Work Plan for Remedial Investigations and Feasibility Studies at the Luzerne Road Site, Queensbury, New York

Work Assignment No.: D003493-16

June 1999

Prepared for:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
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List of Acronyms

ARARs	applicable or relevant and appropriate requirements
ASC	Analytical Services Center
ASP	Analytical Services Protocol
BGS	below ground surface
CAD	computer-aided design
CLP	Contract Laboratory Program
DOT	United States Department of Transportation
DPT	direct push technology
DPW	Department of Public Works
E & E	Ecology and Environment Engineering, P.C.
FWIA	Fish and Wildlife Impact Assessment
GC	gas chromatograph
gpm	gallons per minute
HASP	Health and Safety Plan
HOS	halogenated organic compound scan
ID	inside diameter
IDW	investigation-derived waste
MBE/WBE	Minority Business Enterprise/Women-owned Business Enterprise
MCLs	maximum contaminant levels
mL	milliliter
msl	mean sea level
NTUs	nephelometric turbidity units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance

List of Acronyms (Cont.)

OD	outside diameter
oz	ounce
PCB	polychlorinated biphenyls
POC	point of contact
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PRAP/ROD	proposed remedial action plan/record of decision
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI/FS	remedial investigation/feasibility study
SOW	Scope of Work
SSL	Soil Screening Level
TAGM	New York State Technical and Administrative Guidance Memorandum
TAL	Target Analyte List
TBC	to be considered
TCL	Target Compound List
TSP	trisodium phosphate
USGS	United States Geological Survey
VOC	volatile organic compound

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Introduction

E & E
Ecology and Environment Engineering, P.C.

NYSDEC
New York State Department of Environmental Conservation

RI/FS
remedial investigation/ feasibility study

MBE/WBE
Minority Business Enterprise/Women-owned Business Enterprise

Pursuant to Work Assignment No. D003493-16 received February 4, 1999, Ecology and Environment Engineering, P.C. (E & E) is submitting this work plan to the New York State Department of Environmental Conservation (NYSDEC), Division of Environmental Remediation, for remedial investigation/feasibility study (RI/FS) services at the Luzerne Road Site (No. 6-22-017) in Glens Falls, New York.

Section 2 of this work plan presents background information on the site; Section 3 details the major tasks to be performed; Section 4 contains a project schedule; Section 5 presents a staffing plan; Section 6 presents subcontracting requirements for this work assignment; Section 7 provides a detailed budget prepared in accordance with contractual reporting requirements, including a separate direct administrative labor hours estimate (Form 2.11 (b-1)); and Section 8 presents the Minority Business Enterprise/Women-owned Business Enterprise (MBE/WBE) utilization plan.

2 Background Information

2.1 Site Location and Description

The Luzerne Road Site is comprised of three contiguous properties located at 53 and 55 Luzerne Road and an adjacent New York State-owned property in the Town of Queensbury, County of Warren, New York (see Figure 2-1 for site location). The site is identified as Class 2 in the New York State Registry of Inactive Hazardous Waste Sites, indicating that the site poses a significant threat to public health or the environment. Confirmed hazardous waste disposal at the site includes polychlorinated biphenyls (PCBs) which have been found in site soils and groundwater.

PCB
polychlorinated biphenyl

Reportedly, the site was used as a junkyard by a previous owner, and it is believed that PCB contamination has resulted at the site from electrical capacitor salvaging activities. Similar salvaging activities are reported to have occurred at local residences. During a removal action conducted in 1979, NYSDEC used the adjacent State-owned property to construct a secure, temporary PCB storage cell (see Figure 2-2). Excavated soils from the 53 and 55 Luzerne Road properties and the private residences were placed in the secure cell and the cell was capped. The scope of this remedial investigation includes additional investigation at and around the Luzerne Road properties and at the private residences.

The Luzerne Road Site is located in the southeastern portion of Warren County, approximately one-half mile west of the City of Glens Falls city limits. The area includes a mix of residential and vacant land. The Hudson River is located approximately one-half mile to the south of the site. The site is bounded to the north and west by the Glens Falls Landfill Site, which also is a Class 2 Inactive Hazardous Waste Site. The Glens Falls Landfill Site reportedly received primarily municipal waste as well as an unknown quantity of PCB-containing capacitors and approximately 5 tons of ink sludge. Located to the east of the Luzerne Road Site is a vacant field, and to the south is Luzerne Road, beyond which are private residences. The private residences where previous removal actions occurred are located south and west of the site.

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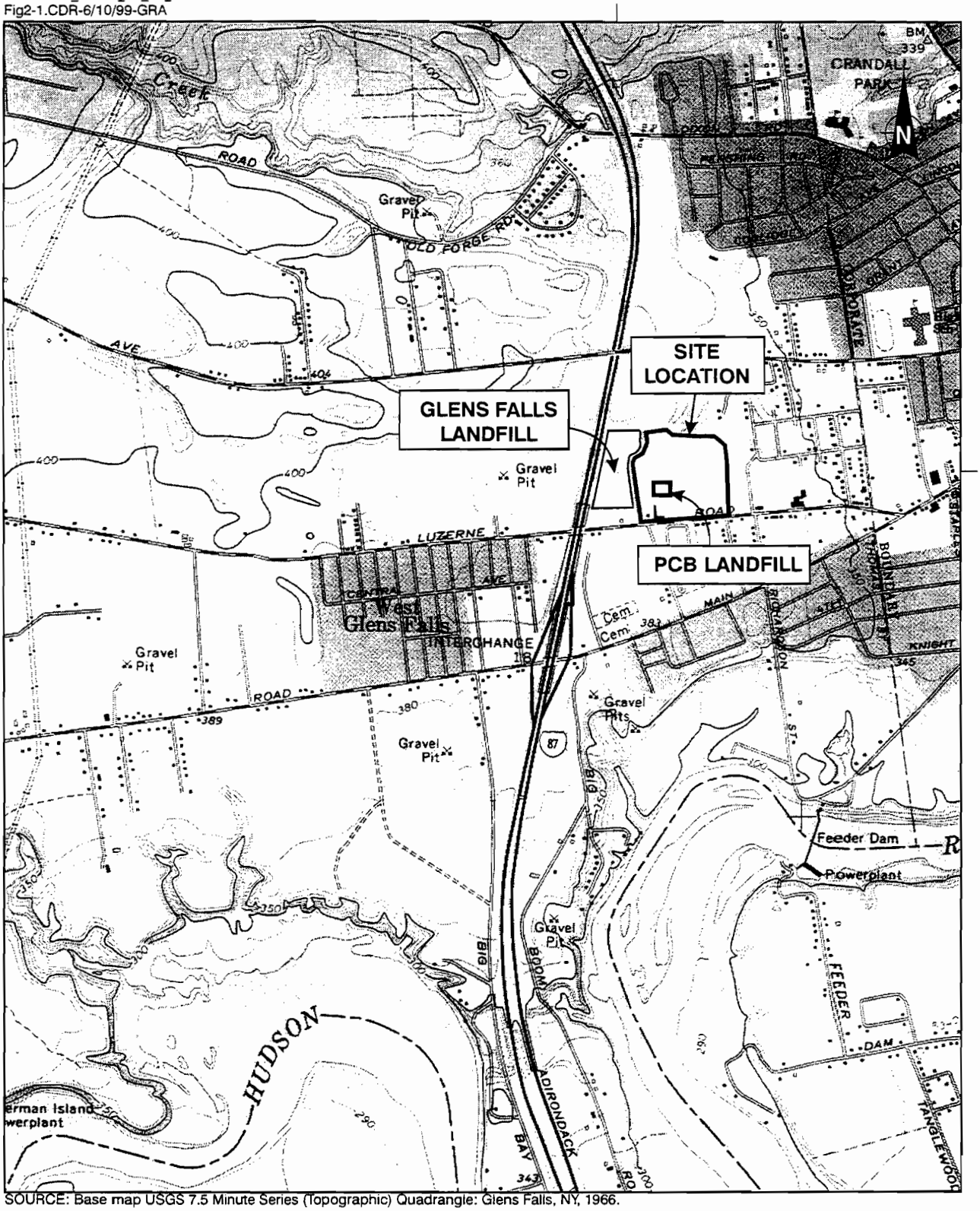
Fig2-1.CDR-6/10/99-GRA



SOURCE: Base map USGS 7.5 Minute Series (Topographic) Quadrangle: Glens Falls, NY, 1966.

SCALE 1:24,000

0 ½ 1 Mile

0 .5 1 Kilometer

Figure 2-1 SITE LOCATION MAP, LUZERNE ROAD SITE, GLENS FALLS, NY

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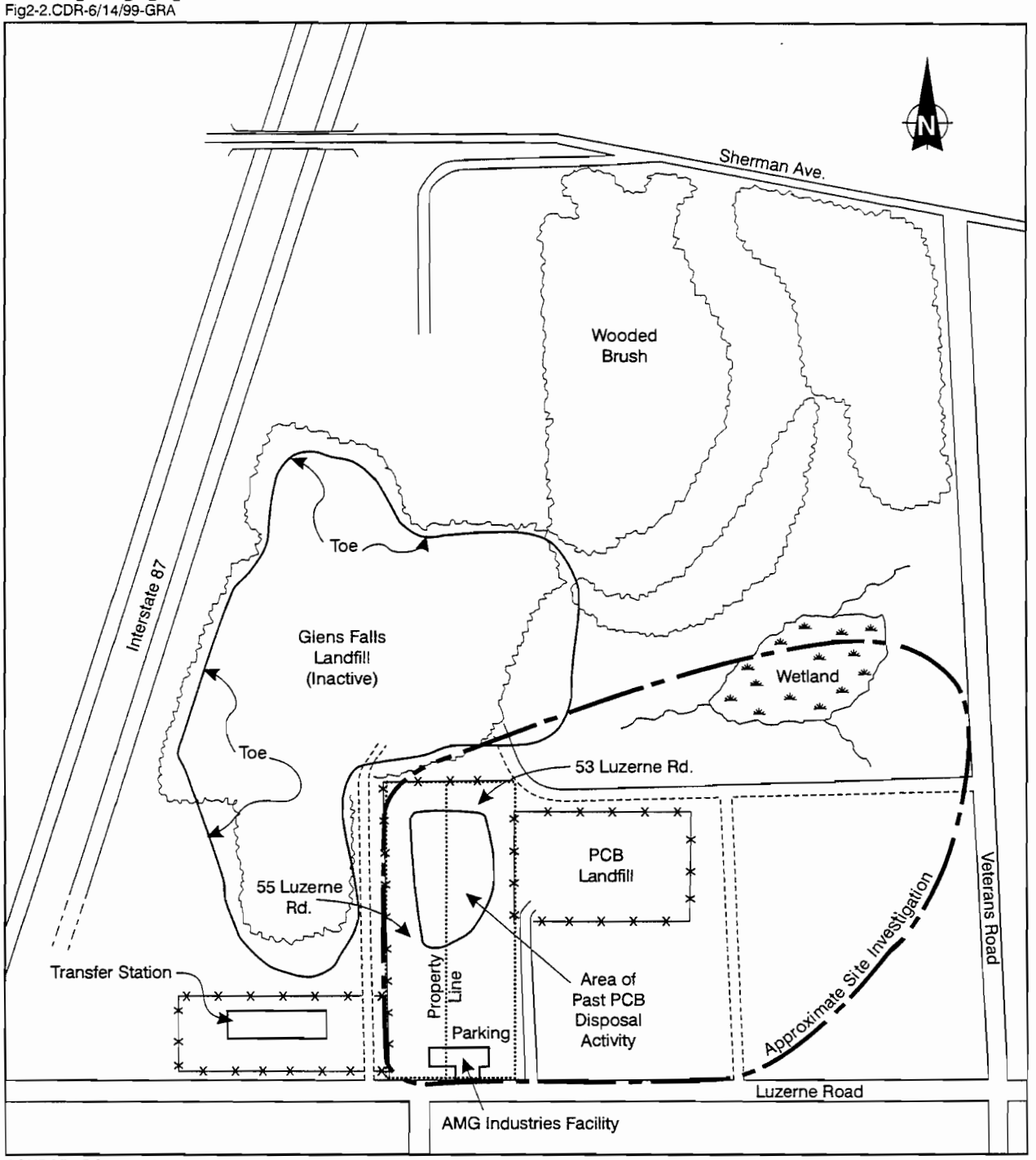
Fig2-2.CDR-6/14/99-GRA



SOURCE: RCRA Environmental 1986

Figure 2-2 SITE MAP, LUZERNE ROAD SITE, GLENS FALLS, NEW YORK

The 55 Luzerne Road property includes approximately 2 acres. The southern portion of the property is occupied by the AMG Industries (the current property owner) facility. The northern portion is a mixture of vacant field and wooded areas. The property is bounded to the west by the former haul road for the Glens Falls Landfill. The property is generally flat. Drainage from the property flows to the west along an excavated swale.

The 53 Luzerne Road property includes approximately 4 acres. The southern half of the property is occupied by a portion of the AMG Industries (the current property owner) facility and a gravel parking area. The northern half is a vacant field. This property is reportedly where the majority of the site's salvaging operation took place and, as a result, is believed to be the most heavily contaminated. The property is generally flat. Drainage from the property flows either to the west to the 55 Luzerne Road property, to the north to a drainage ditch, or to the south to Luzerne Road.

The secure PCB storage cell located on the State-owned land to the east of the site is approximately 2.7 acres in size. The cell is grass-covered and fenced. The area adjacent to the north of the cell is used by the Town of Queensbury for storage of snow. To the north of the snow storage area is a topographic depression, which is assumed to be the former borrow pit for daily cover material when the Glens Falls Landfill was in operation. To the east and south of the cell lies cleared vacant land and wooded land, respectively. To the southeast, private residences are located along the north side of Luzerne Road.

NYSDOH
New York State
Department of Health

Based on New York State Department of Health (NYSDOH) field notes recorded during the 1979 residential soil removal, contaminated soils were removed from seven properties, including the following:

- One residence on Luzerne Road;
- One residence on Indiana Avenue;
- Three residences on Rhode Island Avenue;
- One residence on 4th Street Extension; and
- One residence at an unidentified location.

Additional records indicate two other residences were possibly contaminated with PCBs also, although their locations were not specified.

2.2 Site History

PCB contamination at the site was first discovered in Spring 1979. Sampling completed in April and June 1979 identified three private residences and the 53/55 Luzerne Road property (then known as the Alkes property) as being contaminated. An article in the Saratogan (undated, but assumed to be shortly thereafter) indicated that 15 shallow water supply wells and 45 homes were within a 500-foot radius of the three contaminated residential properties. In August 1979, Dr. Davis Axelrod, Commissioner of NYSDOH, declared a public health emergency regarding the PCB-contaminated properties.

On September 9, 1979, NYSDEC, NYSDOH, the County of Warren, the Town of Queensbury, and the City of Glens Falls entered an agreement to construct the secure PCB cell to dispose of contaminated soils. A letter from EPA dated October 23, 1979, approved the cell construction, outlined waivers for certain construction requirements, and outlined requirements from construction and maintenance of the cell.

Excavation and disposal of soil in the secure cell occurred in late October and early November 1979. While field notes are detailed it appears that the extent of contamination was based on olfactory evidence alone without confirmatory soil testing. On October 31, 1979, three workers were overcome by fumes while excavating on the 53 Luzerne Road property. After that incident, workers were required to wear full-faced respirators with supplied air while excavating at the site.

Following conclusion of the excavation, questions remained as to the adequacy of the removal, specifically whether additional soils should have been removed from three additional residences. When completed, the project had placed approximately 15,000 cubic yards of contaminated soil in the secure cell. However, due to a greater than expected quantity of soil excavated, some contaminated soil was left behind in a 2-acre area on the 53 and 55 Luzerne Road properties. That area was capped with one foot of horse manure and six inches of topsoil.

NYSDEC records indicate that leachate removal was stopped in 1985 and the cap was improved in 1986 to include a geomembrane. Monitoring continued monthly until 1991 and

followed on a quarterly basis thereafter. Monitoring included one upgradient shallow well, one downgradient well, and the secure cell center standpipe. Upgradient groundwater PCB concentrations vary up to 22 µg/l (May 1989), but were typically reported as less than 10 µg/l. The suspected source of these upgradient concentrations is the Glens Falls Landfill. Downgradient groundwater PCB concentrations vary up to 400 µg/l (May 1989), but were typically reported less than 100 µg/l. Leachate concentrations showed a significant increase from typically less than 100 µg/l prior to December 1989 to 98% in June 1991. Leachate levels show a steady decrease from a 10.5 foot depth in April 1989 to a 7.2 foot depth in March 1995. This decrease of leachate levels, without pumping, may indicate a leak in the liner system. In response, approximately 40,000 gallons of leachate were removed from the secure cell during Summer 1995.

In May 1987, a Phase II investigation of the Glens Falls Landfill was completed (RECRA 1987). The scope of the study included air monitoring, a geophysical survey, subsurface investigations (including the installation of five shallow groundwater wells and two hand augers), and the collection of seven soil, seven groundwater, and two sediment samples (see Figure 2-3). The findings included in the report indicated:

- **Environmental Setting:** No wetlands or critical habitats.

- **Groundwater Usage:** The RECRA report indicates that most local residences are serviced by the Town of Queensbury and City of Glens Falls water departments. These departments draw water from the Hudson River, Halfway Creek, and three upland reservoirs. Nearest domestic wells are 1300 feet north of the 55-53 Luzerne Road site along Sherman Avenue in a suspected up- or sidegradient location. No information was included in the RECRA report regarding domestic wells in the downgradient direction. Wells are 20 to 40 feet deep.

- **Geophysical Results**: No indication of plume outside landfill boundary based on terrain conductivity. Seismic refraction indicated approximately 10 feet of loose sand followed by a more consolidated sand.

- **Hydrogeology:** Bedrock varies between shale and limestone and ranges in depth from 110 to 130 feet. Shallow soils (to water table) are lake sands, very fine sands to pebbly sands, well sorted, well drained, and easily excavated. Geotechnical testing indicated 98.8% sand with the remaining 1.2% clay and silt.

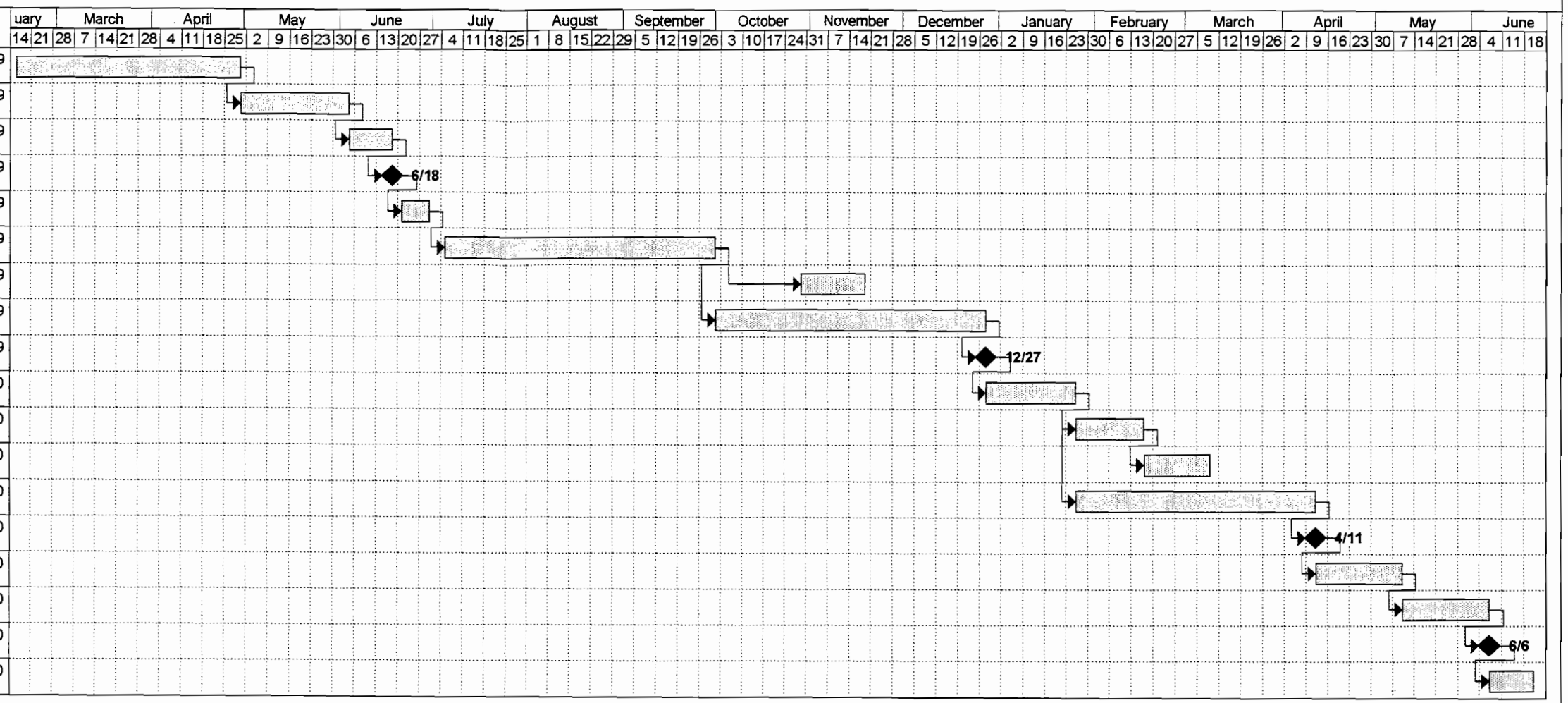
gpm
gallons per minute

msl
mean sea level

Luzerne Road RI/FS

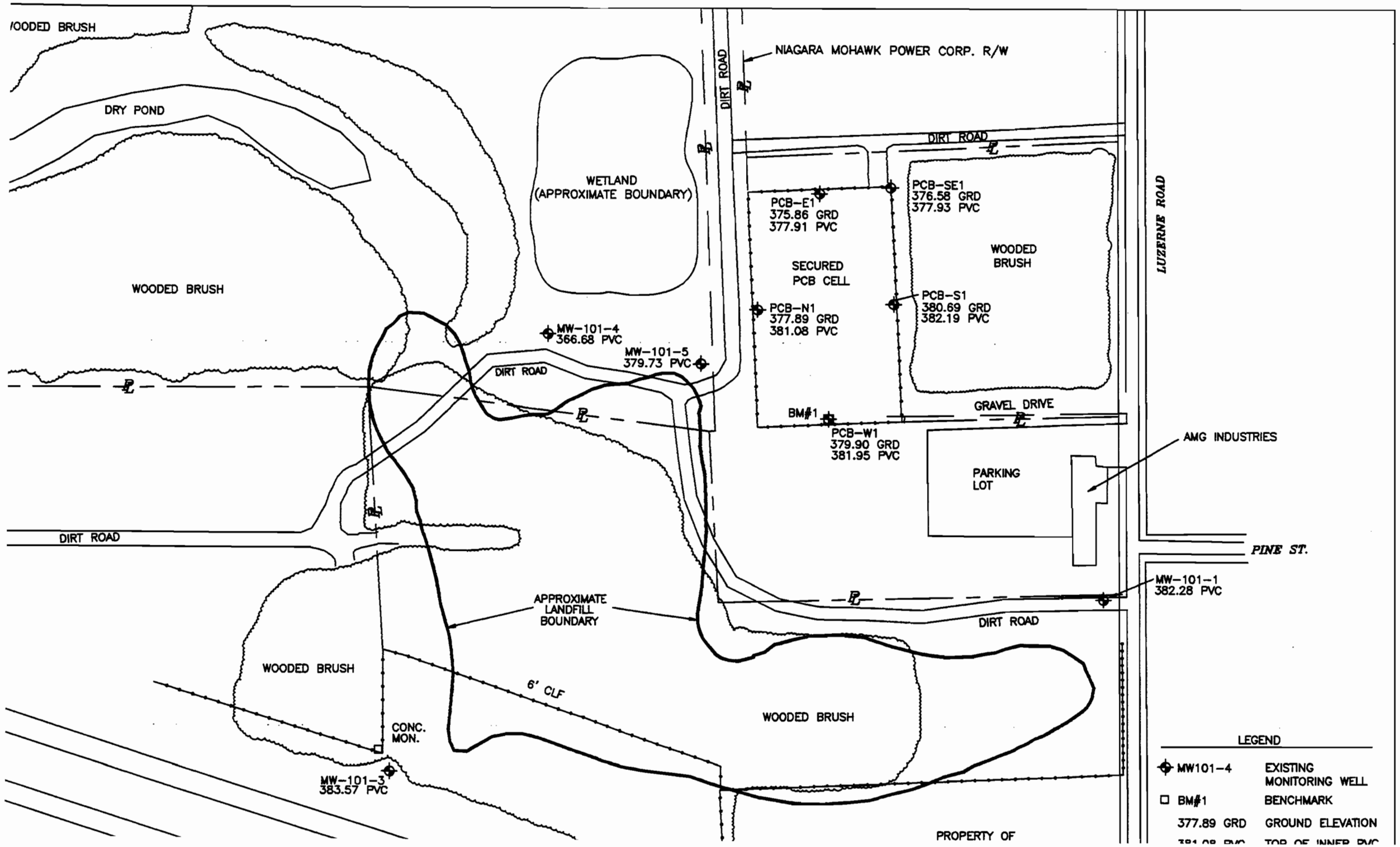
Project Schedule

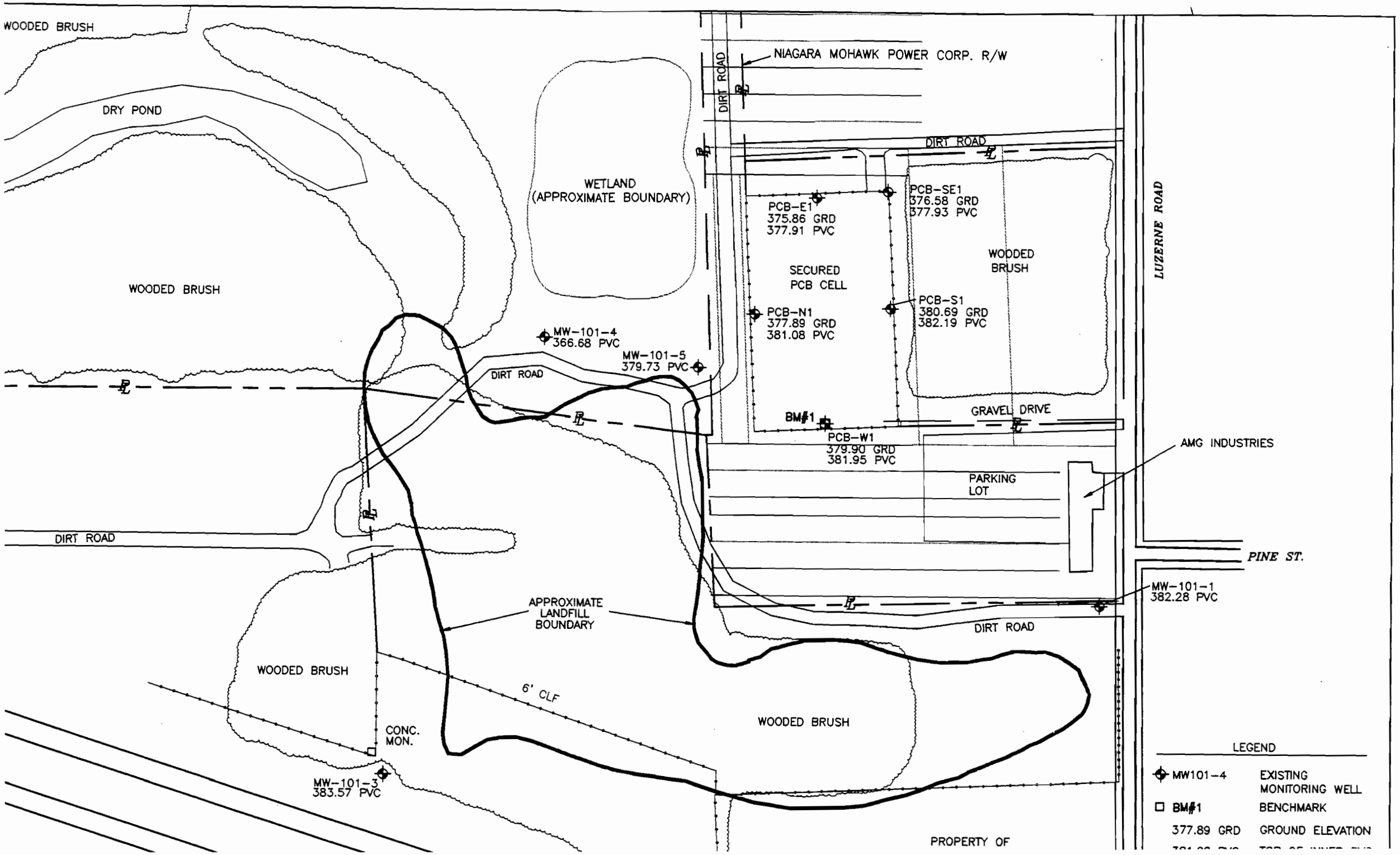
ID	Task Name	Duration	Start	Finish
1	Prepare Draft Work Plan	10.6 wks	Tue 2/16/99	Thu 4/29/99
2	DEC Review	25 days	Fri 4/30/99	Thu 6/3/99
3	Prepare Final Work Plan	10 days	Fri 6/4/99	Thu 6/17/99
4	Submit Final Work Plan	0 wks	Fri 6/18/99	Fri 6/18/99
5	DEC Review	7 days	Mon 6/21/99	Tue 6/29/99
6	Field Investigation	12.8 wks	Mon 7/5/99	Thu 9/30/99
7	Risk Assessments	3 wks	Fri 10/29/99	Thu 11/18/99
8	Prepare RI Report	12.4 wks	Fri 10/1/99	Mon 12/27/99
9	Submit Draft RI Report	0 wks	Mon 12/27/99	Mon 12/27/99
10	DEC Reivew	4.2 wks	Tue 12/28/99	Tue 1/25/00
11	Revise RI Report/Phase II WP	3.2 wks	Wed 1/26/00	Wed 2/16/00
12	Phase II RI	3 wks	Thu 2/17/00	Wed 3/8/00
13	Prepare FS	11 wks	Wed 1/26/00	Tue 4/11/00
	Submit Draft RI/FS Report	0 wks	Tue 4/11/00	Tue 4/11/00
15	DEC Reivew	4 wks	Wed 4/12/00	Tue 5/9/00
16	Prepare Final RI/FS	4 wks	Wed 5/10/00	Tue 6/6/00
17	Sbumit Final RI/FS	0 wks	Tue 6/6/00	Tue 6/6/00
18	Public Review Assistance	2 wks	Wed 6/7/00	Tue 6/20/00



ct: luzerne
Wed 6/9/99

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress


WOODED BRUSH
DRY POND
WETLAND
(APPROXIMATE BOUNDARY)
DIRT ROAD
NIAGARA MOHAWK POWER CORP. R/W
DIRT ROAD
PCB-E1
375.86 GRD
377.91 PVC
PCB-SE1
376.58 GRD
377.93 PVC
WOODED
BRUSH
SECURED
PCB CELL
PCB-N1
377.89 GRD
381.08 PVC
PCB-S1
380.69 GRD
382.19 PVC
LUZERNE ROAD
WOODED BRUSH
MW-101-4
366.68 PVC
MW-101-5
379.73 PVC
DIRT ROAD
BM#1
PCB-W1
379.90 GRD
381.95 PVC
GRAVEL DRIVE
AMG INDUSTRIES
PARKING
LOT
DIRT ROAD
PINE ST.
MW-101-1
382.28 PVC
APPROXIMATE
LANDFILL
BOUNDARY
DIRT ROAD
WOODED BRUSH
6' CLF
WOODED BRUSH
CONC.
MON.
MW-101-3
383.57 PVC
LEGEND
MW101-4 EXISTING MONITORING WELL
BM#1 BENCHMARK
377.89 GRD GROUND ELEVATION
PROPERTY OF


WOODED BRUSH
DRY POND
WOODED BRUSH
WETLAND
(APPROXIMATE BOUNDARY)
NIAGARA MOHAWK POWER CORP. R/W
DIRT ROAD
DIRT ROAD
PCB-E1
375.86 GRD
377.91 PVC
PCB-SE1
376.58 GRD
377.93 PVC
SECURED
PCB CELL
WODDED
BRUSH
PCB-N1
377.89 GRD
381.08 PVC
PCB-S1
380.69 GRD
382.19 PVC
LUZERNE ROAD
MW-101-4
366.68 PVC
MW-101-5
379.73 PVC
DIRT ROAD
BM#1
GRAVEL DRIVE
PCB-W1
379.90 GRD
381.95 PVC
AMG INDUSTRIES
PARKING
LOT
DIRT ROAD
PINE ST.
MW-101-1
382.28 PVC
APPROXIMATE
LANDFILL
BOUNDARY
DIRT ROAD
WOODED BRUSH
6' CLF
WOODED BRUSH
CONC.
MON.
MW-101-3
383.57 PVC
PROPERTY OF
LEGEND
MW101-4
EXISTING
MONITORING WELL
BM#1
BENCHMARK
377.89 GRD
GROUND ELEVATION

QQ8S003B

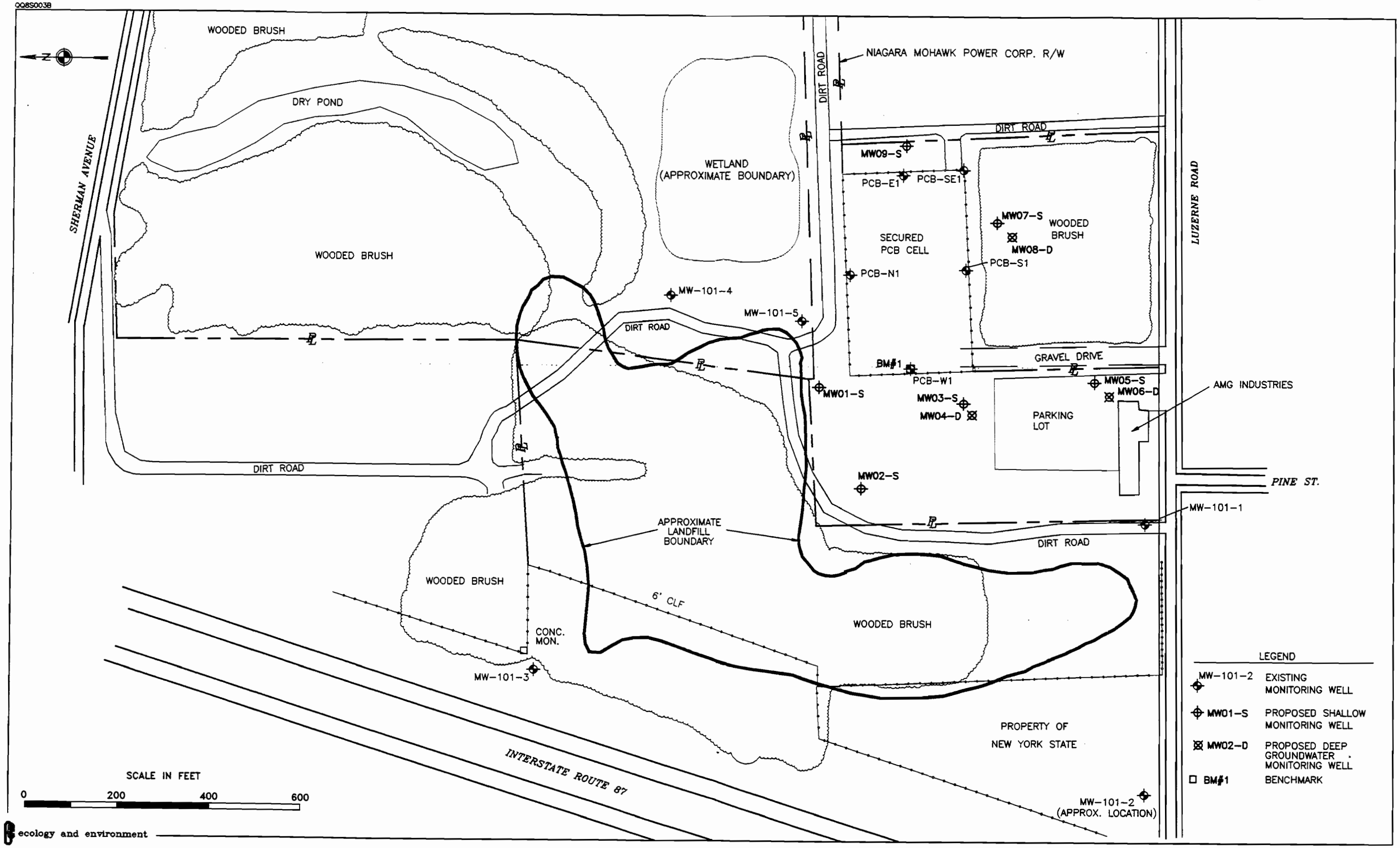


Figure 3-2 PROPOSED GROUNDWATER MONITORING WELL LOCATIONS LUZERNE ROAD SITE QUEENSBURY, NEW YORK

5

Staffing Plan

E & E proposes the following primary staffing plan for completion of this work assignment:

Program Manager: G. Strobel, P.E.
Project Director: M. Wawrowski, P.E.
Project Manager: S. Blair, P.E.

