

---

Formerly Utilized Sites Remedial Action Program (FUSRAP)

---

# ADMINISTRATIVE RECORD

for  
Niagara Falls Storage Site

---



126500

1044.950308.001



**Science Applications International Corporation**  
An Employee-Owned Company

March 8, 1995

U.S. Department of Energy  
Oak Ridge Field Office  
P.O. Box 2001  
Oak Ridge, TN 37831-8758

Attention: Mr. Ronald E. Kirk  
Site Manager - New York Sites

**Subject: Contract DE-AC05-91OR21950**  
**NIAGARA FALLS STORAGE SITE - DELIVERABLE: FIELD SAMPLING AND ANALYSIS**  
**PLAN FOR THE NIAGARA FALLS STORAGE SITE - FINAL**

Dear Mr. Kirk:

Enclosed are four copies of the subject report. By copy of this letter, one unbound and three bound copies have been provided to BNI for records retention purposes.

If you have questions, please contact me at 481-8552.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

*Kevin S. Ironside*

Kevin S. Ironside  
Project Manager

KSI:sh

Enclosures

cc: L. Price, FSRD (w/o)  
B. Seay, FSRD (w/o)  
R. Kirk, FSRD (w/4e)  
D. Harbert, BNI  
P. Huber, BNI (w/2e)  
E. McNamee, BNI (w/e)  
J. Beck, ORAU (w/e)  
PDCC, BNI (w/unb. encl)

No. 1044.950308.001  
Internal Distribution

	Name	Initials	Date
Originator	K. Ironside	KSI	3/8/95
Concurrence	N/A		
Approved	J.D. Waddell	<i>[Signature]</i>	3-8-95

J. Waddell  
T. Patterson  
K. Ironside  
G. Cowart (w/o)  
K. Renfro (w/o)  
DRC  
CRF

800 Oak Ridge Turnpike, P.O. Box 2502, Oak Ridge, Tennessee 37831 (615) 481-4600

Other SAIC Offices: Albuquerque, Boston, Colorado Springs, Dayton, Huntsville, Las Vegas, Los Angeles, McLean, Orlando, Palo Alto, San Diego, Seattle, Tucson

120000

---

# **FIELD SAMPLING PLAN FOR THE NIAGARA FALLS STORAGE SITE**

**NIAGARA FALLS, NEW YORK**

**FEBRUARY 1995**

**FINAL**

---



U.S. Department of Energy  
Oak Ridge Operations Office  
Formerly Utilized Sites Remedial Action Program

**FIELD SAMPLING PLAN FOR THE NIAGARA FALLS SITE, NIAGARA FALLS, NEW YORK**  
**(Preliminary Draft, June 1994)**  
**COMMENT/RESPONSE**

126500

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
1	General	Include units in "cm" or "m."	Metric conversions have been added to all measurement units.
2	pg 1, § 1.1, ¶ 1	Two temporary piles were incorporated into the WCS in 1991. The volume of the material in the pile is 195,000 m <sup>3</sup> (255,000 yd <sup>3</sup> ) and includes 60 drums of rad material.	Updated text to include this information.
3	pg 2, § 1.1, bullet 2	Delete such as animal carcasses. There is one vague reference to this. May not bring up the specter of biohazards.	Text deleted as requested.
4	pg 2, § 1.1, ¶ 2	This casts doubt on the cleanup of VPs	Text revised to clarify.
5	pg 2, § 1.2, ¶ 1, sentence 3	Delete "an interim."	Deleted
6	pg 2 § 1.2, ¶ 1	Pile was reopened in 1991.	Pile was not reopened. Text revised to state, "In 1991 two temporary storage piles were incorporated into the waste containment structure.
7	pg 2, § 1.2, ¶ 2	This paragraph is not specific to NFSS. Specific information is available in the environmental reports.	BNI noted that current text is acceptable in February 9, 1995 meeting.

025 921  
126 500

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
8	pg 4, Fig. 1-2	This does not represent the present configuration because the road around the pile was removed and a new fence was constructed. Some buildings were removed.	Add new BNI figure.
9	pg 5, § 1.2, ¶ 1	<p>Fourmile creek discharges into Lake Ontario ~6 km (4 mi) north of the site. Reword 2nd sentence: Groundwater is present in .....( ), and in isolated sand lenses in the brown clay in the bedrock at depths .....( ).</p> <p>Reword 3rd sentence: Groundwater levels contours indicate that the groundwater flows to the north-northwest at approximately ~1 m/yr (3 ft/yr).</p> <p>Reword last sentence: It is likely that groundwater in the bedrock discharges.....</p>	<p>Text modified consistent with BNI meeting (February 9, 1995).</p> <p>Text modified consistent with BNI meeting (February 9, 1995).</p> <p>Text modified as requested.</p>
10	pg 5, § 1.2, ¶ 4	This is not the case. Delete the paragraph.	Paragraph deleted. This text was developed based on BNI's earlier input on changing groundwater conditions at the site. It is uncertain why this text is no longer accurate.
11	pg 6, § 1.3	2nd paragraph "BNI," 4th paragraph "Bechtel National, Inc." Be consistent.	The BNI acronym is defined on pg 1. No change made.
12	pg 6, § 1.3, ¶ 3	Actually NLO was doing environmental monitoring in the late 70s.	Noted.
13	pg 6, § 1.3, ¶ 4	Chemical characterization was not published because of data gaps identified in the report. It should be referenced in the appropriate sections of this report. "DRAFT".	Deleted reference from report.

025921

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
14	pg 6, § 1.3, ¶ 5	<p>Metal concentrations were compared to average metallic constituents of soils across the U.S.</p> <p>Reword 3rd sentence: Trichloroethane and 1,2-Dichloroethene were detected in several soil gas samples near Building 401. Delete, "in concentrations exceeding state guidelines." Soil gas values are not comparable to groundwater concentrations and do not have state or any other guidelines as criteria.</p>	Text modified to note that the comparison is made to national background averages. Text clarified to note that the organic contaminants detected in soil were found in concentrations below guidelines.
15	pg 7, Fig. 1-3	Delete temporary storage piles. DELETE Soil gas sampling location above guidelines. Soil gas values are not comparable to groundwater or soil concentration guidelines and do not have state or any other guidelines as criteria.	Figure has been revised. Changed "above guidelines" to "elevated organic vapor readings"
16	pg 8, § 1.3, ¶ 4	Metal concentrations for metals in soil, sediments, and surface water may be compared to background levels. Identify the state guidelines that are referred to. Are they secondary drinking water standards? Have table showing what the guidelines are and where they can be found.	Section has been revised. Reference has been made to background and state guidelines. The state water guidelines address all water uses. Added tables which present guidelines.
17	pg 8, § 1.4, ¶ 2 & 3	Where are the background locations mentioned in the 1st sentence of Section 1.4? Add tetrachloroethane to the VOC list. Clarify which other chemicals did not exceed a state standard. EPA and state standards are not always the same.	Clarified that comparison was made to national background concentrations. Section has been revised to more clearly define contaminants of concern.
18	pg 9, Fig. 1-4	Delete temporary storage piles.	Text deleted.

126580

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
19	pg 10, § 1.5, ¶ 1	The extent of groundwater contamination in the vicinity of Building 401 has not been determined; therefore, the data gap should include groundwater sampling in the vicinity of Building 401. Sentence 3: Sediment and surface water downstream of former Building 407 were sampled and no contaminants were found. Why try to locate a source if there are no downstream contaminants?	Text revised to include Building 401. Closest surface water and sediment sampling location downstream of Building 401 is over 2,000 ft. Samples are needed in closer proximity.
20	pg 10, § 1.6, ¶ 3 & 4	There are contradictory statements. Are you or are you not doing onsite analysis. It may not be cost effective.	Deleted reference to onsite laboratory in 4th paragraph.
21	pg 10, § 1.6, ¶ 4	<p>Soil gas sampling results identified volatile organic compounds (VOCs) in the vicinity of Building 401.</p> <p>Groundwater samples should also be collected for VOCs analysis in the vicinity of Building 401.</p> <p>Figure 2-1: The results for TCE and 1,2-DCE are not the soil gas survey results, but are soil samples results.</p> <p>Sentence 1: Location B10 is a soil sampling location, not a well.</p> <p>Sentence 2: There are no deep soil samples collected from two boreholes located within 150 ft of Building 407.</p>	<p>Text has been clarified.</p> <p>Text has been clarified to note that groundwater samples will also be collected around Building 401.</p> <p>Only soil data has been presented in Figure 2-1.</p> <p>Sentence 1 corrected to reference BH-46.</p> <p>Text corrected to reference Building 401 as opposed to 407.</p>
22	pg 11, § 1.6	Background samples should also be collected. There are no plans for an onsite laboratory.	Background sampling has been added. Deleted reference to onsite laboratory.

126520

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
23	pg 12, § 2.1, ¶ 1	How about collecting soil and groundwater samples in the vicinity of Building 401?	Text revised to include Building 401.
24	pg 12, § 2.1.1	<p>Background soil samples should also be collected and analyzed for comparison purpose. If guidelines are not available, then background levels should provide a meaningful tool to determine the extent of contamination.</p> <p>1st sentence: DELETE to the top of the first confining layer (the first confining layer is the brown clay that is just below the topsoil (0 - 3 ft).</p> <p>2nd sentence: DELETE Although .....the exceeded depth is not known.</p> <p>3rd sentence: DELETE to the top of the first confining layer.</p>	<p>Background sampling has been added.</p> <p>Text deleted.</p> <p>Text deleted.</p> <p>Text deleted.</p>
25	pg 13, Fig. 2-1	Delete temporary storage piles. Sampling locations 59, 60, 61: the results for TCE and 1,2-DCE are not the soil gas survey results, but are soil sample results.	Figure clarified to indicate that these data are soil results.
26	pg 14, § 2.1.2	<p>Background samples should also be collected.</p> <p>Collection of samples using the Scoop Method: From how big an area? Horizontal across the stream or down the center of stream?</p>	<p>Added background sediment sample to discretionary sampling.</p> <p>Sampling area has been defined in current text.</p>



025921  
126570

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
27	pg 14, § 2.1.3	The extent of groundwater contamination in the vicinity of Building 401 is not known because samples were not collected for VOCs analysis. The proposed groundwater sampling will be in the vicinity of Building 407. In order to understand the extent of groundwater contamination, groundwater sampling should be performed in the vicinity of Building 401. Additionally, based on soil gas survey and contour maps for PCE and TCE, groundwater sampling should be extended to South 16 ditch.	Groundwater sampling locations have been repositioned to characterize the groundwater around both Buildings 401 and 407.
28	pg 14, § 2.1.3, ¶ 1	"Upper Aquifer" Is it groundwater system?	Clarified text to note that groundwater samples will be collected throughout the depth of the first saturated interval.
29	pg 15, Table 2-1	How about QCs and background samples?	QC and background samples have been added to the table.
30	pg 18, Fig. 2-2	Delete temporary storage piles.  Proposed Direct Push Sampling Locations: Called these deep soil sampling locations previously. Why not keep these and use another symbol to show location of Direct Push Sampling.	Piles have been deleted.  New symbol added for Direct Push Sampling Location.
31	pg 19, § 2.1.4	Background samples should also be collected.	One background surface water has been added.
32	pg 20, § 3.1	This is inadequate and not what was discussed. Need to reference Section 4.0 (Quality Assurance/Quality Control Requirements for Sampling) of <i>Design Basis for Environmental Technology for Formerly Utilized Sites Remedial Action Program, BNI 14501-191-DB-01</i> .	Text modified as requested.
33	pg 20, § 3.2	Delete "assumed to be".	Text deleted.

126500

COMMENTS: BNI (received from P.R. Huber July 29, 1994)			
COMMENT NO.	PAGE/SECT. /PARA.	COMMENT	RESPONSE
34	pg 22	There will be no radiological sampling.	FUSRAP decontamination procedures have been added to this section.
35	pg 23	See comment page 20, Section 3.1	Text modified as requested.
36	Appendix A	This appendix should be deleted from the field sampling plan.	Deleted Appendix A. Moved decontamination procedures to Section 5.0.

