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Unicorn Management Consultants, LLC

October 30, 2014
Refer to: OP-3233

Mr. Michael Infurna
EPA Remedial Project Manager
U.S. Environmental Protection Agency
Region 2
290 Broadway, 20th Floor
New York, New York 10007-1866

Subject: Addendum 7 – LVRR RI/FS Work Plan
Lehigh Valley Railroad Derailment Superfund Site, LeRoy, NY

Dear Mr. Infurna:

In accordance with the Settlement Agreement and Order on Consent for Pre-Remedial Design Investigations, Remedial Design, and Remedial Investigation/Feasibility Study by and between LVRR and EPA, Index No. CERCLA-02-2006-2006 (Settlement Agreement), Unicorn Management Consultants, LLC (UMC), on behalf of the respondent, Lehigh Valley Railroad Company (LVRR), hereby submits Addendum 7 to the Remedial Investigation/Feasibility Work Plan. This addendum includes monitored natural attenuation (MNA) sampling of groundwater monitoring wells, installation of groundwater transducers, proposed new groundwater monitoring wells, evaluation of MNA sampling results, and modeling of TCE bedrock diffusion.

If you should have any questions regarding this submittal, please call me at 203-205-9000, ext. 11.

Sincerely,
UNICORN MANAGEMENT CONSULTANTS, LLC

Francisco Trejo
Project Coordinator
Lehigh Valley Railroad Derailment Superfund Site

Enclosure

cc: C. Magee (NYSDEC) w/enclosure
M. Hill, Esq. (Blank Rome) w/o enclosure

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ADDENDUM 7
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN

Lehigh Valley Railroad Derailment Superfund Site
LeRoy, New York
Index Number CERCLA-02-2006-2006

LEHIGH VALLEY RAILROAD COMPANY
CINCINNATI, OHIO 45202

Prepared By:

Unicorn Management Consultants, LLC
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October 30, 2014

DOCUMENT AUTHORIZATION FORM

ADDENDUM 7
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

Lehigh Valley Railroad Derailment Superfund Site
LeRoy, New York
Index Number CERCLA-02-2006-2006

LEHIGH VALLEY RAILROAD COMPANY

CINCINNATI, OHIO 45202

Prepared By:
Unicorn Management Consultants, LLC
52 Federal Road, Suite 2C
Danbury, CT 06810

October 30, 2014

AUTHORIZATIONS:

Michael O'Connor, P.G., LEP — Date 10/30/14
Manager of Environmental Projects – UMC, LLC
Lehigh Valley Railroad Derailment Superfund Site

Francisco Trejo — Date 10/30/2014
President – UMC, LLC
Remedial Project Coordinator
Lehigh Valley Railroad Derailment Superfund Site

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APPENDICES

1 INTRODUCTION

Unicorn Management Consultants, LLC (UMC) prepared this document, "Addendum 7 to the Remedial Investigation/Feasibility Study Work Plan" (Addendum 7), on behalf of the Lehigh Valley Railroad Company (LVRR). LVRR is the respondent of the Settlement Agreement and Order on Consent for Pre-Remedial Design Investigations, Remedial Design, and Remedial Investigation/Feasibility Study (RI/FS), Index Number CERCLA-02-2006-2006 (hereinafter, "SA") for the Lehigh Valley Railroad Derailment Superfund Site located in Genesee, Monroe and Livingston Counties, near the Town of LeRoy, New York (hereinafter, the "Site"), which was issued by the United States Environmental Protection Agency (USEPA), effective date October 6, 2006. The scope of the LVRR RI/FS was incorporated in the SA, including a Record of Decision (ROD) prepared by the New York State Department of Environmental Conservation (NYSDEC) on March 28, 1997 and a Memorandum to supplement the ROD published by the USEPA on May 15, 2002 (Appendix A of the SA); a Statement of Work (SOW) (Appendix B of the SA); and the work plan titled Final Work Plan for Remedial Investigation / Feasibility Study, Lehigh Valley Superfund Site, Town of Leroy, Genesee County, NY prepared by Foster Wheeler Environmental Corporation (Foster Wheeler) on behalf of the USEPA dated February 2002 (USEPA 2002 RI/FS WP) (Appendix C of the SA); and, Addendum dated September 11, 2006 (Appendix C of the SA).

UMC prepared five additional addenda to the USEPA 2002 RI/FS Work Plan (Addendum 2 through Addendum 6). Addendum 2[1] proposed the final locations of monitoring wells; installation and construction methods of monitoring wells; sampling methodology of monitoring wells; and, surface water and sediment sampling locations. Addendum 3[2] to the RI/FS Work Plan amends the monitoring and FLUTe well installation methodologies. Addendum 4[3] to the RI/FS Work Plan revises the depth intervals in the borings selected for packer testing and proposes modifications to downhole geophysical test methods. Addendum 5[4] to the RI/FS Work Plan revises the groundwater investigation by expanding the monitoring well network to the north in the Spill Area and to the east in the Spring Creek area and proposes a soil gas survey on the east side of Spring Creek. Addendums 2, 3, 4, and 5 were approved by the USEPA. Addendum 6[5] to the RI/FS Work Plan included the collection of surface water samples from Mud and Spring Creeks, a groundwater sample from LVRR-38C and a sample from a residential well at 5 Guthrie Road and has not, as of this date, been approved by the USEPA.