Task 1: Work Plan
J. Nickerson - Prepare Work Plan
S. Blair - Prepare Work Plan
J. Sundquist, Ph.D. - Prepare Work Plan
M. Wawrowski - Prepare Work Plan
T. Lewandowski, P.E. - Review Work Plan

Task 2: Site Characterization
J. Nickerson: Field Team Leader
Two Geologists/Engineers from YEC Engineers: Field Assistants
R. Meyers: Geologist

Task 3: RI Report
J. Nickerson: Author
V. Angelaki: Data Evaluation/Summarization
S. Blair: Review RI

Task 4: Risk Assessment
D. Race: Human Health Risk Assessment
S. Peterson: Ecological Risk Assessment
D. Ross: Field Biologist
C. Comer: Field Biologist

Task 5: FS
M. Morgante: Author
S. Ress: Technology Evaluation/Costing
S. Blair: Review FS

Task 6: Support Activities
J. Nickerson: Presenter
S. Blair: Presenter

6 Subcontracting Requirements

Three subcontractors (including one subconsultant) are required for this project.

An MBE subconsultant (YEC Engineering P.C.) will be used for survey work and assistance in the field. The scope of work for Lu Engineers is included in Appendix A. An estimate for this subconsultant cost is included in the estimated budget and presented in Appendix A.

Drilling services also will be subcontracted. E & E has three drillers retained on a standby basis. A driller has been selected from among these three firms based on low costs for this particular project, according to their standby rates and site-specific mobilization costs. The costs for each of the drillers for this project are summarized in Appendix A. As shown in this summary, Applied Earth Technologies, a WBE, has the lowest cost for this particular project and will be hired for drilling at this site.

A WBE subcontractor (ChemWorld Environmental, Inc.) will be used to perform data reviews and prepare data usability summary reports (DUSRs) for the samples analyzed under this RI. The scope of work to be performed, as well as quotations received to perform this data review work, are presented in Appendix B.

8 MBE/WBE Utilization Plan

8.1 Introduction

E & E fully subscribes to the New York State policy that MBE/WBE firms be afforded the maximum opportunity to participate in contracts offered by New York State agencies. As a prime contractor to NYSDEC, E & E is committed to full compliance with Executive Law Article 15-A and pertinent federal regulations to further MBE/WBE goals and to achieve significant participation by MBE/WBE firms to a level commensurate with their capabilities and responsibilities.

In this section, E & E's general MBE/WBE Utilization Plan is described, including goals for this work assignment and details regarding the services, firms, and portions of work scheduled to be provided by MBE/WBE firms under this work assignment.

8.2 General MBE/WBE Utilization Strategy

E & E maintains an up-to-date affirmative action plan and MBE/WBE hiring plan to ensure equal opportunity for all job applicants, employees, and subcontractors. For the New York State Superfund standby contract, E & E uses the following procedures and resources to meet the established MBE/WBE goals for each work assignment:

- The E & E program and project managers identify and evaluate work that requires or is appropriate for subcontractor services during work plan development These subcontracting opportunities are then divided into discrete tasks that may each be completed by MBE or WBE firms.

- When the discrete tasks are identified, E & E's program or project manager reviews the New York State Directory of Certified Minority and Women-Owned Business Enterprises on the Internet at www.empire.state.ny.us.

- The project manager identifies qualified MBE/WBE contractors and solicits these firms for bids as outlined in Section 8.4 of this plan, Criteria for Selection.

8.3 Typically Subcontracted Services

Typically, E & E has found that opportunities exist for MBE/WBEs in the following work categories:

- Site security fencing;
- Protective services;
- Drilling and monitoring well installation;
- Soil borings;
- Physical soil tests;
- Site and topographical surveys;
- Title searches;
- Engineering services;
- Structural engineering;
- Geophysical engineering;
- Geophysical surveys;
- Photographic services;
- Heavy equipment rental;
- Laboratory data validation;
- Travel services; and
- Photocopying report reproduction services.

8.4 Criteria for Selection

Subcontractors (Nonprofessional Services)

The criteria described below are used to obtain and evaluate bids for nonprofessional subcontracted services. Following the identification of discrete tasks and potential MBE/WBE firms by the

program and project managers, bid solicitations are requested from qualified firms and, to the extent possible, one or more MBE/WBE firms are requested to bid on each task. If the bids exceed $10,000, at least five bids will be obtained. If the bids range between $5,000 and $10,000, three bids will be obtained. In either case, based on the bids submitted, an award will be made to the most responsible MBE/WBE bidder provided that the bid is within 10% of the lowest bid and NYSDEC agrees to accept the MBE/WBE. If the bids are less than $5,000, E & E plans to enlist a sole-source procurement from an MBE/WBE firm.

Subconsultants (Professional Services)

Professional services will be subcontracted to MBE/WBE firms pursuant to applicable New York State regulations.

Small Direct Non-Salary Purchase and Rentals

When appropriate, E & E will purchase miscellaneous supplies and services and rent field equipment with New York State certified MBE/WBE supply vendors and travel agencies. If an item costs less than $1,000, E & E will be satisfied that the price is reasonable. For items costing between $1,000 and $1,500, two bids will be obtained. Three bids will be obtained for items costing between $1,500 and $2,500.

8.5 Work Assignment No. 16 Goals

The established percentage goals for this work are as follows:

		Dollar Amount
Total project amount:		$568,346
Total percent of MBE/WBE work goal:	20%	113,669
- Total percent of MBE work goal:	15%	85,252
- Total percent of WBE work goal:	5%	28,417

8.6 Proposed MBE/WBE Utilization-Work Assignment No. 16

Three tasks, or portions of these tasks, from the Luzerne Road RI/FS have been identified as appropriate for subcontracting. The tasks to be subcontracted, the proposed MBE/WBE subcontractor, and the value of work are identified on Table 8-1. The MBE subconsultants' SOW and price quotes and the WBE subcontractor's SOW and bid are identified in Appendix A.

Table 8-1 MBE/WBE Subcontractor Information

Task	Task Description	Subcontractor Scope of Work	MBE/WBE Subcontractor	Value ($)
1	RI	Airfare - Buffalo, NY/ Albany, NY	Alvarez & Bremer Travel, Inc. (MBE)	$258
2	RI	Field services and surveying	YEC Engineering, PC (MBE)	$67,442
2	RI	Drilling	Applied Earth Technologies (WBE)	$81,599
2	RI	Site Clearing	Applied Earth Technologies (WBE)	$1,000
2	RI	Airfare - Buffalo, NY/ Albany, NY	Alvarez & Bremer Travel, Inc. (MBE)	$4,386
2	RI	Lodging, Glens Falls, NY	Alvarez and Bremer Travel, Inc. (MBE)	$4,440
4	Fish and Wildlife Risk Evaluation	Airfare - Buffalo, NY/ Albany, NY	Alvarez & Bremer Travel, Inc. (MBE)	$516
4	Fish and Wildlife Risk Evaluation	Lodging, Glens Falls, NY	Alvarez and Bremer Travel, Inc. (MBE)	$148
6	Public Participation Support	Airfare - Buffalo, NY/ Albany, NY	Alvarez & Bremer Travel, Inc. (MBE)	$1,032
6	Public Participation Support	Lodging, Glens Falls, NY	Alvarez and Bremer Travel, Inc. (MBE)	$296
3	RI Analytical/Data Validation	Data Review; Data Usability Summary Report (DUSR) Preaparation	ChemWorld Environmental, Inc. (WBE)	$3,535
Total MBE Subcontract Total WBE Subcontract				$78,518 $86,134
Total Contract				$568,346
Percent Total Contract (MBE) Percent Total Contract (WBE)				13.82 % 15.16 %

B

Quality Assurance Project Plan

Introduction

The Quality Assurance Project Plan (QAPP) is an integral part of the work plan for the Luzerne Road RI/FS. The QAPP covers all areas related to the production, review, and reporting of analytical data for the project. Where possible, the QAPP references specific areas of the work plan for information on sampling and analytical requirements. All laboratory QC requirements are provided in NYSDEC ASP, December 1995; the analytical method; or laboratory standard operating procedures (SOPs). The appropriate references and related information are briefly described below.

B.1 Site Information

Site background information is presented in Section 2 of the work plan. Overall, the purpose of the RI is to:

- Characterize the extent of PCB contamination in soil and groundwater at the site;
- Measure the concentration of PCBs in the storage cell, and determine the physical characteristics of the waste material stored in the cell;
- Determine whether contamination is confined to the site, or extends to adjacent properties; and
- Determine whether contamination is migrating off site via transport by surface water.

Sampling and analytical requirements of the work plan are summarized in Table 3-1. The primary contaminants of concern are PCBs, although all types of potential contaminants will be investigated by analysis for TCL and TAL metals. The analytical methods are NYSDEC ASP Contract Laboratory Program (CLP) methods.

All analytical methods will be standard EPA methods following NYSDEC ASP requirements.

Sample container and holding time requirements are specified in Tables 3-2 and 3-3 of the work plan. The holding times are based on verified time of sample receipt and are consistent with NYSDEC ASP requirements.

In addition to laboratory QA samples, field QC samples will be collected as specified in Table 3-1. The types of field QC samples are as follows:

- Field duplicates will be collected for each matrix from each area. The collection frequency will be at least one duplicate per 10 field samples. Field duplicates will be used to evaluate the precision of the sampling and analytical program.

- Rinsate blanks will be collected for areas in which non-dedicated sampling equipment is used, primarily in soil sampling. The collection frequency will be at least one rinsate per 10 field samples using deionized (DI) water obtained from the laboratory. The rinsates will be used to monitor the effectiveness of decontamination procedures between samples.

- Trip blanks will be collected from each area in which samples are analyzed for TCL VOCs. The trip blanks will be prepared in the laboratory or in the field using organic-free DI water obtained from the laboratory. A trip blank will be kept with the field samples each day VOCs are collected and shipped to the laboratory in a cooler containing all the VOC samples.

- Additional sample volume will be provided for MS/MSD analysis for both soil and water samples. The overall collection frequency will be at least one per 20 field samples. The MS/MSD will be used to evaluate potential matrix effects on the quality of the analytical data. The laboratory will analyze matrix spike blanks for each MS/MSD to verify that the method was performed within specification.

B.2 Data Quality Objectives

The analytical data are being generated as part of an RI and will be used in an FS and, potentially, in remedial design. The purpose of an RI/FS is to identify the presence and extent of contamination in environmental media, to judge their potential impact on human and environmental receptors, and to recommend remedies for these impacts.

Quantitative human health risk and environmental risk assessments are being performed as part of this project. In addition, site contamination will be evaluated through comparison to guidance values (for soils and sediments) and standards (for groundwater and surface water) that may be applicable to the media at the Luzerne Road Site.

The methods selected for analysis are adequate for generating data required for calculating site-specific risks to human and environmental receptors, and for comparison to standards and guidance values. For soils, concentrations that would pose significant

threats to human or environmental health are generally well above the detection limit for the contaminants. Some guidance values are back-calculated from models that attempt to estimate soil concentrations acceptable for the prevention of contamination of groundwater through leaching into the aquifer. For some carcinogenic organics, this approach provides guidance values below typical detection limits. However, because of the non-site-specific assumptions in these guidance values, soil rarely must be of such low concentrations to be protective of groundwater. Thus, evaluation of soil concentrations is not limited by the detection limits typically obtained by the analytical methods planned for these investigations.

Groundwater concentration standards are generally lower than soil guidance criteria due to an exposure basis of direct ingestion. All groundwater in New York State is considered a drinking water resource. For metals, the analytical methods selected provide detection limits above class GA groundwater standards. The exceptions are beryllium, with a standard of 3 µg/L compared to a detection limit of 5 µg/L, and aluminum, with a groundwater standard of 100 µg/L compared to a detection limit of 200 µg/L. These are insignificant limitations, however, as natural background concentrations of each of these metals are often found above the detection limit. Thus, concentrations elevated from anthropogenic sources should be readily observable as levels above background.

The NYSDEC ASP CLP methods selected for groundwater samples do not provide detection limits below class GA standards for all compounds detected. However, detection limits are sufficiently low (generally down to 10 µg/L for volatiles, and much lower for semivolatiles) to detect a plume (should one be present). In addition, ASP CLP methods are commonly used for groundwater investigations at hazardous waste sites and have been found to reliably demonstrate the presence of plumes, where present.

B.3 Screening Analyses

The screening method will be a modified Method 8082 analysis with a screening extraction equivalent to EPA Field Screening methods. The method will follow the laboratory standard operating procedure (SOP). The extraction procedure includes weighing one gram of sample into a test tube, drying with sodium sulfate or absorbing the water with methanol, if necessary, and extracting with hexane by vortexing for one minute. Surrogate will be added prior to extraction. If the potential for sulfur interference is indicated, the extract will be subject to clean-up with elemental copper.

The sample will be diluted and analyzed by a capillary column, gas chromatograph (GC) equipped with an electron capture detector.

The GC will be calibrated initially with PCB Aroclor 1254 and 1660 in a linear range of at least 0.5 to 10 ppm. The calibration will be verified daily with acceptance criteria of 60% to 140%. If other PCBs are present or the samples exhibit a weathered pattern, the results will be reported as quantified by the nearest Aroclor. The detection limits will be 0.5 ppm for low level samples. Higher concentration samples will be analyzed at dilution with a high value of up to 2000 ppm. Samples requiring more than one dilution will be reported as extended or greater-than values.

Quality control samples include a blank and matrix spike every 20 samples. Surrogate recoveries will be monitored on samples with concentrations up to 20 ppm. Surrogates in samples with higher concentrations will be diluted out of range. All matrix spike and surrogate recoveries must be within 60% to 140% or the sample will be re-extracted and re-analyzed to determine if the cause is matrix effects or analytical problems. If analytical problems are verified, the laboratory will contact the QA Officer to determine whether the entire batch requires re-extraction and re-analysis. A laboratory control sample may be used if persistent matrix problems are identified.

The laboratory will maintain a sample receipt logbook indicating the sample identification, sample date, sample analysis date, and date sample was returned for destruction. The laboratory also maintains a general logbook documenting all instrument maintenance, communications, method deviations, and other general items. The logbooks will be maintained as part of the project files at the end of the laboratory effort. All PCB samples will be collected in standard glass jars and stored at room temperature. Samples for PCB confirmation will be preselected by the field crew and collected in laboratory-provided containers. The confirmation samples will be stored onsite in a cooler prior to shipment to the laboratory.

B.4 Laboratory Analysis

All analytical work will be performed by E & E's ASC. The ASC is certified by NYSDOH for all methods, including ASP CLP methods. The laboratory QA program is specified in the laboratory's QA Manual (Revision 1, October 1998). The QA Manual is a policy document with specific procedures outlined in laboratory SOPs. The laboratory will follow its current SOPs for CLP, general chemistry, and RCRA methods. The laboratory will

follow NYSDEC ASP holding time and reporting requirements. For CLP methods, the laboratory will use NYSDEC ASP QC criteria. For other methods specified in the work plan, the laboratory will use laboratory reporting limits and internal QC criteria based on statistically generated control limits. Copies of the most current QA Manual, SOPs, and internal control limits are available upon request.

B.5 Data Reporting and Validation

All laboratory reports will be consistent with NYSDEC ASP requirements for Superfund deliverables for the CLP methods and Format B deliverables for general chemistry methods. Samples for RCRA characteristics will be reported with Format A deliverables. All data packages will include NYSDEC ASP Summary Forms. The data package will be sent to the independent validator for the project. The laboratory must also provide a summary package of case narrative and summary forms for results for the project team. No electronic data deliverable is required for this site. Laboratory reports are due 30 days from sample collection.

All data will be subject to independent data usability review by ChemWorld Environmental, Inc. The data usability review will follow NYSDEC requirements for completeness and compliance. The data validator will produce a data validation report (due 60 days from sample collection) as specified in NYSDEC requirements for the contract.

E & E will review the data usability review report (DUSR) to evaluate the impact of any data concerns on the overall usability of results. The findings will be summarized in the QA/QC section of the RI report and reflected in any data qualifiers added to the data in the RI report tables. The DUSR report will be included in the RI report as an appendix.

For the PCB screening samples, all results will be reported in wet weight. The report will include a summary of sample results, surrogate recoveries, and QC sample results. The laboratory will provide copies or originals of all chromatograms to the QA Officer on a weekly basis. All QC problems and corrective actions will be summarized. Any QC failures will be reported to the QA Officer immediately if corrective actions are not effective.

At least 10% of the samples will be confirmed by Method 8082 with a Method 3550B extraction. The confirmation results will require a one week turnaround. The screening results and

confirmation results will be reviewed weekly by the QA Officer to verify the screening methods are meeting data quality objectives.

The QA Officer will perform at least one on-site audit to monitor the field activities and laboratory screening analysis. An audit report will be prepared and submitted with the final report. Any potential problems will be reported to NYSDEC immediately.

Each sample will be tested as is; samples will not be dehydrated, and results will be presented as wet-weight data. For each sample, 1-gram sodium sulfate extraction will be performed. The sample solution will then be diluted 20-fold, and a direct injection of this solution into the GC will occur. If the resulting data indicate a second dilution of either 2- or 200- fold is necessary to more accurately define the PCB concentration, one additional dilute-and-shoot analysis will be performed. This approach is capable of accurately quantifying PCB concentrations in the 50 to 2000 ppm range.

Note that this analysis is targeting only PCB Aroclor 1254 and 1016; it is not a complete scan of all PCBs. Due to the nature by which the PCBs were released to site soils, trichlorobenzene is likely to be present at this site. However, trichlorobenzene will not interfere with this analytical approach.

TITLE: PCB Soil Screening Analysis for PCB 1254 and/or 1260 by Method 8082			
Original Author: G. Rudz		Revision Author: G. Rudz	
Implementation Date: 6/11/99		Last Annual Review Date: 6/11/99	
File Information: L:\SOPs\Final\GC\GC79.ene-06/11/99 4:34 PM			
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

1.0 SCOPE AND APPLICATION

1.1 This Standard Operating Procedure (SOP) describes the procedure for identifying and quantifying polychlorinated biphenyl compounds in soils and sediments by a gas chromatographic procedure.

2.0 METHOD SUMMARY

2.1 Each sample is tested as is; samples are not dehydrated, and results are presented as wet-weight data. For each sample, a 1-gram extraction into 10 mL hexane is performed. The sample extract is diluted 20-fold, and directly injected into a gas chromatograph equipped with an electron capture detector. If the resulting data indicate a dilution is necessary to more accurately define the PCB concentration, a second dilution of either 2- or 200-fold is performed. This approach is capable of accurately quantifying PCB concentrations in the 10 to 35,000 ppm range.

2.2 Note that this SOP is targeting only Aroclor 1254 and 1260.

2.3 Extracts of soil samples for PCB are analyzed on a gas chromatograph equipped with capillary columns and electron capture detectors. The GC is calibrated by injecting three levels of the analytes of interest and measuring response. An aliquot of a sample is injected into the GC and quantitative analysis is performed on the resulting chromatogram by comparing sample response to standard response.

2.4 The following deviations from the method are taken.

2.4.1 The target list of compounds usually reported by this method are listed in Table 11-1.

2.4.2 Minor changes in chromatographic conditions may be used to optimize separation and sensitivity.

2.4.3 DCB is the primary surrogate, TCMX is a secondary surrogate.

2.4.4 Due to the likelihood that one or more surrogates may be interfered with, the following criteria are applied.

2.4.4.1 DCB in Laboratory Control Samples and method blanks must be recovered within in-house limits.

2.4.4.2 DCB recovery will be determined for all samples; if recovery is outside in-house limits, TCMX recoveries will be evaluated and reported.

2.4.4.3 Cases where both DCB and TCMX recoveries fail to meet criteria, and matrix effects are not evident, samples will require rerunning; if still out, reextraction and reanalysis.

3.0 HEALTH AND SAFETY

3.1 All employees should protect themselves at a minimum with safety glasses, protective gloves and a lab coat. For more information see the E & E, Inc., Analytical Services Center Chemical Hygiene Plan located in the QA Library Island shelf 2.

4.0 REFERENCES

4.1 SW-846 3rd Edition, Update III, June 1997, Methods 8000B, 8082, 3660B, 3665A.

4.2 Use checklist C-055 for analyst and peer review.

5.0 DEFINITIONS/ACRONYMS

5.1 **MDL** - Method Detection Limit as determined by 40 CFR Part 136, Appendix B. Method detection limits must be determined yearly for both water and soil matrixes. See SOP A.18 for procedure.

5.2 **PQL** - Practical Quantitation Limit is the concentration above the MDL that can be reasonably obtained and is used as the limit of reporting (Table 1).

5.3 **TCMX** - Tetrachlorometaxylene.

5.4 **DCB** – Decachlorobiphenyl.

6.0 INTERFERENCES/POTENTIAL PROBLEMS

6.1.1 Phthalates may cause false positives. Care should be exercised to reduce exposure of samples to plastics.

6.1.2 Elemental Sulfur – if present in the samples, may cause interferences. Sulfur clean-up using copper may be required. Refer to Section 10.5.4.

6.1.3 Heavy baseline and organics in samples may be cleaned up using acid-partitioning. Refer to Section 10.5.5.

7.0 INSTRUMENTATION AND EQUIPMENT

- Varian 3400 or Hewlett Packard 5890 equipped with electron capture detector and autosampler
- PE Nelson data system with TURBO*CHROM Software
- Restek RTX-5, 30 m column x 0.53mm 1.0 µm film (or equivalent)
- Restek RTX-35, 30 m column x 0.53mm 0.5 µm film (or equivalent)
- Volumetric flasks, Fisher or equivalent
- Gastight syringes, Krackler, or equivalent
- Screwcap vials with Teflon-lined septa, Krackler, or equivalent
- Disposable wiretrol pipettes, Krackler, Restek, or equivalent

8.0 REAGENTS AND MATERIALS

Table 8-1

SUMMARY OF STANDARD AND REAGENTS

Description	Source	Concentration
AR1016/1260 MIX	Restek or equivalent	1000 µg/mL each
AR 1254 MIX	Restek or equivalent	1000 µg/mL
Pesticide Surrogate Mix	Restek or equivalent	2000 µg/mL TCMX and 2000 µg/mL DCB

Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

8.2 Standard Solution Preparation

8.2.1 All stock solutions commercially obtained shall be certified. Certificates are to be kept on file for all stocks received. All stocks and standards are to be stored at 2 - 6 C or lower.

8.2.2 Stock standards expire one year from the date opened, unless an earlier vendor supplied expiration date supercedes.

8.2.3 Working standards expire six months from date prepared unless expiration is superceded by stock expiration.

8.2.4 Unopened stock standards expire or per vendor-specified date if not provided (2) years from Date of Receipt.

Table 8-2

STANDARD AND REAGENT PREPARATION

Stock	Standard Name	Amount of Stock Diluted To	Final Concentration
Pesticide Surrogate Mix	Pest. Surr. Int.	250 µL to 50 mL Hexane	10 µg/mL
AR1016/1260 Mix Pest Surr. Int	AR1660L	2.5 µL plus 25 µL to 50 mL Hexane	See Table 8-3
AR1016/1260 Mix Pest Surr. Int	AR1660M	10 µL plus 100 µL to 50 mL Hexane	See Table 8-3
AR1016/1260 Mix Pest Surr. Int	AR1660H	50 µL plus 500 µL to 50 mL Hexane	See Table 8-3
AR1254 Mix Pest Surr Int	AR1254L	2.5 µL plus 25 µL to 50 mL Hexane	See Table 8-4
AR1254 Mix Pest Surr Int	AR1254M	10 µL plus 100 µL to 50 mL Hexane	See Table 8-4
AR1254 Mix Pest Surr Int	AR1254H	50 µL plus 500 µL to 50 mL Hexane	See Table 8-4
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

Table 8-3

COMPONENTS AND CALIBRATION CONCENTRATIONS OF AR 1660

Compound	µg/mL		
	AR1660L	AR1660M	AR1660H
TCMX	0.005	0.020	0.100
AR1016	0.050	0.200	1.000
AR1260	0.050	0.200	1.000
DCB	0.005	0.020	0.100
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

Table 8-4

AR1254 CALIBRATION LEVELS

Compound	µg/mL		
	AR1254L	AR1254M	AR1254H
TCMX	0.005	0.020	0.100
AR1254	0.050	0.200	1.000
DCB	0.005	0.020	0.100
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

9.0 PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Holding Time

Table 9-1

HOLDING TIMES

Matrix	Client/Project	Preparation (Days)	Analysis (Days)	Container Type and Preservative
Solid	Standard	14 for soil	The PCB extracts from sample preparation are to be analyzed within 40 days from extraction date.	Extracts are stored in a secure area (Sample Custody) in a separate refrigerator from original samples at 2-6 C.
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None	

10.0 PROCEDURE

10.1 Apparatus Setup

10.1.1 The GC is equipped with two columns connected by a "Y" connector to one injection point and 2 electron capture detectors.

10.1.2 The carrier gas flow and temperature profile may vary somewhat to optimize analytical separation.

10.1.3 Recommended temperatures are set as follows: Injector = 200°C; Detector = 300°C Temperature program: Column Initial = 150°C. Initial Hold = 1.0 min. Column Rate = 5°C/min. Column Final = 280°C. Final Hold = minimum of 10 minutes and may be extended due to presence of late-eluting compounds in extracted samples.

10.1.4 The autosampler injects 2.0 µL of sample extract into each GC column. (i.e., 4 µL total injection).

10.1.5 Transfer of extracts to instrument autosampler vials shall be accomplished with disposable pipettes or graduated Wiretrol micro pipettes.

10.2 Establishing Retention Time Windows

10.2.1 Make three injections of mid level Aroclor 1016/1260 standard over 72-hour period.

10.2.2 Calculate the multicomponent retention time windows based on five peaks of the Aroclor 1016/1260 mixture. The windows will apply to all multicomponents. Pattern recognition is still the primary means of identification.

10.2.3 The retention time window is defined as plus or minus 3 times the standard deviation from the retention time of the initial mid-level standards in the continuing calibration sequence. However, analyst experience should weigh heavily. Pattern recognition should primarily be used for multi-response products.
10.2.4 Retain this data so that it can be easily retrieved.
10.2.5 To facilitate analyte identification, the retention time windows are set as percentages (±% realtime of daily calibration) into the data system. These values are slightly wider than calculated windows.
10.3 Initial Calibration
10.3.1 Compound list and Quantitation Limits (Table 11-1).
10.3.2 Analyze an instrument blank (hexane) to verify the analytical system is clean (no target compounds are present greater than the quantitation limit) before Standards.
10.3.3 The initial calibration of PCBs are performed at the three levels identified with suffix L, M, and H (see Tables 8-3 and 8-4) See Table 10-1 for specific calibrations. Calibration standards are identified with a suffix L, M, and H.
10.3.4 Initial calibrations for PCBs only require three-point calibration for AR1660 and 1254.
10.3.5 Note: Hexane = Instrument blank

Table 10-1

INITIAL CALIBRATION SEQUENCE

Hexane
AR1660L
AR1660M
AR1660H
AR1254L
AR1254M
AR1254H

Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

10.3.6 Inject 2.0 µL per column (i.e., 4 µL total injection) of each calibration standard. Tabulate area responses against the mass injected. The results are used to prepare a calibration curve for each analyte.
10.3.7 If the linear correlation coefficient is ≥0.995, linear curve may be used for quantification.
10.3.8 If < 0.995, calculate the correlation coefficient of a second order curve. If the correlation coefficient is >0.995, use this second order curve for quantitation of the compound of interest. Additional concentration levels of standards are required for higher order curves. Refer to Method 8000 for guidance.
10.3.9 Alternatively, if the percent relative standard deviation is less than 20%, linearity through the origin is assumed and the mean calibration factor of the 5 point calibration curve can be used for quantitation of samples. The initial calibration may be acceptable if some analytes have an RSD greater than 20 percent so long as the mean of all the RSD values is less than 20 percent. If these conditions are met, then the compounds individual mean response factor may be used. Average response factor is the preferred method of quantitation.
10.3.10 Calculate the ratio of the response to the amount injected, defined as the calibration factor (CF), for each analyte at each standard concentration.

$$Calibration\ Factor\ (CF) = \frac{Total\ Area\ of\ Peaks*}{Mass\ Injected\ (in\ nanograms)}$$

**Use the total area of the 5 largest peaks for quantitation. The number and specific peaks may need to be adjusted, depending if sample matrix interferences or pattern weathering exists (see Section 11.2).*

10.3.11 Calculate the % Relative Standard Deviation (%RSD) of the calibration factors for the 5-point initial calibration using the following equation:

$$\%RSD = \frac{StandardDeviation}{MeanCalibrationFactor} \bullet 100$$

10.3.12 Quantitation of samples must continue to be done using the procedure initially used.
10.3.13 Following each initial calibration, analyze a reference standard from a second source to verify the curve. The curve is deemed acceptable provided the reference standard calibration is within 15% difference of the mean calibration factor or 15% of the theoretical concentration, dependent on which means of quantitation will be used for analysis.

