FOSTER WHEELER ENVIRONMENTAL CORPORATION

13 February 2002
RAC II-2002-038

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SUBJECT: USEPA RAC II CONTRACT NUMBER: 68-W-98-214
WORK ASSIGNMENT NUMBER: 040-RICO-027S
LEHIGH VALLEY SUPERFUND SITE
SUBMISSION OF FINAL WORK PLAN

Dear Mr. Bachmann and Mr. Moncino:

Foster Wheeler Environmental Corporation is pleased to submit the subject Final Work Plan for the subject Work Assignment. The Final Work Plan is submitted in accordance with Work Assignment Form (WAF) Amendment 4, dated 27 November 2001 (received 28 November 2001) which states the Final Work Plan is to be submitted within 21 days following the Technical Meeting held with EPA and Foster Wheeler Environmental Corporation, which was held on 23 January 2002.

If you have any questions or require additional information, please call me at (973) 630-8112.

Sincerely,

William R. Colvin, PMP, P.G.
RAC II Program Manager

Attachments

cc: P. Olivo - EPA (w/ attachment)

EPA WORK ASSIGNMENT NUMBER: 040-RICO-027S
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FOSTER WHEELER ENVIRONMENTAL CORPORATION
RAC II PROGRAM

FINAL
WORK PLAN
FOR
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
LEHIGH VALLEY SUPERFUND SITE
TOWN OF LEROY
GENESEE COUNTY, NEW YORK

FEBRUARY 2002

NOTICE

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GENESEE COUNTY, NEW YORK

FEBRUARY 2002

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1.0 INTRODUCTION

A Remedial Investigation and Feasibility Study (RI/FS) will be conducted at the Lehigh Valley Superfund Site (the site), in Genesee County, New York by Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) under USEPA RAC II Contract Number 68-W-98-214, Work Assignment Number 040-RICO-027S. The scope of the RI/FS has been developed in accordance with the Statement of Work (SOW) contained in the Work Assignment Form (WAF) issued by the United States Environmental Protection Agency (EPA) on 25 September 2000; WAF Amendment 001, issued 08 February 2001; EPA comments received on 07 August 2001, and 20 November 2001; and the clarifications reached during the 18 January 2002 Risk Technical Meeting and 23 January 2002 Technical Meeting.

The Work Plan is organized into the following sections:

- Section 1 provides a general introduction and statement of the objectives of the RI/FS, and presents an overview of the site background, history, and geologic setting;
- Section 2 summarizes the current state of knowledge of site-related contamination;
- Section 3 describes the planned tasks to meet the objectives of the RI/FS;
- Section 4 presents Foster Wheeler Environmental's project management approach and proposed project schedule;
- Section 5 lists references used in this document; and
- Section 6 lists the abbreviations and acronyms used in this document.

A Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) will be submitted 21 days after submittal of the Final Work Plan. The Work Plan Budget Estimate for the work described in this Work Plan will be submitted 14 days after submission of the Final Work Plan. Work Plan Budget Subtask and Subtask Activity cross references have been added to this Work Plan's Technical headings to improve correlation between the two documents.

1.1 PURPOSE

The objectives of the RI/FS are to:

- Collect the additional site investigation data necessary to support the characterization and development of remedial alternatives for the site;
- Provide remedial alternatives so that a remedy can be selected to eliminate, reduce, or control risks to human health and the environment from groundwater contamination resulting from the train derailment spill; and
- Support a Record of Decision (ROD) within thirty (30) months of EPA's approval of the Work Plan and Budget.

1.2 BACKGROUND

The information presented in the following sections has been summarized primarily from the New York State Department of Environmental Conservation (NYSDEC) RI Report for the Site prepared by Rust Environment and Infrastructure (Rust, 1996), and additional investigations conducted by NYSDEC and New York State

Department of Health (NYSDOH).

1.2.1 Site Location and Description

The Lehigh Valley Train Derailment Site (Spill Site) is located in the Town of LeRoy, Genesee County, New York (Figure 1-1). The Spill Site has been defined as an area of approximately 10 acres in the vicinity of the former Lehigh Valley Railroad crossing at Gulf Road. The area presently known to be affected by groundwater contamination extends from the Spill Site approximately 4.1 miles east, to the town of Caledonia, and is approximately 1.5 miles wide and is referred to as the Study Area (Figure 1-2). The total area of groundwater impact is currently defined to include approximately 6.5 square miles. The Study Area is roughly bounded aerially by the Oatka Creek Valley to the north, the General Crushed Stone Quarry to the west, Route 5 to the south, and Spring Creek Valley to the east.

The topography of the immediate location of the Spill Site is relatively flat, with a gradual slope to the northeast, toward the Oatka Creek Valley. The former railroad grade is level at the Gulf Road crossing at an approximate elevation of 765 feet above mean sea level (MSL). Gulf Road is drained by shallow drainage ditches along each side of the roadbed which generally drain to the east into Mud Creek, a tributary of Oatka Creek. Approximately 200 feet north of the Spill Site are the ruins of the former Knickerbocker Hotel, and approximately 375 feet to the north is a 50 foot deep abandoned limestone quarry. Bordering the Spill Site to the west is an active limestone quarry operated by the General Crushed Stone Company. The active portion of the quarry has been excavated to a depth of approximately 100 feet. To the south and east of the Spill Site, the area is open, with trees and grasslands, and residences along the roads.

1.2.2 Site History

On 6 December 1970, 25 cars of a southbound 114-car freight train operated by the Lehigh Valley Railroad derailed at the Gulf Road crossing approximately two miles east of the Town of Leroy, at the location shown on Figure 1-2. Two chemical tank cars discharged a total of approximately 30,000 gallons of virgin trichloroethene (TCE) onto the ground at Gulf Road. In addition, a freight car discharged part of its load of cyanide crystals onto the ground north of Gulf Road. The cyanide was promptly covered with tarpaulins and removed from the frozen ground surface. The TCE reportedly infiltrated directly into the ground and none was recovered.

By 10 December 1970, the owners of the Knickerbocker Hotel (located approximately 200 feet north of the Spill Site) reported solvent odors in the basement of the building. Within several days of the derailment, several homeowners located east of the Spill Site reported contamination of their domestic wells. One domestic well, located east of the Spill Site at 8389 Gulf Road, was reported to contain a TCE ‘emulsion,’ or non-aqueous phase liquid (NAPL), within several days of the spill. Due to apparent geologic an isotropy, the domestic well at the Knickerbocker Hotel was not impacted by the spill.

In response to residents’ complaints, the Lehigh Valley Railroad attempted to flush the TCE from the ground within days of the spill. A series of ditches and berms were constructed at the Spill Site by the railroad, and the ditches were flushed with approximately 1 million gallons of water, which was trucked to the site or obtained from the General Crushed Stone Quarry. Subsequently, several domestic wells east of the Spill Site were tested and found to be impacted with TCE. In early 1971, the Lehigh Valley Railroad installed granular activated carbon (GAC) units on some affected residential wells and provided cash settlements to other local residents.

The Lehigh Valley Railroad ceased operations in 1976, and the tracks were removed shortly thereafter. The corporate successor to the railroad owns the right-of-way north of Gulf Road, while portions to the south of Gulf Road are owned by the Town of LeRoy and the Northwoods Sportsman’s Club. The Spill Site is currently unsecured and accessible to the public. A fenced area, approximately 50 by 100 feet in size, which was used during the NYSDEC RI for equipment storage is located on the right- of-way approximately 200 feet south of Gulf Road.

1.2.3 Site Geology

Physiographic Setting and Quaternary Geology

The Study Area is situated within the glaciated portion of the Allegheny Plateau Physiographic Province of western New York and is underlain by gently southward dipping sedimentary rocks (primarily carbonate rocks and shales) of Paleozoic age. Erosion of these rocks has produced gentle slopes except where the more resistant rocks have been eroded to produce cuestas. Surface drainage has been incised into the landscape. Glaciation during the Pleistocene period of geologic history has modified the plateau through both erosion and deposition. The Study Area was covered by continental ice glaciers during the Wisconsin glacial stage of the Pleistocene geological epoch. These stages are represented by the Hamburg-Marilla and the Valley Heads drift sheets, respectively (Muller, 1988). Post-glacial erosion, primarily by water, has further modified the landscape to produce, for the most part, a fairly smooth terrain (Isachsen et. al., 2000).

The four USGS 7.5 minute geologic quadrangles that cover the area around and including the Study Area demonstrate a range of geomorphological features reflective of ancient as well as glacial and recent processes. The northwest quadrangle (Churchville, 1978) exhibits a modified glacial terrain consisting of eroded drumlins, meandering glacial meltwater channels, a till plain, and glacial lake (glacio-lacustrine) sediments. The northeast quadrangle (Clifton, 1976) is dominated by a northeast-southwest oriented drumlin field set amidst a till plain. Existing streams in this area have little impact on modifying the current topography. The southeast quadrangle (Caledonia, 1976) exhibits two significant physiographic features, a large delta built into the ancestral valley of the Genesee River (the site of a former glacial lake), and the current Genesee Valley. The southwest quadrangle (LeRoy, 1976) is topographically distinct from the three previously discussed. The topography in this quadrangle predominantly reflects characteristics of the underlying bedrock formations. This quadrangle, from the east-west valley of Oatka Creek to the low hills south of Route 5, is underlain by gently dipping sedimentary bedrock formations that outcrop on, or are very close to, the ground surface (Rust, 1996). The topography is flat with the exception of the Oatka Creek Valley and, to a lesser extent, the valleys of Mud and Spring Creeks. Glacial processes have affected and left a visible mark on this area. In general, the entire area has been washed over by glacial meltwater such that the high land has been eroded, leaving a scoured till and bedrock surface and relict glacial meltwater channels on the land surface (Fairchild, 1909).

Surface drainage in the Study Area follows a dendritic pattern (Figure 1-3). The major surface drainage feature of the area is Oatka Creek, which flows northward along the western border of the Study Area, over Buttermilk Falls, and then eastward along the northern border of the Study Area. Mud Creek drains a good portion of the western end of the Study Area, including the Site, as it flows to the northeast over the Mud Creek Falls to join Oatka Creek approximately 2.6 miles west of the Village of Mumford. Spring Creek appears to be the major outlet for both surface and subsurface drainage within much of the Study Area. This creek forms the eastern boundary of the Study Area as it flows north from Caledonia to join Oatka Creek at the Village of Mumford (Rust, 1996).

The unconsolidated overburden material at the Spill Site consists primarily of fill, glacial till, and weathered bedrock. The fill consists of a gray-brown, coarse to fine gravel and a little coarse to fine sand, with frequent large angular rock fragments and occasional cinders. The glacial till consists of a hard, dry, poorly sorted matrix (15-20% of unit) of a coarse to fine gravel and coarse to fine silt, with a trace of clayey silt. The weathered bedrock consists of light brown to dark gray cherty limestone. North of Gulf Road, near the ruins of the former Knickerbocker Hotel, a one to two-foot thick layer of sandy silt was encountered in the test pits (Rust, 1996).

Overburden within the railroad grade consists primarily of crushed stone railroad ballast overlying native soil, glacial till, and bedrock at relatively shallow (generally less than 5 foot) depths. Bedrock outcrops in the vicinity of the Spill Site consist of the Nedrow member of the Onondaga Formation (Rust, 1996).

Structural Geology

The major structural feature of the region is a homocline; that is, the bedrock dips generally in one direction. Joints are common physical features evident in bedrock outcrops within the western New York region and the Study Area. Joints are locally common in the Akron/Bertie dolomites, as seen in outcrops along Buttermilk Falls and Mud Creek Falls. Rock faces within the quarries indicate an apparent scarcity of joints in the Clarence member of the Onondaga Formation, with joints increasing in abundance or visibility in the overlying Nedrow and Moorehouse members. The joints in the Akron/Bertie appear to be widely divergent and oblique to bedding, whereas the joints in the Onondaga are close to vertical and perpendicular to bedding (Rust, 1996).

Superimposed upon the gently dipping bedrock strata is a complex series of linear post-glacial arches with ruptured crests. These features may be related to subsurface dissolution of evaporite-bearing rocks, isostatic adjustment, and/or glacial rebound, and are particularly noticeable in the area between Mud Creek and Flinthill (Livingston County)/Lime Rock Road (Rust, 1996). The crests of the arches generally trend east-west and are characterized by brittle ruptured crests up to one foot wide. One of these ruptured arches may be present in the area of Church Road and may influence the linearity of the groundwater plume.

During the NYSDEC RI, data were collected in areas of ridge and basin topography along portions of Church and Flinthill Roads. Geophysical data suggest that structural basins are associated with these physiographic features (Rust, 1996).

Bedrock Geology

The bedrock geology of western New York is represented by a sequence of Paleozoic strata resting upon Precambrian metasedimentary rocks. The Paleozoic section is composed of Upper Cambrian through Upper Devonian sedimentary rocks (limestone, dolomite, sandstone, and shale), which regionally attain a composite thickness of approximately 5,500 feet. Some of these bedrock units contain evaporate deposits, such as anhydrite, gypsum, and halite (Isachsen et. al., 2000).

The following is a description of the bedrock units underlying the Study Area. The information has been summarized from the NYSDEC RI (Rust, 1996).

The stratigraphy found within the Study Area is defined as follows:

Geologic Unit		Age
Onondaga Formation		**Devonian**
	Moorehouse Member	
	Nedrow Member	
	Clarence Member	
	Edgecliff Member	
Bois Blanc Formation		
Akron Formation		**Silurian System**
Bertie Formation		
	Williamsville Member	
	Scajaquada Member	
	Falkirk Member	
Camillus Formation		
Syracuse Formation		

The geologic units are described below in ascending order, i.e. from the deepest (oldest) to the shallowest (youngest).

Silurian System

Syracuse Formation

The upper portion of the Syracuse Formation consists predominantly of dolomites and evaporite (anhydrite, gypsum, salt) deposits. Several mining companies have produced gypsum in Erie, Genesee, and Monroe Counties. The mined gypsum beds lie 150 to 225 feet below the base of the Onondaga Formation, which indicates that they lie within the uppermost unit (Unit F) of the Syracuse Formation. The interpreted thickness of Unit F at the MacDonald 1 well in Livingston County is roughly 80 feet (Rickard, 1969). This unit is defined as the base of the Study Area for this investigation due to the presence of the evaporites which preclude its use as a potable water supply.

Camillus Formation

Outcrops of the Camillus Formation were not observed within the Study Area. However, field and drilling evidence collected during the NYSDEC RI indicate that the Oatka Creek Valley north of the Onondaga escarpment is underlain by the Camillus. The northern portions of both the Mud and Spring Creek Valleys are also surmised to be underlain by the Camillus Formation (Rust, 1996).

The entire thickness (approximately 65 feet in the Study Area) of the Camillus Formation was cored at three locations, and at least half of the formation was cored at three other locations during the NYSDEC RI. In the Study Area, the unit consists of a medium light gray to dark gray, fine-grained, crystalline argillaceous dolomite.

Bertie Formation

Overlying the Camillus is the Bertie Formation, a 45-foot thick sequence of argillaceous dolomites. The Bertie Formation is subdivided into three members, in ascending order -- the Falkirk, Scajaquada, and Williamsville dolomites.

Falkirk Member

The Falkirk member ranged from 27 to 32 feet in thickness at the six coring locations. This member of the Bertie ranges from a fine-grained to microcrystalline, thin-bedded to massive, dolomite. Single dipping fractures of narrow aperture commonly occur throughout the Falkirk member. Heavily fractured intervals are rare (Rickard, 1966).

Scajaquada Member

The thickness of this member, as cored during the NYSDEC RI, varies from 1 foot to 8 feet. This member consists of medium dark gray to pale yellowish-brown dolomite layers, with dark gray argillaceous seams and partings. The member is thin-bedded, fine-grained, and occasionally has a laminated appearance (Rickard, 1966).

Williamsville Member

This uppermost member of the Bertie Formation appears to have been completely eroded away at all but two coring locations. The Williamsville is a medium light gray to light gray, laminated, crystalline dolomite with a massive appearance (Rickard, 1966).

Akron Formation

The Akron Formation is the uppermost rock unit of the (complete) Silurian section. The thickness of this unit at the four coring locations where it was encountered during the NYSDEC RI were between 5 and 8 feet. The formation is described as a medium-gray to yellowish gray, fine-grained crystalline dolomite.

Devonian System

Bois Blanc Formation

This formation is less than three feet thick at locations cored during the NYSDEC RI, and disconformably overlies either the Akron Formation or, more commonly, the Scajaquada member of the Bertie Formation. The limestone is generally medium gray to medium light gray, fine-grained to coarse-grained crystalline rock, with 0 to 80 percent by volume chert (Rickard, 1966).

Onondaga Formation

The uppermost (youngest) bedrock formation exposed at the Site and within the Study Area is the Middle Devonian Onondaga Formation. The complete Onondaga section is reported to be approximately 140 feet thick and is composed of five members. In ascending order, the members are the Edgecliff, Clarence, Nedrow, Moorehouse, and Seneca limestones. The Moorehouse and Seneca members are separated by a 2 to 4-inch thick ash bed known as the Tioga Bentonite (Rust, 1996).

Edgecliff Member

This geologic unit consists of medium dark gray to medium light gray fossiliferous limestone (Oliver, 1966). The base of the limestone often contains detrital quartz which rapidly decreases in abundance up section. Light colored chert nodules are scattered throughout the Edgecliff, but are more common at the top of the member as it grades into the Clarence member. The thickness of the Edgecliff at locations cored during the NYSDEC RI ranged from 3 to 11 feet (Rust, 1996).

Clarence Member

The Clarence member is typically a light gray to medium dark gray, medium-grained to microcrystalline, medium to thin-bedded limestone containing up to 70% chert. The Clarence is approximately 31 feet thick. Joints are not well developed in the Clarence, as evidenced by observations of outcrops and quarry exposures, but have been noted near Mud Creek (Rust, 1996).

Nedrow Member

This member is a medium gray to medium light gray, very fine grained to coarse grained crystalline limestone. The core volume is comprised of up to 20% medium dark gray to black chert. The maximum thickness of the Nedrow cored during the NYSDEC RI was 43 feet (Rust, 1996).

Moorehouse Member

The Moorehouse member is medium gray, finely crystalline argillaceous limestone approximately 25 feet thick. Chert is found throughout the member but is most abundant at the top of the section (Rust, 1996).

Although not penetrated by any of the borings during the NYSDEC RI, the Moorehouse member is projected to be present in the Study Area, south of Route 5 and north of Harris Road/Cider Street (Rust, 1996).

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

2.1 INVESTIGATION HISTORY

In 1990 and 1991, the NYSDOH sampled domestic wells east of the Spill Site as part of an unrelated investigation. The sampling included wells between the villages of Mumford and Caledonia. More than 35 domestic wells were found to be impacted by TCE. In response to these findings, GAC units were installed on those wells above the NYSDOH drinking water standard of 5 parts per billion (ppb). Based on the sampling results, the area of impacted groundwater was broadly defined as extending east from the Spill Site, bounded to the south by Route 5, to the north by Oatka Creek Gorge, and by Spring Creek to the east.

In 1991, the NYSDEC and NYSDOH listed the Spill Site on the New York State Registry of Inactive Hazardous Waste Disposal Sites as a "Class 2 Site," signifying that it posed a significant threat to the environment and/or public health and that remedial actions were required. An Operation and Maintenance (O&M) program was initiated to maintain the GAC treatment units installed on the domestic wells. An RI/FS was conducted in 1992-1993 to characterize the nature and extent of the soil and groundwater contamination. The costs for the O&M and RI/FS programs were obtained from the New York State Superfund Program and performed by Rust Environment and Infrastructure.

Ongoing domestic well sampling was conducted from 1991 through 1993 on a generally monthly basis by NYSDOH and Dunn Geoscience (acquired by Rust in 1993) under various programs. The results of these sampling events were reported to the NYSDEC in the Domestic Well and Initial Sampling Report, Operable Unit #1 (Groundwater) (Dunn, 1993b).

A First Phase RI/FS was submitted to the NYSDEC in July 1995. Analytical results from water sampling rounds 1 through 5 were incorporated into the RI Report. Subsequently, three additional rounds of domestic well, surface water, and monitoring well sampling were conducted at the request of the NYSDEC. These rounds, designated 6 through 8, were of limited scope and were performed in October 1994, and January and April 1995, respectively. The results of these additional sampling rounds were submitted to the NYSDEC in the Addendum to Hydrogeologic Investigation Report (Rust, 1996).

The following sections provide a brief summary of the NYSDEC RI/FS objectives and results.

<u>Phase A – Initial Background and Site/Study Area Investigations</u>

Phase A consisted of a compilation and review of available historical records pertaining to the derailment and spill, records concerning subsequent impacts and actions taken to mitigate spill effects, and local geology. An aerial photograph review, fracture trace analysis, field reconnaissance, surficial geophysical survey, and soil gas survey were conducted. These activities were conducted from April through June 1992 and were documented in the report submitted to the NYSDEC titled "Task 2, Phase A Report State Superfund Standby Program, Lehigh Valley Railroad Derailment Site RI/FS Town of LeRoy County of Genesee, New York," dated August 1992.

<u>Phase B – Focused Investigation of Soil Contamination in the Spill Site and an Initial Domestic Well and Environmental Sampling Program</u>

Phase B was defined by the conclusions and recommendations contained in the Phase A report and included a focused investigation of the soils at the Spill Site, collection of groundwater samples from selected domestic wells, and collection of surface water samples from streams, springs, and ponds. The following summarizes the scope and results of the Phase B investigation.

Limited Soil Sampling

NYSDEC personnel collected soil samples at two locations at the Spill Site in September 1992. The sampling locations corresponded with the locations of the two highest results identified during the soil gas survey. The results of the soil sampling indicated TCE concentrations of 290 ppb and 570,000 ppb were present, and thus confirmed the results of the soil gas survey with respect to residual TCE contamination.

Test Pitting – Soil Sampling

Seventeen test pits were dug north and south of the Spill Site in December 1992. The test pits were dug to examine subsurface materials in their natural state, collect samples for geologic logging and chemical analysis, determine the depth to bedrock, and examine the bedrock surface for evidence of fractures. The overburden (soil) consisted of glacial till and manmade materials. Natural bedrock was encountered from 1.5 to 9.25 feet below ground surface (bgs), with bedrock not encountered in one test pit to a depth of 11.5 feet bgs. Depth to bedrock was greater on the north side of Gulf Road. Headspace analysis performed on soil samples using a photoionization detector (PID) ranged from non-detect (ND) to 70 parts per million (ppm).

Groundwater was encountered at the overburden/bedrock interface in Test Pit 4. A sample of this groundwater collected for laboratory analysis contained 32 ppb of TCE.

Twenty-eight soil samples were collected from the 17 test pits for laboratory analysis. Ten soil samples were analyzed for full Target Compound List/Target Analyte List (TCL/TAL) parameters and 18 soil samples were analyzed for TCL Volatile Organic Compounds (VOCs) and cyanide.

TCE was present at elevated (>1 ppm) levels in soil samples collected from six test pits. These results correlated with the results of the soil gas survey. Total 1,2-Dichloroethene (DCE) was detected in soil samples from four test pits. DCE is one of the many breakdown products that naturally occur during weathering/degradation of TCE. DCE was the only breakdown product detected in the soils in the spill area. 1,1,1-Trichloroethane (TCA) was detected in seven soil samples (from seven different test pits) at concentrations that range from 2 to 28 ppb. The source of TCA is not known; however, it was also detected at a low concentration in one nearby domestic well. Benzene was detected in one soil sample and toluene was detected in three soil samples from locations that correspond to the railroad right-of-way and the former parking area of the Knickerbocker Hotel. Concentrations of these compounds were below the laboratory reporting limits. Cyanide was detected in three soil samples at concentrations that ranged from 5 to 25.3 ppm.

Polynuclear Aromatic Hydrocarbons (PAHs) were detected above NYSDEC cleanup objectives in seven soil samples. These occurrences were most likely related to fill and/or runoff associated with Gulf Road and the railroad bedding material. Pesticides were detected in excess of the NYSDEC cleanup objectives in one soil sample. These compounds were not thought to be related to the spill. Several metals (arsenic, cadmium, copper, mercury, nickel, and zinc) were detected in excess of the NYSDEC Recommended Soil Cleanup Objectives and the Eastern USA Background Metals Concentrations. The occurrence of these metals was not attributed to the spill.

Groundwater

The results of domestic well, spring, and sediment sampling were submitted to NYSDEC in the Domestic Well and Initial Environmental Sampling Report (May, 1993). Only the conclusions and recommendations from this report were included as Appendix A of the Phase C RI Report.

The conclusions state that the water quality of sampled domestic wells along Route 5 (south of the Spill Site) rule out the occurrence of DNAPL migration as far as Route 5 within the stratigraphic interval sampled. Analytical results suggest that "the structural feature which contains Mud Creek intercepts easterly-flowing subsurface contaminants, …providing a route to surface discharge points in the Mud Creek valley within a few thousand feet of the Site" (Dunn, 1993).

<u>Conclusions of the Phase B Investigation</u>

Analytical data indicated that a substantial amount of TCE remained in the overburden at the Spill Site. This area was delineated through the soil gas survey and the test pitting program. Six test pits contained TCE that exceeded the NYSDEC Recommended Soil Cleanup Objective of 700 ppb. It was generally observed that in test pits where TCE was detected in excess of the NYSDEC cleanup objectives, the soil column was contaminated from land surface to the top of bedrock. On the basis of the Phase B investigation, it was determined that approximately 15,000 cubic yards of soil at the Spill Site were contaminated with TCE in excess of the NYSDEC Recommended Soil Cleanup level.

<u>Phase C - Comprehensive Hydrogeologic Investigation, Habitat Based Assessment (Fish and Wildlife Impact Analysis) and Human Health Risk Assessment (Quantitative Human Health Evaluation)</u>

The following activities were performed during the Phase C RI: installation of 55 monitoring wells, multiple sampling rounds of the monitoring wells and selected domestic supply wells, and five rounds of sample collection of surface water, spring water, and sediment samples over the Study Area. In addition, a Fish and

Wildlife Impact Analysis (FWIA) and quantitative human health risk assessment were also performed. The following summarizes the scope and results of the Phase C investigation.

Field Investigation

GPR surveys were conducted in July 1993 to gain information about the nature and extent of bedrock deformation, and to help define drilling locations. The radar penetrated 30 to 70 feet deep and confirmed many of the features observed during the Phase A GPR surveys, e.g., dipping bedrock surfaces, thickening or thinning strata, and truncated or chaotic reflection patterns. The GPR survey data was not useful for identifying faulted or fractured bedrock known to exist within the Study Area.

Fifty-eight monitoring wells have been installed at 19 locations. Each location consists of a cluster of one to four monitoring wells. Table 2-1 presents the geologic units monitored in each well. Eighteen well clusters (55 monitoring wells) were installed by Rust in 1993. Three monitoring wells MS-1, MS-2, and MS-3 were installed at the Genesee Country Museum in 1997 under the direction of NYSDEC. Overburden samples, core samples, and rock cuttings were screened for visual evidence of NAPL and organic vapors with a photoionization detector (PID). NAPL was not observed on any of the samples or cuttings. A portable gas chromatograph (GC) was also used to screen for spill-related VOCs in groundwater samples generated through packer testing during drilling. The GC was calibrated to analyze for TCE and cis and trans-1,2-DCE. The data generated were used to delineate the relative level of VOCs in each groundwater zone tested, and assess the distribution of contamination at the Spill Site and in the Study Area. The wells were completed using either stainless steel or PVC screens and risers. Following the completion of well installation, 36 wells were fully developed, nine were partially developed (the wells went dry before five well volumes of water were removed or before turbidity criteria could be achieved), and ten wells were dry.

At 15 monitoring well locations, the deepest borehole was logged using gamma ray and caliper tools. A borehole video log was also obtained at each location. The gamma logs exhibited features that enabled the various geological formations in the Study Area to be identified. The caliper logs recorded interception of fractures by the borehole. In some instances, caliper breaks could be correlated from hole to hole, suggesting regional bedding plane fractures were present.

The video logs provided a visual record of borehole conditions at the 15 locations. Observed features included bedding plane fractures, dipping fractures, stratigraphic contacts, perched water inflow, water inflow below the static water level, "weathered" bedrock zones, and voids. The video data analysis was performed in the field in order to determine well completion zones.

JCI Jones Chemical Facility Investigation

Groundwater and hydrogeologic data was received from EPA on the Former JCI Jones Chemical Facility (Jones Chemical) located east of Spring Creek where a VOC plume has been identified (LFR 1999). A review of the data indicates the plume as currently delineated has no established relationship to the Spill Site. The hydrogeologic relationship of Jones Chemical is not currently known due to pumping effects from Caledonia's municipal supply wells and other production wells in the area. In addition, the influence of Spring Creek as a regional discharge boundary has not been established. The monitoring wells installed at the Jones Chemical Site are screened primarily in the unconsolidated formation and in the upper 20 feet of the bedrock and do not provide adequate data on the bedrock groundwater quality east of Spring Creek.

Aquifer Testing

Hydraulic conductivity (K) tests (slug tests) were conducted on all monitoring wells to evaluate aquifer properties. The results indicate horizontal hydraulic conductivity for all bedrock units ranges from 1.6E-06 cm/sec to 4.8E-02 cm/sec. The high K values are consistent with documented observations, including bedrock core analysis, borehole caliper and video logs, and water level monitoring.

Environmental Monitoring

A comprehensive environmental monitoring program was conducted from July 1993 to July 1994. The purpose of the program was to provide information on the nature and behavior of the hydrogeologic system and fate and transport of the chemicals of concerns (COCs) within the system. The program drew upon the results of the NYSDEC RI investigations and included water level monitoring points, rain gauges, and sampling points (monitoring wells, domestic wells, and environmental locations such as streams, springs, and ponds). Additional baseline sampling, designated as Round 1 of Phase C, was performed in July 1993 and involved the collection of samples from streams, springs, and ponds. Rounds 2 through 5 were conducted on a quarterly basis from November 1993 through July 1994 and consisted of water level data collection and water sample collection from the 55 monitoring wells, domestic supply wells and environmental sampling locations. Although all 55 monitoring wells were sampled during each round (unless the well was dry), not all of the same domestic wells or environmental sampling points were sampled. Certain locations were repeatedly sampled to monitor baseline and changing conditions; however, the variable locations were selected to monitor seasonal changes, to fill in data gaps, and to take advantage of newly discovered monitoring points.

Analytical Results

The environmental sampling demonstrated a pattern of TCE migration from the Spill Site northeast into the Mud Creek valley. TCE concentrations tended to decrease away from the Spill Site and away from the springs discharging into Mud Creek. TCE levels also change in response to high and low groundwater conditions, with increases occurring during the spring high water conditions. Environmental sample results for the central part of the Study Area were generally ND, and the results for Spring Creek ranged from ND to very low levels of TCE.

Domestic wells that were sampled for three or more rounds exhibited varying levels of TCE concentrations. Wells from the Spring Creek area overall exhibited lower TCE concentrations than wells located farther west.

Fate and Transport of Contaminants

Historical documentation of the original spill indicates TCE contaminated two domestic supply wells located 3,300 feet southeast of the Spill Site, within one month of the spill. The Phase B investigation indicated approximately 15,000 cubic yards of overburden materials contaminated with TCE in excess of the NYSDEC-recommended soil cleanup objectives. TCE in the form of NAPL continued to be present in the bedrock vadose zone and sustained the dissolved-phase plume.

The results of the sampling and analytical programs suggested that less than 1% (200 gallons) of the volume of TCE reportedly spilled (30,000 gallons) in the train derailment was contained within the dissolved phase plume. The continued presence of high TCE concentrations relative to degradation products suggested TCE degradation was not occurring to any significant degree.

Lateral and vertical migration of the plume occurred through bedding plane and high-angle fractures. The occurrence of bedding plane fractures at the same stratigraphic position in different borings suggested the fractures may be continuous between the borings. In certain areas, high-angle fractures appeared to be the primary routes of groundwater flow (Rust, 1996).

A volume exchange time (VET) analysis was performed to estimate the time needed to naturally replace a certain volume of water within the area that had been impacted by the contaminant plume. The analysis, using two different approaches, suggested approximately 18 years would be needed to replace water in the fractures (secondary porosity), and an estimated 131 years to replace water in the micropores (primary porosity).

The theory concludes that once a control structure has been set up to remove or isolate the TCE source, natural water volume replacement processes would remove the TCE contamination within the Study Area in a period of 20 years or less.

Feasibility Study

A Feasibility Study (FS) was performed to assess remedial technologies and alternatives for the contaminated area. Two operable units (OUs) were identified. The first OU consisted of the contaminated overburden (soil, railroad ballast, broken rock, fill, etc.) at the Spill Site. The second OU consisted of a combination of the vadose zone and contaminated groundwater and was designated the groundwater OU. The vadose zone thickness exhibited significant variation, not only on a seasonal basis but also in response to instantaneous events such as a significant rainfall or a spring thaw. The variations in water table elevation and the downward percolation of meteoric water can cause additional contamination to be flushed from the vadose zone and into the groundwater. The results of the FS were submitted to the NYSDEC under separate cover.

Quantitative Human Health Evaluation

Based on the findings, two current exposure scenarios had the potential to pose long-term health risks. The pathways identified were: direct contact with Site soils by a nearby resident trespassing on the Site, and ingestion and household use of groundwater by nearby rural residents.

It was determined that direct contact with soils may pose a carcinogenic risk, primarily associated with the presence of PAHs associated with railroad construction/use materials and the presence of PAHs was not related to the derailment/spill.

The non-carcinogenic hazards and excess cancer risks to nearby residents from ingestion and household use of groundwater were primarily due to the presence of TCE. Future use scenarios based upon subsequent habitation of the Spill Site concluded unacceptable health risks existed and that remediation of the TCE-contaminated soils was necessary.

Fish and Wildlife Impact Analysis

The FWIA had two objectives: 1) identify the fish and wildlife resources that exist in the vicinity of the Site, or that existed prior to the introduction of spill-related contaminants, and that could be potentially affected by spill-related contaminants; and 2) determine the impacts, if any, of spill-related contaminants on fish and wildlife resources.

The FWIA also analyzed pathways through which wildlife could potentially be exposed to spill-related contaminants. These pathways included: contact via contaminated surface water or groundwater via discharge through springs, and contaminated sediments. The greatest potential impact would be to aquatic species, mainly fish, macroinvertebrates, and amphibians. The physical properties of the spill-related contaminants indicated that bioaccumulation should not be a significant factor. Therefore, wildlife consumers of potentially impacted fish, macroinvertebrates and/or amphibians were not considered at risk.

Analytical data from the Mud Creek drainageway indicated that the reported TCE concentrations were not a threat to aquatic life. The available sediment data from the Mud Creek drainageway indicated TCE and cis-1,2-DCE concentrations did not represent a threat to the breeding and survival of fish, and that TCE concentrations did not represent a significant threat to human health, based on the toxic effects associated with bioaccumulation.

Data from the Spring Creek drainageway indicated that surface water quality in Spring Creek had not been significantly impacted by spill-related contaminants.

Conclusions

The extensive drilling program revealed that high-angle and bedding plane fractures are found throughout the Study Area in all stratigraphic levels. In some areas, extensive fracture dissolution has enabled the fractures to transmit large amounts of water. Regionally, groundwater flows towards the east. Spring Creek appears to serve as a discharge area for much of the groundwater beneath the Study Area. The creek is sourced by multiple, large volume springs that are projected to occur at or near the top of the Bertie Formation. Thick deltaic deposits east of Spring Creek and south of Caledonia may also receive significant discharge from the hydrogeologic system. Groundwater also discharges in Mud Creek Gorge, via the exposed Bertie and Camillus Formations.

