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SUPERFUND TREATABILITY CLEARINGHOUSE

Document Reference:

Ecology and Environment, Inc. "Summary Report on the Field Investigation of the Sapp Battery Site. Jackson County, Florida." Approximately 170 pp. in two volumes. Technical report prepared for Florida Department of Environmental Regulation (FDER). November 1986.

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SUPERFUND TREATABILITY CLEARINGHOUSE ABSTRACT

Treatment Process:	Immobilization - Cement and Fly Ash Solidification
Media:	Soil/Clayey
Document Reference:	Ecology and Environment, Inc. "Summary Report on the Field Investigation of the Sapp Battery Site." Jackson County, Florida." Approximately 170 pp. in two volumes. Technical report prepared for Florida Department of Environmental Regulation (FDER). November 1986.
Document Type:	Contractor/Vendor Treatability Study
Contact:	Kristen Teepen U.S. EPA - Region IV 345 Courtland Street, N.E. Atlanta, GA 30365 404-347-4727
Site Name:	Sapp Battery Site, Jackson County, FL (NPL)
Location of Test:	Jackson County, FL

BACKGROUND: This treatability study presents the results of field investigations at the Sapp Battery site in Florida, an abandoned battery recycling operation. The site is estimated to contain 14,300 cubic yards of soils with lead levels in excess of 1,000 ppm. The soils in the immediate vicinity of the site are a mixture of brown sand and yellow-brown sandy loam to a depth of five feet. A detailed QA/QC plan and analytical protocols is described in the second volume to the study. A sampling program and fixation study was conducted to evaluate cementitious and pozzolanic cementation technologies for leachate minimization potential. This abstract will focus on the fixation study and the ability of the processes evaluated to immobilize heavy metals.

OPERATIONAL INFORMATION: The cement base solidification process involves sealing the contaminated soil in a portland cement matrix. The pozzolanic process involves sealing the contaminated soil in a matrix of lime and fly ash. Soil samples from 0 to 5 and 5 to 10 foot depth intervals were composited and used. Analysis of the composite sample showed 7100 mg/kg of lead. Soil samples were mixed with varying percentages of solidification agent and water and allowed to set.

PERFORMANCE: Three pozzolanic, three cementitious solidification mixes and one control were prepared for the EP Toxicity leaching test. The results of the chemical fixation analysis are shown in Table 1. The results indicate that the cementitious mixture was much more effective in binding lead than the pozzolanic cement mixture (fly ash and lime). The portland cement mixture exhibited excellent binding capacity for all samples (1126A through C). Compared to the maximum allowable concentration of 5 mgs/liter (EP Toxicity), the analysis of the fixed samples were at or near the lead detection limit. Lead concentrations in the leachate from the pozzolanic

NOTE: Quality assurance of data may not be appropriate for all uses.

mixture were much higher than in the portland cement mixture. The authors offer no explanation for the difference but did indicate that the soils can be solidified to reduce lead concentrations in the leachate to acceptable levels. It is anticipated that cement requirements could be reduced and heavy metal control increased through process optimization.

CONTAMINANTS:

Analytical data is provided in the treatability study report. The breakdown of the contaminants by treatability group is:

Treatability Group	CAS Number	Contaminants
W11-Volatile Metals	7439-92-1	Lead

NOTE: This is a partial listing of data. Refer to the document for more information.

NOTE: Quality assurance of data may not be appropriate for all uses.

TABLE 1

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	Samples				Maximum Allowable EP Toxicity Concentrations (mg/l)
Pozzolanic					
E & E Lab Number 86-*	1126D	1126E	1126F		
Sample Identity	Ash: Lime: Soil	Ash: Lime: Soil	Ash: Lime: Soil	Blank	
	0.25:0.25:1	0.5:0.5:1	0.75:0.75:1		
Lead (mg/l)	76.4	<0.06	7.17	<0.06	5.0
Cementitious					
E & E Lab Number 86-*	1126A	1126B	1126C		
Sample Identity	Concrete: Soil	Concrete: Soil	Concrete: Soil		
	0.5:1	1:1	1.5:1		
Lead (mg/l)	0.085	<0.06	<0.06		5.0

* 86-1126 is a composite of 9 samples. The untreated composite sample has a lead concentration of 71,000 mg/kg. The EP Toxicity Test on the control sample (untreated composite soil material) yielded 59.4 mg/1.

Rec'd 6-23-87
Martha Berry / Elaine Moor
EPA Region IV - Atlanta

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SUMMARY REPORT ON THE FIELD INVESTIGATION OF THE SAPP BATTERY SITE, JACKSON COUNTY, FLORIDA

VOLUME 1 – REPORT

November 1986

Prepared for:

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
2600 Blairstone Road
Tallahassee, Florida 32301

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491

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1. INTRODUCTION

This report presents the results of the field investigation conducted by Ecology and Environment, Inc., (E & E) at the Sapp Battery site in Jackson County, Florida. The investigation was performed under contract to the Florida Department of Environmental Regulation (FDER). The Sapp Battery site is on the U.S. Environmental Protection Agency's (EPA's) National Priority List as a result of heavy metals (lead) and spent acid contamination of the multi-aquifer system underlying the site. This contamination is the direct result of former disposal practices associated with the battery recycling operation.

The site occupies an area of approximately 45 acres immediately north of Jackson County Road 280 and immediately west of the Atlanta and St. Andrews Bay railroad tracks (Section 24, Township 4 North, Range 12 West; Figure 1-1). The site is on a topographic high relative to the cypress swamps of Steele City and Bush Hammock Bays, southeast and northwest of the study area, respectively. The topography of the area reflects the fluvial and karstic processes that have occurred in the past and continue to occur.

The primary objectives of the field investigation were to supplement the results of previous site investigations performed by FDER and EPA, and to provide site characterization support for the feasibility study (FS). The field program consisted of sampling and testing to further characterize soil, sediment, and groundwater conditions in the site vicinity. Prior to beginning the main sampling effort, a priority pollutant confirmation study was conducted on-site in the areas assumed to be most contaminated. The purpose of this study was

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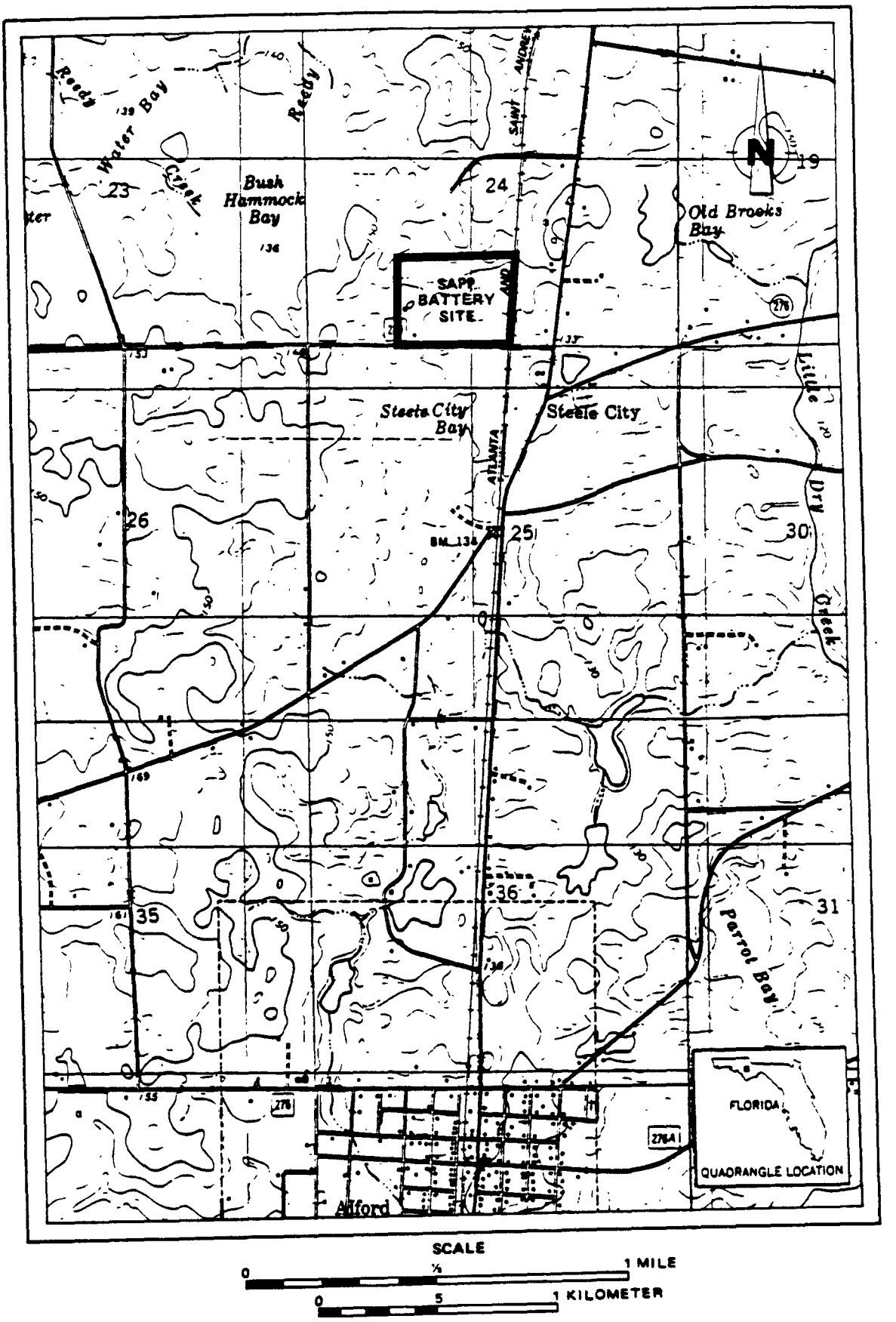

Figure 1–1 LOCATION OF SAPP BATTERY SITE

to aid in the selection of analytical parameters for the main investigation. In addition, background soil, sediment, groundwater, and surface water samples were collected for comparison purposes. This study was performed during the week of September 17, 1985.

After the priority pollutant confirmation study was completed, soil, sediment, and groundwater samples were collected and analyzed periodically. Surface water and biological samples were not collected in order to avoid duplication of: 1) an EPA-funded study by Dr. Robert Livingston, of the Florida State University Biology Department, who performed an integrated evaluation of surface water conditions and biota in local drainage basins for field verification of laboratory bioassays; 2) the FDER Remedial Investigation (RI) in which surface water samples were collected; and 3) a joint FDER, HRS, and Florida Game and Fresh Water Fish Commission Heavy Metals Task Force project during which surface water and biological samples were collected and analyzed.

Soil sampling was conducted from October 28 to November 11, 1985. This phase of the study consisted of collecting soil samples over several depth intervals (usually down to 10 feet) from areas not characterized by previous investigations.

Sediment sampling was performed from November 11 to November 27, 1985. This phase of the study consisted of collecting sediment samples over several depth intervals on-site and in the surrounding off-site cypress swamps.

The first phase of groundwater sampling, conducted on November 2 and 3, 1985, consisted of collecting water samples from residential wells surrounding the site. From November 6 to December 12, 1985, additional shallow, intermediate, and deep monitoring wells were installed to supplement the existing on-site monitoring network. New and existing monitoring wells were sampled from November 17 to December 12, 1985. Sample collection techniques, locations, and the chemical parameters for analysis of soil, sediment, and groundwater samples are discussed in detail in Section 2.

In addition to the sampling program, a fixation study and slug/specific capacity tests were performed from November 20 to December 18, 1985. The fixation study was conducted to evaluate cementitious and pozzolanic cementation technologies for leachate production potential. The results of the fixation study will be presented in Section

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2. The slug/specific capacity tests were conducted to determine the hydrologic characteristics of each of the three aquifer systems underlying the site.

Fieldwork was completed by December 20, 1985.

Most of the soil and sediment samples taken from the deeper sampling intervals were archived pending evaluation of the analytical results from the shallower intervals. Ninety-six soil samples (from the 5- to 7.5-foot and 7.5- to 10-foot intervals) and 33 sediment samples (18 from the 5- to 7.5-foot and 7.5- to 10-foot intervals for the 10-foot borings, and 15 from the 2.5- to 5-foot interval for the 5-foot borings) were archived. Based on E & E's evaluation of the shallower interval data, FDER agreed that 54 of the archived soil samples should be analyzed. These samples were sent to the laboratory on January 8, 1986, for analysis and the results are included in this report.

As requested by FDER, the 25 residential wells sampled November 2 and 3, 1985, were resampled in March 1986. These samples were analyzed for the same parameters as the initial residential well sampling. The results are presented in this report.

1.1 SITE DESCRIPTION, HISTORY, AND PAST INVESTIGATIONS

1.1.1 Site Description

The Sapp Battery site is located in the heart of the densely vegetated rural Florida Panhandle (Figure 1-2; Plate 1, inside back cover). The site in its present condition is dominated by a large bluish-gray synthetic liner which extends over a newly excavated area (Figure 1-3). This area was previously the site of an acid holding pond. A building foundation on the site is all that remains of the Sapp Battery plant. The foundation is situated on a relatively high elevation at the north end of the liner. Remnants of a truck weigh scale and acid drainage trough are apparent on the west side of the foundation. The former Sapp residence was located south of the plant, at the entrance to the site. Only two small building foundations remain of the residence. The synthetic liner and plant foundation are surrounded by a non-continuous layer of broken battery casings. In the vicinity of the former Sapp residence, the battery chips are more weathered and rounded than those found anywhere else, except

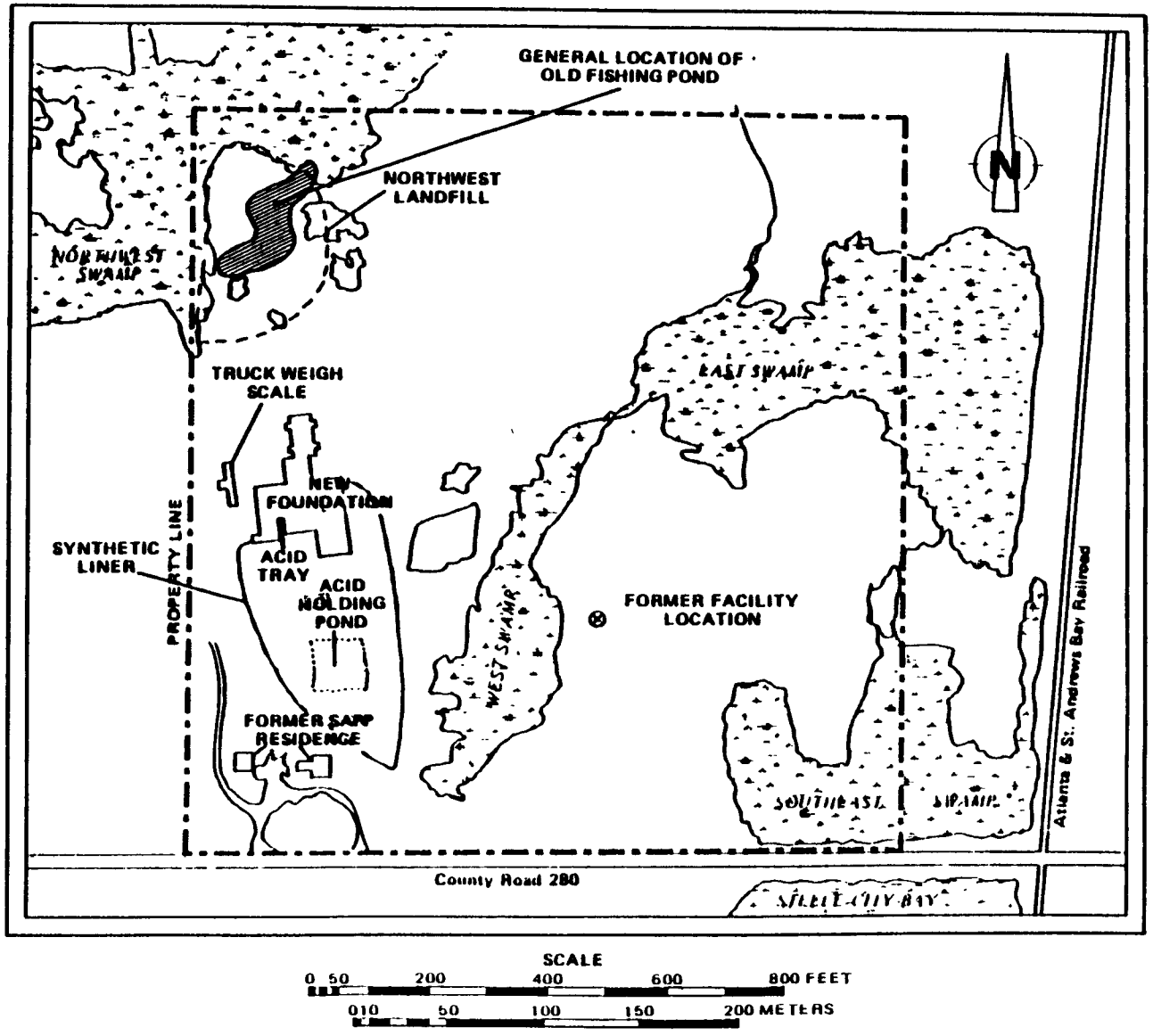

Figure 1-2 SAPP BATTERY SITE DESCRIPTION MAP

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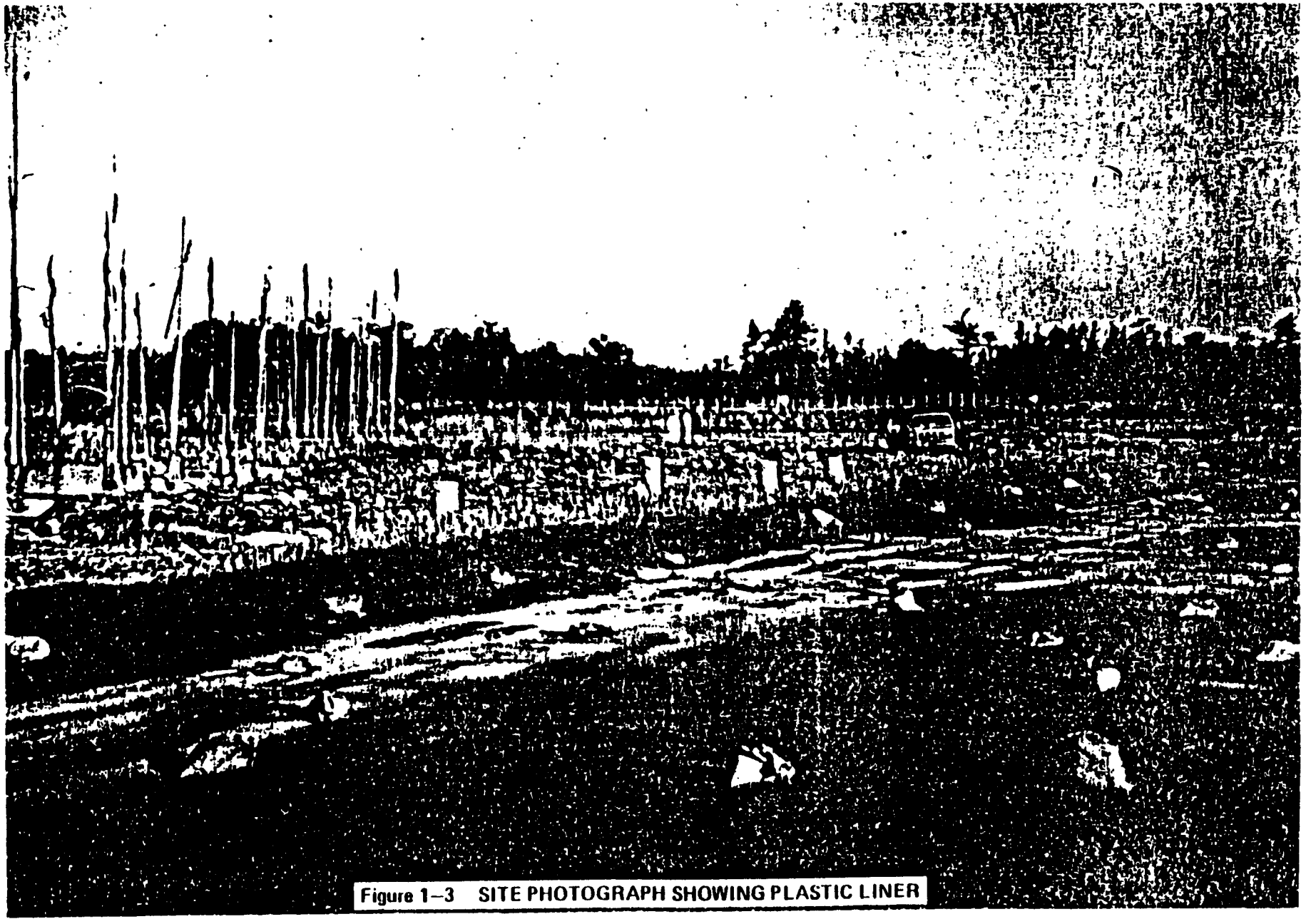

Figure 1–3 SITE PHOTOGRAPH SHOWING PLASTIC LINER

at the location of the old plant. Although the exact location of the old plant is unknown, its general vicinity is believed to be several hundred feet east of the larger and newer plant foundation on the east side of the west swamp.

North of the new plant foundation is a small landfill area which has been primarily filled in with battery chips. This area is referred to here as the Northwest Landfill. According to historical aerial photographs, this area was once a small fishing pond.

A complex system of swamps surrounds the site except directly west of the new plant. These swamp areas include:

- The West Swamp, which receives direct drainage from the old acid holding pond and plant foundation areas;
- The East Swamp, which receives drainage from the West Swamp and northern limits of the area;
- The Northwest Swamp, which receives drainage from the Northwest Landfill area;
- The Southeast Swamp, which receives drainage from the East Swamp; and
- Steele City Bay, which receives drainage from the Southeast Swamp.

Except for the Northwest Swamp area, all of these surface water bodies show contamination, as evidenced by the deterioration of surrounding vegetation, particularly cypress trees, many of which have been killed.

1.1.2 Site History

In 1970, Sapp Battery Service, Inc., (Sapp Battery) began to recycle lead from used automobile batteries at the Jackson County location. The Sapp Battery operation gradually expanded and, by 1978, the facility was processing approximately 50,000 used batteries a week. The residual acid from the smashed battery casings was allowed

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to run southeast down a slope adjacent to the processing plant and into the West Swamp. Drainage from the West Swamp evidently flows south and east into Steele City Bay, which connects to Little Dry Creek approximately 1 mile from the site.

Broken battery casings were primarily disposed of in a man-made fishing pond north of the facility and along the west bank of the West Swamp. However, pieces of battery casings are scattered over most of the site west of the West Swamp and south of the filled fishing pond.

In 1977, FDER became involved with the site in response to complaints from the local population. As a result of FDER's involvement, Sapp Battery attempted to contain their contamination on-site through a series of berms and channels and the holding pond. However, this limited remediation action was a failure, and further legal action resulted in the closing of the Sapp Battery operation in January 1980 (Watts 1984). Later in 1980, EPA initiated emergency remedial action at the site in an attempt to control runoff and leaching of wastes into groundwater. A berm was installed along the site's downgradient boundaries and lime was added to several affected locations.

1.1.3 Past Investigations

The Sapp Battery site was added to the National Priority List in September 1982, and the Groundwater Section of FDER, with support from the U.S. Geological Survey, began an RI of the site (Watts 1984). At the same time, Dr. Robert J. Livingston of Florida State University began the biological work in the affected drainage basin.

The RI primarily consisted of:

- Delineating battery casing disposal areas;
- Collecting shallow soil samples in the area between the plant and the acid holding pond;
- Collecting surface water and sediment samples from sample stations located throughout the Steele City Bay drainage basin to Little Dry Creek; and

- Characterizing the physical and chemical parameters of the groundwater system in the site vicinity by sampling on-site and residential wells.

The RI concluded that the Sapp Battery site contained:

- A large amount of landfilled battery chips (estimated volume, 28,000 cubic yards);

- High lead levels in the upper soil horizon that decreased with depth;

- High concentrations of lead, manganese, and aluminum in on-site and near-site (downgradient) surface water and sediment samples;

- Lead contamination at moderate to high levels in the surficial and intermediate aquifer systems; and

- Low levels of lead (which most likely seeped into the Floridan aquifer system via the sinkhole network in the area) in downgradient residential wells. Previous sampling of residential wells by EPA in March 1980 and by the Florida Department of Health and Rehabilitative Services (DHRS) in August 1982 had not found any violations of drinking water standards; however, the majority of these wells were located upgradient from the Sapp Battery site.

In August 1983, EPA completed a limited feasibility study (FS) to determine the need for initial remedial measures for the Sapp Battery site (NUS Corporation 1983). The objective of this FS was to develop remedial alternatives that would minimize further groundwater and surface water contamination and minimize impacts to public health and safety. The EPA FS concluded that in-place capping of the site with a synthetic liner was the most cost-effective remedial technique; however, the EPA FS further stated that in order to completely evaluate

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the effectiveness of the cap, gaps in the soils data would have to be filled. Because of this data gap, the EPA FS was not finalized.

Based on the RI and an assessment of the need for initial remedial measures by Environmental Science and Engineering, Inc., FDER performed additional soil sampling in the area of the acid holding pond to support an Initial Remedial Measures (IRM) program (ESE, Inc., and OHM Co. 1984; OHM Co. 1984a, b). As a result of this sampling effort, it was concluded that a large volume of soil (14,300 cubic yards) contained lead levels in excess of 1,000 milligrams per kilogram (mg/kg) and that surface lead contamination levels of 500 mg/kg existed south and east of the plant and around the acid holding pond. The recommended IRM was to install a temporary surface seal over soils with lead levels greater than 500 mg/kg.

In 1984, FDER also completed the remedial response objectives and evaluation criteria for a comprehensive FS at the Sapp Battery site (ESE, Inc., 1984). In general, this report addressed response objectives that protect human health, reduce the potential for contaminant migration, and comply with Florida water standards.

Based on the selected IRMs, FDER completed the following remedial measures during 1984 and 1985:

- Removal of about 9,000 cubic yards of contaminated soil and sediment from the acid holding pond area;

- Backfilling of the acid holding pond and excavated areas with clean soil and capping of the area with a synthetic membrane;

- Installation of a rip-rap filter drain where the drainage from the liner empties into the West Swamp;

- Installation of a chain link fence and warning signs to secure the site;

- Installation of a berm and weir system to control storm water runoff;

- On-site treatment of contaminated water from the acid holding pond;

- Removal of a large pile of battery casing debris and contaminated soil.

The Department of Health and Rehabilitative Services in Jackson County conducted blood lead tests on 1,565 persons from Alford, Cottondale, and the surrounding area in December 1984. Several persons were found to have abormally high blood lead levels. Further investigation related these findings to conditions in their homes or work places. No connection with Sapp Battery was established.

In addition to the above investigations, a variety of other studies have been performed. These include: 1) air and surface water sampling performed during the IRMs; 2) nutrient testing of on-site soils by ESE, Inc.; 3) surface water and sediment analyses by the Heavy Metals Task Force (FDER, HRS, and Florida Game and Fresh Water Fish Commission); and 4) groundwater and soil sampling, including the testing of residential wells at several residences near the Sapp Battery site, by ESE, Inc.

Plate 1, an aerial photograph from November 6, 1985, and Plate 2, a topographic map, were generated as part of the current investigation. They illustrate existing condition of the Sapp Battery site.

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1.2 GEOLOGY

The Sapp Battery site lies within the Marianna River Valley Lowlands, the largest physiographic unit in Jackson County (Moore 1955). Moore (1955) states that this terraced lowland area was formed through a complicated sequence of stream erosion, deposition, and capture which resulted in the dissection and lowering of the Miocene-age surface. Although dissolution of the underlying limestone is not considered primarily responsible for the development of the lowlands, the rectangular stream patterns revealed by aerial photomosaics of Jackson County suggest that joints and fractures in the limestone may have exerted a strong influence on the drainage network that developed in the overlying clastic sediments.

Figure 1-4 is a generalized stratigraphic column for Jackson County. Figure 1-5 is a north-south geologic cross section through Jackson County which essentially passes through the Sapp Battery site. The following discussion of the geologic units in the vicinity of the site is summarized from Moore (1955).

The Crystal River Formation, including the uppermost Bumpnose Limestone Member, is the only unit of the Eocene-age Ocala Group which has been recognized in Jackson County. The absence of the older Williston and Inglis Formations of the Ocala Group is attributed to the Jackson County area occupying a structurally positive position that was not submerged by the transgressing sea until the late Eocene.

The Crystal River Formation is a white to cream, generally soft, granular, fossiliferous, permeable limestone that is often entirely composed of orbitoidal foraminiferal tests and bryozoa. It has frequently been hardened to a dense limestone by recrystallization. The Crystal River Formation lies at or near land surface over most of the northern half of Jackson County. To the south, which includes the Sapp Battery site, the unit shows greater variations in local relief and is covered by varying thicknesses of younger sediments (Figures 1-4 and 1-5). The thickness of the Crystal River Formation, including the Bumpnose Limestone, is about 220 feet in Jackson County.

The Bumpnose Limestone Member of the Crystal River Formation is a white, soft, easily crumbled, fossiliferous (foraminifera and bryozoa) limestone that is generally somewhat glauconitic (especially near the

ERA	PERIOD	EPOCH		FORMATION	
CENOZOIC	QUATERNARY	RECENT		River floodplain alluvium	
		PLEISTOCENE		Marine and fluvial terrace deposits	
	TERTIARY	PLIOCENE		*Citronelle Formation*	
		MIOCENE		Tampa Formation	
		OLIGOCENE		Suwannee Limestone Marianna Limestone	
		EOCENE	UPPER	Ocala Group	*Bumpnose Limestone Member*
					Crystal River Formation

SOURCE Modified from Moore, 1955

Figure 1–4 GENERALIZED STRATIGRAPHIC COLUMN FOR JACKSON COUNTY, FLORIDA

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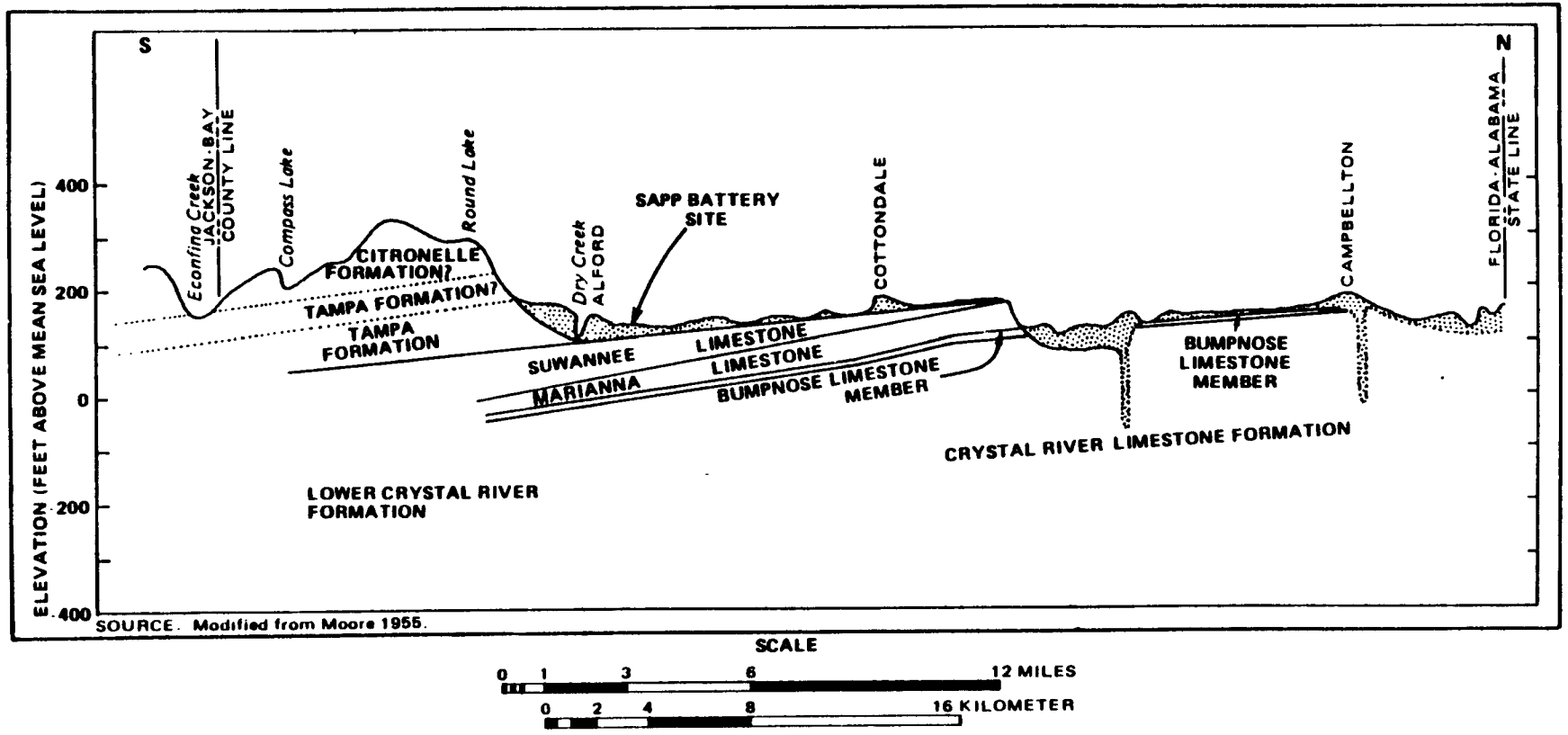

SCALE

0 1 3 6 12 MILES

0 2 4 8 16 KILOMETER

Figure 1–5 NORTH-SOUTH GEOLOGIC CROSS SECTION THROUGH JACKSON COUNTY, FLORIDA

top). This unit ranges from 0 to 15 feet thick, thinning to the southeast.

The Oligocene-age Marianna Limestone is a white to cream to light gray, slightly glauconitic, fossiliferous (foraminifera and bryozoa), massive, impermeable limestone. This unit is fairly uniform in thickness, varying between 25 and 40 feet.

The Oligocene-age Suwanee Limestone in Jackson County consists of tan to buff limestones, dolomitic limestones, and dolomitic to calcareous clays. This unit was subjected to erosion before deposition of Miocene-age sediments began, and ranges from 210 feet to 512 feet thick in the central part of the county near Marianna and Cottondale.

The Miocene-age Tampa Formation in Jackson County is stratigraphically equivalent to the Tampa Limestone, but primarily consists of white, gray, and green clays and clayey marls. The formation is more calcareous in the southeastern part of Jackson County and more argillaceous to the west and northwest; however, the entire formation is characterized by the presence of fine, scattered quartz grains. The unit is thickest in the southeastern and southwestern parts of Jackson County (approximately 50 to 100 feet and 100 to 170 feet, respectively), but thins to the north, pinching out just south of the Sapp Battery site (Figure 1-5).

The post-Miocene sediments of Jackson County, which include a number of stream terrace deposits, consist of cross-bedded clays, sandy clays, clayey sands, sands, and gravels that change laterally and vertically within short distances. Several reports (e.g., Cooke 1945 and Watts 1984) have identified the sediments underlying the stream terrace deposits as the Pliocene-age Citronelle Formation. However, Moore (1955) and Vernon and Puri (1964) suggest that making this differentiation could be difficult because the stream terrace deposits and the Citronelle Formation are similar in color and composition. The post-Miocene deposits in Jackson County can attain thicknesses greater than 100 feet, especially in areas where these sediments have filled fractures or cavities in the underlying limestone.

1.2.1 General Geologic Structure

The rock units in Jackson County dip southeast, south, and southwest as a result of a broad flexure to the north (along the Florida,

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Georgia, and Alabama borders). This flexure is commonly known as the Chattahoochee Anticline. Moore (1955) suggests the presence of an Oligocene to Miocene-age flexure to the south, which is believed to have caused the jointing and fracturing of the limestone bedrock in this area. As a result of this broad structural influence, the joints and fractures in these soft limestone units have been weathered substantially to a point of creating a karstic terrain. This karst characteristic in the Jackson County area is very evident when regional topographic maps are examined. For instance, as displayed in Figure 1-1, karstic features such as sinkholes and hummocks are common.

The karst characteristics are also common at a more localized scale such as that of the Sapp Battery site. These features were determined at the site by FDER in a fracture trace analysis based on aerial photographs. Several lineaments and sinkholes were mapped on the site from this study (Figure 1-6). FDER concluded that at least 11 sinkholes exist in the site vicinity. Two of these sinkholes were confirmed by E & E's deep drilling in the Northwest Landfill area (MW-9A) and near the former Sapp residence (MW-12A).

1.2.2 Regional Soil Conditions

The U.S. Department of Agriculture Soil Survey of Jackson County identified four soil associations in the vicinity of the Sapp Battery site. The Dorovan-Pamlico association was recorded in the swampy areas of the site and is characterized as mainly black muck with a lower horizon of dark grayish-brown sand. The Fuquay Coarse Sand association was recorded as occurring in the area of the site where the battery cutting operation was located, and is characterized as a mixture of brown coarse sand and yellow brown sandy loam to a depth of approximately 5 feet. The Grady Fine Sandy Loam and the Dothan Loamy Sand associations were identified as possibly being present in small areas to the west and north of the site, respectively. Neither of these two latter soil associations differs significantly from the Fuquay Coarse Sand in its chemical or physical properties. However, the extensive earth-moving activities that occurred at the Sapp Battery site in the 1970s and more recently raises doubts as to how

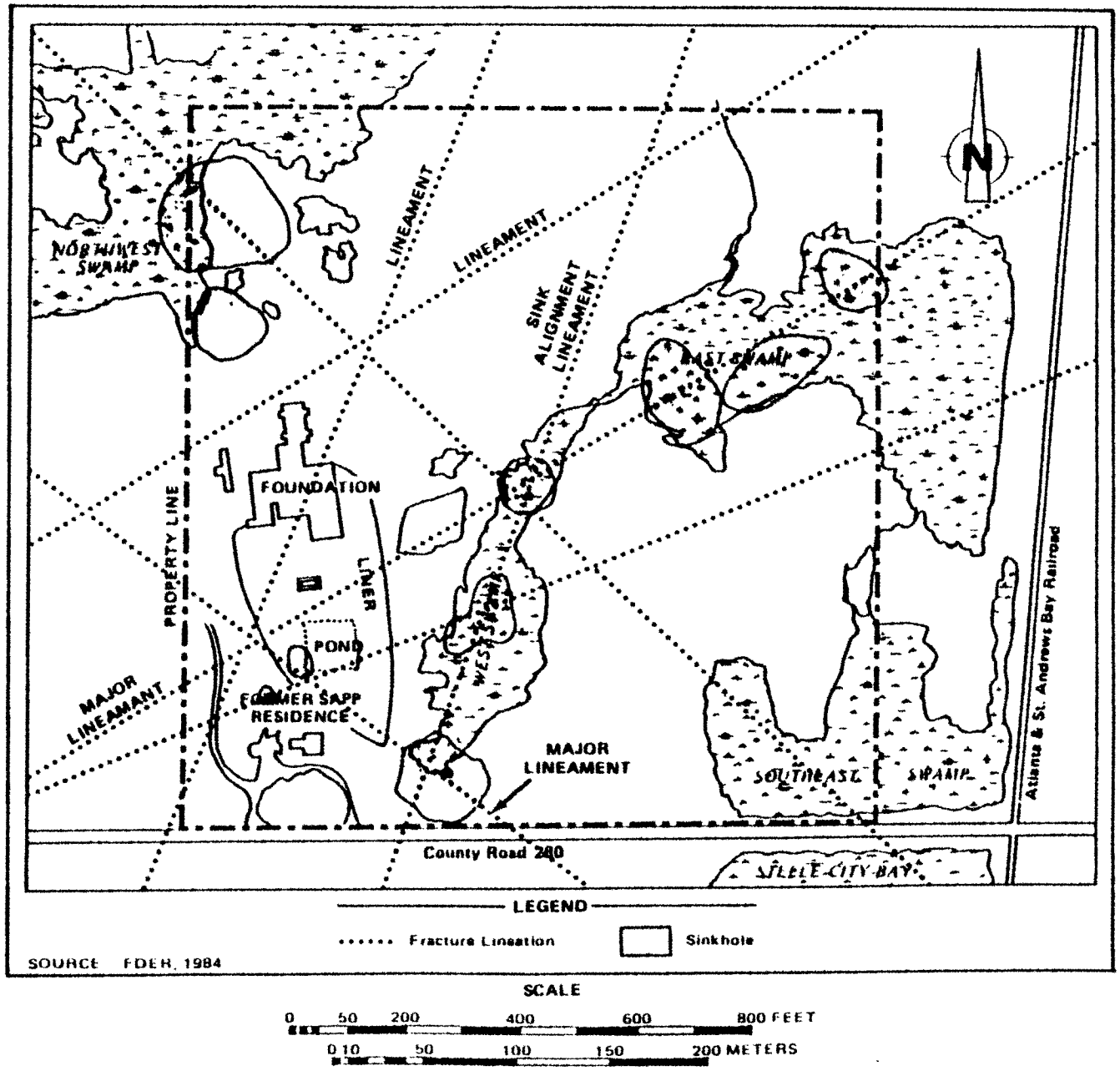

Figure 1–6 FRACTURE LINEATIONS AND SINKHOLE LOCATIONS

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accurately this survey represents current soil conditions at the site. Site soil conditions based on actual field boring results are provided in Section 3.2 of this report.

1.3 SURFACE WATER HYDROLOGY

Surface runoff at the site flows to the several swamps located on and immediately adjacent to the site. The highest elevation on the western portion of the property is at the approximate mid-point of the west property line, where the truck weigh scale foundation is located. From this high point, surface runoff is somewhat radial. The area between the plant foundation and the most southern extent of the Northwest Landfill drains to the Northwest Swamp. Areas east and northeast of the site drain via many small rills to the West Swamp. The area south of the plant foundation is presently covered by a plastic liner which prevents infiltration of rainfall and runoff. It drains and concentrates runoff to the southeast, where dikes direct the water through the limestone rip-rap drain and into the southern end of the West Swamp.

All areas on-site and southwest of the plastic liner drain to the south or southeast and eventually to the road ditch along County Road 280. At several points where runoff spills through the fence and into the road ditch south of the West Swamp, sediments have been washed away, revealing battery chips at least 1 foot thick.

The Northwest Landfill area is nearly level, with runoff being ponded locally in several areas.

Surface drainage from the northern areas east of the Northwest Landfill flows toward the East Swamp. There is an area east of the Northwest Landfill where clay was scraped and used to construct berms, to fill in the acid pond, and as a base for the plastic liner south of the plant foundation. Runoff in this northern area is confined to the large shallow depression created by this operation.

There is an area in the southeast quadrant of the site which is low in elevation and is bordered on three sides by the dike east of the West Swamp, the East Swamp, and the Southeast Swamp. Under high water conditions, this open area floods, and water discharges through a cut in the dike into the Southeast Swamp. This discharge was observed several times after rainfall events during the November/ December fieldwork and again in January by a survey party. Under normal precipitation conditions and periods of slightly raised water table, ponding and marshy conditions occur over much of the area.

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There has not been a surface water connection between the West Swamp and Steele City Bay since 1980, when drainage from the West Swamp to the culvert under County Road 280 was filled and a berm constructed. The Southeast Swamp remains connected to Steele City Bay by a culvert under County Road 280.

Steele City Bay and several wetlands to the east make up a system of interconnected surface water bodies which contribute a relatively low amount of discharge to Little Dry Creek, about 1 mile south-southeast of the Sapp Battery site. Observations made in November 1985, during sediment sampling, indicated that direct surface drainage from this wetland system to Little Dry Creek does not occur under drier conditions.

On November 11, 1985, 10 days after the last rains of Hurricane Juan, the observed rate of discharge through the relatively narrow channel into Little Dry Creek was approximately 1 to 3 cubic feet per second (cfs).

1.4 HYDROGEOLOGY

The groundwater system at the site consists of a complex sequence of anisotropic, heterogeneous aquifers and aquitards. This complexity reflects the karstic nature of the relatively deep subsurface limestones and the depositional history of the overlying unconsolidated sediments.

In general, there are three aquifer systems in the vicinity of the Sapp Battery site: the confined Floridan aquifer system; the overlying semi-confined intermediate aquifer system; and the shallow, unconfined surficial aquifer system. In addition, possibly two or three more localized semi-confined hydrostratigraphic units occur within the intermediate deposits.

The shallow surficial aquifer system in this area of Jackson County lies within Pliocene-age sands and clays and Holocene to Pleistocene-age undifferentiated marine, fluvial, and terrace materials. In general, this aquifer system is present to a depth of 10 to 30 feet below land surface, and is confined below by the upper impermeable clayey layers of the intermediate aquifer system. The potentiometric surface of the surficial aquifer system in this area has a hydraulic gradient to the south-southeast and for the most part is a reflection of topographic conditions. This aquifer is in direct communication with the surrounding cypress swamps; hence, water levels are commonly very near or at land surface in low-lying areas. As a result of the low permeability of the sandy clays and clayey sands that comprise the surficial aquifer system, reported well yields are generally less than 5 gallons per minute (gpm) (Watts 1984).

The semi-confined intermediate aquifer system lies within the Pliocene and Miocene-age clays, sandy clays, and clayey sand sequences, which exhibit great variability with respect to texture and continuity. This aquifer system ranges in thickness from 30 to greater than 100 feet. The great variability of the intermediate aquifer reflects the undulating surface of the underlying limestone as well as the presence of filled-in sinkholes. The intermediate aquifer system exhibits multiple potentiometric surfaces, which are most likely the result of semi-confined perched units being locally present at different elevations throughout its thickness. However, a more

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uniform potentiometric surface, with a hydraulic gradient to the west-southwest, is defined by wells screened generally 30-feet below land surface. Locally, paleo-stream channels have dissected the upper confining units of the intermediate aquifer system, thereby creating a direct connection between this system and the overlying surficial aquifer system. The more impermeable units present in the lower portion of the intermediate aquifer system effectively confine the Floridan aquifer system except where it is breached by sinkholes. Rural and domestic supply wells open to the intermediate aquifer system generally have been reported to have yields of less than 10 gpm (Watts 1984).

On a regional scale, the Floridan aquifer system lies within Oligocene and Eocene-age limestones and dolomites. However, in Jackson County the Eocene-age limestones of the Ocala Group make up the primary storage unit for this artesian system. In the vicinity of the Sapp Battery site, the Floridan aquifer system is believed to be 400 to 600 feet thick, with well yields in excess of 1,000 gpm (Franks 1982). The reported regional hydraulic gradient for the Floridan aquifer system in this area is generally to the east (U.S. Geological Survey 1982).

The hydrology and chemistry of each of the three aquifer systems are discussed in greater detail in Section 3.4.

1.5 REGIONAL SURFACE WATER, SURFACE WATER SEDIMENT, AND BIOLOGICAL EFFECTS

Dr. D. J. Livingston, Florida State University (FSU), with a grant from EPA, began research at Sapp Battery Plant in May 1983. The main thrust of his research dealt with determining the validity of bioassays as predictors of conditions in the field. However, he also drew conclusions regarding conditions of surface water, sediments, and biota at the site and downgradient from it. All of Dr. Livingston's studies dealt with community parameters. No tissue analyses were performed on any organisms.

A series of 14 sampling stations was established, beginning on the site and progressing down Little Dry Creek and Dry Creek to the Chipola River Confluence (Figure 1-7). Sampling began in May 1983 and was concluded in May 1985. After June 1984, the majority of sample types were collected on a quarterly basis. After September 1983, no samples were collected from Station 9 and 10. The following discussion is a summary of the Livingston (1985) sampling results.

1.5.1 Surface Water and Sediment

Surface water and sediment samples were taken quarterly and analyzed for heavy metals. Surface waters were collected as grab samples and sediment samples were taken from the top 2 cm of a 10-cm core sample. Parameters analyzed for were nickel, chromium, zinc, manganese, iron, copper, lead, aluminum, and cadmium. A preliminary scan of sediment and water samples by Proton Induced X-Ray Emission (PIXE) and convention atomic absorbtion emission spectroscopy showed these metals at detectable levels. No other chemical analyses were conducted on these samples. The primary metals of concern in the FSU study were lead and aluminum. Of the seven remaining, cadmium, chromium, copper, iron, and nickel were found in concentrations only slightly above background levels observed at control sites, whereas zinc and manganese seemed to be evenly distributed throughout the system. The following discussion concerns lead, aluminum, and cadmium. Cadmium is included because it is considered a contaminant of concern for surface waters in the risk assessment.

The highest lead levels in surface waters were found at stations 1 and 2 in August 1983 at concentrations of 36 and 11.25 ppm,

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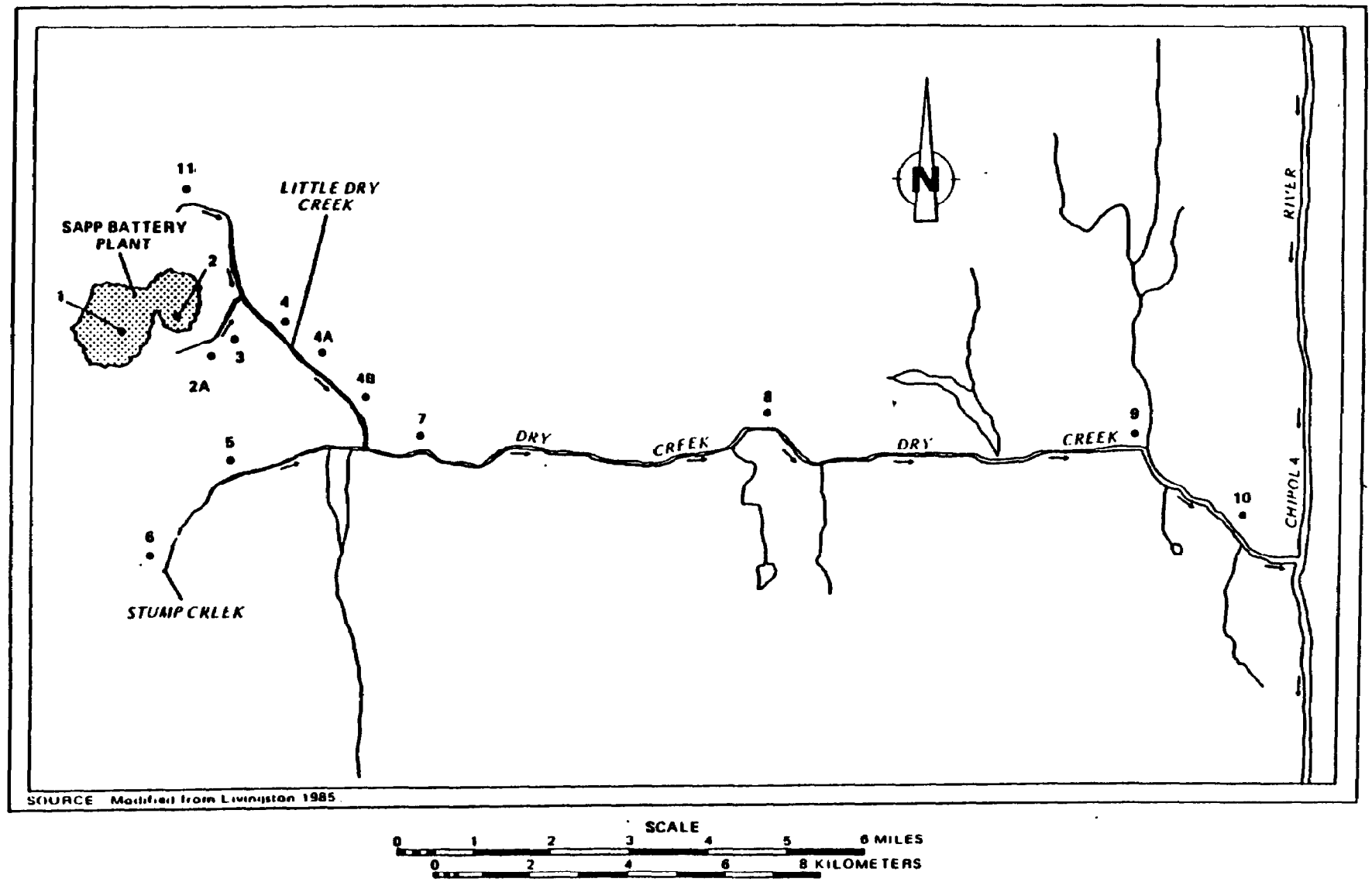

Figure 1–7 CHIPOLA RIVER PROJECT STUDY AREA AND SAMPLE LOCATIONS

respectively. After that time, lead concentrations began to taper off at these stations except in April 5, 1985, at station 1, which showed nearly a seven-fold increase.

Aluminum in surface waters showed relatively high values at stations 1, 2, and 2A during December 1985 (4.5 to 5.2 ppm); January 1985 (3.7 to 22.7 ppm); and April 1985 (2.1 to 6.6 ppm). In general, the lowest levels of aluminum were found during summer months. Generally, the stations exhibiting higher lead and aluminum values in the water also exhibited lower pH values, relative to other stations.

Cadmium in the surface water stations was essentially not detected during the two sampling episodes in 1984, except for 0.02 and 0.09 ppm in stations 2A and 8, respectively, in the July 1984 sampling. However, cadmium was detected at very low concentrations at the majority of stations sampled in 1985, with station 2 exhibiting the highest value, 0.04 ppm.

Lead concentrations in sediment samples collected at stations 1, 2, and 2A were consistently one to two orders of magnitude higher than levels from any of the other stations during any of the sampling events. Lead levels from late 1983 to early 1985 ranged from 184 to 1935 ppm (station 1), 20.5 to 999.5 ppm (station 2), and 16.8 to 47.0 ppm (station 2A). The higher concentrations typically occurred from 1983 to 1984. Lower levels were detected more recently.

Aluminum concentrations in the sediment samples generally followed the lead trends, with the highest concentrations also at stations 1, 2, and 2A, with values ranging from: 8,799 to 24,565 ppm; 7,465 to 18,010 ppm; and 1,330 to 18,200 ppm, respectively, during sampling episodes in 1984 to 1985. As with lead, the increased aluminum values were detected early in the study and decreased in late 1984.

Cadmium in sediment showed the same general trend as lead and aluminum, with the highest concentration at stations 1, 2, and 2A, ranging from: 0.04 to 1.74 ppm; 0.10 to 2.81 ppm; and 0.03 to 0.13 ppm, respectively, throughout the sampling episodes. As with the other two metals, higher values were detected early in the investigation (1983) and lower values at the end (1985).

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A general summary of the FSU study of lead, aluminum, cadmium, and pH results for surface water and sediments are summarized in Tables 1-1, 1-2, and 1-3.

1.5.2 Algae Samples

In the FSU investigation, algal samples were collected qualitatively by hand and with 5-liter containers. These collections were made to generate species lists at each station. Quantitative samples were obtained using diatometers and phytoplankton nets. Samples were taken quarterly at stations 1, 2A, 6, and 7.

Samples obtained using diatometers exhibited the lowest number of individuals at station 1 and the highest numbers at station 2A. The lowest number of species generally occurred at station 1, while the highest was at station 6. No pattern of species diversity or species richness was observed.

Concerning samples taken with the phytoplankton nets, no patterns of species diversity or evenness were noted. The lowest numbers of individuals were noted at station 1. Species richness was highest at stations 6 and 7 (Tables 1-4 and 1-5).

1.5.3 Macroinvertebrates

Infaunal and epibenthic macroinvertebrates were collected qualitatively in sediment core samples and in leaf packs (artificial substrates set out in the stream) during the FSU investigation. Qualitative samples using nets were also taken to aid in creating a species list.

A gradient response to the distribution of heavy metals and low pH in the Little Dry Creek and Dry Creek system was exhibited by infaunal macroinvertebrates (animals found living in the sediments). Seasonal variations were noted; however, an overall pattern of lower species richness, diversity, and evenness associated with higher metal concentrations and lower pH values are exhibited. It should be noted that numbers of individuals varied greatly among the stations. Numerical abundance at some of the most contaminated stations was attributed to proliferation of a very few resistant species.

Table 1-1

LEAD, ALUMINUM, AND CADMIUM CONCENTRATIONS IN
STUMP CREEK, LITTLE DRY CREEK, AND DRY CREEK
SURFACE WATERS DOWNGRADIENT OF THE SAPP BATTERY SITE

LEAD (PPM)

	Station											
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8
July 31, 1984	<.01	--	<.01	<.01	4.55	.80	.23	--	<.01	<.01	<.01	<.01
October 31, 1984	<.01	--	--	--	.64	.25	.01	--	<.01	<.01	<.01	<.01
January 29, 1985	.10	--	--	--	.41	.58	.12	--	.10	.10	.10	.10
April 5, 1985	.10	--	--	.10	2.86	.29	.10	--	.10	.10	.10	.10

ALUMINUM (PPM)

	Station											
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8
July 31, 1984	<.05	--	1.30	3.36	1.12	1.51	1.70	--	1.90	2.70	.54	.58
October 31, 1984	.03	--	--	--	.43	12.52	1.18	--	1.10	.60	.42	.41
January 29, 1985	.50	--	--	--	.68	22.70	3.70	--	.51	.61	.50	.50
April 5, 1985	.50	--	--	.80	3.67	6.60	2.10	--	.65	.53	.50	.50

CADMIUM (PPM)

	Station											
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8
July 31, 1984	<.02	--	<.02	<.02	.02	<.02	.02	--	<.02	<.02	<.02	.09
October 31, 1984	<.02	--	--	--	<.02	<.02	<.02	--	<.02	<.02	<.02	<.02
January 29, 1985	.01	--	--	--	.01	.01	.01	--	.01	.01	.01	.01
April 5, 1985	.01	--	--	.01	.01	.04	.01	--	.01	.01	.01	.01

Notes:

-- Indicates not sampled
Station 11 was usually dry
Sampling at Stations 3 and 5 was discontinued in October 1983
Stations 2A, 4A and 4B were added in May 1984

Source: Livingston 1985

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Table 1-2

LEAD, ALUMINUM, AND CADMIUM CONCENTRATIONS IN STUMP CREEK, LITTLE DRY CREEK, AND DRY CREEK SEDIMENTS DOWNGRADIENT OF THE SAPP BATTERY SITE

LEAD (PPM)

	Station													
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8	9	10
August 1983	--	2.6	--	3.10	1935.0	999.5	--	17.5	--	--	--	--	--	--
September 27, 1983	<.05	12.0	--	.56	184.0	51.6	--	--	--	--	1.20	1.61	2.18	0.79
July 31, 1984	1.48	--	--	1.92	323.5	163.3	28.5	--	2.10	3.84	2.69	15.05	--	--
November 5, 1984	.97	--	--	2.11	208.0	218.67	16.8	--	.97	3.23	2.63	22.9	--	--
January 29, 1985	1.23	--	--	--	454.0	73.19	47.0	--	1.32	1.83	3.30	2.72	--	--
April 5, 1985	2.22	--	--	5.04	252.25	20.5	36.3	--	8.60	2.87	3.11	10.79	--	--

ALUMINUM (PPM)

	Station													
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8	9	10
August 1983	--	.0	--	.00		.00	--	.00	--	--	--	--	--	--
September 27, 1983	.0	.0	.00	.00		.00	--	--	--	--	.00	.00	.00	.00
July 31, 1984	2950.0	--	4090.00	1900.0	21950.0	15166.67	18200.0	--	3430.0	3100.0	5200.0	2480.00	--	--
November 5, 1984	1830.0	--	--	1640.0	9575.0	8533.33	1330.0	--	1200.0	2400.0	2590.0	1230.0	--	--
January 29, 1985	1772.0	--	--	--	24565.0	18010.0	12680.0		1517.0	2864.0	8530.0	3746.0	--	--
April 5, 1985	1552.67	--	--	3740.0	8799.25	7465.0	8204.0	--	5714.0	1829.0	2087.0	1012.0	--	--

Table 1-2 (Cont.)

CADMIUM (PPM)														
	Station													
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8	9	10
August 1983	--	<.90	--	<.90	1.74	2.81	--	.84	--	--	--	--	--	--
September 27, 1983	<2.5	2.31	<.25	<.25	1.02	1.44	--	--	--	--	.61	2.05	<.25	1.07
July 31, 1984	<.02	--	<.02	<.02	.06	.38	<.02	--	<.02	<.02	<.02	<.02	--	--
November 5, 1984	<.02	--	--	<.02	.04	.47	.03	--	<.02	<.02	<.02	<.02	--	--
January 29, 1985	.03	--	--	--	.19	.31	.13	--	.02	.05	.05	.04	--	--
April 5, 1985	.04	--	--	.07	.73	.10	.12	--	.12	.05	.05	.04	--	--

Notes:

-- Indicates not sampled
Station 11 was usually dry
Sampling at Stations 3 and 5 was discontinued in October 1983
Stations 2A, 4A and 4B were added in May 1984

Source: Livingston 1985

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Table 1-3

PH VALUES FOR STUMP CREEK, LITTLE DRY CREEK, AND DRY CREEK SURFACE WATER DOWNGRADIENT OF THE SAPP BATTERY SITE

	Station											
Date	6	5	11	4	1	2	2A	3	4A	4B	7	8
August 1983	5.50	5.7	5.5	5.9	3.4	2.9	--	--	--	--	5.5	5
September 27, 1983	5.1	6.1	6.5	5.3	3.8	3.4	--	--	--	--	5	4.7
July 10, 1984	4	--	3.5	3.4	2.6	2.8	2.8	--	3.8	3.7	3.7	4
October 19, 1984	5.3	--	--	5.7	3.3	3.4	3.4	--	5.5	5.4	5.1	5.2
February 4, 1985	4.2	--	3.9	4.5	3.2	3.2	3.2	--	6.4	5.8	5.2	5.5
April 1, 1985	5.2	--	4.7	4.7	3.5	3.4	3.4	--	5.4	5.4	5.4	4.9

Source: Livingston 1985

Table 1-4

COMMUNITY INDICES OF ALGAE TAKEN WITH DIATOMETERS AT FOUR STATIONS IN THE LITTLE DRY CREEK-DRY CREEK SYSTEM (quarterly, 1984-1985)

	Station			
Date	01	06	07	2A
Number of individuals per mm^2 per slide				
07/26/84	688.00	736.00	1,430.00	2,869.00
10/29/84	403.00	518.00	337.00	2,179.00
01/29/85	702.00	317.00	489.00	1,674.00
04/05/85	1,621.00	1,891.00	2,222.00	4,726.00
Number of species				
07/26/84	14.00	24.00	15.00	25.00
10/29/84	9.00	21.00	10.00	8.00
01/29/85	29.00	28.00	19.00	18.00
04/05/85	7.00	23.00	10.00	13.00

Source: Livingston 1985

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Table 1-5

NET PLANKTON
(numbers/m^3 x 0.0001)
TAKEN IN THE LITTLE DRY
CREEK-DRY CREEK SYSTEM

	Station			
Date	01	06	07	2A
Number of Individuals per m^3				
07/26/84	2,554.35	7,830.48	4,315.38	8,661.25
10/29/84	3,217.58	12,003.70	8,317.11	16,341.11
01/29/85	17,941.60	48,024.38	48,984.53	15,069.93
04/05/85	31,391.49	29,077.64	35,176.28	61,971.38
Number of Species				
07/26/84	19.00	11.00	15.00	9.00
10/29/84	11.00	36.00	25.00	15.00
01/29/85	13.00	38.00	32.00	13.00
04/05/85	17.00	22.00	21.00	14.00

Source: Livingston 1985

Epibenthic macroinvertebrates (organisms living on the sediment surface or slightly above it) exhibited a similar pattern. Seasonal variations were noted.

1.5.4 Fishes

Fish were collected qualitatively by using an electrofisher. No fish were observed in the most highly contaminated areas (stations 1 and 2). Recovery of species richness and numbers of individuals was noted between station 4B and station 7. This pattern follows the gradient exhibited by other types of organisms as well as the gradient of contamination (heavy metals and pH).

Livingston concluded that altered species dominance and a decrease in numbers of individuals and species of periphyton (algae collected in diatometers) as well as net algae, was due to water quality changes in the immediate vicinity of the Sapp Battery site. Also attributed to altered water quality were diminished species richness, diversity, and evenness of infaunal macroinvertebrates and the complete loss of fish fauna. A distinct biological response was observed along the gradient of contamination. This was made obvious by change in the development of the algal community, the establishment of resident invertebrates populations, and the loss of fish fauna.

1.5.5 Heavy Metals Task Force Investigation

The Heavy Metals Task Force conducted several studies in the vicinity of the Sapp Battery Site. These included studies on the Chipola River, including areas potentially affected by the United Metals plant. These investigations were conducted to determine the contribution of heavy metal contamination in water, sediment, and biological samples from the Sapp Battery site and/or the United Metals plant.

In August 1982, FDER conducted a study on water and sediment quality on the Chipola River in the vicinity of the United Metals plant. There was also a sample station (station 14) on Dry Creek, which is the predominant drainage from the direction of Sapp Battery. Water analyzed from station 14 revealed no values for lead or cadmium above detection limits. Manganese was detected at 50 ug/l. This value is much lower than the 630 ppb level analyzed for at station 12,

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which is farther upstream on the Chipola River. Sediment samples from station 14 exhibited 4.2 mg/kg lead and 0.6 mg/kg cadmium (see Figure 1-8). In comparison, a slightly higher lead value of 6.5 mg/kg was detected at station 13, situated on the Chipola River above the Dry Creek-Chipola River confluence. Aluminum was not an analytical parameter in this study (FDER February 1983).

A subsequent study was initiated in March 1983 as a result of findings reported in September 1982 by the Florida Game and Freshwater Commission of high cadmium levels and other metals in whole finfish (largemouth bass, spotted sucker) samples collected in the Apalachicola Basin. Freshwater clam (corbicula sp.) samples were also collected and analyzed for metals. Lead was an order of magnitude higher in the spotted sucker (0.450 mg/kg), as compared to the largemouth bass (0.130 mg/kg) at station 4. Lead values at the remaining stations for both fish exhibited comparable levels both up- and downstream from station 4, with peaks occurring farther downstream in both samples. These downstream values were again higher for the spotted sucker (1.54 mg/kg at station 7) versus the largemouth bass (1.19 mg/kg at station 8). This is due to the fact that suckers feed on benthic organisms and often strain bottom mud in the process. These muds are sinks for heavy metals in aqueous systems. Thus, ingestion of these nutriment fractions would lead to higher tissue metals levels in the sucker versus the bass, which are primarily nektonic carnivores, feeding mainly on small fish. Cadmium values for both fish were below detection limits for the majority of stations. The greater majority of bass samples were below the detection limit of 0.400 ppm. Three stations, 9 (0.406 ppm), 7 (.475 ppm), and 3 (0.440 ppm), exhibited elevated levels. All except one of the sucker samples (from station 7, 0.426 ppm) were below 0.400 ppm (see Figure 1-9). The corbicula clam samples provided a more comprehensive picture of cadmium distribution along the Chipola River. These organisms strain benthic mud for food and ingest mud in the process. As a result, bioconcentration of heavy metals is more easily facilitated in tissue. The highest value was again evident at station 7 (0.548 ppm), while the second and third highest values occurred at stations 2 (0.519 ppm) and 1 (0.488 ppm). From this wide range it can be concluded that cadmium is generally distributed throughout the main stem of the

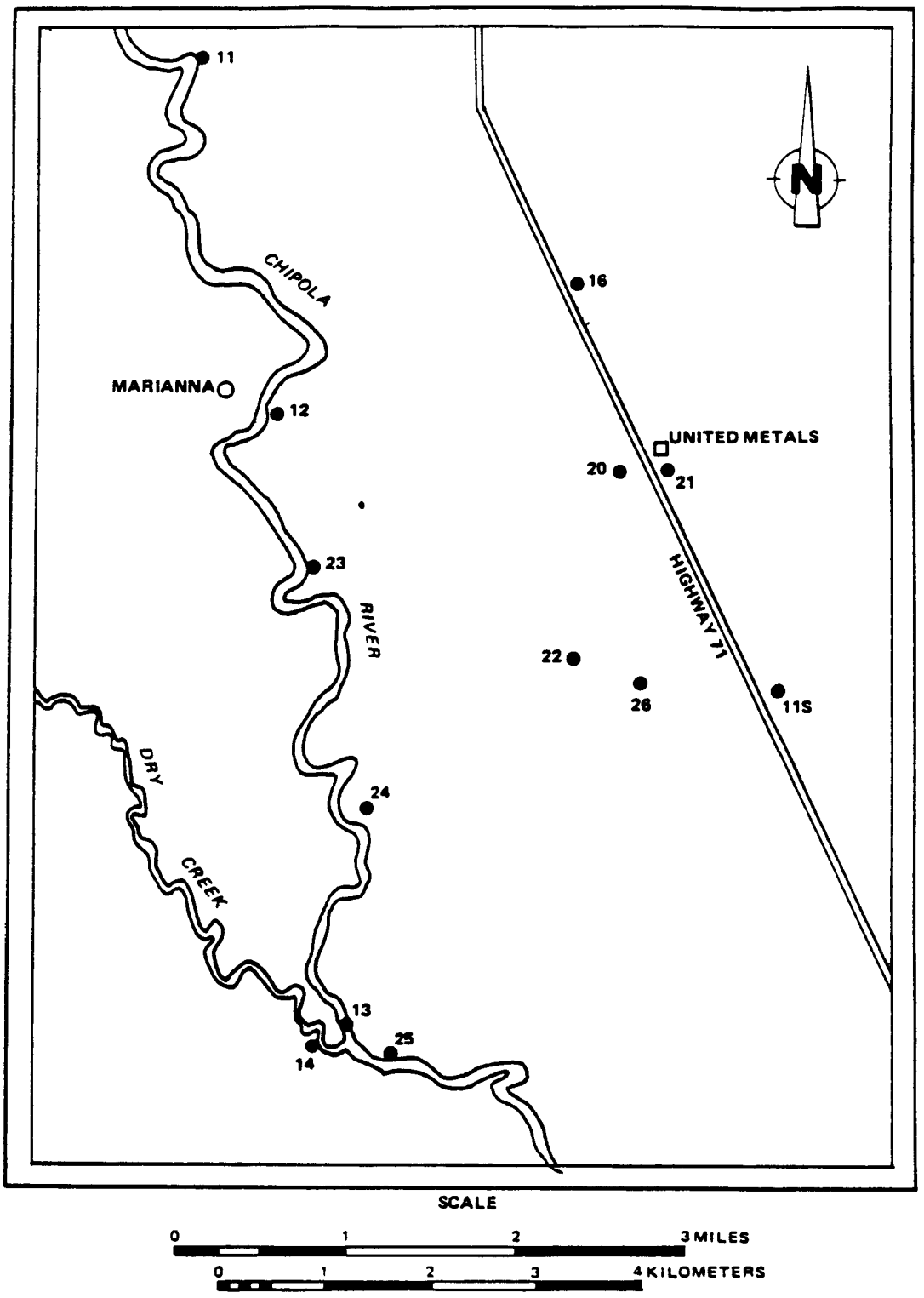

Figure 1–8 CHIPOLA RIVER SAMPLING STATION LOCATIONS

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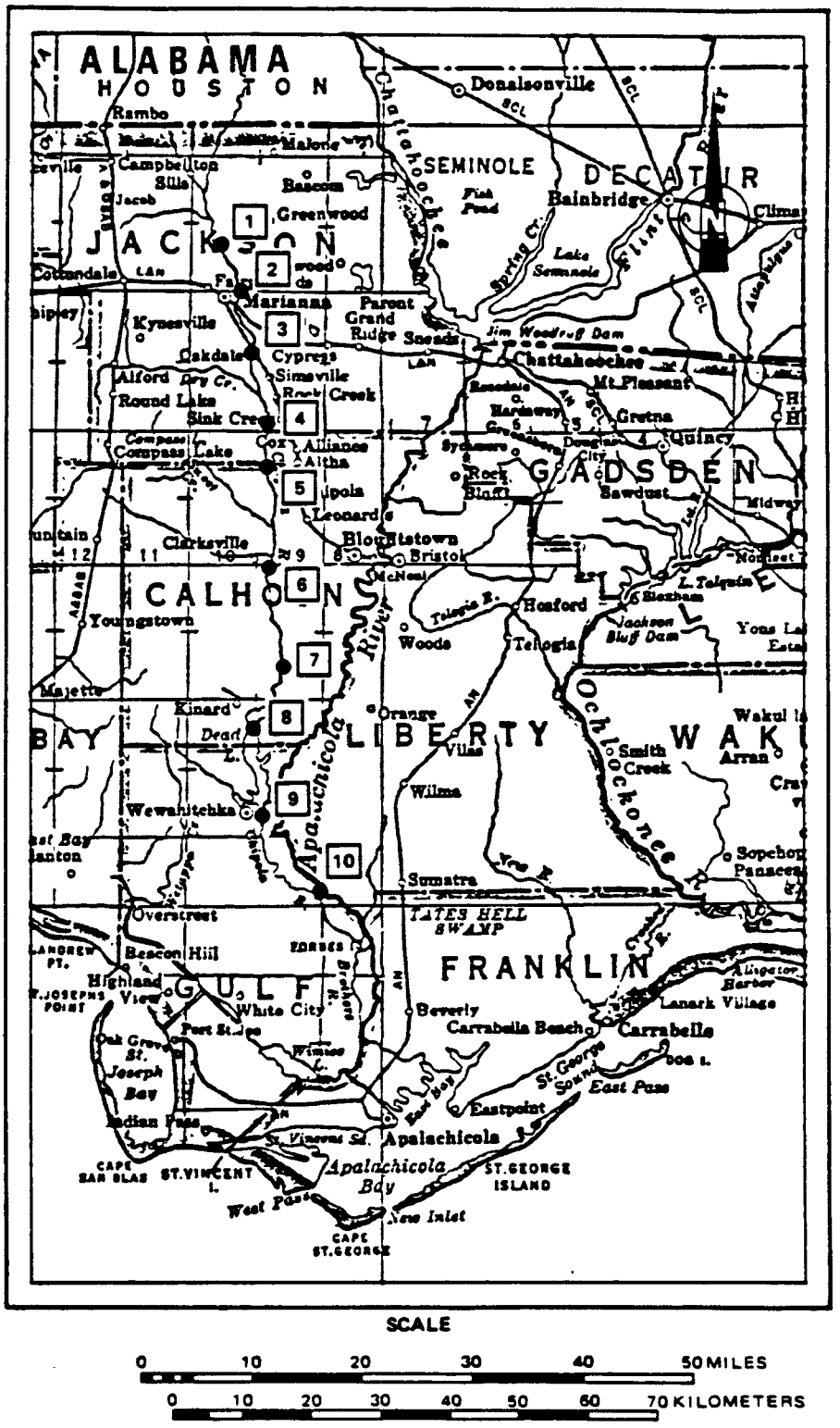

Figure 1–9 CLAMS AND FISH IN CHIPOLA RIVER FGFC/USFWS SAMPLING STATIONS

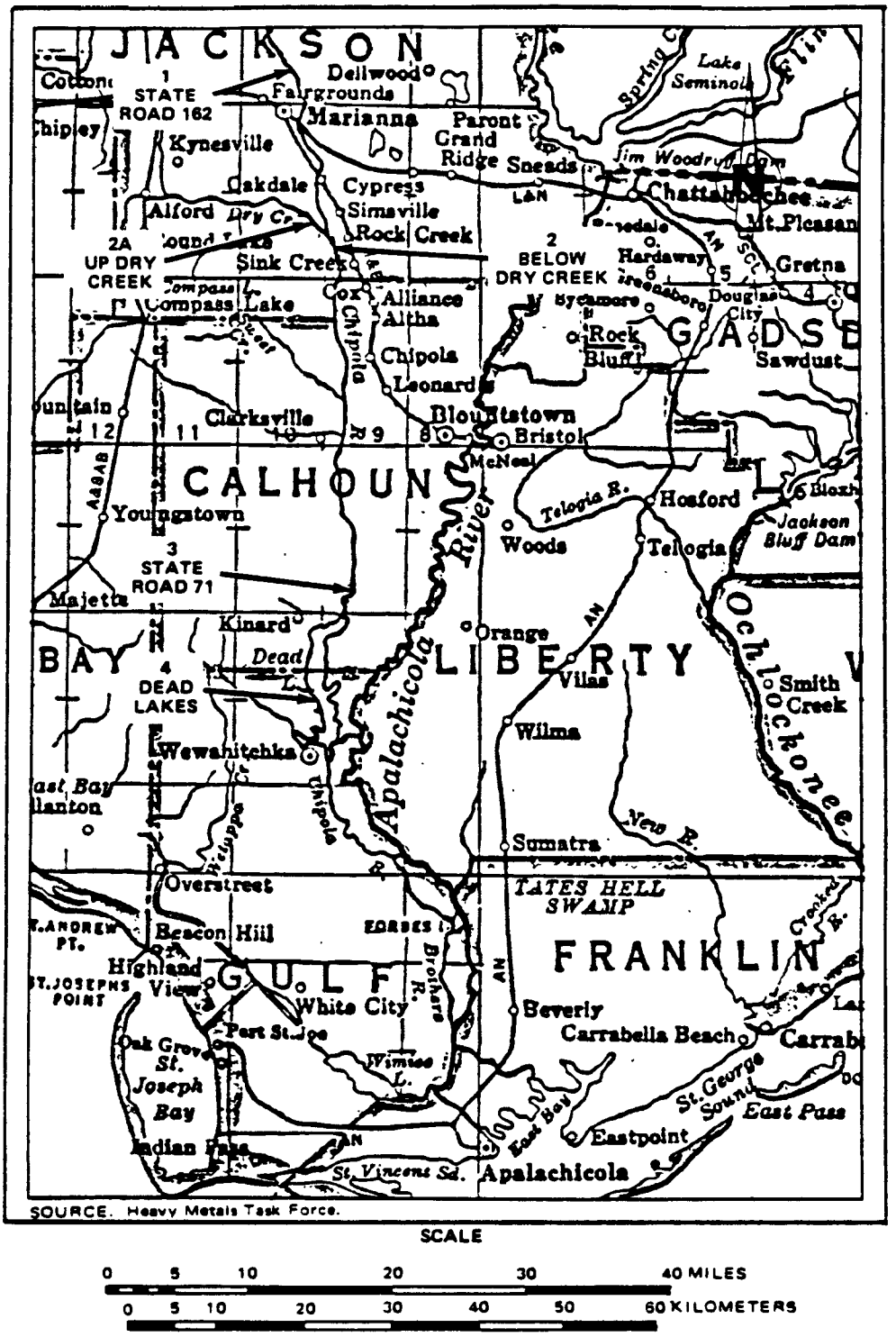

Figure 1–10 FINFISH COLLECTION SITES FOR HEAVY METAL ANALYSIS

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Chipola River and probably exists in small indiscrete point sources (FDER, March 1983). Since no trend of metal concentration existed as a function of station location, a connection with Sapp Battery could not be established.