---

---

# **FIELD SAMPLING PLAN FOR THE NIAGARA FALLS STORAGE SITE**

**NIAGARA FALLS, NEW YORK**

**FEBRUARY 1995**

**FINAL**

---

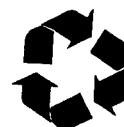
---

*prepared for*

U.S. Department of Energy, Oak Ridge Operations Office, Formerly Utilized Sites Remedial Action Program

*prepared by*

Science Applications International Corporation ESC-FUSRAP  
under Contract No. DE-AC05-91OR21950



## TABLE OF CONTENTS

LIST OF FIGURES .....	iv
LIST OF TABLES .....	v
LIST OF ACRONYMS AND ABBREVIATIONS .....	vi
1. INTRODUCTION .....	1
1.1 SITE BACKGROUND .....	1
1.2 SITE DESCRIPTION .....	2
1.3 SUMMARY OF EXISTING SITE CONDITIONS .....	3
1.4 CONTAMINANTS OF CONCERN .....	5
1.5 PURPOSE AND SCOPE .....	5
1.6 DATA QUALITY OBJECTIVES .....	5
2. FIELD INVESTIGATION APPROACH .....	29
2.1 STAGE 1 .....	29
2.1.1 Soil Sampling .....	29
2.1.2 Sediment Sampling .....	30
2.1.3 Groundwater Sampling .....	30
2.1.4 Surface Water Sampling .....	31
2.2 STAGE 2 .....	31
3. ANALYTICAL PROCEDURES .....	37
3.1 SAMPLE HANDLING, PACKAGING, AND SHIPPING .....	37
4. FIELD NOTEBOOKS AND DOCUMENTATION .....	39
5. DECONTAMINATION .....	41
6. QUALITY ASSURANCE AND QUALITY CONTROL .....	43
7. HANDLING OF INVESTIGATION-DERIVED WASTE .....	45
8. HEALTH AND SAFETY .....	47
9. REFERENCES .....	49

**LIST OF FIGURES**

<b>Figure</b>		<b>Page</b>
1-1	Location Map for NFSS . . . . .	7
1-2	Present Configuration of NFSS . . . . .	8
1-3	Soil and Sediment Contamination Identified at NFSS . . . . .	9
1-4	Groundwater and Surface Water Contamination Identified at NFSS . . . . .	10
2-1	Proposed Soil/Sediment Sampling Locations at NFSS . . . . .	32
2-2	Proposed Groundwater and Surface Water Sampling Locations at NFSS . . . . .	33

## LIST OF TABLES

Table	Page
1-1 Analytical Methods for Soil/Sediment . . . . .	11
1-2 Analytical Results for Volatile Organic Compounds (VOCs) in Soil at NFSS . . .	13
1-3 Toxicity Characteristic Leaching Procedure (TCLP) Analytical Results for Soil at NFSS . . . . .	14
1-4 Soil Gas Survey Results for VOCs at NFSS . . . . .	16
1-5 Analytical Results for Sediment at NFSS . . . . .	22
1-6 Analytical Results for Surface Water at NFSS . . . . .	24
1-7 Analytical Results for Groundwater at NFSS . . . . .	25
1-8 Maximum National Soil Background Concentrations . . . . .	27
1-9 Recommended Soil Cleanup Objectives . . . . .	27
2-1 Sampling Activities and Frequency . . . . .	34
2-2 Preservatives, Containers, and Holding Times . . . . .	35
2-3 Analytical Methods for Soil/Sediment . . . . .	36
2-4 Radiological Analytical Methods for Surface Water/Groundwater . . . . .	36

## LIST OF ACRONYMS AND ABBREVIATIONS

AA	atomic adsorption
AEC	Atomic Energy Commission
BNAE	base/neutral and acid extractable
BNI	Bechtel National, Inc.
°C	degrees Centigrade (Celsius)
cm	centimeter
COC	contaminant(s) of concern
DCE	dichloroethene
DOE	U.S. Department of Energy
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FSP	Field Sampling Plan
ft	foot/feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
ha	hectare(s)
ICPAES	inductively coupled plasma atomic emission spectrophotometry
in.	inch
km	kilometer(s)
L	liter
LOOW	Lake Ontario Ordnance Works
m <sup>3</sup>	cubic meter
μg	microgram
mi	mile(s)
ml	milliliter
NFSS	Niagara Falls Storage Site
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Act
PCE	tetrachloroethene
ppb	parts per billion
ppm	parts per million
QAPjP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TLD	thermoluminescent dosimeter
TNT	trinitrotoluene
VOC	volatile organic compound(s)
WCS	waste containment structure
yd <sup>3</sup>	cubic yard
yr	year

## 1. INTRODUCTION

In 1974, the Atomic Energy Commission (AEC), a predecessor of the U.S. Department of Energy (DOE), instituted the Formerly Utilized Sites Remedial Action Program (FUSRAP). This program is now managed by DOE to identify and cleanup or otherwise control sites where residual radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy under FUSRAP. One of these sites is the Niagara Falls Storage Site (NFSS). The following section provides background information about the site, along with a summary of the nature and extent of contamination, purpose of the investigation, and an outline of the data quality objectives (DQOs).

### 1.1 SITE BACKGROUND

In 1981, under the direction of DOE, Bechtel National, Inc. (BNI) initiated activities to consolidate radioactive waste and radioactively contaminated soils at the site and on vicinity properties. The remedial action was completed in 1988 and resulted in placement of 191,000 cubic meters ( $\text{m}^3$ ) (250,000 cubic yards [ $\text{yd}^3$ ]) of material in the waste containment structure (WCS) and two small temporary storage piles. The two temporary storage piles were incorporated into the WCS in 1991 which increased the total volume of the pile to 195,000  $\text{m}^3$  (255,000  $\text{yd}^3$ ), and includes 60 drums of radiological material. During excavation of radioactively contaminated soils in 1988, a small area with detectable levels of organic vapors was encountered. Samples collected from this area exhibited above-background concentrations of toluene, trichloroethene (TCE), bis(2-ethylhexyl)phthalate, 1,2-dichloroethene (1,2-DCE), and tetrachloroethene (PCE). The results of these analyses demonstrated the need to evaluate past use of the site to determine the potential presence of other nonradioactive contaminants (BNI 1990a).

NFSS has been used for several purposes. Originally, NFSS was part of the Lake Ontario Ordnance Works (LOOW). In the early 1940s, NFSS was developed as a trinitrotoluene (TNT) production facility. During this time, materials were brought to the site to make explosives, but production was never initiated. The primary use of the facility from 1940 to the mid-1950s was for storage, trans-shipment, and disposal of radioactive wastes from several sources. In addition, Building 401 was modified and used for the production of Boron-10 from 1953 to 1959 and from 1965 to 1971.

Historical records indicate that most of the materials stored at the site came from the following sources: Linde, Mallinckrodt Chemical Plant, University of Rochester, Knolls Atomic Power Laboratory, Union Carbide's Electrometallurgical Operations, Middlesex Sampling Plant, Oak Ridge National Laboratory, Eldorado Mining and Refining Co., and Brookhaven National Laboratory. These organizations shipped primarily radioactive materials to the site, but records indicate that nonradioactive materials, chemicals, and waste were also received.



Records of the exact nature of all materials that may have been stored and disposed at the site are incomplete. However, the following materials are likely to be present:

- nitric acid, potassium chlorate, diazodinitrophenol, barium nitrate, and other chemicals used in explosives production that may have been stored at the site after the Army chose not to initiate TNT production;
- research and laboratory wastes;
- solvents and waste oils from the maintenance shop (former Building 407);
- fluorine from a hydrogen fluoride release in the early 1950s and other substances that may have been stored in cylinders and disposed onsite;
- various chemicals shipped to the site for storage but not documented in detail [i.e., "two (railroad) cars of chemicals received from Colorado Mining and Refining Co."];
- heavy metals present in radioactive residues received from Linde and Mallinckrodt Chemical Plant; and
- lead sulfide.

Radioactive ores and residues received at the site, when it was part of the LOOW, contained naturally high concentrations of several heavy metals, and are potential sources of nonradioactive contamination. Records indicate that storage containers often became severely corroded.

## 1.2 SITE DESCRIPTION

NFSS occupies approximately 77 hectares (ha) (190 acres) in northwestern New York within the township of Lewiston (Niagara County). The site is located in a predominantly rural area, approximately 6 kilometers (km) [4 miles (mi)] south of Lake Ontario and 16 km (10 mi) north of the city of Niagara Falls (Figure 1-1). NFSS was developed as a waste storage area for radioactive residues from pitchblende processing and radium contaminated sand, soil, and building rubble. Construction of the WCS was completed in late 1986. In 1991, two temporary storage piles were incorporated into the WCS. Figure 1-2 illustrates the present configuration of the site.

The site is generally level but slopes to the northwest at elevations between 96.9 m and 97.9 m [318 feet (ft) and 321 ft] above mean sea level. The site drains poorly because of the flat terrain and characteristics of the soil. Soils at NFSS are predominantly silt loams underlain by clayey glacial till and lacustrine clay. Sand-gravel lenses are common. Bedrock lies 9.1 m to 15 m (30 ft to 50 ft) beneath the surface and consists of Queenston shale.

The majority of the surface water discharges from the site via the central drainage ditch and its tributary ditches into Fourmile Creek, located northwest of the site. Fourmile creek discharges into Lake Ontario which is located approximately 6 km (4 mi) north of the site. Groundwater is present in isolated sand lenses in the brown clay at depths of 1.5 m to 6.1 m (5 ft to 20 ft), in a sand-gravel zone above bedrock, and in fractures in the bedrock (the primary groundwater system beneath the site). Groundwater level contours indicate that the groundwater flows to the north-northwest with minor influences from surface water drainage. It is likely that groundwater in the bedrock discharges into the northern reaches of the Niagara River near Lake Ontario (BNI 1984).

Lakes and rivers are the predominant sources of potable water in the area surrounding NFSS; approximately 90 percent of the population in Niagara and Erie Counties use water from these sources. Water from Lake Erie serves 65 percent of the population and water from the upper Niagara River serves another 25 percent (DOE 1986). Counties north of the Niagara escarpment, including Lewiston and Porter Townships, also receive much of their water from these sources.

Groundwater is used as a water supply for approximately 10 percent of the population in Niagara and Erie Counties. Its use is primarily agricultural. The main source of this water is the Lockport Dolomite Aquifer, which is absent north of the Niagara escarpment near NFSS. Groundwater wells in the vicinity of NFSS generally have a low yield and supply water of poor quality. The upper groundwater systems in the glacial deposits are sometimes capable of supplying adequate groundwater for domestic use, although these sources may be depleted during dry seasons (DOE 1986).

The climate is classified as humid continental, with a considerable moderating influence from Lake Ontario. The normal temperature range is -3.9 degrees Centigrade (Celsius) (°C) to 24.4°C (25 degrees Fahrenheit (°F) to 76°F), with a mean annual temperature of 8.9°C (48°F). Mean annual precipitation is 80 centimeters (cm) (32 inches [in.]). Snowfall averages 140 cm/year (yr) (56 in./yr), accounting for about 10 percent of the annual total precipitation (Gale Research Company 1985).

### 1.3 SUMMARY OF EXISTING SITE CONDITIONS

The present configuration of NFSS is shown in Figure 1-2 (BNI 1990b). The dominant feature inside NFSS is the 4-ha (10-acre) WCS which is enclosed within a dike and cutoff wall, each constructed of compacted clay. The cutoff wall extends a minimum of 45.7 cm (18 in.) into an underlying gray clay unit. The dike and cutoff wall, in conjunction with an engineered earthen drainage cover or cap, enclose the wastes in a clay envelope. This clay envelope provides a barrier and prevents the migration of waste from the WCS.

BNI currently maintains site security, performs maintenance as required, and implements the environmental monitoring program. Access to the site is controlled by a 2-m (7-ft) fence that encloses the property.

An environmental monitoring program was initiated under FUSRAP in 1981. Under this program, levels of gamma radiation and concentrations of radioactivity in air, surface water, groundwater, and sediment are monitored to verify compliance with DOE radiation protection standards. Analytical results indicate that NFSS is in compliance with these standards. Groundwater has been analyzed for radioactive and nonradioactive contaminants, and concentrations of heavy metals that exceed background levels have been detected.

