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NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

SUPERFUND STANDBY CONTRACT

FINAL
LONG TERM MONITORING PLAN

NORTH LAWRENCE OIL DUMP SITE

TOWN OF NORTH LAWRENCE, NEW YORK
SITE NO. 6-45-013

WORK ASSIGNMENT NO. D00003826-03

AUGUST 1998

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WORK ASSIGNMENT NO. D003826-03

FINAL
LONG TERM MONITORING PLAN

NORTH LAWRENCE OIL DUMP SITE
TOWN OF NORTH LAWRENCE, NEW YORK
SITE NO. 6-45-013

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

Harding Lawson Associates
Portland, Maine

AUGUST 1998

Submitted by:

Glenn Daukas
Project Manager

Approved by:

William J. Weber, P.E.
Program Manager

LONG TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE

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1.0 INTRODUCTION

Harding Lawson Associates (formerly ABB Environmental Services), under contract to the New York State Department of Environmental Conservation (NYSDEC), is submitting this Draft Long-Term Monitoring Plan (LTMP) at the North Lawrence Oil Dump Site (NLODS). This work has been performed under NYSDEC Contract No. D002472.

1.1 PURPOSE AND SCOPE

The purpose of the LTMP is to identify the tasks to monitor the long-term effectiveness of the remedial actions at the NLODS. Long-term monitoring of this site is assumed to be 30 years, and is to be conducted in accordance with the requirements of this document.

This LTMP describes: (1) procedures, including visual inspection activities; the collection of groundwater samples; required analytical parameters and laboratory methods; the reporting requirements to be followed to monitor the long-term effectiveness of the remedial action; and (2) maintenance activities and corrective measures to be undertaken should monitoring data indicate they are necessary.

This document is organized as follows: Section 1.0 is an overview of past site activities; Section 2.0 presents regulatory information used in developing the LTMP; Section 3.0 is divided into two subsections: Section 3.1 presents the LTMP for the remediated wetlands, while Subsection 3.2 presents the LTMP for the lagoon and disposal cell, and Section 4.0 presents the maintenance activities to be undertaken at NLODS.

The document appendices are organized as follows:

Appendix A Baseline Biological Monitoring Report
Appendix B Remedial Construction Technical Specifications
Appendix C Boring Logs for Monitoring Wells MW-102A, MW-102B, MW-301, MW-302, MW-303.
Appendix D Historical Groundwater Analytical Data from the Remedial Investigation Report (E.C. Jordan Co., 1993)
Appendix E Quality Assurance Project Plan for the North Lawrence Oil Dump Site (E.C. Jordan Co., 1991)

Appendix F Health and Safety Plan
Appendix G Record of Decision, North Lawrence Oil Dump Site, March 1993.
Appendix H Record Drawing

1.2 SITE BACKGROUND

The following subsection is a brief descriptions of the history of the NLODS.

1.2.1 Site Description and History

The NLODS is located in the Town of Lawrence, St. Lawrence County, New York (See Figure 1-1). The NLODS is an inactive hazardous waste site which consists primarily of a waste disposal lagoon. The lagoon is approximately 600-feet long and 75-feet wide and is immediately adjacent to a New York State Department of Environmental Conservation (NYSDEC) regulated 150-acre wetland and a former non-regulated municipal dump. During the middle to late 1960's, the lagoon was operated as a disposal area and received waste oils and oil sludge.

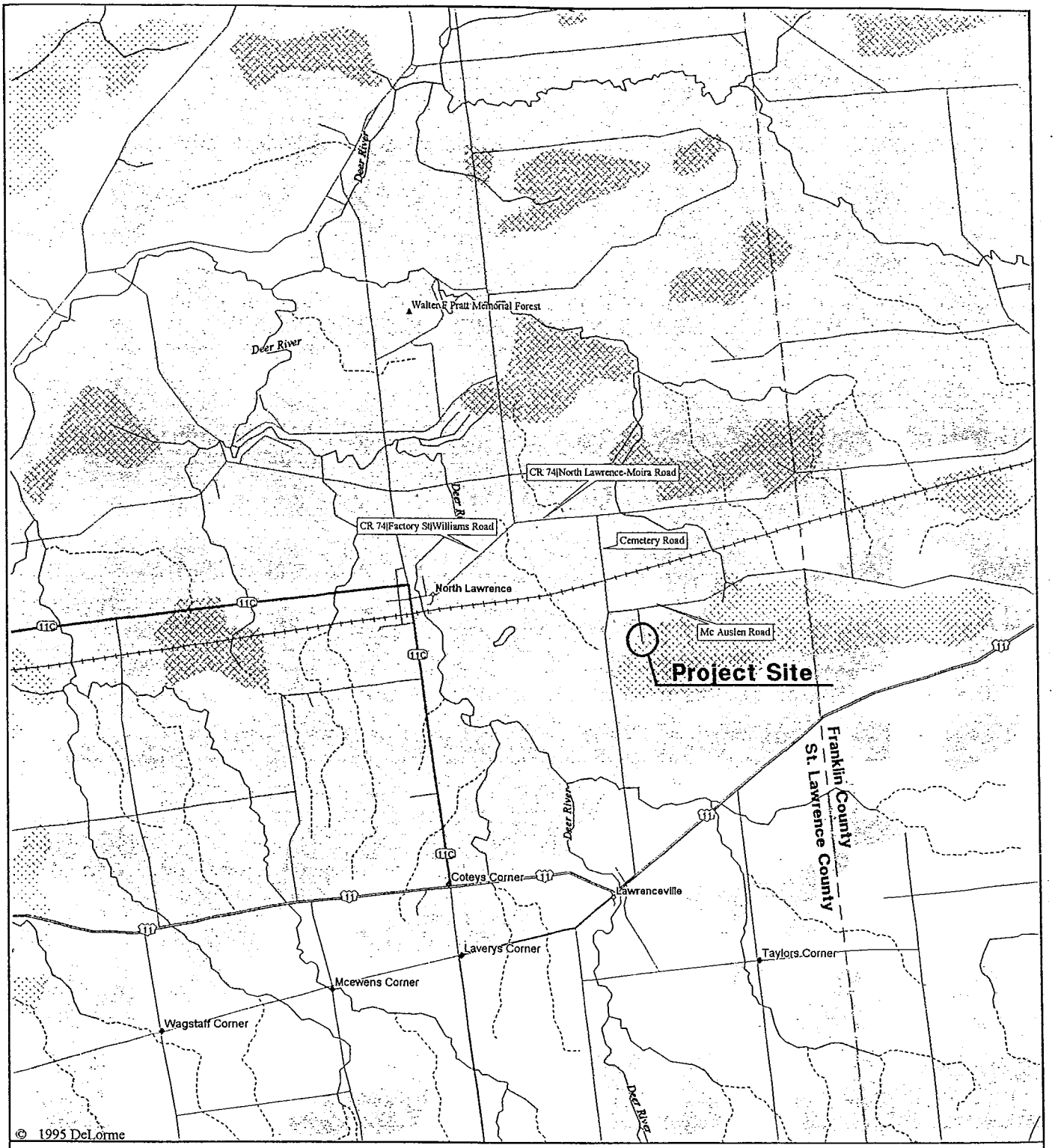
In 1980, NYSDEC staff observed oil stains on vegetation 18-inches above the water in the southeastern end of the lagoon. Samples collected show elevated concentrations of polychlorinated biphenyls (PCBs) in the lagoon sediments. The NYSDEC contracted E. C. Jordan Co. on October 1988 to complete a Phased Remedial Investigation and Feasibility Study (RI/FS).

E.C. Jordan Co. (ABB Environmental Services (ABB-ES)) submitted the Final Remedial Investigation and Feasibility Study Reports in March 1993. The remedial investigation confirmed extensive contamination in the lagoon and wetlands, primarily with PCBs and lead. The feasibility study evaluated several remedial alternatives. Based on the Feasibility Study Report, a Record of Decision (ROD) was issued in March 1993 to perform on-site solidification/stabilization of the contaminants.

1.2.2 Selected Remedy

The major components of the selected remedy include the following

- Performing a pilot test of the solidification/stabilization process.



SOURCE: DeLorme "Street Atlas USA" Version 3.0 for Windows, Copyright © 1995 CD-ROM.

LEGEND

WETLAND

FORESTED LAND

OPEN LAND

N

Scale in Miles

0 1 2

FIGURE 1-1
SITE LOCATION MAP
LONG-TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY

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- Excavation and on-site solidification/stabilization of the top 2 to 4 feet of soils in the lagoon contaminated with oil, PCBs, lead and volatile organic chemicals, and 12" of sediments from selected areas of the adjacent wetland contaminated with PCBs, mercury and lead. The treated soils would be disposed in an on-site disposal cell.

- Refilling the excavated lagoon and wetland areas with clean soil and seeding of those areas. A disposal cell would be constructed to maintain at least 2 to 3 feet separation between the high seasonal groundwater elevation and the bottom of the disposal cell.

The final remedy will not remove lead contamination above the threshold of tolerance of biological organisms throughout all contaminated areas in the wetland because of the physical damage that would occur. Therefore, the long-term monitoring program includes a special pre- and post-construction monitoring program to evaluate the potential impacts of the remaining contamination on the wetland biota as compared to a neighboring uncontaminated wetland.

This alternative will reduce potential threats to the environment by reducing the toxicity, mobility and availability of site contaminants.

Since treated and residual waste will be left on site, the final remedy will also include:

- Access restrictions (fencing),

- Institutional controls to minimize land and groundwater use, and

- Environmental monitoring.

1.3 LTMP FOR WETLANDS

The LTMP for the wetlands addresses the monitoring of biological conditions in the wetland.

This biological/wetlands monitoring plan provides a framework for the biological and wetlands monitoring programs. This plan outlines the approach to accomplish the following objectives:

- Track ongoing ecological trends in wetlands at the NLODS following remediation.

- Evaluate the extent of bioaccumulation and biomagnification of PCBs, lead, and mercury in wetland biota at the NLODS.

- Evaluate if exposure to residual lead is resulting in an increased incidence of disease or other physiological disorders in palustrine wetland biota.

- Evaluate the toxicity and bioavailability of contaminants in NLODS palustrine wetland sediments.

In addition to addressing these objectives, this report also contains a wetlands restoration and monitoring plan, including wetland delineation and permitting tasks.

As outlined in this plan, each program involves the same general approach: (1) establish baseline (i.e., pre-remediation) conditions; (2) conduct post-remediation monitoring; and (3) periodically evaluate post-remediation conditions against pre-determined criteria. The approach for establishing baseline conditions has drawn primarily upon available existing information with some additional studies. In conducting the post-remediation monitoring, newly gathered data (i.e., sediment chemistry, toxicity, and bioaccumulation potential) will be compared against baseline data and against data from the reference location to evaluate the success of the remediation effort in reducing the contamination in and toxicity of wetland sediments. In monitoring the success of the wetland restoration, criteria such as vegetative cover, plant vigor, and wildlife use will be evaluated. The biological monitoring and wetlands restoration plans are presented below in Section 2.0.

1.4 LTMP FOR LAGOON AND DISPOSAL CELL

The LTMP for the lagoon and disposal cell addresses the monitoring of:

- groundwater
- disposal cell site

and maintenance of the:

- cover system
- groundwater monitoring wells
- gas vents
- fence

- roadways

The LTMP for the wetlands disposal cell are presented in the following sections. Quality Assurance and Quality Control (QA/QC) procedures will be conducted as described in the Quality Assurance Project Plan (QAPP) for the North Lawrence Oil Dump Site (E.C. Jordan Co., 1991a). Health and safety procedures will be conducted as described in the Health and Safety Plan (HASP) for the North Lawrence Oil Dump Site (E.C. Jordan Co., 1991b).

2.0 WETLAND MONITORING PLAN

This biological monitoring plan outlines the approach to be used in implementing the long-term biomonitoring program at the NLODS. Biomonitoring provides a direct link to the condition of ecological receptors in an area. It is often a more timely and cost-effective means of assessing the actual bioavailability and toxicity of contaminants to ecological receptors. Biomonitoring activities to be conducted at the NLODS shall involve collection of sediment samples for chemical analysis and bulk sediment toxicity tests, and collection of biological samples for chemical analysis. These activities shall provide information regarding the success of the selected remedy in decreasing concentrations of contaminants in the ecosystem surrounding the site relative to baseline (pre-remediation) conditions and relative to the reference location.

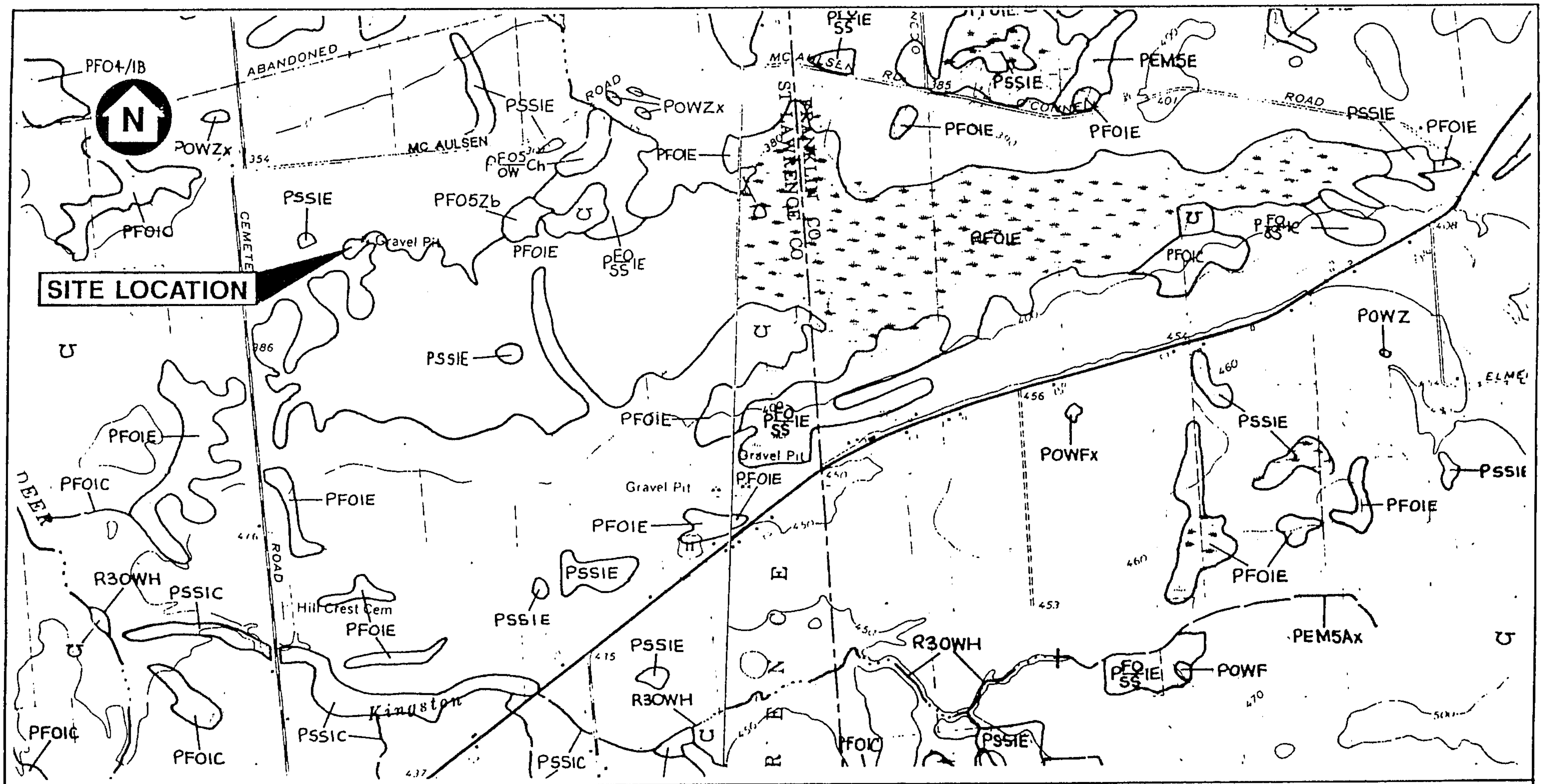
2.1 BASELINE CONDITIONS

The initial phase of the biological monitoring program is the establishment of baseline ecological conditions in the palustrine wetland at the site, in the absence of remediation. A brief description of preremediation conditions is presented below, followed by a discussion of baseline data for sediment chemistry, toxicity testing, and bioaccumulation investigations.

2.1.1 Site Description

The NLODS is in a relatively undeveloped area, and is surrounded to the north by forested upland, and to the south and east by forested/scrub-shrub wetland (see Figure 2-1). Topography in the immediate vicinity is generally flat, sloping to the north and northwest, with an approximate 1 percent grade. Surface water drainage from the site is directed into the wetland south of the site. Regional surface water flow from the wetland is northeast to Redwater Brook and then to the north.

2.1.1.1 Lagoon. The primary area of concern at the site was the lagoon, which was approximately 600 feet long and 75 feet wide and can been divided into two distinct sections. The northern section primarily contains oily sludge with little standing water. This section of the lagoon was devoid of vegetation, except for a small "island" containing a



LEGEND

P	PALUSTRINE	Z	INTERMITTENTLY EXPOSED/ PERMANENT
FOI	FORESTED, BROAD-LEAF DECIDUOUS	F	SEMIPERMANENT
SSI	SCRUB-SHRUB, BROAD-LEAF DECIDUOUS	C	SEASONAL
FOS	FORESTED, DEAD	A	TEMPORARY
EM5	EMERGENT, NARROW-LEAF, PERSISTENT	Ʊ	UPLAND
OW	OPEN WATER	b	BEAVER
E	SEASONAL SATURATED	x	EXCAVATED

SCALE IN FEET

0 2000 4000

FIGURE 2-1
NATIONAL WETLANDS INVENTORY MAP
LONG-TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY

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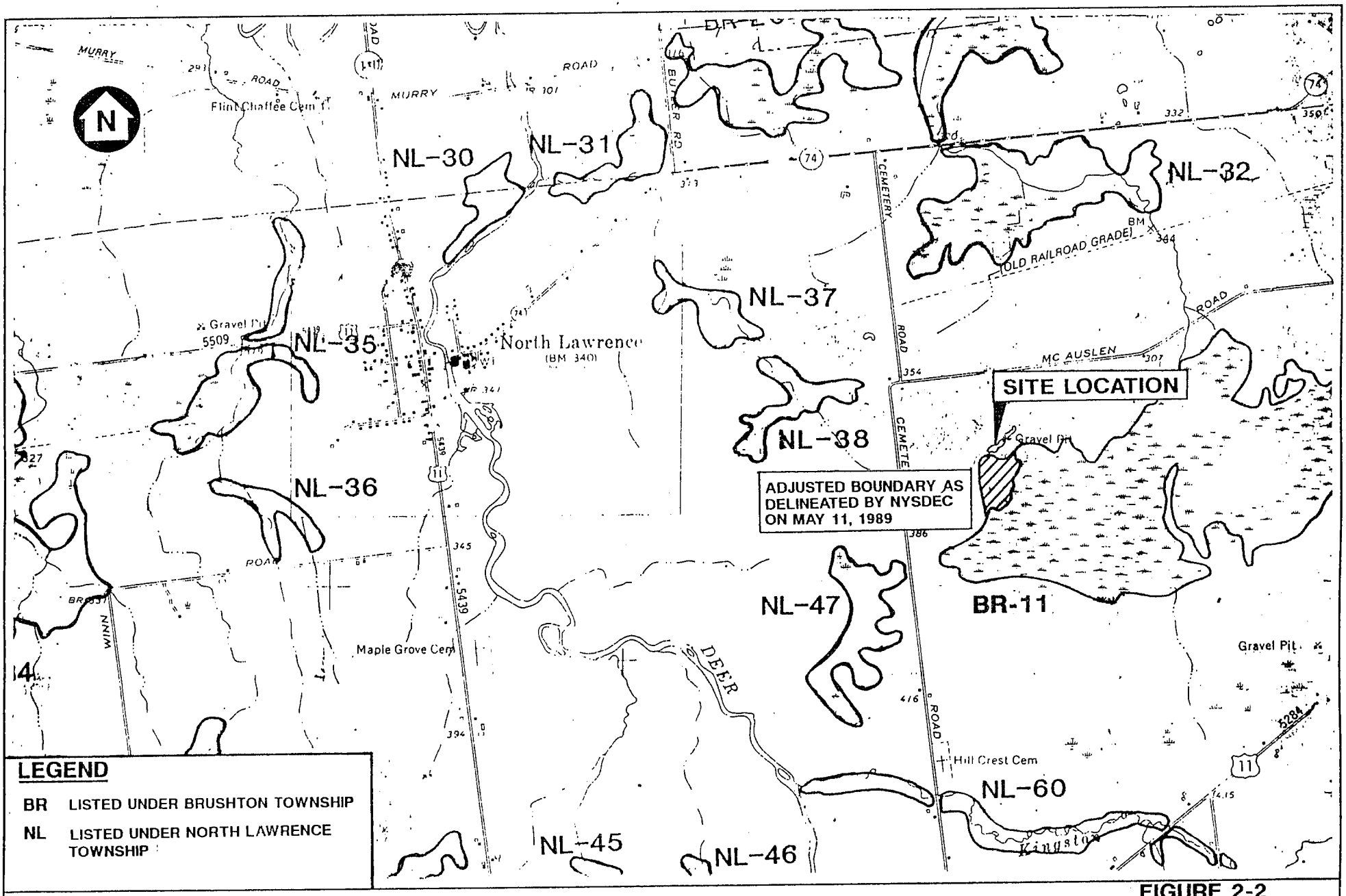
few small trees; it offered little or no habitat for aquatic organisms. However, because the perimeter of the lagoon was surrounded by woody vegetation, it offered some edge habitat for terrestrial and semi-terrestrial wildlife. The southern section of the lagoon contained ponded water several feet deep and emergent vegetation (i.e., primarily cattails) borders along some of this ponded area. Like the northern part of the lagoon, trees and shrubs surrounded this section, providing limited habitat for terrestrial and semi-terrestrial wildlife. In addition, this section of the lagoon offered pond-like habitat to aquatic and terrestrial organisms.

2.1.1.2 Wetlands and Wetland Vegetation. Federal and State-designated freshwater palustrine wetlands are adjacent to the former lagoon area to the south and east. The National Wetlands Inventory Map (North Lawrence quadrangle) and New York State Freshwater Wetlands Map (St. Lawrence County, Map 12 of 69, October 21, 1987) are presented in Figures 2-1 and 2-2 respectively. Freshwater Wetland BR-11, listed on the New York State map, lies adjacent to the lagoon. This wetland is approximately 1.3 miles long and up to 0.7 mile wide, and is significant both for its size and its state regulation status. The boundary of the section of Wetland BR-11 adjacent to the site was delineated by NYSDEC in accordance with state regulations on May 11, 1989. The federal wetland boundary was delineated by HLA personnel on August 21 and 22, 1995; a report summarizing the delineation activities is presented in Appendix A. On the National Wetland Inventory map (North Lawrence quadrangle), the area southeast of the site is designated a large palustrine forested, broad-leaved deciduous seasonally-saturated wetland (PFO1E). Based on observations during wetland delineation activities, this wetland may be more appropriately classified as a forested/shrub wetland.

The section of wetland adjacent to the former lagoon area is a forested/shrub wetland. Dominant tree species in the wetland include red maple (*Acer rubrum*) and northern white cedar (*Thuja occidentalis*). American elm (*Ulmus americana*) and black ash (*Fraxinus nigra*) are also common sub-dominant trees. Common shrub species include red-osier dogwood (*Cornus stolonifera*), northern arrowwood (*Viburnum recognitum*), and winterberry (*Ilex verticillata*). The herbaceous layer includes tussock sedge (*Carex stricta*), with sensitive fern (*Onoclea sensibilis*) and cinnamon fern (*Osmunda cinnamomea*). Duckweed (*Lemna minor*), a small floating plant, was also observed in some areas.



SOURCE: NEW YORK STATE FRESHWATER WETLANDS MAP, ST. LAWRENCE COUNTY, MAP 12 OF 69, OCTOBER 21, 1987.

FIGURE 2-2
NEW YORK STATE FRESHWATER WETLANDS MAP
LONG-TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY
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2.1.1.3 Upland Vegetation. Upland forested areas primarily contain deciduous hardwood trees and an understory typical of a hardwood forest. Deciduous tree canopy species include gray birch (*Betula populifolia*), bigtooth aspen (*Populus grandidentata*), and quaking aspen (*Populus tremuloides*). Evergreens include eastern white pine (*Pinus strobus*) and eastern red cedar (*Juniperus virginiana*). The shrub layer is sparsely populated with tree saplings and an occasional black cherry (*Prunus serotina*). The herbaceous layer includes white and red trillium (*Trillium grandiflorum* and *T. erectum*, respectively), trout lily (*Erythronium americanum*), bracken fern (*Pteridium aquilinum*), and christmas fern (*Polystichum acrostichoides*). Figure 2-3 presents a pre-remediation general vegetative cover map for the site and is attached for reference.

2.1.1.4 Species and Habitats of Special Concern. Based on correspondence with NYSDEC (NYSDEC 1990, 1992a,b), there are no known rare, threatened, or endangered species or habitats of special concern in the vicinity of the NLODS.

2.1.2 Bulk Sediment Chemistry

Baseline contaminant levels in site sediment (and surface water) are available from the existing analytical database for the NLODS. The primary contaminants of concern in the NLODS sediment include PCBs, lead, mercury, and total petroleum hydrocarbons (TPH). Baseline sediment concentrations of these contaminants include those presented previously in the RI report (ABB-ES, 1993) and the Draft Pre-Design Sampling and Pilot Test Report (ABB-ES, 1995), as well as those collected as part of the baseline sediment toxicity tests discussed below.

2.1.3 Bulk Sediment Toxicity Testing2.1.3 Bulk Sediment Toxicity Testing

To evaluate the effects of contaminated sediments from the NLODS wetland on aquatic organisms, controlled whole sediment laboratory toxicity tests were conducted in 1995 to establish baseline conditions regarding sediment toxicity. The results of the sediment toxicity tests were presented in a letter report (ABB-ES 1995).

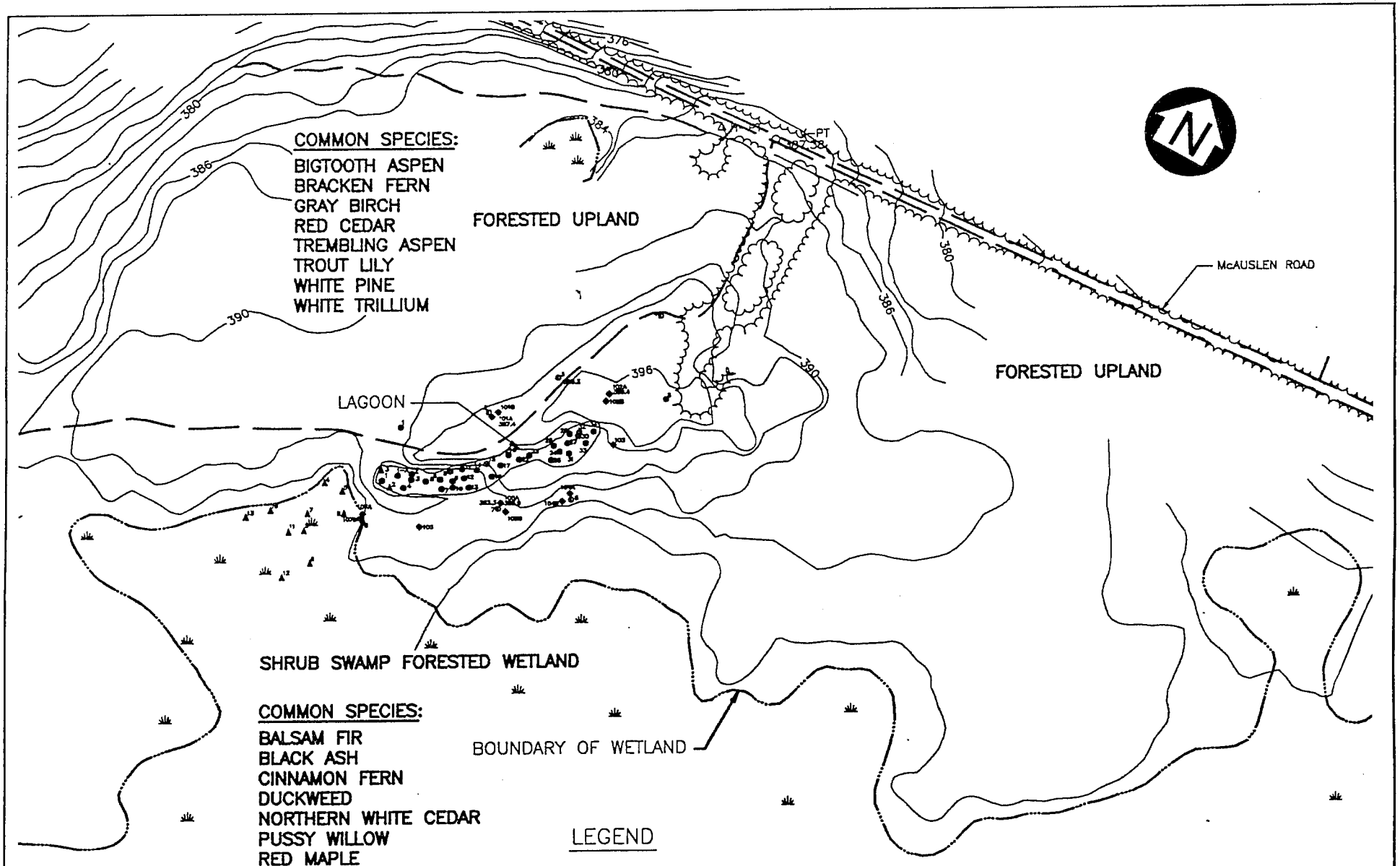

FIGURE 2-3
VEGETATIVE COVER MAP
LONG-TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY

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As stated, the primary contaminants of concern in the NLODS wetland sediment include PCBs, lead, mercury TPH. The baseline sediment toxicity tests provided an indication of the spatial distribution of toxicity in NLODS wetland sediment.

2.1.3.1 Methodology. The objective of these tests was to obtain laboratory data to evaluate adverse effects associated with exposure of the freshwater invertebrate species *Hyalella azteca* (an amphipod) and *Chironomus tentans* (a chironomid midge) to whole sediment from the NLODS wetland. The results of these toxicity tests provide a baseline evaluation of the toxicity of the sediment present in the NLODS wetland.

Sixteen short-term chronic toxicity tests for *Chironomus tentans* and *Hyalella azteca* were conducted (with whole sediment samples and no dilutions) to provide a screening level spatial distribution of the sediments within the NLODS wetland that result in toxicity. The ***(full name)***ASTM Standard Guide for Conducting Sediment Toxicity Tests with Freshwater Invertebrates (E 1383; ASTM, 1993) and the draft United States Environmental Protection Agency (USEPA) Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates (USEPA, 1994) were used as the laboratory standard.

Specific test protocols outlined in USEPA (1994) for the amphipod (10-day growth and survival) and midge (10-day growth and survival) were followed. Collection of sediment samples for chemical analysis and toxicity testing was conducted concurrently, allowing for evaluation of chemical and physical stressors in the baseline and post-remediation monitoring. Sediment samples for toxicity testing were stored at 4?C during the period between sediment sample collection and toxicity testing in accordance with protocols established in the ASTM Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing (E 1391-90; ASTM, 1993).

Statistical analyses to assess the significance of any differences in survival and growth between the NLODS reference samples and/or negative control sediment sample and the NLODS whole sediment samples were performed using standard parametric statistical analyses.

2.1.3.2 Sampling Stations. Twenty potential sediment sampling stations for the NLODS were selected at existing sediment sample locations; toxicity testing was conducted at 16 of these 20 stations, including a reference location near the southern end of the wetland. These stations were selected to provide a range of PCB, lead, mercury, and TPH concentrations, as well as to provide broad spatial coverage of the site.

In order to ensure that the sediment samples collected for the toxicity testing accurately reflect the contamination reported in the pre-design sampling report, sediment samples from 20 stations were collected for analytical chemistry evaluation; sufficient sediment was collected from each station to conduct toxicity tests. The following analyses were conducted with all 20 samples: total organic carbon (TOC), TPH, PCBs, lead, and mercury. Analytical chemistry methods and detection limits were comparable to those presented in the May, 1995 Draft Pre-Design Sampling and Pilot Test Report (ABB-ES, 1995). A rapid turn-around time was obtained from the analytical chemistry laboratory (i.e., under 7 days). Following review of these analytical data, a subset of the 20 stations was selected for toxicity testing.

2.1.3.3 Results. The results of the bulk sediment toxicity tests are summarized in Table 2-1 and Figure 2-4. These data were used in conjunction with other factors evaluated in the Sediment Toxicity Characterization Report to revise the area of excavation in the NLODS wetlands. The following factors affected the excavation limits:

- presence or absence of TPH, lead, mercury, and PCBs in bulk sediment samples,
- concentrations of TPH, lead, mercury, and PCBs in bulk sediment samples,
- responses of *Hyalella azteca* and *Chironomus tentans* in the sediment toxicity tests, and
- concentrations of TPH, lead, mercury, and PCBs in sediment relative to reported toxicity of these analytes in literature-reported laboratory toxicity tests and available sediment quality guidelines.

2.1.4 Bioaccumulation Investigation

PCBs, mercury, and, to a lesser extent, lead bioaccumulate in wetlands biota. The approach and results of the baseline biological evaluation are presented in Appendix A.

Sample Location	PCB (ug/kg)	Lead (mg/kg)	Mercury (a)(mg/kg)	TPH (mg/kg)	TOC (mg/kg)	Mean % Survival		Mean Dry Wt (mg)	
						Hyalella	Chironomus	Hyalella	Chironomus
SD-501	210u	16.4	0.27u	10u	271000	NE	NE	NE	NE
502	480j	318	0.25	10u	201000	79	73	0.248	1.318
503	510j	888	0.69u	10u	727000	95	89	0.153	1.156
504	1300	708	0.35	10u	688000	94	81	0.147	**0.93****
505	25000	2200	0.39u	63000	649000	**14****	**0****	0.116	0
506	14600	2670	0.2	89000	359000	**28****	**0****	0.043	0
507	530u	131	0.68u	10u	177000	91	84	0.144	0.954
508	370j	203	0.24	10u	416000	93	93	0.093	1.243
509	3800	282	0.57u	10u	510000	91	59	0.261	**0.547****
510	17900	1600	0.13	370000	529000	**3****	**0****	0	0
510D	14600	1030	0.45u	130000	421000	NE	NE	NE	NE
511	1500	492	0.35	5800	667000	**44****	**19****	0.04	0.545
512	2380	216	0.19	8800	192000	**0****	**0****	0	0
513	93u	1.7	0.12u	10u	1580	NE	NE	NE	NE
514	130u	17	0.28	10u	80700	63	91	0.084	1.135
515	5400	279	0.22u	18000	50100	**0****	**0****	0	0
516	120u	3	0.15u	10u	111000	NE	NE	NE	NE
517	110u	5.4	0.14u	10u	1410	93	81	0.096	**0.799****
518	730	111	0.40u	2000	68600	65	**50****	0.087	0.752
519 (Ref.)	140u	3.6	0.17u	10u	16800	89	81	0.121	1.404
519D (Ref.)	140u	3.6	0.18u	10u	6520	NE	NE	NE	NE
AVERAGE(b):	4051	548	0.21	24259					
MAXIMUM:	25000	2670	0.35	250000					
Control	NE	NE	NE	NE	NE	89	94	0.153	1.621

(a) Mercury concentrations for 502, 504, 506, 508, 510, and 511 are from a re-analysis of the sample by the analytical laboratory; reported as ND in initial analysis at SQLs ranging from 0.42 to 0.85 mg/kg.

(b) Average concentrations calculated using one-half the SQL for non-detects ("u"-qualified results).

Mean % survival following 10 days exposure to bulk sediments

Mean dry weight (mg) of survivors following 10 days exposure to bulk sediments

** = Statisically different from reference sample (519)

NE = Not Evaluated.

Samples obtained 8/21/95 to 8/23/95.