During the period 1983 through 1985, a variety of fishes were taken from five stations on the Chipola and Apalachicola rivers (see Figure 1-10). Fillets were analyzed for lead, mercury, and cadmium. Statistical values indicated an increase of lead and cadmium in suckers versus bass, and a general increase in year-class metal levels for the aforementioned rivers. On a further 1985 Chipola River study, a mean comparison for lead exhibited similar trends. Additionally, a slight gradient existed for lead up- and downgradient from the Dry Creek-Chipola River confluence. Lower concentrations existed upriver from the confluence at station 1, while higher levels existed at the confluence, near stations 2 and 2a. Mean and standard deviation values at station 2a (up Dry Creek) indicated lower levels of lead than at station 2 (Department of Interior 1985). Thus, contamination from the Sapp Battery site may be a contributing factor to increased levels of lead and cadmium in Chipola River fish. However, evidence is not sufficient to indicate the Sapp site as the primary source of contamination.

2. FIELDWORK

2.1 PRIORITY POLLUTANT CONFIRMATION STUDY

Prior to beginning the major portion of the fieldwork, a limited number of samples was collected and analyzed for priority pollutants (i.e., purgeable organics, acid base/neutral extractable organics, pesticides, total metals, cyanide, and sulfates). The purpose of this limited sampling was to confirm the analytical parameters for the main investigation. Soil and sediment sample locations are listed in Table 2-1; surface water and groundwater sample locations are listed in Table 2-2. All sampling locations are shown on Figure 2-1.

For background purposes, soil, sediment, groundwater, and surface water samples were collected from areas which were likely to be unaffected by contamination from the Sapp Battery site, off-site and to the west. The background soil sample was collected in the south-central portion of an open pasture adjoining the site to the west (Jackie Farren's property); the background sediment and surface water samples were taken from the west Steele City Bay area; and the background groundwater sample was collected from an assumed upgradient residential well owned by Mr. Emmett Roark. These background samples were collected prior to the on-site fieldwork.

In order to qualitatively represent site contamination, four soil samples, four sediment samples, four groundwater samples, and three surface water samples were collected on-site. The soil samples were collected in the Northwest Landfill area and the west bank of the West Swamp. The sediment samples were taken from the Northwest Swamp, West Swamp, East Swamp, and Southeast Swamp. The soil and sediment

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Table 2-1

SOIL/SEDIMENT SAMPLES COLLECTED FOR THE PRIORITY POLLUTANT CONFIRMATION STUDY

Sample/ Location Number	Location/Description
Soils	
FSY01	Pasture west of site, 5-foot boring composite (background)
FSG23P	Northwest landfill, on-site grid station 23, 5-foot boring composite
FSG54P	Northwest landfill, on-site grid station 54, 5-foot boring composite
FSA06P	West bank of West Swamp, station 06, 5-foot boring composite
FSA09P and DSA09P (duplicate)	West bank of West Swamp, station 09, 5-foot boring composite
SBB01	Soil/sediment sample jar (8-ounce) trip bottle blank
FSR01	Soil sampling equipment field rinsate sample
Sediments	
FMH16	West Steele City Bay, southwest of site, 5-foot boring composite (background)
FMH17	West Swamp, 5-foot boring composite
FMH18	East Swamp, 5-foot boring composite
FMH19	Southeast Swamp, 5-foot boring composite
FMH20	Northwest Swamp, 2.5-foot boring composite

Table 2-2

SURFACE WATER/GROUNDWATER SAMPLES COLLECTED
FOR THE PRIORITY POLLUTANT CONFIRMATION STUDY

Sample/ Location Number	Location/Description
Surface Water	
FSW01	West Steele City Bay, southwest of site (background)
FSW02 and DSW02 (duplicate)	West Swamp
FSW03	Southeast Swamp
FSW04	Steele City Bay, west of culvert under railroad tracks
Groundwater	
FEW03A	Monitoring well MW-03A
FEW0388	Monitoring well MW-0388
FEW03C	Monitoring well MW-03C
FEW09C	Monitoring well MW-09C
FRW01	Residential well (Emmett Roark residence), southwest of site
GWB01	Water sample trip bottle blanks (1/2 gallon, 1 liter, 40 ml)
GWR01	Monitoring well sampling equipment field rinsate sample

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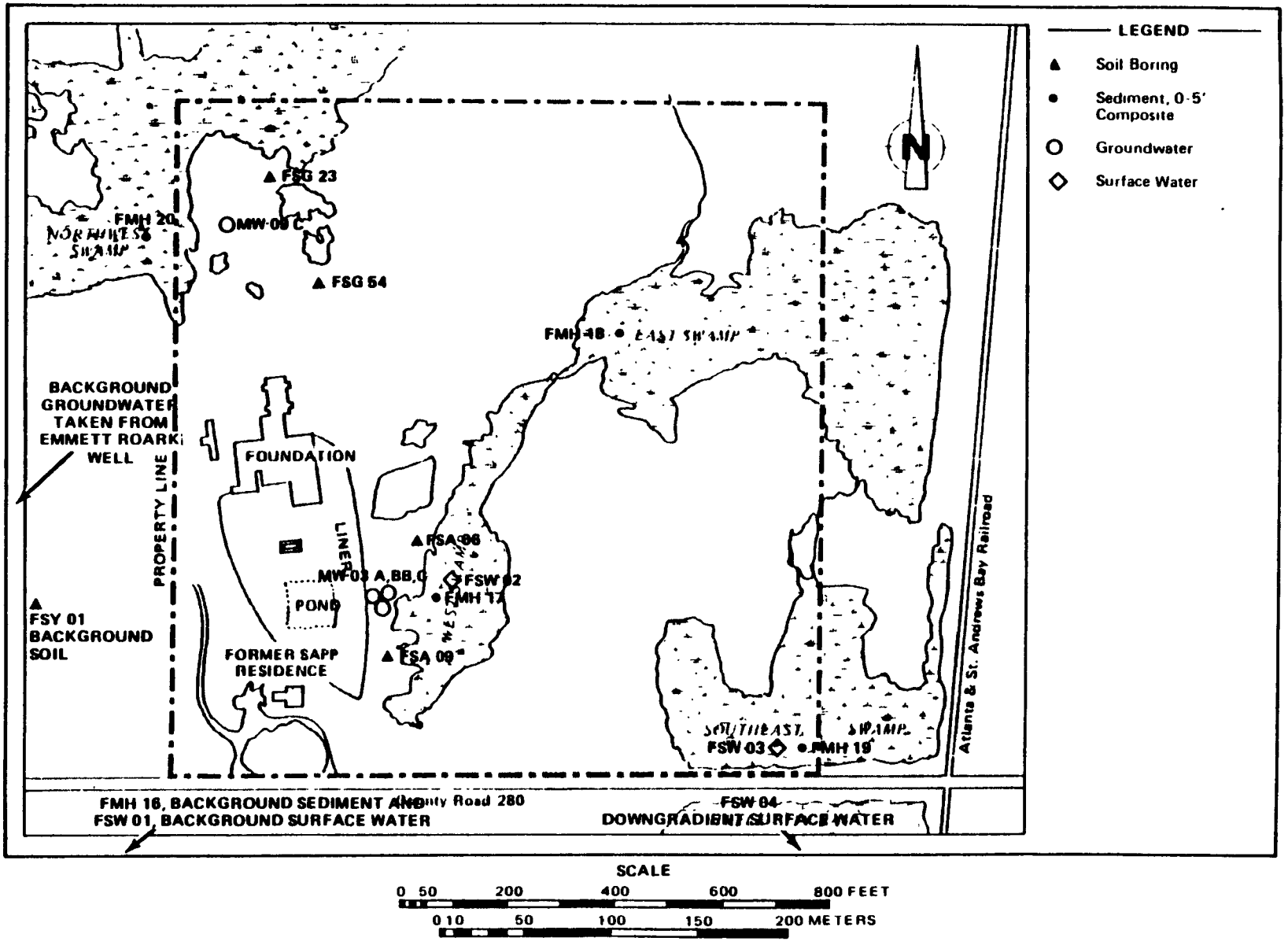

Figure 2–1 PRIORITY POLLUTANT CONFIRMATION STUDY SAMPLE LOCATIONS

samples were collected using a modified hand augering technique and composited over a 0- to 5-foot depth interval.

The groundwater samples were collected from existing wells MW-03A, MW-03BB, MW-03C, and MW-09C. These samples were obtained using a polyvinyl chloride (PVC) bailer after three well volumes of water had been purged from each well.

Sampling techniques are discussed in detail in Sections 2.2, 2.3, and 2.4 for soil, sediment, and groundwater, respectively.

The three surface water samples were collected near the west bank of the West Swamp, the west bank of the East Swamp, and in Steele City Bay, west of the culvert under the railroad tracks. These samples were obtained by submerging the sample container under the water until the container was full. Conductivity, pH, and temperature were measured at all surface water and groundwater sampling locations.

Duplicate samples (approximately 10% of the total number of samples), sampling equipment rinsates, and trip bottle blank samples were collected for QA/QC purposes (see Section 4). All parameters for solids and water were analyzed at the detection limits specified in the QAPP, except where matrix effects or high concentrations limited the volume used for analysis, or required dilution or changing the detection limit to "best achievable." As requested by FDER, complete data packages were compiled for 12 of these samples in accordance with standard EPA procedures. The analytical results of this initial confirmation study are discussed in Section 3.1.

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2.2 SOIL SAMPLING/FIXATION STUDY

2.2.1 Soil Sampling

Soil samples were collected from a total of 89 locations: surface composite samples at 18 locations; eight 5-foot borings; 61 10-foot borings; and two 15-foot borings (see Table 2-3). The samples were analyzed for either pH, lead, and percent moisture, or pH, lead, cadmium, antimony, and percent moisture. Analytical results for the soil samples are discussed in Section 3.2.

All subsurface soil samples were collected using some type of boring equipment, either a 4-inch solid stem auger, 4-inch bucket auger, or 2-inch split-spoon. All of the boring equipment was constructed from hardened steel, with the exception of one of the bucket augers, which was constructed from stainless steel. Most of the samples were obtained using disposable plastic spoons and homogenized in plastic zip-lock storage bags before being placed into 8-ounce sample jars. Plastic spoons were used to reduce the potential for outside metals to contaminate the soil sample. In several instances, however, a stainless steel spoon was used to collect a sample where extremely dense clays were encountered and plastic spoons were not practical.

As shown on Figure 2-2, a total of 18 surface soil composite sampling locations were established: 13 in the southeastern portion of the site (three of which--FSS16, 17, and 18--were located in the area of the former Sapp Battery facility), four in the northern portion of the site, and one in the southwest corner of the site. Each sample was collected as a composite of five aliquots from a 25-foot-diameter area. Each aliquot was collected from a depth of 0 to 0.5 foot, using a plastic spoon, and the total sample was homogenized in a plastic zip-lock storage bag before being placed into the appropriate sample container. Spoons and bags were discarded after each sample.

Fifteen of the 18 samples were analyzed for pH, lead, and percent moisture. The remaining three samples, taken from the area of the former facility, were analyzed for pH, lead, cadmium, antimony, and percent moisture.

There were certain procedures common to all of the soil borings conducted on the site. Observations made of lithology (soil/sediment

Table 2-3

ORGANIZATION OF COLLECTED SOIL SAMPLES

Prefix Code	Description	Total Locations	Total Samples Analyzed[1]	Total Samples Archived	Archived Samples Analyzed
FSA-	10-foot borings conducted along the west bank of the West Swamp	13	72	0	0
FSB-	10-foot borings conducted along the south side of the southwest berm	6	20	12	6
FSC-	10-foot borings conducted through the concrete foundation of the Sapp Battery plant	2	7	4	0
FSE-	5-foot borings conducted along the east bank of the West Swamp	8	27	0	0
FSG-	10-foot borings conducted in a grid pattern north of the plant	40	130	80	48
FSL-	15-foot borings conducted in the Northwest Landfill	3*	3	0	0
FSS-	Surface soil composite sample locations	18	19	0	0

Key:

1. Totals given include duplicate samples collected (DS*-).

*One location did not involve sampling (exploration only).

Note: Samples collected for Priority Pollutant Confirmation Study not included.

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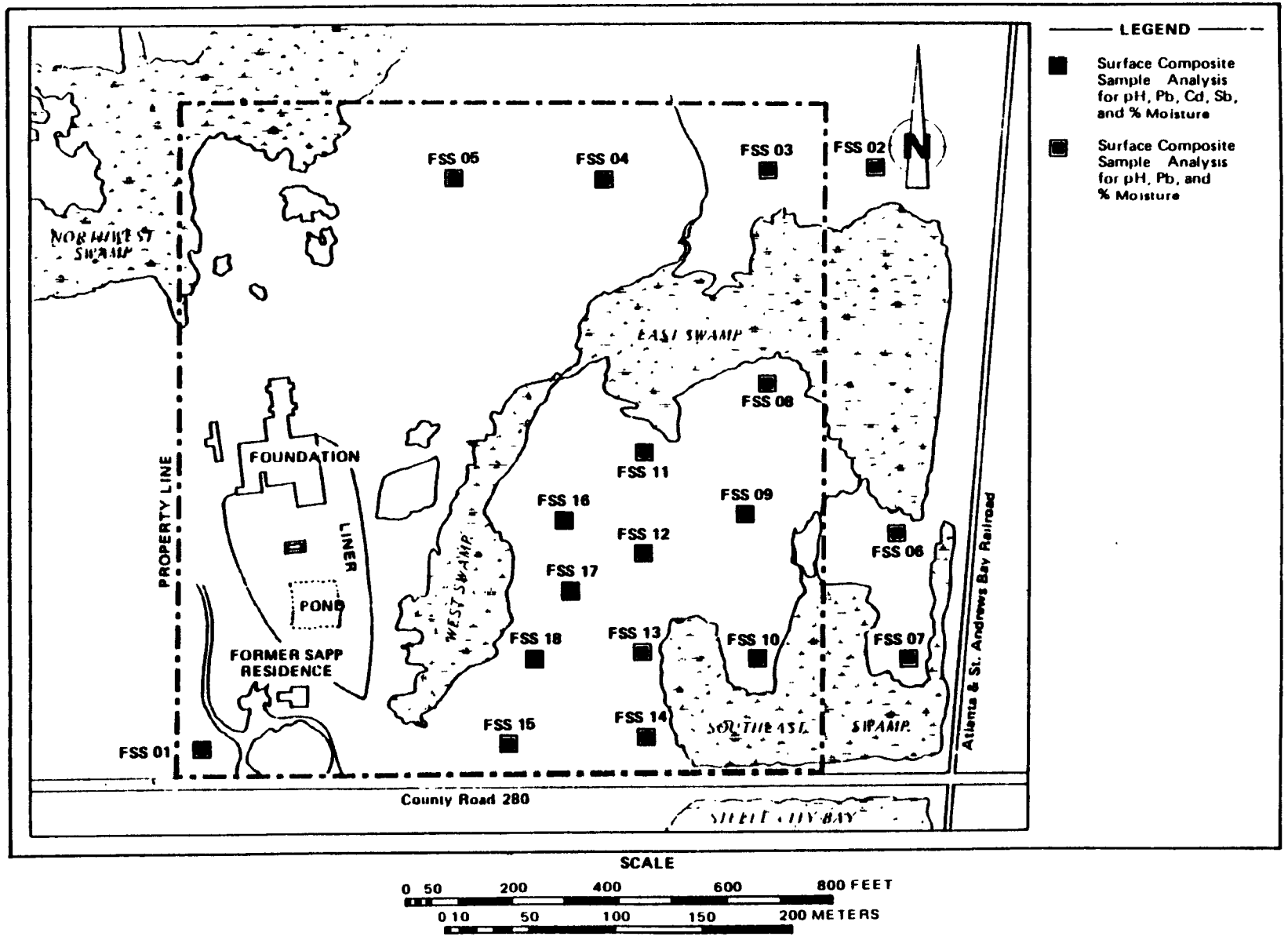

Figure 2–2 SURFACE COMPOSITE SAMPLE LOCATIONS (FSS)

characteristics, depth of battery chip/casings fill, and depth to water table, when possible) were recorded at each hole. Upon completion of each boring, the boreholes were grouted to the surface with portland cement. There were a few instances where cave-ins prevented grouting of the entire hole.

There were enough 4-inch-diameter solid stem auger flights to complete 10 boreholes before decontamination was necessary. After completing 10 borings, all of the auger stems were pressure-washed, scrubbed with trisodium phosphate and water, rinsed with tap water, and then rinsed with distilled water. In contrast, both auger bits were needed for each boring, and these were decontaminated between boreholes. The two solid stem auger bits used for the borings were decontaminated after each boring by scrubbing in trisodium phosphate, using non-metallic brushes. Toothbrushes were used to clean between auger teeth. The bits were rinsed with tap water and then with distilled water. Sampling personnel washed their gloves between samples.

The eight 5-foot borings, FSE01 through FSE08, are located adjacent and parallel to the east bank of the West Swamp (Figure 2-3). Sampling was conducted over depth intervals of 0 to 0.5 foot, 0.5 to 2.5 feet, and 2.5 to 5 feet.

It was originally planned to drill the 5-foot borings using a drill rig and solid stem augers; however, a high water table and flooding along the east bank of the West Swamp resulting from the heavy rains associated with Hurricane Juan prohibited vehicular access to these sample locations. Locations FSE04 through FSE07 were under water as much as 1 foot.

At each 5-foot boring location, the 0 to 0.5-foot sample was collected as a grab sample and homogenized before being placed into the sample container. Borings were continued manually to 5 feet. Sampling at FSE01 and FSE02 was conducted using a split-spoon core sampler which was driven to depth with a sledge hammer. Although representative samples were obtained, this method was discontinued after the first two holes because it proved to be too time-consuming. Furthermore, because the split-spoon would not yield the necessary amount of soil needed to obtain a duplicate sample from an interval, an additional coring adjacent to the first was required. The split-spoon

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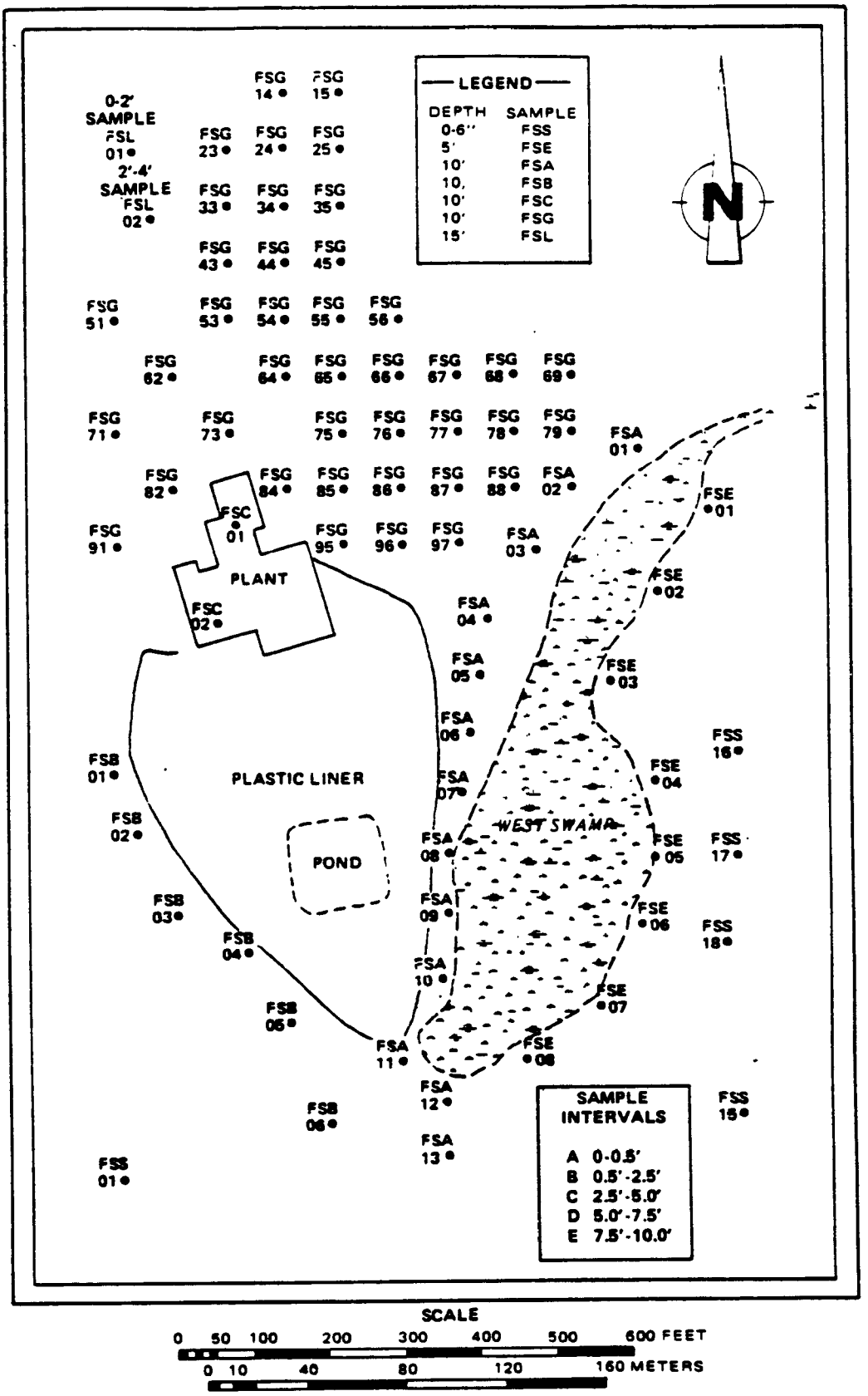

Figure 2–3 SOIL BORING SAMPLE LOCATIONS

was decontaminated before taking each sample. The outside of each core was scraped off before the sample was collected and homogenized.

Borings FSE03 through 08 were dug using a 4-inch stainless steel bucket auger. Due to the potential for caving-in of the hole, as well as the problem of surface and subsurface water entering the hole, a 5-foot length of PVC casing was advanced downhole simultaneously with the augering. This technique was successful, especially in areas of fluid sands and muds, as well as for borings situated in areas under water at the time of the fieldwork. In addition, the installation of PVC casing enabled proper grouting of the open hole upon completion of the borings.

When collecting samples from the bucket auger, the materials on both the tip and the upper portion of the auger were removed. Only the material from the inner core of the bucket was collected so as to minimize the amount of soil in the sample which had come into contact with the inner walls of the auger as well as any overlying loose material. The bucket auger was rinsed between sample intervals and, along with the PVC casing, was thoroughly decontaminated between boreholes. Plastic spoons and zip-lock bags were discarded.

Samples taken from FSE04 through 06 (directly west of the former Sapp Battery facility) were analyzed for pH, lead, cadmium, antimony, and percent moisture. The other 5-foot borings were analyzed for pH, lead, and percent moisture only.

The sixty-one 10-foot borings were conducted on the western half of the property (Figure 2-3). Each of these borings was sampled continuously over depth intervals of 0 to 0.5 foot, 0.5 to 2.5 feet, 2.5 to 5 feet, 5 to 7.5 feet, and 7.5 to 10 feet.

Forty of the 10-foot borings were located in a grid pattern extending north of the plant foundation and covering most of the northwest quadrant of the site. Most locations were spaced at 75 feet; however, the southwestern portion of the grid is based on 150-foot centers as requested by FDER, due to the absence of buried casings in this area and the low potential for heavy contamination. Boring locations in the grid are referenced as FSG14 through FSG97 (with the two-digit number referencing the position of the point in columns 1 through 9 and rows 1 through 9, respectively).

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Several changes in grid boring locations were made due to field conditions. FSG14 was moved 14 feet southeast due to large trees preventing further access. FSG15 was moved 8 feet east, away from the dug-out pond on the north property line. FSG51 was moved 10 feet to the southeast because of muddy conditions which prevented rig access. FSG69 was moved 10 feet south of the berm on which it was originally surveyed; and FSG91 was offset 8 feet northeast to avoid a deep puddle.

All of the 10-foot borings in the grid were drilled using a drill rig. A 4-inch diameter solid stem auger flight was drilled to a depth of 5 feet and hydraulically extracted to avoid mixing the soil sample material. The outside deposits on the auger were scraped off to remove materials originating from the walls of the borehole during extraction. After the 0 to 5-foot samples were collected, a clean 10-foot length of auger was inserted and the borehole was drilled from 5 to 10 feet. After hydraulically extracting the 10 feet of auger, the outside material was scraped off the lower flight and the 5- to 10-foot samples were collected.

At all boring locations in the grid, the lower two samples (5 to 7.5 feet and 7.5 to 10 feet) were archived pending the review of the analytical data from the 0 to 5-foot samples. Where warranted, selected samples were removed from storage and analyzed. The selection and analyses of archived samples are discussed in Section 3.2.4.

Samples FSG34A, FSG35A-C, FSG43A-C, and FSG44A-C were split with EPA, and complete data packages were prepared for these samples in accordance with standard EPA procedures. These data packages were submitted under separate cover.

Samples collected at seven 10-foot boring locations in the area of the Northwest Landfill were analyzed for pH, lead, cadmium, antimony, and percent moisture. All other samples collected in the grid were analyzed for pH, lead, and percent moisture.

Thirteen of the 10-foot borings (FSA01 through 13) were drilled along the west bank of the West Swamp and to the south where the West Swamp drains toward County Road 280 (Figure 2-3). Originally, FSA01 through 12 were plotted directly adjacent and parallel to the bank of the swamp. However, field personnel decided to relocate FSA04 through 07 further upland to the west because it was felt that these borings

would provide more useful information if located more centrally in this battery chip-filled area between the boring grid of the previous IRM effort and the West Swamp.

Each of the FSA borings was sampled continuously over the same intervals as those in the grid; however, all samples were analyzed for pH, lead, cadmium, antimony, and percent moisture, including those taken over the 5 to 7.5-foot and 7.5 to 10-foot intervals. No samples from this group were archived.

Due to a high water table and flooding resulting from the heavy rains of Hurricane Juan, the drill rig could only gain access to seven of the 13 FSA boring locations: FSA01, 05, 06, 07, 08, 12, and 13. The FSA drill rig borings were conducted in a manner identical to that described for the grid borings.

Six of the FSA 10-foot borings were conducted by hand with a 4-inch bucket auger. The auger was decontaminated at the completion of each interval. At locations FSA09 and FSA10, PVC casing was pushed downhole 5 feet to prevent a cave-in while augering the lower intervals and to aid the grouting process. The PVC casing was decontaminated between boreholes.

Six 10-foot borings (FSB01 through 06) were conducted along the southwest side of the berm that borders the liner-covered area (Figure 2-3). The borings were spaced at intervals averaging approximately 125 feet. Each of the borings was drilled using a drill rig and sampled in the manner described for the 10-foot grid borings. Upon completion, all holes were grouted to the surface with portland cement.

Samples from the lower two intervals (5 to 7.5 feet and 7.5 to 10 feet) in each boring were archived pending evaluation of analytical data from the upper intervals (0 to 5 feet). Archived samples selected for analysis are discussed in Section 3.2.4. Samples from the upper three intervals of all FSB borings were analyzed in the laboratory for pH, lead, and percent moisture.

Two 10-foot borings penetrated the foundation of the Sapp Battery plant building (Figure 2-3). One boring was drilled through the foundation of the battery cutting saw room (FSC02), and the other was drilled through the storage room foundation on the north side of the building (FSC01). A 12-inch-diameter hole was first cut through the

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concrete foundation at each location to provide access for the auger. The borings and sampling were conducted with a drill rig in the manner described above for the 10-foot grid borings. Upon completion, both holes were grouted to the surface with portland cement.

The lower two samples from each boring were archived pending evaluation of analytical data from the upper intervals. The upper intervals (0 to 5 feet) were analyzed for pH, lead, cadmium, antimony, and percent moisture.

Three borings were drilled in the battery casing dump adjacent to the Northwest Swamp (Figure 2-3). Two of the borings (FSL01 and FSL02) were drilled to 15 feet; FSL03 was drilled to only 10 feet. Borings FSL01 and FSL02 were located in the north-central and south-central portions of the filled area, respectively. In both cases, 15 feet of auger flight was drilled through the fill and then extracted up the drill rig derrick with a winch. The depth of fill was determined from the augers and a sample was taken from mid-depth of the fill in each case (and analyzed for lead, cadmium, antimony, pH, and percent moisture). Because the depth of fill was shallower than expected in each case (2 feet at FSL01 and 6.5 feet at FSL02), a third boring was conducted on the western edge of the fill area, adjacent to the Northwest Swamp, to confirm the findings of the first two borings. Boring FSL03 indicated fill and sparse battery casings to a depth of approximately 5 feet. No sample was collected from FSL03 since it was drilled for exploratory purposes only and was outside the planned scope of work.

2.2.2 Fixation Study

Based on the initial data, lead-tainted soil samples were collected in the soil sampling grid near the northeast portion of the landfill. Composite samples weighing about 2,500 grams each were collected from the 0 to 5-foot and 5 to 10-foot intervals. The method of collection was the same as described earlier. These samples were shipped to E & E's laboratory immediately following collection to undergo the fixation study.

Two basic fixation methods were evaluated for leachate production of contaminated soils from the Sapp Battery site. The fixation methods chosen for study were cementitious and pozzolanic cementation.

Much of the information concerning these techniques is proprietary; therefore, development of solidification matrices was based on information contained in Morgan et al. (1984).

The cementitious (cement-based) solidification technique involves the sealing of contaminated soil in a matrix of portland cement, whereas the pozzolanic solidification technique involves the sealing of contaminated soil in a matrix of lime and fly ash. In the scope of work, the pozzolanic technique called for a matrix of cement kiln dust and fly ash; however, the cement kiln dust was unavailable and lime was substituted.

The study consisted of fixing contaminated soil from the 0 to 5-foot and 5 to 10-foot depth intervals. The composite was divided into 100-gram samples to be used in the fixing process. Samples from each depth interval were mixed with varying percentages of solidification agent (cement or lime and fly ash) and water. Three cement/soil combinations and three lime/fly ash/soil combinations were mixed for each depth interval. Tables 2-4 and 2-5 outline the amounts used for each mix.

Due to the dryness of the soils at the time of fixing, 30 weight percent water was added to the solidification agent/soil mixture to assure that binding would occur. This weight percentage of water was selected based on a fixation study by Morgan et al. (1984). The mixing of dry soil with dry solidification agent did not produce a bound matrix. Addition of water was necessary to solidify the soils.

The following procedure was used in mixing the solidification agent and contaminated soil:

- To prepare the soil composites, all of the soils from each respective depth interval (0 to 5 feet and 5 to 10 feet) were placed in a clean container and mixed with a stainless steel tablespoon until homogeneous.

- To prepare the soil/cement mixtures, 100 grams of soil from each depth interval composite was placed in a clean container along with an appropriate amount of cement in accordance with Table 2-4, and mixed with a stainless steel tablespoon until

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Table 2-4

SOIL SOLIDIFICATION - CEMENTITIOUS MATRIX

Depth Interval (feet)	Soil:Cement Ratio	Soil (grams)	Cement (grams)	Water (grams)
0-5	1:0.5	100	50	45
	1:1.0	100	100	60
	1:1.5	100	150	75
5-10	1:0.5	100	50	45
	1:1.0	100	100	60
	1:1.5	100	150	75

homogeneous. If the mix remained "powdery" and did not bind, the corresponding amount of water was added and mixed until homogeneous.

- To prepare the soil/fly ash/lime mixtures, 100 grams of soil from each depth interval composite was placed in a clean container along with an appropriate amount of fly ash and lime in accordance with Table 2-5, and mixed with a stainless steel tablespoon until homogeneous. If the mixture remained "powdery" and did not bind, the corresponding amount of water was added and mixed until homogeneous.

Each of the 12 solidification mixes was allowed to dry for a minimum of 24 hours. After the 24-hour drying period had elapsed, the 12 solidification samples, along with two control samples (a 100-gram sample from the 0 to 5-foot soil composite and a 100-gram sample from the 5 to 10-foot soil composite) were analyzed for EP toxicity. A total of 14 EP toxicity tests were conducted.

Based on the priority pollutant confirmation study, lead- contaminated soil samples were obtained adjacent to location FSG54. These samples, however, exhibited such low lead concentrations that an accurate analysis could not be performed, i.e., only 2.62 mg/kg lead was detected in the non-fixed control sample for EP toxicity analysis.

As a result, a new sample collection scheme was developed. This consisted of compositing portions of samples from locations FSG-53A, B, C; FSG-76A, B, C; and FSG-87A, B, and C. For compositing purposes, these samples were sieved through a 10-mesh screen and homogenized in a glass jar with a spatula. Analysis of the composite sample showed a concentration of 71,000 mg/kg. In accordance with the procedures described above, three pozzolanic solidification mixes, three cementitious solidification mixes, and one control sample were prepared for the EP Toxicity test. The results of this revised fixation study are presented and discussed in Section 3.2.7.

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Table 2-5

SOIL SOLIDIFICATION - POZZOLANIC MATRIX

Depth Interval (feet)	Soil: Pozzalime Ratio	Soil (grams)	Fly Ash (grams)	Lime (grams)	Water (grams)
0-5	1:0.5	100	25	25	45
	1:1.0	100	50	50	60
	1:1.5	100	75	75	75
5-10	1:0.5	100	25	25	45
	1:1.0	100	50	50	60
	1:1.5	100	75	75	75

2.3 SEDIMENT SAMPLING

Sediment samples were collected from a total of 36 locations: 2.5-foot borings at 12 locations, 5-foot borings at 15 locations, and 10-foot borings at nine locations (see Table 2-6). These borings were conducted in swamp areas both on- and off-site. Sediment sample locations are given in Figures 2-4 and 2-5.

Sediment samples were analyzed for pH, lead, cadmium, and antimony. Sediment sample collection involved the use of a 4-inch stainless steel bucket auger. All samples were collected using disposable plastic spoons and homogenized in plastic zip-lock bags prior to being placed into 8-ounce sample jars. Plastic was used for sample collection and homogenization in order to reduce the potential for outside metals to contaminate the sediment sample. In some instances, however, extremely competent clays were encountered and the use of plastic spoons was not practical. Consequently, stainless steel spoons were used for sample collection.

Sediment sample collection techniques were similar to those used for soil sampling. The samples were collected as composites over specific depth intervals designated as interval A (0 to 0.5 foot), interval B (0.5 to 2.5 feet), interval C (2.5 to 5 feet), interval D (5 to 7.5 feet), and interval E (7.5 to 10 feet).

Most sediment borings were conducted by two field personnel in chest waders; however, several of the 5 and 10-foot borings involved the use of a 14-foot jon boat and up to three persons.

Of the 12 2.5-foot sediment samples (FMT01 through 05 and FMT07 through 13), seven (FMT07 through 13) were collected off-site to the east-southeast in an area bordered by the railroad tracks, County Road 276, and Williams Road (Figure 2-5). This area encompasses approximately 1.5 square miles and includes Steele City, Steele City Bay, and Little Dry Creek. The remaining five 2.5-foot sediment samples (FMT01 through 05) were collected in the Northwest Swamp (Figure 2-4).

The original location for FMT01 was situated on top of a grassy knoll, 400 feet north-northwest of FMH04. Field personnel decided to move the FMT01 location 400 feet east of its original location, slightly inside the perimeter of the Northwest Swamp. This new

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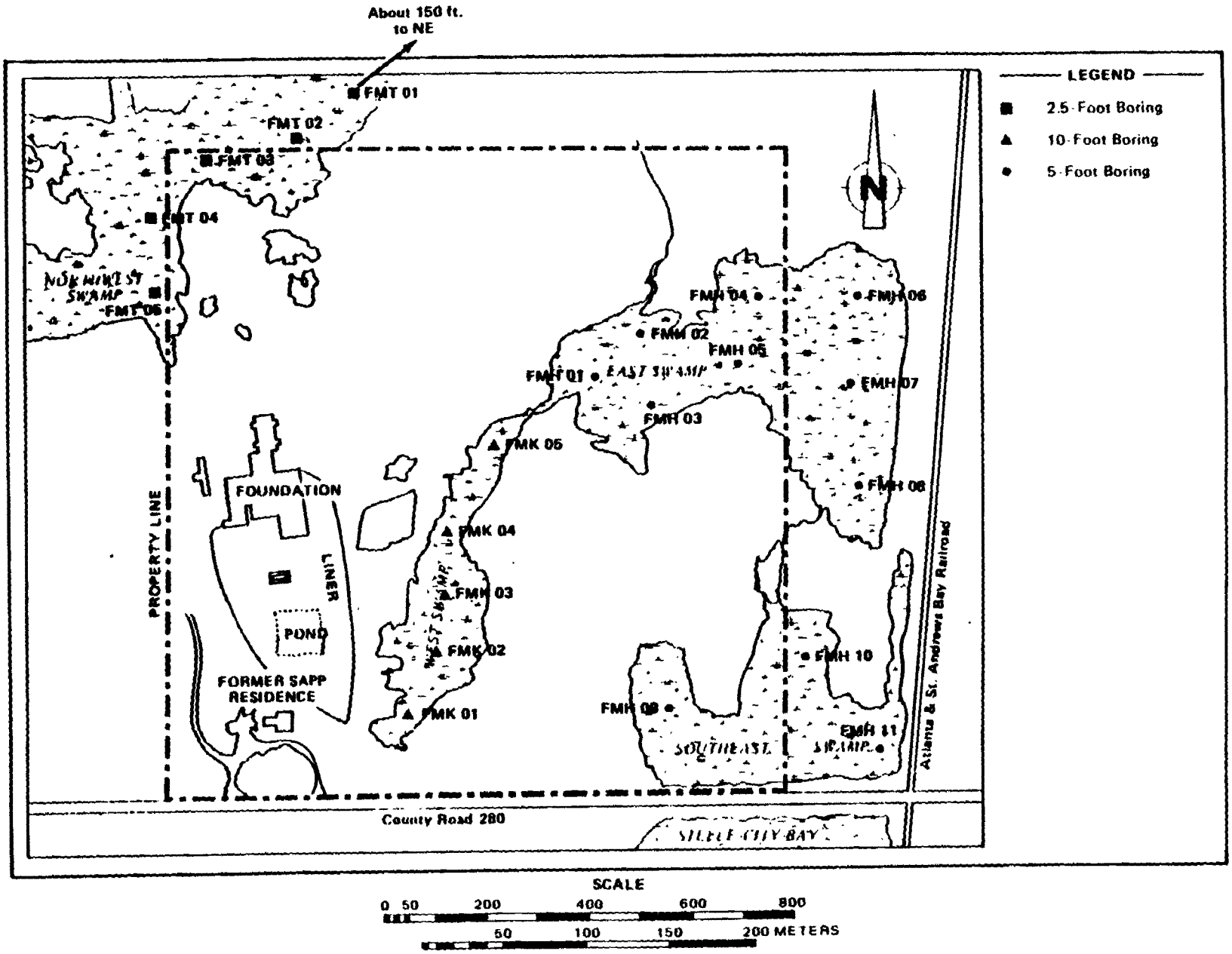
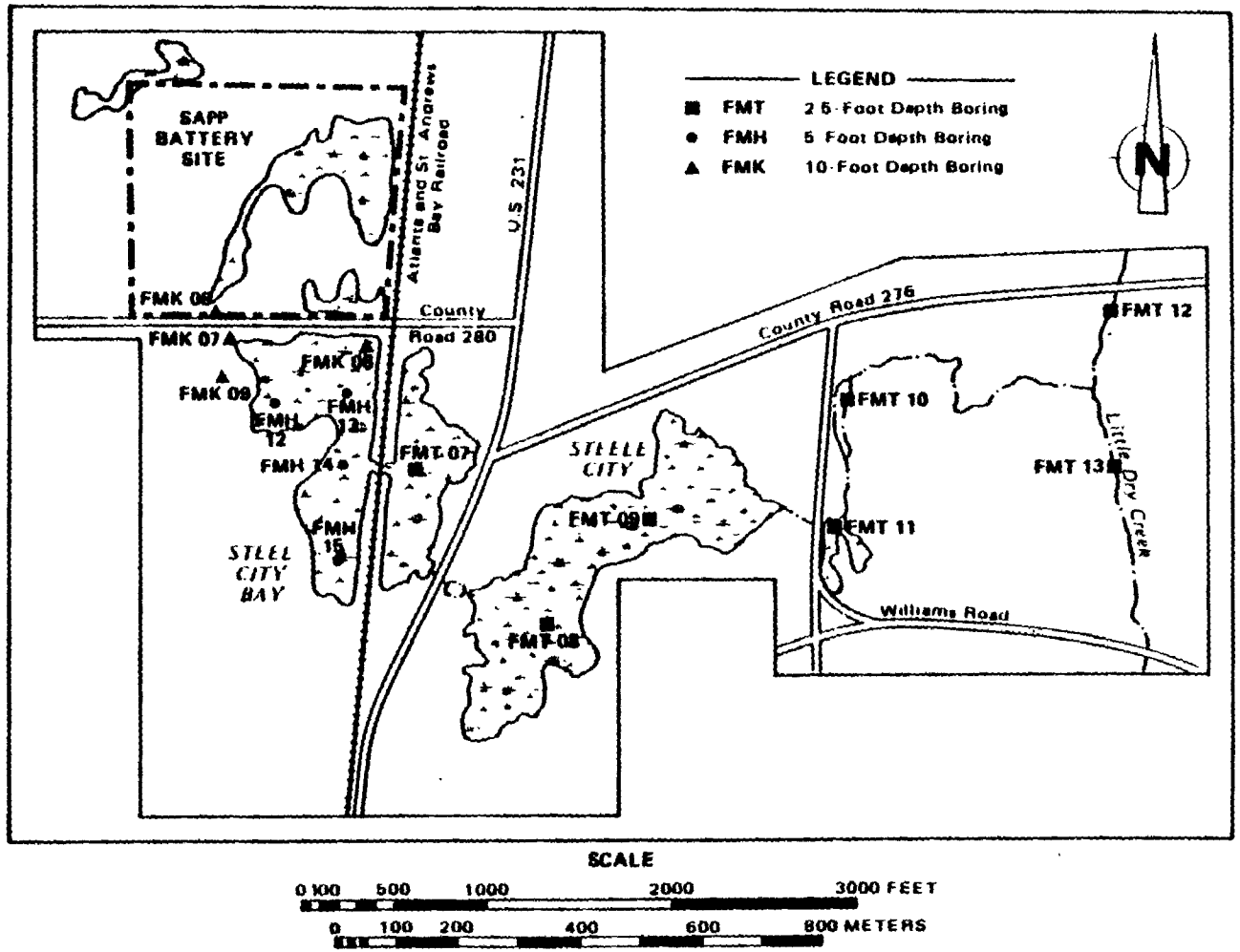


Figure 2–4 ON–SITE AND ADJACENT SEDIMENT SAMPLE LOCATIONS



SCALE

0 100 500 1000 2000 3000 FEET

0 100 200 400 600 800 METERS

Figure 2–5 OFF–SITE SEDIMENT SAMPLE LOCATIONS

Table 2-6

ORGANIZATION OF COLLECTED SEDIMENT SAMPLES

Prefix Code	Description	Total Locations	Total Samples Analyzed[1]	Total Samples Archived	Archived Samples Analyzed
FMH-	5-foot sediment borings conducted in East Swamp, Southeast Swamp, and Steele City Bay	15	33	15	0
FMK-	10-foot sediment borings conducted primarily in the West Swamp and Steele City Bay	9	31	18	0
FMT-	2.5-foot sediment borings conducted in the Northwest Swamp, east of the railroad tracks, primarily in Steele City Bay and Little Dry Creek	12	27	0	0

Key:

1. Totals given include duplicate samples collected (DS*-).

Note: Samples collected for Priority Pollutant Confirmation Study not included.

location allowed collection of an FMT01 sediment sample at a sufficiently discrete distance from FMT02 to maintain representativeness.

Each 2.5-foot boring involved the collection of samples from the A and B intervals. All samples were collected with plastic spoons, homogenized in plastic zip-lock storage bags, and placed into the appropriate 8-ounce sample jar. Spoons and bags were discarded after each use. Between each sampling interval, the bucket auger was scrubbed with trisodium phosphate, rinsed with tap water, and then rinsed with distilled water. The 24 samples were analyzed for pH, lead, cadmium, and antimony.

Of the fifteen 5-foot sediment borings, eight were located in the East Swamp (FMH01 through 08, Figure 2-4); four were located in Steele City Bay, south of the site and west of the railroad tracks (FMH12 through 15, Figure 2-5); and three were located in the Southeast Swamp (FMH09 through 11, Figure 2-4). Samples were collected over the A, B, and C intervals using the same sampling and decontamination techniques as for the 2.5-foot borings. However, given the fluid nature of the sediments and the associated greater potential for caving-in of the hole, a 5-foot length of PVC casing was advanced downhole simultaneously with the augering. This technique facilitated proper sampling and decreased the possibility of cross-contamination between sampling intervals. The PVC casing was decontaminated after each borehole. The A and B interval samples were analyzed for pH, lead, cadmium, and antimony; the C interval samples were archived pending evaluation of the analytical results for the A and B horizons.

Of the nine 10-foot sediment sampling borings, five were located in the West Swamp (FMK01 through 05; Figure 2-4); one was located on the north side of County Road 280, adjacent to the culvert that was constructed in the original drainage connection between the West Swamp and Steele City Bay (FMK08, Figure 2-5); two were located in the northwestern and northeastern corners of that portion of Steele City Bay west of the railroad tracks (FMK07 and 06, respectively; Figure 2-5); and one was located south of the western site boundary, between two cleared areas where apparently there may have once existed swamp-like conditions (FMK09; Figure 2-5). However, the lithologies encountered in borehole FMK09 had greater affinity to the soil borehole lithologies than the sediment borehole lithologies.

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Samples were collected over the A, B, C, D, and E intervals for each 10-foot boring using the same sampling and decontamination techniques as for the 5-foot borings. However, in most instances stainless steel spoons were used to collect the 5 to 7.5-foot and 7.5 to 10-foot samples, due to the occurrence of an extremely competent clay at these horizons which made the use of plastic spoons impractical. Similar to the bucket auger, the stainless steel spoons were scrubbed with trisodium phosphate, rinsed with tap water, and then rinsed with distilled water between major sampling intervals. The A, B, and C interval samples (0 to 5 feet) were analyzed for pH, lead, cadmium, and antimony, and the D and E interval samples (5 to 10 feet) were archived pending evaluation of the analytical results for the A, B, and C horizons.

2.4 GROUNDWATER INVESTIGATION

2.4.1 Residential Well Sampling

As requested by FDER, 25 residential wells (Figure 2-6) were sampled during the first week of fieldwork. These samples were analyzed for lead, cadmium, nickel, arsenic, manganese, aluminum, selenium, and antimony at detection limits specified in the Quality Assurance Project Plan. Three duplicate samples and one trip bottle blank were obtained and analyzed to meet QA/QC requirements.

Each residential well was allowed to flow for about 5 minutes in order to purge the system prior to sampling. All residential well samples were preserved with nitric acid, iced in coolers, and shipped to the E & E laboratory. The pH, specific conductivity, and temperature of each well were measured and recorded in the field.

2.4.2 Monitoring Well Installation and Development

To better delineate the extent of groundwater contamination at the site, 13 new monitoring wells were added to the existing network of 29 monitoring wells and two plant wells (Figure 2-7). The additions consisted of five wells approximately 130 feet deep, four wells approximately 60 feet deep, and four wells approximately 20 feet deep.

Many of the new wells were clustered in order to evaluate hydraulic head differences and water quality variations between aquifer systems. Hence, two entirely new clusters containing shallow, intermediate, and deep wells were installed in the eastern area of the site in the direction of regional groundwater flow. In addition, wells were installed in the unsampled aquifer systems at existing locations MW-06, MW-09, and MW-12 in order to provide clusters. For background purposes, existing residential wells were identified, and a single shallow well was installed at a northwest location that had not yet been characterized.

The five approximately 130-foot wells were installed concurrently with the eight shallower wells. Where possible, both drill rigs employed the hollow stem auger technique. When conditions did not permit the use of hollow stem augers, a fluid-rotary technique was used. In these cases, biodegradable revert was used as the drilling fluid to help prevent the introduction of extraneous metals into the

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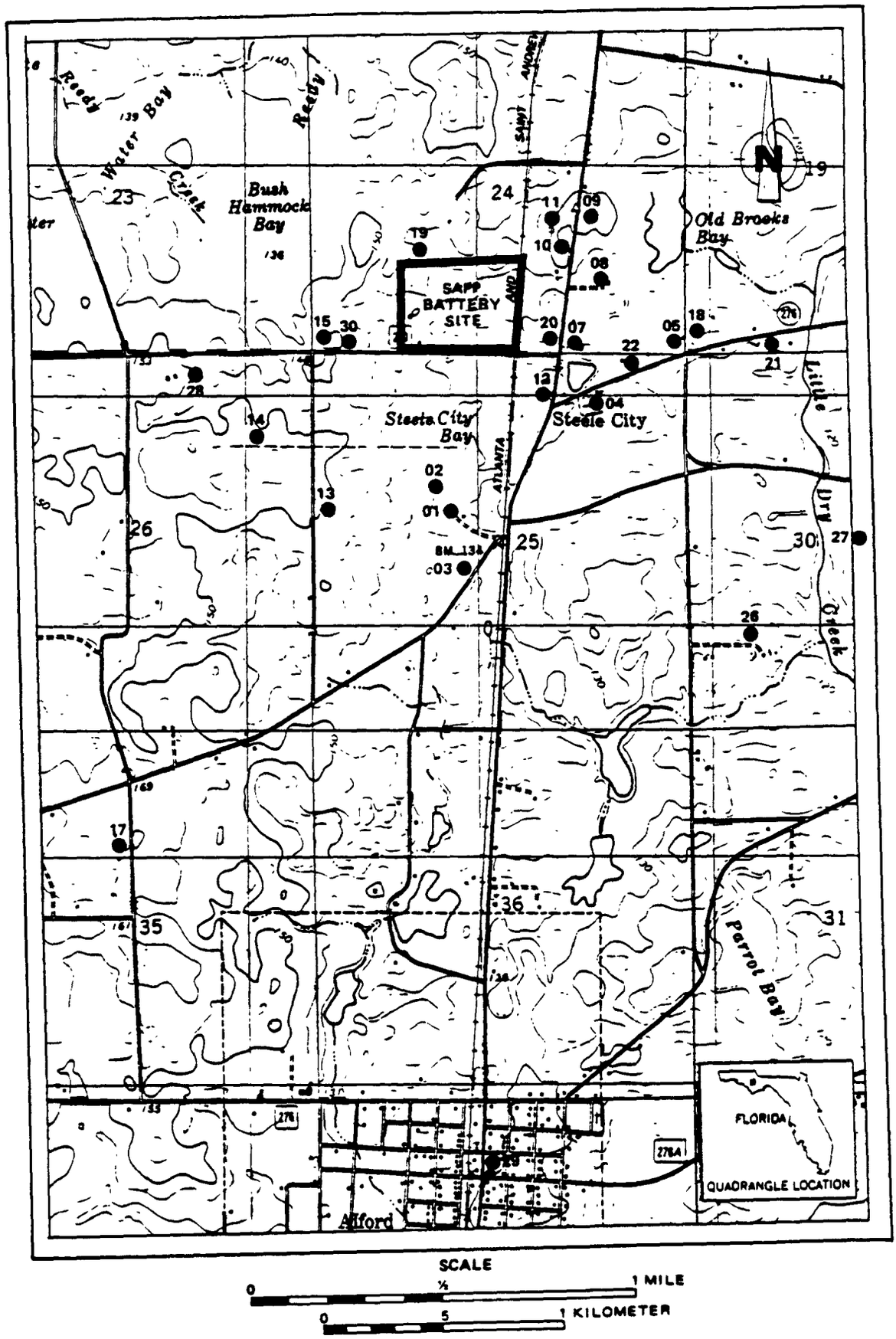

Figure 2–6 LOCATIONS OF RESIDENTIAL WELLS SAMPLED NOVEMBER 2–4, 1985.

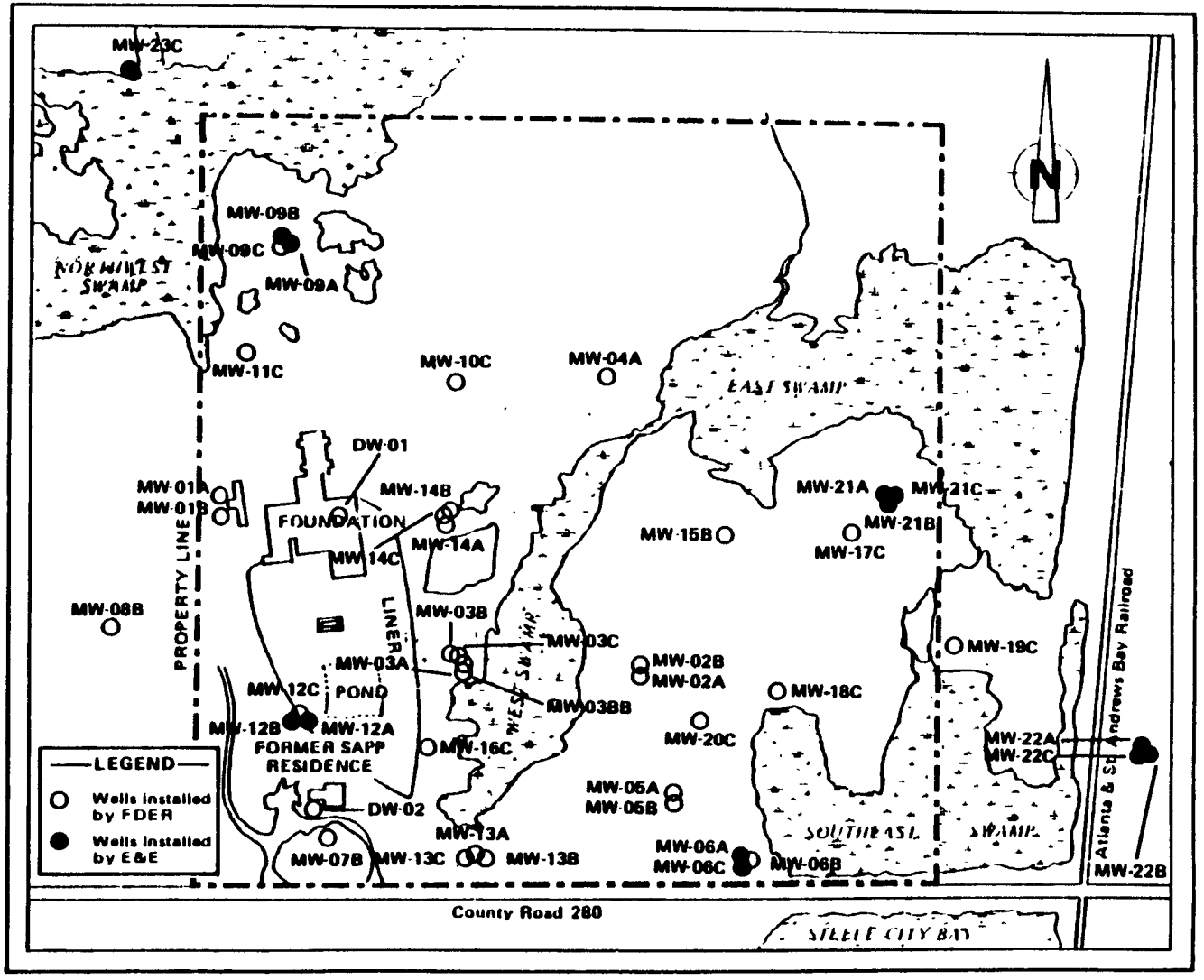

Figure 2–7 LOCATIONS OF SAPP BATTERY SITE MONITORING WELLS
(Includes original site wells DW–01 and DW–02 as well as plugged monitoring well MW–02A)

groundwater. The excess revert displaced from backfilling the annulus in the borehole was sprayed with clean water onto the site surface and left to biodegrade. Table 2-7 provides data on the drilling technique used for each of the 13 new wells. Appendix D contains the drillers' logs.

Well construction (Figure 2-8) consisted of inserting a 2-inch inside-diameter, flush-threaded, Schedule 40 PVC casing with a 10-foot, 0.010-slotted PVC screen at the bottom into the newly drilled borehole. Clean gravel was placed in the annular space between the well screen and borehole wall to act as a filter between the screen and the formation. This gravel extended from the borehole bottom to 2 feet above the screen and casing joint. The next 2 feet above the gravel was filled with a bentonite plug to seal the screen from the above annulus. The annular area above the bentonite plug was back-filled with a 50/50 bentonite/lean concrete mixture to a level 2 feet below the ground surface. The remaining 2 feet was filled with 100% concrete and covered by a 2- by 2-foot square concrete pad formed to route drainage away from the well. Finally, a 4-inch nominal-diameter steel security cover with keyed-alike locks was placed over the protruding well pipe and set into the moist concrete. All wells were then surveyed accurately for location and elevation during development of the site base map.

After each well had been completed, it was developed by forcing compressed air against the well screen wall for 10 minutes and then stopping the air for two minutes to let the well fully recharge. Each well was subjected to this cycle of air purging and surging until such parameters as pH, temperature, and specific conductivity had stabilized.

2.4.3 Monitoring Well Sample Collection

Immediately prior to sampling each well, a total of three well volumes was purged. This purging phase was used to obtain samples in-situ for determination of ambient aquifer system conditions following development and well stabilization. Teflon or PVC bailers were used to collect all samples. Samples to be analyzed for metals were preserved with nitric acid, iced in coolers, and shipped to the E & E laboratory. In addition to the sampling effort (discussed in Section

Table 2-7

CONSTRUCTION DATA FOR SUPPLEMENTARY MONITORING WELLS

Well Number	Drilling Technique	Depth Below Land Surface (feet)	Well Head Elevation Above Mean Sea Level (feet)
MW06A	8-inch hollow stem auger	134	133.66
MW06C	6-inch hollow stem auger	21	133.57
MW09A	Fluid rotary	127	143.75
MW09B	6-inch hollow stem auger	53	143.63
MW12A	8-inch hollow stem auger	130	138.60
MW12B	Fluid rotary	60	138.53
MW21A	8-inch hollow stem auger	131	134.14
MW21B	Fluid rotary	60	134.32
MW21C	6-inch hollow stem auger	21	133.06
MW22A	8-inch hollow stem auger	134	137.30
MW22B	6-inch hollow stem auger	62	136.19
MW22C	6-inch hollow stem auger	26	136.63
MW23C	6-inch hollow stem auger	17	140.39

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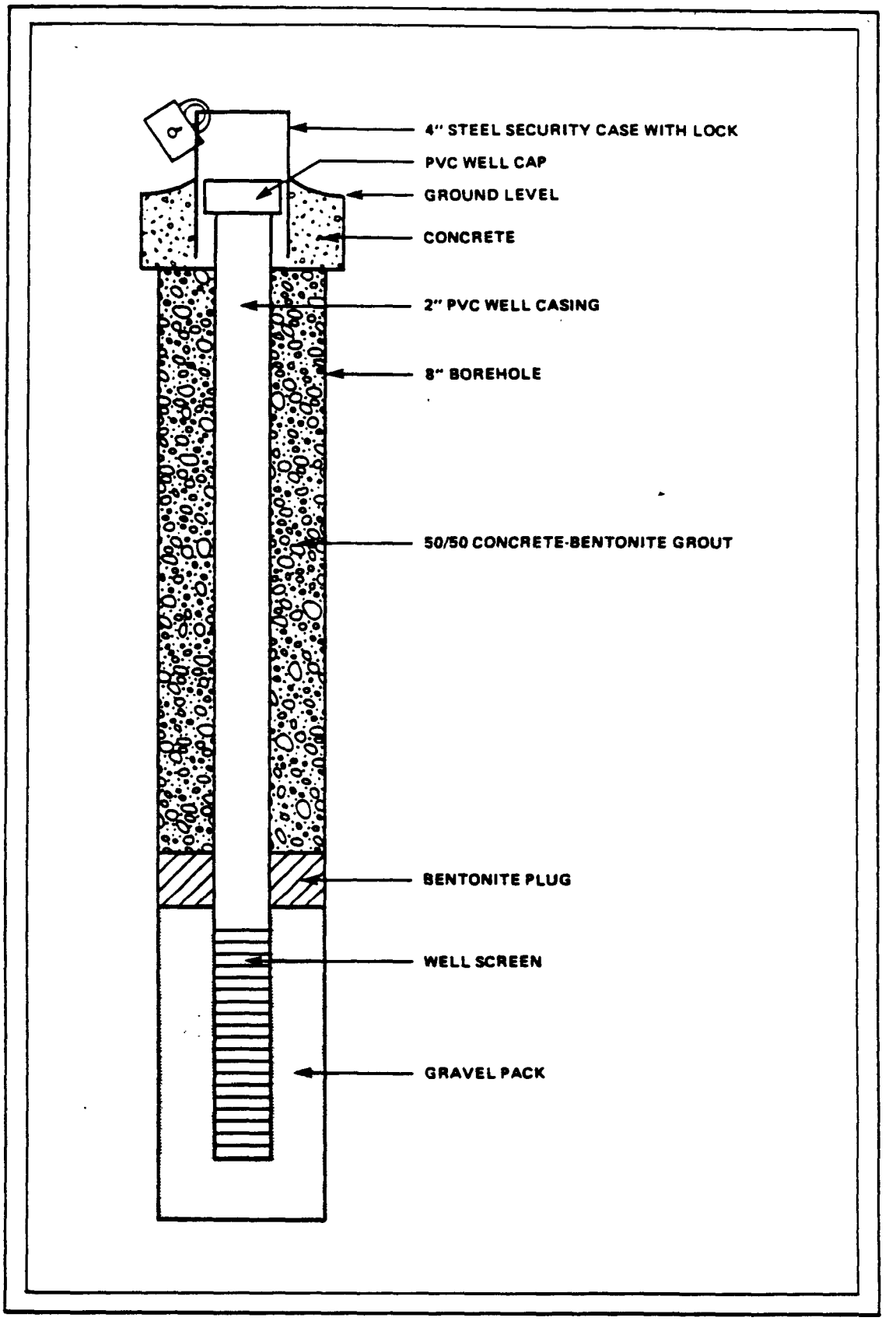

Figure 2–8 TYPICAL MONITORING WELL CONSTRUCTION

3.4), pH, specific conductivity, and temperature were measured and recorded in the field.

All on-site monitoring wells (i.e., the 13 new wells, the 29 existing wells, and the two plant wells) were sampled and analyzed for lead, cadmium, arsenic, manganese, aluminum, selenium, and antimony. Three duplicate samples, two trip bottle blanks, and four equipment rinsate samples were included with these samples in order to meet QA/QC requirements. The duplicate samples were collected from wells selected in the field. All parameters were analyzed at detection limits specified in the Quality Assurance Project Plan.

2.4.4 Slug and Specific Capacity Tests

A total of nine slug tests and four specific capacity tests were performed at the site following the monitoring well sampling effort in mid-December 1985. The objective of this study was to obtain generalized hydraulic conductivity (K), transmissivity (T), seepage velocity (V), specific capacity (Cs), and well yield (Wy) data for the on-site aquifer systems.

Slug tests were conducted in monitoring wells MW-06A, MW-06B, MW-06C, MW-12A, MW-12B, MW-12C, MW-22A, MW-22B, and MW-22C (Figure 2-7). These wells were selected for slug testing because they constitute clusters that penetrate each of the three major aquifer systems. In addition, these locations represent a cross section of the hydrogeologic conditions across the site. Each slug test was conducted by introducing a known volume of clean water into the well and continuously monitoring the water level response using a transducer system.

In addition to the slug testing, specific capacity tests were performed at wells MW-02B, MW-06B, MW-14A, and MW-14C. These wells were chosen because they offered the best combination of water- transmitting characteristics (as defined by the recharge rates observed during the purging operations) and lithology with respect to the requirements for a successful test and representativeness. Each of these tests involved pumping the respective well for about 1 hour at full capacity and measuring drawdown continuously throughout this period with the transducer system.

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3. RESULTS OF ANALYSES AND DATA INTERPRETATION

3.1 PRIORITY POLLUTANT CONFIRMATION STUDY

3.1.1 Soils

The five soil samples and one duplicate sample were analyzed for priority pollutant metals, sulfate, volatile organics, acid/base/neutral organics, and pesticides (Appendix B).

FSA09P (and duplicate sample DSA09P) yielded the highest levels of inorganics. Lead concentration is very high in the sample, and arsenic and sulfates are present at levels significantly above the other soil samples.

One or more of the following volatile organics were detected in all of the soil samples: acetone; 1,1,1-trichloroethane; chloroform; methylene chloride; and 2-butanone. The occurrence of these contaminants in the samples is attributable to laboratory cross contamination. All of these compounds are common laboratory solvents, and each was found to be present in the laboratory instrument blank associated with this soil sample run.

Base/neutral analyses of the soil samples revealed the presence of an array of polynuclear aromatics and phthalates. However, the bulk of these compounds were detected in FSA09P (and duplicate DSA09P) only. Bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were the only base/neutral organic compounds detected in FSG23P, FSG54P, FSA06P, and the background sample FSY01. The occurrence of phthalates in the samples is not easily explained; however, bis(2-ethylhexyl)-phthalate is a common cross contaminant derived from both the laboratory and field decontamination processes. Plasticizers leaching from buckets, brushes, water jugs, sprayers, insect repellent, and PVC pipe

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are potential sources leading to cross contamination of this compound. It should be noted that bis(2-ethylhexyl)phthalate was found to be considerably higher in FSA09P and duplicate DSA09P (15,000 ug/kg and 14,000 ug/kg, respectively). Again, leaching plasticizers are the probable source, as this sample location was in an area of densely deposited plastic battery chips.

The analysis of soil sample FSA09P also showed the presence of 10 polynuclear aromatic compounds (PNAs). Chrysene was detected at 800 ug/kg, phenanthrene was detected at 700 ug/kg in FSA09P, and naphthalene at 500 ug/kg in the duplicate. The remaining PNA compounds were found to be present but below the quantifiable detection limit of 500 ug/kg. It is likely that these compounds are present in this area due to residual motor oils and/or fuels associated with runoff from the plant, or in the fill material (greasy battery casings) placed here. N-nitrosodiphenylamine and 4-nitrophenol were also found below quantifiable detection limits.

A soil sampling equipment rinsate was collected at one point after a decontamination period. Trace amounts of sulfate, lead, and nickel were detected. The results indicate that cleanliness of equipment was adequate and that residual metals contaminants were of such low levels as not to affect the integrity of data. The presence of acetone; 1,1,1-trichloroethane; and methylene chloride in the bottle blank is associated with laboratory sources (as evidenced by laboratory instrument blanks and trip bottle blank analysis).

3.1.2 Sediments

The five sediment samples collected were analyzed in the laboratory for priority pollutant metals, sulfate, volatile organics, acid/base/neutral organics, and pesticides (Appendix B).

FMH17, collected from the West Swamp, yielded the highest concentrations of metals. Very high lead (6,560 mg/kg) and elevated levels of antimony, arsenic, and copper are most notable in FMH17. Arsenic was found at 1.76 mg/kg in the East Swamp (FMH18), and cadmium was present in the East and Southeast swamps (0.975 mg/kg and 0.19 mg/kg, respectively).

Acetone; 1,1,1-trichloroethane; and chloroform are present in all samples. 2-butanone is present in all samples except FMH20 (Northwest

Swamp). As these compounds are common laboratory cross contaminants (and were each present in the laboratory instrument blank), it is most probable that their presence is entirely attributed to a laboratory source. Methylene chloride occurs in FMH19 and 20 and can be attributed to sample bottle preparation, since it was also detected in the trip bottle blank (SBB01). Ethylbenzene and benzene were detected in the Southeast Swamp (FMH19) below the 50 ug/kg quantifiable detection limit. If these contaminants are not derived from a laboratory source, it is possible that they could have been contributed by vehicle exhaust, or runoff associated with the adjacent County Road 280 and nearby railroad bed. The presence of naphthalene (500 ug/kg) in FMH19 is quite possibly associated with the asphalt pavement of County Road 280, where tars may leach this material and runoff may carry it a short distance to the Southeast Swamp.

Toluene was detected below the quantifiable detection limit in both the East Swamp (FMH18) and Southeast Swamp (FMH19), and 4-methylphenol was detected at 1,100 ug/kg in the East Swamp.

The presence of phthalates in all sediment samples, including the background location FMH16, suggests possible cross contamination from plastic decontamination containers, etc. (see Section 3.1.1). The highest concentration of bis(2-ethylhexyl)phthalate occurs in the West Swamp sediment sample (FMH17, 3,000 ug/kg) and may reflect the leaching of plasticizers from the large volume of plastic battery chips in this small area.

3.1.3 Surface Water

Lead was detected in all surface water samples, including the background sample FSW01 (0.014 ppm) collected as part of the priority pollutant confirmation survey (Appendix B). However, the concentration in the West Swamp was two orders of magnitude higher than in the other three locations (1.01 ppm and 1.06 ppm in FSW02 and duplicate sample DSW02, respectively). Low levels of sulfate (24 to 66 ppm) were also detected at all four locations.