10.4 Calibration Verification
10.4.1 The working calibration curve or calibration factor must be verified at the beginning of the analytical sequence, and if a lapse in time >12 hours, has occurred from last continuing standard.
10.4.2 An instrument blank (hexane) is run to verify that the analytical system is clean (no target compounds are present > PQL).
10.4.3 A calibration check standard equivalent to the mid-level calibration standard must be analyzed at the beginning of the analytical sequence and after no more than every 20 samples. Use AR1016/1260 mid-level (AR1660M).
10.4.4 The quantitation method used must be the same throughout the analytical run.
10.4.4.1 If the mean calibration factor is used for quantitation, then the calibration factor must be ≤ 40% difference (see Section 10.4.6) from the mean calibration factor.
10.4.4.2 If the regression curve is used for quantitating, then the concentration of the calibration check standard must be ≤ 40% drift (see Section 10.4.6) from the theoretical concentration (i.e., 60 – 140% recovery).
10.4.5 Calculate % Drift and % Difference using the equations below.
When using a curve:

$$\%\ Drift = \frac{CalculatedConcentration - Theoretical\ Concentration}{TheoreticalConcentration} \bullet 100$$

When using mean calibration factor:

$$\%\ Difference = \frac{CF\ Verification\ \ Standard - \overline{CF}}{\overline{CF}} \bullet 100$$

10.5 Sample Analysis

10.5.1 Once a successful initial calibration is complete, the primary analytical daily or batch sequence may begin (see Table 10-2).

Table 10-2 Daily Calibration Sequence			
Aroclor 1660 M or Aroclor 1254			
Samples not to exceed 20. Recommended – 10.			
Aroclor 1660 M or Aroclor 1254 (alternate)			
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

10.5.2 After every 20 samples or less, a 1660 mid level standard is analyzed.
If any PCB is detected in a sample at a level which exceeds the linear range of the calibration curve, the sample is diluted by a maximum of 200 times to extend the calibration range.
10.5.2.1 Instrument blanks (hexane) may be interspersed throughout the analytical run to check for carryover or when the system is run unattended (autosampler).
10.5.2 Additional instrument blanks may be run after suspect samples or before standards to help eliminate matrix carry over.
10.5.3 When peak detection is prevented by the presence of sulfur, the sample is treated and reanalyzed.
10.5.4 The copper cleanup of sample extracts is as follows:
Transfer an aliquot (1.0ml) of sample extract to a clean autosampler vial. Add ~ 0.5 to 1.5 grams of copper. Tighten the top on the vial and agitate the sample for 15 minutes, if a reaction occurs, re-agitate the sample for another 10-15 minutes. Centrifuge the extract if needed. Transfer the extract to another vial, leaving behind all solid precipitate and copper. All cleanup must be done in a fume hood.
10.5.5 Samples exhibiting matrix interferences can be further cleaned up using sulfuric acid.
10.5.5.1 Transfer 0.5-1 mL of extract into a clean vial. Add approximately 0.5 mL of concentrated sulfuric acid.
10.5.5.2 Vortex 10 seconds. Let settle, transfer portion of hexane extract to either autosampler vial for analysis or additional treatment with sulfuric acid if still highly colored.

10.6 Confirmation Analysis

NA

Instrument Maintenance

Table 10-3 ROUTINE MAINTENANCE PROCEDURES			
Equipment/ Instrument	**Symptom**	**Operation**	**Frequency**
V3400/HP5890	Retention time shift	Change septum	Daily (or as needed)
V3400/HP5890	High baseline	Bake out column, detector	As needed
V3400/HP5890	Non-linear calibration	Replace detector; replace column	As needed
Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

11.0 DATA REDUCTION/EVALUATION/REPORTING

11.1 If quantitating from a linear curve, the equation below is provided as a manual check.

$$\text{Concentration} = \text{mg/kg}, \mu\text{g/L} = \left[\frac{y-b}{m}\right]\frac{Vt}{S} \bullet Df$$

where:

y = Area of target analyte from initial curve.
b = Intercept (area).
m = Slope (area /[µg/mL]).
S = Mass of soil sample extracted in grams (g) or (volume of water sample extracted in liters [L]).
Vt = Final volume of the extract in milliliters (mL).
Df = Dilution factor. The dilution factor equals µL of extract used to make dilution + µL clean solvent used to make dilution divided by µL of extract used to make dilution.

11.2 Due to weathering effects or matrix interference, it is not always possible to quantitate samples using the same five peaks used in calibrating. All samples must be quantitated using a minimum of three peaks for each PCB and these same peaks from the calibration must be used to calculate concentrations. Peaks used for quantitation must be clearly identified on chromatograms of standards and samples.

Target Compounds and Reporting Limits

Table 11-1

TARGET COMPOUNDS/ANALYTES AND QUANTITATION LIMITS

Compound/Analyte	Type	PQL Soil (mg/kg)
Aroclor-1016	T	10
Aroclor-1254	T	10
Aroclor-1260	T	10
TCMX	Q	NA
DCB	Q	NA
Revision: 0 / Status: Final / Method: 8082		Minor Revision Date: None

Key Type:

NA = Not applicable.
T = Compound/analyte is target compound routinely reported.
M = Compound/analyte is listed in the method but is not routinely reported by E & E.
C = Compound/analyte is specified by the client and can be analyzed under this method.
S = Compound/analyte is routinely used as a matrix spike (MS).
L = Compound/analyte is routinely used as a LCS spike (LCS).
Q = Compound/analyte is used as a surrogate spike (SUR).

12.0 QUALITY CONTROL/QUALITY ASSURANCE/CORRECTIVE ACTION

12.1 Refer to the Quality Control Table below and the following sections for corrective actions.

12.2 Each sample is spiked with the surrogates DCB and TCMX. The DCB is the primary surrogate. Calculate its recovery. If peaks interfere with DCB, TCMX should be evaluated for acceptance. Proceed with corrective action when two surrogates are out of limits for a sample.

12.3 The sample is to be reextracted and reanalyzed unless it can be documented (chromatogram) that factors such as matrix effects are responsible. A corrective action report must be filed.

12.4 If any quality control criteria cannot be met, but the problem is correctable, the sample(s) affected must be reanalyzed.

12.5 Data that must be submitted with out of control events must be accompanied by a corrective action report.

12.6 If any criteria cannot be met, but the problem is correctable, the sample(s) affected must be reanalyzed.

Table 12-1

ROUTINE QUALITY CONTROL SAMPLES

QC Type	Frequency	Acceptance Criteria	Corrective Action
Method Blank	1 per preparation batch of 20 or fewer samples.	> PQL	Reanalyze samples having concentrations > Quantitation limits.
Matrix Spike (MS)	1 per preparation batch of 20 or fewer samples.	60 – 140%	Reanalyze QC sample if within hold times. Notify Project Manager immediately.
Laboratory Control Sample (LCS)	1 per extraction batch of 20 or fewer samples.	60 – 140%	Notify Project Manager immediately. If MS good, note in narrative. Reassess entire batch.
Surrogate (SUR)	Every sample, blanks and QC.	60 – 140%	Re-extract batch for blank or LCS failure. Re-extract affected sample(s) unless matrix effect is evident from chromatogram.

Revision: 0	Status: Final	Method: 8082	Minor Revision Date: None

13.0 SPECIAL PROJECT REQUIREMENTS

NA

14.0 SAMPLE DISPOSAL

14.1 See waste disposal SOP A.10.

15.0 EXAMPLE FORMS

NA

END OF SOP

C

Health and Safety Plan

- **Groundwater:** Groundwater flow is to the southeast with a hydraulic gradient of 0.005 ft/ft. Water table depths range between 375.82 to 363.24 mean sea level (msl).

- **Analytical Results**:
  - **Air:** No detects above background concentrations.

  - **Subsurface Soil:** 1,1-dichloroethene and 1,1,2,2-tetrachloroethane were detected in soil samples collected during installation of two wells boreholes, MW101-4 and MW101-5, located north of the secure cell.

  - **Surface Soil and Sediment**: PCBs were reported in all samples but one (HA101-1) located northeast of the secure cell. The maximum PCB concentration was reported at HA101-2 (160 parts per million [ppm]) located on the 53 Luzerne Road property. A halogenated organic compound scan (HOS) indicated these compounds in all samples, with a maximum at HA101-2.

ppm
parts per million

HOS
halogenated organic compound scan

  - **Groundwater**: PCBs were reported in samples from two wells, MW101-5 (a downgradient well at the landfill) and MW-101-1 (located near the AMG Industries facility). Aroclor 1016 was reported in a sample from MW101-5 at a concentration of 62 parts per billion (ppb). Halogenated organic compounds were reported in samples from both upgradient and downgradient wells. The maximum concentration (4 ppm) was reported in a sample from downgradient well MW101-5.

In November 1991, a remedial investigation of the AMG property (including 53 and 55 Luzerne Road) was completed for AMG Industries (CHA 1991). The study included an electromagnetic survey and shallow soil investigation. The results indicated significant contamination remaining on the 53 Luzerne Road property. A maximum concentration of 62,300 ppm of PCB in soil was reported at a depth of approximately 10 feet. No contamination was reported on the 55 Luzerne Road property. Subsequent to the investigation, approximately 25 yards of soil were excavated from two locations near the AMG Industries facility (CHA 1992).

In March 1997, supplemental investigations were completed around the Glens Falls Landfill (E & E 1997). The primary focus of this study was to evaluate groundwater conditions in the vicinity of the Glens Falls Landfill. The study included 22 Geoprobes, the installation of four piezometers, a total of 36 shallow groundwater

samples, and six soil samples from two locations. The results of this study indicated the 53 Luzerne Road property contains highly concentrated PCBs. PCBs are migrating off the site in the groundwater at levels contravening New York State groundwater standards. The sources of this groundwater contamination are either the landfill, the secure cell area, or the 53 Luzerne Road property, or a combination of each. Groundwater flow is to the east-southeast at 1.1 ft/day.

2.3 Work Plan Scope

Under this work assignment, E & E will provide RI/FS services to NYSDEC for the Luzerne Road Site inclusive of the three contiguous properties (53 Luzerne Road, 55 Luzerne Road, and the Secure Cell property), and up to nine private properties.

This work plan has been developed for the first phase of investigation. Following completion of these studies, and if directed to do so by NYSDEC, E & E will prepare an addendum to this work plan for supplemental second phase investigations.

Remedial Investigation

The RI to be conducted by E & E will include:

- Record search and identification of receptors;
- Surface and subsurface soil sampling (from borings and Geoprobes);
- Groundwater well installation, development, sampling, and slug testing; and
- Surface water/sediment sampling.

The objective of the RI will be to identify and define the extent of soil and groundwater contamination at the Luzerne Road Site, the residual contamination at up to nine private residences, and to identify the site's possible risks to human health and the environment. Data collected from the investigations will be tabulated, summarized, and evaluated.

A quantitative risk assessment will not be completed for the Luzerne Road Site. Based on previous investigations, it is expected that PCBs will pose the most significant human health risk at the site. It is commonly accepted to use established state and federal criteria when establishing cleanup goals for these substances. Thus, a quantitative assessment may not be necessary.

An assessment of human exposure pathways will be completed in addition to a comparison of environmental testing data with state and federal criteria for identified contaminants. Based on this comparison and other data developed from the RI, a determination will be made whether a more rigorous quantitative assessment is necessary. The human health risk assessment is discussed in more detail in Section 3.4.

Feasibility Study

Upon receipt of data from the RI, an FS will be performed. The FS will identify which areas of the site may require remedial action and will develop and compare appropriate remedial alternatives.

3 Major Tasks and Subtasks

The tasks and requirements of this work assignment are specified in Schedule 1, Item D, of E & E's standby Contract, *Work Element II - Phased Remedial Investigation/Feasibility Study*. The following is a summary of the work assignment scope.

3.1 Task 1: Project Work Plan

This task involves the development of this work plan for the Luzerne Road RI/FS. Work plan development is divided into two subtasks: 3.1.1 Site Visit and Scoping Session, and 3.1.2 Detailed Work Plan Development. The work plan is predicated on the Work Assignment No. D003493-16 issued by NYSDEC on February 9, 1999, and subsequent scoping discussions held with NYSDEC representatives.

3.1.1 Site Visit and Scoping Session

E & E met with Dave Tromp, Walt Demick, Eric Hausamann, and James Ludlam in Albany, New York, on February 25, 1999, to discuss site background information and visit the site. Subsequently, E & E visited the Glens Falls Department of Public Works (DPW) and the Town of Queensbury Planning Office to obtain additional background information. Based on a review of the site background information and discussions with NYSDEC, E & E developed a draft Scope of Work (SOW), which was submitted to NYSDEC on March 12, 1999. E & E and NYSDEC held a scoping conference call on March 30, 1999, during which NYSDEC approved the proposed SOW and E & E commenced preparation of this work plan.

DPW
Department of Public Works

SOW
Scope of Work

3.1.2 Detailed Work Plan Development

E & E is submitting this work plan for NYSDEC's review and approval. This work plan addresses the issues discussed during scoping sessions and includes a description and purpose of the major tasks and subtasks, a project schedule identifying milestones and deliverables, a staffing plan, budget with 2-11 forms and supporting documentation, M/WBE utilization plan, subcontractor

identification, subcontractor SOW, a Quality Assurance/Quality Control (QA/QC) Plan, and a Health and Safety Plan (HASP).

QA/QC
Quality Assurance/ Quality Control

HASP
Health and Safety Plan

VOC
volatile organic compound

TCL
Target Compound List

TAL
Target Analyte list

PPE
personal protective equipment

3.2 Task 2: Remedial Investigations

The RI proposed for the Luzerne Road Site will investigate site soils, surface water/sediment, and groundwater to determine whether site contaminants are present in environmental site media and the extent of these contaminants. Investigation subtasks are listed below, along with the corresponding proposed analyses. Figures 3-1 and 3-2 show the proposed subsurface soil sampling grid and the proposed groundwater monitoring well locations at the Luzerne Road Site, respectively.

PCB is the primary site contaminant; therefore, PCB analysis will be included in all environmental evaluations. Also, because background data indicates a volatile organic compound (VOC) was detected during previous remediation activities, VOC analysis will be included on a limited basis. Additional analyses include those needed to provide data necessary for the FS. Due to the unknown contaminants in site groundwater, groundwater from selected existing and all new groundwater monitoring wells installed as part of this RI will be submitted for analysis for the full Target Compound List (TCL)/Target Analyte List (TAL) suite of analyses. Table 3-1 summarizes the proposed sampling and analysis at the Luzerne Road Site.

Note that all field activities are expected to be conducted by personnel wearing Level D personal protective equipment (PPE). Due to the potential presence of PCB in dust, upgrades to Level C may be necessary. In addition, VOC concentrations in the breathing zone will be continuously monitored.

3.2.1 Task 2.1: Field Remedial Investigation

3.2.1.1 Record Search and Contaminant Receptor Identification

Previous environmental site assessments of the site and adjacent areas have been conducted; however, background data presented on the site is not thorough. Therefore, E & E will begin the project by conducting background research to determine useful details concerning site history. Aerial photographs of the site from the 1960s, 1970s, and 1980s will be obtained, if possible, to determine which parts of the site or surrounding area may have been affected, but have not yet been explored. Contact with, and possibly visits to, local and state agencies will be made to obtain historical records on site activities and violations, if any. Interviews with

Table 3-1 Sampling and Chemical Analysis Cost Summary
Luzerne Road Site, Glens Falls, NY

Analysis	Method	Number of Field Samples	QA/QC Samples						Total Number of Samples
			Field Duplicates	Trip Blanks	Rinsate Blank	MS	MSD	MSB	
Groundwater - Existing Wells									
TCL Volatiles (VOCs)	CLP 95-1	10	1	2	0	1	1	1	16
TCL Semivolatiles (BNAs)	CLP 95-2	10	1	0	0	1	1	1	14
TCL PCB	8082	10	1	0	0	1	1	1	14
TCL Pesticides	8081B	10	1	0	0	1	1	1	14
TAL Metals (+Mercury)	CLP-M	10	1	0	0	1	1	1	14
Cyanide	CLP-M	10	1	0	0	1	1	1	14
Groundwater - New Wells (6 shallow & 3 deep)									
TCL Volatiles (VOCs)	CLP 95-1	9	1	1	0	0	0	0	11
TCL Semivolatiles (BNAs)	CLP 95-2	9	1	0	0	0	0	0	10
TCL PCB	8082	9	1	0	0	0	0	0	10
TCL Pesticides	8081B	9	1	0	0	0	0	0	10
TAL Metals (+Mercury)	CLP-M	9	1	0	0	0	0	0	10
Cyanide	CLP-M	9	1	0	0	0	0	0	10
Surface Water									
TCL PCBs	CLP 95-3	4	1	0	0	1	1	1	8
Sediment									
TOC	415.1M	12	1	0	0	1	1	1	16
Subsurface Soil - Containment Cell									
TCL Volatiles (VOCs)	CLP 95-1	4	1	1	1	1	1	1	10
TCL PCBs	8082	4	1	0	1	1	1	1	9
pH	9045C	4	1	0	1	0	0	0	6

Table 3-1 Sampling and Chemical Analysis Cost Summary
Luzerne Road Site, Glens Falls, NY

Analysis	Method	Number of Field Samples	QA/QC Samples						Total Number of Samples
			Field Duplicates	Trip Blanks	Rinsate Blank	MS	MSD	MSB	
TOC	415.1	4	1	0	1	1	1	1	9
Oil and Grease	9071A	4	1	0	1	1	1	1	9
COD	410	4	1	0	1	0	0	0	6
Subsurface Soil - Geoprobe Confirmation									
TCL PCBs	8082	160	8	0	0	8	8	8	192
Subsurface Soil - Residential Soils									
TCL Volatiles (VOCs)	CLP 95-1	27	2	4	0	1	1	1	36
TCL PCBs	8082	27	2	0	0	1	1	1	32
TOC	415.1M	9	1	0	0	1	1	1	13
Subsurface Soil - Monitoring Wells									
TCL Volatiles (VOCs)	CLP 95-1	9	1	9	1	1	1	1	23
Subsurface Soil - Grid Sampling									
TOC	415.1M	22	1	0	0	1	1	1	26

Key:

ASC = E & E's Analytical Services Center
MS = matrix spike
MSD = matrix spike duplicate
MSB = matix spike blank
PCB = polychlorinated biphenyl
QA = Quality Assurance
QC = Quality Control
SVOCs = semivolatile organic compounds
TAL = Target Analyte List
TC = Target Compound List
TOC = total organic carbon
VOCs = volatile organic compounds

surrounding business owners, the local town historian, and relevant City of Glens Falls employees will also be conducted to obtain additional background information. A search for uses of private drinking water wells will be made. E & E will attempt to identify whether the wells are used as either a primary drinking water source or as a supplemental source for watering lawns or gardens. In addition, uses of nearby surface water will be researched to determine if surface water is used for drinking water downgradient of the site. The search for private wells and surface water usage will be limited to downgradient or downstream locations only.

As a component of the record search, E & E will collect names and addresses of officials and residents who wish to be kept informed of the findings of the RI/FS. This list will be forwarded to, and maintained by, NYSDEC. Some investigation has already been conducted at the Glens Falls Landfill west of the site. Any additional information that may be available from site characterization activities conducted at that site (such as groundwater and soil data) will be pursued. Based on these data, potential receptors of contaminants will be identified. The data may also be used to modify sample quantities and analyses, and will be evaluated with respect to selection of sample locations. All collected data will be summarized and included in the RI report.

To assist in learning about past activities at the site, E & E proposes creating and distributing a questionnaire to local residents. The purpose of this questionnaire is to determine any important facts about the site that previous studies may have overlooked. Data from this questionnaire may be used to select groundwater monitoring well positions, or to identify other areas of sampling which should be included during Phase I activities.

3.2.1.2 On-Site Soil Investigation

To fully characterize the extent of soil contamination that may exist in the area of the secure cell, subsurface soil will be investigated in three efforts: shallow borings on a grid system, soil sampling during installation of groundwater monitoring wells, and soil sampling at the PCB landfill cell. Each effort is described below.

NYSDEC will first establish access permission to conduct the field investigation on all areas of this site to be studied. Site investigation activities will commence following establishment of entry permission.

Shallow Subsurface Soil Sampling by DPT on Grid

PCB presence in soils surrounding the PCB cell will be sampled through a series of shallow soil borings installed according to a grid established over the study area. The grid will extend approximately 300 feet to the east and west of the secure landfill area, 100 feet wide to the north of the cell property, and 300 feet wide to the east of the cell property. Internodal spacing between core holes is planned to be 50 feet. In addition, two east-west positioned lines of coreholes will be installed south of the landfill cell; one adjacent to the fence and one at approximately the midpoint between the cell and Luzerne Road. Internodal spacing along these two lines of coreholes will also be 50 feet. Based on site conditions noted during a site walkover, clearing/grubbing likely will be necessary to facilitate access to this southern area, as well as some monitoring well locations. The proposed grid sampling area is indicated on Figure 3-1.

DPT
direct push technology

Soil borings will be installed into the water table using direct push technology (DPT). A Geoprobe or equivalent unit is expected to be used for the soil boring activity. Each soil boring will be continuously sampled in 3-foot increments from grade to a depth of approximately 2 feet into the water table, if possible, to identify the presence of an LNAPL layer or a smear zone, if either exists. Based on existing local geologic data gathered during subsurface investigations at the Glens Falls Landfill west of the Luzerne Road Site, the average DPT borehole depth is anticipated to be 20 feet.

A composite sample collected over each 3-foot soil interval will be analyzed for PCBs. Most analyses will be performed using a PCB screening testing system. The screening procedure will involve a modified form of the USEPA SW846 Method 8082. Appendix B includes a more detailed description of the screening procedure as well as the laboratory Standard Operating Procedure for completing the screening procedure. Screening data will be supported by submitting 10% of the samples to a NYSDOH-certified laboratory for verification by USEPA Method 8082.

Initially, soil borings will be installed on a 100-foot grid pattern. In those parts of the grid where PCB contamination is identified, nodes on 50-foot intervals will be installed. This will minimize the exploring areas where PCB does not exist.

Based on the size of the exploration area, E & E estimates soil cores will be installed at 202 grid nodes. On average, five soil samples will be collected from coreholes on the north and east sides of the site, as well as from coreholes on one of the southern two rows. E & E estimates seven samples will be collected from

grid points positioned on the west side of the cell, and on the second of the two southern rows. Not including a contingency value for unplanned samples and quality assurance/quality control samples, E & E estimated 1,234 soil samples will be collected from the sampling grid and submitted for PCB analysis using a screening test system. Table 3-2 summarizes the borehole and sample quantities.

Table 3-2 Soil Boring and Subsurface Soil Sample Summary

Source	Holes	Lines	Total Nodes	Samples per Hole	Total Number of Samples
Geoprobe					
West Lines	16	2	32	7	224
	14	5	70	7	490
North Lines	8	2	16	5	80
South Lines	11	1	11	5	55
	10	1	10	7	70
East Lines	9	7	63	5	315
Grid Totals			**202**		**1234**
Residential Properties	3	9	27	7	189
Cell Landfill	4	1	4	3	12
Geoprobe Totals			**233**		**1435**
Hand Auger (Drainage Ways)					
Ditches	3	3	9	1	9
Wetland Area	3	1	3	1	3
Hand Auger Totals			**12**		**12**
Drill Rig					
Shallow Wells			6	13	78
Deep Wells			3	20	60
Drill Rig Totals			**63**		**138**
Grand Total					**1585**

Site records indicate VOCs were occasionally emitted from the soil during site excavation and cell construction activities. Therefore, organic vapor presence in soil cores and at the top of the soil borehole will be monitored during boring installation. Soil samples yielding detectable organic vapor readings (which are determined not to result from methane) will be submitted for volatile organic analysis.

All soil cuttings will be containerized on site. These containerized soil cuttings will be placed within the fence of the PCB cell for temporary storage. All coreholes will be backfilled with bentonite chips to a depth of 2 feet from ground surface. Following bentonite hydration, the top 2 feet will be backfilled with bentonite/cement grout.

Containment Cell Subsurface Soil Sampling

Subsurface soil sampling will be accomplished using two methods: DPT borehole installation and soil borings for Shelby tube collection, as explained below.

- **DPT Boring Installation**

  Two DPT soil borings will be installed in the soil containment cell at locations to be determined in the field based on observations and data from surrounding core samples. Three soil samples from each corehole will be obtained for PCB and geotechnical characterization to provide data necessary for evaluating remedial technologies. Table 3-2 summarizes the boring and sample analysis quantities. Geotechnical analyses are listed in Table 3-3. These probe holes will penetrate the existing cap; thus, each will require backfilling with a sealing/plugging material such as cement/bentonite grout and/or bentonite pellets followed by hydration.

Table 3-3 Geotechnical Analytical Summary, Luzerne Road RI, Glens Falls, NY

Analysis	Method Number	Estimated Number of Field Samples
Geotechnical Analysis of Site Soils		
Moisture Content	D2216	5
Humic Content	D2794-87	5
Atterberg Limit	D4318	5
Particle Size: Sieve Analysis	D422	5
Particle Size: Hydrometer	D422	5
Dry Density	D2937-94	5
Specific Gravity	D854	5

- **Soil Boring and Shelby Tube Collection**
  At locations to be determined in the field, soil samples will be collected by use of a Shelby tube sample collection system. At each of three boreholes, the drill rig on site used to install the shallow monitoring wells will be used to bore through soil to the desired depth. The drill rig crew will then collect one Shelby tube sample. Shelby tubes will be submitted to a geotechnical analytical laboratory for dry density analysis. This information will be useful in evaluating remedial alternatives. Sample location depths will be determined based on PCB analysis data of soil collected by DPT, and based on soil type encountered.

Two other Shelby tube samples may be collected at other locations around the site at the discretion of the field team based on soil type and contaminant concentrations.

Soil Sampling During Monitoring Well Installation

During shallow groundwater monitoring well installation, soils will be continuously split-spoon sampled from grade to the desired depth, which is expected to be between 20 and 25 feet below ground surface (BGS). Soil from each of the split-spoon samples from each of six wells will be submitted for PCB analysis using the immunoassay system. If organic vapors are detected during borehole installation, one sample from the depth interval yielding these OVA readings will be collected and submitted for VOC analysis.

BGS
below ground surface

Split spoon samples will also be collected during deep monitoring well installation. However, due to site geologic conditions, split-spoon sampling can be conducted only until the depth at which the first large boulder is encountered.

3.2.1.3 Off-Site Residential Soil Investigation

Background records indicate that possible PCB presence at seven residential properties was remediated through soil excavation in 1979. However, post-excavation sampling was not conducted to verify the completeness of the remediation. In addition, questions remained regarding potential PCB contamination at two additional properties. During this RI field program, subsurface soil at remediation areas at each of these nine residences will be evaluated to more thoroughly determine if the previous remedial efforts were complete.

The field team leader, accompanied by a NYSDEC representative or designee, will visit each of the nine residences at which PCB contamination was previously found or is suspected due to past

activities, to learn the approximate location where previous remedial activities occurred. The locations will be flagged using pin flags or wooden stakes. Following marking of all eight residences, DPT will be used at each residence to install three boreholes. Boreholes will be installed from grade to a depth of approximately 20 feet BGS, depending on the depth at which PCB-containing soils may have previously been in place. Soil from each 3-foot depth interval will be submitted for PCB analysis using the PCB screening system. For planning purposes, E & E proposes analyzing seven of the samples from each of three holes installed at each of the nine residences. If organic vapors are detected during borehole installation, one sample from the depth interval yielding these OVA readings will be collected and submitted for VOC analysis. Table 3-2 summarizes the boring and sample analysis quantities.

While intrusive activities are performed on residential properties, work zones will be clearly taped- or roped-off to keep the public at a safe distance during these activities. Air monitoring will also be performed. This will include monitoring for organic vapors, particulates, and explosivity both within the workers' breathing zone and within the work zone. The air monitoring program is described in more detail in Section 3.2.2.2 and Appendix C, Health and Safety Plan.

3.2.1.4 Groundwater Investigation

The groundwater investigation will consist of several facets to evaluate chemical characteristics, flow rate, and existence of contaminant plumes. The discussion below describes the approach for addressing these factors.

Groundwater Monitoring Well Installation and Sampling

E & E plans to install six shallow and three deep groundwater monitoring wells at the site. The proposed well locations are indicated on Figure 3-2. All shallow wells are expected to be installed to a maximum depth of about 25 feet and set in unconsolidated sands. Wells will be constructed of 2-inch inside diameter (ID) polyvinyl chloride (PVC), with a screen positioned across the water table. In each well, soil samples will be collected from grade to the bottom of the borehole or to refusal, whichever is first encountered.

ID
Inside diameter

PVC
polyvinyl chloride

Three deep wells will be paired with three of the shallow wells to explore geologic and water quality conditions at the lowest point in the upper aquifer. Deep wells will be installed from grade to the depth of the first confining layer, which is expected to be bedrock at a depth of approximately 110 to 130 feet BGS. Each well will

be constructed of 2-inch PVC, and equipped with a 10-foot screen positioned at the bottom of the borehole.

One of the three deep wells will be installed in a highly-contaminated area on the 53 Luzerne Road property. This well will be constructed with a telescoping design so as not to drag contaminated soil deeper into the aquifer. An upper large-diameter (8 or 10-inch) casing will be installed to a depth of 40 feet BGS. Once grouted into place, the well will be extended to a depth of approximately 120 feet using a 4-inch diameter drill bit. This will seal off the upper zone of the aquifer from the lower zone, minimizing the potential for vertical migration of contaminants through drilling activities.

One round of groundwater samples from each well will be collected; all samples will be submitted for the full TCL/TAL suite of analyses. At the time of sample collection, groundwater pH, temperature, conductivity, and turbidity will be evaluated.

Two rounds of groundwater level data will be scheduled, separated by an adequate time period to assess seasonal effects.

In addition to the six shallow and three deep new groundwater monitoring wells, 10 groundwater monitoring wells currently exist at the site. Each of these wells will be redeveloped. One sample from each of these 10 wells will be collected and submitted for full TCL/TAL analyses.

Hydraulic Conductivity

Hydraulic conductivity of the upper (overburden) aquifer will be evaluated by the use of either a rising head or falling head slug test on each of the wells, as described in the field procedure methodology (see Section 3.2.3). Data from these tests will be presented in the RI report. If water movement rates are sufficiently rapid so as not to yield high quality slug test data, single well drawdown tests will be performed.

3.2.1.5 Surface Water and Sediment Evaluation

In addition to site soils, the adjacent wetland north of the site, and three drainage way channels leading to or from it, will also be explored. If drainage ways contain water, one water sample will be collected from each. Also, one water sample will be collected from the wetland area. All water samples will be submitted for PCB analysis using Method 8082.

Sediment samples will be collected at three points in each drainage channel and at three points in the wetland. At each point, a hand

auger will be used to extract soil samples from the upper 6 inches of the sediment. Sediment samples will be submitted for PCB analysis using the PCB screening system. Ten percent of the sediment samples collected will be submitted for PCB analysis using Method 8082 and for total organic carbon analysis.

3.2.1.6 PCB Screening Analysis

Soil and sediment samples will be submitted for a PCB screening analysis using a modified Method 8082 approach as described in Appendix B. The PCB screening will be performed at E & E's ASC. The analysis will be calibrated for Aroclor 1254 or 1016 only. These Aroclors have been targeted based on historical site data. If other PCBs are present or the samples exhibit a weathered pattern, the results will be reported as quantified by the nearest Aroclor. The detection limits will be 0.5 ppm for low level samples. Higher concentration samples will be analyzed at dilution with a high value of up to 2000 ppm. Samples requiring more than one dilution will be reported as extended or greater-than values. Samples with potential sulfur contamination will be cleaned up prior to analysis. The laboratory will provide summary results for all samples as well as copies of the chromatograms.

At least 10% of the samples will be confirmed by Method 8082 with extraction by Method 3550B. The confirmation results will require a one-week turnaround. The screening results and confirmation results will be reviewed weekly by the QA Officer to verify the screening methods are meeting data quality objectives.