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[1] Addendum 2 Remedial Investigation/Feasibility Study Work Plan, Lehigh Valley Railroad Derailment Superfund Site, LeRoy, New York, Unicorn Management Consultants, LLC, October 2009.

[2] Addendum 3 Remedial Investigation/Feasibility Study Work Plan, Lehigh Valley Railroad Derailment Superfund Site, LeRoy, New York, Unicorn Management Consultants, LLC, July 2010

[3] Addendum 4 Remedial Investigation/Feasibility Study Work Plan, Lehigh Valley Railroad Derailment Superfund Site, LeRoy, New York, Unicorn Management Consultants, LLC, September 2010

[4] Addendum 5 Remedial Investigation/Feasibility Study Work Plan, Lehigh Valley Railroad Derailment Superfund Site, LeRoy, New York, Unicorn Management Consultants, LLC, April 2012

[5] Addendum 6 Remedial Investigation/Feasibility Study Work Plan, Lehigh Valley Railroad Derailment Superfund Site, LeRoy, New York, Unicorn Management Consultants, LLC, November 2012

LVRR conducted Remedial Investigation (RI) activities from 2008 – 2014 and presented the findings to the USEPA in the Draft Remedial Investigation Report dated August 2014 (August 2014 LVRR RI).

This Addendum 7 to the USEPA 2002 RI/FS Work Plan proposes the following tasks to address data gaps identified during the August 2014 LVRR RI.

2 TASK 1 – ADDITIONAL MONITORED NATURAL ATTENUATION GROUNDWATER SAMPLING AND ANALYSIS

[Amends USEPA 2002 RI/FS Work Plan Section, 3.3.5.1 Monitored Natural Attenuation Characterization Sampling (Subtask 3.05.01)]

In email/letter correspondences from UMC to the USEPA dated June 27, 2014 and August 1, 2014 (Appendix A), UMC proposed that groundwater samples be collected from Site monitoring wells for laboratory and field analysis of select monitored natural attenuation (MNA) parameters. The correspondences detailed the sampling procedures and the analyses to be performed. The objective of the proposed MNA groundwater sampling event was to obtain additional data to assess the potential for natural degradation of dissolved-phase trichloroethene (TCE) in Site groundwater. The USEPA approved the proposed MNA groundwater sampling event in an email correspondence to UMC dated August 26, 2014 (Appendix A).

In accordance with the above-referenced UMC and USEPA correspondences, UMC conducted the MNA sampling event between September 29 and October 16, 2014 and submitted the samples to ALS Environmental (ALS) located in Rochester, NY for selected MNA parameter analyses. Figure 1 indicates the location of Site monitoring wells from which groundwater samples were collected during the September/October 2014 MNA sampling event.

Following receipt of the analytical results from ALS, UMC will forward the data to Trillium, Inc. (Trillium) located in Downington, PA for third party data validation. A comprehensive discussion of the Site MNA results and the potential for the natural degradation of dissolved-phase TCE will be included and submitted to the USEPA in a report as discussed in Section 6, Task 5 Data Analysis and Report Preparation, of this Addendum 7.

3 TASK 2 – ADDITIONAL TRANSDUCER INSTALLATIONS AND DATA ASSESSMENT

[Amends USEPA 2002 RI/FS Work Plan, Sections 3.3.4.2 and 3.3.4.3 Groundwater Elevation Measurements (Subtask 3.04.02)]

In an email correspondence from UMC to the USEPA dated August 1, 2014 (Appendix A), UMC proposed the installation of additional transducers in select Site monitoring wells and Spring Creek to continually record changes in groundwater and surface water elevations allowing for a more comprehensive assessment of the impact of precipitation and snow melt events on Study Area groundwater and surface water level fluctuations, vertical hydraulic gradients, and contaminant migration. The transducer installations were approved by the USEPA in their email correspondence dated August 26, 2014 (Appendix A).

UMC installed the transducers in October 2014 during the September/October 2014 MNA sampling event. Figure 1 indicates the location of transducers installed by UMC. The transducers were installed in select monitoring well clusters at various depths screened in

stratigraphic units of interest and in Spring Creek at a point immediately down stream of monitoring well cluster LVRR-24. The transducers were synchronized to begin recording data simultaneously, and programed to record groundwater and surface water levels every 15 minutes.

UMC will collect the transducer data during subsequent Site visits conducted over a minimum of one year. A comprehensive discussion of the Site transducer data including groundwater and surface water level fluctuations, vertical hydraulic gradients, and contaminant migration will be included and submitted to the USEPA in a report as discussed in Section 6, Task 5 Data Analysis and Report Preparation, of this Addendum 7.

4 TASK 3 – DISCRETE FRACTURE NETWORK NUMERICAL MODELING OF MASS TRANSFER AND MATRIX BACK DIFFUSION

[Amends USEPA 2002 RI/FS Work Plan, Sections 3.6.2 and 3.6.3]

Bedrock coring and bedrock matrix sampling and analysis conducted by UMC during LVRR RI activities identified a large mass of TCE present in the Spill Area bedrock both above and below the water table. Other LVRR RI activities including packer testing, geophysical testing, and bedrock transmissivity testing provided input parameters and datasets required for Discrete Fracture Network (DFN) numerical modeling. UMC proposes to present the LVRR RI data to Dr. Beth Parker and Mr. Steven Chapman who will perform the DFN numerical modeling with the objective of assessing the magnitude and longevity of back diffusion effects from the rock matrix on overall Site groundwater quality (Operable Unit 2) and the timeframes to meet Site RAOs that will be established in the LVRR Feasibility Study. In addition, the DFN numerical modeling will provide additional data to determine if the conditions at the Site are such that they would limit or prevent the effectiveness of the bedrock vapor extraction (BVE) remedy selected in the ROD pursuant to Section III, Part A of the SOW (Operable Unit 1), the results and discussion of which will be presented as an addendum to the LVRR BVE Data Summary Report.