Arsenic, silver, and zinc were each detected in only one sample (FSW03, 0.006 ppm; FSW02, 0.006 ppm; and FSW04, 0.034 ppm, respectively). In contrast, nickel was detected in the duplicate West Swamp sample (DSW02, 0.023 ppm), as well as in the background sample (FSW01,

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0.038 ppm). As with the soil and sediment samples, the only volatile organic compounds detected in the surface water samples were compounds such as acetone; chloroform; 1,1,1-trichloroethane; and methylene chloride which also were detected in the laboratory instrument blank, and hence are attributed to laboratory sources. Of the base/neutral extractable compounds, only bis(2-ethylhexyl)phthalate was detected, the highest concentration occurring in background sample FSW01 (27 ppb). Acid compound 2-methylphenol was detected at 270 ppb in sample FSW02, but its presence could not be confirmed in duplicate sample DSW02 or after a re-extraction and analysis of FSW02.

3.1.4 Groundwater

All on-site monitoring well samples (FEW03C, FEW03BB, FEW03A, and FEW09C) exhibited lead contamination, whereas lead was not detected in the background well sample (FRW01) (Appendix B). The samples from the surficial aquifer system (FEW03C and FEW09C) showed the greatest lead contamination (4.96 and 6.27 ppm, respectively), whereas the samples from the underlying intermediate and Floridan aquifer systems (FEW03BB and FEW03A, respectively) exhibited a progressive decrease in the level of lead contamination (1.28 and 0.609 ppm, respectively). Only samples FEW03BB and FEW03C exhibited sulfate concentrations above the 250 ppm recommended USEPA and FDER drinking water standards (2,000 and 330 ppm, respectively).

Antimony, arsenic, and cadmium concentrations were found to be above primary EPA drinking water standards and FDER standards for arsenic and cadmium (0.05 ppm for arsenic, and 0.01 ppm for cadmium) in sample FEW03C (0.118 ppm antimony, and 0.282 ppm arsenic) and sample FEW03BB (0.246 ppm cadmium). THere are no primary or secondary FDER drinking water standards for antimony. Relatively high nickel and zinc concentrations were also detected in sample FEW03BB (0.495 and 2.20 ppm, respectively). However, this zinc concentration is significantly below the recommended primary EPA and FDER drinking water standard (5.0 ppm). There is no recommended or required standard for nickel. Primary drinking water standards were used for comparison purposes, as these relate to public health.

Similar to the soil, sediment, and surface water samples, the only volatile organic compounds detected in the groundwater samples

were compounds such as acetone; 1,1,1-trichloroethane; and methylene chloride which were also detected in the laboratory instrument blank, and hence are attributed to laboratory sources. Of the base/neutral extractable compounds, only bis(2-ethylhexyl)phthalate was detected. However, it was detected in all of the samples, including the sample obtained from the background well. Of the acid compounds, 2-methylphenol was found to be present at a level below the detection limits in sample FEW03C.

Similar to the results for the soil sampling equipment rinsate and soil bottle blank, only trace metal concentrations were detected in the groundwater sampling equipment rinsate. The only organic compounds detected in the rinsate and bottle blanks were those attributable to laboratory sources.

3.1.5 Conclusion

The analytical results of the priority pollutant confirmation survey for soil and sediment samples suggest that lead contamination is the primary problem, especially in the West Swamp and on its west bank. These samples also showed elevated concentrations of antimony, arsenic, and cadmium. Based on the findings of the priority pollutant sampling, all of these parameters were chosen for analysis except arsenic. The selected metals were also likely constituents of the type of batteries processed at the site, based on findings of earlier investigations.

Of the organics detected in soils and sediments, most notable was the occurrence of phthalates and PNAs in the battery chip fill associated with FSA09. These contaminants can be expected to occur where heavy concentrations of crushed automobile batteries result in weathering plastics as well as residual oils and greases. Assuming this to be typical of battery casing fill, no further organics analysis of subsequent soil and sediment samples was deemed necessary.

The analytical results of the priority pollutant confirmation survey for surface water samples suggested that lead contamination was the primary problem and that the highest levels of lead contamination were restricted to the West Swamp. Given that lead contamination of these surface waters is (1) assumed to be a direct result of runoff from contaminated soils and (2) appears to be restricted to on-site

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locations, then any remedial action directed toward elimination of soil contamination should also serve to eliminate the source of surface water contamination. In light of the above, and in order to avoid duplication with the EPA-funded study by Dr. Livingston mentioned in Section 1 and with the 1983 FDER sampling (Watts 1984), it was considered unnecessary to collect additional surface water samples during the main part of the investigation.

The analytical results for the groundwater samples indicated that all three of the on-site aquifer systems were contaminated with lead, and thus that lead should be the major focus of the subsequent investigation. It was also determined that groundwater samples should be analyzed for cadmium, antimony, arsenic, and selenium because each of these metals had been detected at a concentration above the USEPA and FDER drinking water standards during the priority pollutant investigation or the 1983 FDER sampling effort (Watts 1984). Finally, aluminum and manganese were also included for analysis because the results of the 1983 FDER sampling effort (Watts 1984) indicated that these metals were occurring in high concentrations due to the decomposition of soil clays caused by the sulfuric acid.

Despite the presence of sulfate concentrations above the drinking water standard in two samples, it was decided by FDER not to include this parameter in the main investigation because the existing data base from the FDER 1983 sampling effort was considered adequate.

Although relatively high concentrations of zinc and nickel did occur in one sample, it was not considered necessary to include these metals among the analytical parameters. Zinc was not present in concentrations above the drinking water standard. Nickel (for which there is no standard) was found in the background sample at approximately the same level as had been detected in most of the on-site monitoring well samples collected by FDER in 1983 (Watts 1984).

3.2 SOILS

The shallow (0 to 10-foot) subsurface lithology at the site consists of two units: a unit of sandy clay/clayey sand overlying a unit of stiff, tight clay. Both of these units exhibit great variability in their textural characteristics and color. In general, however, the sandy clay/clayey sand is fine to medium-grained and tan to orange-brown in color. In contrast, the clay unit contains little sand (although rounded sand-, gravel-, and pebble-sized quartz was noted on occasion) and is most commonly maroon or red with white to gray marbling.

Although the clay unit is usually encountered within 5 feet of land surface, lateral correlation of lithologic units is extremely difficult because of the extensive earth-moving activities which occurred at the site in the 1970s, as indicated by aerial photographs. This extensive earth movement is also reflected in the three large fill areas on-site where battery chips mixed with the sandy clay/clayey sand were found at depths as great as 6.5 feet northeast of the plant foundation, and possibly as great as 10 feet in the Northwest Landfill area (Figures 3-1 and 3-13).

The following discussion presents the analytical data for the soil sampling effort (see also Table C-1 in Appendix C-1). Results for the equipment rinsate and trip bottle blank samples are discussed in Section 4.

3.2.1 Surface Soils (0 to 0.5-Foot Interval)

All of the soil samples were analyzed in the laboratory for pH. For the total suite of surface samples (0 to 0.5-foot depth), including those collected as surface composites (FSS01 through 18) and those collected at the A interval of the borings, pH ranged from 2.66 (FSE08) to 8.54 (FSC01). For these samples, pH values above 6.5 were generally associated with those samples exhibiting the highest lead concentrations (Figures 3-2 and 3-3). In many cases, these are also the areas that contain battery chips (Figure 3-1). However, because there are several exceptions to this trend, it is not possible to draw a direct correlation of pH to depth of chips, lead, antimony, or cadmium.

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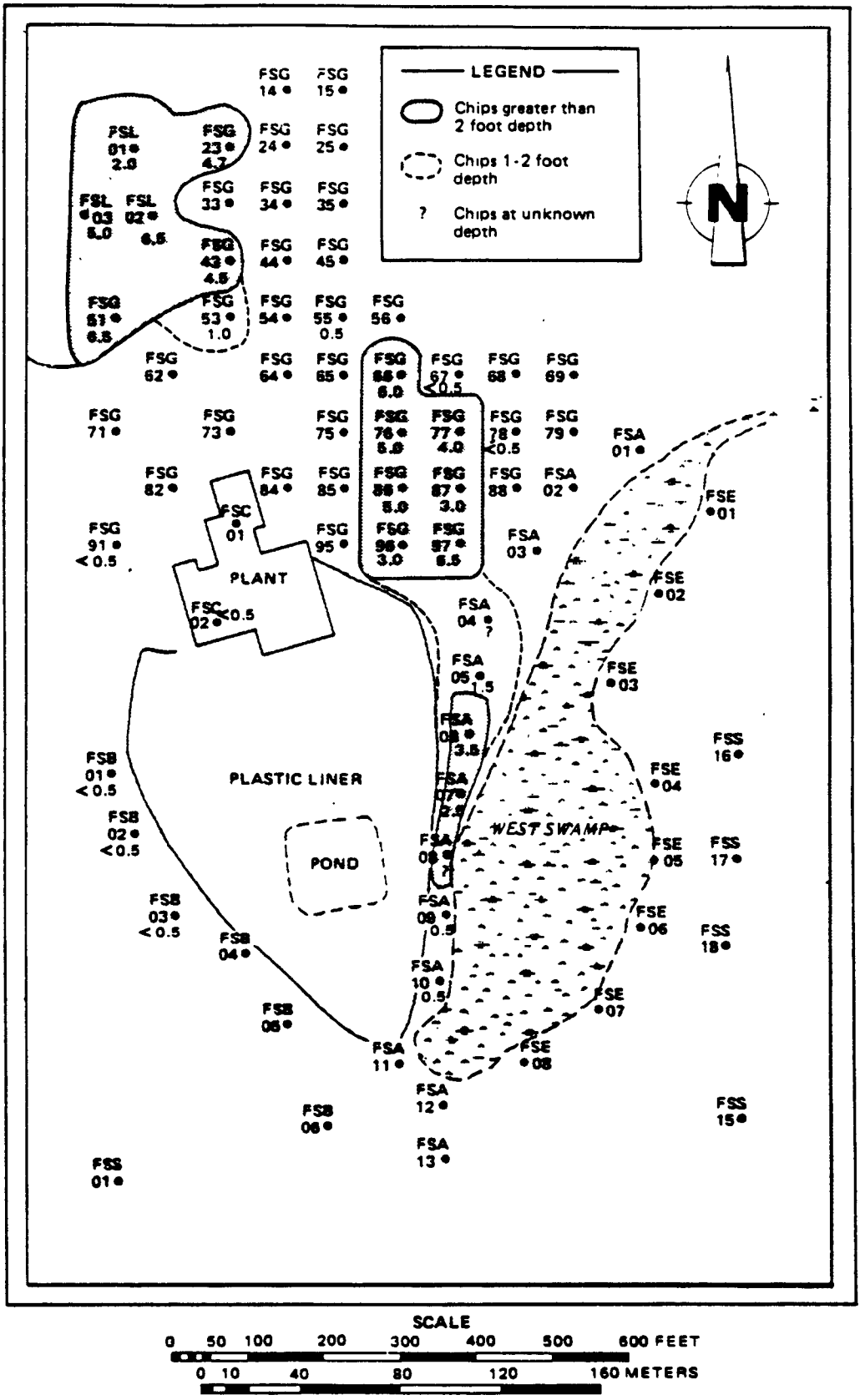

Figure 3–1 OCCURRENCE OF BATTERY CHIPS (Depth In Feet)

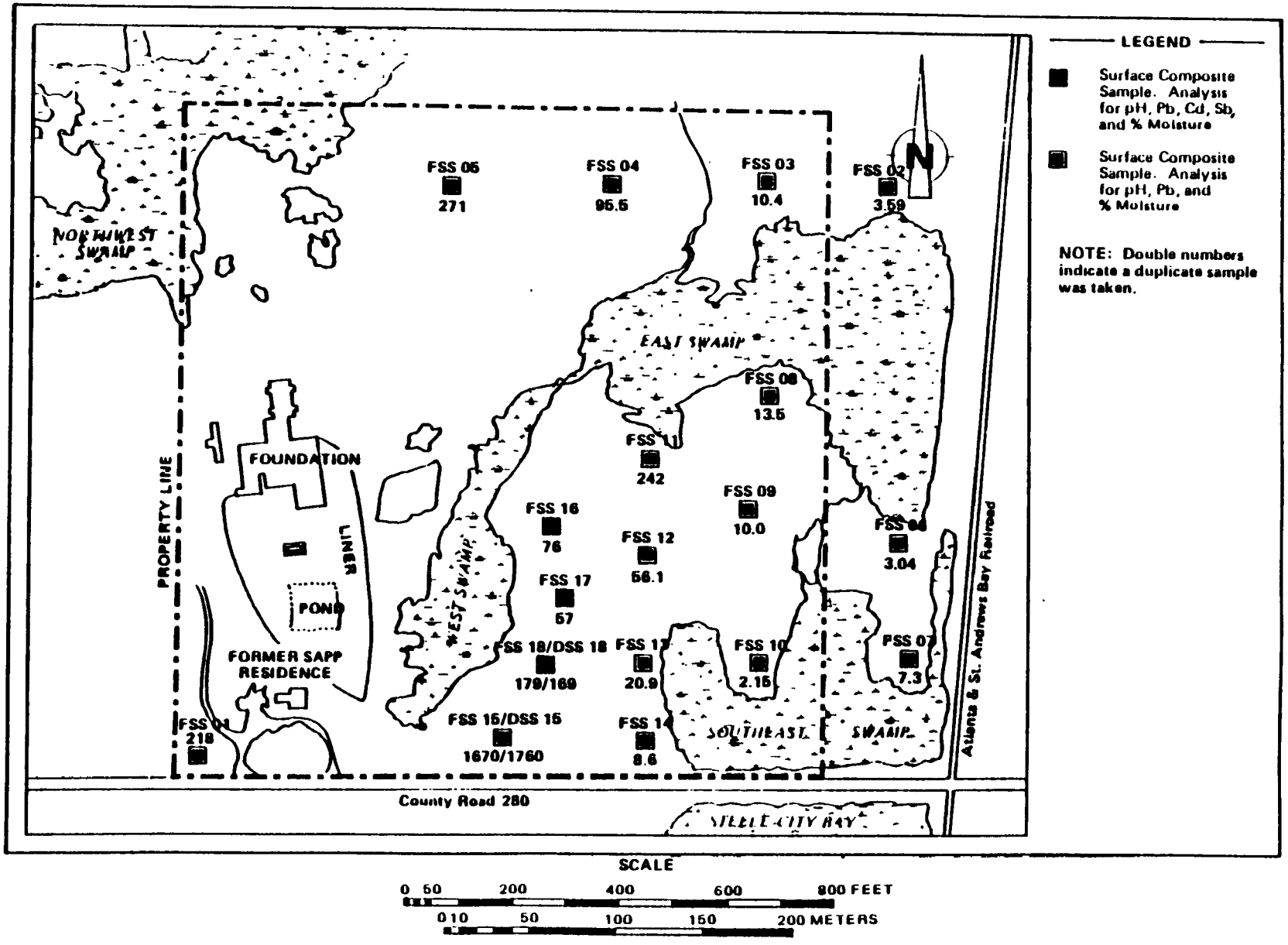

Figure 3–2 LEAD CONCENTRATIONS (mg/kg) IN THE SURFACE SOIL COMPOSITE SAMPLES

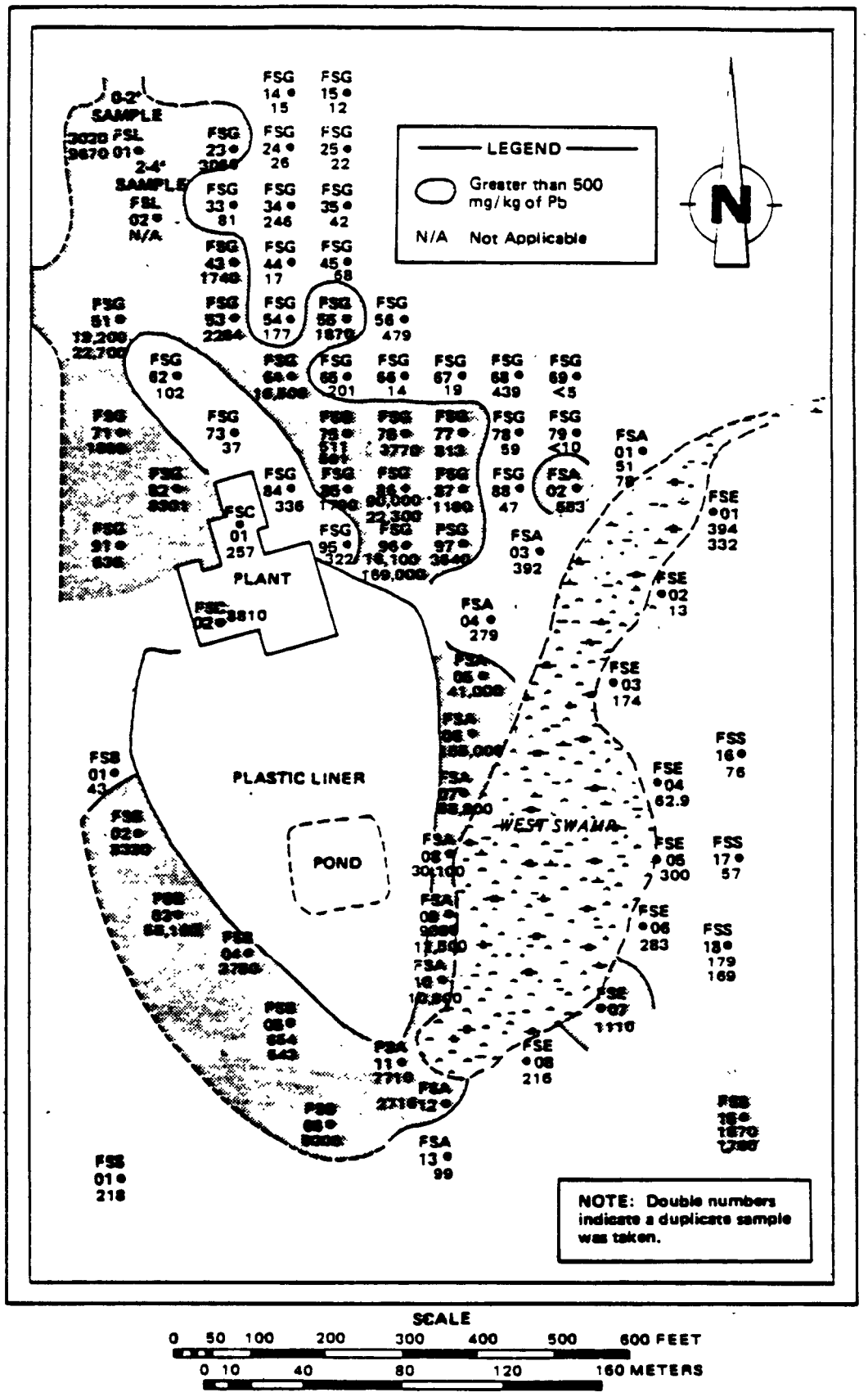

Figure 3–3 LEAD CONCENTRATIONS (mg/kg) IN THE A INTERVAL (0–0.5 Feet) SAMPLES OF ON–SITE SOIL BORINGS

Areas where lead concentrations were lowest (surface samples on the far eastern and northeastern portion of the site; Figures 3-2 and 3-3) exhibited pH values of approximately 4 to 5.5. There are no apparent indications of a trend when comparing pH to lead, antimony, and cadmium concentrations in the B interval (0.5 to 2.5 feet), C interval (2.5 to 5 feet), D interval (5 to 7.5 feet), and E interval (7.5 to 10 feet). High lead concentrations were noted in samples with pH values of less than 4.0, greater than 6.5, and in between. Similarly, samples with very low lead concentrations exhibit the same wide range of pH values.

Analysis of the A interval samples and surface composite samples (FSS01 through 18) indicate widespread lead contamination in the surface (Figures 3-2 and 3-3).

The surface soils between the plastic liner and the West Swamp are grossly contaminated, as indicated by samples FSA05A through 10A, which exhibit lead concentrations of 9,390 to 155,000 mg/kg. Another area of gross contamination occurs northeast of the plant foundation, where FSG86A and 96A show lead concentrations of 90,000 and 16,100/169,000 mg/kg, respectively. Concentrations of 22,300 and 169,000 mg/kg lead were recorded in the duplicate sample analyses for FSG86A and 96A. In the southwestern corner of the Northwest Landfill area, FSG51A yielded 19,200 mg/kg lead (22,700 mg/kg in the duplicate sample analysis). Along the earthen berm southwest of the plastic liner, FSB03A exhibited 66,100 mg/kg lead.

Areas where high lead levels (greater than 500 mg/kg) are found include: (1) the battery chip-filled area between the West Swamp and the plastic liner, (2) the battery chip-filled area northeast of the foundation, (3) the northwest battery casing landfill, (4) the area around the truck weighing scales northwest of the plant foundation, (5) beneath the plant foundation at FSC02A, and (6) along the southwestern side of the plastic liner extending to the south of the West Swamp. East of the West Swamp, only FSE07A and FSS15 showed lead levels greater than 500 mg/kg (1,110 mg/kg and 1,670 mg/kg, respectively).

In the surface samples analyzed for antimony and cadmium, it is readily seen that the levels at which these metals occur generally are proportional to the lead concentrations in the same sample interval.

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This is most evident in Figure 3-4, where lead and antimony levels are compared for FSA01 through FSA13. Antimony and cadmium were also present in FSC02A (beneath the plant foundation), and in lesser concentrations on the east bank of the West Swamp (FSE05A), and at several locations around the Northwest Landfill.

3.2.2 B Interval Soils (0.5 to 2.5 feet)

At the B interval (0.5 to 2.5 feet), five distinct areas exhibit lead concentrations greater than 500 mg/kg lead (Figure 3-5). The area between the plastic liner and the West Swamp remains highly contaminated, with FSA06B, FSA07B, and FSA08B containing 57,000, 45,900, and 29,800 mg/kg lead, respectively. A group of six grid locations northeast of the plant foundation have lead concentrations ranging from 3,940 to 96,600 mg/kg. Battery chips and whole casings occur in this area to depths ranging from 3 to 6.5 feet.

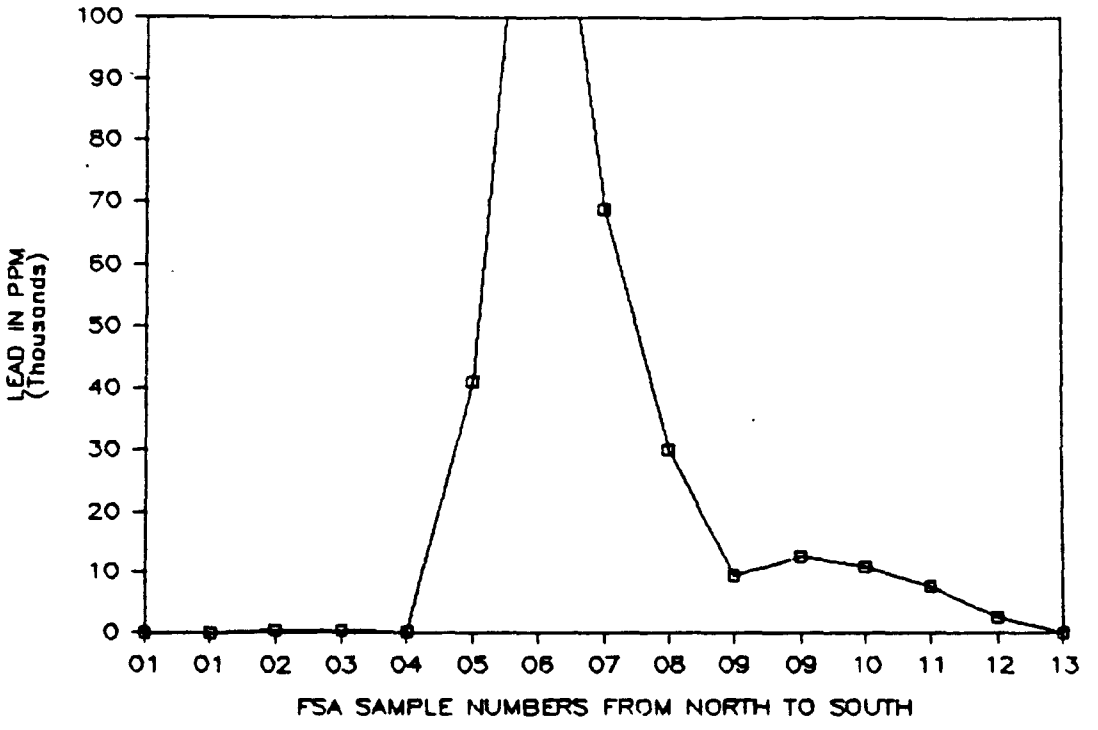
The Northwest Landfill area is heavily contaminated with lead over the B interval. Whole battery casings, large chips, and other debris extend to at least this depth in the fill throughout the landfill area (as indicated at 10-foot and 15-foot boring locations). The lead concentration at FSG51 increases to 84,200 mg/kg over the B interval, whereas the lead levels at FSG23B and FSG53B increase with depth to 4,790 and 16,700 mg/kg, respectively.

Southwest of the plastic liner and adjacent to the former location of the acid holding pond, FSB02B and FSB03B showed 325 mg/kg lead (746 mg/kg in the duplicate sample) and 650 mg/kg lead, respectively. South of the liner and the West Swamp, FSB06B, FSA11B, and FSA13B exhibited lead levels of 3,260, 4,750, and 4,735 mg/kg (8,842 mg/kg in the duplicate sample), respectively.

Figure 3-6 indicates a continuing correlation between lead and antimony. In contrast, cadmium levels are low, occurring somewhat more sporadically, and not necessarily proportional to lead concentrations.

3.2.3 C Interval Soils (2.5 to 5.0 feet)

At the C interval (2.5 to 5 feet), there are four general areas where high lead levels continue to occur (see Figure 3-7). Lead



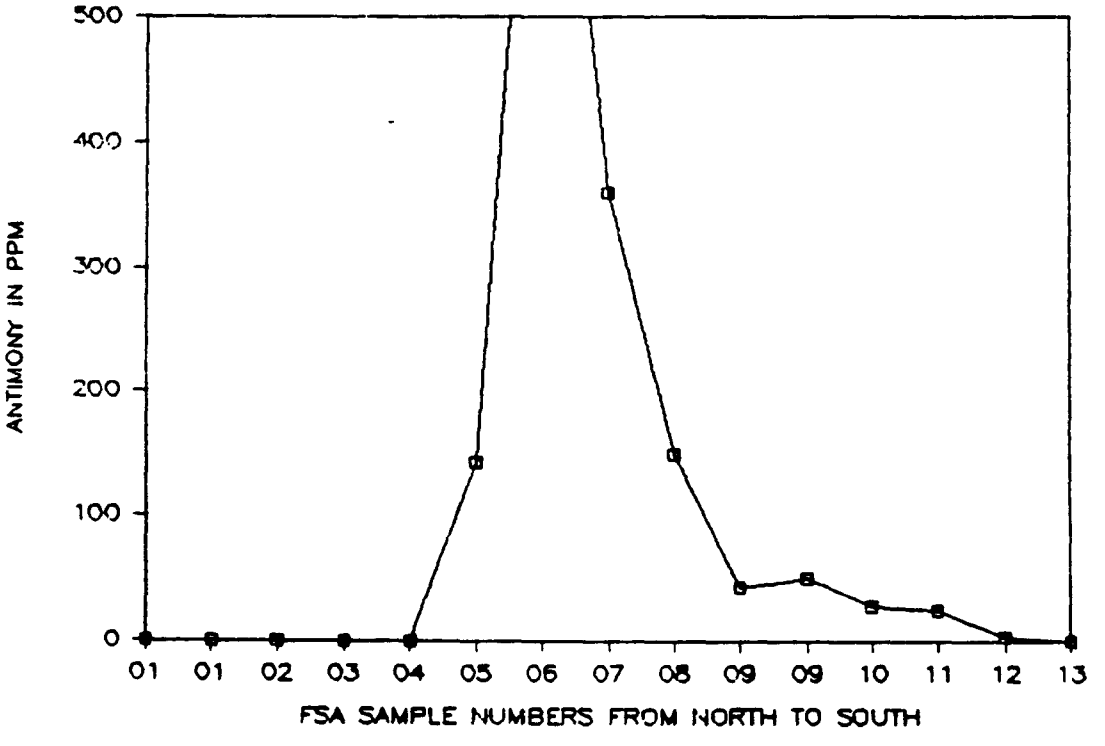


Figure 3–4 LEAD VERSUS ANTIMONY IN THE A INTERVAL (0 to 0.5 foot depth) IN FSA SAMPLES ALONG THE WEST BANK OF THE WEST SWAMP

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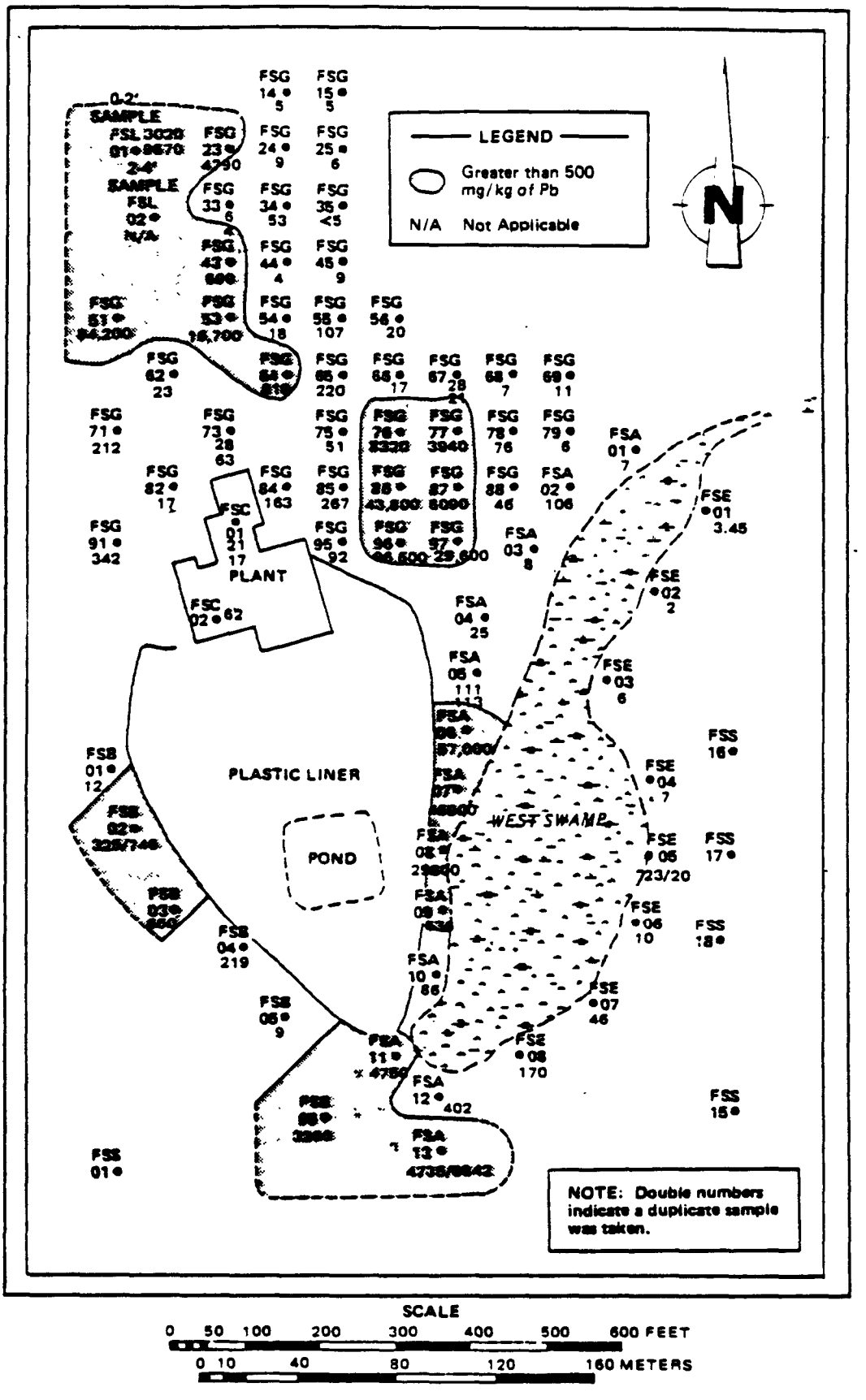
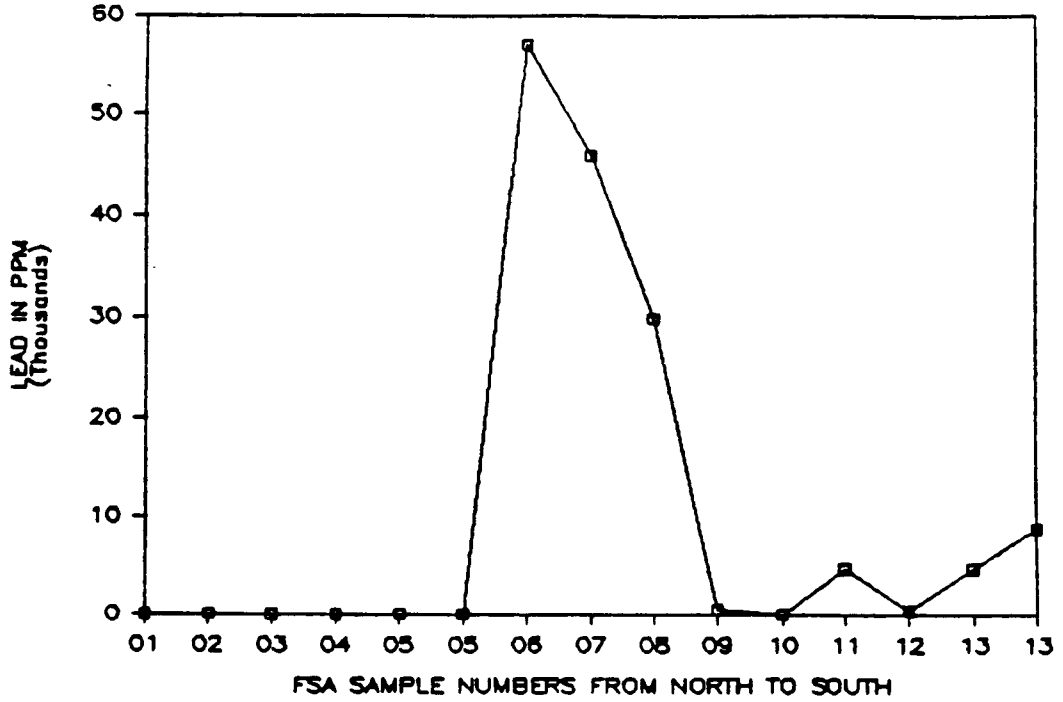


Figure 3–5 LEAD CONCENTRATIONS (mg/kg) IN THE B INTERVAL (0.5–2.5 Feet) SAMPLES OF ON–SITE SOIL BORINGS



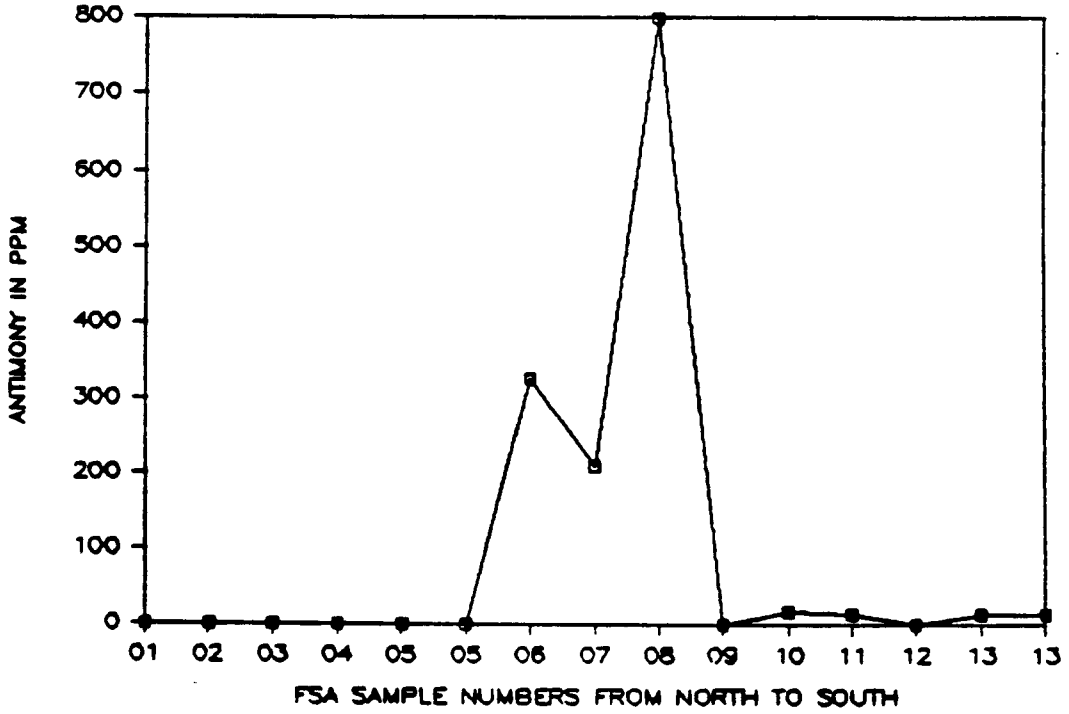


Figure 3–6 LEAD VERSUS ANTIMONY IN THE B INTERVAL (0.5 to 2.5 foot depth) IN FSA SAMPLES ALONG THE WEST BANK OF THE WEST SWAMP

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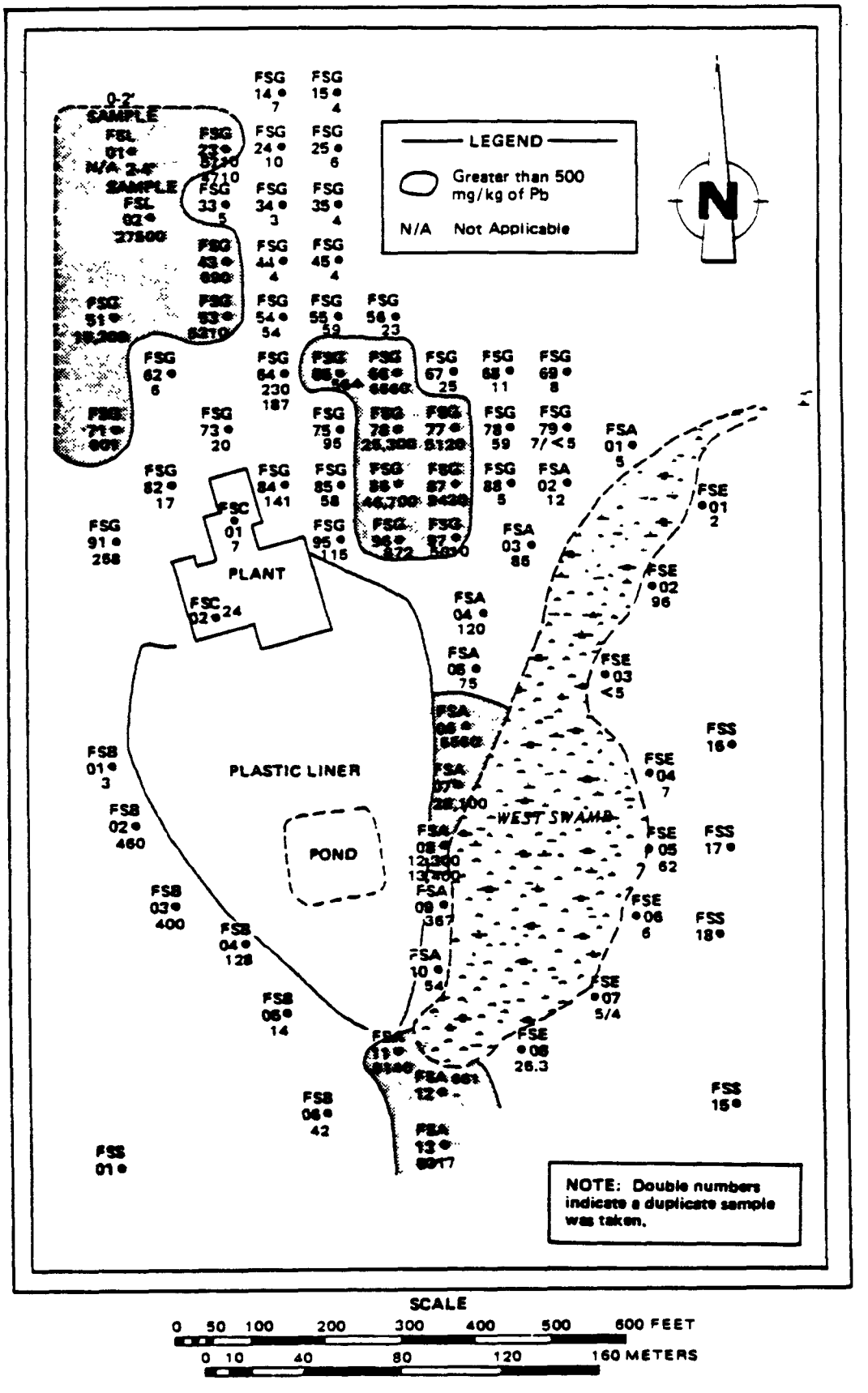

Figure 3–7 LEAD CONCENTRATIONS (mg/kg) IN THE C INTERVAL (2.5–5.0 Feet) SAMPLES OF ON–SITE SOIL BORINGS

concentrations in the area southwest of the plastic liner decrease to just under 500 mg/kg in FSB02C and FSB03C (460 and 400 mg/kg, respectively). In contrast, between the liner and the West Swamp, the lead levels at FSA06C, FSA07C, and FSA08C remain very high, ranging from 6,560 to 28,100 mg/kg.

The battery chip-filled area northeast of the plant foundation also remains highly lead-contaminated at the C interval. Eight boring locations had lead levels greater than 500 mg/kg. This indicates more extensive lead contamination laterally than at the B interval. In addition, five of these locations show a substantial increase in lead concentrations at this depth; in particular, FSG66 increased from 17 mg/kg in the B interval to 6,560 mg/kg in the C interval, whereas FSG76 increased from 8,320 mg/kg in the B interval to 25,300 mg/kg in the C interval.

The Northwest Landfill area also continues to exhibit high lead levels at the C interval, with FSL02 exhibiting a lead concentration of 27,500 mg/kg. (FSL02 was conducted as a 15-foot boring in the landfill.)

Lead occurs in FSG71C at 601 mg/kg, almost three times higher than that detected in the overlying interval. Similarly, south of the West Swamp, FSA11, FSA12, and FSA13 show increasing lead concentrations in the C interval.

As at the A and B intervals, antimony levels in the C interval FSA samples generally increase and decrease in parallel with the lead concentration (Figure 3-8). Similarly, in the Northwest Landfill, antimony levels increase with increasing lead concentrations. Cadmium is present at 1.1 mg/kg in FSC02C (beneath the plant foundation), where the lead concentration is 24 mg/kg.

A single composite sample was collected at mid-depth of the battery casing fill (6.5 feet total depth).

3.2.4 D and E Interval Soils (5.0 to 7.5 Feet and 7.5 to 10.0 Feet)

As discussed in Section 2.2, samples from the D interval (5 to 7.5 feet) and E interval (7.5 to 10 feet) of the 48 FSB, FSC, and FSG borings were archived pending evaluation of the analytical data from the A, B, and C interval samples. Based on the results of the A, B, and C evaluations, it was determined that the D and E interval samples

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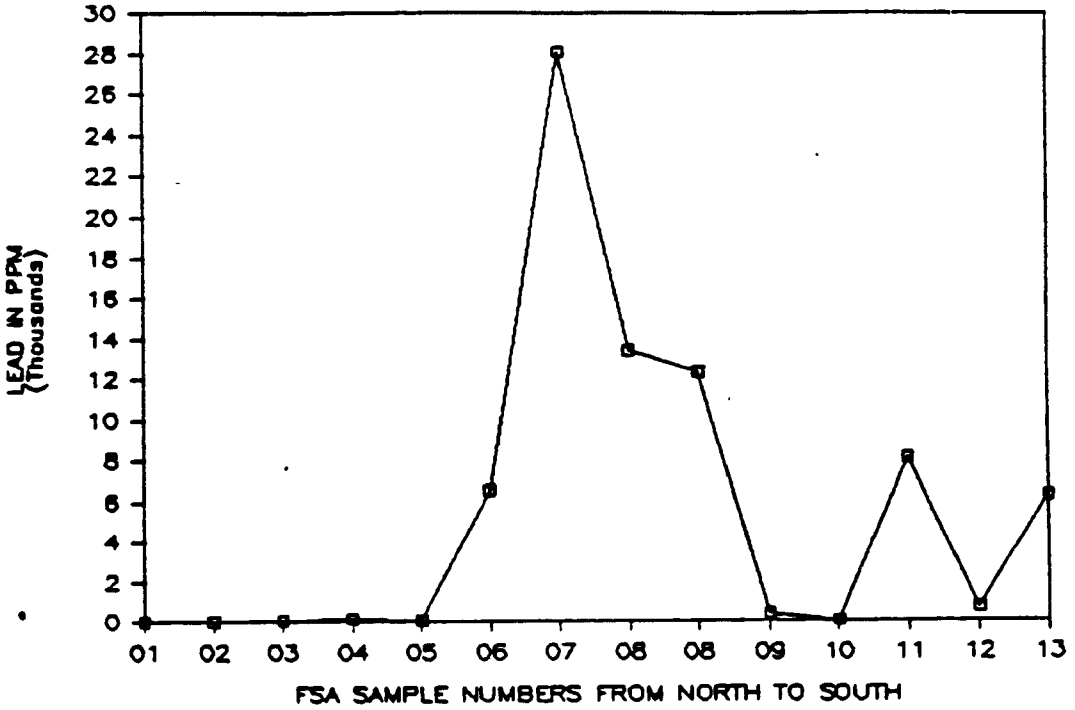

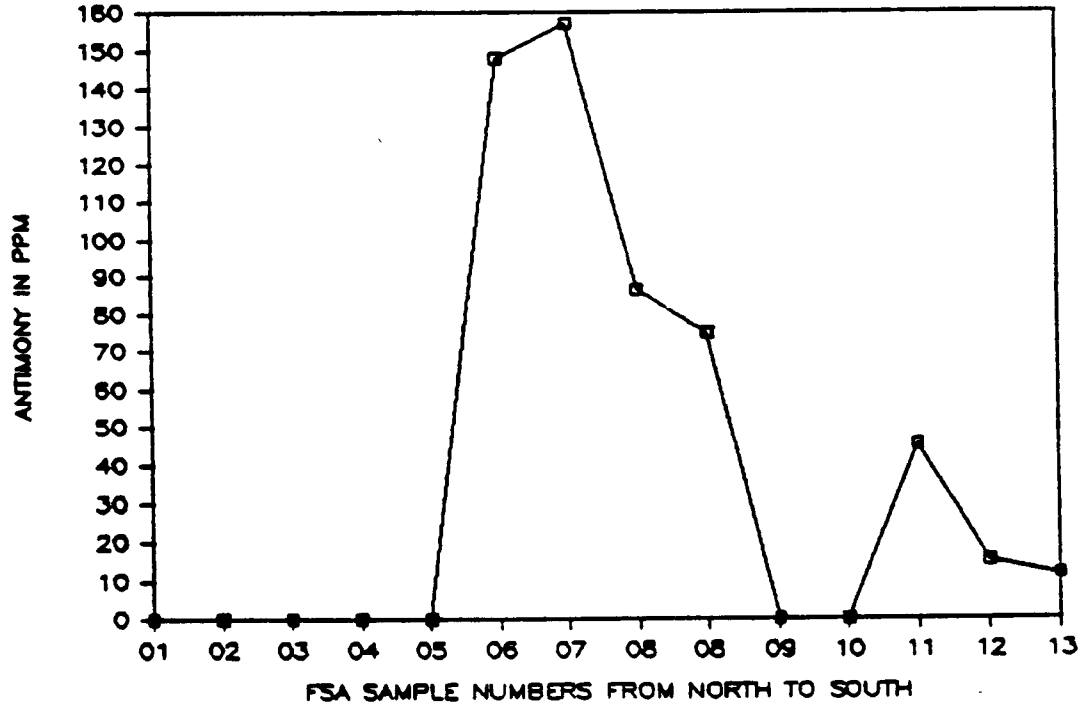

Figure 3–8 LEAD VERSUS ANTIMONY IN THE C INTERVAL (2.5 to 5.0 foot depth) IN FSA SAMPLES ALONG THE WEST BANK OF THE WEST SWAMP

from 27 locations (54 samples) should be analyzed. Of these 27 locations, 18 (36 samples) were selected based on the occurrence of high lead concentrations in the C interval, seven (14 samples) were chosen based on their proximity to locations that exhibited high C interval lead concentrations, and two (four samples) were chosen as background locations. The sample locations for each of these categories are as follows:

- Locations with High Lead Concentration in C Interval

FSG23	FSG71	FSG95
FSG51	FSG76	FSG96
FSG53	FSG77	FSG97
FSG64	FSG86	FSB02
FSG65	FSG87	FSB03
FSG66	FSG91	FSB04

- Locations proximate to locations with High Lead Concentration in C Interval

FSG54	FSG75	FSG88
FSG56	FSG78	
FSG67	FSG85	

- Background Locations

FSG15	FSG34

The 54 D and E samples were analyzed in January 1986. The results of these analyses are included in Table C-1 (Appendix C) and, together with the results of the previously conducted analyses of the FSA D and E interval samples, are discussed below.

Figures 3-9 and 3-10 show the lead concentrations measured in the D and E interval samples, respectively. Comparison of Figure 3-9 with the corresponding C interval data of Figure 3-7 indicates that, in general, lead concentrations are substantially lower in the D interval. Only two samples (FSG64D and FSB04D) exhibit increased lead concentrations in the D interval (from 230 to 1,110 mg/kg and 128 to

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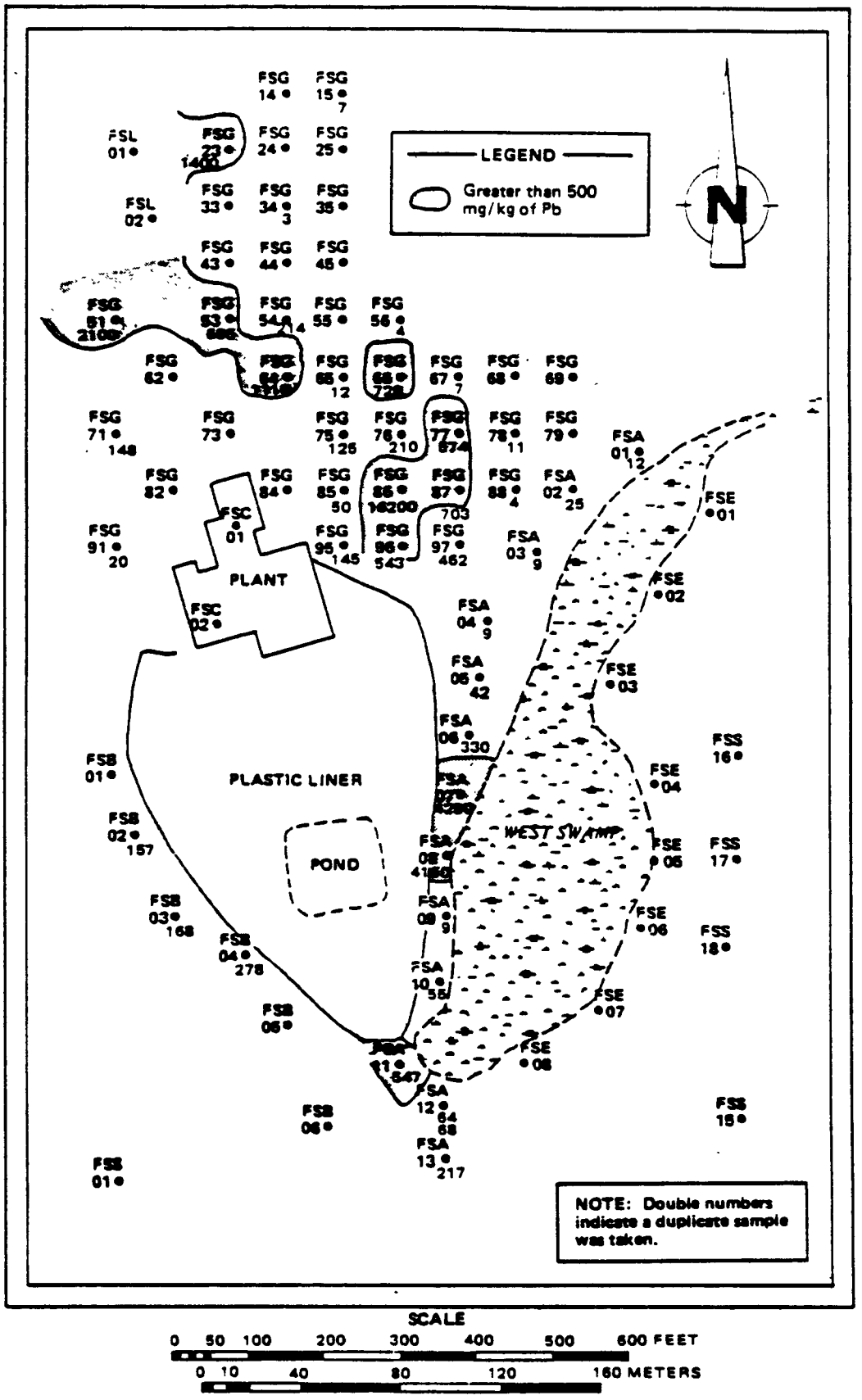

Figure 3–9 LEAD CONCENTRATIONS (mg/kg) IN D INTERVAL (5.0 TO 7.5 FEET) SAMPLES OF ON–SITE SOIL BORINGS

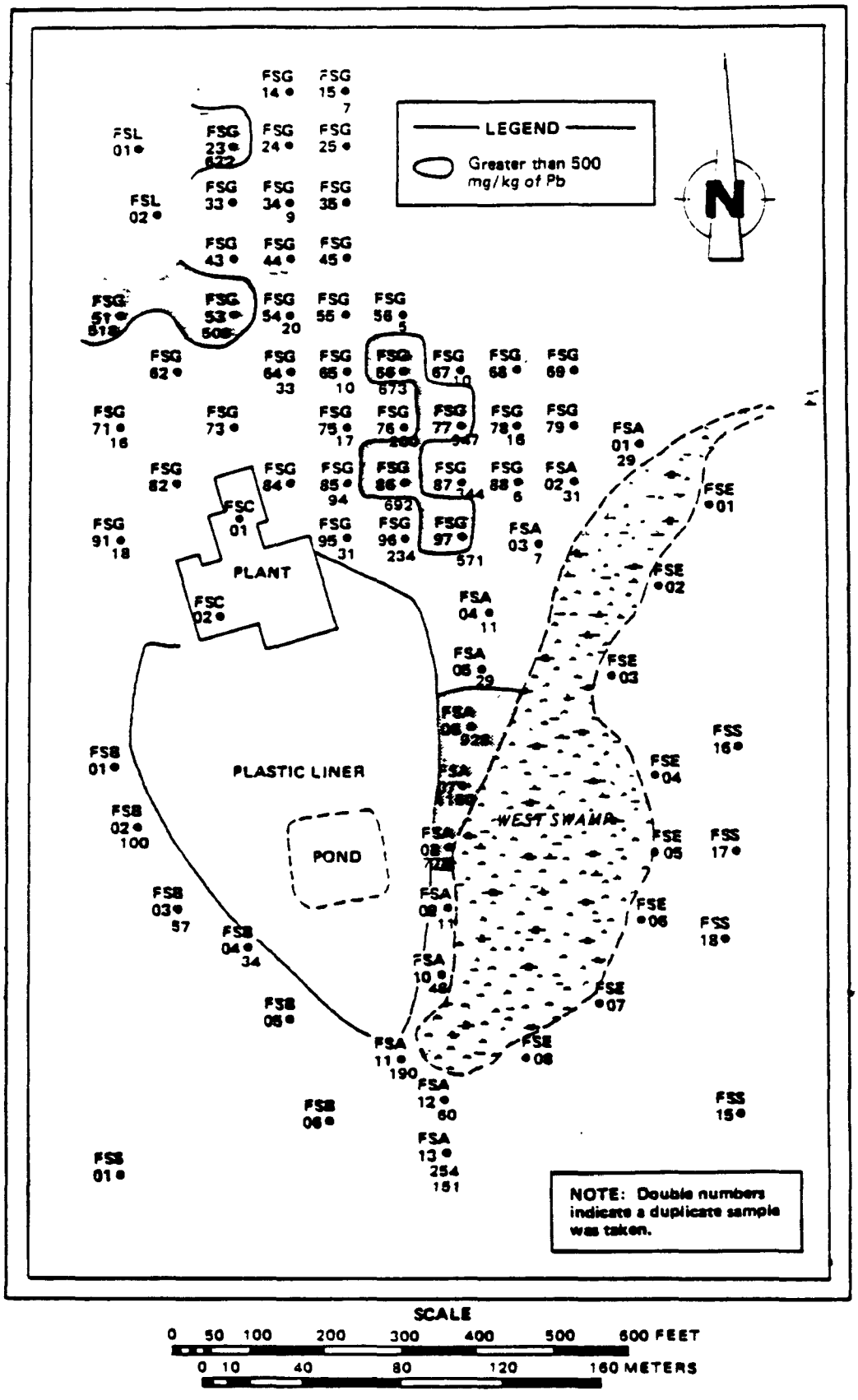

Figure 3–10 LEAD CONCENTRATIONS (mg/kg) IN E INTERVAL (7.5–10.0 Feet) SAMPLES OF ON-SITE SOIL BORINGS

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278 mg/kg, respectively). However, many of the D interval samples continue to show relatively high lead concentration at locations where C interval concentrations were high (in particular, the 16,200 mg/kg level detected in FSG86D).

The changes in lead concentrations between the D and E intervals are not as well-defined as those between the C and D intervals, although the overall trend is toward substantially lower concentrations in the E interval samples. Several samples still exhibit lead concentrations greater than 500 mg/kg, and FSA06E is the only E interval sample to exhibit a substantial increase in lead concentration relative to the D interval value (from 330 to 928 mg/kg).

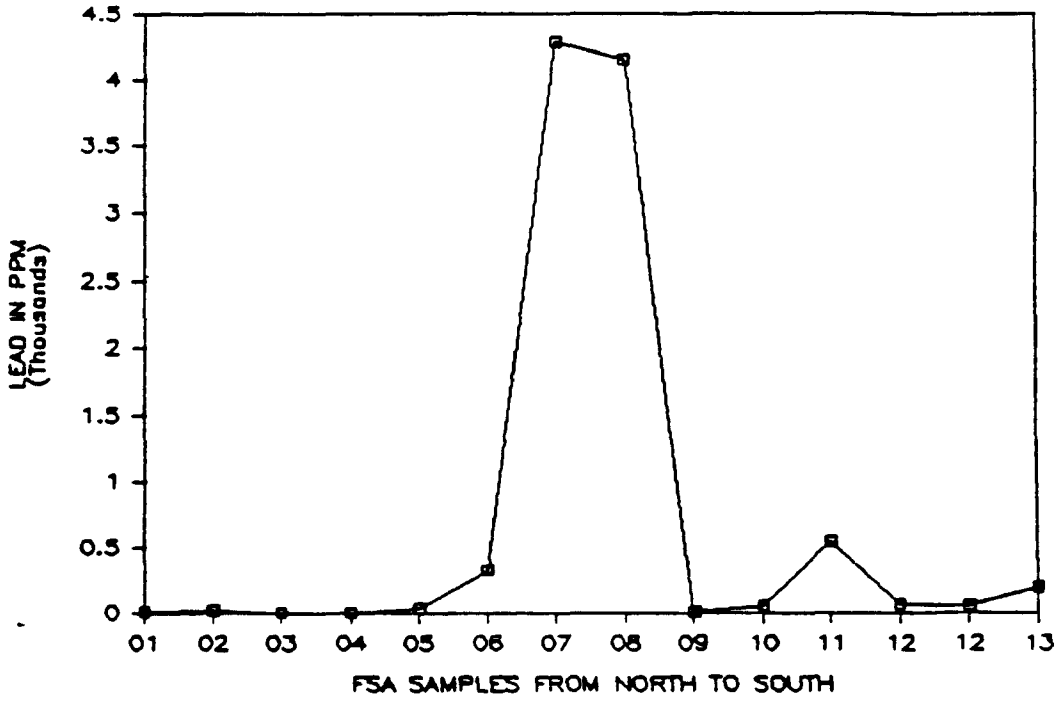
In general, antimony concentrations decrease in parallel with the lead concentrations (Figures 3-11 and 3-12). In contrast, the 4.82 mg/kg cadmium detected in FSA13D was the highest concentration found in any soil sample analyzed for this metal.

3.2.5 Northwest Landfill Characterization

There were several borings conducted in and around the northwest landfill (Figure 3-13). FSL01 and FSL02 were conducted as 15-foot exploratory borings, where a sample was collected at mid-depth of the battery chip fill and analyzed for pH, lead, cadmium, antimony, and percent moisture. FSL01 had 2 feet of fill which consisted primarily of whole battery casings mixed with sandy clay. The remaining 13 feet of the borehole was a brown-gray sandy clay. A composite sample of 0 to 2 feet had 3,020 mg/kg lead, in the primary sample, and 9,670 mg/kg lead in the duplicate sample. FSL02 was found to have 6.5 feet of battery casings and sandy clay fill. The remaining 8.5 feet of the borehole was a brown-gray sandy clay. A sample collected from 2 to 4 feet indicated 27,500 mg/kg lead.

Because FSL01 had only 2 feet of battery chip fill (less than expected), a third exploratory hole (FSL03) was bored to 10 feet on the western edge of the landfill. Five feet of battery chip fill was encountered, underlain by 5 feet of gray sandy clay. No samples were collected.

Five 10-foot grid borings are situated within the limits of the landfilled area along the southern and eastern edges. As shown in Figure 3-13, these boreholes had battery casings and chips mixed with



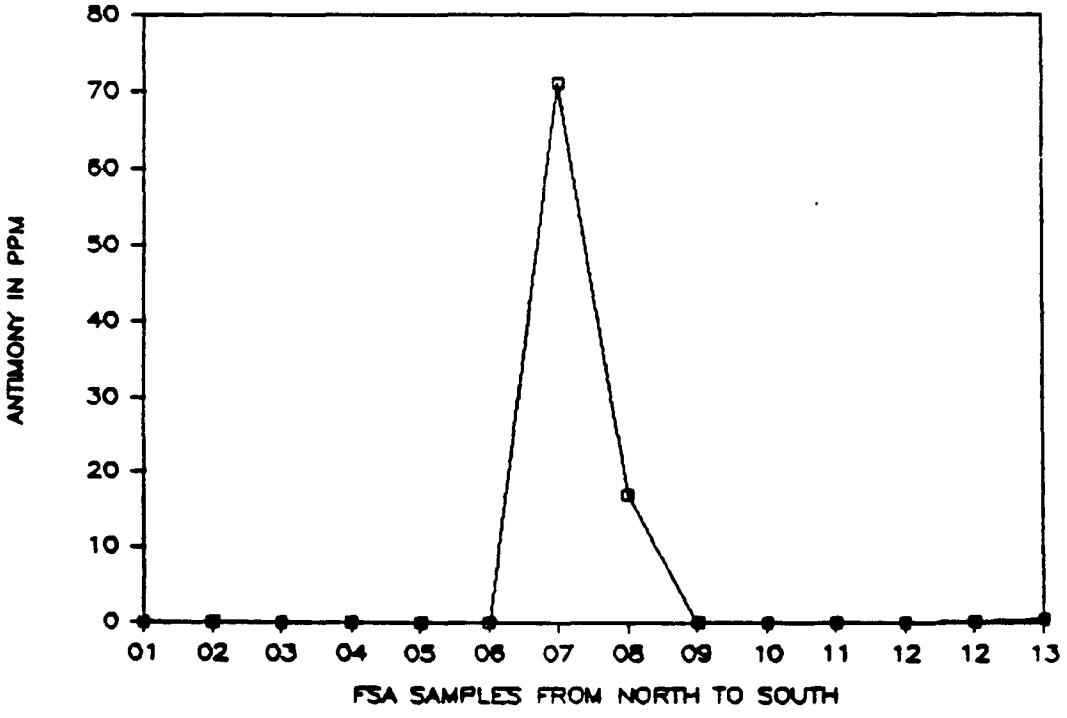


Figure 3–11 LEAD VERSUS ANTIMONY IN THE D INTERVAL (5.0 to 7.5 foot depth) FSA SAMPLES ALONG THE WEST BANK OF THE WEST SWAMP

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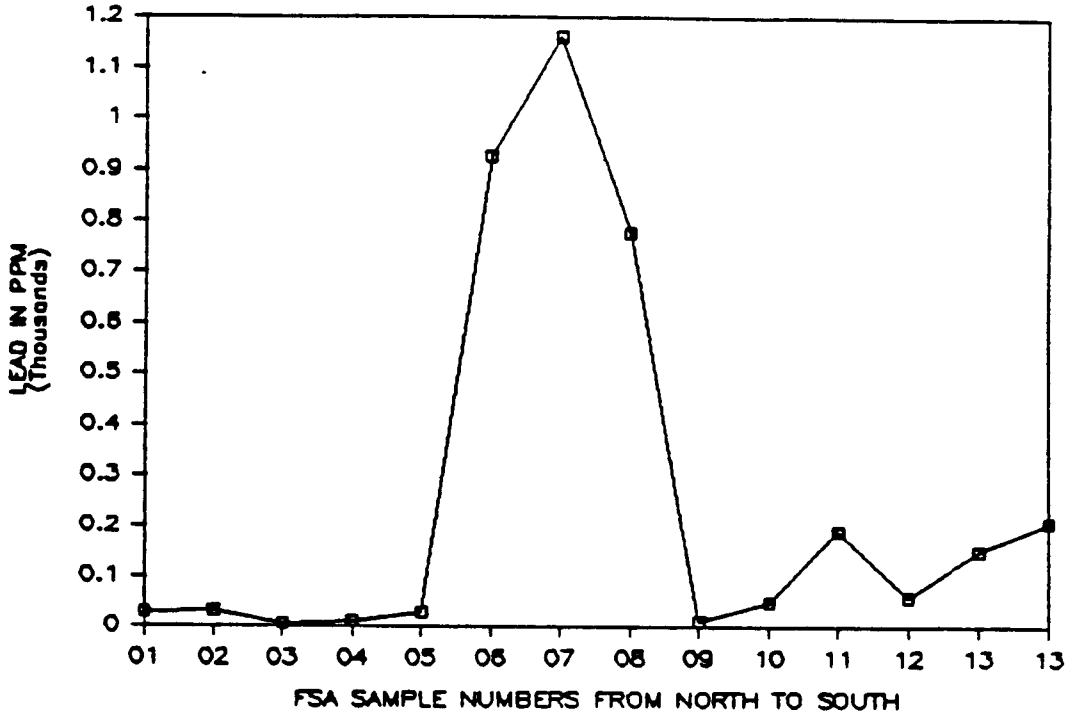

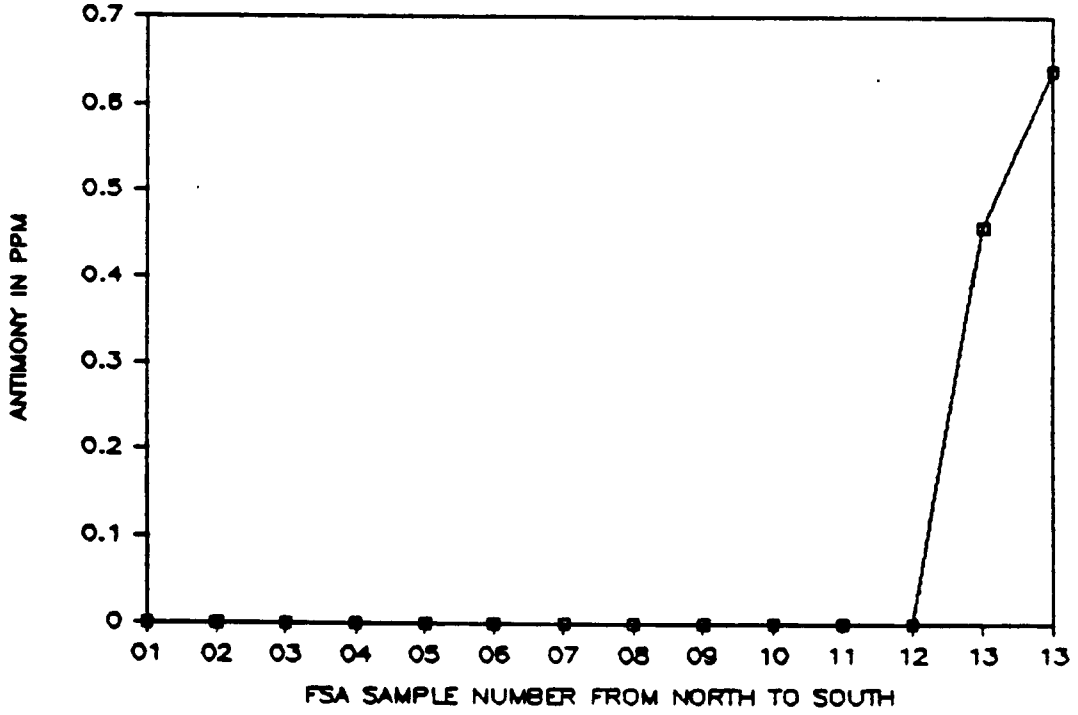

Figure 3–12 LEAD VERSUS ANTIMONY IN THE E INTERVAL (7.5 to 10.0 foot depth) FSA SAMPLES ALONG THE WEST BANK OF THE WEST SWAMP

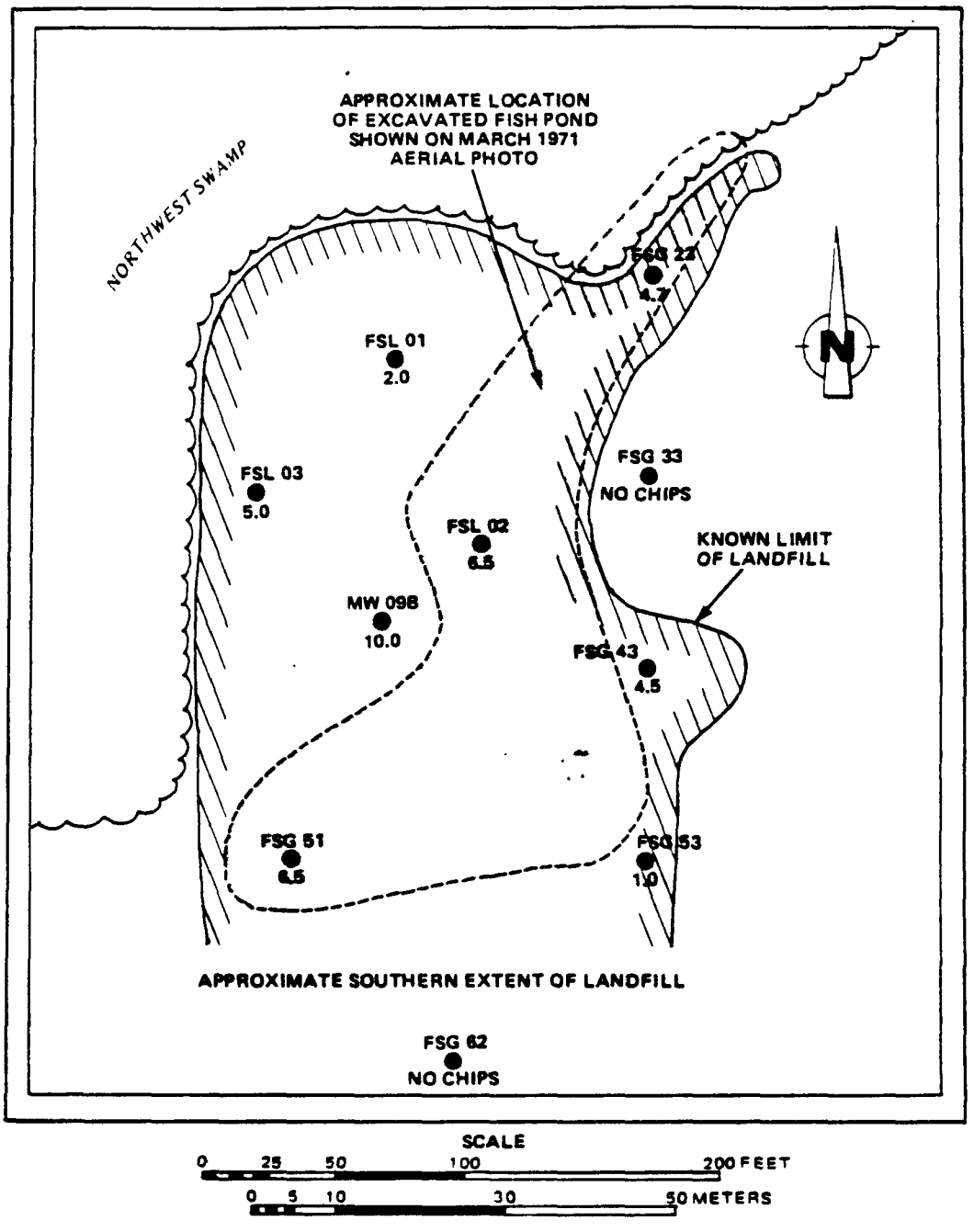

Figure 3–13 DEPTH OF BATTERY CASING FILL IN NORTHWEST LANDFILL AREA

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sandy clay to depths ranging from 1 to 6.5 feet. During the installation of monitoring well MW09B, drilling logs recorded that battery chips occurred in fill material to a depth of approximately 10 feet.

Borings conducted within the limits of the landfill indicate that battery chip fill varies from 1 to at least 10 feet in thickness. However, the landfill was preceded by a fish pond excavated around 1970/1971 to an unknown depth and extending across most of the currently filled area (Figure 3-13).

To what maximum depth battery casing and/or contaminated fill material was placed into this pond site is not known. It is possible that battery casing fill extends beyond 10 feet at one or more locations.