A chemical characterization of NFSS was conducted in 1990 by BNI. The primary objective of the chemical characterization activities was to identify the nature and extent of nonradiological contamination at the site. Characterization activities consisted of collecting and analyzing soil, sediment, surface water, and groundwater samples and conducting a soil gas survey. The results from this characterization are presented in Tables 1-1 through 1-7, and have been compared to: maximum national background averages defined by Braunstein (1981), to soil cleanup guidelines presented in New York State Department of Environmental Conservation (NYSDEC) (1992), and to surface water and groundwater quality standards defined in Water Resources (1991).

In soil samples, magnesium, lead, thallium, and zinc were detected in concentrations above maximum national background ranges (Table 1-8). Background soil samples are proposed to be collected as part of this investigation in order to determine if background metals are naturally high in this area. TCE, 1,2-DCE, toluene, fluoranthene, pyrene, butylbenzylphthalate, and carbon disulfide were also detected in one or more soil samples, but in concentrations well below the state recommended soil cleanup objectives (Table 1-9). The results from samples tested for hazardous waste characteristics, as defined by the Resource Conservation and Recovery Act (RCRA), indicated that the material is not RCRA-hazardous. It is uncertain whether or not antimony, arsenic, cadmium, mercury, molybdenum, and selenium concentrations in soil exceed background conditions and/or state guidelines, because historical detection limits are greater than guidelines. Metals contamination will need to be re-evaluated after site specific background sampling has been performed.

The soil gas survey revealed a moderately elevated concentration of TCE north of Building 401 in the central portion of the survey area; lower concentrations were found to the south and east (see Figure 1-3). PCE and cis-1,2-DCE were also found near Building 401 at concentrations near detection limits. PCE was present at relatively low concentrations in the north-central portion of the site, just south of the area known to be radioactively contaminated. Benzene, toluene, trans-1,2-DCE, and methylene chloride were not detected at concentrations exceeding their respective detection limits in any of the samples.

Analysis of sediment samples collected from onsite and central drainage ditch locations indicated the presence of copper, magnesium, thallium, and zinc at above maximum national background concentrations. Analysis of samples collected from the sump (Location SMO6) north of Building 401 indicated above background concentrations of magnesium and thallium (Figure 1-3). Because the detection limit for cadmium, molybdenum, antimony, and selenium exceeded regulatory guidelines, it is uncertain whether or not they are contaminants of concern (COCs).

Analysis of surface water samples collected from onsite locations indicated the presence of magnesium, thallium, and zinc at concentrations exceeding maximum national background concentrations (Figure 1-4). Because the detection limit for historical silver, lead, selenium, and vanadium analyses exceeded regulatory guidelines it is uncertain if these metals are COCs at the site.

Analysis of groundwater samples indicated that the metals cadmium, magnesium, thallium, vanadium, and/or zinc exceeded state guidelines in Wells BH-46, BH-48, BH-50, BH-51, BH-60, and BH-61 (Figure 1-4). It is uncertain if silver, lead, and selenium concentrations in groundwater exceed regulatory guidelines because the historical detection limits are greater than background. Analytical results indicated that concentrations of volatile and base/neutral and acid extractable (BNAE) organics are well below regulated levels.

#### **1.4 CONTAMINANTS OF CONCERN**

The results from initial characterization studies performed at NFSS were compared against applicable state standards and maximum background concentrations reported for soils across the United States (Braunstein, 1981) in order to identify COCs at the site. Based on this comparison, the metals cadmium, copper, lead, magnesium, thallium, vanadium, and zinc were identified as the primary COCs for the site.

While TCE, 1,2-DCE, and PCE were not detected in concentrations exceeding regulatory guidelines, they are still being considered COCs because organic compounds such as these are suspected to have been used or stored in the vicinity of Buildings 401 and former Building 407.

#### **1.5 PURPOSE AND SCOPE**

The conclusions from a recent data sufficiency evaluation determined that there are several gaps in the NFSS characterization database which need to be filled in order to complete the characterization of this site. These data gaps include the need to define the presence and depth of organic and/or metal contamination in soil and groundwater in the near vicinity of Building 401 and former Building 407. Former Building 407 was historically used to store solvents and waste oil. In addition, there is a need to complete the sediment and surface water characterization downstream from Building 401 and former Building 407. The work proposed in this Field Sampling Plan (FSP) will resolve these data insufficiencies.

#### **1.6 DATA QUALITY OBJECTIVES**

The U.S. Environmental Protection Agency's (EPA) DQOs Procedure (1993) was utilized in the development of this FSP. The EPA procedures assisted in identifying the data gaps discussed in Section 1.5; thus, it helped in determining the number of additional samples needed

to eliminate the data gaps, in defining the sampling locations, and finally, in determining what minimum data quality requirements are needed to meet sampling objectives.

The number and location of additional sampling points are presented in text, tables, and maps in Section 2. The following text, therefore, focuses on data quality requirements.

The analytical methods to be performed on soil, surface water, groundwater, and sediment samples are summarized in Tables 2-3 and 2-4 and will be accompanied by a Summary Level analytical data package. Onsite screening of environmental samples will not be performed since the relatively small number of samples being collected does not justify the cost of setting up an onsite laboratory. The only analyses that are proposed to be performed in the field are pH, temperature, and conductivity measurements, which will be performed at a Screening Level.

Since there currently is no site-specific background analytical data which historical sampling data can be compared, one background soil and one direct push groundwater sampling location are proposed. One discretionary background sediment and surface water sample are also proposed. These samples will be collected only if the historical upstream sampling locations are determined not to represent upstream conditions.

While existing groundwater monitoring Well BH-46, which is located approximately 1,000 ft downgradient from Building 401 and the former solvent and waste storage Building 407, shows no evidence of volatile organic contamination in groundwater, soil gas sampling results identified low concentrations of cis-1,2-DCE, TCE, and PCE in the vicinity of this building and former Building 407. Also, deep soil samples collected from three boreholes located to the north and south of Building 401 show TCE and/or 1,2-DCE in concentrations as high as 440 micrograms ( $\mu\text{g}$ )/L and 59  $\mu\text{g}$ /L, respectively. In order to determine if volatile organics are a problem in groundwater in the vicinity of Building 401 and former Building 407, numerous groundwater samples are proposed to be collected using the Direct Push Method. The analysis of these samples will provide data of sufficient quality to determine if volatile organics are a problem in groundwater in this area.

One surface water and one sediment sample are proposed to be collected from the South 16 Ditch for volatile organic compounds (VOCs) and metals analysis. A second sediment sample is proposed to be collected at the north end of the west drainage ditch. The results from these samples will determine if the volatile organics detected in nearby soil samples are migrating through surface water and sediment. These analyses will be accompanied by a Summary Level data package.