The modeling will be conducted to evaluate three conditions: current conditions with no remedial action; aggressive source removal from the vadose and saturated zones, and; removal of mass from the unsaturated zone only. The modeling results will provide estimates of the magnitude of mass transfer during back diffusion and the timeframes for such transfer under the different scenarios. Appendix B contains a copy of the proposal for modeling presented to UMC by Dr. Parker and Mr. Chapman.

A comprehensive discussion of the DFN numerical modeling for Operable Unit 2 Groundwater will be included and submitted to the USEPA in a report as discussed in Section 6, Task 5 Data Analysis and Report Preparation, of this Addendum 7.

5 TASK 4 - ADDITIONAL MONITORING WELL INSTALLATIONS, SAMPLING, AND ANALYSIS

[Amends USEPA 2002 RI/FS Work Plan, Section 3.3.3 Hydrogeological Assessment (Subtask 3.03)]

UMC identified data gaps during the preparation of the August 2014 LVRR RI requiring the delineation of the dissolved-phase TCE plume northwest of the Spill Area. In addition, an off-Site source of TCE is suspected northwest of the Spill Area which may be contributing to the low level dissolved-phase TCE concentrations observed in that area.

To address the above-referenced data gaps, UMC proposes to install two groundwater monitoring well clusters, one at the north end of Neid Road on residential property or in the Town of LeRoy-maintained Neid Road right-of-way (LVRR-43); and, the other west of Neid Road in the former General Crushed Stone Quarry (LVRR-44). Figure 2 indicates the proposed monitoring well locations. The final location of the monitoring wells will be contingent on obtaining access from the property owners involved.

5.1 PROPOSED MONITORING WELL CONSTRUCTION OF LVRR-43 AND LVRR-44

The proposed monitoring wells will be installed as follows:

- Each bore hole will be advanced a minimum of two feet into competent bedrock using air rotary drilling techniques. Eight inch diameter steel casing will then be set in competent bedrock at each location, grouted in place using a bentonite/cement slurry, and allowed to cure for at least 24 hours before advancing six inch diameter borings below the casing to their final depths.
- Two inch diameter monitoring wells consisting of solid polyvinyl chloride (PVC) riser pipe and ten foot sections of 0.20-inch slotted well screen set at the proposed intervals will be installed in each boring and a sand pack will be placed in the boring annulus to at least two feet above the top of the screen. The remainder of the well annulus will be grouted to within approximately one foot of the ground surface using a bentonite/cement slurry or bentonite to limit the vertical movement of groundwater along the boring.
- Following construction, the monitoring wells will be developed using a submersible pump and dedicated Teflon tubing. Groundwater will be purged from each well while surging the pump and tubing up and down within the screened interval of the well until the water is visibly clear or a minimum of three volumes of groundwater is purged from the well. The purge water will be contained in 55-gallon steel drums and transported to the secure Site staging area located on Gulf Road pending characterization and off-Site disposal.
- The wells will then be surveyed for location and elevation relevant to the existing monitoring well network.
- A containment pad will be constructed around each borehole during drilling to contain generated waste including drill cuttings and groundwater generated during drilling or well development. The generated waste will be collected in 55-gallon drums and transported to the secure Site staging area located on Gulf Road. Soil and groundwater samples will be collected from the drums for waste characterization and off-Site disposal.

Site groundwater TCE concentrations have slightly exceeded the Site-specific New York State Standards, Criteria, and Guidelines (SCGs) for TCE of five micrograms per liter (µg/l) in groundwater samples historically collected from the B and C intervals of monitoring wells LVRR-37 and DC-06, installed at depths intersecting the Bertie Formation and upper-most portion of the Camillus Formation, respectively. Therefore, UMC will install ten foot sections of well screen in the proposed monitoring wells, set in generally the same stratigraphic intervals, anticipated to correspond to elevations of approximately 670 to 680 feet above mean seal level (amsl), and 685 to 695 feet amsl, respectively. In addition, ten foot sections of PVC screen will be set both above and below the intervals intersecting the Onondaga Formation and the lower-most portion of the Camillus Formation, respectively. The final elevations of screened intervals in the proposed monitoring wells will be contingent on final monitoring well locations and observed field conditions.

5.2 ADDITIONAL GROUNDWATER SAMPLING AND LABORATORY ANALYSIS

Groundwater samples will be collected from the newly installed monitoring wells using low-flow sampling methods consistent with Standard Operating Procedure (SOP) #36 titled "Low Flow Purging and Sampling of Monitoring Wells" included in Appendix A of UMCs' updated Site-specific Quality Assurance Project Plan (QAPP), and submitted to the USEPA in October 2014. The groundwater samples collected from the newly installed monitoring wells will be submitted to ALS for MNA parameter analyses consistent with the USEPA-approved September-October MNA sampling event procedures. In addition, the samples will be submitted for New York Codes, Rules and Regulations (NYCRR) Part 360-2 landfill parameter analyses including total kjeldahl nitrogen (TKN), total dissolved solids (TDS), and total iron, lead, potassium, sodium, chloride, and bromide. Copper sulfate has been detected in domestic wells in this area and will be added to the list of parameters.

