 and 10 – 300 ppb for PCE and TCE, respectively.

In addition, the PDI confirmed that the vertical gradient was as expected, downward at western boundary of the plume and upward near the unnamed stream on the eastern boundary. Further, the PDI concluded that collection trenches would be more efficient than zero-valent iron for the barrier systems.

The following tables update TCE and PCE data from the three areas of the Site since the 2010 FYR. Area A is located upgradient of the compliance boundary and includes the Landfill Area, former Lagoon

Area and the capped portion of the former Marshy Area. Area B is located immediately downgradient of the compliance boundary and now extends southward approximately 200 feet to the Downgradient Boundary Trench. Area C extends downgradient from the Downgradient Boundary Trench and ends where the VOC plume reaches ICLs, between P-02 and P-08. Figure 1-1 from the 2011 Focused Feasibility Study shows the three areas of the Site. Figures 3 and 4 from the 2015 *Draft Long-Term Monitoring Baseline Sampling Report (Round 1) - Fall 2014* show the location of the two collection trenches and provide PCE and TCE concentrations in October 2014, the most recent comprehensive sampling event (see Appendix C).

AREA A GROUNDWATER ***TCE AND PCE CONCENTRATIONS SINCE 2010 FYR*** ***Concentrations in µg/L***					
Date		**W-32S1**	**W-32T**	**W-04D**	**W-04T**
Trend in last FYR	TCE	Down	Up	fluctuating	stable
	PCE	Down	Fluctuating	Fluctuating	down
Spring 2010	TCE	1,600	1,700	1,800	4,300
	PCE	20,000	17,000	13,000	14,000
Fall 2010	TCE	960	1,500	1,700	4,100
	PCE	8,700	11,000	7,000	14,000
Spring 2011	TCE	NS	NS	NS	NS
	PCE				
Spring 2012	TCE	1,700	1,500	630	3,200
	PCE	7,400	10,000	4,900	11,000
August 2012 PDI[1]		Western Edge	Centerline[2]	Eastern Edge	
	TCE	0.66 – 80	300 – 5,000	ND – 72	
	PCE	0.9 – 13	670 – 33,000	0.4 - 110	
October 2014 Baseline[3]		Not Sampled			

[1] PDI included samples from ten newly installed piezometers along the compliance trench location. Data from these piezometers comprise the values presented here.
[2] For comparison between historical data and the PDI, wells W-32S1, W-32T, W-04D, and W-04T are located along the centerline.
[3] As stated in the approved LTMP, because there was sufficient historical data no sampling of Area A was performed during the baseline event.

AREA B GROUNDWATER ***TCE and PCE CONCENTRATIONS SINCE 2010 FYR*** ***Concentrations in µg/L***						
Date		**P-09**	**W-06D**	**P-10**	**W-09S1**	**W-09T**
Trend in last FYR	TCE	Down	Fluctuating	Up	down	Up
	PCE	up	Fluctuating	Up	down	Up
Spring 2010	TCE	5,300	1,200	2,100	130	410
	PCE	13,000[1]	4,200	2,100	190	500
Fall 2010	TCE	4,400	730	4,700	45	800
	PCE	8,400	2,000	6,000	67	850
Spring 2011	TCE	NS	NS	NS	NS	NS
	PCE					
Spring 2012	TCE	6,500	1,100	4,200	79	530
	PCE	17,000	3,200	7,700	110	510
August 2012 PDI	TCE	NS	NS	NS	190	910
	PCE				260	880
August 2012 PDI[1]		Western Edge		Centerline	Eastern Edge	
	TCE	9.5 – 26		120 – 1100	0.23 – 42	
	PCE	9.8 – 26		98 – 1000	1.2 - 48	
October 2014 Baseline[2]		ND – 73		580 – 6100	0.72	
		ND – 87		720 – 4500	1.3	

[1] PDI included samples from ten newly installed piezometers along the compliance trench location.
[2] These concentration ranges are from PDI piezometers and post-PDI wells W-33S/T, W-34S/T, W-35S/T, and W-36T.

AREA C GROUNDWATER ***TCE and PCE CONCENTRATIONS SINCE 2010 FYR*** ***Concentrations in µg/L***					
Date		**P-01**	**P-02**	**P-08**	**P-19**
Trend in last FYR	TCE	Up	Stable	Stable	Up
	PCE	Up	Stable	Stable	Up
Spring 2010	TCE	240	ND	ND	63
	PCE	310	0.49	ND	47
Fall 2010	TCE	150	6.9	0.51	76
	PCE	140	8.4	0.69	54
Spring 2011	TCE	NS	NS	NS	NS
	PCE				
Spring 2012	TCE	130	7.5	ND	110
	PCE	130	8.8	ND	100
August 2012 PDI	TCE	NS	NS	NS	120
	PCE				98
October 2014 Baseline	TCE	190	2.1	ND	96
	PCE	190	2.2	0.38J	87
Trend in this FYR	TCE	Fluctuating	Fluctuating	Stable	Up
	PCE	Fluctuating	Fluctuating	Stable	up

Surface Water

As noted above, prior to the 2011 Amended ROD the Settling Defendants conducted routine monitoring in accordance with the April 2000 Demonstration of Compliance Plan. For surface water, six locations were sampled annually for VOCs and periodically for metals. These locations included upstream of the landfill (SW-08), the landfill toe of slope swale (SW-18), the Unnamed Stream (SW-15/SW-P21 and SW-04/SW-P23), and Barney Brook (SW-05 and SW-06). As described in more detail in the 2010 FYR, the salient points from these monitoring events are the following:

- SW-18 remains the most contaminated location. SW-18 is located just downgradient of the landfill compliance boundary; and
- Concentrations have been increasing at SW-P19, 150 feet downstream from SW-18. This suggests that the groundwater plume core is continuing to migrate farther away from the landfill compliance boundary.

There have been five surface water sampling events since the 2010 FYR: August 2010, November 2010, August 2011, March 2012, and October 2014. Following the Pre-design Investigation, three locations are now being sampled for the Long-Term Compliance Monitoring, SW-P19, SW-P21, and SW-P23 (the SW-18 location no longer exists with the construction of the Compliance Boundary Trench and culvert that prevents groundwater discharge to the toe of slope swale). These three sampling locations were co-located in 2005 and 2006 when stream piezometers were installed in the Unnamed Stream.

According to the approved January 2015 Long-Term Monitoring Plan (page 4-8), sampling for inorganic contaminants in groundwater and surface water was to be performed prior to and in support of the 2015 FYR. However with the delay in the construction of the groundwater interceptor trenches, the next sampling event after the Pre-Design Investigation was the scheduled Baseline Event which did not include inorganic sampling for either groundwater or surface water.

The following table presents concentrations of TCE, PCE and 1,2-dichloroethene (1,2-DCE) detected during the sampling events since the 2010 FYR. The locations are listed from upstream to downstream, with the first location listed being the background surface water location. The existing surface water monitoring data establishes that the downstream limit of VOC concentrations in surface water that exceed PLs is at the SW-22 location.