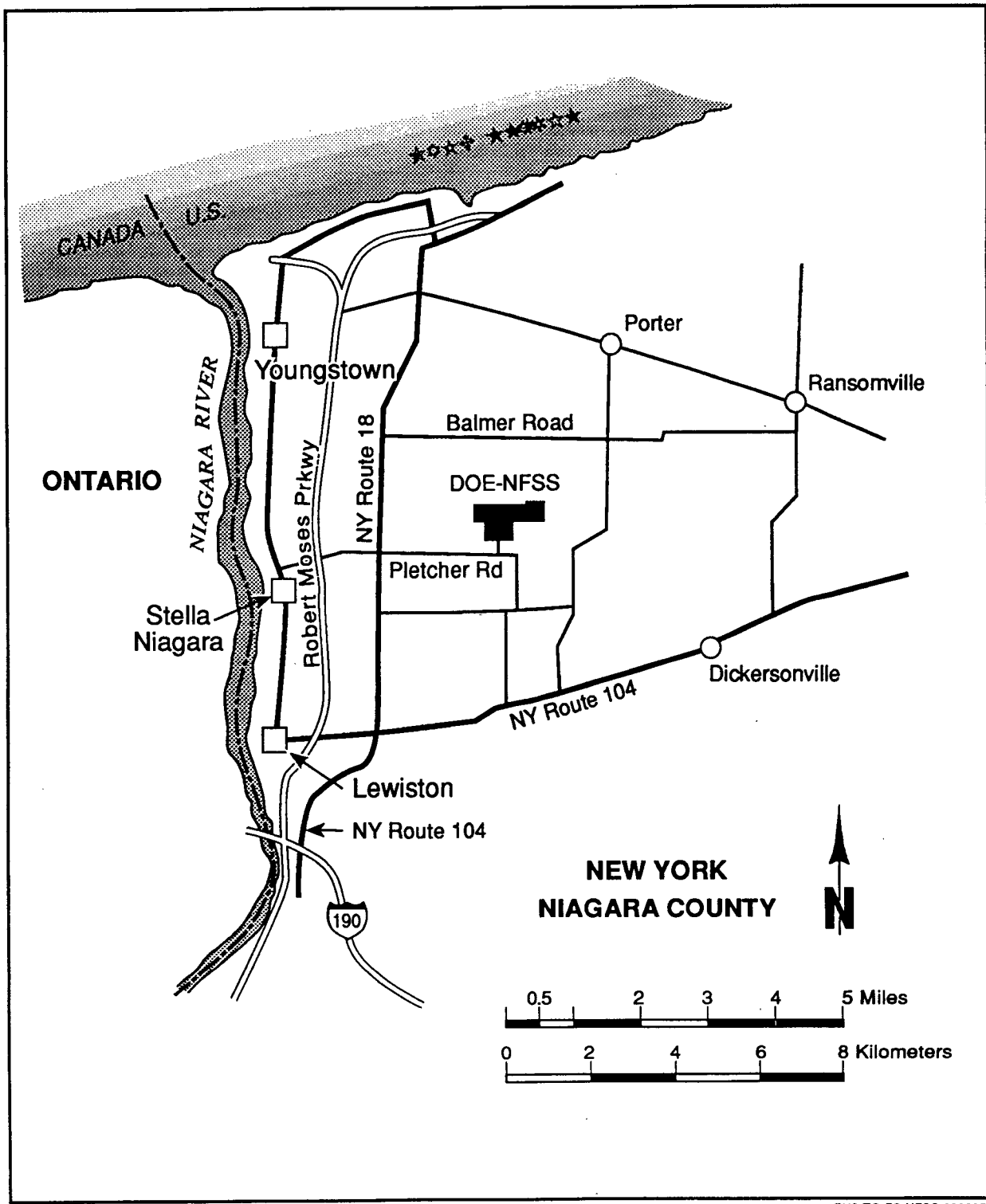


Figure 1-1. Location Map for NFSS

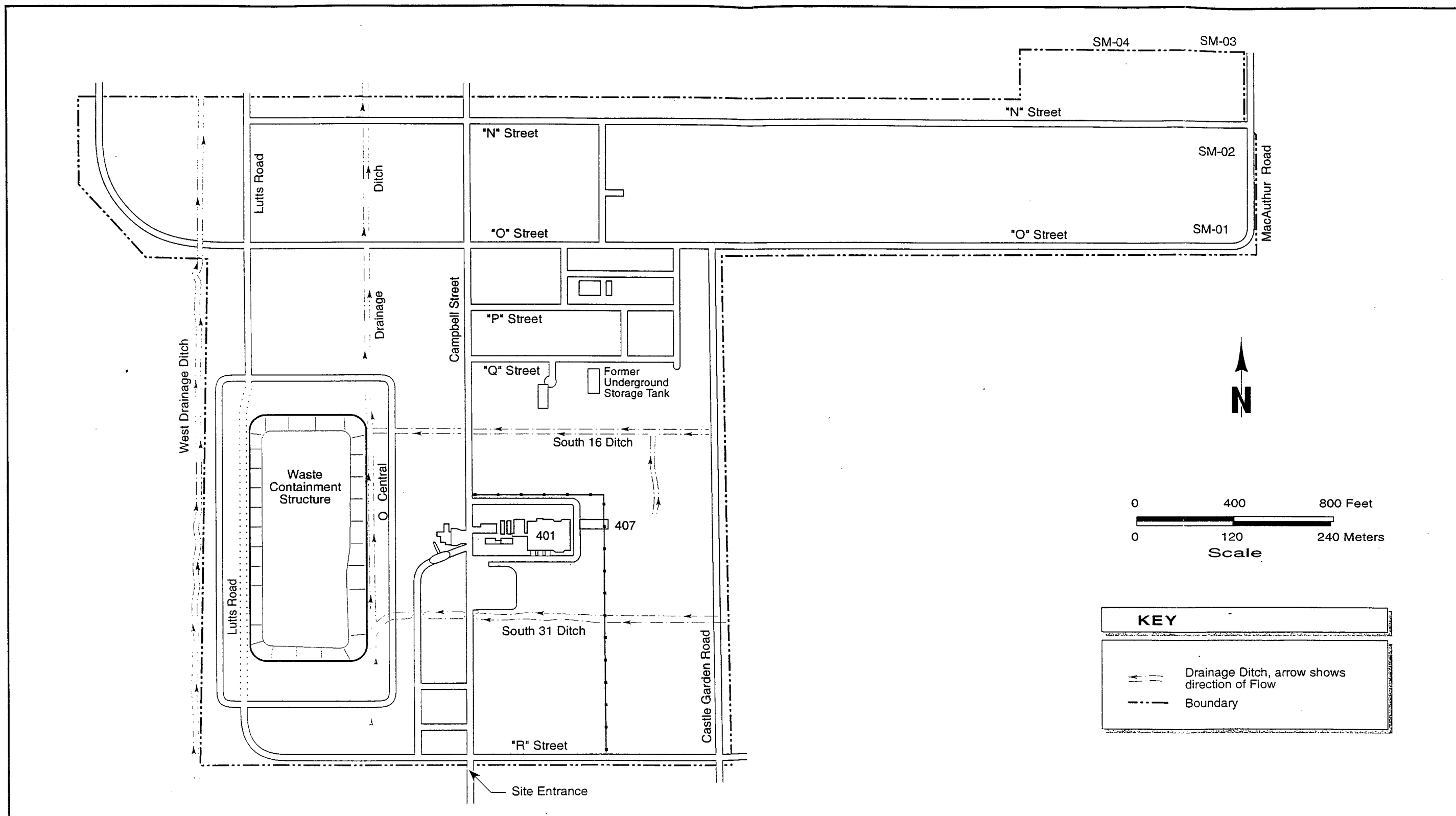


Figure 1-2. Present Configuration of NFSS





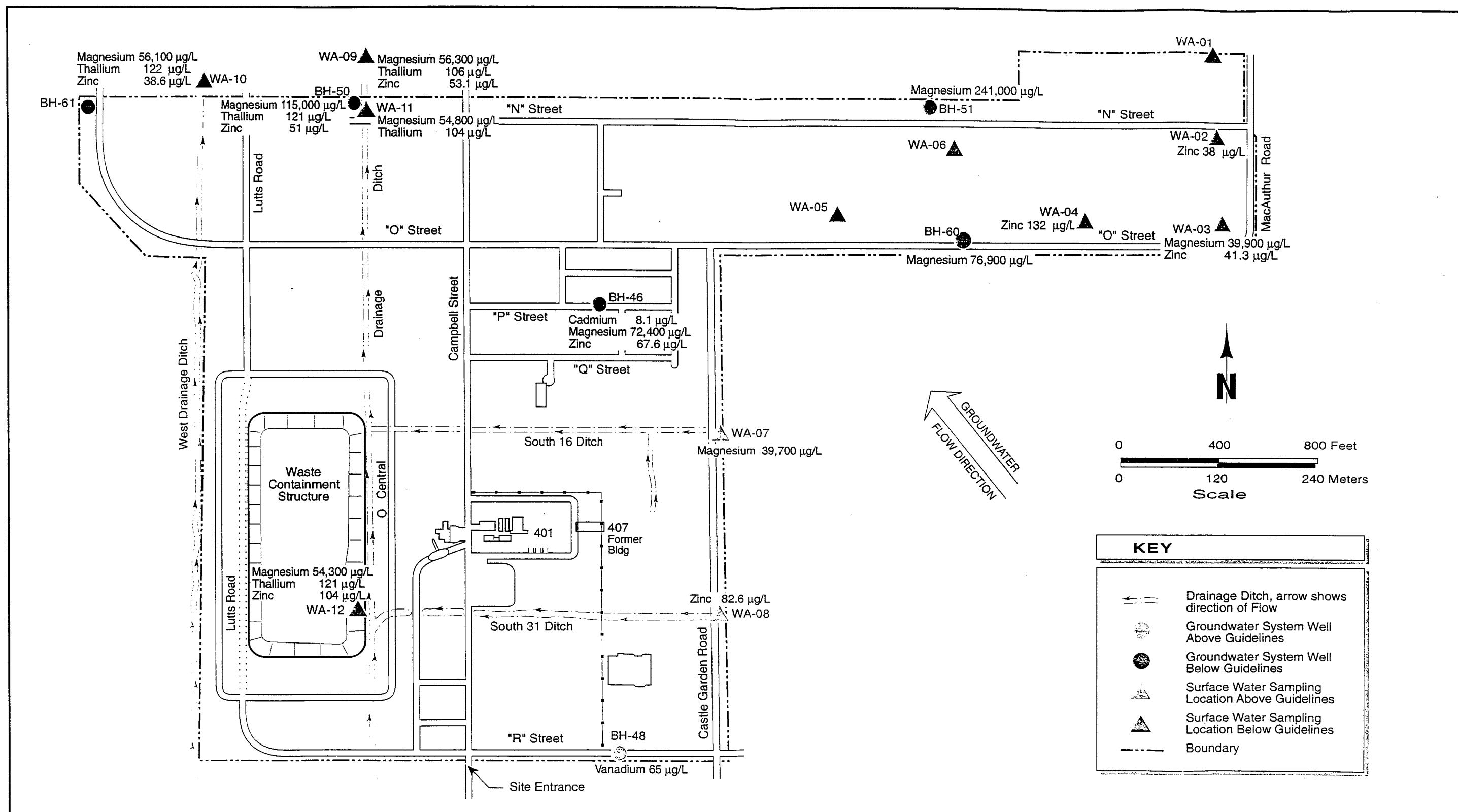


Figure 1-4. Groundwater and Surface Water Contamination Identified at NFSS

Table 1-1. Analytical Results for Soil at NFSS.

Parameter	Concentration by Location													
	B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14
<b>Metals (ppm)</b>														
Silver	2.2*	2*	2*	1.8*	1.8*	1.9*	2.2*	2.3*	2*	1.8*	1.6*	1.9*	1.6*	1.7*
Aluminum	12,600	12,400	17,500	21,400	16,600	18,000	10,100	12,400	5,180	11,400	8,070	8,690	10,800	12,700
Arsenic	22.1*	20.1*	98.1*	89.7*	92.1*	95.5*	22.1*	23.4*	19.6*	17.7*	16.1*	18.9*	16.3*	17.3*
Boron	22.1*	20.1*	23.5	18*	18.4*	19.1*	22.1*	23.4*	19.6*	17.7*	16.1*	18.9*	16.3*	500
Barium	134	173	121	254	106	136	148	178	64	147	84.2	156	192	208
Beryllium	1.1*	1*	0.98*	1.2*	0.92*	0.96*	1.1*	1.2*	0.98*	1	0.81*	0.95*	0.85	0.9
Calcium	23,400	45,700	59,600	5,770	54,300	15,900	25,300	6,810	33,500	20,100	47,400	48,100	6,760	5,570
Cadmium	1.1*	1*	0.98*	0.9*	0.92*	0.96*	1.1*	1.2*	0.98*	0.88*	0.81*	0.95*	0.82*	0.86*
Cobalt	11.1*	10.9	12.8	9*	11.7	9.6*	12	11.7*	9.8*	13.5	10.5	10.3	12.7	8.6*
Chromium	15.5	17.1	22	23.8	20.3	20.2	25.8	17.8	6.7	15.1	11.4	11.3	15.2	16.5
Copper	41.3	22.6	24.2	47	26.6	23.5	29.8	30.5	25.4	33.7	26.5	24.5	22.9	31.1
Iron	25,700	23,200	24,900	13,500	23,600	23,700	20,300	22,600	11,000	25,500	17,000	19,100	19,200	10,100
Mercury	0.11*	0.11*	13,500	0.12*	0.12*	0.13*	0.13*	0.12*	0.12*	0.12*	0.12*	0.12*	0.12*	0.12*
Potassium	1,110*	1,970	0.12*	1,740	3,370	2,130	1,110*	1,170*	982*	884*	1,070	946*	815*	864*
Magnesium	6,650	10,700	12,300	5,040	11,600	5,780	6,760	5,800	6,460	7,070	9,120	8,240	5,430	3,620
Manganese	579	571	772	120	758	424	625	650	699	734	717	619	1,000	105
Molybdenum	22.1*	20.1*	19.6	18*	18.4*	19.1*	22.1*	23.4*	19.6*	17.7*	16.1*	18.9*	16.3*	17.3*
Sodium	1,110*	1,000*	980*	898*	921*	955*	1,110*	1,170*	982*	884*	806*	946*	815*	2,800
Nickel	21.6	22.6	24.9	22.3	21.5	16.5	19.5	23.3	11	22.6	18.9	18.5	25.6	15.1
Lead	22.1*	20.1*	17.6*	16.2*	16.6*	17.2*	368	23.4*	19.6*	17.7*	16.1*	18.9*	16.3*	17.3*
Antimony	13.3*	12.1*	11.8*	10.8*	11.1*	11.5*	13.3*	14.1*	11.8*	10.6*	9.7*	11.4*	9.8*	10.4*
Selenium	22.1*	20.1*	98.1*	89.7*	92.1*	95.5*	22.1*	23.4*	19.6*	17.7*	16.1*	18.9*	16.3*	17.3*
Thallium	88.5	75.7	109*	89.7*	104*	95.5*	84.8	90.5	54.8	104	77.2	79.2	82.1	61.2
Vanadium	21.6	21.2	29.7	26.9	29.7	31.3	19.6	24.7	13.1	26.3	17.2	18.3	17.2	14.1
Zinc	54.3	53.6	56.8	59.5	53.1	37.7	605	59.4	37.2	47.9	53.7	47.3	42.7	49.5
Percent solids	87.5	87.5	85.6	81.1	86.2	79.7	75.6	85.1	84.9	80.8	84.4	85.6	84.9	81.9

126500

Table 1-1. (continued)

Concentration by Location														
Parameter	B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14
<u>Mobile ions (ppm)</u>														
Carbonate	2*	2*	2*	2*	2*	2*	2*	2*	8*	2*	2*	2*	2*	2*
Chloride	28.6*	28.6*	29.2*	30.8*	29*	31.4*	72.7	29.4*	29.4*	31*	33.3	29.7	29.4*	62.7
Fluoride	3.6	7.2	10.2	4.1	11	4.6	39	4.6	10.8	11	7.3	6.1	4.9	1,470
N, as nitrite	0.57*	0.57*	0.58*	0.62*	0.58*	0.63*	0.66*	0.59*	0.6*	0.62*	0.59*	0.58*	0.59*	0.77
N, as nitrate	0.57*	0.57*	0.58*	2.6	0.81	0.69*	0.66a	0.68*	4.3	1.2	2.8	0.8	2.3	3.3
P, as phosphate	597	690	664	779	658	477	645	585	622	655	680	679	682	748
Sulfite	5.7	5.7*	2*	2*	2*	2*	2*	2*	2*	2*	2*	2*	2*	2*
Sulfate	287	127	158	110	96.9	832	632	275	63.1	166	247	205	121	29.5*
<u>Organics (ppb)</u>														
Carbon disulfide	12	25	ND <sup>a</sup>	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	22	ND	ND	ND	ND	ND	ND	11	ND	ND	ND	29
Fluoranthene	ND	ND	ND	ND	ND	ND	570	ND	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND	560	ND	ND	ND	ND	ND	ND	ND
Butylbenzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	460