IDW
investigation-derived waste

3.2.1.7 Investigation-Derived Waste (IDW)

All soil cuttings generated during soil boring and monitoring well installation will be handled according to procedures outlined in Section 3.2.2.13. If soil cuttings are placed in drums, data from analysis of boring soils will be used to evaluate the contents of the drums so that they may be properly disposed. Drums will be moved to an on-site location as directed by NYSDEC.

3.2.1.8 Base Map Development and Site Survey

Surveying will consist of two separate ground survey tasks: one prior to field investigation activities and one following field investigation activities. Each of these tasks is described below.

Initial Survey

This initial surveying effort consists of two components: establishing a grid and conducting a topographic survey. Initially, a grid containing 202 points around the site will be created to establish Geoprobe soil boring locations. Internodal spacing will be 50 feet. All nodes are to be marked by a wooden lath equipped with a

brightly-colored ribbon tied to the top. All laths are to be labeled according to the node labeling system established for the site.

The topographic survey consists of surveying the site and constructing a site topographic map utilizing a 1-foot contour interval. Each contour will be assigned a "Z" elevation within the AutoCAD electronic file for use in digital terrain modeling.

Also included in the topographic survey will be the surveying of selected fixed features. The horizontal and vertical positions of 10 existing groundwater monitoring wells will be established. At each well, ground elevation and top of inner casing are to be measured. Also, the horizontal location of fixed features will be established. The list of features includes, but is not limited to, Luzerne Road, Veterans Road, the perimeter of the wetland, approximately three streams, approximately four telephone poles, the AMG properties building, and the fence traversing the landfill toe.

CAD
computer-aided design

The surveying subcontractor (YEC Engineers) will provide E & E with a draft hard copy map and a computer-aided design (CAD) electronic file of this survey. YEC will establish local horizontal and vertical site control unless existing NGS monumentation is within approximately 0.5 miles of the site.

3.2.1.9 Post Investigation Survey

The second survey effort will involve two components. First, the vertical and horizontal position, ground surface elevation, and top of inner casing elevation of all groundwater monitoring wells installed during this RI will be measured. Second, at each of eight residences, the horizontal control of three Geoprobe borehole locations, the house, nearest street(s) adjacent to the property, and other relevant site features such as driveways and telephone poles will be established. This second survey is to be commenced during the last week of field activities so that the field investigation team can show the survey team the points to be surveyed. Note that this second survey involves entering onto private property; therefore, it will be conducted under the accompaniment and/or permission of NYSDEC personnel only.

Well elevation data collected during this second survey will be added to the first CAD base map. A separate residential area CAD map will be developed.

3.2.2 Field Methodology

The following sections describe the field methodologies for activities outlined in Sections 3.2.1 and 3.2.2.

3.2.2.1 Base Map Development/Site Survey Procedures

A detailed topographic base map of the Luzerne Road Site and immediate vicinity will be developed by an MBE subcontractor (YEC) to E & E. The base map will be prepared by a ground survey. The ground survey will include the establishment of a local site benchmark based on a local USGS benchmark, if one is in close proximity to the site. If a USGS benchmark is not readily available, an arbitrary elevation will be assigned to the site benchmark(s) installed on the site. Additionally, horizontal and vertical controls will be established for a variety of notable site features. All relevant features of the sites and adjacent areas (e.g., site buildings, residences, fences, existing wells, etc.) will be plotted at a scale of 1 inch = 50 feet. Contours will be plotted at the appropriate intervals. The base maps will be produced on a CAD system and will be included in the RI report.

Additional surveying will be performed by the subcontractor in conjunction with the base maps. This additional surveying will include coordinates and elevations for each previously existing and new groundwater monitoring well, sampling location, and other key points. These locations will then be plotted on the base maps. Unsurveyed data (e.g., approximate property lines) developed through the use of current tax maps and the initial site visit will also be indicated on the map.

3.2.2.2 Air Monitoring

Air monitoring will be performed by the Site Safety Officer during drilling and soil boring activities to characterize airborne contaminant levels, including volatile organic vapors, cyanide gas, and particulates. The air monitoring will be conducted for the protection of site workers and the community, and to characterize environmental samples. The HASP specifies the monitoring equipment to be used for contaminants of interest and the frequency with which the monitoring will be performed.

Action levels for each monitoring instrument are also detailed in the HASP. Levels of organic vapors and particulates will be measured in the workers' breathing zone; action levels are based on those readings. Oxygen-deficient and combustible atmospheres will not be monitored in the workers' breathing zone. Instead, these monitors will be positioned at a location that will measure a worst-case contaminant level and will provide the earliest possible warning that a hazardous condition may be forming. Also, monitoring for particulates will be performed in the work zone, which will not be the breathing zone all of the time. This method will be more protective, as dust tends to be concentrated at the location where it is generated, rather than equally dispersed along the

downwind perimeter of the site. Appropriate actions (initially, evacuation of the immediate work area) will be taken if established action levels are exceeded. Perimeter monitoring will be conducted if the action level is obtained at the work area. All air monitoring results, as well as wind direction and speed (estimates), will be documented in the site log book.

3.2.2.3 Subsurface Soil Sampling by DPT

Subsurface soil samples will be collected at the Luzerne Road Site in three parts of this RI: in the grid, at the containment cell, and on residential property. The samples will be collected using the equipment and procedures described below.

- Decontaminated stainless steel spoon;
- Glass jars;
- Appropriate sample containers (see Table 3-3); and
- Cooler with ice.

Each soil core will be laid on sheet plastic for extraction from the sampling device. Once extracted, the core will be scanned with an OVA to evaluate the presence and concentration of organic vapors. A general description of the soil core will be noted in the logbook. If organic vapors are present, a portion of the core will be used to fill two 40-ml VOA vials. The filled sample containers will be placed on ice. The remainder will be homogenized, and a portion will be used to fill one 4-oz jar. The jar will be labeled and submitted for PCB screenings and analysis.

3.2.2.4 Containment Cell Investigation

DPT soil boring in the containment cell will be conducted as described above. Shelby tube collection will be conducted by the subcontracted drilling team. All Shelby tubes collected are to be sealed with wax, labeled as to their orientation, and shipped promptly to the geotechnical laboratory for analysis.

3.2.2.5 Subsurface Soil Sampling During Monitoring Well Installation

Subsurface soil sampling during well installation will be conducted via split spoon sampling. For each split spoon collected, the following sampling equipment and procedures will be used:

- Decontaminated stainless steel spoon;
- Glass jars;

- Appropriate sample containers (see Table 3-3); and
- Cooler with ice.

Once extracted from the hole, the split spoon sampler will be laid on sheet plastic and opened to expose the soil core. The core will be scanned with an OVA to evaluate the presence and concentration of organic vapors. A description of the soil core will be noted in the logbook. If organic vapors are present, a portion of the core will be used to fill two 40-ml VOA vials. The filled sample containers will be placed on ice. The remainder will be homogenized, and a portion will be used to fill one 4-oz jar. The jar will be labeled and submitted for PCB screening analysis.

3.2.2.6 Residential Property Investigation

Subsurface soil sampling by DPT boring installation at residential properties will be conducted as described above under Section 3.2.2.3. Soil boring locations will be marked for future surveying by the surveying team.

3.2.2.7 Monitoring Well Installation, Development, Sampling, and Aquifer Testing

Nine monitoring wells will be drilled, installed, developed, sampled, and aquifer tested at the Luzerne Road Site (see Figure 3-2). The monitoring wells are expected to be drilled and installed into overburden. Methods for drilling and installing both the shallow and deep overburden monitoring wells are described below.

Monitoring Well Installation

The boreholes for the shallow overburden or bedrock wells will be advanced through the overburden using 4.25-inch ID hollow-stem augers. Continuous split-spoon sampling will be conducted at each well. The samples will be collected using a standard 2-inch outside-diameter (OD) split spoon driven by a 140-pound drill rig hammer. If a hydraulic hammer is not used, blow counts will be recorded for each split-spoon sample. Drill cuttings generated during drilling will be handled according to procedures outlined in Section 3.2.2.13.

OD
outside diameter

Two types of deep monitoring wells will be installed: telescoping and non-telescoping. For each of the three deep overburden wells, a 3.25-inch ID auger and continuous split-spoon sampling will be used to drill from grade to the depth at which split-spoon sampler refusal is reached. These small-diameter augers will then be extracted from the borehole. In the one telescoping casing, either an 8.25- or 10.25-inch auger will be used to drill to a depth of 40 feet. Depending on the auger size used, either 6- or 8-inch ID

carbon steel casing will then be inserted into the hole and grouted in place. The grout will be allowed to set a minimum of 24 hours prior to continuing well drilling. The remaining overburden will then be drilled using either 4- or 6-inch ODEX drilling equipment until bedrock is encountered. This is expected to be at a depth of approximately 110 to 130 feet. For the two non-telescoping wells, a 4- or 6-inch ODEX drilling system will be used to drill from grade to bedrock. Augers and drilling equipment will be decontaminated using high pressure steam.

The shallow wells will be constructed using 10 feet of 2-inch Schedule 40 PVC machine-slotted screen (0.010-inch slot) which will be installed from the bottom of the hole up to 2 feet above the top of the water table, followed by 2-inch ID Schedule 40 PVC riser casing. The deep monitoring wells will be constructed similarly. However, their screens will be completely submerged for all nine wells, and a sand filter pack composed of chemically inert, well-sorted, coarse-grained sand will be placed from the bottom of the hole to 1 to 2 feet above the top of the screen. A 2-foot-thick bentonite pellet seal will be placed above the sand, followed by Portland cement/5% bentonite grout to surface. The wells will be completed either 2 feet aboveground surface with locking, protective steel casings set in concrete drainage pads, or flush to ground surface (see Figures 3-3 and 3-4). The necessity for flush mount wells will be determined in the field. Vented PVC well caps will be placed on each well casing for wells completed aboveground, and water-tight caps will be placed on flush mount wells. The deep overburden well scenario is similar. However, the screen is set at the bottom of the hole, entirely within the aquifer.

Monitoring Well Development

Following construction of new wells, each new and existing well will be developed using PVC or stainless steel bailers and/or submersible pumps until pH, specific conductance, and temperature have stabilized and turbidity of the discharge is 50 nephelometric turbidity units (NTUs) or less. The wells will initially be surged in order to draw fine sediments out of the sand pack and into the well for removal. If, after significant effort, substantial improvement has been noted through the development process but the proposed goal of 50 NTUs has not been met, the E & E and NYSDEC project managers will be notified. Development completion will then be based upon mutual agreement between E & E and NYSDEC. Development water from the wells will be handled according to methodology described in Section 3.2.2.13.

NTUs
nephelometric turbidity units

Groundwater Sampling

Groundwater samples will be collected from the nine new and 10 previously-existing groundwater monitoring wells at the Luzerne Road Site. The wells will be sampled no sooner than 24 hours after development is complete in order to allow the well to recover with groundwater representative of the underlying formations in the immediate vicinity of the well.

Purging and sampling will be accomplished using disposable polyethylene bailers on new polypropylene line. Prior to purging, static water levels will be measured to within ±0.01 foot in each well and piezometer. All wells will be purged of three to five times the volume of water standing in the well. Purged water will be containerized in the same manner as the development water. Temperature, pH, specific conductance, and turbidity will be measured and recorded during purging. If 50 NTUs cannot be obtained after well purging, the well(s) will be allowed to settle no longer than 24 hours before sampling the metals portion. Upon returning to the well, E & E will remeasure and record the turbidity. No additional purging will be performed. If 50 NTUs cannot be achieved, the E & E and NYSDEC project managers will be consulted. Turbidity at the time of sampling will be noted on the chain-of-custody documents. No field filtering will be performed. The groundwater samples will be tested for the parameters outlined in Table 3-1.

Aquifer Testing

Upon completion of monitoring well installation, development, and sampling, aquifer testing will be performed on the nine new wells. The procedure will consist of slug injection/withdrawal tests to determine the hydraulic conductivity and transmissivity of the soils in the immediate vicinity of each well screen. This will be accomplished by recording water level changes (±0.01 foot) by a downhole data logger following the injection (falling head test) and withdrawal (rising head test) of a solid slug or slug of water to and from the well being tested. If the well screen and sand filter pack are completely submerged in the aquifer, a falling head test will be performed. However, if the well screen or filter pack is partially above the water table, then a rising head test will be performed because any water displaced in the well by slug injection will favorably saturate the unsaturated portion of the sand pack, resulting in erroneous readings.

02:000699_QQ01_00_01_90-B0148
Fig 3-3.CDR-4/23/99-GRA

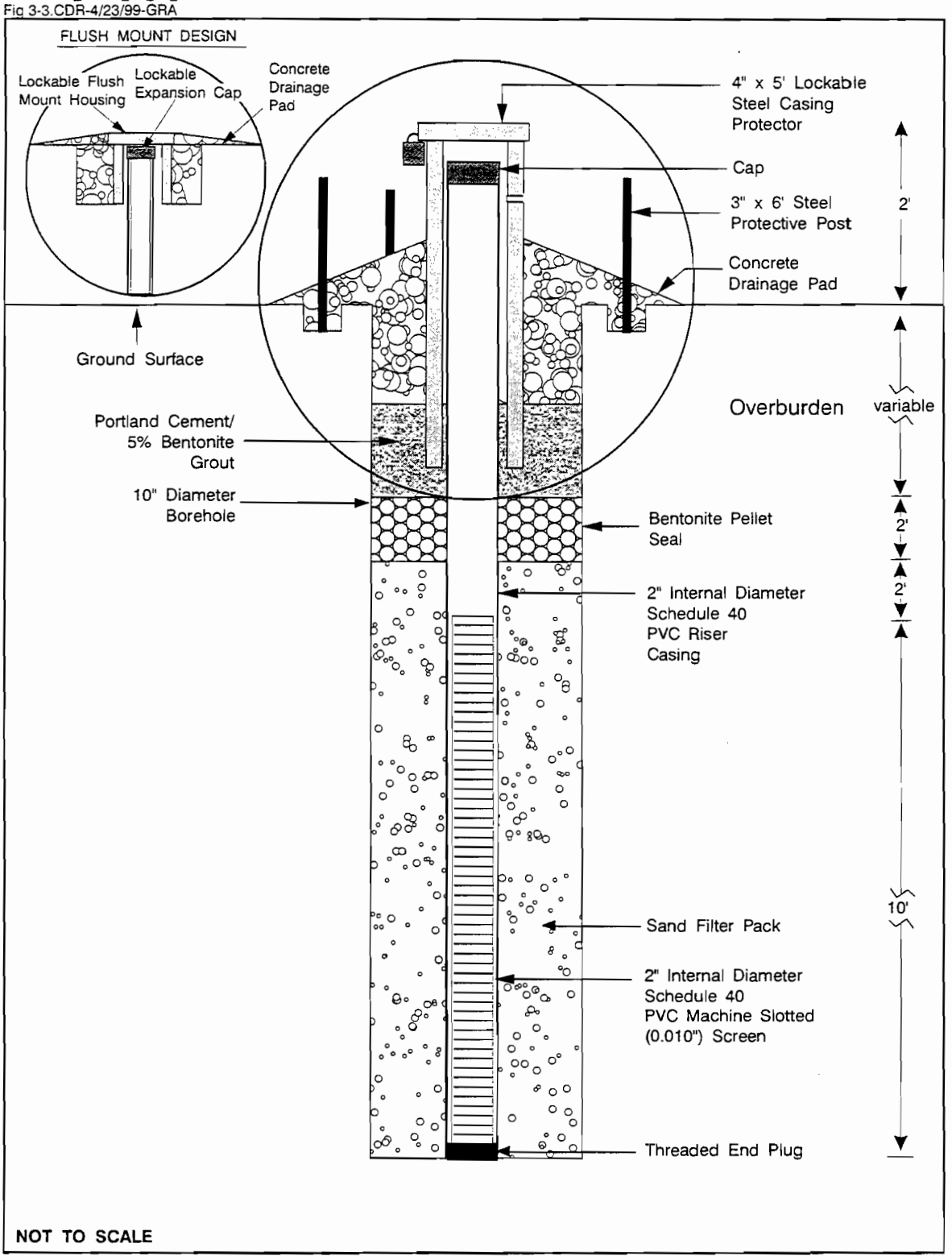


Figure 3-3 PROPOSED CONSTRUCTION FOR SHALLOW OVERBURDEN MONITORING WELLS

02:000699_QQ01_00_01_90-B0148
Fig3-4.CDR-4/23/99-GRA

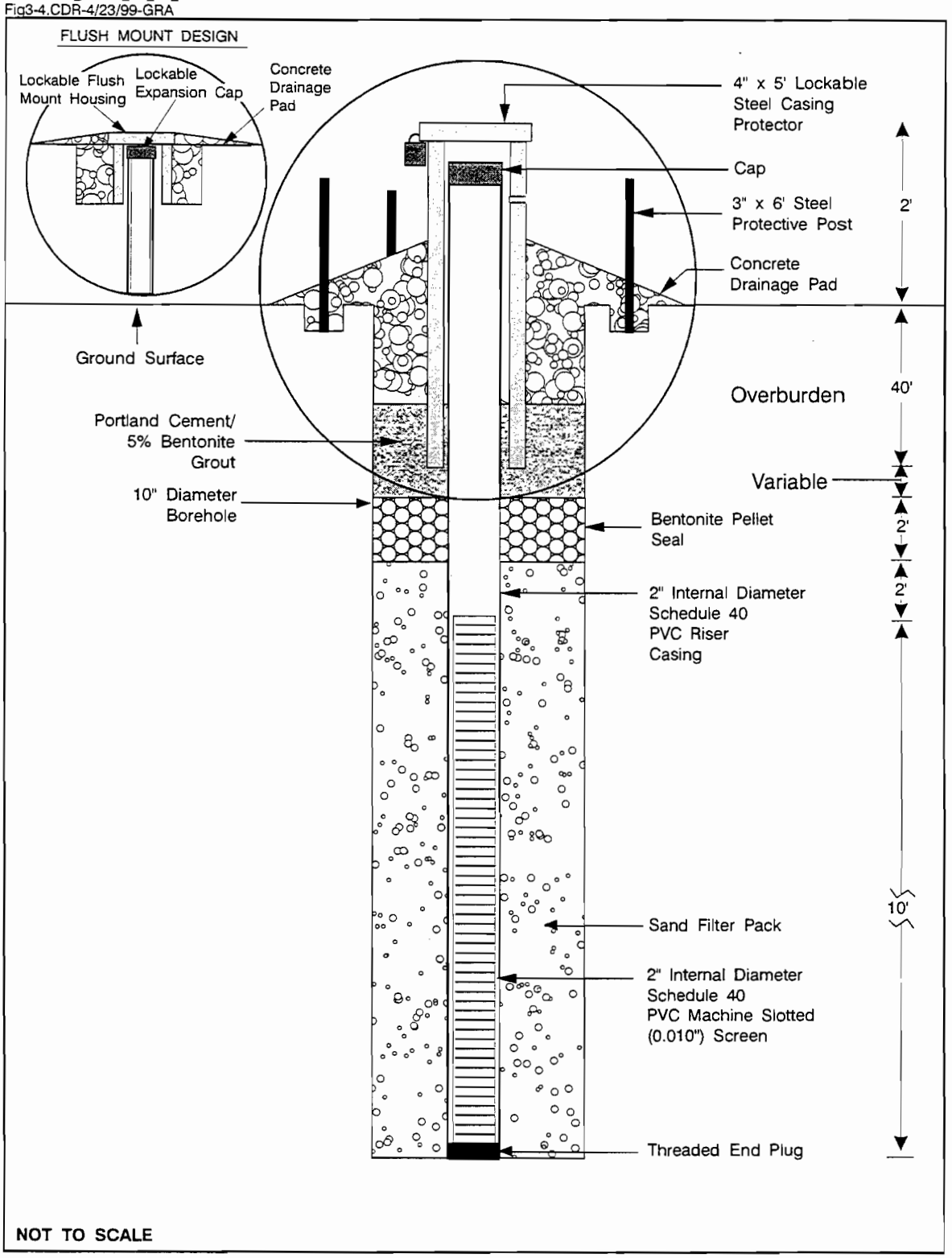


Figure 3-4 PROPOSED CONSTRUCTION FOR TELESCOPING OVERBURDEN GROUNDWATER MONITORING WELL

The tests will be performed using the equipment and methodologies described below.

Equipment and Supplies

- Water level indicator;
- Burgh Schoenenberger Loggerhead data logger, or equivalent;
- Solid slug of known volume;
- Bailer and dedicated nylon rope;
- Large capacity funnel;
- Clean potable water; and
- Laptop computer.

Slug Test Procedures

Falling Head Test

- Measure and record static water level in well;
- Determine if falling head test is applicable (i.e., screen and sand pack must be fully submerged in the aquifer). If not, then perform rising head test only (see below);
- Spray loggerhead with clean water to dislodge any solids in holes at the tip;
- Insert loggerhead in well several feet below the surface of the water table to allow clearance for the solid slug to be inserted (if used). Do not allow the unit to touch the bottom of the well because solids may plug transducer tip;
- Allow well to equilibrate to the initial static water level; and
- Rapidly insert a solid slug (by lowering the slug into the well with dedicated nylon rope until it is completely submerged) or inject several gallons of clean water into the well (by pouring the water from a bucket into a large funnel). Begin recording the falling head with the loggerhead data logger as soon as the slug is completely in the well. If a solid slug is used, be careful not to lower the slug into the transducer probe. Record the

falling head until it has returned to at least 90% of its initial static level or until no significant change in head is recorded within one hour.

Rising Head Test

- Measure and record static water level in well;
- If the loggerhead is not already in the well from the falling head test, spray the transducer with clean water to dislodge any solids in holes at the tip;
- Insert the loggerhead in well several feet below the surface of the water table to allow clearance for the solid slug to be inserted. Do not allow the unit to touch the bottom of the well because solids may plug the transducer tip;
- If the solid slug is not already in the well below the water table from the falling head test, insert the slug or bailer in the well, and allow the well to equilibrate to the initial static water level; and
- Rapidly remove the slug or bailer and begin recording the rising head with the loggerhead as soon as the slug is completely out of the water column within the well. Record the rising head until it has returned to at least 90% of its initial static level or no significant change in head is recorded within one hour.

3.2.2.8 Surface Water/Sediment Sampling

Surface water samples will be collected from the wetland and wetland tributaries, if present. If no surface water is present at the time of sampling or upon completion of all field activities at the site, only the sediment portion at that sampling location will be collected. The samples will be collected using the equipment and procedures described below.

Surface Water Sampling

The surface water sample will be collected at the same location as the sediment sample. The surface water sample will be collected first, followed by the sediment sample, to minimize turbidity. Equipment and sampling procedures are described below.

Equipment and Supplies

- pH, specific conductivity, temperature, and turbidity meters;

mL
milliliter

- Dedicated stainless steel or glass beakers (500 milliliter [mL] minimum volume), or 8-oz glass jars;
- Appropriate sample containers and sample preservation solutions (see Table 3-4); and
- Cooler with ice.

Surface Water Sampling Procedures

- Submerge the appropriate container into the water. Submerge a decontaminated beaker, glass jar, or the appropriate sample container into the water. If a beaker or glass jar is used, slowly pour the contents into the appropriate sample bottles.
- Add preservatives (if necessary) as indicated in Table 3-4, and label the sample containers as specified in Section 3.2.2.10.
- Measure pH, temperature, specific conductance, and turbidity.

Table 3-4 Sample Containers, Volumes, Preservation, and Holding Times for Liquid Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Preservation	Maximum Holding Time[a]
Purgeable (volatile) organics	40-ml glass vial with teflon-backed septum	Three; fill completely, leaving no head space	Cool to 4°C (ice in cooler)[c]	7 days
Extractable organics (BNAs) and pH	80-ounce glass amber bottles with teflon-lined caps	One; fill completely	Cool to 4°C (ice in cooler)[c]	Must be extracted within 5 days; analyzed within 40 days
Pesticides/PCBs	80-ounce glass amber bottles with teflon-lined caps	One; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 40 days
Metals (excluding hexavalent chromium) and Hardness	1-liter washed polyethylene bottle with polyethylene-lined caps	One; fill completely	Nitric acid to below pH 2 (approx. 1.5 ml concentration HNO_3 per liter), cool to 4°C (ice in cooler)	6 months[b]

Table 3-4 Sample Containers, Volumes, Preservation, and Holding Times for Liquid Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Preservation	Maximum Holding Time[a]
Cyanide	1-liter polyethylene bottle with polyethylene-lined caps	One; fill completely	Sodium hydroxide to pH 12 and cool to 4°C (ice in cooler)	12 days or 24 hours, if sulfide present

Note: All sample bottles will be prepared in accordance with EPA bottle washing procedures and QC-tested before use.

[a] Holding time is based on the time from verified time of sample receipt at the laboratory.
[b] Maximum holding time for mercury is 26 days.
[c] If residual chlorine is present in drinking water from residential taps, sodium thiosulfate will be added to the sample: 3 mg per 40-mL vial, and 80 mg per liter (189 mg per 80-ounce bottle).

Key:

BNAs = Base neutral acid extractables.
HNO_3 = Nitric acid.
PCBs = Polychlorinated biphenyls.

- Place samples in a cooler maintained with ice at 4°C. Ship the cooler to the laboratory via overnight delivery with chain-of-custody documents prepared in accordance with the procedure specified in Section 3.2.2.10.

Sediment Sampling

Equipment and Supplies

- Dedicated stainless steel spoons or trowels;
- Appropriate sample containers (see Table 3-5); and
- Cooler with ice.

Table 3-5 Sample Containers, Volumes, Preservation, and Holding Times for Soil, Sediment, and Solid Waste Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Preservation	Maximum Holding Time[a]
Purgeable (volatile) organics[c]	40-ml glass vial with teflon-backed septum	Two; fill completely, leaving as little head space as possible	Cool to 4°C (ice in cooler)	7 days

Table 3-5 Sample Containers, Volumes, Preservation, and Holding Times for Soil, Sediment, and Solid Waste Samples

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per sample)	Preservation	Maximum Holding Time[a]
Extractable organics (BNAs)	8-oz. glass jar with teflon-lined cap	One; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 40 days
Pesticides/ PCBs				Must be extracted within 5 days; analyzed within 40 days
Metals[c]				6 months[b]
Cyanide				12 days or 24 hours, if sulfide present
TOC				26 days
PCB Screening	4 oz. clear glass	One; fill completely	None	Extracted within 48 hours from sampling

Notes: All sample bottles will be prepared in accordance with EPA bottle-washing procedures and QC-tested before use. Additional samples also will be taken for geotechnical analyses.

[a] Holding time is based on the time from verified time of sample receipt at the laboratory.
[b] Maximum holding time for mercury is 28 days. For inorganic analyses, technical requirements for sample holding time have been established for water matrices only. However, they also are suggested for use as guidelines in evaluating soil/sediment data.
[c] Specified requirements would also apply for this type of TCLP analysis.

Key:

BNAs = Base Neutral Acid Extractables.
PCBs = Polychlorinated biphenyls.
TOC = Total organic carbon.

Sediment Sampling Procedures

- Using a stainless steel spoon or trowel, collect samples to be analyzed for volatile organics first, if an OVA reading is detected, followed by the remainder of the sample parameter portions. All miscellaneous debris is removed first.

- Place samples in a cooler maintained with ice at 4°C. Ship the cooler to the laboratory via overnight delivery with chain-of-custody documents prepared in accordance with procedures specified in Section 3.2.2.10.

3.2.2.9 Sample Containers and Preservation

The volumes and containers for the liquid and solid samples are presented in Tables 3-4 and 3-5, respectively. Sample preservation and holding time requirements also are presented in these tables. For additional information pertaining to sampling requirements

QAPP
Quality Assurance Project Plan

ASC
Analytical Services Center

DOT
United States Department of Transportation

POC
point of contact

(including QA/QC), see the Quality Assurance Project Plan (QAPP) in Appendix B of this work plan. Pre-washed sample containers will be provided by E & E's Analytical Services Center (ASC) and prepared in accordance with EPA bottle washing procedures.

Samples will be stored on ice pending delivery to E & E's ASC. In addition, all water sample portions to be submitted for metals analysis will be preserved by adding concentrated nitric acid until the sample pH is lowered to 2.0 standard units or less. All water sample portions to be submitted for cyanide analysis will be preserved by adding concentrated sodium hydroxide until the sample pH is raised to 12.0 standard units or higher. Sample pH will be checked in the field by pouring a small amount of the previously preserved sample into a separate container and checking the pH using indicator paper. Preservation procedures will be documented in the field logbooks. If residential tap water samples are chlorinated, the VOC portion will be preserved with 3 mg of sodium thiosulfate per 40-mL vial and 80 mg per liter (189 mg per 80-oz bottle).

3.2.2.10 Sample Labeling, Packaging and Shipping, and Custody

Sample Labeling

All samples will be assigned a unique sample identifier. Labels for each sample container will contain the sample identifier, date of sample collection, analytical parameters, and type of preservation used. Any change in the label information prepared prior to the sample collection will be initialed by the sampler.

Sample Packaging and Shipping

Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. The bags will be placed in coolers in such a manner as to eliminate the chance of breakage during shipment. Ice in plastic bags will be placed in the coolers to keep the samples at 4°C throughout shipment.

Sample shipment will be performed in strict accordance with all applicable United States Department of Transportation (DOT) regulations. The samples will be shipped to E & E's ASC in Lancaster, New York, by an overnight courier service. Arrangements will be made with the E & E ASC point of contact (POC) for samples that are to be delivered to a laboratory on a weekend and for water samples requiring hexavalent chromium analysis, so that holding times are not compromised.

E & E ASC POC:

Mr. William Howard
Ecology and Environment Analytical Services Center
4493 Walden Avenue
Lancaster, NY 14086
716/685-8080

Sample Custody

A sample is considered to be in custody under the following situations:

- The sample is directly in your possession,
- The sample is clearly in your view,
- The sample is placed in a locked location, or
- The sample is in a designated secure area.

In order to demonstrate that the samples and coolers have not been tampered with during shipment, adhesive custody seals will be used. The custody seals will be placed around the cap of each sample container and across the cooler lids in such a manner that they will be visibly disturbed upon opening of the sample container or cooler. The seals will be signed or initialed and dated by field personnel when affixed to the container and cooler.

Documentation of sample chain-of-custody is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory. Each sample cooler will be accompanied by a chain-of-custody record to document the transfer of custody from the field to the laboratory. All information requested in the chain-of-custody record will be completed. In addition, the airbill number assigned by the overnight courier will be listed on the chain-of-custody record. One copy of the chain-of-custody form will be retained by the samplers and placed in the project records file. The remaining pages will be sealed in a plastic bag and placed inside the cooler. Upon receipt at the laboratory, the chain-of-custody documents will be completed. It is the responsibility of E & E ASC to document the condition of custody seals and sample integrity upon receipt.

3.2.2.11 Analytical Program

Table 3-1 provides a summary of sampling and analysis for the Luzerne Road Site. Analysis of all samples collected during the RI/FS will be subject to the NYSDEC Contract Laboratory Program (CLP) as defined in the Analytical Services Protocol (ASP) of December 1995. All analyses will be performed by E & E's ASC. Data generated by E & E's ASC will undergo internal data validation and independent data validation by a third party data validator (Chemworld Environmental, Inc.).

CLP
Contract Laboratory Program

ASP
Analytical Services Protocol

TSP
trisodium phosphate

3.2.2.12 Decontamination Procedures

All decontamination will be performed in accordance with NYSDEC-approved procedures. Sampling methods and equipment have been chosen to minimize decontamination requirements and prevent the possibility of cross-contamination. All drilling and DPT soil boring equipment will be decontaminated prior to drilling or boring, after drilling each monitoring well or installation of each boring, and after the completion of all drilling and soil boring. Special attention will be given to the drilling assembly, augers, split spoons, and the backhoe bucket. Split spoons will be decontaminated prior to and following each use. Decontamination of drilling will consist of:

- Removal of foreign matter, followed by
- High-pressure steam cleaning.

Split spoons and other non-disposable sampling equipment will be decontaminated using the procedure above or by the following procedure:

- Initially clean all foreign matter;
- Scrub with brushes in trisodium phosphate (TSP) solution;
- Rinse with deionized water;
- Rinse with 10% nitric acid;
- Triple-rinse with deionized water; and
- Allow to air dry.

A temporary decontamination area will be established in the secure area on each site using heavy plastic sheeting as a pad. The primary purpose of the pad will be to decontaminate heavy equipment, such as the drill rig and backhoe. Fluids generated during

decontamination will be handled according to procedures outlined in Section 3.2.2.13.

3.2.2.13 Disposal of Investigation-Derived Waste

At least four types of IDW will be generated: drill cuttings, drill decontamination water, groundwater, and PPE. Waste streams will be segregated and not mixed. Drill cuttings from well and boring installations will be containerized on site and disposed of in accordance with New York State Technical and Administrative Guidance Memorandum (TAGM) HWR-89-4032 issued by NYSDEC on November 21, 1989. A registry of all drums, a description of their sources and contents, and documentation of the analytical results from tests on the containerized solids will be provided to the client.