In all, 14 samples were collected (as well as three duplicate samples) from seven locations on the northwest landfill. Lead levels for these 14 samples ranged from 690 mg/kg (FSG43 at the B and C intervals) to 84,200 mg/kg (FSG51 at the B interval). An average concentration for the lead-contaminated soils of the landfill, based on analysis of FSL01 and FSL02, is 16,922 mg/kg lead. When considering the additional 12 samples collected in the filled area, the mean lead concentration in the samples is 13,911 mg/kg, with a standard deviation of 21,883 mg/kg.

3.2.6 Soils Investigation Summary

In summary, gross lead contamination of the surface soils (0 to 0.5 foot) is generally restricted to the western half of the Sapp Battery site (Figures 3-2 and 3-3). In contrast, gross lead contamination of soils between 0.5 and 10 feet below land surface is, for the most part, restricted to four areas (Figures 3-5, 3-7, 3-9, and 3-10): the Northwest Landfill; northeast of the plant foundation; between the West Swamp and the plastic liner; and south of the West Swamp and plastic liner. The high lead concentrations in the first three of these areas appears to be correlated with the greater thicknesses of battery chip fill (Figure 3-1), whereas lead contamination in the southernmost area is probably a result of its being located in a former surface drainage path (see Section 1.3).

Although lead concentrations generally decrease with depth down to 10 feet, there are many exceptions to this trend. This

inconsistency presumably reflects the combined influences of variability in source distribution together with variability in soil infiltration and cation exchange capacities. In particular, the usually substantial decrease in lead concentrations from the C interval to the D and E intervals (Figures 3-7, 3-9, and 3-10) presumably reflects the reduced permeability characteristics of the increasingly clayey soils. Nevertheless, the possibilities of lead contamination of deeper (i.e., below 10 feet) soils cannot be ruled out due to: (1) the continued occurrence of high lead concentrations at the D and E interval depths, (2) the less well-defined pattern of change for lead concentration between the D and E intervals, (3) the great lateral and vertical variability in soil lithology, and (4) the general association of groundwater contamination in all three on-site aquifer systems with areas of elevated shallow (0 to 10 feet) soil contamination (see Section 3.4). However, the overall trend toward reduced lead concentrations with depth over areas of reduced size does suggest that deeper soil contamination might only have a minimal long-term adverse environmental impact if not included as part of the final clean-up program.

Overall, cadmium concentrations are lower and occur somewhat more sporadically than antimony concentrations. In contrast, changes in antimony concentration more closely parallel changes in lead concentration, both within a single interval as well as between intervals (see Figures 3-4, 3-6, and 3-8). It is probable that a remedial program designed to clean up the lead-contaminated soils would effectively reduce any adverse environmental impacts associated with cadmium and antimony soil contamination.

3.2.7 Fixation Study

The results of the chemical fixation analysis for the lead extracts are presented in Table 3-1. As is illustrated in this table, the cementitious mixture was much more effective in binding lead than the pozzolanic cement.

The cementitious mixture (Portland-Type 4) exhibited excellent binding capacity for all samples (1126A, B, C). This is represented

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Table 3-1

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS
FROM EP TOXICITY TESTS (mg/l)

	Samples				Maximum Allowable Concentration
Pozzolanic					
E & E Lab Number 86-	1126D	1126E	1126F		
Sample Identity	Ash: Lime: Soil	Ash: Lime: Soil	Ash: Lime: Soil	Blank	
	0.25:0.25:1	0.5:0.5:1	0.75:0.75:1		
Lead	76.4	<0.06	7.17	<0.06	5.0
Cementitious					
E & E Lab Number 86-	1126A	1126B	1126C		
Sample Identity	Concrete: Soil	Concrete: Soil	Concrete: Soil		
	0.5:1	1:1	1.5:1		
Lead	0.085	<0.06	<0.06		5.0

*86-1126 is a composite of FSG-53 A, B, C; FSG-76 A, B, C; FSG-87 A, B, C. The composite has a lead concentration of 71,000 mg/kg. The EP Toxicity test on the control sample (untreated composite soil material) yielded 59.4 mg/l.

by the extremely low recoverable lead values for each sample. As compared to the maximum allowable concentration of 5.0 mg/L, all three samples were near or below detection limits. Only 1126A exhibited a slight lead recovery of 0.085 mg/L. The concentrations of 1126B and C were below the detection limit of 0.06 mg/L.

Lead recovery from samples from the pozzolanic mixture showed an order of magnitude difference between 1126E (<0.06 mg/L), 1126D (76.4 mg/L) and 1126F (7.17 mg/L).

These results demonstrate that Portland type IV cement and a 1:1 mixture of soils to pozzolan will solidify the soils and reduce the concentration of lead in the leachate to acceptable levels. It is expected that cement requirements will be reduced and control of contaminants increased with process optimization.

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3.3 SEDIMENTS

The analytical results generated by the sediment sampling conducted in November/December are presented in Table C-2 in Appendix C. The following discussion on the occurrence and distribution of lead, cadmium, and antimony in swamp and creek sediments within the study area is keyed to five geographical areas in order to more clearly address the trends occurring in each. These five areas are: (1) the Northwest Swamp, (2) the West Swamp, (3) the East Swamp, (4) the Southeast Swamp, and (5) Steele City Bay/Little Dry Creek wetland system.

Sediment borings were conducted to depths of 2.5 feet (FMT borings), 5 feet (FMH borings), and 10 feet (FMK borings). The sampling intervals were at depths identical to those for the soil borings: interval A (0 to 0.5 foot), interval B (0.5 to 2.5 feet), interval C (2.5 to 5 feet), interval D (5 to 7.5 feet), and interval E (7.5 to 10 feet).

3.3.1 Northwest Swamp

In the Northwest Swamp, five 2.5-foot borings were conducted (FMT01 through FMT05; Figures 2-4 and 3-14). The A interval samples at all locations showed elevated lead levels ranging from 111 to 593 mg/kg. This would indicate that the swamp has been affected by the Northwest Landfill as well as by surface runoff from the area northwest of the plant foundation, which discharges to the swamp south of FMT05. Lead levels decrease greatly in the B interval at all locations, ranging from 25 mg/kg in FMT05B to 70 mg/kg in FMT04B. This decrease most likely reflects the uptake of lead by the organic-rich sediments that overlie the shallow tight clays encountered within the A interval.

A trace of cadmium (0.66 mg/kg) was detected in FMT03A, whereas traces of antimony were detected in both FMT03A and FMT05A (0.66 and 0.55 mg/kg, respectively). At each of the five locations, pH decreases with depth.

3.3.2 West Swamp

In the West Swamp, five 10-foot borings were conducted (FMK01 through 05; Figures 2-4 and 3-14). The upper A, B, and C interval samples were analyzed for pH, lead, cadmium, antimony, and percent

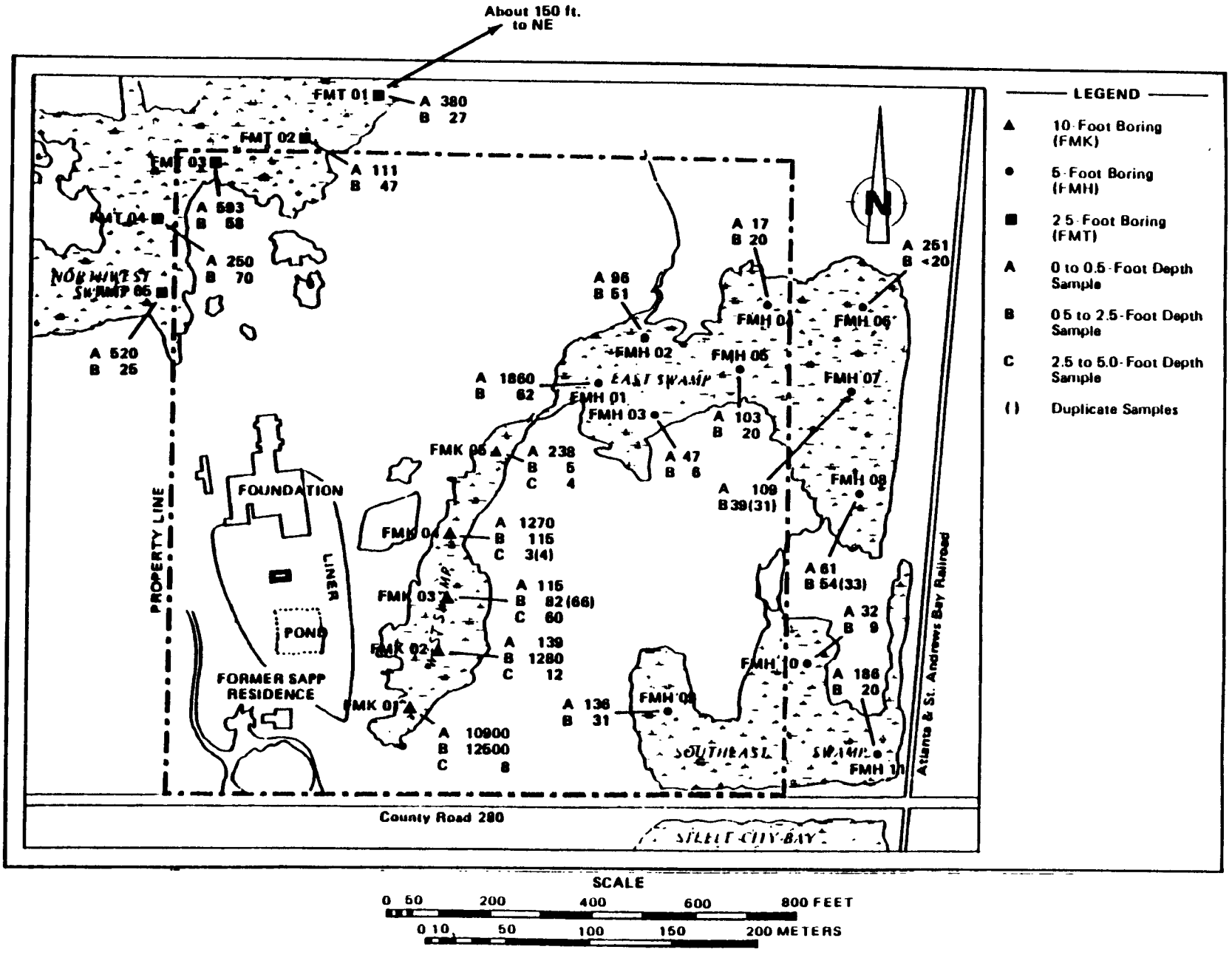

Figure 3–14 LEAD CONCENTRATIONS (mg/kg) IN ON-SITE A, B, AND C INTERVAL SEDIMENT SAMPLES

moisture. The lower (D and E) interval samples were archived pending the analytical results for the upper samples.

In the upper 6 inches (A interval), lead levels were found to be quite high in FMK01A and FMK04A only (10,900 and 1,270 mg/kg, respectively). This suggests that high lead levels in surface sediments are somewhat unevenly distributed throughout the West Swamp; however, the southernmost portion of the swamp is most highly contaminated. In the southernmost sample (FMK01A), where the highest lead level occurs, a cadmium concentration of 1.15 mg/kg and an antimony concentration of 36.2 mg/kg were detected.

In the B intervals of FMK01 through 05, it becomes even more apparent that lead has been concentrated in the southern end of the West Swamp. Lead increases in FMK01B to 12,500 mg/kg and in FMK02B to 1,280 mg/kg, whereas FMK03B exhibits a slight decrease, and FMK04B and FMK05B show a drastic decrease with depth (Figure 3-14). Cadmium increases slightly in FMK01B and antimony increases in both FMK01B and FMK02B.

The C interval in borings FMK01 and FMK02 shows a substantial decrease in lead contamination. This suggests that lead contamination must sharply decrease at some point within the overlying B interval.

It should be noted that although FMK03 does not show excessive lead contamination in the A, B, and C intervals (115, 82, and 60 mg/kg, respectively), it does exhibit the smallest decrease in lead concentration with depth. This boring was conducted in the deepest depression in the swamp, and tighter clay materials were not encountered above approximately 5 feet (i.e., the clay was much deeper than in the other four borings). Consequently, either the more permeable nature of the overlying sandy materials has allowed lead contamination to migrate into the deeper horizons, or the reduced cohesiveness of this material increases the tendency for mixing to occur during augering, affecting the representativeness of the sample.

Cadmium and antimony were not detected in any of the C interval samples in the West Swamp.

Almost all of the 15 samples from the West Swamp which were analyzed exhibited pH values of 4.0 to 5.5. The exceptions were the most highly lead-contaminated samples (FMK01A and 01B), which had pH values of 7.05 and 6.00, respectively. Analogous to the situation

with the shallow soil samples along the southwest bank of the West Swamp, these higher pH values could be a result of acid-neutralization by a lime trench that was constructed on the west bank by EPA in 1979 as an emergency remedial effort.

Based on the upper interval results, analysis of the archived D and E interval samples from the West Swamp was not deemed necessary.

3.3.3 East Swamp

Eight 5-foot borings were conducted throughout the East Swamp (FMH01-08; Figures 2-4 and 3-14). The A and B interval samples were analyzed for pH, lead, cadmium, antimony, and percent moisture; the C interval sample was archived pending the analytical results for the upper intervals.

In the upper 6 inches (A interval), only sample FMH01A exhibited a very high lead concentration (1,860 mg/kg); the other seven A interval samples ranged from 17 to 251 mg/kg lead. The West Swamp drains into the East Swamp, and therefore, lead-contaminated sediments have in the past been carried into the East Swamp and primarily deposited at the mouth of the canal discharge (i.e., in the vicinity of FMH01). The lead levels that occur in the other seven A interval samples do not indicate any lateral pattern of dispersion and seem to occur somewhat sporadically (Figure 3-14).

Cadmium occurs above detection limits in six of the eight A interval samples and, like antimony, does not exhibit a lateral dispersion pattern. The highest cadmium and antimony levels occur in FMH06A (3.74 mg/kg and 48.1 mg/kg, respectively) in the extreme northeastern portion of the swamp.

The B interval samples generally indicate the same trend of decreasing lead values as seen in the Northwest and West swamps. Only FMH04B indicated an increase in lead concentration with depth (up to 20 mg/kg).

In general, cadmium concentrations are lower in the B interval samples. However, cadmium levels in FMH01B and FMH06B (1.21 and 2.85 mg/kg, respectively) decrease only slightly in contrast to the sharp decreases in lead. Antimony levels decrease sharply from the A to B intervals in all cases.

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With the exception of FMH01 and FMH06, the East Swamp samples showed little change in pH with depth. The pH values slightly increased or slightly decreased with depth in six of the borings, ranging from 3.34 to 3.72 in the B interval samples. However, in FMH01 and FMH06, pH decreased sharply with depth (from 4.79 to 3.07 and from 3.71 to 2.79, respectively). The FMH01 and FMH06 samples also exhibited the highest lead levels and sharpest decrease in lead concentration with depth.

Based on the A and B interval trends in the East Swamp, it was decided not to analyze the C interval archived samples.

3.3.4 Southeast Swamp

Three 5-foot borings were conducted in the Southeast Swamp (FMH09, 10, and 11; Figures 2-4 and 3-14). The A and B interval samples were analyzed for pH, lead, cadmium, antimony, and percent moisture; the C interval sample was archived pending the analytical results for the upper intervals.

Station FMH11, located in the extreme southeast corner of the swamp, adjacent to the culvert crossing under County Road 280 into Steele City Bay, was the only boring conducted in open water. Borings FMH09 and FMH10 were conducted in two of the unsubmerged northern reaches of this swamp.

Sample FMH11A showed the highest lead and antimony levels (186 and 14 mg/kg, respectively), as well as the only occurrence of cadmium (1.93 mg/kg) above detection limits. Lead levels decreased substantially in the B interval in all samples (Figure 3-14), and neither antimony nor cadmium was detected.

In FMH11, pH dropped from 4.35 in the A interval to 3.39 in the B interval. The other two borings showed no change of pH with depth.

Based on the A and B interval trends for the metals in question, none of the C interval samples were analyzed for the Southeast Swamp.

3.3.5 Steele City Bay

As discussed in Section 2.3 and illustrated in Figures 2-5 and 3-15, three 10-foot borings were conducted in Steele City Bay (FMK06, 07, and 09), four 5-foot borings were conducted in Steele City Bay (FMH12 through 15), and seven 2.5-foot borings were conducted in wetlands from U.S. Highway 231 to Little Dry Creek (FMT07 through 13).

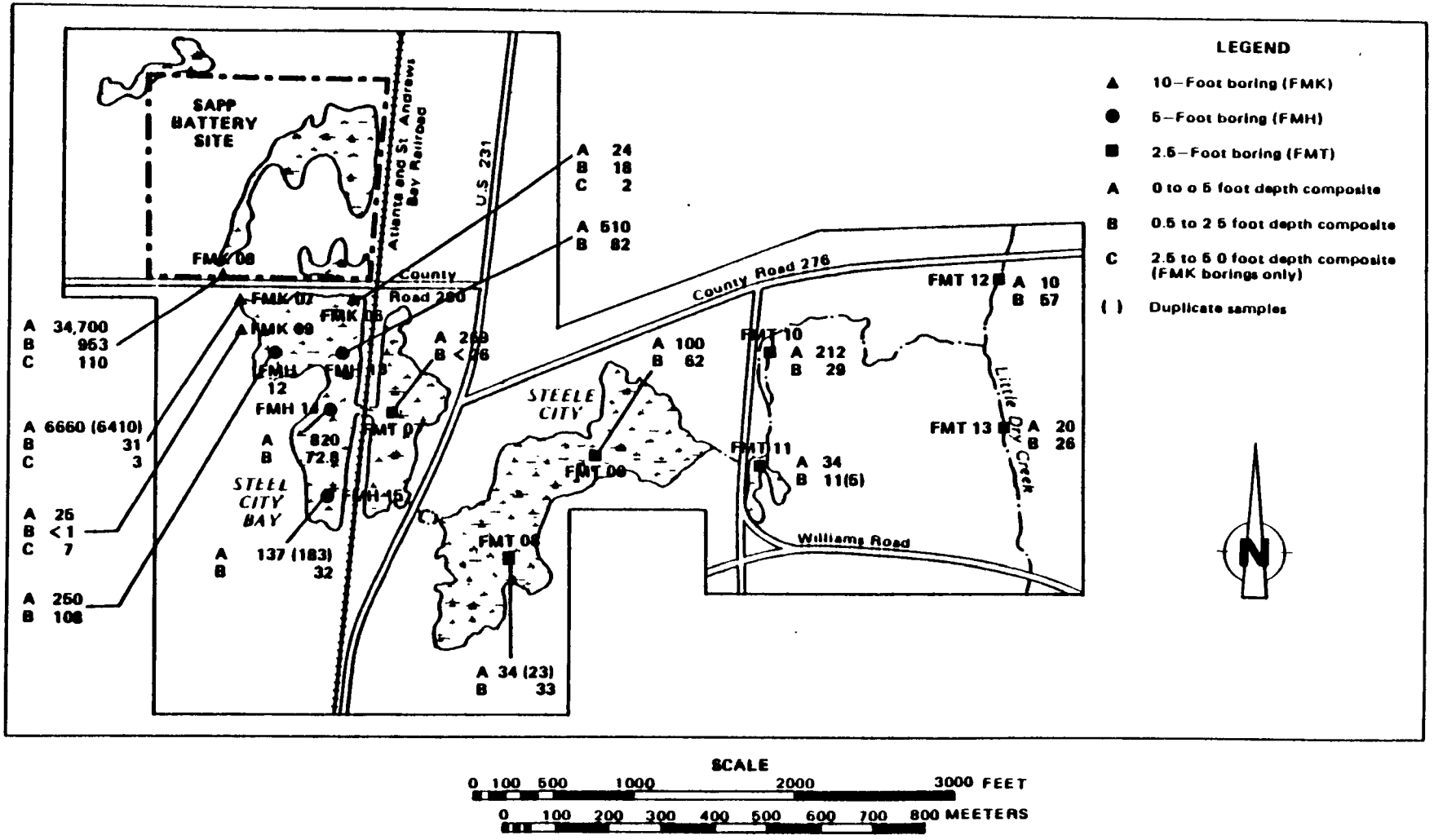

Figure 3–15 LEAD CONCENTRATIONS (mg/kg) IN OFF-SITE A, B, AND C INTERVAL SEDIMENT SAMPLES

One 10-foot boring (FMK08) was conducted at the entrance to the culvert under County Road 280, just north of the road. All samples were analyzed for the selected metals, except for the samples from the D and E intervals of the 10-foot borings and the C interval of the 5-foot borings, pending review of the results of the upper intervals.

In general, the trend of lead concentration decreasing with depth that was seen for the on-site swamps was also seen throughout the off-site wetlands system. This was most dramatic in boring FMK08, situated in the former drainage path from the site to Steele City Bay. Here, a lead concentration of 34,700 mg/kg was detected in the A interval, decreasing to 953 mg/kg in the B interval and to 110 mg/kg in the C interval. The same trend occurs in FMK07 (40 feet southeast of the culvert), where lead decreases from 6,660 mg/kg (6,410 mg/kg in the duplicate sample) in the A interval to 31.4 mg/kg and 2.57 mg/kg in the B and C intervals, respectively. Cadmium and antimony concentrations similarly decrease with depth. Vertical trends are, for the most part, consistent, and lateral dispersion of lead contamination can be seen to extend as far as the FMT09A sediments. However, in the area south of the culvert crossing to FMT11, lateral migration becomes somewhat more difficult to determine. Sample FMT10A, collected in the small wetland area adjacent to the road connecting County Road R276 and Williams Road, yielded 212 mg/kg lead. It is possible that this location has been affected by the drainage it receives from the adjacent road and a nearby automobile salvage operation directly to the north. In addition, FMT12A and FMT12B (upstream sample location in Little Dry Creek, 100 feet downstream from the County Road 276 bridge) showed lead values of 10 and 57 mg/kg, respectively, which are higher than the lead concentrations in the A and B intervals of FMT13 (downstream from the confluence with the Steele City Bay surface drainage). The lead detected in the FMT12 samples suggests the possibility that runoff from County Road 276, or some other source north of the bridge, is contributing lead to the drainage system. Consequently, the lead contamination in FMT10A, as well as the upstream contamination in FMT12A and B, raise the possibility that the lead detected in FMT13A and B may not be entirely attributable to transport from the Sapp Battery site via the Steele City Bay wetlands system.

It should be noted that in some cases (particularly in Steele City Bay) lead values were considerably higher than those in sediment samples collected in the same general areas by FDER in 1983. It is possible that this is due to the fact that the FDER samples were collected from the upper inch of sediment only, whereas the E & E sediment samples were collected from the upper 6 inches. Given that the major contamination stress of the Steel City Bay swamps occurred over such a relatively short period of time, organic detritus accumulations may have been so rapid that some of the more contaminated sediments are several inches below the surface. The lower portion of the 6-inch core may contain lead values that better reflect this earlier period in the swamp's history.

Based on the fairly well-defined trends of decreasing lead, cadmium, and antimony concentrations with depth in all of the Swamp sediments, it was not recommended that any of the archived C, D, and E interval samples be analyzed.

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3.4 GROUNDWATER

3.4.1 Hydrologic Analysis

All wells installed for this study complement the existing monitoring system constructed during the FDER-RI. Hence, the monitoring wells fall into three depth categories: (1) the C level wells, with depth ranges of 5 to 20 feet, to observe the surficial aquifer system; (2) the B level wells, with depths ranging from 35 to 100 feet, to observe the intermediate aquifer system; and (3) the A level wells, with depths ranging from 110 to 190 feet, to observe the Floridan aquifer system. Although a few wells are classified A wells, the lithology in which the screen was set reflected B level stratigraphy. This is the case for MW-09A, MW-12A, and MW-13A.

Water levels were measured and recorded for all 44 monitoring wells at the Sapp Battery site on December 11, 1985. Tables D-1 through D-3 in Appendix D present these data in feet above mean sea level (MSL). From the listed data, potentiometric maps were constructed for each aquifer system.

3.4.1.1 Aquifer Potentiometric Surfaces

The water levels for the surficial aquifer system at the site exhibit a horizontal gradient of less than 1% to the southeast (Figure 3-16). The water table elevation ranges from 136 feet above MSL in the northwest portion of the site to 127 feet MSL in the southeast portion. The gradient increases west of the West Swamp and levels off to the east. A groundwater trough dipping southward appears to occur in the area of well MW-16C. This trough most likely is a result of the one-time connection between the West Swamp and Steele City Bay, before County Road 280 was constructed. In addition, as shown on the map, both the West Swamp and East Swamp areas have a direct influence on the surficial aquifer system, inasmuch as the water table gradient levels off to the east.

The major potentiometric surface within the intermediate aquifer system slopes to the south-southwest in the western portion of the site; in the eastern half of the site it slopes to the west (see Figure 3-17). Horizontal gradients are, on the average, about 1% in both cases. Water level elevations range from about 136 feet MSL in the north and east to 122 feet MSL in the southwest. Figure 3-17

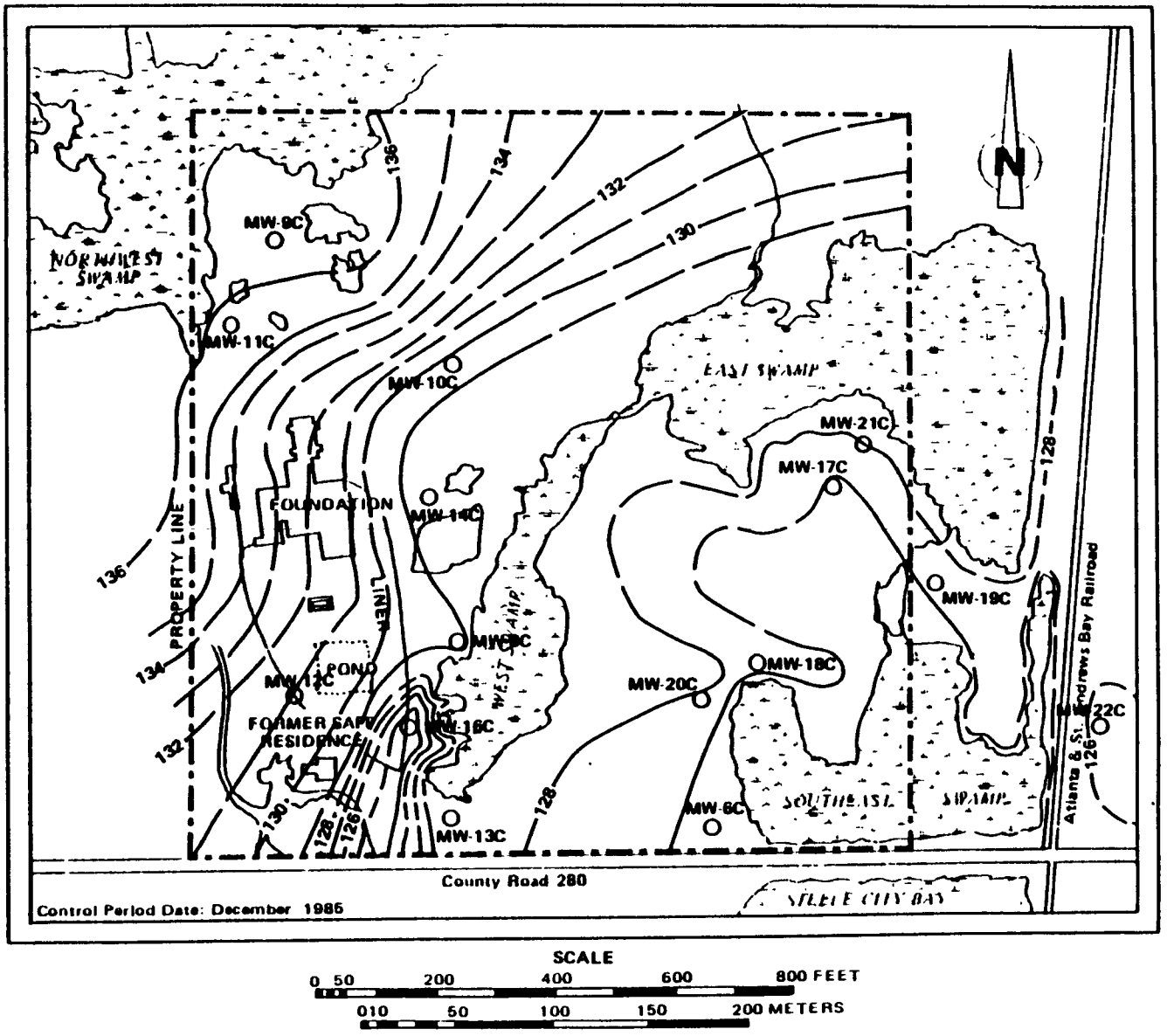

Figure 3–16 GENERALIZED POTENTIOMETRIC MAP OF THE SURFICIAL AQUIFER SYSTEM (FEET ABOVE MEAN SEA LEVEL)

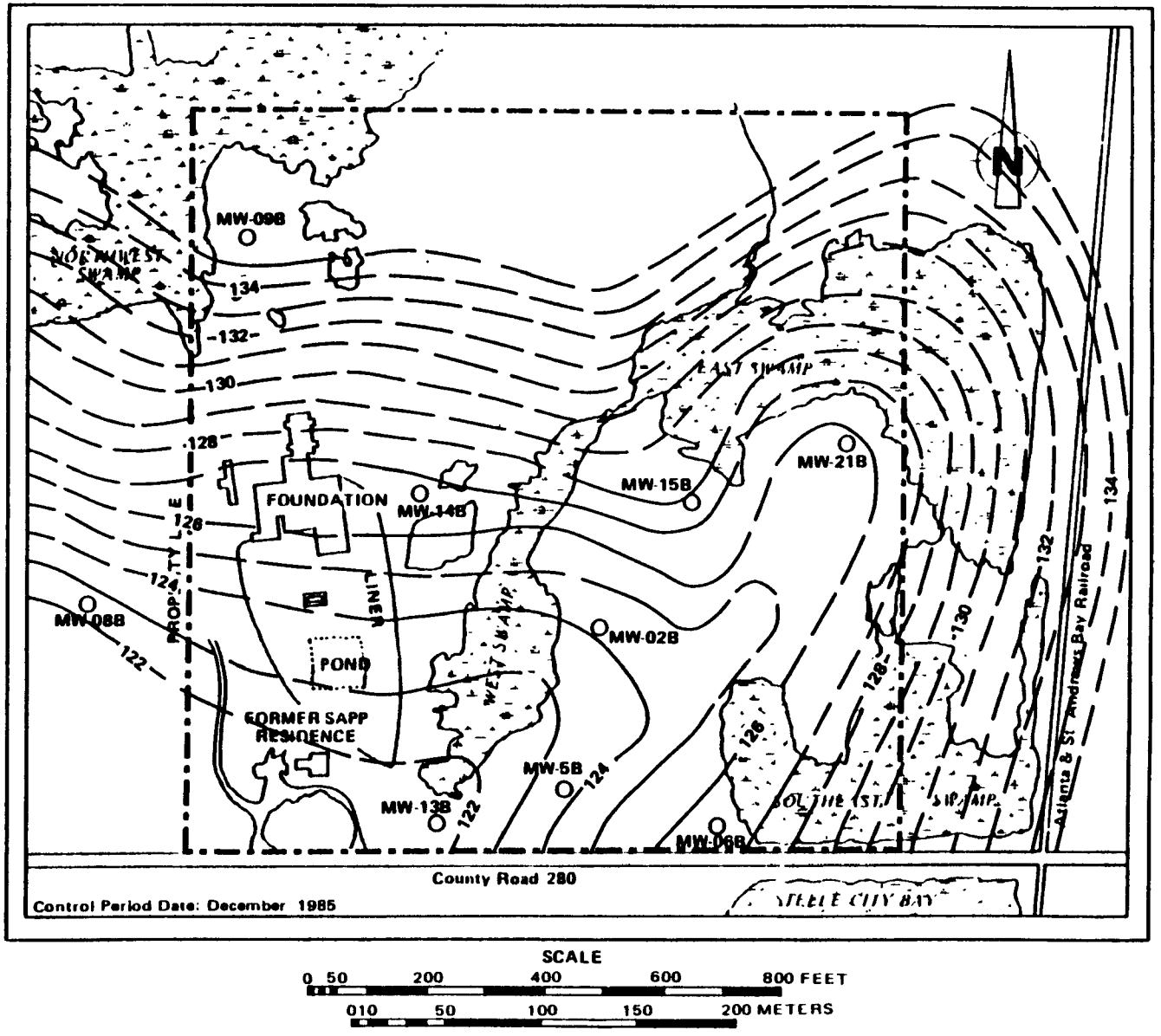

Figure 3–17 GENERALIZED POTENTIOMETRIC MAP OF THE INTERMEDIATE AQUIFER SYSTEM (FEET ABOVE MEAN SEA LEVEL)

indicates the presence of a southwest-trending groundwater trough that extends across the eastern half of the site. This feature appears to be the result of a buried paleo-stream channel that meanders southwesterly through the intermediate sediments. Water levels in five wells (MW-01B, -03BB, -07B, -12B, and -22B) open to the intermediate aquifer system do not correlate with the major potentiometric surface. Three of these wells (MW-01B, -07B, and -22B) may represent an additional semi-confined aquifer within the intermediate system, possibly lying within the Suwannee or Marianna limestone. The remaining two wells (MW-03BB and MW-12B) have water levels that suggest a third minor zone within the intermediate aquifer system.

The Floridan aquifer system in this area exhibits a general easterly flow direction, toward the Chipola River (Figure 3-18). The horizontal hydraulic gradient is very gentle (less than 0.01%), with a water level of 101 feet MSL in the west and 99 feet MSL in the east. This study confirmed the conclusion of the FDER-RI (Watts 1984) that several sinkholes breach the Floridan aquifer system at the site. Based on the monitoring well borehole logs, this breaching is limited to the area west of the West Swamp, with evident penetration at the MW-09 and MW-12 locations, in addition to those identified in the FDER-RI at the MW-03 and MW-13 locations.

3.4.1.2 Aquifer Physical Test Results

As mentioned in Section 2.4, limited slug and specific capacity tests were conducted on 13 wells at the site (see Table D-4 in Appendix D). Raw field data from these tests were used to calculate transmissivity (T), hydraulic conductivity (K), seepage velocity (V), specific capacity (Cs), and well yield (Wy) values.

The method used to calculate K and T values from the slug test data is based on a technique for determining these parameters from partially penetrating wells in unconfined and confined aquifers (Bouwer and Rice 1976). For this procedure, semilogarithmic graphs are prepared for decreasing water level versus increasing time. Values from the straight line portion of the graph (or the immediate response) are used for obtaining K and T from two equations derived by Bouwer and Rice (1976). The calculated values for each slug test are given in Table D-4 in Appendix D. It should be understood that

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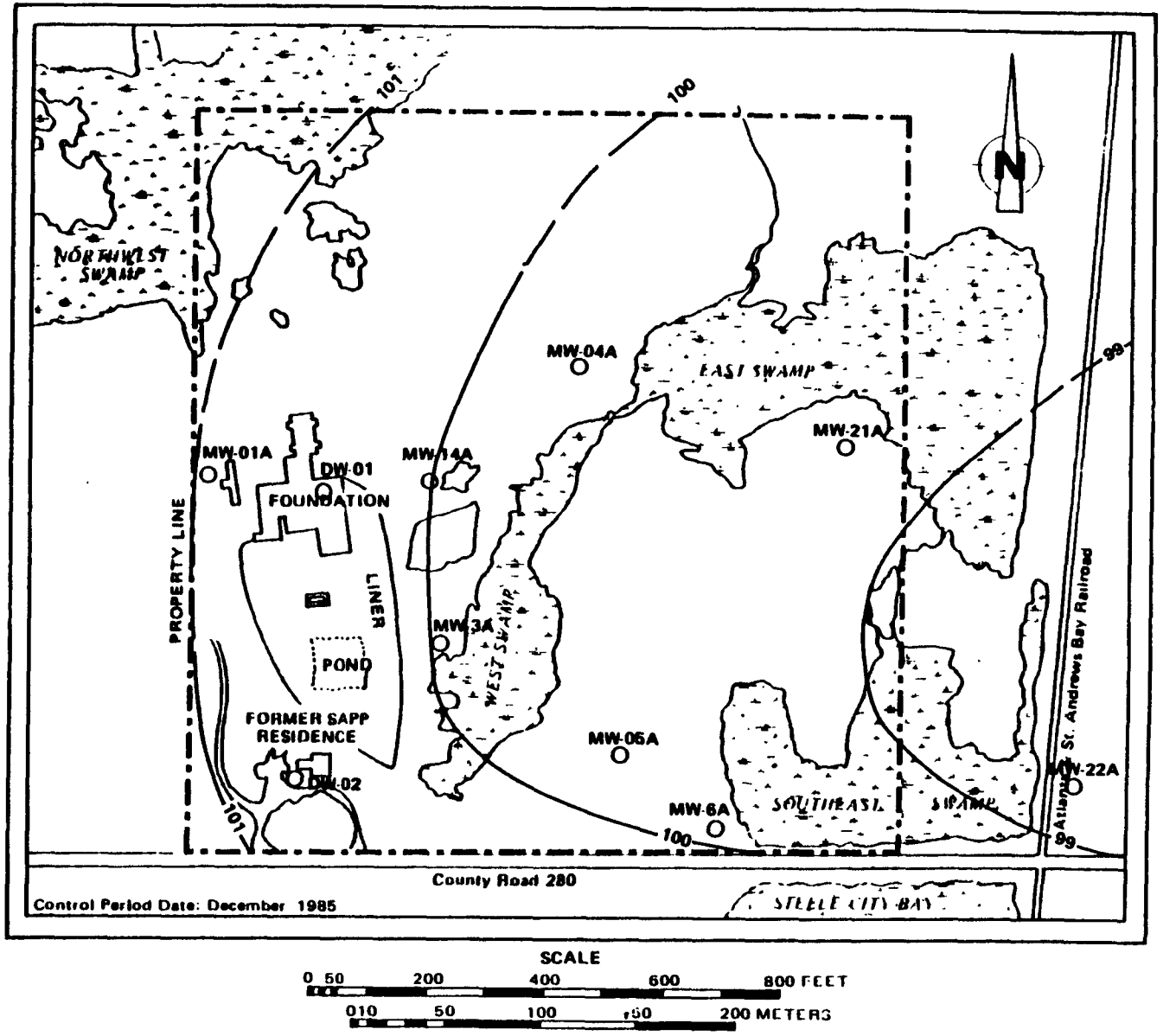

SCALE

0 50 200 400 600 800 FEET

0 10 50 100 150 200 METERS

Figure 3–18 GENERALIZED POTENTIOMETRIC MAP OF THE FLORIDAN AQUIFER SYSTEM (FEET ABOVE MEAN SEA LEVEL)

because the slug test procedure evaluates only an area of the aquifer within a short radial distance of the well, values will not necessarily be representative of the aquifer system as a whole or of its heterogeneity. In addition, this procedure assumes that: flow above the water table can be ignored; head losses as water enters the well are negligible (i.e., the well screen does not impede water movement); and the aquifer is homogeneous and isotropic.

The T values shown in Table D-4 in Appendix D are very low for all of the B and C level wells and for MW-12A; for wells MW-06A and MW-22A, the T values are high. Data for B and C level wells and for MW-12A are consistent with predicted values, due to the sandy clay/clayey sand deposits at the screened intervals in these wells. As expected, the T values for wells MW-06A and MW-22A are much greater than those for the B and C level wells; however, these values are an order of magnitude lower than the pump test T value given in the FDER-RI (53,836 gpd/ft). This difference most likely results from the much shorter radial distance of investigation for the slug test technique, in that it does not reflect the effect of enhanced flow paths associated with the zones of secondary permeability known to occur in the Floridan aquifer system. Thus, the pump test data are far more accurate than the slug test results.

In general, the K values range from 10^{-3} to 10^{-6} centimeters per second (cm/sec). These values are consistent with the ranges defined by Freeze and Cherry (1979) for the respective material type and with the calculated values for the designated core sample in the FDER-RI. Similar to the T values, the K values for MW-06A and 22A are slightly lower than the FDER RI pump test value of 5×10^{-3} cm/sec. This difference is probably due to the limitations of the slug test technique. However, the T and K values in the slug- tested wells reflect the values that were expected based on observed pumpage and lithologic characteristics.

Horizontal groundwater seepage velocities were calculated from the previously determined K values using estimated effective porosities. This procedure involves using the equation $V = KI/n$, as described by Fetter (1980), where:

K = hydraulic conductivity,
I = hydraulic gradient, and
n = effective porosity.

The calculated V values listed in Table D-4 in Appendix D indicate very slow movement of groundwater in all three aquifer systems. However, the V values for even the more transmissive A level wells (MW-06 and MW-22) may still represent an underestimation of actual flow velocities as a result of the limitations of the slug test technique in relation to the existence of enhanced flow paths, as discussed above.

The raw specific capacity (Cs) data generated in the field were evaluated in accordance with the method given by Freeze and Cherry (1979). The calculated values are shown in Table D-4 in Appendix D. From these data, theoretical well yields were determined by dividing the Cs value by a footage value at which the aquifer would effectively be pumped. In all cases, this depth was considered to be at the well bottom. Most of the B and C level wells and wells MW-09A, MW-12A, and MW-13A will have yields similar to that of well MW-14C.

Wells MW-02B and MW-06B show yields greater than the rest of the B level wells (except for MW-03BB) because they are located in the apparent gravelly paleo-stream channel of the intermediate aquifer system. It is believed that well MW-03BB would produce similar yields, based on observations made during purging. The well yield difference between MW-02B and MW-06B reflects the fact that MW-02B has a higher percentage of the very rounded milky white quartz gravel found in the eastern deposits.

As expected, the yield illustrated for well MW-14A is substantially greater than the B and C level well yield values. Except for wells MW-09A, MW-12A, and MW-13A*, the other wells in the A network will exhibit yields similar to that of MW-14A, and a few will exhibit substantially greater yields. For instance, during development of wells MW-06A, MW-21A, and MW-22A, it was estimated that these wells would likely produce in excess of 500 gallons per minute (gpm).

3.4.2 Chemical Analysis

3.4.2.1 Aquifer Field Parameters

Tables D-5 through D-8 in Appendix D present the pH, conductivity, and temperature values measured in the field for all monitoring

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*Based on the water levels measured in these wells (Table D-3 in Appendix D) as well as on the hydrogeologic parameters calculated for well MW12-A (Table D-4 in Appendix D) monitoring wells MW-09A, MW-12A, and MW-13A will henceforth be considered open to the intermediate aquifer system.

and residential wells sampled during the current investigation as well as during the 1983 FDER sampling. In addition, Tables D-12B and D-12C list these parameters for samples collected from the residential wells by ESE, Inc., in April 1984 and January 1985.

Examination of these data reveals several trends and anomalies. First, groundwater from the residential Floridan aquifer system wells surrounding the site exhibits the most uniformly alkaline pH values as well as consistently low conductivities (Tables D-8, D-12B, and D-12C), reflecting the fact that these wells have not been as severely affected by contamination from the Sapp Battery operation. In contrast, the pH of groundwater from the on-site Floridan aquifer system wells (Table D-7) has generally decreased from the reported 1983 FDER monitoring well values, which agrees with the generally increased level of contamination indicated by the corresponding metals data.

For the most part, the groundwater in the surficial and intermediate aquifer systems (Tables D-5 and D-6) has exhibited a significant increase in pH from the reported 1983 values, reflecting the cessation of acid-generating operations and the subsequent remedial activities at the site. This effect is most dramatically illustrated in the southeast corner of the site, where the pH of groundwater from wells MW-18C, MW-19C, and MW-20C has increased from 3.0-3.5 to 5.0-5.8. Wells that continue to produce groundwater of a somewhat low pH (<5) can be divided into two categories: those which lie within or downgradient of heavily contaminated areas (MW-03BB, MW-03C, and MW-16C); and those which lie immediately downgradient from the acidic water of the East Swamp (MW-15B and MW-21C).

The conductivities measured in groundwater from the on-site wells show significant variability within each aquifer system (Tables D-5 through D-7, Appendix D). In general, the lower conductivity values reflect the interaction of the groundwater with the aquifer matrix in the proximity of recharge areas, whereas the higher conductivity values reflect elevated metal concentrations. However, there is no linear correspondence between metal concentration and conductivity (i.e., the highest conductivities do not occur in groundwater exhibiting the highest metal concentrations), as is readily apparent when the

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data in Tables D-5 through D-7 are compared with the corresponding metal concentrations in Tables D-8 through D-11. This deviation from a linear correspondence is probably the result of a combination of two factors:

1. The fact that the conductivities were obtained from unfiltered and unacidified samples, whereas the metal concentrations reflect analyses of unfiltered samples that had been preserved with concentrated nitric acid to a pH of approximately 1 (i.e., adsorbed or matrix metal ions could have been leached from suspended sediments within the sample); or

2. The presence of anionic or cationic species (e.g., iron, magnesium, or sulfate) that were not included in the analyses.

The first of the above two factors will be considered in greater detail later in this section.

3.4.2.2 Aquifer Lead Concentrations

Figures 3-19 through 3-22 present the lead concentrations measured in groundwater from the surficial aquifer system, intermediate aquifer system, and Floridan aquifer system (on-site and residential wells), respectively, during the current investigation as well as during the 1983 FDER sampling effort. These results, as well as the analytical results for the other metals, are presented in Tables D-9 through D-16 in Appendix D.

Figures 3-19 through 3-22 illustrate that essentially all of the on-site monitoring well samples exhibit some degree of lead contamination, whereas only groundwater from residential wells east, east-southeast, and east-northeast of the site currently exhibit lead concentrations above assumed background levels, as shown by MW-23C, 22C, and 22B, and other upgradient residential wells (<5 to 7 ppb; see Figure 3-22).

Lead values detected in residential wells over five sampling episodes follow the east, east-southeast, and east-northeast trend (See Table D-12D). Residential wells GW-01, GW-03, GW-09, GW-10, GW-12, GW-20 and GW-21 (See Figure 2-6) usually show positive lead

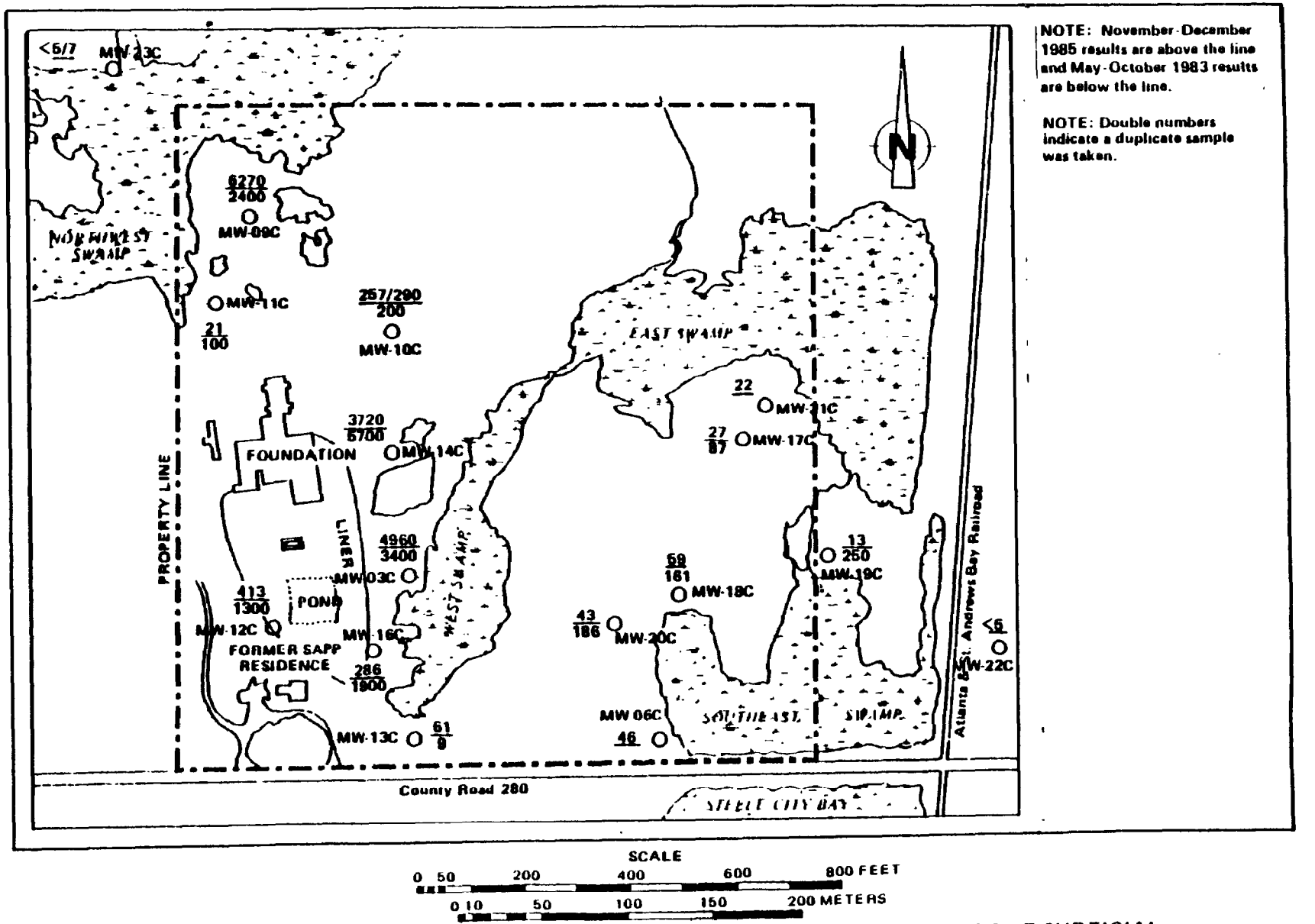

Figure 3-19 LEAD CONCENTRATIONS (ppb) IN MONITORING WELLS OPEN TO THE SURFICIAL AQUIFER SYSTEM

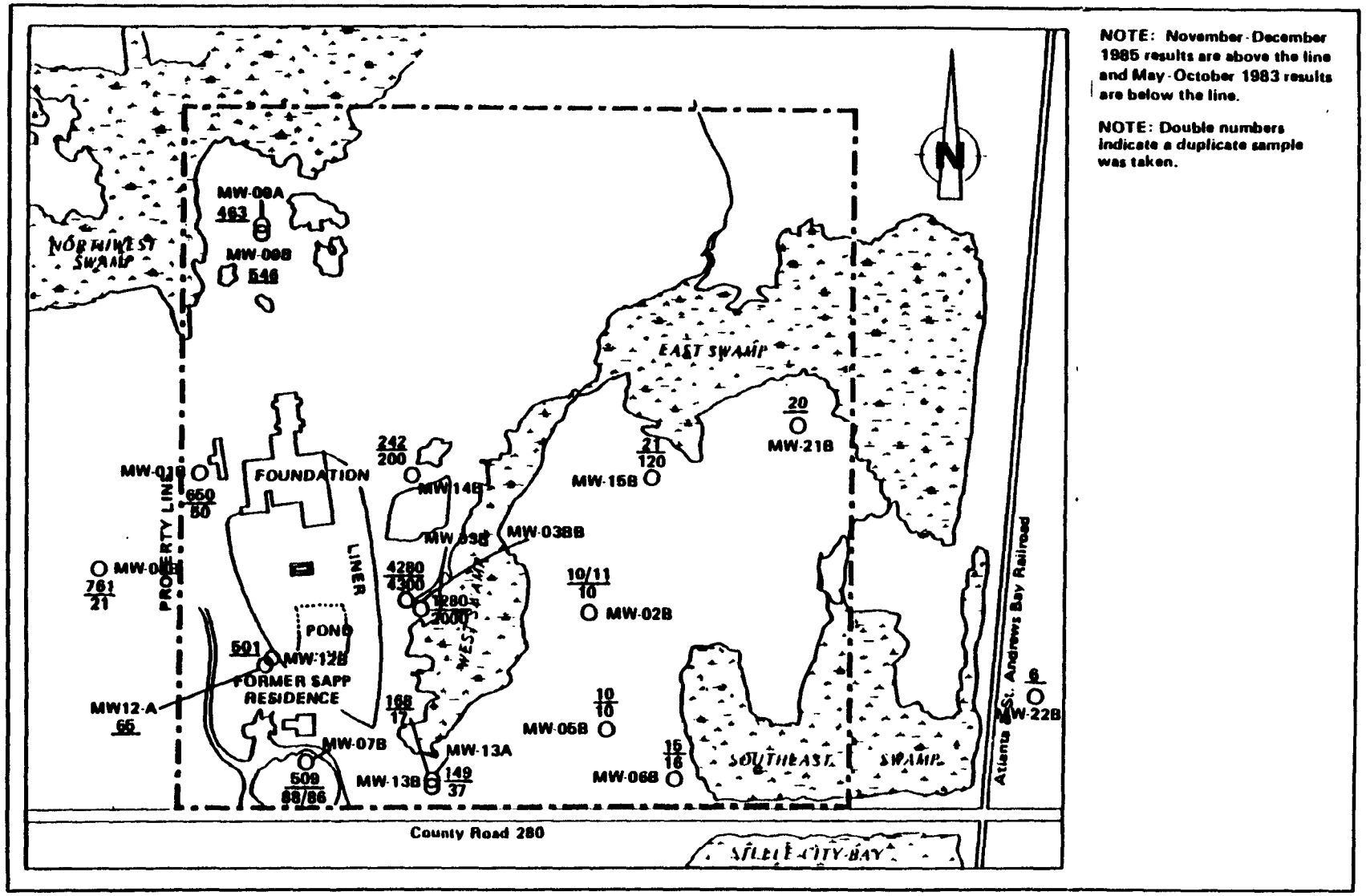

Figure 3–20 LEAD CONCENTRATIONS (ppb) IN WELLS OPEN TO THE INTERMEDIATE AQUIFER SYSTEM

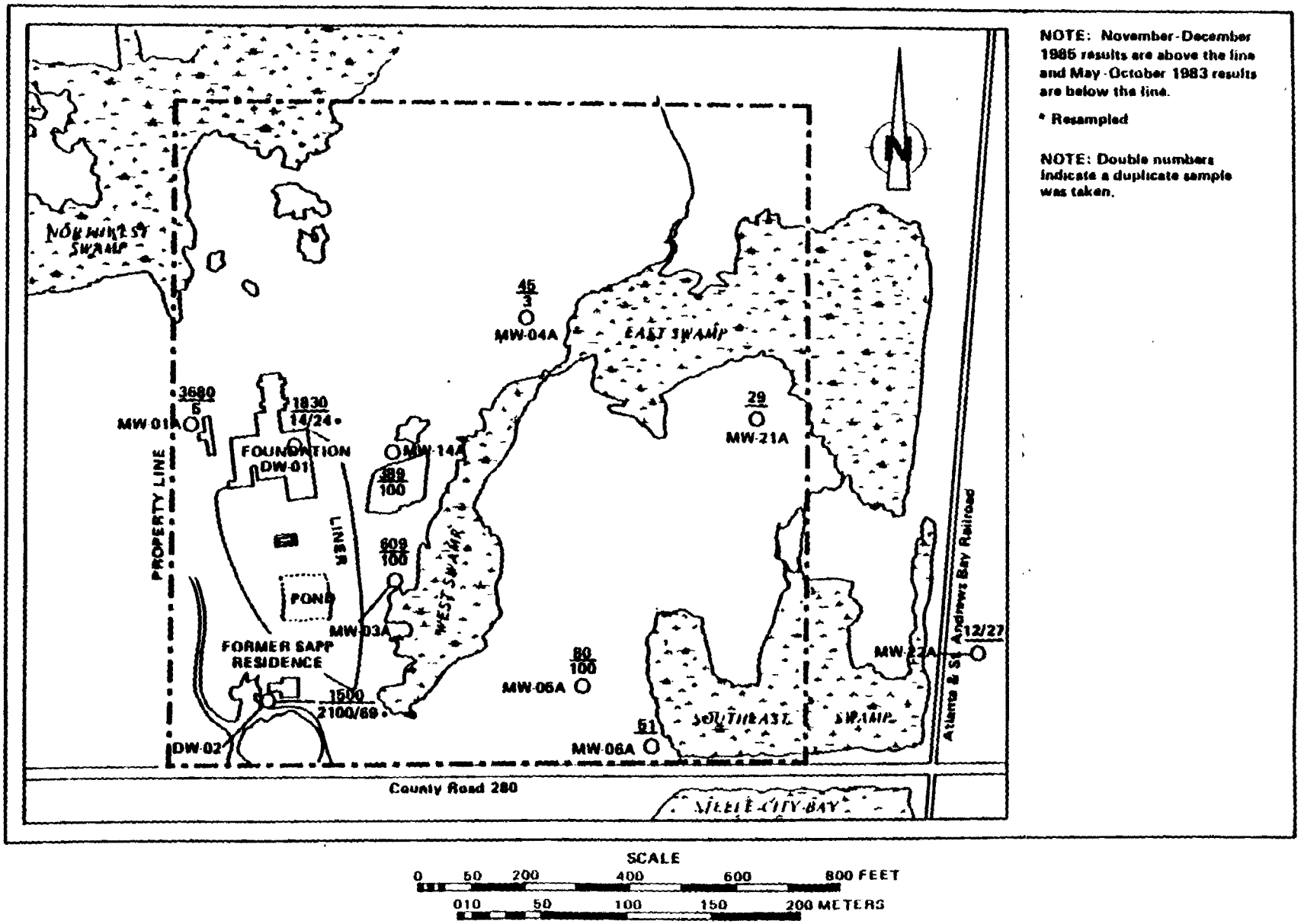

Figure 3-21 LEAD CONCENTRATIONS (ppb) IN WELLS OPEN TO THE FLORIDAN AQUIFER SYSTEM

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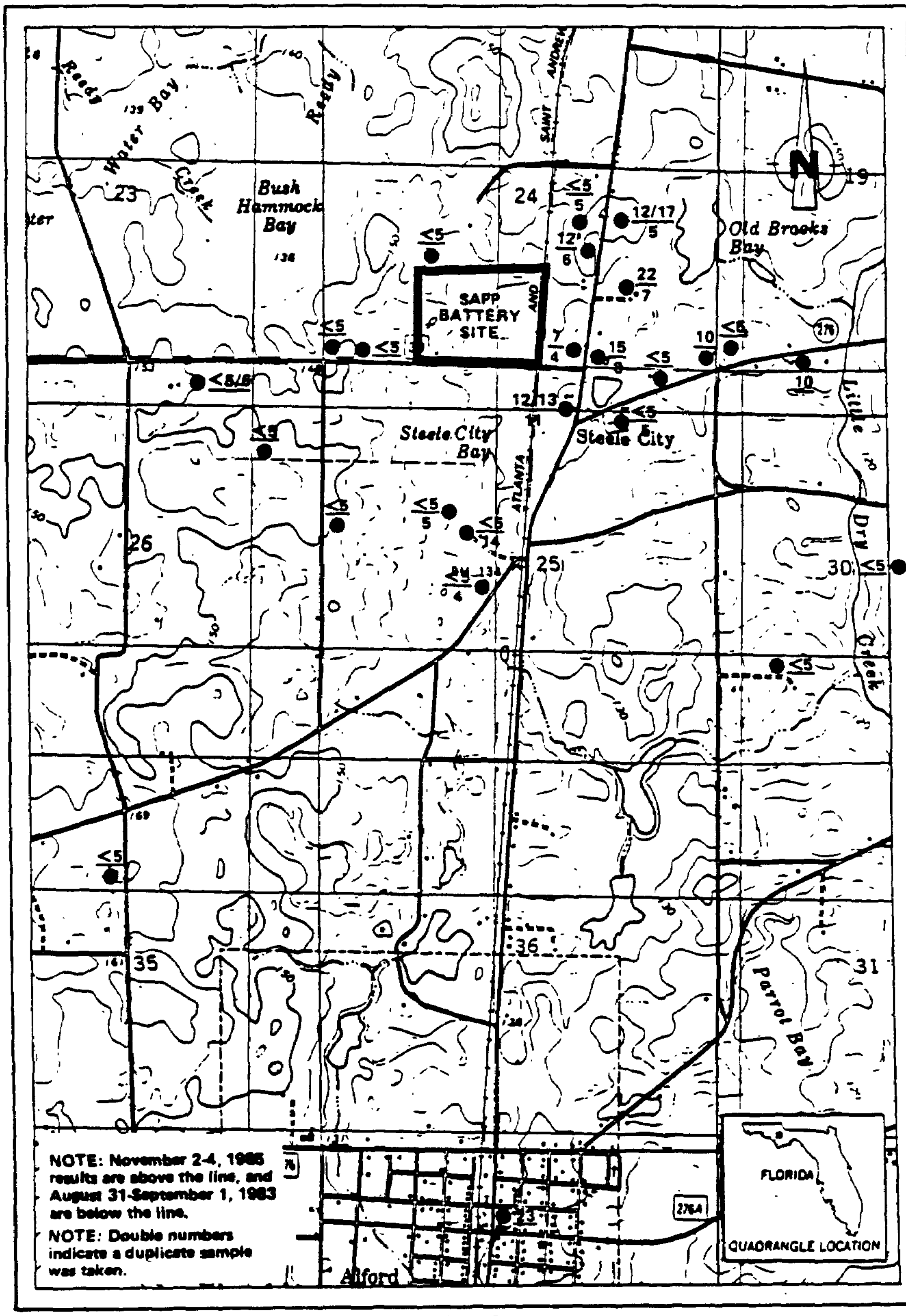

SCALE

0 ½ 1 MILE

0 .5 1 KILOMETER

Figure 3–22 LEAD CONCENTRATIONS (ppb) IN RESIDENTIAL WELLS

values. From 1983 to 1986 the lead values are somewhat sporadic. In many cases, lead was detected in one sampling, undetected in the next sampling, and detected again in the third sampling effort. In any case, the three-year monitoring period did not show any significant lead increases with time and the majority of residential well contamination is below 20 ppb.

The highest lead concentrations within the surficial aquifer system occur across the western half of the site in close correspondence with the areas of maximum soil contamination (Figures 3-2, 3-3, and 3-5). Similar to the increase of pH discussed earlier, groundwater from the surficial wells in the southeastern quadrant of the site currently exhibits reduced lead concentrations compared to the 1983 FDER levels. It is believed that soils and groundwater in this area were initially subject to lead contamination as a result of the area being the original location of the Sapp Battery operation and, more importantly, overflow and infiltration of contaminated waters from the West Swamp. As a result of the cessation of site operations and the subsequent remedial activities, this primary source of contamination was eliminated and the elevated lead concentrations diminished by the flushing action of infiltrating rainwater. As will be discussed in the next section, it is probable that the current levels of lead contamination exhibited by groundwater from these wells is primarily controlled by the direction of flow within the surficial aquifer system.

Analogously, it is assumed that the decreases in lead concentration on the western half of the site (most notably in the vicinity of the pond) reflect the influence of the remedial activities. Although this explanation cannot be readily applied to explain the decreased lead concentration in the sample from monitoring well MW-11C, it is more significant that a relatively low lead concentration was detected at this location in both instances. Given the presence of highly contaminated soils immediately to the north (Figures 3-2, 3-3, and 3-5), the presence of the low lead levels supports the potentiometric map for this aquifer system, which indicates that flow should be predominantly from the west-northwest (i.e., from an uncontaminated area).

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In contrast to the beneficial effects of the remedial activities discussed above, these same activities have probably resulted in the increased lead concentration detected in the groundwater from monitoring well MW-13C, given that much of the surface runoff from the site is now funneled to this location.

Figure 3-20 indicates that the highest lead concentrations in the intermediate aquifer system also occur across the western half of the site in areas where the surficial aquifer system was most contaminated. Similar to the results for the surficial aquifer system, changes in the intermediate system lead concentrations from 1983 to 1985 can be attributed to the effects of remedial activities combined with the direction of groundwater movement.

Lead concentrations measured in the on-site Floridan aquifer system monitoring wells (Figure 3-21) are again highest in the western half of the site. Furthermore, the Floridan system groundwater (with the exception of MW-05A) exhibits very large increases in lead concentration relative to the 1983 levels. A possible explanation for these results will be offered in the next section.

3.4.2.3 Aquifer Selected Metals Concentrations

Among the other metal species for which analyses were conducted--arsenic, antimony, cadmium, selenium, nickel (in the residential wells only), aluminum, and manganese--only the latter two metals (aluminum and manganese) were found in high concentrations in a number of samples (Tables D-9 through D-12, Appendix D). Arsenic concentrations significantly exceeded EPA and FDER primary drinking water standards (0.05 ppm) in two samples (MW-03C and MW-12A, 0.282 and 0.092 ppm, respectively). The EPA recommended guideline on antimony (0.146 mg/l) was not exceeded in any sample. In contrast, cadmium concentrations in excess of the drinking water standard (0.01 ppm) were found in several samples: MW-12C, 16C, and 18C (0.014, 0.076, and 0.023 ppm, respectively); MW-03B, 03BB, and 07B (0.021, 0.246, and 0.032 ppm, respectively); and DW-02 and MW-13A (0.026 and 0.011 ppm, respectively). Selenium was detected in 11 on-site monitoring wells, with four exhibiting concentrations in excess of the EPA drinking water

standard of 0.01 ppm. These four wells are: MW-3A, MW-3B, MW-14B, and MW-16C. They had selenium concentrations of 0.029, 0.020, 0.013, and 0.019 ppm, respectively. Only one residential well sample exhibited a nickel concentration above the detection limit of 0.020 ppm (GW-18, 0.025 ppm). In general, the occurrence of these metals was associated with the presence of relatively high concentrations of lead.

Most of the on-site groundwater samples exhibit very high aluminum and manganese concentrations (Tables D-9 through D-11, Appendix D). In FDER's interpretation of the analytical results of the 1983 sampling, these high concentrations were attributed to decomposition of the aquifer matrix materials by acidic groundwater (Watts 1984). Although a comparison of the 1983 pH data in Tables D-5 through D-7 with the corresponding aluminum and manganese concentrations in Tables D-13 through D-15 supports this interpretation, it cannot be as readily invoked to explain the results of the current sampling program because many of the groundwater samples with elevated aluminum or manganese concentrations do not exhibit low pH values. Furthermore, although the FDER-RI, using equilibrium thermodynamics, calculated a maximum theoretical aluminum solubility of 149 ppb for the Floridan aquifer system (at a pH of 7.4), the fact that Floridan lead concentrations currently far exceed the calculated maximum theoretical lead solubility of 81 ppb suggests that reaction kinetics may play an even more critical role in the precipitation of metal species than expected. Consequently, despite the alleviation of the acidic conditions favorable to leaching, the potentially slow precipitation of metal complexes could possibly result in very high concentrations of aluminum and manganese being retained in solution.

Interpretation of these data becomes even more difficult when the lead versus aluminum, lead versus manganese, and aluminum versus manganese relations are considered (Tables D-9 through D-11, Appendix D). Although the highest aluminum and manganese concentrations are generally associated with high lead concentrations, the correspondence is very imperfect and exhibits major deviations in all three aquifer systems (with the exception of the lead versus manganese relation in the surficial aquifer system). Furthermore, manganese and aluminum concentrations exhibit a very poor correlation, even though both

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metals are assumed to be derived from acid decomposition of aquifer matrix materials. Similar deviations from a linear correspondence occur in the 1983 FDER results (Tables D-13 through D-15, Appendix D).

Despite the complexities described above, there is a possible interpretation if consideration is given to the following:

1. Several of the groundwater samples contained suspended sediments derived from the aquifer. Given that the samples were not filtered before preservation with concentrated nitric acid (to a pH of approximately 1), any adsorbed or matrix metals associated with the suspended material could have been subject to leaching. This probably also influenced the 1983 FDER results, although the effect may have been somewhat reduced in the low pH samples.

2. Under the relatively acidic groundwater conditions that existed during the 1983 FDER sampling effort, aluminum and lead appear to have been more mobile than manganese, based on the occurrence of these metals in groundwater from the downgradient residential wells east of the site (Table D-16).

3. In contrast, under the more alkaline pH conditions that existed during the current sampling program, manganese appears to have replaced aluminum as the more mobile species. This conclusion is indicated by the close correlation of manganese and lead in the surficial aquifer system in which the change in pH conditions was most pronounced, and the fact that manganese now accompanies lead in groundwater from those downgradient residential wells which previously exhibited elevated aluminum concentrations.

4. Groundwater pH is not the only control on metal species mobility; hence, the extremely intricate combined effect of pH, redox conditions, presence of complexing ions or organic species, mineralogy and cation exchange capacity of the aquifer matrix material, and reaction kinetics--all of which

may exhibit vertical and lateral variability on-site--will determine to what extent a specific metal is mobilized at any given moment or location.

Consequently, it is possible that in response to physical and temporal variations in the hydrogeochemical environment of the Sapp Battery site, aluminum and manganese have been locally mobilized or demobilized (i.e., precipitated or adsorbed onto the aquifer matrix). The pattern of groundwater metal concentrations that this could produce might be to some extent obscured by the leaching of adsorbed or matrix metals due to acidification of unfiltered samples (especially if located in a zone of current or past demobilization). As discussed in the following section, the excellent agreement between the pattern of lead concentrations in each aquifer system and the corresponding general groundwater flow directions indicated by Figures 3-16 through 3-18 suggests that lead is mobile under the existing conditions and not as subject to the factors which produce the variability in aluminum and manganese.

3.4.3 Contaminant Migration

It is clear from the results of the current sampling effort that all three aquifer systems underlying the Sapp Battery site are contaminated. As noted in the preceding section, the highest lead concentrations occur over the western half of the site in close association with those areas exhibiting the highest levels of soil contamination (compare Figures 3-2 through 3-4 with Figures 3-18 through 3-20). Comparison of Figures 3-16 and 3-17 shows that water level elevations in the surficial aquifer system are higher than those in the intermediate aquifer system across much of the site. Consequently, there exists a natural vertical hydraulic gradient that is much greater than the shallow horizontal gradient, and the contaminants could readily migrate from the surficial to the intermediate aquifer system, especially at those locations where sinkholes, paleo-stream channels, or more permeable confining unit lithologies provide better hydraulic connection. This potential for downward migration would have been particularly strong prior to the cessation of site operations in January 1980 as a result of the drawdown response in these

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systems to the presumably high pumpage at the plant well (DW-01). This postulation is based on the fact that a pump test conducted by the U.S. Geological Survey on October 26-27, 1983, indicated that all three aquifer systems exhibit a drawdown response to pumpage of a well open to the Floridan aquifer system. The results of this pump test are presented in the FDER-RI.

Water level elevations in the Floridan aquifer system (Figure 3-18) are more than 20 feet lower than those of the overlying intermediate aquifer system. This large vertical hydraulic gradient would certainly support downward migration of contaminants into the upper part of the Floridan aquifer system, especially where confinement is less effective (i.e., due to breaching by sinkholes or changes in confining unit lithology). Pumping of well DW-01 prior to January 1980 would not only have enhanced this downward migration potential, but also would have provided a mechanism for the transport of contaminants deeper into the aquifer system.

The current sampling program indicated much higher on-site concentrations of lead in groundwater from the Floridan aquifer system than were found during the 1983 FDER sampling effort (see Figure 3-21). It would appear that whereas in 1983 only a dilute contaminant front had penetrated to the screened interval depths of the monitoring wells open to this system, by the time of the 1985 sampling an undilute contaminant front had penetrated to these depths. However, the mechanism for creating this strong downward dispersion in the absence of on-site pumpage is not clear. It seems probable that complex hydrogeochemical interactions associated with changes in groundwater and aquifer matrix chemistry induced by penetration of the contaminant front (e.g., the lower pH values discussed previously) have had the effect of creating an enhanced downward dispersion component.

Comparison of Figures 3-16 through 3-18 with Figures 3-19 through 3-21 reveals the close correlation between the distribution pattern of lead concentrations and the general direction of groundwater flow within each aquifer system. In accordance with the respective flow systems, the contaminant front is generally migrating east-southeast in the surficial aquifer system, south-southwest in the intermediate aquifer system, and east in the Floridan aquifer system. The

southwesterly component of contaminant front migration in the intermediate aquifer system is of particular significance because of the potential for eventual contamination of the Floridan aquifer system west and southwest of the site via downward leakage.

The following section presents the results of a computer simulation of contaminant front migration within each of the three on-site aquifer systems.

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3.5 COMPUTER SIMULATION OF CONTAMINANT FRONT MIGRATION

3.5.1 Description of Models

The results of the groundwater investigation reported in Section 3.4 showed that each of the on-site aquifer systems was subject to high levels of lead contamination at specific locations. The areas of greatest groundwater contamination were generally associated with areas of highest soil contamination. Furthermore, the contaminant front seemed to be migrating in the direction of groundwater flow indicated by the potentiometric maps (Figures 3-16 through 3-18). Consequently, groundwater flow and solute transport models were applied to each of the three aquifer systems to simulate the migration of the contaminant front over time. Input data for these models were limited to the 44-well monitoring network. Residential wells were not included because of the distance of each from the site and the detail needed to illustrate the required contaminant isopleths. It was not necessary to apply an overly sophisticated groundwater flow model to the site because a water level data base had been developed in the field. A simple flow model based on Darcy's Law was applied to this data base in order to convert the groundwater heads to a groundwater velocity field.

The finite element solute transport model used for the simulation of contaminant front migration for all aquifers is known as FEMWASTE and was developed by Oak Ridge National Laboratory (Yeh 1981) and recommended by EPA (1985). For a comparison and check of the finite element model, the Floridan Aquifer lead plume was also modeled and simulations performed using a simplified Random-Walk (Prickett, *et al.*, 1981) solute transport finite difference model. The Random-Walk model prediction was further used to predict the general effect of pumping the Floridan Aquifer for remedial purposes.