TABLE 2-1

SUMMARY OF ANALYTICAL DATA AND TOXICITY TEST RESULTS
LONG-TERM MONITORING PLAN
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY

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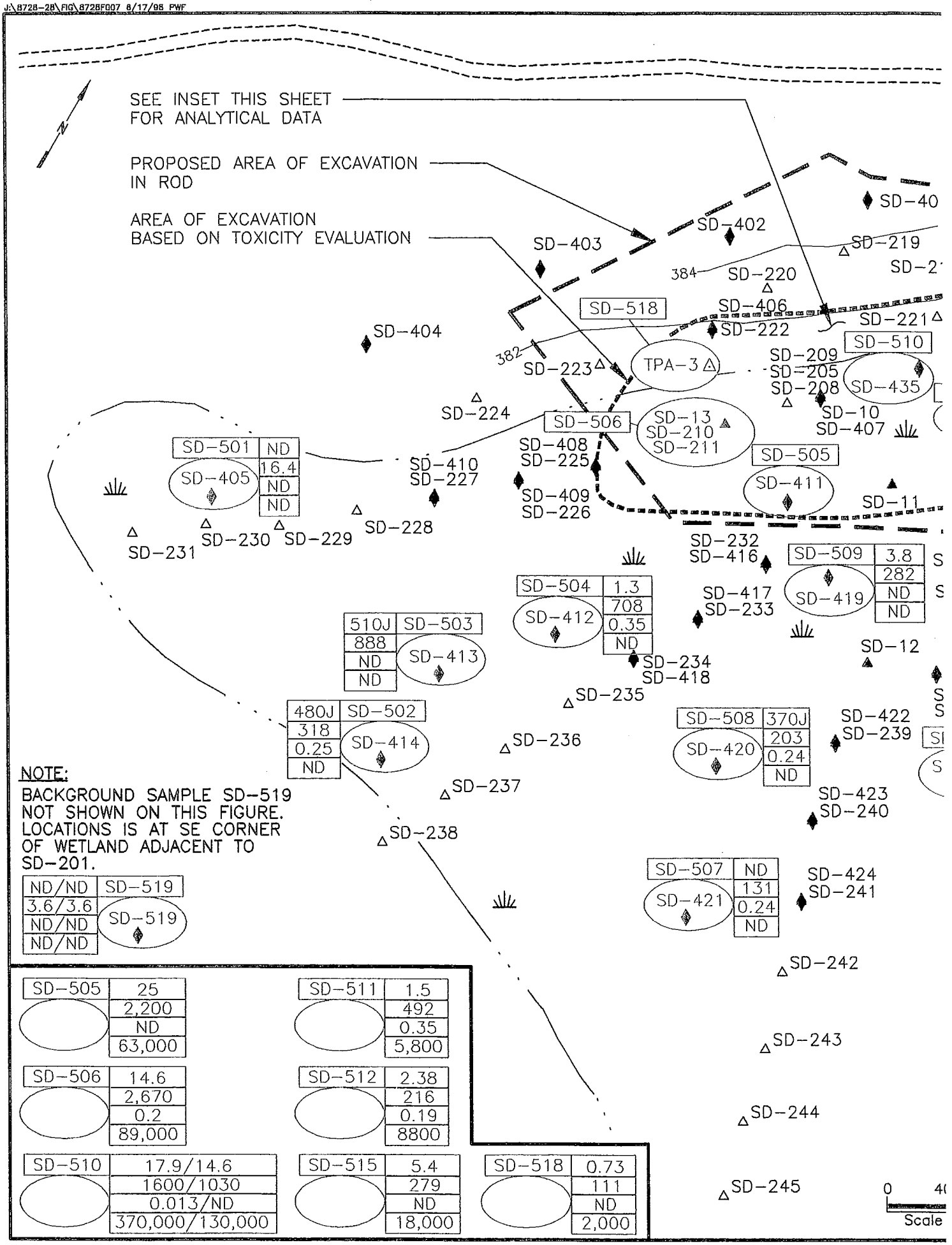

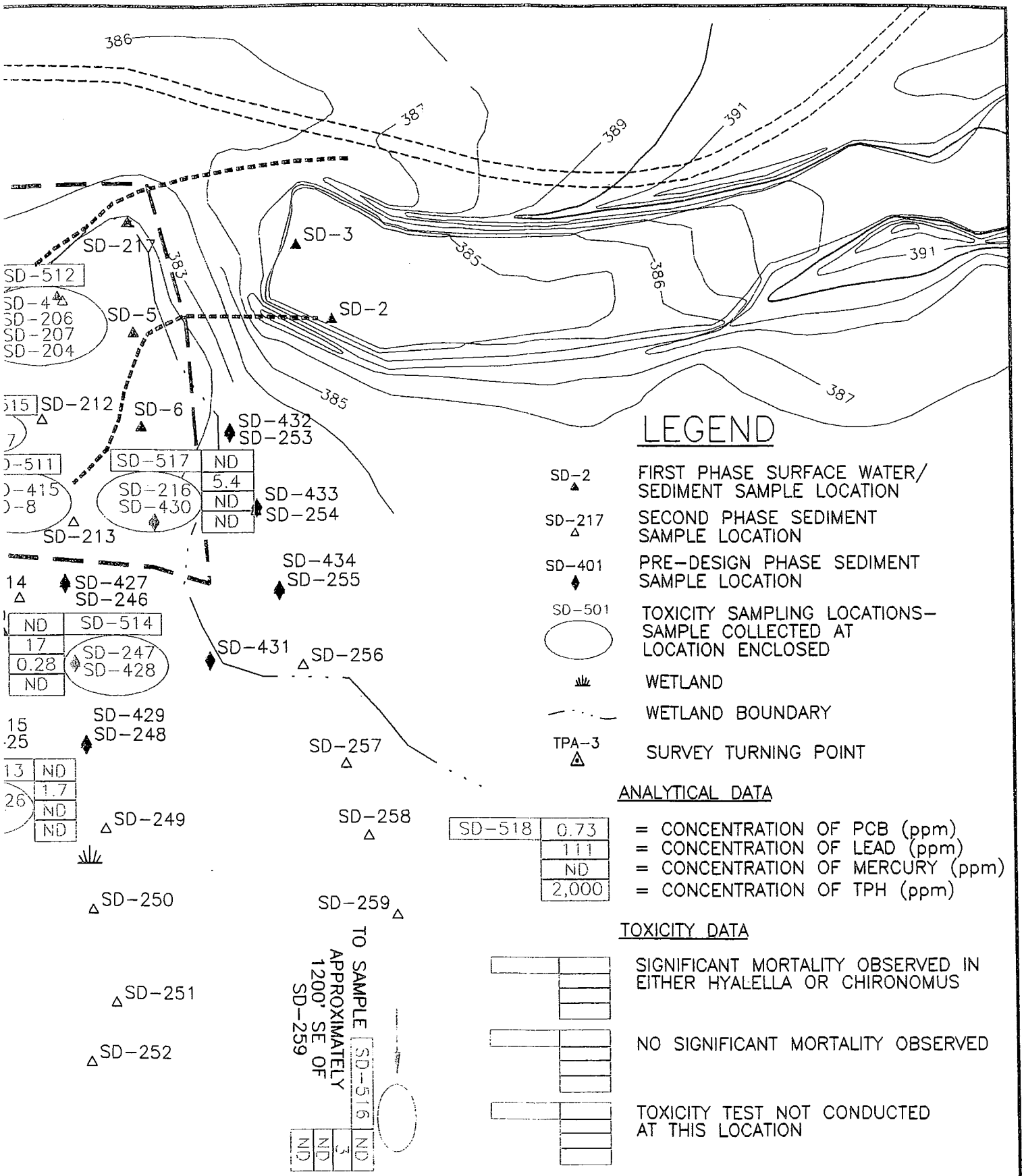

LEGEND

SD-2	FIRST PHASE SURFACE WATER/ SEDIMENT SAMPLE LOCATION
SD-217	SECOND PHASE SEDIMENT SAMPLE LOCATION
SD-401	PRE-DESIGN PHASE SEDIMENT SAMPLE LOCATION
SD-501	TOXICITY SAMPLING LOCATIONS- SAMPLE COLLECTED AT LOCATION ENCLOSED
	WETLAND
	WETLAND BOUNDARY
TPA-3	SURVEY TURNING POINT

ANALYTICAL DATA

SD-518	0.73	= CONCENTRATION OF PCB (ppm)
	111	= CONCENTRATION OF LEAD (ppm)
	ND	= CONCENTRATION OF MERCURY (ppm)
	2,000	= CONCENTRATION OF TPH (ppm)

TOXICITY DATA

SIGNIFICANT MORTALITY OBSERVED IN EITHER HYALELLA OR CHIRONOMUS

NO SIGNIFICANT MORTALITY OBSERVED

TOXICITY TEST NOT CONDUCTED AT THIS LOCATION

Harding Lawson Associates
Engineering and Environmental Services

BULK SEDIMENT TOXICITY TESTS
LONG-TERM MONITORING PLAN
Project: NORTH LAWRENCE OIL DUMP SITE
Location: NORTH LAWRENCE, NY

FIGURE **2-4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
DEL	2820.01		5/98	

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eet

2.2 POST-REMEDIATION MONITORING

Remediation of the site involved excavation and stabilization of the primary contaminant source, as well as removal of contaminated sediments in the surrounding wetland. Following remediation, post-remediation monitoring shall be conducted to provide information regarding the success of the selected remedy in decreasing contaminant levels in the wetland ecosystem surrounding the NLODS to levels that do not pose a threat to the environment. Post-remediation monitoring shall include chemical analysis and toxicity testing of bulk sediment, as well as collection and analysis of biological tissue samples. Analytical procedures will follow those procedures used in the baseline sampling program (see Appendix A). These post-remediation data can then be compared to those obtained under baseline conditions and in the reference location to measure and monitor remediation-related improvements, as well as any short-term impacts, in ecological conditions over time.

2.2.1 Sediment Chemistry

Sediment samples shall be collected from the same on-site and reference stations that were sampled during the baseline sediment toxicity investigation. Collection of samples from the same location will help reduce or eliminate any differences due to variations in sediment concentrations throughout the wetland. Bulk (whole) sediment samples shall be analyzed for TPH, lead, mercury, PCBs, and TOC. Laboratory analyses will be conducted by a NYSDEC certified laboratory. A rapid turn-around time shall be obtained from the analytical chemistry laboratory (i.e., under 7 days). Following review of these analytical data, 16 out of the 20 stations will be selected for toxicity testing.

2.2.2 Sediment Toxicity Testing

Controlled whole sediment toxicity tests shall be conducted using *Hyalella azteca* and *Chironomus tentans*. The objective of this post-remediation testing will be to evaluate changes in sediment toxicity following completion of remediation activities at the site. Toxicity will be evaluated using the same methodology as described above in the baseline conditions section (Subsection 2.1.3.1). Tests will be conducted on 16 of the 20 sediment samples collected, as described above. The results of the toxicity tests can then be compared to the baseline data, and to data from the reference location, to measure remediation-related improvements, as well as any short-term impacts, in ecological conditions over time.

2.2.3 Bioaccumulation Monitoring

Post-remediation biological sampling shall be conducted in order to evaluate the success of the selected remedy in decreasing or eliminating contaminant concentrations in the wetland ecosystem. Efforts will be made to collect organisms similar to those collected during the baseline investigation (herbaceous plants, earthworms, small mammals, and frogs), although biological species sampled may differ somewhat due to variations in the availability of organisms.

Sampling techniques used to collect biological samples shall be similar to those used during the baseline investigation and shall include hand collection (plants, earthworms), snap traps (small mammals) and dip nets (amphibians). A license to collect or possess biological samples shall be obtained from the special licenses unit of the NYSDEC Division of Fish and Wildlife prior to each sampling event.

Biological samples shall be collected from the same transect locations identified in the baseline investigation (see Figure 2-5). Comparable sets of samples will also be collected from 3 additional transects from within the remediated wetland area. At each location, efforts will be made to collect organisms similar to those collected during the baseline investigation. Upon time of collection, a gross examination of each specimen shall be performed, and the occurrence of any observable abnormalities (e.g., skeletal deformities, lesions, tumors) shall be noted. All biological samples shall be stored and shipped on ice (4? C). All samples shall be analyzed for total PCBs, mercury, and lead. TOC and percent lipid shall also be measured.

Post-remediation tissue data shall be summarized and compared against the data representing baseline conditions.

2.3 Monitoring Schedule

No field work will be conducted at the NLODS until the Final Post-Closure Biological/Wetlands Monitoring Plan has been accepted by NYSDEC.

The first post-remediation biomonitoring effort shall be conducted in November 2000. This biomonitoring includes collection of sediment samples for chemical analysis and toxicity testing, as well as collection of biological samples for tissue analysis. The timing of the

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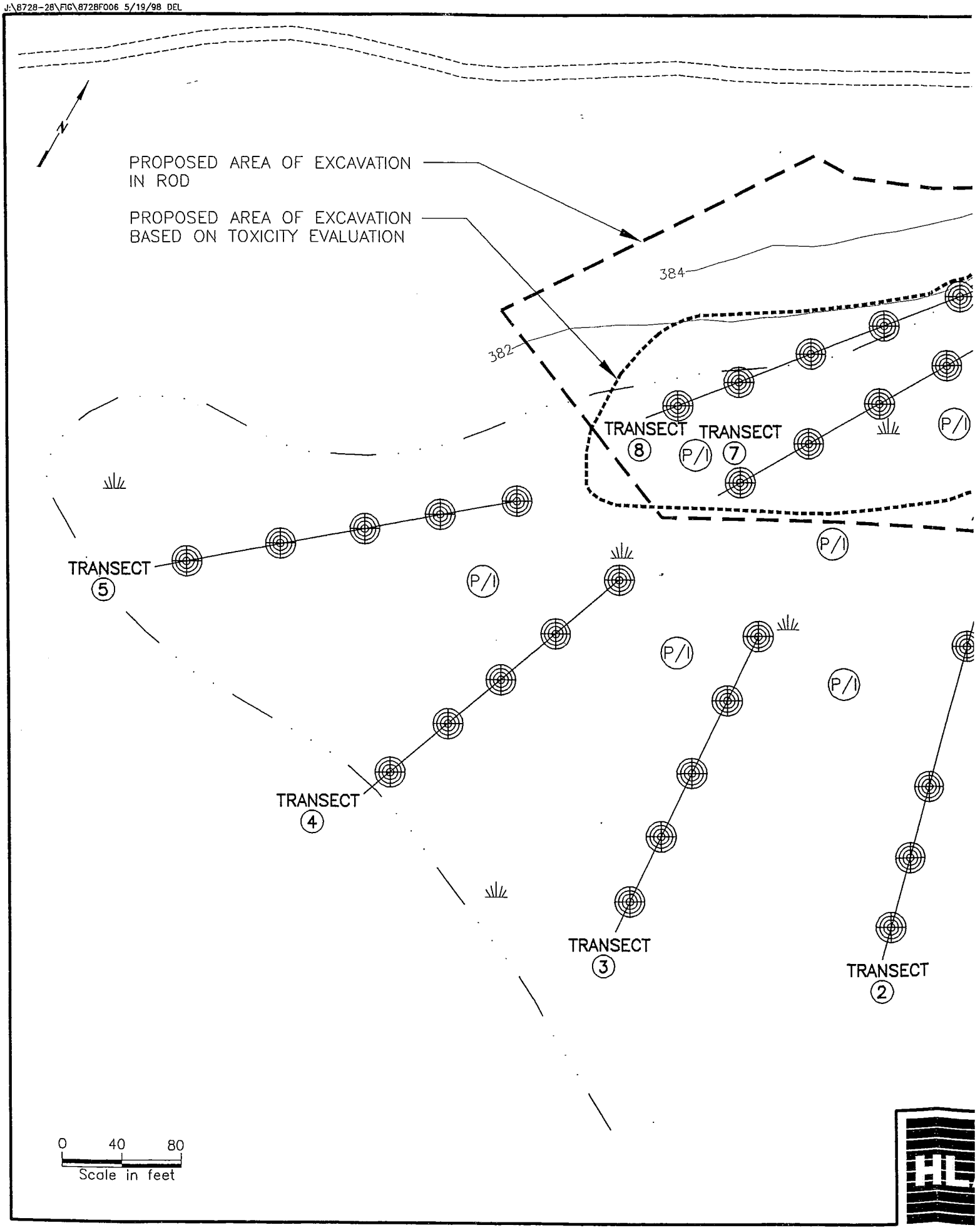
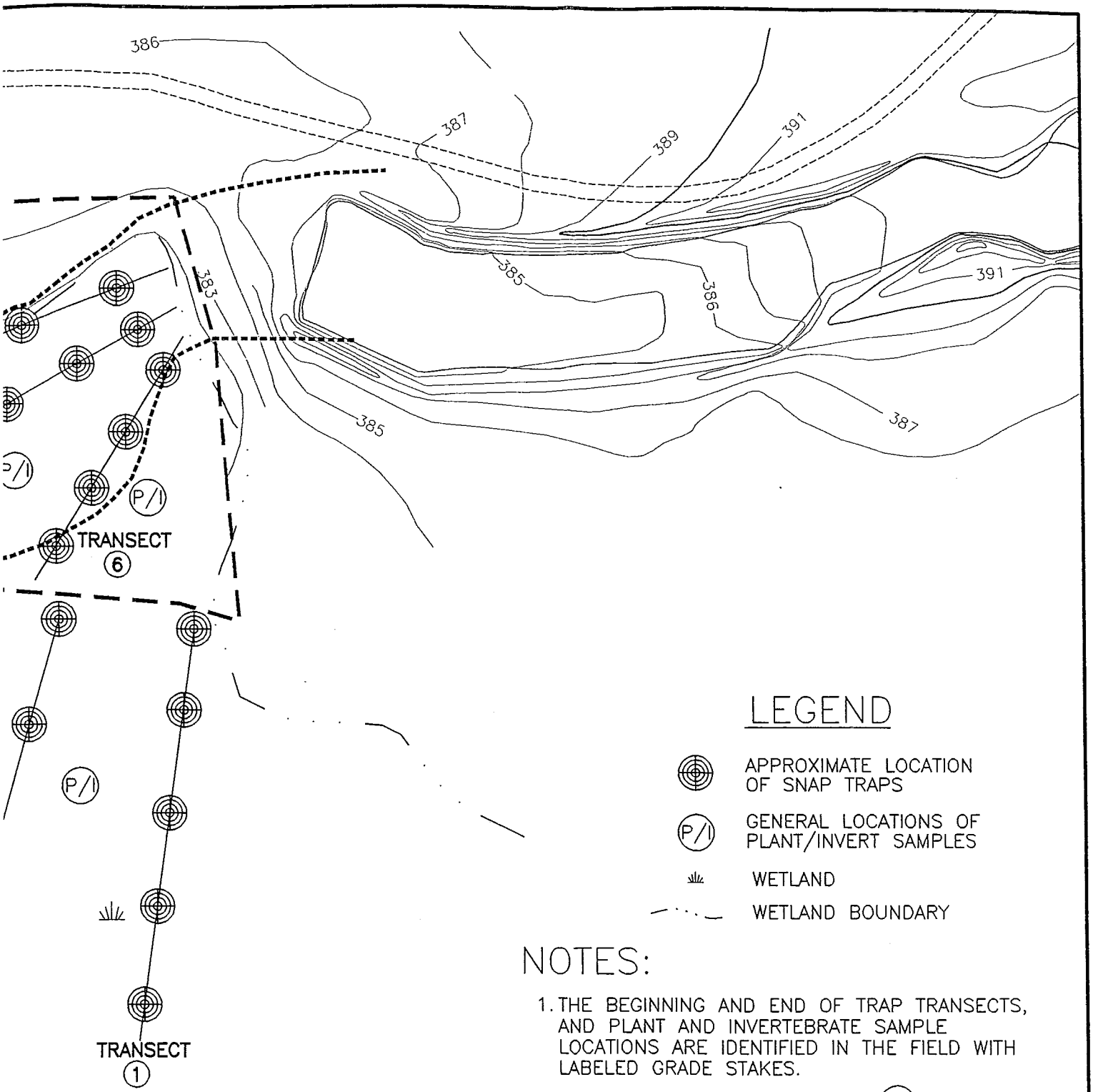




LEGEND

- APPROXIMATE LOCATION OF SNAP TRAPS
- (P/I) GENERAL LOCATIONS OF PLANT/INVERT SAMPLES
- WETLAND
- WETLAND BOUNDARY

NOTES:

1. THE BEGINNING AND END OF TRAP TRANSECTS, AND PLANT AND INVERTEBRATE SAMPLE LOCATIONS ARE IDENTIFIED IN THE FIELD WITH LABELED GRADE STAKES.
2. TRANSECTS 6,7,8, AND THE 3 (P/I) SAMPLES NEAR THEM, HAVE NOT YET BEEN ESTABLISHED IN THE FIELD.

Harding Lawson Associates
Engineering and Environmental Services

Title: BIOLOGICAL SAMPLE LOCATIONS-NLODS WETLAND LONG-TERM MONITORING PLAN

Project: NORTH LAWRENCE OIL DUMP SITE
Location: NORTH LAWRENCE, NY

FIGURE 2-5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
DEL	2820.01		5/98	

field effort for the biological sampling shall be prior to or concurrent with sediment sampling.

The need for any additional biomonitoring shall be determined based on the results of the first post-remediation biomonitoring effort. If, based on the results of this biomonitoring event, sediment and biological contaminant levels and toxicity have decreased and remain at acceptable levels, discontinuation of the biological sampling component of the long-term biomonitoring plan will be recommended.

If results of the third biomonitoring event do not indicate a reduction in sediment and biological contaminant levels and toxicity, additional biomonitoring will be scheduled for 5, 10, 15, 20, and 30 years following remediation. Following each biomonitoring effort, analytical chemistry will be compared with the baseline conditions and with other previous years. The summarized data shall be interpreted with respect to pre-remediation data, as well as with data from the reference location. If elevated sediment or tissue levels remain, or if toxicity tests suggest that toxicity to receptors in the wetlands may be occurring, additional removal actions may be recommended.

2.4 POST-REMEDIATION MONITORING REPORTS

Following the completion of the field activities and associated activities (e.g., data validation and interpretation), a letter report shall be prepared and presented to NYSDEC. The report shall contain a brief site history, a discussion of the purpose of the report, methods, results and conclusions or recommendations.

Post-Remediation Monitoring Reports must be sent to NYSEC within six months of the monitoring event.

The reports are to be sent to:

Mr. Darrell Sweredoski, P.E.
Regional Hazardous Waste Engineer
NYSDEC Region 6
317 Washington Street
Watertown, New York 13601

With a copy each to:

Mr. Gerald J. Rider, Jr., P.E.
Chief, Operation & Maintenance Section
NYSDEC – Div. of Env. Remediation
50 Wolf Road, Room 260
Albany, New York 12233-7010

Ms. Christina Dowd
NYSDEC – Div. of Fish & Wildlife
50 Wolf Road, Room 576
Albany, New York 12233-4756

2.5 WETLAND RESTORATION AND MONITORING PLAN

The preceding section of this monitoring plan outlined the approach for evaluating chemical-related impacts in the wetland surrounding the NLODS. The removal of contaminated sediments from the palustrine wetlands at the site has resulted in the disturbance and alteration of the wetlands, and therefore wetlands restoration and monitoring activities are also being performed to help restore the wetland to pre-remediation conditions.

This wetland restoration plan outlines the approach to be used in implementing the wetlands restoration program at the NLODS. This plan proposes to restore the 1.2 acres (51,900 square feet) of freshwater palustrine wetlands with an equivalent area of *in situ* self-sustaining wetlands. Monitoring of the wetlands over time will provide an indication of the success of the restoration and revegetation of the wetlands, and will help determine the necessity for any additional wetland restoration activities. The following subsections describe the approach that will be used to restore the wetland following completion of the sediment-removal activities at the site, and monitoring the wetlands over a period of time to ensure successful restoration.

2.5.1 Baseline Conditions

In order to characterize and document existing conditions in the affected wetlands, baseline conditions shall be documented prior to commencement of any remediation activities. Baseline information regarding soils types and vegetative cover types is available from the First Phase RI Report (E.C. Jordan, 1990) and the Final RI (ABB-ES, 1993).

2.5.1.1 Vegetative Cover Types. Both upland and wetland areas are located in the vicinity of the NLODS. Vegetative cover types in these two areas are discussed in Sections 2.1.1.2 and 2.1.1.3 of this Post-Closure Biological/Wetlands Monitoring Plan.

2.5.2 Description of Wetlands Alteration

Approximately 1.2 acres of contaminated palustrine wetland sediments southwest of the lagoon were excavated to a depth of approximately one foot (Figure 2-4).

The primary vegetative cover type that was altered by remedial activities at NLODS was red maple-hardwood swamp, described previously in Subsection 2.1.1.2.

2.5.3 Restoration

The restoration specification was designed to substantially meet the provisions of the NYSDEC Freshwater Wetlands Permit Requirements (6 NYCRR Part 663), which state that a wetland mitigation proposal must meet the following general requirements:

(i) *the mitigation must occur on or in the immediate vicinity of the site of the proposed project;*

(ii) *the area affected by the proposed mitigation must be regulated by the Act ... after mitigative measures are completed;*

(iii) *the mitigation must provide substantially the same or more benefits than will be lost through the proposed activity.*

Following excavation of contaminated sediments, clean soil was placed in the excavated area to achieve pre-remediation elevations and topography. The area has become partially re-vegetated already by seeding in from surrounding wetland. It is anticipated that shrub and tree seedlings as well as additional herbaceous species and forbes , will self-colonize the wetland restoration area and that little to no supplemental planting will be required.

2.5.4 Monitoring and Inspections

Monitoring and maintenance of the remediated wetland area shall be supervised by the wetland restoration specialist. Monitoring the restored wetland area at the site is critical to project success. The revegetation success and overall health of the remediated wetland shall be monitored over time until the criteria for acceptance have been met.

During the monitoring period, annual site inspections shall be conducted by the wetland restoration specialist to document the success of the restoration effort. These annual inspections shall occur concurrent with the annual disposal cell groundwater monitoring events. The site shall be photographed over time from an array of fixed reference points in order to convey information regarding the status and success of the restoration project. Following these inspections, annual wetlands restoration compliance monitoring reports shall be provided to NYSDEC until criteria for final acceptance have been met. These reports shall include information regarding:

- **Species Diversity**

  A list of all species colonizing the restoration area shall be provided. This shall be compared to a list of species in the adjacent, unaltered wetland. .

- **Vegetative Cover of the Restored Area**

  The areal coverage of all species colonizing the restoration area will be recorded.

- **Plant Vigor**

  Plant vigor will be qualitatively evaluated and signs of nutrient deficiencies or hydric stress will be evaluated. Any areas in which herbaceous plants are not established, or in which established vegetation has been damaged by wildlife or other causes, will be noted.

- **Wildlife Use**

  Wildlife use will be qualitatively evaluated. All wildlife and signs of wildlife observed in the restoration area will be recorded.

Site photographs shall be included in each inspection report.

2.5.5 Final Acceptance

The project shall be considered acceptable once the following criteria are met:

- At least 75 percent of the surface area of the restoration wetland shall be re-established with wetland plant species within 2 growing seasons following wetland restoration activities.

- At least 10 percent of new wetland vegetation (by area) shall consist of woody wetland plant species (i.e., trees and/or shrubs) that are expected to seed in naturally from surrounding areas.

- At least 85 percent of the surface area of the restoration wetland shall be re-established with wetland plant species within 5 growing seasons following wetland restoration activities.

2.5.6 Supplemental Planting (if necessary)

If herbaceous wetland vegetation fails to become established in at least 75 percent of the wetland restoration area, supplemental seeding shall be conducted. Because achievement of the proper elevation is critical to the overall success of the restored wetland area, elevations within the wetland restoration area shall be re-evaluated prior to seeding and, if necessary, regrading shall be conducted until spot elevations are within +/- 0.2 feet of the original (pre-excavation) elevation. A native wetland herbaceous seed mix will be broadcast in any areas that have not naturally re-vegetated. This seed mix may include, but not be limited to, cattails (*Typha latifolia*), soft rush (*Juncus effus*), bulrush (*Scirpus sp.*), jewelweed (*Impatiens capensis*), tussock sedge (*Carex stricta*), mann grass (*Glyceria sp.*), and other sedge species (e.g., *Carex lurida*). The species included in the seed mixture should be selected based on their ability to prevent erosion, the time required for their establishment, their value to wildlife, and their suitability for use at the site.

If woody wetland plant species fail to naturally recolonize at least 10 percent of the restoration area, supplemental plantings shall be made. The majority of woody wetland plants shall be obtained from a wetland nursery specializing in native northeastern stock. Suggested species for supplemental planting shall consist of those presented in Table 2-2. Supplemental seeding and planting will be conducted in accordance with remedial construction contract technical specification 02935 - Wetland Restoration (Appendix B).

Table 2-2
Supplemental Restoration Planting (if required)

SPECIES	SIZE	FORM	SPACING/DENSITY	TOTAL NUMBER
Trees				
Acer rubrum	5-6 ft height	B&B	30 ft o.c.	TBD
Fraxinus nigra	5-6 ft height	B&B	30 ft o.c.	TBD
Thuja occidentalis	5-6 ft height	B&B	30 ft o.c.	TBD
Shrubs				
Cornus stolonifera	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Vaccinium corymbosum	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Sambucus canadensis	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Viburnum recognitum	3-4 ft height	B&B [1]	20 ft o.c.	TBD

NOTES:
1. If shrubs are not available as B&B, then plants shall be supplied in 3 gallon containers.

o.c. = On Center
B&B = Balled and Burlapped
TBD = To Be Determined

2.5.6.1 Timing of Planting. It is anticipated that all planting can be completed within a 3 to 5 day period. Planting shall be conducted between the months of April through September. Plantings shall occur when plants are either entering or emerging from a dormant period. No planting shall occur until all grading has been completed and approved by the wetland restoration specialist.

2.5.6.2 Method of Planting. Prior to planting, a base map depicting locations and distribution of plants or groups of plants shall be constructed. This map shall be reviewed by the wetlands restoration specialist. Plant locations shall then be staked for approval by the wetlands restoration specialist. Placement of wetland plants shall be conducted by hand or with modified farm equipment (e.g., tree planter). Standard nursery tree and shrub planting methods shall be used for all woody vegetation. Woody vegetation shall be planted at densities specified in Table 2-2. All trees and shrubs shall be balled and burlapped, unless otherwise noted. Plantings of trees and shrubs shall be interspersed to maximize species diversity. No fertilizer or lime shall be used within the wetlands restoration area.

2.5.7 Reporting

This subsection presents the reporting schedule and format that will be followed in reporting the activities and results of the Wetland Restoration Monitoring.

Following the completion of restoration activities, site inspections shall be conducted annually until criteria for final acceptance have been met. If supplemental plantings are required, site inspections shall be conducted annually following re-planting until criteria for final acceptance have been met. The findings of each inspection, as well as any recommended additional supplemental or replacement plantings or other possible mitigative measures, shall be summarized in a brief letter report presented to NYSDEC.

The Annual Inspection Reports must be sent to NYSDEC within 60 days of the inspection.

The reports are to be sent to:

Mr. Darrell Sweredoski, P.E.
Regional Hazardous Waste Engineer
NYSDEC Region 6
317 Washington Street
Watertown, New York 13601

With a copy each to:

Mr. Gerald J. Rider, Jr., P.E.
Chief, Operation & Maintenance Section
NYSDEC – Div. of Env. Remediation
50 Wolf Road, Room 260
Albany, New York 12233-7010

Ms. Christina Dowd
NYSDEC – Div. of Fish & Wildlife
50 Wolf Road, Room 576
Albany, New York 12233-4756

3.0 DISPOSAL CELL MONITORING

This subsection presents the LTMP for the disposal cell. The purposes of the LTMP for this sites is to monitor the performance of the disposal cell cover and appurtenances to confirm they perform as designed and that maintenance issues are identified and responded to appropriately. Components of the LTMP for the disposal cell are:

- visual inspection
- groundwater sampling and analysis
- gas monitoring
- data evaluation
- report preparation

3.1 VISUAL INSPECTION

Visual inspection of the cover system is performed to identify evidence of:

- cap erosion
- differential settlement resulting in soil cracking or ponded water
- seeps
- animal burrows
- vegetative distress
- presence of rooted species (trees and shrubs)
- deteriorating equipment such as gas vents and monitoring wells

Monitoring of landfill appurtenances will include:

- identifying deteriorating equipment such as fencing, gates, and drainage structures, and

- identifying deterioration of access roads.

Site observations shall be made by a civil, environmental, or geotechnical engineer experienced in landfill site monitoring and familiar with the remedial design, corrective measures, and maintenance and repair activities at the site. Observations shall be recorded in writing as quantitatively as practical and photographs will be taken as a supplement if deemed appropriate by the inspector. A Post-Closure Site Inspection Check List (Figure 3-1) shall be completed by the inspector and included in the Post-Remediation Monitoring Report. The length, width, depth, and location of erosion channels, depressions, or seeps shall be recorded. The location, size, and numbers of animal burrows should be noted. Vegetative stress shall be described according to location, areal extent, species, and nature of distress. The presence and location of rooted species, such as trees and shrubs, shall be noted. Additionally, the condition of the security fence, posts, gates, locks, and signs shall be observed. Potential causes of any damage will be noted and repair and preventative measures shall be recommended. Observations will be summarized in a letter report following each inspection.

The condition of groundwater monitoring wells and gas vents will be assessed during the sampling rounds. Monitoring well identification labels shall be checked, covers and grouting inspected, and the general condition of the well and protective casing noted. The condition of the gas vents shall be noted. Evidence of clogging or instability (leaning over) shall require maintenance.

Visual inspections will commence following completion of remedial construction activities. Written notification shall be received by NYSDEC five working days prior to beginning site monitoring activities. The frequency of visual inspection will be quarterly during the first year, and could decrease to twice a year (spring and fall) thereafter in the absence of significant detrimental findings (i.e., persistent vegetative stress, differential settlement, erosion). During snow-covered periods, the disposal cell will be inspected for any obvious signs of settlement, sloughing and erosion, in addition to inspection of fencing, drainage

Figure 3-1

Post-Closure Site Inspection Checklist
North Lawrence Oil Dump Site

Date: _____
Weather: _____
Personnel (Organization): _____
Instructions: Complete the checklist of visual evaluation items and then complete specific data items. Field measurements should be made with a cloth tape and noted on a site plan. Estimated measurements should be so noted. Attach hand sketches or photographs to the site plan to further define conditions or problems.

I. VISUAL EVALAUTION ITEMS

	CONDITION: (Check)				
		Not	Action Required?		
	Acceptable	Acceptable	Yes	No	REMARKS
1) Vegetative Cover					
a) Disposal Cell	_____	_____	_____	_____	
b) Lagoon	_____	_____	_____	_____	
c) Wetland	_____	_____	_____	_____	
2) Site Drainage					
a) Sediment Build-Up	_____	_____	_____	_____	
b) Pooling or Ponding	_____	_____	_____	_____	
c) Slope Integrity	_____	_____	_____	_____	
d) Erosion Protection (Riprap, grout, vegetation)	_____	_____	_____	_____	
e) Obstruction of Culverts	_____	_____	_____	_____	
3) Condition of Access					
a) Road Condition	_____	_____	_____	_____	
b) Gates/Locks/Signs	_____	_____	_____	_____	
4) Integrity of Ground Water Monitoring Wells	_____	_____	_____	_____	
5) Integrity of Cap					
a) Erosion Damage	_____	_____	_____	_____	
b) Leachate Break-through	_____	_____	_____	_____	
c) Settlement	_____	_____	_____	_____	
6) Gas Venting System					
a) Vents free of obstructions	_____	_____	_____	_____	
b) Gas readings (measure)	_____	_____	_____	_____	
7) Other (e.g., Litter, Unauthorized Dumping, etc.)	_____	_____	_____	_____	

II. SPECIFIC DATA ITEMS (Write N.A. if not applicable)
A. Erosion and Settlement:
1) Approximate size in feet of eroded cap area(s). (List Separately)
a. _____ feet by _____ feet
b. _____ feet by _____ feet
c. _____ feet by _____ feet
2) How deep is the most extreme point of erosion when measured from the adjacent surface. (List Separately)
a. _____ feet
b. _____ feet
c. _____ feet

Figure 3-1

Post-Closure Site Inspection Checklist
North Lawrence Oil Dump Site
(continued)

3) Approximate size in feet of eroded areas outside the soil cap area such as drainage ditches, roads or slopes._____
4) Attach a hand sketch or photograph to be attached to this report, showing location(s) of the eroded area(s). Identify each area by using the letter a, b, c, etc. from Question 1.
5) Approximate size in feet of leachate breakout(s). (List Separately)
a. _____ feet by _____ feet
b. _____ feet by _____ feet
c. _____ feet by _____ feet
6) Approximate size in feet of any settlement area within the soil cap area. (List Separately)
a. _____ feet by _____ feet
b. _____ feet by _____ feet
c. _____ feet by _____ feet
7) Approximate depth of each settlement area when measured from the adjacent surface. (List Separately)
a. _____ feet
b. _____ feet
c. _____ feet
8) Attach a hand sketch or photograph to the attached site plan showing the location of the settlement area(s). Identify each area by using letter a, b, or c, etc. from Question 6.

_____

_____
Signature of Inspector(s)

Attachments

_____ Yes _____ No

structures and signage. If site monitoring indicates that the cap and appurtenances are performing adequately after five years, the frequency of inspection may be reduced to once per year (spring), with the approval of NYSDEC.

If conditions detrimental to the cover system, monitoring wells, gas vents, and drainage structures are observed, then an assessment of the existing conditions will be undertaken by the inspector, in consultation with NYSDEC, to identify appropriate corrective measures in accordance with Section 4.0, Maintenance Plan, of this LTMP.

3.1.1 Reporting

Results of the visual inspections will be documented in Post-Remediation Monitoring Reports for NLODS and submitted to NYSDEC within 30 days of inspection activities. When the frequency of visual inspections is reduced (e.g., quarterly, semiannually), the results of the inspections will be documented in a single report presenting the other monitoring activities (water quality and gas monitoring).

Post-Remediation Monitoring Reports must be sent to NYSDEC within six months of the monitoring event.