\*Detection limit

<sup>a</sup>ND - no detectable concentration

126500

**Table 1-2. Analytical Results for VOCs in Soil at NFSS.**

Parameter	Depth (ft)	Concentration (ppb) by Location			
		59	60	80	161
Trichloroethene	0-1	51	ND <sup>a</sup>	10	43
	1-2	49	12	32	70
	2-3	65	ND	21	440
	3-4	ND	20	7	90
1, 2-dichloroethene (total)	0-1	ND	ND	ND	ND
	1-2	ND	ND	ND	ND
	2-3	ND	ND	ND	18
	3-4	ND	ND	ND	59

<sup>a</sup>ND - no detectable concentration

**Table 1-3. Toxicity Characteristic Leaching Procedure (TCLP) Analytical Results for Soil at NFSS.**

Parameter	Concentration (ppb) by Location	
	B13	B14
<u>Volatiles</u>		
Vinyl Chloride	10 <sup>a</sup>	10 <sup>a</sup>
1, 1-Dichloroethene	5 <sup>a</sup>	5 <sup>a</sup>
Chloroform	ND <sup>b</sup>	5 <sup>a</sup>
1, 2-Dichloroethane	5 <sup>a</sup>	5 <sup>a</sup>
2-Butanone	10 <sup>a</sup>	10 <sup>a</sup>
Carbon Tetrachloride	5 <sup>a</sup>	5 <sup>a</sup>
Trichloroethene	5 <sup>a</sup>	5 <sup>a</sup>
Benzene	5 <sup>a</sup>	5 <sup>a</sup>
Tetrachloroethene	5 <sup>a</sup>	5 <sup>a</sup>
Chlorobenzene	5 <sup>a</sup>	5 <sup>a</sup>
<u>BNAEs</u>		
Pyridine	12 <sup>a</sup>	12 <sup>a</sup>
1, 4-Dichlorobenzene	12 <sup>a</sup>	12 <sup>a</sup>
2-Methylphenol	12 <sup>a</sup>	12 <sup>a</sup>
3-Methylphenol	12 <sup>a</sup>	12 <sup>a</sup>
4-Methylphenol	12 <sup>a</sup>	12 <sup>a</sup>
Hexachloroethane	12 <sup>a</sup>	12 <sup>a</sup>
Nitrobenzene	12 <sup>a</sup>	12 <sup>a</sup>
Hexachlorobutadiene	12 <sup>a</sup>	12 <sup>a</sup>
2, 4, 6-Trichlorophenol	12 <sup>a</sup>	12 <sup>a</sup>
2, 4, 5-Trichlorophenol	60 <sup>a</sup>	60 <sup>a</sup>
2, 4-Dinitrotoluene	12 <sup>a</sup>	12 <sup>a</sup>
Hexachlorobenzene	12 <sup>a</sup>	12 <sup>a</sup>
Pentachlorophenol	60 <sup>a</sup>	60 <sup>a</sup>

Table 1-3. (continued)

Parameter	Concentration (ppb) by Location	
	B13	B14
<u>Volatiles</u>		
<u>Metals</u>		
Silver	500 <sup>a</sup>	500 <sup>a</sup>
Arsenic	500 <sup>a</sup>	500 <sup>a</sup>
Barium	1,000 <sup>a</sup>	2,990
Cadmium	100 <sup>a</sup>	100 <sup>a</sup>
Chromium	500 <sup>a</sup>	500 <sup>a</sup>
Mercury	2 <sup>a</sup>	0.2 <sup>a</sup>
Lead	500 <sup>a</sup>	500 <sup>a</sup>
Selenium	100 <sup>a</sup>	100 <sup>a</sup>
<u>Pesticides</u>		
Gamma-BHC (Lindane)	0.1 <sup>a</sup>	0.1 <sup>a</sup>
Heptachlor	0.1 <sup>a</sup>	0.1 <sup>a</sup>
Endrin	0.2 <sup>a</sup>	0.3 <sup>a</sup>
Methoxychlor	1.2 <sup>a</sup>	1.2 <sup>a</sup>
Toxaphene	2.4 <sup>a</sup>	2.5 <sup>a</sup>
Chlordane	1.2 <sup>a</sup>	1.2 <sup>a</sup>
<u>Herbicides</u>		
2, 4-D	2 <sup>a</sup>	2 <sup>a</sup>
2, 4, 5-TP (Silvex)	1 <sup>a</sup>	1 <sup>a</sup>
<u>Inorganics</u>		
% Solids	86.9	82.4
Cyanide (ppm)	1.2 <sup>a</sup>	1.2 <sup>a</sup>
Corrosivity (pH units)	7.8	8.2
Sulfide (ppm)	0.3 <sup>a</sup>	0.3 <sup>a</sup>
<sup>a</sup> Detection limit		
<sup>b</sup> No detectable concentration		

Table 1-4. Soil Gas Survey Results for VOCs at NFSS.

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
1	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
2	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
3	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
4	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
5	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
6	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
7	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
8	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
9	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.05
10	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
11	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
12	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
13	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
14	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
15	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
16	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
17	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
18	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
19	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
20	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
21	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
22	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
23	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
24	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
25	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
26	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
27	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
28	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
29	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126570

Table 1-4. (continued)

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
30	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
31	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
32	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
33	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
34	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
35	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
36	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
37	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
38	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
39	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
40	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
41	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
42	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
43	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
44	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
45	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
46	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
47	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
48	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
49	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
50	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
51	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
52	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
53	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
54	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
55	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
56	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
57	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126520



Table 1-4. (continued)

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
58	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
59	4	<1.0	<1.0	<1.0	2.52	<1.0	44.5	<0.05
60	4	<1.0	<1.0	<1.0	9.0	<1.0	1.7	<0.05
61	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
62	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
63	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
64	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
65	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
66	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
67	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
68	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
69	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
70	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
71	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	0.12
72	4	<1.0	<1.0	<1.0	<1.0	<1.0	0.35	0.44
73	3	<1.0	<1.0	<1.0	<1.0	<1.0	2.1	0.6
74	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
75	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
76	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
77	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
78	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
79	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
80	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	1.22
81	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
82	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
83	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
84	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
85	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126520

Table 1-4. (continued)

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
86	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
87	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
88	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
89	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
90	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
91	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
92	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
93	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
94	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
95	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
96	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
97	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
98	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
99	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
100	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
101	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
102	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
103	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
104	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
105	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
106	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
107	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
108	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
109	2	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
110	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
111	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
112	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
113	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126500

Table 1-4. (continued)

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
114	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
115	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
116	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
117	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
118	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
119	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
120	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
121	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
122	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
123	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
124	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
125	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
126	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
127	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
128	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
129	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
130	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
131	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
132	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
133	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
134	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
135	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
136	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
137	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
138	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
139	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
140	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
141	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126500

Table 1-4. (continued)

Sample Number	Sampling Concentration ( $\mu\text{g/L}$ )							
	Depth (ft)	Benzene	Toluene	Trans-1,2-DCE	Cis-1,2-DCE	Methylene Chloride	TCE	PCE
142	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
143	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
144	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
145	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
146	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
147	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
148	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
149	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
150	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
151	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
152	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
153	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
154	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
155	4	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<0.05
156	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
157	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
158	4	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
159	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05
160	3	<1.0	<1.0	<1.0	<1.0	<1.0	<0.1	<0.05

126520

Table 1-5. Analytical Results for Sediment at NFSS.

Concentration in Parts per Million (ppm)									
Parameter	SM01	SM02	SM03	SM04	SM05 <sup>a</sup>	SM06	SM07 <sup>a</sup>	SM08	SM09
Silver	1.7 <sup>b</sup>	2.1 <sup>b</sup>	2.3 <sup>b</sup>	4.4 <sup>b</sup>	3.8	2.4 <sup>b</sup>	2.8 <sup>b</sup>	2.2 <sup>b</sup>	3.1 <sup>b</sup>
Aluminum	12,900	18,300	10,300	13,300	19,500	16,100	14,500	15,700	19,100
Arsenic	17.2 <sup>b</sup>	21.5 <sup>b</sup>	22.7 <sup>b</sup>	43.8 <sup>b</sup>	26.7 <sup>b</sup>	23.6 <sup>b</sup>	27.7 <sup>b</sup>	22.2 <sup>b</sup>	31 <sup>b</sup>
Boron	17.2 <sup>b</sup>	21.5 <sup>b</sup>	22.7 <sup>b</sup>	43.8 <sup>b</sup>	26.7 <sup>b</sup>	23.6 <sup>b</sup>	27.7 <sup>b</sup>	22.2 <sup>b</sup>	31 <sup>b</sup>
Barium	83.8	162	78.1	138	180	160	138	168	144
Beryllium	0.86 <sup>b</sup>	1.1 <sup>b</sup>	1.1 <sup>b</sup>	2.2 <sup>b</sup>	1.3 <sup>b</sup>	1.2 <sup>b</sup>	1.4 <sup>b</sup>	1.1 <sup>b</sup>	1.6 <sup>b</sup>
Calcium	26,700	49,400	6,480	11,500	51,300	69,200	36,100	52,900	38,200
Cadmium	0.86 <sup>b</sup>	1.1 <sup>b</sup>	1.1 <sup>b</sup>	2.2 <sup>b</sup>	1.3 <sup>b</sup>	1.2 <sup>b</sup>	1.4 <sup>b</sup>	1.1 <sup>b</sup>	1.6 <sup>b</sup>
Cobalt	9.5	12.6	11.4	21.9 <sup>b</sup>	14.9	11.8 <sup>b</sup>	15.4	13.2	15.5 <sup>b</sup>
Chromium	17	24.3	16.1	25.3	116	27.4	225	20.3	35.7
Copper	23.8	35.1	27.5	52.9	151	28.2	38.8	29.2	39.1
Iron	20,200	25,900	14,700	25,600	30,000	25,000	24,200	25,300	28,700
Mercury	0.12 <sup>b</sup>	0.12 <sup>b</sup>	0.31	0.23 <sup>b</sup>	0.16 <sup>b</sup>	0.13 <sup>b</sup>	0.17 <sup>b</sup>	0.12 <sup>b</sup>	0.18 <sup>b</sup>
Potassium	2,290	3,120	1,910	2,190 <sup>b</sup>	3,810	2,570	1,880	2,950	3,180
Magnesium	7,830	10,500	3,460	5,820	14,900	23,600	9,530	12,000	11,000
Manganese	527	906	191	358	733	1,610	1,160	795	620
Molybdenum	17.2 <sup>b</sup>	21.5 <sup>b</sup>	22.7 <sup>b</sup>	43.8 <sup>b</sup>	26.7 <sup>b</sup>	23.6 <sup>b</sup>	27.7 <sup>b</sup>	22.2 <sup>b</sup>	31 <sup>b</sup>
Sodium	858 <sup>b</sup>	1,070	1,140	2,190 <sup>b</sup>	1,340	1,180 <sup>b</sup>	1,380	1,110	1,550 <sup>b</sup>
Nickel	20.5	25.8	17.3	27.7	45	18.4	25.8	25.1	28.7
Lead	17.2 <sup>b</sup>	21.5 <sup>b</sup>	27.3	50.2	102	23.6 <sup>b</sup>	27.7 <sup>b</sup>	22.2 <sup>b</sup>	31 <sup>b</sup>
Antimony	10.3 <sup>b</sup>	12.9 <sup>b</sup>	13.6 <sup>b</sup>	26.3 <sup>b</sup>	16 <sup>b</sup>	14.2 <sup>b</sup>	16.6 <sup>b</sup>	13.3 <sup>b</sup>	18.6 <sup>b</sup>
Selenium	17.2 <sup>b</sup>	21.5 <sup>b</sup>	22.7 <sup>b</sup>	43.8 <sup>b</sup>	26.7 <sup>b</sup>	23.6 <sup>b</sup>	27.7 <sup>b</sup>	22.2 <sup>b</sup>	31 <sup>b</sup>
Thallium	79.5	111	54.7	101	115	115	106	106	116
Vanadium	18.9	31	16.3	22.9	33	30.7	26.8	26.8	30.3
Zinc	71.1	77.1	928	1,830	268	66.4	99.4	60.1	158

126500

Table 1-5. (continued)

Concentration in Parts per Million (ppm)									
Parameter	SM01	SM02	SM03	SM04	SM05 <sup>a</sup>	SM06	SM07 <sup>a</sup>	SM08	SM09
Percent solids	83.5	81.2	74.2	42.7	62	78.9	59.9	80.1	54.7
Carbonate	2 <sup>b</sup>	20	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Chloride	29.9 <sup>b</sup>	30.8 <sup>b</sup>	33.7 <sup>b</sup>	58.5 <sup>b</sup>	182	31.7 <sup>b</sup>	41.7 <sup>b</sup>	40.4	65.3
Fluoride	7	8	12.3	5.5	24	2.8	5	12	25.9
N, as nitrite	0.6 <sup>b</sup>	0.62 <sup>b</sup>	0.67 <sup>b</sup>	1.2 <sup>b</sup>	0.81 <sup>b</sup>	6.3 <sup>b</sup>	0.83 <sup>b</sup>	0.62 <sup>b</sup>	0.91 <sup>b</sup>
N, as nitrate	2.2	1	3.4	3.8	1.4	6.3 <sup>b</sup>	3.3	2.3	3.3
P, as phosphate	612	641	595	660	930	530	847	586	681
Sulfite	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Sulfate	158	98.4	642	58.5 <sup>b</sup>	2,890	43 <sup>b</sup>	107	184	111
Concentration in Parts per Billion (ppb)									
Methylene Chloride	14	ND <sup>c</sup>	ND	ND	ND	ND	ND	ND	ND
Acetone	45	ND	ND	ND	ND	250	ND	32	ND
Aroclor-1242	ND	ND	1,700	ND	ND	ND	ND	ND	ND
Aroclor-1260	ND	ND	1,600	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl) phthalate	ND	ND	ND	ND	1,200	ND	ND	ND	ND
<sup>a</sup> Background location <sup>b</sup> Detection limit <sup>c</sup> ND - no detectable concentration									

126500

Table 1-6. Analytical Results for Surface Water at NFSS.