In conjunction with the collection of groundwater samples from the newly installed monitoring wells, UMC will collect groundwater samples from LVRR-20 and LVRR-37, located on Neid Road, and DC-06, located at the intersection of Neid Road and Gulf Road. UMC will submit the groundwater samples collected from LVRR-20, LVRR-37, and DC-06 to ALS for landfill parameter, and copper sulfate analyses. These data will be used to assess overall groundwater quality in the vicinity of Neid Road and impacts to Site groundwater in that area that may potentially be attributed to off-Site sources.

UMC will collect, store, and transport the groundwater samples under chain-of-custody consistent with USEPA protocols and UMC's Site-specific QAPP. Quality assurance and quality control samples will be collected consistent with SOP #18 titled "Collection of Quality Control Samples" included in Appendix A of UMCs' Site-specific QAPP.

Following receipt of the groundwater sample analytical results from ALS, UMC will forward the data to Trillium for third party data validation. A comprehensive discussion of the installation, sampling, and analysis of LVRR-43 and LVRR-44 will be included and submitted to the USEPA in a report as discussed in Section 6, Task 5 Data Analysis and Report Preparation, of this Addendum 7.

6 TASK 5 – DATA ANALYSIS AND REPORT PREPARATION

UMC proposes to present the findings of Task 1, 2, 3, and 4 in a comprehensive report for submittal to the USEPA as an Amendment 1 to UMC's Draft August 2014 LVRR RI Report as follows:

- Following receipt of the Task 1 validated September/October 2014 MNA sampling event data from Trillium, UMC will collate the data in tabular format and compare the results to remedial action objectives (RAOs) established in the ROD (5 ppb for TCE in groundwater) and to the New York State 6 NYCRR Part 703 (Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations) and New York State Department of Environmental Conservation Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (TOGGS 1.1.1, revised 1998). UMC will also compare the results to data collected during earlier MNA groundwater

sampling events as part of the LVRR RI activities and assess the overall data as it pertains to the fate and transport of dissolved-phase TCE in Site groundwater and the potential for degradation of TCE by natural attenuation mechanisms.

- The transducer data collected during Task 2 will be collated in tabular format and presented graphically and in map view depicting seasonal groundwater and Spring Creek surface water elevation fluctuations and groundwater flow direction and gradient in the stratigraphic units of interest to assess groundwater and surface water elevation fluctuations as required in the USEPA 2002 RI/FS Work Plan.

- The findings of DFN numerical modeling conducted in Task 3 will be summarized and presented in tabular and text format, as appropriate, including conclusions based on available data regarding the magnitude and longevity of back diffusion effects from the rock matrix on overall Site groundwater quality and the timeframes to meet Site RAOs that will be established in the LVRR Feasibility Study.

- Following receipt of the validated Task 4 groundwater sample data from Trillium, UMC will collate the data in tabular format and assess the data as it pertains to overall groundwater quality in the vicinity of Neid Road and impacts to Site groundwater in that area that may potentially be attributed to off-Site sources.

FIGURES

Unicorn Management Consultants, LLC

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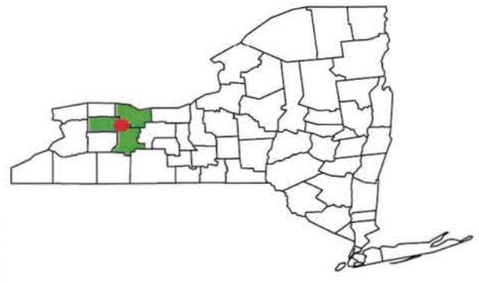
Project Name:	Lehigh Valley Railroad Derailment Superfund Site

Figure 1

Author: RTM	**Checked By:**
Project #: 2032	**Created:** 10/27/09 **Revised:** 10/30/14
Scale: 1 in:2,250 ft	**File:** Fig1_transducers