The reports are to be sent to:

Mr. Darrell Sweredoski, P.E.
Regional Hazardous Waste Engineer
NYSDEC Region 6
317 Washington Street
Watertown, New York 13601

With a copy each to:

Mr. Gerald J. Rider, Jr., P.E.
Chief, Operation & Maintenance Section
NYSDEC – Div. of Env. Remediation
50 Wolf Road, Room 260
Albany, New York 12233-7010

Ms. Christina Dowd
NYSDEC – Div. of Fish & Wildlife
50 Wolf Road, Room 576
Albany, New York 12233-4756

3.2 GROUNDWATER MONITORING

A groundwater monitoring program will be conducted to evaluate the effectiveness of the remedial alternatives implemented at NLODS. Comparison of groundwater elevation and chemistry upgradient and downgradient of the disposal cell will provide a means for evaluating the performance of these remedial actions. The groundwater monitoring program will begin following the completion of remedial construction activities. The following subsections present the number and location of wells to be sampled, compounds to be analyzed, frequency of sampling, and reporting requirements.

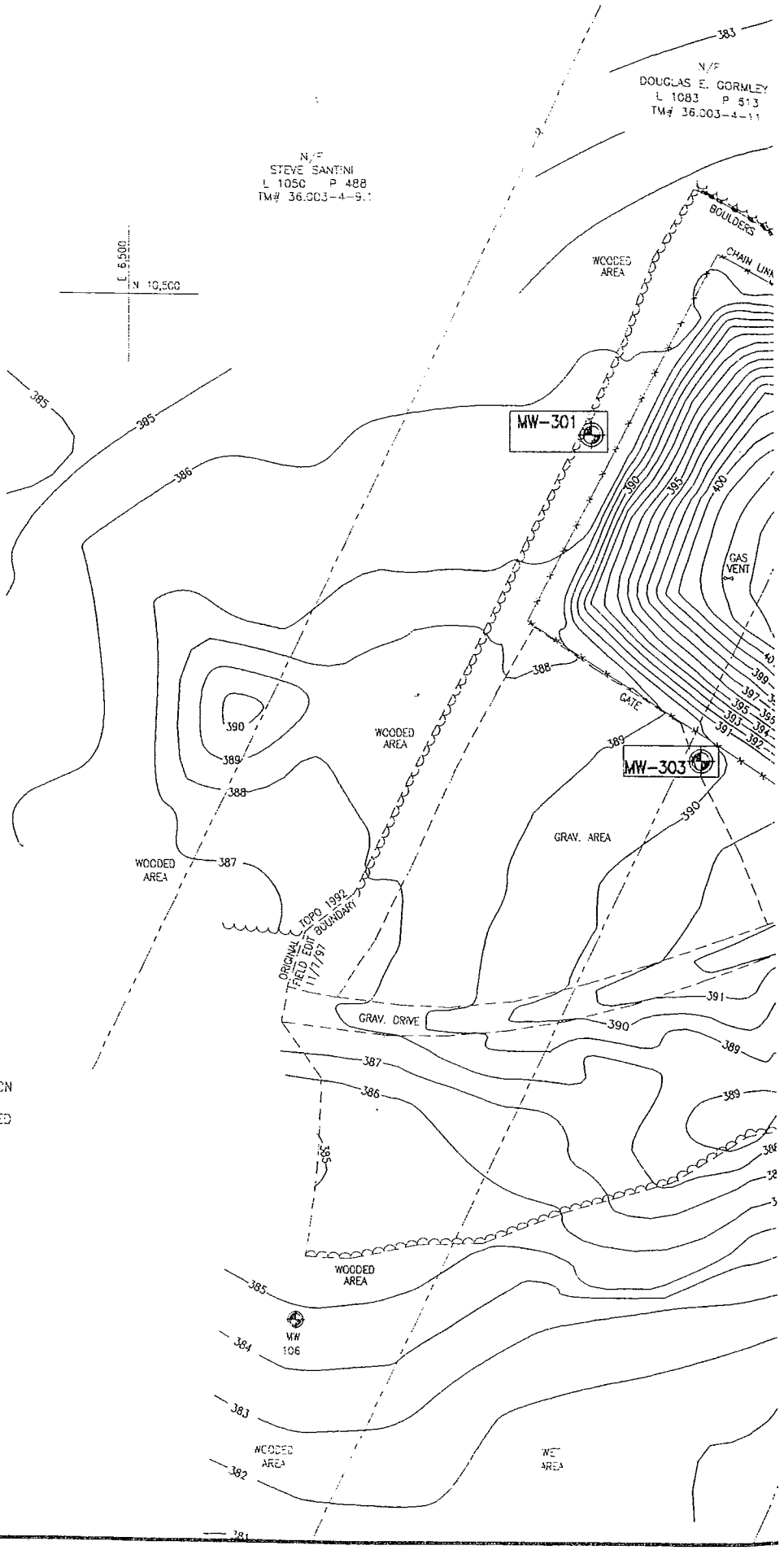
3.2.1 Sampling Locations

The LTMP for the disposal cell includes the collection of groundwater level measurements and the sampling and analysis of groundwater. Groundwater levels will be measured and recorded along with pertinent well details. Five groundwater monitoring wells (MW-102A, MW-102B, and MW-301 through MW-303) will be samples for laboratory analysis and waster elevations for the purpose of monitoring the disposal cell. The monitoring well locations and elevation data are presented in Figure 3-2.

3.2.2 Analytical Parameters

Groundwater samples collected from monitoring wells associated with the disposal cell, will be analyzed for TCL VOCs, TPH, PCBs, lead, and mercury following the NYSDEC Analytical Services Protocol. Groundwater sampling will be conducted in accordance with the QAPP (E.C. Jordan Co., 1991a).

Should the laboratory be unable to meet the method detection limits during a regularly scheduled sampling event, resampling will not be conducted. The data will be evaluated and reported to NYSDEC. The data evaluation will consider the applicability of the data to the long term monitoring plan objectives and recommend how the data should be utilized.

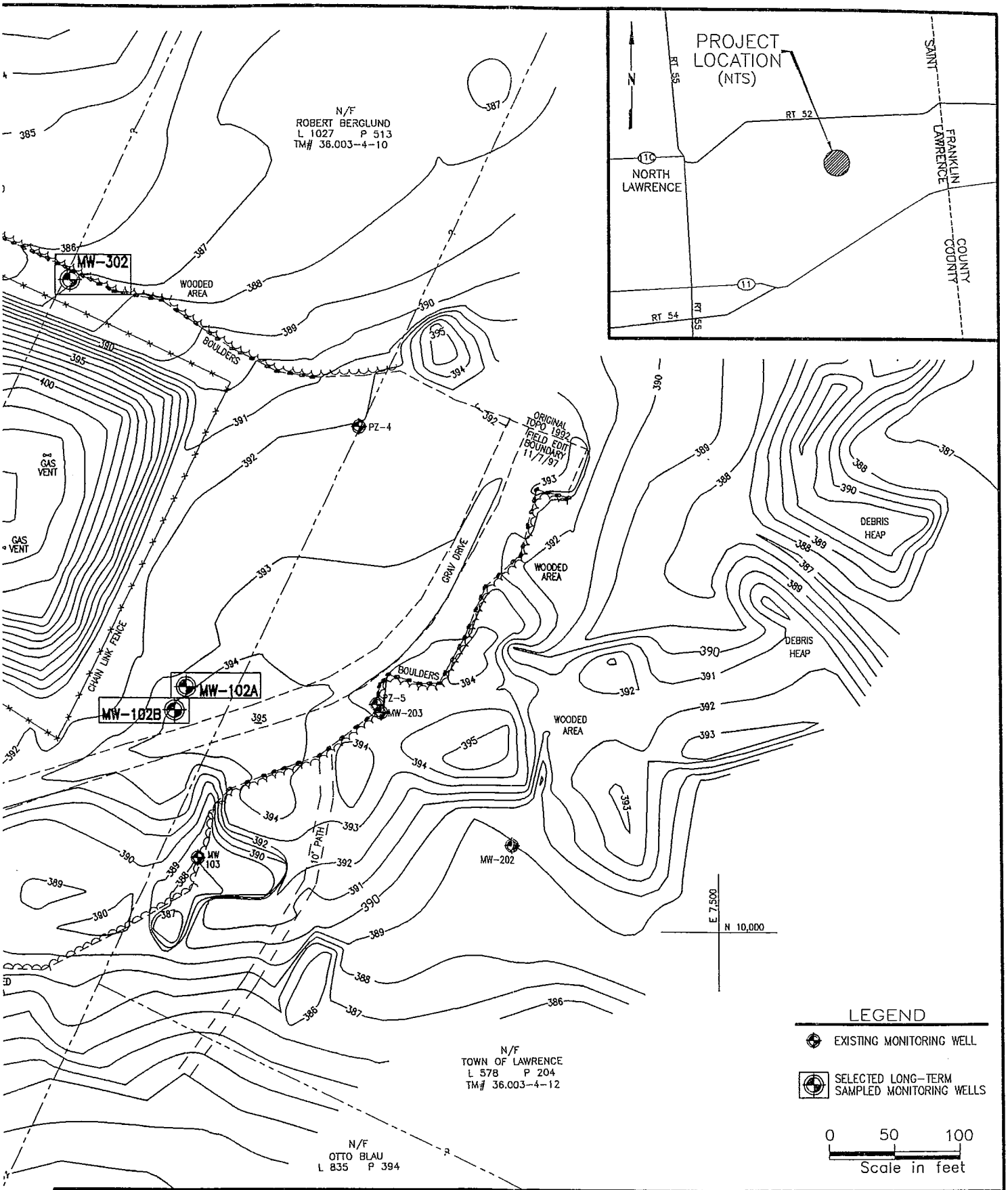


SURVEY NOTES:

1) COORDINATE SYSTEM AND ELEVATIONS ARE ASSUMED & BASED ON POINTS SET BY MODI ASSOCIATES, CLAY, NY IN MAY 1989.

2) LOCATIONS & TOPOGRAPHIC INFORMATION SHOWN HEREON ARE BASED ON THE RESULT OF A FIELD EDIT SURVEY PERFORMED IN NOVEMBER 1997 AND ARE NOT INTENDED TO DELINEATE ANY OWNERSHIP.

SELECTED LONG-TERM MONITORING WELLS TABLE OF ELEVATIONS			
DESCRIPTION	ELEVATION		
	GROUND	CASE	RISER
MW-301	386.3	389.52	389.31
MW-302	386.7	390.03	389.83
MW-303	389.9	392.95	392.72
MW-102A	393.72	–	395.86
MW-102B	394.26	–	396.30



Harding Lawson Associates
Engineering and Environmental Services

GROUNDWATER MONITORING WELL LOCATIONS LONG-TERM MONITORING PLAN

Project: NORTH LAWRENCE OIL DUMP SITE
Location: NORTH LAWRENCE, NY

FIGURE 3-2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
DEL	2820.01		5/98	

Figure 3-3

Sample Information Record
North Lawrence Oil Dump Site

SITE _____ SAMPLE CREW _____
SAMPLE LOCATION/WELL NO. _____
FIELD SAMPLE I.D. NUMBER _____ DATE _____
TIME _____ WEATHER _____ TEMPERATURE _____
WELL INFORMATION:
DEPTH TO WATER _____ MEASUREMENT METHOD _____
DEPTH OF WELL _____ MEASUREMENT METHOD _____
VOLUME REMOVED _____ REMOVAL METHOD _____
FIELD TEST RESULTS:
COLOR _____ pH _____ ODOR _____
TEMPERATURE (oF) _____ SPECIFIC CONDUCTANCE (umhos/cm) _____
OTHER (OVA, Methane meter, etc.)

CONSTITUENTS SAMPLED:

REMARKS:

WELL CASING VOLUMES

GAL/FT	1-1/4" – 0.077	2: = 0.16	3" = 0.37	4" = 0.65
	1-1/2" = 0.10	2-1/2" = 0.24	3-1/2" = 0.50	6" = 1.46

Location of monitoring well with reference to permanent reference points

The usefulness of the data will depend on the contaminant levels relative to the detection limits during a specific sampling event and the reason for the laboratory's inability to meet the detection limit. Corrective measures are to be implemented prior to the next scheduled sampling event. Conditions may exist which cannot be corrected, i.e., highly turbid water samples causing analytical equipment interference. In those instances corrective measures may not be practicable.

3.2.3 Sampling Frequency

The LTMP will begin following the completion of remedial construction activities. Samples are to be obtained annually for the 30-year monitoring period. A Sample Information Record (Figure 3-3) is to be completed for each groundwater sample and the records are to be included in the Post-Remediation Monitoring Report.

3.2.4 Reporting

All water level and analytical data will be reported and evaluated annually. The water quality data and data evaluation will be presented in Post-Remediation Monitoring Reports submitted to the NYSDEC within 90 days after the sampling event. The reports will also include the results of the visual inspection and gas monitoring activities.

Post-Remediation Monitoring Reports must be sent to NYSDEC within six months of the monitoring event.

The reports are to be sent to:

Mr. Darrell Sweredoski, P.E.
Regional Hazardous Waste Engineer
NYSDEC Region 6
317 Washington Street
Watertown, New York 13601

With a copy each to:

Mr. Gerald J. Rider, Jr., P.E.
Chief, Operation & Maintenance Section
NYSDEC – Div. of Env. Remediation
50 Wolf Road, Room 260
Albany, New York 12233-7010

Ms. Christina Dowd
NYSDEC – Div. of Fish & Wildlife
50 Wolf Road, Room 576
Albany, New York 12233-4756

4.0 MAINTENANCE PLAN

4.1 DISPOSAL CELL MAINTENANCE ACTIVITIES

Items identified during the site inspection requiring routine corrective maintenance shall be repaired within 60 days of the submittal of the inspection report to the NYSDEC provided weather or access do not restrict repair activities and the scope of repairs can reasonably be accomplished within the 60-day period. Major repair schedules will be identified as part of the assessment of significant potential effects to the remedial action. Reports of all maintenance activities will be provided to NYSDEC within 30 working days after completing the activity. The required Remedial Construction Technical Specifications are presented in Appendix B.

Maintenance reports are to be submitted to:

Mr. Darrell Sweredoski, P.E.
Regional Hazardous Waste Engineer
NYSDEC Region 6
317 Washington Street
Watertown, New York 13601

With a copy each to:

Mr. Gerald J. Rider, Jr., P.E.
Chief, Operation & Maintenance Section
NYSDEC – Div. of Env. Remediation
50 Wolf Road, Room 260
Albany, New York 12233-7010

Ms. Christina Dowd
NYSDEC – Div. of Fish & Wildlife
50 Wolf Road, Room 576
Albany, New York 12233-4756

Mr. Gary Litwin
NYS Department of Health
Division of Environmental Health Assessment
Bureau of Environmental Exposure Investigation, Room 205
2 Univeristy Place
Albany, NY 12203-3399

4.1.1 Cover Maintenance

The vegetative cover will be mowed twice a year to prevent the growth of deep rooted, woody species, and to encourage the development of good grass growth. Areas noted during inspections to have poor vegetative growth shall be reseeded and the area maintained, in accordance with the NLODS Remedial Construction Technical Specification 02931 - Seeding (Appendix B). Animal burrows into the cover system will be repaired as needed. The effort required to repair such holes will depend on the depth of the burrow. Shallow burrows into the vegetative soil and/or barrier protection layer(s) will be filled and seeded with suitable materials in accordance with remedial construction contract Technical Specifications 02221 - Excavation, Backfill, and Compaction and 02931 - Seeding (Appendix B), respectively.

Deeper burrows, which penetrate the hydraulic barrier will require filling to the geomembrane surface, and patching the geomembrane in accordance with remedial construction contract Technical Specifications 02776 - Polyethylene Geomembranes (Appendix B). The vegetative layer shall then be reconstructed and the disturbed area revegetated in accordance with the Technical Specifications. This method of repair protects the integrity of the hydraulic barrier layer and will not significantly impact the cover system due to the small size of animal burrows with respect to the size of the site. Elimination of animal problems will be accomplished by trapping and relocating or extermination.

4.1.2 Erosion Control Maintenance

Erosion of the cover system, identified during site inspections, shall be repaired as needed in a manner that provides a long-term solution to such damage. The activities required to repair erosive damage to the cover system will depend on the extent of erosion into the cover. At a minimum, the eroded area will be excavated to the vertical and lateral extent of the lowest affected cover layer. Reconstruction of each cover component shall be in accordance with remedial construction contract Technical Specification 02221. The disturbed area shall be seeded in accordance with remedial construction contract Technical Specification 02931.

Erosion of the runoff control structures (drainage ditches), identified during site inspections, shall be repaired as needed in a manner and schedule similar to that described above. The activities required to repair erosive damage to the ditches shall also depend on the extent of damage. The final grades of all repaired areas shall conform to the grades and slopes of the surrounding areas and comply with the limits of design grades and slopes.

4.1.3 Settlement and Subsidence Control Maintenance

The grades and slopes of the site are expected to be sufficient to provide positive drainage slopes even after the anticipated subsidence. Should excessive post-closure settlement or damage to the cap as a result of settlement be identified during site inspections, repair of the cap will be implemented as necessary to confirm that the cover system layers remain continuous, that a positive slope is maintained, and that ponding does not occur. Subsidence will typically occur gradually. Therefore, a semiannual or annual inspection frequency will be sufficient to identify settlement problems.

The corrective action for ponding caused by subsidence of the drainage ditches and the cover system will be excavation of the soil above the geomembrane, removal of a section of geomembrane, and placement of additional soil material below the hydraulic barrier layer in conformance with remedial construction contract Technical Specification 02221. This material will be brought to the slopes and grade of the hydraulic barrier layer in the surrounding area to provide uninterrupted positive drainage over the surface of the hydraulic barrier layer. New sections of geomembrane will be placed with sufficient overlap and in conformance to remedial construction contract Technical Specifications 02776 - Polyethylene Geomembranes.

Following restoration of the hydraulic barrier grade, the overlying layers shall be reconstructed in accordance with the applicable technical specifications.

4.1.4 Maintenance of Groundwater Monitoring System

During the 30-year post-closure period, monitoring wells may require replacement because of excessive casing corrosion, settlement, physical damage, and so forth. To continue providing monitoring data representative of groundwater in the vicinity of an old monitoring well, the new well will be installed to the same depth and in a location as close as possible to the old well. Monitoring wells will be installed as shown on Figure 4-1 and Technical Specification 02673 - Monitoring Wells (Appendix B).

Annual routine maintenance of monitoring wells will include inspection and maintenance of identification markings on each well; and inspection and replacement as necessary of caps, locks, seals, and grouting.

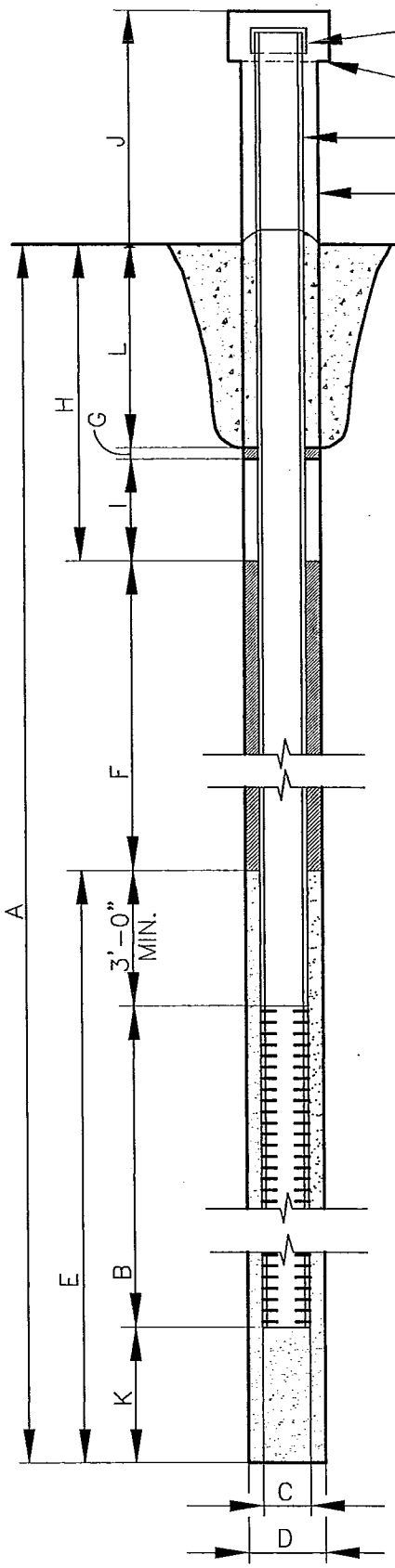
4.1.5 Maintenance of Gas Vents

The gas vents will require maintenance consisting of inspection and possibly replacement of damaged vent riser pipe, Gas vent construction is shown in details on the remedial construction contract drawings.

4.1.6 Fence Maintenance

Routine fence maintenance will include oiling gate hinges and replacing locks. Oiling of gate hinges is not to be conducted on the same day as groundwater sampling. Holes in the chain-link or siltation fence identified in the monitoring program will be repaired as needed. Minor erosion rills or animal burrows beneath the fence will be identified and repaired as necessary. Such repairs should occur within 60 days of submittal of the monitoring report

J:\8728-07\8728C303 5/19/98 DEL



A. BOREHOLE DEPTH – VARIES

B. WELLSCREEN LENGTH – 10 FT.

C. WELLSCREEN DIAMETER – 2" I.D.

D. BOREHOLE DIAMETER – 4"

E. SAND PACK – 15 FT.

F. MINIMUM 10 FT. BENTONITE SEAL

G. NOMINAL 2" BENTONITE SEAL

H. DEPTH TO TOP OF WELLSCREEN SEAL – VARIES

I. BENTONITE/CEMENT SLURRY – VARIES

J. HEIGHT OF PVC WELL CASING ABOVE GROUND – 2.8 FT.

K. DEPTH OF SAND PACK BELOW SCREEN – 2 FT.

L. CONCRETE SEAL – 3 FT.

Harding Lawson Associates
Engineering and Environmental Services

Title: MONITORING WELL CONSTRUCTION LONG-TERM MONITORING PLAN

FIGURE 4-1

Project: NORTH LAWRENCE OIL DUMP SITE
Location: NORTH LAWRENCE, NY

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
DEL	2820.01		5/98	

to NYSDEC, provided weather or access does not restrict repair activities and that the scope of repairs can reasonably be accomplished within the 60-day period.

4.1.7 Roadway Maintenance

Periodic maintenance of the access road may be necessary. Drainage ditches will be kept free-draining, and the effects of any unauthorized use of the roadside, such as excavation, shall be repaired as necessary. Should the condition of the access road deteriorate to a state requiring more extensive maintenance than addition of materials and/or regrading, a repair plan and schedule will be prepared and submitted to NYSDEC for approval. The approved repair plan will be implemented in accordance with the schedule. These repairs should be made in accordance with remedial construction contract Technical Specification 02221 (Appendix B) and the remedial construction contract drawings.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
ASTM	American Society for Testing and Materials
FS	Feasibility Study
HASP	Health and Safety Plan
HLA	Harding Lawson Associates, Inc.
LTMP	long-term monitoring plan
NYSDEC	New York State Department of Environmental Conservation
NLODS	North Lawrence Oil Dump Site
PCB	Polychlorinated Biphenyl
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

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BASELINE BIOLOGICAL MONITORING REPORT

08749-07

July 15, 1997

Mr. Amen Omorogbe
Project Manager
Division of Hazardous Waste Remediation
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233-7010

Subject: North Lawrence Oil Dump Site
Work Assignment No. D002472-26
Baseline Biological Monitoring Report

This letter report presents the results of the baseline biological monitoring program conducted at the North Lawrence Oil Dump Site (NLODS) during the period of 4-8 November 1996. The biological sampling was administered following the tasks and objectives presented in the Biological Sampling Plan (ABB-ES, 1996). The purpose of the sampling program was to determine a baseline level of contamination in biota within the NLODS wetland prior to remediation, focusing on lead and PCB concentrations in biota at three trophic levels. Samples were collected from the NLODS wetland and an offsite reference area. Biota sampled included small mammals, terrestrial invertebrates, plants and amphibians. This report contains a discussion of field activities, sample handling and analytical procedures, and analytical results. It has been revised to incorporate comments provided by Richard Koeppicus dated April 21, 1997.

1.0 Field Activities

1.1 Identification of the Reference Wetland

A suitable location for the reference wetland was identified from information provided in a report titled *Contamination Pathways Characterization, Summary Report, Contamination Pathways RI/FS, York Oil Superfund Site, Moira, New York* (Blasand, Bouck & Lee, Inc, 1995). The actual location was identified in the field by ABB-ES and NYSDEC personnel. The location of this wetland relative to the NLODS wetland is shown in Figure 1.

Although this site is a suitable reference location, there were some differences in hydrological conditions and dominant vegetation forms between the reference and NLODS wetland. At the NLODS wetland, water was ponded and or at or near the surface throughout the site, whereas at the reference wetland, most of the dry land within the reference wetland was associated with microrelief around the shrubs and trees present at the site. The NLODS wetland is a forested wetland with a well-developed shrub-dominated understory. The reference wetland is a forested/scrub-shrub wetland, dominated by shrubs and saplings (< 30 feet tall), with emergent grasses dominating the understory/ground cover at the site in distinct tussocks with mound and pool microrelief. The lower-

511 Congress Street
P.O. Box 7050
Portland, ME 04112-7050

Telephone
(207) 775-5401

Fax
(207) 772-4762

A subset of the small mammals collected from the NLODS and reference wetlands were composited into five separate-samples, respectively (Table 3). In the NLODS wetland each sample was a composite of two to six individuals, because of their small size relative to the sample quantity requested by the laboratory for the chemical analyses (25 g for PCBs, 15 g for percent lipid, and 10 g for lead). In the reference wetland, three of the five samples consisted of a composite of two individuals, the remaining two samples were composed of a single individual.

1.3.2 Invertebrates

Earthworms were collected from five locations within the NLODS and reference wetlands. An area of roughly one meter square was sampled in order to gather enough sample quantity to conduct the requested chemical analysis. A hand shovel was used to dig worms, each shovel full was sorted and any earthworms present were composited. Approximately 50 grams of earthworms were collected at each location. Earthworm sample locations are indicated in Figures 2 and 3 for the NLODS wetland and reference wetland, respectively.

1.3.3 Plants

Herbaceous plants were collected from five locations in the NLODS and reference wetlands. The targeted species, identified in the field, was from the sedge family *Cyperaceae*. All of the plants collected were of the genus *Carex*. Plant species from this genus are a common food source for birds and small mammals and they were present in abundance at both the NLODS and reference wetlands. Plant samples consisted a composite of the edible portions of several plants. Samples were collected with clippers. Plant sample locations are indicated in Figures 2 and 3 for the NLODS wetland and reference wetland. Although five samples were collected only four were analyzed, as one of the plant samples from both locations was sacrificed in order to allow the analysis of the amphibian samples.

1.3.4 Amphibians

During the sampling program, frogs of the genus *Rana* were observed throughout the NLODS wetland. A decision was made in the field, to collect an amphibian sample, as they would likely represent a primary food source for medium size mammals and wading birds (e.g., raccoons and great blue herons). Six green frogs (*Rana clamitans melanota*) were collected from the NLODS wetland and retained for chemical analysis. However, in the reference wetland amphibians seemed to be less prevalent. This was probably due to the denser ground cover present at the reference wetland. One northern leopard frog (*Rana pipens*) was collected reference wetland during the sampling program, and retained for chemical analysis.

2.0 Sample Handling, Preparation, and Analysis

Samples were shipped to the analytical laboratory at 4° C , and analyzed within the required sample holding times. Samples were homogenized to a uniform consistency by chopping into pieces and blending with liquid nitrogen into a powder. Plant, invertebrate, and amphibian samples were analyzed for percent lipid, total PCBs, and lead. For small mammals, femur bones were removed and analyzed for lead only; and the remainder of the body was analyzed for percent lipid and total PCBs.

3.4 Amphibians

Frogs (*Rana spp.*) collected at the NLODS and reference wetlands were analyzed for PCBs, percent lipids, and lead (Table 7). PCBs were not detected in frogs collected from the NLODS or reference wetlands. The percent lipids measured in frogs were slightly higher in the reference wetland as compared to the NLODS wetland (2.13 and 1.46, respectively). Lead was detected in frog samples collected from both the NLODS and reference wetlands (0.07 and 0.28 ppm, respectively). Unlike the other biota, lead was detected in frogs at a higher concentration in the reference wetland.

4.0 Risk Evaluation

This section contains a brief discussion and interpretation of these measured tissue concentrations relative to baseline ecological risks. In the 1990 and 1992 ecological risk assessments (E.C. Jordan, 1990; 1992), risks to ecological receptors from PCBs and lead in the NLODS wetland were evaluated through the use of a food web model. Potential risks for certain receptors (shrew, woodcock, and garter snake) were identified, based on an HI>1.

Risks were recalculated using PCB and lead concentrations measured in small mammals, invertebrates (earthworms), amphibians (frogs), and plants collected from the NLODS wetland and the reference wetland. In the NLODS wetland, the contribution of sediment was evaluated by considering only the concentrations from samples that would remain following remediation (i.e., from outside of the area to be remediated); these were identified in the Sediment Toxicity Characterization Report (ABB-ES, 1995). Sediment sample locations are identified in Figure 4, and the analytical results are presented in Table 8. The risk calculations for the NLODS wetland and reference wetland are presented in Table 9 and Table 10, respectively.

The exposure assumptions presented in the baseline ecological risk assessment (E.C. Jordan, 1992) were used to recalculate risks. Exposure routes for the shrew and woodcock included direct sediment ingestion, ingestion of contaminated invertebrates, and ingestion of contaminated plants. For the garter snake, exposure routes included direct ingestion of contaminated sediment, invertebrates, small mammals, and herptofauna. The assumed dietary composition for the garter snake was changed slightly from that used previously to include herptofauna instead of small birds, as site-specific chemical data on this prey species was available.

Risks were quantitatively evaluated using hazard quotients (HQs), which were calculated by dividing the estimated exposure level (TBD) by the toxicological benchmark (RTV). Acute exposure HQs were calculated by dividing the dose based on the maximum concentration of PCBs and lead in sediment and prey species by the acute RTVs; chronic exposure HQs were calculated by dividing the dose based on average concentrations of PCBs and lead in sediment and prey species by the chronic RTV. This is consistent with the approach used in the two existing ecological risk assessments for NLODS (E.C. Jordan, 1990; and 1992).

The findings presented in Table 9 suggest that small mammals that forage exclusively within the NLODS wetland could potentially be at risk as a result of lead concentrations, although acute and chronic HQs were only slightly greater than 1 (HQs of 1.37 and 9.33, respectively). Incidental ingestion of sediment containing lead is the pathway contributing to the majority of predicted

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TABLE 2

SUMMARY OF WORMS, PLANTS, AND FROGS COLLECTED AT THE NLODS AND REFERENCE WETLANDS

NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

SITE	TRANSECT	ORGANISM	WEIGHT (g)	DATE	TIME
NLODS	T1-W	WORM	46	11/5/96	1500
NLODS	T2-W	WORM	50+	11/5/96	1530
NLODS	T5-W	WORM	50+	11/6/96	1510
NLODS	T5(N)-W	WORM	50+	11/6/96	1542
NLODS	T1(N)-W	WORM	50+	11/6/96	1630
REF	R1-W	WORM	NA	11/7/96	930
REF	R2-W	WORM	NA	11/7/96	1000
REF	R3-W	WORM	NA	11/7/96	1220
REF	R4-W	WORM	NA	11/7/96	1630
REF	R5-W	WORM	NA	11/7/96	1700
NLODS	T1-P	PLANT	NA	11/6/96	1415
NLODS	T2-P	PLANT	NA	11/6/96	1430
NLODS	T3-P	PLANT	NA	11/6/96	1440
NLODS	T4-P	PLANT	NA	11/6/96	1450
NLODS	T5-P	PLANT	NA	11/6/96	1500
REF	R1-P	PLANT	NA	11/7/96	1100
REF	R2-P	PLANT	NA	11/7/96	945
REF	R3-P	PLANT	NA	11/7/96	955
REF	R4-P	PLANT	NA	11/7/96	1025
REF	R5-P	PLANT	NA	11/7/96	1020
NLODS	T2-F	FROG	> 50	11/6/96	1700
REF	R5-F	FROG	NA	11/7/96	1020

TABLE 3

SAMPLE NUMBERS AND COMPOSITING OF BIOLOGICAL SAMPLES
COLLECTED AT THE NLODS AND REFERENCE WETLANDS

NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

SAMPLE #:	SITE	TRANSECT	TRAP #	DATE	TIME	SPECIES	WEIGHT (g)	SHIPPED
	REF	3	5	11/7/96	840	WFM	15	11/7/96
Earthworms								
BIO-611	NLODS	T1-W		11/5/96	1500	WORM	46	11/6/96
BIO-612	NLODS	T2-W		11/5/96	1530	WORM	50+	11/6/96
BIO-613	NLODS	T5-W		11/6/96	1510	WORM	50+	11/7/96
BIO-614	NLODS	T5(N)-W		11/6/96	1542	WORM	50+	11/7/96
BIO-615	NLODS	T1(N)-W		11/6/96	1630	WORM	50+	11/7/96
BIO-616	REF	R1-W		11/7/96	930	WORM	---	11/7/96
BIO-617	REF	R2-W		11/7/96	1000	WORM	---	11/7/96
BIO-618	REF	R3-W		11/7/96	1220	WORM	---	11/7/96
BIO-619	REF	R4-W		11/7/96	1630	WORM	---	11/8/96
BIO-620	REF	R5-W		11/7/96	1700	WORM	---	11/8/96
Plants								
BIO-621	NLODS	T1-P		11/6/96	1415	PLANT	---	11/7/96
BIO-622	NLODS	T2-P		11/6/96	1430	PLANT	---	11/7/96
BIO-623	NLODS	T3-P		11/6/96	1440	PLANT	---	11/7/96
BIO-624	NLODS	T4-P		11/6/96	1450	PLANT	---	11/7/96
BIO-625	REF	R1-P		11/7/96	1100	PLANT	---	11/7/96
BIO-626	REF	R2-P		11/7/96	945	PLANT	---	11/7/96
BIO-627	REF	R3-P		11/7/96	955	PLANT	---	11/7/96
BIO-628	REF	R4-P		11/7/96	1025	PLANT	---	11/7/96
Frogs								
BIO-629	NLODS	T2-F		11/6/96	1700	FROG	> 50	11/7/96
BIO-630	REF	R5-F		11/7/96	1020	FROG	---	11/7/96

NLODS = North Lawrence Oil Dump Site
REF = Reference Wetland
Species abbreviations:
WFM = white-footed mouse (Peromyscus leucopus)
STS = short-tailed shrew (Blarina brevicauda)
MS = masked shrew (Sorex cinereus)
MV = meadow vole (Microtus pennsylvanicus)

TABLE 5

EARTHWORM TISSUE ANALYSIS RESULTS

NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

Media	Sample ID	% Lipid	Total PCB ug/kg wet wt.[a]	Lead mg/kg wet wt.	% Moisture	Total PCB ug/kg dry wt.	Lead mg/kg dry wt
Site Locations							
EW	BIO611	1.22	< 50	2.4	0.861	< 50	17
EW	BIO612	1.26	< 50	2.3	0.866	< 50	17
EW	BIO613	1.66	< 50	0.99	0.841	< 50	6
EW	BIO614	1.38	< 50	0.98	0.852	< 50	7
EW	BIO615	1.49	< 130	1.7	0.897	< 130	17
		Average	ND	1.7		ND	13
		Maximum	ND	2.4		ND	17
Reference Locations							
EW	BIO616	1.23	< 99	0.35	0.872	< 99	2.7
EW	BIO617	1.33	< 67	0.6	0.857	< 67	4.2
EW	BIO618	1.08	< 50	0.52	0.859	< 50	3.7
EW	BIO619	1.34	< 50	1.2	0.854	< 50	8.2
EW	BIO620	1.61	< 100	0.37	0.848	< 100	2.4
		Average	ND	0.61		ND	4.3
		Maximum	ND	1.2		ND	8.2

[a] The following PCBs were analyzed for and not detected:
Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and 1260. Sample Quantitation Levels (SQLs) ranged from 50 to 130 ppb.
EW = Earthworms
ND = Not Detected

TABLE 7

FROG TISSUE ANALYSIS RESULTS

NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NEW YORK

Media	Sample ID	% Lipid	Total PCB ug/kg wet wt.[a]	Lead mg/kg wet wt.	% Moisture	Total PCB ug/kg dry wt.	Lead mg/kg dry wt.
Site Location							
FR	BIO629	1.46	< 50	0.07	0.808	< 50	0.36
Reference Location							
FR	BIO630	2.13	< 130	0.28	0.741	< 130	1.08

[a] The following PCBs were analyzed for and not detected Aroclor-1016, -1221, -1232, -1242, -1248, -1254, and -1260. Sample Quantitation Levels (SQLs) ranged from 50 to 130 ppb.
FR = Frog

TABLE 9

Estimated Risk: Calculated with Site Specific Tissue Data

North Lawrence Oil Dump Site
North Lawrence, New York

I. Site-Specific Concentration

		PCBs mg/kg	Lead mg/kg
Sediment [a]	Max.	3.8	888
	Avg.	0.642	234
Small Mammals [b]	Max.	0.25	11.5[c]
	Avg.	0.123	4.5[c]
Earthworms [b]	Max.	ND	2.4
	Avg.	ND	1.7
Plants [b]	Max.	ND	1.8
	Avg.	ND	0.9
Amphibians [b]	Max.	ND	0.07
	Avg.	ND	0.07

