Lehigh Valley Railroad Derailment Superfund Site LeRoy, New York

August 2023

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan describes remedial alternatives that the United States Environmental Protection Agency (EPA) considered to address contamination in the groundwater, soil, bedrock, soil vapor and surface water associated with the Lehigh Valley Railroad Derailment Superfund Site (the Site), including the source of the Site contamination located in the Town of LeRoy, Genesee County, New York, as well as groundwater contamination in Genesee, Monroe, and Livingston Counties, and also identifies the preferred remedial alternative for all media along with the rationale for the preference.

This Proposed Plan describes EPA's preferred comprehensive remedy for two operable units (OUs) or cleanup phases for the Site. The Proposed Plan proposes an amendment to a portion of the original OU1 remedy, associated with contamination in soil and bedrock in specific areas of the Site. It also proposes a remedy for OU2 for the four-mile groundwater plume contaminated with trichloroethene (TCE) where contaminated groundwater discharges to surface water and contaminated soil vapors previously impacted indoor air as a result of soil vapor intrusion in properties located in areas of groundwater contamination at the Site.

This Proposed Plan was developed by EPA, the lead agency for the Site, in consultation with the New York State Department of Environmental Conservation (NYSDEC), the support agency. EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, also known as Superfund), as amended, and Sections 300.430(f) and 300.435(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The nature and extent of contamination at the Site and the remedial alternatives summarized in this Proposed Plan are further described in the 2014 Remedial Investigation OU2 (RI) Report, the 2023 Feasibility Study (FS) Report and the 2019 Assessment of Groundwater Restoration Potential and Technical Impracticability (AGTI) Report, as well as other documents in the Administrative Record file for the Site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site, the Superfund activities that have been conducted there, and the preferred remedial alternative that is being proposed.

MARK YOUR CALENDAR

Public Comment Period:
August 18, 2023 to September 18, 2023
EPA will accept written comments on the Proposed Plan during the public comment period. Send comments on the Proposed Plan to:

Ms. Maria Jon, Remedial Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, NY 10007-1866
Email: jon.maria@epa.gov

Public Meeting:
August 29, 2023 at 6:00 P.M.
EPA will hold a public meeting to discuss the Proposed Plan and all the alternatives presented in the Feasibility Study at the Caledonia Mumford High School, 99 North Street, Caledonia, New York. To learn more about the public meeting, please contact:

Mr. Michael Basile, Community Involvement Coordinator
U.S. Environmental Protection Agency
Email: basile.michael@epa.gov
Phone: 646-369-0055

The Administrative Record (supporting documentation) for public review is available at:
https://www.epa.gov/superfund/lehigh-valley-rr

Caledonia Public Library
3108 Main Street, Caledonia, NY 14423

Woodward Memorial Library
Wolcott Street, LeRoy, NY 14482

EPA Records Center, Region 2
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308
Hours: Monday-Friday – 9 A.M. to 5 P.M.

COMMUNITY ROLE IN SELECTION PROCESS

The purpose of this Proposed Plan is to inform the public of EPA's Preferred Remedial Alternative and to solicit public comments, pertaining to all the remedial alternatives evaluated in the FS, including EPA's Preferred Alternative. EPA's final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments.

A public meeting will be held during the public comment period to present this Proposed Plan and information regarding the investigations at the Site and to receive public comment. Some investigative information, including the conclusions of the various studies that were performed to assess treatment options, to elaborate on the reasons for proposing the Preferred Remedial Alternative and to receive comments from the public. Information on the public meeting and how to submit written comments can be found in the above-noted "Mark Your Calendar" text box.

Comments received at the public meeting, as well as written comments received during the comment period, will be addressed and documented in the Responsiveness Summary section of the forthcoming OU2 Record of Decision (ROD) and OU1 ROD Amendment. The ROD is the document that memorializes the alternative that has been selected as a remedy and the basis for the selection of the remedy.

SCOPE AND ROLE OF ACTION

Site remediation activities are sometimes segregated into different phases or operable units (OUs), so that remediation of different, discrete environmental media or geographic areas of a site can proceed separately, whether sequentially or concurrently. EPA has designated two OUs for the Site. OU1 addresses the provision of an alternate water supply to area residences and businesses that have been or have the potential to be impacted by the LVRR contaminated groundwater plume, as well as contamination within the Spill Zone, present in soil and extending into the bedrock. OU2 addresses the approximately four-mile contaminated groundwater plume, contaminated groundwater discharging to surface water, as well as contaminated vapors that may migrate into residences as a result of soil vapor intrusion.

In March of 1997, prior to the Site being proposed for listing on the National Priorities List (NPL), NYSDEC selected a remedy for the Site which included: 1) the installation of a waterline to provide potable water to approximately 70 affected residences and businesses near the Site; 2) the installation of an in-situ bedrock vapor extraction (BVE) system within a 10-acre dense nonaqueous phase liquid (DNAPL) zone (Spill Zone); and 3) ex-situ soil vapor extraction (SVE) of approximately 10,000 cubic yards of TCE-contaminated soil. In July of 1999, following the January 1999 final listing of the Site on the NPL, EPA concurred with the waterline component of the NYSDEC remedy, and, subsequently, in May 2002, concurred with the BVE and SVE components of the NYSDEC remedy.

The waterline component of the selected remedy was successfully implemented in 2003. However, as explained in more detail in the Site History section below, the components of the remedy addressing contaminated soil and bedrock have not been successfully implemented.

This Proposed Plan contemplates a comprehensive remedy for the Site through both a ROD amendment for OU1 and ROD for OU2, which would comprise the final comprehensive remedy for the Site.

SITE BACKGROUND

The Site is located in Genesee, Monroe and Livingston Counties, New York, in a rural setting. The surrounding area is used for residential, recreational, and commercial purposes. The Site is generally divided into two areas of interest, the Spill Zone and Study Area, which are both shown on Figure 1.

The Spill Zone is approximately 10 acres in size and is defined as the physical location of the 1970 train derailment which resulted in contamination of overburden soils and bedrock with TCE, in the vicinity of the former LVRR crossing at Gulf Road. The Spill Zone also includes a former railroad bed, a former quarry material staging area, and the foundation of a former hotel. Currently, the 10-acre Spill Zone is mostly undeveloped industrial, commercial, residential, and passive recreational land, largely covered with grass, brush, and wooded areas.

The larger Study Area is roughly bounded by the Oatka Creek Valley to the north, the Dolomite Quarry and Hanson Quarry to the west, Route 5 to the south, and Spring Creek Valley to the east. The Study Area includes a TCE-impacted groundwater plume emanating from the Spill Zone which extends eastward approximately four miles to Spring Creek. Mud Creek, an area of interest, is a frequently dry stream bed which carries substantial water flow during flood events and is located approximately 600 feet (ft) to the east of the Site.

According to EPA's EJSCREEN, there are no demographic indicators for the area that would indicate a community with environmental justice concerns. Therefore, it is not anticipated that implementation of the proposed action will result in adverse impacts to environmental resources that would affect low income, minority populations living within the vicinity of, or using, the Site.

Site History

The Site is the location of a former train derailment that occurred on December 6, 1970, at the Gulf Road railroad crossing in the Town of LeRoy. The train, operated by the potentially responsible party (PRP), Lehigh Valley Railroad Company, derailed, and two tank cars containing trichloroethene (TCE) ruptured and spilled their contents (estimated 30,000 gallons) onto the ground. This area is referred to as the 10-acre Spill Zone. TCE is the primary contaminant of concern (COC) and is a chlorinated volatile organic compound (VOC), commonly used as a solvent. A third car containing a crystalline form of cyanide was also reported to have partially spilled. The cyanide was recovered shortly after the derailment; however, the TCE infiltrated into the ground and was not recovered.

In early 1971, residents near the Site complained of TCE odors in homes and reported contamination of nearby drinking water wells. The PRP conducted limited cleanup activities at the spill location in response to the residents' concerns. Ditches were constructed in the Spill Zone and were flooded with water to flush the TCE out of the ground. Carbon filters were installed on several private wells to remove TCE from drinking water.

In 1990 and 1991, the New York State Department of Health (NYSDOH) sampled private water wells east of the Site and discovered TCE concentrations in more than 35 residential wells above the NYSDOH drinking water standard of 5 micrograms per liter (μg/L). Based on this information, EPA installed point-of-entry carbon treatment units on all contaminated private wells. In November 1991, the Site was added to the New York State (NYS) Registry of Inactive Hazardous Waste Disposal Sites.

In 1992, NYSDEC initiated a remedial investigation and feasibility study (RI/FS) at the Site. NYSDEC completed the RI Report in 1996, and two FS Reports in early 1997. The NYSDEC RI found TCE concentrations in soil ranging from 46 to 840,000 micrograms per kilogram (μg/kg) and that a source of TCE contamination remained in the unsaturated soil and bedrock in the Study Area, the nearby surface water, and the groundwater with a plume extending almost four miles east and southeast of the Spill Zone.

As noted above, in 1997, prior to the Site being listed on the NPL, NYSDEC selected a remedy for the Site which included ex-situ SVE and in-situ BVE as source-control measures, and a waterline extension to provide a potable water supply to affected residents and businesses.

On August 7, 1998, NYSDEC requested that EPA approve its ROD and assume responsibility for the source-control components of the remedy. At the same time, the State agreed to continue its work on the waterline component of the selected remedy.

The waterline component of the remedy was completed by NYSDEC in 2003. The carbon treatment units installed on all affected domestic wells were removed and the properties were connected to the waterline. The waterline connections were completed in all four of the municipalities that were affected by the TCE plume (Town of Wheatland, Town of LeRoy, and the Town and Village of Caledonia). The waterline is currently providing potable water to approximately 70 affected residences and businesses in the area.

In September 2006, EPA signed an Administrative Settlement Agreement and Order on Consent with LVRR requiring the company to undertake certain investigations and design work needed for an SVE system. The investigations focused on determining the extent of the groundwater contamination and investigating whether vapors from the groundwater were affecting homes above the plume. LVRR was also required to install systems to vent vapors at the homes if vapor intrusion was found to be an issue.

WHAT IS NEEDED TO HAVE A COMPLETE VAPOR INTRUSION PATHWAY?
In order for a vapor intrusion pathway to be complete, there must be volatilization of contaminants from contaminated groundwater or other subsurface sources through the vadose zone, *i.e.*, above the water table, to the soil vapor underneath a structure (*i.e.*, sub-slab soil vapor). These contaminants can then migrate through the sub-slab into indoor air. Contaminant vapors move from an area of higher concentration to an area of lower concentration. The vapor intrusion pathway is complete when Site-related contaminants migrate into indoor air where vapors may be inhaled.

Starting in 2008, measures were initiated to protect property owners from exposure to vapors arising from contamination in groundwater volatilizing into soils and subsequently into residences, a process known as soil vapor intrusion. To date, more than 35 properties have been sampled to determine if contamination has migrated into indoor air. As a result of the sampling, sub-slab depressurization systems (SSDSs) were installed in 12 homes to mitigate potential exposures associated with soil vapor intrusion (SVI).

On March 21, 2014, EPA issued an Administrative Order to LVRR for the remediation of soil using SVE. The in-situ SVE system was installed and became operational during July 2015. The SVE system operated continuously in the Spill Zone for two years until it was shut down in July 2017. Despite removing over 284 pounds of VOCs, the post-SVE data indicated that cleanup goals had not been achieved. The residual concentrations above cleanup goals were likely associated with rock fines present in the overburden materials that are highly diffused into the rock matrix. EPA determined that continued SVE cleanup would not attain cleanup levels or accomplish RAOs.

A BVE pilot study was performed by NYSDEC in 1999. The NYSDEC's pilot study indicated that, while there were uncertainties, ex-situ SVE and in-situ BVE should be effective in achieving the soil cleanup objectives (SCOs) in the State ROD. LVRR agreed to conduct pre-remedial design investigations while undertaking the remedial design of the SVE system and the groundwater RI/FS. LVRR pursued additional evaluations of the feasibility of BVE, as documented in reports from 2011 through 2014, a BVE Memorandum in 2018 and a focused BVE Report in 2019. The potential effectiveness of BVE, given additional information gained during the RI/FS process, was discussed at length throughout this period into 2023. Based upon review of the results of the pilot study and subsequent evaluations, EPA has concluded that given the nature of the vadose zone (bedrock) and the large fluctuations in groundwater levels found at the Site, as well as the size, migration, and location of the TCE mass (diffused into the saturated and unsaturated bedrock), implementation of BVE would not remove enough mass to result in significant improvement of contamination in the bedrock or groundwater. This decision is discussed in further detail below as it relates to the bedrock vadose zone (BVZ) alternatives. The BVZ is defined as the portion of subsurface bedrock media that is the zone above the water table which fluctuates up to 40 ft seasonally and may be influenced by pumping from the adjacent quarry typically from approximately May 1st through January 1st each year; and that is generally located within the immediate vicinity of the Spill Zone. Typically, a portion of the BVZ that is unsaturated exists from 0-25 ft below ground surface (bgs) with a portion of the BVZ that is seasonally saturated between 25 – 70 ft bgs.