3.5.1.1 FEMWASTE Model for All Aquifers at the Sapp Battery Site

Figure 3-23 shows the 120-node, 99-element FEMWASTE finite element grid system that was developed for the Sapp Battery site. As can be seen from the figure, this grid system was developed so that almost all of the on-site monitoring wells occur as nodal points. It should be understood that each aquifer was modeled separately, and three-dimensional techniques were not employed. For each aquifer system,

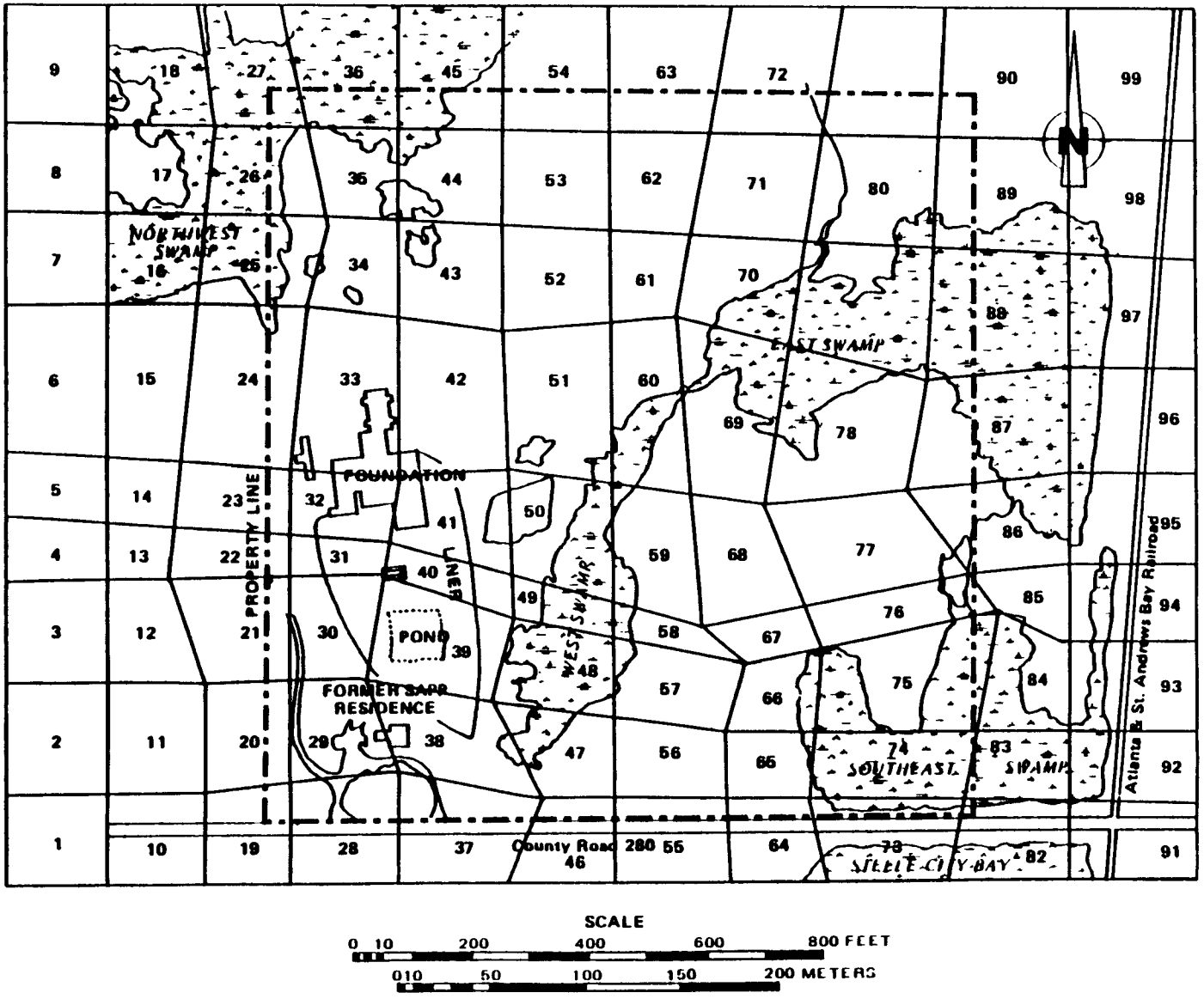

Figure 3–23 FEMWASTE ELEMENT GRID SYSTEM FOR ALL THREE AQUIFERS AT THE SAPP BATTERY SITE

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the nodal points associated with monitoring wells that exhibited the highest levels of groundwater contamination were chosen to represent source areas for the contaminant plume. For instance, for the Floridan aquifer simulation, monitoring wells DW-1, DW-2, MW-1A, MW-3A, and MW-14A were considered source points.

3.5.1.2 Random-Walk Model for the Floridan Aquifer at the Sapp Battery Site

Figure 3-24 displays the Random-Walk finite difference grid system which was used for the Floridan Aquifer at the Sapp battery site. As illustrated, nine columns lie along the "x" axis (East-West), and eight rows along the "y" axis (North-South). Hence, a total of 72 cells exist for this simulation. The distance between each cell is 200 feet. The contaminant source positions for this model were assumed to be two rectangular areas which covered: 1) the pond and synthetic liner vicinity south of the foundation, and 2) the northwest landfill location. The contamination mass for this model was calculated based on the average existing lead concentrations of Floridan Aquifer monitoring wells DW-1, DW-2, MW-1A, MW-3A, and MW-14A.

3.5.1.3 Model Parameters

The model parameters listed in Table 3-2 were used in the computer simulations. Lead was chosen as the chemical parameter to be simulated in the solute transport model because the analytical results of the groundwater sampling effort clearly indicate that the lead concentration distribution within each aquifer system most closely parallels the groundwater flow pattern. In addition, lead is the contaminant of most concern at this site (Sections 3.4.2 and 3.4.3). For this same reason, a low retardation factor of 1 and a first-order decay constant of 0 for lead was assumed. Although lead is probably being adsorbed onto the aquifer matrices to some extent, this effect is believed to be sufficiently small as to not significantly affect the simulation. A porosity of 0.3 was assumed for each aquifer system, the values for the coefficients of longitudinal and traverse dispersivity were obtained from available literature, and the hydraulic conductivities were based on field measurements carried out by FDER (Watts 1984) and E & E's current groundwater investigation. Finally,

Table 3-2

MODEL PARAMETERS
USED IN COMPUTER PROGRAM

Lead retardation factor	1
First-order decay constant	0
Porosity	0.3
Longitudinal dispersivity	205 ft
Transverse dispersivity	0
Hydraulic conductivity	
• Surficial aquifer system	0.283 ft/day
• Intermediate aquifer system	0.072 ft/day
• Floridan aquifer system	14.4 ft/day
Starting date	1985

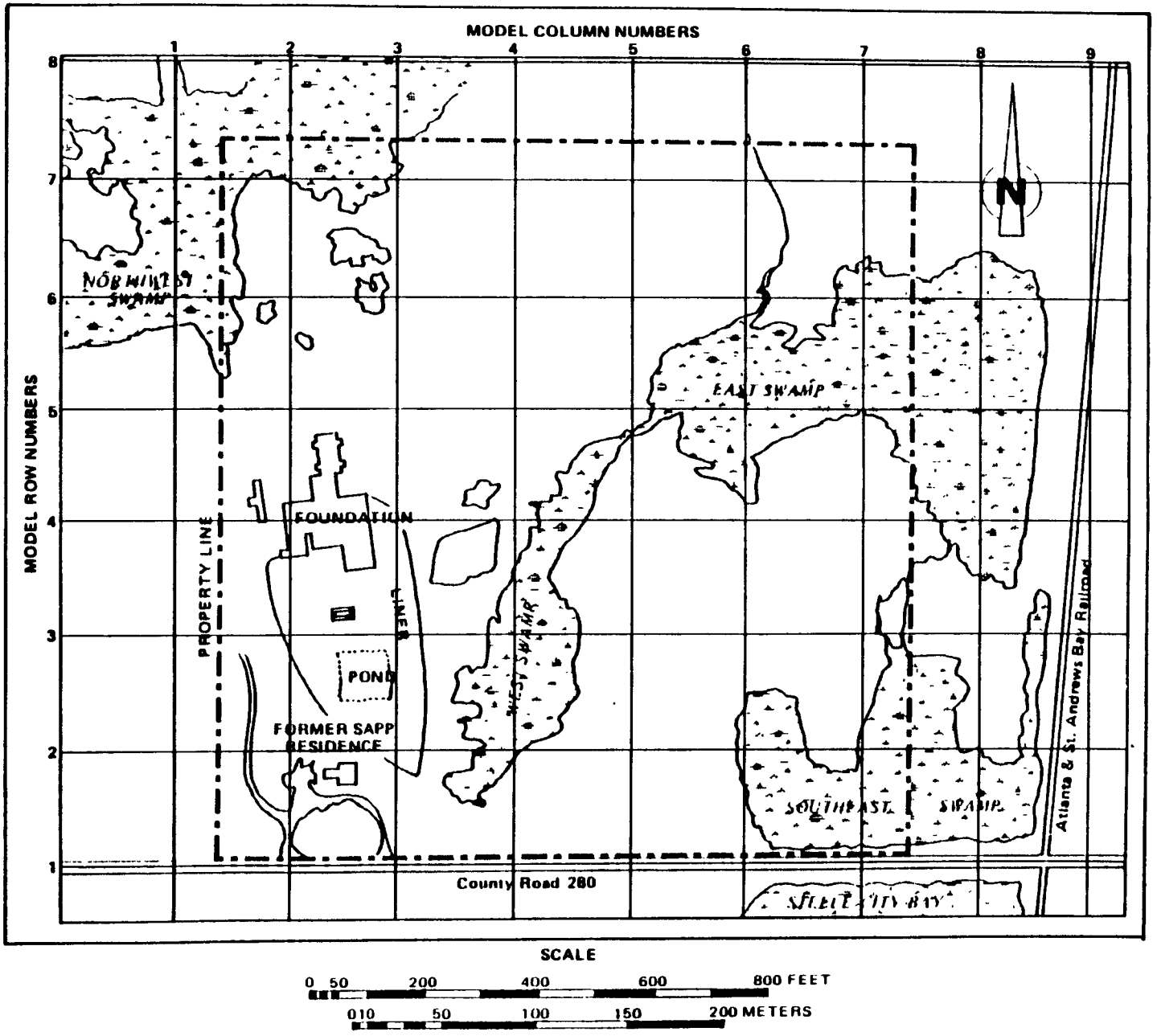

Figure 3–24 RANDOM-WALK FINITE DIFFERENCE GRID SYSTEM FOR THE FLORI[illegible]N AQUIFER AT SAPP BATTERY

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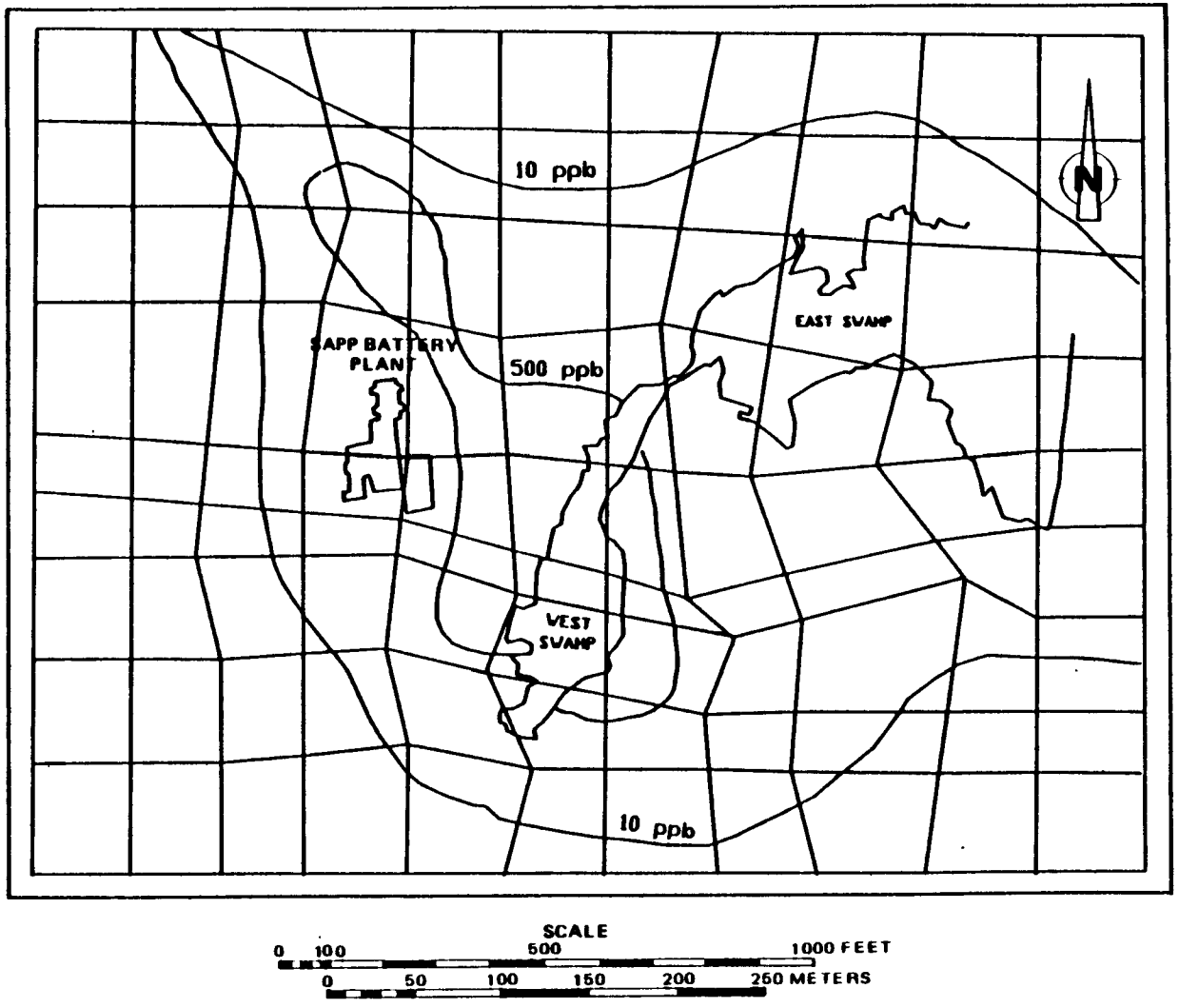

Figure 3–25 COMPUTED LEAD PLUME, 1 YEAR PREDICTION (1986) SURFICIAL AQUIFER (FEMWASTE)

the starting date of 1985 for the computer simulation of solute transport was selected because the finite element model considers that monitoring wells with the highest levels of contamination represent source areas, and the most current data was collected in 1985. Once the 1985 data were entered into the models, the present simulation was reviewed and calibrated to achieve the best resemblance to the outermost monitoring wells, i.e., MW-05A, 05B; MW-06A, 06B; MW-08B; MW-21A, 21B; and MW-22A, 22B. Although node points do not exist for residential wells, the data from the residential well samples were taken into consideration when the model was calibrated. From the best fit 1985 models, 1- and 5-year (1986 and 1990) lead contaminant plume predictions were performed. In addition, a 5- and 10-year (1990 and 1995) prediction was conducted with the Random-Walk simulation of the Floridan aquifer.

3.5.2 Simulation Results

3.5.2.1 FEMWASTE Model Predictions for all Aquifers

The groundwater velocity fields generated by the model indicate that the groundwater flow rate is very low within the surficial and intermediate aquifer systems (0.5 to 4.0 ft/year in both), whereas it is much higher (10 to 70 ft/year) within the Floridan aquifer system. This difference in flow velocity between the shallow and deep aquifer systems is reflected in the predicted positions of the contaminant fronts within each aquifer system (Figures 3-25 through 3-30). The position of the 500-ppb lead contour for the surficial and intermediate systems represents only slight migration of the contaminant front toward the southeast and southwest, respectively. This is amplified by the fact that only a very slight change in the size of the 500-ppb contour exists between the 1- and 5-year prediction maps. The position configuration of the 500-ppb lead contour in the Floridan system indicates a large degree of front migration toward the east, increasing significantly from the 1-year to the 5-year prediction. Furthermore, the 5-year simulation for the Floridan system shows the 10-ppb lead contour as still on-site (Figure 3-30). However, the analytical results for the residential well samples east of the site (Section 3.4.2) indicate that this contour has already moved off-site. This discrepancy most likely reflects the fact that the values of the

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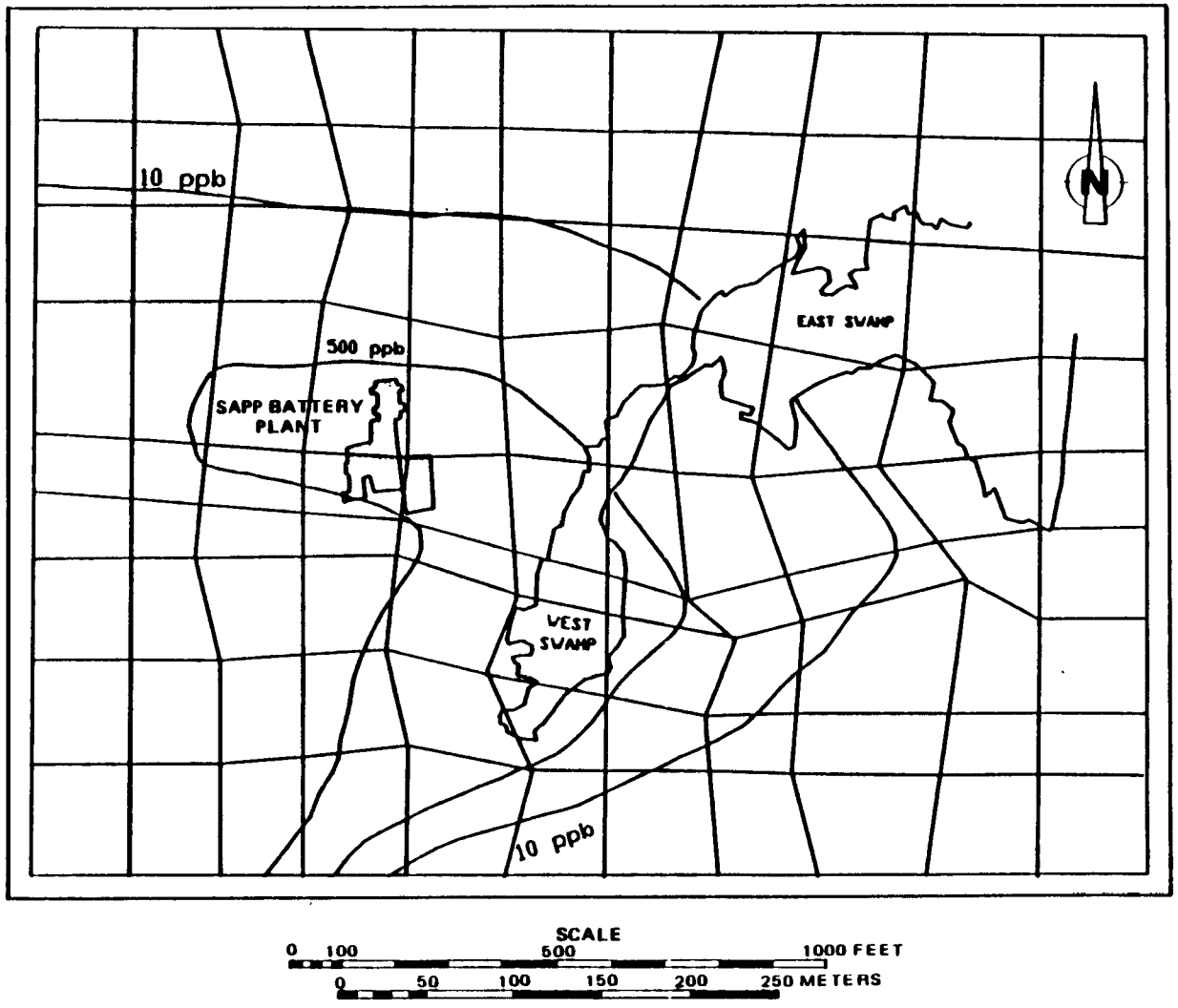

Figure 3–27 COMPUTED LEAD PLUME, 1 YEAR PREDICTION (1986) FLORIDAN AQUIFER (FEMWASTE)

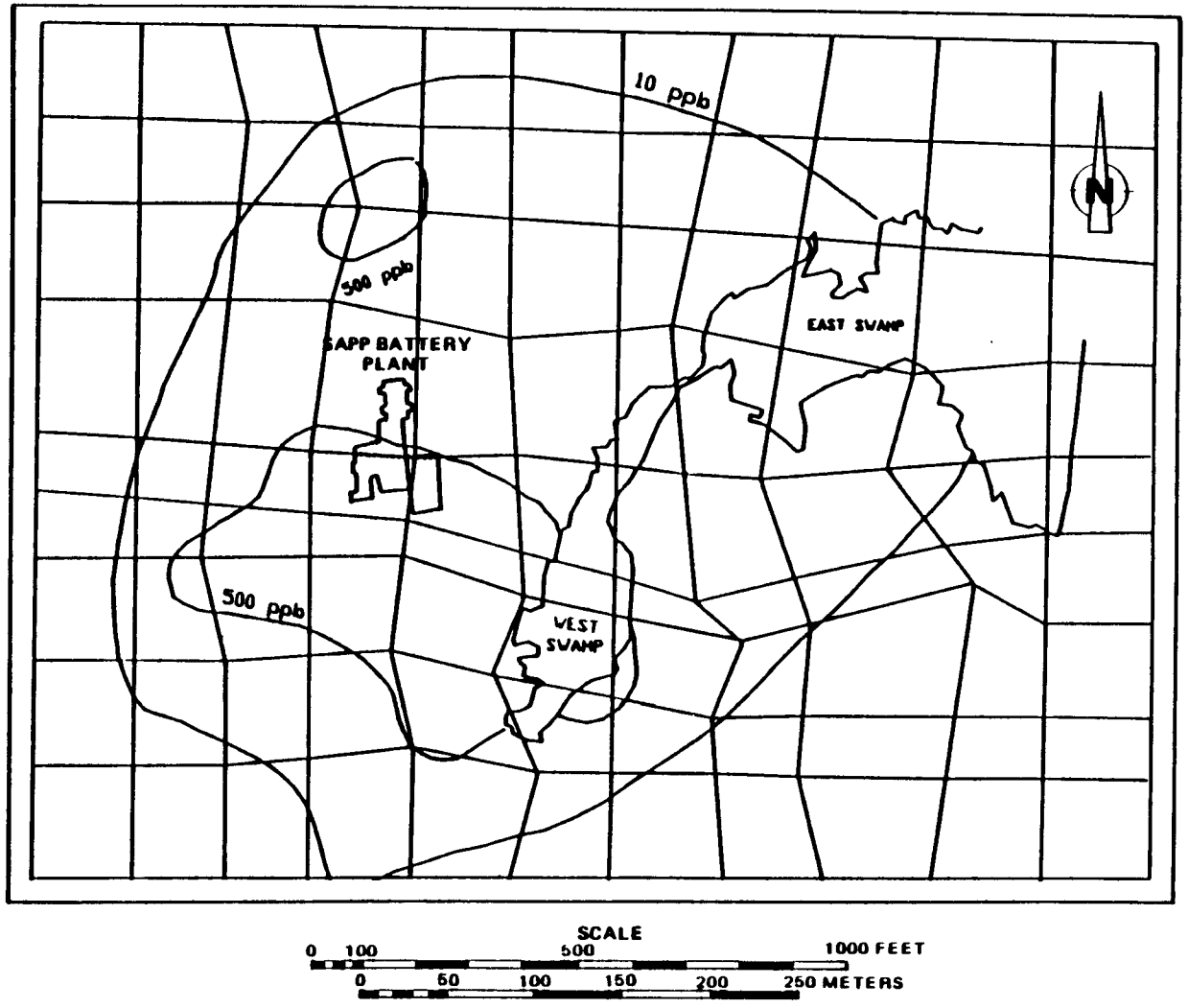

Figure 3–26 COMPUTED LEAD PLUME, 1 YEAR PREDICTION (1986) INTERMEDIATE AQUIFER (EMWASTE)

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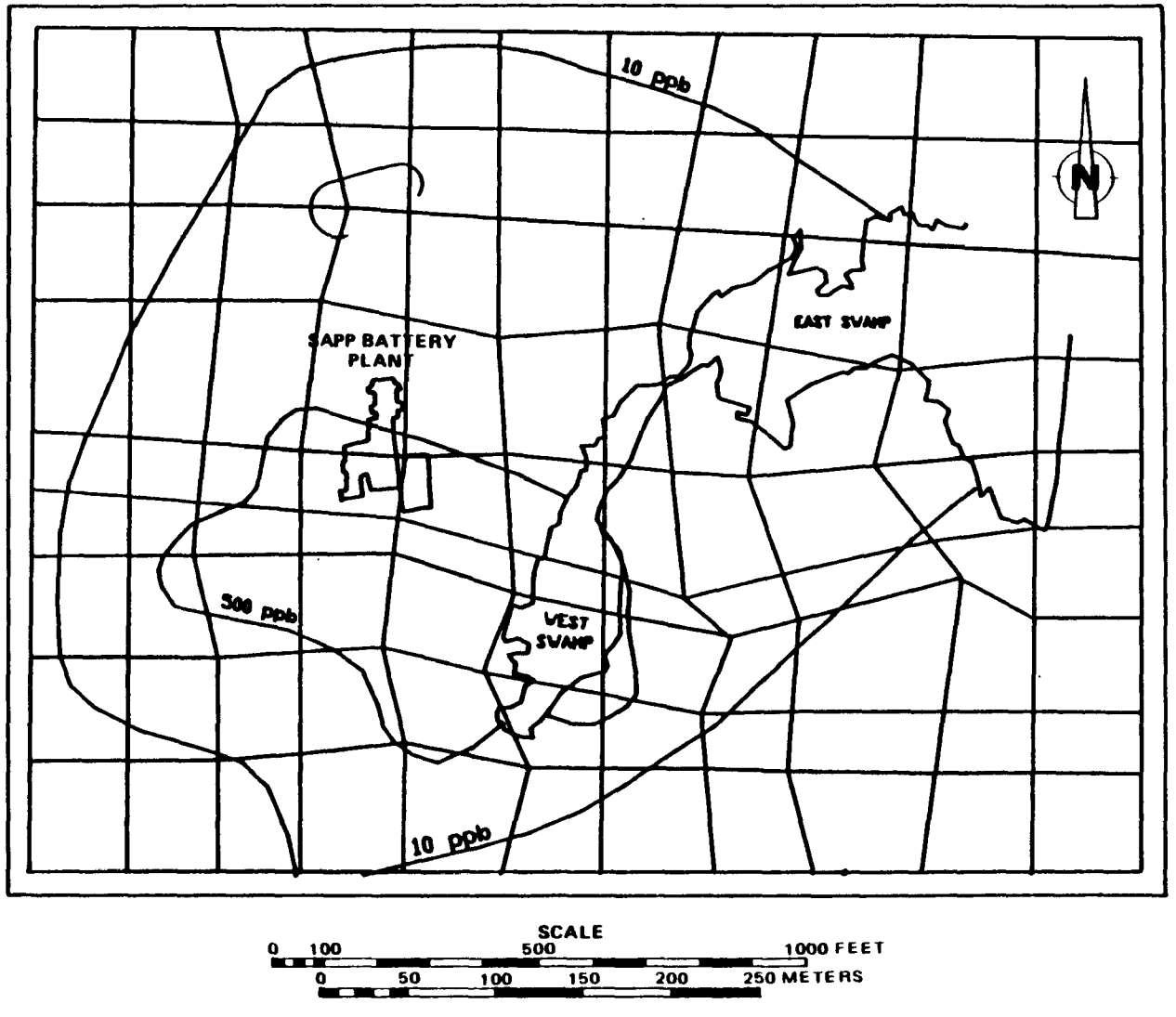

Figure 3–29 COMPUTED LEAD PLUME, 5 YEAR PREDICTION (1990)
INTERMEDIATE AQUIFER (FEMWASTE)

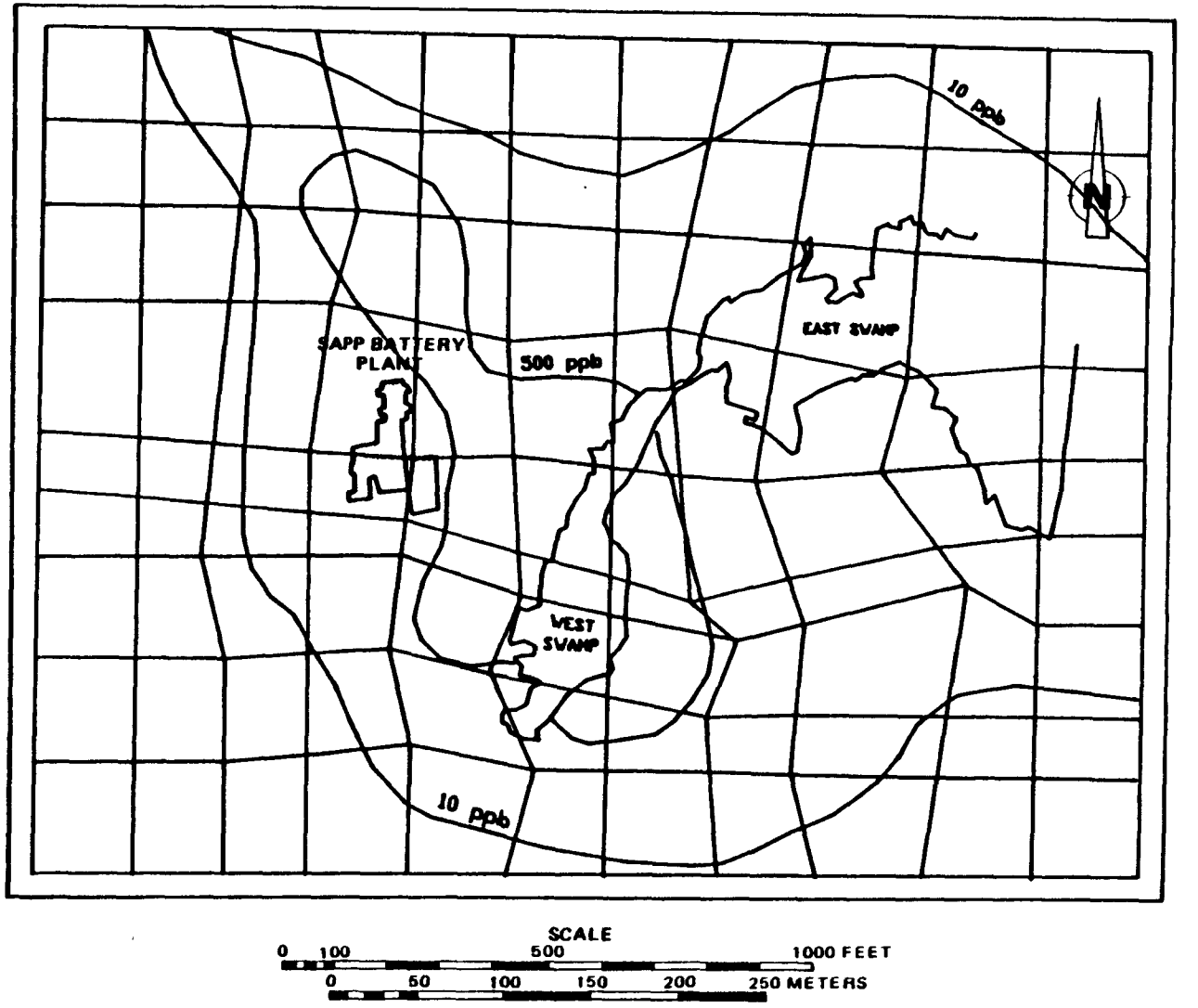

Figure 3–28 COMPUTED LEAD PLUME, 5 YEAR PREDICTION (1990) SURFICIAL AQUIFER (FEMWASTE)

hydrologic parameters used in the model are somewhat conservative, in that they do not fully account for the secondary permeability characteristics of the karstic terrain. Consequently, it could be hypothesized that the 500-ppb lead contour for the Floridan aquifer system would also exist slightly further to the east in five years than is indicated by Figure 3-30.

3.5.2.2 Random-Walk Model Predictions for the Floridan Aquifer

Figures 3-31 and 3-32 show the Random-Walk prediction for the lead plume configuration in 1990 and 1995. In general, the Random-Walk predictions have a similar trend to that of the FEMWASTE predictions discussed earlier. This is based on the fact that other models show the plume extending toward the east, south, and west. The contamination front appears to be most significant in the southerly direction. The actual concentration limits, however, of the Random-Walk predictions are much greater than those of the FEMWASTE model. For example, in 1990, the 10-ppb isopleth of the FEMWASTE simulation is at the same general position as the 50-ppb isopleth in the Random-Walk prediction. Based on the existing data for the surrounding residential wells, it appears that the Random-Walk prediction is more in line with actual future plume migration. The 1995 Random-Walk prediction shows additional spreading of the lead plume to the point that the 50-ppb isopleth is off the base map except in the northeast quadrant. Therefore, based on these estimates and assuming that the site soils (or source) are not treated, the nearby surrounding residential wells are most likely to have lead concentrations in excess of 50 ppb by 1995.

3.5.3 Random-Walk Model Prediction of Various Floridan Aquifer Pumping and Treatment Schemes

Six different scenarios were used to make a Random-Walk prediction of the effects of pumping and treating the Floridan Aquifer in the Sapp Battery site vicinity. These essentially include pumping the Floridan Aquifer at 1 million, 0.5 million, and 0.25 million gallons per day (mgpd) and either injecting that water back into the Floridan system downgradient of the site or discharging directly to a local surface drainage point.

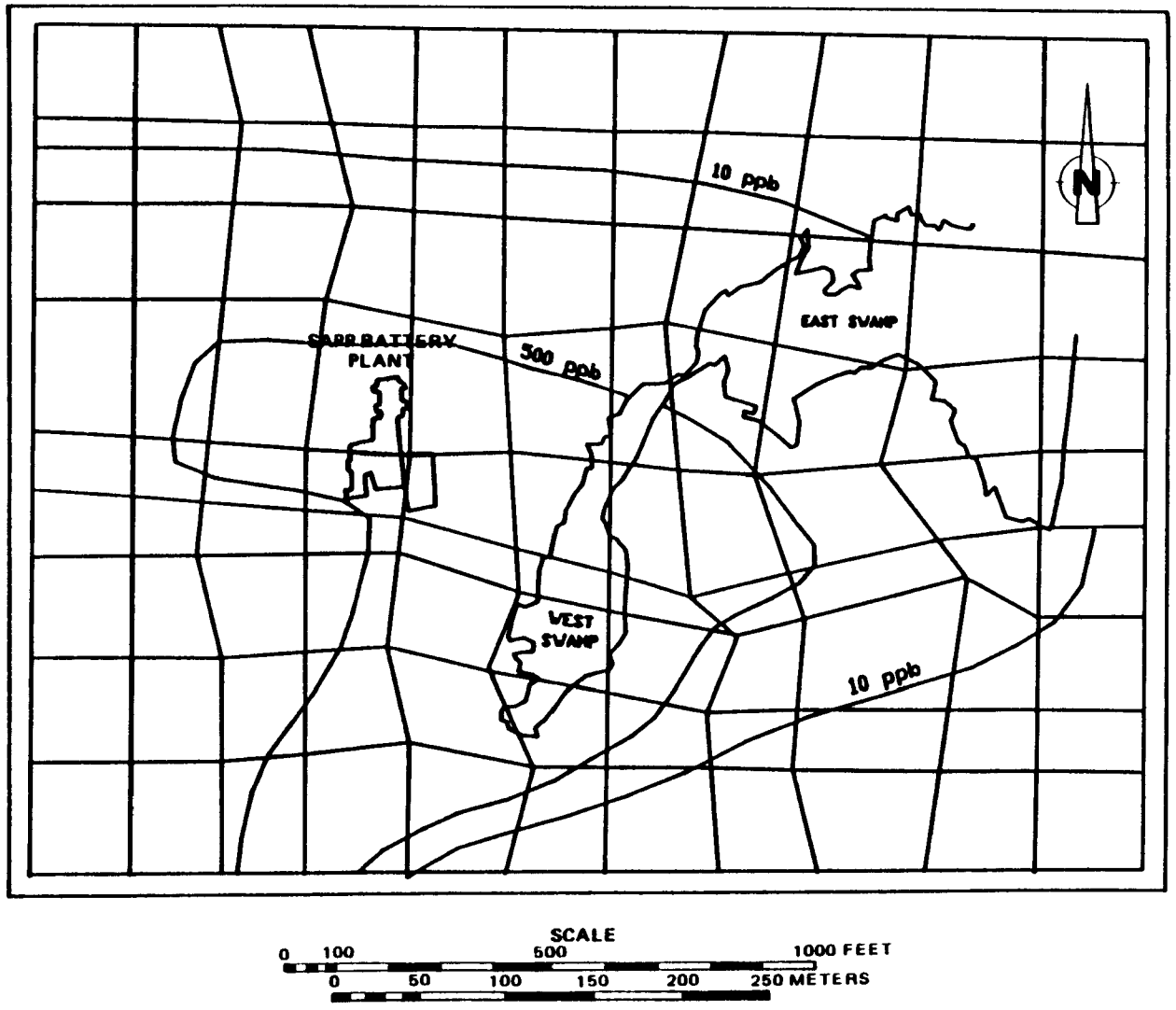

Figure 3–30 COMPUTED LEAD PLUME, 5 YEAR PREDICTION (1990) FLORIDAN AQUIFER (FEMWASTE)

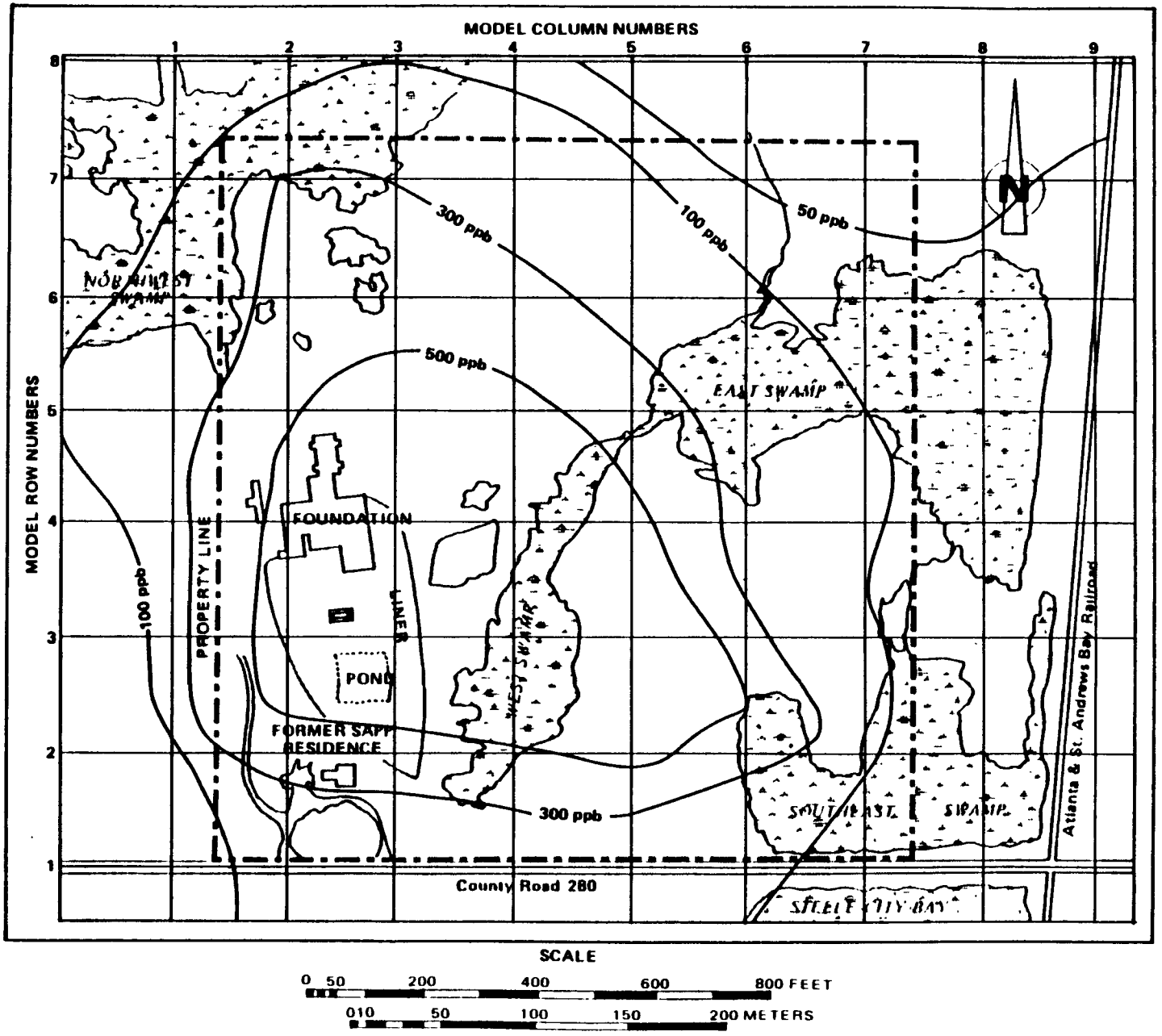

Figure 3–32 COMPUTED LEAD PLUME, 10 YEAR PREDICTION (1995) FLORIDAN AQUIFER (RANDOM-WALK)

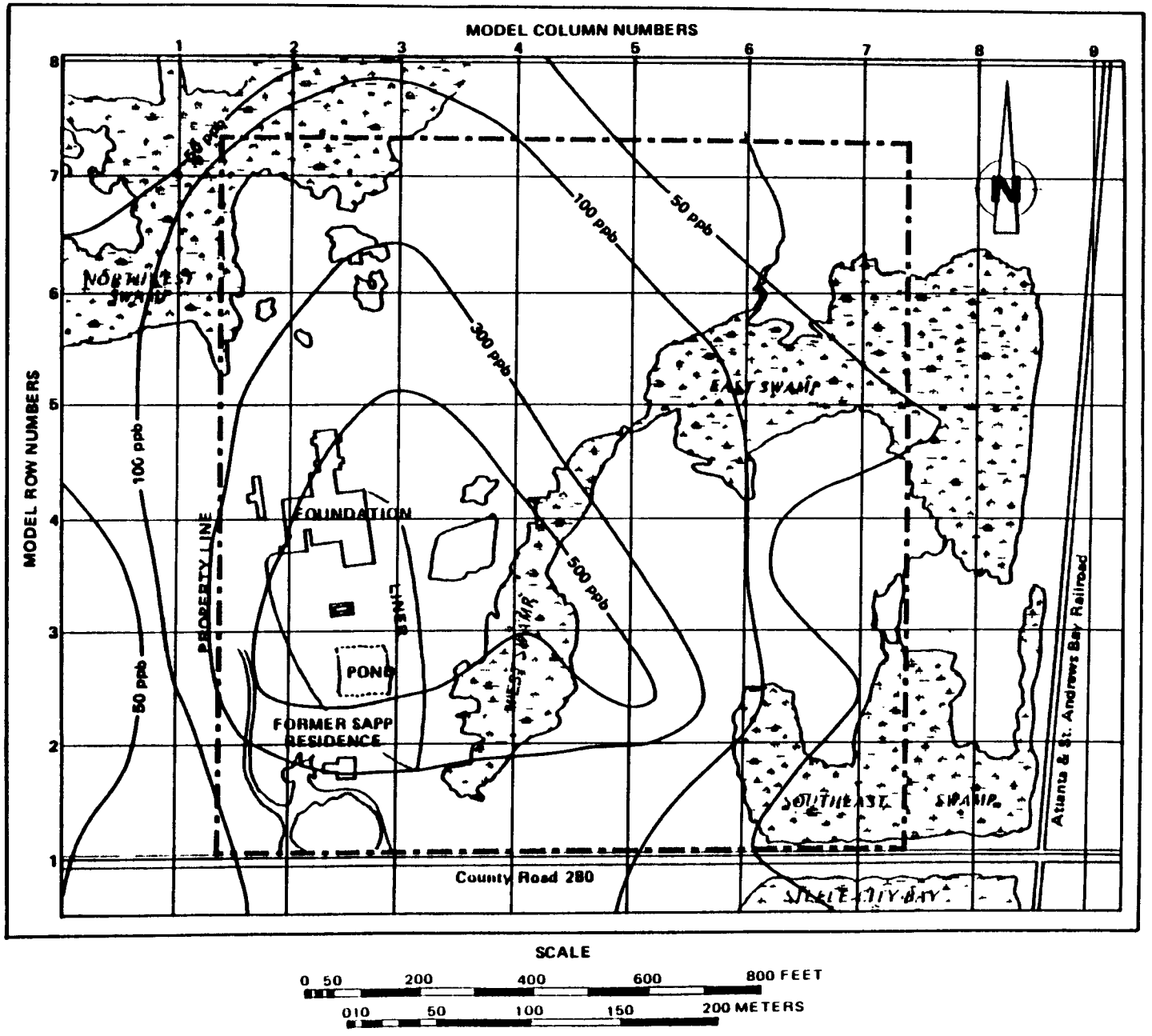

Figure 3–31 COMPUTED LEAD PLUME, 5 YEAR PREDICTION (1990) FLORIDAN AQUI (RANDOM-WALK)

Table 3-3

VARIOUS RANDOM-WALK MODEL PREDICTIONS FOR PUMPING AND TREATING THE FLORIDAN AQUIFER AT THE SAPP BATTERY SITE

Scenerio	Pumping Rate*	Injection Rate*	Surface Discharge Rate*	Pumping Well Concentration After Source Stpped (ppb)		
				1 year (1988)	5 year (1992)	10 year (1997)
1A	1	0	1	437	32	--
1B	1	1	0	423	35	--
2A	0.5	0	0.5	570	135	3
2B	0.5	0.5	0	588	129	5
3A	0.25	0	0.25	730	308	51
3B	0.25	0.25	0	672	241	72

*MGPD = Million gallons per day

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The interrelationships between the shallow and intermediate aquifer systems and between groundwater and surface water were not modeled. This would require three-dimensional modeling, which was beyond the scope of this study. Furthermore, the complexity of the vertical aquifer system, due to factors such as sinkholes and karstic features, is too great to be modeled with reasonable confidence, even using three-dimensional models.

Table 3-3 lists the prediction results for the various pumping rates at 1, 5, and 10 years. This format assumes that the contamination source will be stopped by 1987 through soil and sediment remediation.

In general the data on Table 3-3 show that pumping at 1 mgpd with either injection or surface water discharge would clean the aquifer to below drinking water standards in less than 5 years. However, at such a large pumping rate, the concentration of the contaminant begins at 423 to 437 ppb lead and decreases with time. Thus, an extremely large treatment method with the ability to effectively clean less than 500 ppb would be needed. At 0.25 mgpd, on the other hand, the pumping well lead concentration increases because it is not being diluted by clean aquifer water from the surrounding area. However, an additional 5 years (1997) is needed to get close to present day drinking water standards.

number, date, sample number, parameters to be analyzed for, and preservation media. Before the samples were packed in a cooler for shipment to E & E's laboratory, they were photographed and the sample number, location, date and time of collection, parameters to be analyzed for each sample, and any comments were entered onto a chain-of-custody form. One copy of this form was included in the sample cooler, and a second copy was filed in the Tallahassee office. All data recorded in the sample log, on sample identification tags, and on chain-of-custody forms were written in ink.

4.1.2 Samples

During sampling, field QA/QC was conducted in accordance with standard operating procedures. These procedures, outlined in E & E's Quality Assurance/Quality Control Procedures Manual, were developed in accordance with EPA standards. The QA/QC samples consisted of sample duplicates, sampling equipment rinsates, and trip bottle blanks. Tables 4-1 through 4-5 present a complete list of the QA/QC sample analysis requirements. Appendix F includes all QA/QC sample results under separate cover.

Sample duplicates were selected randomly. One sample duplicate was taken for approximately every 10 samples. Duplicates of samples to be archived were not collected. Duplicate samples are gathered as a check for homogeniety of the sample medium and are not an indication of the consistency of laboratory analyses. Soil and sediment duplicate samples showed some wide variations for lead but the majority did not exceed an order of magnitude difference. Accessory metals such as antimony and cadmium show good correlations where they were detected. Typically, soil metal duplicates show more deviation than other media. This is attributed to the fact that: contaminants are not isotropically dispersed in soil, especially hard clays; and physical homogenization is more difficult. If, for example, a duplicate sample contained more clay, a higher percentage of metals would occur due to the increased medium for adsorption. As the majority of soil samples at Sapp Battery were clayey, these trends were reflected by metal variations between the original and duplicate samples.

Sampling equipment was decontaminated after each sample was taken (see Section 2). To evaluate the effectiveness of the equipment

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4. QUALITY ASSURANCE/QUALITY CONTROL

4.1 FIELDWORK

4.1.1 Documentation

Daily logs and data forms were kept in sufficient detail to enable reconstruction of the events that occurred during the project. This information was also kept to refresh the memory of field personnel if called on to give testimony during legal proceedings.

Daily logs (site, task, and individual) were kept in bound, waterproof notebooks with numbered pages. Entries were made in waterproof ink, dated, and signed. Corrections were made by crossing a line through the error and entering the corrected information. All corrections were initialed and dated by the person making the change.

The site log was the responsibility of the site team leader and included the daily log of on-site activities.

A summary of task log inclusions is provided in the Quality Assurance Project Plan (QAPP), Feasibility Study for Sapp Battery site, Jackson County, Florida, November 1985, p. 5-29.

Photographs are the most accurate record of field observations and are crucial to validating actual field situations. Information noted in the field notebook concerning photographs can be found in the QAPP for the Sapp Battery site, p. 5-30.

Sample log books were used to record: specific sample station numbers, date and time the sample was taken, sample location, parameters to be analyzed for, and any comments.

Samples were placed in the appropriate sample jars with appropriate sample identification labels. These labels included the job

Table 4-3

MONITORING WELL QA/QC SAMPLE ANALYSIS REQUIREMENTS

Required Samples	Duplicates	Sampling Equipment Rinsates	Trip Bottle Blanks	Total	Analyses
44	4	5	2	55	pH, lead, cadmium, antimony, aluminum, arsenic, manganese, selenium
4	0	1	1	6	Priority pollutant organics, priority pollutant metals, acid/base neutral extractables, pesticides, sulfate, cyanide

Table 4-4

RESIDENTIAL WELL QA/QC SAMPLE ANALYSIS REQUIREMENTS

Required Samples	Duplicates	Sampling Equipment Rinsates	Trip Bottle Blanks	Total	Analyses
25	2	0	0	27	pH, lead, aluminum, cadmium, antimony, arsenic, manganese, nickel, selenium
1	0	0	0	1	Priority pollutant organics, priority pollutant metals, acid/base neutral extractables, pesticides, sulfate, cyanide

Table 4-5

SURFACE WATER QA/QC SAMPLE ANALYSIS REQUIREMENTS

Required Samples	Duplicates	Sampling Equipment Rinsates	Trip Bottle Blanks	Total	Analyses
4	1	0	0	5	Priority pollutant organics, priority pollutant metals, acid/base neutral extractables, pesticides, sulfate, cyanide

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Table 4-1

SOIL QA/QC SAMPLE ANALYSIS REQUIREMENTS

Required Samples	Duplicates	Sampling Equipment Rinsates	Trip Bottle Blanks	Total	Analyses
145	11	3	0	159	pH, lead, % moisture
108	14	6	6	134	pH, lead, cadmium, antimony, % moisture
5	1	1	1	8	Priority pollutant organics, priority pollutant metals, acid/base neutral extractables, pesticides, sulfate, cyanide

Table 4-2

SEDIMENT QA/QC SAMPLE ANALYSIS REQUIREMENTS

Required Samples	Duplicates	Sampling Equipment Rinsates	Trip Bottle Blanks	Total	Analyses
81	9	8	1	99	pH, lead, cadmium, antimony, % moisture
5	0	0	0	5	Priority pollutant metals, priority pollutant organics, acid/base neutral extractables, pesticides, sulfate, cyanide

(7.12 ppm). Given that the background lead level for the Sapp Battery area is considered to be about 30 ppm, whereas contaminated sample concentrations are, at a minimum, an order of magnitude higher, even this relatively high rinsate lead concentration would have little effect on the analytical results for the soil samples. It is probable that lead was inadvertently introduced in particulate form during collection of this rinsate sample. In contrast, the lead values of 1.48 and 1.77 ppm in rinsate samples FSR04 and FSR07, respectively, are most likely the result of airborne dust particles contaminating the equipment after the decontamination and during rinsate sample collection. Antimony and cadmium values were below detection limits (.06 and .005, respectively) for all rinsate samples except FSR07, which showed cadmium at 0.007 ppm. Again, this can be attributed to contamination by aeolian particles during collection of the rinsate sample.

Most of the eight sediment sampling equipment rinsates samples exhibited lead concentrations below detection limits. The low levels in FSR15 (1.95 ppm) and FSR18 (0.036 ppm) can again be attributed to airborne contamination of the equipment.

Of the six groundwater rinsate samples, only GWR02 and GWR04 showed lead concentrations (0.028 ppm) above the detection limits. These values are also attributed to airborne contamination.

Parameters noted in the field during sampling (pH, conductivity, temperature, color, and texture) were recorded by sampling personnel and filed at the end of each day. Meters used in the field were subject to regular maintenance and calibration. Calibration and maintenance data were also recorded and filed.

Further information on QA/QC requirements and procedures is given on pp. 5-18 through 5-20 of the QAPP for the Sapp Battery site (November 1985).

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decontamination procedure, sampling equipment rinsate samples were taken. After the equipment had been subjected to the usual decontamination procedure, distilled water was poured over or through it and collected for analysis. One rinsate sample was generally taken for each day of sampling. However, on days when only a very few samples were taken, collection of a rinsate sample was omitted.

For every lot of bottles used to collect samples, an empty bottle (trip bottle blank) was carried into the field during sampling and then shipped to the laboratory for analysis. The purpose of the trip bottle blank is to certify that the bottles were not contaminated during handling on-site. To ensure that the distilled water used in the decontamination of sampling equipment, which was purchased from local grocery and drug stores, was not contaminated, four of the trip bottle blank bottles (two soil/sediment and two water) were filled with this water. Both the soil/sediment (SBB01-07) and groundwater (GBB02, 03) bottle blanks exhibited metal concentrations below detection limits. Soil blank SBB01 showed 9 ug/l acetone; 4 ug/l 1,1,1-trichloroethane; and 7 ug/l methexene chloride upon analysis for priority pollutant volatile organics. However, these compounds were noted as being present in the corresponding instrument blanks only slightly above the 3 ug/l detection limit. As a result, all nine bottle blanks were intrinsically clean.

Water for on-site use was obtained from the supply well at the Alford Fire House, located approximately 2 miles south-southeast of the site in the Town of Alford (GW-29; Figure 2-6). A sample of this water was analyzed and found to contain 0.023 ppm lead, the highest concentration detected in an off-site residential well. The results of the groundwater investigation strongly suggest that contamination of this well must be attributed to some unknown source rather than the Sapp Battery site. A second Alford Fire House sample was collected and analyzed to confirm these data. The results indicated 0.013 ppm lead. It is also unlikely that the presence of this lead had any significant effect on the analytical results of the investigation, given that all sampling equipment was rinsed with distilled water before re-use.

Of the 10 soil sampling equipment rinsate samples that were collected and analyzed, FSR06 exhibited the highest lead concentration

quantity of surrogate and internal standard compounds is added. The organic volatile compounds, including surrogate and internal standards, are purged from solution in a stream of inert gas and trapped from vapor on a suitable material. The trap tube is then heated, and the trapped materials desorbed by backflushing into a gas chromatograph under standard conditions. Eluting peaks enter a mass spectrometer. Individual components are identified by mass spectrum and quantified by primary ion ratio to that of the internal standard.

Semi-volatile Compounds. Soil or water aliquots, to which a measured quantity of surrogate compounds has been added, are extracted into methylene chloride. Water samples are extracted twice: once at pH 12 for extraction of basic and neutral components, and once at pH 2 for extraction of acidic components (mainly phenols). Soil samples are extracted once using a sonication apparatus. Extracts (combined if necessary) are spiked with internal standard solution and analyzed by GC/MS. Peaks are identified and quantified as for volatile compounds.

Pesticides and PCBs. Soil or water samples to which a surrogate standard has been added are extracted into methylene chloride. The extract is exchanged into hexane and cleaned up by column chromatography. The extract is then analyzed by gas chromatography/electron capture detector by external standard procedures.

4.2.1.2 Metals Analyses

The following summary of analytical methods for metals analysis is taken from E & E's Standard Operating Procedures Manual. Either inductively-coupled argon plasma spectroscopy (ICP) or atomic absorption spectrophotometry was used as appropriate to meet contract required detection limits. Table 4-6 summarizes metal detection limits and methods used to analyze sample digestates.

Sample digestion procedures depend on the matrix, the method of analysis used, and the metal being analyzed. These are summarized below.

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4.2 LABORATORY SAMPLE ANALYSIS

Samples of groundwater, well water, surface water, soils, and sediments were analyzed for metals and organics using analytical methods promulgated by EPA for use on CERCLA (or Superfund) investigations. These procedures are described generally in Section 4.2.1 below.

Samples were analyzed by E & E's laboratory in Buffalo, New York, and by Environmental Protection Systems, Inc., (EPS) in Pensacola, Florida. Both laboratories are approved by FDER for the analyses they conducted. The E & E laboratory is contracted to EPA to provide organics analysis for the Superfund program, and laboratory personnel are thoroughly familiar with the analytical and reporting requirements of that program. EPS is currently seeking certification by EPA to participate in the organics analysis portion of the Superfund program. Both E & E and EPS results were subject to quality assurance (QA) review by E & E's independent staff of QA chemists. Neither laboratory was aware of sample designations as duplicates or blanks at the time of analysis.

4.2.1 Analytical Methods

Samples were analyzed by EPA Contract Laboratory protocols. Full details are provided in the following references:

- Statement of Work for Organics Analysis, Multimedia, Multiconcentration, EPA Contract Laboratory Program, revised July 1985.

- Statement of Work for Inorganics Analysis, Multimedia, Multiconcentration, EPA Contract Laboratory Program, revised August 1985.

The analytical methods are briefly described below.

4.2.1.1 Organic Analyses

Volatile Compounds. Soil or water aliquots are introduced to the purge tube of a purge-and-trap apparatus. A precisely measured

- For water samples analyzed by furnace atomic absorption (FAA) for arsenic, cadmium, lead, selenium, and thallium:

  Shake the sample, and transfer 100 mL to a 250-mL beaker. Add 1 mL 50% HNO_3 and 2 mL 30% H_2O_2. Cover with a watch glass and heat for 2 hours at 95°C, making sure the sample does not boil. Cool the sample and filter it, and bring back to 100 mL with reagent water. The sample is now ready for analysis.

- For water samples analyzed by ICP, and FAA analysis for antimony:

  Shake the sample and transfer 100 mL to a 250-mL beaker. Add 2 mL 50% HNO_3 and 10 mL 50% HCl. Heat on a steam bath or hot plate until the volume has been reduced to 25% to 50% of the original volume, without boiling. Cool the sample and filter it, and bring it back to 100 mL with reagent water. The sample is now ready for analysis.

- For water samples analyzed for mercury, using cold vapor atomic absorption spectrophotometry (CVAA):

  Shake the sample and transfer 100 mL to a 300-mL BOD bottle. Add 5 mL 0.5N H_2SO_4 and mix. Add 2.5 mL concentrated nitric acid and mix. Add 15 mL 5% potassium permanganate solution, or more if the purple color discharges. Add 8 mL 5% potassium persulfate solution, and heat the bottle to 95°C for two hours in a water bath. At the end of the digestion period, cool and add 6 mL of 12% sodium chloride/hydroxylamine sulfate solution to reduce excess permanganate. Wait at least 30 seconds, then add 5 mL stannous sulfate and immediately analyze.

- For sediment samples analyzed for all metals except mercury:

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Table 4-6

SUMMARY OF CONTRACT-REQUIRED DETECTION LIMITS

Element	CRDL Soil (mg/kg)	CRDL Water (ug/l)	Methods (soil and water)
Aluminum	--	200	ICP
Antimony	12	60	FAA
Arsenic	2	10	FAA
Barium	--	200	ICP
Beryllium	1	5	ICP
Cadmium	1	5	FAA
Calcium	--	5,000	ICP
Chromium	2	10	ICP
Cobalt	--	50	ICP
Copper	5	25	ICP
Iron	--	100	ICP
Lead	1	5	FAA
Magnesium	--	5,000	ICP
Manganese	--	15	ICP
Mercury	0.04	0.2	CVAA
Nickel	8	40	ICP
Potassium	--	5,000	ICP
Selenium	1	5	FAA
Silver	2	10	ICP
Sodium	--	5,000	ICP
Thallium	2	10	FAA
Vanadium	--	50	ICP
Zinc	4	20	ICP
Cyanide	25	10	Color

Note: CDLs are best achievable and will vary according to concentration and variations in the respective matrix.

ICP = inductively-coupled plasma specroscopy
FAA = furnace atomic absorption spectrophotometry
CVAA = cold vapor atomic absorption spectrophotometry

minutes. Cool and add 6 mL 12% sodium chloride/hydroxylamine sulfate solution to reduce the excess permanganate. Add 55 mL reagent water. Add 5 mL stannous sulfate (6.3) and immediately analyze.

- For percent solids--soils, sediments, sludges:

  Transfer a representative portion of the sample to a tared weighing dish. Weigh and record weight. Place dish, sample, and tilted cover in drying oven at 103° to 105°C. Cool sample in desiccator and weigh. Repeat process until constant weight is attained. Record each weight, and calculate percent solids. Do not analyze sample.

Sample digestates were analyzed by ICP, FAA, or CVAA as indicated on Table 4-6. The following QA/QC was performed: initial calibration and calibration verification, continuing calibration verification, preparation blank analysis, interference check sample analysis, ICP serial dilution analysis, matrix spike analysis, duplicate sample analysis, furnace AA QC analysis, and laboratory QC sample analysis. Sediment, soil, and sludge samples were also analyzed for moisture content, and metals content will be reported on a dry-weight basis.

It is permissible to use ICP procedures for analysis when the CRDL cannot be met, provided that the actual sample level is at least twice the detection limit for the ICP analysis. As an example, for lead in water: CRDL is 5 ug/L; ICP detection limit is 40 ug/L; sample value is 90 ug/L. If the sample is less than 80 ug/L, it must be analyzed by FAA.

4.2.2 Reporting and Quality Assurance

Reporting procedures for this project were as required: either a simple data tabulation, or a full-scale CLP data package was prepared according to the procedures in the relevant statements of work. In each case, the report included details on QA/QC procedures and results. All data are submitted in the Appendix of this summary document. Duplicate and blank samples from the field were submitted blind

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Add 1.0 g homogenized sample to a conical beaker. Add 10 mL 50% HNO_3, mix and cover with a watch glass. Reflux the sample at 95°C for 10 minutes. Allow the sample to cool, and then add 5 mL concentrated nitric acid and reflux for 30 minutes. Do not allow total volume to be reduced to less than 5 mL. Again cool the sample, and add 2 mL reagent water and 3 mL 30% H_2O_2. Warm gently until effervescence begins, and then wait until it subsides. Cool the beaker. Continue to add 30% H_2O_2 in 1 mL aliquots until either there is no further effervescence, or until a total of 10 mL has been added. Then:

For ICP analysis; and FAA analysis for antimony:

Add 5 mL 50% HCl and 10 mL reagent water. Return the covered beaker to the hot plate and heat for an additional ten minutes. After cooling, filter through a Whatman #42 filter and dilute the digestate to 100 mL with reagent water. Dilute the digestate 1:1 (200 mL final volume) with reagent water.

For FAA analysis of arsenic, cadmium, lead, selenium, and thallium:

Do not add the reagents specified above. Rather, continue heating the digestate until the volume has been reduced to about 2 mL. Then add 10 mL reagent water and warm the mixture. Cool and filter through a Whatman #42 filter paper, and dilute to 100 mL with reagent water. Dilute the digestate 1:1 (200 mL final volume) with reagant water.

- For sediment samples analyzed for mercury:

Weigh 0.2 g sample into a BOD bottle. Add 5 mL 0.5N H_2SO_4 and 2.5 mL concentrated nitric acid. Heat for two minutes at 95°C in a water bath. Cool, add 50 mL reagent water, 15 mL 5% potassium permanganate solution, and 8 mL 5% potassium persulfate solution. Mix thoroughly and heat to 95°C for 30

4.2.3 Analytical Quality Assurance Results and Discussions

USEPA Contract Laboratory Program (CLP) procedures were used to analyze all samples where applicable. These analytical procedures include a specified level of QC analyses, and limits to which such analyses should conform. In addition, E & E's own QA/QC procedures were superimposed where necessary onto CLP QA/QC procedures to provide an added level of assurance.

4.2.3.1 Organic Analyses

For organic analyses by GC/MS, the CLP-required QA/QC procedures can be summarized as follows:

- Instrument calibration at five concentration levels;
- Daily certification of instrument tune;
- Daily verification of initial five-point calibration;
- For each sample, verification of extraction and analysis recovery through use of surrogate standards;
- For each sample, quantification of found contaminants and surrogate compounds by internal standard procedure;
- For each found contaminant, examination of the mass spectrum against a laboratory-generated standard mass spectrum to verify identification;
- For each batch of samples, analysis of two sample aliquots identically spiked with specified compounds for precision and accuracy assurance; and,
- For specified samples in this project, reporting in standard format all samples, quality control samples, quality control summaries, calibration information, and mass spectra.

to the laboratories for analysis. For this project, in general, there was good agreement between field duplicate samples, and negligible contamination of blanks. This confirms that field procedures were well in control, and that laboratory performance was of the required standard. In addition, the laboratory added to the sample batch spiked samples, replicates, standards, and method blanks at a frequency specified in the statements of works in order to provide continuing and real-time information on data quality. All percent differences were within the 95% confidence intervals and fell within EPA guidelines. The spike sample provided by the EPA (EPA-1) was clean for all parameters. For organic analyses, surrogate recoveries must be within specified limits for the extraction and analysis to be considered valid. All percent recoveries for spiked organic samples were well within ranges specified in EPA CLP protocols. Percent recoveries of less than 50% for pentachlorophenol (36%) and 4-nitrophenol (28%) (Appendix B) were normal for these compounds, the acceptable range being between 10 and 100 percent. This wide range reflects the inherent difficulty in recovery of these compounds under standard laboratory analyses. All furnance atomic absorption samples are spiked at least once with a specified level of analyte to guard against matrix interference. If recovery is not within the range of 85% to 115%, the method of standard addition must be employed.

Deviations from the standard detection limits as required by the QA plan were a function of several variables. Method detection limits reflect perfect conditions using clean samples for analyses. Because these conditions do not usually exist, detection limits can vary from the normal CDL value. Matrix effects can interfere with limits, as they represent compounds existing within the analyzed medium that behave in a similar manner to the compound of interest. As such, they may interfere with absorption and make interpretation more difficult. Similarly, high concentrations of a substance can limit the volume used for analysis and may require subsequent dilution. This would alter the detection limit as well.

4.2.3.2 Inorganic Analyses

Metals analyses were conducted using atomic absorption spectrophotometry (AAS) or inductively coupled argon plasma emission spectrophotometry (ICP), as required under CLP protocols and as necessary to achieve contract detection limits. CLP QA/QC requirements are summarized below.

- Instruments must be calibrated initially at three levels (AAS) or two levels (ICP). The calibration must be verified by analysis of a solution independently prepared from alternate stock standards.

- At the beginning and end of every analytical run, a linear range verification standard must be run. This standard defines the upper limit of the calibration range and analyses beyond this range can not be reported. This standard must read within 5% of true value. A low standard at twice the Contract Required Detection Limit (CRDL) must read between 1X CRDL and 3X CRDL.

- A mid-range standard at the beginning and end of the analytical run, and at a frequency of 10% during the run, must read with 10% of true value (20% for mercury).

- A preparation blank can not be digested for each batch of 20 samples and must show no more than CRDL of each metal.

- For ICP analysis, an Interference Check Sample (ICS) must be run at the beginning and end of each analytical run. Results for all included elements must agree to with ±20% of true value.

- One sample in each batch of 20 must be spiked before digestion with all analytes of interest at specified levels. All spikes must be recovered between 75% and 125%: for any analyte that is not recovered within these limits, associated sample results must be flagged with the letter R. An exception to this rule is allowed when the native sample concentration is

Twelve samples were analyzed for organic compounds as E & E job number U-2387 and reported with a full CLP-type data package on November 8, 1985. Quality control results are discussed below.

Surrogate recoveries were within CLP specified limits, with two exceptions. Sample FRW-01 (E & E number 85-6629) showed toluene-D8 recovery of 114% against an allowable range of 88% to 110%. No HSL compounds were found in the volatile fraction of this sample, with the exception of acetone, 2-butanone, and 1,1,1-trichloroethane, which were attributed to laboratory contamination. The sample was not reanalyzed, as the effect of the high recovery of toluene would be to increase the apparent concentration of contaminant compounds. Sample DSW-02 showed low recoveries of nitrobenzene-D5 and 2-fluoro-biphenyl surrogates in the semivolatile fraction. The sample was therefore reextracted and reanalyzed and surrogate recoveries were as a whole acceptable. (Nitrobenzene-D5 was still low, at 34%, against a permitted range of 35-114%, but CLP procedures allow one surrogate in the semivolatiles fraction to be out of range.) Matrix spike analyses in duplicate for all compounds were within CLP target values. (1,1-dichloroethene was not used in the matrix spike solution for volatiles, since at that time we were not able to obtain a pure standard in an appropriate solvent from USEPA. This was noted in the case narrative for this batch of samples.) Reagent blank analysis results for organics were within allowable contamination limits, with the exception of the result for 2-butanone (which we have attributed to the concurrent building construction) in the volatiles samples. GC/MS tuning met criteria in all instances. Calibration criteria for both the five-point initial calibration and the daily single-point verification were met, with one exception. Vinyl chloride exhibited a percent difference of 27.5% (25% is allowable) between the initial five- point mean response factor and the daily verification response factor on 27 September 1985. This was noted in the case narrative and it was determined that this discrepancy had no analytical significance, since vinyl chloride was not detected in any sample.

Similar criteria and similar standards of performance to criteria applied to all organic analyses conducted under this contract.

Other samples analyzed and reported under this contract met similar criteria of quality.

4.2.3.3 Data Reporting

For a full QA analysis of data generated using the CLP protocols, we recommend that a full data package to CLP specifications should be required. This contains all supporting QA/QC and calibration information, and facilitates proper assessment by FDER.

four (or more) times the spike amount. In this case, sample results need not be flagged.

- One sample in each batch of twenty must be analyzed in duplicate. Relative percent difference (RPD) between these analyses must be 20% or less where sample values are 5X CRDL or more. If one or both sample values are less than 5X CRDL, then the values must agree to within ±CRDL.

- Furnace AAS procedures require particular QC analyses. Each sample will be injected in duplicate. In addition, each sample digestate will also be spiked and analyzed similarly in duplicate. Spike recovery must be in the range 85% to 115%, or multiple standard addition (MSA) will be required for quantification.

Samples analyzed for antimony, cadmium, and lead as E & E job number U-2571 were analyzed and reported with a full CLP-type data package on January 27, 1976. Quality control results are discussed below. Method blanks showed all three elements not detectable (i.e., <CRDL) in all cases.

Linear range verification standards for Sb and Cd at 10,000 ug/l and for Pb at 100,000 ug/l were run and were within ±5% of true value. (See pages 28, 30, 31 of data package). Mid-range standards at 1,000 ug/l (ICP) or 50 ug/l (Pb by AAS) were run and met specifications (Form II, pages 13 and 14 of data packages). ICS values were within 20% of true (page 16). Spike sample recoveries are listed on Form V, pages 17 and 18. Recoveries for Pb and Cd were good, but low for Sb, at 56%. This prompted an investigation, and a telephone call to USEPA in Cincinnati resulted in the information that other analysts had had the same problem. It appears that EPA have never fully tested this digestion procedure for antimony in soils, and that losses result from volatilization. A copy of a QC memo (E & E internal) detailing this problem is attached as Appendix G. Duplicate analyses results (form VI, pages 19 and 20), where calculated, were within specification of ±CRDL.

system by the Heavy Metals Task Force do not reveal any significant trends that would indicate an influence from the Sapp Battery Site.

In general, there are three major areas of soil contamination at the site extending to a depth of 10 feet: (1) along the west bank of the West Swamp; (2) in the area immediately northeast of the plant foundation; and (3) in the Northwest Landfill area.

The swamp sediments which exhibit contamination are primarily at shallow depths in the southern portion of the West Swamp. In general, lead concentrations in these sediments taper off to low levels toward the northern West Swamp and East Swamp areas.

As a result of poor waste management practices, resulting in soils contamination, and the complex hydrogeology at the site, groundwater from the surficial, intermediate, and Floridan aquifer systems shows varying degrees of lead pollution. In essence, the highest groundwater contamination reflects the three contaminated soil areas in the western half of the the site, identified above. Contamination of the deeper aquifer results primarily from:

- o Stratigraphic variations common to this region of Florida (i.e., karst terrain and paleo-stream channels);
- o A high vertical hydraulic gradient between the shallow and deep aquifers; and
- o Historical on-site pumping of the Sapp Battery plant well.

In addition, lateral waste migration is enhanced by the fact that:

- o The surficial aquifer flows generally in an eastward direction at a very slow rate;
- o The intermediate aquifer flows southwestward at a slow rate; and
- o The Floridan aquifer flows eastward at a relatively fast rate.

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5. CONCLUSIONS

The results of this investigation as well as the results of previous investigations reveal significant lead contamination and the presence of several trace metals in surface water, groundwater, sediment, and soil in the vicinity of the Sapp Battery site. This contamination is the direct result of poor waste management practices by the now-defunct Sapp Battery Company.

Surface water and surface water sediment samples selected by FSU in the regional vicinity downgradient of the Sapp Battery site in general show lead contamination which decreases substantially with increased distance from the site, and decreases with time.

Biologic samples collected during the FSU investigation revealed the following:

- Algae species showed no pattern in diversity or evenness;
- Macroinvertebrates commonly exhibited a gradient response to the distribution of metals, and
- Fish species exhibited a gradient response to the contamination distribution found in surface water and surface water sediments.

