Final Report

Pilot Region-Based Optimization Program for Fund-Lead Sites in EPA Region 3

Site Optimization Tracker: Crossley Farm Superfund Site Hereford and Washington Townships Berks County, Pennsylvania

EPA Region III

Solid Waste and
Emergency Response
(5102P)

EPA 542-R-06-006b
December 2006
www.epa.gov

Pilot Region-Based Optimization Program for Fund-Lead Sites in EPA Region 3

Site Optimization Tracker: Crossley Farm Superfund Site Hereford and Washington Townships Berks County, Pennsylvania

EPA Region III

Site Optimization Tracker:

Crossley Farm Superfund Site
Hereford and Washington Townships
Berks County, Pennsylvania

EPA Region III

December 30, 2005

SECTION 1:

CURRENT SITE INFORMATION FORM

Date: 12/30/05 Filled Out By: GeoTrans, Inc.

A. Site Location, Contact Information, and Site Status

1. Site name	2. Site Location (city and State)	3. EPA Region
Crossley Farm	**Huffs Church, Berks County, PA**	**3**

4a. EPA RPM	5a. State Contact
Roy Schrock	**Asuqua Effiong**
4b. EPA RPM Phone Number	5b. State Contact Phone Number
215-814-3210	**717-705-4853**
4c. EPA RPM Email Address	5c. State Contact Email Address
schrock.roy@epa.gov	**aeffiong@state.pa.us**

5. Is the ground water remedy an interim remedy or a final remedy? Interim ☒ Final ☐

6. Is the site EPA lead or State-lead with Fund money? EPA ☒ State ☐

B. General Site Information

1a. Date of Original ROD for Ground Water Remedy	1b. Dates of Other Ground Water Decision Documents (e.g., ESD, ROD Amendment)
September 28, 2001 (OU #2)	**- June 30, 1997 home treatment units (OU #1)** **- June 26, 2004 (ESD for OU #2)** **- 2006 expected OU #2 ROD Amendment**
2a. Date of Projected O&F	2b. Date for Projected Transfer to State
N/A - facility not yet constructed	**N/A - facility not yet constructed**

3. What is the primary goal of the designed P&T system (select one)?

- ☐ Contaminant plume containment
- ☐ Aquifer restoration
- ☒ Containment and restoration
- ☐ Well-head treatment

4. Check those classes of contaminants that are contaminants of concern at the site.

- ☒ VOCs (e.g., TCE, benzene, etc.)
- ☐ SVOCs (e.g., PAHs, PCP, etc.)
- ☐ metals (e.g., arsenic, chromium, etc.)
- ☐ other

5. Has NAPL or evidence of NAPL been observed at the site? Yes ☒ No ☐

6. What is the designed total pumping rate? **100+ gpm**

7. How many extraction wells (or trenches) are there based on design? **~6**

8. How many monitoring wells are proposed to be regularly sampled? **20 to 40**

9. How many samples are proposed to be collected from monitoring wells or piezometers each year? (e.g., 40 if 10 wells are sampled quarterly) **TBD**

10. How many process monitoring samples (e.g., extraction wells, influent, effluent, etc.) are proposed to be collected and analyzed each year? (e.g., 24 if influent and effluent are sampled monthly) **TBD**

11. What above-ground treatment processes are proposed (check all that apply)?

- ☒ Air stripping
- ☐ Carbon adsorption (liquid phase only)
- ☐ Filtration
- ☒ Off-gas treatment
- ☐ Ion exchange
- ☐ Metals precipitation
- ☐ Biological treatment
- ☐ UV/Oxidation
- ☐ Reverse osmosis
- ☐ Other

12. What is the anticipated percentage of system downtime per year? 10% ☐ 10 - 20% ☐ >20% ☐

C. Site Costs

1. Projected Annual O&M costs

O&M Category	Projected Annual Costs for System Start-up (e.g., year 1)	Projected Annual Costs for Steady-State Operation (e.g., after year 1)
Labor: project management, reporting, technical support		
Labor: system operation		
Labor: ground water sampling		
Utilities: electricity		
Utilities: other		
Consumables (GAC, chemicals, etc.)		
Discharge or disposal costs		
Analytical costs		
Other (parts, routine maintenance, etc.)		
O&M Total	**TBD**	**TBD**

The O&M total should be equal to the total O&M costs for the specified fiscal years, including oversight from USACE or another contractor. For costs that do not fit in one of the above cost categories, include them in the "Other" category. If it is not possible to break out the costs into the above categories, use the categories as best as possible and provide notes in the following box.

2. Non-routine or other costs		

Additional costs beyond routine O&M for the specified fiscal years should be included in the above spaces. Such costs might be associated with additional investigations, non-routine maintenance, additional extraction wells, or other operable units. The total costs billed to the site for the specified fiscal years should be equal to the O&M total plus the costs entered in item 2.