SITE CHARACTERISTICS

Site Topography, Geology and Hydrogeology

The Site is located in the Allegheny Plateau Physiographic Province in western New York. The northeastern portion of the Study Area slopes downward toward the northeast and Mud Creek. East of the Spill Zone, the topography slopes generally downward toward Spring Creek along an undulating surface. North of Gulf Road/Flint Hill Road, the topography slopes downward to the north toward Oatka Creek. The southeastern portion of the Spill Zone slopes downward to the east and southeast to Mud Creek. The western section of the Spill Zone is generally higher in elevation and contains piles of quarried rock debris, remnant of historical quarrying activities in the area.

The major surface drainage feature at the Site includes Oatka Creek, which generally defines the northern boundary of the Site. Mud Creek, a seasonal tributary of Oatka Creek, flows from south to north through the western portion of the Site and hydraulically downgradient of the Spill Zone. Other seasonal surface water features are generally defined by the west-to-east-oriented NYS Route 5. South to north-flowing Spring Creek (a tributary of Oatka Creek) generally defines the eastern-most distal end of the TCE plume with monitoring wells beyond that define the eastern-most portion of the Site.

The geology of the Site area generally consists of unconsolidated overburden material, underlain by glacial till (matrix of fine to coarse grained gravel and sand and clayey silt) and glacial fluvial deposits underlain by sedimentary bedrock dipping gently to the south. In the eastern portion of the Site, overburden materials are underlain by weathered limestone bedrock. However, along Spring Creek, bedrock was encountered at depths, considerably deeper than in borings advanced west of Spring Creek. Over most of the Study Area, the Onondaga Formation is the upper most rock unit, dipping gently to the south. However, in the northern and eastern portions of the Study Area, some formations are exposed north and east of an erosional line resulting in an erosional surface sloping north and east into the Oatka Creek and Spring Creek drainages.

Owing to the predominantly carbonate/dolomite nature of the bedrock, the Study Area is characterized by karstic features, including sinkholes, swallets, and sinking streams, as well as numerous springs/seeps along Oatka Creek, Mud Creek, and Spring Creek. The karstic nature of the Study Area bedrock has a dramatic effect on the overall hydrogeology of the area and TCE-impacted groundwater transport mechanisms, including documented groundwater elevation fluctuations of up to 50 ft or more over short time periods.

Conceptual Site Model

The conceptual site model or CSM is based on data collected during Site investigation activities and remedial activities and integrates information on geology, hydrogeology, source areas and receptors.

Sources

As discussed earlier, the 1970 train derailment resulted in approximately 30,000 gallons of TCE and one ton of cyanide crystals being released into the Spill Zone. Immediate cleanup of the spill included the removal of cyanide crystals and the spreading of neutralizers to counteract the effects of any remaining cyanide that could not be removed. TCE released by two ruptured tank cars could not be recovered at the time of the derailment and ultimately migrated into the ground and groundwater. Figure 3 illustrates the extent of the TCE contamination in groundwater.

Since the spill, remedial actions were taken to remove the TCE contamination from the Site with limited success. While the extent of the plume boundary is near steady state, the presence of TCE within the bedrock continues to be a long-term source of contamination. The current source for the dissolved-phase TCE is contamination located in the bedrock matrix porosity, microfractures and matrix pore spaces above and below the water table. Even though Site contaminants were released as DNAPL, it was not observed during the installation and sampling of groundwater monitoring wells during the RI.

Nature and Extent of Contamination

TCE is the principal contaminant of concern at this Site. Many groundwater, surface water, soil and sediment samples were collected at the Site to characterize the nature and extent of contamination. The following summarizes the results of Site investigations conducted by the NYSDEC in 1990 and LVRR from 2008 through 2015:

- Soil sampling activities were conducted in the Spill Zone. The sampling included the collection of approximately 250 soil samples from a total of 174 test borings. Analysis of 28 of the samples detected TCE at concentrations ranging between 7.6 and 460 milligrams per kilogram (mg/kg), exceeding NYSDEC Soil Cleanup Objectives.

- Groundwater samples collected from monitoring wells located in the Spill Zone ((DC-01, DC-02, DC-05, DC-15, DC-16, LVRR-35 and LVRR-36) detected TCE at levels ranging from 450 - 4,400 µg/L, exceeding the drinking water standard of 5 µg/L.

- Wells immediately downgradient of the Spill Zone (DC-03, DC-06, DC-17, LVRR-20, LVRR-34, and LVRR-37) detected TCE at levels ranging from 40 - 760 µg/L.

- Groundwater samples collected from downgradient monitoring wells located by Spring Street (DC-13, DC-14, GCM, LVRR-22, and LVRR-23) detected TCE at levels ranging from non-detect or ND - 11 µg/L, slightly exceeding the drinking water standard of 5 µg/L.

- Groundwater samples collected from downgradient monitoring wells located East of Spring Creek (LVRR-38, LVRR-39, LVRR-40, LVRR-41, and LVRR-42) detected TCE at an estimated concentration of 0.27 µg/l in well LVRR-38C. Analysis of the remaining groundwater samples collected from wells east of Spring Creek did not detect TCE in concentrations exceeding laboratory reporting limits.

Mud Creek, a seasonal tributary of Oatka Creek, flows from south to north through the western portion of the Site and hydraulically downgradient of the Spill Zone. TCE was detected at 320 µg/l in surface water samples collected at the Mud Creek area, including the waterfall and downstream of the waterfall at 380 µg/l. These TCE concentrations exceed the NYSDEC Class C surface water quality standard of 40 µg/L. Additionally, natural volatilization, as well as the rapid rise in the water table displaces TCE-impacted vapor and pushes it upward. This phenomenon results in periodic TCE-impacted VI into residences in down-plume areas.

The DNAPL likely reached a stable position within a relatively short period after the release occurred and then began to dissolve into groundwater that was flowing through fractures in the rock matrix and diffusing into pore spaces within the rock matrix. The TCE mass is essentially immobile relative to the flow of groundwater in the fractures, and back diffusion of contamination provides a long-term source of contamination to the groundwater in the fractures.

Dissolved TCE in groundwater moves eastward with the regional groundwater flow. The groundwater flow also has a vertical component where deeper geologic formations are also impacted by TCE. As groundwater moves eastward it discharges into springs near Oatka Creek and at Spring Creek which manifest themselves as ponds or wetlands south of the Oatka Creek channel.

Currently, the majority of the TCE mass is located in the rock matrix, in micro fractures and in pore spaces above the saturated zone dissolved into pore space groundwater, sorbed onto the bedrock, or as vapors. The diffusion of TCE into and out of the rock matrix occurs dynamically within the entire plume (present day and historic) both in the saturated and vadose zones during times of high water. This process has been documented in the AGTI report from the Spill Zone approximately 2 miles eastward to Limerock Road. As such, the rock matrix provides a continuous source of TCE impacts to groundwater via back diffusion. This occurs when groundwater in the fractures has TCE concentrations that are lower than those in the adjacent bedrock matrix. This is the cause of long-term plume persistence despite the depletion of DNAPL within the Spill Zone. While diffusion processes have been beneficial in causing strong attenuation of the TCE plume and in reducing mass discharge to surface water, it also presents an impediment to plume cleanup in a reasonable timeframe.

The AGTI proposed a variety of remedial alternatives (bedrock vapor extraction, in-situ thermal desorption, groundwater extraction and treatment and subsurface barrier or other in situ injection scenario) and concluded that the restoration of groundwater to its most beneficial use is not technically practical within a reasonable timeframe.

In addition to field data and observations, a Discrete Fracture Network (DFN) model was created, to understand how the various processes controlling plume behavior interact to result in the observed (and interpolated) plume configuration and behavior over various time and distance scales.

The modeling indicates that even complete removal of TCE mass from the Spill Zone or from other areas of the overall plume footprint, will not restore groundwater to its most beneficial use or eliminate risk to human health or the environment within any reasonable timeframe. However, TCE concentrations within the plume and downgradient discharges to surface water will continue to decline due to natural processes.

WHAT IS ROCK MATRIX DIFFUSION?

A highly interconnected fracture network such as the Onondaga Formation provides a relatively large surface area for VOCs to sorb onto and then diffuse, or move, into the pore spaces in the rock itself- a process known as matrix diffusion. The pore volume of the rock matrix at the site is nearly two orders of magnitude larger than the fracture network, allowing it to hold the majority of the contaminant mass. Once the VOCs diffuse into the rock, they are left nearly immobile because of the low hydraulic conductivity of the rock matrix.

In the early stages after a release, diffusion into the matrix can slow the advance of the dissolved plume through the fractures. At first, the diffused mass penetrates only a short distance into the bedrock, but in cases with very large initial DNAPL releases (as at the LVRR site), matrix diffusion can drive high VOC concentrations until it fully penetrates the matrix block. This effect more commonly occurs in source areas, where aqueous mass concentrations are highest and the residence time is the longest.

After a significant period of time (*e.g.*, 50 years) in the fractured bedrock environment, contaminant mass that has moved into the rock matrix, will be higher in concentration than the groundwater within the fractures. At this point, the process of matrix diffusion will reverse, (this is known as back diffusion), slowly releasing the mass in the rock matrix pore water back to the fractures. Back diffusion occurs slowly over a very long period of time (usually in multi-century timeframe). So while contaminant movement through a bedrock aquifer can be retarded or slowed down by diffusion into the rock matrix, this same process is a major limiting factor in effective remediation due to the slow back diffusion process.

SUMMARY OF SITE RISKS

As part of the RI/FS for the Site, a baseline risk assessment (BRA) and a supplemental risk evaluation for soil were conducted to estimate the current and future effects of contaminants on human health and the environment. A BRA is an analysis of the potential adverse human health and ecological effects of releases of hazardous substances from a site if no actions to mitigate such releases are taken, under current and future land and groundwater uses. The BRA includes a human health risk assessment (HHRA, 2016) and a screening-level ecological risk assessment (SLERA). In 2021, EPA conducted a soil risk evaluation that supplemented the baseline risk assessment for the Site.

In the HHRA, cancer risk and noncancer health hazard estimates are based on current reasonable maximum exposure (RME) scenarios and were developed by taking into account various health protective estimates about the concentrations, frequency and duration of an individual's exposure to chemicals selected as contaminants of potential concerns (COPCs), as well as the toxicity of these contaminants. The RME is intended to estimate a conservative exposure scenario that is still within the range of possible exposures.

A four-step human health risk assessment process was used for assessing site-related cancer risks and noncancer health hazards. The four-step process is comprised of: Hazard Identification of COPCs, Exposure Assessment, Toxicity Assessment, and Risk Characterization (see text box titled "What is Risk and How is it Calculated" for additional explanation of these terms).

Human Health Risks

The current land use at the Site, including the approximate 10-acre Spill Zone and the resultant 4.1-mile plume, designated as the Study Area, is mixed use, including residential, recreational, agricultural, and commercial/industrial. Future land use is expected to remain the same. The identification and selection of potential receptor populations was based on both current and potential future land uses of the Site. Media of concern evaluated in the 2016 HHRA included groundwater, as well as surface water and sediments in nearby Mud Creek, Oatka Creek and Spring Creek. As such, the following receptor populations and pathways were quantitatively evaluated in the 2016 HHRA:

- Future Resident (Adult/Child)- Ingestion of groundwater as drinking water, dermal contact with groundwater while bathing or showering, and inhalation of VOCs released during bathing or showering.
- Future Commercial/Industrial Worker- Ingestion of groundwater as drinking water and dermal contact while hand washing.
- Current/Future Construction/Utility Worker- Incidental ingestion of and dermal contact with shallow groundwater in a trench, and inhalation of vapor phase chemicals released from groundwater to a confined space (trench).
- Current/Future Recreational User (Adult/Adolescent/Child)- incidental ingestion of and dermal contact with surface water and sediment while wading or swimming in Mud, Oatka, and Spring Creeks.

In 2021, to supplement the HHRA, EPA conducted an additional risk evaluation for residual TCE source in the Spill Zone soils post-treatment with a SVE system. Residual TCE contamination in the Spill Zone is present on land zoned industrial; therefore, the following receptor populations and pathways were evaluated:

- Current/Future Commercial Worker- incidental ingestion and inhalation of soil particulates released from Spill Zone soils; and
- Current/Future Construction Workers - incidental ingestion and inhalation of soil particulates released from Spill Zone soils.

Two types of toxic effects were evaluated for each receptor in the risk assessments: carcinogenic effects and non-carcinogenic effects. Calculated risk estimates for each receptor were compared to EPA's target threshold values for carcinogenic risk of 1×10^{-6} (one-in-one million) to 1×10^{-4} (one-in-ten thousand) and calculated hazard index (HI) to a target value of 1.