II. Exposure Assumtions [c]

Receptors:	Percent Prey in Diet: Inverts	Plants	Small Mammals	Herpeto-fauna	Soil	Site Foraging Frequency	Ingestion Rate (kg/day)	Body Weight (kg)
Shrew	85%	10%	0%	0%	5%	1	0.037	0.021
Woodcock	85%	10%	0%	0%	5%	0.03	0.22	0.22
Snake	85%	0%	5%	5%	5%	0.3	0.023	0.27

III. Risk Calculations

Receptors:		Total Body Dose		RTVs [d]		Hazard Quotient	
		PCBs	Lead	PCBs	Lead	PCBs	Lead
Shrew	Acute	3.35E-01	8.21E+01	100	60	3.35E-03	1.37E+00
	Chronic	5.66E-02	2.33E+01	6.4	2.5	8.84E-03	9.33E+00
Woodcock	Acute	5.70E-03	1.40E+00	9.1	75	6.26E-04	1.86E-02
	Chronic	9.63E-04	3.97E-01	5	6.25	1.93E-04	6.35E-02
Snake	Acute	5.18E-03	1.20E+00	100	60	4.86E-05	1.98E-02
	Chronic	9.78E-04	3.42E-01	6.4	2.5	1.53E-04	1.37E-01

TABLE 10

Estimated Risk: Calculated with Reference Location Tissue Data

North Lawrence Oil Dump Site
North Lawrence, New York

I. Site-Specific Concentration

		PCBs mg/kg	Lead mg/kg
Sediment [a]	Max.	ND	37.1
	Avg.	ND	24.4
Small Mammals [b]	Max.	0.12	5.5
	Avg.	0.11	2
Earthworms [b]	Max.	ND	1.2
	Avg.	ND	0.61
Plants [b]	Max.	ND	0.35
	Avg.	ND	0.3
Amphibians [b]	Max.	ND	0.28
	Avg.	ND	0.28

II. Exposure Assumtions

Receptors:	Percent Prey in Diet					Site Foraging Frequency	Ingestion Rate (kg/day)	Body Weight (kg)
	Inverts	Plants	Small Mammals	Herpeto-fauna	Soil			
Shrew	85%	10%	0%	0%	5%	1	0.037	0.021
Woodcock	85%	10%	0%	0%	5%	0.03	0.22	0.22
Snake	85%	0%	5%	5%	5%	0.3	0.023	0.27

III. Risk Calculations

Receptors:		Total Body Dose		RTVs [c]		Hazard Quotient	
		PCBs	Lead	PCBs	Lead	PCBs	Lead
Shrew	Acute	NC	5.13E+00	100	60	NC	8.55E-02
	Chronic	NC	3.11E+00	6.4	2.5	NC	1.24E+00
Woodcock	Acute	NC	8.73E-02	9.1	75	NC	1.16E-03
	Chronic	NC	5.30E-02	5	6.25	NC	8.48E-03
Snake	Acute	1.53E-04	8.09E-02	100	60	1.53E-06	1.35E-03
	Chronic	1.41E-04	4.73E-02	6.4	2.5	2.20E-05	1.89E-02

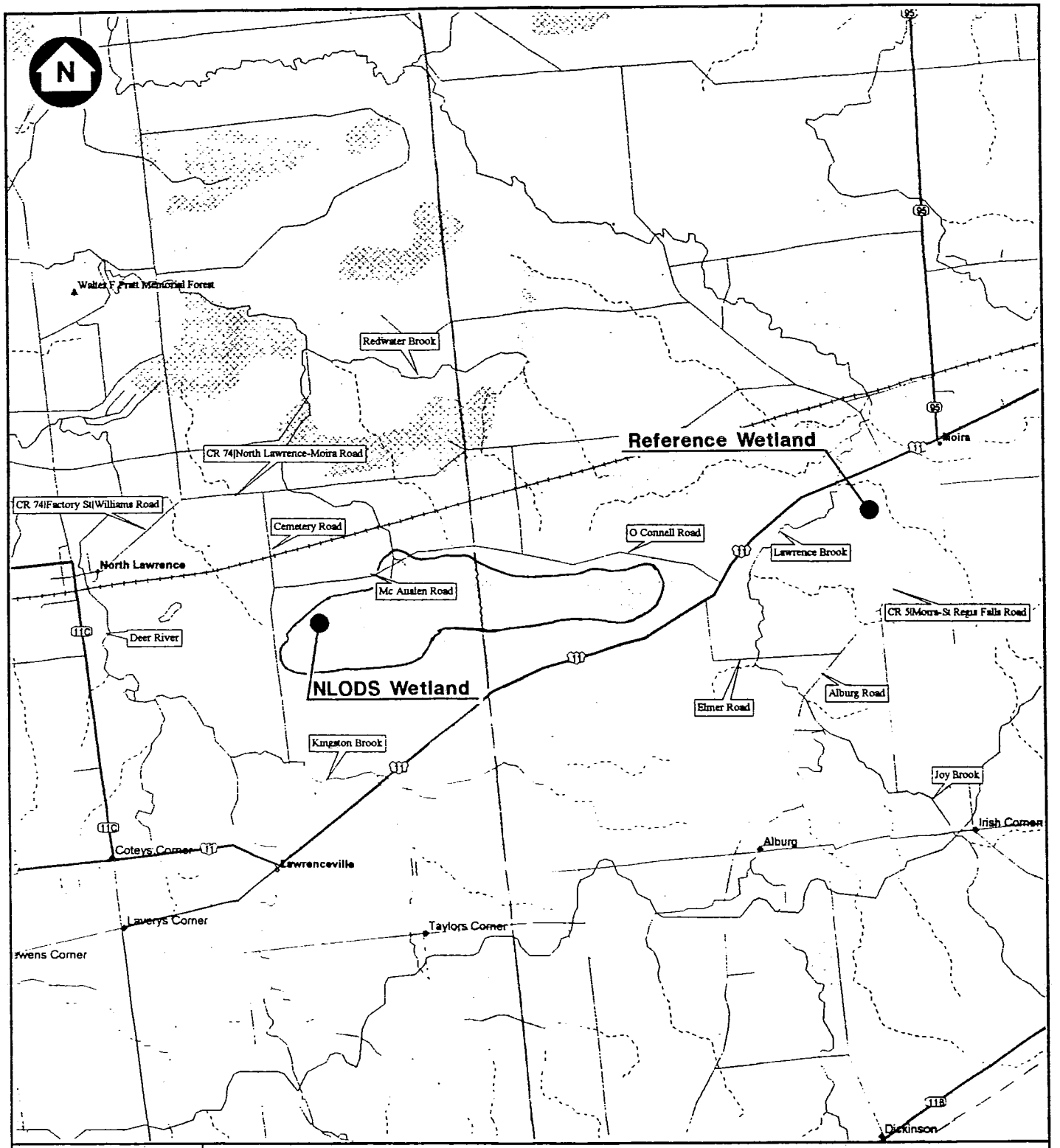
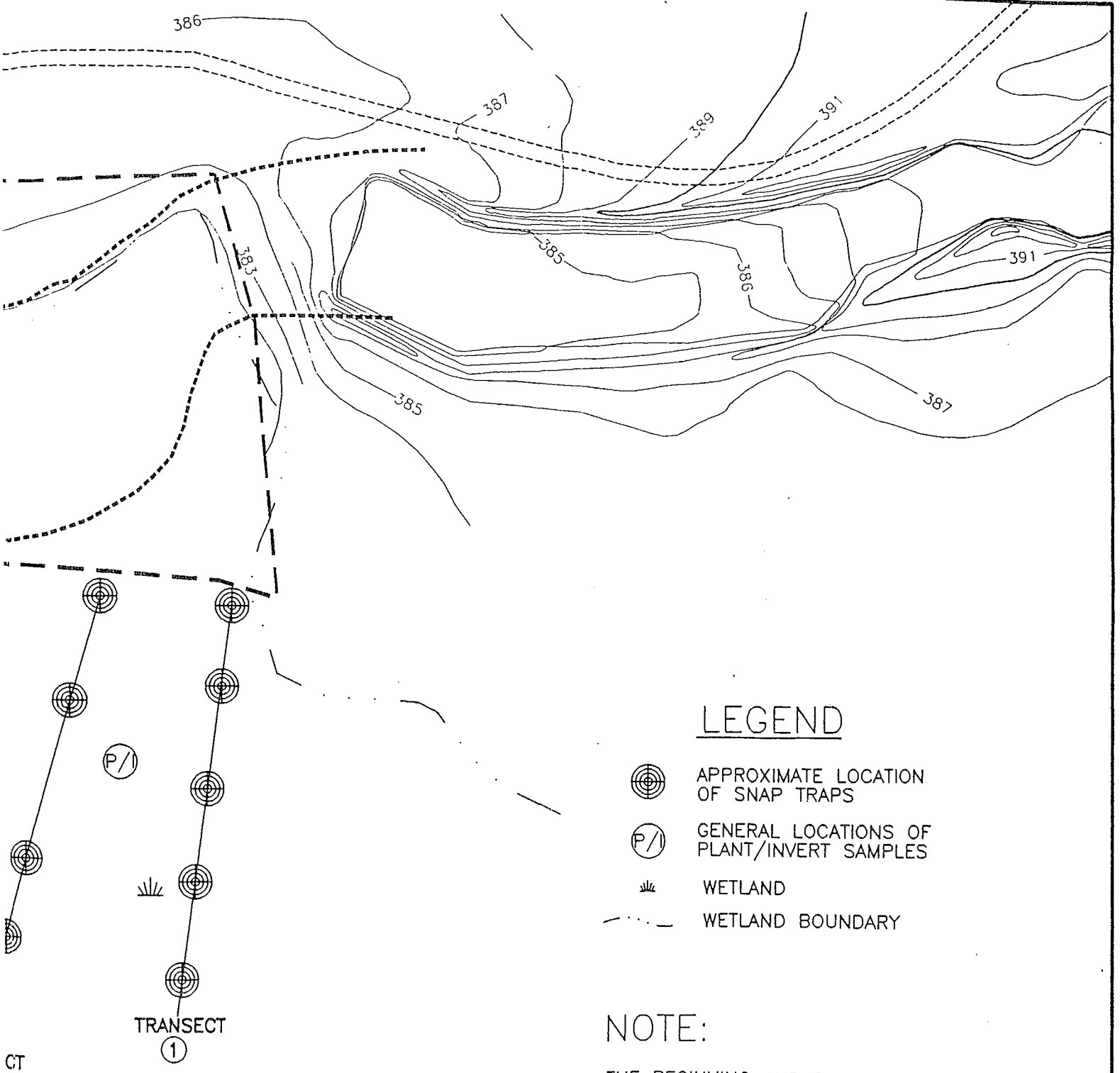


FIGURE 1
SITE LOCATION MAP
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY
ABB Environmental Services

08749-07 C&P



LEGEND

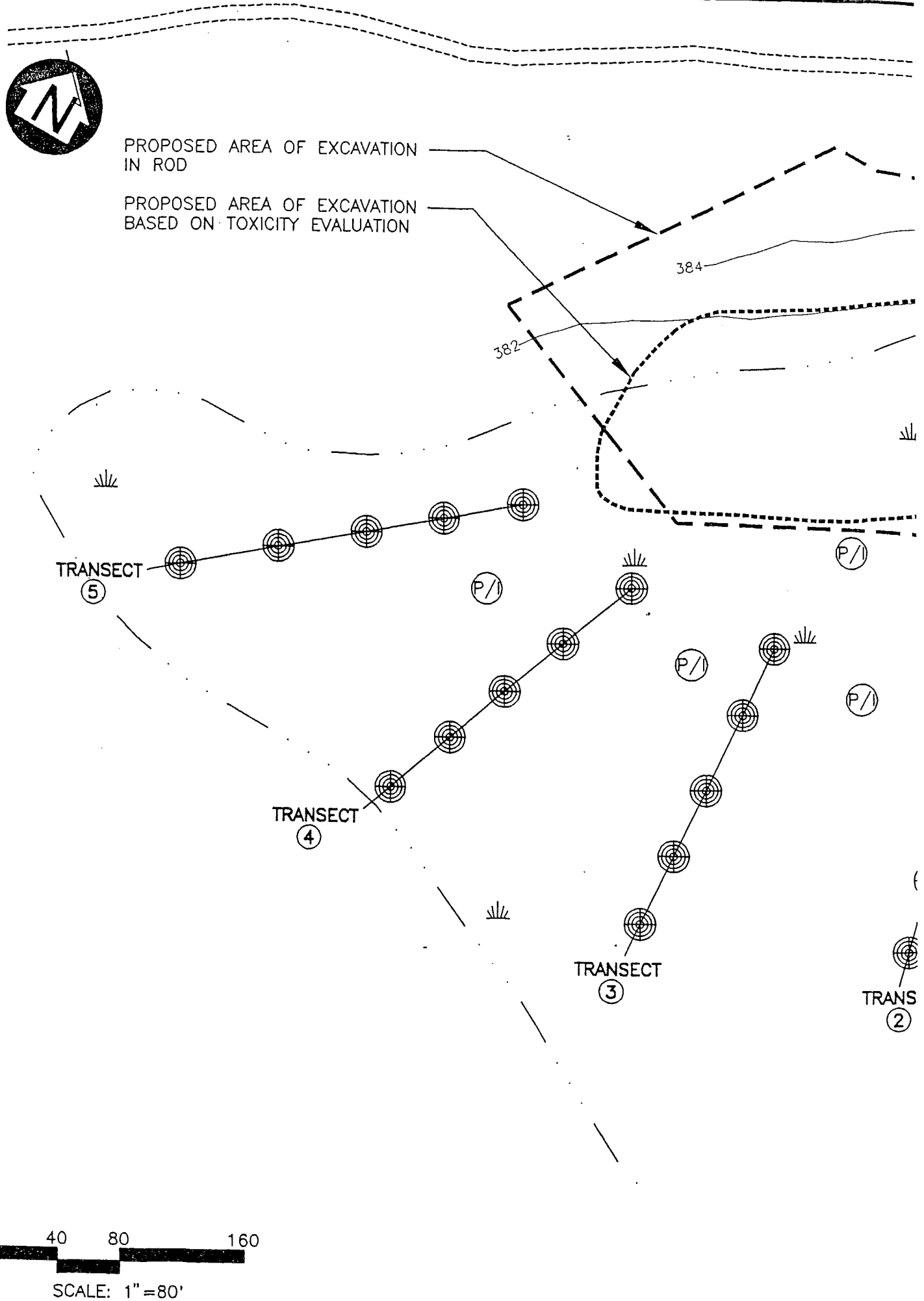
- APPROXIMATE LOCATION OF SNAP TRAPS
- P/I GENERAL LOCATIONS OF PLANT/INVERT SAMPLES
- WETLAND
- WETLAND BOUNDARY

NOTE:

THE BEGINNING AND END OF TRAP TRANSECTS, AND PLANT AND INVERTEBRATE SAMPLE LOCATIONS ARE IDENTIFIED IN THE FIELD WITH LABELED GRADE STAKES.

FIGURE 2
BIOLOGICAL SAMPLE LOCATIONS-NLODS WETLAND
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY

ABB ENVIRONMENTAL SERVICES



J:\8728-28\FIG\8728F003.DWG 2-28-97

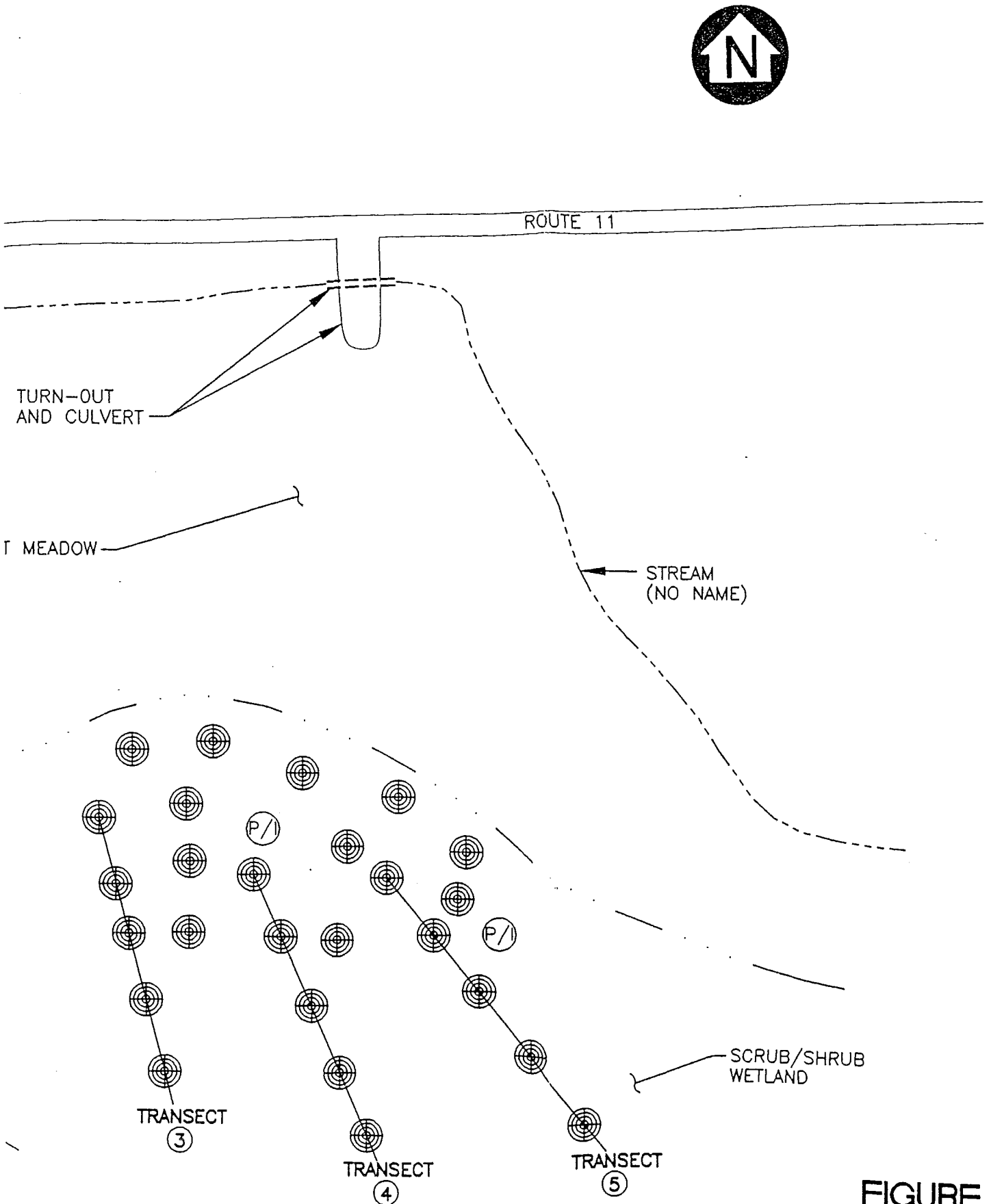
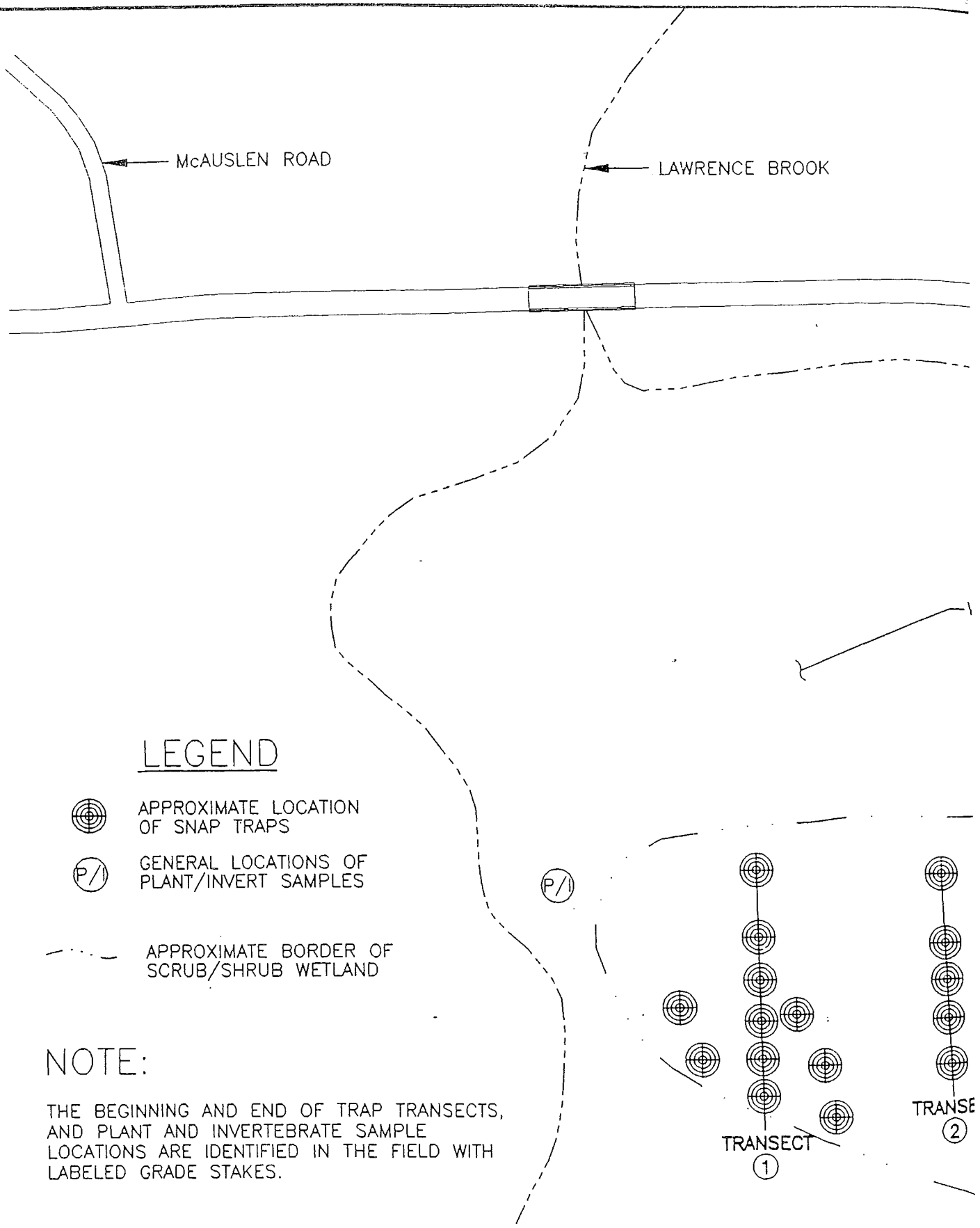


FIGURE 3
BIOLOGICAL SAMPLE LOCATIONS-REFERENCE WETLAND
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, NY



J:\8728-28\FIG\8728F004.DWG 2-28-97 (PLOT 1=80)

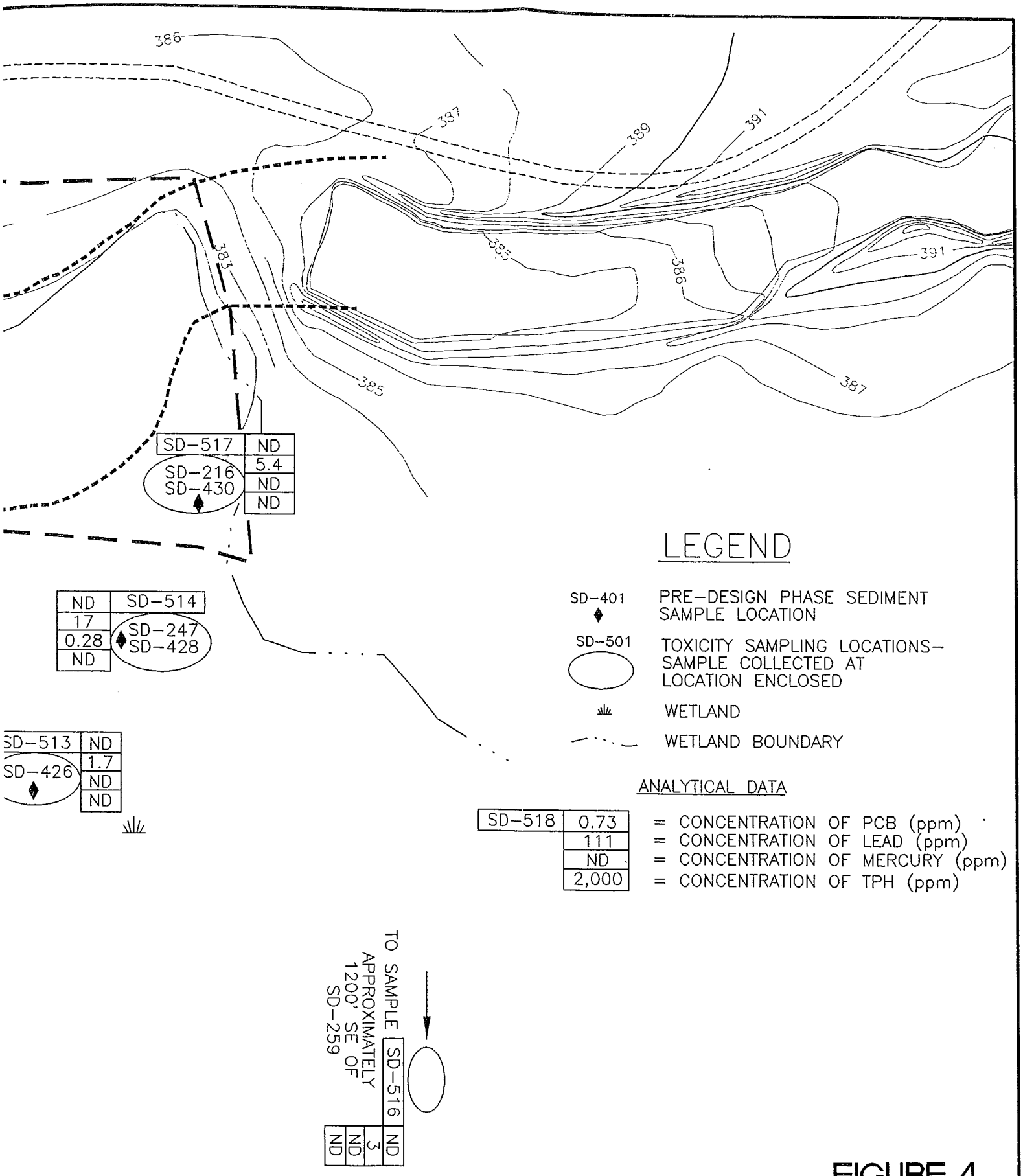
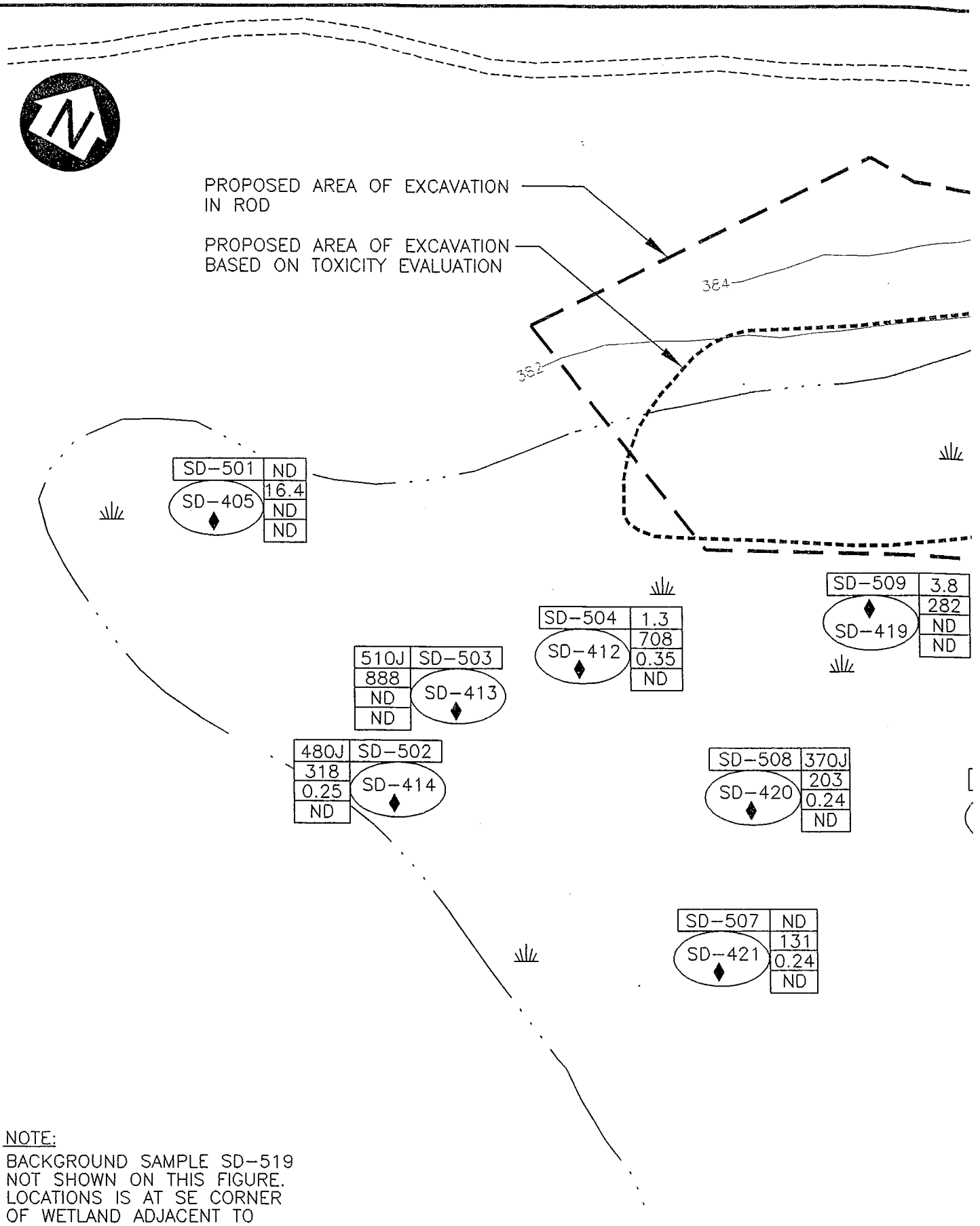


FIGURE 4
SEDIMENT SAMPLE LOCATIONS
NORTH LAWRENCE OIL DUMP SITE
NORTH LAWRENCE, N.Y.

ABB ENVIRONMENTAL SERVICES



J:\8728-28\FIG\8728F005

ATTACHMENT A

Field Notes

Projects (continued)

11/4 1240 A. Fogg + C. Lyman ARRIVE, OVERCAST, GUSTY/WINDY, 45-50°F MET UP W/ JONAH NADEAU, SIGNED IN CONTRACTOR'S LOG BOOK UNPACKED + DRIVE TO SITE

1345 COUNTED OUT TRAPS, GOT BEARINGS ON SITE. S. PART IS REPORTEDLY PRETTY WET, SO MAY HAVE TO INCREASE DENSITY OF TRAPS

1545 FINISHED SETTING SNAP TRAPS
5 TRANSECTS T1 → T5
10 TRAPS PER TRANSECT

TRANSECT 1 Starts in close approximation (south of) SD sample location SD-216

2 Starts in close approximation (south of) SD sample location SD 246

3 STARTS AT/NEAR SD-509/417

4 STARTS AT/NEAR SD-412

5 SD409 + west along wetland boundary

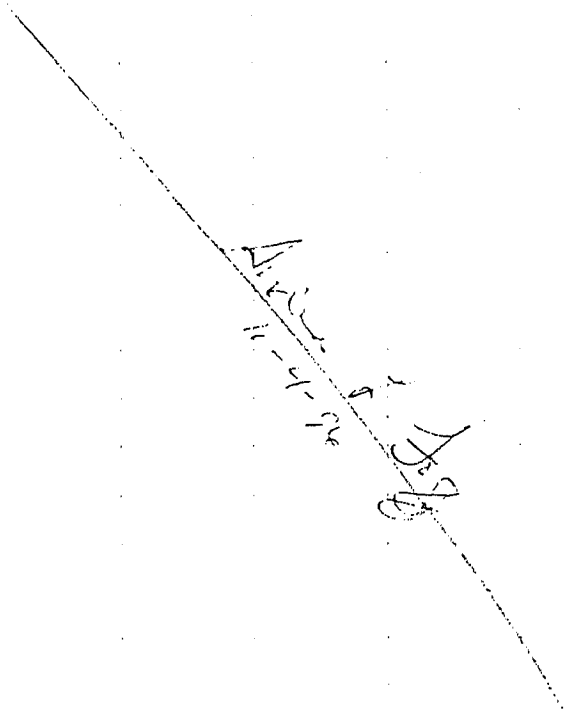
1550 A FOGG + C. LYMAN LEAVING SITE BACK TO FIELD TRAILER TO TRACK DOWN DRY ICE SUPPLIER

(2)

MIKE COX - DEC CONSTRUCTION

IEM
At ~~JAM~~ trailer 359-5086

DEPOT ROAD + IEM are sister companies
Wallace Coles - Asst PM, H+S



(3)

11/5/96

0715 M. Figg + C. Lyman @ field
to...le + to prep. Off to check traps @ NLODS.
Cool + lt. rain (~45°F)

0755 @ T1 #4, Shrew sho.+tailed.
Wt: 30g (-13g trip)
Body: 90 mm
Tail: 32 mm
Hfoot: 14 mm
Sex:

0804 @ T1-9, WHT ft. Mouse/Deer mouse
Wt. 28g (-13g)
Body: 80 mm
Tail: 80
Hfoot: 20
Sex Male.

0812 @ T1-10 WHT fat Mouse/Deer mouse
Wt: 25g (-13g)
Body: 73 mm
Tail: 78 mm
Hfoot: 15 mm
Sex: Male

0825 @ T2-3, Wht foot.
wt: 25g (-13gT)
Body: 85mm
Tail: 78 mm
H Foot: 20 mm
Sex: Male.

0834 @ T3-6, (Vole) woodland
wt: 26g (-13gT)
Body: 80mm
Tail: 28mm
Hfoot: 17mm
Sex: female.

0851 @T5-5 (Wht. foot mouse)
wt: 32g (-13gT)
Body: 90 mm.
Tail: 90 mm
Hfoot: 20 mm
Sex: female

0958 @T5-1 (Shrew)
wt 33g (13gT)
Body: 95 mm.
Tail: 25 mm
Hfoot: 15 mm
Sex: female

0900
- Afrogg / Clymon Meet back to field trailer after running trap line.
DO: Photocopy maps; Get ice

0920
- Afrogg / Clymon mobilize to get ice (for 2nd mammals) & find and set traps @ Ref. Site.

1030
Afrogg @ site trailer, to locate Ref site calling RM to determine land owners ground Ref site & directions on how to get to the Ref. location.

1035 C.Lymon to site to ~~stake~~ Mark Beginning and end of Biological Sampling transects.
Lables on flagged stake indicate Transect # and "beginning" and "end". (Biological sampling transects.

11/5/96
NLODS

[1134] C. LYMAN finished working Biological sample transects. Collected short tail shrew @ TS-1 ⇒ 2nd shrew collected today 11/5
Wt: 33g (~13+)
Body: 85mm
Tail: 25mm
H. foot: 15mm
sex: female

[1140] C. LYMAN MOBILIZE BACK TO TRAILER TO meet Afogg.

[1200] A. Fogg & Clyman mobilize to the Crossroads to get Lunch & p/u flagging tape!

[1300] Afogg & Clyman Return to site trailer & p/u Shovels for Earthworm sampling. NYSDEC (Rich Koeppicus) has arrived on site. Afogg & Rich Proceed on site walkover, discussing Ref location for this field effort. C. Lyman proceeds to transect #1 to dig

11/5/96
NLODS

(cont) Earthworms.

[1410] A. Fogg and Rich K. walked transects (primarily outer boundaries). Then took off in Rich's car to look at old NLODS ref. location on McAuslan Rd. Walked in & along NE side - narrow band of forested wetland type habitat - could run a couple of long transects there. Walked back out & then in along the S. side of the wetland. Also could sample here. Rich worried about lead contam from site.

[1500] Andrea & Rich back to field trailer to look at lead data. Decreases as it goes to McAuslan Rd but still there. Spoke w/ Glenn D. & he said if Rich felt we needed to use the York reference site, we should.

[1530] Andrea & Rich off to search for the site & talk to neighbors re: property owner of the site. Drove around & found access off a bridge (Rt 11) which was not posted. ? nearby house ~~was~~ - no one was home. Walked back in - very wet & hummocky. At the head was a woody area - shrubs & saplings mostly. Diff. from our wetland (NLODS) but should

(7)

11/4/96
NLODS

0700 A. Fogg & C. Lyman on site. Cool & mostly cloudy mid & upper 40°s. Calm.

0717 A Fogg & CLyman proceed to transects to check traps.

0718 @ T1-2 (~~least shrew~~ (Chl) g.) - tail Bicolor - back fur - light underside
wt: 13g (-12g t) - MASKED SHREW (IMMA.)
Body: 47mm
tail: 35mm
Hfoot: 10mm
Sex: Male

0731 @ T1-9 (Wnt rod)
wt: 24 (-12g t)
Body: 80mm
tail: 75mm
Hfoot: 20mm
Sex: Male.