SURFACE WATER						
	TREND DURING LAST FYR			2010 -2014 CONCENTRATIONS		
Contaminant and Performance Level (µg/l)	***1,2-DCE[a]***	***TCE 2.7***	***PCE 0.8***	***1,2-DCE***	***TCE 2.7***	***PCE 0.8***
Upgradient of Landfill Compliance Boundary						
SW-08 Upstream of Landfill	*ND*	*ND*	*ND*	*NS*	*NS*	*NS*
Downgradient of Landfill Compliance Boundary						
SW-18 Toe of Slope Swale (TOSS)	*Stable*	*down*	*stable*	NS[1] *NS[2]* *17[3]* NS[4] NS[5]	*1*	*1.4[4]*
Attenuated Downgradient Plume Area						
SW-P19 150' downstream of TOSS, near W-09 Cluster	*Up*	*Stable*	*Up*	*3.8* *5.1* 8.4 3.3	*1.1* *1.2* 3.1 1.1	*1.3* *1.7* 3.7 0.78
SW-P20 225' downstream of TOSS (sampled in fall event)	*Up*	*Up*	*Up*	*3.1* *5.2* 6.7	*0.87* *1.2* 2.6	*1.2* *1.8* 3
SW-P21/SW-15 300' downstream of TOSS	*Stable*	*Stable*	*stable*	2.0 *2.5* *3.2* 5.3 1.6	0.4 *0.8* *0.7* 2.1 0.54	0.6 *0.9* *1.0* 2.4 0.27
SW-P22 375' downstream of TOSS	*Up*	*Stable*	*stable*	1.2 *2* *2.3* 4.2	0.3 *0.79* *0.5* 1.7	ND *0.92* *0.7* 1.8
SW-P23/SW-04 450' downstream of TOSS	*Stable*	*Stable*	*Stable*	*3.3* *1.3* 4.2 1.7	*0.66J* *0.39* 0.66 0.55	*0.9* *0.49* 0.9 0.33

Notes:

[a] This compound does not have a PL, but is shown to evaluate groundwater discharge to surface water
ND Non-detect
NS Not Sampled
3.1 Shaded value exceeds PL
[1] Aug 2010
[2] *Nov 2010*
[3] *Aug 2011*
[4] Mar 2012
[5] Oct 2014

Groundwater Collection and Treatment System

Pre-design studies indicated groundwater collection trenches would be more cost-efficient and effective than a permeable reactive barrier using zero-valence iron. The Remedial Design was completed in June 2013. The selected remedy consisted of four construction components. One, groundwater collection trenches were to be constructed at the Landfill Compliance Boundary and another approximately 175 feet downgradient. Both trenches were to include the installation of extraction wells, force main, and power and control conduits. Two, excavated soils from the trenches were to be dewatered and then encapsulated above the existing landfill cap. Three, an *ex-situ* treatment system was to be installed in the old SVE/AS building. The treatment system was to consist of an equalization tank, particulate filters, a shallow-tray air stripper, and vapor-phase and liquid-phase carbon units. Discharge water was to be piped to the Unnamed Stream. And four, the toe-of-slope swale was to be lined between the limit of the existing landfill cap to where the swale discharges into the Unnamed Stream, to prevent surface water runoff from entering the collection trench.

Construction of the remedy began in August 2013. Following a suspension for winter conditions, construction resumed in May 2014. A cold startup using clean water was performed in August, baseline sampling took place in October, and actual system startup began in November 2014. Unfortunately, the system experienced multiple shutdowns due to elevated iron concentrations in the pumped water. Following further analysis and evaluation of possible options, two above-ground settling tanks were inserted into the treatment system between the air stripper and liquid-phase carbon units. Operation of the collection trenches and treatment system resumed at the end of May 2015. The system ran continuously other than a brief power outage until early August when the system received a direct lightning strike that knocked out some of the system's electronics. Resumption of the system is expected within the next month.

In broad terms, the September 2012 Amended Statement of Work outlined two components of the Long Term Monitoring Plan to be developed for the Site: compliance monitoring and performance monitoring. The purpose of compliance monitoring is to demonstrate achievement of cleanup standards at designated compliance points within the Barrier Systems and the attainment of groundwater ICLs in Area C through MNA. The purpose of performance monitoring is to verify proper operation and effective contaminant treatment within and between the Barrier Systems. The key lines of evidence include Site contaminants and their breakdown products, hydraulic flow characteristics through and around the Barrier Systems, and groundwater geochemistry.

<u>Compliance Monitoring</u>

Preliminary data since the latest start-up indicated that the settling tanks were providing sufficient residence time allowing the iron to precipitate out of solution, which in turn allowed the treatment system to function as originally designed. Unfortunately, after the system received the lightning strike, acquiring replacement parts and scheduling of personnel resulted in an overall one month shutdown. In the limited operation of the groundwater collection and treatment system, the discharge standards for VOCs and metals were met at the first, second, and fourth week sampling events.

Baseline sampling results are discussed above with the other data collected during this five-year review period.

Performance Monitoring

The preliminary data from the data logging pressure transducers and manual gauging was reviewed. The data suggests that system capture was occurring. The targeted drawdown elevations in the trenches were attained within the first 24 hours of operation and the capture zones of the collection trenches were expanding after one month of operation. The conceptual site model indicates that groundwater flow through the kame sand and ablation till is limited and therefore, steady-state conditions are not expected to be attained for several months after start-up.

Site Inspection

A site inspection was conducted on June 9, 2015, by EPA, VTDEC, and representatives from *de maximis inc.* and Environmental Partners Group, Inc., consultants for the Settling Defendants. The purpose of the inspection was to assess the protectiveness of the remedy, including the presence of fencing to restrict access, the integrity of the cap, the performance of the surface water drainage control structures, and the operation and maintenance of the groundwater collection and treatment system.

During the site inspection, the parties viewed the aboveground components of the groundwater collection and treatment system, walked over the Landfill and Marshy Area cap, and located and inspected the monitoring wells. No significant issues were identified with the fence, drainage structures, or the cap, including the recently constructed cap covering the excavated materials from the two collection trenches. The piping and treatment units for the groundwater collection and treatment system were identified with appropriate markings, and the building housing the treatment components appeared to be well-kept. The two recently added settling tanks installed to address the iron fouling were connected into the treatment system and providing the necessary residence time to allow the iron to settle out. The cap was inspected for vegetative cover, settlement, erosion, animal burrows, and any standing water. The cap appeared to be well maintained with no indications of any breaches to its integrity. Additionally, the drainage swales were checked; no obstructions or excessive vegetative growth were noted. All monitoring locations currently in use were located and all appeared to be in satisfactory condition.

Following the site inspection, the EPA representative drove around the neighborhoods contiguous to the Site to check for new homes and developments. The surrounding area remains predominantly rural residential interspersed with some commercial properties. All residential properties are connected to the public water system. As in the 2010 FYR and subsequent visits to the Site, there did not appear to be any recent land use changes on Burgess Brothers Road.

As first noted in the 2010 FYR, there was a construction and demolition landfill also located on the Burgess Brothers Company property, southeast of the Site. In 2012, the permit for its operation lapsed at the time of its possible sale. Due to the uncertainty of the sale status and lack of permit, the State of Vermont seized the closure bond. The VTDEC Solid Waste program hired Cassella Construction to cap the landfill with a 30” vegetated earthen cap. Construction was completed in 2013. Closure bond money is used to maintain the cap and perform semiannual post closure groundwater monitoring.

Interviews

EPA had general discussions with the Settling Defendants’ consultants during the site inspection. Information regarding zoning was obtained from the Town of Bennington personnel following the site

visit. The Administrative Record for the Site was reviewed with the Reference Librarian of the Bennington Free Library. The Reference Librarian stated that there had been minimal interest in the Administrative Record by community members since the previous FYR.

Gerold Noyes has been the VTDEC project manager since 1999. He has concurred with the monitoring modifications and reporting frequency currently in place and is participating in the reevaluation of the existing remedy. While the reclassification regulations indicate periodic reviews of the reclassification are to be performed, in practice these reviews are not being performed state-wide.

IV. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

- **Landfill and Marshy Area Cap, Bedrock Groundwater: Yes**
- **Contaminated Groundwater and Surface Water: TBD**

Remedial Action Performance

- The source control component selected in the 1998 ROD was completed in 2000. The operation of the SVE/AS was suspended in 2002, then operated intermittently from 2004 to 2012 when the system was decommissioned.
- The remedial objectives of the Landfill and Marshy Area cap have been achieved by preventing direct exposure to waste and contaminated soils and controlling gas emissions. There is no indication that the cap is leaking, therefore the Remedial Action Objective (RAO) of reducing or eliminating the generation of landfill leachate has also been met. The capping system is extremely stable and maintenance free (with the exception of grass mowing), with no areas of erosion or settlement.
- The remedy selected in the Amended ROD has not functioned as designed. A cold start of the collection trenches and treatment system demonstrated that the system was successfully constructed in that all components functioned as designed. However, more suspended iron than was anticipated in the design process has led to multiple shutdowns of the original system. The shutdown caused by the lightning strike has further delayed the evaluation of the plume capture by the collection trenches. Nonetheless, it is anticipated that plume capture will be achieved when the system is successfully operated.
- Analysis of the initial water quality indicates that the treatment system does meet the discharge standards.