Summary of HHRA Results

This section provides a summary of the conclusions of the HHRA documents (both the 2016 HHRA and 2021 supplemental soil risk evaluation) per media. The bolded values in Tables 1 through 3 highlight the cancer risk and noncancer hazards estimates that exceed EPA's threshold criteria for site-related contaminants. Further, media specific COCs were identified in instances when the threshold criteria were exceeded. A complete discussion of the exposure pathways and estimates of risk can be found in the final 2016 HHRA and 2021 supplemental risk evaluation which are available in the administrative record for the Site.

➢ ***Groundwater***

Risk and hazards were evaluated for current and future exposure to contaminated groundwater beneath the Site. The populations of interest included the following receptors: Future child and adult residents, future commercial/industrial worker and current/future construction/excavation worker. As summarized in Table 1 below, the hazard indices for the child resident (12,000), adult resident (7,000), commercial/industrial worker (19) and construction/excavation worker (3.1) exceeded EPA's threshold value of 1. In addition, the combined cancer risk estimates for the child an adult resident of 3.7×10^{-2} and that of a commercial/industrial worker of 1.6×10^{-4} exceeded EPA's threshold range of 1×10^{-6} to 1×10^{-4}. TCE in groundwater was the main contaminant driving unacceptable risk and hazard estimates.

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases under current - and anticipated future - land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated soil and ingestion of and dermal contact with contaminated ground water. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario that portrays the highest level of human exposure that could reasonably be expected to occur is calculated.

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other non-cancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and non-cancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 1×10^4 cancer risk means a "one-in-ten thousand excess cancer risk"; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 1×10^4 to 1×10^6, corresponding to a one-in- ten thousand to a one-in-one-million excess cancer risk. For non-cancer health effects, a "hazard index" (HI) is calculated. The key concept for a non-cancer HI is that a "threshold" (measured as an HI of less than or equal to 1) exists below which non-cancer health hazards are not expected to occur. The goal of protection is 1×10^{-6} for cancer risk and an HI of 1 for a noncancer health hazard. Chemicals that exceed a 1×10^{-4} cancer risk or an HI of 1 are typically those that will require remedial action at the site.

Table 1: Summary of total hazard and risks associated with groundwater[1]

RECEPTOR	Hazard Index	Cancer Risk
Future Child Resident	**12,000**	**3.7E-02**
Future Adult Resident	**7,000**	
Future Commercial/Industrial Worker	**19**	**1.6E-04**
Current/Future Construction/Excavation Worker	**3.1**	1.1E-06

The potential for subsurface vapor intrusion (SVI) is evaluated when Site soils and/or groundwater are known or suspected to contain chemicals that are volatile. Since TCE is considered volatile, a comparison of detected concentrations of TCE found in sitewide groundwater were compared to EPA's chemical-specific, risk-based groundwater vapor intrusion screening levels (VISLs). The VISLs provide groundwater levels associated with an indoor air concentration that represents a cancer risk ranging from 1×10^{-4} and 1×10^{-6} or a noncancer hazard quotient of 1. Concentrations exceeding these groundwater screening values indicate the potential for vapor intrusion exists. Results of the screening evaluation indicate that TCE is present in groundwater at concentrations well above the chemical specific groundwater VISL for TCE of 1.19 ug/L. Based on the results of the screening evaluation, the potential for vapor intrusion exists at the Site and should continue to be evaluated in both the current and future timeframes.

- ***Soil***

Risks and hazards were evaluated for future exposure to residual TCE source within the Spill Zone soil by current/future commercial and construction workers. For the commercial worker, surface soil down to 2 ft bgs was evaluated while for the construction worker, soil down to 10 ft bgs was considered. As summarized in Table 2, the estimated noncancer hazards for these two receptors exceeded 1 with estimates of 25 and 91 for the commercial worker and construction worker, respectively. The noncancer risk driver was TCE in both instances. The estimated cancer risks for these receptor populations evaluated were found to be within EPA's target threshold range of 1×10^{-6} to 1×10^{-4}.

[1] Bolded values indicate risk exceedances.

Table 2: Summary of hazard and risks associated with <u>residual TCE source in soil</u>[2]		
RECEPTOR	Hazard Index	Cancer Risk
Current/Future Commercial Worker	**25**	7.6E-05
Current/Future Construction Worker	**91**	1.1E-05

➢ ***Surface Water and Sediments in the Mud Creek area, Oatka Creek and Spring Creek.***

Risk and hazard were evaluated for current and future exposure by a child, adolescent and adult recreators who may be wading or swimming in nearby Mud, Oatka, and Spring Creeks. Based on the distribution of constituent concentrations in these surface waters, two exposure unit (EU) were designated for use in the HHRA. Mud Creek located adjacent and hydraulically downgradient from the Spill Zone comprises the first EU. Hydraulically downgradient from Mud Creek is Oatka Creek and Spring Creek which were designated as EU 2. The results of the risk assessment are summarized per media and EU in Table 3 below.

Table 3: Summary of total hazard and risks associated with <u>surface water</u> and <u>sediment</u>[3]		
RECEPTOR	Hazard Index	Cancer Risk
Exposure Media: Surface Water in Mud Creek (EU1)		
Current/Future Child Recreator	**14**	6.1E-05
Current/Future Adult Recreator	**6.2**	
Current/Future Adolescent Recreator	**7.9**	NC
Exposure Media: Sediment in Mud Creek (EU1)		
Current/Future Child Recreator	1.5*	2.1E-06
Current/Future Adult Recreator	0.14	
Current/Future Adolescent Recreator	0.73	NC
Exposure Media: Surface Water in Oatka & Spring Creek (EU2)		
Current/Future Child Recreator	0.14	1.7E-05
Current/Future Adult Recreator	0.036	
Current/Future Adolescent Recreator	0.055	NC
Exposure Media: Sediment in Oatka & Spring Creek (EU2)		
Current/Future Child Recreator	2.6*	8.3E-06
Current/Future Adult Recreator	0.24	
Current/Future Adolescent Recreator	0.44	NC

Footnotes:
NC= not calculated

* Hazard exceedance due to thallium, which is not related to the train derailment.

As indicated in Table 3, hazard indices for the child recreator (14), adolescent recreator (7.9) as well as the adult recreators (6.2) visiting Mud Creek exceeded EPA's threshold value of 1. TCE in surface water was the main COC driving the hazards for these recreators. Cancer risk estimates did not exceed EPA's threshold of $1{\times}10^{-6}$ to $1{\times}10^{-4}$ for any media evaluated. Exposure to sediments in Mud Creek resulted in a total hazard slightly above unity (1.5), however, this exceedance was due to thallium in sediments which is not a Site-related constituent. Similarly, exposure to sediments in EU2 (Oatka and Spring Creek) resulted in a slight hazard exceedance with hazard estimates equal to 2.6; however, this exceedance was due to presence of non-Site related thallium in sediments. The presence of TCE in surface water of Mud Creek drove the unacceptable hazard estimates for recreators.

In summary, the result of the 2016 HHRA and the 2021 supplemental soil evaluation indicated that TCE in soil, groundwater and surface water of Mud Creek were associated with cancer and/or noncancer risk estimates that exceeded EPA's threshold criteria. The presence of TCE in groundwater was also found at levels that could be of concern for the vapor intrusion pathway.

Ecological Risk Assessment

A Screening Level Ecological Risk Assessment (SLERA) was prepared to determine whether potential adverse ecological effects are occurring or may occur based on constituents of potential ecological concern concentrations in sediment and surface water. Ecological exposure was

2 Bolded values indicate risk exceedances.

3 Bolded values indicate risk exceedances.

first evaluated using an exposure evaluation approach that quantified potential risk based on the most conservative exposure scenarios. The results indicated that maximum concentrations of some constituents in surface water and sediment exceeded conservative screening criteria. However, the potential for impacts to populations from exposure to those constituents is low when evaluated using refined benchmarks that indicate the risk of real effects to specific receptors. The findings of the exposure estimate and risk characterization support the following conclusions for the exposure area:

1) The low detected concentration of cyanide in surface water at one location in Mud Creek does not pose unacceptable risks for fish communities because the pathway for exposure is incomplete since Mud Creek upstream of Gorge Pond runs dry portions of the year and, therefore, is unable to support fish communities.
2) Acetone is not related to the train derailment and is not a Site-related constituent. It is unlikely to adsorb to sediment and was found in similar concentrations within and outside the historical plume. The lack of sediment quality criteria and ecotoxicity data suggest that this analyte is unlikely to adversely impact macroinvertebrates. Therefore, the presence of this constituent in sediment samples is not considered Site-related and does not pose a significant risk to benthic invertebrate populations.

A Supplemental Ecological Risk Evaluation was completed to estimate the potential for adverse effects to ecological receptors exposed to contaminated soils on the Site (USEPA, 2021b). Analytical data used in the Supplemental Risk Evaluation included TCE concentrations measured in post-SVE soil boring samples collected in August 2017 from 0.5 to 2.5 ft bgs. The risk was evaluated for surface soils because exposure pathways to terrestrial ecological receptors are only complete in surface soil. Exposure point concentrations (EPC) calculated by EPA were compared to the 2 mg/kg value for protection of ecological receptors established by the NYSDEC. This NYSDEC value assumes that the soil-to-earthworm-to-small mammal exposure pathway is the most sensitive wildlife ingestion pathway. In calculating the 2 mg/kg value, NYSDEC assumed an exposure scenario where short-tailed shrews (*Blarina brevicauda*) consume 100 percent of their diet in earthworms and the TCE bioaccumulation from soil to earthworm tissue is based on general bioaccumulation models for organic compounds based on octanol-water partitioning coefficients. Based on this comparison, USEPA calculated a hazard quotient (HQ) for the Spill Zone of 230 based on an EPC of 460.2 mg/kg. Under current conditions, placement of a stone cover as part of the SVE system prevents the establishment of habitat to support a forage base (*e.g.*, earthworms, vegetation, etc.) for ecological receptors and minimizes incidental soil ingestion. However, if the existing cover is removed, there is a potential for future habitat to be present for ecological receptors.

Summary of Human Health and Ecological Risks

EPA concluded that remaining TCE in Site soil poses an unacceptable noncancer risk to human health and the need to take remedial action remains valid. The inhalation pathway was the exposure pathway of concern. Surface water exposure from Mud Creek, containing TCE, poses an unacceptable noncancer risk to human health, and the need to take remedial action remains valid. Ingestion of and dermal contact with contaminated surface water while swimming were the exposure pathways of concern. Exposure to groundwater beneath the Site via ingestion, inhalation and dermal contact drove unacceptable cancer and noncancer hazard for human health receptors. Additionally, TCE is present in groundwater at concentrations that could be of concern for the VI pathway. A streamlined ecological risk evaluation for the soil in the Spill Zone concluded that there is a potential for adverse impact to ecological receptors from exposure to soil if the existing stone cover is removed.

Based on the results of the human health and ecological risk assessments, a remedial action is necessary to protect human health and the environment from actual or threatened releases of hazardous substances.

It is EPA's judgment that the implementation of preferred alternatives, summarized in this Proposed Plan, is necessary to protect human health and the environment from actual of threatened releases of hazardous substances into the environment.

PRINCIPAL THREAT WASTE

Principal threat waste is defined in the box below. TCE released from the train derailment has diffused into the bedrock matrix and continues to be an ongoing source of groundwater contamination. Bedrock and contaminated groundwater at the Site, however, are not considered source materials and, therefore, are not principal threat wastes. Soil is not considered principal threat waste because it does not act as a significant source of contamination to groundwater.

WHAT IS A "PRINCIPAL THREAT"?

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water, or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in groundwater may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are specific goals identified to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered (TBC) guidance, and, if applicable, site-specific risk-based levels.

The RAOs identified in the 1997 NYSDEC ROD were:

- Provide for attainment of Standards, Criteria and Guidance (SCGs) for groundwater quality and surface water quality at the limits of the area of concern, to the extent practicable.
- Prevent, to the extent possible, migration of contaminants in groundwater and reduce the impacts of contaminated groundwater to the environment.
- Reduce, control, or eliminate, to the extent practicable, the soil and bedrock contamination present at the derailment Site.
- Eliminate the potential for human and wildlife exposure to soil containing Site-related contaminants.
- Contain, treat and/or dispose of contaminated soil in a manner consistent with applicable state and federal regulations and guidance.

EPA is amending and supplementing these RAOs with the RAOs detailed below which are organized by media. In developing RAOs for groundwater, EPA expects to return usable groundwater to its beneficial uses (in this case, use as drinking water) wherever practicable, within a timeframe that is reasonable given the characteristics of the site. EPA also acknowledges, however, that groundwater restoration is not always achievable due to limitations in remedial technologies and other site-specific factors. These factors may include technology limitations, contaminant phase contaminant depth, complexity of geological setting, and hydraulic regime.