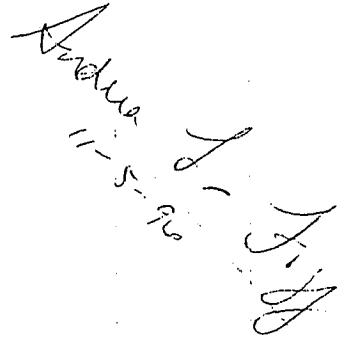
0735 @ T1-10 (Wnt foot) deer?
wt: 32g (-12g t)
Body: 85mm
tail: 92mm
Hfoot: 18mm
Sex: Male

(8)

11/5/96
NLODS

be able to get some small mammals then

1630 Andrea & Rick back to field station to see how Chuck is doing. Found out the fed Ex "drop off" is @ Plattsburgh Airport - 75 miles away. Decided to keep samples on ice overnight A. Fogg & C. Lyman depite @ 1700



11/04/16 NEODS

0746 @ T2-3 (wind/cool)
wt: 28g (-12g)
body 80 mm
Tail: 80 mm
Hfoot: 16 mm
Sex: Male

0752 @ T2-2 (wind)
wt: 26g (-12g)
body: 70 mm
tail: 75 mm
Hfoot: 19 mm
Sex: female

0759 @ T3-1 wind/cool
wt: 25 (-12g)
body 75 mm
tail 72 mm
Hfoot 18 mm
Sex: female

0805 @ T3-6 (Vole)
wt: 23.8 (-12g)
Body: 61 mm
tail: 27 mm
Hfoot 12 mm
Sex: male

11/04/16 NEODS

0823 @ T5-1 (Shrew)
wt: 30g (-12g)
Body: 98 mm
Tail: 20 mm
Hfoot: 15 mm
Sex: female

0850 have bagged & labelled all samples bagged up the ice & got bubble wrap.

Wt. of earthworm samples:
T# 1-W 11/5/16 46g
T# 2-W 11/5/16 50g

1000 finished chain of custody faxed to HES sealed up fed Ex Cooler

1020 At Reference Location

1205 Finished flagging 5 transects R1 → R5. 10 traps each. Started w/ R1 @ Wt. I flagged when Rich F. was here yesterday The next couple of ~~trees~~ poles there we

NLOOS 11/6/94

Would have put transect in more further too wet/wet meadow

1140 Hoagg & CLYMAN Brook for LUNCH.

1330 Hoagg & Clyman Brook on site, to collect EWs & plants.

1415
Transect 1 @ Trap #5 collected Carex sp. from ponded area.

1430
Transect 2 @ Trap #6 collected ~~Carex~~ sp

1440
Transect 3 @ Trap #4 collected Carex sp. C. Lyman said he was having trouble finding worms

1450
Transect 4 @ Trap #3 collected Carex sp.

1500
Transect 5 @ Trap #4 collected Carex sp.

1510 (50+g)
Transect 5 Worm (T5-W) is N ✓ of Transect 5 in a slightly more upland area - many worms. Could not find worms anywhere around Transect 3 - too wet. prob. ½c found worms @ Transect 1 & 2 - closer to source of contam. and upgradient

1515 N. frogj to collect specimen just ✓ caught in T5 #1 another B. brevicauda Short-billed shrew

wt 30g (-13T)
body 95mm
tail 20mm
h.foot 15mm
Sex male

1542
T5 (NW) 50+g (further NW from T5-W taken above)

1630
T1 (NORTH) W 33g

1645 Have seen many frogs in the water collected adjacent to cleared

(14)

area. C. Lyman off w/ headlamp and bag to catch - if successful, we will substitute 1 frog for 1 worm sample & composite 1/2 of the worm samples that were collected - will need to OK w/ Rich (?) 1st; consider & see if we can get one at the other area.

1700 C. Lyman got frogs
A. Fogg + C. Lyman debrief + offsite called Matt Marks @ HES + spoke w/ him re: compositing - asked him to write on worm samples as well as mammals

Arthur L. Fogg
11/6/96

(15)

11/7/96

0700 A. Fogg + C. Lyman on site

0705
T1 #4 Short tailed shrew
wt 37.5 g (+T)
body 90 mm
tail 21 mm
hfoot 19 mm
sex F

T1 #9 WfM
wt 310 g (+T)
body 87 mm
tail 91 mm
hfoot 21 mm
sex M

T3 #5 missing

T4 #2 short-tailed shrew
wt 35 g (+T)
body 83 mm
tail 23 mm
hfoot 15 mm
sex M

Several traps missing - blowing leaves, etc may have obscured them, or they may have been dragged off

0750

leg wt = 13g

820 R2 #7 Wfm still alive
wt 27.5g(FT) hf 19
body 82 mm sex F
tail 72 mm

835 R3 #10 shrew bicolored blunt tip
wt. 16.5g(FT) hfoot 10 mm
body 52 mm sex cantus
tail 39 mm

840 R3 #5 Wfooted mouse
wt 27g(FT) h. foot 20 mm
body 73 mm sex M
tail 73 mm

845 R5 #8 ~~to~~ shrew
wt 17 hf = 11 mm
body 55 mm sex = M
tail 35 mm

850 R1 #8
Wf mouse

wt 29g(FT) h. foot 19 mm
body 76 mm sex M
tail 37 mm but cut off

925 A. Fogg + C. Lyman put out a dozen more traps - 6 around R1 #8
~ around R2
back to vehicle to get stakes, shovel, baggies for plants + worms, + more traps + put out. C. Lyman digging worms A. Fogg putting in stakes, collecting plant samples, + putting out more traps

945 A. Fogg collected R2 plant sample nr. R2-10. State @ R2-1

955 A Fogg collected R3 plant sample nr R3-1. State @ R3-1

1020 A Fogg collected ~~Plot~~ leopard frog @ R5-1. State @ R5-1

1025 Collected plant sample @ R4 & R5
Stake at R4-1
collected plant sample @ R1
Went to help check w/ getting worm samples

Collected 3 Worm Samples
1230 went to lunch
1320 back at trailer to pack up stuff - Fed Ex wont come today, so John will freight to Plattsburg Sample cooler

NOTES for cooler.
- 10 plant samples
- T3 11/6/96 1440
- T4 11/6/96 1450
- T5 11/6/96 1500
- T2 11/6/96 1430
- T1 11/6/96 1415
- R1 11/7/96
- R2
- R3
- R4
- R5

Samples (cont'd)
11/6 T5-1
T1-4
T1-9
T4-2
R3-10
R5-8
R1-8
R3-2
R2-7
5 sm. mason.

worms
- R2 W
- R3 W
- T5(N) W
- T5 W
- T1 N W

1500 Called Chet re: where gloves are.
395-1067-306 TRACKING #
will be delivered by 4:30 pm
1530 finished packing Sample cooler for John & take to drop off this p.m.

215 McRiverRd
N. Lawrence, NY 12967
pick-up #4

1600 Back to Ref. site to collect last 2 worm samples from N2 Transect R1.
1700 Last 2 worm Samples collected
A. Fogg - Clyman office 11/7/96

(20)

11/8/96 N. Foss + C. Lyman onsite
Heavy rain. Collected samples + traps
Labeled baggies + processing back in
USDA field trailer

T1-4 meadow vole
wt. 32g (+T) h.foot 15 mm
body 83 mm sex ?
tail 26 mm

T1-6 masked shrew
wt. 16.5 g (+T)
body 55 mm
tail 38 mm
h.foot 10 mm
sex M

T1-9 wh-footed mouse
wt. 31g
body 73 mm
tail 78 mm
h.foot 19 mm
Sex F

T2-8 Wh footed mouse
wt 29.5 g (+T) tail 76 mm sex M
body 76 mm h.foot 20 mm

(21)

T3-8 White footed mouse
wt 37 g (+T)
body 84 mm
tail 79 mm
h.foot 19 mm
sex F

T3-4 White footed mouse (w/fleas)
Wt 32.5 g
body 78 mm
tail 63 mm
h foot 20 mm
Sex F

T4-6 ~~meadow~~ woodland vole
wt 38 g + T
body 97 mm
tail 32 mm
h.foot 18 mm
sex M

T5-1 woodland vole
wt 46.5 g (+T) h.foot 20 mm
body 103 mm sex M
tail 35 mm

(2)

0805 call WW Video - not open yet off to reference area

0905 done w/ ref. area. Removed traps - will catalog spp. when we get back to trailer after we eat from motel

1000 Back to field trailer C. Lyman packing up. A. Iff cataloging last couple of spp.

R2 - short tailed shrew
wt 34 g (+T)
body 85 mm
tail 25 mm
hfoot 15 mm
sex F

R1-1
R1 - wh. to. footed mouse
wt. 32 g (+T)
body 85 mm
tail 65 mm
hfoot 18 mm
sex F

(2)

R1-2 white footed mouse
wt. 33 g (+T)
body 80 mm
tail 76 mm
hfoot 20 mm
sex ?

1045 filling out chain of custody will fax to Matt Meade
packing coolers + drums.

1100 faxed COC + called Matt Marks re: Sat. delivery.
A Iff + C Lyman off site

Andrea A. Iff
11/8/96

ATTACHMENT B

Analytical Results/Data

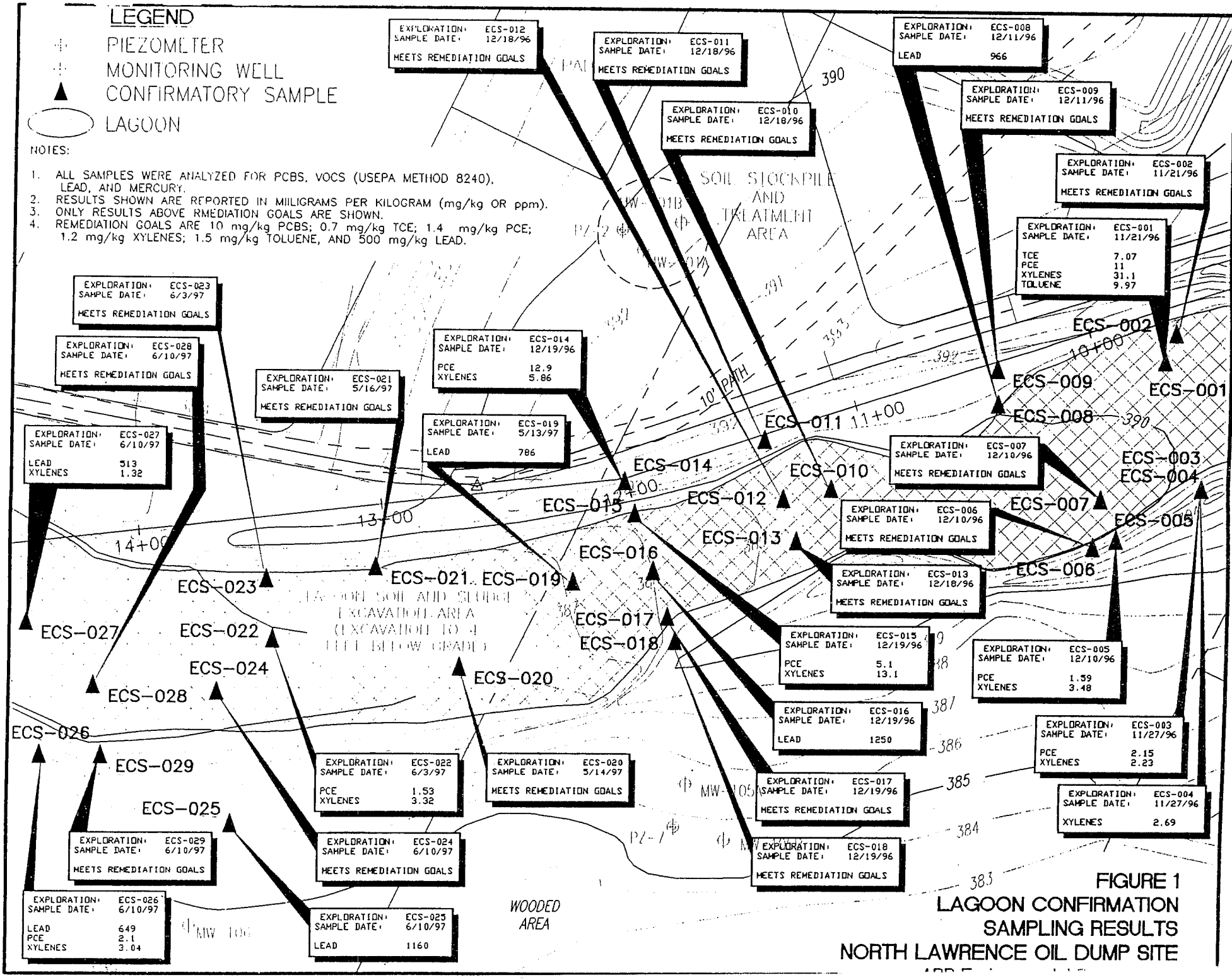


FIGURE 1
LAGOON CONFIRMATION SAMPLING RESULTS
NORTH LAWRENCE OIL DUMP SITE

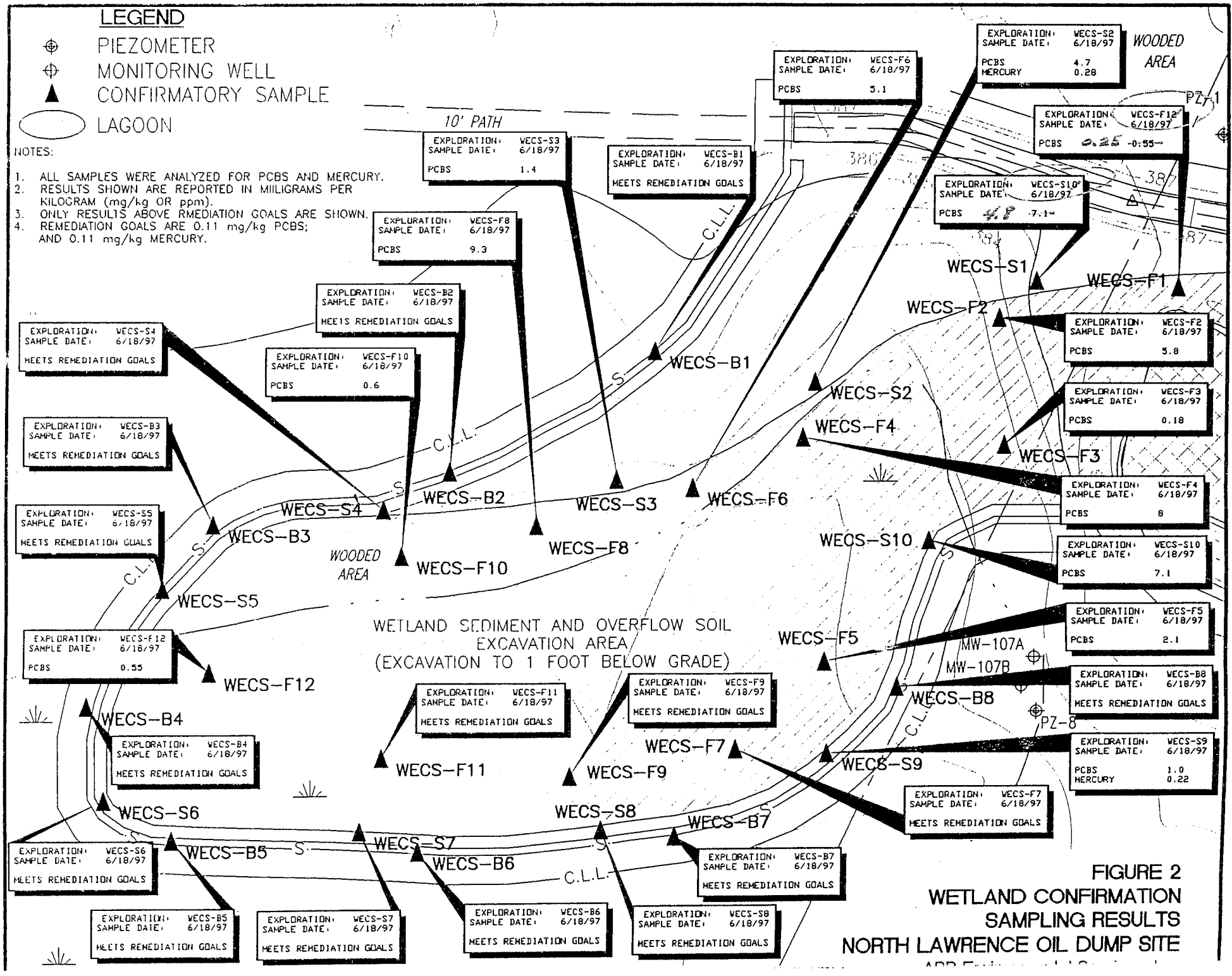


FIGURE 2
WETLAND CONFIRMATION SAMPLING RESULTS
NORTH LAWRENCE OIL DUMP SITE

LONG TERM MONITORING PLAN
REMEDIAL CONSTRUCTION TECHNICAL SPECIFICATIONS

B-1 Excavation, Backfill, and Compaction
B-2 Monitoring Wells
B-3 Polyethylene Geomembranes
B-4 Seeding
B-5 Wetlands Restoration

APPENDIX B-1

SECTION 02221

EXCAVATION, BACKFILL, AND COMPACTION

SECTION 02221

EXCAVATION, BACKFILL, AND COMPACTION

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

A. Sampling and Analysis: Section 01410.
B. Existing Utilities and Underground Structures: Section 02016.
C. Clearing and Grubbing: Section 02102.
D. Erosion Control: Section 02271.
E. Geotextiles: Section 02272.
F. PE Geomembrane: Section 02776.
G. Fences and Gates - Steel: Section 02832
H. Excavation, Handling, and Disposal of Contaminated Material: Section 02990.

1.02 DESCRIPTION OF WORK:

A. This work pertains to the excavation, backfill, and compaction of soils, sludges, sediments, and S/S materials at the NLODS.
B. Work Included:
   1. Trench excavation in earth.
   2. Earthwork for site work.
   3. Excavation of lagoon soil and sludges.
   4. Excavation of wetland sediments.
   5. Grading of disposal cell.
   6. Borrow pit excavations.
   7. Finish grading for access roads.
   8. Gas venting and common borrow layers construction.
   9. Barrier soil and vegetative layers.
   10. Compaction of backfill materials.
   11. Backfill for culverts.
   12. Grading of borrow pit areas.
   13. Soil materials testing.
   14. Borrow study requirements for borrow source(s).

1.03 REFERENCES:

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
B. For all test methods specified, the most recent revision shall apply if different from that listed.
C. American Society for Testing and Materials (ASTM):
   1. ASTM C 117-90, Standard Test Method for Materials Finer than 75-Tm (No. 200) Sieve in Mineral Aggregates by Washing.
   2. ASTM C 136-93, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

3. ASTM D 1557-91, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 [2,700 kN-m/m^3]).
4. ASTM D-1556-90, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
5. ASTM D-2434-68 (R1993), Standard Test Method for Permeability of Granular Soils (Constant Head).
6. ASTM D-2922-91, Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D-3017-88 (R1993), Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Corps of Engineers (COE) Engineering Manual:
1. EM1110-2-1906, Appendix VII, (Chapter 3) Hydraulic Conductivity Tests, Constant Head Cylinder.

E. New York State Department of Transportation (NYSDOT), Standard Specifications, Construction and Materials.

1.04 QUALITY CONTROL:

A. Codes and Standards:
1. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Contractor Provided Soil Testing Service:
1. The Contractor shall provide an independent third-party soil testing service for quality control during source testing. The testing service company shall be approved by the Engineer. The testing service company must demonstrate geotechnical testing experience and shall have sufficient facilities to perform the required quantity of tests at a rate commensurate with the proposed work schedule. The testing service company shall provide access to the Engineer for observation of the facilities and methods used in the geotechnical testing. Source testing is described in Part 2 of this Section.

1.05 QUALITY ASSURANCE:

A. Contractor Provided Soil Testing Service:
1. The Contractor shall provide independent testing services for quality assurance testing of source material and to measure compaction and hydraulic conductivity of materials placed. Compaction and hydraulic conductivity testing is described in Part 3 of this Section. The results of the testing shall be submitted to the Engineer for approval.
2. The Contractor shall provide assistance to the testing service to include sampling of soil materials and provide split samples, when requested.

1.06 SUBMITTALS:

A. The Contractor shall submit the following items:
1. Prior to removal of material from borrow source(s):
a. Borrow study testing results as specified in Article 2.03.
b. A source quality control tracking plan specified in Article 2.04.
c. Documentation of mining and/or other borrow site permits for off-site sources as required by regulatory agencies having jurisdiction.
d. Estimated available and required volume of specified soil.
e. Names and qualifications of independent testing services.

f. Certification of clean material.

2. The Contractor shall provide the following as minimum testing requirements for the characterization of wetland sediments:
   a. A minimum of 2 each of the following: gradation (ASTM C 117-90, C 136-93), organic content, and nutrient analysis.
3. Prior to transporting off-site soil to site:
   a. Method of tracking off-site soil.
   b. Method shall document the transportation, stockpiling and identify location of placement of soil.

1.07 ENGINEER APPROVAL:

A. The Engineer will assess the test results submitted by the Contractor for conformance with materials requirements given in this Section. Earthwork operations involving the use of materials from a particular borrow source will not be allowed until the Contractor receives written notification by the Engineer indicating that the source has been accepted for use.
B. No soil or waste materials may be taken off-site without prior approval by the Engineer.

1.08 JOB CONDITIONS:

A. Existing Utilities:
   1. Contractor shall obtain authorization from the Engineer prior to start of wetland sediment excavation.
   2. Should uncharted piping or other utilities be encountered during excavation, consult the Engineer immediately for directions.
B. Protection of Persons and Property:
   1. Barricade open excavations occurring as part of this work and post with warning signs.

PART 2 - PRODUCTS

2.01 DEFINITIONS:

A. Cohesionless Soil Materials: Gravels, sand-gravel mixtures, sands, and gravelly-sands.
B. Cohesive Soil Materials: Clayey and silty gravels, and sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, and silts.
C. Unsatisfactory Soil Materials: Peat, highly organic soils, frozen soils, and soils which when left in place are too wet or dry to compact. Wetland sediments, lagoon sludge, and lagoon soil will not be considered unsatisfactory soil materials under this contract.

2.02 SOIL MATERIALS:

A. Common Borrow:
   1. Soil suitable for embankment construction, disposal cell base, and lagoon backfill, maximum 6-inch stone size.
   2. Free of frozen material, perishable rubbish, peat and other unsuitable material.
   3. Moisture Content: Sufficient to provide the required compaction and stable embankment and in no case shall the moisture content exceed 4 percent above optimum.

B. Gas Venting Sand:
   1. Well-graded sand or gravel free from vegetative matter, lumps or balls of clay and other deleterious substances.
   2. Gas venting sand shall provide a minimum compacted hydraulic conductivity of $1x10^{-3}$ cm/sec for the density range(s) determined from testing described in Section 2.03.
   3. Meet the following gradation requirements:

Sieve Designation	Percent Passing by Weight
3/8 in.	100
No. 4	35-100
No. 10	20-100
No. 40	0-40
No. 200	0-10

C. Barrier Protection Soil:
   1. Barrier protection soil shall be non-angular, well-graded, free from vegetative matter, lumps or balls of clay, and other deleterious substances.
   2. Meet the following gradation requirements:

Sieve Designation	Percent Passing by Weight
3/8 in.	100
No. 10	40-100
No. 50	15-50
No. 200	0-20

D. Vegetative Soil:
   1. Segregate approved material removed within the confines of the project into piles, clean sufficiently and re-use if meeting the requirements of this Section.
   2. Good quality friable soil free of stones over 2 inches with a minimum 35% and a maximum of 85% passing the No. 200 sieve.
   3. NYSDOT specification 713-01. Reasonably free from subsoil, clay lumps, stones, brush, objectionable stumps, roots, litter, toxic substances, and other material or substances which may be harmful to plant growth or be a hindrance to grading, planting and maintenance operations.
   4. The pH of the material shall be between 5.5 and 7.6.
   5. The organic content shall be not less than 2 percent nor more than 20 percent.
   6. Meet the following gradation:

Sieve Designation	Percent Passing by Weight
2 in.	100
1 in.	85-100
1/4 in.	65-100
No. 200	20-80

E. Aggregate Subbase:
   1. Aggregate for stockpile area, treatment area, trailer area, and disposal cell access road construction.
   2. Sand and gravel free from vegetative matter, lumps or balls of clay and other deleterious substances.
   3. NYSDOT Specification 304-2.02 Type 1, meeting the following gradation requirements:

Sieve Designation	Percent Passing by Weight
3 in.	100
2 in.	90-100
1/4 in.	30-65
No. 40	5-40
No. 200	0-10

F. Coarse Aggregate:
   1. Stone for stockpile area, treatment area, trailer area, and disposal cell access road construction.
   2. Coarse aggregate consisting of crushed stone, crushed gravel or screened gravel, meeting NYSDOT specification 703-02, size designation 3, and the following gradation:

Sieve Designation	Percent Passing by Weight
2 1/2 in.	100
2 in.	90-100
1 1/2 in.	35-70
1 in.	0-15

H. Wetland Replacement Soil:
   1. Soil used to replace excavated wetlands soil shall match the existing wetland soil with respect to particle size distribution, organic content, nutritional status, and drainage class. Vegetative soil may be used if it meets these requirements.

2.03 BORROW STUDY:
   A. A borrow study shall be conducted on all soil materials proposed for construction.
   B. Contractor shall provide the following information with respect to the use of borrow sources:
      1. Estimated volume of material per source.
      2. Test pit logs.
      3. Plans, maps identifying locations of test pits and areal extent of borrow source.
      4. Interpretation of testing data.
      5. Certification of Clean Material:
         a. Submit for each source of material confirmation that the material is not contaminated. A representative sample shall be obtained and analyzed for CLP-

TCL VOCs, SVOCs, PCBs and pesticides, and CLP-TAL inorganics as confirmation of clean backfill material if similar historical data is not available.

C. The testing requirements for soils obtained from off-site sources are listed in Table 02221-1 below.

TABLE 02221-1

OFF-SITE BORROW STUDY
TESTING REQUIREMENTS

	MINIMUM TESTING FREQUENCY		
SOIL MATERIAL	GRADATION (ASTM C117-90, C136-93)	MOISTURE-DENSITY (ASTM D 1557-91)	REMOLDED HYDRAULIC CONDUCTIVITY (EM 1110-2-1906 App. VII (Chapter 3) or ASTM D 2434-68)
Vegetative Soil, Wetland Replacement Soil	1/1,000 cy	NR [1]	NR
Common Borrow	1/1,000 cy	1/1,000 cy	NR
Gas Venting Sand	1/1,000 cy	1/1,000 cy	1/2,500 cy [2]
Barrier Protection Soil	1/1,000 cy	1/1,000 cy	NR
Aggregate Subbase	3 tests/source	2 tests/source	NR
Coarse Aggregate,	3 tests/source	NR	NR

Notes:

1 NR = Not Required.

2 = Tests shall be conducted at a range in densities. At a minimum, include tests at 85, 90 and 95 percent of maximum dry density developed from Proctor curve to determine the range in densities and moisture content that produce the specified hydraulic conductivity.

D. Vegetative Soil and Wetland Replacement Soil:

1. Following are additional requirements for the vegetative soil and wetland replacement soil.
   a. Classify the material according to the Unified Soil Classification System.
   b. Forward representative sampling of the vegetative soil to the local Soil Conservation Service or equivalent testing facility for nutrient analyses. The nutrient analyses will report at a minimum the water pH, soil buffer pH, organic content, and biologically available P, Mg, Ca, and K. Submit testing results to

the Engineer. Based on the nutrient testing results and recommendations by the testing facility, add soil amendments and conditioners, as required for sustained grass growth. Amendments and conditioners shall be approved by the Engineer. Perform nutrient analyses at a minimum testing frequency of 1 per borrow source.

2.04 SOURCE QUALITY CONTROL:

A. Conduct periodic testing of borrow source soil proposed for use. Sampling and testing shall be performed by the Contractor and at the frequencies listed in Table 02221-2.

B. Prepare source quality control plans for all soil materials to be used for backfill and submit for approval. These plans shall specifically address:
   1. Tests proposed for each sample;
   2. Estimated length of time between sampling and submittal of written test results;
   3. Description of the method used to track borrow volumes represented by each sample from excavation through processing, transportation, and placement, and;
   4. Proposed schedule for testing, excavation, and placement of borrow.

C. Prepare and maintain a tracking plan for supplied materials. The plan will address:
   1. The source location and characteristics of borrow material on a daily basis.
   2. The daily volume of borrow material.
   3. The placement location on a daily basis. Location will be referenced to a 100 foot grid and baseline and to lift elevations.
   4. The above information will be tabulated on a tracking chart and will be accompanied by a plan showing daily placement location.

D. Collect samples at the soil borrow source(s) for determination of the parameters listed in Table 02221-2 and demonstration of specification compliance by the Contractor's testing service.

TABLE 02221-2

CONSTRUCTION-PHASE SOURCE
QUALITY CONTROL TESTING

	MINIMUM TESTING FREQUENCY		
SOIL MATERIAL	GRADATION (ASTM C-117, C-136)	MOISTURE-DENSITY (ASTM D-1557)	REMOLDED HYDRAULIC CONDUCTIVITY (EM 1110-2-1906 App. VII or ASTM D-2434)
Vegetative Soil, Wetland Replacement Soil	1/1,000 cy	NR [1]	NR
Common Borrow	1/1,000 cy	1/2,000 cy	NR
Gas Venting Sand	1/500 cy	1/1,000 cy [2]	1/500 cy and 5/change in gradation and moisture-density relationship [3]
Barrier Protection Soil	1/1,000 cy	1/2,000 cy or 2 per change in gradation	NR
Aggregate Subbase	1/1,000 cy	1/500 cy	NR
Coarse Aggregate, Crushed Stone	NR	NR	NR

Note:

1 NR = Not Required.

2 Should change in gradation occur, minimum 3 tests per change in gradation plus 1 test per 500 cy of material representative of the changed material proposed for use.

3 Should change in gradation and moisture-density occur, a minimum of 5 tests per change shall be performed, plus one additional test per 500 cy of material proposed for use. Hydraulic conductivity shall be conducted at a range in densities. At a minimum, test shall be performed at 85, 90 and 95 percent of maximum dry density developed from Proctor curve to determine the range in densities and moisture content that produce the specified hydraulic conductivity.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Examine the areas and conditions under which excavating, filling, and grading are to be performed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work.

B. Prior to beginning of excavation, grading, and embankment operations perform all necessary grubbing.

C. Existing wells that are to remain shall not be disturbed unless they require further extension above the new subgrade and cover by the Contractor. The Engineer shall specify which structures are to remain. Any existing wells or other structures which are to remain that are disturbed by the Contractor shall be replaced by the Contractor at the Contractor's expense.

3.02 EXCAVATION:

A. Classifications:

1. Earth Excavation: Removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, material of any classification indicated in data on subsurface conditions, and other materials encountered that are not classified as rock excavation or unauthorized excavation.
2. Rock Excavation:
   a. Removal and disposal of materials encountered that cannot be excavated without continuous and systematic drilling and blasting or continuous use of a ripper or other special equipment except such materials that are classed as earth excavation.
   b. Typical Materials: Boulders 3 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
   c. Intermittent drilling performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.
3. Unauthorized Excavation:
   a. Removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer.
   b Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by the Engineer.

B. Stability of Excavations:

1. The Contractor is responsible for maintaining safe excavation sideslopes.
2. Slope sides of excavations to comply with local codes and ordinances having jurisdiction.
3. Sheet, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.
4. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

C. Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill.
2. Place, grade, and shape stockpiles for proper drainage.

D. Removal of Unsatisfactory Soil Materials:

1. Excavate unsatisfactory soil materials encountered that extend below required elevations, to additional depth directed by the Engineer.
2. Such additional excavation, provided it is not due to fault or neglect of Contractor, will be measured as directed by the Engineer and paid for under the appropriate bid item.
3. Remove unsatisfactory soil at the direction of the Engineer, solidify/stabilize and place in the disposal cell

E. Excavation of Contaminated Soil and Debris:
1. Excavation of contaminated soil and debris shall be performed in accordance with Section 02990.

F. Cold Weather Protection:
1. Protect excavation bottoms against freezing when atmospheric temperature is less than 350F.
2. Do not place fill or backfill on frozen soil or use frozen material for backfill.

3.03 BACKFILL AND FILL:

A. General: Place soil material in compacted layers to required subgrade elevations, for each area classification listed below:
1. For lagoon area use common borrow up to 6 inches below final grade and a 6 inch compacted layer of vegetative soil to final grade.
2. For disposal cell base, use common borrow meeting the requirements of this Section.
3. For disposal cell cover use materials indicated on the drawings.

B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Collection and analysis of soil samples as required in Section 01410.
2. Acceptance by the Engineer of construction below finish grade.
3. Removal of sheeting, shoring and bracing, and backfilling of voids with satisfactory materials.
4. Removal of trash and debris.

C. Ground Surface Preparation:
1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills in conformance with Section 02102, Clearing and Grubbing.

D. Placement (all backfill material):
1. Place backfill materials in lifts having a loose thickness such that when compacted, the lifts will have the following maximum thicknesses:
   a. Common Borrow: 12 inches
   b. Gas Venting Sand: 12 inches
   c. Barrier Protection Soil: 12 inches
   d. Vegetative Soil Layer: 12 inches
   e. Aggregate Subbase: 6 inches
   f. Coarse Aggregate: 6 inches
   g. Wetland Replacement Soil: 12 inches
2. Before compaction, moisten or aerate each lift as necessary to provide the moisture content required to meet the specified hydraulic conductivity and compaction requirements.
3. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
4. Place backfill and fill materials evenly adjacent to structures, to required elevations.

5. Take care to prevent wedging action of backfill against structures.
6. Place the material uniformly around the structure to approximately the same elevation in each lift.

E. Placement of Barrier Protection Soil Above Geomembrane:
1. Placement of barrier protection soil shall proceed from a stable working area adjacent to the deployed geomembrane and gradually progress outward.
2. Soil is never to be dropped from dump truck or front end loaders directly onto the geomembrane.
3. The soil shall be pushed forward in an upward tumbling action so as not to impact directly on the geomembrane.
4. Soil shall be placed by low ground pressure placement equipment (contact pressures less than 5 psi).
5. Construction equipment including rubber tired vehicles such as automobiles and pickup trucks are not allowed to move directly on the deployed geomembrane.

3.04 COMPACTION:

A. General:
1. Control soil compaction during construction and provide minimum percentage of density specified for each area classification.

B. Density Requirements:
1. Compact soils placed, to meet minimum required percent maximum dry density specified in the Article entitled Field Quality Assurance in Part 3 of this Section.
2. If, in the opinion of the Engineer, based on testing and inspection, subgrade or fills are below specified density or thickness, provide additional compaction, and undertake necessary corrective actions and testing at no additional expense to the Contract.

C. Moisture Requirements:
1. General:
a. Provide moisture control to the extent that the soil remains in a workable state during placement.
b. Where subgrade or layer of soil material must be moisture-conditioned by increasing the moisture content before compaction, uniformly apply water to surface of subgrade, or layer of soil material at such a rate as to avoid free water from appearing on surface during or subsequent to compaction operations.
c. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
d. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

3.05 GRADING:

A. General:
1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas, and in conformance to the Drawings.
2. Smooth finish surface, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
3. Grade areas to drain and to prevent ponding.

4. Elevations shall be within ±0.10 feet.

3.06 FIELD QUALITY CONTROL:

A. Material Thickness:

1. The Contractor shall maintain daily logs of measurements of soil lifts, soil characteristics, and other observations. Installation of a layer measured at 90 percent or less of the required thickness will not be accepted. A running average of 100 percent of the required thickness shall be maintained. Thicknesses of common borrow, gas venting sand, barrier protection soil, and vegetative material shall be checked at 100-foot grid intervals. Thickness of aggregate subbase material shall be checked at a minimum once per 100 linear feet of material placed.

3.07 FIELD QUALITY ASSURANCE:

A. General:

1. The Engineer will inspect, review test results, and approve subgrades before further construction work is performed thereon.
2. The Contractor shall cooperate with and assist with Field Quality Assurance in-place testing, and sampling for laboratory testing as described below.

B. Compaction:

1. The Contractor's independent testing service will measure compaction as in-place density using ASTM D 2922-91 (nuclear methods) or ASTM D 1556-90 (sand cone method) and according to the following schedule:

Material	Required Percent of Maximum Dry Density	Minimum Frequency
a. Common Borrow	Min. 90%	5 per acre per lift
b. Barrier Protection Soil	Min. 90%	5 per acre per lift
c. Gas Venting Sand	See 3.07.B.4	10 per acre per lift
d. Aggregate Subbase		
Roadways	Min. 95%	1/200 L.F.

2. Disposal cell subgrade shall be compacted with a heavy vibratory roller making a minimum of 4 passes over grubbed existing grade.
3. Vegetative soil shall be compacted with a bulldozer making a minimum of 4 passes per lift.
4. Gas venting sand shall be compacted to an in-place density such that it meets or exceeds the minimum hydraulic conductivity requirements. The compaction

requirements will be established from the results of the borrow study. Compaction testing shall occur at a minimum frequency of 5 per acre per lift.

5. Testing locations will be selected at random by the Engineer.
6. Determine maximum dry densities and optimum moisture contents in accordance with ASTM D 1557-91 as specified in Section 2.03.