System Operations/O&M

- The addition of two settling tanks appears to have successfully addressed the iron fouling issue. With extended operation, it is anticipated that the iron concentrations will decrease (seen as a consequence of the guar solution used in the construction of the collection trenches) and the settling tanks may not be needed long-term. Data collected over the summer and fall 2015 will

be evaluated to assess whether to continue inclusion of the settling tanks in the treatment system. If the settling tanks are kept online, then winterization of the tanks will be performed.

- A generator has been installed to provide back-up power in the event of prolonged power loss. It is activated on a weekly schedule to ensure its proper functioning.

Opportunities for Optimization

- At the time of this review with the limited data set, it is too early to identify possible optimization opportunities.

Early Indicators of Potential Issues

- Since the addition of the settling tanks the system has run continuously except for one power outage when the system was successfully remotely re-started.

Implementation of Institutional Controls and Other Measures

- The required institutional controls were implemented prior to the 2005 Five-Year Review and remain in place. The groundwater beneath and immediately around the landfill has been reclassified by the State from Class III to Class IV. This was accomplished through a petition submitted by the VTDEC, at the request of PRPs, to the Secretary of the Agency of Natural Resources of the State of Vermont. This request was approved on November 6, 2003. The Reclassification prohibits the site groundwater from use as a domestic water supply and from irrigation, agricultural, and general industrial and commercial uses.
- Based on the data review, site inspection, and interviews, no immediate threats have been identified and thus no other actions (e.g., removals) are necessary.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy section still valid?

No.

Changes in Standards and TBCs. As part of this five-year review, Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) guidance for the Site set forth in the ROD were reviewed with a view to identifying any newly promulgated or modified standard that may bear on the protectiveness of the remedy.[1] Interim Groundwater Cleanup Levels (IGCLs) were established for this remedy based principally on non-zero Federal Drinking Water Maximum Contaminant Level Goals (MCLGs), MCLs, and Vermont Primary Groundwater Quality Standards. These standards remain unchanged. Additionally, Vermont has issued a pre-rulemaking draft revised Groundwater Protection Rule and Strategy for public comment prior to the start of the formal rulemaking process. The purpose of this Rule and Strategy is (1) to establish (a) classes of

[1] As noted in Section III, Groundwater Collection and Treatment System, construction activities for the Amended ROD have been completed. These activities were undertaken in compliance with the location specific and action specific ARARs identified in the ROD and Amended ROD. Further construction activity is not anticipated.

groundwater; (b) a process for groundwater reclassification and (c) standards for groundwater quality protection, and (2) to ensure that DEC regulatory programs protect groundwater resources. These, together with Interim Groundwater Quality Standards published by the DEC Drinking Water and Groundwater protection Division, effective as of March 18, 2015, have been reviewed and do not call into question any of the established IGCLs.

As noted in Section II, 1,4-dioxane will be added to the sampling program. There is no MCL established for 1,4-dioxane. The Vermont Interim Groundwater Quality Standards set out a new interim enforcement standard of 3 ppb for 1,4-dioxane, and a new interim "preventative action level" of 1.5 ppb. Should future sampling indicate a need for further evaluation of this contaminant at the Site, these values will be considered.

The ROD also established "performance levels" for contaminants detected in surface water (and also in sediments) to evaluate the effectiveness of both source control and groundwater cleanup measures. The Baseline Risk Assessment concluded that surface water and sediments may pose an unacceptable risk to some forms of wildlife. The performance levels will also be considered in future evaluation of risks posed by surface water and sediments and any determination that further action may be necessary. The sediment performance standards were all derived from the Ontario Ministry of the Environment Sediment quality Guidelines. Surface water performance standards were based primarily on Ambient Water Quality Standards, now known as National Recommended Water Quality Criteria (NRWQCs), and Vermont Water Quality Standards. NRWQCs are subject to periodic revisions and revised Vermont Water Quality Standards became effective October 30, 2014. Based on the revised State and federal water quality criteria, a few relatively minor revisions to the surface water performance standards would be noted. In light of the extent of change of the values, and the stated purpose for the performance standards, the revised standards do not call into question the protectiveness of the selected remedy. The updated water quality criteria may be considered in future ecological risk assessment efforts.

Changes in Exposure Pathways. The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures (youth trespassers) and potential future exposures (adjacent resident (child & adult), youth trespasser, and excavation worker). With the completion of the collection trenches, the exposure to excavation workers is no longer present. All of the other exposure pathways remain valid. The ROD and ROD Amendment identified ingestion of overburden groundwater in a future residential use exposure pathway as the only unacceptable risk. Municipal water system service is provided to residences and businesses in the area near the Burgess property. The institutional controls in place continue to prohibit residential use in the twelve acres that encompasses the three-acre Site and there is no evidence of any violations of these controls.

In June 2015, EPA finalized the Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air and updated the vapor intrusion screening levels (VISLs) calculator to develop media-specific risk-based VISLs for groundwater, soil gas, and indoor air. While this potential route of exposure has been found at other sites where residences and businesses are located above groundwater plumes, this is not the case at the Burgess Brothers Site. As described earlier, the Site is located entirely within the Burgess property and the closest structures are located a thousand feet or more from the edge of the groundwater plume. Additionally, the restrictive covenant prohibits use of the Site for residential properties. Therefore, there is no current complete vapor intrusion pathway at the Site. If in the future new development occurs at the Site, there will be a need to conduct a thorough vapor intrusion assessment to ensure that there is no exposure or if exposure exists, the risks are quantified to determine whether any follow-up actions are necessary.

Land use surrounding the Site has not changed appreciably since the 2005 Five-Year Review. The Burgess Brothers Construction Company no longer operates and VTDEC in 2013 closed the adjacent construction and demolition landfill formerly operated by Burgess Brothers Construction Company. Future development of the Site itself is restricted by the restrictive covenants and the Groundwater Reclassification Order.

Changes in Toxicity and Other Contaminant Characteristics. Since the 2010 FYR, there are updates in toxicity values for some contaminants that were identified in the 1990 ROD.

Methylene Chloride cancer and non-cancer toxicity values

On November 18, 2011, EPA finalized the toxicity assessment for methylene chloride. The new values indicate that methylene chloride is more toxic from non-cancer health effects but less toxic from cancer health effects. These toxicity changes would result in an increased non-cancer hazard and a decreased cancer risk from exposure to methylene chloride.

TCE cancer and non-cancer toxicity values

On September 28, 2011, EPA finalized the December 2009 revised toxicity values for TCE. The new values indicate that TCE is more toxic from both cancer and non-cancer health effects. These toxicity changes would result in increased non-cancer hazard and cancer risk from exposure to TCE.

PCE cancer and non-cancer toxicity values

On February 10, 2012, EPA finalized the cancer and non-cancer toxicity values for PCE. These new values indicate that PCE is now more toxic from cancer health effects but less toxic from non-cancer hazard effects. These toxicity changes would result in an increased cancer risk and a decreased non-cancer hazard from exposure to PCE.

Although calculated risks from potential exposure pathways at the Site may differ from those previously estimated due to the updated toxicity values for the contaminants mentioned above, the selected cleanup levels for these contaminants remain unchanged as the MCLs and Ambient Water Quality Criteria selected in the ROD. Therefore, the changes in toxicity values are not expected to affect the protectiveness of the remedy.

Changes in Risk Assessment Methods. Since the 2010 FYR, changes have been adopted to the equations used to calculate risks from exposures to soil, sediment, and groundwater.

In 2014, EPA finalized the Directive to Determine Groundwater Exposure Point Concentrations (EPCs). http://www.epa.gov/oswer/riskassessment/pdf/superfund-hh-exposure/OSWER-Directive-9283-1-42-GWEPC-2014.pdf. This Directive provides recommendations to develop groundwater EPCs. The recommendations to calculate the 95% upper confidence limit (95% UCL) of the arithmetic mean concentration for each contaminant from wells within the core/center of the plume, using the statistical software ProUCL could result in lower groundwater EPCs than the maximum concentrations routinely used for EPCs as past practice in risk assessment, leading to changes in groundwater risk screening and evaluation. In general, this approach could result in slightly lower risk or lower screening levels.