New York State

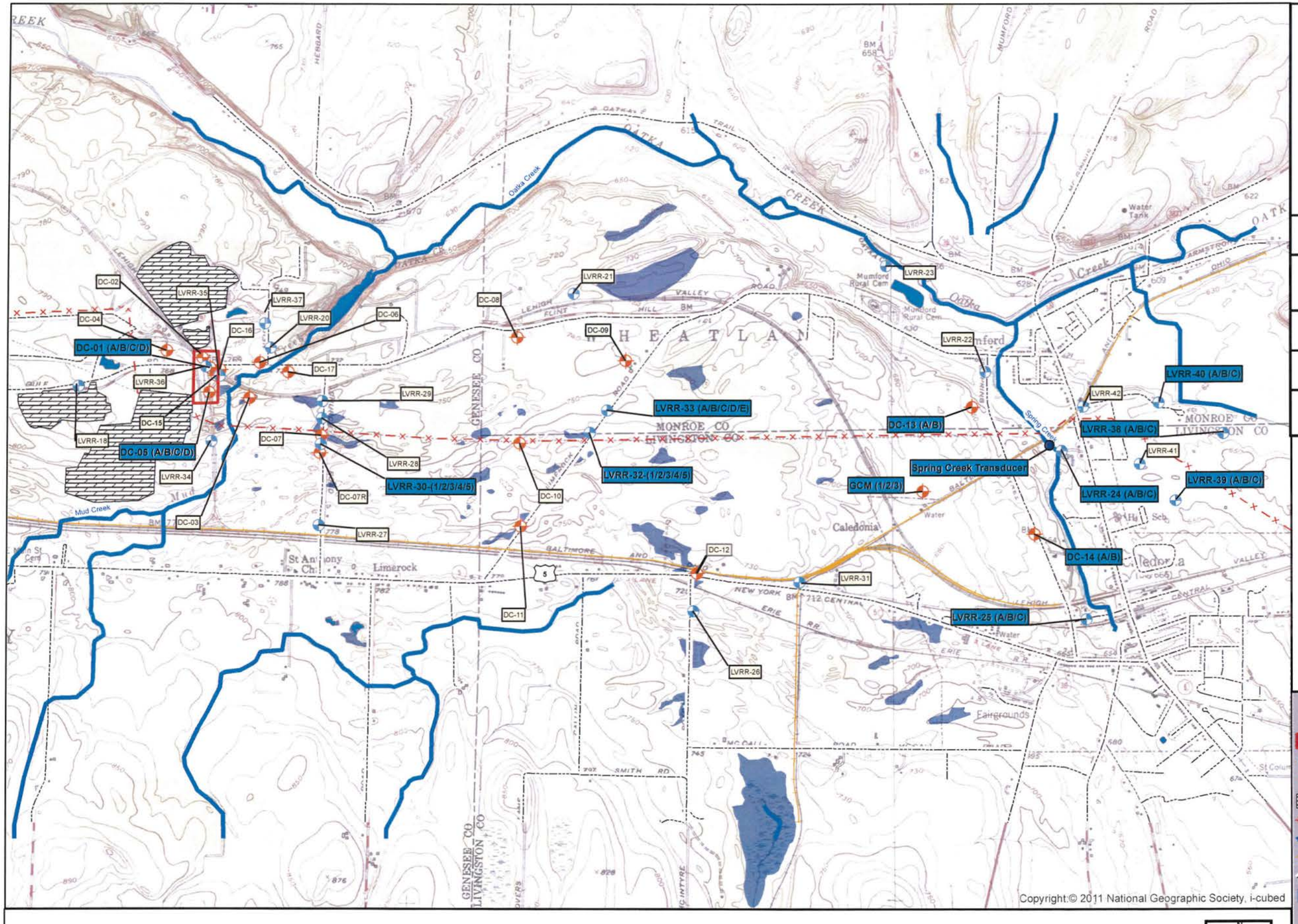


● = Approximate Site Location

Legend

- Approximate Spill Area
- LVRR Monitoring Well Cluster
- DEC Monitoring Well Cluster
- General Crushed Stone Quarry
- Major Transmission Line
- Streams
- Railroad
- Roads
- Karst features based on studies by Mr. Paul Richards, SUNY Brockport

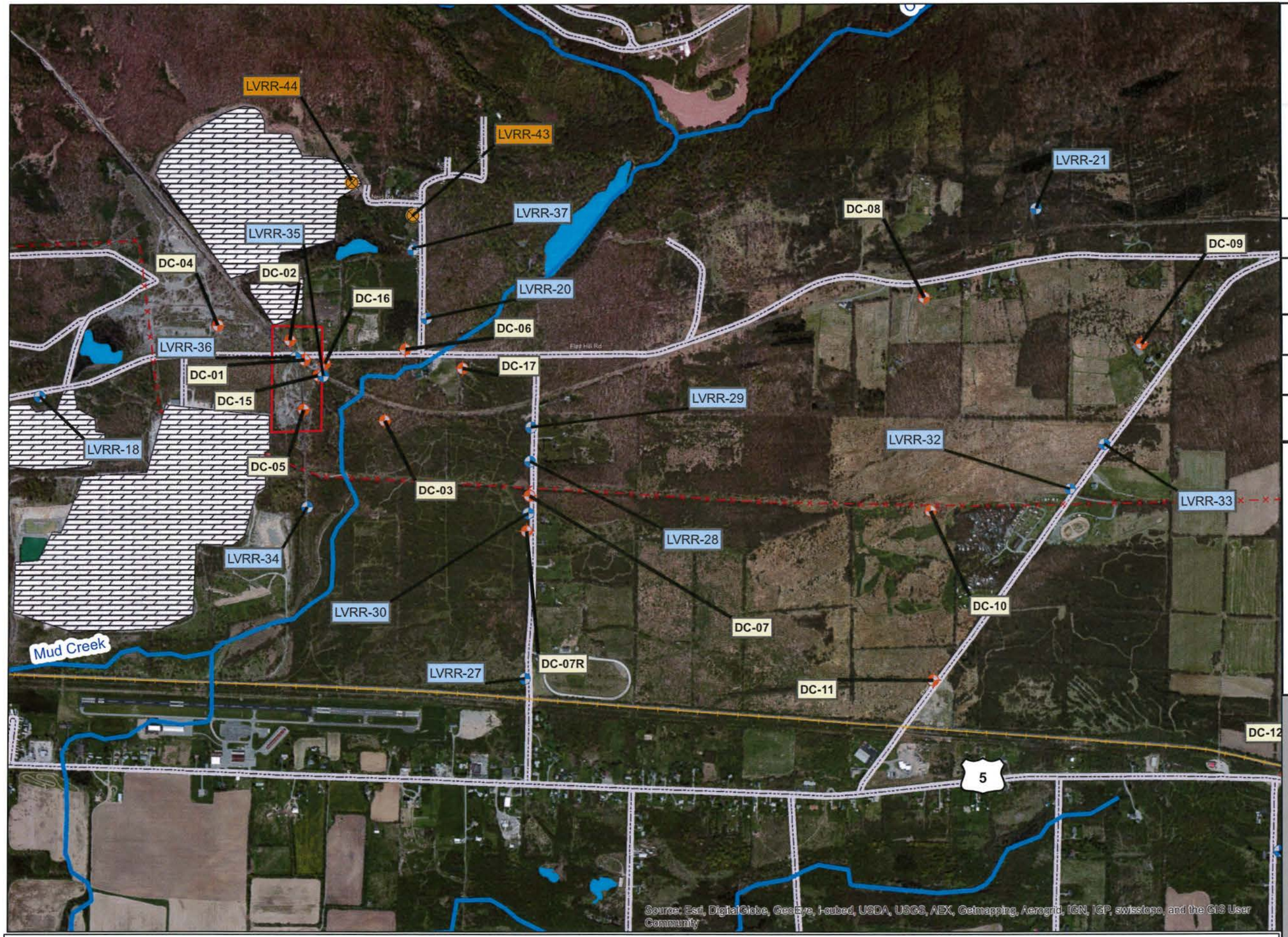
Well Text Boxes in Blue have transducers for the listed well cluster or flute interval