3. Estimated costs for system design and/or construction	

Notes on costs:

The site team decided on the course of action for a ROD Amendment near the end of this project and did not have time to estimate costs for the proposed remedy. As such, reporting on the costs is premature at this point.

D. Five-Year Review

1. Date of the Most Recent Five-Year Review	**September 24, 2004**

2. Protectiveness Statement from the Most Recent Five-Year Review

- ☐ Protective
- ☒ Not Protective
- ☒ Protective in the short-term
- ☐ Determination of Protectiveness Deferred

3. Please summarize the primary recommendations in the space below

Protectiveness statement:

The remedy at OU#1 is protective of human health, and exposure pathways that could result in unacceptable risks to human health are being controlled. To date, forty-eight residential point of entry carbon treatment units have been installed to provide clean drinking water to homes that have been affected by the site contamination. EPA will continue to conduct a semi-annual monitoring program to identify if any additional residences are being affected by the contamination. If so, point of entry carbon treatment units will be installed. New residential construction will be tested by EPA, but if point of entry carbon treatment units are required, the owner will be responsible for installation.

Long-term Protectiveness

In order for the site to be protective of the environment in the long-term, the ground water contamination needs to be controlled and remediated. The interim ROD for OU#2 requires a pump and treat action to cleanup the “hot-spot” source areas. This ROD has not yet been implemented. A final remedy for the site-wide ground water contamination is expected to be developed in a subsequent ROD.

E. Other Information

If there is other information about the site that should be provided please indicate that information in the space below. Please consider enforcement activity, community perception, technical problems to be addressed, and/or areas where a third-party perspective may be valuable.

By the end of the optimization pilot project, the site team had decided to modify the remedy discussed in the OU#2 ROD from a source control P&T system that contained the plume at the 100,000 ug/L contaminant contour to a downgradient P&T system that would contain a larger portion of the plume. The RPM will draft the ROD in 2006 and will likely consider including the potential for source area pumping in addition to the downgradient/containment pumping.

SECTION 2:

FOLLOW-UP HISTORY AND SUMMARIES
INCLUDING
NEW AND UPDATED RECOMMENDATIONS

FOLLOW-UP HISTORY

Date of Original Optimization Evaluation	February 8, 2005 (Evaluation Meeting) July 20, 2005 (Additional Meeting) September 14, 2005 (Site Visit) October 26, 2005 (Final Report)

	Meeting Date	Report Date	Item
X	November 7, 2005	December 30, 2005	Follow-Up #1 (conducted as part of pilot project)
			Follow-Up #2
			Follow-Up #3
			Follow-Up #4
			Follow-Up #5
			Follow-Up #6
			Follow-Up #7
			Follow-Up #8

"x" in box indicates the item has been completed

** Note: Two follow-up meetings were scheduled for this site, but the first scheduled follow-up meeting was used to discuss the draft optimization report and arrange a site visit for both the site team and ROET. Therefore, the second scheduled follow-up meeting is the first true follow-up for this site.*

SUMMARY OF FOLLOW-UP #1

Site or System Name	Crossley Farm Superfund Site
Date of This Follow-Up Summary	December 30, 2005
Date of Follow-Up Meeting or Call (Indicate if Meeting or Call)	November 7, 2005 – Meeting

ROET MEMBERS CONDUCTING THE FOLLOW-UP EVALUATION:

Name	Affiliation	Phone	Email
Norm Kulujian	U.S. EPA Region 3	215-814-3130	kulujian.norm@epa.gov
Peter Schaul	U.S. EPA Region 3	215-814-3183	schaul.peter@epa.gov
Kathy Davies	U.S. EPA Region 3	215-814-3315	davies.kathy@epa.gov
Paul Leonard	U.S. EPA Region 3	215-814-3350	leonard.paul@epa.gov
Eric Johnson	U.S. EPA Region 3	215-814-3313	johnson.eric@epa.gov
Brian Nishitani	U.S. EPA Region 3	215-814-2675	nishitani.brian@epa.gov
Linda Dietz	U.S. EPA Region 3	215-814-3195	dietz.linda@epa.gov
Peter Rich	GeoTrans, Inc.	410-990-4607	prich@geotransinc.com
Rob Greenwald	GeoTrans, Inc.	732-409-0344	rgreenwald@geotransinc.com
Doug Sutton	GeoTrans, Inc.	732-409-0344	dsutton@geotransinc.com
Steven Chang	U.S. EPA OSRTI	703-603-9017	chang.steven@epa.gov