TAGM
New York State Technical and Administrative Guidance Memorandum

Investigation-derived soils and water will be field-screened using visual inspection and an OVA to determine initially whether these wastes are contaminated. If non-volatile contamination is visually noted, the IDW will be placed in 55-gallon drums. Drill cuttings that are not contaminated (based on PCB screening analyses) will be spread on the ground, if possible. If clean cuttings cannot be placed at the well location, they will be drummed. If contaminated soils are identified by field screening, these soils will be containerized in DOT-approved 55-gallon drums.

All groundwater brought to the surface via sampling, well development, or well purging will be containerized in DOT-approved 55-gallon drums.

All drummed cuttings and water will be stored in a secure area on site until analytical results for the respective sites are received. The contents of drums from areas suspected or determined to be contaminated based on PCB screening analytical results may need further characterization to determine the suitability of subsequent disposal methods. If necessary, sampling and disposal of contaminated materials will be performed by the contractor under a contract modification.

All expendable materials generated during the investigation (including, but not limited to, Tyvek clothing, gloves, spoons, and plastic sheeting from the decontamination pad) will be placed in 55-gallon drums and stored at a secure location on site. All drums containing IDWs will be labeled with the type of generated material, site name, location where the material was generated, and date when the material was generated. E & E will not be responsible for waste disposal unless requested by NYSDEC under a separate agreement.

Personal decontamination is discussed in the HASP, which is presented in Appendix B of this work plan.

3.3 Task 3: RI Report

3.3.1 Task 3.1: Luzerne RI Report

An RI report detailing the site background data compiled during the investigation, investigation procedures undertaken, and data interpretation will be published. It will also include a photolog documenting site activities and findings, and both shallow and deep groundwater monitoring well soil boring logs. Data usability summary reports, as well as a general data quality review comparing PCB screening data with PCB verification sample data. The document will also contain both a human health and an ecological risk evaluation.

The RI report will screen the data to present a preliminary evaluation as to which areas may be considered hazardous and may require remedial action. Where contamination is detected, E & E will identify, present, and discuss routes of migration to potential human and environmental receptors and predicted fate of the contaminants.

3.4 Task 4: Risk Assessment

3.4.1 Task 4.1: Human Health Risk Assessment

In accordance with direction from NYSDEC, no formal quantitative risk assessment will be performed. Where contamination is detected, E & E will identify, present, and discuss both the routes of migration to potential human and environmental receptors and the predicted fate of the contaminants for both current and expected future site conditions. It is anticipated that adequate assessment of potential risks can be made through reference to available screening guidances such as NYSDEC's TAGM 4046 and EPA's Soil Screening Levels (SSLs) and New York State Class GA groundwater criteria.

SSL
Soil Screening Level

3.4.2 Task 4.2: Ecological Risk Assessment

As part of the RI Report, E & E will provide the applicable components of an ecological risk assessment. The goals of the ecological risk assessment for the site include:

- Documenting whether actual or potential ecological risks exist,
- Identifying which contaminants pose a risk, and
- Generating data to be used in evaluating remedial activities.

FWIA
Fish and Wildlife Impact Assessment

Consistent with New York State Guidance (*Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites,* October 1994, NYSDEC Division of Fish and Wildlife), the ecological risk assessment will follow the first two steps of a Fish and Wildlife Impact Assessment (FWIA).

- Step I: Site Description: a. site maps; b. description of fish and wildlife resources; and c. description of fish and wildlife resource values.

- Step II: Contaminant-Specific Impact Assessment: a. pathway analysis; b. criteria-specific screening; and c. toxic effect analysis.

Step I: Site Description

Step I includes site mapping, field observations of the value of fish and wildlife resources at and in the vicinity of the site, and identification of applicable fish and wildlife regulatory criteria. To accomplish this task, two biologists will perform a two-day field investigation. Prior to the field investigation, the biologists will develop a base map from available topographical and aerial photography maps and use this information to develop a preliminary covertype map of the area within a 0.5-mile radius of the site. Additionally, federal and state natural resource agencies will be contacted regarding endangered, threatened, and special-concern plants and animals; significant fish and wildlife resources; and federal and state-designated freshwater wetlands present within 2 miles of the site. In the field, the biologists will confirm and extend the covertype map, identifying vegetative species and current land uses. It is anticipated that a sustained effort to identify species occurring within each covertype will not be necessary unless endangered or threatened species are identified. Observations of various species will be noted while completing the covertype survey.

Step II: Contaminant-Specific Impact Assessment

Step II of the FWIA (Contaminant-Specific Impact Assessment) is an iterative process. For planning purposes, E & E assumes that only elements A (pathway analysis) and B (criteria-specific screening) will be performed. In the pathway analysis, potential pathways of contaminant migration and exposure are identified. If potential pathways are identified, a criteria-specific screening will be performed using published numerical criteria established for specific media or biota. If numerical criteria are exceeded, then the need for further analysis of toxic effects is usually required. E & E will develop a scope of work for additional components of the ecological risk assessment if the initial analysis indicates that fish

and wildlife resources are potentially exposed to toxic levels of site-related contaminants of concern.

3.5 Task 5: Feasibility Studies

The FS determines which areas of the site may require cleanup and evaluates alternative approaches to meeting cleanup objectives. The description of the FS in Work Element II of the Superfund Standby Contract calls for FSs that follow the TAGM 4030, *Selection of Remedial Actions at Inactive Hazardous Waste Sites*. In general, this guidance calls for:

- Development of remedial action objectives;
- Identification and screening of remedial technologies;
- Assembly of remedial technologies into remedial alternatives;
- Preliminary screening of remedial alternatives to reduce the number of retained alternatives;
- Detailed analysis of the retained alternatives; and
- Selection of remedy.

However, in the eight years since the publication of this TAGM, experience has been gained in the evaluation and application of remedial technologies, including the remediation of PCB-contaminated sites. Therefore, this process can be streamlined in order to more cost-effectively select a remedy for the site, while still ensuring that a full range of options has been considered. For the FS, E & E assumes that the process can be streamlined to minimize discussion of the identification and screening of technologies and to eliminate the need for a preliminary screening of remedial alternatives. Thus, the process to be followed for the FS is:

- Development of remedial action objectives;
- Identification of technologies appropriate for treating the types of contaminants present;
- Assembly of technologies into alternatives;
- Detailed analysis of alternatives; and
- Selection of remedy.

Each of these components is discussed below.

3.5.1 Development of Remedial Action Objectives

The first step in the FS process is to determine which areas may require remediation. This is accomplished by first developing cleanup goals. Cleanup goals are set for each medium based on medium-specific receptors and exposure routes. A quantitative risk assessment is not being performed for this site; thus, cleanup goals cannot be back-calculated from acceptable risk levels for assumed or observed site-specific exposure routes. Instead, applicable or relevant and appropriate requirements (ARARs) or other guidances to be considered (TBCs) will be used to establish cleanup goals.

ARARs
applicable or relevant and appropriate requirements

TBC
to be considered

MCLs
maximum contaminant levels

No ARARs have been established for soil, except for certain compounds such as PCBs. Thus, cleanup goals require consideration of TBC guidance values, several of which use typical exposure scenarios to calculate soil contaminant concentrations that correspond to acceptable carcinogenic and systemic contaminant risks. These TBC guidance values include the *Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC TAGM 4046), the EPA SSLs, and the EPA Region III Screening Values.

For groundwater, the process is more straightforward. All groundwater in New York is considered a drinking water resource, and therefore subject to state drinking water standards. Class GA maximum contaminant levels (MCLs) will be considered ARARs for the groundwater at each site.

Once the cleanup goals have been set, the area requiring remediation will be determined by comparing the RI data to the cleanup goals.

3.5.2 Development of Remedial Alternatives

Development of remedial alternatives involves identifying technologies appropriate for treating the types of wastes identified in the RI and assembling those technologies into alternatives. Both treatment technologies and containment technologies will be identified. As discussed in Section 3.4, because of the relatively mature nature of treatment technologies for treating PCB-contaminated soils, it is unlikely that a screening process would be required to reduce the number of technologies to be used in alternatives. However, new or innovative technologies that may offer cost or effectiveness advantages will be considered and used in alternatives as appropriate.

Once appropriate technologies have been identified, they will be assembled into alternatives. For example, one alternative may include pumping and treatment of the groundwater on or off site. The alternatives will provide a clear definition of the technologies they incorporate and will span the range of approaches from no action to full site remediation. E & E assumes that approximately five alternatives will be developed for each site, and that each alternative will address all contaminated media.

3.5.3 Detailed Analysis of Remedial Alternatives

In this component of the FS, each alternative will be fully described (including development of capital, operation and maintenance [O & M], and present worth costs), and then evaluated both individually and comparatively. The individual evaluations will analyze each alternative against the following seven criteria:

O&M
operation and maintenance

- Short-term impacts and effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Implementability;
- Cost;
- Compliance with ARARs and TBCs (as appropriate); and
- Overall protection of human health and the environment.

Consideration will also be given to site-specific criteria, public acceptance, and site redevelopment issues. Following individual analyses, the alternatives will be comparatively reviewed and evaluated.

3.5.4 Selection of Remedy

Based on the evaluation in the detailed analysis, E & E will select a remedy that is protective of human health and the environment, cost-effective, and meets ARARs to the extent practicable. The selection of remedy will be made considering a preference for alternatives that include, as a principal element, treatment that significantly and permanently reduces volume, toxicity, and/or mobility of contaminants. A conceptual design of the selected remedy will also be presented.

3.6 Task 6: Support Activities

E & E will provide support to NYSDEC in its Citizen Participation Activities. E & E will attend two public meetings. The first will be to present the draft final work plan to the public. The second will be to present the final RI/FS to the public as part of the proposed remedial action plan/record of decision (PRAP/ROD) process. E & E's support activities may also include review of citizen participation documents (e.g., Citizen Participation Plan, fact sheets, announcements, press releases and media contacts, PRAP, ROD and Responsiveness Summary) for technical accuracy and preparation of up to three specialized figures or diagrams for presentation at the public meetings.

PRAP/ROD
proposed remedial action plan/record of decision

4 Schedule

The project schedule is presented on Figure 4-1.

ecology and environment, inc.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Project: Luzerne Road Site

Project No.: 000699QQ08000100

TDD/PAN No.:

Project Location: Luzerne Road, Glens Falls, NY

Proposed Date of Field Activities: Summer 1999

Project Director: Jon Sundquist

Project Manager: Stephen Blair

Prepared by: Julie Barclay Date Prepared: 4/1/99

Approved by: Keith Horn Date Approved: 4/13/99

1. INTRODUCTION

1.1 POLICY

It is E & E's policy to ensure the health and safety of its employees, the public, and the environment during the performance of work it conducts. This site-specific health and safety plan (SHASP) establishes the procedures and requirements to ensure the health and safety of E & E employees for the above-named project. E & E's overall safety and health program is described in *Corporate Health and Safety Program for Toxic and Hazardous Substances* (CHSP). After reading this plan, applicable E & E employees shall read and sign E & E's Site-Specific Health and Safety Plan Acceptance form.

This SHASP has been developed for the sole use of E & E employees and is not intended for use by firms not participating in E & E's training and health and safety programs. Subcontractors are responsible for developing and providing their own safety plans.

This SHASP has been prepared to meet the following applicable regulatory requirements and guidance:

Applicable Regulation/Guidance
29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER)
Other:

1.2 SCOPE OF WORK

Description of Work: Work will consist of: 1) the surveying of all sample points, geoprobe borehole locations, monitoring wells, etc., 2) monitoring well and geoprobe borehole installation, 3) subsurface soil, surface water and sediment sampling, 4) monitoring well development, purging, and sampling as well as groundwater and leachate level monitoring.

Equipment/Supplies: Attachment 1 contains a checklist of equipment and supplies that will be needed for this work.

The following is a description of each numbered task:

Task Number	Task Description
1	Surveying
2	Monitoring well and geoprobe borehole installation
3	Residential soil sampling
4	Surface water and sediment sampling
5	Monitoring well development and groundwater sampling
6	Aquifer testing
7	Groundwater and leachate level monitoring

1.3 SITE DESCRIPTION

Site Map: A site map or sketch is attached at the end of this plan. (Figures 1 and 2)

Site History/Description (see project work plan for detailed description): A soil remediation effort was conducted on the property in the early 1980s. This remediation appears to have failed, and PCB contamination has spread into the surrounding soil, and possibly the local groundwater.

Is the site currently in operation? ☐ Yes ☐ No

Locations of Contaminants/Wastes: _____

_____

_____

Types and Characteristics of Contaminants/Wastes:

☒ Liquid	☒ Solid	☐ Sludge	☒ Gas/Vapor
☐ Flammable/Ignitable	☒ Volatile	☐ Corrosive	☐ Acutely Toxic
☐ Explosive	☐ Reactive	☒ Carcinogenic	☐ Radioactive
☐ Medical/Pathogenic	Other: _____		

2. ORGANIZATION AND RESPONSIBILITIES

E & E team personnel shall have on-site responsibilities as described in E & E's standard operating procedure (SOP) for Site Entry Procedures (GENTECH 2.2) The project team, including qualified alternates, is identified below.

Name	Site Role/Responsibility
Jon Nickerson	Project/Task Manager
Bob Meyers	Site Safety Officer
Bob Meyers	Field Team Leader
Greg Jones	Team Member

3. TRAINING

Prior to work, E & E team personnel shall have received training as indicated below. As applicable, personnel shall have read the project work plan, sampling and analysis plan, and/or quality assurance project plan prior to project work.

Training	Required
40-Hour OSHA HAZWOPER Initial Training and Annual Refresher (29 CFR 1910.120)	X
Annual First Aid/CPR	X
Hazard Communication (29 CFR 1910.1200)	X
40-Hour Radiation Protection Procedures and Investigative Methods	
8-Hour General Radiation Health and Safety	

Training	Required
Radiation Refresher	
DOT and Biannual Refresher	
Other:	

4. MEDICAL SURVEILLANCE

4.1 MEDICAL SURVEILLANCE PROGRAM

E & E field personnel shall actively participate in E & E's medical surveillance program as described in the CHSP and shall have received, within the past year, an appropriate physical examination and health rating.

E & E's health and safety record (HSR) form will be maintained on site by each E & E employee for the duration of his or her work. E & E employees should inform the site safety officer (SSO) of any allergies, medical conditions, or similar situations that are relevant to the safe conduct of the work to which this SHASP applies.

Is there a concern for radiation at the site? ☐ Yes ☒ No
If no, go to 5.1.

4.2 RADIATION EXPOSURE

4.2.1 External Dosimetry

Thermoluminescent Dosimeter (TLD) Badges: TLD badges are required to be worn by all E & E field personnel on all E & E sites.

Pocket Dosimeters: _____

Other: _____

4.2.2 Internal Dosimetry

☐ Whole body count ☐ Bioassay ☐ Other

Requirements: _____

4.2.3 Radiation Dose

Dose Limits: E & E's radiation dose limits are stated in the CHSP. Implementation of these dose limits may be designated on a site-specific basis.

Site-Specific Dose Limits: _____

ALARA Policy: Radiation doses to E & E personnel shall be maintained as low as reasonably achievable (ALARA), taking into account the work objective, state of technology available, economics of improvements in dose reduction with respect to overall health and safety, and other societal and socioeconomic considerations.

5. SITE CONTROL

5.1 SITE LAYOUT AND WORK ZONES

Site Work Zones: Refer to the map or site sketch, attached at the end of this plan, for designated work zones.

Site Access Requirements and Special Considerations:

Illumination Requirements: All work to be completed in daylight hours.

Sanitary Facilities (e.g., toilet, shower, potable water): Portable toilet and clean water will be available on site.

On-Site Communications:

Other Site-Control Requirements:

5.2 SAFE WORK PRACTICES

Daily Safety Meeting: A daily safety meeting will be conducted for all E & E personnel and documented on the Daily Safety Meeting Record form or in the field logbook. The information and data obtained from applicable site characterization and analysis will be addressed in the safety meetings and also used to update this SHASP, as necessary.

Work Limitations: Work shall be limited to a maximum of 12 hours per day. If 12 consecutive days are worked, at least one day off shall be provided before work is resumed. Work will be conducted in daylight hours unless prior approval is obtained and the illumination requirements in 29 CFR 1910.120(m) are satisfied.

Weather Limitations: Work shall not be conducted during electrical storms. Work conducted in other inclement weather (e.g., rain, snow) will be approved by project management and the regional safety coordinator or designee.

Other Work Limitations: None.

Buddy System: Field work will be conducted in pairs of team members according to the buddy system.

Line of Sight: Each field team member shall remain in the line of sight and within verbal communication of at least one other team member.

Eating, Drinking, and Smoking: Eating, drinking, smoking, and the use of tobacco products shall be prohibited in the exclusion and contamination reduction areas, at a minimum, and shall only be permitted in designated areas.

Contamination Avoidance: Field personnel shall avoid unnecessary contamination of personnel, equipment, and materials to the extent practicable.

Sample Handling: Protective gloves of a type designated in Section 7 will be worn when containerized samples are handled for

labeling, packaging, transportation, and other purposes.

Vermiculite Handling: Respiratory protection (i.e., high-efficiency particulate air filtration) is recommended when vermiculite is used to package samples into shipping containers (some vermiculite contains low concentrations of asbestos).

Other Safe Work Practices: _____

6. HAZARD EVALUATION AND CONTROL

6.1 PHYSICAL HAZARD EVALUATION AND CONTROL

Potential physical hazards and their applicable control measures are described in the following table for each task.

Hazard	Task Number	Hazard Control Measures
Biological (flora, fauna, etc.)	All	• Potential hazard: Ticks and poison ivy in wooded ares. • Establish site-specific procedures for working around identified hazards. • Other:
Cold Stress	NA	• Provide warm break area and adequate breaks. • Provide warm noncaffeinated beverages. • Promote cold stress awareness. • See *Cold Stress Prevention and Treatment* (attached at the end of this plan if cold stress is a potential hazard).
Compressed Gas Cylinders	2, 3, 4, 5, 7	• Use caution when moving or storing cylinders. • A cylinder is a projectile hazard if it is damaged or its neck is broken. • Store cylinders upright and secure them by chains or other means. • Other: OVA hydrogen tank
Confined Space	NA	• Ensure compliance with 29 CFR 1910.146. • See SOP for Confined Space Entry. Additional documentation is required. • Other:
Drilling	2, 3	• See SOP for Health and Safety on Drilling Rig Operations. Additional documentation may be required. • Other: _____ • Other:
Drums and Containers	2, 3, 5	• Ensure compliance with 29 CFR 1910.120(j). • Consider unlabeled drums or containers to contain hazardous substances and handle accordingly until the contents are identified. • Inspect drums or containers and assure integrity prior to handling. • Move drums or containers only as necessary; use caution and warn nearby personnel of potential hazards. • Open, sample, and/or move drums or containers in accordance with established procedures; use approved drum/container-handling equipment. • Other:

Hazard	Task Number	Hazard Control Measures
Electrical	2, 3	• Ensure compliance with 29 CFR 1910 Subparts J and S. • Locate and mark energized lines. • De-energize lines as necessary. • Ground all electrical circuits. • Guard or isolate temporary wiring to prevent accidental contact. • Evaluate potential areas of high moisture or standing water and define special electrical needs. • Other: _____
Excavation and Trenching	NA	• Ensure that excavations comply with and personnel are informed of the requirements of 29 CFR 1926 Subpart P. • Ensure that any required sloping or shoring systems are approved as per 29 CFR 1926 Subpart P. • Identify special personal protective equipment (PPE) (see Section 7) and monitoring (see Section 8) needs if personnel are required to enter approved excavated areas or trenches. • Maintain line of sight between equipment operators and personnel in excavations/trenches. Such personnel are prohibited from working in close proximity to operating machinery. • Suspend or shut down operations at signs of cave in, excessive water, defective shoring, changing weather, or unacceptable monitoring results. • Other: _____ • Other: _____
Fire and Explosion	2, 3	• Inform personnel of the location(s) of potential fire/explosion hazards. • Establish site-specific procedures for working around flammables. • Ensure that appropriate fire suppression equipment and systems are available and in good working order. • Define requirements for intrinsically safe equipment. • Identify special monitoring needs (see Section 8). • Remove ignition sources from flammable atmospheres. • Coordinate with local fire-fighting groups regarding potential fire/explosion situations. • Establish contingency plans and review daily with team members. • Other: _____
Heat Stress	All	• Provide cool break area and adequate breaks. • Provide cool noncaffeinated beverages. • Promote heat stress awareness. • Use active cooling devices (e.g., cooling vests) where specified. • See *Heat Stress Prevention and Treatment* (attached at the end of this plan if heat stress is a potential hazard).
Heavy Equipment Operation	2, 3	• Define equipment routes, traffic patterns, and site-specific safety measures. • Ensure that operators are properly trained and equipment has been properly inspected and maintained. Verify back-up alarms. • Ensure that ground spotters are assigned and informed of proper hand signals and communication protocols. • Identify special PPE (Section 7) and monitoring (Section 8) needs.

Hazard	Task Number	Hazard Control Measures
		• Ensure that field personnel do not work in close proximity to operating equipment. • Ensure that lifting capacities, load limits, etc., are not exceeded. • Other: _____
Heights (Scaffolding, Ladders, etc.)	NA	• Ensure compliance with applicable subparts of 29 CFR 1910. • Identify special PPE needs (e.g., lanyards, safety nets, etc.) • Other: _____
Noise	2, 3	• Establish noise level standards for on-site equipment/operations. • Inform personnel of hearing protection requirements (Section 7). • Define site-specific requirements for noise monitoring (Section 8). • Other: _____
Overhead Obstructions	2, 3	• Wear hard hat. • Other: _____
Power Tools	NA	• Ensure compliance with 29 CFR 1910 Subpart P. • Other: _____
Sunburn	All	• Apply sunscreen. • Wear hats/caps and long sleeves. • Other: _____
Utility Lines	2, 3	• Identify/locate existing utilities prior to work. • Ensure that overhead utility lines are at least 25 feet away from project activities. • Contact utilities to confirm locations, as necessary. • Other: _____
Weather Extremes	All	• Potential hazards: _____ • Establish site-specific contingencies for severe weather situations. • Provide for frequent weather broadcasts. • Weatherize safety gear, as necessary (e.g., ensure eye wash units cannot freeze, etc.). • Identify special PPE (Section 7) needs. • Discontinue work during severe weather. • Other: _____
Other:		• _____ • _____
Other:		• _____ • _____

6.2 CHEMICAL HAZARD EVALUATION AND CONTROL

6.2.1 Chemical Hazard Evaluation

Potential chemical hazards are described by task number in Table 6-1. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Table 6-1
CHEMICAL HAZARD EVALUATION

Task Number	Compound	Exposure Limits (TWA)			Dermal Hazard (Y/N)	Route(s) of Exposure	Acute Symptoms	Odor Threshold/ Description	FID/PID	
		PEL	REL	TLV					Relative Response	Ioniz. Poten. (eV)
1-7	Polychlorinated biphenyl 1242*	1 mg/m3 Sk	0.001 mg/m3 Sk	1 mg/m3 Sk	Y	Inh, Ing, Eye, Skin	Irritation of eyes, chloracne, liver damage	--- Butter-like	--- ---	---
1-7	Polychlorinated biphenyl 1254*	0.5 mg/m3 Sk	0.001 mg/m3 Sk	0.5 mg/m3 Sk	Y	Inh, Ing, Eye, Skin	Irritation of eyes, chloracne, liver damage	--- Butter-like	--- ---	---
1-7	Trichlorobenzene	---	---	---	Y	IInh, Ing, Eye, Skin	Irritation of eyes/skin/mucous membranes	--- Mothballs	100% ---	---

KEY:

* = Chemical is a known or suspected carcinogen.
--- = Information not available

PEL = Permissible Exposure Limit
REL = Recommended Exposure Limit
TLV = Threshold Limit Value
C = Ceiling Limit
CGH = Cough
CNS = Central Nervous System Effects
DIZZ = Dizziness
E/N/I = Eyes/Nose/Throat
FA = Fatigue
F/CC = fibers per cubic centimeter
GD = Giddiness
GI = Gastrointestinal Tract
HA = Headaches
INH = Inhalation
ING = Ingestion
IRR = Irritation
LFC = Lowest Feasible Concentration
LOC = Loss of Consciousness
MG/M3 = Milligrams per cubic meter
NAU = Nausea
PPM = Parts per million
PWP = Poor Warning Properties
URT = Upper Respiratory Tract
V = Vomiting
WK = Weakness
SK = Skin Notation
SP = Slow Pulse
STEL = Short Term Exposure Limit

6.2.2 Chemical Hazard Control

An appropriate combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below published exposure levels (see Section 6.2.1).

Applicable Engineering/Administrative Control Measures: None.

PPE: See Section 7.

6.3 RADIOLOGICAL HAZARD EVALUATION AND CONTROL

6.3.1 Radiological Hazard Evaluation

Potential radiological hazards are described below by task number. Hazard Evaluation Sheets for major known contaminants are attached at the end of this plan.

Task Number	Radionuclide	DAC (µCi/ml)	Route(s) of Exposure	Major Radiation(s)	Energy(s) (MeV)	Half-Life

6.3.2 Radiological Hazard Control

Engineering/administrative controls and work practices shall be instituted to reduce and maintain employee exposures to a level at or below the permissible exposure/dose limits (see sections 4.2.3 and 6.3.1). Whenever engineering/administrative controls and work practices are not feasible or effective, any reasonable combination of engineering/administrative controls, work practices, and PPE shall be used to reduce and maintain employee exposures to a level at or below permissible exposure/dose limits.

Applicable Engineering/Administrative Control Measures:

PPE: See Section 7.

7. LEVEL OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT

7.1 LEVEL OF PROTECTION

The following levels of protection (LOPs) have been selected for each work task based on an evaluation of the potential or known hazards, the routes of potential hazard, and the performance specifications of the PPE. On-site monitoring results and other information obtained from on-site activities will be used to modify these LOPs and the PPE, as necessary, to ensure sufficient personnel protection. The authorized LOP and PPE shall only be changed with the approval of the regional safety coordinator or designee. Level A is not included below because Level A activities, which are performed infrequently, will require special planning and addenda to this SHASP.

Task Number	B	C	D	Modifications Allowed
1		(X)	X	
2		(X)	X	
3		(X)	X	
4		(X)	X	
5		(X)	X	
6		(X)	X	
7		(X)	X	

Note: Use "X" for initial levels of protection. Use "(X)" to indicate levels of protection that may be used as site conditions warrant.

7.2 PERSONAL PROTECTIVE EQUIPMENT

The PPE selected for each task is indicated below. E & E's PPE program complies with 29 CFR 1910.120 and 29 CFR 1910 Subpart I and is described in detail in the CHSP. Refer to 29 CFR 1910 for the minimum PPE required for each LOP.

PPE	Task Number/LOP						
	1	2	3	4	5	6	7
Full-face APR		(X)	(X)				
PAPR							
Cartridges:							
H							
GMC-H		(X)	(X)				
GMA-H							
Other:							
Positive-pressure, full-face SCBA							
Spare air tanks (Grade D air)							
Positive-pressure, full-face, supplied-air system							
Cascade system (Grade D air)							
Manifold system							
5-Minute escape mask							
Safety glasses		X	X	X	X	X	X
Monogoggles							
Coveralls/clothing	X	X	X				

PPE	Task Number/LOP						
	1	2	3	4	5	6	7
Protective clothing:							
Tyvek	(X)	(X)	(X)	(X)	(X)	(X)	(X)
Saranex							
Other:							
Splash apron							
Inner gloves:							
Cotton							
Nitrile							
Latex							
Other:							
Outer gloves:							
Viton							
Rubber							
Neoprene							
Nitrile		X	X	X	X	X	X
Other:							
Work gloves	X	X	X	X	X	X	X
Safety boots (as per ANSI Z41)	X	X	X	X	X	X	X
Neoprene safety boots (as per ANSI Z41)		(X)	(X)	(X)			
Boot covers (type: _____)							
Hearing protection (type: _____)		X	X				
Hard hat		X	X				
Face shield							
Other:							
Other:							

8. HEALTH AND SAFETY MONITORING

Health and safety monitoring will be conducted to ensure proper selection of engineering/administrative controls, work practices, and/or PPE so that employees are not exposed to hazardous substances at levels that exceed permissible exposure/dose limits or published exposure levels. Health and safety monitoring will be conducted using the instruments, frequency, and action levels described in Table 8-1. Health and safety monitoring instruments shall have been appropriately calibrated and/or performance-checked prior to use.

Table 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]	
☐ PID (e.g., HNu IS-101) ☒ FID (e.g., OVA 128-GC)	2, 3, 4, 5, 6	VOCs	Breathing zone	Continuous	**Unknown Vapors** Background to 1 ppm: Level D 1 to 5 ppm above background: Level C 5 to 500 ppm above background: Level B >500 ppm above background: Level A	**Contaminant-Specific**
Oxygen Meter/Explosimeter	2, 3	O_2	Breathing zone	Continuous	**Oxygen** <19.5% or >22.0%: Evacuate area; eliminate ignition sources; reassess conditions. 19.5 to 22.0%: Continue work in accordance with action levels for other instruments.	**Explosivity** ≤10% LEL: Continue work in accordance with action levels for other instruments; monitor continuously for combustible atmospheres. >10% LEL: Evacuate area; eliminate ignition sources; reassess conditions.
Radiation Alert Monitor (Rad-mini or RAM-4)					<0.1 mR/hr: Continue work in accordance with action levels for other instruments. ≥0.1 mR/hr: Evacuate area; reassess work plan and contact radiation safety specialist.	
Mini-Ram Particulate Monitor					**General/Unknown** Evaluate health and safety measures when dust levels exceed 2.5 milligrams per cubic meter.	**Contaminant-Specific**
HCN/H_2S (Monitox)					≥4 ppm: Leave area and consult with SSO.	
Draeger Colorimetric Tubes					**Tube** **Action Level** **Action**	
Air Monitor/Sampler Type:_____ Sampling medium: _____					**Action Level** **Action**	

Table 8-1

HEALTH AND SAFETY MONITORING

Instrument	Task Number	Contaminant(s)	Monitoring Location	Monitoring Frequency	Action Levels[a]
Personal Sampling Pump Type:_____ Sampling medium: _____					**Action Level** **Action**
Micro R Meter					<2 mR/hr: Continue work in accordance with action levels for other instruments. 2 to 5 mR/hr: In conjunction with a radiation safety specialist, continue work and perform stay-time calculations to ensure compliance with dose limits and ALARA policy. >5 mR/hr: Evacuate area to reassess work plan and evaluate options to maintain personnel exposures ALARA and within dose limits.
Ion Chamber					See micro R meter action levels above.
Radiation Survey Ratemeter/Scaler with External Detector(s)					**Detector** **Action Level** **Action**
Noise Dosimeter (Sound Level Meter)					≤85 decibels as measured using the A-weighed network (dBa): Use hearing protection if exposure will be sustained throughout work shift. >85 dBA: Use hearing protection. >120 dBA: Leave area and consult with safety personnel.
Other:					
Other:					

a Unless stated otherwise, airborne contaminant concentrations are measured as a time-weighted average in the worker's breathing zone. Acceptable concentrations for known airborne contaminants will be determined based on OSHA/NIOSH/ACGIH and/or NRC exposure limits. As a guideline, 1/2 the PEL/REL/TLV, whichever is lower should be used.

9. DECONTAMINATION PROCEDURES

All equipment, materials, and personnel will be evaluated for contamination upon leaving the exclusion area. Equipment and materials will be decontaminated and/or disposed and personnel will be decontaminated, as necessary. Decontamination will be performed in the contamination reduction area or any designated area such that the exposure of uncontaminated employees, equipment, and materials will be minimized. Specific procedures are described below.

Equipment/Material Decontamination Procedures (specified by work plan): All down-hole drilling equipment will be decontaminated with a high pressure steam cleaner. All other equipment will be washed with an alconox-clean water solution and triple rinsed with dionized water. Dedicated equipment will be used whenever possible.

Ventilation: All decontamination procedures will be conducted in a well-ventilated area.

Personnel Decontamination Procedures: Remove outer gloves, booties (if worn), and Tyvek (if worn), then remove inner gloves (if worn). Hand wipes should be available on site.

PPE Requirements for Personnel Performing Decontamination: Surgical gloves, safety glasses.

Personnel Decontamination in General: Following appropriate decontamination procedures, all field personnel will wash their hands and face with soap and potable water. Personnel should shower at the end of each work shift.

Disposition of Disposable PPE: Disposable PPE must be rendered unusable and disposed as indicated in the work plan.

Disposition of Decontamination Wastes (e.g., dry wastes, decontamination fluids, etc.): All decontamination fluids are to be drummed. All dry wastes (PPE, etc.) to be double bagged and disposed of at a specified off-site location (TBD).