Parameter	Concentration (µg/L) by Location											
	WA01	WA02	WA03	WA04	WA05	WA06	WA07 <sup>a</sup>	WA08 <sup>a</sup>	WA09	WA10	WA11	WA12
Silver	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>
Aluminum	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>
Arsenic	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>
Boron	117	160	670	428	235	100 <sup>b</sup>	744	495	10,700	249	4,990	7,660
Barium	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>
Beryllium	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>
Calcium	61,400	56,600	130,000	79,000	59,500	14,700	158,000	162,000	143,000	75,800	129,000	155,000
Cadmium	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>
Cobalt	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>
Chromium	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>
Copper	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>
Iron	244	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	115	105	100 <sup>b</sup>	105	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>
Mercury	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>
Potassium	5,000 <sup>b</sup>	5,000 <sup>b</sup>	5,000 <sup>b</sup>	5,420	5,000 <sup>b</sup>	5,000 <sup>b</sup>	5,000 <sup>b</sup>	8,210	5,000 <sup>b</sup>	5,000 <sup>b</sup>	5,000 <sup>b</sup>	6,920
Magnesium	13,900	19,800	39,900	24,400	21,100	13,000	39,700	25,200	56,300	56,100	54,800	54,300
Manganese	15 <sup>b</sup>	468	481	66.7	228	15 <sup>b</sup>	62.8	1,040	126	484	607	15 <sup>b</sup>
Molybdenum	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>
Sodium	5,000 <sup>b</sup>	6,700	27,100	18,500	12,400	5,000 <sup>b</sup>	98,800	651,000	77,100	32,000	61,900	79,300
Nickel	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>
Lead	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>
Antimony	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>
Selenium	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>
Thallium	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	106	122	104	121
Vanadium	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>
Zinc	26.9	38.6	41.3	132	20 <sup>b</sup>	20 <sup>b</sup>	20 <sup>b</sup>	82.6	53.1	38.6	23.7	104
Bis(2-ethylhexyl) phthalate	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	25	10 <sup>b</sup>	10 <sup>b</sup>

126500

<sup>a</sup> Background Location  
<sup>b</sup> Detection Limit

Table 1-7. Analytical Results for Groundwater at NFSS.

Parameter (unit)	Concentration (µg/L) by Location															
	OW5A	OW5B	OW9A	OW9B	OW13A	OW13B	OW14A	OW14B	OW16A	OW16B	BH46	BH48	BH50	BH51	BH60	BH61
Silver	NA <sup>a</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 <sup>b</sup>	NA	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	NA
Aluminum	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 <sup>b</sup>	NA	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	NA
Boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	809	NA	744	787	732	NA
Barium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	200 <sup>b</sup>	NA	200 <sup>b</sup>	200 <sup>b</sup>	200 <sup>b</sup>	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 <sup>b</sup>	NA	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	NA
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	89,200	NA	113,000	149,000	94,500	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.1	NA	5 <sup>b</sup>	5 <sup>b</sup>	5 <sup>b</sup>	NA
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50 <sup>b</sup>	NA	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10 <sup>b</sup>	NA	10 <sup>b</sup>	10 <sup>b</sup>	10 <sup>b</sup>	NA
Copper	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	53.1	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25 <sup>b</sup>
Iron	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	104	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	240	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	214	192	100 <sup>b</sup>	124	100 <sup>b</sup>
Mercury	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>	0.2 <sup>b</sup>
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9,050	NA	8,840	6,830	6,250	NA
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	72,400	NA	115,000	241,000	76,900	NA
Manganese	38.9	15 <sup>b</sup>	112	17.9	15 <sup>b</sup>	15 <sup>b</sup>	122	22.3	16	183	113	682	72.1	64.8	62.7	64.4
Molybdenum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 <sup>b</sup>	NA	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	168,000	NA	168,000	247,000	179,000	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	40 <sup>b</sup>	NA	40 <sup>b</sup>	40 <sup>b</sup>	40 <sup>b</sup>	NA
Lead	6 <sup>b</sup>	6 <sup>b</sup>	3 <sup>b</sup>	3 <sup>b</sup>	6 <sup>b</sup>	6 <sup>b</sup>	6 <sup>b</sup>	3 <sup>b</sup>	6 <sup>b</sup>	6 <sup>b</sup>	100 <sup>b</sup>	3 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	3 <sup>b</sup>
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	60 <sup>b</sup>	NA	60 <sup>b</sup>	60 <sup>b</sup>	60 <sup>b</sup>	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 <sup>b</sup>	NA	100 <sup>b</sup>	100 <sup>b</sup>	100 <sup>b</sup>	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 <sup>b</sup>	NA	120	100 <sup>b</sup>	100 <sup>b</sup>	NA
Vanadium	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	65	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>	50 <sup>b</sup>
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	67.6	NA	51	22	27.7	NA
Acetone	ND <sup>c</sup>	ND	ND	ND	71	ND	25 <sup>d</sup>	ND	ND	ND	13 <sup>d</sup>	ND	ND	ND	ND	NA
Carbon disulfide	ND	ND	ND	ND	ND	ND	ND	12	ND	ND	ND	ND	ND	ND	ND	NA
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	5 <sup>d</sup>	ND	ND	ND	ND	ND	ND	6 <sup>d</sup>	NA

126500



Table 1-7. (continued)

Parameter (unit)	Concentration (µg/L) by Location															
	OW5A	OW5B	OW9A	OW9B	OW13A	OW13B	OW14A	OW14B	OW16A	OW16B	BH46	BH48	BH50	BH51	BH60	BH61
Bis(2-ethyl hexyl) phthalate	45	ND	ND	20	14	11	22	ND	25	13	ND	17	19	22	13	NA
TOC (mg/L)	294	89.5	1.9	20.4	5.1	17.3	1.7	6	3	25.9	NA	5.5	NA	NA	NA	6.2
pH	8.4	7.7	7.5	7.3	10	7.4	7.8	8.1	7.4	7.6	7.6	8.1	11.4	NA	NA	7.2
Sp. cond.* (µmhos/cm)	1,280	1,500	1,640	2,440	1,530	2,080	1,680	1,240	2,300	1,260	1,550	4,930	1,990	NA	NA	1,570
TOX (µg/L)	63	23	20 <sup>b</sup>	20 <sup>b</sup>	20 <sup>b</sup>	48	20 <sup>b</sup>	20 <sup>b</sup>	20 <sup>b</sup>	20 <sup>b</sup>	NA	76	NA	NA	NA	96

\*Not analyzed

<sup>b</sup>Detection limit<sup>c</sup>No detectable concentration<sup>d</sup>Only positive values are listed. Compound was found in method blanks associated with sample.

\*Specific Conductivity

126500

**Table 1-8. Maximum National Soil Background Concentrations<sup>a</sup>**

Analyte	Range of Concentrations Detected (ppm)	Maximum National Background Concentration (ppm)
Magnesium	3,620 - 12,300	6,000
Lead	16.1 - 368	200
Thallium	54.8 - 104	0.1
Zinc	37.2 - 605	300
<sup>a</sup> Source: Braunstein 1981		

**Table 1-9. Recommended Soil Cleanup Objectives<sup>a</sup>**

Analyte	Range of concentrations Detected (parts per billion [ppb])	Cleanup Objective (ppb)
TCE	ND-440	700
1,2-DCE	ND-59	300
Toluene	ND-29	1,500
Fluoranthene	ND-570	50,000
Butylbenzylphthalate	ND-460	50,000
Carbon Disulfide	ND-25	2,700
Pyrene	ND-560	50,000
<sup>a</sup> Source: NYSDEC 1992		

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 2. FIELD INVESTIGATION APPROACH

It is anticipated that only one stage (Stage 1) of sampling will be required to complete the characterization at the NFSS. This sampling is outlined in Section 2.1. If the results from this sampling identify the need for additional data, this FSP will be amended to include Stage 2.

### 2.1 STAGE 1

Since the EPA's DQOs Procedure was used to evaluate the existing NFSS database, it was determined that additional soil, sediment, surface water, and groundwater sampling was needed to complete the site characterization. The objectives of this additional sampling are proposed: to obtain site-specific background analytical data, to define the presence and depth of organic and/or metal contamination in soil and groundwater near Building 401 and former Building 407, and to complete sediment and surface water characterization downstream from these two buildings.

The EPA's DQOs Procedure was utilized in the development of this FSP. This procedure assisted in identifying the data gaps discussed in Section 1.5; thus, it helped in determining the number of additional samples needed to eliminate the data gaps, defining the sampling locations, and in determining what minimum data quality requirements are needed to meet the sampling objectives.

#### 2.1.1 Soil Sampling

In order to complete the soil characterization at NFSS, a total of three onsite boreholes are proposed to be drilled using 6-in. outside diameter augers near the locations shown in Figure 2-1. These borings are not expected to exceed 25 ft in depth. The exact depth will be determined by the field geotechnical representative. One background borehole is also proposed to be drilled at a suitable background location near the site.

During the drilling of each of these boreholes, as many as 13 soil samples will be collected continuously using a 2-ft long, 2-in. diameter split-spoon sampler. A small portion of the soil from each sampling interval will be sealed in a glass jar or Ziplock® bag for a head-space analysis using a portable ionization detector. The soil core sample will then be surveyed using a beta/gamma radiological surveying instrument. This surveying will be performed by slowly passing the instrument probe over the surface of the sample. The results from these field analyses and a detailed lithology description of the sample will be documented in a field logbook.

A total of three soil samples will be collected from each borehole for analytical testing. One sample will be collected from below the lowest estimated water table elevation, while the remaining two samples will be collected systematically above this depth. The onsite samples will be sent to the laboratory to be analyzed for volatile organics and thallium, while the background samples will be analyzed for metals, mercury, volatile organics, BNAEs, and pesticides/PCBs. The analytical results provided by the laboratory will be accompanied by a Summary Level data package (Table 2-1). Sample bottle requirements, preservatives, and analytical holding times are found in Table 2-2 and analytical methods are in Table 2-3.

When the total depth of each borehole is reached, a tremie pipe will be used to grout the borehole closed as the augers are being removed. The grout will be comprised of Portland Type

I/II cement, mixed with approximately four to five percent bentonite powder. The location of each borehole will then be surveyed.

A total of two discretionary boreholes (25 ft) and six soil samples have been set aside in case field observations indicate that additional sampling is required. These samples would be collected in the same manner, and analyzed for the parameters outlined in Tables 2-1 and 2-2.