Additional surface water, surface water sediment, and fish samples collected from a sampling network within the Chipola River

By inputting detailed physical and chemical data into a computer model, the lead migration was simulated and predictions were made for one and five years from the date of sample collection. The simulation, in general, showed that the waste front is migrating very slowly in the surficial and intermediate systems. However, because of the high flow velocity within the Floridan aquifer, lead migration will extend considerably farther to the east of the abandoned Sapp Battery operation in excess of five years from the present time. Furthermore, residential wells immediately east of the site are presently exhibiting minor lead contamination effects. Although this simulation provides lead migration trends in the hydrogeologic regime, several assumptions had to be applied, resulting only in a qualitative overview.

In addition to the lead migration predictions, simulations were performed to determine how pumping would affect contamination in the Floridan aquifer. The pumping simulations showed that the majority of the contamination could be removed from the aquifer in about:

- 5 years at a pumping rate of 1 million gallons per day (mgd),
- 7 years at a pumping rate of 0.5 mgd, or
- 15 years at a pumping rate of 0.25 mgd.

The concentrations of the simulated pumped water would in all cases be less than 1 part per million lead at any given time.

A preliminary fixation study demonstrated that the transport of lead from the soils into the groundwater may be mitigated by excavating and solidifying the soils. Solidification of the soils with defined quantities of Portland cement would reduce the levels of lead in the leachate to below the detection level of 0.06 mg/L.

The data presented in this report, along with the results of the earlier FDER RI, are in direct support of the feasibility study (FS). These documents are intended to serve as the primary data base for the FS report.

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Martha Berry / Elaine Mc

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SUMMARY REPORT ON THE FIELD INVESTIGATION OF THE SAPP BATTERY SITE, JACKSON COUNTY, FLORIDA

VOLUME 2 – APPENDICES

November 1986

Prepared for:

FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION
2600 Blairstone Road
Tallahassee, Florida 32301

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491

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Table 73b Metals in sediments and wa taken from the Little Dry Creek-Dry Creek system ove .e study period.

METALS REPORT

Metals: LD-DC Sediments - 65 Revised 6/4/85

KEY

0.0 - MEANS NOT FOUND
< - MEANS BELOW THE DETECTION LIMIT AT THAT NUMBER
99 - FOR ANY PORTION OF A DATE MEANS THAT IT WAS NOT RECORDED

RIVER: CHIPOLA CODE: 200 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	1.74
COPPER	7.20
LEAD	1935.00
ZINC	5.50
NICKEL	.75
CHROMIUM	17.60

RIVER: CHIPOLA CODE: 201 STATION: 02
TYPE: SEDIMENTS
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	2.81
COPPER	7.35
LEAD	999.50
ZINC	8.60
NICKEL	1.28
CHROMIUM	12.55

RIVER: CHIPOLA CODE: 203 STATION: 03
TYPE: SEDIMENTS
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	.94
COPPER	.50
LEAD	17.50
ZINC	1.05
NICKEL	1.36
CHROMIUM	1.70

RIVER: CHIPOLA CODE: 204 STATION: 04
TYPE: SEDIMENTS
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .90
COPPER	< .10
LEAD	3.10
ZINC	1.82
NICKEL	< .15
CHROMIUM	3.50

RIVER: CHIPOLA CODE: 205 STATION: 05
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-99-83

METAL	MEASURE (PPM)
ALUMINUM	.30
CADMIUM	< .90
COPPER	< .10
LEAD	2.60
ZINC	1.25
NICKEL	< .10
CHROMIUM	1.10

RIVER: CHIPOLA CODE: 218 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	1.02
COPPER	5.30
LEAD	184.30
ZINC	4.84
NICKEL	2.46
CHROMIUM	4.66

RIVER: CHIPOLA CODE: 219 STATION: 02
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	1.44
COPPER	8.30
LEAD	51.60
ZINC	4.16
NICKEL	1.43
CHROMIUM	3.06

RIVER: CHIPOLA CODE: 220 STATION: 04
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.03
CADMIUM	< .25
COPPER	1.00
LEAD	.36
ZINC	1.08
NICKEL	< .53
CHROMIUM	1.19

RIVER: CHIPOLA CODE: 221 STATION: 05
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

RIVER: CHIPOLA CODE: 222 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

APPENDIX A

FSU SURFACE WATER AND SURFACE WATER SEDIMENT DATA

(Source: Livingston, 1985)

LEAD	3.60
ZINC	2.85
NICKEL	1.50
CHROMIUM	2.04

RIVER: CHIPOLA CODE: 269 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	15165.67
CADMIUM	.38
COPPER	11.37
LEAD	167.33
ZINC	7.26
NICKEL	3.20
CHROMIUM	8.87

RIVER: CHIPOLA CODE: 270 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	2950.30
CADMIUM	< .02
COPPER	.60
LEAD	1.48
ZINC	3.22
NICKEL	.76
CHROMIUM	2.37

RIVER: CHIPOLA CODE: 272 STATION: 08
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	2480.30
CADMIUM	< .02
COPPER	1.73
LEAD	15.05
ZINC	4.34
NICKEL	.56
CHROMIUM	1.36

RIVER: CHIPOLA CODE: 266 STATION: 2A
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	18240.33
CADMIUM	< .02
COPPER	3.26
LEAD	28.50
ZINC	6.26
NICKEL	3.90
CHROMIUM	8.76

RIVER: CHIPOLA CODE: 269 STATION: 4B
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	3103.30
CADMIUM	< .02
COPPER	.55
LEAD	1.84
ZINC	8.42
NICKEL	.60
CHROMIUM	1.84

LEAD	323.30
ZINC	13.69
NICKEL	3.45
CHROMIUM	13.23

RIVER: CHIPOLA CODE: 267 STATION: 04
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	1900.00
CADMIUM	< .02
COPPER	.41
LEAD	1.93
ZINC	1.32
NICKEL	.47
CHROMIUM	1.37

RIVER: CHIPOLA CODE: 271 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	5200.00
CADMIUM	< .02
COPPER	.93
LEAD	2.69
ZINC	2.31
NICKEL	.85
CHROMIUM	4.37

RIVER: CHIPOLA CODE: 273 STATION: 11
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	4090.00
CADMIUM	< .02
COPPER	.93
LEAD	3.01
ZINC	5.46
NICKEL	.92
CHROMIUM	3.84

RIVER: CHIPOLA CODE: 268 STATION: 4A
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	3430.00
CADMIUM	< .02
COPPER	.66
LEAD	2.10
ZINC	1.89
NICKEL	.66
CHROMIUM	2.20

RIVER: CHIPOLA CODE: 61 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	3575.00
CADMIUM	.04
COPPER	3.30
LEAD	208.00
ZINC	4.79
NICKEL	1.32
CHROMIUM	5.44

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	2.31
COPPER	5.40
[illegible]	12.00
[illegible]	[illegible]
NICKEL	2.53
CHROMIUM	9.06

RIVER: CHIPOLA CODE: 223 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	.61
COPPER	1.20
LEAD	1.20
ZINC	1.54
NICKEL	< .50
CHROMIUM	2.28

RIVER: CHIPOLA CODE: 225 STATION: 09
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .25
COPPER	3.20
LEAD	2.18
ZINC	3.27
NICKEL	< .50
CHROMIUM	3.39

RIVER: CHIPOLA CODE: 227 STATION: 11
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .25
COPPER	3.50
LEAD	< .50
ZINC	2.56
NICKEL	< .50
CHROMIUM	2.02

RIVER: CHIPOLA CODE: 239 STATION: 04
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	1940.00
CADMIUM	< .03
COPPER	.44
LEAD	2.10
ZINC	1.54
NICKEL	.30
CHROMIUM	1.33

RIVER: CHIPOLA CODE: 241 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	2910.00
CADMIUM	< .02
COPPER	.77

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .25
COPPER	.6
[illegible]	[illegible]
ZINC	[illegible]
NICKEL	[illegible]
CHROMIUM	.46

RIVER: CHIPOLA CODE: 224 STATION: 08
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	2.05
COPPER	.00
LEAD	1.61
ZINC	8.88
NICKEL	2.32
CHROMIUM	17.89

RIVER: CHIPOLA CODE: 226 STATION: 10
TYPE: SEDIMENTS
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	1.57
COPPER	2.30
LEAD	.70
ZINC	1.46
NICKEL	< .50
CHROMIUM	.34

RIVER: CHIPOLA CODE: 238 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	5230.00
CADMIUM	< .02
COPPER	1.30
LEAD	290.00
ZINC	6.00
NICKEL	4.10
CHROMIUM	5.10

RIVER: CHIPOLA CODE: 240 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	10200.00
CADMIUM	.08
COPPER	3.40
LEAD	5.60
ZINC	6.40
NICKEL	4.40
CHROMIUM	.60

RIVER: CHIPOLA CODE: 259 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 07-31-84

METAL	MEASURE (PPM)
ALUMINUM	21450.00
CADMIUM	.06
COPPER	6.61

METAL	MEASURE (PPM)
ALUMINUM	17580.00
CADMIUM	1.37
COPPER	15.70
LEAD	[illegible]
ZINC	[illegible]
NICKEL	[illegible]
CHROMIUM	4.23

RIVER: CHIPOLA CODE: 107 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-14-85

METAL	MEASURE (PPM)
ALUMINUM	19480.00
CADMIUM	2.14
COPPER	36.40
LEAD	880.00
ZINC	< 1.00
NICKEL	4.44
CHROMIUM	6.81

RIVER: CHIPOLA CODE: 143 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	24565.00
CADMIUM	.18
COPPER	6.13
LEAD	454.00
ZINC	< 1.00
NICKEL	4.83
CHROMIUM	15.20

RIVER: CHIPOLA CODE: 148 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	1772.00
CADMIUM	.23
COPPER	.36
LEAD	1.23
ZINC	< 1.00
NICKEL	.55
CHROMIUM	1.22

RIVER: CHIPOLA CODE: 150 STATION: 08
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	3746.00
CADMIUM	.04
COPPER	.93
LEAD	2.72
ZINC	< 1.00
NICKEL	1.32
CHROMIUM	2.77

RIVER: CHIPOLA CODE: 146 STATION: 4A
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	1317.00
CADMIUM	.02

METAL	MEASURE (PPM)
ALUMINUM	4829.00
CADMIUM	.06
COPPER	1.19
LEAD	[illegible]
ZINC	< [illegible]
NICKEL	1.51
CHROMIUM	3.15

RIVER: CHIPOLA CODE: 108 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-14-85

METAL	MEASURE (PPM)
ALUMINUM	1541.00
CADMIUM	.02
COPPER	.44
LEAD	1.24
ZINC	< 1.00
NICKEL	.71
CHROMIUM	1.22

RIVER: CHIPOLA CODE: 144 STATION: 32
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	18010.00
CADMIUM	.31
COPPER	5.85
LEAD	73.10
ZINC	< 1.00
NICKEL	3.25
CHROMIUM	7.34

RIVER: CHIPOLA CODE: 149 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	8530.00
CADMIUM	.05
COPPER	1.32
LEAD	3.30
ZINC	< 1.00
NICKEL	1.53
CHROMIUM	3.54

RIVER: CHIPOLA CODE: 145 STATION: 2A
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	12680.00
CADMIUM	.13
COPPER	3.32
LEAD	47.00
ZINC	< 1.00
NICKEL	3.79
CHROMIUM	8.37

RIVER: CHIPOLA CODE: 147 STATION: 4B
TYPE: SEDIMENTS
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	2864.00
CADMIUM	.03

RIVER: CHIPOLA CODE: 62 STATION: 02
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	9533.33
CADMIUM	.47
COPPER	17.75
LEAD	216.67
ZINC	7.40
NICKEL	1.65
CHROMIUM	8.47

RIVER: CHIPOLA CODE: 64 STATION: 34
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	1640.00
CADMIUM	< .02
COPPER	.43
LEAD	2.11
ZINC	1.23
NICKEL	.50
CHROMIUM	4.43

RIVER: CHIPOLA CODE: 67 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	1830.33
CADMIUM	< .02
COPPER	.34
LEAD	.97
ZINC	1.53
NICKEL	.33
CHROMIUM	1.58

RIVER: CHIPOLA CODE: 68 STATION: 37
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	2590.00
CADMIUM	< .02
COPPER	.67
LEAD	2.53
ZINC	1.81
NICKEL	.80
CHROMIUM	3.05

RIVER: CHIPOLA CODE: 69 STATION: 08
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	1230.30
CADMIUM	< .02
COPPER	.41
LEAD	22.00
ZINC	1.66
NICKEL	.48
CHROMIUM	1.38

RIVER: CHIPOLA CODE: 63 STATION: 2A
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	1330.00
CADMIUM	.03
COPPER	2.41
LEAD	16.00
ZINC	35.30
NICKEL	.48
CHROMIUM	1.21

RIVER: CHIPOLA CODE: 65 STATION: 4A
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	1200.30
CADMIUM	< .02
COPPER	.37
LEAD	.97
ZINC	1.70
NICKEL	.38
CHROMIUM	2.08

RIVER: CHIPOLA CODE: 66 STATION: 4B
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-05-84

METAL	MEASURE (PPM)
ALUMINUM	2400.00
CADMIUM	< .02
COPPER	.74
LEAD	3.23
ZINC	2.48
NICKEL	.64
CHROMIUM	2.01

RIVER: CHIPOLA CODE: 77 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-14-84

METAL	MEASURE (PPM)
ALUMINUM	9400.30
CADMIUM	.46
COPPER	.51
LEAD	404.20
ZINC	7.20
NICKEL	1.60
CHROMIUM	653.00

RIVER: CHIPOLA CODE: 81 STATION: 36
TYPE: SEDIMENTS
SAMPLED-FIELD: 11-14-84

METAL	MEASURE (PPM)
ALUMINUM	1550.00
CADMIUM	< .02
COPPER	[illegible]
LEAD	1.2[illegible]
ZINC	1.97
NICKEL	.47
CHROMIUM	1.72

RIVER: CHIPOLA CODE: 90 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-13-84

RIVER: CHIPOLA CODE: 92 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 12-13-84

RIVER: CHIPOLA CODE: 196 STATION: 4A
TYPE: SEDIMENTS
SAMPLED-FIELD: [illegible]-05

METAL		MEASURE (PPM)
ALUMINUM		5714.00
CADMIUM		.12
COPPER		1.92
LEAD		8.60
ZINC	<	1.00
NICKEL		1.25
CHROMIUM		4.13

RIVER: CHIPOLA CODE: 197 STATION: 4B
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-08-85

METAL		MEASURE (PPM)
ALUMINUM		1829.00
CADMIUM		.05
COPPER		.56
LEAD		2.87
ZINC	<	1.33
NICKEL		.46
CHROMIUM		1.62

RIVER: CHIPOLA CODE: 192 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-08-85

METAL		MEASURE (PPM)
ALUMINUM		8799.25
CADMIUM		.13
COPPER		3.24
LEAD		252.25
ZINC	<	1.00
NICKEL		2.34
CHROMIUM		4.37

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COPPER	.53
LEAD	1.32
ZINC	< 1.50
NICKEL	.62
CHROMIUM	2.20

RIVER: CHIPOLA CODE: 162 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 02-12-85

METAL	MEASURE (PPM)
ALUMINUM	24520.00
CADMIUM	.58
COPPER	4.66
LEAD	133.00
ZINC	< 1.00
NICKEL	4.75
CHROMIUM	14.90

RIVER: CHIPOLA CODE: 175 STATION: 01
TYPE: SEDIMENTS
SAMPLED-FIELD: 03-15-85

METAL	MEASURE (PPM)
ALUMINUM	5155.00
CADMIUM	.23
COPPER	5.17
LEAD	591.00
ZINC	< 1.50
NICKEL	1.50
CHROMIUM	4.49

RIVER: CHIPOLA CODE: 193 STATION: 02
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	7465.00
CADMIUM	.18
COPPER	4.17
LEAD	20.20
ZINC	< 1.00
NICKEL	1.56
CHROMIUM	6.61

RIVER: CHIPOLA CODE: 198 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	1552.67
CADMIUM	.04
COPPER	.43
LEAD	2.22
ZINC	< 1.00
NICKEL	.47
CHROMIUM	1.18

RIVER: CHIPOLA CODE: 500 STATION: 08
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	1312.30
CADMIUM	.04
COPPER	.40
LEAD	10.70
ZINC	< 1.50
NICKEL	.51
CHROMIUM	.97

COPPER	.59
LEAD	1.83
ZINC	< 1.00
NICKEL	.61
CHROMIUM	[illegible]

RIVER: CHIPOLA CODE: 163 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 02-12-85

METAL	MEASURE (PPM)
ALUMINUM	1443.00
CADMIUM	.05
COPPER	.30
LEAD	1.52
ZINC	< 1.00
NICKEL	.56
CHROMIUM	1.12

RIVER: CHIPOLA CODE: 177 STATION: 06
TYPE: SEDIMENTS
SAMPLED-FIELD: 03-15-85

METAL	MEASURE (PPM)
ALUMINUM	891.00
CADMIUM	.04
COPPER	.47
LEAD	3.17
ZINC	< 1.00
NICKEL	.25
CHROMIUM	.71

RIVER: CHIPOLA CODE: 195 STATION: 04
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	3740.00
CADMIUM	.07
COPPER	1.34
LEAD	5.04
ZINC	< 1.00
NICKEL	1.01
CHROMIUM	6.10

RIVER: CHIPOLA CODE: 199 STATION: 07
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	2087.00
CADMIUM	.05
COPPER	.81
LEAD	3.11
ZINC	< 1.55
NICKEL	.64
CHROMIUM	2.11

RIVER: CHIPOLA CODE: 194 STATION: 24
TYPE: SEDIMENTS
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	8204.00
CADMIUM	.12
COPPER	2.35
LEAD	36.30
ZINC	< 1.00
NICKEL	1.75
CHROMIUM	6.54

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METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	.10
LEAD	.25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 232 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.33
CADMIUM	< .10
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 234 STATION: 08
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 236 STATION: 10
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.30
CADMIUM	< .10
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 243 STATION: 04
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	.28
CADMIUM	< .01
COPPER	.02
LEAD	< .01
ZINC	.32
NICKEL	< .01
CHROMIUM	< .05

RIVER: CHIPOLA CODE: 245 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	.89
CADMIUM	< .01
COPPER	.01

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	.10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 233 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 235 STATION: 09
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	.14
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 237 STATION: 11
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	< .10
LEAD	< .25
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 244 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-16-83

METAL	MEASURE (PPM)
ALUMINUM	1.95
CADMIUM	< .01
COPPER	.02
LEAD	< .01
ZINC	.08
NICKEL	.01
CHROMIUM	< .05

RIVER: CHIPOLA CODE: 26 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 02-22-84

METAL	MEASURE (PPM)
ALUMINUM	1.80
CADMIUM	< .01
COPPER	.02

METALS REPORT

Metals EP DC Water (80)

C.. - MEANS NOT FOUND
< - MEANS BELOW THE DETECTION LIMIT AT THAT NUMBER
99 - FOR ANY POSITION OF A DATA MEANS THAT IT WAS NOT RECORDED

RIVER: CHIPOLA CODE: 27 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 03-02-83

METAL	MEASURE (PPM)
ALUMINUM	3.60
CADMIUM	< .01
COPPER	.03
LEAD	.70
ZINC	.90
NICKEL	.00
CHROMIUM	.00

RIVER: CHIPOLA CODE: 206 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	< .50
CADMIUM	.23
COPPER	.31
LEAD	36.50
ZINC	1.53
NICKEL	< .20
CHROMIUM	3.82

RIVER: CHIPOLA CODE: 209 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	< .50
CADMIUM	.16
COPPER	< .10
LEAD	11.25
ZINC	.60
NICKEL	< .20
CHROMIUM	2.88

RIVER: CHIPOLA CODE: 211 STATION: 03
TYPE: SURVEY WATER
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	< .50
CADMIUM	< .10
COPPER	.13
LEAD	.73
ZINC	< .10
NICKEL	< .20
CHROMIUM	.24

RIVER: CHIPOLA CODE: 213 STATION: 04
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-99-83

METAL	MEASURE (PPM)
ALUMINUM	< .50
CADMIUM	.23
COPPER	< .10
LEAD	< .10
ZINC	< .10
NICKEL	< .20
CHROMIUM	< .20

RIVER: CHIPOLA CODE: 216 STATION: 05
TYPE: SURVEY WATER
SAMPLED-FIELD: 08-99-83

METAL	MEASURE (PPM)
ALUMINUM	< .50
CADMIUM	< .10
COPPER	< .10
LEAD	.50
ZINC	< .10
NICKEL	< .20
CHROMIUM	< .20

RIVER: CHIPOLA CODE: 225 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	< .10
LEAD	2.61
ZINC	< .10
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 229 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	< .10
COPPER	.12
LEAD	1.00
ZINC	.25
NICKEL	< .25
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 233 STATION: 04
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

RIVER: CHIPOLA CODE: 231 STATION: 05
TYPE: SURVEY WATER
SAMPLED-FIELD: 09-27-83

RIVER: CHIPOLA CODE: 266 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		.54
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.01
ZINC	<	.02
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 269 STATION: 11
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		1.10
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.01
ZINC	<	.02
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 283 STATION: 4A
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		1.90
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.01
ZINC	<	.02
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 74 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 08-31-84

METAL		MEASURE (PPM)
ALUMINUM		.30
CADMIUM	<	.02
COPPER	<	.01
LEAD		.03
ZINC		.02
NICKEL	<	.08
CHROMIUM	<	.10

RIVER: CHIPOLA CODE: 42 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL		MEASURE (PPM)
ALUMINUM		12.[illegible]
CADMIUM	<	.[illegible]
COPPER	<	.[illegible]
LEAD		.[illegible]
ZINC		.[illegible]
NICKEL	<	.[illegible]
CHROMIUM	<	.10

RIVER: CHIPOLA CODE: 47 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

RIVER: CHIPOLA CODE: 257 STATION: 31
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		.54
CADMIUM	<	.03
COPPER	<	.02
LEAD	<	.01
ZINC	<	.02
NICKEL	<	.06
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 281 STATION: 2A
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		1.70
CADMIUM		.02
COPPER	<	.02
LEAD		.01
ZINC	<	.02
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 284 STATION: 4B
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		2.70
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.01
ZINC		.04
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 41 STATION: 31
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL		MEASURE (PPM)
ALUMINUM		.43
CADMIUM	<	.02
COPPER		.04
LEAD		.04
ZINC		.02
NICKEL	<	.08
CHROMIUM	<	.10

RIVER: CHIPOLA CODE: 46 STATION: 36
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL		MEASURE (PPM)
ALUMINUM		.[illegible]
CADMIUM	<	.[illegible]
COPPER	<	.[illegible]
LEAD	<	.[illegible]
ZINC		.[illegible]
NICKEL	<	.[illegible]
CHROMIUM	<	.10

RIVER: CHIPOLA CODE: 48 STATION: 08
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

LEAD	<	.31
ZINC		.31
NICKEL		.31
CHROMIUM	<	.25

RIVER: CHIPOLA CODE: [illegible] STATION: [illegible]
TYPE: SURVEY WATER
SAMPLED-FIELD: 05-19-84

METAL		MEASURE (PPM)
ALUMINUM		.00
CADMIUM		.30
COPPER		.00
LEAD		.00
ZINC		.30
NICKEL	<	.01
CHROMIUM	<	.00

RIVER: CHIPOLA CODE: 25 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 06-26-84

METAL		MEASURE (PPM)
ALUMINUM		1.10
CADMIUM	<	.01
COPPER		.02
LEAD		2.00
ZINC		.07
NICKEL		.30
CHROMIUM		.00

RIVER: CHIPOLA CODE: 290 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-16-84

METAL		MEASURE (PPM)
ALUMINUM		.90
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.31
ZINC	<	.02
NICKEL	<	.34
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 274 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		1.12
CADMIUM		.02
COPPER	<	.12
LEAD		4.31
ZINC		.02
NICKEL	<	.34
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 292 STATION: 04
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		3.36
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.31
ZINC		.02
NICKEL	<	.34
CHROMIUM	<	.32

LEAD		5.40
ZINC		.05
NICKEL		.23
CHROMIUM		.23

RIVER: [illegible] CODE: 28 STATION: [illegible]
TYPE: SURVEY WATER
SAMPLED-FIELD: 05-06-84

METAL		MEASURE (PPM)
ALUMINUM		.80
CADMIUM	<	.01
COPPER		.01
LEAD		.26
ZINC		.14
NICKEL		.00
CHROMIUM		.03

RIVER: CHIPOLA CODE: 289 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-16-84

METAL		MEASURE (PPM)
ALUMINUM		.83
CADMIUM	<	.02
COPPER	<	.02
LEAD		2.47
ZINC		.32
NICKEL	<	.04
CHROMIUM	<	.02

RIVER: CHIPOLA CODE: 95 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-24-84

METAL		MEASURE (PPM)
ALUMINUM		.83
CADMIUM		.01
COPPER		.02
LEAD		2.52
ZINC		.08
NICKEL		.05
CHROMIUM		.08

RIVER: CHIPOLA CODE: 278 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM		1.51
CADMIUM	<	.02
COPPER	<	.02
LEAD		.80
ZINC		.32
NICKEL	<	.04
CHROMIUM	<	.32

RIVER: CHIPOLA CODE: 285 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 07-31-84

METAL		MEASURE (PPM)
ALUMINUM	<	.30
CADMIUM	<	.02
COPPER	<	.02
LEAD	<	.01
ZINC	<	.32
NICKEL		.34
CHROMIUM	<	.2

COPPER	.03
LEAD	3.45
ZINC	.00
NICKEL	.05
CHROMIUM	.50

RIVER: CHIPOLA CODE: [illegible] STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-08-85 01 15 85

METAL	MEASURE (PPM)
ALUMINUM	7.40
CADMIUM	.03
COPPER	.03
LEAD	2.01
ZINC	.00
NICKEL	.03
CHROMIUM	.00

RIVER: CHIPOLA CODE: 106 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-14-85

METAL	MEASURE (PPM)
ALUMINUM	[illegible]
CADMIUM	[illegible]
COPPER	[illegible]
LEAD	[illegible]
ZINC	[illegible]
NICKEL	[illegible]
CHROMIUM	.50

RIVER: CHIPOLA CODE: 135 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	22.70
CADMIUM	.01
COPPER	.02
LEAD	.50
ZINC	.00
NICKEL	.05
CHROMIUM	.00

RIVER: CHIPOLA CODE: 141 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	.30
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.00

RIVER: CHIPOLA CODE: 137 STATION: 2A
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	3.70
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.00

COPPER	.15
LEAD	.01
ZINC	.01
NICKEL	.01
CHROMIUM	.10

RIVER: CHIPOLA CODE: 109 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: [illegible]-14-85

METAL	MEASURE (PPM)
ALUMINUM	8.30
CADMIUM	.03
COPPER	.03
LEAD	3.50
ZINC	.00
NICKEL	.05
CHROMIUM	.00

RIVER: CHIPOLA CODE: 135 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

RIVER: CHIPOLA CODE: 143 STATION: 03
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	.53
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.00

RIVER: CHIPOLA CODE: 142 STATION: 08
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	.30
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.00

RIVER: CHIPOLA CODE: 138 STATION: 4A
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
ALUMINUM	.51
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.03
NICKEL	.05
CHROMIUM	.00

METAL	MEASURE (PPM)
ALUMINUM	.42
CADMIUM	< .02
COPPER	< .03
LEAD	< .01
ZINC	.13
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 43 STATION: 2A
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL	MEASURE (PPM)
ALUMINUM	1.10
CADMIUM	< .02
COPPER	< .03
LEAD	.01
ZINC	.01
NICKEL	< .08
CHROMIUM	1.10

RIVER: CHIPOLA CODE: 45 STATION: 4B
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL	MEASURE (PPM)
ALUMINUM	.60
CADMIUM	< .02
COPPER	< .03
LEAD	< .01
ZINC	.02
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 66 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 11-14-84 01 10 84

METAL	MEASURE (PPM)
ALUMINUM	3.76
CADMIUM	.01
COPPER	.04
LEAD	1.62
ZINC	.04
NICKEL	.05
CHROMIUM	.07

RIVER: CHIPOLA CODE: 67 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 11-30-84 01 10 85

METAL	MEASURE (PPM)
ALUMINUM	4.20
CADMIUM	.01
COPPER	.03
LEAD	3.35
ZINC	.00
NICKEL	.05
CHROMIUM	.02

RIVER: CHIPOLA CODE: 90 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-13-84 01 10 85

METAL	MEASURE (PPM)
ALUMINUM	4.30
CADMIUM	.01

METAL	MEASURE (PPM)
ALUMINUM	.41
CADMIUM	< .02
COPPER	< .03
LEAD	.03
ZINC	.01
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 44 STATION: 4A
TYPE: SURVEY WATER
SAMPLED-FIELD: 10-31-84

METAL	MEASURE (PPM)
ALUMINUM	1.10
CADMIUM	< .02
COPPER	< .03
LEAD	< .01
ZINC	.04
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 75 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 11-14-84

METAL	MEASURE (PPM)
ALUMINUM	4.40
CADMIUM	< .02
COPPER	< .01
LEAD	1.88
ZINC	.04
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 79 STATION: 36
TYPE: SURVEY WATER
SAMPLED-FIELD: 11-14-84

METAL	MEASURE (PPM)
ALUMINUM	16.60
CADMIUM	< .02
COPPER	< .03
LEAD	< .01
ZINC	.05
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 91 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-13-84

METAL	MEASURE (PPM)
ALUMINUM	5.20
CADMIUM	< .02
COPPER	< .03
LEAD	3.70
ZINC	.03
NICKEL	< .08
CHROMIUM	< .10

RIVER: CHIPOLA CODE: 93 STATION: 36
TYPE: SURVEY WATER
SAMPLED-FIELD: 12-13-84

METAL	MEASURE (PPM)
ALUMINUM	.20
CADMIUM	< .02

RIVER: CHIPOLA CODE: 139 STATION: 48
TYPE: SURVEY WATER
SAMPLED-FIELD: 01-29-85

METAL	MEASURE (PPM)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

RIVER: [illegible] CODE: [illegible] STATION: [illegible]
TYPE: SURVEY WATER
SAMPLED-FIELD: 02-12-85

METAL	MEASURE (PPM)
ALUMINUM	[illegible]
CADMIUM	[illegible]
COPPER	[illegible]
LEAD	[illegible]
ZINC	[illegible]
NICKEL	[illegible]
CHROMIUM	.08

RIVER: CHIPOLA CODE: 176 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 03-19-85

METAL	MEASURE (PPM)
ALUMINUM	.50
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 184 STATION: 02
TYPE: SURVEY WATER
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	6.60
CADMIUM	.04
COPPER	.01
LEAD	.20
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 189 STATION: 06
TYPE: SURVEY WATER
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	.50
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 191 STATION: 08
TYPE: SURVEY WATER

RIVER: CHIPOLA CODE: 164 STATION: [illegible]
TYPE: [illegible]

METAL	MEASURE (PPM)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] CODE: [illegible] STATION: [illegible]
TYPE: SURVEY WATER
SAMPLED-FIELD: 03-19-85

METAL	MEASURE (PPM)
ALUMINUM	[illegible]
CADMIUM	[illegible]
COPPER	[illegible]
LEAD	2.23
ZINC	.53
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 183 STATION: 01
TYPE: SURVEY WATER
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	3.67
CADMIUM	.01
COPPER	.01
LEAD	2.86
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 186 STATION: 04
TYPE: SURVEY WATER
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	.80
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 190 STATION: 07
TYPE: SURVEY WATER
SAMPLED-FIELD: 04-05-85

METAL	MEASURE (PPM)
ALUMINUM	.50
CADMIUM	.01
COPPER	.01
LEAD	.10
ZINC	.00
NICKEL	.05
CHROMIUM	.08

RIVER: CHIPOLA CODE: 185 STATION: 2A
TYPE: SURVEY WATER

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[illegible] and [illegible]

[illegible]

[illegible]

[illegible] GROUND
[illegible] DETECTION LIMIT AT THAT NUMBER
[illegible] PRECISION OF A DATA PLANS THAT IT WAS NOT RECORDED

[illegible] CODE: [illegible] STATION: 01
[illegible] ELUTRIATE OF SEDIMENTS
SAMPLED-FIELD: 02-26-84 ELUTRIATED: 03-04-84

METAL	MEASURE (PPM)
ALUMINUM	.35
[illegible]	< .01
[illegible]	< .03
[illegible]	1.50
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	< [illegible]

[illegible] CODE: 258 STATION: 01
[illegible] ELUTRIATE OF SEDIMENTS
SAMPLED-FIELD: [illegible] ELUTRIATED: 03-25-84

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	.00
COPPER	.00
LEAD	.00
ZINC	.00
NICKEL	.00
CHROMIUM	.01

[illegible]

METAL	MEASURE (PPM)
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	2.[illegible]
[illegible]	< .01

[illegible] CODE: 255 STATION: 06
[illegible] ELUTRIATE OF SEDIMENTS
SAMPLED-FIELD: [illegible] ELUTRIATED: [illegible] 25-84

METAL	MEASURE (PPM)
ALUMINUM	.00
CADMIUM	.00
COPPER	.00
LEAD	.00
ZINC	.00
NICKEL	.00
CHROMIUM	< .01

[illegible] CODE: [illegible] STATION: 01
[illegible] ELUTRIATE OF SEDIMENTS
SAMPLED-FIELD: [illegible] ELUTRIATED: [illegible]-21-84

METAL	MEASURE (PPM)
ALUMINUM	2.[illegible]
[illegible]	.02
[illegible]	< .03
[illegible]	11.50
[illegible]	.11
[illegible]	[illegible]
[illegible]	< .55

[illegible] 0.1[illegible]

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APPENDIX B

PRIORITY POLLUTANT CONFIRMATION STUDY
ANALYTICAL DATA

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ecology and environment, inc.
ANALYTICAL SERVICES CENTER, P O BOX D, BUFFALO, NEW YORK 14225, TEL 716-631-0360
International Specialists in the Environmental Sciences

DATE: November 8, 1985

TO: Florida Department of Environmental Regulation
Job No. U-2387

Case Narrative

General

Enclosed are the analytical results for case no. U-2387. All samples were received in good condition on September 21, 1985.

Volatiles

Vinyl acetate was not present in the calibration standard because we have been unable to obtain a pure standard from USEPA. It was not detected in any sample. For the same reason, 1,1-dichloroethene was not included in the matrix spike solution.

Vinyl chloride (ccc) exhibited a % D greater than 25% on September 27, 1985. Since its presence was not detected in the samples, this has caused no significant effect on the sample data.

Semivolatiles

Di-n-octylphthalate (ccc) exhibited % D more than 25% on October 4, 1985 and pentachlorophenol exhibited % D more than 25% on October 7, 1985 calibration check analyses.

The semivolatile fraction of sample DSW-02 (lab #6631) was analyzed twice because of low surrogate recovery. Both analysis are reported.

2-methylphenol was initially detected in sample FSW-02 (lab #6630) but not in the field duplicate sample DSW-02 (lab #6631). Because of this discrepancy, sample FSW-02 was re-extracted and re-analyzed for the acid phenolic compounds only. No 2-methylphenol was then detected, preventing confirmation of the compound. Information concerning tentatively identified compounds in sample FSW-02 was obtained from the initial analysis of that sample. We are currently investigating this apparent sample contamination.

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QA/QC SAMPLES

Laboratory QC samples are identified by the following table headings:

Quality Control for Accuracy:	Percent Difference - EPA Quality Assurance Materials
Quality Control for Accuracy:	Percent Recovery for Spiked Water (Soil) Samples
Quality Control for Precision:	Results of Analysis of Replicate Water (Soil) Samples

Trip and rinsate blank samples are numbered as follows:

Trip Blanks	Rinsate Samples
SBB01	FSR01
SBB02	FSR02
SBB03	FSR03
SBB04	FSR04
SBB05	FSR05
SBB06	FSR06
SBB07	FSR07
	FSR08
	FSR09
GWB01	FSR16
GWBB01	FSR17
GWBB02	FSR18
GWBB03	
	GWR01
HGWBB	GWR02
	GWR03
	GWR04
	GWR05

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2387

Sample Date: 9/19,20/85 Sampled By: E & E, Inc.

Date Received: 9/21/85 Delivered By: Federal Express

Sample Type: Water Grab

E & E Lab Number 85-	Customer Number	Cyanide mg/L	Sulfate mg/L
6627	FEW 03A	<0.020	29
6628	FSW 01	<0.020	24
6629	FRW 01	<0.020	86
6630	FSW 02	<0.020	29
6631	DSW 02	<0.020	29
6632	FSW 03	<0.020	66
6633	FSW 04	<0.020	38
6634	FEW 03C	<0.020	330
6635	FEW 09C	<0.020	39
6636	FEW 03BB	<0.020	2000
6637	GWR 01	<0.020	1.0
6638	GWB 01	<0.020	1.0

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983.

Supervising Analyst [illegible]

Date: November 20, 1985

036114

Pesticides/PCBs

Heptachlor exhibited a percent difference more than 15% on the October 9, 1985 standard check for quantitation. Delta-BHC, gamma-BHC, heptachlor and endrin exhibited a percent difference more than 20% on the November 1, 1985 standard check for confirmation. Since none of these compounds were confirmed as being present in the samples, the percent difference has no significant effect on the sample data.

If you have any questions on any analyses, please contact me.

Sincerely,

Andrew P. Clifton

APC/cmp

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RESULTS OF WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/L)

E & E Laboratory No.: 85-	6633	6634	6635	6636	6637	6638
Sample Identity	FSW 04	FEW 03C	FEW 09C	FEW 038B	GWR 01	GWB 01
Antimony	<0.060	0.118	<0.060	<0.060	<0.060	<0.060
Arsenic	<0.005	0.282	0.006	0.021	<0.005	<0.005
Beryllium	<0.015	<0.015	<0.015	0.017	<0.015	<0.015
Cadmium	<0.001	0.004	<0.001	0.246	<0.001	<0.001
Chromium	<0.015	<0.015	<0.015	0.037	<0.015	<0.015
Copper	<0.025	<0.025	<0.025	0.061	<0.025	<0.025
Lead	0.055	4.96	6.27	1.28	0.008	0.010
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	<0.020	<0.020	<0.020	0.495	0.053	<0.020
Selenium	<0.005	<0.050	<0.005	<0.050	<0.005	<0.005
Silver	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Thallium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	0.034	0.078	0.085	2.20	<0.020	<0.020

U-2387

RESULTS OF WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/L)

E & E Laboratory No.: 85-	6627	6628	6629	6630	6631	6632
Sample Identity	FEW 03A	FSW 01	FRW 01	FSW 02	DSW 02	FSW 03
Antimony	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Beryllium	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Cadmium	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Copper	0.119	<0.025	<0.025	<0.025	<0.025	<0.025
Lead	0.609	0.014	<0.005	1.01	1.06	0.034
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	0.028	0.038	0.028	<0.020	0.023	<0.020
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	<0.005	<0.005	<0.005	0.006	<0.005	<0.005
Thallium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	0.160	<0.020	0.271	<0.020	<0.020	<0.020

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Analysis	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(µg/L)			
Antimony	6638	<60	120	116	97
Arsenic	6638	<5	25	23.2	93
Cadmium	6638	<1	2.5	3.0	120
Lead	6638	[illegible].8	25	28.8	76
Mercury	6638	<0.2	1.0	1.06	106
Selenium	6638	<5	25	26.5	106
Silver	6638	<5	25	25.8	103
Thallium	6638	<5	25	18.8	75
Cyanide	6638	<20	45	42.6	95

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Chromium	6631	<0.015	<0.015	--
Beryllium	6631	<0.015	<0.015	--
Copper	6631	<0.025	<0.025	--
Nickel	6631	0.023	<0.020	--
Zinc	6631	<0.020	<0.020	--
Silver	6631	<0.005	<0.005	--
Arsenic	6631	<0.005	<0.005	--
Antimony	6631	<0.060	<0.060	--
Selenium	6631	<0.005	<0.005	--
Thallium	6631	<0.005	<0.005	--
Mercury	6630	<0.0002	<0.0002	--
Cadmium	6631	<0.001	<0.001	--
Lead	6631	1.06	1.10	3.7
Cyanide	6636	<0.020	<0.020	--

The relative percent differene cannot be calculated with one result. The original analysis result was only three ug/L above the detection limit so it is not unusual that the replicate resulted in no nickel detected.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2392

Sample Date: 9/20/85 Sampled By: E & E, Inc.

Date Received: 9/24/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number 85-	Customer Number	Cyanide mg/kg*	Water Extractable Sulfate mg/kg**	% Solids
6656	FM Rinsate 2040	<0.020 mg/L	1.0 mg/L	--
6657	FSG 23P	<1	33	87
6658	FSG 54P	<1	86	97
6659	FSA 06P	<1	110	88
6660	FSA 09P	<1	260	87
6661	DSA 09P	<1	290	87
6662	FMH 20	<1	150	74

*As Received

**Dry Weight

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983.

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, "SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst Gary Hahn / KAS

Date: September 20, 1985

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036114

U-2387

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

Element	Concentrations in µg/L		Percent Difference
	Known	Determined	
Antimony	101.5	108.9	7.3
Arsenic	26.7	26.0	2.6
Beryllium	235	219	6.8
Cadmium	3.3	3.2	3.0
Chromium	261	248	5.0
Copper	339	315	7.1
Lead	42.7	42.2	1.2
Mercury	8.73	9.02	3.3
Nickel	207	221	6.8
Selenium	50.2	43.6	13.1
Silver	600	608	1.3
Thallium	25.0	27.1	8.4
Zinc	418	432	3.3

Note: These results are within the 95% confidence interval for these parameters.

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U-2392

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
VOLATILE ORGANIC COMPOUNDS

(results in ug/kg as received unless noted)

		E & E Lab Number 85-	6656	6657	6658	6659	6660	6661	6662
		Sample Identity	FM Rinsate µg/L	FSG	FSG	FSA	FSA	DSA	FMH
PP#	CAS#	Compound	2040	23P	54P	06P	09P	09P	20
		acetone+	6.8	<50	85	310	130	180	190
(4V)	71-43-2	benzene	<3	<50	<50	<50	<50	<50	<50
(6V)	56-23-5	carbon tetrachloride	<3	<50	<50	<50	<50	<50	<50
(7V)	108-90-7	chlorobenzene	<3	<50	<50	<50	<50	<50	<50
(10V)	107-06-2	1,2-dichloroethane	<3	<50	<50	<50	<50	<50	<50
(11V)	71-55-6	1,1,1-trichloroethane+	3.5	<50	<50*	<50*	<50*	<50*	<50
(13V)	75-34-3	1,1-dichloroethane	<3	<50	<50	<50	<50	<50	<50
(14V)	79-00-5	1,1,2-trichloroethane	<3	<50	<50	<50	<50	<50	<50
(15V)	79-34-5	1,1,2,2-tetrachloroethane	<3	<50	<50	<50	<50	<50	<50
(16V)	75-00-3	chloroethane	<3	<50	<50	<50	<50	<50	<50
(19V)	110-75-8	2-chloroethylvinyl ether	<3	<50	<50	<50	<50	<50	<50
(23V)	67-66-3	chloroform+	<3	81	280	<50*	<50*	<50*	96
(29V)	75-35-4	1,1-dichloroethene	<3	<50	<50	<50	<50	<50	<50
(30V)	156-60-5	trans-1,2-dichloroethene	<3	<50	<50	<50	<50	<50	<50
(32V)	78-87-5	1,2-dichloropropane	<3	<50	<50	<50	<50	<50	<50
(33V)	10061-02-6	trans-1,3-dichloropropene	<3	<50	<50	<50	<50	<50	<50
	10061-01-05	cis-1,3-dichloropropene	<3	<50	<50	<50	<50	<50	<50
(38V)	100-41-4	ethylbenzene	<3	<50	<50	<50	<50	<50	<50
(44V)	75-09-2	methylene chloride+	<3*	<50	<50	<50*	<50*	<50*	<50
(45V)	74-87-3	chloromethane	<3	<50	<50	<50	<50	<50	<50
(46V)	74-83-9	bromomethane	<3	<50	<50	<50	<50	<50	<50
(47V)	75-25-2	bromoform	<3	<50	<50	<50	<50	<50	<50
(48V)	75-27-4	bromodichloromethane	<3	<50	<50	<50	<50	<50	<50
(51V)	124-48-1	chlorodibromomethane	<3	<50	<50	<50	<50	<50	<50
(85V)	127-18-4	tetrachloroethene	<3	<50	<50	<50	<50	<50	<50
(86V)	108-88-3	toluene+	<3	<50	<50	<50	<50	<50	<50
(87V)	79-01-6	trichloroethene	<3	<50	<50	<50	<50	<50	<50
(88V)	75-01-4	vinyl chloride	<3	<50	<50	<50	<50	<50	<50
		2 butanone+	<3	<50	<50	89	54	63	<50

*Compound present below measurable detection limit
+Compound present in instrument blank

U-2392

RESULTS OF A WATER AND SOIL ANALYSES
FOR PRIORITY POLLUTANT METALS

(results in mg/kg as received unless noted)

E & E Laboratory No.: 85-	6656*	6657	6658	6659	6660	6661	6662
Sample Identity	FM Rinsate 2040	FSG 23P	FSG 54P	FSA 06P	FSA 09P	DSA 09P	FMH 20
Antimony	<0.060	<6.0	<6.0	<6.0	6.19	8.63	<6.0
Arsenic	<0.005	0.58	0.65	1.92	9.24	7.26	<0.50
Beryllium	<0.015	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Cadmium	<0.001	<0.10	<0.10	1.69	0.136	0.118	<0.10
Chromium	<0.015	11.9	6.5	3.7	5.3	5.8	8.4
Copper	<0.025	<2.5	3.7	3.3	4.0	3.8	<2.5
Lead	0.114	139	262	89.3	27,500	25,200	108
Mercury	<0.0002	<0.10	<0.10	<0.05	<0.05	<0.10	<0.05
Nickel	0.023	5.8	5.7	5.5	4.1	4.4	3.1
Selenium	<0.005	<0.50	<0.50	<0.50	<5.0	<5.0	<0.50
Silver	<0.005	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thallium	<0.005	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	<0.020	9.0	6.6	4.0	4.5	6.2	7.8

*mg/L

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RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL COMPOUNDS

(all results in µg/kg as received)

#	CAS #	Compound	E & E Lab No. 85-	6657	6658	6659	6660	6661	6662
			Sample Identity	FSG 23P	FSG 54P	FSA 06P	FSA 09P	DSA 09P	FMH 20
1B)	83-32-9	acenaphthene		<500	<500	<500	<500	<500	<500
5B)	92-87-5	benzidine		<2500	<2500	<2500	<2500	<2500	<250
3B)	120-82-1	1,2,4-trichlorobenzene		<500	<500	<500	<500	<500	<500
9B)	118-74-1	hexachlorobenzene		<500	<500	<500	<500	<500	<500
12B)	67-72-1	hexachloroethane		<500	<500	<500	<500	<500	<500
18B)	111-44-4	bis(2-chloroethyl)ether		<500	<500	<500	<500	<500	<500
20B)	91-58-7	2-chloronaphthalene		<500	<500	<500	<500	<500	<500
25B)	95-50-1	1,2-dichlorobenzene		<500	<500	<500	<500	<500	<500
26B)	541-73-1	1,3-dichlorobenzene		<500	<500	<500	<500	<500	<500
27B)	106-46-7	1,4-dichlorobenzene		<500	<500	<500	<500	<500	<500
28B)	91-94-1	3,3'-dichlorobenzidine		<1500	<1500	<1500	<1500	<1500	<150
35B)	121-14-2	2,4-dinitrotoluene		<500	<500	<500	<500	<500	<500
36B)	606-20-2	2,6-dinitrotoluene		<500	<500	<500	<500	<500	<500
37B)	122-66-7	1,2-diphenylhydrazine		<500	<500	<500	<500	<500	<500
39B)	206-44-0	fluoranthene		<500	<500	<500	<500*	<500*	<500
40B)	7005-72-3	4-chlorophenyl phenyl ether		<500	<500	<500	<500	<500	<500
41B)	101-55-3	4-bromophenyl phenyl ether		<500	<500	<500	<500	<500	<500
42B)	39638-32-9	bis(2-chloroisopropyl)ether		<500	<500	<500	<500	<500	<500
43B)	111-91-1	bis(2-chloroetoxy)methane		<500	<500	<500	<500	<500	<500
52B)	87-68-3	hexachlorobutadiene		<500	<500	<500	<500	<500	<500
53B)	77-47-4	hexachlorocyclopentadiene		<500	<500	<500	<500	<500	<500
54B)	78-59-1	isophorone		<500	<500	<500	<500	<500	<500
55B)	91-20-1	naphthalene		<500	<500	<500	<500*	500	<500
56B)	98-95-3	nitrobenzene		<500	<500	<500	<500	<500	<500
62B)	86-30-6	N-nitrosodiphenylamine		<500	<500	<500	<500*	<500*	<500
63B)	621-64-7	N-nitrosodipropylamine		<500	<500	<500	<500	<500	<500
66B)	117-81-0	bis(2-ethylhexyl) phthalate		<500*	<500*	<500*	15000	14000	<500
67B)	85-68-7	benzyl butyl phthalate		<500	<500	<500	<500*	<500*	<500
68B)	84-74-2	di-n-butyl phthalate		1300	2300	1800	2000	1500	1800
69B)	117-84-0	di-n-octyl phthalate		<500	<500	<500	<500*	<500	<500
70B)	84-66-2	diethyl phthalate		<500	<500	<500	<500	<500	<500
71B)	131-11-3	dimethyl phthalate		<500	<500	<500	<500	<500	<500
72B)	56-55-3	benzo(a)anthracene		<500	<500	<500	<500*	<500*	<500
73B)	50-32-8	benzo(a)pyrene		<500	<500	<500	<500	<500	<500
74B)	205-99-2	benzo(b)fluoranthene		<500	<500	<500	<500*	<500	<500
75B)	207-08-9	benzo(k)fluoranthene		<500	<500	<500	<500	<500*	<500
76B)	218-01-9	chrysene		<500	<500	<500	800	800	<500
77B)	208-96-8	acenaphthylene		<500	<500	<500	<500	<500	<500
78B)	120-12-7	anthracene		<500	<500	<500	<500*	<500	<500
79B)	191-24-2	benzo(ghi)perylene		<500	<500	<500	<500	<500*	<500
80B)	86-73-7	fluorene		<500	<500	<500	<500	<500	<500
81B)	85-01-8	phenanthrene		<500	<500	<500	700	600	<500
82B)	53-70-3	dibenzo(a,h)anthracene		<500	<500	<500	<500	<500	<500
83B)	193-39-5	indeno(1,2,3-cd)pyrene		<500	<500	<500	<500	<500	<500
84B)	129-00-0	pyrene		<500	<500	<500	<500	<500*	<500
		2-methylnaphthalene		<500	<500	<500	<500*	<500*	<500

*Compound present below measurable detection limits

U-2392

RESULTS OF SOIL ANALYSIS FOR
ACID COMPOUNDS

(all results in µg/kg as received)

PP #	CAS #	Compound	6657 FSG 23P	6658 FSG 54P	6659 FSA 06P	6660 FSA 09P	6661 DSA 09P	6662 FMH 20
(21A)	88-06-2	2,4,6-trichlorophenol	<500	<500	<500	<500	<500	<500
(22A)	59-50-7	p-chloro-m-cresol	<500	<500	<500	<500	<500	<500
(24A)	95-57-8	2-chlorophenol	<500	<500	<500	<500	<500	<500
(31A)	120-83-2	2,4-dichlorophenol	<500	<500	<500	<500	<500	<500
(34A)	105-67-9	2,4-dimethylphenol	<500	<500	<500	<500	<500	<500
(57A)	88-75-5	2-nitrophenol	<500	<500	<500	<500	<500	<500
(58A)	100-02-7	4-nitrophenol	<500	<500	<500	<500*	<500	<500
(59A)	51-28-5	2,4-dinitrophenol	<1500	<1500	<1500	<1500	<1500	<1500
(60A)	534-52-1	4,6-dinitro-2-methylphenol	<1500	<1500	<1500	<1500	<1500	<1500
(64A)	87-86-5	pentachlorophenol	<1500	<1500	<500	<500	<500	<500
(65A)	108-95-2	phenol	<500	<500	<500	<500	<500	<500
		4-methylphenol	<500	<500	<500	<500*	<500*	<500

*Compound present below measurable detection limits

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in µg/L		
Element	Known	Determined	Percent Difference
Antimony	101.5	100.1	1.4
Arsenic	26.7	26.0	2.6
Beryllium	235	213	9.4
Cadmium	3.3	3.19	3.3
Chromium	261	266	1.9
Copper	339	337	0.6
Lead	42.7	42.8	0.2
Mercury	8.73	9.02	3.3
Nickel	207	202	2.4
Selenium	50.2	43.6	13
Silver	600	608	1.3
Thallium	25.0	25.6	2.4
Zinc	418	423	1.2

Note: These results are within the 95% confidence interval for these parameters.

Organo Chlorine Pesticides and PCB's - Results in mg/kg as received

Sample Identification	FM Rinsate 2040	FSG 23P	FSG 54P	FSA 06P	FSA 09P	DSA 09P	FMH 20
E & E Laboratory No. 85-	6656*	6657	6658	6659	6660	6661	6662
Sample Date: 9/20/85							
Compound							
Aldrin	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
a-BHC	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
b-BHC	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
g-BHC	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
d-BHC	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Chlordane	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
4,4'-DDD	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
4,4'-DDE	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
4,4'-DDT	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Dieldrin	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan I	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Endosulfan II	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endosulfan sulfate	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Endrin aldehyde	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Heptachlor	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Heptachlor epoxide	<0.05	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
PCB - 1016	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB - 1221	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB - 1232	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB - 1242	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB - 1248	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
PCB - 1254	<1.0	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
PCB - 1260	<1.0	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
Toxaphene	<1.0	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
Endrin Ketone	<0.10	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016
Methoxychlor	<0.50	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

*ug/L

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2388

Sample Date: 9/19,20/85 Sampled By: E & E, Inc.

Date Received: 9/21/85 Delivered By: Federal Express

Sample Type: Soil

E & E Lab Number 85-	Customer Number	Cyanide mg/kg*	Water Extractable Sulfate mg/kg*	% Solids
6639	FSY 01	<1	25	90
6640	FMH 16	<1	3100	42
6641	FMH 17	<1	2900	78
6642	FMH 18	<1	830	70
6643	FMH 19	<1	3900	60
6644	SBB 01	NA	5 mg/L	--

NA-not analyzed due to insufficient sample

*As Received

Analytical References:

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, "SW-846, Second Edition, U.S. EPA, 1982.

Supervising Analyst [illegible]

Date: [illegible] 20 1985

036114

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Compound	E & E Laboratory No. 85-	µg/L Original Analysis	µg/L Replicate Analysis	Relative Percent Difference RPD
Aldrin	6656	<0.05	<0.05	--
a-BHC	6656	<0.05	<0.05	--
b-BHC	6656	<0.05	<0.05	--
g-BHC	6656	<0.05	<0.05	--
d-BHC	6656	<0.05	<0.05	--
Chlordane	6656	<0.50	<0.50	--
4,4'-DDD	6656	<0.10	<0.10	--
4,4'-DDE	6656	<0.10	<0.10	--
4,4'-DDT	6656	<0.10	<0.10	--
Dieldrin	6656	<0.10	<0.10	--
Endosulfan I	6656	<0.05	<0.05	--
Endosulfan II	6656	<0.10	<0.10	--
Endosulfan sulfate	6656	<0.10	<0.10	--
Endrin	6656	<0.10	<0.10	--
Endrin aldehyde	6656	<0.10	<0.10	--
Heptachlor	6656	<0.05	<0.05	--
Heptachlor epoxide	6656	<0.05	<0.05	--
PCB - 1016	6656	<0.50	<0.50	--
PCB - 1221	6656	<0.50	<0.50	--
PCB - 1232	6656	<0.50	<0.50	--
PCB - 1242	6656	<0.50	<0.50	--
PCB - 1248	6656	<0.50	<0.50	--
PCB - 1254	6656	<1.0	<1.0	--
PCB - 1260	6656	<1.0	<1.0	--
Toxaphene	6656	<1.0	<1.0	--
Endrin Ketone	6656	<0.10	<0.10	--
Methoxychlor	6656	<0.50	<0.50	--

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RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
VOLATILE ORGANIC COMPOUNDS

(all results in µg/L)

PP#	CAS#	Compound	E & E Lab Number 85-	6627 FEW	6628 FSW	6629 FRW	6630 FSW	6631 DSW	6632 FSW
			Sample Identity	03A	01	01	02	02	03
		acetone+		<3*	<3	<3*	27	22	29
(4V)	71-43-2	benzene		<3	<3	<3	<3*	<3*	<3
(6V)	56-23-5	carbon tetrachloride		<3	<3	<3	<3	<3	<3
(7V)	108-90-7	chlorobenzene		<3	<3	<3	<3	<3*	<3
(10V)	107-06-2	1,2-dichloroethane		<3	<3	<3	<3	<3	<3
(11V)	71-55-6	1,1,1-trichloroethane+		<3	<3	<3	<3*	<3*	<3
(13V)	75-34-3	1,1-dichloroethane		<3	<3	<3	<3	<3	<3
(14V)	79-00-5	1,1,2-trichloroethane		<3	<3	<3	<3	<3	<3
(15V)	79-34-5	1,1,2,2-tetrachloroethane		<3	<3	<3	<3	<3	<3
(16V)	75-00-3	chloroethane		<3	<3	<3	<3	<3	<3
(19V)	110-75-8	2-chloroethylvinyl ether		<3	<3	<3	<3	<3	<3
(23V)	67-66-3	chloroform+		<3	<3	<3	11	11	<3*
(29V)	75-35-4	1,1-dichloroethene		<3	<3	<3	<3	<3	<3
(30V)	156-60-5	trans-1,2-dichloroethene		<3	<3	<3	<3	<3	<3
(32V)	78-87-5	1,2-dichloropropane		<3	<3	<3	<3	<3	<3
(33V)	10061-02-6	trans-1,3-dichloropropene		<3	<3	<3	<3	<3	<3
	10061-01-05	cis-1,3-dichloropropene		<3	<3	<3	<3	<3	<3
(38V)	100-41-4	ethylbenzene		<3	<3	<3	<3	<3*	<3
(44V)	75-09-2	methylene chloride+		<3*	<3	<3	61	52	36
(45V)	74-87-3	chloromethane		<3	<3	<3	<3	<3	<3
(46V)	74-83-9	bromomethane		<3	<3	<3	<3	<3	<3
(47V)	75-25-2	bromoform		<3	<3	<3	<3	<3	<3
(48V)	75-27-4	bromodichloromethane		<3	<3	<3	<3	<3	<3
(51V)	124-48-1	chlorodibromomethane		<3	<3	<3	<3	<3	<3
(85V)	127-18-4	tetrachloroethene		<3	<3	<3	<3	<3	<3
(86V)	108-88-3	toluene+		<3	<3	<3	<3	<3*	<3
(87V)	79-01-6	trichloroethene		<3	<3	<3	<3	<3	<3
(88V)	75-01-4	vinyl chloride		<3	<3	<3	<3	<3	<3

*Compound present below measurable detection limit
+Compound present in instrument blank

U-2388

RESULTS OF SOIL AND WATER ANALYSES
FOR PRIORITY POLLUTANT METALS

(all results in mg/kg as received unless noted)

E & E Laboratory No.: 85-	6639	6640	6641	6642	6643	6644*
Sample Identity	FSY 01	FMH 16	FMH 17	FMH 18	FMH 19	SBB 01
Antimony	<6.0	<6.0	7.66	<6.0	<6.0	<0.060
Arsenic	0.71	<1.0	2.95	1.76	<0.50	<0.005
Beryllium	<1.5	<1.5	<1.5	<1.5	<1.5	<0.015
Cadmium	<0.10	<0.10	0.687	0.975	0.190	<0.001
Chromium	4.9	7.9	7.3	8.0	2.6	<0.015
Copper	<2.5	9.7	11.1	5.2	2.9	<0.025
Lead	8.87	8.98	6560	78.6	9.10	<0.005
Mercury	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0002
Nickel	2.5	2.2	4.2	2.9	3.42	<0.020
Selenium	<0.50	<0.50	<5.0	<0.50	<0.50	<0.005
Silver	<0.50	<0.50	<0.50	<0.50	<0.50	<0.005
Thallium	<0.50	<0.50	<0.50	<0.50	<0.50	<0.005
Zinc	6.8	4.2	6.2	6.7	3.1	<0.020

*mg/L

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RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID COMPOUNDS

(all results in µg/L)

PP #	CAS #	Compound	E & E Lab Number 85-	6627	6628	6629	6630	6631	6632
			Sample Identity	FEW 01	FSW 01	FRW 01	FSW 02	DSW 02	FSW 03
(21A)	88-06-2	2,4,6-trichlorophenol		<10	<10	<10	<10	<10	<10
(22A)	59-50-7	p-chloro-m-cresol		<10	<10	<10	<10	<10	<10
(24A)	95-57-8	2-chlorophenol		<10	<10	<10	<10	<10	<10
(31A)	120-83-2	2,4-dichlorophenol		<10	<10	<10	<10	<10	<10
(34A)	105-67-9	2,4-dimethylphenol		<10	<10	<10	<10	<10	<10
(57A)	88-75-5	2-nitrophenol		<10	<10	<10	<10	<10	<10
(58A)	100-02-7	4-nitrophenol		<10	<10	<10	<10	<10	<10
(59A)	51-28-5	2,4-dinitrophenol		<30	<30	<30	<30	<30	<30
(60A)	534-52-1	4,6-dinitro-2-methylphenol		<30	<30	<30	<30	<30	<30
(64A)	87-86-5	pentachlorophenol		<50	<50	<50	<50	<50	<50
(65A)	108-95-2	phenol		<10	<10	<10	<10	<10	<10
		2-methyl phenol		<10	<10	<10	270	<10	<10

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
VOLATILE ORGANIC COMPOUNDS

(all results in ug/L)

PP#	CAS#	Compound	E & E Lab Number 85-	6633 FSW	6634 FEW	6635 FEW	6636 FEW	6637 GW	6638 GW
			Sample Identity	04	03C	09C	03BB	R01	B01
		acetone+		12	15	64	10	<3*	<3*
(4V)	71-43-2	benzene		<3	<3	<3	<3	<3	<3
(6V)	56-23-5	carbon tetrachloride		<3	<3	<3	<3	<3	<3
(7V)	108-90-7	chlorobenzene		<3	<3	<3	<3	<3	<3
(10V)	107-06-2	1,2-dichloroethane		<3	<3	<3	<3	<3	<3
(11V)	71-55-6	1,1,1-trichloroethane+		<3*	<3*	<3*	<3*	<3	<3
(13V)	75-34-3	1,1-dichloroethane		<3	<3	<3	<3	<3	<3
(14V)	79-00-5	1,1,2-trichloroethane		<3	<3	<3	<3	<3	<3
(15V)	79-34-5	1,1,2,2-tetrachloroethane		<3	<3	<3	<3	<3	<3
(16V)	75-00-3	chloroethane		<3	<3	<3	<3	<3	<3
(19V)	110-75-8	2-chloroethylvinyl ether		<3	<3	<3	<3	<3	<3
(23V)	67-66-3	chloroform		<3	<3	<3	<3	<3	<3
(29V)	75-35-4	1,1-dichloroethene		<3	<3	<3	<3	<3	<3
(30V)	156-60-5	trans-1,2-dichloroethene		<3	<3	<3	<3	<3	<3
(32V)	78-87-5	1,2-dichloropropane		<3	<3	<3	<3	<3	<3
(33V)	10061-02-6	trans-1,3-dichloropropene		<3	<3	<3	<3	<3	<3
	10061-01-05	cis-1,3-dichloropropene		<3	<3	<3	<3	<3	<3
(38V)	100-41-4	ethylbenzene		<3	<3	<3	<3	<3	<3
(44V)	75-09-2	methylene chloride+		<3*	<3*	<3*	<3	<3	<3*
(45V)	74-87-3	chloromethane		<3	<3	<3	<3	<3	<3
(46V)	74-83-9	bromomethane		<3	<3	<3	<3	<3	<3
(47V)	75-25-2	bromoform		<3	<3	<3	<3	<3	<3
(48V)	75-27-4	bromodichloromethane		<3	<3	<3	<3	<3	<3
(51V)	124-48-1	chlorodibromomethane		<3	<3	<3	<3	<3	<3
(85V)	127-18-4	tetrachloroethene		<3	<3	<3	<3	<3	<3
(86V)	108-88-3	toluene		<3	<3	<3	<3	<3	<3
(87V)	79-01-6	trichloroethene		<3	<3	<3	<3	<3	<3
(88V)	75-01-4	vinyl chloride		<3	<3	<3	<3	<3	<3

*Compound present below measurable detection limit

+Compound present in instrument blank

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RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL COMPOUNDS

(all results in µg/L)

PP #	CAS #	Compound	E & E Lab No. 85-	6627	6628	6629	6630	6631	6632
			Sample Identity	FEW 03A	FSW 01	FRW 01	FSW 02	DSW 02	FSW 03
(1B)	83-32-9	acenaphthene		<10	<10	<10	<10	<10	<10
(5B)	92-87-5	benzidine		<50	<50	<50	<50	<50	<50
8B)	120-82-1	1,2,4-trichlorobenzene		<10	<10	<10	<10	<10	<10
(9B)	118-74-1	hexachlorobenzene		<10	<10	<10	<10	<10	<10
12B)	67-72-1	hexachloroethane		<10	<10	<10	<10	<10	<10
(18B)	111-44-4	bis(2-chloroethyl)ether		<10	<10	<10	<10	<10	<10
(20B)	91-58-7	2-chloronaphthalene		<10	<10	<10	<10	<10	<10
(25B)	95-50-1	1,2-dichlorobenzene		<10	<10	<10	<10	<10	<10
(26B)	541-73-1	1,3-dichlorobenzene		<10	<10	<10	<10	<10	<10
(27B)	106-46-7	1,4-dichlorobenzene		<10	<10	<10	<10	<10	<10
(28B)	91-94-1	3,3'-dichlorobenzidine		<30	<30	<30	<30	<30	<30
(35B)	121-14-2	2,4-dinitrotoluene		<10	<10	<10	<10	<10	<10
(36B)	606-20-2	2,6-dinitrotoluene		<10	<10	<10	<10	<10	<10
(37B)	122-66-7	1,2-diphenylhydrazine		<10	<10	<10	<10	<10	<10
(39B)	206-44-0	fluoranthene		<10	<10	<10	<10	<10	<10
(40B)	7005-72-3	4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10	<10
(41B)	101-55-3	4-bromophenyl phenyl ether		<10	<10	<10	<10	<10	<10
(42B)	39638-32-9	bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10	<10
(43B)	111-91-1	bis(2-chloroetoxy)methane		<10	<10	<10	<10	<10	<10
(52B)	87-68-3	hexachlorobutadiene		<10	<10	<10	<10	<10	<10
53B)	77-47-4	hexachlorocyclopentadiene		<10	<10	<10	<10	<10	<10
(54B)	78-59-1	isophorone		<10	<10	<10	<10	<10	<10
(55B)	91-20-1	naphthalene		<10	<10	<10	<10	<10	<10
(56B)	98-95-3	nitrobenzene		<10	<10	<10	<10	<10	<10
(62B)	86-30-6	N-nitrosodiphenylamine		<10	<10	<10	<10	<10	<10
(63B)	621-64-7	N-nitrosodipropylamine		<10	<10	<10	<10	<10	<10
66B)	117-81-0	bis(2-ethylhexyl) phthalate		19	27	13	18	14	14
(67B)	85-68-7	benzyl butyl phthalate		<10	<10	<10	<10	<10	<10
68B)	84-74-2	di-n-butyl phthalate		<10	<10	<10	<10	<10	<10
(69B)	117-84-0	di-n-octyl phthalate		<10	<10	<10	<10	<10	<10
(70B)	84-66-2	diethyl phthalate		<10	<10	<10	<10	<10	<10
(71B)	131-11-3	dimethyl phthalate		<10	<10	<10	<10	<10	<10
72B)	56-55-3	benzo(a)anthracene		<10	<10	<10	<10	<10	<10
73B)	50-32-8	benzo(a)pyrene		<10	<10	<10	<10	<10	<10
74B)	205-99-2	benzo(b)fluoranthene		<10	<10	<10	<10	<10	<10
(75B)	207-08-9	benzo(k)fluoranthene		<10	<10	<10	<10	<10	<10
76B)	218-01-9	chrysene		<10	<10	<10	<10	<10	<10
(77B)	208-96-8	acenaphthylene		<10	<10	<10	<10	<10	<10
78B)	120-12-7	anthracene		<10	<10	<10	<10	<10	<10
(79B)	191-24-2	benzo(ghi)perylene		<10	<10	<10	<10	<10	<10
80B)	86-73-7	fluorene		<10	<10	<10	<10	<10	<10
81B)	85-01-8	phenanthrene		<10	<10	<10	<10	<10	<10
82B)	53-70-3	dibenzo(a,h)anthracene		<10	<10	<10	<10	<10	<10
83B)	193-39-5	indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10	<10
84B)	129-00-0	pyrene		<10	<10	<10	<10	<10	<10

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
ACID COMPOUNDS

(all results in ug/L)

PP #	CAS #	Compound	E & E Lab Number 85-	6633	6634	6635	6636	6637	6638
			Sample Identity	FSW 04	FEW 03C	FEW 09C	FEW 038B	GWR 01	GWB 01
(21A)	88-06-2	2,4,6-trichlorophenol		<10	<10	<10	<10	<10	<10
(22A)	59-50-7	p-chloro-m-cresol		<10	<10	<10	<10	<10	<10
(24A)	95-57-8	2-chlorophenol		<10	<10	<10	<10	<10	<10
(31A)	120-83-2	2,4-dichlorophenol		<10	<10	<10	<10	<10	<10
(34A)	105-67-9	2,4-dimethylphenol		<10	<10	<10	<10	<10	<10
(57A)	88-75-5	2-nitrophenol		<10	<10	<10	<10	<10	<10
(58A)	100-02-7	4-nitrophenol		<10	<10	<10	<10	<10	<10
(59A)	51-28-5	2,4-dinitrophenol		<30	<30	<30	<30	<30	<30
(60A)	534-52-1	4,6-dinitro-2-methylphenol		<30	<30	<30	<30	<30	<30
(64A)	87-86-5	pentachlorophenol		<50	<50	<50	<50	<50	<50
(65A)	108-95-2	phenol		<10	<10	<10	<10	<10	<10
		2-Methyl phenol		<10	<10*	<10	<10	<10	<10

*Compound present below measurable detection limits

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Organo Chlorine Pesticides and PCBs - Results in ug/L

Sample Identification	FEW 03A	FSW 01	FRW 01	FSW 02	DSW 02	FSW 03	FSW 04	FEW 03C	FEW 09C	FEW 0388	GW R01	GW B01
E & E Laboratory No. 85-	6627	6628	6629	6630	6631	6632	6633	6634	6635	6636	6637	6638
Sample Date: 9/19,20/85												
Compound												
Aldrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
a-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
b-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
g-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
d-BHC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlordane	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
4,4'-DDD	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
4,4'-DDE	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
4,4'-DDT	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dieldrin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endosulfan I	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan II	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endosulfan sulfate	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endrin	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Endrin aldehyde	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
PCB - 1016	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1221	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1232	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1242	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1248	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
PCB - 1254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PCB - 1260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toxaphene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Endrin Ketone	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Methoxychlor	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

RESULTS OF WATER ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL COMPOUNDS

(all results in ug/L)

PP #	CAS #	Compound	E & E Lab No. 85-	6633	6634	6635	6636	6637	6638
			Sample Identity	FSW 04	FEW 03C	FEW 09C	FEW 03BB	GWR 01	GWB 01
(1B)	83-32-9	acenaphthene		<10	<10	<10	<10	<10	<10
(5B)	92-87-5	benzidine		<50	<50	<50	<50	<50	<50
(8B)	120-82-1	1,2,4-trichlorobenzene		<10	<10	<10	<10	<10	<10
(9B)	118-74-1	hexachlorobenzene		<10	<10	<10	<10	<10	<10
(12B)	67-72-1	hexachloroethane		<10	<10	<10	<10	<10	<10
(18B)	111-44-4	bis(2-chloroethyl)ether		<10	<10	<10	<10	<10	<10
(20B)	91-58-7	2-chloronaphthalene		<10	<10	<10	<10	<10	<10
(25B)	95-50-1	1,2-dichlorobenzene		<10	<10	<10	<10	<10	<10
(26B)	541-73-1	1,3-dichlorobenzene		<10	<10	<10	<10	<10	<10
(27B)	106-46-7	1,4-dichlorobenzene		<10	<10	<10	<10	<10	<10
(28B)	91-94-1	3,3'-dichlorobenzidine		<30	<30	<30	<30	<30	<30
(35B)	121-14-2	2,4-dinitrotoluene		<10	<10	<10	<10	<10	<10
(36B)	606-20-2	2,6-dinitrotoluene		<10	<10	<10	<10	<10	<10
(37B)	122-66-7	1,2-diphenylhydrazine		<10	<10	<10	<10	<10	<10
(39B)	206-44-0	fluoranthene		<10	<10	<10	<10	<10	<10
(40B)	7005-72-3	4-chlorophenyl phenyl ether		<10	<10	<10	<10	<10	<10
(41B)	101-55-3	4-bromophenyl phenyl ether		<10	<10	<10	<10	<10	<10
(42B)	39638-32-9	bis(2-chloroisopropyl)ether		<10	<10	<10	<10	<10	<10
(43B)	111-91-1	bis(2-chloroetoxy)methane		<10	<10	<10	<10	<10	<10
(52B)	87-68-3	hexachlorobutadiene		<10	<10	<10	<10	<10	<10
(53B)	77-47-4	hexachlorocyclopentadiene		<10	<10	<10	<10	<10	<10
(54B)	78-59-1	isophorone		<10	<10	<10	<10	<10	<10
(55B)	91-20-1	naphthalene		<10	<10	<10	<10	<10	<10
(56B)	98-95-3	nitrobenzene		<10	<10	<10	<10	<10	<10
(62B)	86-30-6	N-nitrosodiphenylamine		<10	<10	<10	<10	<10	<10
(63B)	621-64-7	N-nitrosodipropylamine		<10	<10	<10	<10	<10	<10
(66B)	117-81-0	bis(2-ethylhexyl) phthalate		<10*	24	<10*	22	<10*	<10*
(67B)	85-68-7	benzyl butyl phthalate		<10	<10	<10	<10	<10	<10
(68B)	84-74-2	di-n-butyl phthalate		<10	<10	<10	<10	<10	<10
(69B)	117-84-0	di-n-octyl phthalate		<10	<10	<10	<10	<10	<10
(70B)	84-66-2	diethyl phthalate		<10	<10	<10	<10	<10	<10
(71B)	131-11-3	dimethyl phthalate		<10	<10	<10	<10	<10	<10
(72B)	56-55-3	benzo(a)anthracene		<10	<10	<10	<10	<10	<10
(73B)	50-32-8	benzo(a)pyrene		<10	<10	<10	<10	<10	<10
(74B)	205-99-2	benzo(b)fluoranthene		<10	<10	<10	<10	<10	<10
(75B)	207-08-9	benzo(k)fluoranthene		<10	<10	<10	<10	<10	<10
(76B)	218-01-9	chrysene		<10	<10	<10	<10	<10	<10
(77B)	208-96-8	acenaphthylene		<10	<10	<10	<10	<10	<10
(78B)	120-12-7	anthracene		<10	<10	<10	<10	<10	<10
(79B)	191-24-2	benzo(ghi)perylene		<10	<10	<10	<10	<10	<10
(80B)	86-73-7	fluorene		<10	<10	<10	<10	<10	<10
(81B)	85-01-8	phenanthrene		<10	<10	<10	<10	<10	<10
(82B)	53-70-3	dibenzo(a,h)anthracene		<10	<10	<10	<10	<10	<10
(83B)	193-39-5	indeno(1,2,3-cd)pyrene		<10	<10	<10	<10	<10	<10
(84B)	129-00-0	pyrene		<10	<10	<10	<10	<10	<10

*Compound present below measurable detection limits.