10. EMERGENCY RESPONSE

This section contains additional information pertaining to on-site emergency response and does not duplicate pertinent emergency response information contained in earlier sections of this plan (e.g., site layout, monitoring equipment, etc.). Emergency response procedures will be rehearsed regularly, as applicable, during project activities.

10.1 EMERGENCY RESPONSIBILITIES

All Personnel: All personnel shall be alert to the possibility of an on-site emergency; report potential or actual emergency situations to the team leader and SSO; and notify appropriate emergency resources, as necessary.

Team Leader: The team leader will determine the emergency actions to be performed by E & E personnel and will direct these actions. The team leader also will ensure that applicable incidents are reported to appropriate E & E and client project personnel and government agencies.

SSO: The SSO will recommend health/safety and protective measures appropriate to the emergency.

Other: _____

_____

10.2 LOCAL AND SITE RESOURCES (including phone numbers)

Ambulance: 518/792-1119 (Empire Ambulance Svc., 46 Mohican St.)

Hospital: Glens Falls Hospital, 100 Park St. Gen. Info. Line 518/792-3151

Directions to Hospital (map attached at the end of this plan): Take Luzerne Road east, which merges with Broad Street (Main St.). Continue east, turn right onto School St. Hospital in on Park St. located at end of school (see maps of area).

_____

Poison Control: 1-800-336-6997

Police Department: 911

Fire Department: 911

Client Contact: _____

Site Contact: _____

On-Site Telephone Number: _____

Cellular Telephone Number: _____

Radios Available: _____

Other: _____

10.3 E & E EMERGENCY CONTACTS

E & E Emergency Response Center (24 Hours):	716/684-8940
Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)
Regional Office Contact:	_____ (office) _____ (home)
Other:	_____ (office)
a. E & E Emergency Response Center:	716/684-8940
b. Corporate Health and Safety Director, Dr. Paul Jonmaire:	716/684-8060 (office) 716/655-1260 (home)
c. Corporate Safety Officer, Tom Siener	716/684-8060 (office) 716/662-4740 (home)

10.4 OTHER EMERGENCY RESPONSE PROCEDURES

On-Site Evacuation Signal/Alarm (must be audible and perceptible above ambient noise and light levels): _____

_____

On-Site Assembly Area: TBD

Emergency Egress Route to Get Off Site: TBD

Off-Site Assembly Area: TBD

Preferred Means of Reporting Emergencies: Report to FTL; call 911, if necessary.

Site Security and Control: In an emergency situation, personnel will attempt to secure the affected area and control site access.

Emergency Decontamination Procedures: TBD

PPE: Personnel will don appropriate PPE when responding to an emergency situation. The SSO and Section 7 of this plan will provide guidance regarding appropriate PPE.

Emergency Equipment: Appropriate emergency equipment is listed in Attachment 1. Adequate supplies of this equipment shall be maintained in the support area or other approved work location.

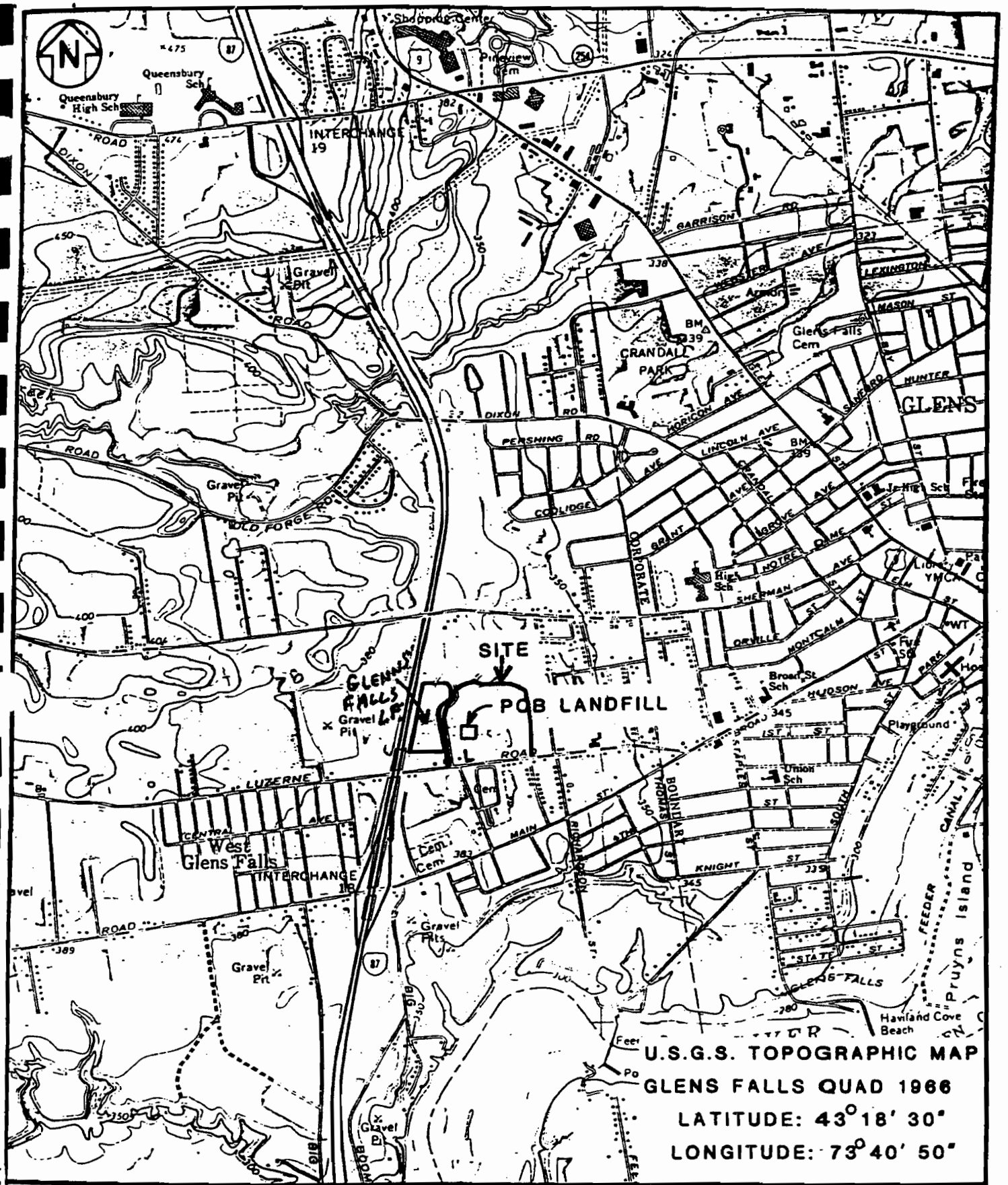
Incident Reporting Procedures: Report to FTL and regional safety coordinator; complete incident report form.

ATTACHMENT 1
EQUIPMENT/SUPPLIES CHECKLIST

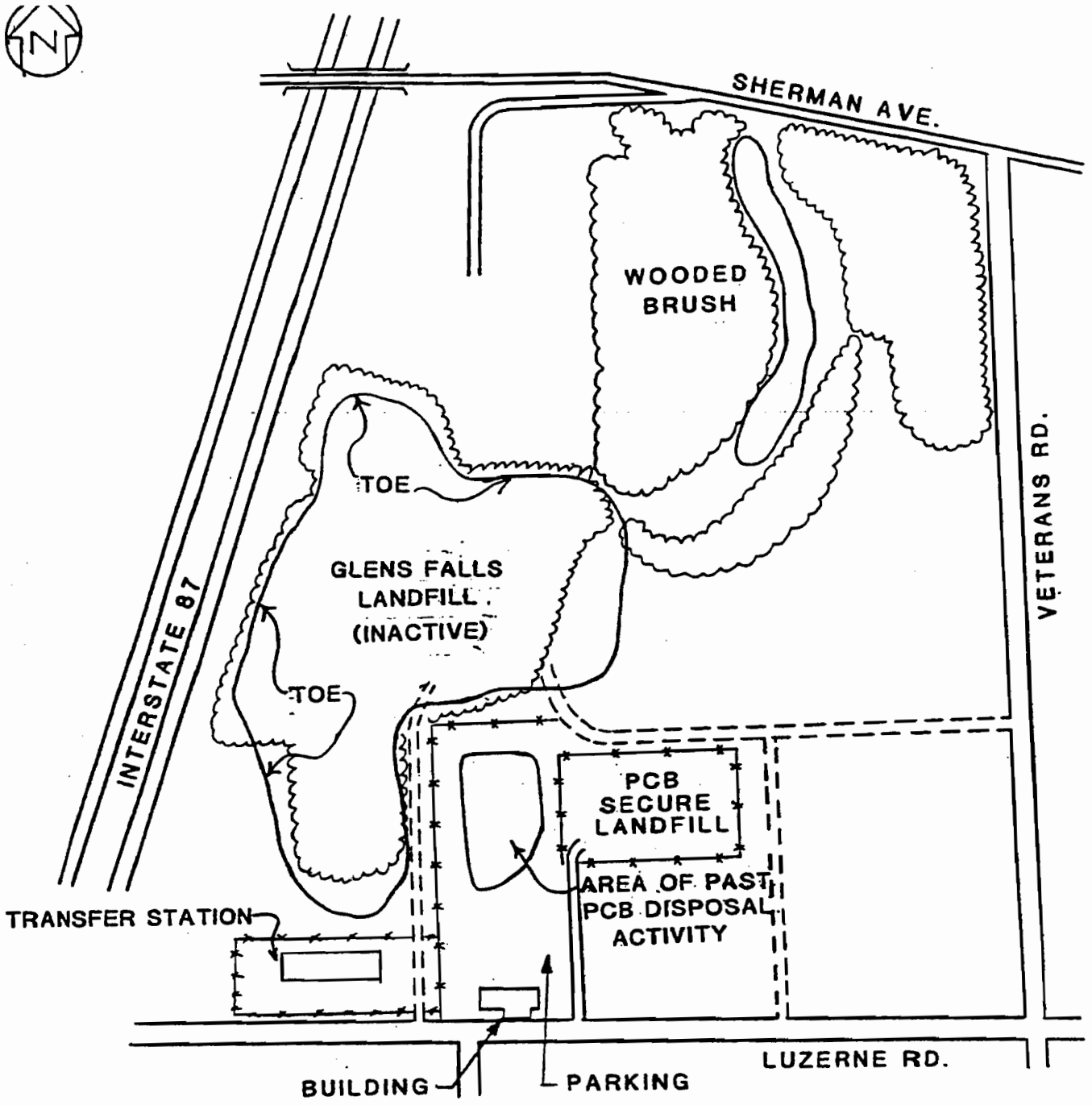
INSTRUMENTATION	No.	EMERGENCY EQUIPMENT	No.
OVA	1	First aid kit	1
Thermal desorber		Stretcher	
O_2/explosimeter w/cal. kit	1	Portable eye wash	1
Photovac tip		Blood pressure monitor	
HNu (probe: _____eV)		Fire blanket	
Magnetometer		Fire extinguisher	1
Pipe locator		Thermometer (medical)	
Weather station		Spill kit	
Draeger tube kit (tubes: _____)			
Brunton compass			
Real-time cyanide monitor			
Real-time H_2S monitor			
Heat stress monitor			
Noise equipment		**DECONTAMINATION EQUIPMENT**	
Personal sampling pumps and supplies		Wash tubs	
MiniRam dust monitor		Buckets	1
Mercury monitor		Scrub brushes	1
Spare batteries (type: _____)		Pressurized sprayer	
		Spray bottle	1
		Detergent (type: alconox)	1
RADIATION EQUIPMENT/SUPPLIES		Solvent (type: _____)	
Documentation forms		Plastic sheeting	1
Portable ratemeter		Tarps and poles	
Scaler/ratemeter		Trash bags	1
1" NaI gamma probe		Trash cans	
2" NaI gamma probe		Masking tape	
ZnS alpha probe		Duct tape	1
GM pancake probe		Paper towels	1
Tungsten-shielded GM probe		Face mask	
Micro R meter		Face mask sanitizer	
Ion chamber		Step ladders	
Alert monitor		Distilled water	
Pocket dosimeter		Deionized water	1
Dosimeter charger			
Radiation warning tape			
Radiation decon supplies			
Spare batteries (type:)			

ATTACHMENT 1
EQUIPMENT/SUPPLIES CHECKLIST

SAMPLING EQUIPMENT		MISCELLANEOUS (Cont.)	
8-oz. bottles	X	Gatorade or equivalent	X
Half-gallon bottles		Tables	
VOA bottles	X	Chairs	
String	X	Weather radio	
Hand bailers	X	Two-way radios	
Thieving rods with bulbs		Binoculars	
Spoons	X	Megaphone	
Knives		Cooling vest	
Filter paper			
Bottle labels	X		
		SHIPPING EQUIPMENT	
		Coolers	X
MISCELLANEOUS		Paint cans with lids, 7 clips each	
Pump	X	Vermiculite	
Surveyor's tape		Shipping labels	X
100' Fiberglass tape		DOT labels:	X
300' Nylon rope		"Up"	
Nylon string		"Danger"	
Surveying flags		"Inside Container Complies ..."	
Camera	X	Hazard Group	
Film		Strapping tape	X
Bung wrench	X	Baggies	X
Soil auger	X	Custody seals	X
Pick		Chain-of-custody forms	X
Shovel		Federal Express forms	X
Catalytic heater		Clear packing tape	X
Propane gas		Permanent markers	X
Banner tape			
Surveying meter stick			
Chaining pins and ring			
Logbooks (large, small)	X		
Required MSDSs	X		
Intrinsically safe flashlight			
Potable water			



Scale: 1=24000			GLENS FALLS LANDFILL GLENS FALLS, N.Y. N.Y.S. SUPERFUND PHASE II	VICINITY MAP
	By	Date		
Dwn.	DLS	3/86		
Ckd.	SSN	3/87		
Ap'vd.	PFA	3/87		
Rev.				
			Project No. 5C280101	A FIGURE 1



LUZERNE ROAD

BRUNING	Scale: NTS		LANDFILL GLENS FALLS N.Y.	SITE MAP
		By / Date		
	Dwn.	MJS 3/86		
	Ckd.	SSN 7/86		
	Ap'vd.	DFA 7/87		
	Rev.	SSN 2/87	Project No. 5C280101	A FIGURE 2

61160-1

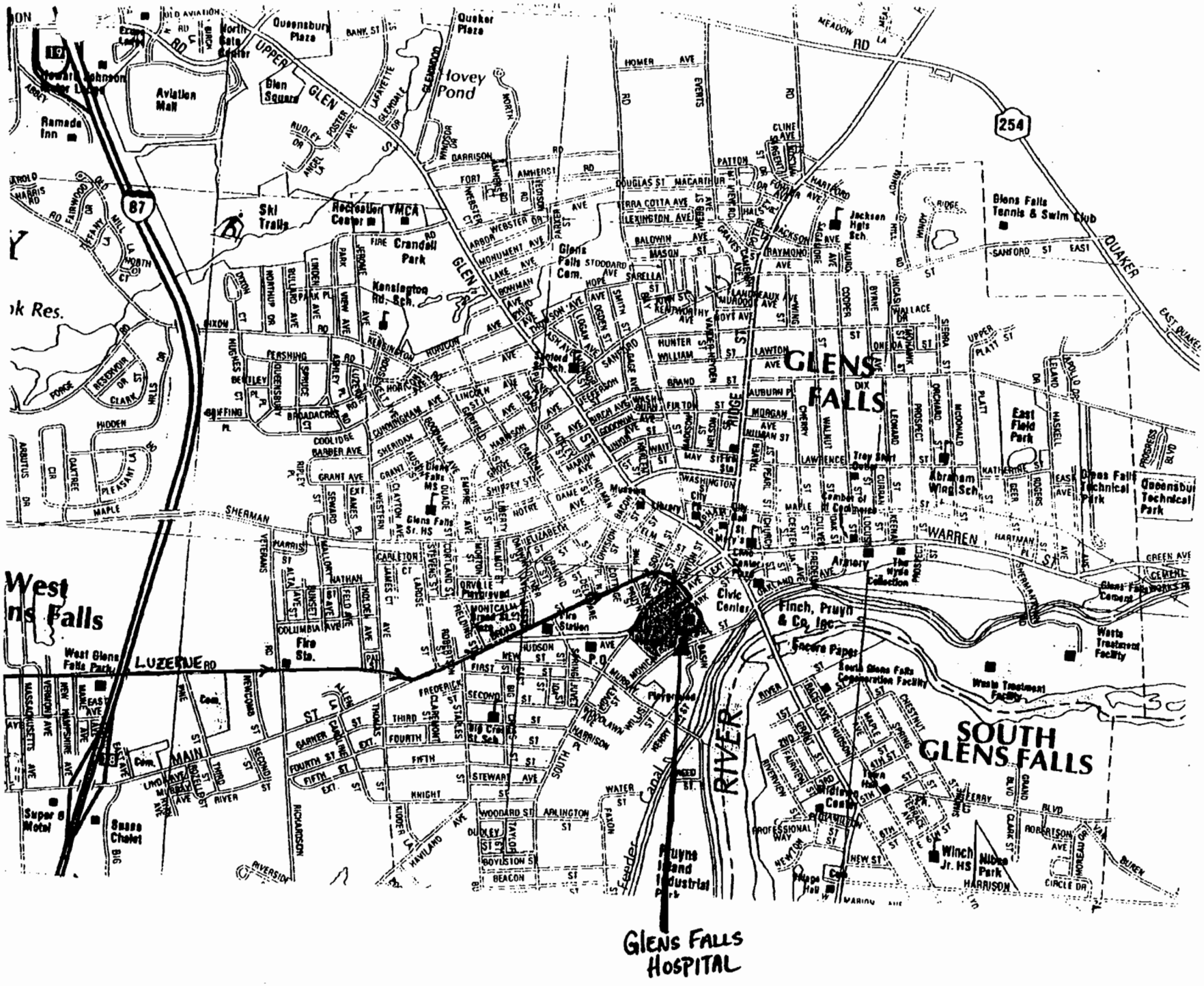


Figure 3 MAP TO HOSPITAL

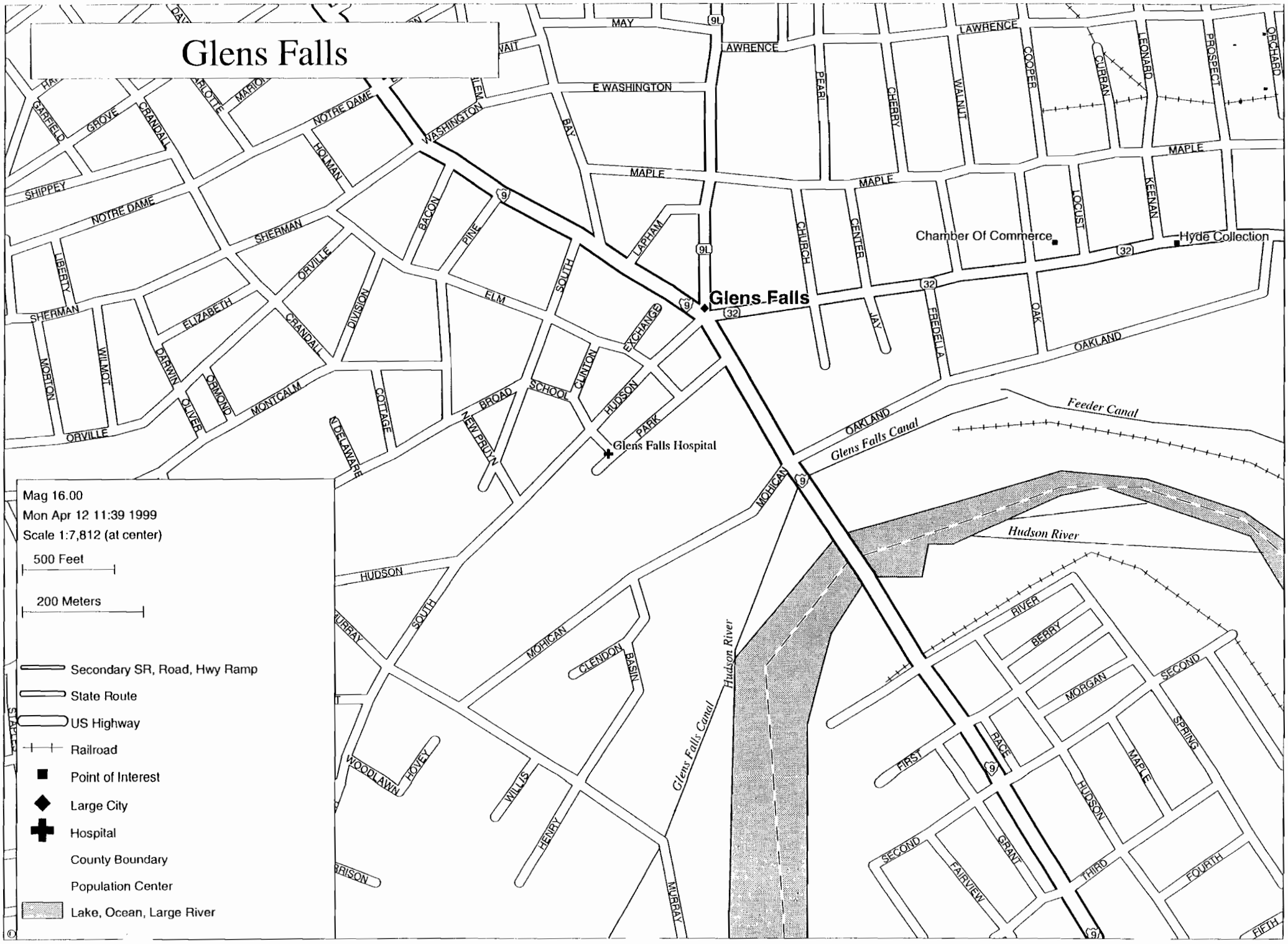


Figure 4 DETAILED M. OF HOSPITAL AREA

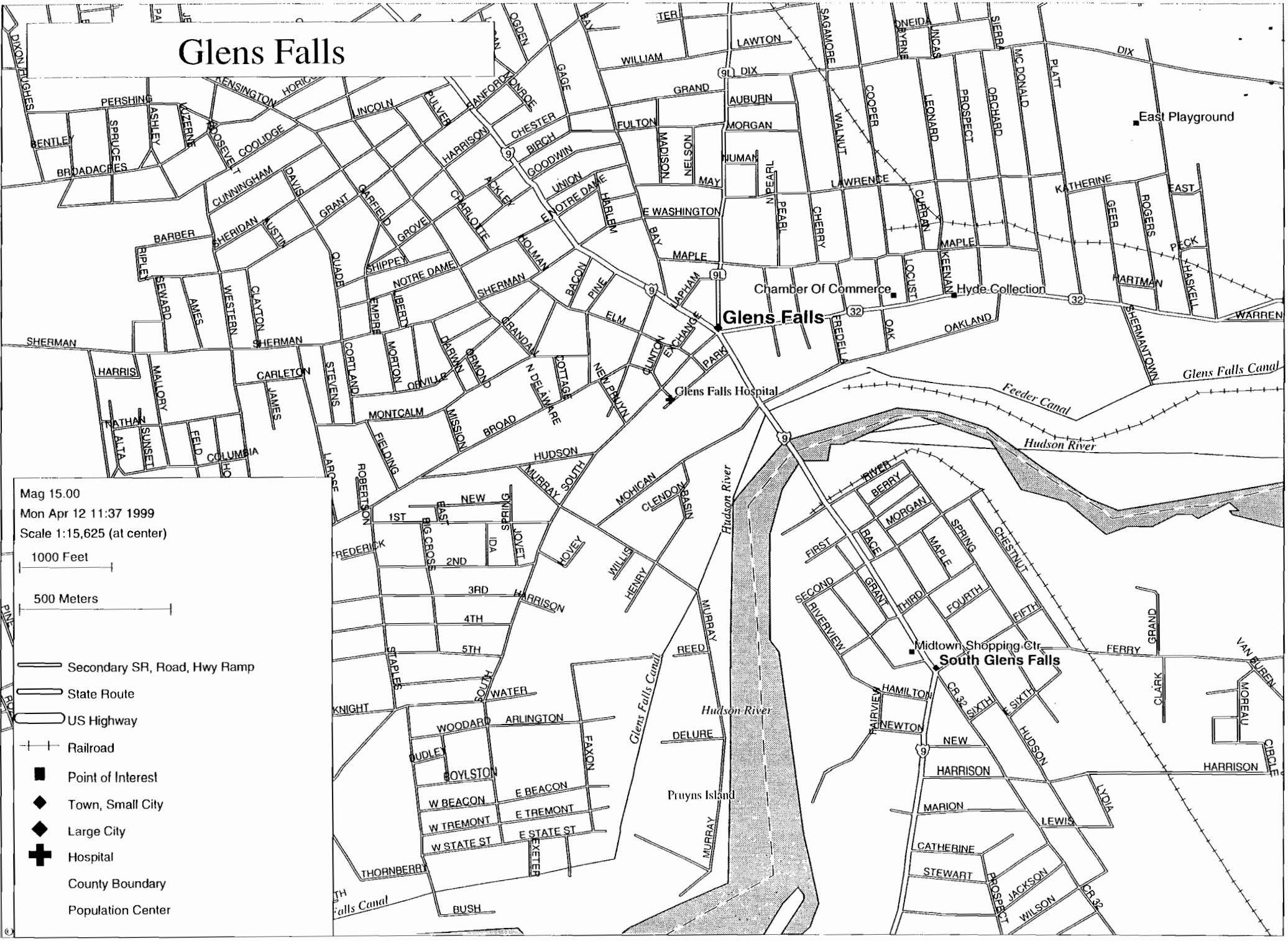


Figure 5 MAP OF HOSPITAL AREA

CHEMICAL NAME: Polychlorinated biphenyl 1242*
CAS NUMBER: 53469-21-9 DOT NAME/ID NO:
SYNONYMS: PCB; POLYCHLORINATED BIPHENYL; AROCHLOR 1242; CHLORODIPHENYL; CHLORINAT

CHEMICAL AND PHYSICAL PROPERTIES:
CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: 1.3 SOLUBILITY: Insoluble in water
PHYSICAL STATE: Colorless to dark liquid
FLAMMABLE LIMITS: -- FLASH POINT:
VAPOR PRESSURE: 0.001 mm Hg @ 20 C FREEZING POINT: -19 C BOILING POINT:
ODOR CHARACTERISTIC: Butter-like Incompatabilities: Oxidizers, chlorine, plastics, rubber, coatings

BIOLOGICAL PROPERTIES:
IDLH: 0.950 PPM TLV-TWA : 1 mg/m3 Sk PEL - TWA: 1 mg/m3 Sk ODOR THRESHOLD: ---
HUMAN (LCLO): TCLO 10 mg/m3 RAT/MOUSE (LC50): LD50: 425 mg/kg
CARCINOGEN: Suspect TERATOGEN: No AQUATIC:
ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):
Personal protection:

Gloves:

E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:
Monitoring:

HEALTH HAZARDS:
Acute Symptoms: Irritation of eyes, chloracne, liver damage

Chronic Symptoms: ---

FIRST AID:
FIRST AID-INHAL:
FIRST AID-EYE:
FIRST AID-SKIN:

DISPOSAL/WASTE TREATMENT:
DISPOSAL OF WASTE:

CHEMICAL NAME: Polychlorinated biphenyl 1254*

CAS NUMBER: 11097-69-1 DOT NAME/ID NO:

SYNONYMS: PCB; POLYCHLORINATED BIPHENYL; AROCHLOR 1254; CHLORODIPHENYL; CHLORINAT

CHEMICAL AND PHYSICAL PROPERTIES:

CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: SOLUBILITY:

PHYSICAL STATE:

FLAMMABLE LIMITS: FLASH POINT:

VAPOR PRESSURE: FREEZING POINT: BOILING POINT:

ODOR CHARACTERISTIC: Butter-like Incompatabilities:

BIOLOGICAL PROPERTIES:

IDLH: 0.380 PPM TLV-TWA : 0.5 mg/m3 Sk PEL - TWA: 0.5 mg/m3 Sk ODOR THRESHOLD: ---

HUMAN (LCLO): RAT/MOUSE (LC50):

CARCINOGEN: TERATOGEN: AQUATIC:

ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):

Personal protection:

Gloves:

E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:

Monitoring:

HEALTH HAZARDS:

Acute Symptoms: Irritation of eyes, chloracne, liver damage

Chronic Symptoms: ---

FIRST AID:

FIRST AID-INHAL:

FIRST AID-EYE:

FIRST AID-SKIN:

DISPOSAL/WASTE TREATMENT:

DISPOSAL OF WASTE:

ecology and environment, inc.

Job No: 000699.QQ08.00.01.00 HAZARD EVALUATION OF CHEMICALS PREPARATION DATE: 4/11/95

CHEMICAL NAME: Trichlorobenzene

CAS NUMBER: 12002-48-1 DOT NAME/ID NO:

SYNONYMS: 1,2,3(solid) OR 1,2,4(liquid) OR 1,3,5 TRICHLOROBENZENE(solid)

CHEMICAL AND PHYSICAL PROPERTIES:

CHEMICAL FORMULA: MOLECULAR WEIGHT: SPG/D: SOLUBILITY:

PHYSICAL STATE:

FLAMMABLE LIMITS: FLASH POINT:

VAPOR PRESSURE: FREEZING POINT: BOILING POINT:

ODOR CHARACTERISTIC: Mothballs Incompatabilities:

BIOLOGICAL PROPERTIES:

IDLH: TLV-TWA : --- PEL - TWA: --- ODOR THRESHOLD: ---

HUMAN (LCLO): RAT/MOUSE (LC50):

CARCINOGEN: TERATOGEN: AQUATIC:

ROUTE OF EXPOSURE: Inh, Ing, Eye, Skin

HANDLING RECOMMENDATIONS (PERSONAL PROTECTIVE MEASURES):

Personal protection:

Gloves:

E = Excellent (> 8 hours); VG = Very Good (4 - 8 hrs); G = Good (1 - 4 hours); P = Poor (< 1 hour)

MONITORING RECOMMENDATIONS:

Monitoring:

HEALTH HAZARDS:

Acute Symptoms: Irritation of eyes/skin/mucous membranes

Chronic Symptoms: ---

FIRST AID:

FIRST AID-INHAL:

FIRST AID-EYE:

FIRST AID-SKIN:

DISPOSAL/WASTE TREATMENT:

DISPOSAL OF WASTE:

Heat Stress Prevention, Recognition, Treatment and Monitoring

1 INTRODUCTION

Field operations during the summer months can create a variety of hazards to E&E personnel. Of main concern are heat related injuries, which may become health or life threatening if not properly treated. Therefore, it is important that all E&E personnel be knowledgeable in the preventive measures, symptom recognition, and effective treatment procedures for heat related injuries.

2. SCOPE

This standard operating procedure (SOP) describes the symptoms and treatment for the classical types of heat stress: heat cramps, heat exhaustion, and heat stroke. Field personnel should take immediate action to prevent a less severe form of heat stress from escalating into one requiring hospital treatment.

In addition, this SOP recommends ways to avoid heat stress, such as frequent rest periods, carefully timed excursions in protective clothing, and monitoring heart rate and body temperature. The site Safety Officer (SSO) has overall responsibility for seeing that these guidelines are followed in the field. However, each individual must be cautious when working in conditions where heat stress is possible.

3. OBJECTIVES

The prevention of heat stress is of paramount importance for field personnel particularly when they must wear heavy of confining protective clothing. The SSO must ensure that all personnel monitor themselves for possible heat stress, and know what to do in a heat emergency. For example, a person who recognizes the symptoms of heat stroke can provide lifesaving first-aid to another, while medical assistance is summoned.

4 EFFECTS OF HEAT

The body's complex thermoregulatory system, links the main organs, the blood supply, the central nervous system and the skin. The central nervous system regulates the requirement for cooling of the main organs; the organs are cooled by the flow of blood; the blood is cooled through it's routing through the skin; and the skin is cooled through the actions of the environment (temperature, humidity, and air movement). This system keeps the body temperature within a small operating range maintaining a delicate balance between heat gains and loss. An internal body "core" temperature of 99° F is considered normal. Depending on a person's individual body systems and their physical activity core temperatures may vary between 97° F and 101° F. *NOTE- A core temperature of more than 101° F in a healthy person is cause for concern, as temperatures nearing 105° F may be life threatening.*

Through the normal processes within the body, a predictable amount of heat is generated. When this heat is lost at a rate higher than its production, the body stays cool. As a person's activities increase, so too does the amount of heat generated by the body. As accumulated heat increases the body's temperature, various processes within the body speed up in an attempt to cool the body. This in turn, also increases the general temperature of the body. The results are that now; not only is there the normal heat to eliminate, but the additional heat created by the added work load **and** the heat created by heightened activity of the internal processes of the body. All of this heat must be reduced to allow the body to operate effectively. Unless the body is allowed to rest and cool, this vicious circle will inevitably lead to an over taxation of the body's cooling mechanisms to a point of exhaustion, and a complete shutdown.