### 2.1.2 Sediment Sampling

A total of two sediment samples will be collected from the surface water drainage downgradient from Building 401 and former Building 407 at the locations shown in Figure 2-1. The two samples will be sent to the laboratory to be analyzed for volatile organics and thallium. Samples for volatile organic analysis will be collected as grab samples using the Scoop Method. These grab samples will be collected from 0 cm to 15 cm (0 ft to 0.5 ft) below the sediment surface area near the center of the drainage. The sediment will be transferred directly from the scoop into a sample jar. The samples collected for all other analyses will also be collected from 0 cm to 15 cm (0 ft to 0.5 ft) below the sediment surface using a scoop from a 1-ft<sup>2</sup> area near the center of the drainage. This sample will be composited in a stainless steel sampling bowl prior to filling sample jars. The analytical results provided by the laboratory will be accompanied by a Summary Level data package (Table 2-1). See Table 2-2 for sample bottle requirements, preservatives, and analytical holding times, and Table 2-3 for analytical methods.

A total of one discretionary sediment sample has been set aside in case field observations indicate the current upstream sampling location is not properly positioned. This sample would also be collected using the scoop method, and analyzed for metals, mercury, volatile organics, BNAEs, and pesticides/PCBs (see Table 2-1).

### 2.1.3 Groundwater Sampling

The Direct Push Method will be used approximately 3 m (10 ft) upgradient from each of the three onsite and one upgradient soil borings to collect as many as three groundwater samples at 1.5 m (5-ft) intervals throughout the depth of the first encountered saturated interval (maximum of 12 samples), with the first sample being collected within the upper 0.6 m (2-ft) of the water column (Figure 2-2). The onsite samples will be sent to the laboratory to be analyzed for volatile organics and thallium, while the background samples will be analyzed for metals, mercury, volatile organics, BNAEs, pH, temperature, specific conductance. The analytical results provided by the laboratory will be accompanied by a Summary Level data package (Table 2-1). See Table 2-2 for sample bottle requirements, preservatives, and analytical holding times, and Table 2-4 for analytical methods.

One water sample from each of the three onsite and one background Direct Push sampling locations will be collected for pH, temperature, and conductivity measurements. These measurements will be made in the field using field instruments.

A total of two discretionary Direct Push sampling locations and six groundwater samples have been set aside in case field observations indicate that additional sampling is required. These samples would be collected in the same manner and analyzed for the parameters outlined in Table 2-1.

Due to the nature of the formation and the small diameter of the sampling hole, it is expected that the formation will collapse immediately after removing the sampling probe. If this

is not the case, these holes will be grouted with Portland Type I/II cement mixed with approximately four to five percent bentonite powder.

#### **2.1.4 Surface Water Sampling**

A total of one onsite surface water sample will be collected from the surface water drainage downgradient from Buildings 401 and former Building 407 at the location shown in Figure 2-2. This sample will be collected as a grab sample using the Bottle Submersion Method and will be sent to the laboratory to be analyzed for volatile organics and thallium (Table 2-1). See Table 2-2 for sample bottle requirements, preservatives, and analytical holding times, and Table 2-4 for analytical methods.

A total of one discretionary surface water sample has been set aside in case field observations indicate the current upstream sampling location is not properly positioned. This sample would also be collected using the Bottle Submersion Method, and analyzed for the parameters outlined in Table 2-1.

A sample of the surface water from the same sampling location will be collected for pH, temperature, and conductivity measurements. These measurements will be made in the field using field instruments.

## **2.2 STAGE 2**

If concentrations exceeding state guidelines are identified in water, additional groundwater characterization may be needed; therefore, this Sampling and Analysis Plan will be amended to outline details of the proposed sampling.

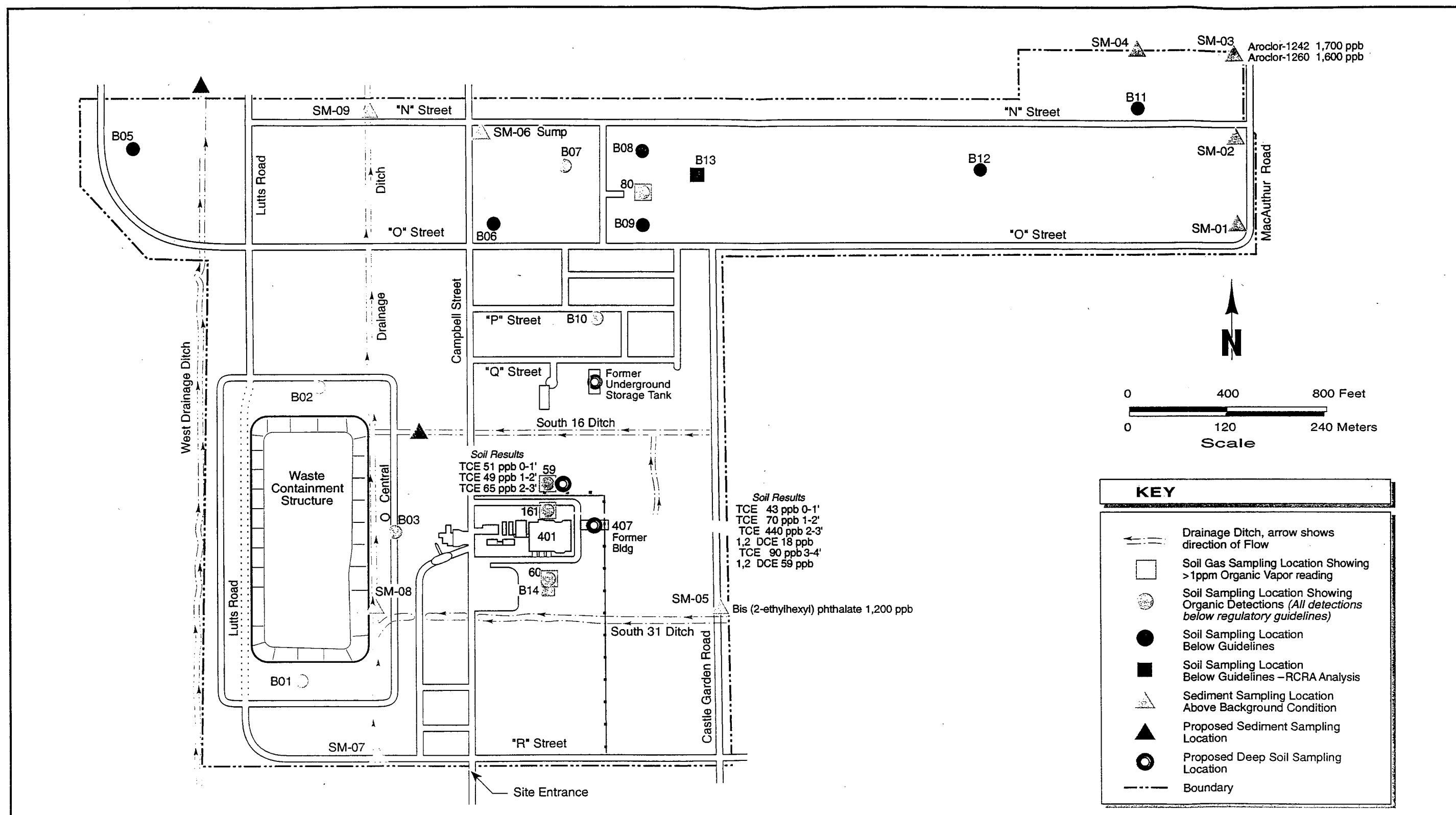


Figure 2-1. Proposed Soil / Sediment Sampling Locations at NFSS

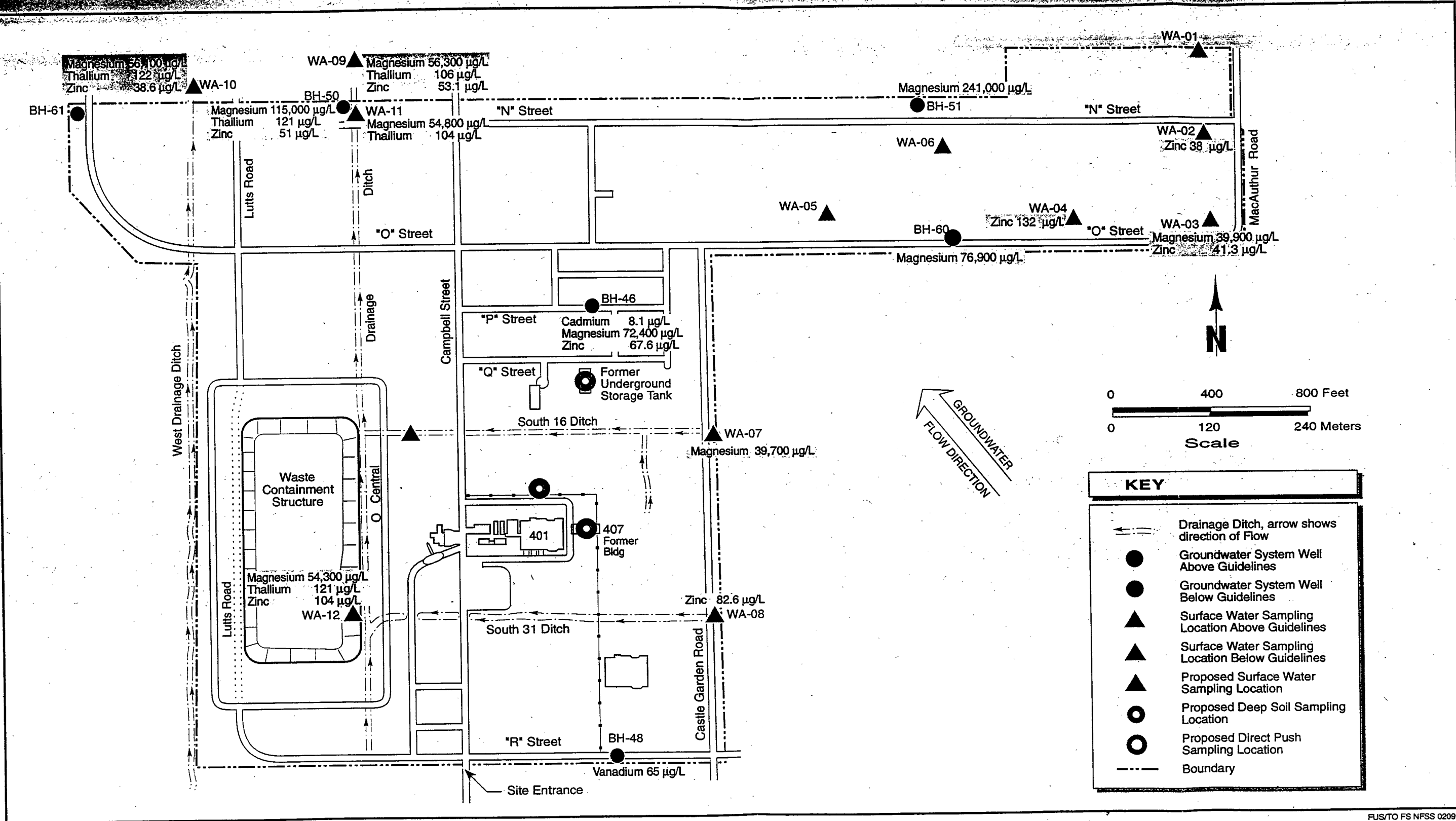


Figure 2-2. Proposed Groundwater and Surface Water Sampling Locations at NFSS



Table 2-1. Sampling Activities and Frequency.