As discussed above, after evaluating the nature and extent of groundwater contamination and the available remedial alternatives for groundwater, EPA has concluded that the available technologies cannot achieve restoration of the contaminated groundwater to drinking water standards. EPA is recommending a waiver of ARARs due to technical impracticability (TI) for groundwater at the Site. The PRP documented its evaluation of the potential for groundwater restoration in the 2019 AGTI report and identified a zone where ARARs are expected to be exceeded for the foreseeable future. EPA acknowledged that this evaluation satisfied the requirements for a TI waiver.

The proposed TI decision applies only to the chemical-specific groundwater standards being waived in the area in which ARARs or other cleanup standards cannot be reached (hereinafter, TI Zone). For the LVRR Site, the TI Zone includes the portion of the groundwater in the Spill Zone and the plume downgradient to Spring Creek. The horizontal and vertical extent of the TI Zone is illustrated on Figure 4, which shows the TI Zone (items 1 and 2 below) and an area around the TI Zone as follows:

1. Red: depicts an area encompassing the approximately 3.1 million square foot Spill Zone and extending vertically to the upper Camillus Formation (a depth corresponding to approximately 120 ft bgs), resulting in a volume of approximately 213 million cubic feet where groundwater TCE concentrations generally exceed 1,000 µg/L;

2. Yellow: depicts an area encompassing approximately 102 million square feet outside of the Spill Zone area extending vertically to the base of the Camillus Formation (ranging from approximately 120 ft bgs in the western extent of the Study Area to outcrops occasionally near Spring Creek, and Oatka Creek), resulting in a volume of approximately 7,821 million cubic feet where groundwater TCE concentrations generally range from 5 µg/L to 1,000 µg/L. The TI boundary at the distal end of the TCE plume was established to include the entire Spring Creek Fault Zone that extends just east of Spring Creek.

3. Gray (Monitoring Zone): depicts an area that encompasses an approximately 39 million square foot area extending vertically to the base of the Camillus Formation (ranging from approximately 120 ft bgs in the western extent of the Study Area to outcrops occasionally near Spring Creek, and Oatka Creek) resulting in a volume of approximately 2,990 million cubic feet where TCE concentrations in groundwater generally range from non-detect to 5 μg/L. Outside of the TI Zone (gray area), the preliminary remediation goals (discussed below) will be used to verify compliance with the TI waiver.

When restoration of groundwater to beneficial uses is not practicable, EPA selects an alternative remedial strategy that is technically practicable, protective of human health and the environment, and satisfies statutory and regulatory requirements of CERCLA. Consistent with the NCP, alternative remedial strategies for TI sites typically address three site concerns: 1) exposure control; 2) source control; and 3) aqueous plume migration. The RAOs outlined below for groundwater, soil vapor, bedrock, surface water and soil address these concerns.

Groundwater RAOs:

- Prevent current and future human exposure (via ingestion, inhalation and dermal contact) to Site-related contaminants in groundwater that exceed federal or state maximum contaminant levels (MCLs);
- Prevent further migration of Site-related contaminants in groundwater at levels exceeding MCLs beyond the delineated areal extent of the groundwater contamination (TI Zone); and,
- Prevent the migration of Site-related contaminants in groundwater to surface water that would result in exceeding applicable surface water quality standards.

Soil Vapor Intrusion (SVI) RAOs:

- Mitigate potential current and future unacceptable risks from subsurface SVI into indoor air.

Bedrock RAOs:

- Mitigate, to the extent practicable, the Bedrock Vadose Zone (BVZ) as an ongoing source of groundwater contamination;
- Accelerate long-term improvement to the groundwater in a reasonable time frame; and,
- Support further risk reduction for the Site as a whole.

Soil RAOs:

- Prevent human exposure to contaminated Spill Zone soil (*i.e.*, contaminated overburden fill material/debris/soil) via incidental ingestion and inhalation above levels that pose an unacceptable risk for commercial use.

Surface Water RAO:

- Prevent unacceptable risk to human receptors from incidental ingestion and dermal contact exposure to contaminated surface and seep water in the Mud Creek area by reducing contaminant levels to the more stringent federal or state standards.

Preliminary Remediation Goals

Preliminary remediation goals (PRGs) are media- and contaminant-specific numerical or qualitative federal and state standards that can be compared directly to RAOs and will be used for developing use restrictions and other actions to prevent exposure and for assessing the extent of the aqueous plume. To evaluate remedial alternatives and support the RAOs, PRGs for the Site were developed for soil, groundwater and surface water. PRGs are related to RAOs and are based on state and federal standards and will be used for developing the final cleanup levels in the ROD, use restrictions and other actions to prevent exposure. PRGs will not be used for achieving restoration of groundwater within the TI zone to the numerical goals but will be used for assessing the extent of the aqueous plume.

As there are no promulgated chemical-specific ARARs for SVI, PRGs were not specifically developed for vapor intrusion. However, applicable TBC criteria includes EPA Vapor Intrusion Screening Levels (VISLs) and NYSDOH *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. The most current EPA VISLs and NYSDOH criteria will be used in the evaluation of the SVI pathway at the Site.

In the 1997 NYSDEC OU1 ROD established the groundwater and surface water PRGs as follows:
Groundwater – 5 μg/L TCE
Surface water – 11 μg/L TCE

For the surface soil, PRGs were as follows:
TCE – 7 mg/kg
1,2-dichloroethene – 3 mg/kg

EPA is proposing to replace the above PRGs with the following:

Table 4: EPA's PRGs

MEDIA	CONTAMINANT OF CONCERN	PRG	UNITS
Groundwater[1]	Trichloroethene (TCE)	5	µg/L
	cis-1,2-dichloroethene	5	µg/L
	trans-1,2-dichloroethene	5	µg/L
	1,1- dichloroethene	5	µg/L
	Vinyl Chloride	2	µg/L
Surface Water[2]	Trichloroethene (TCE)	40	µg/L
Soil[3]	Trichloroethene (TCE)	200	mg/kg

Footnotes:
[1] Lower of the NYSDEC Class GA Drinking Water Standards and NY state and federal Maximum Contaminant Levels (MCL) were selected as PRGs. These PRGs are the ARARs being waived in the TI Zone.
[2] NYSDEC - Part 703: Surface Water Quality Standards for Class C (based on designation of Mud Creek).
[3]6 NYCRR Part 375, Table 375-6.8(b) Commercial use Soil Cleanup Objective. The protection of groundwater SCO was evaluated in the feasibility study, but was not applied because groundwater restoration is not possible.

As reflected in the PRG table above, the primary groundwater COCs include TCE and its breakdown daughter products: cis- and trans- 1,2 dichloroethene, 1,1,- dichloroethene and vinyl chloride.

The OU2 RI and AGTI Reports conclude that a substantial quantity of TCE, released from the original spill, has diffused into the rock matrix. As such, remediation of the bedrock matrix would be difficult as a result of the formation of the bedrock geology, as well as the size, migration, and location of the TCE mass. Currently, there are no published ARARs, TBCs, or other Guidance specific to the BVZ. Therefore, PRGs have not been identified for the BVZ. The AGTI report concludes that the restoration of groundwater, within the Study Area, to its most beneficial use is not technically practical within a reasonable timeframe. Therefore, BVZ RAOs are based on source reduction and exposure control.

SUMMARY OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARs, and utilize permanent solutions, alternative treatment technologies, and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) of CERCLA also establishes a preference for remedial actions that employ, as a principal element, treatment to reduce, permanently and significantly, the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a site. Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants that, at least, attains ARARs under federal and state laws, unless a waiver can be justified pursuant to Section 121(d)(4) of CERCLA, 42 U.S.C. § 9621(d)(4).

The alternatives for addressing contamination at the Site are organized by media and summarized below. Detailed descriptions of the remedial alternatives for addressing the contamination found at the Site are provided in the 2023 FS Report.

The construction time for each alternative reflects only the time required to construct or implement the remedy and does not include the time required to design the remedy, negotiate the remedy performance with any potentially responsible parties or procure contracts for design and construction.

Common Elements of the Alternatives

The proposed alternatives described below, with the exception of the 'No Action' alternative, include major common elements which are implementable and do not change significantly in scope from one alternative to another as follows:

1. Common Elements:
   a.) Institutional Controls in the form of governmental controls (see Appendix C of FS Report); proprietary controls (e.g., easements on Spill Zone parcels); and informational devices relating to groundwater, soil vapor, and the Spill Zone (e.g., notices, publications) to limit exposure to contaminated groundwater and soil vapor;

   b. Monitoring, which includes sampling, of groundwater, surface water, soil vapor and indoor air;
      i. A long-term groundwater monitoring program would be implemented to track and to monitor changes in the groundwater contamination to ensure the RAOs are attained.
      ii. The groundwater data results would be used to evaluate any contaminant migration and changes in VOC contaminants over time.

c. Maintenance of existing SSDSs and installation of new systems, as needed, for impacted properties; and
d. Connection of new homes constructed over the groundwater plume to the current municipal water supply system or the provision of a point-of-entry treatment system if connection to the municipal system is not feasible.

Institutional Controls were evaluated as part of EPA's nine criteria analysis as discussed in more detail below.

Bedrock Vadose Zone (BVZ) Remedial Alternatives

BVZ Alternative 1: No Action

The NCP requires that a "No Action" alternative be developed and considered as a baseline for comparing other remedial alternatives. Under this alternative, no additional action would be implemented.

Capital Cost:	$0
O&M Costs:	$0
Present-Worth Cost:	$0

BVZ Alternative 2: Monitoring and ICs

No active remedial actions would be implemented in the BVZ under Alternative 2. An operations and maintenance (O&M) plan would be prepared to protect workers from TCE exposure by outlining methods and procedures for any on-Site work activities. Additionally, ICs (consisting of deed notices and informational devices) and monitoring (groundwater sampling) would be established to prevent the potential use and exposure of impacted materials, as well as to monitor the groundwater quality through sampling over time.

Capital Cost:	$0
O&M Costs:	$0
Common Elements Costs:	$137,250
Present-Worth Cost:	$137,250
Construction time:	Not Applicable

BVZ Alternative 3a (original OU1 bedrock remedy): BVE in a 10-acre portion of the BVZ, Monitoring and ICs

Under this alternative, which was also part of the selected remedy in the OU1 ROD, a BVE system would be installed within the Spill Zone to address the TCE mass that remains within the unsaturated BVZ in the 10-acre area. This would consist of a network of vapor extraction wells, vacuum extraction pumps, and a treatment system to mitigate the extracted vapors. The extent of the proposed area is based on bedrock TCE vapor with the outer most limits containing concentrations of approximately 10,000 $\mu g/m^3$. TCE within the seasonally saturated BVZ would not be addressed by this alternative as it would not be effective.

Capital Cost:	$8.36 million
O&M Costs:	$1.00 million
Common Elements Costs:	$0.14 million
Present-Worth Cost:	$9.50 million
Construction time:	8 months

BVZ Alternative 3b: BVE in a 2-acre portion of the BVZ, Monitoring and ICs

Under this alternative, a BVE system would be installed within the Spill Zone to address the TCE mass that remains within the unsaturated BVZ in a two-acre area. This consists of a network of vapor extraction wells, vacuum extraction pumps, and a treatment system to mitigate the extracted vapors. The extent of the proposed area is based on bedrock TCE vapor data with the outer most limits containing concentrations of approximately 1,000,000 $\mu g/m^3$. TCE within the seasonally saturated BVZ would not be addressed by this alternative as it would not be effective.

Capital Cost:	$2.73 million
O&M Costs:	$0.85 million
Common Elements Costs:	$0.14 million
Present-Worth Cost:	$3.72 million
Construction time:	4 months

Surface Water (SW) Remedial Alternatives

SW Alternative 1: No Action

The NCP requires that a "No Action" alternative be developed and considered as a baseline for comparing other remedial alternatives. This alternative would not reach remedial action objectives in a reasonable time frame.

Capital Cost:	$0
O&M Costs:	$0
Present-Worth Cost:	$0

SW Alternative 2: ICs and Monitoring

No active surface water remedial action would be implemented as part of this alternative. Improvements in surface water quality would be through natural degradation of TCE by dispersion, dilution, volatilization, biodegradation, and abiotic processes. Monitoring would determine if the surface water quality improved over time.

Capital Cost:	$1.76 million
O&M Costs:	$0
Common Elements Costs:	$0.08 million
Present-Worth Cost:	$1.84 million
Construction time:	Not Applicable

SW Alternative 3: Hydraulic Containment of Contaminated Groundwater with ICs and Monitoring

This alternative would involve the installation and operation of several groundwater extraction wells (and associated treatment and discharge of extracted groundwater) to prevent contaminated groundwater discharges to surface water and active seeps and flows within the Mud Creek area. A Preliminary Design Investigation (PDI) would be undertaken and include collection of seasonal data in the Mud Creek area for flow conditions, groundwater elevations, surface water quality, and identification of fractured rock or karst subsurface flow pathways. Wells and piezometers would be installed, and pump tests would be completed to obtain data on groundwater level fluctuations and flow directions, seep flow rates, changes in COC concentrations, and hydraulic conductivity. Monitoring would determine if the surface water quality improves over time.