Changes in any of the body's cooling system mechanism, such as loss of blood (injury), damage to the skin (sunburn), CNS damage (from chemical exposure) or environmental changes (heat, humidity, wind), will alter this system and at times over tax it to the point of injury.

5 HEAT INJURY PREVENTION

The most important prevention measures are information, knowledge and awareness. Through knowledge of heat stress injury symptoms, the conditions under which these injuries may occur, the preventative measures to be taken, and the treatment of these injuries, field personnel will be better prepared for dealing with these potentially life threatening injuries. Heat stress injury awareness is gained through information pertaining to:

- The environment in which work will be accomplished.
- The preventive measures that can be taken.
- The signs and symptoms of heat injuries.
- The treatment procedures for each type of injury.
- The condition and limitations of the working personnel (age, physical condition, health problems, past heat related injuries).
- The local EMS phone number (911 in effect?), and the location of the nearest medical treatment facility or first aid provider (fire department, police)

5.1 Preventative Measures

- Replenishment of lost fluids and salt.

  Although water and a balanced diet should replace most lost fluids and salts, increased activity and stress requires increased replenishment of these constituents. "Gatorade", or it's equivalent are designed for this purpose. It is recommended that these types of drinks, along with drinking water (not deionized) be available.
- Allow for rest breaks.

  Personnel working in hot climates should be allowed to remove themselves from direct sun exposure, or from any stressful environment (protection level) for a period of time to allow them to recuperate.

  When protective clothing (level C and above) must be worn by E&E personnel, the suggested guidelines for maximum wearing times (**per excursion**) and the rest/work periods (by level of protection) are noted on Tables 2 & 3.

- Revise Work Schedule.

  Take advantage of the cooler morning (5 to 10pm) and evening (6 to 9am) hours to perform work.

Table 1 indicates the apparent temperature felt by the body according to temperature and humidity. As noted, this figure does not take into account the effects brought by air movement (wind).

- Use of Cooling Vests.

  There are a variety of cooling vest types. Some vests contain pockets, situated in strategic places, which hold packets of cooled fluids; other vests may circulate cooled fluids throughout the vest. The cooled fluids aid the body in reducing skin temperature.

6 HEAT RELATED INJURIES

Heat related injuries can be classified into three major categories:

- Heat Cramps, - includes Heat Syncope, Heat Rash, and Heat Fatigue - (Transient)
- Heat Exhaustion (stress), and
- Heat Stroke.

In addition to these injuries, sunburn may at times, (depending on the severity) be considered a heat injury. Even the slightest damage to the skin, through sunburn, will reduce its effective cooling properties and heighten the probability of other heat injuries occurring. Personnel should avoid as much direct exposure to the sun as they can. The use of long sleeve shirts, long pants, hats and sun blocks (depending on the duration of the task) is highly recommended.

6.1 Heat Cramps

Heat cramps will usually affect individuals when their normal rate of perspiration increases. This increase in perspiration leads to a large loss of water and salt creating an imbalance of electrolytes within muscle cells. The first muscles to be affected by this loss are usually the larger muscles of the body; the abdomen and legs. The result produces very painful, and at times debilitating, cramps of the legs and abdominal muscles. Another form of heat cramp, sometimes called a "side stitch", may result from drinking iced water or other drinks too quickly or in too large a quantity prior to or immediately following increased activity.

6.1.1 Symptoms of Heat Cramps

- Muscle cramps in the legs and/or abdomen,
- Pain accompanying cramps,
- Profuse sweating, and
- Feeling faint.

6.1.2 Treatment of Heat Cramps

- Remove the patient from direct exposure to the sun.
- Administer small sips of liquid (water or equivalent replenishing fluid) if the patient is conscious.
- Apply light manual massaging to cramping muscles.
- Transport the patient to the hospital if the cramps persist or worsen.

6.2 Heat Syncope

This injury is normally experienced by those individuals required to stand immobile for long periods of time in hot environments. Heat Syncope is brought about by the lack of blood flow to the brain due to its pooling within dilated blood vessels and lower parts of the body. Heat syncope occurs quickly, and at most times without warning.

6.2.1 Symptoms of Heat Syncope

- Nausea,
- Dizziness, and
- Fainting.

Fainting (heat syncope), can be dangerous to those individuals controlling operations that require concentration, agility and coordination (i.e., heavy equipment).

6.1.2 Treatment of Heat Syncope

Heat syncope is treated in the same manner as heat cramps.

6.3 Heat Rash

Heat rash is brought about by an inflammatory reaction of sweat retained within the skin due to the plugging of sweat glands. Heat rash normally occurs in those areas of the body where an individual perspires the most (arm pits, legs, groin)

6.3.1 Symptoms of Heat Rash

- Profuse tiny raised red vesicles (blister-like)
- Prickly sensations in affected areas.

6.3.2 Treatment of Heat Rash

- Gently wash affected area with soap & water and blot dry.
- Keep affected areas of the body clean and dry (powder). Frequent cleaning throughout the work day may be required.
- Pay close attention to personal hygiene.
- If rash continues or worsens, seek medical attention.

6.4 Heat Exhaustion

Heat exhaustion is caused by over taxation of the cooling mechanism through the pooling of blood in the vessels of the skin. As heat is transported from the interior of the body to the skin, the blood vessels within the skin become dilated to hold and cool the increased amount of blood. This leads to a decrease in the amount of blood available for use throughout the rest of the body. The heart, reacting to the decrease in blood supply, increases its attempt (beat rate and pressure) to move available blood. The blood that can be moved by the heart is overheated, increasing the overall temperature of the body. In a continuing attempt to cool itself, the body increases the activity of other internal organs while decreasing the activity of still other "non-essential" organs. This condition, coupled with the loss of blood through its pooling in the skin, eventually leads to physical collapse.

6.4.1 Symptoms of Heat Exhaustion

- Weak pulse,
- Rapid and usually shallow breathing,
- Profuse perspiration,
- Fainting,
- Generalized weakness,
- Pale, clammy skin,
- Dizziness,
- Unconsciousness.

Fainting, caused by heat exhaustion, can be dangerous to those individuals operating machinery or controlling operations requiring concentration.

6.4.2 Treatment of Heat Exhaustion

- Remove the patient from direct exposure to the sun.
- Remove as much **outer** clothing as possible.
- Administer small sips of liquid (water or equivalent replenishing fluid) if the patient is conscious.
- Provide air movement to cool the patient (i.e., fan).
- Treat the patient for shock (cover, and raise legs).
- Transport the patient to the hospital if injury persists or worsens.

6.5 Heat Stroke

Heat stroke is a profound disturbance of the body's thermo-regulating mechanism, resulting in complete shutdown. It is usually associated with very high "core" temperature and collapse. At times heat stroke may result in convulsions, unconsciousness and even death. Direct exposure to sun, poor air circulation, poor physical conditioning, and advanced age (over forty) bear directly on the tendency of a person to suffer from heat stroke.

Heat stroke is a serious threat to life and carries a twenty-percent mortality rate.

6.5.1 Symptoms of Heat Stroke

- Dry, hot and flushed skin,
- Early loss of consciousness,
- Deep breathing at first, diminishing to shallow or absence,
- Body temperature reaching 105 to 106 degrees or higher, and
- Dilated pupils,
- Full and fast pulse,
- Muscle twitching, growing into convulsions,
- Sudden onset,

6.5.2 Treatment of Heat Stroke **THIS IS A MEDICAL EMERGENCY**

- Remove the patient from direct exposure to the sun.
- Remove as much clothing as possible.
- Reduce body temperature as fast as possible (water immersion, dousing and fanning). Cold packs may be placed under the armpits, in the groin area, around the neck, and/or around the ankles. The patient should **not** be immersed into ice water.
- Protect the patient from hurting themselves during any convulsions.
- Transport the patient to a medical treatment facility as soon as possible.

7 PREDISPOSING CONDITIONS

There are a number of predisposing conditions which heighten a person's susceptibility to heat injuries, that should be considered when personnel are required to work in hot environments. Some of these conditions are:

- **Job Requirement:**

  Where, when, how and how long a person is performing their required task relates directly to their exposure to the elements and their susceptibility to heat injury.

- **Age:**

  The older a person is, the more susceptible they are to suffering from a heat injury.

- **Weight:**

  Extra weight will require the body to work harder to keep it cool. Fat layers acts as depositories for blood and negatively insulate the skin.

- **Physical Condition:**

  The better physical condition a person is in, the less likely they are to suffer from a heat injury.

- **Health & Medications**:

  There are many health conditions, such as respiratory and circulatory maladies, pregnancy; and medications (i.e., blood pressure medications and some antibiotics), which increase a persons susceptibility to heat injury. E&E personnel known to fall in this category are restricted from working in high heat environments. This restriction is noted in the individuals' medical record.

- **Region of Abode:**

  Individuals who reside in a hot environment are less susceptible to heat injuries.

- **Acclimation:**

  Full acclimation requires approximately 2 weeks to develop. When feasible, revised work schedules should be planned to allow for acclimation. When full acclimation is not feasible, a work - rest cycle, which gradually increases heat exposure, should be used.

- **Alcohol Use:**

  Due to its effect on the circulatory system, the use of alcohol increases the risk of heat injury.

- **Tobacco Use:**

  Due to its effect on the circulatory system, the use of tobacco increases the risk of heat injury.

- **Prior Heat Injury:**

  A person who has suffered a heat injury is more prone to suffer another injury.

8 HEAT STRESS MONITORING

8.1 Personnel Monitoring

To fully understand the impact of the hot environment on the workers, and to prevent heat related injuries, monitoring of personnel should be accomplished. Two methods of measuring the effectiveness of an employee's rest-recovery regime follow the Brouha monitoring guidelines and the "modified" Brouha monitoring guidelines (see figure 1). The difference between the two is that in the "modified" guidelines the temperature of the individual is not used for monitoring heat stress. In situations of "severe" hot weather and physical activity, the Brouha monitoring guidelines will be followed. The SSO will decide on the proper guidelines to follow according to work schedule, PPE level, and weather conditions. The monitoring guidelines may be changed by the SSO if changes in work, PPE or weather conditions warrant.

8.1.1 Brouha Monitoring Guidelines

- Prior to beginning work each day, baseline measurements of body temperature (5-7 minutes) and pulse (1 minute) are taken, for each worker.
- A conservative work - rest cycle is established according to local weather conditions, tasks, and PPE being used.
- At the beginning of the first rest cycle, an individuals temperature is taken and their pulse rate is taken for the last 30 seconds of the first minute (P1), the last 30 seconds of the second minute (P2), and the last 30 seconds of the third minute (P3).
- Each pulse measurement is then doubled to find the full pulse rate (beats per minute).
- The pulse rate of the first minute (P1) is subtracted from the pulse rate of the second minute (P2). This is the first recovery measurement (R1).
- The pulse rate of the second minute (P2) is subtracted from the pulse rate of the third

minute (P3). This is the second recovery measurement (R2).

- If the individuals temperature $\leq$99.6 F the work-rest regime is acceptable.
- If P1 $\leq$ 110 beats/min AND R1 and R2 $\geq$ 10 beats/min the work-rest regime is acceptable.
- If the individuals temperature, pulse rate (P1), or recovery rate (R1/R2) do not meet the above criteria, the rest cycle of the work-rest regime will be lengthen by 10 minutes.
- Changes to the work - rest cycles are made in accordance with the findings of the temperature and pulse measurements.

8.1.2 Modified Brouha Monitoring Guidelines

Recovery rate compilation:

- Prior to beginning work each day, baseline pulse measurements (1 minute) are taken, for each worker.
- A conservative work - rest cycle is established according to local weather conditions, tasks, and PPE being used.
- At the beginning of the first rest cycle, an individuals pulse rate is taken for the last 30 seconds of the first minute (P1), the last 30 seconds of the second minute (P2), and the last 30 seconds of the third minute (P3).
- Each measurement is then doubled to find the full pulse rate (beats per minute).
- The pulse rate of the first minute (P1) is subtracted from the pulse rate of the second minute (P2). This is the first recovery measurement (R1).
- The pulse rate of the second minute (P2) is subtracted from the pulse rate of the third minute (P3). This is the second recovery measurement (R2).
- If P1 $\leq$ 110 beats/min AND R1 and R2 $\geq$ 10 beats/min the work-rest regime is acceptable.
- If P1 and/or R1/R2 do not meet the above criteria, the rest cycle of the work-rest regime will be lengthen by 10 minutes.

8.2 Return To Work Prerequisites

Prior to being allowed to return to work an individual's heat stress monitoring readings must indicate that:

- Body temperature (oral) is less than 99.6 (F)
- Pulse Rate is below 110 beats per minute, and
- Recovery rate is equal to or greater than 10 beats per minute.

  Recovery rate is the rate at which the body recovers, measured by radial pulse rate, from exposure to and/or working in a hot environment.

If it is found that the individuals temperature, pulse rate, and/or recovery rate are above the return to work criteria, longer rest cycles will be scheduled. Rest cycles will be lengthen by approximately 10-15 minutes. This monitoring is accomplished at each rest cycle to find the individuals optimum work - rest cycle which will allow them complete recovery.

When protective clothing (level C and above) must be worn by E&E personnel, the suggested guidelines for maximum wearing times (**per excursion**) and the rest/work periods (by level of protection) are noted on Tables 2 & 3.

8.3 Work Area Monitoring

Air temperature and relative humidity measurements are used to monitor work areas for potential heat stress situations. The readings can be achieved using both dry and wet bulb thermometers. These readings are then compared to the established Apparent Temperature Chart (Table 1). Work-rest cycles and personnel monitoring will be established according to the potential for heat stress injuries to occur as indicated by Table 1.

9 DECONTAMINATION

As in other medical emergencies, decontamination should proceed as normally as possible without contributing unduly to the victim's stress or injury. At a minimum, outer protective clothing should be removed as he or she is taken from the contaminated/hazard area. The buddy system is always in effect and backup personnel should be available at the decontamination station (PDS) to either suit up and assist in extraction, or to help decontaminate and undress the victim.

If other serious injuries or more life-threatening conditions exist, and the victim cannot be disrobed or decontaminated completely, the victim (or contaminated areas of their body) should be wrapped in a protective material (plastic) for his or her own safety as well as the safety of the ambulance and hospital personnel. Carefully avoid action that would result in the victim's being further overheated.

Table 1

Apparent Temperature Chart

	Air Temperature*										
	70	75	80	85	90	95	100	105	110	115	120
Humidity	**Apparent Temperature***										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	130
30%	67	73	78	84	90	96	104	113	123	135	148
40%	68	74	79	86	93	101	110	123	137	151	
50%	69	75	81	88	96	107	120	135	150		
60%	70	76	82	90	100	114	132	149			
70%	70	77	85	93	106	124	144				
80%	71	78	86	97	113	136					
90%	71	79	88	102	122						
100%	72	80	91	108				* = Degrees Fahrenheit			

National Weather Service, U.S. News & World Report 7/83

= No Real Threat of Heat Injury

= Heat Injury Possible After Long Exposure and Physical Activity.

= Heat Injury Likely to Occur

= Heat Stroke Imminent

- The above chart does not take into account the cooling effects of air movement.
- Apparent temperature is that which the body senses from the combination of heat and humidity.
- The use of laminated personal protective clothing (i.e., Saranex) creates a 100% relative humidity environment for the wearer.

Table 2 Guidelines for the Use of Protective Clothing	
Ambient Temperature (F)	**Maximum Wearing Time (per excursion)**
Above 90	15 minutes
87.5 - 90	30 minutes*
82.5 - 87.5	1 hour
77.5 - 82.5	1.5 hours
72.5 - 77.5	2 hours

NIOSH - Occupational Health & Safety Guidance Manual for Hazardous Waste Site Workers

* = Approx. 1 SCBA air tank

Table 3 Recommended Rest and Work Percentages As a Function of Level of Protection and Weather Conditions								
PPE Level	**Ambient Temperature (F)**							
	70		**74**		**78**		**≥82**	
	% Rest	**% Work**	**% Rest**	**% Work**	**% Rest**	**% Work**	**% Rest**	**% Work**
A	50	50	75	25	75	25	75	25
B	50	50	50	50	75	25	75	25
C	Continuous		25	75	50	50	75	25
D	Continuous		25	75	25	75	50	50

> = Greater than

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CATEGORY:	H&S 5.3
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STANDARD OPERATING PROCEDURE

HEALTH AND SAFETY ON DRILLING RIG OPERATIONS

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1. Introduction

This document is meant to be used in conjunction with Ecology and Environment, Inc., (E & E) standard operating procedures (SOPs) for field operations and hazardous waste site operations, and incorporates by reference all safety precautions required therein. It specifically addresses the functions and responsibilities of personnel working on or around drilling operations.

E & E personnel are frequently required to oversee a subcontractor's work in the field using drill rigs to take soil and rock samples, and install piezometers and monitoring wells. This document discusses the supervision of subcontract drillers by E & E.

2. Responsibilities and Authority of Subcontract Driller

The subcontract driller has authority to direct its personnel within the area while drilling operations are in progress. Access to the hazardous area around the auger and borehole is restricted by a "super exclusion zone" delineated by a 4-foot by 8-foot sheet of plywood centered over the borehole before drilling. A large hole cut in the plywood allows penetration of the augers. No E & E personnel are allowed in this "super exclusion zone" at any time while drilling is underway.

Housekeeping around the rig is the responsibility of the driller, but all team members should, when necessary, participate in this effort.

2.1 Responsibility and Authority of E & E Personnel

E & E personnel working at a drilling site must act as support to the subcontract drilling team by providing any necessary support functions; however, it is important that E & E personnel are careful not to interfere with the drilling process. Personnel are restricted from approaching the "super exclusion zone" while drilling is underway. If an E & E crew member recognizes an unsafe condition in the work area or on the rig, he should bring it to the attention of the site safety officer (SSO) and team leader if it is not resolved in a timely manner by the subcontractor driller. If conditions are still deemed to be hazardous, team members have the option of contacting their regional safety coordinator (RSC) or Corporate Health and Safety Group in Buffalo.

It is the responsibility of all E & E personnel to have with them on site their issued nondisposable gear, including hard hat, face shield, respirator, steel-toed boots, eyepiece inserts, safety glasses, and appropriate outerwear for the expected weather. It is the E & E employee's responsibility to ensure that all of his/her equipment is in proper working order.

All personnel should be aware of emergency facilities, egress routes, and special medical conditions of their team members. As with all E & E fieldwork, the buddy system is to be enforced.

3. Training Requirements for Site Personnel

3.1 E & E Site Safety Officer

In addition to basic health and safety training, annual health and safety refresher training, first aid, cardiopulmonary resuscitation (CPR), and necessary training in field monitoring of personnel, an SSO should have previous experience as a team member on field drilling projects in order to have a working knowledge of the drill rig and the extreme hazards that can occur with its operation. Where monitoring instrumentation is to be used, the SSO must be properly trained prior to fieldwork. The SSO must have an understanding of the hazards of heat and cold stress, their associated symptoms, and proper work modifications to protect field staff from potential injury.

3.2 Other E & E Personnel

All E & E personnel present on site shall have taken the basic 40-hour health and safety course and annual 8-hour refresher training course. Field personnel also must meet medical and respiratory fitness test requirements established by E & E and Occupational Safety and Health Agency (OSHA).

3.3 Subcontract Driller and Other Subcontract Drilling Personnel

Subcontract drillers and their support personnel on site must, at a minimum, have passed basic 40-hour health and safety training as prescribed by OSHA 29 Code of Federal Regulations (CFR)1910.120. They shall be medically approved and trained to use the level(s) of respiratory protection required on site. Certification of training by the subcontractor shall be required as a deliverable included in E & E's contractual documentation. This training shall be verbally verified and logged on site by the SSO or team leader before starting work.

4. Supervision of Subcontract Drillers

4.1 Responsibilities and Authority of Site Safety Officer

The responsibilities of the SSO at a drilling site where subcontracted drillers are used include the following: rig inspections, personnel monitoring, and personnel protection.

A rig inspection should begin by verifying the following:

- The mast must be located at least 25 feet from any overhead or underground utility lines;
- The location and operation of operational and unencumbered kill switches must be reiterated to all site personnel;
- Outriggers, stabilizers, or jacks are in place, and the rig is level;
- A geophysical survey (e.g., electromagnetic or ground-penetrating radar) or a reliable site history must be obtained to verify the absence of underground utilities, buried obstacles, tanks, and drums;
- A first aid kit and filled eyewash bottle must be readily available;
- A fire extinguisher should be charged to the proper pressure and placed at the rear of the rig during drilling;
- The condition of ropes, chains, and cables must be checked;
- A lifeline or safety belt must be available if mast climbing is necessary;
- The Site Safety Plan (SSP) must be posted with emergency phone list and map of hospital route; and
- A "super exclusion zone" must be established around the borehole, using traffic cones or a 4-foot by 8-foot sheet of plywood. This defined area will be entered during active drilling only by the subcontract driller and his helper(s), except in emergency situations.

If, upon review, the SSO deems that any material item noted above requires replacement or repair, the SSO must make necessary the arrangements for that repair or replacement, and later verify that repair or replacement is sufficient before actual drilling begins. Similarly, if the conditions listed above are not met, the SSO must request that they be met to his satisfaction before allowing drilling to proceed. Working together, the SSO and the subcontract driller should verify that the rig has been checked against the operator's checklist.

The SSO's monitoring duties include calibration and setup of the appropriate monitoring devices, as specified in the SSP. At a minimum, this generally includes an O_2/explosimeter and real-time organic-vapor monitoring capabilities (e.g., HNU, organic vapor analyzer [OVA]). Noise and heat-stress monitoring are employed where appropriate. If the SSO believes additional monitoring devices beyond the directive of the SSP should be employed (e.g., Rad Mini, Mini Ram), it is his/her responsibility to obtain this equipment from the nearest E & E office through the cooperation of the RSC or the Corporate Health and Safety Group. The SSO is also responsible for ensuring that a trained operator for this additional equipment is on site.

It is the responsibility of the SSO to ensure that all safety equipment is in good working order. Day-to-day operations, as well as calibration data, must be recorded in the equipment log or SSO log. Adequate supplies such as breathing air, drinking liquids, and calibration gas must be maintained.

E & E personnel are forbidden from entering the "super exclusion zone" around the borehole while drilling is underway. The SSO must not attempt to take air readings in or around the auger while it is in use, or from cutting samples while the auger is in motion. If possible, an O_2/explosimeter should be set up for unmanned (alarmed) operations at the rig, using an extension hose to continuously draw samples from the borehole area during drilling operations.

The SSO has ultimate authority over the subcontractor with regard to whether work practices meet the requirements of the SSP. Shutdown of work or restriction of personnel are options available to the SSO. The SSO should hold informal site safety briefings at the start of both fieldwork and daily work shifts throughout the course of the project. Although E & E contractually requires subcontractors to provide properly trained and outfitted staff, the SSO should verify verbally at the start-up meeting that the field staff has necessary respiratory approval and OSHA-mandated training, especially at hazardous waste sites. Site safety briefing topics, as well as the names of attendees, will be recorded in the site safety log.

If the SSO has reason to believe that either E & E or subcontractor personnel are under the influence of alcohol or drugs, or are otherwise ill before or during work on site, he or she should consider restricting those team members from site work. Personnel who are to perform work that requires Level C protection must be clean-shaven or they may be restricted at the discretion of the SSO.

The following is a list of basic topics to be discussed at site safety meetings:

- Personnel responsibilities;
- Planned investigation and presumed potential hazards;
- Levels of protection, monitoring plan, and equipment;
- Emergency scenario plans, including use of kill switches;
- Location and operation of kill switches, fire extinguisher, and first aid kits;
- Heat and cold stress hazards;
- "Super exclusion zone" around borehole; and
- Warnings to subcontractors about hazards of climbing the mast without proper safety equipment.

Because heat stress is a constant threat during warm weather, the SSO is responsible for determining whether conditions are unsuitable for work. If site conditions require the assistance

of work modifications, cooling vests, and other cooling means, the SSO may decide that work should not continue. The need for worker monitoring through blood pressure and oral temperature checks will be determined by the SSO with assistance from the RSC and Corporate Health and Safety Group staff, if necessary.

The SSO will be responsible for shutting down the drilling operation if electrical storms occur in the site area.

No refueling operations will be performed until rig engines are shut down. Motor fuels should be stored and dispensed from spring-loaded, OSHA/Factory Mutual-approved metal or polyethylene gas cans.

The SSO should ensure and document that no boreholes are left open or unfilled after drilling equipment is moved. In instances where a hole must be left open and unattended, suitable barricades or the equivalent will be staged around the hole to prevent personnel and equipment from falling in.

4.2 Responsibilities and Authority of Other E & E Personnel

All E & E personnel on site are required to follow the terms of the SSP and the direction of the SSO. Because the SSO cannot be in all places at all times, the crew should observe the subcontractors and condition of their equipment at all times, and report immediately to the team leader and SSO any safety-related issues that are unresolved. Included are such details as dressout, site functions, and decontamination. It is important that the SSO be involved so that proper log entries can be made.

It is a policy of E & E not to provide safety equipment or monitoring instrumentation to subcontractors. Some projects, however, may be arranged in such a manner that allows E & E personnel and subcontractors to share the same expendable supplies.

E & E personnel are forbidden from approaching augers during drilling. Activities at the borehole, such as sampling, require that the operation of equipment be stopped.

5. Drilling Hazards

5.1 General Drilling Hazards

Drilling operations present numerous health and safety hazards to site personnel, subcontractor drillers, and members of the public who may approach the rigs. Drilling hazards that apply to all drilling methods and possible control methods include:

- Slip/trip/fall hazards;
- Ergonomic hazards;
- Moving objects;

- Unguarded points of operation;
- Heat/cold stress;
- Noise;
- Buried or overhead utilities;
- Radiological hazards;
- Lightning;
- Chemical hazards; and
- Biological hazards.

5.2 Physical Hazards (Slip/Trip/Fall Hazards)

Personnel may be injured if they trip over tools or objects, walk on uneven terrain, fall from heights or into holes, or slip on surfaces.

Controls

- Store all tools and supplies away from the super exclusion zone;
- Personnel should use caution when walking on uneven surfaces so that they do not lose their balance;
- Subcontractor drillers must wear a lifeline or safety belt if mast climbing is necessary;
- Boreholes should be barricaded or marked with flags when drilling has been completed to prevent personnel from stepping in the hole; and
- Soil or sand should be applied to wet or slippery surfaces.

5.3 Ergonomic Hazards

Muscle strains, sprains, and injuries can occur when personnel use improper lifting methods, lift objects that are too heavy, improperly reach for objects, or work in awkward positions.

Controls

- Lift with the back as straight as possible, bend the knees, and keep the object close to the body;
- Use two people to move heavy objects such as augers;
- Avoid excessive stretching of the arms when picking up objects; and
- Avoid sudden twisting of the back or working in awkward positions.

5.4 Moving Objects

Site personnel may be injured if they are struck by debris from the borehole or by drilling machinery or components.

Controls

- Wear the appropriate personal protective equipment such as safety boots, safety glasses, and a hard hat; and
- Adequate inspection and maintenance of the drill rig will reduce the likelihood of worn equipment or parts falling and causing accidents.

5.5 Unguarded Points of Operation

The spinning auger on a drill rig or the V-belt drive on a motor are unguarded points of operation that can pull site personnel into the machinery and cause serious injuries.

Controls

- Mechanical guards cannot be placed around the spinning auger on a drill rig. Site personnel must stay away from the spinning auger and avoid wearing loose clothing that could get caught in the auger; and
- Mechanical guards must be placed over V-belt drives.

5.6 Heat/Cold Stress

Drilling is a strenuous job, and heat stress is a major hazard in hot, humid environments, especially when personnel are wearing protective equipment such as coveralls, gloves, boots, and respirators. Cold injury can occur at low temperatures and when the wind-chill factor is low.

Heat Stress

Controls

- Recognize the signs and symptoms of heat stress;
- Monitor workers who are wearing protective clothing; and
- Provide fluid replacement and schedule rest periods in cool locations.

Cold Stress

Controls

- Recognize the signs and symptoms of cold stress;
- Personnel must wear appropriate clothing during cold weather; and
- A warm rest location and fluid replacement should be provided.

5.7 Noise

Excessive noise can cause hearing damage, distract workers, and interfere with communications.

Controls

- In excessive noise areas, wear the hearing protection recommended by the SSO.

5.8 Buried or Overhead Utilities

Contact of drilling tools with electric, gas, steam, process, or other utility lines can result in fires, explosions, electric shock hazards, burns, etc.

Controls

- The boom on the drill rig must be kept at least 25 feet from overhead and buried utilities;
- After buried utilities have been located using an appropriate geophysical survey, the line locations should be marked with flags. Maps of underground utilities should also be checked, if available, to verify locations; and

- Drilling operations should proceed slowly in areas near buried utilities, as the actual utility location may not exactly correspond to the area identified by a flag or as illustrated on a map.

5.9 Radiological Hazards

5.9.1 Nonionizing Radiation

Nonionizing radiation is radiation that emits photon energy that is not sufficient to produce ionization in biological systems. Radio frequencies (including radar and microwave), infrared, visible light, and ultraviolet regions of the electromagnetic spectrum are considered to be nonionizing. Ultraviolet radiation from the sun is usually the major nonionizing radiation hazard present during drilling operations. Ultraviolet radiation can damage the skin and eyes. Potential effects include, but are not limited to, sunburn, skin cancer, photosensitization, and cataracts.

Controls

- Wear sunscreen on all exposed skin areas; and
- Wear safety glasses that block ultraviolet radiation (or sunglasses worn over safety glasses).

5.9.2 Ionizing Radiation Hazards

Ionizing radiation is electromagnetic or particulate radiation with sufficient energy to ionize atoms. Ionizing radiation may be present on some drilling sites and includes:

- Electromagnetic radiation
  - Gamma rays
  - X-rays
- Particulate radiation
  - Alpha
  - Beta
  - Neutrons

Controls

Site personnel can minimize their exposure to external radiation hazards by:

- Limiting exposure time;
- Increasing the distance from the radiation source; and
- Shielding the radiation source.

Some radiation sources can enter the body through inhalation, ingestion, and/or skin contact. Exposure can be controlled through the wearing of personal protective equipment and thorough washing of skin surfaces with soap and water.

5.10 Lightning Hazard

The elevated mast on a drill rig is a potential target of lightning.

Controls

- The SSO will halt drilling operations when electrical storms approach the drilling location.

5.11 Chemical Hazards

Chemical contaminants may be present in the form of gases, vapors, aerosols, fumes, liquids, or solids. Site personnel may be exposed to these contaminants through one or more of the following pathways: inhalation, ingestion, skin, and/or eye contact.

Controls

- Become familiar with the specific drilling operation being used to identify and avoid chemical discharge locations;
- Wear appropriate personal protective equipment;
- Practice contamination avoidance; and
- Stay upwind during grout mixing (silica inhalation hazard).

5.12 Biological Hazards

Biological hazards that may be present during drilling operations include poisonous plants, animals, and insects, and infectious agents.

Controls

- Wear insect repellant at sites where biting insects are prevalent;
- Learn to identify poisonous plants that cause dermatitis, such as poison ivy and poison oak;
- Wear impervious personal protective clothing (e.g., saranex coveralls, latex booties, nitrile surgical gloves) if work must be conducted in areas where site personnel will contact poisonous plants; and
- Avoid potential animal nesting areas and animal carcasses.

6. Drilling Methods and Hazards

6.1 Solid Flight and Bucket Augers

Solid-flight augers (also referred to as solid-stem augers, continuous flight augers, and disk augers) use solid-stem auger sections, with the flighting (curved corkscrew-like blades) connected end-to-end to the cutting head (see Figure 1). Soil cuttings are moved upward to the ground surface by the flighting as the auger penetrates into the soil. Samples are typically collected by removing an auger section, attaching a split-spoon or thin-wall sampler to the end of a drill rod, and placing this arrangement into the borehole. Split-spoon samples are collected by using a hammer connected to the drill rod and split-spoon. The hammer is operated by wrapping sections of rope around a rotating cathead hoist (a wide metal cylinder). A disk auger is similar to a solid-flight auger except that it is larger in diameter and the flighting goes around the stem once. Bucket augers have a cutting edge on the bottom. Once the bucket auger fills with soil cuttings, it is brought to the surface to be emptied. Figure 1 shows various types of bucket augers.

Auger drill methods are used in unconsolidated material for sampling subsurface media, installing groundwater monitoring wells, and identifying depth to bedrock.