Groundwater elevations exhibit considerable fluctuation seasonally and in response to instantaneous precipitation events.

Although NAPL was not actually detected, the high TCE levels seen in some groundwater samples strongly imply the presence of NAPL near some well locations. There is evidence that NAPL spreading has occurred in the vadose zone above the normal position of the water table. Rising groundwater during the spring months comes into contact with this residual NAPL and creates a highly contaminated “slug” of groundwater.

Under current conditions, two potentially complete exposure pathways exist for nearby residents, only one of which is directly related to the spill. Under future conditions, potentially complete exposure pathways exist that pose unacceptable risk conditions that justify remediation of TCE-contaminated soils at the Spill Site.

The FWIA indicated reported TCE concentrations are below the calculated guidance value for protection of aquatic life, and spill-related contaminants have not adversely impacted water quality with respect to aquatic life. Data from Gorge Pond in the Mud Creek drainageway and from Spring Creek indicate water quality in Oatka Creek would not be adversely impacted by spill-related contaminants discharged in the water from these two areas.

Additional Investigations – 1997 -1998

Monitoring Well Installation – Genesee Country Museum

In July 1997, a monitoring well cluster (3 wells) was installed on the property of the Genesee Country Museum, located west of Caledonia, to evaluate the potential threat to the museum’s potable water supply. One round of sampling for VOCs was conducted in July 1997. TCE was detected in the shallow and deep wells at concentrations of 30 ppb and 18 ppb, respectively. TCE was not reported above the detection limit of 10 ppb in the intermediate depth well.

Spill Site Vapor Extraction Pilot Test

In 1998, further investigation of the unsaturated bedrock at the Spill Site was conducted. Twenty-nine wells (60 feet deep) were installed across the ten-acre suspected NAPL zone for use in a pilot vapor extraction test. Rock cores were collected from two well borings for chemical analysis for residual TCE. During drilling, a NAPL sheen was observed on two rock core samples and strong solvent odors were noted during the preparation of many samples for analysis. Data collected indicated that residual NAPL was primarily contained in the upper 35 to 40 feet of the site, with little or no NAPL present below the Clarence member of the Devonion Onondaga Formation. Packer testing of the vapor extraction wells indicated extraction vapors changed with depth across the test area. The vapor extraction test also showed excellent applied vacuum response in some wells and virtually no response in others, highlighting the variable nature of the fractured bedrock. Results of the vapor extraction study indicated that the NAPL source was apparently concentrated in a near north-south trending axis through the Spill Site. The areal and vertical trends combined suggested that the NAPL migrated along the bedding planes (downdip) in a southerly direction, successively dropping into lower stratigraphic layers as it migrated south.

2.2 SUMMARY OF SITE HYDROGEOLOGY

Hydrogeology

The conceptual hydrogeologic model (presented in the NYSDEC RI) consists of a single hydrogeologic unit comprised of sedimentary, bedded limestone and dolomite (carbonate) rock. The sequence comprising the hydrogeologic unit includes the lower members of the Onondaga Formation, the Bois Blanc, Akron, Bertie, and Camillus Formations, and the uppermost strata of the Syracuse Formation (Rust, 1996). The single hydrogeologic unit concept may be over simplified, however, due to the fact that the TCE spill occurred 30 years ago, the groundwater plume has migrated and reached some degree of equilibrium, producing a gross-scale approximation of an isotropic system (Rust ,1996). Localized areas of perched water were identified at a few locations (identified in the Rust Report as DC-2, DC-4, and DC-8 and shown on Figure 3-2). Also, the Falkirk member of the Bertie Formation may be hydraulically isolated from the underlying rocks at well clusters DC-2 and DC-4. Otherwise, the water level data indicate that the entire investigated thickness of bedrock (up to 200 feet) beneath the study area behaves as a single hydrogeologic unit (Rust, 1996). A rubbleized zone was observed in the lower 40 feet of the Camillus Formation that appeared to represent the greatest potential for transmitting groundwater (Rust, 1996). The origin of this zone is unknown, but may be related to the dissolution of evaporite deposits (Rust, 1996). The conceptual hydrogeologic model is one of a dynamic aquifer system that is capable of transmitting large volumes of groundwater over a relatively short period of time (Rust, 1996).

Major bedding planes were observed and correlated (using caliper logs) between wells as far apart as 2.5 miles within the lower Onondaga Formation during the NYSDEC RI. Extensive bedding plane fractures were also observed within the Williamsville member (dolomite) of the Bertie Formation across the Study Area (Rust, 1996). Steeply dipping fractures were identified near the top of the Falkirk member of the Bertie Formation.

Hydraulic conductivity tests (K) yielded high values for a bedrock system. The dipping fractures and solution widened bedding planes provide high permeability flowpaths within the system (Rust 1996). It is postulated that at least two zones of significant recharge to the groundwater system exist (Rust, 1996). Runoff from the till covered uplands south of the Study Area are the source of recharge and sinking streams are the mechanism for recharge (Rust, 1996).

Hydraulic head between wells in many well clusters are remarkable consistent and show very little variation with stratigraphic position (Rust, 1996). This indicates groundwater flow is generally horizontal throughout the study area. Several well clusters showed reversed vertical gradients between high and low groundwater level conditions, with downward gradients present during high water, indicating recharge to the hydrogeologic system (Rust ,1996).

Monitoring wells in the area of Spring Creek (identified in the Rust Report as DC-13 and DC-14) showed the least variation form periods of high water and low water (Rust, 1996). Groundwater levels in the wells located west (upgradient) of Spring Creek were up to 17 feet higher than the elevation of the creek. At all times a downward hydraulic gradient was observed in these well clusters (Rust, 1996). Spring Creek is postulated to receive discharge from the Bertie and Camillus Formations (Rust, 1996).

Groundwater flow was measured in 3 zones during the NYSDEC RI; the Onondaga-upper Bertie Formation (shallow), the Falkirk member of the Bertie Formation (intermediate), and the lower portion of the Camillus (deep). Groundwater levels in the study Area are at their highest in the spring and lowest in the late summer/early fall (Rust, 1996). Continuous water level monitoring indicate that groundwater levels increase slowly over the winter months and then, with the influx of recharge in the spring, begin to discharge to surface water channels (i.e., Mud Creek) (Rust, 1996). Discharge to Spring Creek remains relatively constant throughout the year (Rust, 1996).

The three monitored zones indicate the horizontal component of groundwater flow is generally to the east. During high water conditions, groundwater flow is generally east, with a northerly component in the vicinity of Gulf Road. During low water conditions, groundwater flow is generally due east, toward Spring Creek. Groundwater flow during low water conditions in the Onondaga-Upper Bertie (shallow zone) is radial near the Spill Site, and has a slight southeasterly component (Rust, 1996). Discharge to the Mud Creek channel between Route 5 and Gulf Road occurs during high water conditions.

2.3 SUMMARY OF SITE CONTAMINATION

Extensive groundwater, surface water, soil, and sediment samples were collected at the site to characterize the nature and extent of contamination. Of the two chemicals spilled as a result of the derailment, (TCE and cyanide), only TCE has been found to have migrated away from the Spill Site. Cyanide has been detected at low levels near the spill and in groundwater immediately adjacent to the Spill Site. Cyanide was detected in one groundwater seep in Mud Creek Gorge and groundwater from one monitoring well exceeded the NYSDEC groundwater standard for cyanide.

TCE is the principle groundwater contaminant of concern at the site. In pure form, TCE is a clear, colorless, liquid with a boiling point of 186 degrees Fahrenheit, and a distinct odor. It is 42 percent more dense than water and tends to sink rapidly through the soil and fractured bedrock until it encounters a barrier that restricts its flow. Horizontal migration takes place along joints, fractures, and lithologic boundaries. Throughout the RI performed by Rust (1993-1997), few water samples (monitoring well, domestic well, spring or surface water) exhibited detections of TCE break-down products such as 1,2-DCE. This suggests that natural TCE degradation is not occurring to any significant degree.

2.4 SURFACE AND SUBSURFACE SOIL CONTAMINATION

The following table, taken from Phase B Investigation (Rust, 1996), summarizes the detected contaminants and their maximum reported concentrations in test pit soil samples, which were analyzed for VOCs, SVOCs, pesticides, and metals.

Volatile Organic Compounds	**Maximum Detected Level (ug/kg)**
Trichloroethene	230,000
1,2-Dichloroethene	2,100
Semi-Volatile Organic Compounds	
Benzo (a) Anthracene	3,200
Chrysene	3,000
Benzo (b) Fluoranthene	5,000
Benzo (k) Fluoranthene	4,300
Benzo (a) Pyrene	2,400
Pesticides	
Heptachlor Epoxide	31
Endrin	170

Volatile Organic Compounds	Maximum Detected Level (ug/kg)
Metals	
Arsenic	17,800
Cadmium	2,000
Copper	5,060,000
Mercury	30,400
Nickel	48,800
Zinc	10,200,000

Source: Rust, 1993

2.5 SEDIMENT AND SURFACE WATER CONTAMINATION

Springs discharging TCE-contaminated water were found along Mud Creek below the falls and along Spring Creek. These springs were sampled during the 1993-1994 environmental sampling program. In addition, surface water samples from both the Mud Creek and Spring Creek drainageway were also collected and analyzed. Sediment samples from the drainageway have not indicated adverse TCE impacts. The following table summarizes the concentrations of TCE detected.

Media	Class	Contaminant of Concern	Concentration Range	Frequency of Exceedance
Spring Water	VOCs	Trichloroethene	ND to 1,900 ug/l	7 of 12
Surface Water in Streams	VOCs	Trichloroethene	ND to 29 ug/l	1 of 7
Sediments	VOCs	Trichloroethene	ND to 170 ug/kg	2 of 13

Source: NYSDEC, 1997

2.6 BIOTA CONTAMINATION

A NYSDEC fish hatchery located three miles east of the Spill Site utilizes water from Spring Creek for fish propagation. Although there are springs that discharge TCE-contaminated groundwater to Spring Creek, no adverse wildlife impacts have been identified. The FWIA (Rust, 1996) found that reported TCE concentrations in spring and surface water samples were below the calculated TCE guidance value for protection of aquatic life. Therefore, the FWIA concluded that spill-related contaminants have not adversely impacted water quality in the Mud Creek and Spring Creek drainage-ways with respect to aquatic life.

2.7 GROUNDWATER

The TCE spill has had a significant impact on groundwater within the Study Area. Samples collected from monitoring wells and domestic supply wells frequently exhibited TCE concentrations above the NYSDOH State Criteria Guidance (SCG) of 5 ug/l.

Media	Class	Contaminant of Concern	Concentration Range	Frequency of Exceedance
Groundwater	VOCs	Trichloroethene	ND to 58,000 ug/l	46 of 55

Source: NYSDEC, 1997

3.0 WORK PLAN FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY

The tasks detailed below (Tasks 1 through 16 of the RI/FS), reflect those in the SOW (Attachment 1 of the WAF dated 25 September 2000 as revised in WAF Amendment 1 dated 8 February 2001). This Work Plan is also based on the information in background documents provided by the EPA, NYSDEC, observations made during the 14 November 2000 Site Visit, EPA comments received 07 August 2001 and 20 November 2001, and clarifications reached during the 18 January 2002 Risk Technical Meeting and 23 January 2002 Technical Meeting.

Task 1 Project Planning and Support
Task 2 Community Relations
Task 3 Field Investigation
Task 4 Sample Analysis
Task 5 Analytical Support and Data Validation
Task 6 Data Evaluation
Task 7 Assessment of Risk
Task 8 Treatability Study and Pilot Testing - Not Applicable
Task 9 Remedial Investigation Report
Task 10 Remedial Alternatives Screening
Task 11 Remedial Alternatives Evaluation
Task 12 Feasibility Study Report
Task 13 Post RI/FS Support
Task 14 Negotiation Support
Task 15 Administrative Record
Task 16 Work Assignment Closeout

A detailed description of each task is presented in the following sections.

3.1 TASK 1 - PROJECT PLANNING AND SUPPORT

The project planning task includes the efforts for execution and overall management of all required tasks within the SOW. Technical and management activities required to perform the investigatory and risk assessment activities, along with associated costs, have been developed during the planning phase and are presented in this Work Plan. Activities required for general Work Assignment management, including preparation of monthly progress reports and invoices, that will occur throughout the duration of the project are also included in this task. Specifically, Foster Wheeler Environmental will perform the activities detailed in the following subsections.

3.1.1 Project Administration

Project administration support executed during the performance of this Work Assignment as part of Task 1 includes both RAC II Program support and project-specific management activities.

Program Administration Activities (Subtask 1.01) will include:

- Review of the Work Assignment Technical/Financial status;
- Technical resource management;
- Review of Work Assignment budget;
- Respond to questions from EPA Project Officer/Contracting Officer (PO/CO); and
- Invoicing.

Project Management Activities (Subtask 1.02) will include:

- Preparation of the technical monthly report;
- Review of weekly financial reports;
- Review and update of project schedule;
- Attend quarterly internal RAC II meetings;
- Weekly communication with EPA WAM; and
- Preparation of staffing plans.

3.1.2 Attend Scoping Meeting (Subtask 1.03)

A Scoping Meeting was held between EPA and Foster Wheeler Environmental on 1 February 2001 at which time the SOW was discussed. This meeting focused solely upon the contractual scope of the RI/FS Work Assignment. Minutes summarizing the Scoping Meeting were prepared and submitted to the EPA on 6 February 2001.

3.1.3 Conduct Site Visit (Subtask 1.04)

An on-site visit was conducted by EPA and Foster Wheeler Environmental personnel on 14 November 2000, at which time preliminary technical/logistical issues were discussed. In attendance at the site visit were the EPA geologist, Foster Wheeler Environmental Project Manager and Project Hydrogeologist, and three NYSDEC representatives.

3.1.4 Draft Work Plan and Work Plan Budget Estimate (Subtask 1.05)

This subtask involved the development of this RI/FS Work Plan and the Work Plan Budget Estimate. A technical meeting was held between the EPA project geologist and the Foster Wheeler Environmental Project Manager and Hydrogeology Lead on 22 February 2001. A summary of the meeting was prepared for the EPA geologist and the WAM. Foster Wheeler Environmental presented its approach for the RI to EPA. Discussions were held regarding the need for wells east of Spring Creek and groundwater monitoring.

3.1.5 Negotiate and Revise Draft Work Plan (Subtask 1.06)

Foster Wheeler Environmental and EPA will participate in a Work Plan negotiation meeting at a date yet to be determined via tele-conference, to discuss and agree upon the scope and estimated cost required to accomplish the tasks outlined in this Work Plan.

3.1.6 Evaluate Existing Data and Documents (Subtask 1.07)

A review of various Site background documents provided by the EPA WAM and the NYSDEC has been performed during the preparation of this Work Plan.

The following documents were provided by EPA for review in preparation of this Work Plan:

- Remedial Investigation Report, Volume I of III Spill Site Investigation; Hydrogeologic Investigation; Fish and Wildlife Impact Analysis, Rust, October 1996;

- Addendum to Hydrogeologic Investigation, (Conclusions only), Rust, October 1996;

- Feasibility Study Report, Rust, April 1994;

- Feasibility Study Report, Detailed Analysis of Remedial Alternatives, November 1995;

The following documents were provided by NYSDEC:

- A Pilot Study of TCE Vapor Extraction in Fractured Limestone, unpublished NYSDEC, 1998; and

- Lehigh Valley Railroad Derailment, Recent Sampling Results and Interpretations, NYSDEC, September 1998.

As part of the evaluation of the existing data, existing monitoring and domestic well locations and depths, plume isoconcentration contours, aerial photography, and topography were entered into a project database using ArcView Geographic Information System (GIS) software for evaluation of the current plume delineation and identification of data gaps in development of this Work Plan.

3.1.7 Quality Assurance Project Plan (Subtask 1.08)

A site-specific Quality Assurance Project Plan (QAPP) will be prepared in accordance with EPA QA/R-5 (March 2001), the approved Foster Wheeler Environmental RAC II Program Generic Quality Assurance Project Plan (July 2001), and other EPA Region 2 guidance and/or procedural requirements. This document, which will be submitted 21 days after submittal of the Final Work Plan, will describe the project objectives and organization, functional activities, and quality assurance/quality control (QA/QC) protocols used to achieve the desired Data Quality Objectives (DQOs) for the Site. The QAPP will also describe Foster Wheeler Environmental's field activities and protocols for the investigatory phase of the work, including:

- Sampling objectives;
- Sample chain-of-custody/documentation;
- Sample numbers, matrices, locations, collection frequencies, and type of analyses;
- Sampling equipment and procedures;
- Sample handling, preservation and shipment;
- QA/QC protocols and criteria utilized, including data validation;
- A breakout of samples to be analyzed through the EPA Contract Laboratory Program (CLP) and through other non-CLP sources (e.g., field screening, subcontractor laboratories); and
- Site access/control, security, contingency procedures, management responsibilities, equipment and drum storage areas, and other site operational plans.

3.1.8 Health and Safety Plan (Subtask 1.09)

A site-specific Health and Safety Plan (HASP) will be prepared to provide adequate health and safety protection for field personnel in accordance with 29 CFR 1910.120 (1)(1) and (1)(2), 40 CFR 300.150, and other applicable codes and guidelines. This document, which will be submitted 21 days after submittal of the Final Work Plan, is required for any activity conducted within the Study Area, including reconnaissance, surveying, drilling and collection of environmental samples. At a minimum, the HASP will address employee training, protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan. The HASP will be updated, as warranted, if new conditions or tasks arise during the performance of field investigation activities. A Field Change Request Form will be used to make any required modifications, based on site-specific conditions, to the site-specific HASP.

3.1.9 Non-RAS Analyses (Subtask 1.10)

Although listed as not-applicable in the SOW, during the scoping meeting it was determined that Non-routine Analytical Services (Non-RAS analyses) will be required for several analytical requirements for this Work Assignment. Non-RAS analyses will be provided for the project in accordance with the approved Foster Wheeler

Environmental RAC II Program Delivery of Analytical Services Plan (July, 1998). Foster Wheeler Environmental Corporation will provide the EPA with the results of its Technical/QA Review of the documentation as provided by the selected laboratory in response to the Foster Wheeler Environmental Laboratory Procurement Statement of Work. As per the Foster Wheeler Environmental RAC II Delivery of Analytical Services Plan, Foster Wheeler Environmental Corporation will review and evaluate the Laboratory Quality Assurance Plan (LQAP) including: sample preparation and analytical methods, chain-of-custody, data deliverables and quality control requirements, state certifications, and results of Performance Evaluation sample analysis for the required parameters.

3.1.10 Meetings (Subtask 1.11)

Progress/technical meetings will be held during the course of the project. Foster Wheeler Environmental will provide technical briefings to EPA and review the current status and progress of the project. For project planning purposes, it is assumed that meetings will be held with Foster Wheeler Environmental's Project Manager and an appropriate technical discipline lead (i.e., risk assessment, geology/hydrogeology). After each meeting, the Foster Wheeler Environmental Project Manager will prepare and submit to the EPA WAM, within five (5) calendar days, a meeting minutes letter report briefly summarizing the meeting.

3.1.10.1 Site Reconnaissance (Subtask Activity 1.11.01)

During the Site Reconnaissance activity, it is anticipated that meetings will be conducted for site access support and for a Technical Memorandum comment review meeting.

3.1.10.2 Phase 1 (Subtask Activity 1.11.02)

During the Phase 1, it is anticipated that meetings will be coordinated to discuss project progress on a quarterly basis during periods of significant activity.

3.1.11 Subcontract Procurement (Subtask 1.12)

Foster Wheeler Environmental will procure subcontractors to support the tasks required in this Work Assignment. Subcontract procurement procedures will be performed in accordance with Foster Wheeler Environmental's Government Procurement Procedures which are based on the Federal Acquisition Regulations (FARs) and are the basis of our Government-approved purchasing system.

Subcontract solicitation recipients will be drawn either from Foster Wheeler Environmental's vendor database or a Commerce Business Daily (CBD) announcement if that database yields an insufficient number of potential subcontract firms.

3.1.11.1 Site Reconnaissance (Subtask Activity 1.12.01)

This activity will include subcontracts for Non-RAS Analytical Services, Surveyor, IDW Transportation and Disposal Services.

3.1.11.2 Phase 1 (Subtask Activity 1.12.02)

Subcontractors will provide the following services during Phase 1:

- Field Mobilization Services;
- Drilling Services;
- Downhole Geophysics;
- Surveying Services;

- Non-RAS Analytical Laboratory Services;
- Investigation Derived Waste (IDW) Transportation and Disposal Services; and
- File Closeout Services.

3.1.12 Perform Subcontract Management (Subtask 1.13)

Subcontract management activities will be performed by Foster Wheeler Environmental during the course of this Work Assignment. These activities will occur during the Site Reconnaissance (Subtask Activity 1.13.01) and during Phase 1 (Subtask Activity 1.13.02).

These activities include the following:

- Monitoring of subcontractor progress;
- Maintenance of subcontracting systems and records;
- Issuing subcontract modifications (if warranted); and
- Review and approval of subcontractor invoices.

All subcontractor field activities will be monitored on a daily basis by the Foster Wheeler Environmental Field Operations Leader (FOL) and Health and Safety Officer (HSO).

Changes required to a subcontractor's scope of work will be identified by the Project Manager and EPA will be notified. A change of work will not be made without a prior determination of entitlement and price, and the EPA Contracting Officer's consent (if required). A subcontract modification will be issued to effect the change.

All subcontractor invoices will be submitted to the Foster Wheeler Environmental procurement representative for review and approval.

3.1.13 Revise Phase 1 WP, QAPP, HASP, and Budget (Subtask 1.14)

Following the approval of the Technical Memorandum, changes to the Work Plan, QAPP, and HASP may be required and will be performed, as necessary. Adjustments, if any, to the project budget and schedule will also be made. The sampling locations and depths as well as the types and numbers of analyses to be performed and other components of the Phase 1 Field Investigation described in this Work Plan are provided as preliminary technical considerations and have been used for budgeting purposes.

3.1.14 Pathway Analysis Report (Subtask 1.15)

Foster Wheeler Environmental will prepare a Pathways Analysis Report (PAR) for the Site in accordance with OSWER Directive 9285.7-01D-1, dated 17 December 1997 entitled, "Risk Assessment Guidelines for Superfund, Part D" (RAGS Part D) and Regional Risk Assessment Support Personnel. As agreed in the Scoping Meeting of 1 February 2001, the assessment will address the groundwater impacted by the spill and the surface water and sediment directly impacted by discharge of the impacted groundwater. The PAR will include the following RAGS Part D Tables:

Table No.	Title
1	"A Selection of Exposure Pathways"
2	"Occurrence, Distribution, and Selection of Chemicals of Potential Concern"
3	"Medium-Specific Exposure Point Concentration Summary"
4	"Values Used for Daily Intake Calculations"

5	"Non-Cancer Toxicity Data"
6	"Cancer Toxicity Data"

This expanded list of tables is consistent with the specifications of the EPA Region 2 Risk Specialist presented during the project Scoping Meeting of 1 February 2001. Table 3-1 presents a preliminary selection of exposure pathways developed by Foster Wheeler Environmental. The PAR will present text necessary to support the information included in the RAGS D. Scenarios include groundwater use as tap water and occasional recreational contact with impacted springs and the surrounding sediments. The potential for ambient air emissions and indoor vapor intrusion will also be evaluated as a viable exposure pathways. Both reasonable maximum exposure (RME) and central tendency (CT) exposure parameters will be developed. Specific information to document the Conceptual Site Model and the daily intake parameters contained in RAGS Part D Tables 1 and 4 respectively, will be obtained from:

- Review of previous studies, including the 1996 Remedial Investigation Report, Lehigh Valley Railroad Derailment Site, (1996 RI), prepared by Rust Environmental and Infrastructure for the NYSDEC;

- Review of available area maps indicating locations of land use, residences, and businesses;

- Public records indicating well locations and groundwater and surface water usage;

- Current EPA risk assessment and exposure assessment guidance, including, but not limited to, RAGS Parts A and E (EPA, 1989 and 1997a) and the Exposure Factors Handbook (EPA, 1997b); and

- On-site observation of land use, residential and commercial groundwater consumption, and locations of springs relative to human residential and recreational locations.

The chemical-specific data, to be presented in RAGS Part D Tables 2, 3, 5, and 6, will be derived from the investigations to be carried out by Foster Wheeler Environmental. The evaluated constituents will be limited to those chemicals associated with the derailment spill and present in the groundwater within the Study Area. It is anticipated that preliminary, and limited, full organic/inorganic constituent sampling at the source area will confirm that the constituents to be evaluated will be focused on the chlorinated solvent TCE and its breakdown products (and potentially cyanide.) This assumption is consistent with the material documented to have been spilled in the derailment and with the findings of the 1996 RI (Rust, 1996). In the instance where additional constituents are identified, inclusion of the constituent in the risk evaluation will be determined in consultation with the Region 2 Risk Specialist and the WAM. It is anticipated that consultation with the EPA National Center for Environmental Assessment (NCEA) will be required to obtain toxicity values (reference dose and cancer slope factor values) for one or more constituents.

The potential for TCE to contaminate indoor air will be considered. This pathway will be evaluated by comparing a representative concentration of TCE from the site reconnaissance to a screening value modeled for vapor intrusion from groundwater to indoor air. If the screening suggests an unacceptable health risk, a more sophisticated modeling approach may be proposed in Phase 1 along with indoor air vapor sampling to confirm the modeling results.

3.2 TASK 2 - COMMUNITY RELATIONS

IT Corporation (IT), a team subcontractor, will provide community relations support in accordance with "Community Relations in Superfund - A Handbook."

3.2.1 Community Interviews (Subtask 2.01)

The relevant background information provided by Foster Wheeler Environmental and EPA, including appropriate site location, site lay-out maps, prior public participation plans, and information regarding prior community concerns and activities will be reviewed. Assistance will be provided to the WAM and the EPA Community Relations Coordinator (CRC) in identifying key community members, establishing an interview schedule, developing draft and final interview questions, and conducting the interviews with the appropriate government officials (federal, state, county, and township), environmental groups, local broadcast and print media, and any other appropriate individuals or groups to identify community concerns associated with the RI/FS. A Community Relations Specialist will accompany the WAM and CRC on one round of community interviews in the local area, anticipated to take place over approximately a four-day period. Draft and final interview questions will be provided. On behalf of the EPA, thank-you letters for interview participants will be prepared.

3.2.2 Community Relations Plan (Subtask 2.02)

A draft and final Community Relations Plan (CRP) will be prepared, as follows:

Draft CRP: The Draft CRP will present an overview of the community's concerns and include the following elements: (1) site background, including location, description, and history; (2) community overview, including community profile, concerns, and involvement; (3) community involvement objectives and planned activities, including a schedule to accomplish these objectives; (4) a mailing list of contacts and interested parties; (5) the names and addresses of the information repositories and public meeting facility locations; (6) a list of acronyms; and (7) a glossary.

Final CRP: A Final CRP will be prepared that incorporates EPA comments on the Draft CRP.

3.2.3 Public Meeting Support (Subtask 2.03)

Community relations support will be provided for two public meetings (in the format of formal meetings, site tours, or availability sessions). The public meetings will be held in the vicinity of the site, and will take place in the late afternoon or early evening.

The following work will be performed to support the public meetings:

- Provide support for meeting logistics, including the selection and reservation of a meeting place;
- Provide meeting announcements and sign-in cards;
- Prepare draft and final audio-visual materials;
- Reserve a court reporter for each of the public meetings. A full-page original and a "four on one" page copy, along with a 3.5 inch diskette of the transcripts, will be provided to EPA, with additional copies placed in the information repositories. The diskette will be provided in WordPerfect 8.0, or the most recent EPA-approved word processing format;
- Attend the meeting and assist in setup, such as arrangement of seating, informational material, and audio-visual equipment; and
- Prepare a draft and final meeting summary.

3.2.4 Fact Sheet Preparation (Subtask 2.04)

Four information letters/updates/fact sheets (hereinafter "fact sheets") will be prepared (Draft and Final). The fact sheets will be researched, written, edited, designed, laid out, photocopied, and labeled for mailing prior to submission to the EPA. The fact sheets will consist of the following:

- Two to four 8-1/2" x 11" pages in length;
- Maximum of three illustrations;
- Double-sided black and white reproduction;
- Recycled paper will be used (EPA choice of color; samples will be provided); and
- 250 copies will be reproduced, provided to EPA ready for mailing.

To allow for flexibility in fact sheet length, the fact sheets may be sent as self-mailers or mailed in envelopes.

3.2.5 Proposed Plan Support (Subtask 2.05)

This subtask includes coordination and assistance in the production of the draft and final Proposed Plan describing the preferred alternative and other alternatives evaluated in the Feasibility Study. The plan will be prepared in accordance with the National Contingency Plan (NCP) and EPA Community Relations in Superfund - A Handbook (January 1992). The plan also will describe opportunities for community involvement in the Record of Decision.

The plan will consist of:

- A maximum of 16, 8-1/2" x 11" pages. Four 11" x 17" sheets will be folded to create an 8-1/2" x 11" size booklet. Two copies of the draft and final plan will be prepared; and
- Recycled paper (EPA choice of color; samples will be provided.).

3.2.6 Public Notices (Subtask 2.06)

Public notices will be prepared for each of the two public meetings. Upon EPA approval, the notices will be placed as camera-ready, 2-column x 6-inch display advertisements in the Batavia Daily News, the "Our Towns" zone of the Rochester Democrat & Chronicle (daily paper with Wednesday zone), and the weekly Livingston County News.

3.2.7 Information Repositories (Subtask 2.07)

Copies of all final deliverables will be maintained in the information repositories identified by EPA for the duration of the Work Assignment.

If any community relations documents are found to be missing during the on-site visits and file index reviews, they will be replaced.

3.2.8 Site Mailing List (Subtask 2.08)

The existing Site mailing list will be updated once, and will have approximately 250 entries. After the update, a copy of the mailing list will be submitted to the EPA via e-mail or diskette. Mailing labels will be provided to EPA upon request. EPA will do the actual mailing to the community.

3.2.9 Responsiveness Summary Support (Subtask 2.09)

A responsiveness summary will be prepared that presents a concise and complete summary of significant oral and written comments that EPA receives from the public during the public comment period. All written and verbal comments received during the public comment period will be compiled, organized, and summarized with appropriate responses.

3.3 TASK 3 - FIELD INVESTIGATION

Field investigation activities will be conducted to acquire the data necessary to fill gaps in the understanding of the dynamics of the regional groundwater system and contaminant transport within the Study Area. Data will be collected for use in support of the Human Health and Ecological Risk Assessments and to develop the Feasibility Study with regard to potential groundwater remediation options. Specifically, data will be collected to obtain a current depiction of groundwater conditions including the current extent of the contaminant plume defined by NYSDEC and the impact, if any, on private wells and on one municipal well. The field investigation will be performed in two steps: a Site Reconnaissance and Phase 1 of the field investigation.

In the Site Reconnaissance one round of groundwater samples will be collected across the Study Area from existing monitoring, private, and municipal wells, and analyzed for VOCs and cyanide. Within the historically defined source area, two well clusters will be sampled for full TCL/TAL analysis to characterize the source area and determine if contaminants other than VOCs and cyanide should be included during the Phase 1 investigation. Based on the results of the Site Reconnaissance (described in Section 3.3.1) and any new data obtained from other non-EPA ongoing investigations, a Technical Memorandum will be submitted to EPA with recommendations for final locations of new monitoring wells (tentative locations are included within this plan), various sampling points, and sampling parameters for EPA concurrence. Following approval of the Technical Memorandum, Phase 1 will include: installation of monitoring well clusters; sampling of existing and new wells; sampling of surface water, sediment, seeps, and springs; four seasonal rounds of groundwater sampling, and one storm event groundwater sampling targeted at a small subset of wells at the source area to evaluate the effects of seasonal variations and precipitation on groundwater quality.

The locations presented for the Phase 1 investigation within this Work Plan are preliminary and the number of locations and samples are presented for budgeting purposes. The final locations and data justifying their selections will be proposed in a Technical Memorandum, which will be submitted to EPA for approval.

3.3.1 Site Reconnaissance (Subtask 3.01)

Prior to the Site Reconnaissance, EPA will secure access to all existing monitoring well locations, and all areas of the Study Area that will be investigated during the Site Reconnaissance. Site Reconnaissance sections and objectives are as follows:

SECTION NUMBER	DESCRIPTION	OBJECTIVE
3.3.1.1	Mapping and Site Access Support	Prepare a base map using existing USGS digital map data. Compile property owner addresses to assist EPA with gaining access to all areas to be investigated.
3.3.1.2	Human Health Receptor	Identify surrounding area populations, the likely ways the

SECTION NUMBER	DESCRIPTION	OBJECTIVE
	Reconnaissance	individuals may be exposed to site contamination, and the locations at which exposures may occur.
3.3.1.3	Well Inventory	Supplement the existing inventory of supply wells in the study area for potential sampling during Phase 1.
3.3.1.4	Ecological Resources Reconnaissance	Identify potential sensitive terrestrial and aquatic ecological resources. Surface water, sediment, seep, and spring sampling locations will also be identified for potential sampling during Phase 1.
3.3.1.5	Existing Well Sampling	Obtain current synoptic groundwater quality data in existing private and monitoring wells. Sample two existing monitoring well clusters to define the Phase 1 sampling parameters.
3.3.1.6	Surface Water and Groundwater Elevation Survey	Obtain current synoptic surface water and groundwater elevation data to assist in determining the optimum locations for the new monitoring wells and for surface water and sediment sampling (in Phase 1).
3.3.1.7	Surface Geophysical Survey	Develop signature of known fracture traces for use in selecting monitoring well cluster locations and fracture control of groundwater flow.
3.3.1.8	Technical Memorandum	To guide the selection of the final sampling locations and analyses to be performed in Phase 1.

3.3.1.1 Mapping and Site Access Support (Subtask Activity 3.01.02)

Prior to mobilizing for the Site Reconnaissance, a base map will be prepared of the Study Area. The base map will be assembled using four adjacent USGS Digital Quadrangle maps (LeRoy, Caledonia, Churchville, Clifton), which can be manipulated electronically. Due to the large size of the Study Area, the overall base map will be prepared at a scale anticipated as approximately 1 inch equals 1,000 feet. This map will be used for reference when locating monitoring well, surface water, sediment, seep, and spring sampling locations. Maps specific to Mud Creek, Gorge Pond, Spring Creek, the wetlands east of Caledonia, the aquifer testing well location, and any other locations necessary will be prepared from the electronic base map at an approximate scale of 1 inch equals 50 or 100 feet, as appropriate, to depict sampling locations.