Capital Cost:	$5.43 million
O&M Costs:	$5.09 million
Common Elements Costs:	$0.08 million
Present-Worth Cost:	$10.60 million
Construction time:	1 year

SW Alternative 4: Streambed Cover with ICs and Monitoring

This alternative consists of covering the active Mud Creek stream segments and seeps that are impacted by TCE with stones sourced from nearby quarries. The stones would be placed such that the stream would be well below the top of the streambed cover, thereby preventing direct human contact with TCE-impacted media. Monitoring would determine if the surface water quality improves over time.

Capital Cost:	$2.07 million
O&M Costs:	$0.53 million
Common Elements Costs:	$0.08 million
Present-Worth Cost:	$2.69 million
Construction time:	3 months

SW Alternative 5: In situ Treatment of Contaminated Surface Water, Streambed Cover with ICs, and Monitoring

This alternative includes the streambed cover from Alternative 4 and adds the installation of one or more permeable treatment barriers (PTBs) to create treatment zones as an engineered in situ treatment process. The PTBs would also prevent any potential human contact with TCE-impacted surface water. Once a PDI has been completed for the Mud Creek area, the design, the number of treatment zones, their specific location, configuration, and the process or media to be used within the treatment zones will be determined. The PDI would collect seasonal data for flow conditions, groundwater elevations, surface water quality samples, and identification of fractured rock or karst subsurface flow pathways. Additional geochemical sampling and pilot scale installation of one or more of the PTBs in potential treatment zones would be conducted to determine performance and maintenance requirements of the PTBs. Monitoring would determine if the surface water quality improves over time.

Capital Cost:	$ 4.12 million
O&M Costs:	$ 3.10 million
Common Elements Costs:	$ 0.08 million
Present-Worth Cost:	$ 7.31 million
Construction time:	3 months

<u>Soil Remedial Alternatives</u>

Soil Alternative 1: No Action

The NCP requires that a "No Action" alternative be developed and considered as a baseline for comparing other remedial alternatives. Under this alternative, no additional action would be implemented beyond what was accomplished under the OU1 ROD.

Capital Cost:	$0
O&M Costs:	$0
Present-Worth Cost:	$0
Time frame:	Not Applicable

Soil Alternative 2: Solidification/Stabilization (S/S) or Cover System using Commercial Land-Use Based PRG

Under this alternative, the Spill Zone overburden soils would be remediated using ex situ solidification/ stabilization. Overburden materials exceeding the commercial land-use PRG of 200 mg/kg for TCE in soil to depths ranging up to 10.5 ft bgs would be excavated, mixed with Portland cement (or other material) to immobilize the contamination, and returned to the excavation area underlain by a demarcation layer. Post-excavation samples would be completed to ensure all impacted overburden soil exceeding the commercial land use PRG of 200 mg/kg for TCE has been removed. In addition, placement of topsoil and seed to provide for one foot of clean soil cover will extend to any areas of the Spill Zone where surface soil exceeds 2 mg/kg, which is the NYS value for the protection of ecological receptors. Community air monitoring and dust control measures would be performed to ensure that VOCs are not volatilizing into the air.

On-Site ex-situ treatment of TCE-impacted overburden in a temporary treatment unit and placing the solidified material in the excavation area would need to comply with Resource Conservation and Recovery Act (RCRA) corrective action management unit (CAMU) performance standards including requirements for a liner, leachate collection system, cap, and groundwater monitoring.

Capital Cost:	$1.37 million
O&M Costs:	$0.71 million
Common Elements Costs:	$0.12 million
Present-Worth Cost:	$2.20 million
Construction time:	20 months

Soil Alternative 3: Excavation/Disposal using Commercial Land-Use Based PRG

Under this alternative, the Spill Zone overburden material exceeding the commercial land use PRG for TCE of 200 mg/kg would be excavated to depths of up to 10.5 ft bgs. An estimated total of 1,150 cubic yards (yd^3) (1,840 tons) of overburden would be removed and disposed off-Site at an approved disposal facility. Post-excavation samples would be completed to ensure all impacted overburden material exceeding the PRG of 200 mg/kg for TCE has been removed. The area would then be backfilled using clean, imported soil and/or stone underlain by a demarcation layer. In addition, placement of topsoil and seed to provide for one foot of clean soil cover would extend to areas of the Spill Zone where surface soil exceeds the 2 mg/kg value for the protection of ecological receptors. Community air monitoring and dust control measures would be performed to verify volatilization of VOCs into the air is not occurring.

Capital Cost:	$3.02 million
O&M Costs:	$0.06 million
Common Elements Costs:	$0.12 million
Present-Worth Cost:	$3.20 million
Construction time:	6 months

Soil Alternative 4: Low-Temperature Thermal Desorption (LTTD) using Commercial Land-Use Based PRG

Under this alternative, the Spill Zone overburden material exceeding the commercial land use PRG of 200 mg/kg would be remediated ex-situ using LTTD to depths of up to 10.5 ft bgs. An estimated total of 1,150 yd^3 (1,840 tons) of overburden would be removed, treated via LTTD. Post-excavation samples would be completed to ensure all impacted overburden material exceeding the PRG of 200 mg/kg for TCE has been removed. The area would then be backfilled using clean, imported soil and/or stone underlain by a demarcation layer. In addition, placement of topsoil and seed to provide for one foot of clean soil cover would extend to areas of the Spill Zone where surface soil exceeds 2 mg/kg value for the protection of ecological receptors. Community air monitoring and dust control measures will be performed to verify volatilization of VOCs into the air is not occurring.

On-Site treatment of TCE-impacted overburden by ex situ in a temporary treatment unit and placing the treated material in the excavation area would need to comply with the RCRA CAMU performance standards. If LTTD treatment achieves 90% reduction of TCE or reaches 10 times the universal treatment standard (60 mg/kg), the CAMU would not have to comply with the requirements for a liner, leachate collection system, cap, and groundwater monitoring.

Capital Cost:	$1.82 million
O&M Costs:	$0.06 million
Common Elements Costs:	$0.12 million
Present-Worth Cost:	$2.00 million
Construction time:	16 months

EVALUATION OF ALTERNATIVES

In evaluating the remedial alternatives, each alternative is assessed against the nine evaluation criteria set forth in the NCP, namely the following: overall protection of human health and the environment; compliance with ARARs;

long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; and State and community acceptance. Refer to the text box for a more detailed description of these evaluation criteria.

This section of the Proposed Plan evaluates the relative performance of each alternative, including the Common Elements, particularly ICs, against the nine criteria, noting how each compare to the other options under consideration. A detailed analysis of alternatives can be found in EPA's FS Report supporting this decision, dated July 2023.

BEDROCK ALTERNATIVES

Overall Protection of Human Health and the Environment

BVZ Alternative 1 (No Action) would not meet the RAOs and would not be protective of human health and the environment because no action would be taken. BVZ Alternatives 2, 3a and 3b would address risk mitigation through the ICs. Although the active remedial BVZ alternatives (3a and 3b) would provide for a marginal reduction in TCE mass within the BVZ, the beneficial impact with respect to protection of human health would be negligible given that the majority of the TCE mass would be retained within the bedrock matrix micro pore spaces. None of the alternatives presented would have a beneficial impact to groundwater quality as a result of the matrix diffusion mechanisms that occur between the bedrock matrix porewater and the groundwater media, which would be expected to continue for a significant period of time into the future.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

There are no current federal and/or state ARARs that are applicable for the bedrock source material. None of the bedrock alternatives presented would be sufficient to meet the groundwater ARAR of 5 µg/L across the entirety of the TCE-impacted groundwater plume or to reduce risk, in general, with regards to exposure to TCE-impacted groundwater media.

Long-Term Effectiveness and Permanence

BVZ Alternative 1 would not have any long-term effectiveness and permanence because no action would be taken. BVZ Alternative 2, which involves the implementation of comment elements and ICs, would provide for a permanent and effective means of mitigating potential exposure to TCE-impacted bedrock media and to Site groundwater that is impacted by the TCE present within the bedrock media. BVZ Alternatives 3a and 3b would not be expected to provide any benefit with respect to: i) reducing TCE mass to any practical extent within the BVZ; and ii) reducing TCE concentrations (and associated exposure risk) within the TCE-impacted groundwater media, based on an analysis of the Site data collected through various investigations and modeling efforts.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES

Overall Protectiveness of Human Health and the Environment considers whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) considers whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the Site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment considers an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost considers estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
State/Support Agency Acceptance considers whether the State agrees with EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Reduction of Toxicity, Mobility, or Volume Through Treatment

BVZ Alternative 1, No Action, would not address the contamination through treatment, so there would be no reduction in toxicity, mobility, or volume of the contaminants, and the alternative does not include long-term monitoring of groundwater conditions. As a result of the limitations associated with the matrix diffusion processes within bedrock media, the unpredictable nature associated with the application of BVE in a fractured bedrock media and the generally inconclusive results of the BVE Pilot Study, any implementation of active remediation through BVE (BVZ Alternatives 3a and 3b), would be expected to recover a very small fraction of the TCE mass that lies within the BVZ. Consequently, only a marginal reduction of toxicity, mobility and volume would be expected within the bedrock media when compared to the BVZ Alternatives 1 and 2.

Short-Term Impact and Effectiveness

BVZ Alternative 1 would not have short-term adverse impacts, because no action would be implemented. The activities associated with the BVE system installation phase for BVZ Alternatives 3a and 3b would present a moderate to high degree of risk to on-Site workers, and little to no risk to the community. The elevated risk associated with the installation of the BVE system could be mitigated through the appropriate training of on-Site personnel, and implementation of rigorous safety protocols. Once a BVE system is operational, routine sampling and O&M activities would present a moderate degree of risk to on-Site workers, and little to no risk to the community. In contrast, implementation of either BVZ Alternatives 1 or 2 would not present any increased risk to on-Site workers or the public, in general.

Implementability

BVZ Alternative 1, No Action, would be the easiest of all the alternatives to implement because there would be no remedy to implement. The implementability of the BVZ remedial alternatives (3a and 3b) would be challenging since a large number of extraction wells would be required, uncertainties with regards to their placement, and system operational challenges associated with: i) a highly variable water table and ii) matrix diffusion processes within the bedrock media (both of which would limit that amount of TCE mass that could be recovered by the BVE process). Additionally, the application of BVE would not address the TCE-impacted bedrock that is present below the water table, thus further impacting its implementability and effectiveness. In contrast, there are no technical or administrative implementability issues associated with the BVZ Alternatives 1 and 2.

Cost

BVZ Alternative 1 (No Action) has no cost because no activities would be implemented. Costs associated with the Common Elements alternative (BVZ Alternative 2), which include ICs, are estimated to be approximately $137,250. BVZ Alternatives 3a and 3b have capital worth costs of approximately $8.36 and $2.67 million, and present worth costs for O&M of $1.01 million and $0.85 million, respectively (assuming a three-year system operation time frame). These costs are significant in comparison to the costs associated with the alternative which contains only Common Elements, with little to no benefit achieved through implementation of the active treatment alternatives. The estimated capital cost, O&M, and present worth cost of the various Alternatives are discussed in detail in the 2023 FS Report. For cost estimating and planning purposes, a 30-year time frame was used for O&M.

State Acceptance

NYSDEC is currently evaluating EPA's preferred remedial alternatives as stated in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and all comments are reviewed. Comments received during the public comment period will be addressed in the Responsiveness Summary section of the upcoming ROD.

SURFACE WATER ALTERNATIVES

Overall Protection of Human Health and the Environment

SW Alternative 1 (No Action) would not meet the RAOs and would not be protective of human health and the environment because no action would be taken. The PDI and Common Elements alternative (SW Alternative 2) could provide for some degree of protection of human health through proprietary ICs. Lastly, if the results of the PDI investigations are favorable, SW Alternatives 3, 4, and 5 could potentially be implemented to the extent that they would provide for the protection of human health from TCE-impacted surface water. The Hydraulic Containment (SW Alternative 3) and Streambed Cover (SW Alternative 4) alternatives would provide protection through the containment of the TCE-impacted surface water, whereas the In-situ Treatment with Streambed Cover alternative (SW Alternative 5) would provide protection through both a containment mechanism, and a treatment process. Although Alternative 3 includes a treatment component, the media that it addresses via treatment is groundwater rather than surface water. In reality, SW Alternative 3 would be capturing groundwater prior to daylighting as surface water in Mud Creek and treating for subsequent discharge. As previously discussed, a thorough PDI would need to be conducted in order to obtain specific data, such as seasonal surface water flows, TCE concentrations, and pilot scale data to assist in the implementation of key design elements for each remedial alternative.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The No Action alternative would not comply with NYS standards for surface water TCE concentration within a "Class C" stream (*i.e.*, 40 µg/L). SW Alternative 2 would not comply with ARARs. Implementation of Hydraulic Containment (SW Alternative 3) or the Streambed Cover (SW Alternative 4) would not provide for a reduction in TCE concentrations that would meet the PRG. In-Situ Treatment with Streambed Cover (SW Alternative 5) would achieve the PRG for TCE.