Medium	Planned Activity	Approximate Number of Samples	Analysis	Analytical Support Level <sup>a</sup>
<b>Primary Sampling Program</b>				
Soil	Drill three onsite and one background boreholes to the bottom of the first encountered saturated interval (not to exceed 25 ft). Continuously split-spoon sample throughout the borehole depth. Collect a total of three soil samples from each borehole for analytical testing.	12	VOCs, thallium <sup>b</sup>	Summary
Sediment	Collect two sediment samples from the surface water drainage down gradient from Building 401 and former Building 407.	2	VOCs, thallium <sup>c</sup>	Summary
Surface Water	Collect one surface water sample from the surface water drainage downgradient from Building 401 and former Building 407.	1	VOCs, thallium <sup>c</sup>	Summary
Groundwater	Use the Direct Push Method to collect as many as three groundwater samples at 5-ft intervals throughout the depth of the upper aquifer at three onsite and one background location.	12	VOCs <sup>d</sup>	Summary
	Collect one groundwater sample from each of the three onsite and one background Direct Push sampling locations for characteristic testing.	4	pH, Temperature, and Conductivity	Screening
Quality Control Sampling	One equipment rinsate sample will be collected at the beginning of each day of sampling to check the effectiveness of the decontamination procedure.	12	Analyze rinsate samples for the same parameters as the samples to be collected that day.	Summary
	One trip blank will be sent along with each sample bottle shipment containing one or more samples to be analyzed for volatile organics.	12	VOCs	Summary
	Collect one duplicate sample of each sampling media at a 1 in 10 sampling frequency. A minimum of 1 duplicate is proposed to be collected from each media.	5	Analyze duplicate samples for the same parameters as the original sample.	Summary
	Collect one field blank from the potable water and each lot of distilled/deionized water used for decontamination.	3	VOCs, Metals Mercury, BNAEs, Pesticides/PCBs	Summary
<b>Discretionary Sampling Program</b>				
Soil	As many as two boreholes may be drilled to the bottom of the first encountered saturated interval (not to exceed 25 ft). split-spoon samples would continuously be collected throughout the borehole depth. Collect a total of three samples from each borehole for analytical testing.	6	VOCs, thallium <sup>b</sup>	Summary
Groundwater	The Direct Push Method may be used to collect as many as three groundwater samples at 5-ft intervals throughout the depth of the upper aquifer at two locations.	6	VOCs <sup>d</sup>	Summary
	Collect one groundwater sample from each of the two Direct Push sampling locations for characteristic testing.	2	pH, Temperature, and Conductivity	Screening
Sediment	As many as one background sediment sample may be collect based on a field evaluation of the current background location.	1	VOCs, Metals, mercury, BNAEs, pesticides/PCBs	Summary
Surface Water	Collect one surface water sample from the surface water drainage downgradient from Buildings 401 and 407. As many as one background surface water sample may be collected based on a field evaluation of the current background location.	1	VOCs, metals, mercury, BNAEs, pesticides/PCBs	Summary

<sup>a</sup>These levels are based on EPA 1993<sup>b</sup>Samples collected from background locations should also be analyzed for metals, mercury, BNAEs, and pesticides/PCBs.<sup>c</sup>The sample collected from the background location should also be analyzed for mercury, BNAEs, pesticides/PCBs.<sup>d</sup>Samples collected from background locations should also be analyzed for metals, mercury, BNAEs, pH, temperature, and specific conductance.

Table 2-2. Preservatives, Containers, and Holding Times.

Analyte/Test	Container	Quantity	Preservative	Holding Time
<b>Soil/Sediment</b>				
VOCs	Glass vial with Teflon septum, sealed cap	2/125 milliliter (ml) wide-mouth vials	4°C	14 days
Metals: ICPAES	Glass, amber	1/250 ml wide-mouth jar	4°C	180 days
AA	Glass, amber	1/250 ml wide-mouth jar	4°C	180 days
Mercury:	Glass, amber	1/250 ml	4°C	28 days
BNAEs:	Glass, amber	1/250 ml	4°C	14/40 days
Pesticides/PCBs:	Glass, amber	1/250 ml	4°C	14/40 days
<b>Groundwater/Surface Water</b>				
VOCs	Glass vial with Teflon septum, sealed cap	2/40 ml jar vials	HCl to pH <2, 4°C	14 days
Metals: ICPAES	Polyethylene	1/100 ml jar	HNO <sub>3</sub> to pH <2, 4°C	180 days
AA	Polyethylene	1/100 ml jar	HNO <sub>3</sub> to pH <2, 4°C	180 days
Mercury-cold vapor	Polyethylene	1/100 ml jar	HNO <sub>3</sub> to pH <2, 4°C	180 days
Mercury:	Polyethylene	1 L	HNO <sub>3</sub>	28 days
BNAEs:	Glass, amber	2/950 ml	4°C	7/40
Pesticides/PCBs:	Glass, amber	2/950 ml	4°C	7/40

VOCs      volatile organic compounds  
 ICPAES    Inductively Coupled Plasma Atomic Emission Spectrophotometry  
 AA        atomic adsorption

Table 2-3. Analytical Methods for Soil/Sediment.

PARAMETER	ANALYTICAL TECHNIQUE	LABORATORY METHOD ANALYSIS
		Sample Analysis
Volatile Organics	GC/MS	8240
Thallium	Graphite Furnace AA	7841
Mercury	Cold Vapor	7471
BNAEs	GC/MS	8270
Pesticides/PCBs	GCEC	8080

Table 2-4. Radiological Analytical Methods for Surface Water/Groundwater.

PARAMETER	ANALYTICAL TECHNIQUE	LABORATORY METHOD NUMBER
		Sample Analysis
Volatile Organics	GC/MS	8240
Thallium	Graphite Furnace AA	7841
Mercury	Cold Vapor	7470
BNAEs	GC/MS	8270
pH	a	a
Temperature	a	a
Conductivity	a	a
a = Measurement collected in the field.		

126520

### 3. ANALYTICAL PROCEDURES

A summary of the analytical techniques and laboratory methods to be performed on soil, sediment, and water samples is presented in Tables 2-3 and 2-4. These analytical procedures meet the minimum detect limit requirements needed to address the DQOs outlined in Section 1.6.

See Section 6.0 for issues related to quality assurance/quality control (QA/QC).

#### 3.1 SAMPLE HANDLING, PACKAGING, AND SHIPPING

Sample collection, handling, and chain-of-custody will be conducted according to FUSRAP procedures consistent with *A Compendium of Superfund Field Operations Methods* (EPA 1987). The samples will be packed in vermiculite or "bubble wrap" to minimize the potential for breaking and will be shipped to the laboratory for analysis. Samples will be packed in Blue Ice® (when appropriate), and shipped by overnight mail to an analytical laboratory within 24 hours of the time they are collected (FUSRAP 1994).

126570

**THIS PAGE INTENTIONALLY LEFT BLANK**

#### 4. FIELD NOTEBOOKS AND DOCUMENTATION

All sampling personnel will keep indelible black ink records of field activities in bound field notebooks and on appropriate bound forms on a daily basis. Samplers will record weather conditions, sampling locations and depths, types of samples collected, analyses required, date and time of sampling, chain-of-custody identification numbers and procedures, field measurements, and names of sampling personnel.

All field documentation, analytical data, and reports generated from this data will be assigned a document control number and submitted to the Project Document Control Center as a permanent record. See *Design Basis for Environmental Technology* (FUSRAP 1994) for further details on documentation requirements.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 5. DECONTAMINATION

Decontamination will be conducted as necessary to ensure that personnel and equipment leaving a controlled area meet DOE guidelines for release. Before beginning field sampling activities, all drilling and sampling equipment will be decontaminated using the following methods.

### Large Equipment Decontamination

- 1) Remove soil adhering to augers, drill rod, and other equipment by scraping, brushing, or wiping;
- 2) thoroughly pressure wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e. Liquinox) using a steam cleaner;
- 3) thoroughly rinse equipment with potable water using a steam cleaner;
- 4) air dry; and
- 5) wrap equipment in plastic sheeting to keep it clean before use.

### Sampling Equipment Decontamination

#### *Radiological Decontamination Procedure:*

- 1) remove soil adhering to equipment by scraping, brushing, or wiping;
- 2) thoroughly wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e. Liquinox);
- 3) thoroughly rinse equipment with potable water;
- 4) rinse thoroughly with distilled/deionized water;
- 5) air dry; and
- 6) wrap equipment in aluminum foil to keep equipment clean prior to use.

#### *Chemical Decontamination Procedure (Non-Metals):*

- 1) remove soil adhering to equipment by scraping, brushing, or wiping;
- 2) thoroughly wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e. Liquinox);
- 3) thoroughly rinse equipment with potable water;
- 4) rinse with isopropyl alcohol;



- 126580
- 5) rinse thoroughly with distilled/deionized water;
  - 6) air dry; and
  - 7) wrap equipment in aluminum foil to keep equipment clean prior to use.

*Chemical Decontamination Procedure (Metals):*

- 1) remove soil adhering to equipment by scraping, brushing, or wiping;
- 2) thoroughly wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e. Liquinox);
- 3) thoroughly rinse equipment with potable water;
- 4) rinse with nitric acid (10%);
- 5) rinse thoroughly with distilled/deionized water;
- 6) air dry; and
- 7) wrap equipment in aluminum foil to keep equipment clean prior to use.

All sampling equipment will be decontaminated between samples and all drilling equipment will be decontaminated between boreholes.

## 6. QUALITY ASSURANCE AND QUALITY CONTROL

The FUSRAP document, *Design Basis for Environmental Technology*, will be used as the QAPjP to guide the Niagara Falls sampling effort outlined in this FSP. The FSP and QAPjP together meet the minimum requirements of a Sampling and Analysis Plan as outlined in the EPA guidance document, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1989). As required by this guidance manual, the QAPjP describes the QA/QC protocols necessary to achieve the DQOs dictated by the intended use of the data.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## **7. HANDLING OF INVESTIGATION-DERIVED WASTE**

All waste soil generated by field operations that are suspected of being contaminated based on field screening and historical data will be handled in accordance with BNI waste disposal procedures (BNI 1993). Any drummed waste material shall at a minimum be labeled by noting: the date when the waste was generated, general contents in the drum, and location from where the waste was derived.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 8. HEALTH AND SAFETY

All field operations will be performed under the guidance and direction of the onsite Health and Safety Officer, who will implement the requirements outlined in the site-specific Health and Safety Plan.

Prior to commencing field operations, a site-specific Health and Safety Plan must be available for workers to review. All personnel to implement the field investigation must at a minimum have 40 Occupational Safety and Health Act (OSHA) training hrs and have 8 current hrs of refresher training, be involved in a medical monitoring program that meets the minimum requirements of 29 CFR 1910.120, and be issued a thermoluminescent dosimeter (TLD) when working in a radiological environment. Other general worker health and safety requirements include wearing safety glasses, hard hats, and steel toed boots at all times when present in the work area.

**THIS PAGE INTENTIONALLY LEFT BLANK**

## 9. REFERENCES

BNI (Bechtel National, Inc.) 1984. *Geologic Report for the Niagara Falls Storage Site*, DOE/OR/20722-8, Oak Ridge, Tennessee, June.

BNI 1990a. *Preliminary Assessment for the Niagara Falls Storage Site*, CCN 068232, Oak Ridge, Tennessee, May.

BNI 1990b. *Niagara Falls Storage Site Environmental Report for Calendar Year 1989*, DOE/OR/20722-264, Oak Ridge, Tennessee, May.

BNI 1993. *Waste Management Program Plan for FUSRAP*, Oak Ridge, Tennessee, June.

Braunstein, H.M. (1981). *Environmental, Health, and Control Aspects of Coal conversion - An Information Overview*, Vols. 1 and 2, eds. Copenhaver, and H.A. Pfunder, Ann Arbor: Ann Arbor Science Publishers, Inc.

DOE (U.S. Department of Energy) 1986. *Final Environmental Impact Statement: Long-Term Management of the Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site*, DOE/EIS-0109F, Washington, D.C. April.

EPA (Environmental Protection Agency) 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001a, Washington, D.C., August.

EPA 1989. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, EPA/540/G-89/004, Washington, D.C.

FUSRAP (Formerly Utilized Sites Remedial Action Program) 1994. *Design Basis for Environmental Technology*, CNN 124607, Oak Ridge, Tennessee, July.

Gale Research Company (1985). *Climate of the States*, 3rd Edition, Volume 1, Detroit, Michigan.

NYSDEC (New York State Department of Environmental Conservation) 1992. *Determination of Soil Cleanup Objectives and Cleanup Levels*, New York City, New York, November, (TAGM).

Water Resources, 1991. *New York Water Classifications and Quality Standards*, Title 6, Parts 609 through 704, New York City, New York, August.