Several Site Reconnaissance tasks (ecological characterization, geophysical surveying) are anticipated to require widespread access throughout the Study Area. Wherever possible, Phase 1 drilling locations will be selected to be within public rights-of-way. Local tax maps and utility right-of-way maps will be obtained from local county offices in Monroe, Livingston, and Genesee Counties. A list of Lot and Block numbers, addresses, and property owners will be compiled using local records. It is anticipated that a maximum of 150 property owners will be identified. The list will be provided to EPA for EPA's use in gaining access agreements with property owners. This subtask does not include any site access support other than the preparation of this list. In addition, Foster Wheeler Environmental will visit NYSDEC offices to determine if any NYSDEC sampled domestic wells can be used to reduce the quantity of domestic wells proposed for sampling by Foster Wheeler Environmental during the Site Reconnaissance. However, many of the domestic wells are not anticipated to be valid monitoring points due to the fact that many of them are at an unknown depth. During the plugging and abandoning of residential wells during the water-supply construction by NYSDEC, an opportunity to probe the desired wells for depth may exist. If possible, during the NYSDEC abandonment activities, Foster Wheeler Environmental will obtain data necessary to correlate domestic wells to a stratigraphic unit or depth. This effort will occur during the Site Reconnaissance under the assumption that investigation activities can be coordinated with the NYSDEC construction project. Otherwise, the activity will not be performed.

3.3.1.2 Human Health Receptor Reconnaissance (Subtask Activity 3.01.02)

A human health receptor reconnaissance will be conducted to identify the populations potentially exposed to groundwater at the site, routes by which they will be exposed, and representative locations at which the exposures may occur. It is anticipated exposure may occur via domestic or commercial well water usage, or surface water contact. Initially, a document review of the RI, RA and ROD for the Spill Site will be conducted to understand how previous domestic/commercial well surveys in the vicinity of the Study Area have been conducted and their limitations. In addition, information will be obtained regarding the scope and waterline expansion that will eliminate exposure to some individuals via the drinking water pathway. Secondly, information regarding potential domestic and commercial wells will be identified by requesting or examining records from NYSDEC, as well as the local water board, utility company, and planning (zoning) departments. This information will be included in the well inventory (Section 3.3.1.3). Potential surface water seep or creek locations used for recreation will be identified by a visual inspection of the suspected discharge areas as well as communication with parks and recreation offices. Buildings in which vapors may accumulate may also be identified during the Site Reconnaissance.

The receptor information collected will be summarized to support the sampling locations selected for the Site Reconnaissance and to focus on the baseline human health risk assessment (Phase 1).

3.3.1.3 Well Inventory (Subtask Activity 3.01.03)

Private (domestic and production) wells and municipal wells will be evaluated in the Site Reconnaissance for potential inclusion in the Phase 1 sampling program. The evaluation will include a review of local well records and discussions with well owners and local well drillers. The availability of open hole and depth information, as well as well location and access will be evaluated. Approximately 20 wells may be included in the inventory of private and municipal wells for sampling in Phase 1. These wells may likely be located in the areas described below:

- Downgradient domestic wells located east of the plume (east of Spring Creek) to verify that wells in this area have not been impacted;

- Side gradient domestic wells located south of the plume (south of Route 5 and east of McIntyre Road) to verify the southern extent of the plume in this area;

- Quarry production wells and other upgradient wells which could induce a gradient reversal causing contaminant movement to the west of the spill area;

- Wells within the area of the waterline expansion that will not be sealed that may be used for agriculture, recreation, or commercial use; and

- The Caledonia municipal supply well (located east of Spring Creek), which could induce movement of contaminants and impact municipal water users.

EPA will review and approve the private and municipal well locations planned to be sampled during the Site Reconnaissance.

3.3.1.4 Ecological Resources Reconnaissance (Subtask Activity 3.01.04)

An ecological resources reconnaissance will be performed using the Checklist for Ecological Assessment/Sampling (Appendix B, Representative Sampling Guidance Document, Volume 3) in support of the ecological setting characterization required for the ecological risk assessment. Potential surface water, sediment, spring, seep and other relevant sampling locations will be located and identified during the ecological resources reconnaissance for sampling in Phase 1. The Technical Memorandum will indicate all seeps and springs that were identified during the Site Reconnaissance, not simply those recommended for sampling.

3.3.1.5 Existing Well Sampling (Subtask Activity 3.01.05)

The contaminant plume defined by NYSDEC is based on data representing the highest VOC concentration detected in samples collected from monitoring wells and various domestic wells over extended time periods (Figures 3-1 and 3-2). To obtain a current depiction of groundwater conditions at the Site, sampling of the existing 58 monitoring wells and approximately 30 private wells will be performed during the Site Reconnaissance. Currently, no usable data has been received by Foster Wheeler Environmental from NYSDEC regarding the domestic wells currently sampled. NYSDEC has been unable to provide Foster Wheeler Environmental with a working list of impacted wells or current sampling schedule. As discussed in section 3.3.1.1, if useable data is obtained from NYSDEC, the number of domestic wells proposed for sampling will be decreased accordingly.

The 58 existing monitoring wells are in 19 clusters consisting of one to four wells at the locations depicted in Figure 3-2. Eighteen well clusters (55 wells) were installed by Rust during the 1993 RI and one well cluster (3 wells) was installed at the Genesee Country Genesee Country Museum in 1997. During the Site Reconnaissance, access to selected domestic and monitoring wells will be obtained by EPA and the condition of each well will be evaluated by Foster Wheeler Environmental. Water levels will be measured in all monitoring wells and the presence of DNAPL will be determined using an electronic oil/water interface probe. No additional well development is anticipated unless observed conditions (such as sediment present in the well) warrant such action. Wells will be evaluated to determine if redevelopment is required. If 50% of the length of the screened area or open hole area of a well is occupied by silt, the well will be redeveloped.

Approximately six of the 58 existing monitoring wells in the source area, (two downgradient clusters, DC-1 and DC-2 near the source area), will be sampled and analyzed for a full range of analytical parameters, including Low Concentration VOCs, SVOCs, Pesticides/PCBs, Target Analyte List (TAL) metals and cyanide. The results of this sampling will help guide the selection of additional compounds of potential concern, if any, from further investigation in Phase 1 of the field investigation. The remainder of the 58 existing wells will be sampled and analyzed for VOCs and cyanide. Table 3-2 summarizes the rationale for including these 58 wells in the Site Reconnaissance sampling program. Table 3-4 summarizes the analyses to be performed on the groundwater samples collected during the Site Reconnaissance.

Approximately 30 potential private wells have been selected for potential sampling during the Site Reconnaissance. These samples will be analyzed for VOCs and cyanide. The rationale for the selection of the 30 private wells is summarized on Table 3-3. During the past 10 years private wells have been sampled by NYSDEC and NYDOH (Rust, 1996). Based on the information in this report, the 30 private wells identified at this time for sampling in the reconnaissance were selected using the following criteria:

- Spatial distribution of the wells with respect to the plume identified by NYSDEC;
- Contaminant concentrations;
- Groundwater flow direction; and
- Presence of pumping wells.

The list of potential private wells to be sampled during the Site Reconnaissance may be modified prior to sample collection based on the information collected in Section 3.3.1.3. Specifically, if residences associated with the wells listed on Table 3-3 are found to have been connected to or are planned on being connected to a municipal water supply, these potential private well sampling points may be replaced by other private well sampling points located further away from the extent of the plume. This private well selection criteria will be applied to the wells on Table 3-3 and a final list of private wells will be prepared for EPA approval. The final list will form the basis for the private well access to be obtained by EPA prior to the start of the private well sampling.

3.3.1.6 Surface and Groundwater Elevation Survey (Subtask Activity 3.01.06)

A surface water elevation survey will be conducted in conjunction with the groundwater elevation survey to determine the groundwater and surface water relationships in the Study Area and to determine whether a groundwater divide exists below Spring Creek. This information along with well sampling east of Spring Creek will assist in determining whether or not groundwater contamination has migrated past Spring Creek. The surface water elevation survey will include the vertical and horizontal location of surface water, sediment, spring, seep and other relevant locations identified during the Ecological Resources Reconnaissance. Approximately 10 staff gauges will be installed and surveyed. The tentative locations for staff gauges are shown on Figure 3-4. The staff gauges will have a 5-gallon pail base full of cement and will be placed in a low energy portion of the flowing stream or surface water body. It is anticipated that four staff gauges will be installed in Oatka Creek, three staff gauges will be installed in Spring Creek, two staff gauges will be installed in Mud Creek and one staff gauge will be installed in Gorge Pond. A subcontractor will be procured for the services of a licensed surveyor to survey approximately 10 staff gauges in accordance with EPA's Locational Data Policy (LDP). The LDP requirement will be specified in the subcontract. The elevation measurements of the surface water will be taken in a 1 day period. Groundwater elevation measurements will be taken in the 58 existing monitoring in the same one-day period as the surface water elevation measurements are taken. The data will be evaluated in the Technical Memorandum and will be used to select sampling locations. Sampling locations will be identified on a map within the Technical Memorandum. Sampling locations which appear to be groundwater discharge locations will be clearly marked as such.

3.3.1.7 Surface Geophysical Survey Reconnaissance (Subtask Activity 3.01.07)

During the Site Reconnaissance, a Very Low Frequency (VLF) electromagnetic survey will be conducted to identify and evaluate possible subsurface pathways of contaminant transport and assist in selection of additional monitoring well locations and screen depths. All VLF lines shown on Figure 3-5 will be surveyed. Initially, data from two VLF lines will be evaluated for usefulness in identifying fractures. If the data provides a useful tool for fracture identification, the remaining data will be evaluated. If the data is useful, the results of the VLF survey will be presented in the Technical Memorandum for the Phase 1 recommendations. The initial 2 VLF lines selected for effectiveness screening are the unloading feature and the line near the Church Road vicinity.

The VLF survey will initially be conducted in the area southeast of the Spill site (see Figure 3-5 which illustrates the observed unloading feature) where post-glacial vertical fractures were observed during the Site visit on 14 November 2000. Following deglaciation, regional isostatic rebound resulted in the formation of east-west trending vertical fractures (Rickard, 1966). Approximately five (5) VLF survey lines will then be conducted across the narrow portion of the plume that appears to be structurally controlled (Figure 3-5). The results of the VLF survey lines across the narrow portion of the plume will be compared to the results from the observed unloading feature. Similar results would verify that vertical fracturing is controlling the plume dimensions (narrow and constricted) for the first two miles downgradient of the Spill Site. The results will also be used to finalize the location for a well cluster to be located in a vertical fractured area. The two additional east-west VLF survey lines located north of the plume (Figure 3-5) across Mud Creek and Gorge Pond will be located to determine if these two gorge areas exist due to fracture orientation in these areas parallel to the existing stream. As a result of observations made during the site visit, Mud Creek may represent a fracture lineament which runs from the Spill Site. Therefore, there is potential for Mud Creek to be affected by the plume emanating from the site. The north-south VLF survey line along Spring Street near the east edge of the plume will be surveyed to identify if fractures are controlling the spring/seep discharges to Spring Creek.

3.3.1.8 Technical Memorandum Preparation (Subtask Activity 3.01.08)

At the conclusion of the Site Reconnaissance the field and analytical data will be analyzed and presented in a Technical Memorandum. The Technical Memorandum will include:

· Rationale for new monitoring well cluster locations, depth, and construction details;

· Private and municipal wells to be sampled;

· Spring and Seep locations and recommended sampling program (a map showing all identified seeps will be provided);

· Surface water and sediment sampling locations; and

· Groundwater monitoring program (i.e., wells to be sampled, frequency of sampling, and analytical parameters).

The Technical Memorandum will also include proposed Phase 1 analyses to be performed (type, media, and number). The sampling locations and depths and the number and types of analyses to be performed by media will be finalized upon EPA's approval of the Technical Memorandum.

3.3.2 Mobilization and Demobilization (Subtask 3.02 and Subtask 3.09)

Mobilization activities will be required to support the sampling and surveys to be performed in the Site Reconnaissance (Subtask Activity 3.02.01). During mobilization, all the equipment and materials necessary for the Site Reconnaissance will be procured and transferred to the site. The necessary personnel equipment and materials for conducting the field activities will be assembled during Phase 1 mobilization (Subtask Activity 3.02.01).

The general assembly and work location will be at the Gulf Road Crossing of the former Lehigh Valley Railroad. It is currently anticipated that all site mobilization and staging will occur in the fenced area near the Spill Site. Additional details on the mobilization area, including health and safety zone and trailer locations, will be presented in the Site Quality Assurance Project Plan and also in the Health and Safety Plan.

A storage container will be set up in the fenced area at the spill site used during the previous investigation. A storage container will be necessary due to the amount of equipment required for sampling, processing samples for shipment, and completing the corresponding CLP paperwork.

On-site mobilization activities include:

_ Site preparation;
_ Set up work stations/areas (e.g. sample packing, waste disposal);
_ Organize and store all equipment and supplies, as needed;
_ Procure additional sampling supplies;
_ Set up computer for CLP paperwork generation;
_ Install temporary sanitary facilities; and
_ Garbage removal service.

The following on-site health and safety activities will be performed during mobilization:

_ Establish decontamination area;
_ Identify work zones;
_ Conduct initial site-specific briefing for project team members;
_ Set up monitoring equipment calibration area; and
_ Set up health and safety files.

Office based mobilization will encompass the following activities:

- Initiate utility service
- Coordinate efforts of mobilization/demobilization subcontractor (includes installation of utilities and temporary facilities);
- Prepare list of required field equipment;
- Inventory available Foster Wheeler Environmental equipment;
- Prepare requisitions to lease or purchase equipment;
- Prepare requisitions to purchase expendable field supplies;
- Arrange delivery, storage and setup (as necessary) for all equipment;

Upon completion of the Site Reconnaissance, (Subtask Activity 3.09.01) and Phase 1 (Subtask Activity 3.09.02), demobilization activities will occur including:

_ Removal of wastes from site;
_ Return of rental equipment;
_ Discontinue garbage disposal, electric and telephone services;
_ Return Foster Wheeler Environmental Corporation's equipment;
_ Removal of sanitary facilities;
_ Removal of all equipment and storage trailer and securing of the site;

- Coordinate efforts of mobilization/demobilization subcontractor (includes removal of utilities and decontamination and removal of temporary facilities); and
- Perform necessary site restoration.

3.3.3 Hydrogeological Assessment (Subtask 3.03)

Implementation of the hydrogeological assessment will include installation of monitoring wells, an aquifer pumping test well, and piezometers (for observation of aquifer test drawdown). These activities will be performed by a subcontractor and will be overseen by a Foster Wheeler Environmental geologist. In addition, the subcontractors will be monitored on a daily basis by the Foster Wheeler Environmental Field Operations Leader and Health and Safety Officer. At least one Foster Wheeler Environmental geologist present on site will be cross-trained to serve as the project HSO. In the role of HSO, this individual will answer directly to the Foster Wheeler Environmental Health and Safety Manager. All requirements of the site-specific HASP to be submitted at a later date) will be enforced during site activities.

The purpose of the hydrogeological assessment is to:

- Sufficiently characterize the groundwater system and contaminant migration pathways to develop remedial alternatives for mitigation of Site impacts and evaluate risks to human health and the environment;
- Delineate the downgradient extent of the groundwater contamination in the area of Caledonia; and
- Determine the ultimate discharge area for the groundwater contaminant plume.

The mechanism of contaminant transport (movement along bedding planes or vertical fracture, fracture systems or preferred fracture pathway, etc.) must be clarified to provide the basis for an effective remedial program and assessment of risk. The NYSDEC RI investigation included delineation of the areal extent of the contaminated groundwater plume based on groundwater quality data obtained from the sampling of a combination of domestic wells and monitoring wells. Fifty-eight monitoring wells were installed in 19 clusters during the NYSDEC investigations (1993-1997). All existing monitoring well clusters are within the plume, as currently defined. These clusters provide limited vertical control to determine the depth and preferred pathways of contaminant transport. Domestic well locations are shown in Figure 3-1; monitoring well clusters are shown in Figure 3-2. The NYSDEC wells installed by Rust in 1993 are identified by the prefix DC. The Genesse Country Museum wells are designated by the Prefix MS and are located near the museum's southern property boundary. The domestic wells are typically open-hole bedrock wells and provide little information concerning depth or thickness of the contaminant plume.

To provide a better understanding of the occurrence (horizontal and vertical) and movement of contaminants in the subsurface, approximately 30 additional monitoring wells are tentatively proposed in selected areas where data gaps exist. Wells will be screened in distinct waterbearing zones to evaluate preferred groundwater pathways. Proposed well cluster (2 to 4 wells per cluster) locations are shown on Figure 3-3. Monitoring well locations and rationale are discussed in the following sections. A summary of the rationale for each cluster location is provided on Table 3-5.

The depths and target formations presented below are tentative and will be finalized after the Site Reconnaissance data has been evaluated and the specific locations have been further defined.

Rationale for Well Installation Locations

Proposed monitoring well cluster locations have been selected based on data gaps identified in the conclusions of the NYSDEC RI Report. All of the monitoring wells installed during the NYSDEC RI lie within the plume area as defined by isoconcentration maps contained in the NYSDEC RI Report. Therefore, horizontal delineation of the plume is necessary in all directions.

The delineation of the plume in the NYSDEC RI Report was based on both domestic well and monitoring well sampling. The isoconcentration map in the NYSDEC RI is described as a "worst case" contoured display of maximum TCE concentrations detected at the indicated locations over a period of up to 4 years. The map does not display a synoptic round of sampling. The domestic wells are not valid monitoring points since they are constructed as open hole wells (many of unknown depth) and therefore, cannot be relied upon to provide accurate vertical delineation. To this end, additional monitoring well clusters are planned in the following areas.

Upgradient

Monitoring well cluster (FW-18) is proposed to be installed west of the General Crushed Stone quarry at the approximate location shown on Figure 3-3. The production well at the quarry is documented to be contaminated by TCE. No unimpacted upgradient monitoring wells exist to delineate the western extent of the groundwater plume. Operation of the quarry well may have induced upgradient flow of the dissolved TCE plume to the west. The quarry production well reportedly pumps from two intervals within the same well (shallow and deep). There is also the potential for DNAPL, flowing under the influence of gravity, to migrate in a westerly direction along fractures and/or bedding planes. Data from the 1994 NYSDEC Report indicates the shallow interval was impacted by up to 1,500 ppb total VOCs and the deep interval was impacted by up to 1,300 ppb total VOCs. Previous reports indicate that the upper 200 feet of fractured bedrock to the top of the Syracuse Formation behaves as a single hydrogeologic unit with the water table at about 40 feet below surface.

The FW-18 well cluster is proposed to contain 4 monitoring wells, screened in the following depths/formations, as listed on Table 3-5; 30-50 ft bgs (Nedrow/Clarence); 70-90 ft bgs (Edgecliff/Falkirk); 115-135 ft bgs (Upper Camillus); and 150-170 ft bgs (Lower Camillus). The location and screened intervals are subject to change based on field conditions.

Sidegradient

Monitoring well cluster (FW-27) is proposed to be installed approximately 3,400 feet south of the Spill Site, in the area of Route 5. No unimpacted monitoring wells currently exist in this area to delineate the plume. Based on data collected during the NYSDEC RI, this area is hydraulically sidegradient to the Spill Site and groundwater plume. However, the sedimentary rocks dip to the south and may provide a pathway for DNAPL to migrate in a southerly direction. It was concluded in the NYSDEC RI that the potential exists for the DNAPL to have migrated under gravity flow in a southerly direction, following south-dipping bedding planes, fractures, and lithologic boundaries. Meanwhile, vertical fractures may have allowed the DNAPL to migrate deeper in a stepwise fashion, as it moved to the south. This cluster is proposed to contain 4 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 40-60 ft bgs (Nedrow); 80-100 ft bgs (Clarence); 130-150 ft bgs (Falkirk); and 160-180 ft bgs (Mid Camillus). The location and screened intervals are subject to change based on field conditions.

Monitoring well cluster (FW-20) is proposed to be installed approximately 1,500 feet northeast of the spill site and approximately 1,200 feet north of well cluster DC-6. No unimpacted monitoring wells exist in this area. This area of the plume is currently delineated using only domestic wells, and is of importance due to the fact that northeast trending vertical fractures may control the migration of the plume. A cluster of contaminated domestic wells are located on the western side of the fractures while clean domestic wells are located on the eastern side of the fractures (Figure 3-1). A monitoring well cluster in this area will provide delineation data for the plume and provide data to support the influence of the fracture system on the migration of contaminated groundwater. This cluster is proposed to contain 4 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 20-40 ft bgs (Clarence); 50-70 ft bgs (Basal Nedrow/Mid Falkirk); 80-100 ft bgs (Basal Falkirk); and 125-145 ft bgs (Lower Camillus). The location and screened intervals are subject to change based on field conditions.

Monitoring well cluster (FW-21) is proposed to be installed approximately 1,800 feet northwest of the monitoring well cluster DC-9. In this area, the plume is delineated only by domestic wells, and no unimpacted monitoring wells exist to adequately define the northern boundary of groundwater contamination. Also, this area is of importance due to the fact that northeast trending vertical fractures may control the migration of the plume in this area and which also appears to control the gorge north of Flinthill Road. A cluster of contaminated domestic wells is located on the western side of the fractures while clean domestic wells are located on the eastern side of the fractures (Figure 3-1). A monitoring well cluster in this area will provide delineation data for the plume and provide data to support the influence of the fracture system on the migration of contaminated groundwater and provide data on the fringe of the plume to supplement well clusters DC-8 and DC-9. Well cluster FW-21 is proposed to contain 4 monitoring wells screened in the following depths/formations, as listed on Table 3-5: 5-25 ft bgs (Clarence/Scajaquada); 30-50 ft bgs (Basal Scajaquada/Upper Falkirk); 60-80 ft bgs (Upper Camillus); and 100-120 ft bgs (Lower Camillus). The location and screened intervals are subject to change based on field conditions.

Monitoring well cluster (FW-22) is proposed to be installed north of the intersection of Flinthill Road and Spring Street approximately 1,500 feet north of well cluster DC-13. No unimpacted monitoring wells exist in this area to define the extent of contamination. This area of the plume is currently delineated using only domestic wells. The cluster location will provide delineation for the northeastern extent of the plume. This cluster is proposed to contain 2 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 5-25 ft bgs (Upper Camillus); and 25-45 (Lower Camillus). The location and screened intervals are subject to change based on field conditions.

The groundwater plume in the area west of Caledonia spreads to the south, expanding the width of the plume away from its axis. In this area, the groundwater contamination is delineated by domestic wells only. The widening of the plume may be occurring for one or more reasons. The topography is approximately 100 feet lower in this area than at the Spill Site; therefore, there is less overburden pressure on the horizontal fractures/bedding planes which may allow groundwater to locally flow to the south. The widening of the plume may also be related to transition from the bedrock aquifer to the valley fill aquifer, or to fracture morphology. No bedrock wells exist east of Spring Creek to define the downgradient extent of the plume. Two monitoring well clusters are planned in this area (FW-25 and FW-26) to provide delineation data for the plume and provide data to evaluate the flow of contaminated groundwater to the south, toward currently (believed to be) unimpacted domestic wells. The locations and screened interval are subject to change based on field conditions.

Monitoring Well Cluster FW-25 is proposed to be installed approximately 200 feet east of Route 36 near the New York Central Railroad crossing. The plume widens to the south in this area and its limits are not currently defined. This cluster is proposed to contain 3 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 20-40 ft bgs (Upper Falkirk); 50-70 ft bgs (Upper Camillus); and 80-100 ft bgs (Lower Camillus). This cluster is located between the Jones Chemical Site and Route 36. Monitoring Well Cluster FW-26 is proposed to be installed approximately 2,500 feet south of Route 5 and approximately 1,500 feet east of McIntyre Road. This cluster is proposed to contain 3 monitoring wells, screened in the following depths/formation, as listed on Table 3-5: 80-100 ft bgs (Clarence); 130-150 ft bgs (Falkirk); and 170-190 ft bgs (Mid Camillus). The nearest monitoring well cluster (DC-12) is over 2,500 feet north and has been impacted by VOCs. The plume is currently defined only by domestic wells in this area.

<u>*Downgradient*</u>

The area east of Spring Creek is an important element of the RI to delineate the downgradient extent of the groundwater contamination. No clean unimpacted wells exist in this area to define the downgradient extent. According to NYSDEC, a private domestic well on the east side of Route 36 was sampled and was found to have negative results. The NYSDEC RI concluded that Spring Creek was the ultimate discharge boundary for the plume in an eastward (downgradient) direction. No monitoring well data currently exists to support this conclusion. The discharge of contaminated spring water at Spring Creek indicates that discharge of contaminated water does occur in this area; however, there is no data to support the conclusion that no contaminated groundwater flows beneath the creek. It was concluded in the NYSDEC RI that the springs at Spring Creek are derived from the upper zone of the Bertie Formation. Geologic data indicate that east of Spring Creek the bedrock surface dips steeply. East of Caledonia the bedrock surface drops off significantly in the subsurface where the ancestral Genesee River Valley is located. This valley has been filled with glacial sediments to unknown depth. In order to evaluate the potential for contaminated groundwater to migrate past Spring Creek, to the east, two monitoring well clusters (FW-23 and FW-24) will be installed.

Monitoring Well Cluster FW-23 is proposed to be installed approximately 1,800 feet east of Spring Creek where Route 36 crosses the Baltimore and Ohio Railroad crossing. This cluster is proposed to contain 2 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 5-25 ft bgs (Upper Camillus); and 25-45 (Lower Camillus). Monitoring Well Cluster FW-24 is proposed to be installed approximately 1,500 feet east of Spring Creek near Caledonia High School, east of Route 36. This cluster is proposed to contain 3 monitoring wells, screened in the following depths/formations, as listed on Table 3-5: 10-20 ft bgs (Upper Falkirk); 25-45 ft bgs (Mid Camillus): and 55-75 (Mid Camillus). The location and screened intervals are subject to change based on field conditions.

Based on NYSDEC comments, additional sidegradient and downgradient wells may be required beyond the FW-20 and FW-27 clusters, between the FW-25 and FW-26 clusters, between the FW-21and FW-22 clusters, and between the FW-26 and FW-27 clusters. Following completion of the First Quarterly Sampling round and preparation of the DER, should the plume boundary not be defined, recommendations for additional wells will be made prior to proceeding with the RI/FS Report.

Aquifer Pumping Test Well

An aquifer pumping test will be conducted to provide permeability/flow rate information to serve as the basis for the design of a remedial groundwater extraction alternative during preparation of the Feasibility Study (FS). A groundwater pumping well and four piezometers (Cluster FW-19) for drawdown measurements to monitor the correlative zone of the pumping well will be installed in the vicinity of existing monitoring well cluster DC-7R and Church Road (Figures 3-2 and 3-3). This location was chosen based on the observation that the plume is very narrow, with steep VOC concentration gradients in this area. This may be due to the presence of east-west trending fractures that are potentially influencing the migration of the plume to the east. This location may be a likely area for consideration of a potential remedial action. The pumping well will be installed to a maximum depth of 160 feet bgs to the base of the Camillus Formation. This is the interval with the highest concentration of contamination in the nearby DC-7R cluster. The final well design will be determined during the investigation process. At this time, it is assumed that the well will be fully penetrating. However, based on packer testing and downhole geophysical surveys, a specific zone may be targeted. Piezometers will be installed at an appropriate distance from the pumping well to monitor aquifer response during pumping.

3.3.4 Monitoring Well Drilling and Testing (Subtask 3.04)

Monitoring well installation will be performed using downhole air hammer drilling techniques and diamond bit coring. Installation activities will be supervised by a Foster Wheeler Environmental geologist. Rock cores were obtained during the NYSDEC investigation to establish stratigraphy and correlate bedrock units between well clusters. This existing information (cross-section/well logs) will be utilized to cross-reference the new monitoring wells to formations.

Coring will be performed to assist in targeting well depths to formations (when appropriate). Coring will be performed in the deep well borehole at each well cluster location using NX wireless coring procedures in 5 to 10 foot core runs. An approximately 2-inch diameter rock core will be obtained for the purpose of identifying the rock formation contacts. The formation descriptions and fossil assemblages identified in the previous RI and available regional publications will be used to correlate the geologic units and determine the depth of each geologic formation present at each proposed cluster location. Rock cores will be archived on-site for future reference.

Boreholes will be drilled (air hammer) into competent bedrock. A steel surface casing will be sealed a minimum of 2 feet into bedrock using cement grout prior to the drilling of each well. After the grout has set for a minimum of 24 hours, the borehole will be advanced to the appropriate depth. Rock chip samples will be collected by the site geologist for lithologic description and field screening with a PID to evaluate the presence of VOCs. All pertinent information will be recorded in a bound field logbook.

Monitoring wells (excluding Cluster FW-19) will be completed with 20 feet of 2-inch diameter schedule 40 polyvinyl chloride (PVC) factory slotted screen. A 20 slot size screen with No. 1 Morie sand pack will be used.

The pumping test well (Cluster FW-19) will be completed with 6-inch diameter PVC continuous wrap screen. Well risers will be made of PVC. The screen slot size and filter pack will be determined from material (i.e., rock cores) observed and tested during drilling of the piezometers (which will be installed prior to the pumping well) to assure that the permeability of the filter pack is greater than the surrounding fractured rock. This is particularly important for the pump test to obtain accurate information on the fractured rock hydraulic characteristics.

All piezometers installed for the aquifer test will be cored to identify fracture zones to ensure that the piezometers screens are installed at the appropriate depth. Piezometers will be constructed of 2-inch PVC casing with 20 feet of screen set at the appropriate interval to monitor the influence of the pumping well on the aquifer.

The annular space around each well will be sealed with a bentonite or cement/bentonite slurry appropriate to subsurface conditions encountered. Monitoring wells will be completed either as flush mount or with a 3-foot steel protective stick-up casing, depending on the requirements of the well location.

Monitoring well locations will be surveyed by a licensed New York State Surveyor. Well locations will be surveyed to the nearest 1.0 foot, and ground surface elevation and inner casing elevation will be surveyed to the nearest 0.01 foot.

Drilling equipment will be decontaminated prior to drilling at each new location. A central decontamination pad will be constructed at the Spill Site. Decontamination water will be tested and drummed for proper storage prior to proper disposal.

3.3.4.1 Downhole Geophysics and Packer Testing (Subtask Activity 3.04.01)

The objectives of the downhole geophysical surveying are to determine major fracture zones to be screened in the new monitoring wells and piezometers, identify voids, and identify lithologic units so that the respective formations can be targeted, if appropriate. Geophysical data will be correlated to the NYSDEC and ongoing RI rock core data.

At each new cluster location, the deepest boring (of each well cluster) will be cored and geophysically logged and surveyed with a downhole video camera. Geophysical logging of the deepest boring at each cluster will be used in conjunction with coring data, to determine well depth and screened interval of all wells in the cluster. Geophysical log responses will be correlated to logs and rock cores obtained during the NYSDEC and EPA studies to delineate bedrock units. This information will be used in selection of well completion zones.

Geophysical methods to be used during this investigation include:

- Downhole camera;
- Caliper; and
- Natural Gamma.

The results of the downhole geophysics will be used to modify the proposed screen intervals depending on the geophysical results. The shallow well in each cluster will bridge the water table. The other screened interval depths will be adjusted to intersect highly fractured zones within the targeted formations/depths identified by the geophysics.

To supplement geophysical survey activities described above, downhole packer testing will be performed at approximately 3 well cluster locations. Proposed clusters include FW-19 (anticipated depth 160 feet), FW-20 (anticipated depth 145 feet), and FW-26 (anticipated depth 190 feet.) These locations will be selected following review of the results of the downhole camera and geophysical logging at which time, can be used to supplement the information collected, or provide further clarification/definition of features observed during the camera and logging activity. The deepest well in each selected well cluster will be used in packer testing activity. Packer test zones will be approximately 20 feet in length. It is anticipated that five packer zones per well will be tested (total of 15 packer test zones). Low concentration VOCs will be collected from each zone and will be analyzed using Rapid 24-hour turnaround laboratory services. These data will also be used to assist in monitoring well interval placement. If the result of the packer test results yield a level of data accuracy and quality not achieved by the video camera, geophysical logging, and coring, EPA will be notified and additional packer testing may be performed to better define the monitoring well screen intervals.

3.3.4.2 Groundwater Elevation Measurements (Subtask Activity 3.04.02)

Groundwater elevations will be collected during each quarterly sampling round. The objectives of measuring groundwater elevations are:

- Determine groundwater flow vectors under seasonal conditions;
- Collect sufficient data to prepare potentiometric maps;
- Determine vertical gradients at all well cluster locations; and
- Evaluate the potential for impacted groundwater discharge into surface water bodies.

Each synoptic groundwater level measurement event will be conducted in one day. Synoptic groundwater measurement events will be conducted prior to each groundwater sampling event in all monitoring wells. All data will be recorded and presented in tabular form. Barometric and rainfall data for the date of the measurements will be obtained from a local source (fish hatchery in Caledonia) and evaluated for influence on groundwater levels. Groundwater elevations will be measured from the surveyed inner casing measuring point using an electronic interface probe.

3.3.4.3 Surface Water Elevation Measurements (Subtask Activity 3.04.03)

Surface water elevations will be collected during each quarterly groundwater sampling event. The objectives of measuring surface water elevations are:

- Correlate groundwater and surface water elevations; and
- Assist in calculating the discharge of potentially contaminated groundwater to surface water bodies.

Surface water levels will be measured during the same day as the synoptic groundwater level measurements. Prior to the quarterly measuring events, staff gauges will be located during the Site Reconnaissance.

3.3.4.4 Aquifer Testing (Subtask Activity 3.04.04)

Aquifer testing will be performed at well cluster FW-19 (vicinity of existing DC-7R) to evaluate aquifer permeability, groundwater production rates, and projected area of influence to serve as a basis of design for groundwater extraction alternatives. The aquifer testing will be conducted according to the guidelines described in ASTM Method D4050-91, field procedure for withdrawal well tests for determining hydraulic properties of aquifer systems.

A short term step test will be performed prior to the full-scale aquifer test to determine the optimum pumping rate. Preliminary estimations were performed to determine the anticipated pumping rate for the pumping well. The average hydraulic conductivity obtained from slug tests was used to calculate the anticipated flow rate from a pumping well with approximately 50 feet of draw down. The calculations yielded a pumping rate of up to 200 gallons per minute. This does not take into consideration well loss and other factors so an anticipated pumping rate of 75 to 100 gallons per minute is sufficient. Therefore, the step test will include 3 steps at 50 gpm, 75 gpm and 100 gpm. These rates may need to be adjusted depending on the aquifers response.

The full aquifer test will run for a minimum of 24 hours and an anticipated maximum of 72 hours. If a steady state cone of depression is reached, the test will be terminated prior to the 72 hours. The discharge from the aquifer test will be piped at least 1,000 feet down gradient of the pumping well to assure that recharge of the pumped water does not impact the results of the test. The aquifer recovery will also be monitored until water levels reach 90% of their original levels.

A total of 4 fully penetrating monitoring piezometers will be installed for use during the aquifer test. Two piezometers will be placed perpendicular to the direction of groundwater flow and the strike of the major fracturing. The other 2 piezometers will be placed parallel to the groundwater flow and installed in the same major fracturing as the pumping well and up gradient of the pumping well. This configuration is recommended so as to analyze the hydraulic conductivity and distance draw down parallel to the major fracturing and at right angles to the fracturing. The preferential pathway and higher hydraulic conductivity expected along the fault will produce an elongated cone of depression. The analysis will be important for designing groundwater capture for any groundwater extraction alternatives. Two piezometers will be placed 25 feet from the pumping well and the other 2 piezometers will be placed 100 feet from the pumping well.

Pressure transducers will be installed in the pumping well, the 4 monitoring piezometers, and wells DC7R and DC3. Manual measurements will be made periodically in DC 5, DC16 and DC17. The transducer wells will be checked periodically with an electronic tape. The measurement frequency is approximately as follows:

Manual Frequency	**Transducer Frequency**	**Elapsed Time**
30 sec.	10 sec.	3 min.
1 min.	30 sec.	3 to 15 min.
5 min.	1 min.	15 to 60 min.
10 min.	3 min.	1 to 2 hr.
20 min.	5 min.	2 to 3 hr.
1 hr.	20 min.	3 to 15 hr.
5 hr.	1 hour	15 hr. and greater

The manual measurements may be less frequent if the wells are not responding to the aquifer test.