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RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
ACID COMPOUNDS

(all results in ug/kg as received)

PP #	CAS #	Compound	6639 FSY 01	6640 FMH 16	6641 FMH 17	6642 FMH 18	6643 FMH 19	6644 SBB 01
(21A)	88-06-2	2,4,6-trichlorophenol	<500	<500	<500	<500	<500	NA
(22A)	59-50-7	p-chloro-m-cresol	<500	<500	<500	<500	<500	NA
(24A)	95-57-8	2-chlorophenol	<500	<500	<500	<500	<500	NA
(31A)	120-83-2	2,4-dichlorophenol	<500	<500	<500	<500	<500	NA
(34A)	105-67-9	2,4-dimethylphenol	<500	<500	<500	<500	<500	NA
(57A)	88-75-5	2-nitrophenol	<500	<500	<500	<500	<500	NA
(58A)	100-02-7	4-nitrophenol	<500	<500	<500	<500	<500	NA
(59A)	51-28-5	2,4-dinitrophenol	<1500	<1500	<1500	<1500	<1500	NA
(60A)	534-52-1	4,6-dinitro-2-methylphenol	<1500	<1500	<1500	<1500	<1500	NA
(64A)	87-86-5	pentachlorophenol	<1500	<1500	<500	<500	<500	NA
(65A)	108-95-2	phenol	<500	<500	<500	<500	<500	NA
		4-methylphenol	<500	<500	<500	1100	<500	NA

NA - Not analyzed, insufficient sample.

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RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
VOLATILE ORGANIC COMPOUNDS

(all results in µg/kg as received)

			E & E Lab Number 85-	6639	6640	6641	6642	6643	6644 SBB Bottle Blank ug/L
PP#	CAS#	Compound	Sample Identity	FSY 01	FMH 16	FMH 17	FMH 18	FMH 19	01
		acetone+		66	74	86	120	104	9
(4V)	71-43-2	benzene		<50	<50	<50	<50	<50*	<3
(6V)	56-23-5	carbon tetrachloride		<50	<50	<50	<50	<50	<3
(7V)	108-90-7	chlorobenzene		<50	<50	<50	<50	<50	<3
(10V)	107-06-2	1,2-dichloroethane		<50	<50	<50	<50	<50	<3
(11V)	71-55-6	1,1,1-trichloroethane+		<50*	<50*	<50*	<50*	<50*	4
(13V)	75-34-3	1,1-dichloroethane		<50	<50	<50	<50	<50	<3
(14V)	79-00-5	1,1,2-trichloroethane		<50	<50	<50	<50	<50	<3
(15V)	79-34-5	1,1,2,2-tetrachloroethane		<50	<50	<50	<50	<50	<3
(16V)	75-00-3	chloroethane		<50	<50	<50	<50	<50	<3
(19V)	110-75-8	2-chloroethylvinyl ether		<50	<50	<50	<50	<50	<3
(23V)	67-66-3	chloroform+		<50*	65	<50*	<50*	<50*	<3
(29V)	75-35-4	1,1-dichloroethene		<50	<50	<50	<50	<50	<3
(30V)	156-60-5	trans-1,2-dichloroethene		<50	<50	<50	<50	<50	<3
(32V)	78-87-5	1,2-dichloropropane		<50	<50	<50	<50	<50	<3
(33V)	10061-02-6	trans-1,3-dichloropropene		<50	<50	<50	<50	<50	<3
	10061-01-05	cis-1,3-dichloropropene		<50	<50	<50	<50	<50	<3
(38V)	100-41-4	ethylbenzene		<50	<50	<50	<50	<50*	<3
(44V)	75-09-2	methylene chloride+		<50	<50	<50	<50	<50*	7
(45V)	74-87-3	chloromethane		<50	<50	<50	<50	<50	<3
(46V)	74-83-9	bromomethane		<50	<50	<50	<50	<50	<3
(47V)	75-25-2	bromoform		<50	<50	<50	<50	<50	<3
(48V)	75-27-4	bromodichloromethane		<50	<50	<50	<50	<50	<3
(51V)	124-48-1	chlorodibromomethane		<50	<50	<50	<50	<50	<3
(85V)	127-18-4	tetrachloroethene		<50	<50	<50	<50	<50	<3
(86V)	108-88-3	toluene		<50	<50	<50	<50*	<50*	<3
(87V)	79-01-6	trichloroethene		<50	<50	<50	<50	<50	<3
(88V)	75-01-4	vinyl chloride		<50	<50	<50	<50	<50	<3
		2 butanone+		71	79	56	59	61	<3

*Compound present below measurable detection limit

+Compound present in instrument blank

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Organo Chlorine Pesticides and PCB's - Results in mg/kg as received

Sample Identification	FSY 01	FMH 16	FMH 17	FMH 18	FMH 19	SBB-01
E & E Laboratory No. 85-	6639	6640	6641	6642	6643	6644
Sample Date: 9/19,20/85						
Compound						
Aldrin	<0.008	<0.008	<0.008	<0.008	<0.008	NA
a-BHC	<0.008	<0.008	<0.008	<0.008	<0.008	NA
b-BHC	<0.008	<0.008	<0.008	<0.008	<0.008	NA
g-BHC	<0.008	<0.008	<0.008	<0.008	<0.008	NA
d-BHC	<0.008	<0.008	<0.008	<0.008	<0.008	NA
Chlordane	<0.08	<0.08	<0.08	<0.08	<0.08	NA
4,4'-DDD	<0.016	<0.016	<0.016	<0.016	<0.016	NA
4,4'-DDE	<0.016	<0.016	<0.016	<0.016	<0.016	NA
4,4'-DDT	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Dieldrin	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Endosulfan I	<0.008	<0.008	<0.008	<0.008	<0.008	NA
Endosulfan II	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Endosulfan sulfate	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Endrin	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Endrin aldehyde	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Heptachlor	<0.008	<0.008	<0.008	<0.008	<0.008	NA
Heptachlor epoxide	<0.008	<0.008	<0.008	<0.008	<0.008	NA
PCB - 1016	<0.08	<0.08	<0.08	<0.08	<0.08	NA
PCB - 1221	<0.08	<0.08	<0.08	<0.08	<0.08	NA
PCB - 1232	<0.08	<0.08	<0.08	<0.08	<0.08	NA
PCB - 1242	<0.08	<0.08	<0.08	<0.08	<0.08	NA
PCB - 1248	<0.08	<0.08	<0.08	<0.08	<0.08	NA
PCB - 1254	<0.16	<0.16	<0.16	<0.16	<0.16	NA
PCB - 1260	<0.16	<0.16	<0.16	<0.16	<0.16	NA
Toxaphene	<0.16	<0.16	<0.16	<0.16	<0.16	NA
Endrin Ketone	<0.016	<0.016	<0.016	<0.016	<0.016	NA
Methoxychlor	<0.08	<0.08	<0.08	<0.08	<0.08	NA

NA-Not Analyzed, insufficient sample

RESULTS OF SOIL ANALYSIS FOR PRIORITY POLLUTANT
BASE/NEUTRAL COMPOUNDS
(all results in ug/kg as received)

PP #	CAS #	Compound	E & E Lab No. 86-	6639	6640	6641	6642	6643	6644
			Sample Identity	FSY 01	FM H16	FMH 17	FMH 18	FMH 19	SBB 01
(1B)	83-32-9	acenaphthene		<500	<500	<500	<500	<500	NA
(5B)	92-87-5	benzidine		<2500	<2500	<2500	<2500	<2500	NA
(8B)	120-82-1	1,2,4-trichlorobenzene		<500	<500	<500	<500	<500	NA
(9B)	118-74-1	hexachlorobenzene		<500	<500	<500	<500	<500	NA
(12B)	67-72-1	hexachloroethane		<500	<500	<500	<500	<500	NA
(18B)	111-44-4	bis(2-chloroethyl)ether		<500	<500	<500	<500	<500	NA
(20B)	91-58-7	2-chloronaphthalene		<500	<500	<500	<500	<500	NA
(25B)	95-50-1	1,2-dichlorobenzene		<500	<500	<500	<500	<500	NA
(26B)	541-73-1	1,3-dichlorobenzene		<500	<500	<500	<500	<500	NA
(27B)	106-46-7	1,4-dichlorobenzene		<500	<500	<500	<500	<500	NA
(28B)	91-94-1	3,3'-dichlorobenzidine		<500	<500	<500	<500	<500	NA
(35B)	121-14-2	2,4-dinitrotoluene		<500	<500	<500	<500	<500	NA
(36B)	606-20-2	2,6-dinitrotoluene		<500	<500	<500	<500	<500	NA
(37B)	122-66-7	1,2-diphenylhydrazine		<500	<500	<500	<500	<500	NA
(39B)	206-44-0	fluoranthene		<500	<500	<500	<500	<500	NA
(40B)	7005-72-3	4-chlorophenyl phenyl ether		<500	<500	<500	<500	<500	NA
(41B)	101-55-3	4-bromophenyl phenyl ether		<500	<500	<500	<500	<500	NA
(42B)	39638-32-9	bis(2-chloroisopropyl)ether		<500	<500	<500	<500	<500	NA
(43B)	111-91-1	bis(2-chloroetoxy)methane		<500	<500	<500	<500	<500	NA
(52B)	87-68-3	hexachlorobutadiene		<500	<500	<500	<500	<500	NA
(53B)	77-47-4	hexachlorocyclopentadiene		<500	<500	<500	<500	<500	NA
(54B)	78-59-1	isophorone		<500	<500	<500	<500	<500	NA
(55B)	91-20-1	naphthalene		<500	<500	<500	<500	<500	NA
(56B)	98-95-3	nitrobenzene		<500	<500	<500	<500	<500	NA
(62B)	86-30-6	N-nitrosodiphenylamine		<500	<500	<500	<500	<500	NA
(63B)	621-64-7	N-nitrosodipropylamine		<500	<500	<500	<500	<500	NA
(66B)	117-81-0	bis(2-ethylhexyl) phthalate		<500	<500	<500	<500	<500	NA
(67B)	85-68-7	benzyl butyl phthalate		<500	<500	<500	<500	<500	NA
(68B)	84-74-2	di-n-butyl phthalate		<500	<500	<500	<500	<500	NA
(69B)	117-84-0	di-n-octyl phthalate		<500	<500	<500	<500	<500	NA
(70B)	84-66-2	diethyl phthalate		<500	<500	<500	<500	<500	NA
(71B)	131-11-3	dimethyl phthalate		<500	<500	<500	<500	<500	NA
(72B)	56-55-3	benzo(a)anthracene		<500	<500	<500	<500	<500	NA
(73B)	50-32-8	benzo(a)pyrene		<500	<500	<500	<500	<500	NA
(74B)	205-99-2	benzo(b)fluoranthene		<500	<500	<500	<500	<500	NA
(75B)	207-08-9	benzo(k)fluoranthene		<500	<500	<500	<500	<500	NA
(76B)	218-01-9	chrysene		<500	<500	<500	<500	<500	NA
(77B)	208-96-8	acenaphthylene		<500	<500	<500	<500	<500	NA
(78B)	120-12-7	anthracene		<500	<500	<500	<500	<500	NA
(79B)	191-24-2	benzo(ghi)perylene		<500	<500	<500	<500	<500	NA
(80B)	86-73-7	fluorene		<500	<500	<500	<500	<500	NA
(81B)	85-01-8	phenanthrene		<500	<500	<500	<500	<500	NA
(82B)	53-70-3	dibenzo(a,h)anthracene		<500	<500	<500	<500	<500	NA
(83B)	193-39-5	indeno(1,2,3-cd)pyrene		<500	<500	<500	<500	<500	NA
(84B)	129-00-0	pyrene		<500	<500	<500	<500	<500	NA

*Compound present below measurable detection limits

NA - Not analyzed, insufficient sample.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ppb)			
Beryllium	6639	<15	50	27	54
Chromium	6639	52	200	230	89
Copper	6639	<25	250	179	72
Mercury	6639	<0.2	1	1.06	100
Nickel	6639	27	500	462	87
Zinc	6639	73	500	462	78

*Spike performed on aqueous digest of soil sample. Results reported in ppb.

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Chromium	6639	4.9	6.3	25
Beryllium	6639	<1.5	<1.5	--
Copper	6639	<2.5	3.0	--
Nickel	6639	2.5	5.1	68
Zinc	6639	6.8	7.8	14
Silver	6639	<0.50	<0.50	--
Arsenic	6639	0.71	1.3	59
Antimony	6639	<6.0	<6.0	--
Selenium	6639	<0.50	<0.50	--
Thallium	6639	<0.50	<0.50	--
Cadmium	6639	<0.10	<0.10	--
Lead	6639	8.87	5.31	50
Cyanide	6642	<1	<1	--
Mercury	6643	<0.01	<0.01	--

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Compound	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(µg/kg)			
Trichloroethene	6639	<50	210	170	81
Chlorobenzene	6639	<50	210	180	86
Toluene	6639	<50	210	190	90
Benzene	6639	<50	210	170	81
1,2,4-Trichlorobenzene	6639	<500	1670	1500	90
Acenaphthene	6639	<500	1670	1400	84
2,4-dinitrotoluene	6639	<500	1670	1400	84
pyrene	6639	<500	1670	1200	72
n-nitroso-di-n-propylamine	6639	<500	1670	1400	84
1,4-dichlorobenzene	6639	<500	1670	1100	66
pentachlorophenol	6639	<1500	3300	1200	36
phenol	6639	<500	3300	2300	70
2-chlorophenol	6639	<500	3300	2500	76
4-chlorophenol	6639	<500	3300	2800	85
4-nitrophenol	6639	<500	3300	930	28

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE—EPA QUALITY ASSURANCE MATERIALS

	Concentrations in µg/L		
Element	Known	Determined	Percent Difference
Arsenic	26.7	26.0	2.6
Antimony	101.5	100.1	1.4
Beryllium	235	213	9.4
Cadmium	3.3	3.2	3.0
Chromium	261	266	1.9
Copper	339	337	0.6
Lead	42.7	41.7	2.3
Mercury	8.7	9.0	3.4
Nickel	207	202	2.4
Selenium	50.2	43.6	13.1
Silver	600	608	1.3
Thallium	25.0	25.6	2.4
Zinc	418	423	1.2

Note: These results are within the 95% confidence interval for these parameters.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Compound	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(mg/kg)			
	Matrix Spike				
Lindane	6639	<0.008	0.027	0.021	77.8
Heptachlor	6639	<0.008	0.027	0.022	81.5
Aldrin	6639	<0.008	0.027	0.021	77.8
Dieldrin	6639	<0.016	0.067	0.055	82.1
Endrin	6639	<0.016	0.067	0.052	77.6
4,4'-DDT	6639	<0.016	0.067	0.073	109.0

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Compound	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
			(mg/kg)		
	Matrix Spike Duplicate				
Lindane	6639	<0.008	0.027	0.027	100.0
Heptachlor	6639	<0.008	0.027	0.028	103.7
Aldrin	6639	<0.008	0.027	0.027	100.0
Dieldrin	6639	<0.016	0.067	0.071	106.0
Endrin	6639	<0.016	0.067	0.066	98.5
4,4'-DDT	6639	<0.016	0.067	0.088	131.3

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Table C-1

SOIL SAMPLE DATA - OCTOBER/NOVEMBER 1985

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSA	01	A	51.00	<1	<12	4.62	11.00
DSA	01	A	78.60	<1	<12	4.48	10.00
FSA	01	B	6.46	<1	<12	5.21	12.00
FSA	01	C	4.86	<1	<12	4.97	17.00
FSA	01	D	12.40	<1	<12	5.40	17.00
FSA	01	E	29.30	<1	<12	5.74	18.00
FSA	02	A	553.00	<1	<12	4.49	19.00
FSA	02	B	106.00	<1	<12	4.65	24.00
FSA	02	C	12.00	<1	<12	4.60	13.00
FSA	02	D	24.90	<1	<12	4.76	16.00
FSA	02	E	31.30	<1	<12	4.87	14.00
FSA	03	A	392.00	<1	<12	4.88	20.00
FSA	03	B	8.33	<1	<12	4.45	18.00
FSA	03	C	84.70	<1	<12	4.65	21.00
FSA	03	D	8.54	<1	<12	4.72	17.00
FSA	03	E	7.03	<1	<12	6.94	17.00
FSA	04	A	279.00	<1	<12	5.35	15.00
FSA	04	B	25.00	<1	<12	5.57	19.00
FSA	04	C	120.00	<1	<12	5.09	23.00
FSA	04	D	8.73	<1	<12	5.74	15.00
FSA	04	E	10.60	<1	<12	5.17	15.00
FSA	05	A	41000.00	<1	142.00	5.93	12.00
FSA	05	B	111.00	<1	<12	4.91	17.00
DSA	05	B	113.00	<1	<12	4.95	14.00
FSA	05	C	74.80	<1	<12	4.77	12.00
FSA	05	D	41.70	<1	<12	4.32	17.00
FSA	05	E	29.10	<1	<12	4.33	17.00
FSA	06	A	155000.00	2.79	857.00	6.10	10.00
FSA	06	B	57000.00	1.07	325.00	6.07	15.00
FSA	06	C	6560.00	<1	148.00	4.86	15.00
FSA	06	D	330.00	<1	<12	4.77	16.00
FSA	06	E	928.00	<1	<12	4.65	15.00
FSA	07	A	68800.00	<1	360.00	6.95	16.00
FSA	07	B	45900.00	<1	208.00	5.05	15.00
FSA	07	C	28100.00	<1	157.00	4.81	21.00
FSA	07	D	4290.00	<1	71.20	4.43	15.00
FSA	07	E	1160.00	2.69	<12	4.53	19.00
FSA	08	A	30100.00	<1	148.00	6.79	18.00
FSA	08	B	29800.00	<1	799.00	4.74	21.00
DSA	08	C	13400.00	<1	86.50	4.46	23.00
FSA	08	C	12300.00	<1	74.80	4.11	23.00
FSA	08	D	4150.00	<1	16.80	4.81	21.00
FSA	08	E	778.00	<1	<12	4.49	16.00
FSA	09	A	9390.00	<1	42.70	6.75	15.00
DSA	09	A	12500.00	<1	49.90	7.03	17.00
FSA	09	B	536.00	<1	<12	5.29	18.00
FSA	09	C	367.00	<1	<12	5.56	25.00

APPENDIX C

SOIL AND SEDIMENT ANALYTICAL DATA

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Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSB	06	C	42.00	--	--	3.90	14.00
FSC	01	A	257.00	<1	<12	8.54	11.00
FSC	01	B	20.60	<1	<12	7.26	12.00
DSC	01	B	16.60	<1	<12	7.61	13.00
FSC	01	C	6.54	<1	<12	6.10	18.00
FSC	02	A	8810.00	3.18	169.00	5.61	8.00
FSC	02	B	62.50	1.62	<12	4.20	11.00
FSC	02	C	24.00	1.10	<12	4.25	10.00
FSE	01	A	394.00	--	--	4.66	27.00
DSE	01	A	332.00	--	--	4.89	27.00
FSE	01	B	3.45	--	--	4.66	14.00
FSE	01	C	2.00	--	--	4.27	8.00
FSE	02	A	13.20	--	--	4.55	17.00
FSE	02	B	1.89	--	--	4.47	14.00
FSE	02	C	95.90	--	--	4.37	11.00
FSE	03	A	174.00	--	--	6.61	24.00
FSE	03	B	6.39	--	--	6.79	19.00
FSE	03	C	<5	--	--	6.73	20.00
FSE	04	A	62.90	<1	<12	5.67	14.00
FSE	04	B	7.13	<1	<12	5.58	23.00
FSE	04	C	6.86	<1	<12	6.25	24.00
FSE	05	A	300.00	<1	18.60	5.95	24.00
DSE	05	B	19.80	<1	12	6.22	18.00
FSE	05	B	23.30	<1	<12	6.19	16.00
FSE	05	C	61.70	<1	<12	6.44	16.00
FSE	06	A	283.00	<1	<12	5.68	24.00
FSE	06	B	9.80	<1	<12	6.67	17.00
FSE	06	C	6.25	<1	<12	6.55	18.00
FSE	07	A	1110.00	--	--	5.68	11.00
FSE	07	B	46.10	--	--	5.96	13.00
FSE	07	C	4.81	--	--	6.35	14.00
DSE	07	C	3.89	--	--	6.34	14.00
FSE	08	A	216.00	--	--	2.66	15.00
FSE	08	B	170.00	--	--	3.15	23.00
FSE	08	C	26.30	--	--	2.98	21.00
FSG	14	A	15.50	<1	<12	5.25	15.00
FSG	14	B	4.54	<1	<12	5.52	16.00
FSG	14	C	7.00	<1	<12	5.32	15.00
FSG	15	A	11.90	--	--	5.41	10.00
FSG	15	B	4.63	--	--	5.39	12.00
FSG	15	C	3.75	--	--	5.11	26.00
FSG	15	D	7.29	--	--	4.70	22.00
FSG	15	E	7.33	--	--	4.69	24.00
FSG	23	A	3060.00	<1	<12	5.75	11.00
FSG	23	B	4790.00	<1	17.30	5.84	12.00
FSG	23	C	5710.00	<1	<12	4.53	26.00
DSG	23	C	4710.00	<1	<12	4.49	20.00
FSG	23	D	1400.00	--	--	5.40	31.00
FSG	23	E	622.00	--	--	5.51	32.00

Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSA	09	D	9.33	<1	<12	5.27	33.00
FSA	09	E	10.60	<1	<12	5.33	34.00
FSA	10	A	10800.00	<1	27.60	7.96	17.00
FSA	10	B	86.40	<1	16.80	7.46	24.00
FSA	10	C	54.00	<1	<12	6.64	14.00
FSA	10	D	54.90	<1	<12	6.37	16.00
FSA	10	E	48.20	<1	<12	6.03	17.00
FSA	11	A	7710.00	<1	24.20	7.89	19.00
FSA	11	B	4750.00	<1	13.50	4.84	18.00
FSA	11	C	8140.00	<1	45.50	4.75	30.00
FSA	11	D	547.00	<1	<12	5.07	15.00
FSA	11	E	190.00	<1	<12	5.11	13.00
FSA	12	A	2716.00	<.60	3.60	7.28	18.00
FSA	12	B	402.00	<.65	0.52	6.04	14.80
FSA	12	C	661.00	<.87	15.40	3.46	32.60
FSA	12	D	64.20	<.57	0.23	3.43	28.20
DSA	12	D	68.40	<.50	<.20	3.45	21.80
FSA	12	E	60.30	<.58	<.23	3.44	15.90
FSA	13	A	98.60	<.56	0.22	3.86	9.10
FSA	13	B	4735.00	0.67	13.90	3.30	16.90
DSA	13	B	8842.00	0.78	13.60	3.23	15.20
FSA	13	C	6317.00	<.50	11.80	3.10	21.00
FSA	13	D	217.00	4.82	0.56	3.12	37.70
DSA	13	E	151.00	0.92	0.46	3.33	22.10
FSA	13	E	254.00	1.27	0.64	3.29	19.50
FSB	01	A	43.20	--	--	5.36	14.00
FSB	01	B	11.50	--	--	5.07	15.00
FSB	01	C	2.57	--	--	5.17	16.00
FSB	02	A	8330.00	--	--	6.86	8.00
FSB	02	B	325.00	--	--	5.74	13.00
DSB	02	B	746.00	--	--	5.64	13.00
FSB	02	C	460.00	--	--	5.02	23.00
FSB	02	D	157.00	--	--	4.76	18.00
FSB	02	E	100.00	--	--	4.48	19.00
FSB	03	A	66100.00	--	--	6.02	12.00
FSB	03	B	650.00	--	--	5.00	9.00
FSB	03	C	400.00	--	--	4.97	14.00
FSB	03	D	168.00	--	--	4.58	13.00
FSB	03	E	57.00	--	--	4.80	10.00
FSB	04	A	3780.00	--	--	5.70	10.00
FSB	04	B	219.00	--	--	4.75	12.00
FSB	04	C	128.00	--	--	4.52	15.00
FSB	04	D	278.00	--	--	4.93	11.00
FSB	04	E	34.90	--	--	4.22	10.00
FSB	05	A	543.00	--	--	5.17	10.00
DSB	05	A	654.00	--	--	5.05	9.00
FSB	05	B	9.43	--	--	4.28	12.00
FSB	05	C	13.80	--	--	4.28	14.00
FSB	06	A	5300.00	--	--	6.73	13.00
FSB	06	B	3260.00	--	--	3.77	14.00

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Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSG	56	D	4.42	--	--	5.49	9.00
FSG	56	E	4.78	--	--	5.88	8.00
FSG	62	A	102.00	--	--	4.42	9.00
FSG	62	B	22.70	--	--	5.20	12.00
FSG	62	C	6.34	--	--	5.25	9.00
FSG	64	A	16500.00	--	--	5.73	8.00
FSG	64	B	818.00	--	--	4.69	93.00
DSG	64	C	187.00	--	--	4.91	7.00
FSG	64	D	1110.00	--	--	4.85	10.00
FSG	64	E	33.10	--	--	4.95	22.00
FSG	64	C	230.00	--	--	4.82	7.00
FSG	65	A	201.00	--	--	5.34	12.00
FSG	65	B	220.00	--	--	4.98	10.00
FSG	65	C	564.00	--	--	4.89	9.00
FSG	65	D	12.30	--	--	4.97	9.00
FSG	65	E	10.40	--	--	4.94	9.00
FSG	66	A	14.10	--	--	5.74	9.00
FSG	66	B	17.20	--	--	5.84	9.00
FSG	66	C	6560.00	--	--	5.47	11.00
FSG	66	D	728.00	--	--	5.55	14.00
FSG	66	E	673.00	--	--	5.14	15.00
FSG	67	A	19.00	--	--	5.42	11.00
FSG	67	B	27.60	--	--	5.50	13.00
DSG	67	B	20.70	--	--	5.73	12.00
FSG	67	C	25.10	--	--	5.64	15.00
FSG	67	D	7.00	--	--	5.70	14.00
FSG	67	E	10.20	--	--	5.44	18.00
FSG	68	A	439.00	--	--	4.95	12.00
FSG	68	B	7.11	--	--	5.02	20.00
FSG	68	C	10.60	--	--	5.01	24.00
FSG	69	A	<5	--	--	5.02	12.00
FSG	69	B	11.00	--	--	5.35	13.00
FSG	69	C	7.66	--	--	5.88	15.00
FSG	71	A	1680.00	--	--	4.54	16.00
FSG	71	B	212.00	--	--	4.41	10.00
FSG	71	C	601.00	--	--	4.56	13.00
FSG	71	D	148.00	--	--	4.93	5.00
FSG	71	E	16.30	--	--	4.70	3.00
FSG	73	A	37.20	--	--	4.52	7.00
DSG	73	B	63.30	--	--	4.46	8.00
FSG	73	B	27.80	--	--	4.95	7.00
FSG	73	C	20.40	--	--	4.98	9.00
DSG	75	A	591.00	--	--	5.73	11.00
FSG	75	A	511.00	--	--	6.02	11.00
FSG	75	B	50.60	--	--	6.00	18.00
FSG	75	C	95.30	--	--	5.18	23.00
FSG	75	D	125.00	--	--	5.66	17.00
FSG	75	E	16.60	--	--	5.70	17.00

Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSG	24	A	26.10	--	--	4.67	15.00
FSG	24	B	8.73	--	--	5.21	16.00
FSG	24	C	10.10	--	--	5.23	13.00
FSG	25	A	22.00	--	--	5.13	14.00
FSG	25	B	5.87	--	--	5.11	12.00
FSG	25	C	5.63	--	--	5.04	12.00
FSG	33	A	81.40	1.56	<12	5.71	11.00
FSG	33	B	3.98	<1	<12	5.44	12.00
DSG	33	B	5.50	<1	<12	5.19	11.00
FSG	33	C	4.81	<1	<12	4.97	14.00
FSG	34	A	246.00	<1	<12	5.90	9.00
FSG	34	B	53.40	<1	<12	5.10	17.00
FSG	34	C	3.08	<1	<12	5.00	18.00
FSG	34	D	2.62	<1	<12	5.55	7.00
FSG	34	E	8.84	<1	<12	5.18	7.00
FSG	35	A	41.70	--	--	5.90	12.00
FSG	35	B	<5	--	--	5.22	13.00
FSG	35	C	3.68	--	--	5.32	14.00
FSG	43	A	1740.00	<1	<12	5.66	11.00
FSG	43	B	690.00	<1	<12	4.87	9.00
FSG	43	C	690.00	<1	<12	4.75	13.00
FSG	44	A	17.40	--	--	4.82	7.00
FSG	44	B	3.66	--	--	4.83	9.00
FSG	44	C	4.12	--	--	4.94	12.00
FSG	45	A	68.20	--	--	5.48	11.00
FSG	45	B	8.55	--	--	5.20	16.00
FSG	45	C	3.99	--	--	5.02	16.00
FSG	51	A	19200.00	<1	55.90	5.65	12.00
DSG	51	A	22700.00	<1	42.20	6.18	14.00
FSG	51	B	84200.00	2.20	110.00	5.67	14.00
FSG	51	C	15300.00	<1	16.70	5.15	17.00
FSG	51	D	2100.00	--	--	5.42	12.00
FSG	51	E	518.00	--	--	6.21	9.00
FSG	53	A	2264.00	<1	<12	5.25	10.00
FSG	53	B	16700.00	<1	31.50	6.17	15.00
FSG	53	C	5310.00	<1	18.70	5.10	21.00
FSG	53	D	695.00	<1	<12	5.40	13.00
FSG	53	E	509.00	<1	<12	5.76	15.00
FSG	54	A	177.00	<1	<12	4.75	20.00
FSG	54	B	17.60	<1	<12	4.92	16.00
FSG	54	C	53.90	<1	<12	4.65	16.00
FSG	54	D	214.00	--	--	5.48	23.00
FSG	54	E	19.50	--	--	5.29	20.00
FSG	55	A	1870.00	--	--	5.57	20.00
FSG	55	B	107.00	--	--	4.55	18.00
FSG	55	C	59.00	--	--	5.22	16.00
FSG	56	A	479.00	--	--	5.61	14.00
FSG	56	B	20.20	--	--	5.15	22.00
FSG	56	C	22.90	--	--	4.96	23.00

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Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSG	91	D	20.20	--	--	4.85	18.00
FSG	91	E	18.00	--	--	4.99	14.00
FSG	95	A	322.00	--	--	5.27	8.00
FSG	95	B	91.60	--	--	5.35	9.00
FSG	95	C	115.00	--	--	5.37	10.00
FSG	95	D	145.00	--	--	5.81	9.00
FSG	95	E	31.30	--	--	5.49	11.00
FSG	96	A	16100.00	--	--	6.61	11.00
DSG	96	A	169000.00	--	--	6.72	9.00
FSG	96	B	96600.00	--	--	6.80	14.00
FSG	96	C	872.00	--	--	5.77	13.00
FSG	96	D	543.00	--	--	6.19	9.00
FSG	96	E	234.00	--	--	6.32	10.00
FSG	97	A	3640.00	--	--	7.03	14.00
FSG	97	B	29600.00	--	--	5.78	18.00
FSG	97	C	5010.00	--	--	5.50	16.00
FSG	97	D	462.00	--	--	5.04	13.00
FSG	97	E	571.00	--	--	5.21	12.00
FSL	01		3020.00	<1	14.40	6.89	22.00
DSL	01		9670.00	<1	21.90	6.88	21.00
FSL	02		27500.00	<1	51.00	6.88	18.00
FSS	01		218.00			7.29	14.00
FSS	02		3.59			4.91	18.00
FSS	03		10.40			5.50	6.00
FSS	04		95.50			6.21	10.00
FSS	05		271.00			6.00	13.00
FSS	06		3.04			4.17	8.00
FSS	07		7.30			4.29	18.00
FSS	08		13.50			4.31	21.00
FSS	09		10.00			4.56	19.00
FSS	10		2.15			4.38	14.00
FSS	11		242.00			4.21	13.00
FSS	12		56.10			4.04	34.00
FSS	13		20.90			3.99	22.00
FSS	14		8.62			5.11	19.00
FSS	15		1670.00			5.94	19.00
DSS	15		1760.00			5.76	19.00
FSS	16		76.40	<1	<12	4.24	18.00
FSS	17		56.70	<1	<12	3.96	21.00
FSS	18		179.00	<1	<12	3.72	15.00
DSS	18		169.00	<1	<12	3.52	16.00

Table C-1 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FSG	76	A	3770.00	--	--	5.66	15.00
FSG	76	B	8320.00	--	--	5.47	8.00
FSG	76	C	25300.00	--	--	5.97	11.00
FSG	76	D	210.00	--	--	5.15	12.00
FSG	76	E	200.00	--	--	6.30	9.00
FSG	77	A	813.00	--	--	5.44	10.00
FSG	77	B	3940.00	--	--	5.39	10.00
FSG	77	C	5120.00	--	--	5.61	14.00
FSG	77	D	574.00	--	--	5.21	14.00
FSG	77	E	947.00	--	--	5.22	18.00
FSG	78	A	59.00	--	--	5.92	11.00
FSG	78	B	75.60	--	--	5.70	14.00
FSG	78	C	59.20	--	--	5.71	13.00
FSG	78	D	11.00	--	--	5.35	16.00
FSG	78	E	16.00	--	--	5.53	20.00
FSG	79	A	<10	--	--	5.60	16.00
FSG	79	B	5.83	--	--	5.55	15.00
FSG	79	C	<5	--	--	4.95	17.00
DSG	79	C	7.19	--	--	5.04	20.00
FSG	82	A	8301.00	--	--	5.18	17.00
FSG	82	B	17.00	--	--	4.68	15.00
FSG	82	C	17.20	--	--	4.75	14.00
FSG	84	A	336.00	--	--	3.95	11.00
FSG	84	B	163.00	--	--	4.09	11.00
FSG	84	C	141.00	--	--	4.33	13.00
FSG	85	A	1790.00	--	--	5.35	9.00
FSG	85	B	267.00	--	--	6.12	8.00
FSG	85	C	57.50	--	--	5.55	11.00
FSG	85	D	50.20	--	--	5.15	14.00
FSG	85	E	94.00	--	--	4.89	16.00
FSG	86	A	90000.00	--	--	6.77	10.00
DSG	86	A	22300.00	--	--	6.80	12.00
FSG	86	B	43800.00	--	--	6.58	12.00
FSG	86	C	46700.00	--	--	6.23	12.00
FSG	86	D	16200.00	--	--	6.18	11.00
FSG	86	E	692.00	--	--	5.89	12.00
FSG	87	A	1180.00	--	--	7.87	8.00
FSG	87	B	6090.00	--	--	5.39	8.00
FSG	87	C	9430.00	--	--	4.86	20.00
FSG	87	D	703.00	--	--	5.16	16.00
FSG	87	E	344.00	--	--	5.13	15.00
FSG	88	A	46.70	--	--	5.00	17.00
FSG	88	B	45.50	--	--	5.10	10.00
FSG	88	C	5.35	--	--	6.17	14.00
FSG	88	D	4.17	--	--	5.54	11.00
FSG	88	E	5.61	--	--	5.16	14.00
FSG	91	A	636.00	--	--	4.20	11.00
FSG	91	B	342.00	--	--	4.63	16.00
FSG	91	C	258.00	--	--	4.59	16.00

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Table C-2 (Cont.)

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FMK	05	A	238.00	<1	<12	4.05	23.00
FMK	05	B	5.28	<1	<12	4.05	17.00
FMK	05	C	3.84	<1	<12	4.00	18.00
FMK	06	A	24.20	<1	<12	5.61	33.00
FMK	06	B	18.20	<1	<12	4.78	29.00
FMK	06	C	2.16	<1	<12	3.92	79.00
FMK	07	A	6,660.00	1.33	146.00	5.09	48.00
DMK	07	A	6,410.00	1.34	131.00	5.33	47.00
FMK	07	B	31.40	<1	<12	4.75	17.00
FMK	07	C	2.57	<1	<12	5.12	16.00
FMK	08	A	34,700.00	1.39	216.00	5.27	45.00
FMK	08	B	953.00	<1	<12	5.32	19.00
FMK	08	C	110.00	<1	<12	5.06	16.00
FMK	09	A	25.10	<1	<12	6.37	21.00
FMK	09	B	<1	<1	<12	6.46	19.00
FMK	09	C	6.75	<1	<12	5.93	22.00
FMT	01	A	380.00	<.72	<.29	4.33	52.20
FMT	01	B	27.40	<.49	<.20	4.17	23.80
FMT	02	A	111.40	<.27	<.11	5.37	18.80
FMT	02	B	47.20	<.46	<.18	4.19	28.66
FMT	03	A	593.00	0.66	0.66	4.69	40.70
FMT	03	B	57.50	<.61	<.24	3.97	19.80
FMT	04	A	250.00	<.53	<.21	4.21	39.80
FMT	04	B	69.70	<.50	<.20	3.95	22.10
FMT	05	A	520.00	<.55	0.55	4.22	36.30
FMT	05	B	25.20	<.47	<.19	3.85	21.40
FMT	07	A	269.00	<2.72	8.71	3.90	85.70
FMT	07	B	<26.10	<2.61	1.04	3.49	85.70
FMT	08	A	22.70	<.49	<.20	4.04	39.90
DMT	08	A	34.30	<.31	<.12	4.12	40.00
FMT	08	B	33.20	<.29	<.11	4.02	23.80
FMT	09	A	99.70	<1.10	<.44	4.38	76.90
FMT	09	B	62.00	<.54	<.22	4.20	26.40
FMT	10	A	212.00	1.21	0.87	4.15	72.10
FMT	10	B	28.90	<.47	<.19	3.54	28.10
FMT	11	A	34.00	<.31	<.36	5.48	33.20
FMT	11	B	10.70	<.40	0.16	4.71	18.80
DMT	11	B	5.40	<.43	<.17	4.78	18.10
FMT	12	A	10.10	<.63	<.25	4.15	26.60
FMT	12	B	57.00	<.66	<.16	3.70	22.30
FMT	13	A	20.10	<.35	<.14	5.58	35.70
FMT	13	B	26.30	<.18	<.44	4.30	14.10

Table C-2

SEDIMENT SAMPLE DATA - NOVEMBER/DECEMBER 1985

Location	Number	Depth	Lead (mg/kg)	Cadmium (mg/kg)	Antimony (mg/kg)	pH Units	% Water
FMH	01	A	1,860.00	1.78	7.82	4.79	58.00
FMH	01	B	61.80	1.21	1.06	3.07	53.40
FMH	02	A	96.10	2.13	0.71	3.34	39.30
FMH	02	B	51.40	<.53	<0.21	3.45	16.00
FMH	03	A	46.70	<.62	3.00	3.72	35.80
FMH	03	B	6.30	<.45	<.18	3.38	18.40
FMH	04	A	16.70	0.49	<.20	3.44	24.60
FMH	04	B	19.70	<.43	<.17	3.40	20.40
FMH	05	A	103.00	<.75	10.7	3.38	49.60
FMH	05	B	19.80	<.55	0.22	3.44	27.10
FMH	06	A	251.00	3.74	48.10	3.71	85.10
FMH	06	B	<20.4	2.85	1.63	2.79	80.90
FMH	07	A	109.00	1.35	5.00	3.49	51.50
FMH	07	B	39.30	0.70	<.22	3.47	33.80
DMH	07	B	31.40	0.81	<.20	3.50	30.20
FMH	08	A	61.00	0.70	1.29	3.48	47.40
FMH	08	B	53.60	<.54	<.21	3.46	29.00
DMH	08	B	32.80	<.53	<.21	3.33	27.50
FMH	09	A	136.00	<.54	0.76	3.44	32.40
FMH	09	B	31.20	<.38	<.15	3.52	17.40
FMH	10	A	31.80	<.78	2.33	3.69	49.20
FMH	10	B	8.90	<.39	<.16	3.60	14.60
FMH	11	A	185.65	1.93	14.00	4.35	53.40
FMH	11	B	19.60	<.56	<.23	3.39	29.70
FMH	12	A	250.00	<1.76	5.98	3.60	76.80
FMH	12	B	108.00	<.89	0.71	3.73	62.50
FMH	13	A	510.00	5.07	16.20	3.43	84.40
FMH	13	B	82.40	<3.22	3.86	3.18	84.70
FMH	14	A	820.00	<2.74	42.30	3.59	86.70
FMH	14	B	72.80	2.99	2.99	3.26	81.60
FMH	15	A	137.60	<2.04	2.04	4.20	84.50
FMH	15	B	32.20	<2.51	1.01	4.02	83.90
DMH	15	A	183.80	<2.62	4.19	4.21	85.80
FMK	01	A	10,900.00	1.15	36.20	7.05	30.00
FMK	01	B	12,500.00	1.51	77.40	6.00	32.00
FMK	01	C	7.80	<1	<12	4.35	17.00
FMK	02	A	139.00	<1	<12	5.10	20.00
FMK	02	B	1,280.00	<1	27.50	5.50	33.00
FMK	02	C	12.30	<1	<12	4.45	12.00
FMK	03	A	115.00	<1	<12	4.30	28.00
FMK	03	B	81.60	<1	<12	4.35	24.00
DMK	03	B	65.70	<1	<12	4.55	23.00
FMK	03	C	60.20	<1	<12	4.30	21.00
FMK	04	A	1,270.00	<1	<12	4.50	36.00
FMK	04	B	115.00	<1	<12	4.05	21.00
FMK	04	C	3.78	<1	<12	4.30	17.00
DMK	04	C	2.51	<1	<12	4.25	16.00

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Table D-1

WATER LEVEL ELEVATIONS -
SURFICIAL AQUIFER SYSTEM

Well No.	Well Head Elevation (feet above MSL)	Water Level (feet below TOC)	Water Level (feet above MSL)
MW-03C	133.16	3.99	129.17
MW-06C	133.57	6.94	126.63
MW-09C	143.19	6.67	136.52
MW-10C	138.80	9.24	129.56
MW-11C	142.08	6.67	135.41
MW-12C	137.10	6.15	130.95
MW-13C	132.90	4.12	128.78
MW-14C	134.93	6.24	128.69
MW-16C	134.08	9.62	124.46
MW-17C	131.85	4.87	126.98
MW-18C	130.21	2.36	127.85
MW-19C	131.06	3.37	127.69
MW-20C	131.11	2.89	128.22
MW-21C	133.06	4.57	128.49
MW-22C	136.63	10.66	125.97
MW-23C	140.39	3.63	136.76

APPENDIX D

GROUNDWATER
PHYSICAL AND CHEMICAL
ANALYTICAL DATA

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Table D-3

WATER LEVEL ELEVATIONS -
FLORIDAN AQUIFER SYSTEM

Well No.	Well Head Elevation (feet above MSL)	Water Level (feet below TOC)	Water Level (feet above MSL)
MW-01A	147.10	46.04	101.06
MW-03A	132.98	32.96	100.02
MW-04A	135.10	35.62	99.48
MW-05A	132.20	32.67	99.53
MW-06A	133.66	33.72	99.94
MW-09A*	143.75	27.50	116.25
MW-12A*	138.60	30.43	108.17
MW-13A*	133.11	9.35	123.76
MW-14A	135.21	35.19	100.02
MW-21A	134.14	34.91	99.23
MW-22A	137.30	38.92	98.38
DW-01	144.36	44.26	100.10
DW-02	136.02	35.68	100.34

*These wells are considered to be open to the intermediate aquifer system. See Section 3.4.1.

Table D-2

WATER LEVEL ELEVATIONS -
INTERMEDIATE AQUIFER SYSTEM

Well No.	Well Head Elevation (feet above MSL)	Water Level (feet below TOC)	Water Level (feet above MSL)
MW-01B	147.27	44.87	102.40
MW-02B	131.93	7.03	124.09
MW-03B	133.33	9.62	123.71
MW-03BB	133.02	11.34	121.68
MW-05B	132.21	7.56	124.65
MW-06B	132.30	5.87	126.43
MW-07B	136.68	34.33	102.35
MW-08B	144.71	22.47	122.24
MW-09B	143.63	8.00	135.63
MW-12B	138.53	22.50	116.03
MW-13B	132.93	11.65	121.28
MW-14B	135.77	8.80	126.97
MW-15B	131.46	3.32	128.14
MW-21B	134.32	8.33	125.99
MW-22B	136.19	35.27	100.92

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Table D-5

SURFICIAL AQUIFER SYSTEM - FIELD PARAMETERS

			E & E November - December 1985			FDER August - October 1983		
Number	Well Depth (feet)	Casing Depth (feet)	pH (units)	Conductivity (umhos)	Temperature (°C)	pH (units)	Conductivity (umhos)	Temperature (°C)
MW-03C	10.0	5.0	4.60	615.00	22.16	4.50	485.00	22.00
MW-06C	21.0	11.0	8.20	5.00	22.47	--	--	--
MW-09C	10.0	5.0	5.20	170.00	25.00	5.50	280.00	25.00
MW-10C	14.0	9.0	6.00	517.00	22.40	6.20	335.00	24.00
MW-11C	12.0	7.0	6.00	370.00	21.30	4.80	305.00	25.00
MW-12C	15.0	10.0	6.00	660.00	22.96	4.00	750.00	22.00
MW-13C	12.0	7.0	5.00	372.00	20.12	3.40	660.00	22.00
MW-14C	10.0	5.0	6.00	822.00	22.43	4.20	570.00	22.00
MW-16C	10.0	5.0	3.50	3002.00	24.06	3.30	7500.00	22.00
MW-17C	6.5	1.5	6.20	45.00	19.90	5.50	83.00	--
MW-18C	8.0	3.0	5.80	455.00	18.82	3.00	471.00	--
MW-19C	8.0	3.0	5.00	402.00	19.21	3.50	385.00	--
MW-20C	5.5	0.5	5.00	140.00	18.52	3.20	269.00	--
MW-21C	21.0	11.0	4.60	27.00	21.47	--	--	--
MW-22C	26.0	16.0	6.00	105.00	24.35	--	--	--
MW-23C	17.0	7.0	6.00	10.00	21.02	--	--	--

-- Not taken

Table D-4

HYDROLOGIC PARAMETERS
SAPP BATTERY MONITORING WELLS

SLUG TEST DATA

Well No.	Transmissivity (T) (gpd/ft)	Hydraulic Conductivity (K) (cm/sec)	Seepage Velocity (ft/yr)
MW-06A	9968.57	9.56×10^{-4}	0.90
MW-06B	93.07	5.58×10^{-5}	2.31
MW-06C	127.28	1.53×10^{-4}	0.99
MW-12A	223.03	7.64×10^{-5}	0.99
MW-12B	4.57	1.57×10^{-6}	2.03×10^{-2}
MW-12C	147.95	2.36×10^{-4}	12.23
MW-22A	10491.54	1.01×10^{-3}	10.41
MW-22B	44.09	3.35×10^{-5}	1.39
MW-22C	210.95	1.69×10^{-4}	1.09

SPECIFIC CAPACITY TEST DATA

Well No.	Specific Capacity (SC) (gpm/ft)	Well Yield (WY) (gpm)
MW-02B	0.620	16.12
MW-06B	0.081	2.67
MW-14A	1.690	84.50
MW-14C	0.068	0.476

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Table D-7

FLORIDAN AQUIFER SYSTEM - FIELD PARAMETERS

			E & E November - December 1985			FDER August - October 1983		
Number	Well Depth (feet)	Casing Depth (feet)	pH (units)	Conductivity (umhos)	Temperature (°C)	pH (units)	Conductivity (umhos)	Temperature (°C)
DW-01	188	84	6.00	202.00	21.91	5.8, 7.5	240.00 --	21.00, 22.00
DW-02	118	106	6.00	212.00	23.26	8.00	170.00	22.50
MW-01A	130	110	6.00	210.00	24.93	7.70	250.00	21.00
MW-03A	190	170	6.40	440.00	22.00	8.20	370.00	22.00
MW-04A	130	110	6.00	175.00	20.48	7.60	320.00	21.50
MW-05A	110	105	6.50	57.00	20.91	8.00	295.00	21.50
MW-06A	134	124	6.00	92.00	22.20	--	--	--
MW-09A*	127	117	9.00	200.00	--	--	--	--
MW-12A*	127	117	6.00	200.00	22.88	--	--	--
MW-13A*	115	105	6.00	1372.00	22.31	4.30	1040.00	22.00
MW-14A	80	70	6.00	320.00	20.96	7.00	280.00	21.50
MW-21A	131	121	6.00	262.00	21.75	--	--	--
MW-22A	134	124	6.00	375.00	22.20	--	--	--

*These wells are considered to be open to the intermediate aquifer system. See Section 3.4.1.

-- Not taken

Table D-6

INTERMEDIATE AQUIFER SYSTEM - FIELD PARAMETERS

			E & E November - December 1985			FDER August - October 1983		
Number	Well Depth (feet)	Casing Depth (feet)	pH (units)	Conductivity (umhos)	Temperature (°C)	pH (units)	Conductivity (umhos)	Temperature (°C)
MW-01B	53	36	6.00	340.00	21.45	7.90	205.00	22.00
MW-02B	35	25	6.00	152.00	21.95	5.80	40.00	21.00
MW-03B	65	55	6.00	2275.00	23.45	3.50	7800.00	22.00
MW-03BB	100	90	3.00	4032.00	23.10	3.50	10200.00	22.00
MW-05B	40	30	6.00	110.00	21.68	5.90	60.00	22.00
MW-06B	40	30	9.00	312.00	22.15	6.00	53.00	22.00
MW-07B	54	48	6.30	660.00	--	8.00	310.00	22.00
MW-08B	50	40	7.00	670.00	23.07	6.50	59.00	22.00
MW-09B	53	43	6.70	220.00	--	--	--	--
MW-12B	60	50	6.00	187.00	23.07	--	--	--
MW-13B	65	55	8.00	1222.00	22.72	6.10	160.00	22.00
MW-14B	48	38	6.00	167.00	22.87	6.10	420.00	22.00
MW-15B	30	20	4.50	467.00	20.65	4.00	680.00	22.00
MW-21B	60	50	5.50	22.00	21.65	--	--	--
MW-22B	62	52	6.50	265.00	22.67	--	--	--

-- Not taken

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Table D-9

SURFICIAL AQUIFER SYSTEM METALS DATA - NOVEMBER/DECEMBER 1985
(E & E)

	Metal Concentrations (ppm)						
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium
MW-03C	--	0.118	0.282	0.004	4.960	--	<0.050
MW-06C	52.800	<0.060	<0.005	<0.001	0.046	<0.015	<0.010
MW-09C	--	<0.060	0.006	<0.001	6.270	--	<0.005
MW-10C	35.100	<0.060	<0.005	<0.005	0.257	6.980	<0.010
MW-10C*	45.200	<0.060	<0.005	<0.005	0.290	5.910	<0.010
MW-11C	5.010	<0.060	<0.005	<0.005	0.021	2.240	<0.010
MW-12C	27.800	<0.600	<0.005	0.014	0.413	4.920	<0.005
MW-13C	1.590	<0.060	0.009	<0.005	0.061	0.232	<0.005
MW-14C	3.540	<0.600	<0.005	<0.005	3.720	28.100	<0.050
MW-16C	285.000	<0.060	<0.050	0.076	0.286	6.940	<0.050
MW-17C	0.843	<0.060	<0.005	<0.001	0.027	<0.015	<0.010
MW-18C	73.100	<0.060	<0.005	0.023	0.059	0.722	<0.010
MW-19C	17.300	<0.060	<0.005	0.002	0.013	0.278	<0.010
MW-20C	11.800	<0.060	<0.005	0.006	0.043	0.119	<0.010
MW-21C	56.500	<0.060	<0.005	0.001	0.022	0.028	<0.010
MW-22C	2.460	<0.600	<0.050	<0.005	<0.005	<0.015	<0.005
MW-23C	3.530	<0.060	<0.005	0.007	0.007	<0.015	<0.005
MW-23C*	7.760	<0.060	<0.005	<0.005	<0.005	0.033	<0.005

*Duplicate sample

-- Not analyzed

Table D-8

RESIDENTIAL WELLS - FIELD PARAMETERS

		E & E November - December 1985			FDER August - October 1983		
Number	Well Depth (feet)	pH (units)	Conductivity (umhos)	Temperature (°C)	pH (units)	Conductivity (umhos)	Temperature (°C)
GW-01	150	6.80	200.00	20.00	7.10	225.00	22.00
GW-02	--	7.80	180.00	21.00	7.20	220.00	21.50
GW-03	250	7.70	180.00	19.00	7.30	225.00	21.00
GW-04	250	7.50	240.00	19.50	7.10	260.00	21.50
GW-05	--	7.60	200.00	20.00	--	--	--
GW-07	128	7.80	180.00	21.00	7.30	240.00	22.00
GW-08	172	7.20	66.00	21.00	6.00	39.00	23.00
GW-09	153	7.40	100.00	18.50	7.40	22.00	22.00
GW-10	--	8.20	180.00	20.00	7.70	250.00	21.00
GW-11	160	8.00	160.00	17.00	7.20	280.00	22.00
GW-12	60	7.60	390.00	18.00	7.10	405.00	20.00
GW-13	--	8.00	160.00	19.50	--	--	--
GW-14	--	8.10	140.00	19.00	--	--	--
GW-15	--	7.70	180.00	19.50	--	--	--
GW-17	--	7.80	160.00	19.00	--	--	--
GW-18	--	7.80	140.00	19.00	--	--	--
GW-19	--	7.50	225.00	20.00	--	--	--
GW-20	126	7.40	220.00	17.00	7.10	270.00	23.00
GW-21	--	7.80	160.00	20.50	--	--	--
GW-22	--	7.50	220.00	18.00	--	--	--
GW-26	--	7.80	180.00	19.50	--	--	--
GW-27	--	8.00	120.00	19.50	--	--	--
GW-28	--	7.00	160.00	20.50	--	--	--
GW-29	--	7.80	160.00	19.00	--	--	--
GW-30	--	7.60	220.00	19.00	--	--	--

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Table D-11

FLORIDAN AQUIFER SYSTEM METALS DATA - NOVEMBER/DECEMBER 1985
(E & E)

	Metal Concentrations (ppm)						
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium
DW-01	0.809	<0.060	0.018	<0.005	1.830	2.460	0.008
DW-02	1.120	<0.060	<0.005	0.026	1.500	0.173	<0.005
MW-01A	1.730	<0.600	<0.005	<0.005	3.680	0.030	<0.005
MW-03A	--	<0.060	<0.005	0.003	0.609	--	<0.005
MW-04A	0.559	<0.600	<0.005	<0.005	0.045	0.246	<0.005
MW-05A	3.550	<0.600	<0.005	<0.005	0.080	0.030	<0.005
MW-06A	1.040	<0.060	<0.005	<0.005	0.051	0.113	<0.005
MW-09A*	16.600	<0.060	0.014	<0.005	0.463	0.687	<0.050
MW-12A*	115.000	<0.060	0.092	0.004	0.065	0.849	--
MW-13A*	2.580	<0.060	<0.005	0.011	0.168	0.876	<0.005
MW-14A	5.260	<0.600	<0.005	<0.005	0.389	0.557	<0.005
MW-21A	7.720	<0.060	<0.005	0.002	0.029	0.169	<0.005
MW-22A**	1.030	<0.060	<0.005	<0.001	0.012	0.047	<0.005
MW-22A	1.490	<0.060	<0.005	0.001	0.027	0.055	<0.005

*These wells are considered to be open to the intermediate aquifer system. See Section 3.4.1.
**Duplicate sample

-- Not analyzed

Table D-10

INTERMEDIATE AQUIFER SYSTEM METALS DATA - NOVEMBER/DECEMBER 1985
(E & E)

	Metal Concentrations (ppm)						
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium
MW-01B	8.940	<0.600	<0.005	<0.005	0.650	0.161	<0.005
MW-02B	1.000	<0.060	<0.005	<0.001	0.011	<0.015	<0.010
MW-02B*	0.986	<0.060	<0.005	<0.001	0.010	<0.015	<0.010
MW-03B	58.400	<0.060	<0.005	0.021	4.280	0.493	<0.500
MW-03BB	--	<0.060	0.021	0.246	1.280	--	<0.050
MW-05B	<0.200	<0.060	<0.005	<0.005	0.010	<0.015	<0.010
MW-06B	2.210	<0.060	<0.005	<0.005	0.015	0.025	<0.050
MW-07B	280.000	<0.060	<0.005	0.032	0.509	17.400	<0.050
MW-08B	10.400	<0.060	<0.005	<0.005	0.761	0.060	<0.005
MW-09B	870.000	<0.600	<0.050	<0.005	0.546	0.459	<0.050
MW-12B	987.000	<0.600	<0.050	<0.005	0.501	0.502	<0.005
MW-13B	1.380	<0.060	<0.005	<0.005	0.149	0.184	<0.050
MW-14B	5.410	<0.600	<0.005	<0.005	0.242	0.184	<0.005
MW-15B	18.900	<0.060	<0.005	0.007	0.021	0.415	<0.010
MW-21B	14.200	<0.060	<0.005	0.002	0.020	0.037	<0.005
MW-22B	4.600	<0.600	<0.050	<0.005	0.006	0.110	<0.005

*Duplicate sample

-- Not analyzed

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Table D-12 (Cont.)

	Metal Concentrations (ppm)							
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Nickel	Selenium
GW-21	<0.200	<0.060	<0.005	<0.001	0.010	<0.015	<0.020	<0.005
GW-22	<0.200	<0.060	<0.005	<0.001	<0.005	0.276	<0.020	<0.005
GW-26	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-27	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-28	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-28*	<0.200	<0.060	<0.005	<0.001	0.006	<0.015	<0.020	<0.005
GW-29	<0.200	<0.060	<0.005	<0.001	0.023	<0.015	<0.020	<0.005
GW-30	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005

*Duplicate sample

Table D-12

RESIDENTIAL WELL METALS DATA - NOVEMBER/DECEMBER 1985
(E & E)

	Metal Concentrations (ppm)							
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Nickel	Selenium
GW-01	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-02	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-03	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-04	<0.200	<0.060	<0.005	<0.001	<0.005	0.035	<0.020	<0.005
GW-05	<0.200	<0.060	<0.005	<0.001	0.010	<0.015	<0.020	<0.005
GW-07	<0.200	<0.060	<0.005	<0.001	0.015	<0.015	<0.020	<0.005
GW-08	<0.200	<0.060	<0.005	<0.001	0.022	0.061	<0.020	<0.005
GW-09	<0.200	<0.060	<0.005	<0.001	0.012	<0.015	<0.020	<0.005
GW-09*	<0.200	<0.060	<0.005	<0.001	0.017	<0.015	<0.020	<0.005
GW-10	<0.200	<0.060	<0.005	<0.001	0.012	<0.015	<0.020	<0.005
GW-11	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-12	<0.200	<0.060	<0.005	<0.001	0.012	0.136	<0.020	<0.005
GW-12*	<0.200	<0.060	<0.005	<0.001	0.013	0.138	<0.020	<0.005
GW-13	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-14	<0.200	<0.060	<0.005	<0.001	<0.005	<0,015	<0.020	<0.005
GW-15	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-17	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	<0.020	<0.005
GW-18	<0.200	<0.060	<0.005	<0.001	<0.005	<0.015	0.025	<0.005
GW-19	<0.200	<0.060	<0.005	<0.001	<0.005	0.058	<0.020	<0.005
GW-20	<0.200	<0.060	<0.005	<0.001	0.007	<0.015	<0.020	<0.005

*Duplicate sample

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Table D-14

INTERMEDIATE AQUIFER SYSTEM METALS DATA - AUGUST/OCTOBER 1983
(FDER)

	Metal Concentrations (ppm)								
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium	Nickel	Copper
MW-01B	2.000	0.002	0.003	0.001	0.050	0.040	<0.001	0.035	0.060
MW-02B	0.970	<0.001	0.002	<0.001	0.010	0.010	<0.001	0.009	0.025
MW-03B	880.000	NA	0.001	0.360	4.300	13.000	0.029	0.700	0.130
MW-03BB	100.000	NA	0.001	0.300	2.000	37.000	0.020	0.800	0.230
MW-05B	4.000	<0.001	0.002	<0.001	0.010	<0.010	<0.001	0.005	0.026
MW-06B	3.500	<0.001	0.002	<0.001	0.016	0.030	0.002	0.009	0.026
MW-07B*	1.300	<0.001	0.002	<0.001	0.088	0.190	<0.001	0.021	0.038
	<0.700	<0.200	<0.010	<0.010	0.086	<0.025	NA	NA	NA
MW-08B	0.800	<0.001	0.002	<0.001	0.021	0.060	<0.001	0.008	0.025
MW-13B	0.400	<0.001	0.006	<0.001	0.037	0.110	<0.001	0.012	0.030
MW-14B	0.880	0.002	0.003	<0.001	0.200	0.190	0.013	0.010	0.023
MW-15B	14.000	<0.001	0.003	0.002	0.120	0.860	0.001	0.032	0.040

*First and second lines present August and October 1983 data, respectively.

NA = Parameter was not analyzed

Table D-13

SURFICIAL AQUIFER SYSTEM METALS DATA - AUGUST/OCTOBER 1983
(FDER)

	Metal Concentrations (ppm)								
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium	Nickel	Copper
MW-03C	2.600	0.008	0.092	<0.001	3.400	0.300	<0.001	0.022	0.034
MW-09C	0.600	0.005	0.005	<0.001	2.400	0.170	<0.001	<0.001	0.021
MW-10C	4.000	0.004	0.002	<0.001	0.200	3.700	<0.001	0.003	0.021
MW-11C	3.900	<0.001	0.002	0.002	0.100	2.200	0.003	0.010	0.024
MW-12C	400.000	<0.001	0.001	0.019	1.300	6.400	0.004	0.036	0.065
MW-13C	8.700	0.004	0.008	<0.001	0.009	0.760	<0.001	0.028	0.025
MW-14C	4.100	0.005	0.001	0.005	5.700	26.000	<0.001	0.020	0.050
MW-16C	860.000	0.002	0.001	0.390	1.900	23.000	0.019	0.100	0.140
MW-17C	1.000	<0.200	<0.010	<0.010	0.087	0.054	NA	NA	NA
MW-18C	73.200	<0.200	<0.010	0.041	0.161	1.300	NA	NA	NA
MW-19C	20.200	<0.200	<0.010	<0.010	0.250	0.481	NA	NA	NA
MW-20C	14.900	<0.200	<0.010	<0.010	0.186	0.134	NA	NA	NA

NA = Parameter was not analyzed

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Table D-16

RESIDENTIAL WELL METALS DATA - AUGUST/SEPTEMBER 1983
(FDER)

	Metal Concentrations (ppm)								
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium	Nickel	Copper
GW-01	3.600	<0.001	0.005	0.004	0.014	0.020	<0.001	0.042	0.042
GW-02	0.050	<0.001	0.007	<0.001	0.005	0.010	<0.001	0.010	0.027
GW-03	0.040	<0.001	0.002	<0.001	0.004	0.010	<0.001	0.034	0.028
GW-04	0.070	<0.001	0.002	<0.001	0.005	0.030	<0.001	0.008	0.032
GW-07	0.920	<0.001	0.002	<0.001	0.008	<0.010	<0.001	0.002	0.080
GW-08	1.300	<0.001	0.002	<0.001	0.007	0.020	<0.001	0.007	0.036
GW-09	0.180	<0.001	0.002	<0.001	0.005	0.010	<0.001	0.004	0.031
GW-10	0.060	<0.001	0.003	<0.001	0.006	0.010	<0.001	0.006	0.050
GW-11	0.130	<0.001	0.002	<0.001	0.005	0.010	<0.001	0.009	0.032
GW-12	7.100	<0.001	0.001	<0.001	0.011	0.090	<0.001	0.011	0.030
GW-20	0.040	<0.001	0.002	<0.001	0.004	<0.010	<0.001	0.001	0.024

Table D-15

FLORIDAN AQUIFER SYSTEM METALS DATA - AUGUST/OCTOBER 1983
(FDER)

	Metal Concentrations (ppm)								
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium	Nickel	Copper
MW-01A	0.080	<0.001	0.002	<0.001	0.005	0.010	<0.001	0.007	0.024
MW-03A	0.880	0.002	0.002	<0.001	0.100	0.060	<0.001	0.012	0.031
MW-04A	0.210	<0.001	0.001	<0.001	0.003	0.030	<0.001	<0.001	0.023
MW-05A	44.000	0.002	0.005	0.034	0.100	0.090	0.001	0.200	0.080
MW-13A*	210.000	<0.001	0.002	0.001	0.017	2.900	0.004	0.033	0.072
MW-14A	2.400	0.001	0.002	0.001	0.100	0.060	<0.001	0.021	0.032
DW-01	3.000	<0.001	0.002	<0.001	0.014	0.070	<0.001	0.009	0.024
DW-02**	0.600	0.005	0.002	0.005	2.100	0.160	<0.001	0.042	0.130
	<0.700	<0.200	<0.010	<0.010	0.069	<0.025	NA	NA	NA

*MW-13A is considered to be open to the intermediate aquifer system. See Section 3.4.1
**First and second lines present August and October 1983 data, respectively.

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Table D-12B

RESIDENTIAL WELL METALS DATA - JANUARY, 1985 (ESE)

ENVIRONMENTAL SCIENCE & ENGINEERING 03/06/85 STATUS: FINAL

PROJECT NUMBER 84486240
FIELD GROUP: SBGW1
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER:
FIELD GROUP LEADER: D.VICTOR

PARAMETERS	SOURCE # / METHOD #	GW-1 472900	GW-2 472901	GW-3 472902	GW-4 472903	GW-5 472904	GW-7 472906	GW-8 472907	GW-9 472908	GW-10 472909	GW-11 472910
		SAMPLE NUMBERS									
DATE		1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85
TIME		1435	1440	1447	1053	1112	1247	1258	1338	1315	1308
ALKALINITY,T.(MG/L-CACO3)	410 0	106	109	112	137	125	126	14	115	127	140
LEAD,TOTAL(UG/L)	1051 0	17.0	<3.0	7.5	<3.0	<3.0	35.7	<3.0	6.6	<3.0	<3.0
COPPER,TOTAL(UG/L)	1042 0	8.1	8.4	7.5	<5.0	7.0	6.0	5.0	10.7	5.1	14.3
ANTIMONY,TOTAL(UG/L)	1097 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 0	<0.5	<0.5	<0.5	<0.5	<0.5	4.2	<0.5	<0.5	<0.5	<0.5
NICKEL,T.(UG/L)	1067 0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0	<9.0
ARSENIC,TOTAL(UG/L)	1002 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MANGANESE,(UG/L)	1055 0	<2	<2	<2	43	<2	<2	5	<2	<2	<2
ALUMINUM,TOTAL(UG/L)	1105 0	<37	<37	<37	<37	<37	91	<37	<37	55	<37
SELENIUM,TOTAL(UG/L)	1147 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PH,FIELD(STD UNITS)	400 0	7.55	7.52	7.46	6.50	7.20	7.20	5.97	7.38	7.20	7.05
SP.COND.,FIELD (UMHOS/CM)	94 0	212	203	222	252	242	231	43.0	211	244	278
WATER TEMP (C)	10 0	18.4	20.1	20.0	19.0	19.0	19.0	19.0	19.2	19.2	20.0
SULFATE (MG/L)	945 0	<1	<1	<1	1	<1	3	<1	<1	<1	10
SULFIDE(MG/L-S)	745 0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.20	<0.02	<0.02	<0.02

Table D-12A

RESIDENTIAL WELL METALS DATA/MARCH 1986 (E & E)

	Metal Concentrations (ppm)							
Number	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Nickel	Selenium
GW-01	<0.2	<0.06	<0.005	<0.005	0.021	<0.015	<0.04	<0.005
GW-02	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-03	<0.2	<0.06	<0.005	<0.005	0.016	<0.015	<0.04	<0.005
GW-04	<0.2	<0.06	<0.005	<0.005	<0.005	0.048	<0.04	<0.005
GW-05	<0.2	<0.06	<0.005	<0.005	<0.005	<0.015	<0.04	<0.005
GW-06	<0.2	<0.06	<0.005	<0.005	<0.005	<0.015	<0.04	<0.005
GW-07	<0.2	<0.06	<0.005	<0.005	<0.005	<0.015	<0.04	<0.005
GW-08	<0.2	<0.06	<0.005	<0.005	<0.005	0.090	<0.04	<0.005
GW-09	0.261	<0.06	<0.005	<0.005	0.012	<0.015	<0.04	<0.005
GW-10	<0.2	<0.06	<0.005	<0.005	0.006	<0.015	<0.04	<0.005
GW-11	<0.2	<0.06	<0.005	<0.005	0.009	<0.015	<0.04	<0.005
GW-12	0.302	<0.06	<0.005	<0.005	0.024	0.125	<0.04	<0.005
GW-13	0.205	<0.06	<0.005	<0.007	<0.005	<0.005	<0.04	<0.005
GW-14	<0.2	<0.06	<0.005	<0.005	<0.005	<0.015	<0.04	<0.005
GW-15	<0.2	<0.06	<0.005	<0.005	0.007	<0.015	<0.04	<0.005
GW-16	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-17	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-18	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-20	<0.2	<0.06	<0.005	<0.005	0.006	<0.015	<0.04	<0.005
GW-21	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-22	<0.2	<0.06	<0.005	<0.005	0.008	<0.015	<0.04	<0.005
GW-26	<0.2	<0.06	<0.005	<0.005	0.008	<0.015	<0.04	<0.005
GW-27	<0.2	<0.06	<0.005	<0.005	0.007	<0.015	<0.04	<0.005
GW-28	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-30	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005
GW-31	<0.2	<0.06	<0.005	<0.005	0.005	<0.015	<0.04	<0.005

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Table D-12B (Cont.)

ENVIRONMENTAL SCIENCE & ENGINEERING 03/06/85 STATUS: FINAL

PROJECT NUMBER 84416240
FIELD GROUP: SBGWI
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER:
FIELD GROUP LEADER: D.VICTOR

PARAMETERS	SEQRET # METHOD #	SAMPLE NUMBERS GW-22 472921	GW-26 472925	GW-27 472926	GW-28 472927
DATE		1/30/85	1/31/85	1/31/85	1/31/85
TIME		1124	1155	1205	1120
ALKALINITY,T.(MG/L-CACO3)	410 0	82	113	79	98
LEAD,TOTAL(UG/L)	1051 0	<3.0	<3.0	3.2	42.2
COPPER,TOTAL(UG/L)	1042 0	<5.0	9.3	7.3	8.4
ANTIMONY,TOTAL(UG/L)	1097 0	<1.0	<1.0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 0	<0.5	<0.5	<0.5	<3.0
NICKEL,T,(UG/L)	1067 0	<9.0	<9.0	<9.0	<9.0
ARSENIC,TOTAL(UG/L)	1002 0	<1.0	<1.0	<1.0	<1.0
MANGANESE,(UG/L)	1055 0	<2	<2	<2	2
ALUMINUM,TOTAL(UG/L)	1105 0	<37	<37	51	<37
SELENIUM,TOTAL(UG/L)	1147 0	<1.0	<1.0	<1.0	<1.0
PH,FIELD(STD UNITS)	400 0	7.55	7.74	7.78	7.47
SP.COND.,FIELD (UMHOS/CM)	94 0	181	232	208	210
WATER TEMP (C)	10 0	19.2	21.5	20.4	21.1
SULFATE (MG/L)	945 0	<1	<1	<1	2
SULFIDE(MG/L-S)	745 0	<0.02	<0.02	<0.02	<0.02

Table D-128 (Cont.)