SITE TEAM MEMBERS (INCLUDING CONTRACTORS) INTERVIEWED

Name	Affiliation	Phone	Email
Roy Schrock	U.S. EPA Region 3	215-814-3210	schrock.roy@epa.gov

IMPLEMENTATION STATUS OF ALL RECOMMENDATIONS UNDER CONSIDERATION BUT NOT PREVIOUSLY IMPLEMENTED

Recommendation	E-2.1 Design/Install Downgradient Migration Control System		
Recommendation Reason	Protectiveness	**Implementation Status**	In progress

Comments: The site team and ROET agreed on a suitable location for a downgradient P&T system, and the RPM is proceeding with preparation of a ROD Amendment stating the change in location of the P&T system from the source area to a downgradient location. The RPM and Regional counsel are also looking at the current feasibility study to determine if it is adequate for the ROD Amendment or if additional analysis will be needed. In addition to specifying downgradient P&T, the ROD will be call for the following items:

- a treatment system that uses air stripping, rather than UV/oxidation, as the primary technology for treating VOCs
- discharge of treated water to surface water
- a pump test in the source area that could be fed into the proposed downgradient treatment system

Recommendation	E-2.2 Vapor Intrusion Investigation		
Recommendation Reason	Protectiveness	**Implementation Status**	In progress

Comments: The site team is working with the Regional laboratory in Fort Meade to conduct a vapor intrusion study. The team from Fort Meade is putting together the work plan. Approximately 50 homes lie over the plume, and the study will evaluate those homes that are located above TCE concentrations of 10 ug/L or more (approximately 20 homes). The evaluation will likely take place in early winter. The ROET encouraged the site team to look at subslab sampling rather than indoor air samples, and to follow sampling protocols established at other sites.

Recommendation	E-4.1 Consideration of Aggressive Source Remediation Technologies		
Recommendation Reason	Site Closeout	**Implementation Status**	Under Consideration

Comments: The ROET has suggested that the site consider alternative technologies as a routine course of action once the plume is contained. The team has indicated they intend to keep source area remediation as a component of the remedy, and they plan to do further testing of alternatives (see further discussion under “New or Updated Recommendations from This Follow-Up”).

Key for recommendation numbers:

- *E denotes a recommendation from the original optimization evaluation*
- *F1, F2, etc. denote recommendations from the first, second, etc. follow-up meeting*
- *The number corresponds to the number of the recommendation as stated in the optimization evaluation or follow-up summary where the recommendation was provided*

RECOMMENDATIONS PREVIOUSLY IMPLEMENTED OR THAT WILL NOT BE IMPLEMENTED

None.

OTHER CHANGES, UPDATES, OR SIGNIFICANT FINDINGS SINCE LAST FOLLOW-UP

None other than those highlighted above.

NEW OR UPDATED RECOMMENDATIONS FROM THIS FOLLOW-UP

1. Reconsider parameters of source area pump test

   The site team is planning a source area pump test to determine the concentrations that might be present under pumping conditions. The RPM noted the test might include pumping from six extraction wells at a total of 40 gpm for six months. Prior to conducting the test, vaults for each of the already completed extraction wells would be constructed with necessary controls. This is a large scale pump test, and the costs may outweigh the benefits since designing and conducting the pump test would be similar in designing and installing a source area P&T system.

   The ROET suggests that, for long-term source area extraction, contaminated water from the source area be fed to the proposed downgradient treatment system after it is built. The amount of source area water can be adjusted based a number of parameters, including the treatment system capacity, the treatment system design concentration, the flow rate and influent concentrations from the downgradient extraction system, and the flow rate and concentrations from the source area extraction system. Under this scenario, pumping from the source area would likely be lower than 40 gpm and could be adjusted accordingly. The ROET therefore suggests a two-week pump test in the source area, at a lower flow rate, to get an improved understanding of the flow rate and concentrations that would be blended with the water from the downgradient extraction system. This type of short-term, low-rate test could potentially be performed in advance of designing and constructing the downgradient system. Based on this information and information from pump tests in the location of the downgradient extraction system, the site team could design the downgradient extraction system accordingly. A reasonable result of the source area pump test may be that the site team “over-designs” the treatment system for the downgradient extraction system by selecting the “next biggest” air stripper to accommodate some additional flow from the source area. This approach with a reduced-scope pump test should be significantly lower in cost than that planned by the site team and should provide the site team with useful information for designing the downgradient treatment system. The potential cost savings associated with this reduced-scope approach are difficult to estimate but might be $225,000 or more (assuming a cost of $75,000 for a two-week pump test and perhaps $300,000 to $500,000 for the six month pump test).