Long-Term Effectiveness and Permanence

The long-term effectiveness under the No Action and the ICs and Monitoring alternatives (SW Alternatives 1 and 2) would not be achieved, as these two alternatives do not provide for a method to address surface water TCE concentrations that exceed the PRG. Assuming favorable results are obtained from the PDI, SW Alternatives 3, 4, and 5 could all provide for an effective long-term solution with regards to surface water TCE-impacts in the Mud Creek area. In addition to favorable results from the PDI, the implementation of routine O&M procedures would be another key component with regards to the long-term effectiveness of SW Alternatives 3, 4, and 5.

Reduction of Toxicity, Mobility, or Volume Through Treatment

SW Alternative 1, No Action, would not address the contamination through treatment so there would be no reduction in toxicity, mobility, or volume of the contaminants. The No Action alternative does not include long-term monitoring of the ongoing groundwater conditions. The No Action and the Common Elements alternatives (SW Alternatives 1 and 2) do not provide for any reduction of toxicity, mobility or volume of TCE impacts. Since SW Alternatives 3 and 5 all provide for a method of containment for contaminated groundwater discharging to surface water, the two alternatives would then provide for a reduction in the toxicity, mobility and volume of TCE with regards to the surface water pathway. SW Alternative 5 also provides for an additional mechanism that may result in the reduction of toxicity, mobility and volume of TCE in surface water through a treatment process.

Short-Term Impact and Effectiveness

SW Alternative 1 (No Action) would not have short-term adverse impacts because no action would be implemented. The system installation activities associated with SW Alternatives 3, 4 and 5 would present a moderate to high degree of risk to on-Site workers, and little to no risk to the community. A significant component of this risk is the result of construction activities that would need to be conducted in largely wooded and uneven terrain. The elevated risk associated with the installation of these remedial systems could be mitigated through the appropriate training of on-Site personnel, use of proper construction equipment, and implementation of safety protocols. Routine sampling and O&M activities associated with the proposed remedial systems would present a moderate degree of risk to on-Site workers and little to no risk to the community. In contrast, implementation of either the No Action or the Common Elements alternatives would not present any increased risk to on-Site workers or the public in general.

Implementability

SW Alternative 1 (No Action) would be the easiest of all the alternatives to implement because there would be no remedy to implement. No technical implementability issues are associated the No Action and Common Elements alternatives. SW Alternatives 3, 4 and 5 would all require a PDI to be conducted initially in order to determine the design parameters associated with their implementation. Depending on the results of the PDI, each of these three alternatives would require a significant amount of construction activities to be conducted within a heavily wooded area, as well as the Mud Creek streambed itself. Access roads would need to be constructed for construction equipment and on-Site workers to access the various locations where system infrastructure needs to be installed. SW Alternatives 3 and 5 would require an installation phase that may take half-a-year or more to complete. Additionally, SW Alternative 3 would require a significant footprint to house all the necessary equipment necessary for its implementation. SW Alternatives 3 and 5 would require extensive routine O&M activities associated with their long-term operation. This could include servicing of pumps, motors and treatment equipment, replacement of treatment media, and/or waste disposal. In contrast, the long-term O&M activities associated with SW Alternative 4 would be simple and straightforward, and significantly easier to manage over the long-term.

Cost

The estimated capital cost, O&M, and present worth cost of the various alternatives are discussed in detail in the 2023 FS Report. For cost estimating and planning purposes, a 30-year time frame was used for O&M. The cost estimates are based on the available information. SW Alternative 1 (No Action) has no cost because no activities would be implemented. Costs associated with the ICs and Monitoring alternative (SW Alternative 2) are estimated to be approximately $81,750. Capital costs associated with implementation of the proposed PDI are $2.12 million. Capital costs for Hydraulic Control & Common Elements (SW Alternatives 3), Streambed Cover & Common Elements (SW Alternative 4), and In-situ Treatment, Streambed Cover & Common Elements (SW Alternative 5) are estimated to be approximately $5.43 million, $2.07 million and $4.12 million, respectively. Note that these costs also include the implementation of the proposed PDI. Present worth costs for O&M for these three alternatives are estimated to be approximately $5.09 million, $534,000 and $3.10 million, respectively (assuming a 30-year O&M period). Present worth costs are calculated based on a 7% discount rate for each year of system O&M. The corresponding total costs for these three alternatives are estimated to be approximately $10.6 million, $2.69 million and $7.31 million, respectively. The costs for SW Alternatives 3 and 5 are significant in comparison to the other alternatives presented, as they will incur more upfront capital expenditures and higher O&M costs over the course of their operation.

State Acceptance

NYSDEC is currently evaluating EPA's preferred alternatives, as stated in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and all comments are reviewed. Comments received during the public comment period will be addressed in the Responsiveness Summary section of the upcoming ROD.

<u>**Soil Remedial Alternatives**</u>

Overall Protection of Human Health and the Environment

Soil Alternative 1 (No Action) would not meet the RAOs and would not be protective of human health and the environment because no action would be taken. Except for the No Action Alternative, all alternatives are protective of human health and the environment. Soil Alternatives 3 and 4 reduce TCE concentrations on-Site through physical removal. Although Soil Alternative 2 does not reduce TCE concentrations, solidification would mitigate wind/surface water erosion and incidental ingestion/inhalation and placement within a lined/capped CAMU would make these alternatives equally as protective.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

EPA has identified NYSDEC's soil cleanup objectives (SCOs) (6 NYCRR § 375-6.5) as an ARAR, a "to-be considered," or other guidance to address contaminated soil at the Site. Refer to soil PRG in the table above. The No Action Alternative does not achieve the soil PRGs. Since all alternatives involve removal of soil and any treatment options would be expected to meet the soil PRGs for the soil placed back on the ground, post-excavation soil samples would verify attainment of the PRGs. Imported soil for backfill under Soil Alternative 3 would be tested to verify conformance with the allowable constituent levels for imported fill soil. Since Soil Alternative 2 (solidification) would not achieve any reduction in soil TCE concentrations, the CAMU would need to comply with the requirements for a liner, leachate collection, cap, and groundwater monitoring.

Long-Term Effectiveness and Permanence

The No Action Alternative provides no long-term effectiveness toward achieving the RAOs. All alternatives prevent direct contact with residual impacts. Soil Alternative 3 provides the greatest long-term effectiveness and permanence since the TCE-impacted soil media is removed from the Site. If proven effective through pilot testing, Soil Alternative 4 (LTTD) will permanently reduce TCE concentrations on-Site.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Soil Alternative 1, (No Action), would not address the contamination through treatment, so there would be no reduction in toxicity, mobility, or volume of the contaminants, and the alternative does not include long-term monitoring of groundwater conditions. Soil Alternative 2 (solidification) would reduce the mobility but not the toxicity or volume of TCE impacted soil media. Soil Alternative 3 (off-Site disposal) would reduce the toxicity, mobility, and volume on-Site; however, the off-Site reduction in toxicity and/or volume depends on the form of treatment/disposal at the Treatment, Storage and Disposal Facility (TSDF). Soil Alternative 4 (LTTD) would reduce the volume of TCE in the soil media but the overall reduction in volume and toxicity depends on the form of emissions control employed.

Short-Term Impact and Effectiveness

Soil Alternative 1 would not have short-term adverse impacts because no action would be implemented. All other soil alternatives would result in noise, dust, and vapor impacts; however, these are considered minimal and controllable through proper construction techniques. Evaluation of additional emissions controls for crushing that might be required under Soil Alternative 2 (solidification) would be considered during pilot-testing. Except for Soil Alternative 2, the work would be sequenced to minimize the time the excavation will remain open and safety measures would be in place. Construction of a CAMU for Soil Alternative 2 would require an open excavation for a significant period to install the liner and leachate collection system. Soil Alternative 4 would require significant fuel for the LTTD reactor and, since natural gas is not available near the Site, propane or heating oil tanks would need to be kept on-Site resulting in short-term risk to both human health and the environment.

Implementability

Soil Alternative 1 (No Action) would be the easiest of all the alternatives to implement because there would be no remedy to implement. Soil Alternative 2 (solidification) would have significant technical and administrative implementability issues surrounding construction of a CAMU in the Spill Zone. Since ex-situ solidification and stabilization of the soil media does not result in a TCE concentration reduction, the CAMU would have to comply with the requirements for a liner, leachate collection system, cap, and groundwater monitoring. Administrative issues include require agency approval of the CAMU design. The impacted soil media would need to be excavated and stockpiled or placed in roll off containers pending CAMU construction. The impacted material would need to be covered to prevent erosion. Design and construction of a CAMU would extend the time for these remedial alternatives by approximately 12 months. Other implementability issues include determining the type and amount of binding agent that will effectively solidify the impacted soil media and securing the appropriate equipment. The footprint of the CAMU would need to be larger than the excavation area to manage the grade change due to volume increases through the addition of the solidification agent.
Soil Alternative 3 (off-Site disposal) would require traffic coordination for off-Site transport to the TSDF, securing a disposal contract with out-of-State TSDF, and locating a borrow source for backfill material. Soil Alternative 4 requires a pilot test to verify effectiveness, securing specialized equipment for LTTD, and emissions control. Soil Alternative 4 is estimated to take up to 18 months to implement.

Cost

A comparative summary of the cost estimates for each alternative is presented in Table 5.

State Acceptance

NYSDEC is currently evaluating EPA's preferred alternatives as stated in this Proposed Plan.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and all comments are reviewed. Comments received during the public comment period will be addressed in a responsiveness summary section of the upcoming ROD.

PREFERRED ALTERNATIVES

Climate resiliency was evaluated in reviewing the alternatives. Potential Site impacts from climate change have been assessed and EPA's preferred alternative would be not at risk as a result of the expected effects of climate change in the region and near the Site.

After a thorough review of the proposed remedial alternatives, EPA recommends the following preferred remedy for the various media:

1. Groundwater: For the approximately four-mile TCE plume, EPA proposes a combination of monitoring and ICs while invoking a TI waiver for chemical-specific groundwater ARARs in the TI Zone because groundwater cannot be restored in a reasonable timeframe. Outside of the TI Zone, the ARARs will remain as the final cleanup goal. Long-term monitoring and groundwater use restrictions would be required.
2. Bedrock Vadose Zone – BVZ Alternative 2: ICs and Groundwater Monitoring. The BVZ and the groundwater in the Spill Zone is included in the extent of the TI zone (Figure 4).
3. Soil – Alternative 3: Excavation and off-Site disposal.

4. Surface Water – Alternative 5: In-situ treatment of contaminated surface water with streambed cover, ICs, and monitoring.
5. Common Elements:
   a. Institutional Controls in the form of governmental controls (see Appendix C of FS Report); proprietary controls (e.g., easements on Spill Zone parcels); and informational devices relating to groundwater, soil vapor, and the Spill Zone (e.g., notices, publications) to limit exposure to contaminated groundwater and soil vapor;
   b. Monitoring, which includes sampling, of groundwater, surface water, soil vapor and indoor air as follows:
      i. A long-term groundwater monitoring program would be implemented to track and to monitor changes in the groundwater contamination to ensure the RAOs are attained.
      ii. The groundwater data results would be used to evaluate any contaminant migration and changes in VOC contaminants over time.
   c. Maintenance of existing SSDSs and installation of new systems, as needed, for impacted properties; and
   d. Connection of new homes constructed over the groundwater plume to the current municipal water supply system or the provision of a point-of-entry treatment system if connection to the municipal system is not feasible.

With this comprehensive remedy for OU1 and OU2, this Proposed Plan also proposes the following changes to the OU1 ROD:

1. Eliminating the BVE source control measure;
2. Eliminating ex-situ SVE;
3. Updating the surface water standard for TCE from the original cleanup goal of 11 µg/L to the current NYSDEC standard of 40 µg/L;
4. Addressing soil contamination beneath Gulf Road by implementing ICs to restrict access and to require proper soil management if the roadbed is disturbed in the future; and
5. Updating the RAOs as discussed above.

A Site Management Plan (SMP) would also be developed for long-term O&M to provide for:

a) reviews of the effectiveness of the engineering and institutional controls;
b) proper management of the Site remedy post-construction;
c) long-term groundwater monitoring and health and safety requirements;
d) maintenance of existing vapor mitigation systems;
e) inspection of the plume area for new home construction and associated installation of new vapor mitigation systems; and
f) new connections to the public waterline or the provision of a point-of-entry treatment system if connection to the municipal system is not feasible.

Because this preferred alternative would result in contaminants remaining on-Site above levels that allow for unlimited use and unrestricted exposure, CERCLA requires that the Site remedy be reviewed at least once every five years. Also, provisions would be made for periodic reviews and certifications of the institutional and engineering controls. If justified by these reviews, additional remedial action may be implemented at the Site.