Groundwater sampling will be taken during the step test and during the aquifer test. Three samples will be taken during the step test. One sample at the beginning of the first step, one sample at the end of the second, and one at the end of the third step. The samples will be analyzed for volatile organics. During the aquifer test, samples will be taken at 6 hours, 12 hours and then every 12 hours, with a final sample at the end of the test. The samples will be analyzed for volatile organics, temperature, conductivity, pH, and dissolved oxygen. The final sample will also be analyzed for TAL metals, suspended solids, and dissolved solids. Step test samples will be analyzed for quick turnaround analysis.

Further details will be provided in the site-specific QAPP.

3.3.5 Environmental Sampling (Subtask 3.05)

Foster Wheeler Environmental will conduct a variety of environmental sampling activities during Phase 1, including:

- Groundwater Sampling;
- Spring/Seep Water Sampling;

- Spring/Seep Sediment Sampling;
- Stream Surface Water Sampling; and
- Stream Sediment Sampling.

Additional details regarding these tasks are provided in the following sections.

3.3.5.1 Groundwater Sampling (Subtask Activity 3.05.01)

Contaminant Plume Characterization Sampling

Four quarterly rounds of groundwater sampling will be conducted to supplement the data collected during the Site Reconnaissance. All new and existing monitoring wells will be sampled seasonally at three month intervals representing seasonal conditions (spring, fall, summer, and winter). A single limited scope post storm sampling event will be conducted to assess intermittent high water conditions, as discussed below. The first round of groundwater sampling will be conducted a minimum of 2 weeks following well installation completion.

Fifty-eight existing monitoring wells at the 19 cluster locations and the proposed 30 new wells will be sampled. If data results indicate that less wells are required for the Quarterly Sampling, the appropriate recommendation will be made to EPA in the Technical Memorandum. Sampling will be conducted by purging 3 well volumes prior to collecting samples using bottom filling bailers. Details of the groundwater sampling procedures and a summary table of analytical parameters will be included in the QAPP. All groundwater samples will be analyzed for Low Concentration VOCs and cyanide. In addition, field parameters will be measured at the time of quarterly groundwater sampling events and will include the following parameters:

- Dissolved oxygen (DO);
- Oxidation reduction potential (ORP);
- pH;
- Hardness;
- Conductivity;
- Turbidity; and
- Temperature.

The results of the first round of quarterly groundwater sampling event from the existing and newly installed wells will be included in the RI. Subsequent rounds will be included in an addendum to the RI.

Storm Event Sampling

A single, limited scope, groundwater sampling event will be conducted following a significant summer rainfall event. The purpose of the storm sampling event is to evaluate the influx of surface water through the fractured bedrock and its impact on groundwater quality. It has been established during the previous investigation that elevation rises in the water table are significant during precipitation events and that VOCs are mobilized from the unsaturated zone, resulting in anomalous VOC concentrations downgradient of the Spill Site. Groundwater samples will be collected within 3 days of a rainfall event of 2-inches or greater and analyzed for Low Concentration VOCs and Cyanide.

Samples will be collected from the following 8 monitoring well clusters in the vicinity of the Spill Site and will include the same analytical parameters as discussed in the Contaminant Plume Characterization Sampling section.

Storm Event Sampling Rationale

Well Cluster	Rationale
DC-1	To assess the impact of influx of water at the spill site.
DC-2	To assess the impact of influx of water immediately downgradient of spill site.
DC-3	To assess the impact of influx of water to the east of the fracture system parallel to Mud Creek Gorge
DC-6	To assess the impact of influx of water to the west of the fracture system parallel to Mud Creek Gorge
DC-7R	To assess the impact of influx of water along the fracture system along the axis of the plume.
FW-18	To assess the potential for groundwater to discharge to the quarry operation during rain events
FW-20	To assess the potential for downgradient movement of impacted groundwater during rain events
FW-27	To document upgradient groundwater quality during rain events.

During the Storm Event Sampling, seeps which may occur (as indicated in NYSDEC comments) in the wetland west of Spring Creek will be visually searched for. If found, these locations will be marked and sampled for Low Concentration VOCs and cyanide. A total of up to 3 locations will be sampled. Samples will be processed along with groundwater samples collected during the storm event for efficiency.

Monitored Natural Attenuation Characterization Sampling

The MNA characterization program includes acquisition of groundwater quality data needed to evaluate chlorinated solvent attenuation and to evaluate flow and migration regimes for attenuation process effectiveness, limitations, and constraints. From the Spill Site, the groundwater contaminant plume extends more than 3 miles to the east. Zones of negative vertical gradient (downflow) and positive vertical gradient (upflow) exist along the axis of the plume. Stormwater events have been shown to significantly impact both plume migration and chemistry. Therefore, a monitored natural attenuation (MNA) characterization program has been designed to respond to these conditions.

During the first quarterly groundwater sampling event (Phase 1), MNA samples will be collected from a total of twenty-five (25) existing monitoring wells. The following locations have been identified for MNA parameter analysis:

Well Cluster	**Number of Wells**	**Plume Location**	**Hydraulic Gradient**
DC-1	4	Source area	Downward in upper 2 wells, upward in 2 deeper wells
DC-7	4	Plume axis	Upward
DC-8	4	Downgradient, north of plume axis	Variable, downward during low water, upward during high water
DC-9	3	Downgradient, north of plume axis	Upward
DC-10	4	Plume axis	Downward in upper 2 wells, upward in 2 deeper wells
DC-12	4	Downgradient, south of plume axis	Downward
DC-13	2	Downgradient edge of plume	Downward

During the contaminant plume characterization sampling, groundwater sampling, the following parameters will be measured with the use of field instruments:

- Dissolved oxygen
- PH
- hardness
- ORP
- turbidity
- conductivity, and
- temperature

These data will be included in the MNA evaluation. The following additional natural attenuation parameters will be measured with the use of field test kits at the 25 monitoring wells included in the MNA evaluation.

- Oxygen (confirmation of field instrument results), and
- CO_2

Groundwater samples will also be sent to a laboratory for analysis of the following parameters that will be evaluated within the MNA evaluation:

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

Uses of Data in the FS Alternative MNA Evaluation

The following table presents the uses of collected data during the MNA evaluation:

Analytical Parameters	**Uses of Collected Data In FS**
Standard Plate Count, Microtoxicity, Toxic Metals (if suspected), Potassium, Phosphorous. Methane, CO_2, pH, Sulfide, Nitrite, Temperature. Alkalinity, CO_2.	For evaluation of microbial viability. For evidence of mineralization.
Nitrate, Oxygen, Chloride, Propane, Propene, Ethene, Ethane, Methane.	For evidence of dechlorination.
Oxygen, ORP, Manganese, Nitrite, Sulfide. Sulfate, Oxygen, Nitrate.	For indication of the oxidation/reduction state of the groundwater. For evidence that electron acceptors are present.
Ammonia, Ferrous Iron, Manganese, Phosphorous. Potassium, Calcium.	For evidence that key nutrients are present. For use in cross-checking analyses.
Methane, Propane, Ethane, Ammonia, Ethene,	For indication that growth substrates are

Analytical Parameters	Uses of Collected Data In FS
TPH, TOC, BOD, COD.	present.
Note 1: Many of the parameters listed above are helpful in evaluating more than one of the many indications that natural attenuation may be viable for chlorinated hydrocarbon remediation in groundwater.	
Note 2: Oxygen and CO_2 will be measured in the field using test kits.	
Note 3: Dissolved oxygen, pH, hardness, ORP, turbidity, conductivity, and temperature will be measured in the field using field instruments.	

Details of groundwater sampling procedures will be provided in the site-specific QAPP. The QAPP will present detailed tables which will include information such as matrix, type of sample, number of sample locations, i.e., Summary of Analytical Requirements.

3.3.5.2 Spring/Seep and Surface Water/Sediment Sampling (Subtask Activity 3.05.02)

Spring/seep water, spring/seep sediment, stream surface water and stream sediment sampling will be performed during Phase 1. During the Site Reconnaissance, data will be collected (Section 3.3.1.4) and evaluated to determine the optimum locations for spring, seep, surface water, and sediment locations. Recommendations for sample locations will be made in the Technical Memorandum.

The objectives of these efforts will be:

- Evaluate the potential for contaminated groundwater to impact various surface water bodies located north and east of the Study Area;
- Evaluate the potential for specific stratigraphic horizons to transmit contaminated groundwater;
- Develop trend analysis data for surface water and sediment sampling results (historic and newly acquired);
- Evaluate the potential impact to sediments from the discharge of contaminated groundwater from springs and seeps; and
- Gather analytical data for use in the Human Health and Ecological Risk Assessments.

The spring/seep water/sediment and stream surface water/sediment sampling will encompass the following locations (Figure 3-4):

- Oatka Creek;
- Mud Creek;
- Gorge Pond;
- Spring Creek; and
- Wetlands east of Spring Creek.

Spring and Seep Sampling

Seeps and springs are found throughout the Study Area. Both perennial and intermittent springs were observed in Mud Creek and Spring Creek during the NYSDEC RI. NYSDEC has indicated that numerous seeps are present in the wetland west of Spring Street and during precipitation events have produced large quantities of water with surprisingly high concentrations of TCE. During the storm event sampling (see Section 3.3.4.1) additional seep locations will be visually searched and included in the sampling program for Low Concentration VOCs and Cyanide. A total of 3 seeps will be sampled at this location, if found. Review of the historical surface water data revealed variable concentrations of TCE from springs/seeps discharging to Mud Creek. The locations of historical NYSDEC sampling points are not available.

It is anticipated that approximately 14 spring/seep locations will be sampled for water (and, sediment, if present) in the areas of Mud Creek, Gorge Pond and Spring Creek (these do not include the potential 3 additional seeps to be located west of Spring Street due to precipitation events) and approximately 21 surface water/sediment samples will be collected from Oatka Creek, Mud Creek, Gorge Pond, Spring Creek and the wetlands to the east of Spring Creek. Figure 3-4 shows the areas where the 14 spring/seep (and sediment, if present) samples will be collected and the approximate locations of the 21 surface water/sediment sampling points. Specific sample locations for spring/seep (and sediment, if present) and surface water/sediment will be identified during the establishment of sampling points (during the Site Reconnaissance subtask). Details of spring/seep sampling procedures and analytical summary table information will be provided in the site-specific QAPP. Locations of sampling points within individual areas are presented below.

Mud Creek

The channel of Mud Creek passes immediately to the east of the Spill Site and runs northeast, discharging into Oatka Creek. Data collected during the NYSDEC RI indicates that Mud Creek Gorge exists due to erosion along northeast trending vertical fractures. These vertical fractures, in conjunction with subhorizontal bedding planes and fractures, transmit a significant amount of groundwater, some of which discharges along the steep walls of the gorge. Discharge of contaminated groundwater to Mud Creek Gorge was documented during the previous investigation. Seeps will be identified at various stratigraphic horizons on opposite sides of the gorge walls for sampling. Sample locations will be chosen that represent different vertical horizons to evaluate the potential for specific stratigraphic horizons to transmit contaminated groundwater. Samples will be collected on opposite sides of the gorge if present, to evaluate whether the vertical fractures that influenced the formation of the gorge act as a discharge boundary for contaminated groundwater.

It is anticipated that approximately six (6) spring/seep locations will be sampled from the channel of Mud Creek Gorge to evaluate the potential for contaminated groundwater to discharge into the creek. The area encompassing the locations of the sampling is shown on Figure 3-4. These locations are tentative and may be modified based on the results of the Site Reconnaissance, as recommended in the Technical Memorandum. The actual number and location will likely depend upon temporal hydrologic conditions. Sample locations will be selected based on visual, olfactory, and field screening results that may indicate contamination is present. Samples will include spring/seek water, and sediment if present. The six water seep/spring samples will be analyzed for Low Concentration VOCs and cyanide. Three of these (two from the west side and one from the east side) will also be analyzed for Full TCL/TAL parameters. Water quality data parameters (pH, temperature, TDS hardness, dissolved oxygen, and specific conductivity) will be recorded at the time of sampling. If samples collected for the full range of parameters indicate that an unexpected problem associated with the site exists, EPA will be notified and additional parameters (other than VOCs and Cyanide) will be added for future sampling.

Gorge Pond

The gorge which contains Gorge Pond is located on the bedrock slope of Oatka Creek Valley, east of Mud Creek. The pond is apparently spring fed as no inflow or outflow is noted on aerial photographs or topographic maps. No data was collected during the NYSDEC RI in this area. It is likely that, as with Mud Creek Gorge, this gorge exists due to erosion along northeast trending vertical fractures. These vertical fractures, in conjunction with subhorizontal bedding planes and fractures, may transmit groundwater, some of which discharges to the pond. During the Site Reconnaissance, seeps (if present) will be identified at various stratigraphic horizons on opposite sides of the gorge walls for sampling. Sample locations will be chosen that represent different vertical horizons to evaluate the potential for specific stratigraphic horizons to transmit contaminated groundwater. Domestic well sampling during the NYSDEC RI indicated that a cluster of TCE impacted wells exists to the west of this feature, while a cluster of clean wells exists to the east. Samples will be collected on opposite sides if present of the gorge to evaluate whether the vertical fractures that influenced the formation of the gorge act as a discharge boundary for contaminated groundwater.

It is anticipated that approximately four spring/seep locations will be sampled from the channel of Gorge Pond to evaluate the potential for contaminated groundwater to discharge into the pond. The area encompassing the locations of the sampling is shown on Figure 3-4. These locations are tentative and may be modified based on the results of the Site Reconnaissance. Final Sample locations will be presented in the Technical Memorandum. Sample locations will be selected based on visual, olfactory, and field screening results that may indicate contamination is present. The actual number and location will likely depend upon temporal hydrologic conditions. The samples (from each side of the gorge) will be analyzed for Low Concentration VOCs and cyanide. Water quality data parameters (pH, temperature, TDS hardness dissolved oxygen, and specific conductivity) will be recorded at the time of sampling.

Spring Creek

Spring Creek is fed by springs that originate on the western side of the creek. During the NYSDEC RI, these springs were identified to represent discharge from the upper Bertie Formation, along bedding planes and sub-horizontal fractures. Samples (one contaminated with up to 1,900 ppb TCE) were collected from several undocumented locations during the previous investigation. It is not known if vertical fractures influence the groundwater discharge in this area. To evaluate the water quality of the spring discharge along the north-south trending reach of Spring Creek, samples will be collected at various points along the creek. Samples will be collected at intervals that will allow an interpretation to be made concerning where the area of contaminated discharge occurs. VLF geophysical data collected along Spring Creek will be evaluated to attempt to identify vertical fractures. Particular care will be employed when selecting sampling locations to locate vertical fractures from which to collect samples. Sampling locations will be biased toward areas where vertical fractures are identified or suspected.

It is anticipated that approximately four spring/seep locations will be sampled from the discharge area of Spring Creek to evaluate the potential for contaminated groundwater to discharge to the creek. The area encompassing the locations of the sampling is shown on Figure 3-4. An upstream sample will be collected south (upstream) of the railroad crossing at Caledonia to avoid potential railroad related impacts. The locations are tentative and may be modified based on the results of the Site Reconnaissance. Final sample locations will be presented in the Technical Memorandum. The actual number and location will likely depend upon temporal hydrologic conditions. Sample locations will be selected based on visual, olfactory, and field screening. Samples will include water and sediment, if present. The samples (from each side of the gorge) will be analyzed for Low Concentration VOCs and cyanide. In addition, water quality data parameters (pH, temperature, TDS hardness dissolved oxygen and specific conductivity) will be recorded at the time of sampling.

Spring Creek Semi-permeable Membrane Devices (Diffusion Bags)

Semi-permeable membrane devices (SPMDs), also referred to as diffusion samplers, will be used to evaluate potential transport of groundwater containing volatile organic compounds to groundwater discharge points along Spring Creek. The Site Reconnaissance phase of the investigation will be used to assess the environmental characteristics of the seeps/spring bottom substrates for their suitability for using SPMDs and also the final construction of the type of SPMDs to be used.

The diffusion samplers are to be constructed of non-polar, dense polyethylene bags or tubes. The samplers for volatile compounds rely on a passive partitioning process which operates under the assumption that net chemical migration occurs across a semi-permeable membrane until near equal chemical concentrations exit on both sides of the membrane (i.e, chemical equilibrium).

For application of this methodology at the Lehigh Valley Superfund Site, the results of surface and groundwater elevation sampling and observations during the ecological reconnaissance of the seeps and springs along Spring Creek will be used to identify the final deployment area. Three seeps/springs with the potential for plume related discharge and one upgradient seep suspected to be beyond the influence of the plume will be sampled using SPMDs. Up to three replicate, SPMDs will be deployed at each of the identified seeps or springs.

The diffusion samplers will be filled with de-ionized water as the sequestration fluid and will be buried in the sediments in the seep/spring channel (Savoie et al. 1998; Huckins et al. 1993). Sequestration fluid provides the basis for development of a passive diffusion gradient across the encapsulating bag and environmental media being evaluated. A review of SPMD designs will be performed to select the final design of the sampler for this application. A passive diffusion device similar to that described in Savoie et al. (1998) is recommended or deployment at the seep/spring locations at this time. After allowing the sampler sequestration fluid (de-ionized water) and groundwater discharge to equilibrate over time (up to 30 days depending upon hydrologic characteristics), the samplers will be removed from the spring basin and the fluid will be analyzed by low range, VOC laboratory methods. This sampling approach minimizes the degree of disturbance and potential for loss of highly volatile compounds to the atmosphere using more traditional sampling techniques.

Stream Surface Water and Sediment Sampling

Surface water and sediment sampling and analysis will be conducted in Mud Creek, Spring Creek, Oatka Creek, and the area of Gorge Pond. Approximately twenty-one (21) sampling locations are anticipated, located in areas downgradient of the project area and in upstream background locations, as shown on Figure 3-4. The locations are tentative and maybe modified based on the results of the Site Reconnaissance. Final sampling locations will be presented in the Technical Memorandum. Surface water and sediment samples will be co-located and collected at the same time. Locations have been tentatively identified based on several criteria: to evaluate the surface water quality in areas where it is known that TCE-contaminated surface water discharges from the bedrock (i.e., springs/seeps) into surface water; to evaluate the persistence of TCE in surface water and sediment; and in support of the ecological risk assessment. Samples at proposed locations SW/S 1 through 5 will be analyzed for a Full TCL/TAL parameters. If sampling at these locations, which are in close proximity to the source area, indicate an unexpected problem exists with the site, EPA will be notified, and the appropriate additional parameters will be added for future sampling. Surface water and sediment sampling procedures and analytical summary table information will be detailed in the site-specific QAPP.

Mud Creek Gorge

It is anticipated that five (5) surface water/sediment samples will be collected, as shown on Figure 3-4 (SW/SED-1 through 5). Mud Creek is an intermittent stream along its reach across the outcrop belt of the Onondaga Formation in the area of the Spill Site. The losing portion of the stream channel begins at Route 5 (approximately 1 mile south [upgradient] of the Spill Site) and continues to the lower portion of the Mud Creek Gorge, where perennial spring discharge feeds the stream. Surface water and sediment samples will be collected for comparison to spring/seep sample results to evaluate the potential for TCE to remain persistent in the surface water and sediment. Overland flow only occurs along this reach of the creek during spring run-off events. Therefore, it appears that no relevant upgradient background location can be sampled which is representative of the stream flow across the Study Area. Since TCE is extremely volatile and does not persist in surface water, the surface water/sediment sampling locations will be selected at near shore quiet water locations where fine sediment deposition occurs. This will bias sample locations toward areas where TCE would likely be found.

Surface water samples will be collected directly into the sample containers to minimize volatilization. The surface and sediment samples (two samples) from Mud Creek will be analyzed for Low Concentration VOCs and cyanide. In addition, the samples will also be analyzed for the remaining suite of Full TCL/TAL analytical parameters. Samples will be field screened using a PID. Water quality data (pH, temperature, TDS hardness, dissolved oxygen and specific conductivity) will be recorded at the time of sampling. Sediment samples will also be analyzed for TOC.

Gorge Pond

Gorge Pond is apparently a spring fed pond, with minimal surface water inflow or outflow, as seen in aerial photographs and the USGS topographic map. The lack of surface water flowing through the pond may create an environment in which TCE could be persistent. This pond was not sampled during the NYSDEC RI.

It is anticipated that two (2) surface water/sediment samples will be collected, as shown on Figure 3-4 (SW/SED-11 and 12). These locations are tentative and may be modified based on the results of the Site Reconnaissance final sampling locations will be presented in the Technical Memorandum. The locations have been tentatively identified primarily based on the limited size of the pond. If field observations during the Site Reconnaissance indicate that flow occurs in this area, sampling locations may be modified. Since TCE is extremely volatile and does not persist in surface water, the surface water/sediment sampling locations will be located at near shore quiet water locations where fine sediment deposition occurs. This will bias sample locations toward areas where TCE would likely be found.

Surface water samples will be collected directly into the sample containers to minimize volatilization. Samples of the collected surface and sediment samples from Gorge Pond will be analyzed for Low Concentration VOCs and cyanide. Samples will be field screened using a PID. Water quality data (pH, temperature, TDS hardness, dissolved oxygen and specific conductivity) will be recorded at the time of sampling. All sediment samples will also be analyzed for TOC.

Spring Creek

Spring Creek is a significant discharge boundary for shallow bedrock groundwater flow. The creek is apparently fed primarily by springs originating from subhorizontal bedding plane fractures, and to a lesser extent, vertical fractures in the bedrock. The creek runs perpendicular to the axis of the plume, with the highest concentrations found approximately half way between Caledonia and Mumford (the length of the creek located in the Study Area). Surface water and sediment samples will be collected for comparison to spring/seep sample results to evaluate the potential for TCE to remain persistent in the surface water and sediment. Data will also be evaluated for use in the ecological risk assessment. One upstream sample location (SW/SED-13) has been selected for comparison purposes.

It is anticipated that approximately five (5) surface water/sediment samples will be collected, as shown on Figure 3-4 (SW/SED-13 through 17). Final sampling locations are tentative and may be modified based on the Site Reconnaissance final sampling locations will be presented in the Technical Memorandum. The locations have been identified primarily based on the length of the creek through the Study Area. Since TCE is extremely volatile and does not persist in surface water, the surface water/sediment sampling locations will be located at near shore quiet water locations where fine sediment deposition occurs. Where relevant, sample locations will be located in close proximity to spring/seep sample locations. This will bias sample locations toward areas where TCE would likely be found. The collected surface and sediment samples from Spring Creek will be analyzed for Low Concentration VOCs and cyanide. Samples will be field screened using a PID. Water quality data (pH, temperature, hardness, dissolved oxygen and specific conductivity) will be recorded at the time of sampling. All sediment samples will also be analyzed for TOC.

Oatka Creek

The Oatka Creek basin is the discharge point for surface water within the Mud Creek drainage basin. Oatka Creek is suspected to be influenced by local groundwater regimes. This groundwater regime is believed to be highly influenced by the Mud and Spring Creek sub-basins. The creek flows eastward and is assumed to be the northern hydrologic boundary of the Study Area. Surface water/sediment samples will be collected along the reach of the creek throughout the Study Area and at one upstream location outside the suspected area of influence of the groundwater plume.

It is anticipated that approximately five (5) surface water/sediment samples will be collected, as shown on Figure 3-4 (SW/SED-6 though 10). These locations are tentative and may be modified based on the findings of the Site Reconnaissance. Final sample locations will be presented in the Technical Memorandum. The locations have been selected primarily based on the length of the Creek and it's confluence with tributaries. One (1) upstream location (SW/SED-6) has been selected west of the Spill Site, where discharge from the area of the plume is not suspected. This location will provide a reference sample for comparison to downstream locations. Sample locations are planned in Oatka Creek upstream and downstream of the confluence with Mud Creek and Spring Creek to evaluate the potential for TCE discharge from those creeks to be persistent within Oatka Creek. No apparent flow from the Gorge Pond enters Oatka Creek; therefore, no sampling is proposed at this time. If field observations during the Site Reconnaissance indicate that flow occurs in this area, sampling locations may be modified.

Surface water samples will be collected directly into the sample containers to minimize volatilization. Collected surface and sediment samples will be analyzed for Low Concentration VOCs and cyanide. Sample location (SW/SED-6), will be analyzed for Full TCL/TAL parameters. Samples will be field screened using a PID. Water quality data (pH, temperature, TDS hardness, dissolved oxygen and specific conductivity) will be recorded at the time of sampling. All sediment samples will also be analyzed for TOC.

<u>Wetland Area</u>

A large wetland area located approximately 1.5 miles east of Spring Creek is suspected to be a significant discharge point for groundwater flow from the Lehigh Valley aquifer. This wetland also receives flow from Oatka Creek. The wetland occupies a buried bedrock valley filled with glacially deposited sediments. The depth to bedrock is unknown in this area, but available information indicates the bedrock surface drops off sharply in the area just east of Caledonia. The presence of the wetland indicates groundwater discharge is occurring in this area. Therefore, sampling is warranted to determine the potential for upward flow from the bedrock to discharge into the wetland. No historical sampling of this area has occurred to date and therefore, sampling is warranted. Samples will be collected at intervals along a north-south line (perpendicular to the axis of the plume) to evaluate the potential for plume discharge to the wetlands.

Four surface water and sediment samples (SW/SED-18 though 21) will be collected to confirm the absence/presence of TCE along the western shoreline of the wetlands, as shown on Figure 3-4. Tentative sampling points are proposed along a north-south line between Route 5 and Oatka Creek. Two (2) of the collected surface and sediment samples (2 locations) will be analyzed for Low Concentration VOCs and cyanide only, and the remaining two (2) samples, will be analyzed for Full TCL/TAL parameters for characterization and ecological risk assessment purposes. Samples will be field screened using a PID. Water quality data (pH, temperature, TDS hardness dissolved oxygen and specific conductivity) will be recorded at the time of sampling. All sediment samples will also be analyzed for TOC.

3.3.5 <u>Ecological Characterization (Subtask 3.06)</u>

As part of the ecological reconnaissance, a qualitative vegetation habitat survey will be performed to identify terrestrial habitats associated with Mud Creek, Spring Creek, select reaches of Oatka Creek, and the wetland area located to the east of Spring Creek. In areas where field delineation is needed, specifically areas affected by contamination, wetlands will be identified using the three parameter method (1987 Federal Manual). A site figure indicating the average of each wetland type as well as their respective locations will be provided. Wetlands will be identified using tools such as the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) and/or New York State wetland maps. The survey will consist of identifying vegetation communities present. Vegetation communities will be characterized by identifying and recording dominant vegetation within four stratum: tree, woody shrub/sapling, herbs, and woody vines. Representative vegetation stations will be recorded within the vegetation communities. Incidental wildlife species observed during the field efforts will be recorded and will be described based upon direct visual observation or indirect observations (i.e., scat, tracks, middens, etc.). Aquatic habitats will be qualitatively described based upon velocity, water quality and observable aquatic organisms present. This characterization will be used to support the screening level Ecological Risk Assessment in Section 3.7.2 and will be performed consistent with ERAGs.

No quantitative biological sampling such as bioassays, bioaccumulation studies or biota sampling will be conducted. As part of the Baseline Ecological Risk Assessment (BERA) (if warranted) benthic macroinvertebrate surveys and fish population surveys may be performed. A detailed work plan will be developed as part of the BERA task which will outline these quantitative evaluations.

The threatened and endangered species documentation search for the study area will be updated via request to NYSDEC Natural Heritage Program; and United States Fish and Wildlife Service (USFWS). If applicable, a Section 7 consultation will be requested from USFWS to ensure that any proposed investigation activities will not jeopardize the continued existence or cause the destruction of critical habitat for any listed species.

3.3.6 Geophysical Survey (Subtask 3.07)

The surface geophysical survey and downhole geophysical activities were discussed in prior subtasks.

3.3.7 Investigation Derived Waste (IDW) Characterization and Disposal (Subtask 3.08)

All Investigation Derived Waste (IDW) generated during the field sampling efforts will be characterized and disposed in accordance with local, state, and federal regulations. All refuse not contaminated by hazardous materials will be disposed as conventional municipal solid waste. All rock cuttings; unused samples; decontamination wash/rinse water; unused sample preservation and equipment decontamination fluids; contaminated personal protective clothing, debris, and expendables generated on-site during the field investigation will be characterized to determine their appropriate disposition. Materials determined to be hazardous waste will be shipped to an acceptable Treatment, Storage, or Disposal Facility (TSDF) for disposal. All IDW characterization and disposal will be performed by a qualified subcontractor. The QAPP will describe the storage of IDW during the RI. A list of identified facilities will be provided to EPA for approval.

The following describes the treatment of investigation derived wastewater by waste stream:

3.3.7.1 Monitoring Well Development/Sampling IDW (Subtask Activity 3.08.01 and 3.08.02)

Monitoring well purging/sampling water will be collected from the well cluster locations in a mobile tank truck for transport to a frac tank staged at the Spill Site. It is anticipated that the maximum water generated by the monitoring well development will be on the order of 6,000 gallons, water from groundwater sampling events will be approximately 2,600 gallons for the existing wells during the Site Reconnaissance (Subtask Activity 3.08.01) and 3,500 gallons for existing wells and new wells for each of the four quarterly sampling events and storm event sampling (Subtask Activity 3.08.02).

A temporary GAC treatment unit will be staged at the Spill Site. The effluent of the frac tank will be piped to the influent of the GAC. If necessary, bag filters will be installed to remove suspended particles prior to treatment. The GAC unit will consist of two units piped in series with sample ports between the GAC units and at the effluent point. The GAC units will be sized based on the known concentrations of VOCs from previous sampling data with a safety factor of approximately 300 percent (i.e., the lead GAC unit will be sufficient to remove 3 times the maximum concentration of VOCs in the total volume of water treated).

Prior to discharge, a water sample will be collected from the frac tank for fast turnaround VOC analysis. A confirmatory calculation will be performed to verify the GAC unit is sufficient to treat the waste water. During treatment/discharge, water samples will be collected from between the GAC units and from the effluent of the second GAC unit to verify the performance of the treatment system (standard turnaround time analysis). Should breakthrough occur, the first carbon unit will be removed from service, the second unit will become the primary unit, and a clean unit will be placed in series.

The effluent of the GAC unit will be piped to the dry portion of the Mud Creek stream bed approximately 200 feet east of the Spill Site. Treated water will be to the stream discharged during a dry period at a maximum rate of approximately 10 gallons per minute to ensure infiltration without runoff. Water will be discharged to the surface in such a manner to prevent erosion or sedimentation.

3.3.7.2 Aquifer Test Discharge IDW (Subtask Activity 3.08.02)

Since the actual flow rate for the aquifer test has not yet been determined, it is unknown how much water will be generated during the test. At the anticipated flow rate of 50 to 100 gpm, the potential exists for approximately 450,000 gallons of water to be generated during the step test and 72-hour test. To containerize all the discharge water would require approximately twenty 20,000 gallon frac tanks. Since there is not sufficient room at the Spill Site to stage these tanks, it is anticipated that water will have to be discharged during the test. Therefore, a GAC unit will be staged at the pumping well location to treat the water during the test. The GAC unit will be sized following characterization of the groundwater based on the maximum detected VOC concentrations from well clusters in the vicinity (DC-7, DC-7R. FW-19) and a flow rate of greater than 100 gpm. The GAC unit will be sufficient to treat the maximum anticipated volume of discharge water. A frac tank will be placed before the GAC unit to provide ample water storage should a problem develop with the GAC unit.

Water samples will be collected from between the GAC units and from the effluent at 6 hour intervals for analysis for VOCs using test kits on-site. Should breakthrough occur, the first carbon unit will be removed from service, the second unit will become the primary unit, and a clean unit will be placed in series.

Discharge water from the step test and aquifer test will be discharged to the ground surface a minimum of 1,000 feet downgradient of the pumping well and piezometers. Water will be discharged to the surface in such a manner to prevent erosion or sedimentation.

3.3.7.3 Drill Cuttings IDW (Subtask Activity 3.08.02)

Drill cuttings and water generated during drilling will be containerized on-site. These materials will be disposed of by a licensed IDW subcontractor based on analytical results. A total of 10 water samples and 10 rock chip samples will be collected (one water and one rock chip sample from each cluster location) of waste, generated during drilling activities. These samples will be analyzed for Low Concentration VOCs and cyanide. If sample data indicates levels to be at or below NYSDEC criteria, the containerized waste will be discharged to ground surface at the Spill Site. Water not meeting the criteria will be treated at the on-site GAC unit prior to discharge to the ground surface.

Decontamination fluids will be containerized and characterized for off-site disposal.

3.4 TASK 4 - SAMPLE ANALYSIS

3.4.1 <u>Analytical Services Provided via CLP or DESA or EPA-ERT (Subtask 4.01)</u>

Foster Wheeler Environmental will secure analytical services for all Routine Analytical Service (RAS) sample analyses available through the EPA Contract Laboratory Program (CLP) or from the EPA Division of Environmental Science and Assessment (DESA) Laboratory in Edison, New Jersey. These services will be secured during the Site Reconnaissance (Subtask Activity 4.01.01) TCL VOCs, SVOCs, Pesticides/PCBs, TAL metals and Cyanide; and Low Concentration VOCs. During Phase 1 (Subtask Activity 4.01.02), the same services will be secured, with the addition of MNA parameters.

RAS sample slots will be scheduled in the CLP via the Regional Sample Control Center (RSCC) and Contract Laboratory Analytical Support Services (CLASS) offices. Analyses which are not available through the CLP or from the EPA DESA Laboratory will be analyzed by subcontract analytical laboratories.

3.4.2 Analytical Services Provided via Subcontract Laboratories (Subtask 4.02)

Foster Wheeler Environmental will secure Non-CLP analytical services via subcontract laboratories for the analysis of TOC in sediment samples, hardness in surface water samples, water quality parameters in groundwater samples, monitored natural attenuation parameters and quick turnaround Low Concentration VOCs and cyanide in aquifer step test discharge water. These services will be secured during the Site Reconnaissance (Subtask Activity 4.02.01) and Phase 1 (Subtask Activity 4.02.02).

3.5 TASK 5 - ANALYTICAL SUPPORT AND DATA VALIDATION

Foster Wheeler Environmental will coordinate with EPA sample management personnel for the analysis and validation of all RAS environmental samples collected during the Site Reconnaissance and Phase 1 programs. Foster Wheeler Environmental will arrange for the analysis of, and perform the validation of, all Non-CLP environmental samples collected during the field investigation program. The following subsections describe the activities Foster Wheeler Environmental will perform associated with the analysis and validation of all field sample results.

3.5.1 Collect, Prepare and Ship Samples (Subtask 5.01)

Foster Wheeler Environmental will prepare and ship all environmental samples collected during the Site Reconnaissance (Subtask Activity 5.01.01) and Phase 1 (Subtask Activity 5.01.02) from the site under Task 3 in accordance with the QAPP. A summary of the environmental and associated QA/QC samples to be collected by matrix type will be provided in the QAPP. Foster Wheeler Environmental will procure and provide the sample containers for all environmental sampling. Arrangements will be made for sample shipment and delivery schedules with the RSCC and CLASS of files, the DESA Laboratory (as necessary), and the appropriate subcontract laboratories.