2. Use subslab sampling for the vapor intrusion evaluation

   It is recommended that the site team initiate the vapor intrusion evaluation by conducting subslab sampling at the target residences rather than conducing indoor air sampling. A number of residential activities could lead to false positive results from indoor air sampling. By beginning with subslab sampling, the site team can first establish a link between the ground water contamination and vapor contamination at the target residence. While subslab sampling is being conducted, the homes should be evaluated for potential preferential flow paths that may facilitate vapor intrusion. If subslab sampling results in elevated vapor concentrations at some residences, the site team could then return to those residences to conduct indoor air sampling, using appropriate protocols and sampling for specific contaminants of concern. These considerations will likely have little effect on the overall cost of the vapor intrusion evaluation.

Updated Cost Summary Table

Recommendation	Reason	Implementation Status	Estimated Capital Costs ($)	Actual Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Actual Change in Annual Costs ($/yr)
Original Optimization Evaluation Recommendations						
2.1 Design/Install Downgradient Migration Control System	Protectiveness	In progress	Not quantified		Not quantified	
2.2 Vapor Intrusion Investigation	Protectiveness	In progress	$30,000		$0	
4.1 Consideration of ISCO, Source Area Pumping or Alternative Technology	Site Closeout	Under Consideration	Not quantified		Not quantified	
New or Updated Recommendations from Follow-up #1, November 7, 2005						
1. Reconsider parameters of source area pump test	Cost Reduction		($225,000)		$0	
2. Use subslab sampling for the vapor intrusion evaluation	Cost Reduction		$0		$0	

Costs in parentheses imply cost reductions.

APPENDIX: A

ARCHIVE OF TECHNICAL ASSISTANCE PROVIDED BY THE ROET

Note: Technical assistance items are provided in reverse chronological order.

Technical Assistance Item #1
Prepared December 30, 2005

The ROET visited the site with the site team on September 14, 2005 and revised the draft optimization evaluation report accordingly. The findings from the site visit were included in the revised optimization evaluation report submitted on October 26, 2005. Therefore, this technical assistance item is only included to document the site visit in the site's technical assistance archive.

APPENDIX: B

BASELINE SITE INFORMATION SHEET AND OPTIMIZATION EVALUATION REPORT

Streamlined
Optimization Evaluation Report

Crossley Farm Superfund Site
Hereford and Washington Townships
Berks County, Pennsylvania

EPA Region III

October 26, 2005

SECTION 1:

BASELINE SITE INFORMATION FORM

Date: 10/26/05 Filled Out By: GeoTrans

A. Site Location, Contact Information, and Site Status

1. Site name	2. Site Location (city and State)	3. EPA Region
Crossley Farm	**Huffs Church, Berks County, PA**	**3**

4a. EPA RPM	5a. State Contact
Roy Schrock	**Asuqua Effiong**
4b. EPA RPM Phone Number	5b. State Contact Phone Number
215-814-3210	**717-705-4853**
4c. EPA RPM Email Address	5c. State Contact Email Address
schrock.roy@epa.gov	**aeffiong@state.pa.us**

5. Is the ground water remedy an interim remedy or a final remedy? Interim ☒ Final ☐

6. Is the site EPA lead or State-lead with Fund money? EPA ☒ State ☐

B. General Site Information

1a. Date of Original ROD for Ground Water Remedy	1b. Dates of Other Ground Water Decision Documents (e.g., ESD, ROD Amendment)
September 28, 2001 (OU #2)	**June 30, 1997 home treatment units (OU #1)** **June 26, 2004 (ESD for OU #2)**
2a. Date of Projected O&F	2b. Date for Projected Transfer to State
N/A - facility not yet constructed	**N/A - facility not yet constructed**

3. What is the primary goal of the designed P&T system (select one)?	4. Check those classes of contaminants that are contaminants of concern at the site.
☐ Contaminant plume containment	☒ VOCs (e.g., TCE, benzene, etc.)
☐ Aquifer restoration	☐ SVOCs (e.g., PAHs, PCP, etc.)
☒ Containment and restoration	☐ metals (e.g., arsenic, chromium, etc.)
☐ Well-head treatment	☐ other

5. Has NAPL or evidence of NAPL been observed at the site? Yes ☒ No ☐

6. What is the designed total pumping rate? **40 gpm, design # for 100 ppm plume**

7. How many extraction wells (or trenches) are there based on design? **6**

8. How many monitoring wells are proposed to be regularly sampled? **20 to 40**

9. How many samples are proposed to be collected from monitoring wells or piezometers each year? (e.g., 40 if 10 wells are sampled quarterly) **TBD**

10. How many process monitoring samples (e.g., extraction wells, influent, effluent, etc.) are proposed to be collected and analyzed each year? (e.g., 24 if influent and effluent are sampled monthly) **TBD**