D. Moisture:
   1. The Contractor's independent testing service shall measure moisture content at all locations chosen for density testing and at other locations deemed appropriate by the Engineer.
   2. Moisture content shall be measured by nuclear methods, ASTM D 3017-88.

E. Hydraulic Conductivity:
   1. The Contractor's Testing Service will measure the hydraulic conductivity of remolded samples taken from the gas venting layers. The Contractor shall cooperate and assist in accessing and obtaining samples.
   2. Hydraulic conductivity testing shall be performed on the gas venting sand at a minimum frequency of 10 tests per acre per lift.
   3. Remolded hydraulic conductivity of the gas venting layer shall be determined by the constant head or falling head method described in U.S. Army COE EM Manual 1110-2-1906 (Appendix VII, Chapter 3) or ASTM D 2434-68 (R1993).
   4. The remolded hydraulic conductivity will be measured at densities representative of the in-place density (as determined by ASTM D 2922-91 or ASTM D 1556-90) for each location selected for testing.
   5. Conformance Requirements.
      b. Gas Venting Layer - For each acre the mean of the 5 required hydraulic conductivity tests must be equal or be greater than $1x10^{-3}$ cm/sec with no test less than $5x10^{-4}$ cm/sec.

F. Deficient Areas of Work:
   1. If, in the opinion of the Engineer, based on reports of testing service and inspection, the subgrade or fills are below specified density or thickness, the Contractor shall undertake necessary corrective actions and conduct additional testing at his expense. The Engineer may retest a rejected area once prior to the Contractor undertaking additional corrective actions. If the Contractor chooses to rework an area which has been rejected for nonconformance with the density criteria a second time and it fails testing once again, the Contractor shall excavate the rejected area and reconstruct it with new material. The Contractor may rework an area rejected for nonconformance with the specified thickness or grading requirements until it meets the specification, provided such work does not cause the area to deviate from the other requirements of conformance.
   2. Should an area be rejected for nonconformance to the hydraulic conductivity requirements, the contractor may rework the area. If the area fails the requirements a second time, the Contractor shall excavate the rejected area to one-half the distance between the accepted and rejected areas and reconstruct it with new material.

3.08 VEGETATIVE SOIL:

A. Deposit on prepared areas to obtain a reasonable uniform compacted depth as shown on the Drawings. Spread and till, raking out all pieces of sod, roots, and grass.
B. Compact into an even uniform layer by rolling to prepare for liming, fertilizing, and seeding.

3.09 MAINTENANCE:

A. Protection of Graded Areas:
   1. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.
   2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas:
   1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF WASTE MATERIALS:

A. Remove trash, debris, and waste materials, from NLODS property and properly dispose of it in a lawful and acceptable manner, at no additional cost to the Department.
B. Do not dispose in designated flood plain or wetlands area.
C. No materials may be taken off-site without prior approval by the Engineer.

END OF SECTION

APPENDIX B-2

SECTION 02673

MONITORING WELLS

SECTION 02673

MONITORING WELLS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

A. Special Project Procedures and Submittals: Section 01125
B. Submittals: Section 01340
C. Health and Safety: Section 01392
D. Excavation, Backfill and Compaction: Section 02221

1.02 DESCRIPTION OF WORK:

A. Provide all necessary personnel, equipment, and materials required to install monitoring wells and appurtenances, decommission specified monitoring wells and piezometers affected by remedial construction activities, as detailed on the Drawings and described in the Specifications. Obtain approval of the monitoring well locations from the Engineer prior to drilling.

B. Well depth and screen location shall be based upon the position of the water table and subsurface geology. Provide Engineer with drilling log data for approval of well depths and well screen locations. Three soil borings are to be advanced to 8 feet below the groundwater table, estimated total depth per boring is approximately 15 feet below ground surface. Groundwater monitoring wells are to be installed in the soil borings such that the bottom 8 feet of the 10-foot long well screen is below the groundwater table.

C. Work to be Completed:

1. Drill three soil borings at the approximate locations shown on the Drawings.
2. Install a 2-inch inside diameter (ID) polyvinyl chloride (PVC) well screen and associated appurtenances in each boring.
3. Develop the wells as specified in Section 3.02.C.

D. Decommission existing wells MW-101A and MW-101B and existing piezometers PZ-2 and PZ-3 which are shown on the Drawings.

1.03 SUBMITTALS:

A. Boring Logs
B. Well Completion Diagrams
C. Driller Qualifications
D. The following data associated with PVC well materials, bentonite products, cement and sand pack materials shall be submitted in writing to the Engineer a minimum of two weeks prior to mobilization to the site as part of the approval request. Only new, unopened packages may be brought on-site.

- Brand Name(s).
- Manufacturer(s).
- Manufacturer's address(es) and telephone number(s).
- Product description(s) from package label(s)/manufacturer's brochure(s).
- Intended use(s) for this product.

1.04 QUALITY ASSURANCE:

A. Qualifications: Driller shall have 1 or more years experience in monitoring well drilling techniques.

B. Calibration: Contractor shall maintain records of calibration of all monitoring instrumentation identified in Part 2.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Drill Rigs And Tools:

1. Drill rig(s) shall have adequate capacity and power for the work described in this Technical Specification. They shall be specifically designed and manufactured for air rotary drilling.
2. All drill rig(s) and tools shall be brought to the site in good working condition and shall be maintained so as to minimize the potential for breakdown to occur during normal working hours. Drill rig(s) and tools that are not adequate, in the opinion of the Engineer, will not be permitted.

B. Solvents, Glues, Lubricants, Drilling Fluids, And Antifreeze:

1. During completion of the work, the Contractor will not use any glues or solvent welding to join monitoring well components.
2. The Contractor may only use Teflon tape, or vegetable-based lubricants on the threads of downhole drilling and sampling equipment. Additives containing lead or copper shall not be used. Any hydraulic or other fluids in the drill rig, pumps, or other field vehicles/equipment shall not contain any polychlorinated biphenyls (PCBs).
3. Pure bentonite clay is the only drilling fluid additive allowed. The use of this drilling fluid additive will only be permitted if borehole advancement cannot be completed with water alone. No organic additives shall be used. The use of any bentonite must be approved by the Engineer prior to the arrival on-site of the drilling equipment (rigs). This includes bentonites (powders, pellets, etc.) intended for drilling mud, grout, slurry, seals, etc.
4. Antifreeze added to pumps, hoses, etc., may not contain rust inhibitors and/or sealants. Antifreeze shall be completely purged from all pumps and hoses prior to drilling activities. The Contractor shall note, on the boring log, the date, reasons, quantities, and brand name of antifreeze used.

C. Drill Casing/Air Rotary Hammer:

1. Contractor shall provide drill casing and air rotary tools in quantities and sizes adequate for expeditious performance of the work described in the specifications.
2. All test borings are to be cased to there full depth as required to adequately maintain the borehole and permit monitoring wells to be properly installed. Open-hole drilling will only be permitted as approved by the Engineer.

D. Well Materials:

1. Riser shall be 2-inch ID, Schedule 40, PVC with lengths flush-threaded together of sufficient length to extend 2.8 feet above ground surface.
2. Screen shall be 2-inch ID, Schedule 40, PVC, flush threaded, with 0.010 inch machine cut slots, and shall be 10-feet long.
3. Protective carbon steel casing shall be six-feet long with a 4-inch ID.

4. Provide a locking well cap with brass keyed-alike padlocks such as Best Products or approved substitute. Locking well caps or covers shall extend down over the outside of the protective casing a minimum of 3 inches. Flip-top lids are not acceptable.
5. Bottom of well screens shall be provided with a PVC screw-on bottom plug.
6. Well materials shall be steam cleaned with potable water prior to installation in the borehole, and protected by wrapping in plastic or placing on clean surface.

E. Backfill Materials:
1. Backfill materials shall consist of sand pack and bentonite slurry seal placed as specified or as directed by the Engineer.
2. From bottom of boring backfill shall be as follows:
   a. From the bottom of the boring to one foot above well screen: sand pack (Morie #00, or equivalent).
   b. Top of sand pack to two feet below ground surface: bentonite pellets/chips (hydrated in place).
   c. Two feet below ground surface to ground surface: concrete.

F. Monitoring Instrumentation:
1. The Contractor shall provide all Health and Safety equipment including a photo ionization detector (PID), lower explosive limit/oxygen (LEL/O_2) meter, or additional instrumentation as required in the Contractor's Health and Safety Plan (HASP).
2. The Contractor shall provide instrumentation to monitor well development water turbidity, pH, conductivity, and temperature during well development.

PART 3 - EXECUTION

3.01 BORINGS

A. Drilling:
1. Borings for monitoring well installation are to be completed using air rotary techniques and minimum 4-inch inside diameter (ID) flush-threaded steel casing.

B. Disposal of Cuttings and Drill Fluids:
1. Drill cuttings generated during completion of the borings may be spread on the surface of the disposal cell prior to cap construction at a location approved by the Engineer. Off-site disposal of drill cuttings will be required after cap construction begins. Off-site disposal will be the responsibility of the Contractor and will include containerization, analytical characterization, transportation, and disposal at an approved disposal facility.
2. Water generated during completion of the borings and development of monitoring wells shall be containerized in 55 gallon DOT Spec 17 drums, supplied by Contractor, and staged at an area approved by the Engineer. All drums shall be either new or reconditioned and in structurally good shape. All drums shall be clean. All drums will be staged after the boring is complete by the Contractor. At no time shall drill water or well development water be discharged directly into existing natural bodies of water. Contractor shall provide necessary equipment to move and stage these drums and if necessary treat the water with a granular activated carbon treatment media such as Carbtrol® at the designated area. Water from drilling and monitoring well development will be screened by the Contractor with a photo-ionization detector (PID). Water with PID reading below 5 ppm may be discharged to the ground surface

at a location approved by the Engineer. Discharge of water to the disposal cell surface shall not be allowed once cap construction begins. Water with PID readings 5 ppm or above shall be passed through granular activated carbon before being discharged to the ground surface at a location approved by the Engineer. If the PID reading of the treated water continues to exceed 5 ppm Contractor shall sample and analyze drill water for waste characterization in accordance with the requirements of the disposal facility the Contractor will use. The Contractor will transport and dispose of contaminated water in an approved disposal facility.

3.02 MONITORING WELLS

A. After each boring is completed to the specified completion depth and the condition of the borehole is approved by the Engineer, the well shall then be placed in the center of the borehole casing using sufficient PVC riser pipe to reach 2.8 feet above ground surface. After the well is in place, backfilling may begin according to Part 2: Backfill Materials.

B. A 6-foot length of 4-inch ID carbon steel pipe (protective casing) shall then be cemented in place. The protective casing shall extend at least 1 inch and no more than 2 inches above the well riser. The location and number of the well will be prominently and permanently marked on the protective steel casing. The protective casing shall be provided with a locking cap and brass padlock. All backfill placed in the boring shall be approved by the Engineer prior to use.

C. Each well shall be developed by alternately pumping and surging using a submersible pump no sooner than 24 hours after well placement. Water generated during development of the wells will be handled as outlined in Section 3.01.B. The wells will be developed until the pumped water has a turbidity reading of 50 NTUs or less or the well has been pumped for a maximum of 6 hours and a minimum of 5 well volumes removed. Additionally, pH, temperature, specific conductivity and turbidity will be monitored until stabilization. Well development will be documented in a field notebook. The well will not be considered complete by the Engineer until it has been properly developed.

3.03 GROUNDWATER OBSERVATIONS:

A. Observations and recording of water levels during and at the completion of the drilling operations on a site shall be made according to the following guidelines:

1. Date, time, and depth from the ground surface to the first encountered water surface.
2. Date, time, and depth to the water surface at the completion of each borehole, both immediately before removing the casing and before leaving the boring location upon well installation prior to development.
3. Notes regarding weather: rain, snow, clear; temperature (estimate to nearest 100F).
4. Notes regarding any special drilling techniques or procedures.
5. Records must be specific - Example: If hole is dry, record "Dry at depth of X Feet".

B. Observations of groundwater levels as specified above are considered the responsibility of the Contractor.

3.04 NUMBER AND LOCATION OF BORING:

A. The exact location of monitoring wells will be designated and authorized by the Engineer in the field.

B. The Drawings show the approximate area where borings will be made.

3.05 PROTECTION OF WORK, PUBLIC AND PROPERTY:

A. The means, methods, procedures, and techniques to be used by the Contractor are the responsibility of the Contractor, and shall be designed to meet the intent of the specifications.

B. The Contractor shall continuously protect its work from damage and protect adjacent property as provided by law. The Contractor shall maintain lights and other safety devices as required. The Contractor shall promptly repair all damages caused by its operations. When using internal combustion equipment, The Contractor shall have available at the work site emergency fire extinguishers or other approved fire fighting apparatus at all times.

C. During its operations, the Contractor may occupy only those portions of the site for which the required permits have been obtained by the Contractor. If the Contractor desires to use additional areas outside of those required for the borings, it shall arrange for such areas at its own expense.

D. Fill all drill holes and rawest areas where the grass is damaged. Any abutting property which is damaged as the result of the Contractor's operations shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

E. All drilling casings shall be withdrawn from the drill holes unless directed to be left in place by the Engineer.

3.06 COMPLETION OR ABANDONMENT OF BORINGS:

A. Borings shall not be abandoned before reaching the final depth authorized by the Engineer except with the approval of the Engineer. No payment will be made for borings abandoned because of an accident or negligence attributable to the Contractor.

B. Borings abandoned before reaching required depth, because of an obstruction or other reasonable cause not permitting completions of the boring by standard procedures, shall be replaced by a supplementary boring adjacent to the original and carried to the required depth. Penetration to the completed depth of the original boring may be made by means other than specified above only with the Engineer approval.

C. Payment will be made for the approved portion of the abandoned hole plus the supplementary boring provided (1) the boring is abandoned for reasons acceptable to the Engineer, (2) the Contractor presents records as specified, plus a report on the obstruction which necessitated relocating the boring.

D. Specific backfilling procedures required for the boring in which the well is to be installed are described in Part 3 - Execution. Abandoned borings may be allowed to collapse and backfilled with native soil. In the event contaminated soil is encountered, the borehole will be cement grouted from the water table to ground surface. No grouting will be permitted below the water table.

3.07 DECOMMISSIONING EXISTING WELLS

A. Decommission existing wells and piezometers shown on the Drawings in accordance with the requirements of this Section.

B. Decommission wells/piezometers using the following procedures (taken from Section 2.5.3.3 of the NYSDEC Monitoring Well Decommissioning Procedures).

1. Fill the casing with grout tremied from the bottom of the well/piezometer casing.
2. Puncture the bottom of the well/piezometer casing.
3. Pull the well/piezometer protective casing and the well/piezometer casing from the ground, while maintaining grout at the ground surface within the casing.

4. If the casing can not be pulled, at a minimum the upper four feet of the well casing shall be removed by the Contractor, as approved by the Engineer.

C. Selecting, Mixing, and Placing Grout

1. Selecting Grout Mixture

a. There are two types of grout mixtures that may be used to seal wells: a standard mix and a special mix. Both mixes use Type I Portland Cement and six percent bentonite by weight. The difference between the two mixes is the volume of water used. The special mix uses less water and is used in situations where excessive loss of the standard grout mix is possible, for example in highly-fractured bedrock or coarse gravels.

b. Standard Grout Mixture

1. For most boreholes, the following standard mixture will be used:
One 94-pound bag type I Portland Cement
3.9 pounds powdered bentonite
7.8 gallons potable water
This mixture results in a grout with a bentonite content of four percent by weight, and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases a special mixture will be used.

c. Special Grout Mixture

1. In cases where excessive use of grout is anticipated, such as high permeability formations and highly fractured or cavernous bedrock formations, the following special mixture will be used:
One 94-pound bag type I Portland Cement
3.9 pounds powdered bentonite
6.0-7.8 gallons potable water (depending on desired thickness)
The special mixture also results in a grout with a bentonite content of four percent by weight, but the amount of added water is decreased to produce a thicker mixture. The least amount of water that can be added for the mixture to be readily pumpable is six gallons per 94-pound bag of cement.

2. Grout Mixing Procedures

a. Calculate the volume of grout required to fill the borehole before beginning to mix the grout. If possible, the grout basin should be large enough to hold all of the grout necessary for the borehole. Tall cylindrical and long shallow basins should not be used as it is difficult to obtain a homogeneous mixture in these types of basins.

b. Mix grout until smooth, homogeneous mixture is achieved. No lumps or dry clots should be present. Grout can be mixed manually or with a mechanized mixer. One acceptable type of mixer is a vertical paddle grout mixer. Colloidal mixers should not be used as they tend to excessively decrease the thickness of the grout for the above recipes.

3. Grout Placement

a. Grout will be placed in the borehole from the bottom to the top. This will be accomplished by using a tremie pipe of not less than 1-inch diameter. Grout will then be pumped into the borehole at a rate of 5-10 gpm until the grout appears at the land surface. At this time the rate of settling should be observed. When the grout level stabilizes, casing will be removed from the hole. As each

section is removed, grout will be added to keep the level just below land surface. If the grout level cannot be maintained near the land surface, this will imply excessive loss of grout and an alternate grouting method must be used. One possibility is to grout in stages, whereby the first batch of grout is allowed to partially cure before a second batch of grout is added. Upon completion of grouting, it is important to make sure the final grout level is approximately five feet below land surface. A ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well.

D. Dispose of well decommissioning materials in the disposal cell prior to closure.

3.08 CLEAN UP:

A. Upon completion of the work, the Contractor shall remove its rigs and all surplus and unused material and leave the site in a clean condition to the satisfaction of the Engineer. This shall include, but not be limited to, the leveling (to the ground surface) of drill cuttings generated during completion of the soil borings.

3.09 DECONTAMINATION:

A. All drill rigs shall be steam cleaned, and if necessary, scrubbed with Liquinox and potable water prior to setting up at the drilling location, prior to drilling each boring and prior to departure from the site. More frequent decontamination of rigs may be required depending on actual exposure to contaminated conditions. Other nonsampling equipment (i.e., submersible pump, discharge hose, and electrical wires) shall be steam cleaned after each sample has been collected. Heavy equipment (drill rigs, augers, rods, and associated equipment) will be steam cleaned before the exploration program and after each exploration is completed. See Section 01392 Health and Safety for decontamination requirements. Alternative decontamination procedures and methods shall be approved by the Engineer prior to their use. Perform decontamination at a specially designated decontamination area as authorized by the Engineer.

3.10 INSPECTION OF WORK:

A. The Engineer shall at all times have access to the work, and the Contractor shall provide proper facilities for such access and for inspection. Drilling and well installation shall be in accordance with the requirements of these specifications and authorizations of the Engineer and will be inspected by a representative of the Engineer at its discretion.

END OF SECTION

APPENDIX B-3

SECTION 02776

POLYETHYLENE GEOMEMBRANES

SECTION 02776

POLYETHYLENE GEOMEMBRANES

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:

A. Excavation, Backfill and Compaction: Section 02221

1.02 DESCRIPTION OF WORK:

A. Furnish all labor, materials, and equipment to install smooth polyethylene (PE) geomembrane on the disposal cell surfaces and textured PE geomembrane on the sideslopes of the disposal cell in conformity with the Drawings and as specified in this section.

1.03 REFERENCES:

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. For all test methods specified, the most recent revision shall apply if different from that listed.

C. American Society for Testing and Materials (ASTM):

1. ASTM D 638-89, Test Method for Tensile Properties of Plastics.
2. ASTM D 746B-79, Brittleness Temperature of Plastics and Elastomers by Impact.
3. ASTM D 751-89, Method of Testing Coated Fabrics (as modified in MSF 54, App. A).
4. ASTM D792-86, Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
5. ASTM D 1004-66, Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
6. ASTM D 1204-84, Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
7. ASTM D 1505-85, Test Method for Plastics by the Density-Gradient Technique.
8. ASTM D 1603-76, Test Method for Carbon Black in Olefin Plastics.
9. ASTM D1693-70, Test Method for Displacement Environmental Stress-Cracking of Ethylene Plastics.
10. ASTM D 3015-85, Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
11. ASTM D 3083-89, Specifications for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining - Type IV Dumb-bell at 2 ipm.
12. ASTM D4437-84, Integrity of Field Seams Used in Joining Manufactured Flexible Polymeric Sheet Geomembranes.
13. ASTM D 5321-92, Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

D. Federal Test Method Standard (FTMS)

1. FTMS 101C, Method 2065, Puncture Resistance.

E. United States Environmental Protection Agency (USEPA)
   1. Technical Guidance Document: "Quality Assurance and Quality Control for Waste Containment Facilities." Sept. 1993.
   2. Technical Guidance Document: "Inspection Techniques for the Fabrication of Geomembrane Field Seams." May 1991.

1.04 SUBMITTALS:
A. Manufacturer's Data:
   1. Experience information for approval before material shipment.
   2. Supplier's and manufacturer's certificates for approval before material shipment as specified in Quality Control in Part 1 of this Section.
   3. Shipment Warranty for approval before material shipment specified in Manufacturer's Warranty in Part 1 of this Section.
   4. Panel layout with seam locations and details for approval before material shipment.
   5. Quality control testing reports before material shipment as specified in Source Quality Control in Part 2 of this Section.
   6. Field Technical Service reports during installation and before acceptance as specified in Field Quality Control in Part 3 of this Section.

B. Installer's Data:
   1. Experience information for approval before material shipment.
   2. Cold/wet weather seaming procedures for approval before start of installation.
   3. Site preparation certificate before start of installation as specified in Quality Control in Part 1 of this Section.
   4. Warranty before acceptance of installed liner as specified in Manufacturer's Warranty in Part 1 of this Section.

C. Contractor Provided Third-Party Independent Geomembrane Testing Service:
   1. Experience information for approval before subcontracting.
   2. Proposed testing procedures for approval before testing.

1.05 QUALITY CONTROL:
A. Qualifications:
   1. Manufacturer's Experience:
      a. Production and in service use of similar geomembrane materials for not less than 1 year.
      b. At least 10 million square feet of VLDPE, LLDPE, or HDPE geomembrane has been installed.
   2. Installer's Experience:
      a. Installation of at least 1 million square feet of VLDPE, LLDPE, or HDPE geomembrane using dual hot wedge seaming methods by both company and its field representative.
      b. Installation of pipe boots and other penetration fabrications on projects totaling at least 1 million square feet using extrusion welding by both the company and its boot specialists.

B. Certifications:
   1. Resin suppliers to manufacturer shall certify resin used contains less than 2% clean recycled polymer by weight, a density between 0.93 to 0.95 g/cc and a melt index between 0.1 to 1.1 gram/10 min.

2. Manufacturer shall certify the geomembranes meet the specifications.
3. Installer shall certify site preparation is acceptable for geomembrane installation and warranty including the following issues:
   a. Subgrade directional changes will not create sharp bends in the geomembrane.
   b. Subgrade is adequately firm and dry to allow satisfactory seaming.
   c. Subgrade surface is free of hard and sharp objects capable of damaging the liner.
4. Furnish test data that the smooth and textured geomembranes meet the frictional requirements listed in Table 02776-1.

1.06 QUALITY ASSURANCE

A. Contractor Provided Geosynthetic Inspection and Testing (CQA Representative) Service.
   1. The Contractor will provide an independent third-party consultant to inspect placement of the geomembrane, obtain samples of the geomembranes for testing, perform quality assurance testing of the geomembranes, and to review the results of the quality assurance testing.
   2. The Contractor shall provide assistance to the testing and inspection service which may include sampling geomembrane materials and providing split samples, when requested.

1.07 DELIVERY, STORAGE, AND HANDLING OF GEOMEMBRANE:

A. Using indelible marking, identify each roll with:
   1. Name of manufacturer
   2. Manufacturer's batch code
   3. Physical dimensions (thickness, length, width)
   4. Roll number.
   5. Date of fabrication.
   6. Directions for unrolling and unfolding.

B. Individually package and protect to prevent damage during shipment and storage.
   1. Identify each package in the same fashion as the sheet within and show the date of shipment.

C. Storage:
   1. Indoors: In original, unopened protective covering.
   2. Outdoors:
      a. On a pallet protected from direct sun rays.
      b. Provide heat reflective opaque cover to create free flowing air space.

1.08 PROJECT CONDITIONS:

A. Temperature Constraints:
   1. Extrusion or Fusion Bonding of Field Seams:
      a. Take ambient temperature readings at no longer than two-hour intervals, two feet above the liner, using thermocouples or other acceptable means.
      b. If ambient temperature, as described above, is measured above 1050F, seaming shall proceed with increased caution because of difficult working conditions.
      c. If ambient temperature, as described above, is measured between 1050F and 400F, seaming may proceed without additional constraints.

d. If ambient temperature is below 400F, additional constraints will be imposed in accordance with the approved cold weather procedures.

2. Cold Weather Seaming:
   a. Submit for approval cold weather procedures for seaming when temperatures drop below 400F or any time other than from April 15 to November 1.
   b. Cold weather procedures shall include but not be limited to the following:
      1.) Preheating sheets
      2.) Providing liner protection with coverings
      3.) Changing test frequencies
      4.) Bridging
      5.) Increasing trial welding

B. Contractor provided Geomembrane Testing Service:
   1. The Contractor shall provide an independent testing service to perform direct shear tests on both smooth and textured PE geomembrane to determine frictional properties.
   2. The testing service shall show demonstrated experience in direct shear testing of PE geomembranes.
   3. The testing service shall provide proposed method of performing direct shear interface testing. Testing requirements are provided in Paragraph 2.03.

1.09 MANUFACTURER'S WARRANTY:

A. Warrant that geomembranes shall be free from defect in materials for a period of 20 years.
   1. Will not develop cracks or holes.
   2. Is immune to chemical attack and degradation by chemicals specified in the manufacturer's literature.

B. Should defects or service degradation occur during the 20 year warranty period, the manufacturer shall supply repair or replacement material or refund the pro-rata part of the unexpired term of the warranty at the then-current price.

C. Warranty shall continue in effect on the repaired or replaced material for the unelapsed term of the original warranty.

D. The Department will present in writing to manufacturer and installer claim for alleged breach of warranty within 30 days after alleged defect is noticed.

1.10 INSTALLER'S WARRANTY:

A. Warrant liner for a period of (5) years to the owner against improper installation.
   1. The warranty shall include timely repair or replacement of defective installation workmanship.
   2. The Department will present in writing to manufacturer and installer claim for alleged breach of warranty within 30 days after alleged defect is noticed.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. PE geomembrane shall be manufactured by SLT North America, Inc., 200 S. Trade Center Pkwy., Conroe, Texas; GSE Lining Technology Inc., 19103 Gundle Road, Houston, Texas; National Seal Co., 1245 Corporate Blvd. #300, Aurora, IL; or approved substitute.

2.02 SMOOTH AND TEXTURED PE GEOMEMBRANE:

A. Description:
   1. Polyethylene resin density between 0.93 and 0.95 g/cc.
   2. No additives, fillers or extenders unless otherwise specified.
   3. Two percent carbon black in resin for ultraviolet resistance.

B. Physical Characteristics:
   1. Physical properties required of the geomembranes are shown on Table 02776-1.
   2. The textured geomembrane shall be textured on both sides.

C. Factory Bonded Seam:
   1. Fabricate calendered sheeting into large sections by using one of the following seaming techniques:
      a. Hot air/hot wedge.
      b. Flat weld extrusion.
   2. Seam strengths shall exhibit the same physical strength as the parent material.
   3. Fabricated seams shall pass a 100 percent vacuum test.

D. Extrusion Joining Resin:
   1. Produced from the same material as the sheet resin.
   2. Physical properties shall be the same as those of the resin used in the manufacture of the liner.
   3. Black.
   4. Color natural resin through addition of 2.0 to 3.5 percent master batch colorant before use.

2.03 GEOMEMBRANE DIRECT SHEAR TESTING:

A. Description:
   1. Prior to construction and once soil materials have been selected from borrow studies, perform direct shear testing on geomembranes to determine interface friction values (degrees) between smooth and textured geomembranes and overlying or underlying soil materials.
   2. Both smooth and textured geomembranes shall be interfaced with the gas collection sand and the barrier protection soil.
   3. Testing shall be performed in accordance with ASTM D 5321 using a 12 in. x 12 in. direct shear box. Testing shall be performed at normal loads between 2 and 5 psi.
   4. A minimum of 3 tests per geomembrane per interface soil shall be performed (for a total of 12 tests).
   5. Acceptance shall be based on meeting the minimum value listed in Table 02776-1.

2.04 OTHER MATERIALS:

A. Pipe Boots, Vents, Patches:
   1. Same material and thickness as the geomembrane or a compatible approved equal.

B. Mechanical Fastenings:
   1. Material, size, and type as detailed on the Drawings or approved Shop Drawings.

2.05 SOURCE QUALITY CONTROL:

A. Manufacturer Testing:
   1. Furnish factory quality control test data on rolls to be shipped for material thickness, tensile strength and tear resistance.

2. Furnish test data on fabricated seams.

2.06 SOURCE QUALITY ASSURANCE:

A. CQA Testing:

1. Rolls delivered to the site:

a. Prior to geomembrane installation the Contractor's Independent Third-Party Construction Quality Assurance (CQA) Representative shall obtain random samples 3 feet long by roll width from rolls at locations selected by the CQA Representative at a rate of one sample per 40,000 s.f or once per change in resin batches. Samples are to be sent by the CQA Representative to the Contractor's Geosynthetic Testing Service to determine density, carbon black content, thickness and tensile characteristics. Testing shall be performed in accordance with the methods listed in Table 02776-1.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION:

A. Requirements:

1. Remove all sharp objects, debris or foreign matter, creating a smooth surface.
2. Slightly rounded corners shall be provided at directional changes in the area to be covered and in the anchor trench so as to avoid sharp bends in the geomembrane.
3. Surface must be free of standing water and in a dry condition.
4. Maintain surface requirements during geomembrane installation.

3.02 HANDLING AND PLACEMENT

A. Requirements

1. Remove protective wrapping from rolls to be deployed only after subgrade has been approved by the Engineer.
2. Geomembranes shall be deployed in strict accordance with good construction practice and in particular in such a manner as to prevent any damage to the material.
3. If possible, actual placement shall proceed from the highest elevation to the lowest to facilitate drainage in the event of precipitation.
4. Methods of deployment shall consist of inserting a steel support pipe through the roll core. The slings or lifting chains shall be attached at one end to the support pipe and at the other end to the bucket of a front end loader or lifting device. A spreader bar should be used to support and spread the slings. The core pipe and spreader bar shall not bend or flex excessively when a full roll is lifted.
5. The Contractor shall install in one day only the amount of geomembrane that can be covered with the available backfill soils. The geomembrane shall not be left uncovered at the end of the day with the exception of the edges of the sheet.

3.03 FIELD SEAMS:

A. Preparation:

1. Clean dust and dirt from areas to become seam interfaces.
2. For extrusion bonded seams, roughen slick sheet surfaces to become seam interfaces with a hand-held disk grinder.

a. The grinder grit paper should be no coarser than #80 or finer than #100.
b. Grinding depth must roughen membrane surface but must not exceed 10% of the membrane thickness.
c. The grinder marks shall not appear beyond 1/8 inch on each side of the extrudate after seaming. Place cap strip or patch, over entire seam length where excessive grinding (>1/8 inch beyond weld or >10% of membrane thickness) occurs.
d. Grinding shall not take place more than 10 minutes before placement of extrudate to prevent surface oxidation of the surface.

3. For hot wedge fusion-bonded seams, sheet surface should not be roughened by grinding or other means. Surfaces to be bonded must be clean and dry.
4. Sheet shall be dry. Seaming shall not occur over fully saturated subgrade soil without appropriate procedures and precautions, as the heat will draw water to the seam.
5. Ambient Temperature: See Article entitled Project Conditions in Part 1 of this Section.

B. Seaming Methods:
1. Make maximum use of large panels unless special requirements are necessary for liner configuration and termination.
2. To the maximum extent possible, field seams shall be made parallel to the slope (i.e., up and down) as opposed to horizontally along the slope. Where horizontal seams are necessary, the higher elevation membrane shall overlap the lower elevation membrane. The number of seams shall be minimized in corners and odd-shaped geometric locations.
3. Overlap adjacent sheets a minimum of 4 inches.
4. Use the following field seaming technique to seam geomembrane panels together:
a. Dual Hot Wedge Fusion Bonding:
1) Each seaming unit shall include a thermometer giving machine temperature at the metal surface.
2) Maintain seaming unit at a recordable temperature determined by on-site conditions.
3) Seaming unit temperature shall not vary more than 500F. above or below recommended temperatures.
4) Press geomembranes together mechanically.
5. Use the following seaming method for repairs or patches and in areas where use of the dual hot wedge is not feasible (e.g., pipe and manhole penetrations):
a. Extrusion Welding:
1) Soften liner material by heated air.
2) Air Temperature Impinging on Sheet: 4200F to 6800F.
3) Installation supervisor shall determine exact temperature used based on scrap welds.
4) Directly following heat application, extrude a 1½ inch minimum width resin strip between overlapped sheets. For flat welds and for flat fillet welds extrude a 1½-inch minimum width resin strip centered over the exposed overlap edge.
5) Extrusion Die Resin Temperature: 4280F to 5360F.
6) Firmly press overlapped sheets together by mechanical means to form the extrusion joint.

C. Seaming Wrinkles:
1. Cut fishmouths or wrinkles along the top ridge of the wrinkle, and overlap for a flat surface.
2. Seam the cut fishmouths or wrinkles where the overlap is greater than 3 inches.
3. Where the overlap is less than 3 inches, patch with oval or round patch extending a minimum of 6 inches in all directions.

D. Patching:
   1. Use extrusion or fusion welding to bond materials.
   2. Clean liner material of all dirt, dust and other foreign material.
   3. Roughen smooth surfaces and heat material as required.
   4. Cut patch in oval or round shape, extending a minimum of 6 inches beyond hole, in all directions.

E. Small Hole Repairs:
   1. Use an extrusion hand welder.
   2. Clean liner material of all dirt, dust and other foreign material.
   3. Roughen smooth surfaces and air heat to prescribed temperature.
   4. Extrude a resin strip over the hole.

3.04 PIPE BOOTS, VENTS, AND PATCHES:

A. Construct as shown on Drawings and as recommended by manufacturer.

B. Use seaming techniques to the membrane as recommended by the manufacturer.

C. Install all devices to provide an effective, watertight seal.

3.05 MECHANICAL FASTENINGS:

A. Construct mechanical fastenings and sealing details as shown on Drawings, and as recommended by manufacturer.

B. Sealing Materials and Contact Adhesives:
   1. Compatible with membrane and chemical environment of installation.
   2. As recommended by manufacturer.

C. Install all devices to provide an effective watertight seal.

3.06 FIELD QUALITY CONTROL:

A. Manufacturer's Technical Service:
   1. Provide geomembrane manufacturer technical representative at job site to ensure compliance with installation directions:
      a. Pre-construction conference. To be attended by the geomembrane installation site manager.
      b. When all membrane installation begins.
      c. At substantial completion of the installation.
      d. After written notification from the Department that installation is not in conformance with manufacturer's recommended procedures or specifications.
   2. Technical representative shall:
      a. Observe work.
      b. Report in writing to Contractor and Engineer any unsatisfactory conditions or recommendations for improvement in procedures.

B. Contractor's CQC Manager shall observe all installation of geomembrane and report progress to Engineer.

C. . Tests:
   1. Test Welds:
      a. Run a test weld from each seaming machine a minimum of 3 times per day, at the beginning of the day, around mid-day, and near the end of the day. In addition, test welds shall be run when a new operator takes over or whenever the welding machines are shut off and allowed to cool down, or when machines are idle for more than 60 minutes. If the ambient temperature, as defined in Project Conditions, Part 1 of this Section, drops 200 or more in 2 hours, a test weld shall also be performed.

b. Test strip should be at least 48 in. for extrusion welds and 96 in. for hot wedge welds measured along the length of the seam and extended at least 6 in. on each side of the seam. Run test weld under the same conditions that exist for welding of the seam.
   1) The test weld shall be cut in 14 in. coupons and be distributed to the following parties:
      - to the installer to perform field testing.
      - to the CQA Representative for field testing/screening purposes.
   2) Each sample coupon shall be marked with test weld date, ambient temperature, and welding machine number.
   3) For field testing/screening, a passing test weld for peel shall exhibit Film Tear Bond (FTB) with no brittle cracking and have a peel separation of 10% or less.
   4) For field testing/screening, a passing test weld for shear shall exhibit necking of the parent material prior to any necking or splitting of the weld.

2. Dual Hot Wedge Air Channel Seams:
   a. The hot wedge develops 2 welds separated by an air channel. This channel will be used for air testing in both field seams and seams created during manufacturing. The first phase of the test shall be to establish continuity along the entire length of the seam. This will be done by sealing one end of the seam, inserting a manometer (consisting of a hollow needle, pressure gauge and air valve) into the air channel, and pumping air through the channel. The opposite end shall then be inspected for passage of air. Once continuity is established, the opposite end of the seam from the manometer shall be sealed and the channel shall be pumped to 30 psi. The initial start pressure is read once the air in the air channel has had a chance to stabilize at the ambient liner temperature (up to a 5 minute wait). Once the pressure has stabilized (no lower than 25 psi) the test can start. The pressure shall not drop more than 3 psi in 5 minutes. Any leaks found shall be repaired by extrusion welding and vacuum tested. The hole made by the manometer needle will be patched and the patch will be vacuum or spark tested.
   b. If the air channel is found to be plugged during the continuity test, then the plug shall be located. The pressure test shall be conducted on each side of a plug. It may be necessary to cut away the plug and patch the area after the pressure test.
   c. Subject to approval, those dual hot wedge seams not feasible for air pressure testing shall be 100% vacuum tested.
   d. The Contractor shall provide at a minimum, two operational dual hot wedge welders with a third backup welder to be used only in emergencies.