3.5.2 Sample Management (Subtask 5.02)

Foster Wheeler Environmental will provide sample management, including chain of custody procedures, information management, data storage, and sample retention. Communication will be maintained with the RSCC and CLASS offices, the DESA Laboratory (as necessary), and the appropriate subcontract laboratories, regarding the scheduling, tracking and oversight of the sample analyses, validation, and quality assurance issues. In addition, Foster Wheeler Environmental will oversee subcontracted laboratories in accordance with its EPA-approved RAC II Delivery of Analytical Services Plan (July 1998). Sample management will be performed during the Site Reconnaissance (Subtask Activity 5.02.01) and Phase 1 (Subtask Activity 5.02.02).

3.5.3 Data Validation (Subtask 5.03)

All CLP RAS data will be validated by EPA Region II Hazardous Waste Support Section personnel in Edison, New Jersey. All data analyzed by the EPA DESA Laboratory in Edison, New Jersey will be validated by DESA Laboratory personnel. Foster Wheeler Environmental will provide data validation of all Non-CLP data analyzed by subcontract laboratories utilizing the Non-CLP laboratory Statements of Work (SOWs), applicable sections of the EPA National Functional Guidelines for Organic and Inorganic Data Validation, best professional judgement, and relevant sections of the following EPA Region II Data Validation Standard Operating Procedures (SOPs):

- SOP No. HW-2: Evaluation of Metals Data for the Contract Laboratory Program, Rev. 11, January 1992; and

- SOP No. HW-13: Organic Data Review for Low Concentration Waters, Rev. 2, October 1996.

All Foster Wheeler Environmental data validators performing this task have been trained and are certified by EPA Region II in validating the parameters of interest associated with the project. All Non-CLP data validation reports will be summarized according to EPA Region II Data Validation SOPs. Data validation will be performed during the Site Reconnaissance (Subtask Activity 5.03.01) and Phase 1 (Subtask Activity 5.03.02).

Data validation reports for the CLP and Non-CLP packages will be provided to the EPA WAM after all the data has been validated.

3.6 TASK 6 - DATA EVALUATION

This task includes work efforts related to the compilation and evaluation of existing data and field sampling data obtained during this Work Assignment, and a discussion of the usability of all data.

3.6.1 Data Usability Evaluation (Subtask 6.01)

Foster Wheeler Environmental will both quantitatively and qualitatively evaluate the usability of the additional sample analysis data obtained during this work assignment's investigatory phase and will qualitatively evaluate the usability of existing data. The usability of the Site Reconnaissance (Subtask Activity 6.01.01) and Phase 1 (Subtask Activity 6.01.02) data will be determined by examining data validation summary reports, and by confirming that the sampling procedures and analytical results were obtained following the applicable protocols, are of sufficient quality to satisfy the DQOs defined in this Work Plan and the QAPP, and can be relied upon for performing the risk assessments, the FS, and subsequent remedial design efforts. Any uncertainties associated with the data will be assessed. The results of this evaluation, along with an assessment of the suitability for use of the data obtained during past investigations, will be presented in a Data Evaluation Report to the EPA.

3.6.2 Data Reduction, Tabulation, and Evaluation (Subtask 6.02)

All validated data assessed to be usable and relevant from the Site Reconnaissance (Subtask Activity 6.02.01) and Phase 1 (Subtask Activity 6.02.02) will be compiled and summarized in tabular format with an independent verification at each step in the process to reduce the probability of transcription/typographical errors. Any computerized entry of data will be reviewed prior to use.

Tables of analytical results will be organized by matrix (e.g., surface water, groundwater, sediment); analytical fraction (e.g., VOCs, cyanide); hydrogeological framework (e.g., shallow downgradient, shallow upgradient); and/or segregated according to specific contaminant source area and/or other unique areas, if warranted. All analytical tables will identify individual samples by unique sample location/well identification numbers that correspond to those presented on Study Area sample location maps and will include the sample collection dates, detection limits for parameters not detected, and laboratory and/or data validation qualifiers. Standard units for results reporting (e.g., ug/L for groundwater; ug/kg for sediment organic parameters sediment; and mg/kg for sediment inorganic parameters) will be used in the text, tables, and figures when discussing the analytical results. Analytical result tables will also specify the applicable standard or criterion for each constituent, and highlight any results that exceed these criteria.

The EPA protocol for eliminating field sampling analytical results based on laboratory/field blank contamination results will be clearly explained. Discussion of approved sampling results will not be qualified by suggesting that a particular chemical is a common laboratory contaminant or was detected in a laboratory blank. If the reported result has passed QA/QC, it will be considered valid. Field rinsate blank analyses will be discussed in detail if decontamination solvents are believed to have contaminated field samples.

All tabulated data to be utilized will be presented in a Technical Memorandum (Data Evaluation Report) and provided to the EPA for review and concurrence prior to its use.

Prior to the initiation of RI field investigation activities, the most recent round of VOC sampling data for the existing monitoring wells/domestic wells will be tabulated and entered into the site GIS database. To evaluate the chemical information and identify data gaps and define predictive trends in the data, this data set will undergo a statistical analysis using Statistica® (or equivalent) software. At the completion of the field investigation, all RI chemical data will be incorporated into the Site GIS. A statistical analysis of the RI investigation data will then be performed (Statistica® software). This data set also will undergo Kriging techniques (GeoStat® software) for the chemical results across the various hydrogeologic zones.

Geologic information will be entered into the GIS database for each of the existing monitoring wells and all new monitoring wells. This will include location, elevation, depth, screen interval, and three (3) key geologic unit boundaries. These data will be used to produce isoconcentration maps, including potetionmetric data, for synoptic analysis of existing data. The NYSDEC RI Report contained one isoconcentration map that depicted the worst case analyses for all wells for samples collected over a four (4) year period. Therefore, the existing data will be reevaluated by sampling event, coupled with potentiometric data to evaluate seasonal variations in groundwater quality and to draw conclusions regarding the dynamics of the groundwater contaminant plume. Maps will be produced for each stratigraphic/potentiometric zone. Conclusions will be made regarding the effects of seasonal water table fluctuations on groundwater quality and potential seasonal variations in contaminated groundwater discharge to springs and surface water.

3.6.3 Modeling (Optional) (Subtask 6.03)

Computer simulation of the groundwater system is not presently anticipated.

3.6.4 Technical Memorandum (Data Evaluation Report) (Subtask 6.04)

A Data Evaluation Report will be prepared and submitted to the EPA for review and approval. A technical memorandum is included in the Site Reconnaissance under Subtask Activity 3.01.08.

This report following Phase 1 will include:

- A tabulation of all data acquired during this Work Assignment;
- Both a quantitative and qualitative evaluation of the usability of the chemical data obtained during the Phase 1 field effort;
- A qualitative evaluation of the suitability for use of chemical data obtained during prior investigations, along with justifications for excluding any past data (if warranted); and

- A discussion of any apparent trends in the chemical data.

3.7 TASK 7 - ASSESSMENT OF RISK

3.7.1 Baseline Risk Assessment (Human Health) (Subtask 7.01)

Foster Wheeler Environmental will evaluate and assess the current and potential future risk to human health posed by exposure to contaminants identified in the groundwater and associated surface water and sediments at the site. The following subsections present the principal elements addressed in the Draft and Final Baseline Human Health Risk Assessment Reports.

3.7.1.1 Draft Baseline Human Health Risk Assessment Report

Foster Wheeler Environmental will prepare a Draft Baseline Human Health Risk Assessment Report in accordance with *Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual (Part A) Interim Final. USEPA Publication EPA/540/1-89/002. December 1989* (RAGS Part A) and subsequent supplementary guidance. The risk assessment will address the following:

- *Pathways Analysis Report* - The draft PAR will be incorporated, along with EPA's comments, into the Draft Baseline Human Health Risk Assessment Report.

- *Risk Characterization* - Chemical-specific toxicity information, combined with quantitative and qualitative data from the Exposure Assessment, will be combined with statistically calculated contaminant exposure point concentrations in EPA-derived exposure models. The models will be utilized to determine if concentrations of contaminants in the groundwater plume or in associated springs are currently, or could potentially, affect human health.

- *Identification of Limitations/Uncertainties* - Critical assumptions (e.g., background concentrations and conditions) and uncertainties stated in the report will be discussed with respect to their impact on the risk characterization.

- *Summary of Risk Findings* - The health risks associated with the groundwater plume and associated springs will be identified and discussed.

3.7.1.2 Final Human Health Risk Assessment Report

After the Draft Baseline Human Health Risk Assessment Report has been reviewed and commented on by EPA, a written response to each comment will be submitted to the EPA for review. Any further resolution/clarification of specific comments or responses will be rectified with the EPA prior to revising the draft report.

Once required revisions are finalized and agreed to by EPA, the Draft Baseline Human Health Risk Assessment will be revised, as warranted. The Final Baseline Human Health Risk Assessment Report will be submitted to EPA after final resolution of EPA comments.

3.7.2 Screening Level Ecological Risk Assessment (Subtask 7.02)

A Screening Level Ecological Risk Assessment (SLERA) will be performed for the Lehigh Valley Site. The SLERA shall be performed consistent with guidance provided in EPA (1997) *Ecological Risk Assessment Guidance for Superfund* (ERAGS). The SLERA is inclusive of Steps 1 and 2 of ERAGSs, and has the potential to expand to a Baseline Ecological Risk Assessment (BERA) (Steps 3 through 8). The focus of the

RI/FS is the groundwater plume contaminated with volatile organics and possibly cyanide and the potential migration pathways which could result in exposure of ecological receptors. The primary compounds of concern have been identified as trichloroethene, and its potential degradation products and cyanide. The objectives of the SLERA are:

- Identify contaminants of potential concern as a result of the historical spill (TCE, degradation products, and cyanide);
- Describe the environmental setting at the Site with an emphasis on ecological receptors;
- Describe the fate and transport pathways present at the Site;
- Develop an Ecological Site Conceptual Model for exposure pathways for ecological receptors; and
- Conservatively assess risks to ecological receptors from identified contaminants found in various environmental media through contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

The SLERA will include the following steps:

Step 1, Screening Level Problem Formulation and Ecological Effects Evaluation:

- Describe the environmental setting and contaminants known or suspected to exist;
- Identify contaminant fate and transport mechanisms and pathways that exist;
- Develop a Site Conceptual Model and pathways of exposure for ecological receptors likely to be exposed; and
- Develop the preliminary Problem Formulation for the Study Area.

Step 2, Screening Level Preliminary Exposure Estimates and Risk Calculation:

- Compare maximum exposure concentrations of contaminants in environmental media to eco-screening values for identification of contaminants of potential ecological concern (COPECs); and
- Evaluate risks to ecological receptors from identified exposure pathways for identification of COPECs.

Performance of Step 1 will rely upon the results from historical sampling events performed by Rust, Environment and Infrastructure (1996) and the results of the Site Reconnaissance and sampling during the RI. As part of the Site Reconnaissance, an ecological checklist will be completed as recommended in ERAGS (1997). During preparation of the SLERA, primary evaluations will be made through comparison with ecological bench marks and not comparison to background conditions. The data to be presented will include a description of habitats associated with the site including vegetation cover-types and observations of wildlife species. A description of potential fate and transport pathways shall be included to describe mechanisms for site-related contaminants to migrate to areas supporting ecological receptors. An exposure pathway analysis will be included to assess the potential exposure pathways through which aquatic and terrestrial eco-receptors may be exposed. For this operable unit, which considers only the groundwater plume, the primary migration pathway to be considered shall be the groundwater to surface water/sediment pathway.

Performance of Step 2 will rely upon the analytical results for groundwater, surface water, and sediments obtained from data collected as part of the NYSDEC Fish and Wildlife Impact Analysis (Rust, 1996) and additional data collected as part of this investigation. Additional data on surface water and groundwater concentrations, and potential hydrogeological influences on migration and discharge to local streams, will be evaluated using groundwater data collected for plume delineation. These data will be used to better quantify the fate and transport pathways for contaminated groundwater to discharge to surface water.

Proposed Preliminary Assessment Endpoints

Based upon review of the available historical data, the following preliminary assessment endpoints are anticipated for consideration in the SLERA:

- Protection of benthic community structure and function in the aquatic habitats receiving or potentially receiving groundwater discharge;
- Protection of fish communities in the aquatic habitats receiving groundwater discharge; and
- Protection of wildlife species drinking from the surface water receiving groundwater discharge.

These assessment endpoints are anticipated for initial consideration in the SLERA and will likely be refined and refocused pending the conclusions of the SLERA.

Eco-Screening for Contaminants of Potential Ecological Concern (COPECs)

Exposure to the Study Area-related contaminants will consider direct contact with contaminated abiotic media as the primary exposure pathway. The direct contact screening process will compare observed abiotic media concentrations for direct comparison to media-specific conservative benchmarks. The major mechanism for an effects based assessment for the screening will be direct toxicity through contact with abiotic media.

Direct Comparison to Media-Specific Benchmarks

As per the amended SOW, the media of concern includes surface water and sediments. Maximum exposure concentrations for environmental media will be used for comparison to eco-screening values. Sources for the eco-screening benchmarks, as identified in the amended WAF, will be the following documents:

- EPA Ambient Water Quality Criteria;
- NYSDEC Ambient Water Quality Standards and Guidance Values; and
- NYSDEC (1999). Technical Guidance for Screening Contaminated Sediments

Additional sources for screening level values will include the following:

- Efroymson, R.A., G.W. Suter, II, B.E. Sample, and D.S. Jones. 1997. Preliminary Remediation Goals for Ecological Endpoints. Office of Environmental Management. Oak Ridge National Laboratories. Oak Ridge, TN.

These documents list the screening values for multiple media for a number of select direct effects endpoints. The final screening value will be the lowest screening value presented for all benchmarks for each specific abiotic media. A Hazard Quotient (HQ) will be calculated as the quotient of the maximum concentration and the screening level benchmark.

$$HQ = MEC/ESB$$

Where:

HQ = Hazard Quotient (unitless);
MEC = Maximum Exposure Concentration (mg/Kg or ug/Kg); and
ESB = Media Specific Eco-Screening Benchmark (mg/Kg or ug/Kg).

Where the HQ equals or exceeds 1.0, or if a contaminant lacks an ecological screening benchmark, the contaminant will be retained for further potential evaluation. A brief discussion concerning the COPECs fate in the environment and their toxicological properties will be provided.

Uncertainty Tracking and Description

Basic assumptions, applications of assumptions, or variables used in the initial screening level assessment will be identified and the overall impact on risk estimation will be defined. As part of the SLERA approach, the inherent uncertainty will err to conservatively overestimate risks whenever possible so as to minimize the potential for concluding a Type I error (i.e., false negative) with regard to risks to ecological receptors.

Summary and Conclusion for the SLERA

Results of the SLERA will be presented in a preliminary draft report that will be used to determine if a BERA will be necessary as part of Scientific Management Decision Point (SMDP) #1. This decision will be made in consultation with the Biological Technical Assistance Group (BTAG) as part of SMDP #1. If deemed necessary, the BERA will be scoped as part of the formal problem formulation meeting which will occur prior to initiating Step 3 of the ERAGS (EPA 1997) process.

3.7.3 Baseline Ecological Risk Assessment (Optional) Subtask 7.03)

A BERA, inclusive of Steps 3 through 8 of ERAGS, will be prepared for the Study Area if it is concluded by the SLERA that contaminants present from the historical spill pose a potential risk to environmental receptors. EPA will issue a Work Assignment Amendment in the event the BERA is required. The basis for performing the BERA will be the protection of initial assessment endpoints proposed from the SLERA and the focus will be limited to VOCs and cyanide. This will be fully expanded upon in the baseline problem formulation. While the full scope of the BERA awaits greater detailed formulation, the following tasks are proposed for use as measurement endpoints and risk hypotheses for the assessment endpoints presented in the SLERA Work Plan. A detailed scope of work will be developed for implementing the field effort outlined below as part of the consultation with the Region II BTAG.

Risk Hypothesis for Assessment Endpoint #1:

[To determine if VOCs and cyanide from the historical spill are affecting benthic community structure and function in streams receiving groundwater discharge]

The measurement endpoint for testing the above hypothesis will be to quantitatively sample the benthic community in Spring Creek and Mud Creek in depositional areas where fine sediments are present. Four locations (based on habitat similarity) and an appropriate reference location (outside site influences) shall be sampled from each creek. Four replicates per location will be collected for statistical comparisons of metrics outlined in "Rapid Bioassessment Protocols for Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates and Fish," (EPA, 1999). Locations will be identified following the performance of the SLERA and ecological Site Reconnaissance based upon data collected during the SLERA. Surface water and sediment samples will be co-located with the benthic invertebrate sampling location and analytical data will be used to compare contaminant concentrations to observed trends in benthic community metrics. Alternatively, surface water on sediment toxicity testing will be proposed should stream conditions preclude collection of benthic macroinvertebrates. Additional measurement endpoint will include a comparison of surface water and sediment data to the appropriate screening level benchmarks outlined in the SLERA.

Risk Hypothesis for Assessment Endpoint #2:

[To determine if VOCs and cyanide from the historical spill are affecting the fish community structure and health in streams receiving groundwater discharge]

The measurement endpoint for testing the above hypothesis will be to quantitatively sample the fish community in Spring Creek and Mud Creek. Two reaches of similar length, one upstream from the suspected groundwater discharge area and one adjacent to or downstream from the discharge area, will be sampled in each stream. Locations will be identified following the performance of the SLERA and ecological reconnaissance based upon data collected during the SLERA. These areas may be co-located with stations sampled for invertebrates. Fish will be collected from defined reaches using backpack electroshocking equipment or seine and block nets. Fish will be identified to species, enumerated from each reach, and measured for total length and weighed. A qualitative external examination to record the occurrence of external abnormalities or conditions (i.e., lesions, fungal infection, excess parasitism, etc.) will be performed. A qualitative comparison between the reference reach and potential impacted reaches shall be made. Additional testing may include toxicity testing using a representative fish test species for discrete endpoints outlined from the baseline problem formulation. Detailed methods for this evaluation and the final scope will be outlined in the BERA Work Plan Addendum which will be prepared at the direction of EPA. Alternatively, toxicity testing with a representative fish species will also be considered as a potential measurement endpoint.

Risk Hypothesis for Assessment Endpoint #3:

[To determine if wildlife species which utilize the streams receiving groundwater discharge are at risk from exposure to VOCs and cyanide from the historical spill]

The measurement endpoint for testing the above hypothesis will be to utilize the available data to quantitatively model exposure of select representative wildlife receptors. Results of pathway analysis and COPEC fate and transport characteristics will be used to evaluate exposure routes to terrestrial wildlife receptors. The final selection of receptors will be based upon species observed or likely to be utilizing the local streams. Exposure point concentrations will likely be the 95% Upper Confidence Limit (UCL) or mean concentration observed from Spring Creek and Mud Creek. Exposure parameters will be developed from approaches and species specific ingestion rates summarized in “Wildlife Exposure Factors Handbook, Volume 1 (EPA, 1993). Detailed methods, species considered and exposure parameters shall be outlined in detail in the BERA Work Plan Addendum upon receipt of an amended WAF.

The above risk hypotheses and measurement endpoints are provided as the basis of a general outline for the baseline ecological risk assessment. The BERA will be performed consistent with the ERAGS guidance.

3.8 TASK 8 - TREATABILITY STUDY AND PILOT TESTING

No treatability study or pilot testing currently is planned under this Work Assignment.

3.9 TASK 9 - REMEDIAL INVESTIGATION REPORT

Environmental data will be collected to define the horizontal and vertical extent of groundwater contamination. Existing standards and guidelines (e.g., drinking water standards, water quality criteria, and other criteria accepted by the EPA as appropriate for the situation) will be used for comparison with site data to evaluate potential effects to human and ecological receptors. The findings of the RI will be presented in the Draft and Final RI Reports.

3.9.1 Draft Remedial Investigation Report (Subtask 9.01)

A Draft RI Report will be submitted pursuant to the RI/FS schedule presented in this Work Plan. The report will be prepared according to the guidelines provided by the EPA in the SOW. The Draft RI will include:

- Site Background;
- Investigation/Methodology;
- Site Characteristics;
- Nature and Extent of Contamination;
- Fate and Transport; and

- Summary and Conclusions.

The Risk Assessment Reports will be referenced and included as appendices.

Additional details regarding the content and presentation requirements for specific sections of the RI Report are presented in the following subsections:

Site Background

Foster Wheeler Environmental will present information about the regional conditions and conditions specific to the site under investigation.

This shall include the following:

- An index map will be used to show the Study Area location within New York State. This will be provided as an inset on a regional Study Area location map;

- A regional map will be included which shows the location of the Study Area relative to nearby residential/industrial areas, public water supply wells, schools, parks, wetlands, surface waters, other hazardous waste sites, etc.;

- A Study Area map will be included which shows the location of present and past structures/features. A key will be provided to explain the nature of each site feature; and

- A topographic contour map (compiled from existing USGS topographic data) will be provided for portions of the Study Area. Due to the overall size of the Study Area, separate maps will be used for areas of concern, as warranted. The scale on these maps will provide sufficient detail so that sample locations can be accurately plotted in relation to features. A consistent scale shall be used for all the large scale maps.

The current and/past status of the Study Area will be clearly defined.

- All previous environmental studies and investigations will be summarized and fully referenced. The summary will explain the goals and objectives of each study, discuss the key findings and provide any relevant data summaries (chemical analyses, contaminant plume -maps, etc.) in the text or in the appendices.

- A map will be provided which shows the locations of all previous environmental sampling and monitor well locations. Many sampling locations of the NYSDEC RI were not surveyed for exact locations, therefore, areas of previous sampling will be located based on previous maps and text descriptions of sampling locations, if possible.

- The federal, state and local regulatory history will be documented and discussed. Key memos, correspondence, court orders and other relevant documents relating to significant regulatory actions will be clearly referenced. A chronological list of documents will be used to summarize this information in addition to the text.

- All previous environmental sampling results will be summarized. Due to the volume of data from past sampling events, the data will be referenced in appendices or by reference. Summary tables and/or text will clearly indicate the types of media that were analyzed, sampling dates, analytical parameters, the method of detection limits for "non-detect" values. The parties responsible for each round of sampling and analyses will be clearly identified. Any significant sampling/lab QA/QC problems shall also be noted.

- All ecological concerns such as sensitive habitats, wetlands, threatened or endangered species will be discussed.

Remedial Investigation

Descriptions of the following major investigative topics will be included:

- Field Investigation and Technical Approach;
- Chemical Analysis and Analytical Methods;
- Field Methodologies;
- Biological;
- Surface Water;
- Sediment;
- Monitoring Well Installation;
- Groundwater Sampling; and
- Hydrogeological Assessment

Well Logs

Graphical boring logs will be prepared to describe the subsurface conditions encountered during intrusive operations. Well logs will be prepared according to the following protocol.

- In developing final well logs from a rough field logs, there will be no attempt to simplify the logs by eliminating data or observations obtained in the field. If necessary additional pages can be included with the well log to explain any drilling problems, unusual observations, detailed stratigraphic descriptions or any other information that helps convey how the boring was installed and the nature of the subsurface conditions that were encountered;

- Boundaries between hydrogeologic units defined in the report will be notated on well logs;

- Mean sea level elevations will be provided for ground level and top of casing. Survey grid coordinates will be provided in addition to a short verbal description of well location;

- The well/boring installation method and material used will be completely summarized on the well log and/or well construction diagram. Precise descriptions will be provided for all cement, grouts, filter packs, seals, etc., to include specific compositions, trade names, depths of placement as well as any other pertinent details. The volumes of these materials used in the construction of a well shall also be reported; and

- Well development/purging procedures will be documented for each well. This will be included on the well log and summarized in a table. Information included will be the type of pump used in development, pumping rate, volume of water removed from the well, duration of well development and any water quality parameters (TDS, conductivity, pH) measured during the well development.

Geophysical Investigation Results

- Maps will be provided that clearly show the locations of the geophysical stations/traverse lines and their relationship to potential contaminant source areas;

- All details relating to types of geophysical instruments used, their use in the field (i.e. instrument spacing, QA/QC measurements, interference, etc.) and any other information that may impact the geophysical data such as solar/magnetic storms will be reported;

- All raw, uninterpreted data used to support document conclusions will be provided in the appendices. A complete explanation shall be provided as to how the raw data were manipulated/corrected in developing the geophysical conclusions;

- GPS data for the geophysical station/traverse lines will be included in the appendices.

- The effective depth of exploration and limitations for each geophysical technique will be clearly defined. Calculations will be provided, if appropriate, to show how the depth of exploration was determined;

- The possible cause of all significant geophysical anomalies and their relationship to known or suspected contaminant source areas will be discussed;

- An attempt will be made to correlate geophysical data with other data available for the site; and
- Geophysical anomalies due to sharp topographic changes (this would affect an electromagnetic survey) or interference from trucks, power lines and fences will be identified and explained.

Identifying Conditions Warranting Immediate Removal Action

A discussion will be provided of any conditions identified that may warrant an immediate removal action to protect human health or the environment. Examples of this type of situation include leaking drums, leaking storage tanks, potentially explosive conditions, and contaminated drinking water wells. No such conditions are anticipated due to the documented nature of the TCE spill. However, if warranted, Foster Wheeler Environmental will discuss these conditions in the RI Report and will provide sufficient details to evaluate the feasibility of conducting an immediate removal action.

Regional Hydrogeological Framework

Refinement of the regional hydrogeology framework model began during preparation of the Work Plan with the development of the GIS database and review of previously collected data and will continue throughout the RI. The RI Report discussion will focus on regional hydrogeologic information relevant to the Study Area. Regional discussions will focus on characterizing only those factors that control or impact groundwater flow patterns and/or groundwater quality. The discussion will focus on how the physical characteristics of the regional hydrogeologic framework relate to site-specific contamination problems. Regional patterns of groundwater use by public, private, and quarry wells and their potential impact on contaminant migration patterns will be discussed. All statements/information regarding regional hydrogeology will be fully referenced.

Site Hydrogeological Framework

The development of the Study Area hydrogeologic framework will be based primarily on site-specific information. The hydrogeologic framework will be defined in descriptive terms based on subsurface sediment/lithologic characteristics, groundwater quality information, and potentiometric data.

Specifically, the following protocol will be used to develop the site hydrogeologic framework:

- All key points of the conceptual hydrogeologic framework will be supported by the data collected as part of the report and/or the previous NYSDEC RI;

- Well logs, soil boring logs, and test pit logs, including all logs from previous investigations, will be included in the report appendices;

- Glacial till will not be assumed to be impermeable. Fractures, common in glacial tills, can provide efficient pathways for contaminant migration;

- The term "aquitard" and "aquiclude" will not be utilized in the report. As recommended by the USGS, the term "confining unit" will be used instead of the terms "aquitard", "aquiclude", and "aquifuge" (USGS Open-File Report 86-534, Aquifer Nomenclature Guidelines);

- The term "confining unit" shall be used only when it has been clearly established that the confining unit and the hydrogeologic units below it are unaffected by Site-related contaminants and/or potentiometric head data indicates that the unit serves as a hydraulic barrier to vertical groundwater flow;

- A clay or till unit shall not be assumed to form an impenetrable barrier to downward migration of ground-water contamination based of laboratory on slug test data alone;

- Groundwater will not be assumed to discharge completely to nearby streams or surface waters without vertical hydraulic gradient information from well clusters located near the stream/lake, surface water flow information, and other forms of supporting information;

- A brief summary of the hydrogeologic framework for the Study Area will be provided to the EPA for review as part of the DER, before the text of the first draft document is developed. This will serve to resolve issues such as the number of aquifer units, the presence or absence of confining units and the direction of groundwater flow before the numerous maps, tables, and figures are developed. Agreement on these basic issues before the first draft document is submitted to the EPA will result in a document that will require fewer revisions; and

- Accurate geologic cross sections will be developed.

Potentiometric Contour Maps

- All groundwater elevations/potentiometric values will be expressed in terms of mean sea-level elevations;

- A potentiometric map will be developed for each aquifer zone for which there are groundwater elevation-measurements from three or more wells. The base map used to develop potentiometric maps will show topographic contours, roads, surface waters, drainage features, boundary and potential/known groundwater contaminant source areas, residential areas and any other significant cultural features.;

- Potentiometric maps will represent only one round of groundwater level measurements;

- The date and time when the groundwater measurements were obtained will be stated-in the map's title block;

- The elevations of surface waters in the immediate vicinity of the map will be indicated on the map. Surface water elevation measurement points will be indicated on the map;

- A table shall be provided listing the exact time that each water level measurement was made, depth to water from the measuring point, mean sea level elevation of groundwater, surveyed elevation of the measuring point, and surveyed elevation of ground surface for each well;

- The wells used to develop a particular map will be distinguished using a larger or bolder symbol so that they clearly stand out from other wells screened in different aquifer units. The mean sea level elevation of groundwater for each well will be listed in bold type next to each well; and

- Groundwater elevation data from wells for which no well log descriptions and/or construction log is available will not be used on potentiometric maps.

Nature and Extent of Contamination

All available information will be integrated to develop a full understanding of the site Study Area. The discussion of the nature and extent of site-related contaminants will focus on those contaminants that pose the most significant risk to human health and the environment and exceed the ARARs. The source of groundwater contamination will be described as the documented TCE/cyanide spill which resulted from the train derailment.

Valid sampling results from previous investigations will be considered when developing an interpretation of site-related contamination. The text shall clearly describe the vertical and horizontal limits of the understanding of the extent of contamination. If sampling efforts have not defined the vertical and lateral extent of contamination, any data gaps of the extent of contamination will be clearly defined and recommendations made as to what additional sampling would be required to determine the extent of contamination.

Previous sampling results will be quantitatively compared to sampling results from the RI investigation, only when the same or equivalent sample collection methods, analytical methods, QA/QC protocols, etc. were employed. If different methods, protocols, etc. were used, only qualitative comparisons will be made.

Physical and chemical properties of contaminants (e.g., density, solubility, and mobility) exert significant effect on their distribution in the environment and their patterns of transport. Therefore, pertinent physical and chemical properties of site-related contaminants will be summarized in a table. Assumptions will not be made regarding the valence state of inorganic contaminants if only "total" analyses have been performed. Relative solubilities of contaminants may also control the levels at which they occur in groundwater or surface water, and concentrations of particular groundwater contaminants will be compared to their solubilities. If a groundwater contaminant's concentration exceeds one percent of its effective solubility limit, the potential presence of a non-aqueous phase liquid source is indicated. If a groundwater contaminant's concentration exceeds its solubility limit, a pure phase product exists either as a layer or in colloidal form.

The potential for a layer of dense non-aqueous phase liquid (DNAPL) will be addressed, since TCE (which is denser than water) is the known site contaminant.

Site-Specific Background Levels for Environmental Media

Site-specific background levels will be determined for groundwater, surface water and sediment using information that relates directly to the Study Area. This information will include the results of upgradient background sampling and analyses conducted in the vicinity of the Study Area.

Fate and Transport

This section of the RI report will address three major issues.

- Contaminant Characteristics
- Transport Processes
- Contaminant Migration Trends

A qualitative assessment of the environmental fate and transport of site-related contaminants will be conducted.

No assumptions will be made regarding the valence state of inorganic contaminants if only "total" analyses have been performed. For example, no conclusions will be made regarding whether or not chromium detected in a groundwater sample is Cr+3, Cr+4, Cr+5 and/or Cr+6 if only total chromium analyses have been conducted.

Physical properties of, site contaminants such as density, solubility, and mobility will be discussed in relation to patterns of contaminant transport. A table will be used to summarize this information.

Cosolvent effects will be considered in evaluating the potential mobility of contaminants in the environment. Many contaminants such as certain pesticides are relatively immobile. However, if they are mixed with other chemicals prior to or during their disposal their mobilities can be significantly increased. Factors that may affect contaminant migration such as colloidal transport, groundwater pH and redox potentials will also be considered.

The potential for deep (denser than water) layer of non aqueous phase liquid (NAPL) contaminants must be considered since it is known that 30,000 gallons of pure TCE was spilled.

The levels of particular groundwater contaminants will be compared with their solubilities. If contaminant levels exceed one percent of their solubility limit, this may indicate that a pure phase of the product may be present in the subsurface. If groundwater contaminant levels exceed the solubility limit then it will be surmised that a pure phase of the product may exist either as a layer of pure product or in a colloidal form.

When discussing groundwater/surface-water analytical results, the text and tables will state if the samples were filtered or unfiltered. Filtered results will only be used after consulting with the EPA.

Isoconcentration maps will be used to depict the RI sampling results, and will illustrate the level and current extent of site-related contamination. In addition, information from groundwater isoconcentration maps and cross-sections may be used to support decisions regarding the need for additional monitoring wells, the threat to off-site groundwater sources, and the scope of potential groundwater remediation. All applicable sampling information will be used in the development of the isoconcentration contour maps. Factors such as sampling and analytical protocols, well construction details, and screened intervals will be considered when comparing RI sampling results to sampling results from other sources. Different symbols will be used to distinguish wells that were not installed by Foster Wheeler Environmental during the RI investigation. Only qualitative conclusions will be drawn regarding relative changes in contamination levels over time if the data base consists of several different sampling events which used different sample collection/analytical protocols and methodology.

All residential or public water supply wells and/or surface water discharge points will be indicated on the contaminant isoconcentration maps. If important public water supply or industrial wells lie outside the area represented by the map, annotations will be placed in the margins that indicate their distance and direction from the map boundary.

All indicators of the probable extent of the groundwater contaminant plume will be considered when developing the isoconcentration maps. The degree of confidence in various portions of an isoconcentration map will be indicated by using solid lines (high confidence), dashed lines (low confidence), and dotted lines or question marks (very low confidence).

Summary and Conclusions

This section will integrate all available information to develop a comprehensive understanding, or "conceptual model," of the Study Area. The intent will be to describe the current state of understanding of the link between the nature and magnitude (volume and mass) of source contamination, the applicable contaminant transport mechanisms, and the current nature and extent of site-related contamination. The summary will include an assessment of the limits of understanding, so that recommendations for additional sampling may be made to eliminate any critical data gaps. This model can then be used to predict future contaminant migration and to support decisions regarding remedial actions.

General Report Preparation Guidelines

Sampling, monitoring well location and related data will be documented in accordance with the EPA's Locational Data Policy (LDP) The LDP elements required include lat/long coordinates, documentation of the method used to obtain coordinates, estimation of the accuracy of the measurement, and description of the entity that the lat/long coordinates represent. Data will conform to the EPA Region II website which provides additional information and links regarding LDP: http://www.epa.gov/region02/gis/ldpimp.htm.

The following guidelines will be used in preparing the Draft Remedial Investigation Report:

Table/Figure Guidelines

- The original source of each figure will be referenced. If a preexisting figure has been modified, the figure will indicate the original source of the figure which has been modified.

- The area of interest will be enlarged to fill as much of the available space on the page/plate as possible.

- All units, symbols, patterns and scales used on figures will be fully explained in a key provided on the figure.

- Whenever possible, key figures/tables will be inserted in the text following the page on which they are first referenced.

- All text and symbols used on maps, tables and figures will be legible. To avoid data loss-during reproduction nothing in a original will be smaller than 17 characters per inch (CPI).

- Page numbers will be given to figures so that they can be easily located or replaced in the text.

- Well identification numbers will indicate the depth interval or hydrogeologic zone that they are screened in. For example, D-1 might indicate deep well number one and S-7 might indicate well number seven. The designation of depth zones and well identification numbers will be consistent throughout the various phases of an investigation.