11. What above-ground treatment processes are proposed (check all that apply)?

☐ Air stripping	☐ Metals precipitation
☐ Carbon adsorption (liquid phase only)	☐ Biological treatment
☐ Filtration	☒ UV/Oxidation
☐ Off-gas treatment	☐ Reverse osmosis
☐ Ion exchange	☒ Other **oxidation process**

12. What is the anticipated percentage of system downtime per year? 10% ☐ 10 - 20% ☐ >20% ☐

C. Site Costs

1. Projected Annual O&M costs

O&M Category	Projected Annual Costs for System Start-up (e.g., year 1)	Projected Annual Costs for Steady-State Operation (e.g., after year 1)
Labor: project management, reporting, technical support		
Labor: system operation		
Labor: ground water sampling		
Utilities: electricity		
Utilities: other		
Consumables (GAC, chemicals, etc.)		
Discharge or disposal costs		
Analytical costs		
Other (parts, routine maintenance, etc.)		
O&M Total	**TBD**	**TBD**

The O&M total should be equal to the total O&M costs for the specified fiscal years, including oversight from USACE or another contractor. For costs that do not fit in one of the above cost categories, include them in the "Other" category. If it is not possible to break out the costs into the above categories, use the categories as best as possible and provide notes in the following box.

2. Non-routine or other costs		

Additional costs beyond routine O&M for the specified fiscal years should be included in the above spaces. Such costs might be associated with additional investigations, non-routine maintenance, additional extraction wells, or other operable units. The total costs billed to the site for the specified fiscal years should be equal to the O&M total plus the costs entered in item 2.

3. Estimated costs for system design and/or construction	

Notes on costs:

The actual nature of the system to be constructed is not yet finalized. As such, reporting on the costs is considered premature. However, it is noted here that the ROD treatment process included air stripping, vapor treatment with GAC, and reinjection of treated water, and the July 2004 ESD changed the primary treatment method to advanced oxidation (PhotoCat). Based on the ROD and ESD, the capital cost was expected to be on the order of $3.5 million, and the present worth of the remedy was expected to be on the order of $8.65 million (ROD) or $6.50 million (ESD)

D. Five-Year Review

1. Date of the Most Recent Five-Year Review	**September 24, 2004**

2. Protectiveness Statement from the Most Recent Five-Year Review

- ☐ Protective
- ☒ Not Protective
- ☒ Protective in the short-term
- ☐ Determination of Protectiveness Deferred

3. Please summarize the primary recommendations in the space below

Protectiveness statement:

The remedy at OU#1 is protective of human health, and exposure pathways that could result in unacceptable risks to human health are being controlled. To date, forty-eight residential point of entry carbon treatment units have been installed to provide clean drinking water to homes that have been affected by the site contamination. EPA will continue to conduct a semi-annual monitoring program to identify if any additional residences are being affected by the contamination. If so, point of entry carbon treatment units will be installed. New residential construction will be tested by EPA, but if point of entry carbon treatment units are required, the owner will be responsible for installation.

Long-term Protectiveness

In order for the site to be protective of the environment in the long-term, the ground water contamination needs to be controlled and remediated. The interim ROD for OU#2 requires a pump and treat action to cleanup the "hot-spot" source areas. This ROD has not yet been implemented. A final remedy for the site-wide ground water contamination is expected to be developed in a subsequent ROD.

E. Other Information

If there is other information about the site that should be provided please indicate that information in the space below. Please consider enforcement activity, community perception, technical problems to be addressed, and/or areas where a third-party perspective may be valuable.

Based on the ROD for OU #2 which documents the regional ground water contamination at the Site, EPA initiated an OU #3 Remedial Design, which is a pilot test evaluation of in-situ chemical oxidation in the "hot spot" area. Based on the OSE report recommendations, a new remedy concept with pumping further downgradient than was previously planned in the ROD/ESD for OU #2 may be considered. That revised remedy concept would likely require an additional ESD if it were to be implemented.

SECTION 2:

STREAMLINED OPTIMIZATION EVALUATION FINDINGS AND RECOMMENDATIONS

Site Name: Crossley Farm Superfund Site   Date of Report: October 26, 2005

ROET MEMBERS CONDUCTING THE STREAMLINED OPTIMIZATION EVALUATION:

Name	Affiliation	Phone	Email
Norm Kulujian	U.S. EPA Region 3	215-814-3130	kulujian.norm@epa.gov
Kathy Davies	U.S. EPA Region 3	215-814-3190	davies.kathy@epa.gov
Peter Rich	GeoTrans, Inc.	410-990-4607	prich@geotransinc.com
Rob Greenwald	GeoTrans, Inc.	732-409-0344	rgreenwald@geotransinc.com
Steve Chang	U.S. EPA OSRTI		chang.steve@epamail.epa.gov
Jean Balent (by phone)	U.S. EPA OSRTI	202-564-1709	balent.jean@epa.gov