0 1,250 2,500 5,000 7,500 10,000 Feet

Addendum 7 Site Basemap and Transducer Locations

M/N



0 1,450 2,900 5,800 Feet

Addendum 7-
Lehigh Valley Proposed Monitoring Well Clusters- Neid Road

M/N

Unicorn Management Consultants, LLC

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Suite 2C
Danbury, CT
06810

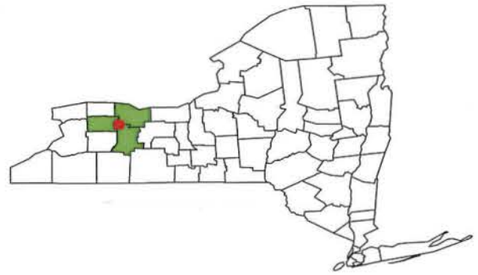
(203) 205-9000

Project Name:	Lehigh Valley Railroad Derailment Superfund Site

FIGURE 2

Author: RTM	**Checked By:**
Project #: 2032	**Created:** 10/29/14 **Revised:** 10/31/14
Scale: 1 in:1,092 ft	**File:** Addendum7_LVRR_Neid

New York State



● = Appoximate Site Location

Legend

- LVRR Proposed Monitoring Well Clusters
- LVRR Monitoring Well Cluster
- Spill Area
- NYS DEC Monitoring Well Cluster
- Major Transmission Line
- Streams
- Railroad
- Roads

APPENDIX A

52 Federal Road, Suite 2C
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Unicorn Management Consultants, LLC

June 26, 2014
OP-3182

Mr. Michael Infurna
EPA Remedial Project Manager
U.S. Environmental Protection Agency
Region 2
290 Broadway, 22th Floor
New York, New York 10007-1866

Subject: Monitored Natural Attenuation Sampling
Lehigh Valley Railroad Derailment Superfund Site, LeRoy, NY

Dear Mr. Infurna:

Unicorn Management Consultants, LLC (UMC), on behalf of Lehigh Valley Railroad (LVRR), will perform monitored natural attenuation (MNA) sampling of the groundwater monitoring wells at the LVRR Derailment Superfund Site to provide additional data remedy evaluation.

For your information, the MNA sampling performed during the RI, detailed in section 3.3.5.1 of the RI Work Plan, requires the following:

Parameters to be measured in the field:

Dissolved Oxygen	pH	hardness	ORP
Turbidity	Conductivity	Temperature	

Measured with field test kits: Oxygen and carbon dioxide (CO_2)

Analyzed by a laboratory:

TOC	Alkalinity	Nitrite	Phosphorous	Ethane	Propene
BOD	Sulfate	Calcium	Manganese	Ethene	Microtoxicity
COD	Sulfide	Ammonia	Chloride	Methane	Standard Plate
TPH	Nitrate	Potassium	Ferrous Iron?	Propane	Count

LVRR proposes to perform a new round of MNA sampling to provide additional natural attenuation parameters in support of evaluating potential remedial remedies. LVRR will perform the MNA sampling from the existing monitoring well network.

Monitored Natural Attenuation Sampling Procedures

Groundwater samples will be collected from the constructed monitoring wells via the low-flow sampling procedure following UMC SOP 1-36 (attached). Samples will be collected and handled according to UMC SOP 1-11R2 (attached). The FLUTe wells will be sampled according to the procedure outlined by FLUTe (Rev., May 2009 – attached). The sampling protocol by FLUTe does not include measurement of purging parameters (DO, turbidity, ORP, temperature, pH, or conductance) typically measured during low-flow sampling. The purging procedure will be modified to include use of a multi-meter to measure these parameters during purging. The MNA parameters selected to be analyzed are:

Parameters to be measured in the field:

Dissolved Oxygen	pH	Temperature
Turbidity	Conductivity	ORP

Measured with field test kits: Carbon dioxide (CO_2) and ferrous iron.