Green remediation techniques may be implemented as part of the preferred alternative to minimized environmental impacts consistent with EPA Region 2's Clean and Green Policy[4] and NYSDEC's Green Remediation Program Policy-DER-31.[5]

The total, estimated, present worth cost for the proposed remedy is $14,082,504 (see Table 5). Further details of the overall cost are presented in the FS Report.

Basis for the Remedy Preference

The preferred alternative for groundwater involves a TI waiver of chemical-specific ARARs based on the following factors: (1) the limited options available to successfully treat contamination in fractured bedrock with extensive evidence of matrix diffusion into the rock over a wide area; (2) the expected limited ability of the groundwater contamination to expand beyond its current extent; and, (3) the limited potential for treatment or containment of contamination remaining in the Spill Zone to result in a measurable improvement in groundwater quality anywhere in the aquifer within a reasonable time period. It also includes monitoring and institutional controls, mentioned as common elements.

[4] https://www.epa.gov/greenercleanups/epa-region-2-clean-and-green-policy

[5] http://www.dec.ny.gov/docs/remediation_hudson_pdf/der31.pdf.

The preferred alternative for Bedrock Vadose Zone – BVZ Alternative 2: ICs and Groundwater Monitoring was selected over BVZ Alternatives 3a and 3b. As demonstrated in the FS, the source reduction RAOs cannot be met because of matrix diffusion, complexity of the fracture network, and the groundwater elevation fluctuations in the BVZ. The active remedial BVZ alternatives (3a and 3b) would not achieve any appreciable reduction of TCE mass in the long term due to the matrix diffusion mechanisms that occur between the bedrock matrix porewater and the groundwater media, which would be expected to continue for a significant period of time into the future. This is also the basis for EPA proposing a TI waiver as to restoration of groundwater. The implementation of long-term groundwater monitoring and ICs would provide for an effective means of mitigating potential exposure to TCE-impacted bedrock media, and to Site groundwater that is impacted by the TCE that is present within the bedrock media.

The preferred Soil alternative (Soil Alternative 3 - excavation and off-Site disposal) was selected over other alternatives because it is expected to achieve the greatest degree of long-term effectiveness and permanence by removing impacted soils. Excavation Soil Alternative 3 is technically feasible, is a proven technology and more reliable than the soil treatment presented in Soil Alternatives 4 and 5. It is expected that this alternative could be substantially implemented within five to six months at a cost comparable to the other alternatives and provide for long-term reliability of the remedy.

The preferred Surface Water - SW Alternative 5: in-situ treatment of contaminated surface water with streambed cover, ICs and monitoring, was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through treatment of contaminants, and the use of engineering and institutional controls. The preferred SW Alternative reduces the risk within a reasonable time frame, at a cost comparable to other alternatives, and provides for long-term reliability of the remedy. A PDI would be undertaken and include collection of seasonal data in the Mud Creek area for flow conditions, groundwater elevations, surface water quality, and identification of fractured rock or karst subsurface flow pathways.

Based upon the information currently available, EPA believes that the preferred alternatives meet the threshold criteria and provide the best balance of trade-offs among the other alternatives with respect to the balancing criteria.

As discussed above, EPA is proposing an ARAR waiver for the federal and state drinking water and groundwater standards at the Site because of the technical impracticability of achieving ARARs in the TI Zone.

EPA expects the preferred remedy to satisfy the following statutory requirements of Section 121(b) of CERCLA: (1) the proposed remedy is protective of human health and the environment; (2) it complies with ARARs for all media except for where ARARs are waived; (3) it is cost effective; (4) it utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) it satisfies the preference for treatment.

FOR FURTHER INFORMATION

The Administrative Record file, which contains copies of the Proposed Plan and technical supporting documentation, is available at the following information repositories:

USEPA – Region II
Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4325
Hours: Monday – Friday: 9:00 am to 4:30 pm

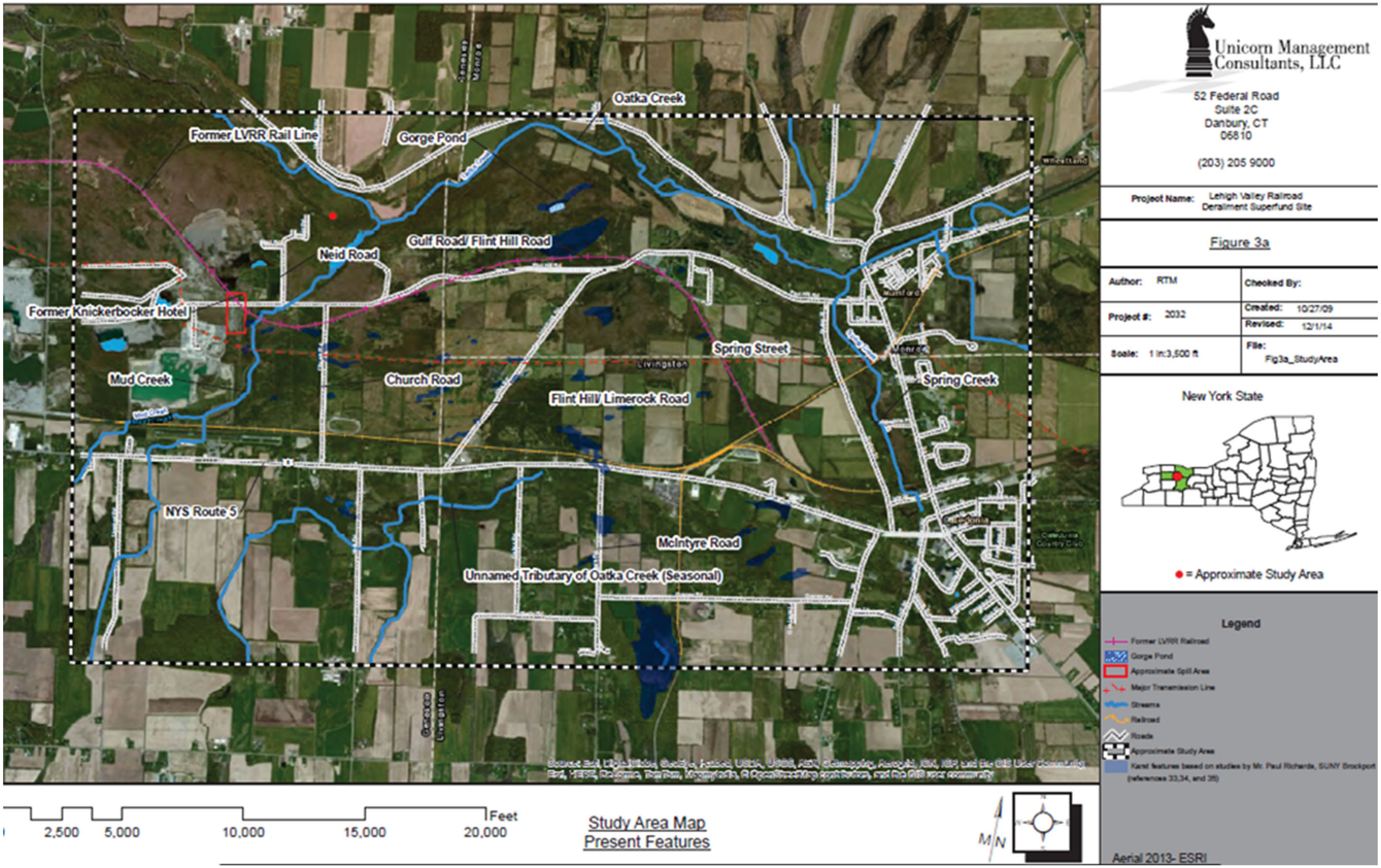
In addition, the Administrative Record file is available on-line on the Site Profile Page:
https://www.epa.gov/superfund/lehigh-valley-rr

For general information or questions about EPA's Superfund program, please contact the EPA Regional Public Liaison: George Zachos, zachos.george@epa.gov or (732) 321-6621 or toll free at (888) 283-7626.

Table 5: Costs for the Proposed Remedy

Media	Description	Capital Cost	O&M Cost	Institutional Controls Costs	Present-Worth Cost
Groundwater	TI waiver (includes monitoring)	$0	$2,253,200	$524,000	$2,778,000
Soil Vapor Intrusion	Indoor air	$0	$659,704	$0	$659,704
Bedrock Vadose Zone	Alternative BVZ - 2: ICs and Groundwater Monitoring	$0	$0	$137,250	$137,250
Soil	Alternative 3 - excavation and off-Site disposal	$3,017,897	$62,000	$121,750	$3,202,000
Surface Water	Alternative SW-5: In-situ treatment of contaminated surface water with streambed cover, ICs and monitoring	$4,121,550	$3,102,250	$81,750	$7,305,550
				Total	**$14,082,504**

Note: The soil alternative includes one foot of clean soil cover in areas of the Spill Zone where surface soil exceeds 2 mg/kg, which is the SCO value for the protection of ecological receptors.



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Former LVRR Rail Line
Gorge Pond
Gulf Road/ Flint Hill Road
Neid Road
Former Knickerbocker Hotel
Spring Street
Spring Creek
Mud Creek
Church Road
Flint Hill/ Limerock Road
NYS Route 5
McIntyre Road
Unnamed Tributary of Oatka Creek (Seasonal)
Unicorn Management Consultants, LLC
52 Federal Road
Suite 2C
Danbury, CT
06810
(203) 205 9000
Project Name: Lehigh Valley Railroad Derailment Superfund Site
Figure 3a
Author: RTM
Checked By:
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Created: 10/27/09
Revised: 12/1/14
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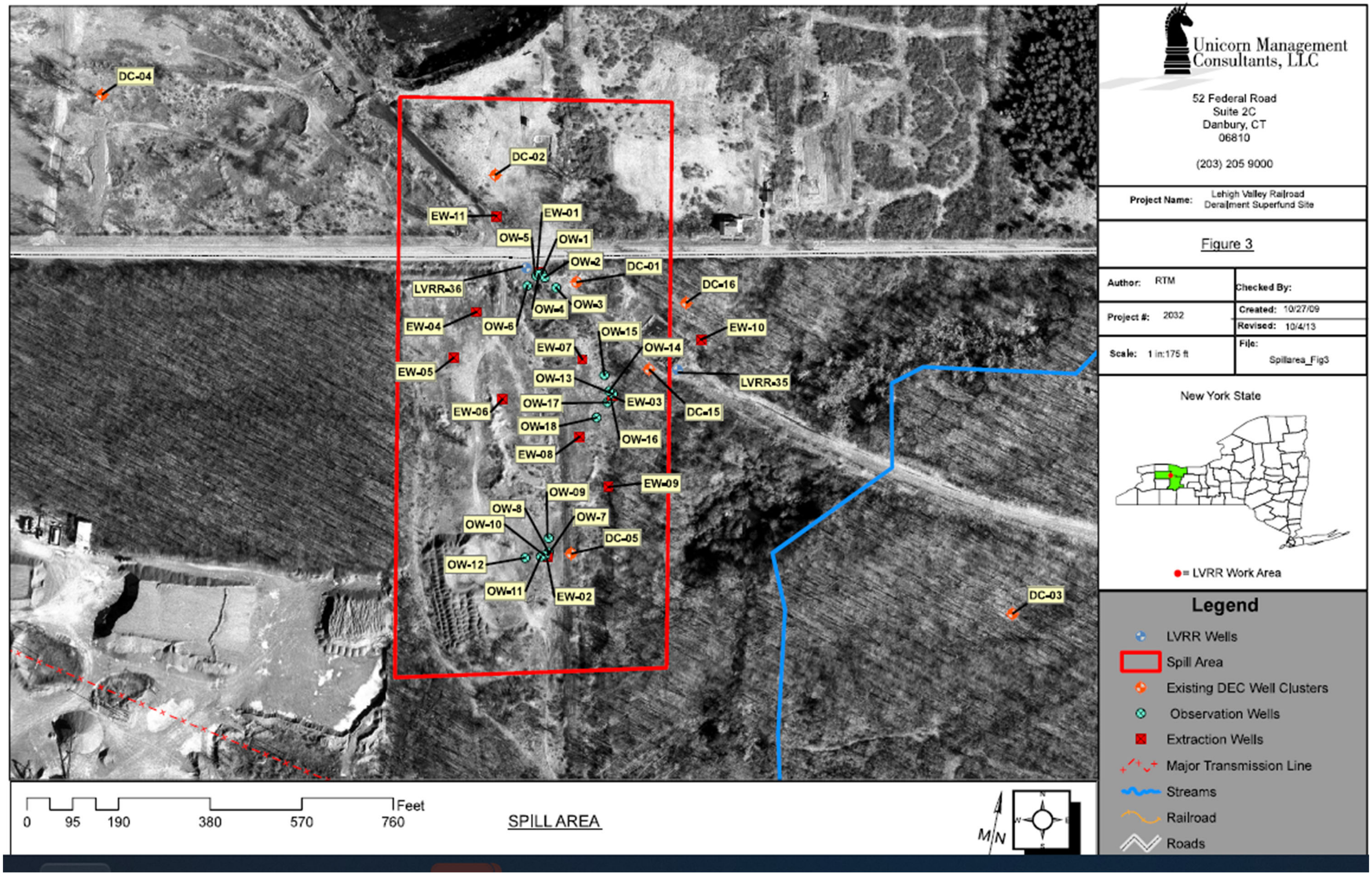
20,000
Study Area Map
Present Features
Aerial 2013- ESRI