- Residential wells will be referred to by an alpha-numeric system such as RES-1. A table will be included which provides the street address and any construction/operational information on these wells. Family names will not be used to refer to residential wells because property owners/renters can change. The use of family names can also result in public relations problems.

Map Format

- All maps will include an accurate north arrow, scale, a title explaining the purpose of the map, an explanation of all symbols/notations. A reference will be provided to the source of the map if it is based on a pre-existing map.

- The scale will include both a written scale and a graphical scale. The inclusion of a graphical scale is essential because its accuracy will be retained even if the map is deliberately or inadvertently enlarged or reduced through reproduction processes. A written scale would no longer be accurate once a map has been enlarged or reduced.

- Due to the size of the Study Area, (approximately 4.1 miles by 1.6 miles), the overall site plan will be presented at a scale of 1 inch equals 1,000 feet. Monitoring well locations will be plotted on the base map. Topographic contours will be used from existing USGS 7.5 minute quadrangle maps with a contour interval of 20 feet. Other features shown on the base map will include domestic well locations, residences, roads, railroads, surface water drainage, and quarries. Smaller areas, specifically Mud Creek Gorge, Gorge Pond, and the area of Spring Creek, will be shown at a scale of 1 inch equals 50 feet to accurately show sampling locations.

- The surveyor's reference point/ benchmark will be identified on the map and discussed in the text.

- Text and numbers will be oriented on the map so that north arrow is pointing in an upward direction as one reads the map. The orientation of text and numbers relative to north will be consistent from map to map throughout the report.

- All units, symbols, and patterns used on the map will be fully described in an explanation included on the map. For groundwater elevation or groundwater contaminant level values, the map explanation will state exactly how the map values were derived. The date that the data were collected will be indicated if the data are representative of a certain point in time.

- The map title and figure/plate number will be shown in large bold type so that the map can be quickly identified.
- Maps will be presented in a digitized format, as specified by the EPA.

<u>Presenting Analytical Results</u>

- Tables of analytical results will be organized in a logical manner such as by sample location number, sampling zone, or some other logical format.

- Analytical results will not be ordered by laboratory identification numbers since these numbers do not correspond to those used on sample location maps.

- The sample location/well identification number will always be used as the primary reference for the analytical results. The sample location number will also be indicated if the laboratory sample identification number is used.

- Analytical tables will indicate the sample collection dates.

- The detection limit will be indicated in instances where a parameter was not detected.

- Analytical results will be reported in the text, tables and figures using a consistent convention such as ug/1 for groundwater analyses and mg/kg for soil analyses.

Discussion of Laboratory/Field Blank Contamination

- The EPA's protocol for eliminating field sample analytical results based on laboratory/field blank contamination results will be clearly explained.

- Discussions of approved sampling results will not be qualified by suggesting that a particular chemical is a common lab contaminant or was detected in the lab blank. If the reported result has passed QA/QC it shall be considered valid. In cases where the chemical in question was known to have been used and/or disposed on site, positively identified at high levels in other environmental media, and passes QA/QC protocols, the sampling results will not be questioned as being due to laboratory contaminants.

- Field equipment rinsate blank analyses results will be discussed in detail if decontamination solvents are believed to have contaminated field samples.

3.9.2 Final Remedial Investigation Report (Subtask 9.02)

After review of the Draft RI by EPA, Foster Wheeler Environmental will incorporate final EPA comments into the Final RI.

3.10 TASK 10 - REMEDIAL ALTERNATIVES SCREENING

Following submittal of the Final RI Report remedial alternatives will be developed for the Study Area. A range of alternatives will be evaluated, including:

- No Action alternative;
- Containment alternative involving little or no treatment; and
- Treatment alternatives encompassing both currently accepted and innovative technologies.

All alternatives will be developed consistent with the NCP, "*Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*", "*Considerations in Ground Water Remediation at Superfund Sites*", and any more recent guidance, policies or procedures applicable to remediation activities performed under CERCLA.

Procedures for Development of Remedial Alternatives and Preliminary Screening of Alternatives will include:

1. Establishment of Remedial Action Objectives (RAOs) - Based on the findings of the RI, RAOs will be developed to protect human health and the environment. The RAOs will specify the contaminants and media of concern, exposure routes and receptors, and acceptable contaminant levels or ranges for each exposure route (i.e., preliminary remediation goals).

2. Establishment of General Response Actions - General Response Actions (GRAs) will be established for each media of concern at the site, taking into consideration the physical and chemical characteristics of the site and the RAOs. General Response Actions to be considered include: no action, limited action (e.g., institutional controls, use restrictions, Monitored Natural Attenuation (MNA), etc.), containment and treatment.

3. Identification and Screening of Applicable Remedial Technologies - For each of the GRAs developed for each media of concern, remedial technologies and process options will be identified and screened to select those technologies and process options that are applicable to the conditions and contaminants present at the site. The screening is based primarily on the technical capability of the technology/process option to address the contaminants of concern. Although a number of process options for a given technology type may be retained during the screening, a single process option considered representative

of the technology type will be identified for alternative development based on a qualitative comparison of the effectiveness, implementability, and cost of the process options within the technology type. Any additional treatability study needs will be identified during the screening of technologies.

4. Development of Remedial Alternatives - Remedial alternatives will be developed by combining representative process options into overall remedial alternatives (media-specific) in accordance with the requirements of the NCP. Remedial alternatives' descriptions will include size and configuration of selected process options, estimated time frame for implementation and operation and maintenance requirement for remedial alternatives, estimated flow rate or treatment rate, spatial requirements, disposal requirements including distances for disposal, permitting requirements, technical or administrative limitations, and other factors that may affect the overall performance of the alternative. If a large number (e.g., greater than 5 or 6) of viable alternatives are developed for a specific media, a preliminary screening of alternatives will be qualitatively performed using the general criteria of effectiveness, implementability, and cost to reduce the number of alternatives to be combined into site-wide alternatives and carried forward for detailed evaluation. Innovative technologies will be considered throughout the screening process if there is a reasonable belief that they offer potential for better treatment performance or implementability, few or lesser adverse impacts than other available approaches, or lower costs than demonstrated technologies.

3.10.1 Draft Technical Memorandum (Subtask 10.01)

A Draft Remedial Alternatives Screening Memorandum will be submitted that will identify the potential remedial alternatives developed for the site. The screening of technologies and process options, the evaluation of process options to select representative process options for alternative development, and the preliminary screening of alternatives (if necessary) will be summarized in tabular format. A brief text summary of the remedial alternatives development and screening will be provided.

3.10.2 Final Technical Memorandum (Subtask 10.02)

A Final Technical Memorandum, incorporating EPA comments, will be submitted after receipt of EPA's final comments on the Draft Technical Memorandum.

3.11 TASK 11 - REMEDIAL ALTERNATIVES EVALUATION

The remedial alternatives that pass the preliminary screening (or all alternatives if no screening is performed) will be subject to detailed evaluation against seven of nine CERCLA evaluation criteria (the remaining two criteria are evaluated after State and public review of the FS and Proposed Remedial Action Plan (PRAP). Following the individual evaluation of each of the alternatives relative to the seven criteria, a comparative analysis between alternatives will be performed. Both the individual and comparative analyses will conform to the requirements of the NCP, the "Interim Guidance for Conducting RI/FS under CERCLA" (EPA, 1988), and other applicable guidance. Brief descriptions of the nine evaluation criteria are provided below:

Short-Term Effectiveness

This criterion addresses the effects of the alternative during the construction and implementation phase until the remedial actions have been completed and the designed level of protection has been achieved. Each alternative is evaluated with respect to its effects on the community and on-site workers during the remedial action, environmental impacts resulting from implementation, and the amount of time until protection is achieved.

Long-Term Effectiveness

This criterion addresses the results of a remedial action in terms of the risk remaining at the site after the response objectives have been met. The primary focus of this evaluation is to determine the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The factors to be evaluated include the adequacy, suitability, and long-term reliability of management controls for providing continued protection from residuals (i.e., assessment of potential failure of the technical components).

Reduction of Toxicity, Mobility, or Volume

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the contaminants. The factors to be evaluated include the treatment process employed, the amount of hazardous material destroyed or treated, the degree of reduction expected in toxicity, mobility, or volume, and the type and quantity of treatment residuals.

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. Technical feasibility considers construction and operational difficulties, reliability, ease of undertaking additional remedial action (if required), and the ability to monitor its effectiveness. Administrative feasibility considers activities needed to coordinate with other agencies (e.g. state and local) in regard to obtaining permits or approvals for implementing remedial actions.

Cost

This criterion addresses the capital costs, annual operation and maintenance costs, and present worth analysis.

Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor, and material necessary to perform remedial actions. Indirect costs include expenditures for engineering, financial, and other services that are not part of the actual installation activities but are required to complete the installation of remedial alternatives. Annual operation and maintenance costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. All costs will be estimated to provide an accuracy of +50 percent to -30 percent.

A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, typically the current year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that would be sufficient to cover all costs associated with the remedial action over its planned life. A discount rate of five percent will be considered unless the market values indicate otherwise during the performance of the FS.

Compliance with ARARs

This criterion is used to determine how each alternative complies with applicable or relevant and appropriate federal and state requirements, as defined in CERCLA Section 121.

Overall Protection of Human Health and the Environment

This criterion provides a final check to assess whether each alternative meets the requirement that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under the evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

State Acceptance

This criterion evaluates the technical and administrative issues and concerns the state may have regarding each of the alternatives. The factors to be evaluated include those features of the alternatives that the state supports, reservations of the state, and opposition of the state. The evaluation of this criterion is not performed until the public reviews the Proposed Plan, and is then addressed in the responsiveness summary and the ROD, and, if necessary, an addendum to the FS Report.

Community Acceptance

This criterion incorporates public concerns into the evaluation of the remedial alternatives. Community acceptance cannot be determined during development of the FS Report. The evaluation of this criterion is not performed until the public reviews the Proposed Plan, and is then addressed in the responsiveness summary and the ROD, and, if necessary, an addendum to the FS Report.

3.11.1 Draft Technical Memorandum (Subtask 11.01)

A Draft Remedial Alternatives Evaluation Technical Memorandum which provides a technical description of each alternative retained for detailed evaluation following the initial alternative screening will be prepared. The memorandum will include identification of key ARARs associated with each alternative and a summary of the performance of each alternative with respect to the evaluation criteria. As discussed above, only data on seven of the criteria will be presented in the memorandum. The memorandum will also include a summary of the comparative analysis between alternatives with respect to the evaluation criteria. The memorandum will consist of tabular results of the remedial alternative evaluation and comparative analysis, accompanied by a brief text summary of the items identified above.

3.11.2 Final Technical Memorandum (Subtask 11.02)

A Final Technical Memorandum, incorporating EPA comments, will be submitted after receipt of EPA's final comments on the Draft Technical Memorandum.

3.12 TASK 12 - FEASIBILITY STUDY REPORT

The FS Report will be prepared under this task. The FS Report will provide detailed documentation of each step completed during the feasibility study, including a summary of site background and data from the RI Report, a summary of remedial alternatives, cost analysis, institutional analysis, public-health analysis, and environmental analysis. The report will include a description of the initial screening study process and the detailed evaluations of the remedial action alternatives studied. All of the information previously summarized in the technical memoranda (e.g., development of RAOs, identification of GRAs, evaluation against the nine evaluation criteria, comparative analysis of alternatives, etc.) will be presented in detail in the FS Report. As part of the detailed evaluation of alternatives, the limitations of utilizing treatability study results will be discussed and evaluated. If the limitations are deemed too great, Foster Wheeler Environmental will recommend additional studies to be performed prior to remedial design (i.e., pre-design investigations and pilot studies).

3.12.1 Draft Feasibility Study Report (Subtask 12.01)

A Draft FS Report will be submitted for EPA review following the submittal of the Final Remedial Alternatives Evaluation Technical Memorandum. The FS Report will consist of an Executive Summary and four sections. The Executive Summary will be a brief overview of the entire study and the analysis underlying the remedial actions that were evaluated. Section 1 will summarize existing Site conditions and the nature and extent of contamination as documented in the RI Report. Section 2 will present the Remedial Action Objectives, General Response Actions, and technology and process option screening. Sections 3 and 4 will present the screening and detailed evaluations of the alternatives, respectively. The FS Report will be prepared and presented in the format specified in "Interim Final Guidance for Conducting RI/FS under CERCLA" (EPA, 1988).

3.12.2 Final Feasibility Study Report (Subtask 12.02)

A Final FS Report, incorporating EPA comments, will be submitted after receipt of EPA's final comments on the Draft FS Report.

3.13 TASK 13 - POST RI/FS SUPPORT

Foster Wheeler Environmental will provide community relations and other technical support during the preparation of the ROD as requested by EPA. The majority of post RI/FS activities, including public meeting support, technical assistance during preparation of the Proposed Plan, repository maintenance, public notices, etc., have been included in Task 2. However, Task 2 does not include technical support during preparation of the ROD (after preparation of the Responsiveness Summary). Additional technical support that may be required during preparation of the ROD (e.g., preparation of an FS Addendum) is included in this task.

3.13.1 Feasibility Study Addendum (Subtask 13.01)

During preparation of the ROD, a Feasibility Study Addendum may be required to incorporate State and/or community concerns into the FS Alternative Evaluations or to incorporate new issues or concerns that may be recognized during the public participation period and preparation of the Responsiveness Summary. The anticipated scope of work for an FS Addendum includes incorporation of additional information into alternative descriptions and/or re-evaluation of existing alternatives relative to the evaluation criteria, but does not include development or evaluation of new alternatives. Foster Wheeler Environmental will prepare and submit a draft FS Addendum for EPA review. A Final FS Addendum will be submitted after receipt of EPA's final comments on the Draft FS Addendum.

3.14 TASK 14 - NEGOTIATION SUPPORT

As stated in the SOW, negotiation support is typically not required in a fund-lead project such as the Lehigh Valley Superfund Site RI/FS. However, in the event that a PRP or PRP group takes over part or all of the subsequent activities during the performance of the RI/FS, the EPA may request negotiation support.

3.14.1 Attend/Provide Technical Support at Negotiation Meetings (Subtask 14.01)

This task includes:

- Meeting preparation;
- Draft and Final Meeting Notes (with EPA review and approval of final documents);
- Preparation of meeting materials (with EPA review and approval of final documents); and
- Meeting attendance.

3.14.2 Review/Comment PRP Documents (Subtask 14.02)

- Review PRP documents; and
- Prepare Draft and Final comments on PRP documents.

3.15 TASK 15 - ADMINISTRATIVE RECORD

EPA Region II currently has a separate Records Management Contract vehicle to support the activities provided under this work assignment. Therefore, no work is currently planned under this task. The SOW specifies that providing updated deliverables may be required under this task, as described below.

3.15.1 Provide Updated Deliverables (Subtask 15.01)

Foster Wheeler Environmental will submit revised deliverables in paper, electronic, or other storage formats as required to assist the EPA in updating the Administrative Record (AR) or Site file for this project.

The following may be required:

- Minor editing of deliverables (Work Plan, CRP, Risk Assessment, RI Report, FS Report).
- Up to five copies (paper and/or electronic format) will be provided.

3.16 TASK 16 - WORK ASSIGNMENT CLOSEOUT

Upon notification from EPA that all technical work performed under this work assignment is complete, all necessary project closeout activities will be performed as specified in the contract. These activities will include:

- Closing out all subcontracts;
- Preparation of a technical and financial Work Assignment Closeout Report (WACR);
- Indexing and consolidating project records and files; and
- Providing microfiche and archiving of documents.

Further details of these activities are provided in the subsections that follow.

3.16.1 Work Assignment Closeout Report (WACR) (Subtask 16.01)

Final costs and LOE for all activities conducted by Foster Wheeler Environmental under this work assignment will be included in a WACR and provided in electronic format (WordPerfect 8 and/or Lotus 1-2-3, Release 9.0) on diskette. Costs and LOE (by P-level) will be categorized in the same detail and format as the elements contained in the Work Plan and the SOW. The WACR will be prepared in the Project Officer Interface (POI) system.

3.16.2 Document Indexing (Subtask 16.02)

Work Assignment files in Foster Wheeler Environmental's possession will be indexed in accordance with the current approved EPA file index structure (e.g., Administrative Record Index, EPA Superfund File Index, and/or project guidelines for Closeout of Work Assignment). Prior to duplication and storage, a file QA audit will be performed to ensure all file elements are present, in order, and that any duplicate or draft technical report copies are removed from the project file. A File QA Audit Report will be prepared noting any missing file elements or discrepancies for resolution prior to duplication, distribution, and storage.

3.16.3 Document Retention/Conversion (Subtask 16.03)

All project files will be archived in accordance with Federal Records Center and contract requirements. Adherence to these requirements will be verified during the file QA audit, with any deviations noted to the Foster Wheeler Environmental Project Manager for resolution prior to final project files closeout. Subsequent to the resolution of all outstanding issues, the project files will be microfilmed by a subcontractor and distributed and stored in accordance with RAC II requirements.

4.0 PROJECT MANAGEMENT APPROACH

4.1 PROJECT ORGANIZATION

The Project Manager and Remedial Investigation Lead is John C. Potenza, P.G. The Project Manager has the primary responsibility for development of the RI/FS Work Plan; acquisition of scientific, engineering or additional specialized technical support; and other aspects of the day-to-day activities associated with the project. Mr. Potenza will identify staff requirements, direct and monitor project progress, and ensure quality procedures are implemented for adherence to applicable codes, guidelines, and regulations. Mr. Potenza is responsible for the successful execution of the project within the established budget and schedule.

Assisting the Project Manager are the project task leads for the technical disciplines. They are:

- Ms. Monica Caravati - Human Health Risk Assessment Lead;
- Mr. John Schaffer - Ecological Risk Assessment Lead;
- Mr. Donald Campbell, - Field Operations Leader (FOL);
- Mr. Robert Chozick, Ph.D., P.E. - Feasibility Study Lead;
- Mr. Grey Coppi, - Health and Safety Manager; and
- Mr. Jon Gabry, Ph.D. - Project Quality Assurance Officer.

A project organizational chart is provided in Figure 4-1.

4.2 PROJECT SCHEDULE

Table 4-1 outlines the schedule for major project deliverables, as specified in the SOW as amended. The overall baseline project schedule is provided as Figure 4-2.

The project schedule includes the following clarifications received at the 23 January 2002 technical meeting:

- The Pathways Analysis Report (Subtask 1.15) will be submitted 30 days after the Data Validation Report (Subtask 5.03) is submitted.
- The Draft Baseline Risk Assessment (Subtask 7.01 and 7.02) Report (HH and/or ECO) will be submitted 30 days after EPA Approval of the Pathways Analysis Report (Subtask 1.15). The Draft Remedial Investigation (RI) Report (Subtask 9.01) will be submitted 90 days after EPA approval of the Phase 1 Technical Memorandum.
- Subtask 10.01 and 10.02 are the Draft Remedial Alternatives Screening Technical Memorandum and the Final Remedial Alternatives Screening Technical Memorandum, respectively. The Final Remedial Alternatives Screening Technical Memorandum (Subtask 10.02) will be submitted 14 days after receipt of EPA's final comments on the Draft Remedial Alternative Screening Technical Memorandum (Subtask 10.01).
- The Draft Remedial Alternatives Evaluation Memorandum (Subtask 11.01) will be submitted 30 days after the Final Remedial Alternatives Screening Technical Memorandum (Subtask 10.02) is submitted.

The above are slight modifications to the "Summary of Major Submittals for the Remedial Investigation/Feasibility Study at Lehigh Valley Site;" revised attachment 1 in Work Assignment form Amendment Number 0001.

4.3 COST ESTIMATE

The estimated Level of Effort hours and costs for completing the SOW described in this Work Plan will be submitted 14 days after submittal of the Final Work Plan.

5.0 REFERENCES

Checklist for Ecological Assessment/Sampling (Appendix B, Representative Sampling Guidance Document, Volume 3)

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Levine Fricke (LFR), June 1999. Remedial Investigation Report for Former JCI Jones Chemical, Inc. Facility, Caledonia, New York, Administrative Order on Consent Index No. II, CERCLA 10210.

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Efroymson, R.A., G.W. Suter, II, B.E. Sample and D.S. Jones. 1997. Preliminary Remediation Goals for Ecological Endpoints. Office of Environmental Management. Oak Ridge National Laboratories. Oak Ridge, TN.

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USGS 7.5 Minute Quadrangle, Clifton, New York (1976)

USGS 7.5 Minute Quadrangle, LeRoy, New York (1976)

USGS 7.5 Minute Quadrangle, Churchville, New York (1978)

6.0 GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
CBD	Commerce Business Daily
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLASS	Contract Laboratory Analytical Support Services
CLP	Contract Laboratory Program
COCs	Chemicals of Concern
COPCs	Chemicals of Potential Concern
COPECs	Contaminants of Potential Ecological Concern
CPI	Characters Per Inch
CRC	Community Relations Coordinator
CRP	Community Relations Plan
CT	Central Tendency
DCE	1,2-Dichloroethene
DER	Data Evaluation Report
DESA	Division of Environmental Science and Assessment
DNAPL	Dense Non-Aqueous Phase Liquid
DQOs	Data Quality Objectives
EPA	United States Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ERAGS	Ecological Risk Assessment Guidance for Superfund
ERRS	Emergency and Rapid Response Services
ESB	Eco-Screening Benchmark
ETQ	Ecological Toxicity Quotient
Fa	Farmington Loam
FARs	Federal Acquisition Regulations
FOL	Field Operations Leader
FS	Feasibility Study
FID	Flame Ionization System
FWIA	Fish and Wildlife Impact Analysis
GAC	Granular Activated Carbon
GC	Gas Chromatograph
GIS	Geographic Information System
GPR	Ground Penetrating Radar
GPS	Global Positioning System
GRAs	General Response Actions
HASP	Health and Safety Plan
HSA	Hollow-Stem Auger
HSO	Health and Safety Officer
IDW	Investigation Derived Waste
IT	IT Corporation
LNAPL	Light Non-Aqueous Phase Liquid
LOE	Level-of-Effort
MCL	Maximum Contaminant Level
MEC	Maximum Exposure Concentration
MNA	Monitored Natural Attenuation
MSL	Mean Sea Level
NAPL	Non-Aqueous Phase Liquid
NCEA	National Center for Environmental Assessment
ND	Non-Detect

NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ODC	Other Direct Cost
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PAR	Pathways Analysis Report
PCBs	Polychlorinated Biphenyls
PCI	Post Construction Investigation
PID	Photoionization Detector
PO/CO	Project Officer/Contracting Officer
POI	Project Officer Interface
ppb	Parts Per Billion
ppm	Parts Per Million
PRAP	Proposed Remedial Action Plan
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidelines for Superfund
RAOs	Remedial Action Objectives
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDI	Remedial Design Investigation
RI/FS	Remedial Investigation and Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RSCC	Regional Sample Control Center
RTDF	Remedial Technologies Development Forum
SCM	Site Conceptual Model
SLERA	Screening Level Ecological Risk Assessment
SMOP	Scientific Management Decision Point
SMP	Site Management Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TBC	To Be Considered
TCE	Trichloroethene
TCL	Target Compound List
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSDF	Treatment, Storage, or Disposal Facility
UCL	Upper Confidence Limit
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VET	Volume Exchange Time
VLF	Very Low Frequency
VOC	Volatile Organic Compound
WACR	Work Assignment Closeout Report
WAF	Work Assignment Form

WAM	Work Assignment Manager

Attachments

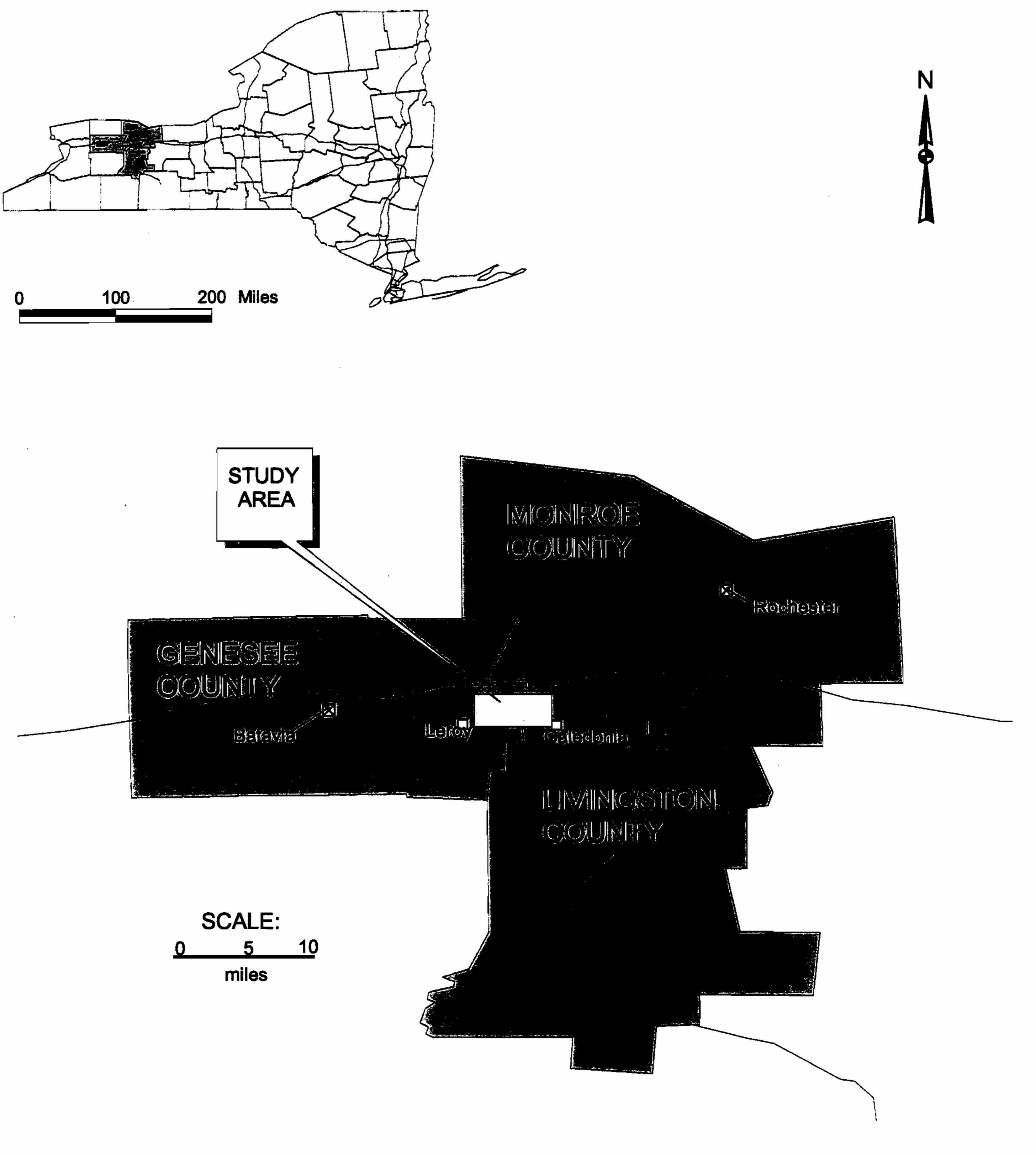


Figure 1-1
Lehigh Valley Train Derailment Superfund Site

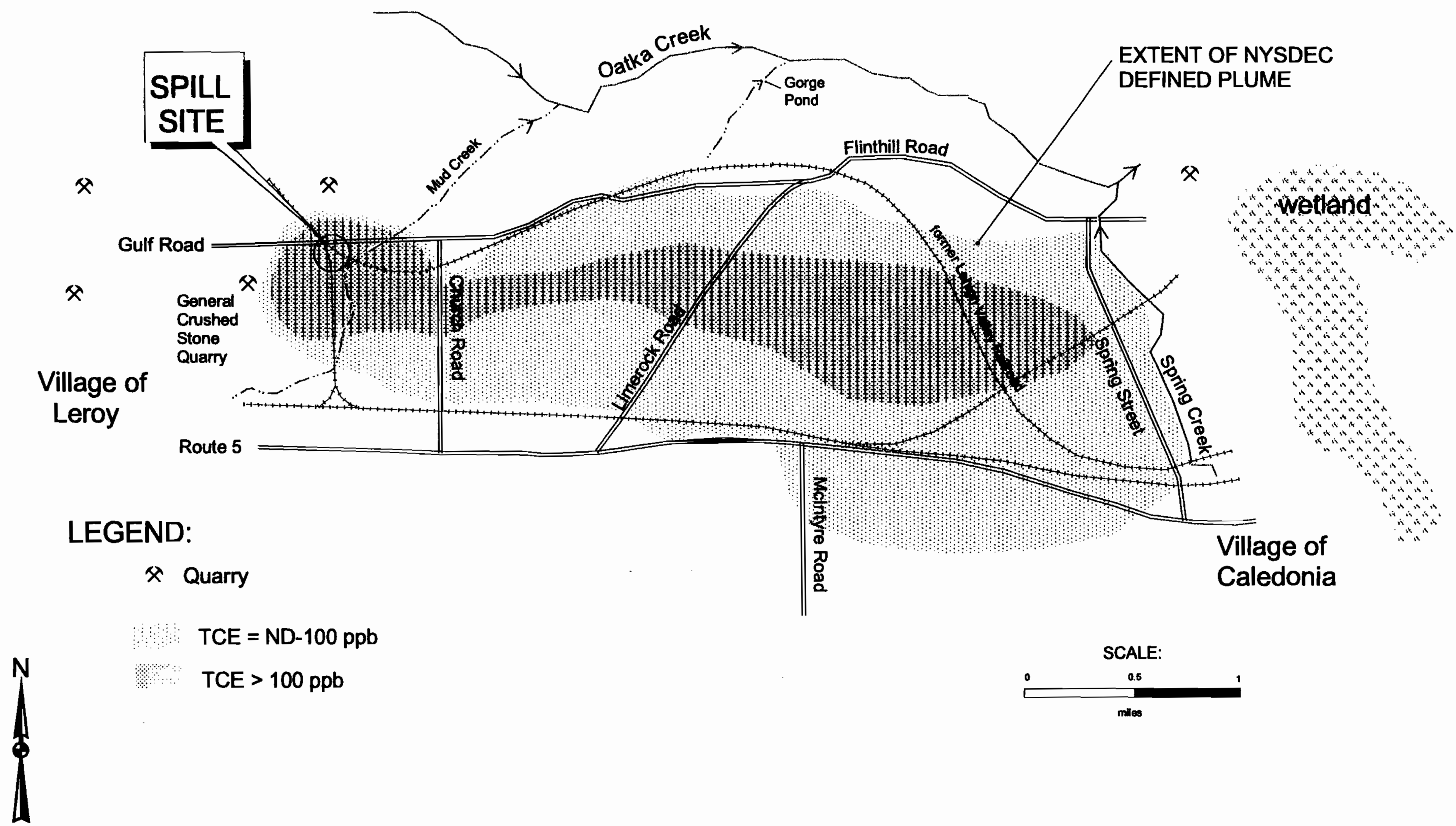
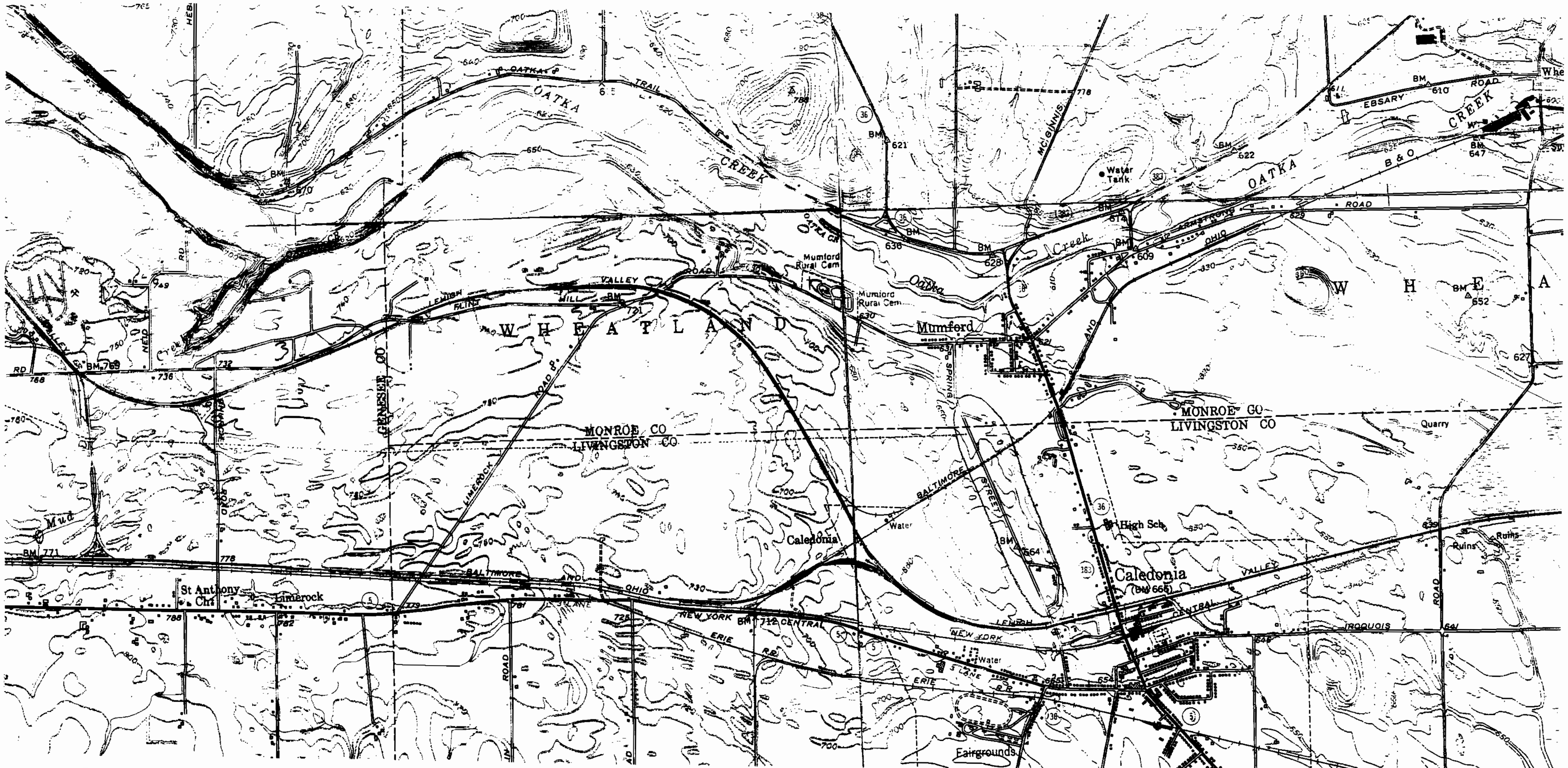


Figure 1-2
Lehigh Valley Railroad Derailment Study Area



Source: USGS 7.5 minute quadrangles
Leroy (1976)
Caledonia (1976)
Churchville (1978)
Clifton (1976)