3. Extrusion Seams (Flat Seams and Fillet Seams):
   a. Vacuum Test: Perform vacuum test by experienced personnel using vacuum test box or other approved vacuum method where feasible along extrusion or fusion bonds (i.e., patches, pipe boots, etc.)
      1) Spread soap solution over seam being tested, press vacuum box down and apply suction for 30 seconds.
      2) When the vacuum box is moved along the seam during testing, maintain a 3 inch overlap with section tested.
      3) The appearance of bubbles in rapid succession during the test is indicative of a leak.
      4) Repair and retest structural faults in the welded seam.

4. Destructive Tests:
   a. Samples:
      1) Take random weld samples at locations selected by the CQA Representative at a frequency of 1 sample per 500 feet of welded seam, or at a minimum of 1 per seam, or at least one sample for each welding machine used on the project.

2) The test strip shall be cut in 14 in. coupons and be distributed to the following:
   - $ the installer to perform Construction Quality Control (CQC) testing.
   - $ the CQA Representative for field testing/screening purposes and independent laboratory for testing.
   - $ the Department for archiving.
3) Each sample coupon shall be marked with date, location of sample, orientation with respect to machine direction, and welding machine number.

b. Field Testing:
1) For field testing/screening, a passing test weld for peel shall exhibit Film Tear Bond (FTB) with no brittle cracking of 10% or less.
2) For field testing/screening, a passing test weld for shear shall exhibit FTB with necking of the parent material prior to any necking or splitting of the weld.

c. Patches and Repairs:
1) If the sample of the seam tested fails the criteria, cut samples 10 feet on both sides of failing sample. Send second sample to testing laboratory for analysis.
2) If the criteria is not achieved for the second samples, follow the same procedure outlined above until the entire area of inadequate seaming is identified.
3) Place a patch over the entire failed area of the seam.
4) All repairs require 100% passing by non-destructive vacuum box testing.

d. Visual Inspection:
1) Visually inspect all seams and geomembrane panels in-place for holes, blemishes, pores, penetrations or other detrimentation defects.

3.07 FIELD QUALITY ASSURANCE:

A. Cooperation: Contractor shall cooperate with the efforts and schedules of the work performed by the CQA Representative.

B. The CQA Representative will:
1. Observe all non-destructive seam tests described under Field Quality Control.
2. Observe each roll of liner material for defects.
3. Review the manufacturer's quality control certificate for each roll delivered to the site.
4. Cut coupons, conduct field destructive testing of seam samples and forward passing samples to independent laboratory for testing. Perform air testing at boots.
5. Conduct photographic documentation of the geomembrane installation.
6. Keep a logical record of documentation of geomembrane installation. This will include panel placement log, seam testing and inspection log, and liner repair log.

C. Laboratory Testing:
1. From each 14 in. coupon submitted for destructive testing to the Contractor's Testing Service laboratory, five shear tests and five peel tests will be run, each on a 1 in. strip of material. Shear tests will be ASTM D 4437-84, 6.3 or equivalent and peel tests will be ASTM D 4437-84, 6.2 or equivalent.
2. Seam samples submitted to the independent laboratory for testing shall conform to the pass/fail criteria for all peel and shear tests.
3. The shear strength (tensile strength) of 4 of the 5 specimens obtained from each sample shall be equal to or exceed 80% of the mean tensile stress at yield of the parent material.
4. The peel test of 4 of the 5 specimens obtained from each sample shall exhibit a Film Tear Bond (FTB) and have a peel seam separation of 10% or less. The peel seam separation is the area of the seam separation expressed as a percentage of the original fused area.

3.08 PROTECTION OF GEOMEMBRANE:

A. Vehicle traffic in direct contact with the installed geomembrane is not allowable and should be reported immediately to the CQA Representative.
B. Placement of soil and pipes above installed liner must be done so in a manner so as to not nick, cut, scrape, puncture or otherwise damage the geomembrane.
C. Reasonable care must be taken at all times to protect the geomembrane from any activity with potential to damage the installed geomembrane.
D. All damaged areas noted must be repaired and brought to the attention of the Department and the CQA Representative.

3.09 CLEANUP:

A. Dispose of all trash and waste.
B. Remove all excess material and equipment.
C. Leave the premises in a neat and acceptable condition.

TABLE 02776-1

PHYSICAL PROPERTIES OF PE GEOMEMBRANE

PROPERTY	TEST METHOD	SMOOTH VALUE	TEXTURED VALUE
Thickness (mil) - ave/min	ASTM D 751 (conical tip micrometer)	60/54	60/54
Minimum Tensile Properties (each direction)	ASTM D 638 Type IV Dumb-bell at 2 ipm		
1. Tensile Strength at Yield (lbs/in)		144	144
2. Tensile Strength at Break (lbs/in)		300	300
3. Elongation at Yield (%)		13	13
4. Elongation at Break (%)		600	600
Tear Resistance Initiation (lbs min.)	ASTM D 1004, Die. C	50	50
Puncture Resistance (lbs min.)	FTMS 101C Method 2065	90	90
Density (g/cc)	ASTM D1505	0.93-0.95	0.93-0.95
Dimensional Stability (%)	ASTM D1204 (in each direction)	+/- 1	+/- 1
Low Temperature Brittleness (no failure to this temperature)	ASTM D746 (Procedure B)	-120°F	-120°F
SEAM STRENGTH (lbs/in min.)			
Shear	ASTM D4437	125	125
Peel	ASTM D4437	100	100
Peel Separation (% max)		10	10
ENDURANCE PROPERTIES (minimums)			
Carbon Black Content (%)	ASTM D1603	2-3	2-3
Environment Stress Crack (minimum hours)	ASTM D1693	2000	2000

Carbon Black Dispersion	ASTM D3015	A1,A2, B1	A1,A2, B1
FRICTIONAL RESISTANCE			
Interface with both the barrier protection soil and the gas collection sand, normal load of 2 to 5 psi (degrees, min.)	ASTM D5321[(1)]	17°	26°

Notes:
N/A = Not Applicable
[(1)] = 12 in. x 12 in. size Direct Shear Box

END OF SECTION

APPENDIX B-4

SECTION 02931

SEEDING

SECTION 02931

SEEDING

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:
- A. Erosion Control: Section 02271
- B. Excavation, Backfill, and Compaction: Section 02221
- C. Erosion Control Details

1.02 DESCRIPTION:
- A. Where indicated on the Drawings, provide seed as specified herein. Furnish and place lime, fertilizer, seed, and mulch in the areas indicated, and maintain new seeding through the contract maintenance period.

1.03 SUBMITTALS:
- A. Hydraulic Seeding Method:
  1. If the Hydraulic Seeding Method is used: Submit a certified statement for approval to the Engineer as to the number of pounds of materials to be used per 100 gallons of water, and specify the number of square feet of seeding that can be covered with the quantity of solution in the hydroseeder.

PART 2 - PRODUCTS

2.01 MATERIALS: Obtain and retain as part of the project records, certifications, and/or labels of materials supplied.
- A. Topsoil: See Section 02221, Excavation, Backfill, and Compaction.
- B. Fertilizer:
  1. NYSDOT Type No. 3: 10-6-4 grade containing at least 10 percent available nitrogen, 6 percent readily available phosphoric acid and 4 percent total available potash in conformity with the Standards of the Association of Official Agricultural Chemists.
  2. Supply in unopened bags with the weight, contents and guaranteed analysis shown thereon or on a securely attached tag.
- C. Lime: Ground limestone composed of not less than 88 percent calcium and magnesium carbonate; at least 60 percent shall pass a No. 100 mesh screen, 90 percent shall pass a No. 20 mesh screen.
- D. Seed: Shall meet the minimum requirements approved by the Department of Seeds Investigations, New York State Agricultural Station, Geneva, New York.
  1. The grass seed mixture shall include no "primary noxious weed seeds."
  2. Furnish in fully-labeled, standard sealed containers.
  3. Percentage and germination of each seed type in the mixture, purity, and weed seed content of the mixture shall be clearly stated on the label.
  4. The weight of pure live seed (PLS) is computed by the labeled purity percent times the labeled germination percent times the weight.

a. To illustrate the method of computing to PLS from the tag basis, the following example is given: Required: 20 pounds PLS of a particular variety--stock available is 99.41% pure and 92% germination--20 divided by the product of 0.9941 and 0.92 equals 21.8 pounds on the tag basis to furnish 20 pounds of PLS.

5. Subject to the testing provisions of the Association of Official Seed Analysis, with the month and year of test clearly stated on the label.
6. May be tested after it has been delivered to the project.
7. Seed which has become wet, moldy, or otherwise damaged will not be acceptable.
8. Use seed mixture as specified below:

Name	Wt. of Pure Live Seed/Acre
Red Fescue (Festiga Rubra)	50
Perennial Ryegrass (Lolium Perenne)	30
White Clover (Trifolium Repens)	5
Total	85

9. Other suitable seed mix is acceptable if approved by the St. Lawrence County Soil and Water Conservation District and by the Engineer.
10. For temporary seeding requirements see Section 02271, Erosion Control.

E. Mulch:
1. Wood Fiber - NYSDOT 713-11.
2. Hay - NYSDOT 713-18.
3. Straw - NYSDOT 713-19.

PART 3 - EXECUTION

3.01 PREPARATION:
A. All Areas to be Seeded:
1. Shall be worked with a disk, harrow, dragged with a chain, mat or blade, machine-raked, or hand-worked as necessary to provide a reasonably firm but friable seedbed.
2. Shall meet the specified grades and are free of growth and debris.
3. Take care to prevent the formation of low places and pockets where water will stand.

B. Depth of Tillage:
1. 4 inches or as directed by the Engineer.
2. On slopes steeper than 2:1, reduce depth of tillage as directed.

C. Where ryegrass has been planted for temporary erosion control and has not been eliminated prior to the completion of the work, disk at least 4 inches deep and seed to permanent grasses.

3.02 APPLICATION:
A. Topsoil: See Section 02221, Excavation, Backfill, and Compaction.
B. Fertilizer and Lime:
1. Apply by means of a mechanical spreader or other acceptable method which is capable of maintaining a uniform rate of application.

2. Conduct when the soil is in a moist condition and at least 24 hours before sowing the seed.
3. Fertilizer shall be applied at the rate based on the results of the Nutrient Analysis specified in Section 02221, "Excavation, Backfill, and Compaction," Subsection 2.03.

C. Seeding:
1. Perform erosion control items of work such as seeding and mulching upon completion of a unit or portion of the project.
2. When immediate protection of newly graded areas is necessary at a time which is outside of the normal seeding season, apply hay mulch with the seeding done at the same time or done later, or both, as ordered.
3. When immediate seeding is required on areas of the project which are not to be regraded or disturbed, use specified seed mixture.
4. Areas of the project which are to be left temporarily and which will be regraded or otherwise disturbed later during construction may be ordered to be seeded with winter ryegrass to obtain temporary control, spread at the rate of approximately 1 pound PLS per 1,000 square feet.
5. The Engineer reserves the right to prohibit the use of any equipment that is unsuitable or inadequate for the proper performance of the work; immediately remove all rejected equipment from the project.

D. Mulch:
1. Undertake immediately after each area has been properly prepared.
2. Apply hay that has been thoroughly fluffed at approximately, but not to exceed, 3 tons per acre unless ordered otherwise.
3. Blowing chopped mulch will be permitted when authorized.
4. Authorization will be given when it can be determined that the mulch fibers will be of such length and applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants.
5. Hay mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see ground through the mulch.
6. Remove matted mulch or bunches.
7. When specified, use asphalt emulsion as a tie-down, at a rate not less than 100 gallons per acre.
8. Dispose of all baling wire or rope outside the limits of the project in approved areas.

3.03 SEEDING SEASONS:

A. Conduct permanent seeding between May 15 and June 30, between August 15 and September 1, or as directed or permitted by the Engineer.

B. Do not seed during windy weather or when the ground is frozen, excessively wet, or otherwise untillable.

3.04 SEEDING METHODS: Fertilizer, limestone, mulch material if required, and seed of the type specified may be placed at the locations shown or ordered by one of the following methods, provided an even distribution is obtained. The maximum seeding depth shall be 1/4-inch when using methods other than hydroseeding.

A. Dry Method:

1. Power Equipment: Use mechanical seeders, seed drills, landscape seeders, cultipacker seeders, fertilizer spreaders, or other approved mechanical seeding equipment or attachments when seed, limestone, and fertilizer are to be applied in dry form.
2. Manual Equipment: On areas which are inaccessible to power equipment, permission may be given to use hand-operated mechanical equipment when the materials are to be applied in dry form. The use of hand shovels to spread the materials will not be allowed.
3. Do not mix limestone and fertilizer together prior to their application, but work into the soil together to the specified depth.
4. After seeding, compact the entire area by a suitable roller weighing 60 to 90 lbs. per lineal foot.
5. Allow at least 24 hours between fertilizing and seeding.
6. Unless otherwise ordered, mulch areas covered with seed.

B. Hydraulic Method:

1. The application of grass, seed, fertilizer, limestone, and a suitable mulch, if approved, may be accomplished in one operation by the use of an approved spraying machine.
2. Mix materials with water in the machine and keep in an agitated state in order that the materials may be uniformly suspended in the water.
3. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of limestone, fertilizer, and grass seed are equal in quantity to the required rates.
4. Flush and clean hydraulic seeding and fertilizing machine each day before seeding is to be started, and thoroughly flush of all residue after the completion of application on every 10 acres.
5. If the results of the spray operations are unsatisfactory, abandon this method and apply the materials by the dry method.
6. When inoculum is required, mix with the seed and spray.
7. Compaction or rolling not required.
8. Unless mulch material required is applied during the seeding operation or within 1/2 hour following the seeding operation, take measures to protect the seed from sunlight and heat such as the use of a light brush dragged over the seeded areas to stir the seed into the soil, taking care not to carry the seed ahead.

3.05 CARE AFTER SEEDING:

A. Protect and care for seeded areas until final acceptance of the work, and repair any damage to seeded areas caused by pedestrian or vehicular traffic or other causes, at the Contractor's expense.

B. If necessary, place barricades of brush or other materials and suitable signs to protect the seeded areas.

C. Apply water to maintain proper moisture to promote growth. Use approved water wagons or tanks or other approved devices to apply water in the form of a spray or sprinkle without erosive force. Apply water prior to 10:00 a.m. and after 4:00 p.m. to minimize losses due to evaporation.

D. Cut back weeds growing in seeded areas to prevent them from dominating the desired grass plants.

E. Hay mulch to be provided as described on the Drawings.

F. To be acceptable, a stand of grass shall show a reasonably thick, uniform stand, free from sizable areas of thin or bare spots, with a uniform count of at least 1000 plants of grass per square foot.

G. Reseed any parts of seeded areas which fail to show a uniform stand until all areas are covered with grass, at the Contractor's expense.

H. Maintenance Period:

1. This period shall extend for 90 days or until the turf has been mowed 3 times or until all work on the entire area has been completed and accepted.
2. In this time do all necessary mowing to keep the grass between 3 and 6 inches in height.
3. Acceptable grass areas shall have a coverage of not less than 80% of permanent grasses at the termination of the maintenance period.

END OF SECTION

APPENDIX B-5

SECTION 02935

WETLANDS RESTORATION

SECTION 02935

WETLANDS RESTORATION

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE:
- A. Erosion Control: Section 02271
- B. Excavation, Backfill, and Compaction: Section 02221
- C. Erosion Control Details

1.02 DESCRIPTION:
- A. Where indicated on the Drawings, restore wetlands vegetation as described herein. Furnish and place plants and seed in the areas indicated, and monitor and maintain vegetation throughout the wetlands restoration period.
- B. Wetland restoration planting activities under this contract are to consist of seeding and mulching the backfilled excavation area as specified in this Section.

1.03 SUBMITTALS:
- A. Certification
  1. Submit data substantiating that materials comply with specified requirements.
  2. Submit seed vendor's certified statement for grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING:
- A. Packaged Materials:
  1. Deliver in containers showing weight, analysis and name of manufacturer.
  2. Protect materials from deterioration during delivery, and while stored at the site.

1.05 JOB CONDITIONS:
- A. Installer must examine the subgrade, verify the elevations, observe the conditions under which the work is to be performed, and notify the Engineer of unsatisfactory conditions.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- C. Proceed with and complete the work as rapidly as portions of the site become available, working within seasonal limitations for each kind of work required.
- D. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.
- E. Planting and Seeding Seasons: Unless variance is requested in writing and approved by the Engineer, planting and seeding shall be conducted between the months of April through September.

1.06 GUARANTEE:
- A. The period of the guarantee shall conform with the requirements of Paragraph 3.07.D of this specification.

B. Replant those areas, which in the opinion of the Engineer, show a poor stand of grass with the same material, size, and as originally specified at no additional cost.

PART 2 - PRODUCTS

2.01 MATERIALS: Obtain and retain as part of the project records, certifications, and/or labels of materials supplied.

A. Seed:

1. The wetland herbaceous seed mixture shall include no "primary noxious weed seeds."
2. Furnish in fully-labeled, standard sealed containers.
3. Percentage and germination of each seed type in the mixture, purity, and weed seed content of the mixture shall be clearly stated on the label.
4. The weight of pure live seed (PLS) is computed by the labeled purity percent times the labeled germination percent times the weight.
   a. To illustrate the method of computing to PLS from the tag basis, the following example is given: Required: 20 pounds PLS of a particular variety--stock available is 99.41% pure and 92% germination--20 divided by the product of 0.9941 and 0.92 equals 21.8 pounds on the tag basis to furnish 20 pounds of PLS.
5. Subject to the testing provisions of the Association of Official Seed Analysis, with the month and year of test clearly stated on the label.
6. May be tested after it has been delivered to the project.
7. Seed which has become wet, moldy, or otherwise damaged will not be acceptable.
8. Provide a seed seed mix that may include, but not be limited to, soft rush (Juncus effusus), bulrush (Scripus sp.), jewelweed (Impatiens capensis), tussock sedge (Carex stricta), manna grass (Glyceria sp.), and other sedge species (e.g., Carex lurdia).

B. Miscellaneous Landscape Materials:

1. Mulch:
   a. Hay or straw: Long fibered hay or straw, reasonably free from noxious weeds and other undesirable material. Do not use wet, decayed, or compacted as to inhibit even and uniform spreading. Do not use chopped hay, grass clippings or other short fibered material unless directed.

PART 3 - EXECUTION

3.01 PREPARATION:

A. All wetland restoration activities shall be in accordance with this specification and according to the construction drawings.

B. Prior to commencement of wetland sediment excavation, the area shall be staked by the Contractor. Staking shall include stakes defining grades, lines, and elevations specified in the drawings, as well as boundaries, depths of cuts, boundaries of wetland excavation, boundaries of wetland alteration, limits of work, and erosion control.

3.02 EROSION CONTROL:

A. An erosion control barrier consisting solely of staked haybales shall be placed downgradient of the restoration wetland in order to minimize erosion of restoration wetland soils into the unaltered wetland. The erosion control barrier will also serve to delineate the limit of construction work, which will include the area to be replanted and the surrounding area required to conduct the work.

B. If required by the wetland restoration specialist, disturbed upland areas adjacent to the restored wetland area will be graded, loamed, and seeded to prevent erosion. This shall be done in accordance with Section 02931 - Seeding.

C. All erosion control devices shall be inspected, repaired, and replaced as necessary.

D. Remove and dispose of all erosion control devices upon successful completion of the wetlands restoration or as directed by the Engineer.

3.03 ACCESS:

A. No vehicles, equipment, or pedestrian traffic shall be permitted within the wetland restoration area other than in association with said restoration and the construction of monitoring wells at the locations shown on the contract Drawings.

B. All equipment access (i.e., bulldozer, payloader, and backhoe) to the restoration area shall be from the altered regions, rather than from vegetated wetland. No equipment shall be permitted within adjacent, un-disturbed wetlands. No excavated materials, equipment, or supplies shall be deposited or stored on adjacent wetland areas, or within any other area subject to the jurisdiction of Section 404 of the Clean Water Act or the New York State Freshwater Wetlands Act.

C. If de-watering of the restoration area is necessary, pumping shall be implemented using best management practices, and sediment-laden water shall be discharged to an upland region of wetland surrounded by an earthen berm or siltation fencing, as approved by the Engineer.

3.04 SOIL REPLACEMENT:

A. Backfilling:

1. Backfilling shall commence immediately following acceptance of analytical results for the excavation area.
2. Backfilled materials shall be allowed to settle for approximately two weeks, or two substantial rainfall events.
3. Backfill material shall meet the requirements specified in Section 02221 - Excavation, Backfill, and Compaction.

B. Grading:

1. Prior to planting, and after backfilled soils have been allowed to settle, the restoration area shall be created to meet the grade existing prior to excavation activities.
2. Grading shall be refined so that spot elevations are within +/- 0.2 feet of the pre-excavation elevation.

C. All Areas to be Seeded:

1. Shall be worked with a disk, harrow, dragged with a chain, mat or blade, machine-raked, or hand-worked as necessary to provide a firm seedbed.
2. Shall meet the specified grades and are free of growth and debris.

3.05 APPLICATION:

A. Seeding:

1. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage.
2. Rates of Application:
   a. Seed: 1 lb/3,000 sq. ft.
3. Mechanical Method:
   a. Use broadcast seeding method of application.
4. Mulching:
   a. Hay or straw:
      (1) Spread evenly and uniformly over any designated areas or as directed by the Engineer in the field so to avoid damage to seeded areas.
      (2) Unless otherwise directed, apply mulch at the rate of 3 tons per acre.
      (3) Avoid heavy application.
      (4) Thin lumps and thick mulch material.

3.06 WATERING:

A. If necessary, thoroughly water all seeded areas immediately after seeding.
B. Apply water only by open-end hose at a very low pressure to avoid air pockets and displacement of seeds.
C. The Contractor is to provide water.

3.07 CARE AFTER SEEDING:

A. Protect and care for seeded areas until final acceptance of the work, and repair any damage to seeded areas caused by pedestrian or vehicular traffic or other causes, at the Contractor's expense.
B. Place a sign with the following or similar language in a visible location at the site which is acceptable to the Engineer: "Wetland Restoration Area - Please Do Not Disturb".
C. If necessary, apply water to maintain proper moisture to promote growth. Use approved water wagons or tanks or other approved devices to apply water in the form of a spray or sprinkle without erosive force. Apply water prior to 10:00 a.m. and after 4:00 p.m. to minimize losses due to evaporation.
D. The wetlands restoration shall be considered acceptable once the following criteria are met:
   1. At least 75 percent to the surface area of the restoration wetland shall be re-established with wetland plant species within 2 growing seasons following wetland restoration activities.
   2. At least 10 percent of the new wetland vegetation (by area) shall consist of woody wetland plant species (i.e., trees and/or shrubs) that are expected to seed in naturally from surrounding areas.
   3. At least 85 percent of the surface area of the restoration wetland shall be re-established with wetland plant species within 5 growing seasons following wetland restoration activities.

3.08 SUPPLEMENTAL PLANTING (NOT PART OF THIS CONTRACT)

A. Plant Materials:
   1. Provide plants and shrubs as specified in Table 02935-1.
   2. Substitutions: In the event that trees, shrubs, or other plant material specified in the drawings or plant list are in the opinion of the Contractor, impossible or unreasonably difficult to obtain, immediately notify the Engineer to discuss appropriate

substitutions. Do not substitute plant material without the prior approval of the Engineer.

3. Sizes: Plants larger than specified in the plant list may be used if approved by the Engineer, but use of such plants shall not increase the contract price. If the use of the larger plants is approved, the spread of roots or ball of earth will be in proportion to the size of the plants.
4. Grown under similar climatic conditions to the location of the project for at least 2 years prior to award date of this Contract.
5. Standard quality true to name and type and first class representatives of their species or variety.
6. Normal, well-developed branches and vigorous fibrous root system.
7. Healthy, vigorous plants free from defects, decay, disfiguring roots, sun-scald injuries, abrasions of the bark, plant diseases, insect pests, eggs, borers, and all forms of infestations or objectionable disfigurements.
8. Source of supply of all plant material shall be given in writing.
9. In preparing plants for moving, take all precautions customary in good trade practice.
10. Dig all plants immediately before moving unless otherwise specified or recommended by supplier.
11. Balled and burlapped plants: Prepare with a solid ball of earth of minimum specified size held in place securely by burlap and a stout rope.
12. Oversize or exceptionally heavy plants: Acceptable if the size of the ball or spread of the roots is proportionately increased to the satisfaction of the Engineer.
13. Broken, loose, or manufactured balls: Not acceptable.
14. Pack, transport and handle all plants with utmost care to insure adequate protection against injury and drying.
15. Any inspection certificates required by law shall accompany each shipment invoice or order of stock and, on arrival, file the certificate with the Engineer.
16. Provide container grown freshly dug plant materials.
17. Do not use plant materials which have been in cold storage or heeled-in.
18. Do not prune prior to delivery.
19. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape.
20. Provide protective covering during delivery.
21. Deliver plant materials after preparation for planting is completed and plant immediately.
22. If planting is delayed more than 6 hours after delivery, set shrubs in shade, protect from weather and mechanical damage, and keep roots moist.
23. Do not remove container grown stock from containers until planting time.
24. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.
25. Inspection: The Engineer reserves the right to inspect tress and shrubs either at place of growth or at site prior to planting, for compliance with requirements for name, variety, size and quality.

B. Guarantee:

1. The period of the guarantee shall conform with the requirements of Paragraph 3.07.D of this specification.

2. Remove and replace trees and shrubs found to be dead or in unhealthy condition during guarantee period.
3. Replant missing trees and shrubs.
4. Make replacements during the specified planting seasons following end of guarantee period.
5. Furnish and plant replacements which comply with requirements shown and specified.
6. Also, replace trees and shrubs which are in doubtful condition at end of guarantee period unless, in the opinion of the Engineer it is advisable to extend guarantee period for a full growing season.
7. The Engineer will make another inspection at the end of extended guarantee period, if any, to determine acceptance or rejection.
8. If more than 30 percent of the woody species within the wetland restoration area fail to survive the initial growing season, additional supplemental or replacement plantings shall be made. Replacement plantings shall be of the same size and species specified in Table 02935-1.

C. Preparation:
1. Because achievement of the proper elevation is critical to the overall success of the restored wetland area, elevations within the wetland restoration area shall be re-evaluated prior to supplemental planting and , if necessary, regrading shall be conducted until spot elevations are within +/- 0.2 feet of the original (pre-excavation) elevation.
2. The contractor shall construct a base map depicting locations and distribution of plants or groups of plants within the restoration area. This map shall be submitted to the wetland restoration specialist for approval prior to commencement of any supplemental planting activities.
3. Excavate pits in accordance with Typical Planting Details with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage.
4. Loosen hard subsoil in bottom of excavation.
5. For balled and burlapped trees and shrubs, make excavations at least twice as wide as the ball diameter plus allowance for setting of ball on a 12" or 9" layer of planting soil mixture, respectively.
6. For container grown stock, excavate as specified for ball and burlapped stock, adjusted to size of container width and depth.

D. Planting:
1. Prior to planting, plant locations shall be staked for approval by the Engineer and plantings of trees and shrubs shall be interspersed to maximize species diversity.
2. Balled and burlapped stock:
   a. Set on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades.
   b. When set, carefully remove burlap from sides of balls; retain on bottom only if removal is impossible without damage to root balls.
   c. Place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets.
   d. When excavation is approximately 2/3-full, water thoroughly before placing remainder of backfill.
   e. Repeat watering until no more is absorbed.

f. Water again after placing final layer of backfill.

3. Container grown stock: Set as specified for balled and burlapped stock, removing containers in such a way as to not damage roots.
4. Dish completed planting pits to form shallow saucer to collect water.

END OF SECTION

Table 02935-1
Supplemental Restoration Planting (NOT PART OF THIS CONTRACT)

SPECIES	SIZE	FORM	SPACING/DENSITY	TOTAL NUMBER
Trees				
Acer rubrum	5-6 ft height	B&B	30 ft o.c.	TBD
Fraxinus nigra	5-6 ft height	B&B	30 ft o.c.	TBD
Thuja occidentalis	5-6 ft height	B&B	30 ft o.c.	TBD
Shrubs				
Cornus stolonifera	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Vaccinium corymbosum	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Sambucus canadensis	3-4 ft height	B&B [1]	20 ft o.c.	TBD
Viburnum recognitum	3-4 ft height	B&B [1]	20 ft o.c.	TBD

NOTES:
1. If shrubs are not available as B&B, then plants shall be supplied in 3 gallon containers.

o.c. = On Center
B&B = Balled and Burlapped
TBD = To Be Determined

BORING LOGS FOR MONITORING WELLS MW-102A, MW-102B, MW-301, MW-302, MW-303

NORTHERN TECHNICAL SERVICES

8 East Main Street, Malone NY 12953

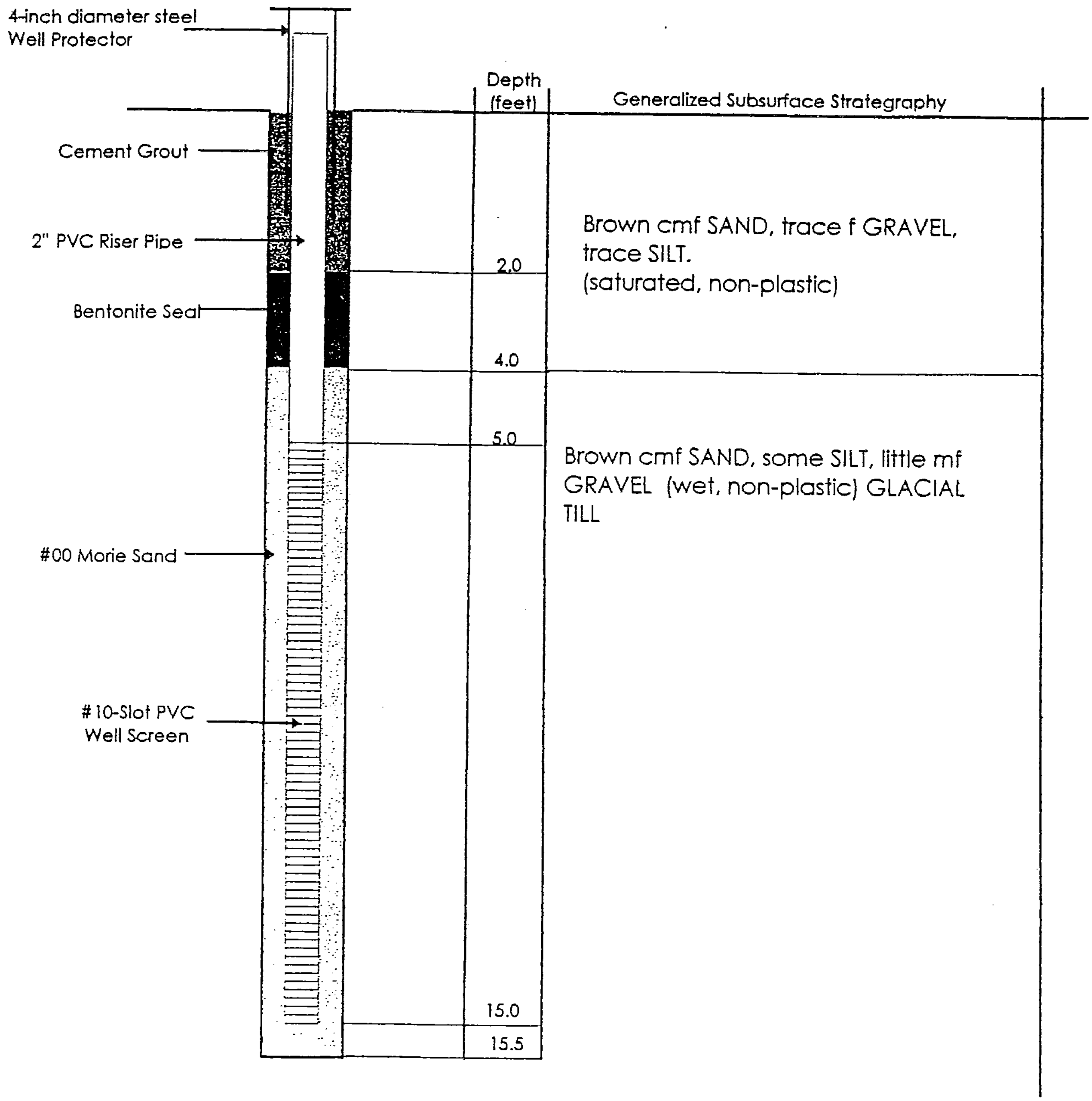
MONITOR WELL INSTALLATION DETAIL

CLIENT: IEM Sealand Corporation
North Lawrence, New York

Well No.: MW-301
NTS Report No.: JN103-3-7-97

PROJECT: North Lawrence Oil Dump Site
North Lawrence, New York

Date: 7/1/97
DRILLERS: C. Wheeler, L. DeBuque



7/21/97 TEN

NORTHERN TECHNICAL SERVICES
8 East Main Street, Malone, New York 12953
Phone (518) 481-5008, Fax 483-2932

FIELD DATA SHEET
MONITOR WELL EVACUATION AND SAMPLING

HISTORICAL:

Project: North Lawrence Oil Dump — Well Number: MW-301
North Lawrence, N.Y. — NTS Project No.: JN103-3-7-97

Client: IEM Sealand Corp — Well Depth: 15.0 Feet
North Lawrence, N.Y. — Well Diameter: 2.0 Inches

EVACUATION:

Development method: Pump & Surge — Date: 7/3/97

Initial Static Water Level: 1.41 Feet B.G.S. — Developer(s): C. Wheeler

Event	Water Level (Ft.) B.G.S.	Time	Cum. amt. rem.	Temp. (°F)	pH (S.U.)	Cond. (MHOS)	Turbidity (NTU)	COMMENTS (color, odor, turbidity, recovery)
one	1.41	8:00	5 gal	53		690	129	No odor very turbid
two	2.23	10:20	10 gal	56			120	Slow Recovery
three	1.91	13:40	20 gal	55		660	101	
four	2.12	15:45	30 gal	56		630	51	
five								
six								

Well Volume Calculations

diameter	volume
1 1/2"	0.092 gal/feet
2"	0.163 gal/feet
3"	0.367 gal/feet
6"	1.47 gal/feet

Volume ≈ 2.2 gal

SAMPLING:

Date: _____ Time: _____ Sampled by: _____

Weather: _____ Field refrigeration: yes no

COMMENTS:

7/21/97 TEL

NORTHERN TECHNICAL SERVICES

8 East Main Street, Malone NY 12953

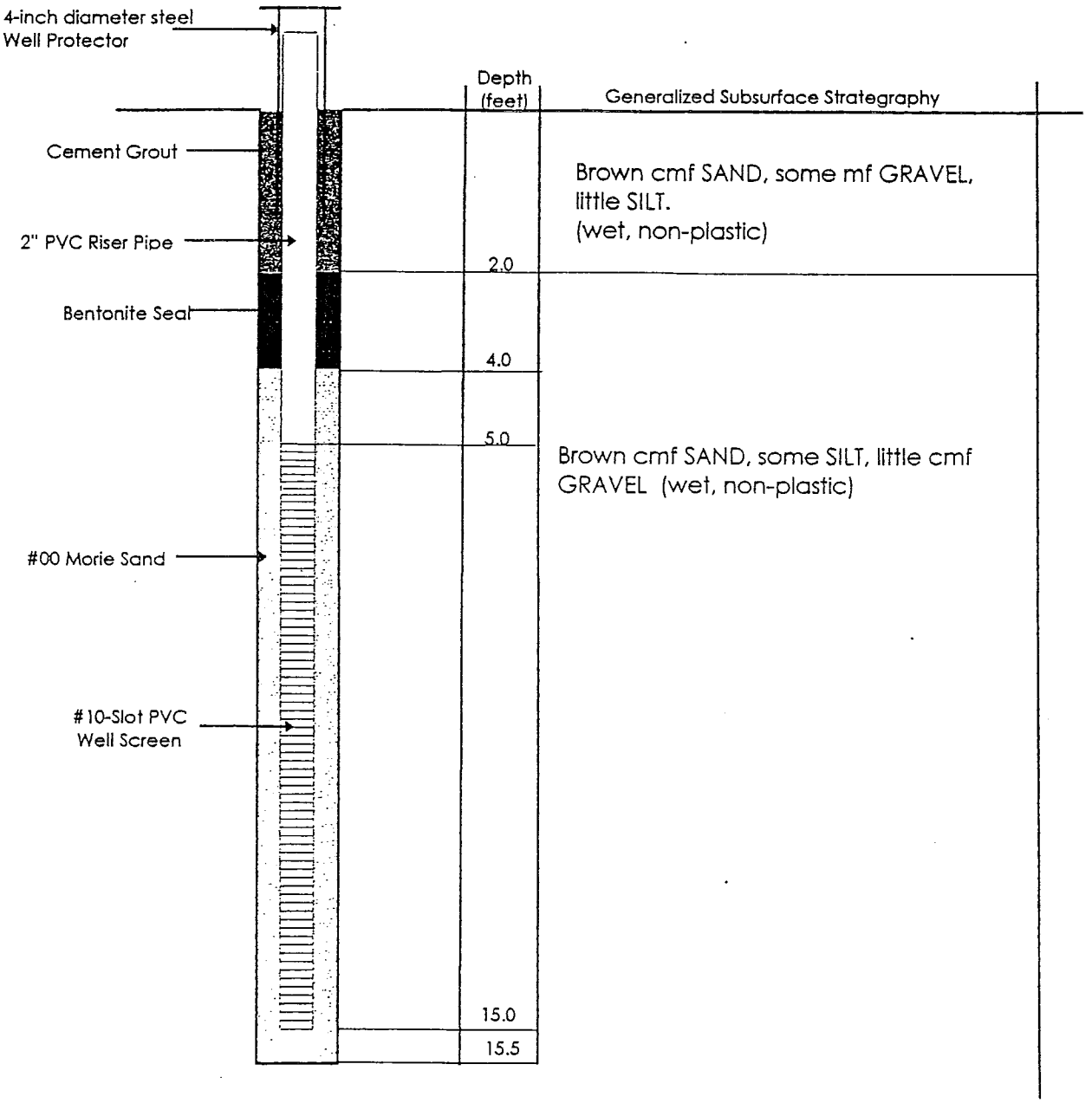
MONITOR WELL INSTALLATION DETAIL

CLIENT: IEM Sealand Corporation
North Lawrence, New York

Well No.: MW-302
NTS Report No.: JN103-3-7-97

PROJECT: North Lawrence Oil Dump Site
North Lawrence, New York

Date: 7/2/97
DRILLERS: C. Wheeler, L. DeBuque



NORTHERN TECHNICAL SERVICES
8 East Main Street, Malone, New York 12953
Phone (518) 481-5008, Fax 483-2932