Figure 1



Unicorn Management Consultants, LLC
52 Federal Road
Suite 2C
Danbury, CT
06810
(203) 205 9000
Project Name: Lehigh Valley Railroad Derailment Superfund Site
Figure 3
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Checked By:
Project #: 2032
Created: 10/27/09
Revised: 10/4/13
Scale: 1 in:175 ft
File: Spillarea_Fig3
New York State
= LVRR Work Area
Legend
LVRR Wells
Spill Area
Existing DEC Well Clusters
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Extraction Wells
Major Transmission Line
Streams
Railroad
Roads
DC-04
DC-02
EW-11
EW-01
OW-5
OW-1
OW-2
DC-01
LVRR-36
OW-4
OW-3
DC-16
EW-04
OW-6
OW-15
EW-10
EW-07
OW-14
EW-05
OW-13
LVRR-35
OW-17
EW-03
DC-15
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EW-08
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OW-8
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SPILL AREA
M N

Figure 2

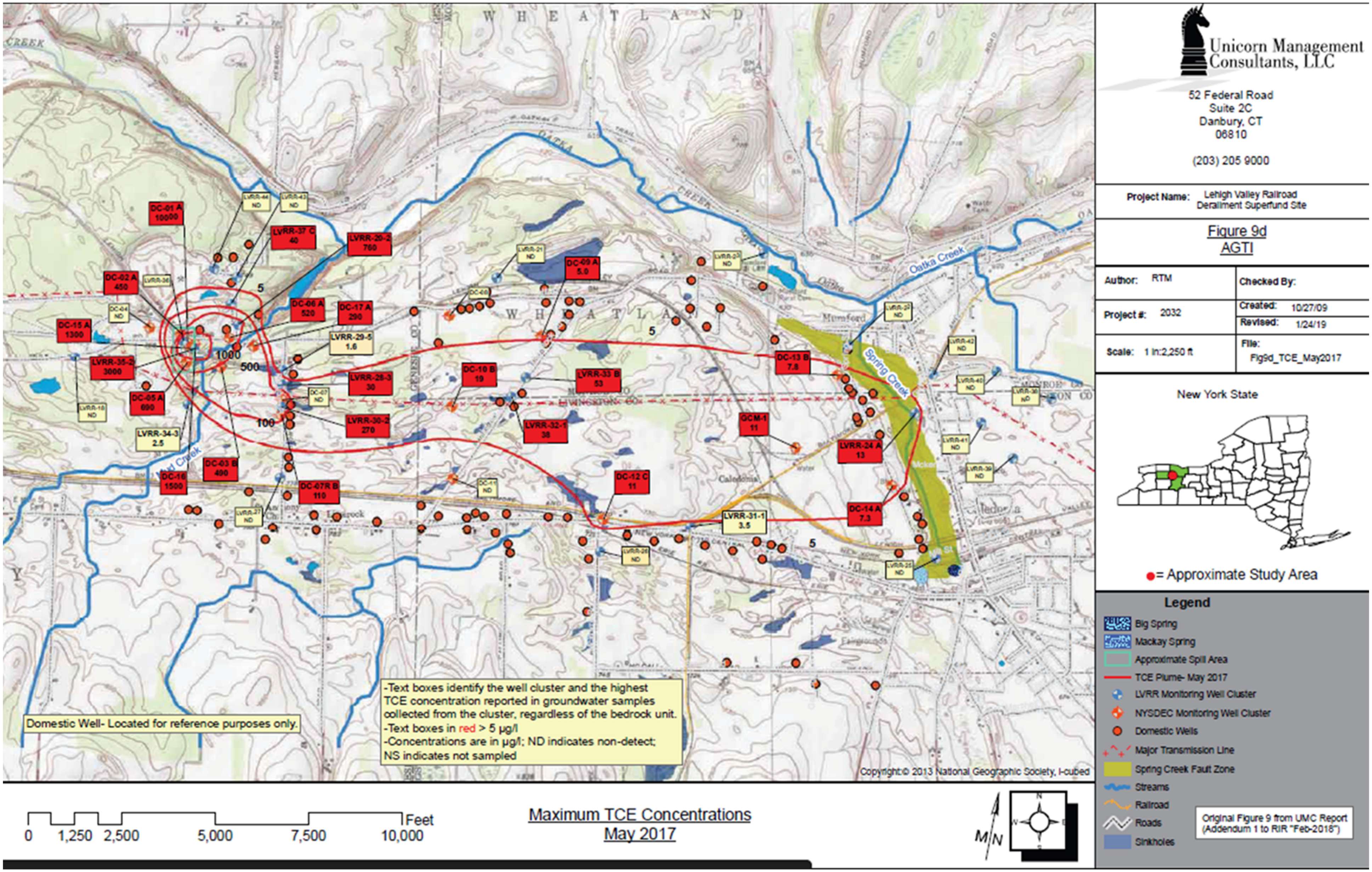

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Figure 9d
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Author: RTM
Checked By:
Project #: 2032
Created: 10/27/09
Revised: 1/24/19
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New York State
= Approximate Study Area
Legend
Big Spring
Mackay Spring
Approximate Spill Area
TCE Plume- May 2017
LVRR Monitoring Well Cluster
NYSDEC Monitoring Well Cluster
Domestic Wells
Major Transmission Line
Spring Creek Fault Zone
Streams
Railroad
Roads
Sinkholes
Original Figure 9 from UMC Report (Addendum 1 to RIR "Feb-2018")
Maximum TCE Concentrations
May 2017
0 1,250 2,500 5,000 7,500 10,000 Feet
Domestic Well- Located for reference purposes only.
-Text boxes identify the well cluster and the highest TCE concentration reported in groundwater samples collected from the cluster, regardless of the bedrock unit.
-Text boxes in red > 5 µg/l
-Concentrations are in µg/l; ND indicates non-detect;
NS indicates not sampled
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Oatka Creek
Spring Creek
DC-01 A 10000
DC-02 A 450
DC-15 A 1300
LVRR-35-2 3000
DC-05 A 690
LVRR-34-3 2.5
DC-16 1500
DC-03 B 490
DC-07R B 110
LVRR-37 C 40
LVRR-20-2 760
DC-06 A 520
DC-17 A 290
LVRR-29-5 1.6
LVRR-28-3 30
LVRR-30-2 270
DC-09 A 5.0
DC-10 B 19
LVRR-33 B 53
LVRR-32-1 38
GCM-1 11
DC-12 C 11
LVRR-31-1 3.5
DC-13 B 7.8
LVRR-24 A 13
DC-14 A 7.3
1000
500
100
5

Figure 3

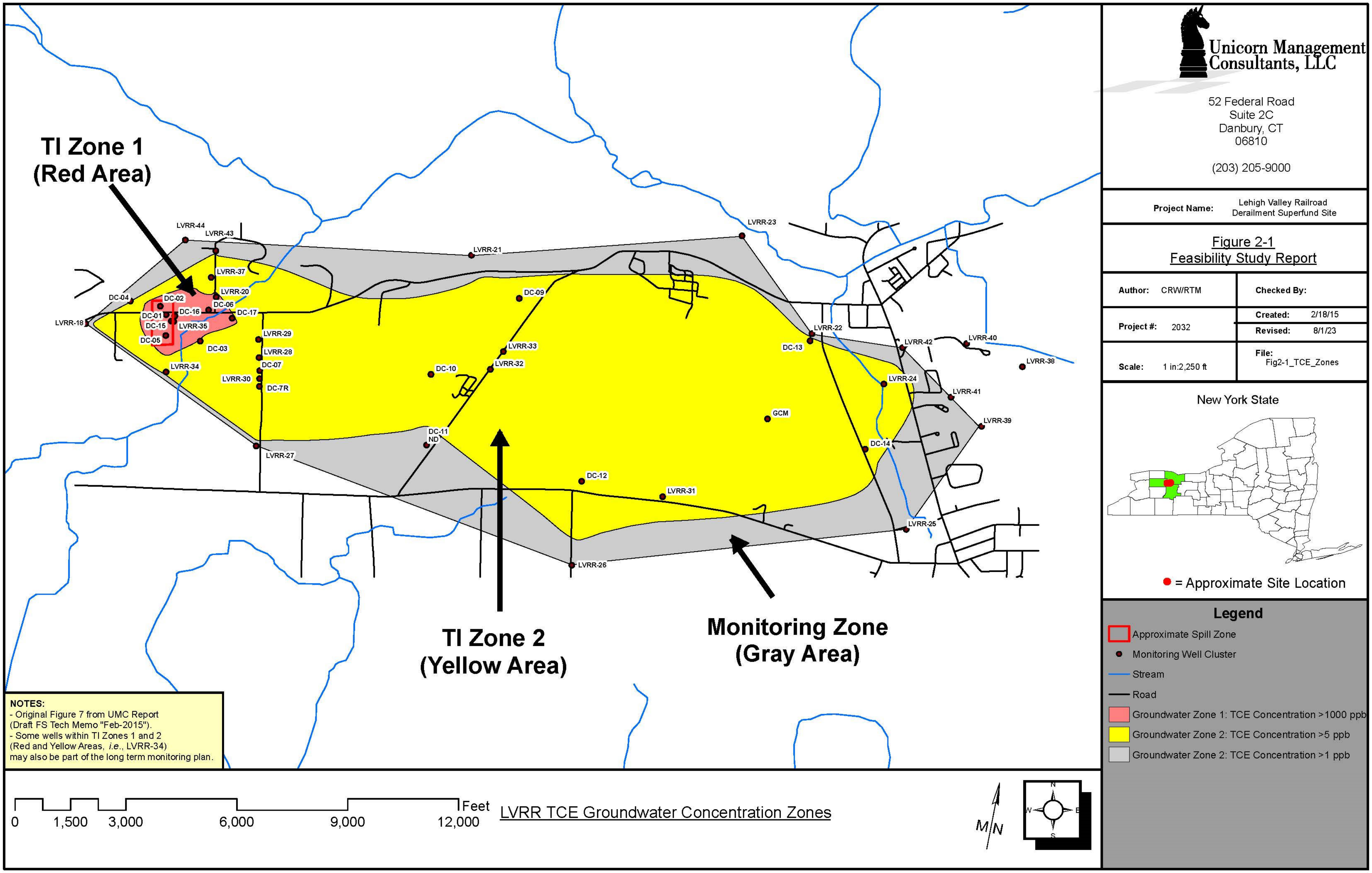
TI Zone 1
(Red Area)
TI Zone 2
(Yellow Area)
Monitoring Zone
(Gray Area)
LVRR-44
LVRR-43
LVRR-37
LVRR-20
DC-04
DC-02
DC-06
DC-17
DC-01
DC-16
DC-15
LVRR-35
DC-05
DC-03
LVRR-18
LVRR-34
LVRR-29
LVRR-28
DC-07
LVRR-30
DC-7R
LVRR-27
LVRR-21
DC-09
LVRR-33
LVRR-32
DC-10
DC-11
ND
DC-12
LVRR-31
LVRR-26
LVRR-23
LVRR-22
DC-13
GCM
LVRR-42
LVRR-40
LVRR-38
LVRR-24
LVRR-41
LVRR-39
DC-14
LVRR-25
NOTES:
- Original Figure 7 from UMC Report
(Draft FS Tech Memo "Feb-2015").
- Some wells within TI Zones 1 and 2
(Red and Yellow Areas, i.e., LVRR-34)
may also be part of the long term monitoring plan.
0
1,500
3,000
6,000
9,000
12,000
Feet
LVRR TCE Groundwater Concentration Zones
M
N
Unicorn Management
Consultants, LLC
52 Federal Road
Suite 2C
Danbury, CT
06810
(203) 205-9000
Project Name:
Lehigh Valley Railroad
Derailment Superfund Site
Figure 2-1
Feasibility Study Report
Author: CRW/RTM
Checked By:
Project #: 2032
Created: 2/18/15
Revised: 8/1/23
Scale: 1 in:2,250 ft
File:
Fig2-1_TCE_Zones
New York State
= Approximate Site Location
Legend
Approximate Spill Zone
Monitoring Well Cluster
Stream
Road
Groundwater Zone 1: TCE Concentration >1000 ppb
Groundwater Zone 2: TCE Concentration >5 ppb
Groundwater Zone 2: TCE Concentration >1 ppb

Figure 4