Figure 1 - 3
Lehigh Valley
Superfund Site
Regional Topography

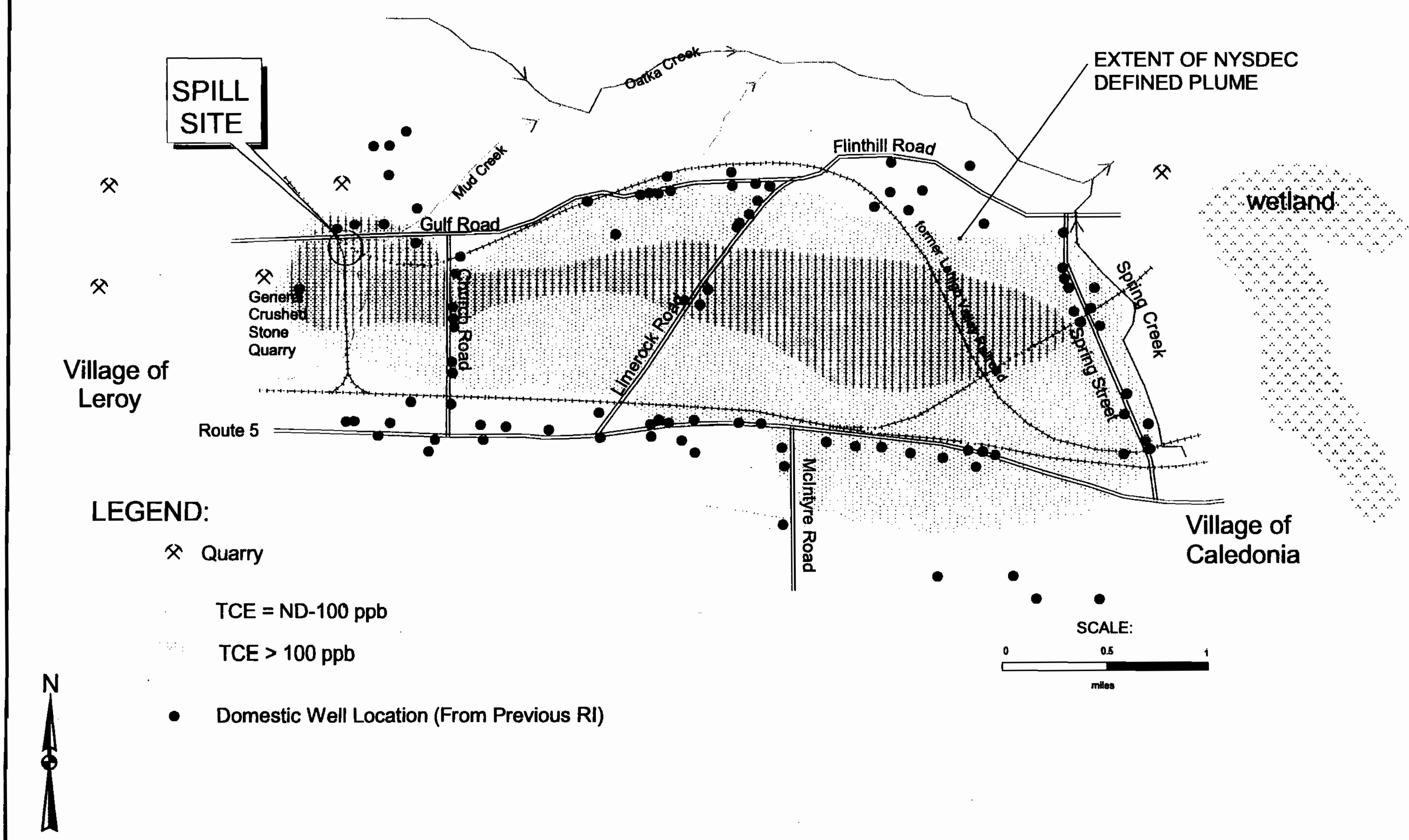


Figure 3-1
Domestic Well Locations

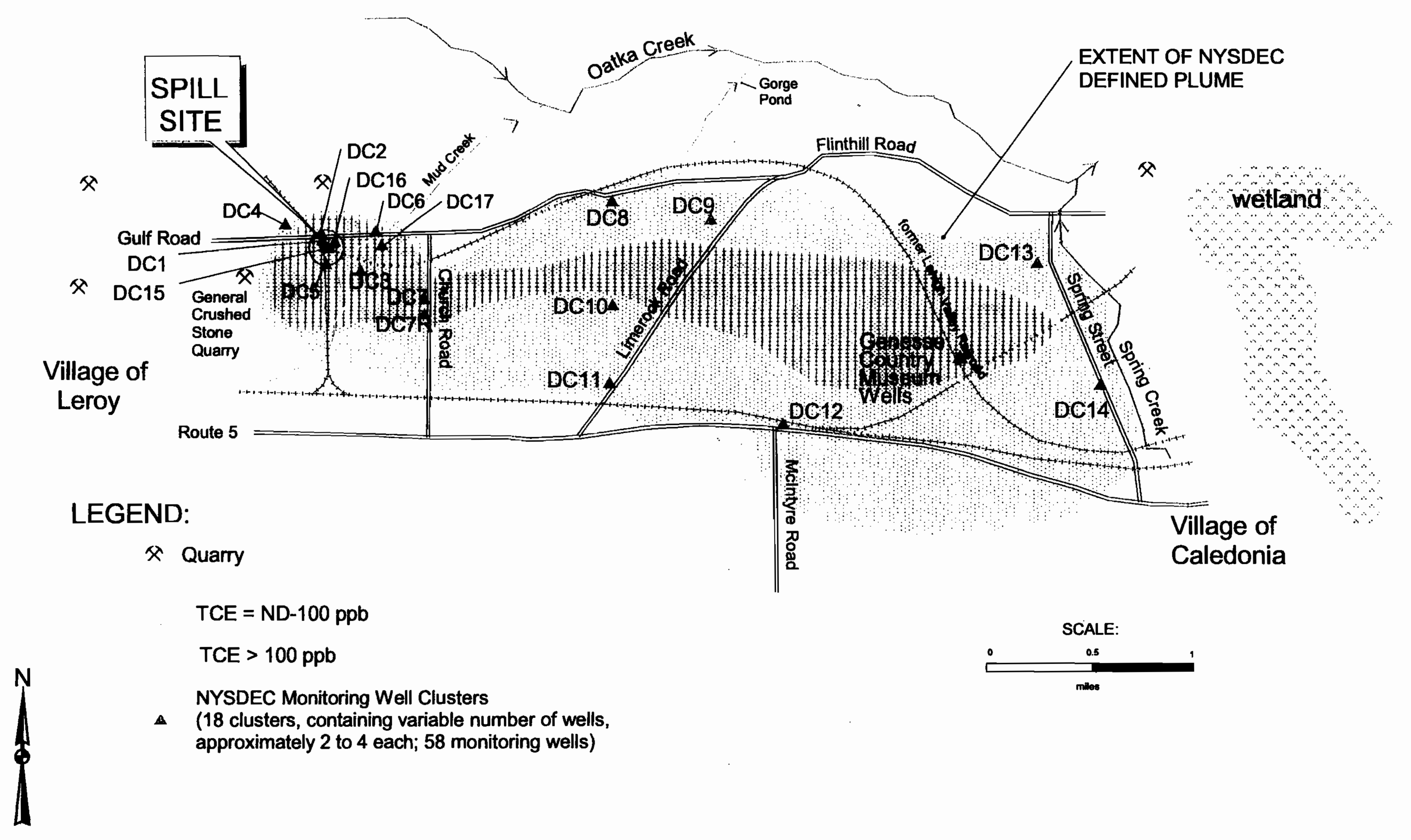


Figure 3-2
NYSDEC Monitoring Well Cluster Locations

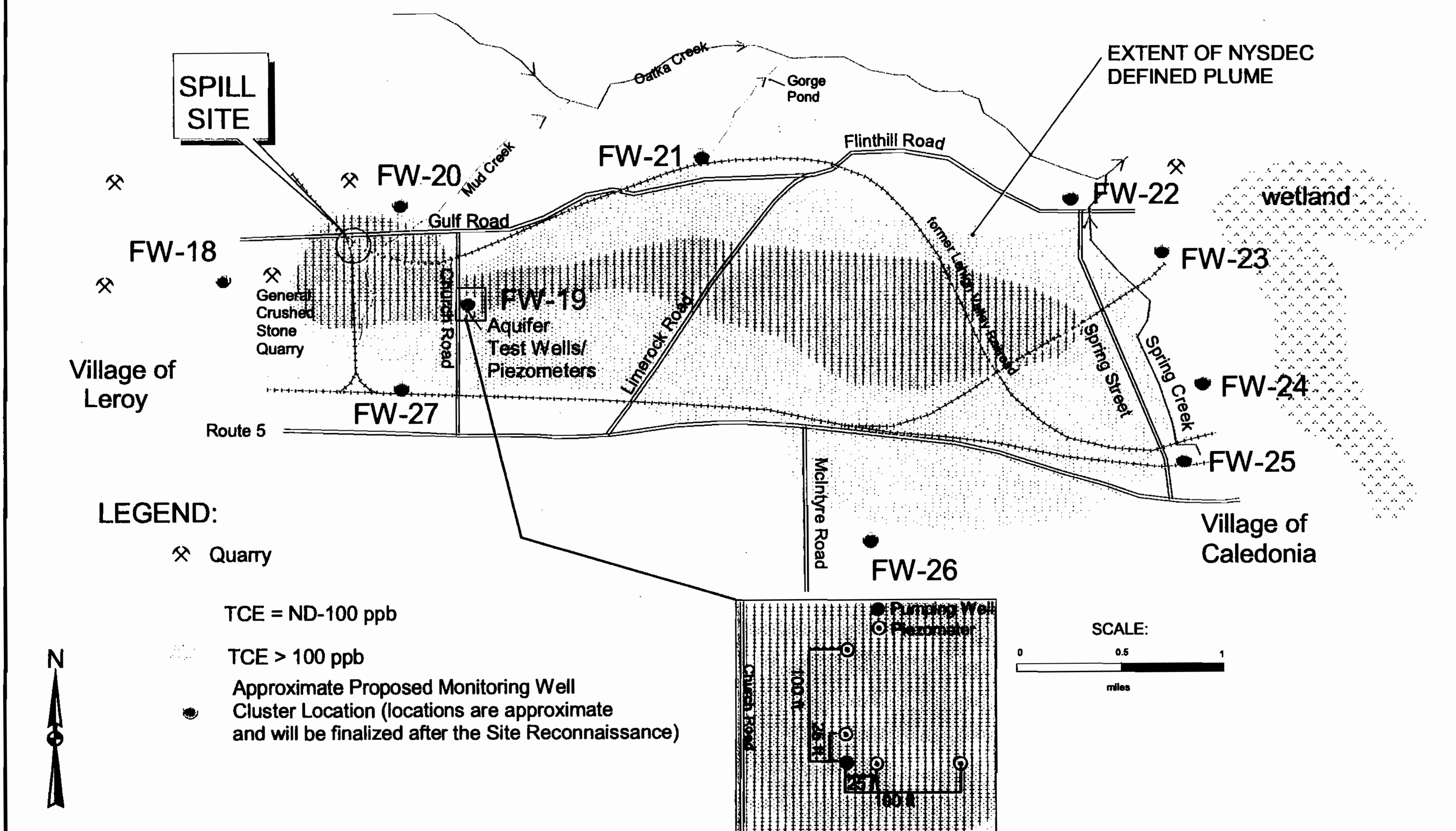


Figure 3-3
Proposed Monitoring Well Locations

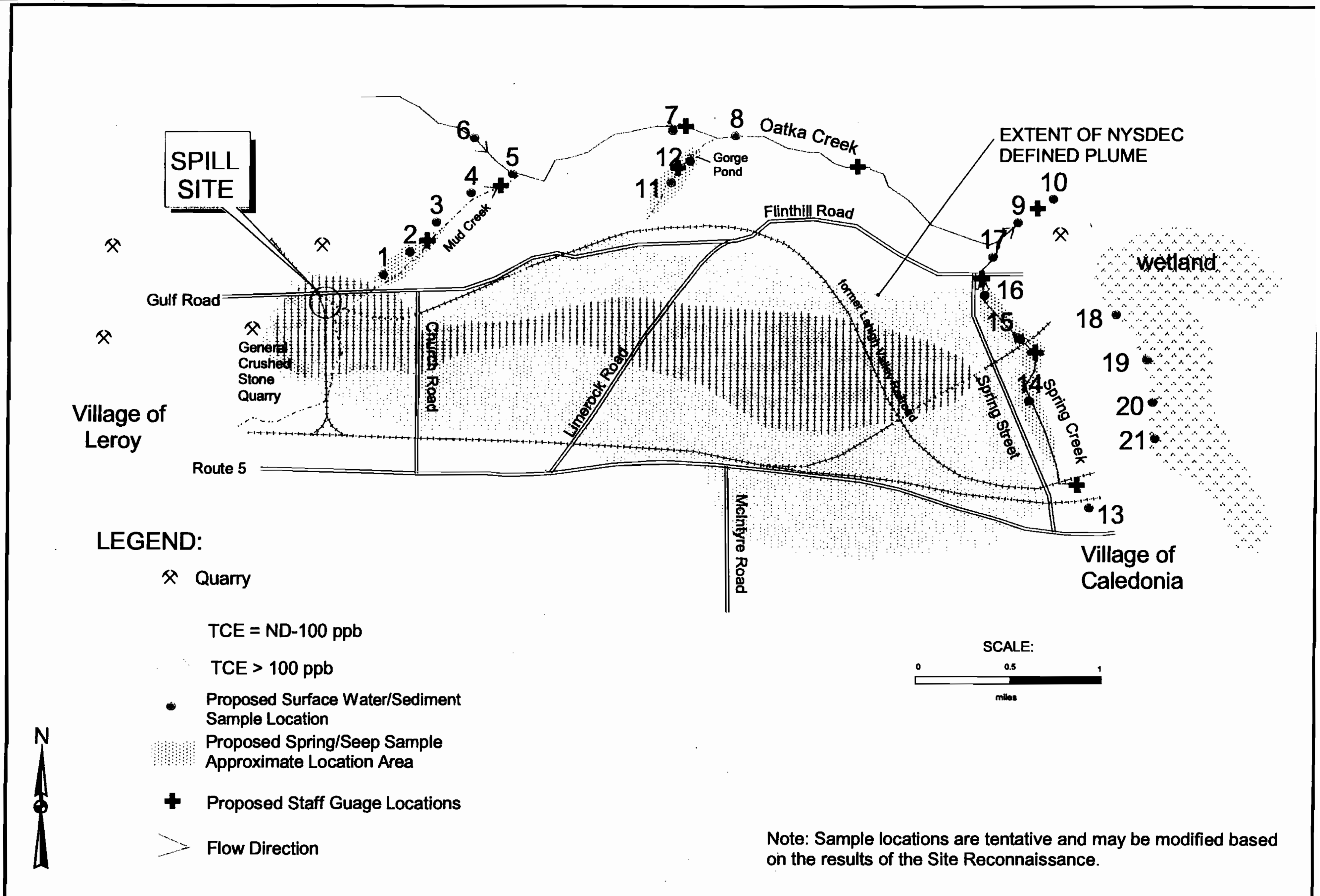


Figure 3-4
Proposed Surface Water/Sediment and Spring/Seep Sample Locations

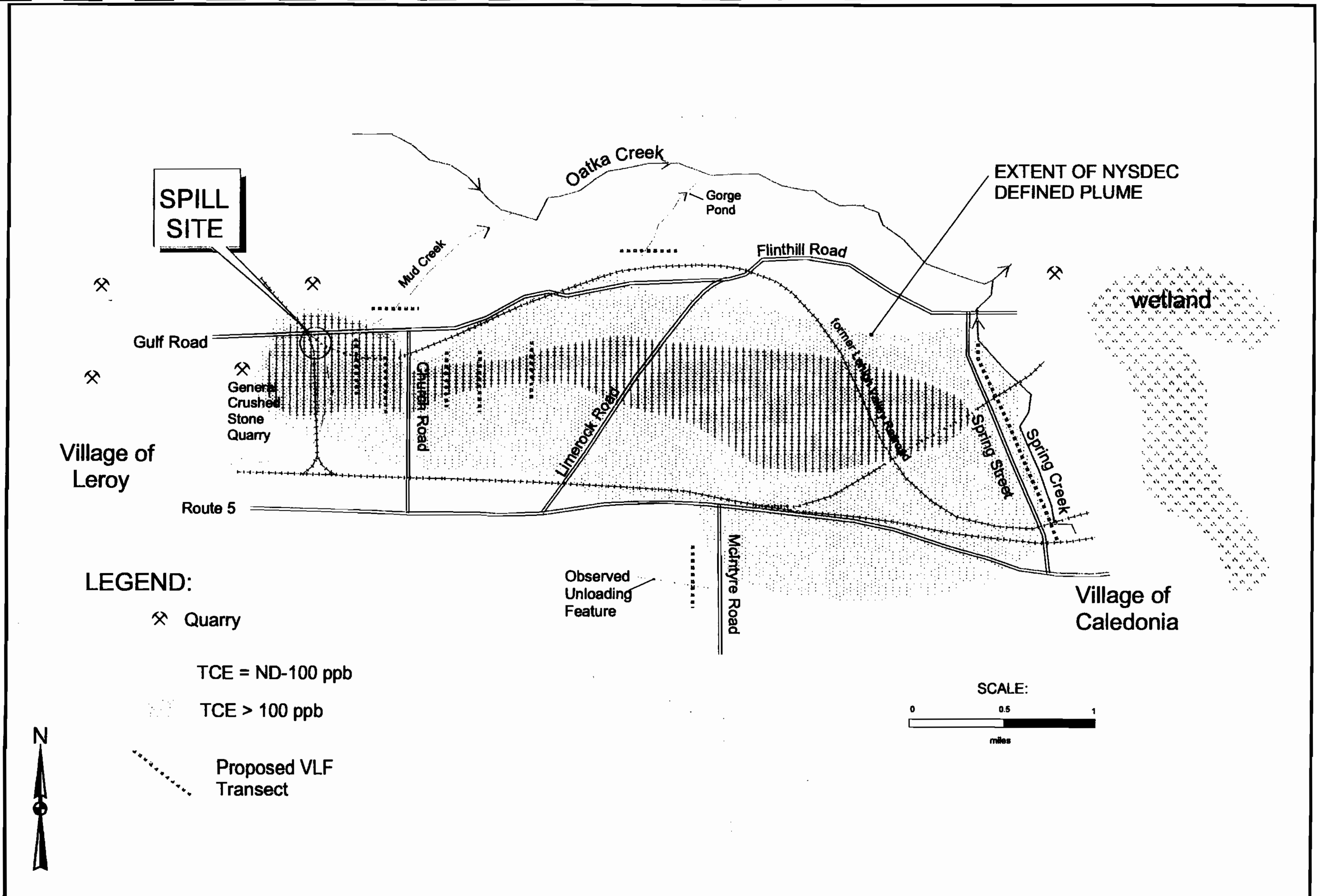
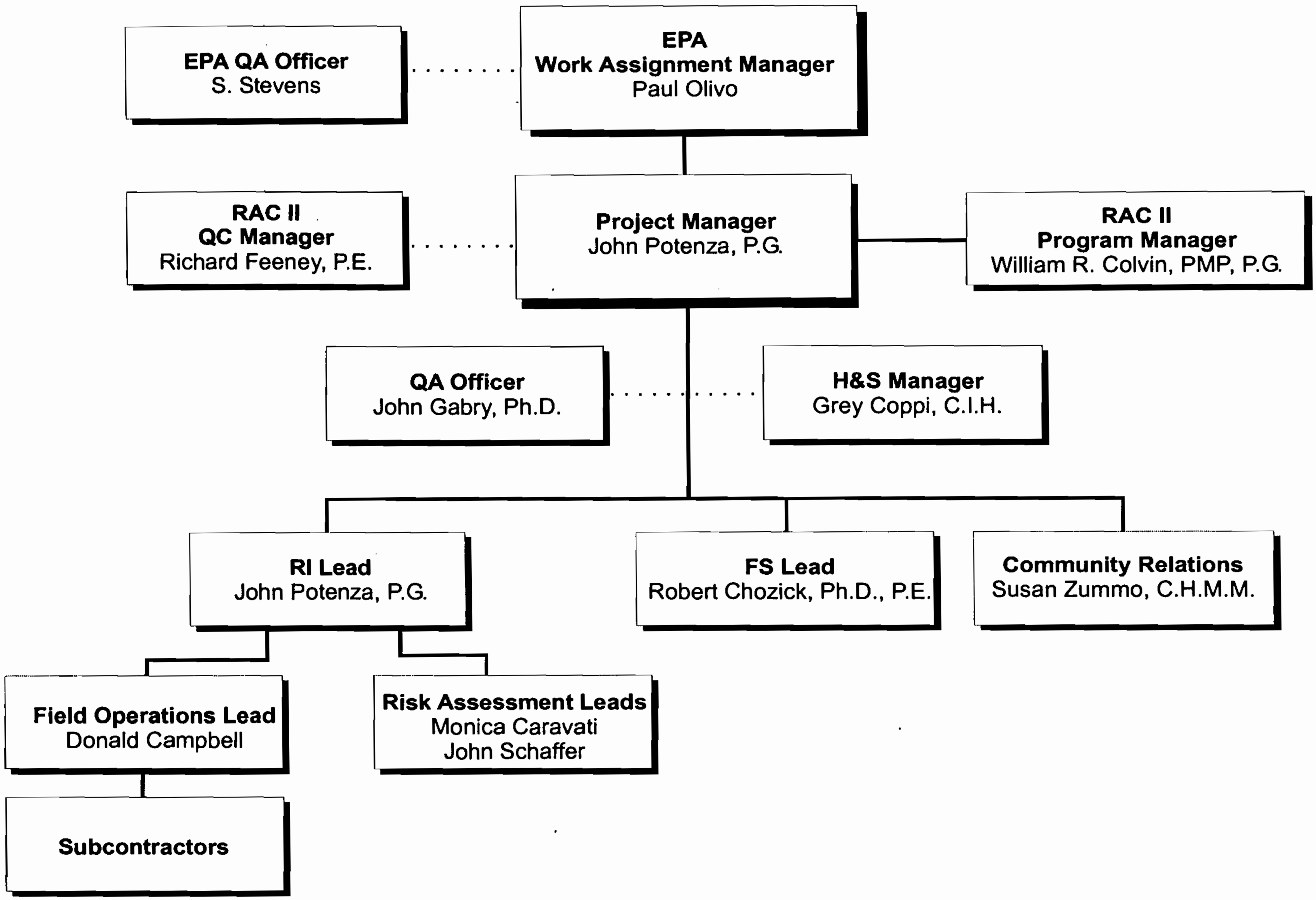
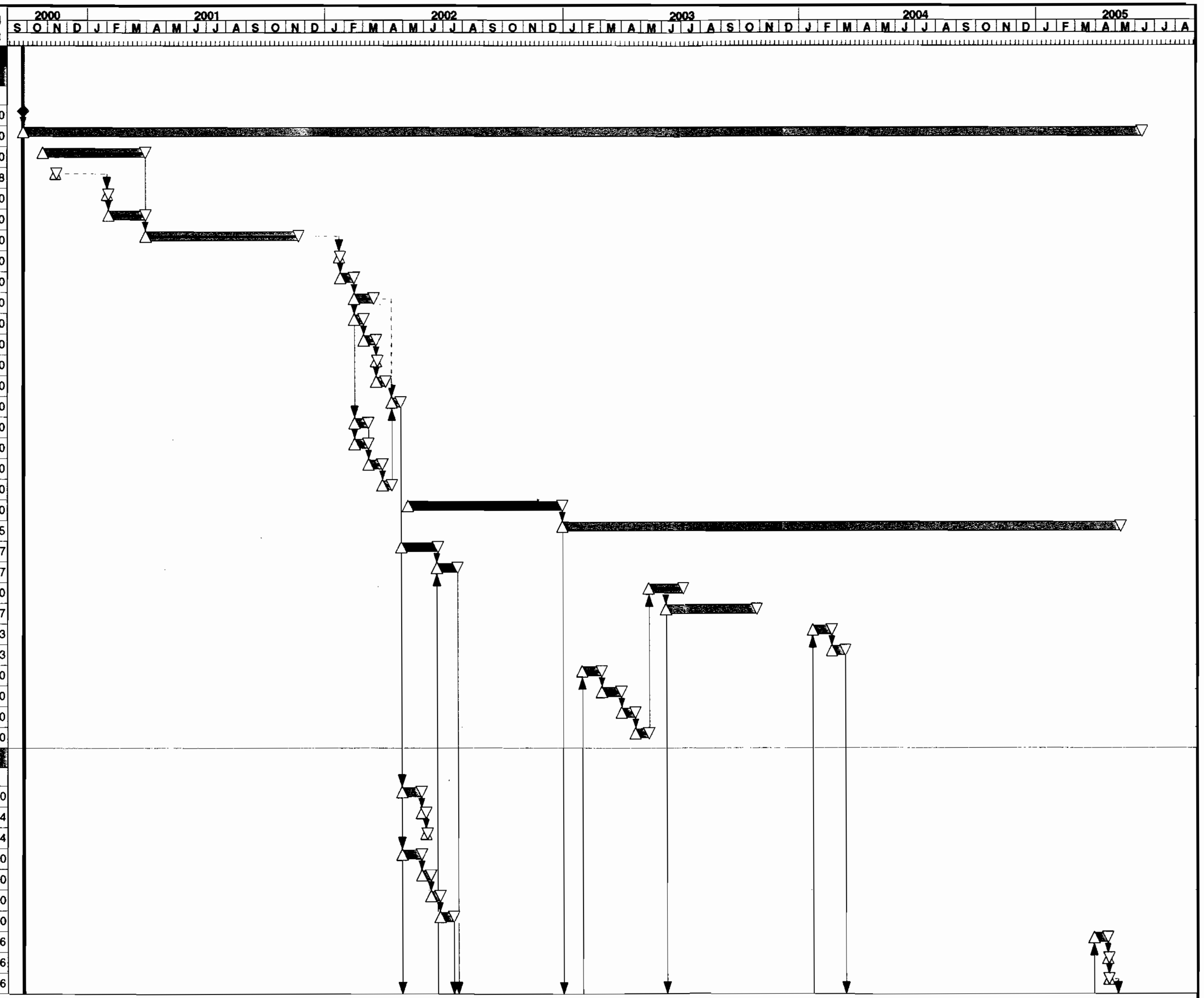


Figure 3-5
Proposed VLF Geophysical Survey Locations

Figure 4-1
Project Organization Structure
Lehigh Valley RI/FS



Activity ID	Activity Description	Calendar Days	Early Start	Early Finish	Total Float
LEHIGH VALLEY SUPERFUND SITE - WA 040-RICO-027S					
T0400100	Work Assignment Issued	0	25SEP00*		40
T0400101	Project Administration	1,720	25SEP00	10JUN05	40
T0400102	Evaluate Existing Data and Documents	157	25OCT00*	30MAR01	0
T0400103	Site Visit	1	14NOV00*	14NOV00	78
T0400104	Scoping Meeting	1	01FEB01*	01FEB01	0
T0400105	Draft Work Plan /Budget Estimate	57	02FEB01	30MAR01	0
T0400109	EPA Review of Draft Work Plan	235	31MAR01	20NOV01	0
T0400111	Work Plan Technical Meeting	1	23JAN02*	23JAN02	0
T0400113	Final Work Plan	21	24JAN02	13FEB02	0
T0400115	EPA Review Final Work Plan	30	14FEB02	15MAR02	0
T0400120	Revised Budget Estimate	14	14FEB02	27FEB02	0
T0400121	EPA Review Budget Estimate	20	28FEB02	19MAR02	0
T0400122	Negotiate Budget Estimate	1	20MAR02	20MAR02	0
T0400123	Final Budget Estimate	14	20MAR02	02APR02	0
T0400124	EPA Approve Work Plan and Budget Estimate	15	11APR02	25APR02	0
T0400125	Prepare Draft Quality Assurance Project Plan	21	14FEB02	06MAR02	0
T0400126	Prepare Draft Health and Safety Plan	21	14FEB02	06MAR02	0
T0400127	EPA Review/Comment QAPP and HASP	21	07MAR02	27MAR02	0
T0400128	Final QAPP and HASP	14	28MAR02	10APR02	0
T0400129	Site Reconnaissance Meetings	236	07MAY02*	28DEC02	0
T0400130	Phase I Meetings	860	29DEC02	06MAY05	75
T0400140	Site Reconnaissance Subcontract Procurement	57	25APR02*	20JUN02	1,097
T0400142	Site Reconnaissance Subcontract Management	30	20JUN02	19JUL02	1,097
T0400146	Phase I Subcontract Procurement	52	10MAY03	30JUN03	0
T0400148	Phase I Subcontract Management	140	05JUN03	22OCT03	637
T0400150	Pathway Analysis Report	30	19JAN04	17FEB04	403
T0400152	EPA Approval of Pathway Analysis Report	21	18FEB04	09MAR04	403
T0400160	Draft Phase I Work Plan & Budget Estimate	30	28JAN03	26FEB03	0
T0400162	EPA Review Phase I Work Plan & Budget	30	27FEB03	28MAR03	0
T0400164	Final Phase I Work Plan & Budget Estimate	21	29MAR03	18APR03	0
T0400166	EPA Approval of Phase I Work Plan & Budget Est	21	19APR03	09MAY03	0
T0400201	Prepare Draft Community Interview Summaries	30	26APR02	25MAY02	1,090
T0400203	EPA Review Community Interview Summaries	6	26MAY02	31MAY02	1,144
T0400205	Submit Community Interview Summaries	2	01JUN02	02JUN02	1,144
T0400207	Prepare Draft Community Relations Plan	30	26APR02	25MAY02	1,090
T0400209	EPA Review Community Relations Plan	20	26MAY02	08JUN02	1,090
T0400211	Finalize Community Relations Plan	14	09JUN02	22JUN02	1,090
T0400212	EPA Approval of Final CRP	20	23JUN02	12JUL02	1,090
T0400215	Prepare Draft/Final Fact Sheet (w/EPA Rev)	21	26MAR05	15APR05	76
T0400217	EPA Review Fact Sheet	1	16APR05	16APR05	76
T0400219	Public Notices	1	17APR05	17APR05	76



Start Date 25SEP00
Finish Date 20JUL05
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WA40

LEHIGH VALLEY SUPERFUND SITE
WA NO. 040-RICO-027S

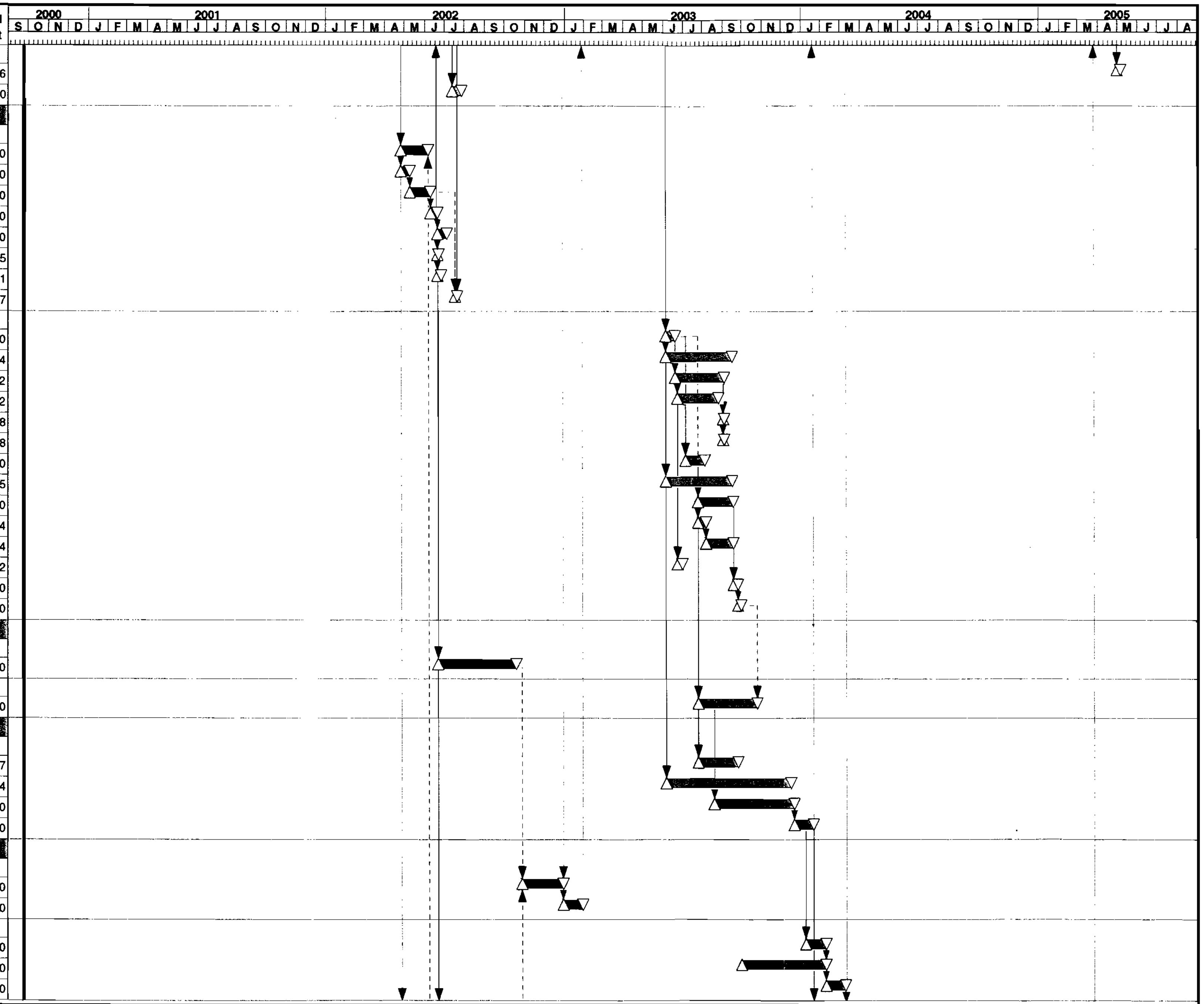
PROJECT BASELINE SCHEDULE

SITE RECONNAISSANCE
CRITICAL PATH

FIGURE 4-2

Sheet 1 of 3

Activity ID	Activity Description	Calendar Days	Early Start	Early Finish	Total Float
T0400220	Public Meeting Support	4	02MAY05	05MAY05	76
T0400229	Update Site Mailing List	14	13JUL02	26JUL02	1,090
Site Reconnaissance					
T0400300	Site Reconnaissance Mapping/Access	42	26APR02	06JUN02	0
T0400301	Site Reconnaissance Well Inventory	13	26APR02	08MAY02	0
T0400302	EPA Access	32	10MAY02	10JUN02	0
T0400303	Site Reconnaissance Mobilization	10	11JUN02	20JUN02	0
T0400304	Site Reconnaissance Existing Well Sampling	14	21JUN02	04JUL02	0
T0400305	Site Reconnaissance Surface & GW Elev Survey	1	21JUN02	21JUN02	1,125
T0400306	Site Reconnaissance Geophysical Survey	5	21JUN02	25JUN02	1,121
T0400307	Site Reconnaissance Demob / Waste Disposal	2	18JUL02	19JUL02	1,097
Phase I Field Investigation					
T0400321	Phase I Mobilization	14	05JUN03	18JUN03	0
T0400331	Hydrogeological Assessment	102	05JUN03	14SEP03	584
T0400333	Monitoring Well Installation/Development	75	19JUN03	01SEP03	2
T0400335	Downhole Geophysics	64	22JUN03	24AUG03	2
T0400337	Groundwater Elevation Measurements	1	01SEP03	01SEP03	688
T0400339	Surface Water Elevation Measurements	1	01SEP03	01SEP03	688
T0400340	Hydraulic Testing (Pump Test)	30	04JUL03	02AUG03	0
T0400341	Oversight of Subcontractors	102	05JUN03	14SEP03	675
T0400345	Environmental Sampling	54	24JUL03	15SEP03	0
T0400349	Surface Water and Sediment Sampling	12	24JUL03	04AUG03	674
T0400355	Groundwater Sampling	42	05AUG03	15SEP03	674
T0400361	Ecological Characterization	7	23JUN03	29JUN03	752
T0400391	Investigation Derived Waste IDW	7	16SEP03	22SEP03	0
T0400393	Phase I Demobilization	6	23SEP03	28SEP03	0
Site Reconnaissance					
T0400400	Site Reconnaissance CLP Analysis and Validation	119	21JUN02	17OCT02	0
TASK 4 - SAMPLE ANALYSIS					
T0400401	Phase I Sample Analysis	92	24JUL03	23OCT03	0
TASK 5 - ANALYTICAL SUPPORT AND DATA VALIDATION					
T0400501	Phase I Collect, Prepare and Ship Samples	61	24JUL03	22SEP03	667
T0400503	Phase I Sample Management	193	05JUN03	14DEC03	584
T0400505	Phase I Data Validation	124	18AUG03	19DEC03	0
T0400507	Phase I Data Validation Report	30	20DEC03	18JAN04	0
Site Reconnaissance					
T0400600	Site Reconnaissance Technical Memorandum	63	27OCT02	28DEC02	0
T0400601	EPA Approval of Site Reconnaissance Tech	30	29DEC02	27JAN03	0
TASK 6 - DATA EVALUATION					
T0400602	Phase I Data Usability Evluation	31	07JAN04	06FEB04	0
T0400603	Phase I Data Reduction,Tabulation and	131	29SEP03	06FEB04	0
T0400607	Phase I Technical Memo(Data Evaluation Report)	30	07FEB04	07MAR04	0