FIELD DATA SHEET
MONITOR WELL EVACUATION AND SAMPLING

HISTORICAL:

Project: North Lawrence Oil Dump — Well Number: MW-302
North Lawrence, N.Y. — NTS Project No.: JN103-3-7-97

Client: TEM Sealand Corp — Well Depth: 15.0 Feet
North Lawrence, N.Y. — Well Diameter: 2.0 Inches

EVACUATION:

Development method: Pump & Surge — Date: 7/3/97

Initial Static Water Level: 1.80 Feet BGS — Developer(s): C. Wheeler

Event	Water Level (Ft.) BGS	Time	Cum. amt. rem.	Temp. (°F)	pH (S.U.)	Cond. (MHOS)	Turbidity (NTU)	COMMENTS (color, odor, turbidity, recovery)
one	1.80	8:30	5 gal	60		710	160	Brown very turbid.
two		11:00	10 gal	57			120	slow recovery
three	2.32	14:10	20 gal	56		680	90	
four	2.91	16:30	30 gal	57		690	45	
five								
six								

Well Volume Calculations

diameter	volume
1 1/2"	0.092 gal/feet
2"	0.163 gal/feet
3"	0.367 gal/feet
6"	1.47 gal/feet

Volume ≈ 2.1

SAMPLING:

Date: _____ Time: _____ Sampled by: _____

Weather: _____ Field refrigeration: yes no

COMMENTS:

7/21/97 JEV

NORTHERN TECHNICAL SERVICES

8 East Main Street, Malone NY 12953

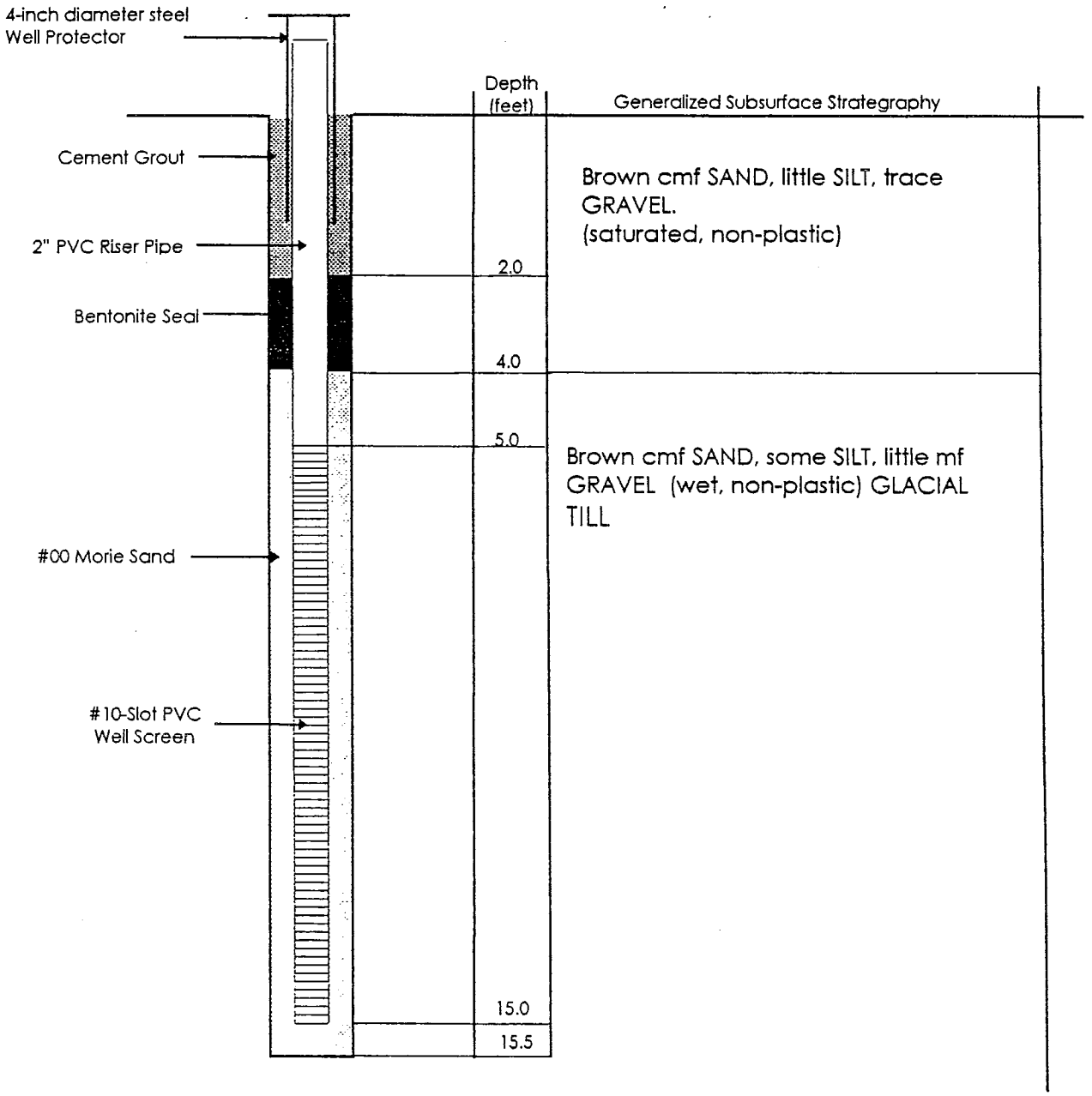
MONITOR WELL INSTALLATION DETAIL

CLIENT: IEM Sealand Corporation
North Lawrence, New York

Well No.: MW-303
NTS Report No.: JN103-1-7-97

PROJECT: North Lawrence Oil Dump Site
North Lawrence, New York

Date: 7/2/97
DRILLERS: C. Wheeler, L. DeBuque



7/2/97 VER

NTS
8 East Main Street, Malone, New York 12953
Phone (518) 481-5008, Fax 483-2932

FIELD DATA SHEET
MONITOR WELL EVACUATION AND SAMPLING

HISTORICAL:

Project: North Lawrence O.I Dump
North Lawrence, N.Y.
Well Number: MW-303
NTS Project No.: JN103-3-7-97

Client: IEM Sealand Corp.
North Lawrence N.Y.
Well Depth: 15.0 Feet
Well Diameter: 2.0 Inches

EVACUATION:

Development method: Pump & Surge
Date: 7/3/97

Initial Static Water Level: 2.30 B.G.S. Feet
Developer(s): C. Wheeler

Event	Water Level (Ft.)	Time	Cum. amt. rem.	Temp. (°F)	pH (S.U.)	Cond. (MHOS)	Turbidity (NTU)	COMMENTS (color, odor, turbidity, recovery)
one	2.30	7:30	10 gal	57			500	No odor Very turbid
two	2.69	9:45	30 gal	56			120	Turbid, Fair recovery
three	2.51	12:30	45 gal	54		690	80	
four	2.40	15:00	60 gal	55		630	50	clear, no odor
five								
six								

Well Volume Calculations

diameter	volume
1 1/2"	0.092 gal/feet
2"	0.163 gal/feet
3"	0.367 gal/feet
6"	1.47 gal/feet

SAMPLING:

Date: _____ Time: _____ Sampled by: _____

Weather: _____ Field refrigeration: yes no

COMMENTS:

			BORING NO. 102A
CLIENT NORTH LAWRENCE OIL DUMP SITE			PROJECT NO. 5809-02
CONTRACTOR AMERICAN AUGER AND DITCHING, INC.		DATE STARTED 3-27-89	COMPLTD. 3-28-89
METHOD Wireline	CASING SIZE 4"	HNU 11.7/10.2	PROTECTION LEVEL MOD. D
GROUND EL	SOIL DRILLED 40.4'	ROCK DRILLED 0'	BELOW GROUND
LOGGED BY M.J. Woodruff	CHECKED BY Ciarchetto	DATE 4-29-89	Page 1 of 2

DEPTH (FT)	HNU AMB. AIR	SAMP NO. & TYPE NO.	SAMPLE	CLP	GC	OTHER	FEET RECOVERY	SOIL/ROCK DESCRIPTION	SOIL CLASS OR ROCK FRACTURES	BLOWS/6-IN	WELL DATA	EL. (FT)
0		S-1	✓				1.5/2.0	0.4' Organics, grass, roots, mat, frozen. 0.6' Silty-sand, brown, some coarse gravel, dry, frozen. 0.2' Gravel, fine, dry. 0.3' Sand, orange-brown, fine to medium dry.		7 8 9 9		0 concrete
5		S-2	✓				1.4/2.0	Sand, light brown, fine to coarse, some fine gravel, trace cobbles, dry to moist.		31 22 23 29		5
10		S-3	✓				1.4/2.0	Sand, light brown, fine to coarse, some medium gravel, trace silt, trace cobble, moist.		33 30 47 70		10
15		S-4	✓				1.1/1.1	Till, sand and silt, gray, fine, moist.		35 110 50(1")		15 Grout
20		S-5	✓				1.4/1.9	Till, silty-sand, gray, fine, trace small to medium gravel, saturated.		21 30 43 100(4.5")		20
25		S-6	✓				1.1/1.4	Till, sand, gray, fine to coarse, some small to medium gravel, saturated.		38 75 100(5")		25 seal
30		S-7	✓				0.4/0.9	Till, silty-sand, gray, fine, little fine gravel, few boulders, wet.		96 100(4")		30 silica sand
35		S-8					0/0.2	Boulder - no sample.		50(4")		35
40												40

* U= THIN WALL S= SPLIT SPOON R= ROCK

E.C. JORDAN CO.

BORING NO. 102A

CLIENT NORTH LAWRENCE OIL DUMP SITE | PROJECT NO. 5809-02

CONTRACTOR AMERICAN AUGER AND DITCHING, INC. | DATE STARTED 3-27-89 | COMPLTD. 3-28-89

METHOD WIRELINE | CASING SIZE 4" | HNU 11.7/10.2 | PROTECTION LEVEL MOD. D

GROUND EL | SOIL DRILLED 40.4' | ROCK DRILLED 0 | BELOW GROUND

LOGGED BY M.J. Woodruff | CHECKED BY Gianchetto | DATE 4-29-89 | Page 2 of 2

DEPTH (FT)	HNU AMB. AIR	SAMP NO. & TYPE NO.	SAMPLE	CLP	GC	OTHER	FEET RECOVERY	SOIL/ROCK DESCRIPTION	SOIL CLASS OR ROCK FRACTURES	BLOWS/6-IN	WELL DATA	EL. (FT)
40		S-9	✓		✓		0.3/0.4	Till, silty-sand, fine to medium, some medium gravel, moist.		103 (5")		40.4
								B.O.E. at 40.4 feet				
45												

* U= THIN WALL S= SPLIT SPOON R= ROCK

E.C. JORDAN CO.

BORING NO. 102B

CLIENT NORTH LAWRENCE OIL DUMP SITE			PROJECT NO. 5809-02
CONTRACTOR AMERICAN AUGER AND DITCHING, INC.		DATE STARTED 3-28-89	COMPLTD. 3-29-89
METHOD Wireline	CASING SIZE 4"	HNU 11.7/10.2	PROTECTION LEVEL MOD. D
GROUND EL	SOIL DRILLED 10'	ROCK DRILLED 0'	BELOW GROUND
LOGGED BY M.J. Woodruff	CHECKED BY Gianchette	DATE 4-29-89	Page 1 of 1

DEPTH (FT)	HNU AMB. AIR	SAMP NO. & TYPE NO.	SAMPLE	CLP	GC	OTHER	FEET RECOVERY	SOIL/ROCK DESCRIPTION	SOIL CLASS OR ROCK FRACTURES	BLOWS/6-IN	WELL DATA	EL. (FT)
		S-1					0/0.4	NO RECOVERY		58 (5")		0 Concrete
5												3 Seal 4 5 silica sand
		S-2	✓		✓		0.3/0.9	Silty-sand, brown, little medium gravel, saturated.		65 125 (5")		
10								Boulders				10
								B.O.E. at 10 feet				

* U= THIN WALL S= SPLIT SPOON R= ROCK

E.C. JORDAN CO.

HISTORICAL GROUNDWATER ANALYTICAL DATA FROM THE REMEDIAL INVESTIGATION REPORT (E.C. JORDAN CO., 1993)

TABLE 4-1

WATER LEVEL DATA

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

LOCATION	GROUND SURFACE (ft. MSL)	RISER ELEVATION (ft. MSL)	1989								
			3-20	3-22	3-23	3-24	3-24	3-27	3-28	3-30	4-3
PZ-1	387.16	388.93	384.03	384.03	384.08	384.13	384.08	385.30	386.10	–	386.12
PZ-2	390.41	392.53	386.18	386.18	386.13	386.22	386.03	386.92	387.32	–	388.88
PZ-3	391.04	392.79	386.94	386.54	386.79	386.84	386.79	388.09	388.68	–	389.29
PZ-4	393.08	396.15	386.25	386.15	386.20	386.25	386.20	386.83	387.20	–	388.47
PZ-5	393.29	395.56	389.36	388.01	389.01	389.08	388.96	390.89	391.41	–	390.90
PZ-6	384.47	386.74	383.19	383.08	383.08	383.24	383.14	384.17	384.27	–	384.62
PZ-7	385.21	386.92	383.32	383.05	383.22	383.27	383.22	384.07	384.42	–	384.68
PZ-8	382.86	394.82	381.57	381.57	381.62	381.62	381.62	381.97	382.02	–	377.79
MW-101A	390.66	392.88	–	–	–	–	–	–	–	387.96	388.34
MW-101B	390.44	392.78	–	–	–	–	–	–	–	388.11	388.96
MW-102A	393.72	395.86	–	–	–	–	–	–	–	389.31	389.80
MW-102B	394.26	396.30	–	–	–	–	–	–	–	389.97	390.37
MW-103	387.87	390.16	–	–	–	–	–	–	–	388.05	–
MW-104A	385.52	387.03	–	–	–	–	–	–	–	–	–
MW-104B	384.85	386.58	–	–	–	–	–	–	–	–	–
MW-105A	385.82	387.72	–	–	–	–	–	–	–	–	–
MW-105B	385.54	387.65	–	–	–	–	–	–	–	384.06	384.50
MW-106	384.85	386.85	–	–	–	–	–	–	–	384.36	384.37
MW-107A	382.51	384.50	–	–	–	–	–	–	–	–	382.89
MW-107B	382.62	385.24	–	–	–	–	–	–	–	381.82	381.92
MW-201	386.90	388.58	–	–	–	–	–	–	–	–	–
MW-202	388.90	391.21	–	–	–	–	–	–	–	–	–
MW-203	393.30	395.11	–	–	–	–	–	–	–	–	–
MW-204	380.90	382.69	–	–	–	–	–	–	–	–	–

(continued)

TABLE 4-1

WATER LEVEL DATA

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

LOCATION	GROUND SURFACE (ft. MSL)	RISER ELEVATION (ft. MSL)	1989							
			4-10	4-11	4-13	4-14	5-9	5-10	5-11	5-12
PZ-1	387.16	388.93	385.73	–	385.53	385.49	384.73	384.55	384.61	384.77
PZ-2	390.41	392.53	389.03	–	388.92	388.85	387.93	387.76	387.89	388.12
PZ-3	391.04	392.79	389.29	–	389.21	389.11	387.92	387.76	388.01	388.27
PZ-4	393.08	396.15	389.40	–	389.19	389.10	389.44	389.22	–	389.38
PZ-5	393.29	395.56	391.00	–	390.82	390.74	389.81	389.59	389.57	389.75
PZ-6	384.47	386.74	384.20	–	384.16	384.18	383.23	383.09	383.30	383.46
PZ-7	385.21	386.92	384.24	–	384.19	384.17	383.12	382.85	383.16	383.31
PZ-8	382.88	394.82	381.57	–	381.52	381.53	380.61	380.54	380.62	380.72
MW-101A	390.66	392.88	388.44	388.35	388.35	388.28	387.38	387.29	387.27	387.44
MW-101B	390.44	392.78	389.19	389.03	389.09	388.98	388.07	387.94	387.97	388.23
MW-102A	393.72	395.86	390.14	–	390.04	389.96	389.12	–	390.36	389.38
MW-102B	394.26	396.30	391.10	391.03	391.02	390.96	390.07	–	390.23	390.12
MW-103	387.87	390.16	388.21	388.09	388.05	388.02	386.94	386.93	386.96	386.95
MW-104A	385.52	387.03	–	–	384.75	384.30	383.32	383.25	383.38	383.56
MW-104B	384.85	386.58	–	–	383.89	384.31	383.24	383.26	383.26	383.46
MW-105A	385.82	387.72	384.82	384.72	384.74	384.73	383.71	382.65	383.12	383.87
MW-105B	385.54	387.65	383.84	383.73	*	383.79	382.64	382.67	382.78	383.04
MW-106	384.85	386.85	383.95	383.84	383.88	383.85	382.83	382.93	382.77	383.55
MW-107A	382.51	384.50	382.64	382.58	382.60	382.53	381.61	381.57	381.55	381.69
MW-107B	382.62	385.24	381.59	381.56	381.56	381.57	380.67	380.81	380.76	380.79
MW-201	386.90	388.56	–	–	–	–	–	–	–	–
MW-202	388.90	391.21	–	–	–	–	–	–	–	–
MW-203	393.30	395.11	–	–	–	–	–	–	–	–
MW-204	380.90	382.69	–	–	–	–	–	–	–	–

(continued)

TABLE 4-1
WATER LEVEL DATA
NORTH LAWRENCE OIL DUMP SITE
REMEDIAL INVESTIGATION

LOCATION	GROUND SURFACE (ft. MSL)	RISER ELEVATION (ft. MSL)	1991			1992		
			11-13	11-16	11-20	1-13-92	1-15-92	6-5-92
PZ-1	387.16	388.93	380.26	380.59	381.48	383.78	-	384.45
PZ-2	390.41	392.53	381.38	381.19	383.40	386.25	384.89	387.57
PZ-3	391.04	392.79	380.94	381.03	382.68	386.38	-	387.95
PZ-4	393.08	396.15	379.01	DRY	379.38	386.60	386.69	389.15
PZ-5	393.29	395.56	379.83	-	380.89	386.34	386.61	390.13
PZ-6	384.47	386.74	379.60	380.63	-	382.59	-	383.35
PZ-7	385.21	386.92	380.57	381.57	382.31	383.22	-	383.37
PZ-8	382.86	384.82	380.00	381.20	380.90	381.05	-	381.12
MW-101A	390.66	392.88	381.12	381.42	383.05	385.88	386.43	387.04
MW-101B	390.44	392.78	381.42	381.60	383.73	386.39	387.04	387.72
MW-102A	393.72	395.86	380.56	380.76	383.81	386.91	387.11	388.94
MW-102B	394.26	396.30	DRY	384.42	382.30	387.94	387.65	389.99
MW-103	387.87	390.16	380.44	384.49	383.32	385.66	-	-
MW-104A	385.52	387.03	379.79	380.42	380.83	392.98	-	383.74
MW-104B	384.85	386.58	379.70	381.03	381.08	382.51	-	383.07
MW-105A	385.82	387.72	380.62	381.87	382.37	383.56	-	383.83
MW-105B	385.54	387.65	380.46	382.26	382.31	382.87	-	382.87
MW-106	384.85	386.85	380.65	382.34	382.52	382.72	383.60	383.07
MW-107A	382.51	384.50	380.17	381.26	381.18	381.67	Frozen	381.66
MW-107B	382.62	385.24	380.02	381.19	380.94	381.12	381.29	381.12
MW-201	386.90	388.56	-	-	369.41	377.16	-	382.22
MW-202	388.90	391.21	-	378.31	378.79	381.8	382.08	387.58
MW-203	393.30	395.11	-	-	379.53	385.83	-	388.76
MW-204	380.90	382.69	-	-	380.44	Frozen	-	380.54

Notes:

ft. MSL = feet mean sea level

* = Bailed prior to water levels being collected.

TABLE 5–14

SUMMARY OF VOLATILE ORGANIC DATA FOR FIRST PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

SAMPLE LOCATION	PARAMETER (µg/L)				
	ACETONE	2–BUTANONE	TRICHLOROETHENE	BENZENE	TETRACHLOROETHENE
CRQL	10	10	5	5	5
MW–101A	–	R	–	–	–
MW–101B	–	36 J	–	–	–
MW–102A	–	–	–	–	–
MW–102B	–	–	–	–	–
MW–102B DUP	–	–	–	–	–
MW–103	–	R	–	–	–
MW–103 DUP	–	R	–	–	–
MW–104A	–	R	–	–	–
MW–104B	–	–	93	12	42
MW–105A	–	R	–	–	–
MW–105B	–	–	–	–	–
MW–106	32	–	–	–	–
MW–107A	–	4000 JD	–	–	–
MW–107B	–	–	–	–	–

Notes:

– = Not detected

CRQL = Contract Required Quantitation Limit

D = Sample concentration was obtained by dilution to bring result within calibration range.

J = Estimated value due to non–compliant quality control criteria.

R = Rejected value due to non–compliant quality control criteria.

µg/L = micrograms per liter

TABLE 5–15

SUMMARY OF VOLATILE ORGANIC DATA FOR SECOND PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

SAMPLE LOCATION	PARAMETER (µg/L)		
	ACETONE	TRICHLOROETHENE	TETRACHLOROETHENE
CRQL	10	5	5
MW-101A	–	–	–
MW-101B	–	–	–
MW-102A	10B	–	–
MW-102B	–	–	–
MW-103	–	–	–
MW-104A	–	–	–
MW-104B	–	34	14
MW-105A	–	–	–
MW-105B	24B	–	–
MW-106	–	–	–
MW-107A	–	–	–
MW-107B	–	–	–
MW-201	–	–	–
MW-202	–	–	–
MW-203	11B	–	–
MW-203 (DUP)	–	–	–
MW-204	–	–	–

Notes:

– = Not detected

B = Analyte was detected in both the sample and the associated laboratory method blank.

CRQL = Contract Required Quantitation Limit

µg/L = micrograms per liter

TABLE 5–16

SUMMARY OF SEMIVOLATILE ORGANIC DATA FOR SECOND PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

SAMPLE LOCATION	PARAMETER (µg/L)
	bis(2–Ethylhexyl)phthalate
MDL	10
MW–201	10
MW–202	–
MW–203	–
MW–203 (DUP)	–

Notes:

DUP = duplicate sample was collected

MDL = method detection limit

µg/L = micrograms per liter

TABLE 5-17

SUMMARY OF INORGANIC DATA FOR FIRST PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

PARAMETER (µg/L)	CRQL (µg/L)	MW-101A	MW-101B	MW-102A	MW-102B	MW-102B DUP	MW-103	MW-103 DUP	MW-104A	MW-104B	MW-105A	MW-105B	MW-106	MW-107A	MW-107B
Aluminum	200	–	–	–	–	–	–	–	–	–	–	–	1100	–	–
Barium	200	–	–	–	–	–	–	–	–	–	–	–	–	–	520
Beryllium	5	–	–	–	–	–	–	–	5	–	–	–	–	5	–
Calcium	5000	43000	43600	17500	39100	39800	46100	50100	50600	49100	48600	54900	29100	27000	33200
Chromium	10	–	–	–	–	–	–	–	10	–	–	–	–	–	–
Cobalt	50	–	–	–	–	–	–	70	–	–	–	–	–	–	50
Iron	100	–	–	–	–	–	–	–	1490 J	–	2120 J	–	720 J	–	730 J
Magnesium	5000	17700	21000	5570	10500	10200	18000	20300	20800	27400	20700	24700	9640	23900	15100
Manganese	15	71	33	–	92	103	408	447	1210	62	47	253	44	46	190
Potassium	5000	–	–	34000 J	–	–	–	–	–	–	–	–	5980 J	6400 J	–
Sodium	5000	14000	7000	27000	–	–	5000	5000	53000	15000	9000	12000	14000	18000	73000
Zinc	20	–	–	–	–	65 J	–	–	–	7390 J	–	–	–	–	–

Notes:

CRQL = Contract Required Quantitation Limit

J = Indicates an estimated concentration because quality control criteria were not met.

µg/L = micrograms per liter

TABLE 5-18

SUMMARY OF INORGANIC DATA FOR SECOND PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

PARAMETER (µg/L)	CRQL (µg/L)	MW-101A	MW-101B	MW-102A	MW-102B	MW-103	MW-104A	MW-104B	MW-105A	MW-105B	MW-106	MW-107A
Aluminum	200	8780	15400	–	586	985	10000 E*	347 E*	–	45300	8810 E*	65900 E*
Arsenic	10	–	–	–	–	–	–	–	–	–	–	19.7 N
Barium	200	–	283	–	–	–	–	261	–	986	–	894
Calcium	5000	77500	109000	30000	49600	79000	85600	68800	47500	274000	91000	253000
Chromium	10	43	53	–	–	–	49.1*	10.4*	–	77.8	34.6*	146*
Copper	25	29.9	77.8	–	–	–	–	–	–	73.3	–	392
Iron	100	12700	22200	338	775	1730	17200	2590	1060	73700	14400	101000
Lead	3	13	17.8	–	–	–	11.9 S	–	–	41.8 S	8.4	47.1
Magnesium	5000	31100	46700	13300	21200	30200	44800	26400	22200	101000	24000	106000
Manganese	15	275	884	18.7	28.9	84.2	347	1320	27.2	1620	439	2590
Mercury	0.2	–	–	–	–	–	–	–	–	–	–	0.56
Nickel	40	45.6	45.6	–	–	–	–	–	–	87.9	–	321
Potassium	5000	–	–	–	–	–	5830	–	–	12000	–	25100
Silver	10	–	–	–	–	–	–	–	–	–	–	–
Sodium	5000	8600	8290	–	–	–	15000	47600	6650	11000	9020	19700
Vanadium	50	–	–	–	–	–	–	–	–	87.7	–	102
Zinc	20	853	62.1	–	49.1	–	24200*	–	41.4	355	42.3*	2830*

(continued)

TABLE 5–18

SUMMARY OF INORGANIC DATA FOR SECOND PHASE GROUNDWATER SAMPLES

NORTH LAWRENCE OIL DUMP SITE

REMEDIAL INVESTIGATION

PARAMETER (µg/L)	CRQL (µg/L)	MW–107B	MW–201	MW–202	MW–203	MW–203 DUP	MW–204
Aluminum	200	2460 E*	–	–	1710	800	25700 E*
Arsenic	10	–	–	–	–	–	–
Barium	200	506	–	–	–	–	518
Calcium	5000	38900	53500	88500	73900	68500	89400
Chromium	10	9.1	–	–	43.6	38.9	67.1*
Copper	25	–	–	–	29.9	28.4	58.6
Iron	100	4480	143	191	2990	1760	32000
Lead	3	3.1	–	–	–	–	12.5
Magnesium	5000	19000	23200	43700	29500	27400	44100
Manganese	15	225	341	370	101	61.3	887
Mercury	0.2	–	–	–	–	–	–
Nickel	40	–	–	–	–	–	124
Potassium	5000	–	–	–	–	–	10500
Silver	10	–	29.9	–	–	–	–
Sodium	5000	81000	–	14100	–	–	43600
Vanadium	50	–	–	–	–	–	58.8
Zinc	20	–	–	23.2	22.7	–	110*

Notes:

* = Duplicate analysis was not within control limits.

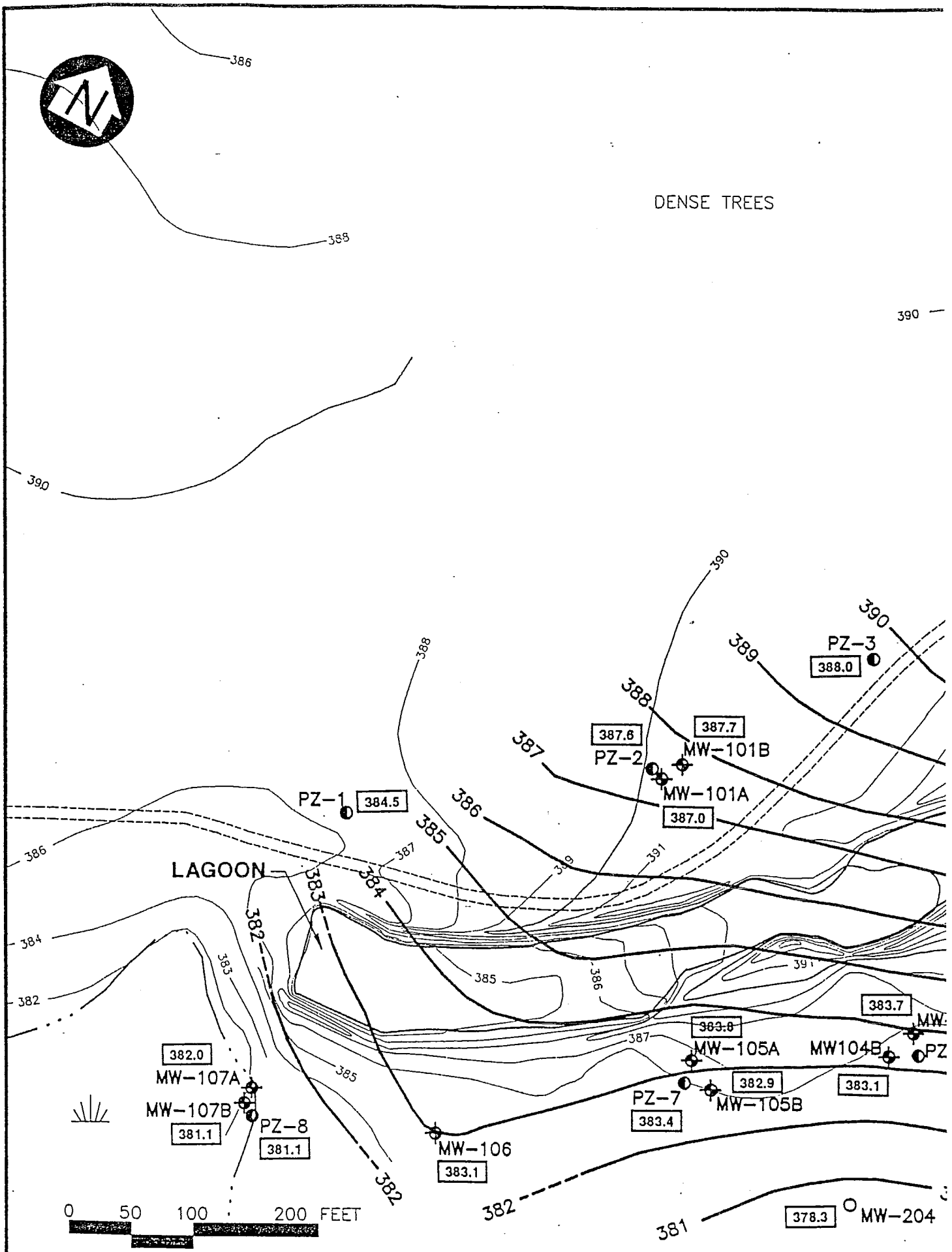
CRQL = Contract Required Quantitation Limit

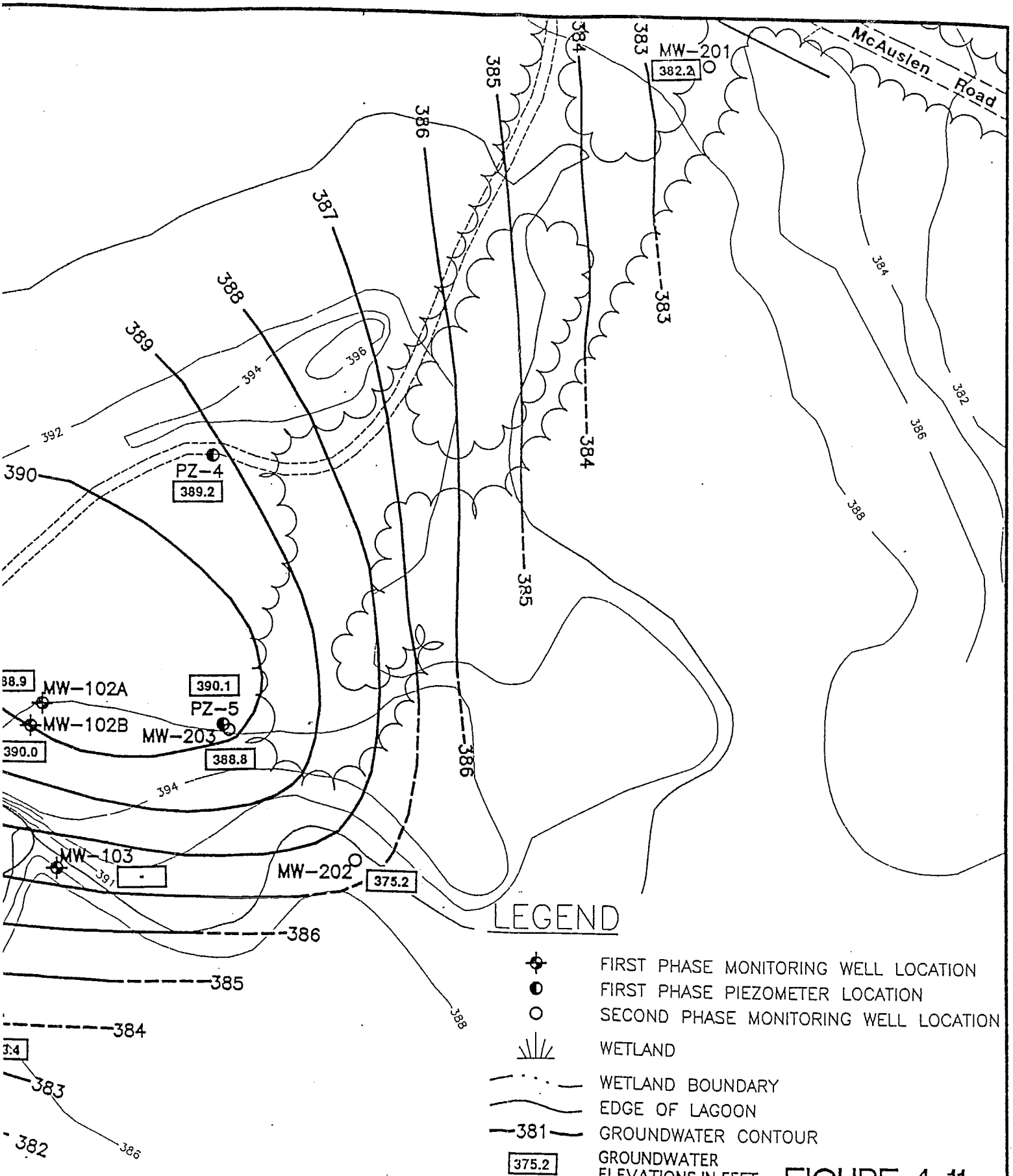
E = The reported concentration is estimated because of the presence of an interference.

S = The reported concentration was determined by the method of standard additions.

µg/L = micrograms per liter

N = Spike sample recovery not within criteria


N
DENSE TREES
386
388
390
PZ-1
384.5
PZ-2
387.6
MW-101A
387.0
MW-101B
387.7
PZ-3
388.0
LAGOON
382.0
MW-107A
MW-107B
381.1
PZ-8
381.1
MW-106
383.1
PZ-7
383.4
MW-105A
383.8
MW-105B
382.9
MW104B
383.7
383.1
MW-204
378.3
0 50 100 200 FEET
SCALE: 1"=100'
NOTE: GROUNDWATER CONTOUR
BASED ON WATER LEVEL DATA



RE INTERPOLATED
JRED JUNE 5, 1992.

FIGURE 4-11
SHALLOW GROUNDWATER CONTOURS
NORTH LAWRENCE OIL DUMP SITE
REMEDIAL INVESTIGATION