Analyzed by a laboratory:

TOC	Alkalinity	Nitrite	Phosphorous	Ethane	Standard Plate Count
BOD	Sulfate	Calcium	Manganese	Ethene	
COD	Sulfide	Ammonia	Chloride	Methane	Hardness
Propane	Nitrate	Potassium	Propene	Microtoxicity	

The MNA samples will be collected in the following order:

VOCs
Dissolved gases
Total organic carbon
Total metals
Sulfate, sulfide, chloride
Nitrate, nitrite, ammonia
BOD, COD, alkalinity, hardness
Bacteria

The FLUTe wells often do not produce large volumes of water and the required sample volume for the MNA parameters may not be possible. To collect a complete suite of samples, the samples may be collected on multiple days. Holding times for BOD, nitrate, nitrite, and microtoxicity are 48 hours and standard plate count is 6 hours. The laboratory sets up to analyze BOD, nitrate/nitrite and microtoxicity on Wednesdays and Fridays, making sample collection on Saturday and Sunday not possible. These parameters, along with standard plate count, are not critical to well stabilization. Therefore, for monitoring wells sampled over the weekend, these samples will be collected on Monday using bailers. Use of bailers for these specific parameters should not compromise the sample integrity as they are typically collected as grab samples at water treatment facilities.

The attached figure shows the locations of the monitoring wells. The wells will be sampled from least to highest TCE concentration. Wells located east of Spring Creek and along Spring Creek will be sampled first and the sampling will progressively move westward to the Spill Area. This will reduce the potential for sample cross contamination. Duplicate and MS/MSD samples will be collected on the order of 1 per 20 samples. One equipment blank sample will be collected for each day of sampling when the low-flow sampling equipment is used. One trip blank sample for VOCs will be present in each cooler submitted to the laboratory. All field work will be documented in field books and field sheets.

LVRR is ready to perform this additional round of sampling, the 13th round since 2010, upon approval or concurrence from EPA. The sampling is scheduled to begin in late July and is anticipated to take four to six weeks to complete.

If you should have any questions, please call me at your earliest convenience.

Sincerely,
UNICORN MANAGEMENT CONSULTANTS, LLC

Francisco Trejo
Project Coordinator

O'Connor, Michael

From: O'Connor, Michael <moconnor@unicornmgt.com>
Sent: Friday, August 01, 2014 12:05 PM
To: Infurna, Michael
Cc: Francisco Trejo; Amy Leonard
Subject: LVRR MNA Sampling

Mike,

When we do the MNA sampling we want to add a few things to get more data.

1. Install additional transducers in DC-5, LVRR-25, LVRR-33, LVRR-38, LVRR-39, LVRR-40, GCM, and 1 in Spring Creek, and
2. Identify if any former domestic wells on Neid Rd that have not been abandoned and sample 1 to provide a more northern sample point to delineate the TCE in that area.

We are currently obtaining well construction details for some of the air-coupled transducers to calculate the water levels. These will not be available for submission with the revised RI report. We would like to include this data in an Addendum report to include the MNA sampling results and the data from the new transducers.

If you have any questions, please call.

Sincerely,

Mike

O'Connor, Michael

From: Francisco Trejo <ftrejo@unicornmgt.com>
Sent: Tuesday, August 26, 2014 11:17 AM
To: O'Connor, Michael
Cc: MHill (MHill@blankrome.com)
Subject: Fwd: LVRR MNA sampling

Michael, FYI & Action...
FT

Sent from my Verizon Wireless 4G LTE DROID

-------- Original Message --------
Subject: LVRR MNA sampling
From: "Infurna, Michael" <Infurna.Michael@epa.gov>
To: Francisco Trejo <ftrejo@unicornmgt.com>
CC: "Badalamenti, Salvatore" <Badalamenti.Salvatore@epa.gov>,"Infurna, Michael" <Infurna.Michael@epa.gov>

Good Morning Francisco,

We have reviewed the MNA sampling protocols in your June 27th, 2014 E-Mail to me entitled "ProposedLVRR MNA sampling" and your later E-mail to me dated August 1, 2014 entitled "LVRR MNA Sampling".

The protocols detailed in these 2 E-Mails are approved. In addition, your request to include this MNA data (sampling results and the data from the new transducers) in an Addendum report is also approved.

If you have any questions, please let me know.

APPENDIX B

Technical Memo

To: Michael O'Connor, Unicorn Management Consultants, LLC

From: Steven Chapman, M.Sc., P.Eng. and Dr. Beth Parker, Ph.D.

Date: September 25, 2014 (DRAFT FOR INTERNAL REVIEW)

Re: Discrete Fracture Network Numerical Modeling of Mass Transfer and Matrix Back Diffusion Lehigh Valley Railroad (LVRR) Derailment Superfund Site, LeRoy, New York

Background

It is now well-established that rock matrix diffusion plays a critical role in the evolution of contaminant plumes and remedial efficacy in fractured sedimentary rock. Matrix diffusion causes evolution of source zones, where dense nonaqueous phase liquids (DNAPLs) were the initial source of contamination, but evolves over years to decades to a condition where most or all of the DNAPL has dissolved and occurs as dissolved and sorbed mass in the primary (i.e. rock matrix) porosity (ϕ_m) (Parker et al., 1994; 1997). In most sedimentary rock types, ϕ_m ranges from 2 to 20%. While the rock matrix comprises the bulk of the contaminant storage capacity, nearly all active groundwater flow and downgradient contaminant transport occurs in the secondary (i.e. fracture) porosity (ϕ_f). This is much lower than ϕ_m (generally in the range of 10^{-3} to 10^{-5}) and as a result groundwater velocities can be very high in many fractures (i.e. several meters per day or larger).