SITE TEAM MEMBERS (INCLUDING CONTRACTORS) INTERVIEWED

Name	Affiliation	Phone	Email
Roy Schrock	U.S. EPA Region 3 (RPM)	215-814-3210	Schrock.roy@epa.gov
Bernice Pasquini	U.S. EPA Region 3 (Hydro)	215-814-3326	pasquini.bernice@epa.gov
Bruce Rundell	U.S. EPA Region 3 (Hydro)	215-814-3317	Rundell.bruce@epa.gov

The original meeting associated with the optimization evaluation for this site was conducted on February 8, 2005 at the Region III building in Philadelphia. Discussions pertaining to an original draft optimization evaluation report were conducted on July 20, 2005 at the Region III building in Philadelphia. During those discussions, it was decided that a revised optimization evaluation report would be prepared after a site visit was conducted. This site visit was conducted on September 14, 2005. The individuals listed above were all present for the site visit, with the exception of Jean Balent and Steve Chang. There were also additional participants and observers at the site visit from EPA Region III, site contractors, and GeoTrans.

1.0 SIGNIFICANT FINDINGS BEYOND THOSE REPORTED ON SITE INFORMATION FORM

- The site is located on a hilltop with steep slopes to the west and the south. There were several contaminant source areas at the site from disposal in the 1960s and 1970s. These source areas include the borrow pit, the EPIC (Environmental Photograph Information Center) Pit area, and potentially a former quarry. In 1998 approximately 1,200 drums and 15,000 tons of contaminated soil were removed from the EPIC pit area. Contaminated soil is not thought to be a significant continuing source of ground water contamination because bedrock is close to the surface and dumping at the source areas likely allowed quick migration of the solvents into the bedrock

- In 1983, odors in residential well water were observed and investigation was started. At that time 8 private wells were found to be impacted, with six at TCE levels above 200 ug/l and a maximum of 8,500 ug/l. By 1987, 15 POET systems were installed at nearby residences.

- The ground water contamination reaches deep bedrock (up to 400 feet below ground surface). The contaminant plume is extensive, approximately 2 miles long. Contaminant levels over 1 mg/l TCE emanate from multiple source areas and combine to form the long plume. At the time of the RI (1999), contaminant levels above 10 mg/l were present over an area about 1,000 feet long and 500 feet wide.

- EPA currently operates about 48 POETS in the area. There are no current plans to extend a potable water line into the area. EPA samples about 120 private wells and springs on a semiannual frequency.

- The site remedial plan described in the ROD, and subsequent plans including the *Basis of Design* report, described a source area P&T system extracting water within the delineated area of 100,000 ug/l TCE. The ROD treatment process included air stripping, vapor treatment with GAC, and reinjection of treated water. The July 2004 ESD changed the primary treatment method to advanced oxidation (PhotoCat). Based on the ROD and ESD, the capital cost was expected to be on the order of $3.5 million, and the present worth of the remedy was expected to be on the order of $8.65 million (ROD) or $6.50 million (ESD).

- The P&T system proposed in the ROD/ESD for OU2 has been on hold, and in-situ chemical oxidation (ISCO) with potassium permanganate has been tested on a small scale. The results of the ISCO test have proven difficult to interpret.

- The primary objective stated in the OU2 ROD was to contain contamination in the fractured bedrock aquifer at the site and reduce contamination in the aquifer and surface water springs to MCLs or below. The ROD states that discharge standards for the P&T system and the cleanup standards for the site are both MCLs (5 ug/l for TCE).

- Since the ROD, additional residential wells have been impacted, but these wells are still within the confines of the RI delineated contaminant plume (i.e., there is no indication the extent of the plume has expanded).

2.0 RECOMMENDATIONS TO IMPROVE SYSTEM PROTECTIVENESS

2.1 DESIGN/INSTALL A MIGRATION CONTROL SYSTEM AND A TREATMENT PLANT DOWNGRADIENT OF THE INTERIM SYSTEM PREVIOUSLY PLANNED FOR OU #2

The optimization team believes that the active treatment of the 100,000 ug/l TCE plume near the borrow pit area, which is the planned interim remedy as per the ROD/ESD for OU2, should not be the initial focus of an interim or final remedy. Instead, the optimization team initially recommended that the initial focus should be on designing and installing ground water extraction wells and a ground water treatment plant (air stripping with discharge to surface water) further downgradient. This was discussed with the site team during a meeting on July 20, 2005, and after further discussions with the site team during the site visit on September 14, 2005, there appeared to be agreement that this approach had merit.