In 2014, EPA finalized the Directive on the Update of Standard Default Exposure Factors and Frequently Asked Questions associated with these updates.

http://www.epa.gov/oswer/riskassessment/superfund_hh_exposure.htm (items # 22 and #23 of this web link). Many of these exposure factors differ from those used in the risk assessment supporting the 1998 ROD. These changes in general would result in a slight decrease of the risk estimates for most chemicals.

Although calculated risks from potential exposure pathways at the Site may differ from those previously estimated, slightly higher for some contaminants and slightly lower for others, the revised methodologies themselves are not expected to affect the protectiveness of the remedy. A review of Site information identifies that these updates do not call into question the protectiveness of the groundwater remedy.

Expected Progress Towards Meeting RAOs. The RAOs, with the exceptions of preventing the migration of contaminated groundwater beyond the landfill compliance boundary and meeting surface water performance standards, have been met. It is anticipated that with the operation of the groundwater collection trenches that the migration from the landfill will be prevented within the calendar year. Given the low permeability of the kame sand and ablation till, exceedance of surface water performance standards beyond the Downgradient Barrier Trench may persist for an extended period.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light which could affect the protectiveness of the remedy.

Technical Assessment Summary

Based on the data reviewed, observations from the site inspection, and interviews, the remedy is functioning as intended by the ROD and the ROD Amendment. The Landfill and Marshy Area cap constructed in 1999 is stable. Institutional controls have been implemented such that exposure pathways are currently controlled. Initial data from the groundwater collection trenches and treatment system suggest that the groundwater plume is being captured. The primary ARARs for site groundwater are the MCLs and the VT GWPRS. These are not being met either at the landfill compliance boundary or in the groundwater downgradient of the landfill compliance boundary. They are being met at the institutional control boundaries.

Land use surrounding the Site has not changed and is not expected to change significantly in the future. The Burgess Brothers Construction Company no longer operates. Future development of the Site itself is restricted by the institutional controls and the Groundwater Reclassification Order.

V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 4: Issues and Recommendations/Follow-up Actions

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
OU1	Inconsistent operation of groundwater extraction system	Operate groundwater extraction and treatment system to assess remedy performance	Settling Defendants	EPA	2/26/2016	No	Yes

VI. PROTECTIVENESS STATEMENTS

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Addendum Due Date (if applicable):* Click here to enter a date.
Protectiveness Statement: The remedy at the Burgess Brothers Superfund Site currently protects human health and the environment because exposure pathways for direct contact and groundwater ingestion have been controlled by the Landfill and Marshy Area cap and institutional controls, respectively. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure long-term protectiveness: the groundwater collection trenches have to operate successfully to capture and treat contaminated groundwater to prevent further migration of the contaminant plume from the landfill and to capture the portion of the plume that has already migrated from the landfill.	

VII. NEXT REVIEW

The next five-year review report for the Burgess Brothers Landfill Superfund Site is required five years from the completion date of this review.

APPENDIX A – EXISTING SITE INFORMATION

A. SITE CHRONOLOGY

CHRONOLOGY OF SITE EVENTS

Date	Event
1940s	Location of the Site was a sand and gravel operation
Early 1950s – 1976	Site used as a metal salvage facility and disposal area for industrial waste, including solid, semi-solid and liquid wastes
1967 - 1976	Portion of Site used for a liquid waste and sludge lagoon
1976	Disposal operations ceased
1976	VTAEC site inspection; surface water and leachate samples collected
1984 – 1989	Preliminary environmental investigations and monitoring performed by VTDEC, EPA, and Union Carbide Corporation
1985	VTDEC conducted Preliminary Site Assessment.
1988	EPA proposed Site for listing on National Priorities List (NPL)
1989	EPA added Site to NPL
1991	EPA entered into Administrative Order by Consent with PRPs to conduct a Remedial Investigation/Feasibility Study (RI/FS). Initiated multi-phase RI
1994	Groundwater monitoring begins
1997	RI and Baseline Risk Assessment completed
1998	FS completed
1998	EPA issued Record of Decision selecting a remedy
1999	EPA, VTDEC and Settling Defendants entered into a Consent Decree for Remedial Design/Remedial Action (RD/RA) with Statement of Work included as Appendix A
1999	Completed RD; Start of remedy construction
2000	Site attained construction completion milestone
2000	Initiated Operation and Maintenance (O&M) of SVE/AS system
2001	EPA approved Final Remedial Action Construction Report
2001	EPA approved Post-Closure O&M Plan
2001	Start of full scale SVE/AS operation
2002	AS shut down (SVE operation continued)
2003	Groundwater Reclassification Petition Approved
2004	Final Year 2 Remedy Evaluation Report
2005	Grant of Environmental Protection Easement and Declaration of Restrictive Covenants recorded on portion of Burgess Brothers Construction Company property
2005	SVE system shut down
2005	First Five-Year Review Report
2005	Settling Defendants performed additional field work in response to FYR Report
2007	EPA requested a Focused Feasibility Study be prepared to address groundwater contaminant plume and impact to surface water. SVE system restarted
2008 – 2010	Long-term monitoring of groundwater, surface water and sediments continued
2011	FFS completed
2011	Proposed Plan released and information/public hearing meeting held
2011	Amended ROD signed
2012	Statement of Work modified by EPA, VTDEC, and Settling Defendants
2012	Pre-Design Investigation completed

2013	Construction of two groundwater collection trenches and ex-situ treatment system initiated
2014	Construction completed; system startup begun
2015	Modification to *ex-situ* treatment system to address colloidal iron

B. BACKGROUND

The background information was previously presented in the 2010 Five-Year Review and the information is repeated below.

Physical Characteristics

- The Site is located in southern Vermont in the Towns of Woodford and Bennington, between Burgess Road and the Walloomsac Brook, as shown in Figure 1. The latitude of the Site is 42 52' 40" and the longitude is 73 09' 00". The Site, as described in the Record of Decision (ROD), is approximately a three-acre area located in the northeastern section of a 60-acre parcel owned by Clyde Burgess Jr. (hereinafter the Burgess Property) Subsequent to the ROD, and as discussed herein, two institutional controls were placed on twelve acres, encompassing the three-acre Site. The landfill area of the Site occupied approximately 60,000 square feet, which included two cells covering an area of approximately 4,000 square feet. Access to the Site is through the Burgess Brothers Construction Company's facility on Burgess Road, approximately one mile southeast of the junction of Burgess Road and State Highway 9.

- The general topography surrounding the Site consists of land surfaces sloping toward the Site from both east and west and the land surface of the Site itself sloping from north to south. The land surface slope lessens south of the landfill to the site boundary. All surrounding land adjacent to the Site is Burgess Property. To the north, the Green Mountain National Forest borders the Burgess Property.

- The site geology consists of an unconsolidated overburden comprised of a kame sand and ablation glacial till, underlain by a lodgement till, underlain by bedrock. Combined, the kame sand and ablation glacial till are up to 35 feet thick. The lodgement till, which separates the kame sand and ablation till from the bedrock, is approximately 35 to 90 feet thick. Bedrock consists of shallow weathered bedrock, deep weathered bedrock, and competent bedrock. The weathered bedrock consists of schist and gneiss; the competent bedrock consists of massive to thick bedded quartzite with frequent high-angle fractures.

Hydrology

- Surface water flow from the hillside area east of the landfill (known as Harmon Hill) is controlled by several drainage swales, which flow southwesterly into a surface water body that became known as the "Unnamed Stream" during the RI/FS. The Unnamed Stream originates on the Burgess Property and it flows southwesterly into Barney Brook, which empties into the Walloomsac River. Both Barney Brook and the Walloomsac River are classified by the State of Vermont as Class B waters,

which are set forth as waters of a quality that consistently exhibit good aesthetic value and provide high quality habitat for aquatic biota, fish and wildlife. The uses of Class B waters are public water supply (with filtration and disinfection), irrigation and other agricultural uses, swimming and recreation and the Walloomsac River serves as a public drinking water source for the Bennington Water Resources Department.