6.2 Hollow-Stem Auger

A drill rig rotates a hollow-stem auger (see Figure 2) and moves it vertically into the soil. The hollow stem allows use of continuous or intermittent soil sampling techniques. Once the required depth has been reached, screens and casing for monitoring wells can be placed in the

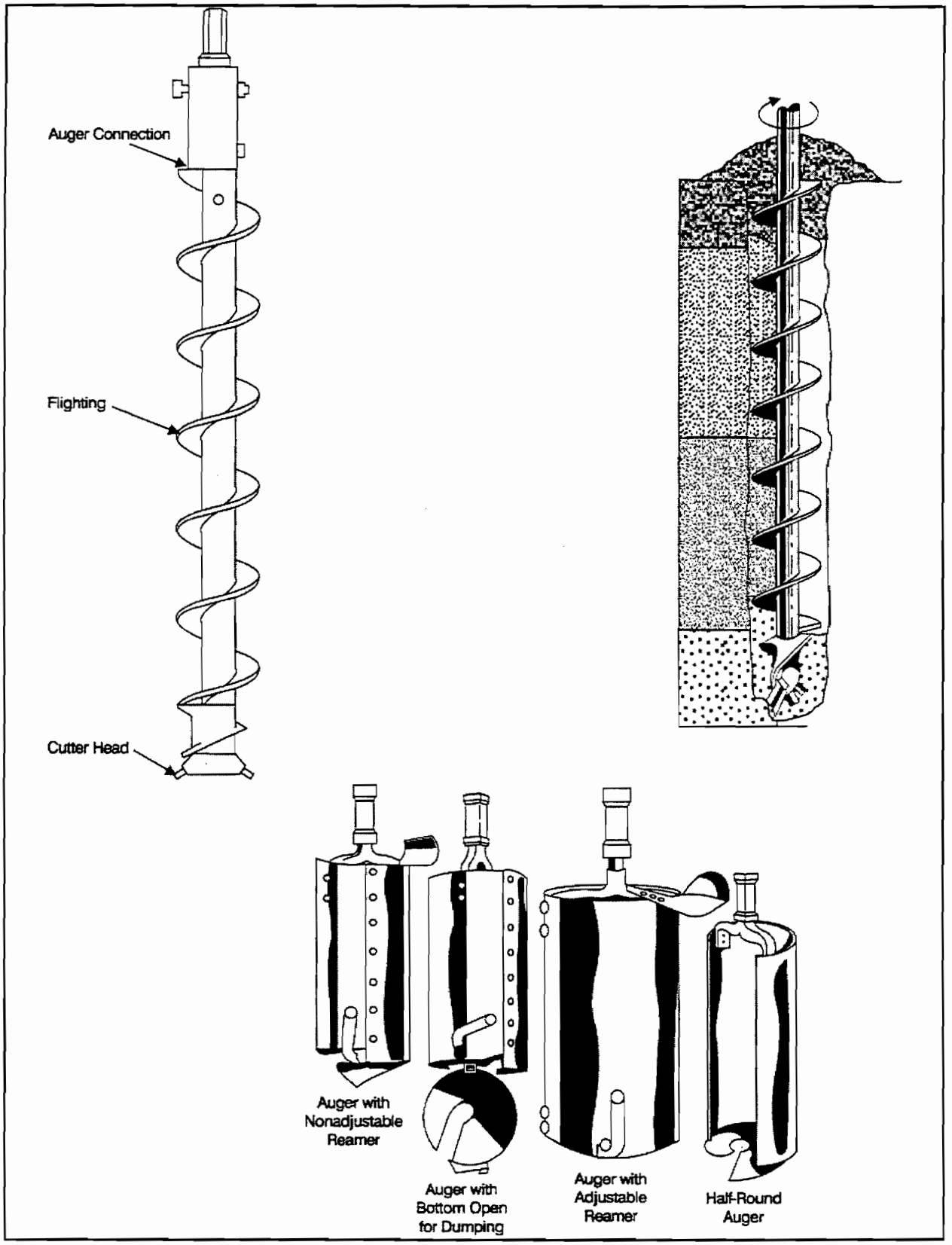

Figure 1 Solid Flight and Bucket Augers

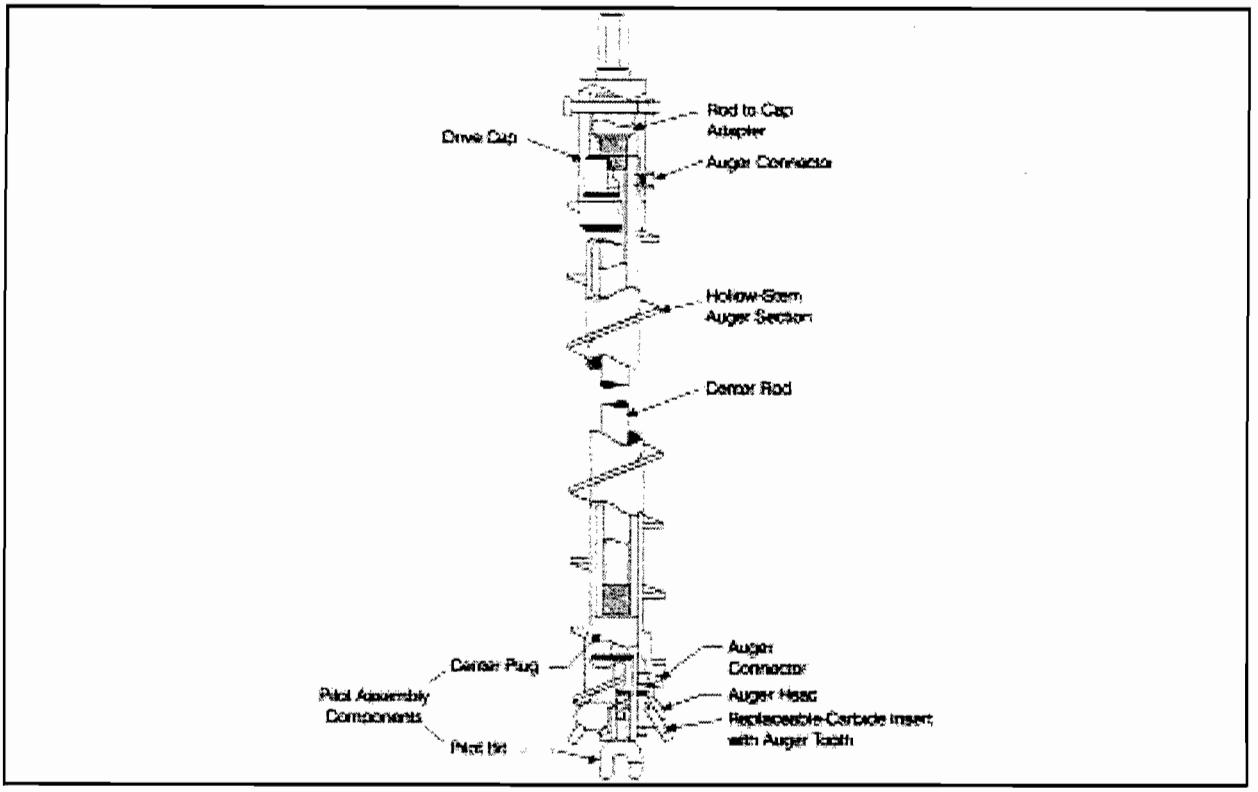

Figure 2 Hollow-Stem Auger

hollow-stem gravel pack and grout is added as the auger is pulled out of the borehole. Hollow-stem auger drilling is a common method of monitoring well installation.

6.2.1 Auger Drilling Hazards

Physical Hazards

Spinning Auger. The spinning auger is not equipped with a metal guard; therefore, it is imperative that personnel use extreme caution when working near spinning augers, as contact with the auger can cause personnel to be pulled into the auger and crushed between the auger and the drill rig. Only approved drillers will remain in proximity to the borehole during drilling, and an approximate 4- by 8-foot "super exclusion area" will be established around the moving auger at all times. The "super exclusion zone" may be established by placing a 4- by 8-foot sheet of plywood over the borehole, or by placing flagging or traffic cones around a 4- by 8-foot perimeter. No personnel, except the driller and the driller's helper, will enter this zone during drilling. The SSO will issue warnings to those personnel not authorized to enter this zone.

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is in good condition prior to the start of drilling operations. In addition, drillers must

make sure that proper hoisting procedures are used to reduce the likelihood of dropping drill steel or sampling gear.

Drill Rig Lurching. The drill rig has a tendency to lurch and shake when the auger comes into contact with harder materials. This is especially true when hollow-stem auger drilling methods are utilized. The rig can also lurch seriously in hearing sands. Site personnel should be aware of possible drill rig movement and move away from the rig if lurching or shaking occurs.

Noise. If split-spoon sampling is conducted, a hammer is used to drive the spoon into the soil. The hammer generates a loud noise when it contacts a metal surface. Site personnel are required to wear appropriate hearing protection during hammering operations.

6.3 Open-Hole Rotary Methods

A direct mud rotary drilling system (also direct [liquid] rotary, hydraulic rotary, or reverse [circulation] rotary) is shown in Figure 3. Drilling fluid (mud) is pumped through drill rods to a bit. The mud flows back to the surface through the space between the drill rods and the borehole and is discharged at the surface through a pipe into a tank, tub, pond, or pit. After the cuttings settle, a pump recirculates the liquid back through the drill rods. The mud serves to:

- Cool and lubricate the bit;
- Stabilize the borehole well; and
- Prevent the inflow of fluids from formations.

A shale shaker can collect a sample from the circulated fluid by placing it in the discharge flow before the settling pit. In addition, the drilling fluid flow can be shut off and split-spoon, thin-wall, or consolidated-core samplers can be used to collect a sample by inserting a sampler through the drill rods. Reverse circulation rotary drilling is a variation of mud rotary drilling in that the mud flows from the mud pit down the borehole outside the drill rods, passes up through the bit carrying cuttings into the drill rods, and is then discharged into the mud pit. The equipment used is similar to the direct mud rotary method, except most of the equipment is larger.

Equipment Breaks. A break in support equipment for drill steel could cause equipment to fall and injure site personnel. Equipment inspection is required to ensure it is in good condition prior to the start of drilling operations.

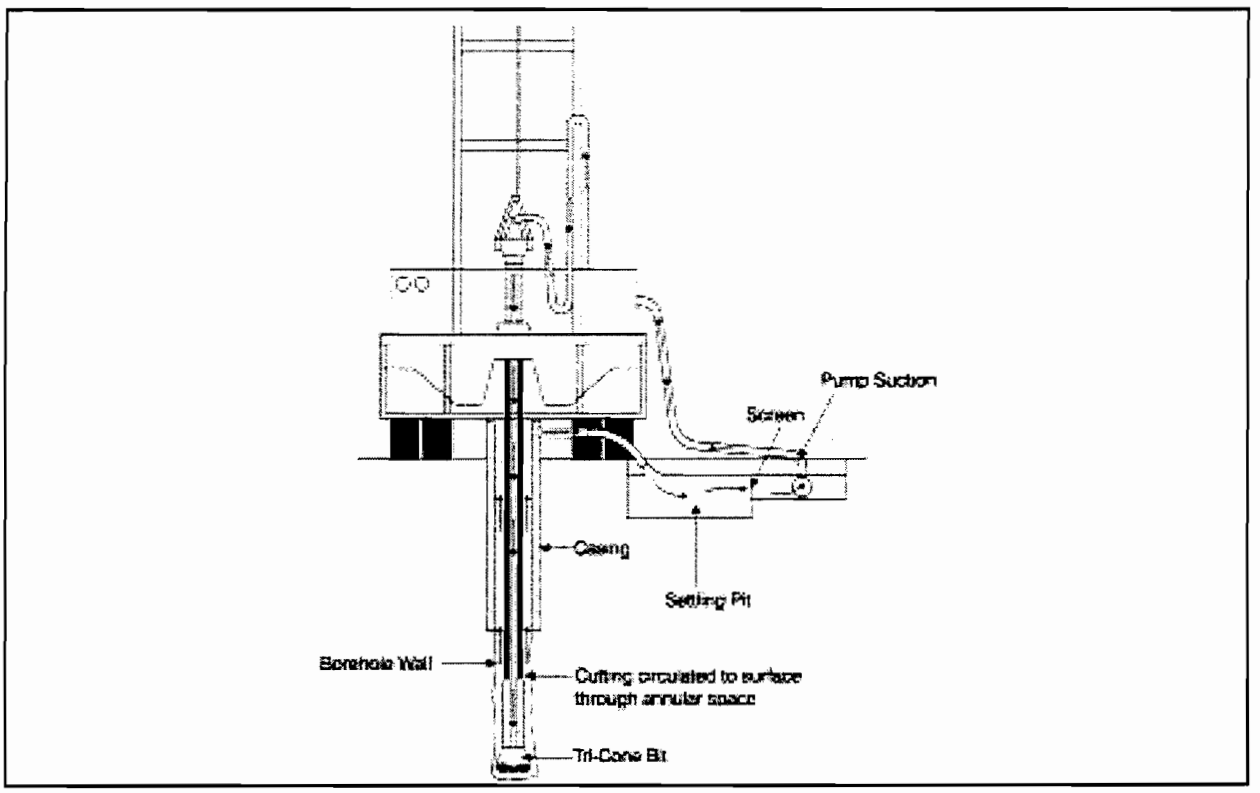

Figure 3 Open-Hole Rotary Method

Slippery Conditions. Because the use of drilling mud will create slippery conditions around the drill rig and support area, mud should be contained to the immediate work area. Slippery spots should be dried with sand/dirt to reduce slipping hazards. Gloves should be changed when they become coated with mud.

6.4 Direct Air Rotary with Rotary Bit/Downhole Hammer

Also called an air rotary with roller-cone (tri-cone) bit, down-the-hole hammer, or air percussion rotary, the rig setup for air rotary with a tri-cone or roller-cone bit is similar to direct mud rotary (see Figure 3), except the method uses air instead of water and drilling mud. The main components of a drill string using a tri-cone bit are illustrated in Figure 4. Compressed air is forced down through the drill rods to cool the bit, and cuttings are carried up the open hole to the surface. A cyclone slows down the air velocity, forcing the cuttings into the container. A roller-cone drill bit is used for hard-to-soft consolidated rock and unconsolidated formations. When a downhole hammer is utilized, it replaces the roller-cone bit (see Figure 4). The hammer produces a pounding action as it rotates. Other features are similar to the rotary bit, except small amounts of surfactant and water are used for dust and bit temperature control.

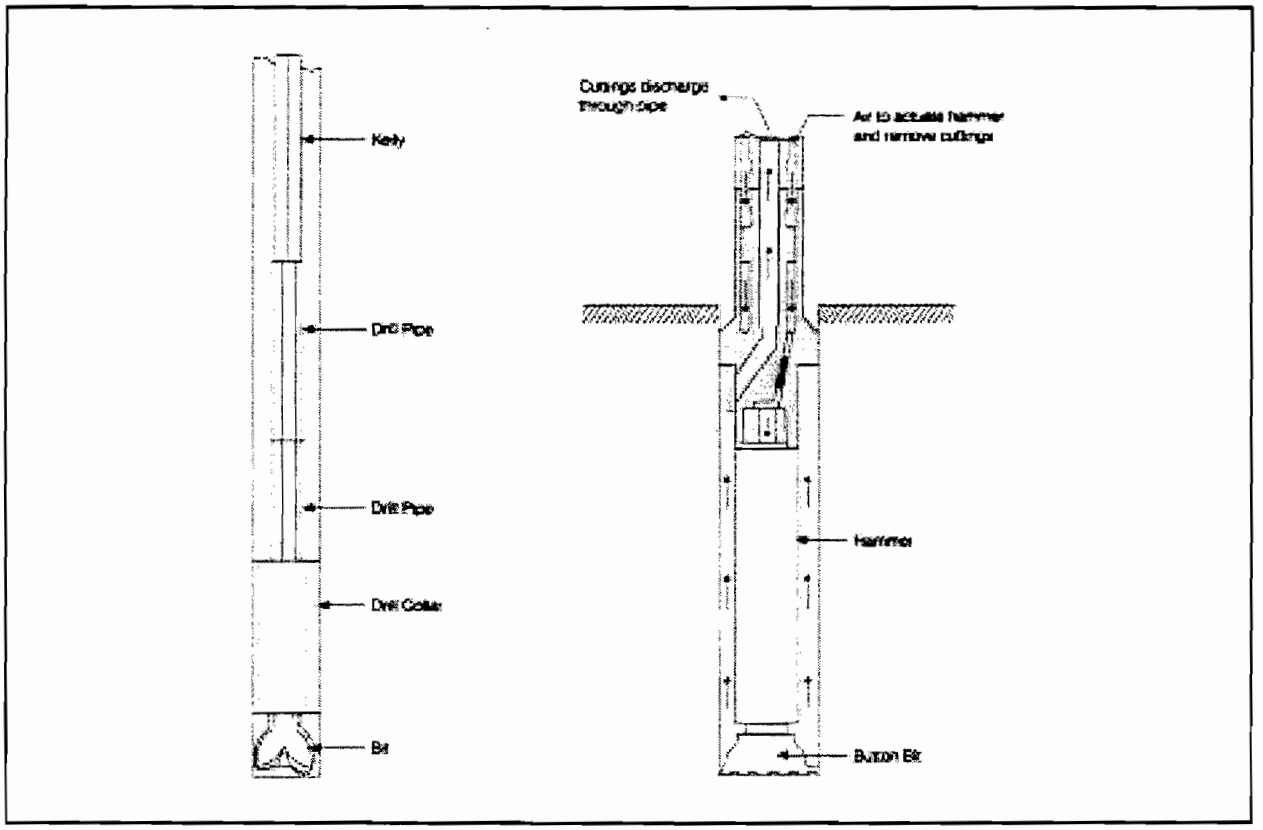

Figure 4 Direct Air Rotary

Physical Hazards

Noise. Excessive noise is generated from the use of air compressors, casing drivers, and downhole hammers. Site personnel are required to wear hearing protection during drilling operations.

Cuttings and Water. Cuttings and water blown from the hole can strike and injure site personnel. Site personnel must stay away from this discharge location and wear appropriate personal protective equipment.

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is in good condition prior to the start of drilling operations. In addition, drillers must make sure that proper hoisting procedures are followed to reduce the likelihood of falling drill steel or sampling gear.

6.5 Cable Tool

A cable tool drill rig operates by repeatedly lifting and dropping tools attached to a cable into a borehole. Figure 6-5 shows the components of a cable tool rig. This drilling method crushes rock and a spudding beam mixes the crushed particles with water. The water and debris is removed by a bailer or pump. In unconsolidated formations, a casing is driven into the ground. In consolidated formations, drilling is conducted without the use of a casing.

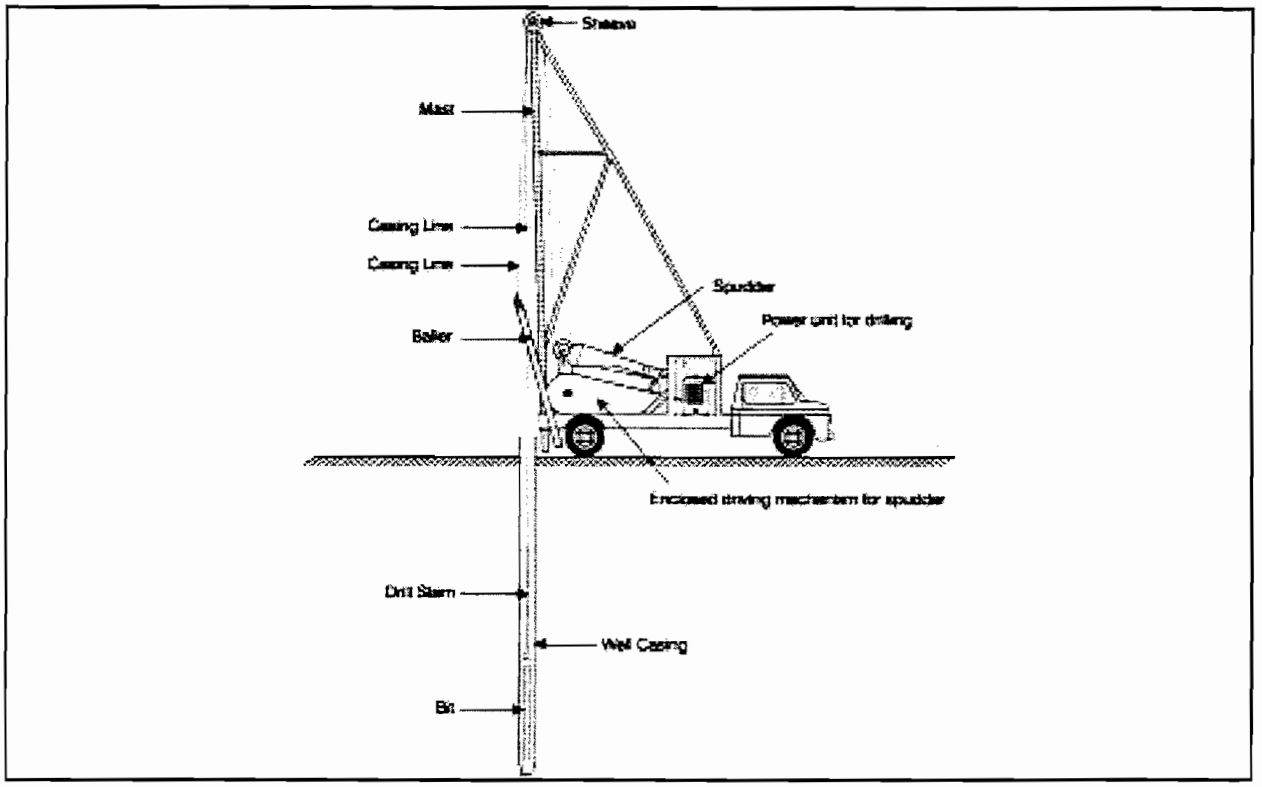

Figure 5 Cable Tool Drill Rig

Physical Hazards

Noise. The spudding beam generates excessive noise. All personnel must wear appropriate hearing protection during drilling operations.

Rig Movement. The drill rig tends to lurch as the drill string is raised and lowered. Site personnel must maintain an adequate distance from the rig during drilling operations.

Overhead Equipment. Drill string and bailers are hoisted during drilling operations and present an overhead hazard to site personnel if a tool falls from a height.

6.6 Casing Advancement: Rotary Drill-Through Methods

6.6.1 Drill-Through Casing Driver and Dual Rotary Method

Casing driver advancement (also referred to as air (mud) rotary drill or downhole hammer with casing drivers, air rotary casing hammer, and air drilling with casing hammer) involves a driver that moves the casing as drilling occurs (see Figure 6) during the use of conventional direct air (mud) or downhole hammer equipment. Drill cuttings move upward in the space between the drill pipe and the casing. The diameter of the casing is slightly larger than the bit so it can be easily removed.

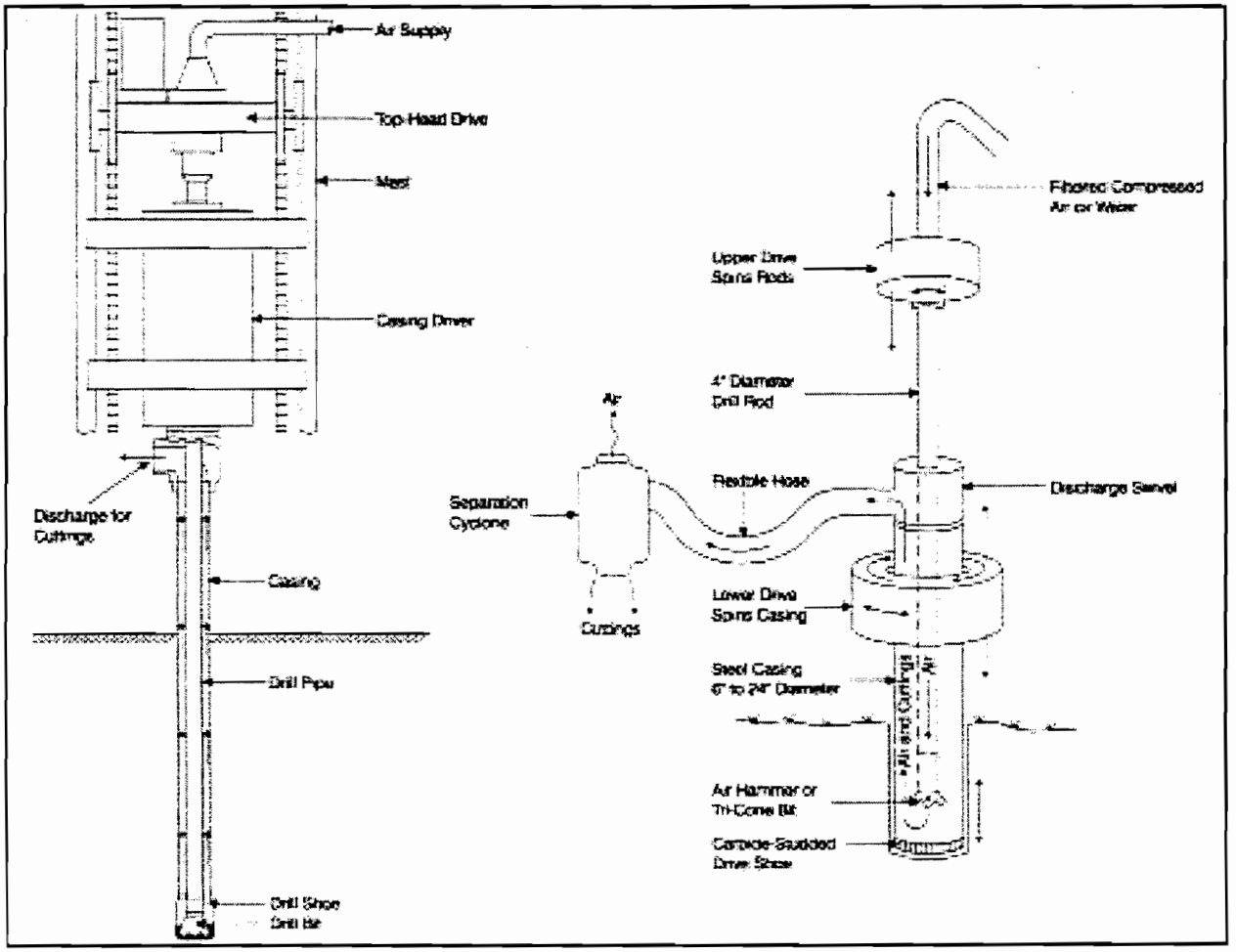

Figure 6 Casings

In dual rotary advancement, the casing is moved by using a rotating steel casing provided with a carbide-studded drive shoe. The carbide ring cuts through the overburden material. Rotary drilling (usually air) takes place at the same time using a downhole hammer or tri-cone bit. Drilling can be conducted either inside or ahead of the casing.

This type of drilling is used to install monitoring wells in unconsolidated formations, where loss of circulation of drilling fluids is a problem, and/or where prevention of cross-contamination of aquifers is important.

6.6.2 Reverse Circulation (Rotary, Percussion Hammer, and Hydraulic Percussion)

The reverse-circulation rotary drilling method can utilize air rotary with a downhole hammer or bit or mud rotary. Two or three casings can be used.

Reverse circulation dual-wall rotary. This method is similar to downhole hammers with a casing driver or air rotary-cone bit, except air is moved down the space between the casing and the drill pipe to the bit, and soil cuttings are pushed to the surface through the drill pipe (see Figure 7).

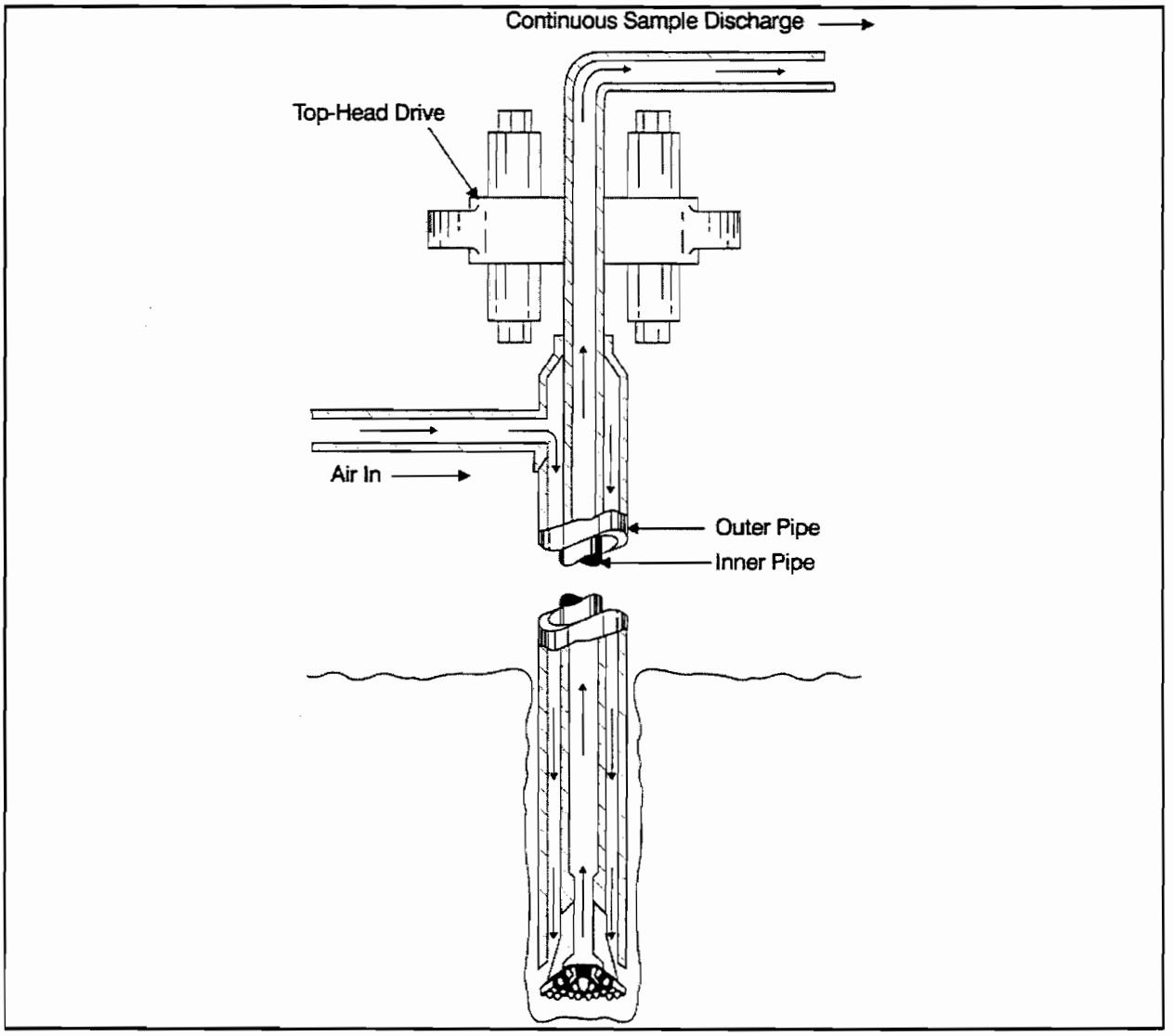

Figure 7 Reverse Circulation Rotary Method

Reverse circulation dual-wall percussion hammer. The percussion hammer operates in a similar manner of reverse circulation as the dual-wall rotary method, except the drive method is different. Either two or three casings are used. Compressed air is moved into the space between the outer and inner pipes, and soil cuttings are discharged from the inner pipe to a cyclone. A percussion hammer on the most of the drill rig strikes an anvil on the top of the drive assembly. Two or three casings are driven, and the bit does not rotate.

Hydraulic percussion. This method is similar to the jet-percussion method, except a check valve is located between the bit and the lower part of the drill pipe. Water fills the space between the drill rods and well casing and the drill rods are lifted and dropped. A reciprocating motion moves the water and drill cuttings to the surface where they enter a tank. Water is returned to the hole from the tank. Casing is driven as drilling proceeds.

Physical Hazards—Reverse Circulation Dual-Wall Rotary

Noise. Excessive noise is generated from the use of air compressors, casing drivers, and downhole hammers. Site personnel are required to wear hearing protection during drilling operations.

Cuttings. Cuttings and debris discharged from the hole can strike and injure site personnel. Site personnel must stay away from the discharge point and wear appropriate personal protective equipment.

Overhead Equipment. If wire line core sampling is conducted, drill steel and sampling gear will be lifted overhead. Site personnel must conduct the necessary equipment inspections to ensure it is good condition prior to the start of drilling operations. In addition, drillers must make sure that proper hoisting procedures are followed to reduce the likelihood of dropping drill steel or sampling gear.

Physical Hazards—Hydraulic Percussion

Slips/Falls. Site personnel can slip on wet ground around the drill rig or fall into the water tank. Site personnel must keep the drilling location clear of debris and contain spillage prior to and during drilling operation.