The evolution of source zones causes the contaminant flux to the downgradient plume to change, generally declining over time as DNAPL disappears and at later stages the plume may be largely sustained by back diffusion of contaminant mass from the rock matrix. Mass transfer to the rock matrix via diffusion from groundwater flowing in fractures causes attenuation of plume transport rates and fluxes to downgradient receptors, which can be viewed as a positive effect. However at later times, following either natural depletion of the source or active source zone remediation, the downgradient plume may be sustained by back diffusion from the matrix to the fractures, such that downgradient water quality improvements may not be observed for long periods of time and be significantly reduced (e.g. Parker et al., 2010). The magnitude and longevity of back diffusion effects depends on site-specific conditions related to the fracture network, groundwater flow system, rock matrix properties, biotic and abiotic degradation rates in both the primary and secondary porosity, and contaminant release conditions. Discrete Fracture Network (DFN) numerical simulations incorporating the key transport processes and representing site conditions can provide insight into these effects.

DFN Model Application at LVRR Site

The trichloroethene (TCE) DNAPL release at the Lehigh Valley Railroad (LVRR) Derailment Superfund Site in LeRoy, New York site is unique in that the location, nature (volume and composition) and timing of the release is known with certainty. Completed and ongoing investigations as part of the Remedial

Investigation / Feasibility Study (RI/FS) have included application of new and innovative investigation methodologies that provide detailed information on contaminant mass distribution in the primary (i.e. matrix) porosity from highly resolved contaminant profiles from rock matrix subsampling and analysis using techniques developed by Dr. Parker and colleagues at the University of Waterloo / Guelph and licensed to Stone Environmental for commercial application, referred to as COREDFN™. The matrix concentrations, converted to equivalent porewater concentrations via partitioning calculations, can be compared to concentrations in the secondary (i.e. fracture) porosity collected from groundwater sampling during packer testing and from monitoring well clusters and Water FLUTe™ multilevel systems (MLS) (Cherry et al., 2007), although at coarser resolution compared to the rock matrix data providing insight on current plume status. Rock matrix sampling showed presence of much contaminant mass in the matrix adjacent to and near observed fractures / transport pathways, confirming significant mass diffused into the rock matrix. In addition to contaminant mass distribution, other information on fracture network characteristics have been collected from logging of continuously cored holes, and geophysical characterization and FLUTe Transmissivity Profiling (Keller et al., 2014) of several additional holes. Also measurements of rock matrix properties has been conducted on representative samples, providing ranges of key parameters controlling matrix diffusion and contaminant mass storage, including matrix porosity (ϕ_m) and fraction organic carbon (f_{oc}) used in matrix porewater concentration estimates.

The characterization efforts provide model input parameters and datasets required for Discrete Fracture Network (DFN) numerical modeling. This modeling is proposed to address some key questions relative to the magnitude and longevity of back diffusion effects from the rock matrix and timeframes to meet MCLs. The proposed modeling approaches have been applied at other sites, including the Cornell Dubilier Electronics (CDE) Superfund site in New Jersey to support a Technical Impracticability (TI) Waiver (Chapman et al., 2013). Two general levels of modeling are possible: 1) 'stylistic' or screening-level DFN flow and transport modeling incorporating site parameters and data to the extent possible, using a 2-D steady state flow and transient contaminant transport DFN numerical model (FRACTRAN) that incorporates matrix diffusion and other relevant processes, but requires simplifications of the fracture network and flow system; and 2) more comprehensive modeling efforts using a combination of sophisticated transient groundwater flow models (e.g. FEFLOW) combined with steady state and/or transient DFN transport models (e.g. FRACTRAN and/or HydroGeoSphere).

The proposed modeling effort will be focused on the first level, which will provide insight on impacts of matrix diffusion on contaminant transport, attenuation and mass fluxes in the plume and on the magnitude and timeframes of back diffusion effects. Comparisons of the current mass distribution and degree of plume attenuation (derived from rock core VOC analyses at locations along the plume flowpath, along with groundwater monitoring data) will be made with model predictions. Efforts will be made to incorporate field parameters and data sets to the extent possible in simulations, including bulk hydraulic conductivity (K_b) derived from pumping tests and borehole packer testing, and hydraulic gradients from site monitoring to estimate Darcy flux, as well as fracture information including apertures derived from transmissivity testing for generation of reasonable fracture networks. The proposed simulations will be process-based in that the matrix diffusion and other key processes will be included; however it is recognized that this 'screening level' modeling with steady state flow cannot incorporate

the full complexity of the flow system at this site, such as transient effects of pumping or major karst features such as sinkholes with large water influxes causing dilution effects, or rapid changes in the water table position. Simulations will require assumptions and simplifications given the complex flow system conditions, but some uncertainties will be addressed through sensitivity analyses. Relevant questions that the proposed level of modeling are expected to be able to address include estimates of magnitude of back diffusion effects and timeframes to achieve MCLs under different scenarios:

a. Current conditions, no further remedial action
b. Aggressive source removal from vadose and saturated zone
c. Removal of mass from unsaturated zone only

It is important to note that while the latter two conditions will be modeled, it is not at all clear that such actions / conditions are possible given the site conditions. More comprehensive modeling would only be considered later if questions or issues arise that require more advanced analysis.

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