Based on discussions during the site visit, there appeared to be consensus that extraction wells could be located along Airport Road (between the West Branch of Perkiomen Creek and Dale Road), and along Dale Road between Airport Road and Dairy Lane (perhaps extending just east of Dairy Lane). This is illustrated on Figure 1. This is downgradient of the borrow pit area (the extraction location associated with the ROD/ESD for OU2), but more upgradient that than the extraction area originally suggested by the optimization team. A treatment plant could be built in the vicinity of the intersection of Airport Road and Dale Road, with discharge of treated water to the West Branch of Perkiomen Creek.

Benefits associated with this general recommendation include the following:

- The strategy in the ROD/ESD for OU2 only contains the 100,000 ug/l contour for TCE as an interim remedy. That would still allow for extremely high concentrations of TCE to remain outside of the contained area until a final remedy was established, which decreases the potential for restoration of ground water, springs, and surface water downgradient of the extraction system. However, the approach suggested herein would place initial focus on containing a much larger area. Based on Figures 4 and 5 of the OU2 ROD, TCE concentrations near the recommended extraction locations were closer to 1,000 ug/l rather than 100,000 ug/l. Therefore, pumping in the locations recommended herein would leave much lower contaminant concentrations (and much lower contaminant mass) outside of the contained area. This increases the protectiveness of the initial action, and increases the likelihood for restoration of ground water, springs, and surface water downgradient of the extraction system.

- The high TCE concentrations anticipated from extraction in the borrow pit area apparently caused considerable concern during the design process, resulting in an ESD for the treatment process (change from air stripping to UV oxidation). A system located further downgradient will have lower influent concentrations, such that air stripping can definitely be utilized. This will cost less money to design, implement, and operate.

- A treatment system located near the borrow pit area, as envisioned in the ROD/ESD for OU2, did not allow an option for discharging the treated water to surface water. Therefore, injection or infiltration of treated water would be required, and this significantly increases the likelihood of operational difficulties due to fouling and/or inability to infiltrate an appropriate rate of treated water. It also requires land to be utilized for recharge, and creates potential for NAPL to be mobilized by the infiltrated water. A system located further downgradient, as recommended herein, will have the potential for treated water to be discharged to surface water (i.e., to the West Branch of Perkiomen Creek).

- The Region III hydrogeologists indicated during the site visit that the geology in the vicinity of the extraction locations recommended herein is likely more favorable for achieving high extraction rates, relative to the borrow pit area. (Note that a detailed review of the very complex geology at this site to determine if this assertion is likely correct is beyond the scope of this optimization evaluation).

- While ISCO may prove potentially viable for mass removal in focused areas, the optimization team believes ISCO cannot provide the plume containment indicated as the primary ROD objective. Furthermore, the effectiveness of ISCO may be limited if there are large DNAPL pools, which is likely the case. The optimization team believes the extraction and treatment approach suggested herein is preferable to an ISCO-only approach. Once containment of the downgradient plume is demonstrated, source area in-situ alternatives could be further considered.

If this recommendation is implemented, an ESD or a ROD amendment will be required. The specific number of wells, locations of wells, and well rates would require detailed hydrogeologic analysis that is beyond the scope of this evaluation. This may require drilling of test wells, aquifer testing, and perhaps modeling. Due to the complicated geology at this site, these efforts will require the site-specific geology expertise of site contractors and EPA hydrogeologists. Because there are many site-specific factors associated with the complex geology and site access, costs for these design efforts have not been quantified.

2.2 VAPOR INTRUSION

Springs SW-10, SW-11, SW-13, and SW-15 are reported to have TCE concentrations around 200 ug/l in the OU2 ROD. This indicates that shallow ground water has similar or higher concentrations. The impacted shallow ground water is near residences. The optimization team did not find consideration of a vapor intrusion pathway in the documents reviewed. The site team should consider vapor sampling for VOCs in residences located above impacted shallow ground water. Assuming that sampling of 10 residences is required, we estimate a cost of $30,000 including a brief work plan and report.

3.0 Recommendations to Reduce Cost

None, this is not an operating system.

4.0 Recommendations to Speed Site Closeout

4.1 Consideration of Aggressive Source Remediation technologies

Once hydraulic containment is established for the downgradient plume, source removal options should once again be considered. However, the optimization team cautions against expenditure on any source removal technology without a clear understanding of how the technology will hasten progress to site closure and without guarantees of performance from vendors. If the application of a technology will remove mass but not speed up site cleanup (because significant mass still remains as a continuing source of dissolved ground water impacts), then implementing that technology is of questionable value. Pilot testing should only be performed on aggressive source remediation technologies after an evaluation has been performed to determine that scale-up to full-scale implementation is feasible from a cost perspective.

Prioritization and Sequencing of Recommendations

As discussed above, the downgradient migration control system design and construction should take precedence over continued evaluation of source removal options. Vapor intrusion investigations, if applicable based on residence locations, should be a high priority.