- The Site contains two groundwater systems. Shallow groundwater is found within the overburden soils and flows generally from the landfill to the south-southeast. Groundwater elevation data indicate generally upward gradients in the overburden in the Marshy Area, with the groundwater discharging into the Unnamed Stream. Hydraulic testing indicates that the overburden soils have low permeability, low yield, and low saturated thickness. Farther downgradient from the landfill, the groundwater flow direction is south-southwest. Groundwater within the bedrock flows towards the west-southwest, generally following the hill slope topography.

Land and Resource Use

- The primary land use in the vicinity of the Site is undeveloped forest. Burgess Brothers Construction Company (Burgess Brothers) uses the area immediately to the north for limited sand and gravel mining operations, the stockpiling of soil (for screening and resale), and for limited scrap metal storage.

- Industrial, commercial, and residential properties are located along Burgess Road, approximately one mile southwest of the Site. Approximately half-mile to the northwest is a residential development along Barney Road, which is connected to municipal water. Since completion of the Remedial Action, a combination residential dwelling and commercial building has been constructed by Burgess Brothers approximately 1000 feet to the northwest of the landfill. This building is connected to the municipal water supply system on Barney Road.

- Two municipal water supply systems, Ryder Spring and Morgan Spring, are located within one mile of the Site. These systems are operated by the Bennington Water Resources Department. Two private drinking wells are located within one mile of the Site. Repeated sampling of the residential wells and springs during the RI and Supplemental RI (1990-1996) indicated no impact from the Site. Since completion of the RI and Supplemental RI, additional monitoring wells have been installed at the Site downgradient of the landfill that have been used to define the limits of the contaminant plume. Sample results from these downgradient wells have been used to confirm that the contaminant plume does not reach any of these municipal and private water supplies.

History of Contamination

- Starting in the early 1950s the Site was used as a metal salvage facility and disposal area. Metals, sludge, rejected small appliance and military specialty batteries were also disposed at the Site. The two lagoon cells (unlined pits) received both liquid wastes and sludge from approximately 1967-1976. These wastes consisted of lead contaminated wastewater, spent solvents, and battery wastes. From 1971-1976, approximately 2,371,100 gallons of liquid waste (primarily trichloroethene (TCE) and tetrachloroethene (PCE), and 241,090 pounds of solid or semi-solid wastes (primarily lead

sludge) were reportedly disposed of at the Site. Site investigations and information provided by the former site operator indicated the landfill also received newspaper and building demolition debris.

- The groundwater in the kame sand and ablation till has been impacted by the landfill, and most probably by the disposal of wastes into the former lagoon cells. Volatile organic compounds, (VOCs) including vinyl chloride, chloroethane, 1,1-dichloroethene, 1,2- dichloroethene,1,1,1-trichloroethane, PCE, TCE, methylene chloride, and benzene, and several metals have been detected at elevated levels.

- The VOC contamination in the groundwater in the kame sand and ablation till extends approximately 300 feet downgradient from the edge of the Landfill and Marshy Area cap. Long-term sampling of groundwater monitoring wells indicates that the limit of the VOC plume has not changed significantly since monitoring began in 1994. The limited downgradient extent of VOCs in the kame sand and ablation till is consistent with the low permeability of these geologic units.

- Sampling of existing bedrock groundwater monitoring wells appears to indicate that the groundwater within the bedrock remains unaffected by the landfill.

- Sediments in the Marshy Area were impacted by landfill operations. Surface water in that portion of the Unnamed Stream that flows near the landfill continues to show low level impacts of VOCs and there are sporadic detections of VOCs found farther downstream.

Initial Response

- In 1976, the Vermont Agency of Environmental Conservation (VTAEC, now Vermont Department of Environmental Conservation (VTDEC)) conducted a site inspection and collected samples of surface water and leachate from seeps in the landfill side slopes. In 1984, VTAEC again sampled surface water and leachate, and also private drinking water supplies in the area. In 1985, VTAEC completed a Preliminary Assessment and Site Investigation.

- In February 1989, at the request of VTDEC, EPA conducted a site inspection which included surface water sampling. Additional EPA sampling included soil gas surveys, soil sampling in the former lagoon area, surface water sampling and sediment sampling in the Marshy Area. In March 1989, EPA placed the Site on the NPL.

- In 1989, Eveready Battery Company (now Energizer) installed wells and sampled groundwater, surface water, soil, and sediment. Due to the remote location of the Site, access by trespassers was not a recurrent problem and placing a fence around the Site was not deemed necessary at that time. Burgess Brothers restricted access to the Site by requiring that all visitors sign in at its office as they entered or exited the property.

- Early response actions also included the removal of all scrap metal from the landfill area and regrading the landfill and surrounding land to promote surface water drainage.

Basis for Taking Action

- Pursuant to an Administrative Order by Consent effective August 27, 1991, the Settling PRPs commenced a Remedial Investigation and Feasibility Study (RI/FS) for the Site under EPA oversight.

The Settling PRPs completed and EPA issued an RI Report in February 1997, and the Settling PRPs completed and EPA issued an FS Report in March 1998.

- The RI found elevated levels of VOCs, semi volatile organic compounds (SVOCs), and metals within the landfill and, specifically, within the former lagoon cells which were considered a “hot spot“. Significantly elevated levels of VOCs, SVOCs, and metals were found within the soils and sediments in the Marshy Area. Elevated levels of VOCs were found in the overburden groundwater in the Landfill Area, former lagoon cells, Marshy Area, and downgradient of the landfill.

- The greatest human health risks were projected for the future ingestion of shallow groundwater at the Site. Both average (l x $l0^{-3}$) and maximum (7 x 10^{-2}) cancer risk estimates exceeded EPA's benchmark of 10^{-4}. The highest noncarcinogenic hazard potential (HI=300) was also projected with the ingestion of maximum concentrations of shallow groundwater from wells at the Site. Both average (HI=20) and maximum (HI=300) noncancer hazard estimates exceeded EPA's benchmark of unity. Vinyl chloride, PCE, TCE, and 1,1-dichloroethene are some of the key contributors to these risk estimates.

- All carcinogenic and noncarcinogenic risk values estimated for consumption of groundwater from deeper aquifers were below 10^{-4} or a HI<1 and were not determined to warrant a remedial action. Exposure to surface and subsurface soils outside of the landfill boundary were below 10^{-4} or a HI<1 and were not determined to warrant a remedial action. All carcinogenic and noncarcinogenic risk values estimated for exposure to stream sediments and surface water were also below 10^{-4} or a HI<1.

- The ecological risk assessment concluded that exposure to contaminants in surface soils outside of the original landfill boundary and Marshy Area could impact some wildlife species foraging in those areas.

C. REMEDIAL ACTIONS

The remedial action information was previously presented in the 2010 Five-Year Review and the information is repeated below.

Remedy Selection

The ROD for the Burgess Brothers Site was signed on September 25, 1998. Remedial Action Objectives (RAOs) were developed as a result of data collected during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD. The RAOs for the Site were as follows:

Landfill RAOs

- Prevent, to the extent practicable, the potential for water to contact or infiltrate through the debris mass and lagoon.

- Prevent, to the extent practicable, the generation of landfill seeps and the migration of landfill impacted surface water into the unnamed streams adjacent to the landfill (Marshy Area).

- Control landfill gas emissions so methane gas does not present an explosion hazard; prevent, to the extent practicable, the inhalation of landfill gas containing hazardous substances, pollutants, or contaminants; and meet state and federal air standards.

- Prevent, to the extent practicable, the migration of contaminated groundwater/leachate beyond the points of compliance by controlling the source of the contamination.

- Minimize the potential for slope failure of the debris mass associated with the landfill cap.

- Prevent, to the extent practicable, direct contact with and ingestion of soil/debris within the landfill and beneath the landfill.

- Control, to the extent practicable, surface water runoff to minimize erosion.

- Prevent, to the extent practicable, the migration of contamination from the lagoon area.

- Prevent, to the extent practicable, the saturation of the landfill debris mass from upgradient groundwater.

Groundwater RAOs

- Prevent, to the extent practicable, the ingestion of landfill impacted bedrock groundwater exceeding Maximum Contaminant Levels (MCLs), Vermont Primary Ground Water Quality Standards, or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each compound or a hazard quotient of unity for each noncarcinogenic compound by any individual who may use the bedrock groundwater or within an area that the groundwater could become impacted as a result of pumping activities.