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LEHIGH VALLEY SUPERFUND SITE
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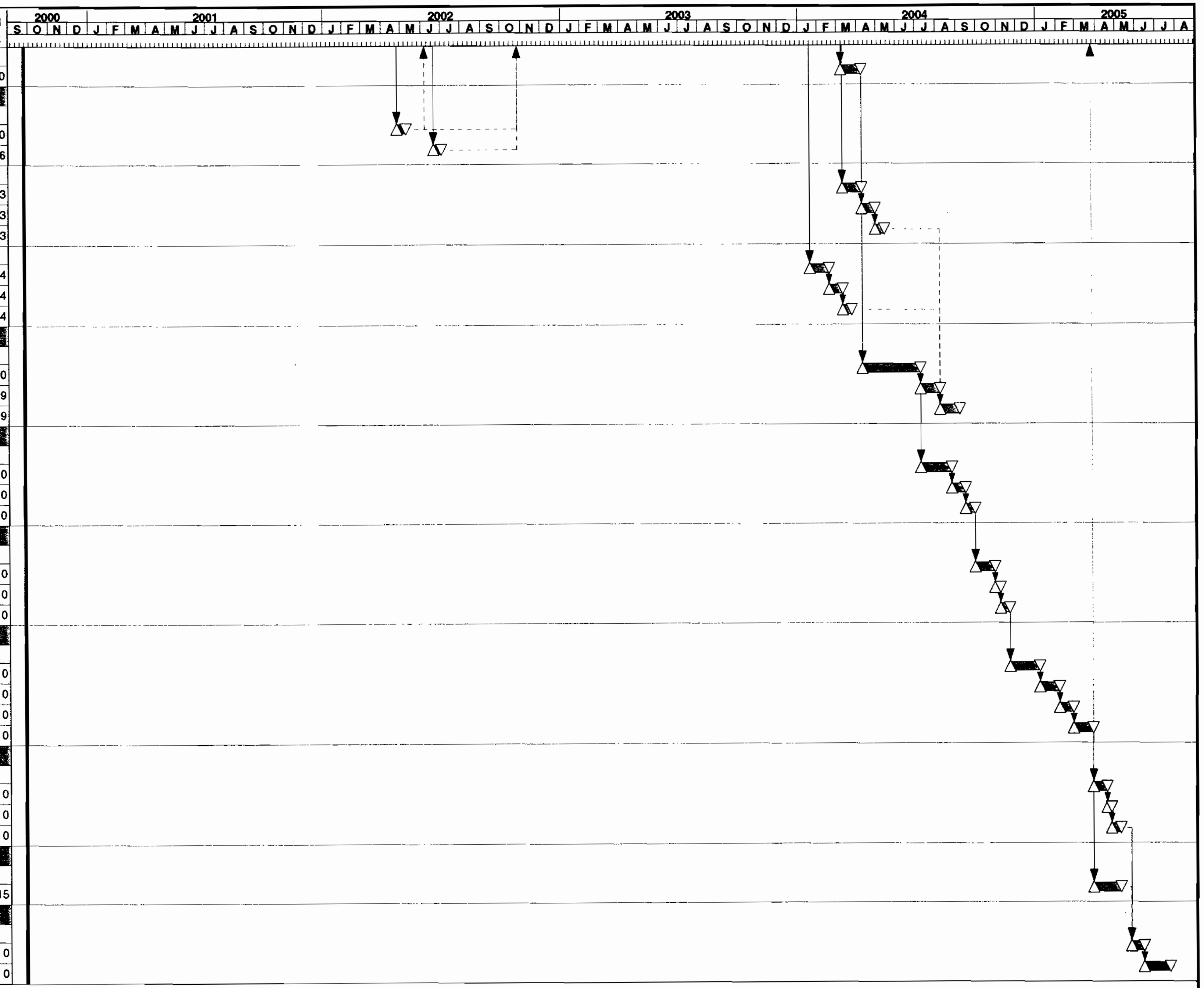
PROJECT BASELINE SCHEDULE

SITE RECONNAISSANCE
CRITICAL PATH

FIGURE 4-2

Activity ID	Activity Description	Calendar Days	Early Start	Early Finish	Total Float
TASK 6 - DATA EVALUATION					
T0400609	EPA Approval of Phase I Technical Memorandum	31	08MAR04	07APR04	0
Site Reconnaissance					
T0400700	Site Reconnaissance Human Health Receptor	13	26APR02	08MAY02	20
T0400701	Site Reconnaissance Ecological Resource	12	21JUN02	02JUL02	116
BASELINE HUMAN HEALTH RISK ASSESSMENT					
T0400702	Phase I Draft Human Health Risk Assessment	30	10MAR04	08APR04	403
T0400703	Phase I EPA Review Human Health Risk	21	09APR04	29APR04	403
T0400705	Phase I Finalize Human Health Risk Assessment	14	30APR04	13MAY04	403
SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT					
T0400711	Phase I Draft Ecological Risk Assessment	30	19JAN04	17FEB04	454
T0400713	Phase I EPA Review Ecological Risk Assessment	21	18FEB04	09MAR04	454
T0400715	Phase I Finalize Ecological Risk Assessment	14	10MAR04	23MAR04	454
T0400901	Preparation of Draft RI Report	90	08APR04	06JUL04	0
T0400903	EPA Review of Draft RI Report	30	07JUL04	05AUG04	319
T0400905	Final RI Report	30	06AUG04	04SEP04	319
T0401001	Draft Technical Memorandum	47	07JUL04	22AUG04	0
T0401003	EPA Review of Technical Memo	21	23AUG04	12SEP04	0
T0401005	Finalize Technical Memorandum	14	13SEP04	26SEP04	0
T0401101	Draft Technical Memorandum	30	27SEP04	26OCT04	0
T0401103	EPA Review of Technical Memo	10	27OCT04	05NOV04	0
T0401105	Finalize Technical Memorandum	14	06NOV04	19NOV04	0
T0401200	Preparation of Draft FS Report	45	20NOV04	03JAN05	0
T0401203	EPA Review Draft FS Report	30	04JAN05	02FEB05	0
T0401205	Finalize Feasibility Study Report	21	03FEB05	23FEB05	0
T0401207	EPA Approval of Final RI/FS Report	30	24FEB05	25MAR05	0
T0401301	Draft FS Addendum	21	26MAR05	15APR05	0
T0401303	EPA Review FS Addendum	7	16APR05	22APR05	0
T0401305	Finalize FS Addendum	14	23APR05	06MAY05	0
T0401501	Provide Updated Deliverables	42	26MAR05	06MAY05	15
T0401601	Work Assignment Close-Out (Notification)	20	22MAY05	10JUN05	0
T0401603	Work Assignment Completion Report	40	11JUN05	20JUL05	0



Start Date 25SEP00
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LEHIGH VALLEY SUPERFUND SITE
WA NO. 040-RICO-027S

PROJECT BASELINE SCHEDULE

SITE RECONNAISSANCE
CRITICAL PATH

FIGURE 4-2

Sheet 3 of 3

TABLE 2-1
GEOLOGIC UNIT(S) MONITORED IN EACH WELL

Well ID	Geologic Unit(s) Monitored
DC-1A	Basal Nedrow/Upper Falkirk
DC-1B	Falkirk
DC-1C	Upper/Mid Camillus
DE-1D	Lower Camillus
DC-2A	Clarence
DC-2B	Basal Edgecliff/Mid Falkirk
DC-2C	Basal Falkirk/Upper Camillus
DC-2D	Lower Camillus
DC-3A	Upper Clarence/Upper Bois Blanc
DC-3B	Falkirk
DC-3C	Upper Camillus
DC-3D	Lower Camillus
DC-4A	Lower Clarence/Mid Edgercliff
DC-4B	Basal Edgecliff/Mid Falkirk
DC-4C	Mid Camillus
DC-4D	Basal Camillus/Upper Syracuse
DC-5A	Lower Nedrow/Mid Edgecliff
DC-5B	Mid Edgecliff/Mid Falkirk
DC-5C	Upper/Mid Camillus
DC-5D	Basal Camillus/Upper Syracuse
DC-6A	Mid Clarence/Lower Edgecliff
DC-6B	Bois Blanc/Mid Falkirk
DC-6C	Upper Camillus
DC-6D	Lower Camillus
DC-7	Basal Nedrow/Mid Falkirk
DC-7RA	Upper Nedrow/Upper Falkirk
DC-7RB	Falkirk
DC-7RC	Mid Camillus
DC-7RD	Basal Camillus/Upper Syracuse
DC-8A	Lower Clarence/Upper Scajaquada
DC-8B	Lower Scajaquada/Mid Falkirk
DC-8C	Basal Falkirk/Upper Camillus
DC-8D	Lower Camillus
DC-9A	Lower Falkirk/UpperCamillus
DC-9B	LowerCamillus/Upper Syracuse
DC-9C	Syracuse
DC-10A	Basal Nedrow/Mid Scajaquada
DC-10B	Falkirk
DC-10C	Basal Falkirk/UpperCamillus
DC-10D	Mid Camillus
DC-11A	Lower Clarence/Mid Scajaquada
DC-11B	Upper/Mid Camillus
DC-12A	Lower Nedrow/Bois Blanc
DC-12B	Mid Scajaquada/Mid Falkirk
DC-12C	Basal Falkirk/
DC-12D	Mid Camillus
DC-13A	Mid Camillus
DC-13B	Lower Camillus/Upper Syracuse
DC-14A	Falkirk
DC-14B	Upper Camillus
DC-15A	Basal Nedrow/UpperFalkirk

Well ID	Geologic Unit(s) Monitored
DC-15B	Syracuse
DC-16	Lower Nedrow/Upper Falkirk
DC-17A DC-17B	Lower Clarence/Lower Falkirk Syracuse

TABLE 3-2 (Sheet 1 of 3)
SITE RECONNAISSANCE
MONITORING WELL CLUSTER SAMPLING PROGRAM
LOCATION AND RATIONALE

CLUSTER NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
DC-1	Spill Area	Impacted	Evaluate groundwater quality at 4 vertical horizons at the spill site.	Located directly at the spill site VOCs exceed NY State groundwater standard. Will investigate vertical and horizontal extent of the plume.
DC-2	Spill Area	Impacted	Evaluate groundwater quality at 4 vertical horizons in the vicinity of the spill site.	VOCs exceed NY State groundwater standard. Will define current conditions in the most impacted area. Will investigate vertical and horizontal extent of the plume.
DC-3	Southeast of spill area	Impacted	Evaluate groundwater quality at 4 vertical horizons 1,250 feet southeast of the spill site.	VOCs exceed NY State groundwater standard. Will define current conditions in the spill site area. Will investigate vertical and horizontal extent of the plume.
DC-4	Northwest of spill area	Impacted	Evaluate groundwater quality at 4 vertical horizons 1,000 feet west of the spill site for spill contaminants and decay products.	Hydraulically upgradient, may be impacted from another source. VOCs exceed NY State groundwater standard. Will investigate vertical and horizontal extent of the plume.
DC-5	South of spill area	Impacted	Evaluate groundwater quality at 4 vertical horizons 500 feet directly south of the spill site for spill contaminants and decay products.	VOCs exceed NY State groundwater standard in all 4 wells. Will investigate vertical and horizontal extent of the plume.
DC-6	Downgradient of spill area	Impacted	Evaluate groundwater quality at 4 vertical horizons 1,800 feet east of the spill site, adjacent to Mud Creek Gorge for spill contaminants and decay products.	VOCs exceed NY State groundwater standard. Will investigate vertical and horizontal extent of the plume.
DC-7	Downgradient of spill area	Impacted	Evaluate groundwater quality along the axis of the plume 2,900 feet east-southeast of the spill site for spill contaminants and decay products.	This well has not shown impacts in the past even though it is located in the axis of the plume. Adjacent wells have shown significant impact. The well has not been sampled since 1994. Data will help evaluate fracture flow along the plume axis.

CLUSTER NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
DC-7R	Downgradient of spill area	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 4 vertical horizons 3,100 feet southeast of the spill site along the axis of the plume where high concentrations have been detected.	Adjacent to monitoring well DC-7, this cluster has contained VOCs above the NY State groundwater standards. Data will help evaluate fracture flow along the plume axis.
DC-8	Sidegradient, north of the axis of the plume	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 4 vertical horizons 1.4 miles east-southeast of the spill site where moderate concentrations have been detected.	Previous data indicate that perched groundwater is present in this area and that complex groundwater flow is occurring. Data will help define the northern extent of the plume. Will investigate vertical and horizontal extent of the plume.

TABLE 3-2 (Sheet 2 of 3)
SITE RECONNAISSANCE
MONITORING WELL CLUSTER SAMPLING PROGRAM
LOCATION AND RATIONALE

CLUSTER NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
DC-9	Sidegradient, north of the axis of the plume	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 3 vertical horizons 1.8 miles east of the spill site where moderate concentrations have been detected.	Data will help define the northern extent of the plume, east of potential fracture systems in the gorge pond area. Will investigate vertical and horizontal extent of the plume.
DC-10	Downgradient of spill area, along the plume axis	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 4 vertical horizons 1.4 miles east-southeast of the spill site where high concentrations have been detected along apparent fractures.	Data will help define the extent of the plume and characterize the vertical and horizontal extent of the plume along the axis of the plume.
DC-11	Sidegradient, south of the axis of the plume	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 2 vertical horizons 1.5 miles southeast of the spill site where moderate concentrations have been detected.	Data will help define the Will investigate vertical and horizontal extent of the southern extent of the plume.
DC-12	Sidegradient, south of the axis of the plume	Impacted	Evaluate groundwater quality for spill contaminants and decay products at 4 vertical horizons 2.3 miles southeast of the spill site where moderate concentrations have been detected.	Data will help define the vertical and horizontal extent of the southern portion of the plume in an area where the plume widens to the south.
DC-13	Downgradient, north of plume axis	Impacted	Evaluate groundwater quality at 2 vertical horizons north of the plume axis 3.3 miles east of the spill site near Spring Creek for spill contaminants and decay products.	Data will help define the vertical and horizontal extent of the plume to the northeast of the spill site in the area of Spring Creek, near it's confluence with Oatka Creek. This area is currently mapped as the downgradient edge of the plume.

DC-14	Downgradient, south of plume axis	Impacted Evaluate groundwater quality at 2 vertical horizons 3.6 miles east-southeast of the plume axis near Spring Creek for spill contaminants and decay products.	Data will help define the vertical and horizontal extent of the southeast portion of the plume in the area of Spring Creek. This area is currently mapped as the downgradient edge of the plume.	Data will help define the vertical and horizontal extent of the southeast portion of the plume in the area of Spring Creek. This area is currently mapped as the downgradient edge of the plume.
DC-15	Spill Area	Impacted	Evaluate groundwater quality at 2 vertical horizons just southeast of the spill site for spill contaminants and decay products.	Located at the spill site VOCs exceed NY State groundwater standard. Will investigate vertical and horizontal extent of the plume.

TABLE 3-2 (Sheet 3 of 3)
SITE RECONNAISSANCE
MONITORING WELL CLUSTER SAMPLING PROGRAM
LOCATION AND RATIONALE

CLUSTER NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
DC-16	Spill Area	Impacted	Evaluate groundwater quality at 1 vertical horizon just 350 ft east of the spill site for spill contaminants and decay products.	Located at the spill site VOCs exceed NY State groundwater standard. Will investigate vertical and horizontal extent of the plume.
DC-17	Downgradient of spill area	Impacted	Evaluate groundwater quality at 2 vertical horizons 1,900 ft east the spill site for spill contaminants and decay products.	Located east of Mud Creek. Data will help evaluate the influence of the fracture system and it's impact on groundwater flow and investigate vertical and horizontal extent of the plume.
Genesse County Museum Wells	Sidegradient, north of the axis of the plume	impacted	Evaluate groundwater quality for spill contaminants and decay products at 3 vertical horizons east of the spill site where moderate concentrations have been detected.	Data will help define the vertical and horizontal extent of the plume in the central portion of the plume where data points are sparse. VOCs have exceed NY State groundwater standard in 2 of the 3 wells.

TABLE 3-3 (Sheet 1 of 4)
SITE RECONNAISSANCE
PRIVATE WELL SAMPLING PROGRAM
LOCATION AND RATIONALE

WELL NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
G-1	Downgradient of source area	Impacted	Evaluate groundwater quality near the spill site.	Most highly impacted domestic well located immediately downgradient of the spill site. Historically one of the most impacted wells. Data will supplement data from monitoring well cluster DC-4.
G-2	Downgradient of source area	Impacted	Evaluate groundwater quality near the spill site for spill contaminants and decay products	Highly impacted domestic well located immediately downgradient of the spill site. Historically one of the most impacted wells.
G-5	Upgradient of source area	Impacted	Evaluate groundwater quality upgradient near the spill site.	Quarry production well to be sampled to evaluate the potential for pumpage to induce upgradient migration of contamination. No monitoring wells exist in this area.
G-8	Downgradient along plume axis	Impacted	Evaluate groundwater quality in the narrow portion of the plume for spill contaminants and decay products.	Located on Church Road where the plume axis narrows and the concentration gradient is high. Data will assist in defining the narrow portion of the plume. This well has historically shown minor impact and will aid in defining the northern side of the plume.
G-9	Downgradient along plume axis	Impacted	Evaluate groundwater quality in the narrow portion of the plume for spill contaminants and decay products.	Located on Church Road where the plume axis narrows and the concentration gradient is high. Data will assist in defining the narrow portion of the plume. This well has historically shown significant impacts and will aid in defining the plume axis.
G-10	Downgradient along plume axis	Impacted	Evaluate groundwater quality in the narrow portion of the plume.	Located on Church Road where the plume axis narrows and the concentration gradient is high. Data will assist in defining the narrow portion of the plume. This well has historically shown significant impacts and will aid in delineating the plume axis.
G-11	Downgradient along plume axis	Impacted	Evaluate groundwater quality in the narrow portion of the plume.	Located on Church Road where the plume axis narrows and the concentration gradient is high. Data will assist in defining the narrow portion of the plume. This well has historically shown minor impacts and will aid in defining the steep concentration gradient south of the plume axis.
G-12	Upgradient along plume axis	Impacted	Evaluate groundwater quality upgradient of the narrow portion of the plume for spill contaminants and decay products.	Located on Church Road on the upgradient side of the plume. This well has historically shown minor impacts and will aid in defining the southern extent of the plume. No monitoring wells exist in this area.

TABLE 3-3 (Sheet 2 of 4)
SITE RECONNAISSANCE
PRIVATE WELL SAMPLING PROGRAM
LOCATION AND RATIONALE

WELL NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
G-19	Upgradient along plume axis	Not Impacted	Evaluate groundwater quality upgradient of the narrow portion of the plume.	Located on Church Road this is a historically clean well to define the southern extent of the plume near the intersection with Route 5. No monitoring wells exist in this area.
M-1	Downgradient along plume axis	Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products	Well varied from non-detect to low concentrations of VOCs. Well is located within the plume, yet does not exhibit elevated concentrations on a regular basis. Data will investigate the potential fracture control of the plume.
M-2	Downgradient along plume axis	Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Consistent detection of VOCs significantly above the NY State groundwater standards. Located along the northern edge of the plume in a cluster of domestic wells, near monitoring well DC-6 cluster.
M-5	Downgradient along plume axis	Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Consistent detection of VOCs above the NY State groundwater standards. Located along the northern edge of the plume in a cluster of domestic wells.
M-9	Downgradient along plume axis	Not Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Consistently non detect for VOCs, data will help define the edge of the plume. Located along the northern edge of the plume in a cluster of domestic wells.
M-12	Downgradient along plume axis	Not Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Well varied from non-detect to low concentrations of VOCs. Well is located within the plume, yet does not exhibit elevated concentrations on a regular basis. Data will investigate the potential fracture control of the plume.
M-14	Downgradient along plume axis	Impacted	Evaluate the narrow portion of the plume for spill contaminants and decay products.	Consistent detection of VOCs above the NY State groundwater standards. Located near —12, this well was non-detect for VOCs in all but the last sampling event (1994) when low levels of TCE were detected. Data from this well will investigate the potential for fracture control of the plume.
M-16	Downgradient along plume axis	Not Impacted	Evaluate the groundwater quality south of Oatka Creek for spill contaminants and decay products.	Consistently non detect for VOCs, data will help define the edge of the plume. Located north of the plume in an area where no monitoring wells exist.
M-21	Downgradient along plume axis	Not Impacted	Evaluate the groundwater quality west of Spring Creek for spill contaminants and decay products	Consistently non detect for VOCs, data will help define the edge of the plume. Located close to the northern edge of the plume.

TABLE 3-3 (Sheet 3 of 4)
SITE RECONNAISSANCE
PRIVATE WELL SAMPLING PROGRAM
LOCATION AND RATIONALE

WELL NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
M-27	Downgradient along plume axis	Impacted	Evaluate widening of the plume in upgradient location for spill contaminants and decay products.	Well varied from non-detect to low concentrations of VOCs. Data will help define the plume where no monitoring wells currently exist.
L-1	Downgradient along plume axis	Impacted	Evaluate the narrow portion of the plume for spill contaminants and decay products	Consistently elevated VOCs detected. Concentrations vary over one order of magnitude. Data will help define current conditions. Located along the axis of the plume in the area of highest VOC concentration.
L-2	Upgradient along plume axis	Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products	Consistently elevated VOCs detected. Data will help define current conditions and investigate potential fracture control of the plume. Located along the southern edge of the plume west of monitoring well DC-12 cluster.
L-4	Upgradient along plume axis	Not Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Consistently non detect for VOCs, data will help define the edge of the plume and investigate potential fracture control of the plume. Located just west of impacted well L-2.
L-10	Upgradient along plume axis	Not Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	Consistent low levels of VOCs have been detected. Data will help define current conditions and investigate the apparent widening of the plume in an upgradient direction. Located just south of impacted well L-2.
L-14	Downgradient along plume axis	Impacted	Evaluate the narrow portion of the plume for spill contaminants and decay products.	Well varied in VOC concentration from non-detect to 180 ppb. Data will help define current conditions and investigate the potential fracture control of the plume axis. Located along the axis of the plume in the area of high VOC concentration.
L-17	Upgradient along plume axis	Impacted	Evaluate widening of the plume in upgradient location for spill contaminants and decay products.	Consistent low levels of VOCs have been detected. Data will help define current conditions and investigate the apparent widening of the plume in an upgradient direction. Located in an area where no monitoring wells currently exist.
L-19	Upgradient along plume axis	Impacted	Evaluate potential fracture control of the plume for spill contaminants and decay products.	One isolated detect for VOCs, data will help define the edge of the plume. This well is at the southern edge of the plume. Data will investigate isolated VOC occurrence detected in this well. No monitoring wells currently exist in this area.

TABLE 3-3 (Sheet 4 of 4)
SITE RECONNAISSANCE
PRIVATE WELL SAMPLING PROGRAM
LOCATION AND RATIONALE

WELL NUMBER	LOCATION	PREVIOUS SAMPLING RESULTS	DATA OBJECTIVES	SAMPLING RATIONALE
L-24	Upgradient along plume axis	Not Impacted	Evaluate widening of the plume in upgradient location for spill contaminants and decay products.	Consistently non detect for VOCs, data will help define the edge of the plume. Located south of the plume in an area where no monitoring wells exist. Data will investigate the widening of the plume to the south near Caledonia.
L-27	Downgradient along plume axis	Impacted	Evaluate groundwater quality near Spring Creek for spill contaminants and decay products.	Consistently elevated VOC concentrations have been detected in this well. Data will help define the plume in the area of Spring Creek where no monitoring wells currently exist. Located along the axis of the plume where discharge to Spring Creek is suspected.
L-29	Upgradient along plume axis	Impacted	Evaluate widening of the plume in upgradient location for spill contaminants and decay products.	Consistently non detect for VOCs, data will help define the southern edge of the plume where no monitoring wells currently exist. Data will investigate the widening of the plume to the south near Caledonia.
L-33	Downgradient along plume axis	Impacted	Evaluate groundwater quality near Spring Creek for spill contaminants and decay products.	Consistently elevated VOC concentrations have been detected in this well. Data will help define the plume in the area of Spring Creek where no monitoring wells currently exist. Located along the axis of the plume just east of L-27, this well exhibits much lower VOC concentrations. Data will be used to investigate the eastern edge of the plume where no monitoring wells currently exist.

TABLE 3-4 (Sheet 1 of 2)
SITE RECONNAISSANCE
ANALYSES TO BE PERFORMED ON GROUNDWATER SAMPLES COLLECTED FROM PRIVATE WELLS AND MONITORING CLUSTERS

Well Number*	Analytical Parameters				
	TCL VOCs	Cyanide	TCL SVOCs	TAL Metals	Pesticides/ Herbicides
Private Well					
G-1	1	1			
G-2	1	1			
G-5	1	1			
G-8	1	1			
G-9	1	1			
G-10	1	1			
G-11	1	1			
G-12	1	1			
G-19	1	1			
M-2	1	1			
M-5	1	1			
M-8	1	1			
M-11	1	1			
M-12	1	1			
M-14	1	1			
M-16	1	1			
M-21	1	1			
M-27	1	1			
L-1	1	1			
L-2	1	1			
L-4	1	1			
L-11	1	1			
L-14	1	1			
L-17	1	1			
L-19	1	1			
L-24	1	1			
L-25	1	1			
L-27	1	1			
L-29	1	1			
L-33	1	1			
Monitoring Well Cluster					
DC-1	4	4	4	4	4
DC-2	4	4	2	2	2
DC-3	4	4			
DC-4	4	4			

TABLE 3-4 (Sheet 2 of 2)
SITE RECONNAISSANCE
ANALYSES TO BE PERFORMED ON GROUNDWATER SAMPLES COLLECTED FROM PRIVATE WELLS AND MONITORING CLUSTERS

Well Number*	Analytical Parameters				
	TCL VOCs	**Cyanide**	**TCL SVOCs**	**TAL Metals**	**Pesticides/ Herbicides**
DC-5	4	4			
DC-6	4	4			
DC-7	1	1			
DC-7R	4	4			
DC-8	4	4			
DC-9	3	3			
DC-10	4	4			
DC-11	2	2			
DC-12	4	4			
DC-13	2	2			
DC-14	2	2			
DC-15	2	2			
DC-16	1	1			
DC-17	2	2			
Genesse County Museum Wells (MS-1, MS-2, MS-	3	3			
Total Number of Groundwater Samples/Analyses	**88**	**88**	**6**	**6**	**6**
Trip Blanks	14				
Field Blanks	14	14	1	1	1
Duplicates	5	5	1	1	1
Total Number of Analyses	**121**	**107**	**8**	**8**	**8**

* DC and MS well prefixes from NYSDEC investigation reports.

TABLE 3-5
PROPOSED PHASE 1 MONITORING WELL CLUSTER LOCATIONS
SCREENING DEPTH/TARGET INFORMATION

Proposed Well Clusters	Wells Per Cluster	Maximum Anticipated Depth	Packer Testing	**ScreenDepth/Target Foundation**			
				Shallow	Intermediate 1	Intermediate 2	Deep
FW-18	4	175	No	20-40 Nedrow/ Clarence	70-90 Edgecliff/Falkirk	115-135 Upper Camillus	150-170 Lower Camillus
FW-19	1	160	Yes	Fully Penetrating Aquifer Test Well			
FW-20	4	160	Yes	20-40 Clarence	50-70 Basal Nedrow/Mid Falkirk	80-100 Basal Falkirk	125-145 Lower Camillus
FW-21	4	160	No	5-25 Clarence/ Scajaquada	30-50 Basal Scajaquada/ Upper Fallkirk	60-80 Upper Camillus	100-120 Lower Camillus
FW-22	2	60	No	5-25 Upper Camillus	No Intermediate Well	No Intermediate Well	25-45 Lower Camillus
FW-23	2	60	No	5-25 Upper Camillus	No Intermediate Well	No Intermediate Well	25-45 Lower Camillus
FW-24	3	60	No	10-20 Upper Falkirk	25-45 Mid Camillus	No Intermediate Well	55-75 Mid Camillus
FW-25	3	60	No	20-40 Upper Fallkirk	50-70 Upper Camillus	No Intermediate Well	80-100 Lower Camillus
FW-26	3	160	Yes	No Shallow Well	80-100 Clarence	130-150 Falkirk	170-190 Mid Camillus
FW-27	4	175	No	40-60 Nedrow	80-100 Clarence	130-150 Falkirk	160-180 Mid Camillus

Note: Well depth and target formation are preliminary, based on available information and are subject to modification based on field conditions. Substantial modification will include EPA concurrence.

TABLE 3-6
SUMMARY OF PHASE 1 SAMPLE LOCATION/RATIONALE

MATRIX	LOCATIONS	RATIONALE
Mud Creek Gorge		
Surface Water	SW-1 to SW-5	Evaluate groundwater discharge to surface water in support of human
Spring and Seeps Water/Sediment	undefined locations, up to 6 water and 6 sediment samples	health and ecological risk assessment
Sediment	Sed-1 to Sed-5	Evaluate groundwater discharge impact to sediments in support of human health and ecological risk assessment
Oatka Creek Sampling		
Surface Water	SW-6	Document upgradient background conditions.
Surface Water	SW-7 to SW-10	Evaluate groundwater discharge to surface water in support of human health and ecological risk assessment
Sediment	Sed-6 to Sed-10	Evaluate groundwater discharge impact to sediments in support of human health and ecological risk assessment
Gorge Pond Sampling		
Surface Water	SW–11 to SW-12	Evaluate groundwater discharge to surface water in support of human
Spring and Seeps Water/Sediment	undefined locations, up to 4 water and 4 sediment samples	health and ecological risk assessment
Sediment	Sed-11 to Sed-12	Evaluate groundwater discharge impact to sediments in support of human health and ecological risk assessment
Spring Creek Channel		
Surface Water	SW-13	Document head water conditions.
Surface Water	SW-14 to SW-17	Evaluate groundwater discharge to surface water in support of human
Spring and Seeps Water/Sediment	undefined locations, up to 4 water and 4 sediment samples	health and ecological risk assessment
Sediment	Sed-13 to Sed-17	Evaluate groundwater discharge impact to sediments in support of human health and ecological risk assessment
Wetland Sampling		
Surface Water	SW-18 to SW-21	Evaluate groundwater discharge to surface water in support of human health and ecological risk assessment
Sediment	Sed-18 to Sed-21	Evaluate groundwater discharge impact to sediments in support of human health and ecological risk assessment
Groundwater		
Existing Monitoring Wells	58 well @ 19	May be reduced pending Technical Memorandum
Domestic Wells	undefined	Currently not anticipated, pending Technical Memorandum recommendations
New Monitoring Wells (30)	Cluster FW-18	Upgradient background wells

(3 wells per cluster)	Cluster FW-19	Aquifer test well
	Cluster FW-20	Evaluate movement toward Mud Creek and Northern Edge
	Cluster FW-21	Evaluate movement toward Gorge Pond and Northern Edge
	Cluster FW-22	Evaluate movement toward Spring Creek and Northern Edge
	Cluster FW-23	Evaluate downgradient movement
	Cluster FW-24	Evaluate downgradient movement
	Cluster FW-25	Evaluate movement toward Caledonia and Southern Edge
	Cluster FW-26	Evaluate Southern Edge
	Cluster FW-27	Evaluate Southern Edge

TABLE 4-1 (Sheet 1 of 2)

SUMMARY OF MAJOR DELIVERABLES FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY

TASK	DELIVERABLE	NO. OF COPIES	DUE DATE (Calendar Days)
1.4	Draft RI/FS Work Plan	3	60 days after scoping meeting
1.7	QAPP	3	21 days after receipt of final EPA Work Plan comments.
1.8	HASP Plan	3	21 days after receipt of final EPA Work Plan comments.
1.10	Meeting Minutes	1	5 days after meeting
1.13	Pathways Analysis Report	2	30 days after receipt of all validated data
2.1	Community Interview Summaries	2	30 days after work plan approval
2.2	Draft Community Relations Plan (CRP)	2	30 days after work plan approval
2.2	Final CRP	2	14 days after final comments from EPA on Draft CRP
2.4	Fact Sheets	3	7 days prior to public meeting/event
2.6	Public Notices	3	14 days before public meeting/event
2.8	Site Mailing List	2	14 days after approval of Final CRP
5.3	Data Validation Reports	1	30 days after receipt of all analytical results from laboratory
7.1	Draft Risk Assessment Report (baseline HH and screening level Eco)	3	30 days after submission of the Pathways Analysis Report
7.1	Final Risk Assessment Report (baseline HH and screening level Eco)	3	14 days after receipt of EPA final comments on draft report
9.1	Draft Remedial Investigation (RI) Report	6	90 days after receipt of all validated data
9.2	Final RI Report	6	30 days after receipt of EPA final comments on draft report

TABLE 4-1 (Sheet 2 of 2)

SUMMARY OF MAJOR DELIVERABLES FOR THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY

TASK	DELIVERABLE	NO. OF COPIES	DUE DATE (Calendar Days)
10.1	Draft Remedial Alternatives Technical Memorandum	3	30 days after final RI report submission
10.2	Final Remedial Alternatives Technical Memorandum	3	14 days after receipt of EPA final comments on draft memorandum
11.1	Draft Remedial Alternatives Evaluation Memorandum	3	30 days after Final Remedial Alternatives Technical Memorandum submission
11.2	Final Remedial Alternatives Evaluation Memorandum	3	14 days after receipt of EPA final comments on draft Technical Memorandum
12.1	Draft Feasibility Study Report	3	45 days after submission of Final Remedial Alternatives Memorandum
12.2	Final Feasibility Study Report	3	21 days after receipt of EPA final comments on draft FS
16.1	Work Assignment Completion Report	3	30 days after Work Assignment Closeout Notification from EPA