Other Action Items

None

Cost Summary Table

Recommendation	Reason	Priority (High/Other)	Estimated Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)
2.1 Design/Install a Migration Control System and a Treatment Plant Downgradient of the Interim System Previously Planned for OU #2	Protectiveness	High	Not quantified*	Not quantified*
2.2 Vapor Intrusion Investigation	Protectiveness	High	$30,000	$0
4.1 Consideration of Aggressive Source Remediation Technologies	Site Closeout		(unknown)	

Costs in parentheses imply cost reductions.

**Given that an operating system does not exist yet, and the recommended extraction and treatment system is only conceptual at this point, potential changes in capital and annual costs have not been quantified.*

FIGURES

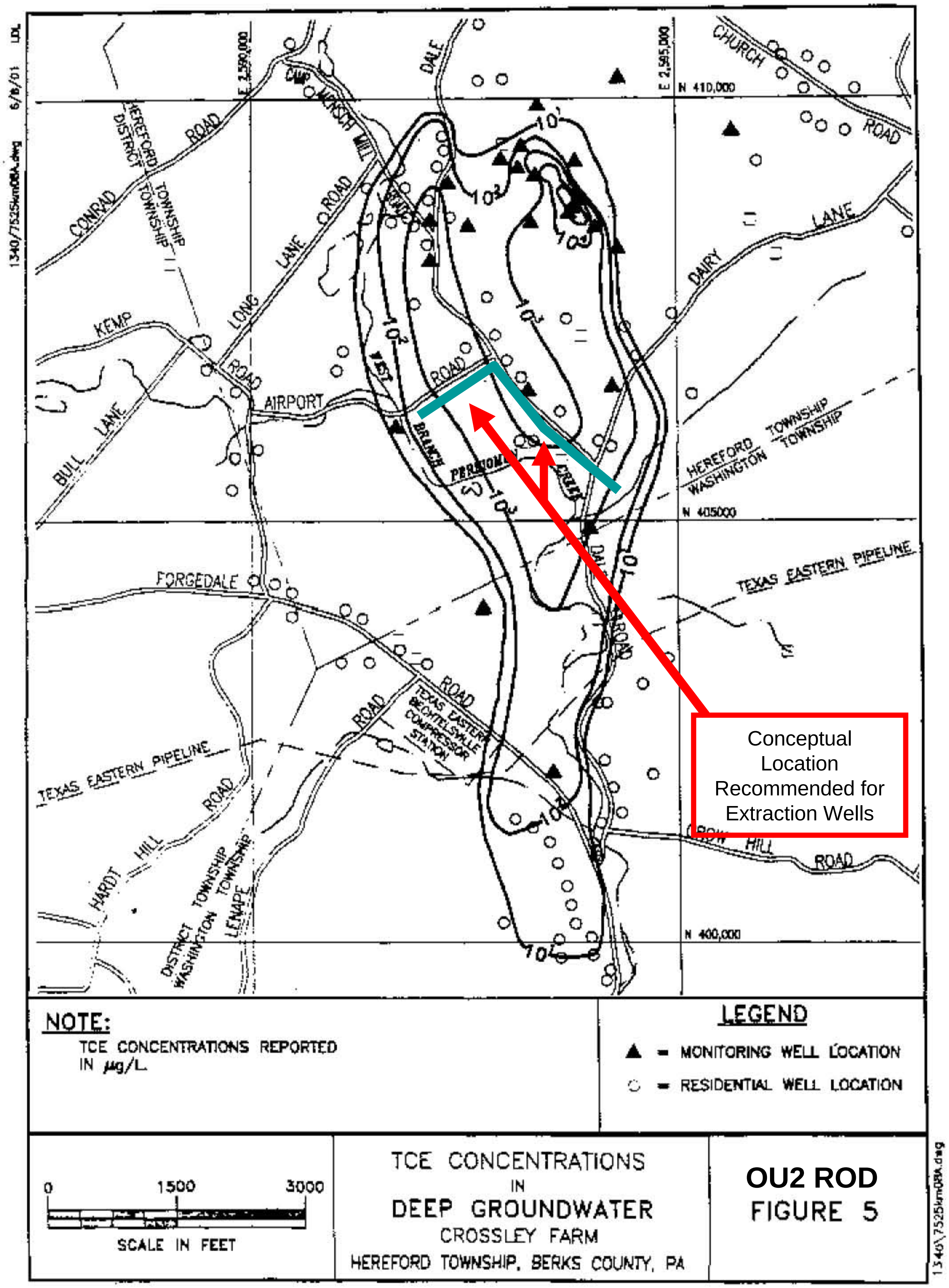

Figure 1: Conceptual Location Recommended for Extraction Wells