- Restore the bedrock groundwater at the edge of the Waste Management Unit (downgradient edge of Landfill and Marshy Area cap) to MCLs, Vermont Primary Ground Water Quality Standards, or in their absence, the more stringent of excess cancer risk of 1×10^{-6} for each compound or a hazard quotient of unity for each noncarcinogenic compound.

Surface Water RAOs

- Protect off-site surface water by preventing the occurrence of landfill impacted seeps.

- Prevent, to the extent practicable, ecological impacts from contaminants in the Marshy Area.

- Meet federal and state Applicable Relevant and Appropriate Requirements (ARARs) for any surface water discharge.

Ecological RAOs

- Protect surface water, to the extent practicable, from exceedances of the Ambient Water Quality Criteria (AWQC) Acute and Chronic Standards.

- Protect sediments, to the extent practicable, from exceedances of the Aquatic Sediment Quality Guidelines of the Ontario Ministry of the Environment.

Remedy Implementation

In May 1999, the EPA entered into a Consent Decree with three responsible parties for the RD/RA of the remedy selected by EPA. The PRPs had initiated the RD prior to the entry of the Consent Decree, however, and it was completed in June 1999. Construction activities were conducted at the Site between July 6 and October 28, 1999.

The site achieved Construction Completion status on March 29, 2000. The following describes the implementation of the major components of the remedy selected in the 1998 ROD:

a. Landfill Cap Area

The top slope of the Landfill Area was graded to approximately three percent and the side slopes were graded at three horizontal to one vertical (3:1) or flatter. Prior to any intrusive activity, erosion and sedimentation controls were implemented to protect the swales, Unnamed Stream, and wetlands adjacent to and south of the Landfill Area. These controls were inspected on a routine basis and maintained until soil stabilization was established. Grading of the Landfill Area took into account the adjacent swales, Unnamed Stream, and wetlands and minimized adverse effects to these areas. Landfill grading and capping led to the loss of approximately 0.64 acres of wetlands. (As required by the Consent Decree, the responsible parties resolved their liability for any natural resource damages associated with the loss of wetlands). The adjacent swales were re-routed through a conduit adjacent to the Landfill and Marshy Area cap. A continuous multi-layer, or composite barrier, cap was constructed over the Landfill Area. The cap was designed and constructed, and is being operated and maintained to meet the performance requirements of the Resource Conservation and Recovery Act (RCRA) Subtitle C regulations.

b. Landfill Gas Management

Landfill gas within the gas collection layer of the landfill capping system is passively vented to the atmosphere through two gas vents located at the highest elevation of the landfill. Ambient air and gas vent monitoring was conducted prior to startup of the SVE/AS system on December 13, 2000. Ambient air monitoring was conducted at three locations (one upgradient and two downgradient), and, at the same time, the two passive gas vents within the landfill cap were also field screened and sampled.

Sampling results of the gas vents found VOC concentrations below Performance Levels set forth in the 1998 ROD by at least four orders of magnitude. Although Performance Levels are not applicable to ambient air, the sampling results of ambient air found VOC concentrations below the Performance Levels by at least six orders of magnitude.

c. Marshy Area Cap

The Marshy Area cap was constructed using a 24-inch thick permeable soil barrier, with the top 6 inches comprised of topsoil. The barrier design was based on factors such as constructability, maintenance, and ability to achieve RA objectives. The Marshy Area cap covers an area of approximately one-half acre. To promote positive drainage from the area, soils were shaped to achieve a minimum 3% grade toward drainage swales that were constructed as part of the multi-barrier cap over the landfill.

d. SVE/AS System

The SVE/AS system was constructed to remediate soils in the lagoon area considered to be the source of groundwater contamination. The air sparging system was designed to be used in conjunction with the SVE system to remediate the saturated zone soils by forcing air into the groundwater beneath the lagoon area. This

induced airflow accelerates the volatilization of VOCs in both the saturated and vadose zones, forcing them upwards towards the air extraction wells. The SVE system removes VOCs from the vadose zone soils by drawing air through the extraction wells and producing a vacuum in the subsurface. VOCs contained within the vadose zone migrate toward the air extraction wells where they are removed for capture in granular activated carbon canisters. Any condensate collected from system operation is characterized and treated off-site, as appropriate.

e. Surface Water Management

Surface water drainage controls were constructed to minimize erosion of the cap and impacts to abutting wetlands. Drainage swales were installed on the top and perimeter of the landfill to control runoff. The Landfill Area was also revegetated and is maintained to prevent erosion. Storm water runoff from the Landfill Area is managed in accordance with Vermont Water Quality Standards. The drainage system of the cap is capable of handling a 100-year, 24-hour storm event.

f. Institutional Controls

Institutional controls restricting access consist of appropriate signage, fencing, and a secured gate. A Grant of Environmental Protection Easement and Declaration of Restrictive Covenants was placed on the Burgess Brother property for the twelve acres encompassing the landfill, Marshy Area, and the downgradient area. In addition to these controls, the State of Vermont reclassified the groundwater for the same area to further limit future use of the site.

The Grant of Environmental Protection Easement and Declaration of Restrictive Covenants by Clyde Burgess Jr. serves to ensure the integrity of the Remedial Action as constructed, including the Landfill and Marshy Area cap, the SVE/AS, the landfill gas collection system and the surface water drainage infrastructure. This easement also prohibits the use of the groundwater as a drinking water supply and the use of the land for residential purposes.

The groundwater beneath and immediately around the landfill has been reclassified by the state from Class III (suitable for human consumption with minimal treatment) to Class IV (not potable). This was accomplished through a petition submitted by the VTDEC, at the request of the PRPs, to the Secretary of the Agency of Natural Resources of the State of Vermont. This request was approved on November 6, 2003. The Reclassification prohibits the Site groundwater from use as a domestic water supply and from irrigation, agricultural, and general industrial and commercial uses.

This reclassification is to serve as an interim control to remain in effect while the selected remedy is proceeding and shall remain in effect until the cleanup and performance levels are attained.

System Operation/Operation and Maintenance

The operation, maintenance, and environmental monitoring activities for the Site are being implemented by the PRPs in accordance with the long term operation and maintenance plan approved by EPA on April 12, 2001. Post-Closure Environmental Monitoring (PCEM) is being performed at the Site to monitor air, groundwater, surface water, and sediment for documentation of compliance. PCEM is also performed to monitor effectiveness of remedial actions, including capping of the landfill and operation of the SVE/AS. Sampling is conducted in accordance with the Environmental Monitoring Plan (EMP) and the Quality Assurance Project Plan (QAPP).

Since the 2005 FYR, the primary activities associated with the O&M include the following:

- Visual inspection of the cap with regard to access restrictions (fence & gate), vegetative cover, settlement, stability, and any need for corrective action. In addition, the cap is scheduled to be mowed semi-annually;
- Inspection of the drainage swales for blockage, erosion and instability, and any need for corrective actions;
- Inspection of the condition of groundwater monitoring wells;
- Environmental monitoring: semi-annual monitoring is conducted for most shallow (sand) wells, annual monitoring is conducted for ablation glacial till wells, surface water, and sediment, and bi-annual monitoring is conducted for all bedrock groundwater wells;
- Operation and maintenance of the SVE system

The major cleanup activities of the Burgess Brothers Site occurred during the construction phase of the Remedial Action (Landfill and Marshy Area cap). The remaining components of the remedy are the operation of the SVE system to address source control and monitoring of the groundwater plume. Because of this, as indicated in the planned O&M activities listed above, the primary O&M activities are geared towards the operation of the SVE system, monitoring of groundwater, surface water, and sediments, inspections, and monitoring of the cap.

APPENDIX B

PRESS RELEASE ANNOUNCING THE FIVE-YEAR REVIEW

News Release

U.S. Environmental Protection Agency
New England Regional Office
January 5, 2015

Contact: Emily Bender, 617-918-1037

EPA Will Review 24 Hazardous Site Cleanups during 2015

Boston, Mass.– EPA will review site clean ups and remedies at 20 Superfund Sites and oversee reviews at 4 Federal Facilities across New England this year by doing scheduled Five-Year Reviews at each site.

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

The Superfund Sites where EPA will begin Five Year Reviews in FY' 2015 (October 1, 2014 through September 30, 2015) are below. Please note, the Web link provided after each site provides detailed information on the site status and past assessment and cleanup activity. The web link also provides contact information for the EPA Project Manager and Community Involvement Coordinator at each site. Community members and local officials are invited to contact EPA with any comments or current concerns about a Superfund Site or about the conclusions of the previous Five Year Review.

The Superfund Sites at which EPA is performing Five Year Reviews over the following several months include the following sites.

Connecticut
Durham Meadows, Durham
http://www.epa.gov/region1/superfund/sites/durham

Old Southington Landfill, Southington
http://www.epa.gov/region1/superfund/sites/oldsouthington

Raymark Industries, Stratford
http://www.epa.gov/region1/superfund/sites/raymark

Solvents Recovery Services of New England, Southington
http://www.epa.gov/region1/superfund/sites/srs

Maine

Brunswick Naval Air Station (Federal Facility), Brunswick
http://www.epa.gov/region1/superfund/sites/brunswick

Callahan Mining Corp., Brooksville
http://www.epa.gov/region1/superfund/sites/callahan

Eastland Woolen Mill, Corinna
http://www.epa.gov/region1/superfund/sites/eastland

Loring Air Force Base (Federal Facility), Limestone
http://www.epa.gov/region1/superfund/sites/loring

Pinette's Salvage Yard, Washburn
http://www.epa.gov/region1/superfund/sites/pinette

Saco Municipal Landfill, Saco
http://www.epa.gov/region1/superfund/sites/sacolandfill

Massachusetts

Atlas Tack Corp., Fairhaven
http://www.epa.gov/region1/superfund/sites/atlas

Cannon Engineering Corp., Bridgewater
http://www.epa.gov/region1/superfund/sites/cannon

Charles-George Reclamation Trust Landfill, Tyngsborough
http://www.epa.gov/region1/superfund/sites/charlesgeorge

Fort Devens (Federal Facility), Ayer, Harvard, Lancaster & Shirley
http://www.epa.gov/region1/superfund/sites/devens

Groveland Wells No. 1 & 2 Site, Groveland
http://www.epa.gov/region1/superfund/sites/groveland

Materials Technology Laboratory (US ARMY, Federal Facility), Watertown
http://www.epa.gov/region1/superfund/sites/amtl

New Bedford Harbor, New Bedford
www.epa.gov/nbh

PSC Resources, Palmer
http://www.epa.gov/region1/superfund/sites/psc

New Hampshire

Somersworth Sanitary Landfill, Somersworth
http://www.epa.gov/region1/superfund/sites/somersworth

South Municipal Water Supply Well (Five Year Review Addendum), Peterborough
http://www.epa.gov/region1/superfund/sites/southmuni

Troy Mills Landfill, Troy
http://www.epa.gov/region1/superfund/sites/troymills

Rhode Island

Stamina Mills Inc., North Smithfield
http://www.epa.gov/region1/superfund/sites/stamina

West Kingston Town Dump/URI Disposal Area, South Kingstown
http://www.epa.gov/region1/superfund/sites/wkingston

Vermont

Burgess Brothers Landfill, Woodford and Bennington
http://www.epa.gov/region1/superfund/sites/burgess

# # #

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

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

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

APPENDIX C

SITE FIGURES

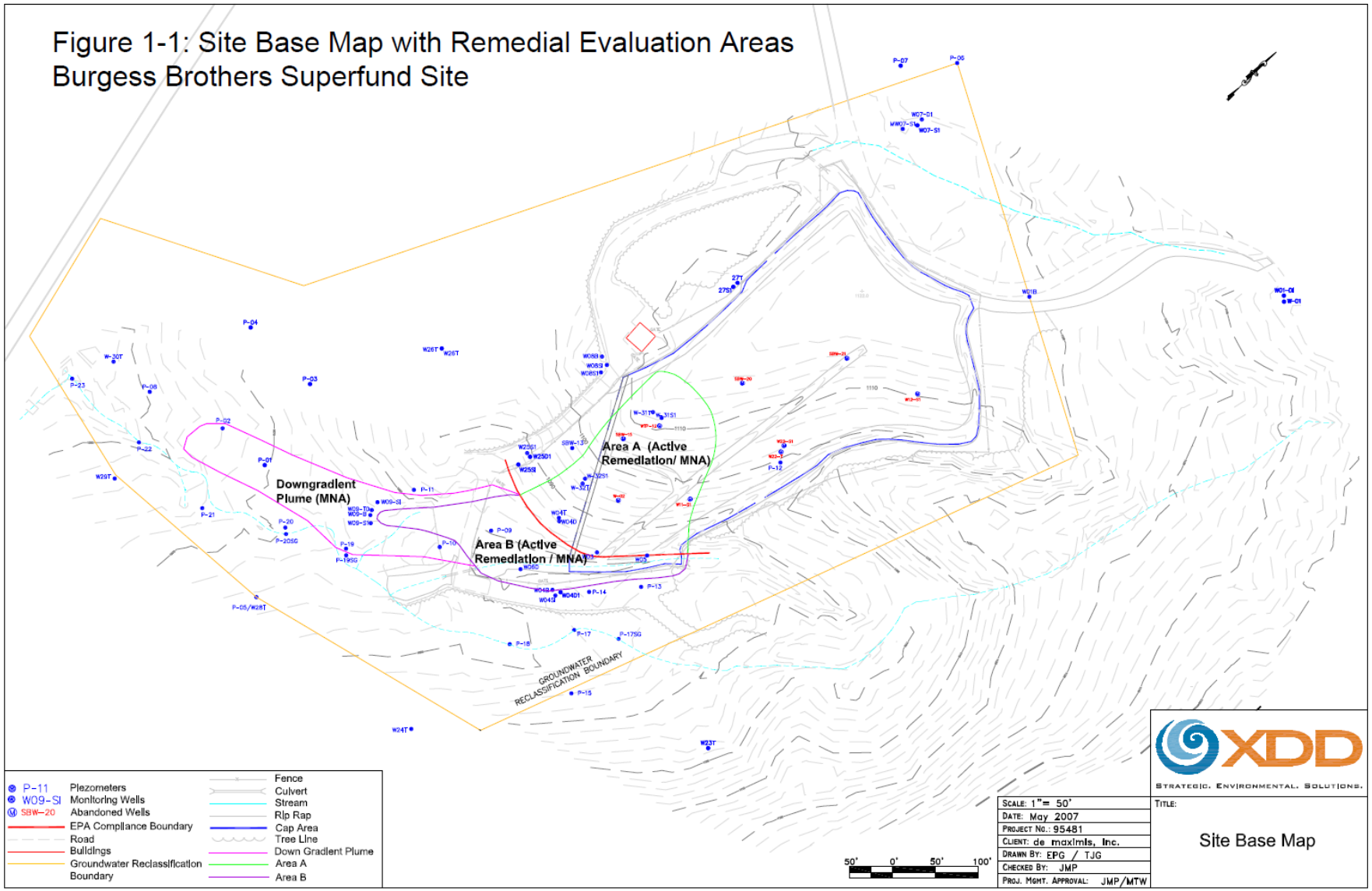
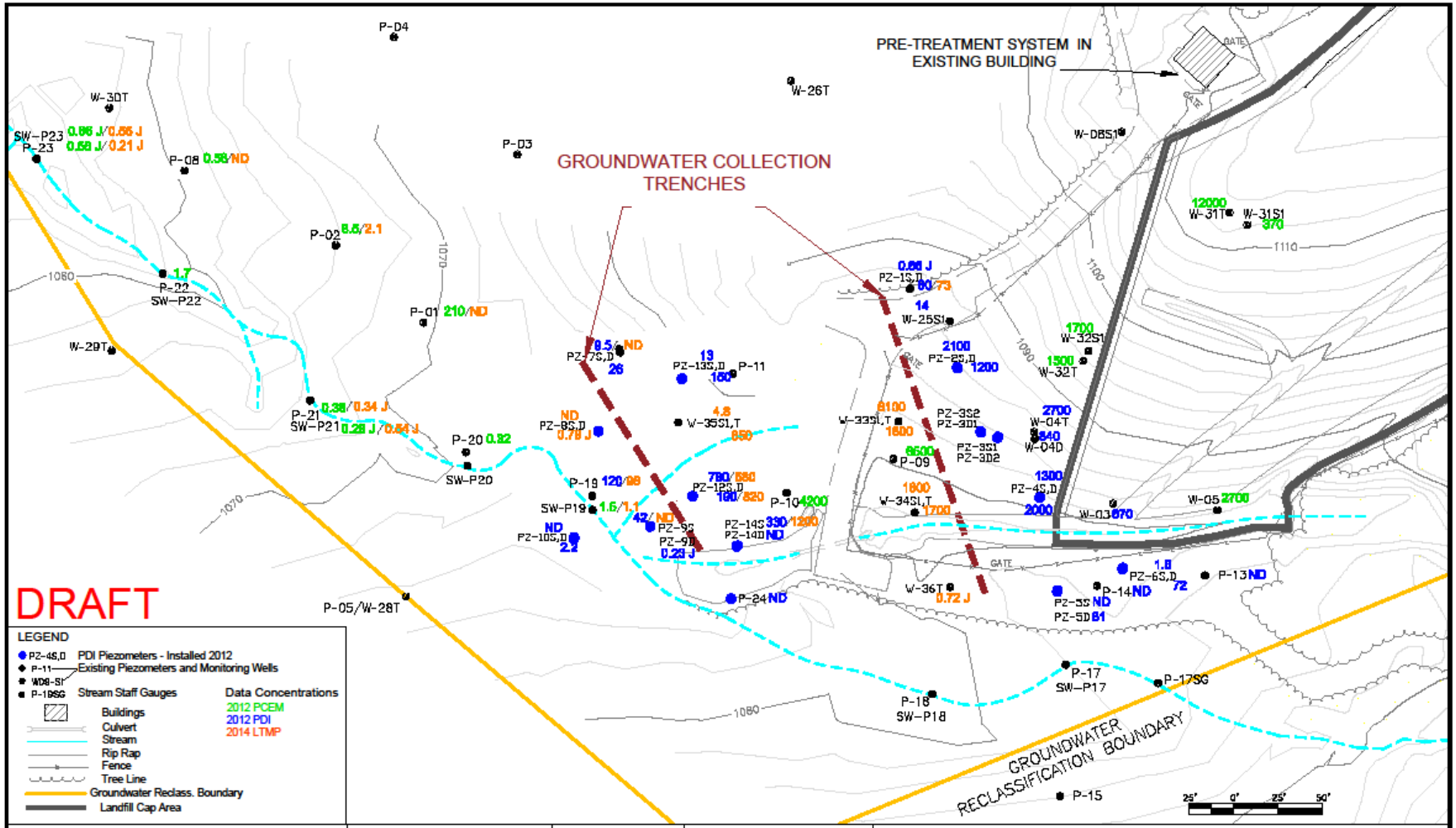


Figure 1-1: Site Base Map with Remedial Evaluation Areas
Burgess Brothers Superfund Site
Downgradient Plume (MNA)
Area A (Active Remediation/ MNA)
Area B (Active Remediation / MNA)
GROUNDWATER RECLASSIFICATION BOUNDARY
P-11 Piezometers
W09-SI Monitoring Wells
SBW-20 Abandoned Wells
EPA Compliance Boundary
Road
Buildings
Groundwater Reclassification Boundary
Fence
Culvert
Stream
Rip Rap
Cap Area
Tree Line
Down Gradient Plume
Area A
Area B
50' 0' 50' 100'
XDD
STRATEGIC. ENVIRONMENTAL. SOLUTIONS.
SCALE: 1"= 50'
DATE: May 2007
PROJECT No.: 95481
CLIENT: de maximis, Inc.
DRAWN BY: EPG / TJG
CHECKED BY: JMP
PROJ. MGMT. APPROVAL: JMP/MTW
TITLE:
Site Base Map



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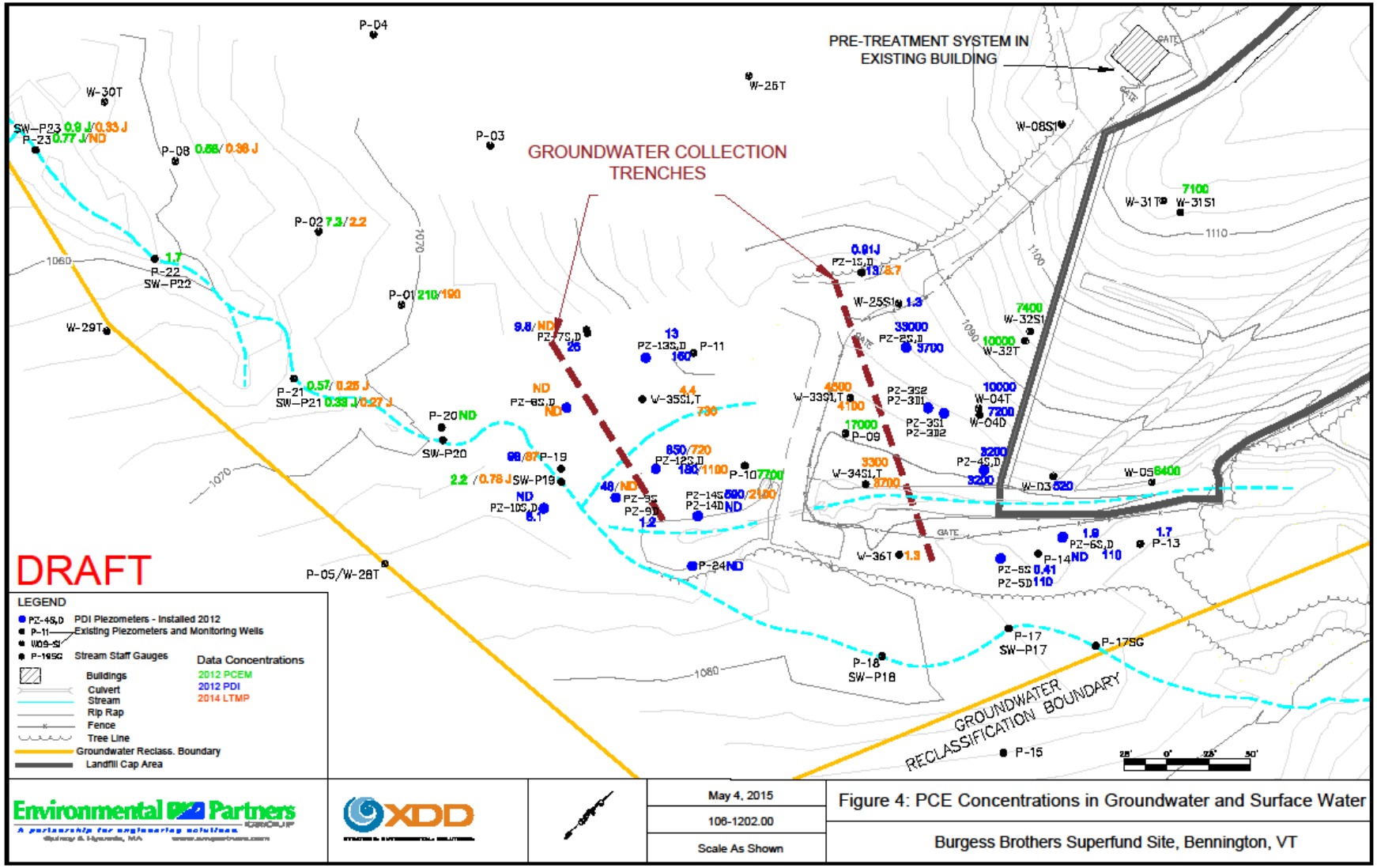
XDD

May 4, 2015
106-1202.00
Scale As Shown

Figure 3: TCE Concentrations in Groundwater and Surface Water

Burgess Brothers Superfund Site, Bennington, VT



Environmental Partners	May 4, 2015	Figure 4: PCE Concentrations in Groundwater and Surface Water
XDD	106-1202.00	Burgess Brothers Superfund Site, Bennington, VT
	Scale As Shown	