ENVIRONMENTAL SCIENCE & ENGINEERING 03/06/85 STATUS: FINAL

PROJECT NUMBER 84416240
FIELD GROUP: SBGWI
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER:
FIELD GROUP LEADER: D.VICTOR

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS GW-12 472911	GW-13 472912	GW-14 472913	GW-15 472914	GW-16 472915	GW-17 472916	GW-18 472917	GW-19 472918	GW-20 472919	GW-21 472920
DATE		1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85	1/30/85
TIME		1427	1640	1650	1040	1050	1515	1100	1720	1438	1130
ALKALINITY,T.(MG/L-CACO3)	410 0	287	97	84	111	105	99	146	150	135	110
LEAD,TOTAL(UG/L)	1051 0	23.7	<3.0	<3.0	<3.0	39.1	10.0	5.6	3.2	<3.0	3.7
COPPER,TOTAL(UG/L)	1042 0	73.1	8.8	6.2	<5.0	10.4	58.2	<5.0	<5.0	14.6	10.0
ANTIMONY,TOTAL(UG/L)	1097 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 0	<0.5	<0.5	<0.5	<0.5	3.2	<0.5	<0.5	<0.5	<0.5	<0.5
NICKEL,T,(UG/L)	1067 0	<9.0	<9.0	<9.0	<9.0	<9.0	94	<9.0	<9.0	<9.0	<9.0
ARSENIC,TOTAL(UG/L)	1002 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MANGANESE,(UG/L)	1055 0	107	4	<2	<2	6	28	296	83	<2	2
ALUMINUM,TOTAL(UG/L)	1105 0	125	38	<37	<37	74	<37	<37	67	<37	<37
SELENIUM,TOTAL(UG/L)	1147 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PH,FIELD(STD UNITS)	400 0	7.04	7.53	7.52	6.86	7.24	7.64	7.00	7.30	7.37	7.52
SP.COND.,FIELD (UMHOS/CM)	94 0	305	165	165	220	228	192	260	198	272	216
WATER TEMP (C)	10 0	17.0	13.0	20.1	20.0	20.2	19.6	19.5	18.4	19.4	19.6
SULFATE (MG/L)	945 0	4	<1	<1	<1	<1	<1	4	<1	10	<1
SULFIDE(MG/L-S)	745 0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

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Table D-12C (Cont.)

ENVIRONMENTAL SCIENCE & ENGINEERING 05/09/84 STATUS: FINAL

PROJECT NUMBER 83228200
FIELD GROUP: SAPPW
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER: RUSS BOWEN
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # / METHOD #	SAMPLE NUMBERS 11 356110	12 356111	13 356112	14 356113	15 356114	16 356115	17 356116	18 356117	19 356118	20 356119
DATE		4/6/84	4/6/84	4/6/84	4/6/84	4/6/84	4/6/84	4/6/84	4/8/84	4/7/84	4/7/84
TIME		1150	1220	1330	1405	1450	1550	1700	1750	1030	1150
ALKALINITY,T.(MG/L-CACO3)	410 0	137	201	94	83	112	95	75	82	150	131
SULFATE (MG/L)	945 0	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
SULFIDE(MG/L-S)	745 0	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
LEAD,TOTAL(UG/L)	1051 0	<3.0	11.6	7.7	6.4	3.5	3.1	3.1	3.9	3.1	3.5
COPPER,TOTAL(UG/L)	1042 0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
ANTIMONY,TOTAL(UG/L)	1097 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
NICKEL,T,(UG/L)	1067 0	<6.0	<6.0	<6.0	<6.0	<6.0	6.6	<6.0	6.6	12	6.6
ARSENIC,TOTAL(UG/L)	1002 0	<0.3	<0.3	<0.3	0.4	<0.3	<0.3	<0.3	<0.3	0.5	<0.3
MANGANESE,(UG/L)	1055 0	<3	90	<3	<3	<3	<3	<3	<3	110	<3
ALUMINUM,TOTAL(UG/L)	1105 0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
SELENIUM,TOTAL(UG/L)	1147 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PH,(STD UNITS)	400 0	7.70	7.30	8.00	8.00	7.80	7.90	8.30	8.00	7.00	7.70
WATER TEMP (C)	10 0	21.6	19.6	20.8	21.2	20.3	20.6	20.4	20.0	19.7	23.2
SP.COND.,FIELD (UMHOS/CM)	94 0	276	395	197	174	232	223	159	182	297	277

Table D-12C

RESIDENTIAL WELL METALS DATA - APRIL, 1984

ENVIRONMENTAL SCIENCE & ENGINEERING 05/09/84 STATUS: FINAL

PROJECT NUMBER 83228200
FIELD GROUP: SAPPH
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER: RUSS BOWEN
FIELD GROUP LEADER: TOM PARK

PARAMETERS	STORET # METHOD #	SAMPLE NUMBERS 1 356100	2 356101	3 356102	4 356103	5 356104	6 356105	7 356106	8 356107	9 356108	10 356109
DATE		4/5/84	4/5/84	4/5/84	4/5/84	4/5/84	4/5/84	4/6/84	4/6/84	4/6/84	4/6/84
TIME		1400	1500	1600	1710	1850	1900	900	950	1030	1100
ALKALINITY,T.(MG/L-(CACO3)	410 0	107	109	113	139	124	145	121	4	105	125
SULFATE (MG/L)	945 0	3	2	2	<1	<1	<1	4	<1	<1	<1
SULFIDE(MG/L-S)	745 0	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	<0.02
LEAD,TOTAL(UG/L)	1051 0	3.9	<3.0	3.9	4.7	<3.0	6.9	<3.0	<3.0	3.5	5.2
COPPER,TOTAL(UG/L)	1042 0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
ANTIMONY,TOTAL(UG/L)	1097 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 0	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5
NICKEL,T,(UG/L)	1067 0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
ARSENIC,TOTAL(UG/L)	1002 0	<0.3	<0.3	<0.3	<0.3	<0.3	4.7	<0.3	<0.3	<0.3	<0.3
MANGANESE,(UG/L)	1055 0	<3	<3	<3	37	<3	300	<3	16	<3	<3
ALUMINUM,TOTAL(UG/L)	1105 0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
SELENIUM,TOTAL(UG/L)	1147 0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PH,(STD UNITS)	400 0	7.50	7.80	7.90	7.60	7.70	7.70	7.40	5.50	7.60	7.70
WATER TEMP (C)	10 0	21.1	21.0	20.5	20.0	20.4	19.6	20.2	21.4	20.9	20.7
SP.COND.,FIELD (UMHOS/CM)	94 0	233	224	230	274	255	292	265	39.0	224	259

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Table D-12D

COMPARISON OF RESIDENTIAL WELL LEAD DATA
FOR ALL SAMPLING EPISODES
(ppb)

Location	FDER 1983	ESE 1984	ESE 1/1985	E & E 11/1985	E & E 3/1986
GW-1	14.0	3.9	17.0	<5.0	21.0
GW-2	5.0	<3.0	<3.0	<5.0	<5.0
GW-3	4.0	3.9	7.5	<5.0	16.0
GW-4	5.0	4.7	<3.0	<5.0	<5.0
GW-5	NS	<3.0	<3.0	10.0	<5.0
GW-6	NS	6.9	NS	NS	NS
GW-7	8.0	<3.0	6.0	15.0	<5.0
GW-8	7.0	<3.0	<3.0	22.0	<5.0
GW-9	5.0	3.5	6.6	12.0	12.0
GW-10	6.0	5.2	<3.0	12.0	6.0
GW-11	5.0	<3.0	<3.0	<5.0	9.0
GW-12	11.0	11.6	23.7	13.0	24.0
GW-13	NS	7.7	<3.0	<5.0	<5.0
GW-14	NS	6.4	<3.0	<5.0	<5.0
GW-15	NS	3.5	<3.0	<5.0	7.0
GW-16	NS	3.1	4.5	NS	NS
GW-17	NS	3.1	10.0	<5.0	5.0
GW-18	NS	3.9	5.6	<5.0	<5.0
GW-19	NS	3.1	3.2	<5.0	<5.0
GW-20	4.0	3.5	<3.0	7.0	6.0
GW-21	NS	<3.0	3.7	10.0	5.0
GW-22	NS	3.9	<3.0	<5.0	8.0
GW-26	NS	NS	12.1	<5.0	8.0
GW-27	NS	NS	3.2	<5.0	7.0
GW-28	6.0	NS	12.1	<5.0	<5.0
GW-29	NS	NS	NS	23.0	NS
GW-30	NS	NS	NS	<5.0	<5.0
GW-31	NS	NS	NS	NS	<5.0

NS = Not sampled

Table D-12C (Cont.)

ENVIRONMENTAL SCIENCE & ENGINEERING 05/09/84 STATUS: FINAL

PROJECT NUMBER 83228200
FIELD GROUP: SAPPW
PARAMETERS: ALL SAMPLES: ALL

PROJECT NAME SAPP BATTERY
PROJECT MANAGER: RUSS BOWEN
FIELD GROUP LEADER: TOM PARK

SAMPLE NUMBERS

PARAMETERS	STORET # / METHOD #	21 356120	22 356121
DATE		4/7/84	4/7/84
TIME		1220	1330
ALKALINITY,T.(MG/L-(ACO3)	410 / 0	109	142
SULFATE (MG/L)	945 / 0	<1	<1
SULFIDE(MG/L-S)	745 / 0	<0.02	<0.02
LEAD,TOTAL(UG/L)	1051 / 0	<3.0	3.9
COPPER,TOTAL(UG/L)	1042 / 0	<6.0	<6.0
ANTIMONY,TOTAL(UG/L)	1097 / 0	<1.0	<1.0
CADMIUM,TOTAL(UG/L)	1027 / 0	<0.5	0.6
NICKEL,T,(UG/L)	1067 / 0	<6.0	17
ARSENIC,TOTAL(UG/L)	1002 / 0	<0.3	1.3
MANGANESE,(UG/L)	1055 / 0	3	271
ALUMINUM,TOTAL(UG/L)	1105 / 0	<50	<50
SELENIUM,TOTAL(UG/L)	1147 / 0	<1.0	<1.0
PH,(STD UNITS)	400 / 0	7.90	7.60
WATER TEMP (C)	10 / 0	20.5	20.3
SP.COND.,FIELD (UMHOS/CM)	94 / 0	226	290

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

328 EAST GADSDEN STREET • PENSACOLA, FLORIDA 32501 • 904/434-0846

FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 1 of 2

Boring No. MW-9B Field Technician _____ Date Time 1500 SD FD Next Day

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-9B			
			0.0	1.0	Brown silty sand with battery chip fill			
			1.0	10.0	Battery chips becoming clayey at 10.0'			
			10.0	18.0	Light or medium grey sandy clay, very wet			
			18.0		Medium grey highly plastic clay-clay			
				38.0	loosened up about 24.0 feet.			
			38.0	43.0	Medium grey slightly sandy/gravel clay very wet slurry			
			43.0		Medium grey coarse sandy clay, wet slurry with			
					some milkey white and clear quartz well			
				55.0	rounded pea sized gravel			
					Comments: HNu = 0ppm to 43.0'			
					HNu = 3 ppm after 43.0'			
					NOTE: 55.0 feet is bottom of hole because			
					rig was bending at 55.0' where sandy water			
					occurred. Afraid of damaging rig. Also			
					bentonite plug used in bottom of hollow stem			
					to keep sand out of auger.			
					Construction:			
					1. 2" PVC Triloc with seal			
					2. 10.0' 0.01" slotted screen			
					3. 0' 16/40 sand-53.0' PVC in ground. Hole			
					caved in to 36.0'-37.0'			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-2 By _____

Field Technician

APPENDIX E

DRILLER'S LOGS

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ecology and environment

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. _____ of _____

Boring No. MW-21B Field Technician _____ Date 11-8-85 Time 1030 SD 1730 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-21B			
			0.0	2.0	Black/brown sandy soil			
			2.0	7.0	Tan/orange medium sub-angular sandy clay			
			7.0		Light grey and orange medium sandy clay			
				25.0	with sparse black cinder fragments			
			25.0	42.5	Light grey and orange medium sandy clay			
			42.5		Gravel with same grey white sandy clay			
				45.0	as above. Note: Bit grinding at 42.5'			
			45.0	59.0	Light grey medium sandy clay			
			59.0	61.0	Milkey white quartz gravel with grey and white clay			
			61.0	62.0	Light grey medium sandy clay			
					NOTE: Revert Mix: VariFlo, Soluble Polymeer,			
					American Colloid Co.			
					1. Had cave-in as tremmie operations in			
					progress so sand packed thicker.			
					2. Also well was plugging between 18.0' and			
					20.0' deep due to large diameter hole to small			
					diameter			
					Construction:			
					1. Sand pack and cave in = 23.0'			
					2. Bentonite pellets 1/4" = 2.0'			
					3. Grout mix = 34.0'			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler.

Sub: Larry M. Jacobs & Associates, Ir

Remarks: Field logs documented by Ecology and Environment

Driller: Jim Dudley

~~Helper: R. Maddox~~

Method: Rotary with revert

No. Sacks Drilling Mud: _____

Type Drill Rig: _____

By _____

Field Technician

Larry M. Jacobs & Associates, Inc.
Consulting Geotechnical Engineers
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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 2 of 2

Boring No. MW-9B Field Technician _____ Date Time 1500 SD FD Next Day

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					4. 2.0' Bentonite Pellets (Geo-Pel)			
					5. 25.0' Grout			
					6. 13.0' concrete with pad			

* Number of blows of 140 lb. hammer dropped 30 inches to drive 3 in. split-spoon sampler.

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-3 By _____
Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 2 of 2

Boring No. MW-12B Field Technician _____ Date Time 1010 SD 1300 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-12B			
					Comments: Red/brown layers in upper 5'-15'			
					show various tints			
					Construction:			
					1. 2" PVC Triloc with seal 63.0'			
					2. 10.0' 0.01" slotted screen			
					3. 14.0' 16/40 sand. Cave-in at 9.0'-10.0' filled			
					in after 1 bag of sand			
					4. Bentonite slurry 2.0' bentonite pellets (Geo-Pel)			
					5. 35.0' grout			
					6. 2.0' concrete with pad			

* Number of blows of 140 lb hammer dropped 30 inches to drive 3 in split-spoon sampler

Sub: Larry M. Jacobs & Associates, Inc.
Driller: Jim Dudley
Helpers: R. Maddox, J. Fountain
Method: Rotary with revert

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-6 By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 1 of 2

Boring No. MW-12B Field Technician _____ Date _____ Time 1010 SD 1300 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-12B			
			2.0		Light brown/peach clay, very fine sand, some			
				5.0	chips			
			5.0		Clay, grey and red/brown increasing with depth,			
					get coarses sand and brown, red, and black rounded			
					gravel pebbles with depth. grey clay and red/brown			
				10.0	clay layers alternate			
			10.0		Red/brown clay and medium fine sand slurry			
				15.0	Bottom of bit shows same as 5.0'-10.0'			
					Note: Cuttings come up as a slurry of clay			
					mud, and fine sand. Descriptions based on clay			
					chunks that wrap around and are brought up.			
			15.0	20.0	As above			
			20.0	25.0	As above, but no pebbles and more gravel			
			25.0		Pink/purple clay, fine sand less than above.			
					red/brown bands, coarse sand and gravel.			
					Cuttings still come up as slurry. Clay is			
				30.0	plastic and more cohesive			
			30.0		As above, but less sand and gravel, several			
				35.0	large (1/2") rounded quartz pebbles			
			35.0		As above, but darker and greyish, more fine			
					sand, less gravel and pebbles. Clay is plastic,			
				40.0	but not as tight			
			40.0	45.0	As above, but no gravel or pebbles			
			45.0		Cuttings-clay and fine sand slurry-Same dark grey			
				60.0	purple clay			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: E-5 By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 2 of 3

Boring No. MW-22B Field Technician _____ Date 11-19-85 Time 0830 SD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-22B Continued			
			0.0	4.0	No cuttings			
			4.0	9.0	No cuttings			
			9.0	14.0	No cuttings			
			14.0	19.0	No cuttings			
			19.0	24.0	No cuttings			
			24.0		Peach colored sandy clay; sand is fine, some			
				29.0	silt. Very wet at 27.0'-29.0'			
			29.0		Very wet peach colored sandy clay with			
				36.0	some silt; as above			
			36.0		Cream colored wet sandy clay; sand is			
					coarse-medium, sub-angular. Sand begins to			
					increase, may be more properly called a			
				39.0	clayey sand			
			39.0		Peach-cream colored wet sandy clay; clay			
				42.5	coarse-medium and sub-angular			
			42.5	43.0	As above, but back to just cream			
			43.0	44.0	Back to peach			
			44.0		Cream-peach clayey sand; sand is coarse to			
					medium, sub-angular. Sand becoming finer			
					(more fine-medium than medium-coarse) with			
				49.0	depth			
			49.0		Cream-peach clayey sand/sandy clay, silty			
				54.0	clay with depth. No cuttings.			
			54.0		Went cream-peach silty sand, some clay.			
				59.0	sand very fine to fine			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-8 By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 1 of 3

Boring No. MW-22B Field Technician _____ Date Time 1325 SD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-22B			
			0.0		Tan coarse sand and gravel, sand is medium			
					to coarse, tan to light brown; gravel predominantly			
				5.0	white rounded quartz			
			5.0		Fine-medium sandy clay; sand is tan to			
				10.0	red/brown, clay = light grey			
			10.0	14.0	As above			
			14.0		Fine-medium sandy clay; some gravel (white,			
					grey, and red/borwn quartz at top), sand			
					finer and lower content with depth; clay becomes			
					predominantly pinkish/brown with some light			
				19.0	grey and peach colors			
			19.0		Fine sandy clay; clay color as above-Bottom			
					of bit-fine sandy clay, clay is marbled combination			
					of light grey, pinkish/brown, peach and orange/red			
				24.0	brown			
			24.0	29.0	As above			
			29.0		Light grey silty clay with some very			
				34.0	fine sand; clay = plastic-Bottom of bit same			
			34.0		Same as above-Few cuttings clayey "soup" with			
				39.0	some silt and sand- Loss of circulation			
			39.0		No cuttings-swallows another tank of revert			
					Hole caves in bottom 5.0'-7.0'			
					Jim Dudley notes activity and discoloration of water			
					in annulus of MW-22A-B. Levine confirms bubbling			
				44.0	when another tank of revert is pumped in.			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: 16:00 Pull rods from hole and will attempt to complete using 6" auger on 11-19-85
Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-7 By _____
Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. _____ of _____

Boring No. MW-21C Field Technician _____ Date 11-7-85 Time 1155 SD 1530 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-21C			
			0.0		Light brown fine medium clayey sand with			
				2.0	rust splotches slightly moist			
			2.0	6.0	Light grey fine medium quartz sandy clay			
			6.0	7.5	Brown tan fine medium clayey sand; moist			
			7.5		Light grey fine medium quartz sand clay			
					with very sparse small black cinder fragments			
				9.0	moist			
			9.0		Tan fine medium sandy clay with black			
				22.0	organic fragments (coal like); wet			
					NOTE: Sand comes from Clark Sand Company			
					in Pensacola, Florida. Grout consistency is			
					before (MW-6C)			
					Construction:			
					1. 2" PVC Triloc with seal			
					2. 10.0' 0.01" slot screen			
					3. 12.0' 16/40 sand			
					4. 2.0' bentonite pellets (Geo-Pel)			
					5. 5.0' grout			
					6. 2.0' concrete with pad			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

Sub: Larry M. Jacobs & Associates, Ir

~~Driller: Jim Dudley~~

Helper: R. Newby

Method: 6" Hollow Stem

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ E-10 By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 3 of 3

Boring No. MW-22B Field Technician _____ Date 11-19-85 Time 0830 SD 1107 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-22B Continued			
			59.0		Same as above. Encounter something hard			
				63.0	at 61.0'-62.0'.			
					Jim Dudley gives me sample from bottom of			
					hole (he says)-greyish clay with silt and fine			
					sand clay is plastic and moist			
					NOTE: 13:30 Pull augers bottom 20.0'-25.0'			
					covered with green clay, sometimes fluid,			
					sometimes more cohesive. Bottom of bit			
					shows gravel-Samples taken. Gordon			
					Dean agrees that well should be completed			
					in green clay and gravel because it should			
					produce water.			
					Construction			
					53.0'-2" PVC with Triloc seal and 10.0' of			
					0.01" slotted screen. Well completed at 62.0'			
					with 3.0' stickup. 13.0' sand. 2.0' Bentonite			
					pellets. 4.5' grout. 2.5' cement.. 2.0' bentonite			
					Construction completed 16:40. Barely got			
					surface return-need to check depth after it			
					sets.			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Sub: Larry M. Jacobs & Associates, Inc.

Driller: Jim Dudley

Helpers: R. Maddox, J. Fountain

Method: Rotary with revert

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____

By _____

Field Technician

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Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-239

_____ Weather _____

Name of Project: Sapp Battery Page No. 1 of 2

Boring No. MW-23C Field Technician _____ Date Time 1405 SD 1505 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-23C			
			0.0	0.4	Organic rich, dark brown topsoil			
			0.4		Dark grey, moist, silty fine sand w/some clay			
				5.0	fairly cohesive			
			5.0		As above, but higher water content, still cohesive			
				6.5	but runnier			
			6.5		Dark grey fine silty sand intermixed with			
					red/brown clayey sand/sandy clay-not as much			
					water as above-Begin to pick up unusual aroma			
					disinfectant? chlorine? Root segment 1' long,			
				7.5	1/2" maximum diameter			
			7.5		Medium grey, fairly dry silty fine sand with			
					some clay. Comes up hole as disaggregated			
				9.5	clumps ("popcorn")			
			9.5		Medium grey/beige fine silty sand, moist and			
				12.0	runny, but is cohesive, some clay			
			12.0		As 7 1/2-9 1/2, but more sand, fine-medium, light			
				14.5	grey/beige. Larger disaggregated clumps.			
			14.5		Light grey/beige sandy clay/clayey sand;			
				19.5	fine sand, still some silt. Moist, but not runny.			
			19.5	22.0	As 14.5-19.5			
			22.0	22.5	As above, but more grey than beige			
					NOTE: Aroma from 6.5' does not weaken			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

No. Sacks Drilling Mud: _____

Type Drill Rig: _____ By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. _____ of _____

Boring No. MW-22C Field Technician _____ Date Time 1330 SD 1419 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet		Depth Stratum Feet		Visual Classification	*Blows Per 6"		
	From	To	From	To		1st	2nd	3rd
					MW-22C			
			0.0	3.5	Black/dark grey silty sand with roots			
			3.5	5.0	Dark grey coarse sandy clay; moist			
			5.0	6.5	Light greyish green slightly sandy clay			
			6.5	10.5	Medium grey clayey coarse sand; moist			
			10.5	12.5	Tan and yellow sandy clay; moist			
			12.5	14.0	Rust red slightly sandy clay; moist; not much sand			
			14.0	23.0	Maroon gray fine slightly sand clay; very wet clayballs			
			23.0	26.0	Peach cream colored sandy clay; very wet			
					Comments: Water table at 10.0'			
					HNu in hole = 8 ppm			
					Construction:			
					1. Sand Pack = 14.0'			
					2. Bentonite = 2.0'			
					3. Grout = 8.0'			
					4. Concrete = 2.0'			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment Sub: Larry M. Jacobs & Associates, Inc

No. Sacks Drilling Mud: _____ Driller: Jim Dudley

Helpers: R. Maddox, J. Fountain

Type Drill Rig: _____ E-11 Method: 6" Hollow Stem

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. _____ of _____

Boring No. MW-6C Field Technician _____ Date 11-6-85 Time 1400 SD 1650 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-6C			
			0.0		Brown to black (topsoil) fine-medium quartz			
				3.5	clayey sand, moist, vegetation (0-6")			
			3.5	6.0	Grey fine clay quartz sand, very moist			
			6.0		Light grey medium sandy clay, very wet			
				10.0	becoming gravelly at 9.0'			
			10.0		Very light grey to white slightly medium			
				13.0	sandy clay, very wet and sticky			
			13.0		Very light grey medium/coarse sandy clay-			
					clayey sand, less wet than preceeding interval,			
				22.0	Note: hit gravel (or Limestone fragments) at 13.0'			
					NOTE: Completed at 1630: Will set final two feet			
					of concrete with security cover in the morning			
					in order to let grout settle.			
					Note: PVC is Brainard-Kilman Triloc			
					Construction:			
					Note: Sandy clay ran back up in hollow stem			
					and couldn't get 2" PVC pipe down so pumped			
					water down hollow stem to blow out clay.			
					1. Bottom of PVC at 21.0'			
					2. 10.0 feet screen			
					3. 12.0' sand (type 16/40)			
					4. 2.0' bentonite pellets			
					5. 5.0' grout			
					6. 2.0' concrete and pad			

* Number of blows of 140 lb hammer dropped 30 inches to drive 2 in split-spoon sampler

Sub: Larry M. Jacobs & Associates, Inc.

Remarks: Field logs documented by Ecology and Environment Driller: Jim Dudley

No. Sacks Drilling Mud: _____ Helper: R. Newby

Method: Hollow Stem 6"

Type Drill Rig: _____ By _____

Field Technician

Larry M. Jacobs & Associates, Inc.

Consulting Geotechnical Engineers

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FIELD BORING LOG

For: _____ Project No. 85-289

_____ Weather _____

Name of Project: Sapp Battery Page No. 2 of 2

Boring No. MW-23C Field Technician _____ Date _____ Time 1405 SD 1505 FD

Ground Elev. _____ Datum _____ Gr. Water Elev. _____

Sample No.	Sample Depth—Feet From	Sample Depth—Feet To	Depth Stratum Feet From	Depth Stratum Feet To	Visual Classification	*Blows Per 6" 1st	2nd	3rd
					MW-23C			
					Construction:			
					1. 2" PVC with Triloc seal			
					2. 10.0' 0.01" slotted screen			
					3. 6.0'-7.0' casing			
					4. Well=16.0'-17.0' LSD			
					5. 14.0'-15.0' sand and cave-in materials			
					6. 2.0' bentonite pellets			
					7. 2.0' concrete and pad			

* Number of blows of 140 lb hammer dropped 30 inches to drive 3 in split-spoon sampler

Remarks: Field logs documented by Ecology and Environment

Sub: Larry M. Jacobs & Associates, Inc.
Driller: Jim Dudley

No. Sacks Drilling Mud: _____

Helpers: R. Maddox, J. Fountain
Method: Hollow Stem

Type Drill Rig: _____

By _____
Field Technician

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LAYNE-CENTRAL COMPANY
FORMATION LOG

CONTRACT Sapp Battery CONTRACT NO. 1669-170 DATE 1-12-86

CITY Alford COUNTY Jackson STATE Florida

LOCATION Outside fence by R.R. track - East

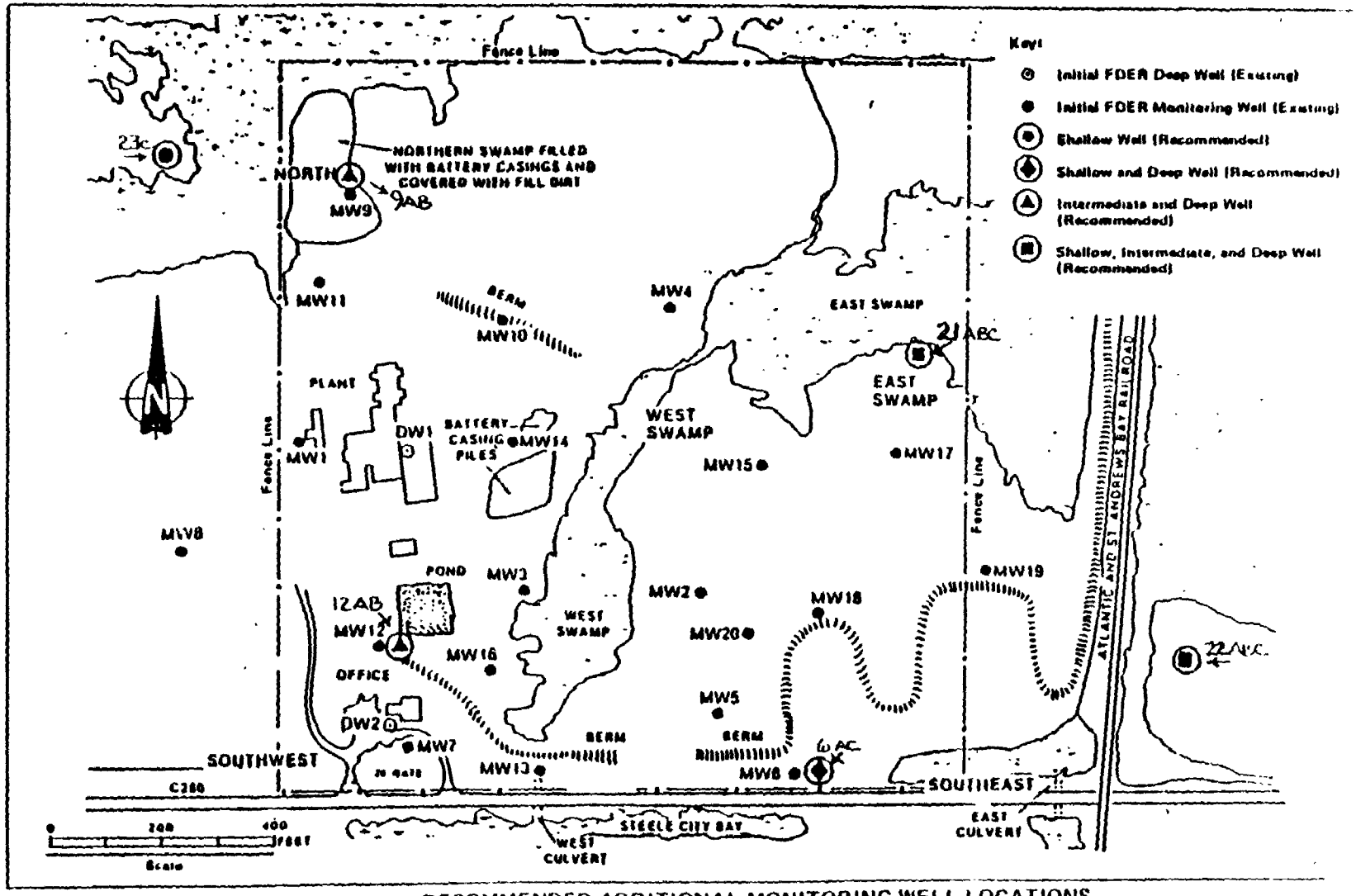
TEST HOLE NO. _____ WELL NO. 21-A ELEVATION N.A. SIZE SLUSH PIT none

DATE BEGAN 11-18-85 DATE COMPLETED 11-19-85 ELECTRIC LOG none

SAMPLE NO.	INCHES MUD	WT. MUD	FORMATION	THICKNESS EA. STRATA	TOTAL DEPTH
			Sandy red clay	20	20
			Sand	22	42
			Sandy clay	21	63
			Sand and gravel	22	85
			Pink lime rock	50	135

Continued ---

Drilled by J. W. Johnson
Check by B. J. Kight



RECOMMENDED ADDITIONAL MONITORING WELL LOCATIONS

A- DEEP
B- INTERMEDIATE

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LAYNE-CENTRAL COMPANY
FORMATION LOG

CONTRACT Sapp Battery CONTRACT NO. 1669-170 DATE 1-12-86

CITY Alford COUNTY Jackson STATE Florida

LOCATION Northwest corner of waste site

TEST HOLE NO. _____ WELL NO. 9-A ELEVATION N.A. SIZE SLUSH PIT None

DATE BEGAN 11-27-85 DATE COMPLETED 12-12-85 ELECTRIC LOG none

SAMPLE NO.	INCHES MUD	WT. MUD	FORMATION	THICKNESS EA. STRATA	TOTAL DEPTH
			Fill (W) battery cases	4	4
---			Muck - swamp wood	6	10
			Gray clay	3	13
			Sand	5	18
			Gray clay	12	30
			Fine sand	30	60
			Sand and gravel	75	135

Continued ---

Drilled by J. W. Johnson
Checked by B. J. Kight

LAYNE-CENTRAL COMPANY
FORMATION LOG

CONTRACT Sapp Battery CONTRACT NO. 1669-170 DATE 1-12-86

CITY Alford COUNTY Jackson STATE Florida

LOCATION Southwest corner of waste site near trailer

TEST HOLE NO. _____ WELL NO. 12-A ELEVATION N.A. SIZE SLUSH PIT none

DATE BEGAN 12-3-85 DATE COMPLETED 12-5-85 ELECTRIC LOG none

SAMPLE NO.	INCHES MUD	WT. MUD	FORMATION	THICKNESS EA. STRATA	TOTAL DEPTH
			Sandy red clay	4	4
			Gray sand	22	26
			Gray clay	11	37
			Sand and clay	24	61
			Sand and gravel	27	88
			Fine sand	47	135

Continued ---

Drilled by J. W. Johnson
Checked by B. J. Kight

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LAYNE-CENTRAL COMPANY
FORMATION LOG

ONTRACT Sapp Battery CONTRACT NO. 1669-170 DATE 1-12-86

ITY Alford COUNTY Jackson STATE Florida

OCATION Southeast corner of waste site

EST HOLE NO. WELL NO. 6-A ELEVATION N.A. SIZE SLUSH PIT none

ATE BEGAN 11-20-85 DATE COMPLETED 11-26-85 ELECTRIC LOG none

SAMPLE NO.	INCHES MUD	WT. MUD	FORMATION	THICKNESS EA. STRATA	TOTAL DEPTH
			Sandy red clay	4	4
---			Gray sandy clay	32	36
			Sand (W) clay	43	79
			Sand & gravel	16	95
			Pink lime rock	40	135

ntinued ---

Drilled by J. W. Johnson
Checked by B. J. Kight

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FORMATION LOG

CONTRACT Sapp Battery CONTRACT NO. 1669-170 DATE 1-12-86

CITY Alford COUNTY Jackson STATE Florida

LOCATION Northwest corner of waste site

TEST HOLE NO. _____ WELL NO. 22A ELEVATION N.A. SIZE SLUSH PIT None

DATE BEGAN 11-12-85 DATE COMPLETED 11-15-85 ELECTRIC LOG none

SAMPLE NO.	INCHES MUD	WT. MUD	FORMATION	THICKNESS EA. STRATA	TOTAL DEPTH
			Red sandy clay	6	6
			Grey sandy clay	32	38
			Sand	17	55
			Sand and gravel	20	75
			Red clay	17	92
			Pink lime rock	43	135

Continued ---

Drilled by J. W. Johnson
Checked by B. J. Kight

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SAPP BATTERY SITE FS
SAMPLE IDENTIFICATION SYSTEM[1]

I.D. Prefix	Description
FSA	10-foot soil borings, west bank of west swamp
FSB	10-foot soil borings, along southern berm
FSC	10-foot soil boring, through facility foundation
FSE	5-foot soil borings, east bank of west swamp
FSG	10-foot soil boring, grid north of facility
FSL	15-foot soil boring, northwest landfill
FSS	Surface soil sample location
FMH	5-foot sediment boring, swamps
FMK	10-foot boring, swamps
FMT	2.5-foot boring, swamps
FGW	Residential Well samples, November 1985
HGW	Residential Well samples, March 1986
FNW	New Well samples, wells installed by E & E
FEW	Existing Well samples, wells installed previously
FPW	Facility Wells
FSF	Fixation Study Samples
D--	Duplicate samples
GWR	Field Equipment Rinsate - well sampling
FSR	Field Equipment Rinsate - soil/sediment sampling
SBB	Trip Bottle Blank

[1]Excludes priority pollutant sample analyses
(Summary Report Appendix A)

APPENDIX F

SAPP BATTERY SITE SUMMARY REPORT
DATA CATALOG

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SUITE 205, 2574 SEAGATE DRIVE, TALLAHASSEE FLORIDA 32301 TEL 904 877 1978
International Specialists in the Environment

MEMORANDUM

TO: Brent Hartsfield, FDER

FROM: J. Paul Oxer, PE

DATE: December 16, 1985

SUBJ: SAPP BATTERY FEASIBILITY STUDY: RESIDENTIAL WELL SAMPLING RESULTS

Attached are the results of the analytical work for samples taken October 28 for the listed residential wells. Sample identities are listed below.

Station	Location
FGW-01	Carl Dilmore Residence
FGW-02	Joseph Duncan Residence
FGW-03	James Burdeshaw Residence
FGW-04	Salem Baptist Church
FGW-05	Mr. Jensenius Residence
FGW-07	J. W. Crooms Residence
FGW-08	L. R. Barnes Residence
FGW-09	Richard Bush Residence
DGW-09	Richard Bush Residence (Duplicate)
FGW-10	Vester Davis Residence
FGW-11	Lester Ellerbee Residence
FGW-12	Lester Ellerbee Tab. Well
DGW-12	Lester Ellerbee Tab. Well (Duplicate)
FGW-13	Roscoe Kent Residence
FGW-14	William Stoneberger Residence
FGW-15	Rufus Mayo Residence
FGW-17	Harold Williams Residence
FGW-18	Carolyn Skipper Residence
FGW-19	Jackie Farren Residence

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RESIDENTIAL WELL
SAMPLE ANALYSES DATA

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/kjs

DATE: December 11, 1985

SUBJECT: Sapp Battery Report; Job U-2565

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on twenty-nine samples received at the Analytical Services Center on November 6, 1985. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
enclosure

Station	Location
FGW-20	Delores Brown Residence
FGW-21	Sandra Rowe Residence
FGW-22	Jill Cosper Residence
FGW-26	James Braxton Residence
FGW-27	Amos Morris Residence
FGW-28	Charles Taylor Residence
DGW-28	Charles Taylor Residence (Duplicate)
FGW-29	Alford Fire Department
FGW-30	Rufus Mayo Residence
GWBB-01	Trip Bottle Blank

JPO/cm

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2565 RE: FM-2140

Sample Date: 11/2,4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Water Grab

E & E Lab Number 85-	7763	7764	7765	7766	7767	7768	7769	Blank
Customer Number	FGW-09	DGW-09	FGW-10	FGW-11	FGW-12	DGW-12	FGW-13	
				results in mg/L				
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	0.012	0.017	0.012	<0.005	0.012	0.013	<0.005	<0.005
Manganese	<0.015	<0.015	<0.015	<0.015	0.136	0.138	<0.015	<0.015
Nickel	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: December 26, 1985

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ecology and environment, inc.
International Specialists in the Environment

LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2565 RE: FM-2140

Sample Date: 11/2,4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Water Grab

E & E Lab Number 85-	7756	Blank	7757	7758	7759	7760	7761	77
Customer Number	FGW-01		FGW-02	FGW-03	FGW-04	FGW-05	FGW-07	FGW
				results in mg/L				
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.
Lead	<0.005	<0.005	<0.005	<0.005	<0.005	0.010	0.015	0.
Manganese	<0.015	<0.015	<0.015	<0.015	0.035	<0.015	<0.015	0.
Nickel	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst Stacy Hale / FZB

Date: December 6, 1985

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2565 RE: FM-2140

Sample Date: 11/2,4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Water Grab

E & E Lab Number 85-	7777	7778	7779	7780	7781	7782	7783	7784
Customer Number	FGW-22	FGW-26	FGW-27	FGW-28	DGW-28	FGW-29	FGW-30	GWBB-01
				results in mg/L				
Aluminum	<0.2	<0.2	<0.2	<0.2	0.248	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	<0.005	<0.005	<0.005	<0.005	0.006	0.023	<0.005	<0.005
Manganese	0.276	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Nickel	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: December [illegible], 1985

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2565 RE: FM-2140

Sample Date: 11/2,4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Water Grab

E & E Lab Number 85-	7770	7771	7772	7773	7774	7775	7776
Customer Number	FGW-14	FGW-15	FGW-17	FGW-18	FGW-19	FGW-20	FGW-21
				results in mg/L			
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.010
Manganese	<0.015	<0.015	<0.015	<0.015	0.058	<0.015	<0.015
Nickel	<0.02	<0.02	<0.02	0.025	<0.02	<0.02	<0.02
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1986.

Supervising Analyst [illegible]

Date: December 6, 19[illegible]

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Aluminum	7759	<200	2000	1582	79.1
	7776	<200	2000	2210	110
Antimony	7759	<60	500	578	116
	7776	<60	500	503	101
Arsenic	7759	<5	20	16.0	80.0
	7776	<5	20	23.5	118
Cadmium	7759	<1	5	4.78	95.6
	7776	<1	5	5.57	111
Lead	7776	1.8	20	38.5	184
Manganese	7759	35	200	186	75.5
	7776	<15	200	215	108
Nickel	7759	<20	400	312	78.0
	7776	31	400	428	99.2
Selenium	7759	<5	10	6.7	67.0
	7776	<5	10	11.4	114

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Antimony	7759	<0.06	<0.06	--
	7776	<0.06	<0.06	--
Aluminum	7759	<0.2	<0.2	--
	7776	<0.2	<0.2	--
Arsenic	7759	<0.005	<0.005	--
	7776	<0.005	<0.005	--
Cadmium	7759	<0.001	<0.001	--
	7776	<0.001	<0.001	--
Lead	7759	<0.005	0.024	--
	7776	0.010	<0.005	--
Manganese	7759	0.035	0.035	0.0
	7776	<0.015	<0.015	--
Nickel	7759	<0.02	<0.02	--
	7776	<0.02	0.031	--
Selenium	7759	<0.005	<0.005	--
	7776	<0.005	<0.005	--

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SUITE 205, 2574 SEAGATE DRIVE, TALLAHASSEE, FLORIDA 32301, TEL 904 877 1978
International Specialists in the Environment

May 14, 1986

Mr. Brent Hartsfield
Bureau of Operations
Florida Department of Environmental
Regulation
2600 Blair Stone Road
Tallahassee, FL 32301

RE: SAPP BATTERY FEASIBILITY STUDY: 2ND ROUND OF RESIDENTIAL WELL SAMPLING RESULTS

Dear Brent:

Attached are the results and respective QA/QC data of the analytical work for residential well samples taken March 12-13, 1986. Sample identities and a summary of the detected metal species are also attached.

In comparison to the earlier lead data, these results follow the same general trend as specified in the draft Sapp field report, where the highest lead concentrations are showing up southeast of the site. Furthermore, the Lester Ellerbee, Carl Dilmore, and James Burdeshaw residence wells have elevated lead levels on the order of 0.010 to 0.020 ppm in comparison to the last sampling round.

When E & E finalizes the draft Sapp Summary Report, these data will be incorporated in the residential well section.

Please call if you have any questions in reference to this work.

Yours truly,

ECOLOGY AND ENVIRONMENT, INC.

Richard J. Rudy

Richard J. Rudy
Hydrogeologist

RJR/cm

cc: J. Paul Oxer

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	761	4.4
Antimony	101.5	102.7	1.2
	101.5	100.7	0.8
Arsenic	26.7	29.1	8.9
	26.7	28.5	6.7
Cadmium	3.3	3.44	4.2
	3.3	3.16	4.2
Lead	42.7	41.6	2.6
Manganese	348	353	1.4
Nickel	207	215	3.9
Selenium	50.2	37.4	25.5
	50.2	37.9	24.5

Note: These results are within the 95% confidence interval for these parameters.

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MEMORANDUM

TO:	Rick Rudy
FROM:	Gary Hahn
DATE:	April 21, 1986
SUBJECT:	Sapp Battery Report; Job U-3048
CC:	Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on twenty-nine samples received at the Analytical Services Center on March 17, 1986. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
enclosure

SAFT BATTERY SITE

SUMMARY OF DETECTED METAL SPECIES

Sample Identity		Lead	Manganese	Aluminum	Cadmium
HGW-01	Carl Dilmore Residence	0.021			
HGW-02	Joseph Duncan Residence				
HGW-03	James Burdeshaw Residence	0.016			
HGW-04	Salem Baptist Church		0.048 0.0520	<0.200 0.2150	
HGW-05	Jansenius Residence				
HGW-07	George Crooms Residence				
HGW-08	James Barnes Residence		0.090		
HGW-09	Richard Bush Residence	0.012		0.261	
HGW-10	Vester Davis Residence	0.006			
HGW-11	Lester Ellerbee Tabernacle	0.009			
HGW-12	Lester Ellerbee Residence	0.024 0.0210	0.125 0.1200	0.302 0.2680	
HGW-13	Roscoe Kent Residence			0.205	0.007
HGW-14	Bill Stoneburger Residence				
HGW-15	Rufus Mayo Residence	0.007			
HGW-17	Harold Williams Residence	0.005			
HGW-18	Carolyn Skipper Residence				
HGW-19	Jackie Farren Residence				
HGW-20	Delores Brown Residence	0.006			
HGW-21	Sandra Rowes Residence	0.005			
HGW-22	William Casper Residence	0.008			
HGW-26	James Braxter Residence	0.008			
HGW-27	Amos Morris Residence	0.007			
HGW-28	Charles Taylor Residence				
HGW-29	Alford Fire Department	(Not Sampled 2nd Round)			
HGW-30	Teresa Mayo Residence				
HGW-31	Emmet Roark Residence			<0.200 0.2190	

NOTE: Blank spaces represent non-detected results and all values are parts per million (ppm).

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-3048 RE: FM-2140

Sample Date: 3/12-13/86 Sampled By: E & E, Inc.

Date Received: 3/17/86 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 86-	1808	1809	1810	1811	Prep Blank	Prep Blank	312	1813
Customer Number	HGW 07	HGW 08	HGW 09	HGW 10	380	381	HGW 11	HGW 12
			Results in mg/L					
Aluminum	<0.2	<0.2	0.261	<0.2	<0.2	--	<0.2	0.302
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	--	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005
Lead	<0.005	<0.005	0.012	0.006	--	<0.005	0.009	0.024
Manganese	<0.015	0.090	<0.015	<0.015	<0.015	--	<0.015	0.125
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	--	<0.04	<0.04
Selenium	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: [illegible]

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-3048 RE: FM-2140

Sample Date: 3/12-13/86 Sampled By: E & E, Inc.

Date Received: 3/17/86 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 86-	1802	1803	1804	1805	1806	1807
Customer Number	HGW 01	HGW 02	HGW 03	HGW 04	DHGW 04	HGW 05
	Results in mg/L					
Aluminum	<0.2	<0.2	<0.2	<0.2	0.215	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lead	0.021	<0.005	0.016	<0.005	<0.005	<0.005
Manganese	<0.015	<0.015	<0.015	0.048	0.052	<0.015
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: April 21, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-3048 RE: FM-2140

Sample Date: 3/12-13/86 Sampled By: E & E, Inc.

Date Received: 3/17/86 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 86-	1820	1821	1822	1823	1824	18[illegible]
Customer Number	HGW 19	HGW 20	HGW 21	HGW 22	HGW 26	HGW 27
			Results in mg/L			
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lead	<0.005	0.006	0.005	0.008	0.008	0.007
Manganese	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: April 24, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-3048 RE: FM-2140

Sample Date: 3/12-13/86 Sampled By: E & E, Inc.

Date Received: 3/17/86 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 86-	1814	1815	1816	1817	1818	1819
Customer Number	DHGW 12	HGW 13	HGW 14	HGW 15	HGW 17	HGW 18
			Results in mg/L			
Aluminum	0.268	0.205	<0.2	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.005	0.007	<0.005	<0.005	<0.005	<0.005
Lead	0.021	<0.005	<0.005	0.007	0.005	<0.005
Manganese	0.120	<0.015	<0.015	<0.015	<0.015	<0.015
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

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Date: _____

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Element	E & E Laboratory No. 86-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Aluminum	1811	<0.2	<0.2	--
	1829	0.219	<0.2	--
Antimony	1811	<0.06	<0.06	--
	1829	<0.06	<0.06	--
Arsenic	1811	<0.005	<0.005	--
	1829	<0.005	<0.005	--
Cadmium	1811	<0.005	<0.005	--
	1829	<0.005	<0.005	--
Lead	1811	0.006	0.006	0
	1829	<0.005	<0.005	--
Manganese	1811	<0.015	<0.015	--
	1829	<0.015	<0.015	--
Nickel	1811	<0.04	<0.04	--
	1829	<0.04	<0.04	--
Selenium	1811	<0.005	<0.005	--
	1829	<0.005	<0.005	--

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-3048 RE: FM-2140

Sample Date: 3/12-13/86 Sampled By: E & E, Inc.

Date Received: 3/17/86 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 86-	1826	1827	1828	1829	1830	Prep Blank	Prep Blank
Customer Number	HGW 28	HGW 30	HGW 31	DHGW 31	HGW 88	382	383
			Results in mg/L				
Aluminum	<0.2	<0.2	<0.2	0.219	<0.2	<0.2	--
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	--
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	--	<0.005
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
Lead	<0.005	<0.005	<0.005	<0.005	<0.005	--	<0.005
Manganese	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	--
Nickel	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	--
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	--	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst _____

Date: _____

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

Element	Concentrations in ug/L		Percent Difference
	Known	Determined	
Aluminum	729	709	2.7
	729	841	15.3*
Antimony	101.5	83.0	18.2
	101.5	93.0	8.4
Arsenic	26.7	29.1	9.0
	26.7	31.2	16.8
Cadmium	39.0	39.8	2.0
	39.0	39.9	2.3
Lead	42.7	42.8	0.2
Manganese	348	368	5.7
	348	357	2.6
Nickel	207	218	5.3
	207	214	3.4
Selenium	10.9	11.6	6.4
	10.9	11.1	1.8

Note: These results are within the 95% confidence interval for these parameters.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Element	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Aluminum	1811	<200	2000	1720	86.0
	1829	219	2000	1678	73.0
Antimony	1811	<60	500	481	96.2
	1829	<60	500	468	93.6
Arsenic	1811	<5.0	20	18.7	93.5
	1829	<5.0	20	20.1	100
Cadmium	1811	<5.0	50	59.8	120
	1829	<5.0	50	50.5	101
Lead	1811	6.0	20	28.3	112
	1829	<5.0	20	18.7	93.5
Manganese	1811	<15	200	208	104
	1829	<15	200	203	102
Nickel	1811	<40	400	405	101
	1829	<40	400	405	101
Selenium	1811	<5.0	10	10.6	106
	1829	<5.0	10	10.4	104

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2681 RE: FM-2130

Sample Date: 11/19-26/85 Sampled By: E & E, Inc.

Date Received: 12/2/85 Delivered By: Federal Expr[illegible]

Sample Type: Water Grabs

E & E Lab Number 85-	8759	8760	8761	8762	8763	8764
Customer Number	FEW-02B	DEW-02B	FEW-15B	FEW-17C	FEW-18C	F[illegible]-19C
			all results in mg/L			
Aluminum	1.00	0.986	18.9	0.843	73.1	17[illegible]3
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<[illegible]06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<[illegible].005
Cadmium	<0.001	<0.001	0.007	<0.001	0.023	0.[illegible]2
Lead	0.011	0.010	0.021	0.027	0.059	[illegible]13
Manganese	<0.015	<0.015	0.415	<0.015	0.722	0.[illegible]78
Selenium	<0.010	<0.010	<0.010	<0.010	<0.010	<[illegible]010

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 198[illegible].

Supervising Analyst [illegible]

Date: January 6, 1986

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MONITORING WELL
SAMPLE DATA

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Aluminum	8769	<200	2000	2352	118
Antimony	8764	<0.06	120	119.7	99.8
Arsenic	8769	<5	25	26.7	107
Cadmium	8762	<1	2.5	3.2	128
Lead	8769	7.7	25	29.1	86
Manganese	8769	<15	200	236	118
Selenium	8769	<10	25	26.4	106

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2681 RE: FM-2130

Sample Date: 11/19-26/85 Sampled By: E & E, Inc.

Date Received: 12/2/85 Delivered By: Federal Express

Sample Type: Water Grabs

E & E Lab Number 85-	8765	8766	8767	8768	8769	8770	8771
Customer Number	FEW-20C	FNW-06C	FNW-21C	GWR-02	GWR-03	GWBB-02	GBBB-03
				all results in mg/L			
Aluminum	11.8	52.8	56.5	<0.2	<0.2	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.006	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Lead	0.043	0.046	0.022	0.028	0.008	<0.005	<0.005
Manganese	0.119	<0.015	0.028	<0.015	<0.015	<0.015	<0.015
Selenium	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst Jay Hahn/KKB

Date: January 6, 1986

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U-2681

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	709	2.7
Antimony	101.5	107.6	6.0
Arsenic	26.7	26.4	1.1
Cadmium	3.30	3.43	3.9
Lead	42.7	44.7	4.7
Manganese	348	346	0.6
Selenium	10.9	11.1	1.8

Note: These results are within the 95% confidence interval for these parameters.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Aluminum	8769	<200	<200	--
Antimony	8769	<0.06	<0.06	--
Arsenic	8769	<5	<5	--
Cadmium	8769	<1	<1	--
Lead	8769	7.7	10.3	29
Manganese	8769	<15	<15	--
Selenium	8769	<10	<10	--

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2700 RE: FM-2130

Sample Date: 12/3-4/85 Sampled By: E & E, Inc.

Date Received: 12/5/85 Delivered By: Federal Express

Sample Type: Water Grabs

E & E Lab Number 85-	Sample Identity	Aluminum	Antimony	Arsenic	Cadmium	Lead	Manganese	Selenium
				all results in mg/L				
Prep Blank 197	--	<0.2	<0.6	--	<0.005	<0.1	<0.015	-- <0.005
8845	FEW-01A	1.73	<0.6	<0.005	<0.005	3.68	0.[illegible]	<0.005
8846	FEW-01B	8.94	<0.6	<0.005	<0.005	0.650	0.[illegible]1	<0.005
8847	FEW-04A	0.559	<0.6	<0.005	<0.005	0.045	0.[illegible]46	<0.005
8848	FEW-05A	3.55	<0.6	<0.005	<0.005	0.080	0.0[illegible]	<0.005
8849	FEW-12C	27.8	<0.6	<0.005	0.014	0.413	4.9[illegible]	<0.005
8850	FEW-14A	5.26	<0.6	<0.005	<0.005	0.389	0.5[illegible]7	<0.005
8851	FEW-14B	5.41	<0.6	<0.005	<0.005	0.242	0.[illegible]84	<0.005
8852	FEW-14C	3.54	<0.6	<0.005	<0.005	3.72	28.[illegible]	<0.05
8853	FNW-09B	870	<0.6	<0.05	<0.005	0.546	0.[illegible]59	<0.05
8854	FNW-12B	987	<0.6	<0.05	<0.005	0.501	0.[illegible]62	<0.005
8855	FNW-22B	4.96	<0.6	<0.05	<0.005	0.006	0.1[illegible]0	<0.005
8856	FNW-22C	2.46	<0.6	<0.05	<0.005	<0.005	<0.[illegible]15	<0.005
8857	GWR-04	<0.2	<0.6	<0.05	<0.005	0.028	<0.015	<0.005
Prep Blank 194	--	--	<0.6	<0.05	<0.005	<0.005	--	--
Prep Blank 209	--	<0.2	<0.6	<0.05	<0.005	<0.1	<0.015	<0.005
Prep Blank 210	--	--	<0.6	<0.005	<0.005	--	--	<0.005

Analytical References:

U.S. EPA Contract Laboratory Report, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 20, 1986

MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: January 20, 1986

SUBJECT: Amended Sapp Battery Report, Job No. U-2700

Attached is the amended laboratory report of the analysis conducted on thirteen samples received at the Analytical Services Center on December 5, 1985. Please replace the incorrect page with the amended one. We apologize for any inconvenience this may have caused. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of the original report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	744	2.0
Antimony	101.5	96.1	5.3
Arsenic	26.7	28.4	6.4
Cadmium	39.0	45.7	17
Lead	42.7 42.7	43.3 40.9	1.4 4.2
Manganese	348	352	1.1
Selenium	10.9	9.2	16

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Aluminum	8845	1.73	1.88	8.3
Antimony	8845	<0.6	<0.6	--
Arsenic	8845	<0.005	<0.005	--
Cadmium	8845	<0.005	<0.005	--
Lead	8845	0.368	0.357	3.0
Manganese	8845	0.030	0.028	6.9
Selenium	8845	<0.005	<0.005	--

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2723 RE: FM-2130

Sample Date: 12/4-6/85 Sampled By: E & E, Inc.

Date Received: 12/7/85 Delivered By: Federal Express

Sample Type: Water Composite

E & E Lab Number 85-	8939	8940	8941	8942	8943	8944
Customer Number	FEW-16C	FNW-06A	FNW-23C	DNW-23C	FPW-01	FPW-07
			results in mg/L			
Aluminum	285	1.04	3.53	7.76	0.809	1.12
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.05	<0.005	<0.005	<0.005	0.018	<0.005
Cadmium	0.076	<0.005	0.007	<0.005	<0.005	0.026
Lead	0.286	0.051	0.007	<0.005	1.83	1.50
Manganese	6.94	0.113	<0.015	0.033	2.46	0.172
Selenium	<0.05	<0.005	<0.005	<0.005	0.008	<0.005

Analytical References:

U.S EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 5, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2723 RE: FM-2130

Sample Date: 12/4-6/85 Sampled By: E & E, Inc.

Date Received: 12/7/85 Delivered By: Federal Express

Sample Type: Water Composite

E & E Lab Number 85-	8933	8934	8935	8936	8937	8938	Prep
Customer Number	FEW-06B	FEW-07B	FEW-08B	FEW-13A	FEW-13B	FEW-14	Blank
			results in mg/L				
Aluminum	2.21	280	10.4	2.58	1.38	1.59	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005	0.009	<0.005
Cadmium	<0.005	0.032	<0.005	0.011	<0.005	<0.005	<0.005
Lead	0.015	0.509	0.761	0.168	0.149	0.061	<0.005
Manganese	0.025	17.4	0.060	0.876	0.184	0.232	<0.015
Selenium	<0.05	<0.05	<0.005	<0.005	<0.05	<0.005	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.u

Supervising Analyst [illegible]

Date: January 23 1986

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U-2723

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	816	11.9
Antimony	101.5	104.1	2.6
Arsenic	26.7	28.4	6.4
Cadmium	39.0	42.5	9.0
Lead	42.7	42.0	1.6
Manganese	348	372	6.9
Selenium	10.9	9.50	12.8

Note: These results are within the 95% confidence interval for these parameters.

U-2723

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Manganese	8944	0.173	0.155	11.0
Aluminum	8944	1.12	1.08	3.6
Arsenic	8944	<0.005	<0.005	--
Selenium	8944	<0.005	<0.005	--
Antimony	8944	<0.06	<0.06	--
Lead	8944	1.50	1.44	4.1
Cadmium	8944	<0.005	<0.005	--

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LABORATORY REPORT

FOR

SAPP BATTERY

Job No.:	U-2737	RE:	FM-2130
Sample Date:	12/6-10/85	Sampled By:	E & E, Inc.
Date Received:	12/11/85	Delivered By:	Federal Express
Sample Type:	Water Grab		

E & E Lab Number 85-	9013	9014*	9015	9016	9017	9018	9019	Prep Blank
Customer Number	FEW-03B	FNW-12A	FNW-21A	FNW-21B	FNW-22A	DNW-22A	GWP-05	
				Results in mg/L				
Aluminum	58.4	105	7.72	14.2	1.03	1.49	<0.2	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	0.092	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.021	0.004	0.002	0.002	<0.001	0.001	<0.001	<0.001
Lead	4.28	0.598	0.029	0.020	0.012	0.027	<0.005	<0.005
Manganese	0.493	0.844	0.169	0.037	0.047	0.055	<0.015	<0.015
Selenium	<0.5	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

* - Filtered prior to analysis.

Analytical References:

U.S. EPA Contract Laboratory, Inorganic Statement of Work, 1984. March 1983.

Supervising Analyst [illegible]

Date: [illegible]

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/KB

DATE: January 6, 1986

SUBJECT: Sapp Battery Report; Job U-2737

cc: Lab file, QA/QC file

Attached is the laboratory report of the analysis conducted on seven samples received at the Analytical Services Center on December 11, 1985. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	713	2.2
Antimony	101.5	101.0	0.5
Arsenic	26.7	27.8	4.1
Cadmium	3.3	3.43	3.9
Lead	42.7	39.2	8.2
Manganese	348	353	1.4
Selenium	10.9	9.7	11.0

Note: These results are within the 95% confidence interval for these parameters.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Antimony	9013	<0.06	<0.06	--
Arsenic	9013	<0.005	<0.005	--
Cadmium	9013	0.021	0.022	4.6
Lead	9013	4.28	6.38	39.3
Selenium	9013	<0.5	<0.5	--

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/KB

DATE: January 17, 1986

SUBJECT: Sapp Battery Report; Job No. U-2779

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on one sample received at the Analytical Services Center on December 13, 1985. Analysis was performed according to U.S. EPA Contract Laboratory Program, Inorganic Statement of Work 1984. The submitted sample was filtered prior to analysis per your instructions.

All samples, on which this report is based, will be retained by E&F for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	9015	<60	120	110	91.7
Arsenic	9015	<5	25	29.3	117
Cadmium	9018	1.1	2.5	3.59	99.6
Lead	9015	29.2	25	54.1	100
Selenium	9017	<5	25	23.2	92.8

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U-2779

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

Element	Concentrations in ug/L		Percent Difference
	Known	Determined	
Aluminum	729	749	2.7
Arsenic	26.7	28.8	7.9
Manganese	348	330	5.2
Selenium	10.9	10.5	3.7

Note: These results are within the 95% confidence interval for these parameters.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2779

Sample Date: 12/12/85 Sampled By: E & E, Inc.

Date Received: 12/13/85 Delivered By: Federal Express

Sample Type: Water Comp

E & E Lab Number 85-	9101	Prep
Sample Identity	FNW-09A	Blank
	results in mg/L	
Aluminum	16.6	<0.2
Antimony	<0.06	<0.06
Arsenic	0.014	<0.005
Cadmium	<0.005	<0.005
Lead	0.463	<0.1
Manganese	0.687	<0.015
Selenium	<0.05	<0.005

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 17, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2689 RE: FM-2130

Sample Date: 11/26-27/85 Sampled By: E & E, Inc.

Date Received: 12/3/85 Delivered By: Federal Express

Sample Type: Water

E & E Lab Number 85-	8806	8807	8808	8809	Prep Blank
Sample Identity	FEW 10C	DEW 10C	FEW 05B	FEW 11C	
	all results in mg/L				
Aluminum	35.1	45.2	<0.2	5.01	<0.2
Antimony	<0.06	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005
Lead	0.257	0.290	0.010	0.021	<0.00
Manganese	6.98	5.91	<0.015	2.24	<0.015
Selenium	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 6, 1986

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/KDS

DATE: January 6, 1986

SUBJECT: Sapp Battery Report; Job U-2689

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on four samples received at the Analytical Services Center on December 3, 1985. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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U-2689

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	816	11.9
Antimony	101.5	96.1	5.3
Arsenic	26.7	26.4	1.1
Cadmium	39.0	45.7	17.2
Lead	42.7	42.0	1.6
Manganese	348	372	6.9
Selenium	10.9	10.2	6.4

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Aluminum	8808	<0.2	0.205	--
Antimony	8808	<0.06	<0.06	--
Arsenic	8808	<0.005	<0.005	--
Cadmium	8808	<0.005	<0.005	--
Lead	8808	0.010	0.0096	4.1
Manganese	8808	<0.015	<0.015	--
Selenium	8808	<0.005	<0.005	--

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/NTS

DATE: December 13, 1985

SUBJECT: Sapp Battery Report; Job No. U-2566

Attached is the laboratory report of the analysis conducted on one hundred and thirty-six samples received at the Analytical Services Center on November 5, 1985. Analysis was performed according to U.S EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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SOIL SAMPLE ANALYTICAL DATA

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Expr: is

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7818	FSS-10	4.38	2.15	86
7819	FSS-11	4.21	242	87
7320	FSS-12	4.04	56.1	75
7821	FSS-13	3.99	20.9	78
7822	FSS-14	5.11	8.62	91
7823	FSS-15	5.94	1670	81
7824	DSS-15	5.76	1760	71
Prep Blank*	--	--	<0.005	--
7825	FSS-16	4.24	76.4	82
7826	FSS-17	3.96	96.2	79
7827	FSS-18	3.72	179	95
7828	DSS-18	3.52	169	84
7829	FSG-45A	5.48	68.2	19
7830	FSG-45B	5.20	8.55	4
7831	FSG-45C	5.02	3.99	84
7832	FSG-55A	5.57	1870	0
7833	FSG-55B	4.55	107	82
7834	FSG-55C	5.22	59.0	84
7835	FSG-56A	5.61	479	85

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [signature]

Date: [signature]

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F-54

MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: January 21, 1986

SUBJECT: Amended Sapp Battery Report; Job No. U-2566

Attached is the amended laboratory report of the analysis conducted on one hundred and thirty-six samples received at the Analytical Services Center on November 5, 1985. Please replace the incorrect page with the attached amended page. We apologize for any inconvenience this may have caused. Analysis was performed according to U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7801	FSB-05C	4.28	13.8	86
7802	FSE-01A	4.66	394	73
7803	DSE-01A	4.89	332	73
7804	FSE-01B	4.66	3.45	86
Prep Blank*	--	--	<0.005	--
7805	FSE-01C	4.27	2.00	92
7806	FSE-02A	4.55	13.2	83
7807	FSE-02B	4.47	1.89	86
7808	FSE-02C	4.37	95.9	89
7809	FSS-01	7.29	218	86
7810	FSS-02	4.91	3.59	82
7811	FSS-03	5.50	10.4	94
7812	FSS-04	6.21	97.9	90
7813	FSS-05	6.00	271	87
7814	FSS-06	4.17	3.04	92
7815	FSS-07	4.29	7.30	82
7816	FSS-08	4.31	13.5	79
7817	FSS-09	4.56	10.0	81

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work. 1984.

Supervising Analyst [illegible]

Date: December 13, 1985

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
Prep Blank*	--	--	<0.005	--
7785	FSB-01A	5.36	43.2	86
7786	FSB-01B	5.07	11.5	85
7787	FSB-01C	5.17	2.57	84
7788	FSB-02A	6.86	8330	92
7789	FSB-02B	5.74	325	87
7790	DSB-02B	5.64	746	87
7791	FSB-02C	5.02	460	77
7792	FSB-03A	6.02	66,100	88
7793	FSB-03B	5.00	650	91
7794	FSB-03C	4.97	400	86
7795	FSB-04A	5.70	3780	90
7796	FSB-04B	4.75	219	88
7797	FSB-04C	4.52	128	85
7798	FSB-05A	5.17	543	90
7799	DSB-05A	5.05	654	91
7800	FSB-05B	4.28	9.43	88

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst Gary Hale

Date: December 13, 1985

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7854	FSG-86A	6.77	90,000	90
7855	DSG-86A	6.80	22,300	88
7856	FSG-86B	6.58	43,800	88
7857	FSG-86C	6.23	46,700	88
7858	FSG-87A	7.87	1180	92
7859	FSG-87B	5.39	6090	82
7860	FSG-87C	4.86	9430	80
7861	FSG-95A	5.27	322	92
7862	FSG-95B	5.35	91.6	91
7863	FSG-95C	5.37	115	90
7864	FSG-96A	6.61	16,100	89
Prep Blank*	--	--	<0.005	--
7865	DSG-96A	6.72	169,000	91
7866	FSG-96B	6.80	96,600	86
7867	FSG-96C	5.77	872	87
7868	FSG-62A	4.42	102	91
7869	FSG-62B	5.20	22.7	88
7870	FSG-62C	5.25	6.34	87
7871	FSG-64A	5.73	16,500	91
7872	FSG-64B	4.69	818	93

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7836	FSG-56B	5.15	20.2	78
7837	FSG-56C	4.96	22.9	77
7838	FSG-65A	5.34	201	88
7839	FSG-65B	4.98	220	90
7840	FSG-65C	4.89	564	91
7841	FSG-66A	5.74	14.1	91
7842	FSG-66B	5.84	17.2	91
7843	FSG-66C	5.47	6560	89
7844	FSG-75A	6.02	511	89
Prep Blank*	--	--	<0.005	--
7845	DSG-75A	5.73	591	89
7846	FSG-75B	6.15	50.6	82
7847	FSG-75C	5.18	95.3	77
7848	FSG-76A	5.66	3770	85
7849	FSG-75B	5.47	8320	92
7850	FSG-76C	5.97	25,300	89
7851	FSG-77A	5.44	813	90
7852	FSG-77B	5.39	3940	90
7853	FSG-77C	5.61	5120	86

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst: [illegible]

Date: December 12, 1985

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7891	FSG-91A	4.20	636	[illegible]
7892	FSG-91B	4.63	342	[illegible]
7893	FSG-91C	4.59	258	[illegible]
7894	FSG-53A	5.25	2260	[illegible]
7895	FSG-53B	6.17	16,700	[illegible]
7896	FSG-53C	5.10	5310	[illegible]
7897	FSG-54A	4.75	177	[illegible]
7898	FSG-54B	4.92	17.6	[illegible]
7899	FSG-54C	4.65	53.9	[illegible]
7900*	SBB-02	NR	<0.01	[illegible]
7901*	SBB-03	NR	<0.01	[illegible]
7902*	SBB-04	NR	<0.01	NR
7903*	FSR-02	NR	0.029	[illegible]
7904*	FSR-03	NR	0.155	[illegible]
7905*	FSR-04	NR	1.48	[illegible]

*mg/L

NR-Analysis Not Requested

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 198[illegible].

Supervising Analyst [illegible]

Date: January [illegible], 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7873	FSG-64C	4.82	230	93
7874	DSG-64C	4.91	187	93
7875	FSG-71A	4.54	1680	84
7876	FSG-71B	4.41	212	90
7877	FSG-71C	4.56	601	87
7878	FSG-73A	4.52	37.2	93
7879	FSG-73B	4.95	27.8	93
7880	DSG-73B	4.46	63.3	92
7881	FSG-73C	4.98	20.4	91
7882	FSG-82A	5.18	8301	83
7883	FSG-82B	4.68	17.0	85
7884	FSG-82C	4.75	17.2	86
Prep Blank*	--	--	<0.005	--
7885	FSG-84A	3.95	336	89
7886	FSG-84B	4.09	163	89
7887	FSG-84C	4.33	141	87
7888	FSG-85A	5.35	1790	91
7889	FSG-85B	6.12	267	92
7890	FSG-85C	5.55	57.5	89

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [signature]

Date: [illegible] 1985

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER AND SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Antimony	7839	<12	<12	--
	7895	31.5	23.7	28.3
	7904	<0.06	<0.06	--
Cadmium	7839	<1	<1	--
	7895	<1	<1	--
	7904	<0.005	<0.005	--
Lead	7812	97.9	116	16.9
	7839	220	121	58.1
	7868	102	101	0.9
	7904	0.155	0.149	3.9
	7795	3780	4630	20.2
	7895	16,700	11,100	42.6
pH	7794	4.97	4.99	0.4
	7804	4.66	4.63	0.6
	7814	4.17	4.44	6.3
	7824	5.76	5.74	0.3
	7836	5.15	5.12	0.6
	7846	6.15	6.12	0.5
	7856	6.58	6.64	0.9
	7867	5.77	5.75	0.3
	7877	4.56	4.60	0.9
	7887	4.33	4.36	0.7
	7897	4.75	4.43	9.1
	7905	1.49	1.51	1.3

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2566 RE: FM-2040

Sample Date: 10/29-11/4/85 Sampled By: E & E, Inc.

Date Received: 11/5/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number 85-	Customer Number	Antimony	Cadmium
		mg/kg as received	
7825	FSS-16	<12	[illegible]
7826	FSS-17	<12	[illegible]
7827	FSS-18	<12	[illegible]
7828	DSS-18	<12	[illegible]
Blank*	--	<0.06	<0.005
7894	FSG-53A	<12	[illegible]
7895	FSG-53B	31.5	[illegible]
7896	FSG-53C	18.7	[illegible]
7897	FSG-54A	<12	[illegible]
7898	FSG-54B	<12	[illegible]
7899	FSG-54C	<12	[illegible]
7900*	SBB 02	<0.06	<0.005
7901*	SBB 03	<0.06	<0.005
7902*	SBB 04	<0.06	<0.005
7903*	FSR 02	<0.06	<0.005
7904*	FSR 03	<0.06	<0.005

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1034.

Supervising Analyst [illegible]

Date: [illegible]

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

Element	Concentrations in ug/L Known	Determined	Percent Difference
Antimony	101.5	123.6	21.7
Cadmium	39.0	41.9	7.4
Lead	435	448	3.0
	42.7	44.4	4.0
	42.7	41.4	3.0
	42.7	40.4	5.4
	42.7	40.0	6.3
	42.7	43.8	2.6
	42.7	45.1	5.6
	42.7	41.0	4.0
	42.7	40.5	5.2
	42.7	39.1	8.4

Note: These results are within the 95% confidence interval for these parameters.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER AND SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	7839R*	33.6	500	478	88.9
	7895R*	121	500	627	101
	7904R*	<60	500	786	157
Cadmium	7839R*	<5	50	57.7	115
	7895R*	<5	50	61.6	123
	7904R*	<5	50	64.7	129
Lead	7839R*	618	500	1104	97.2
	7868R*	504	500	1189	137
	7812R*	620	500	958	67.6
	7904R*	140	500	788	130

*Results in ug/L because spiking performed during digestion procedure.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2571 RE: FM-2040

Sample Date: 11/4-5/86 Sampled By: E & E, Inc.

Date Received: 11/6/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
Prep Blank*	--	--	<0.005	--
7937	FSG-35A	5.90	41.7	88
7938	FSG-35B	5.22	<5	87
7939	FSG-35C	5.32	3.68	86
7940	FSG-44A	4.82	17.4	93
7941	FSG-44B	4.83	3.66	91
7942	FSG-44C	4.94	4.12	88
7943	FSG-67A	5.42	19.0	89
7944	FSG-67B	5.50	27.6	87
7945	DSG-67B	5.73	20.7	87
7946	FSG-67C	5.64	25.1	85
7947	FSG-68A	4.95	439	84
7948	FSG-68B	5.02	7.11	90
7949	FSG-68C	5.01	10.6	76
7950	FSG-69A	5.02	144	88

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 10, 198[illegible]

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn JH/KS

DATE: January 10, 1986

SUBJECT: Sapp Battery Report; Job U-2571

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on thirty-nine samples received at the Analytical Services Center on November [illegible], 1985. Analysis was performed according to U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

For all analyses, the EPA Contract Required Detection Limits (CRDL) were followed. However, since many samples required dilutions to achieve the EPC CLP spike protocol, the reported detection limits may vary. All dilution factors are on record.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2571 RE: FM-2040

Sample Date: 11/4-5/86 Sampled By: E & E, Inc.

Date Received: 11/6/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead	Antimony	Cadmium	Solids %
			mg/kg as received			
7963	FSG-34A	5.90	246	<12	<1	9[illegible]
7964	FSG-34B	5.10	53.4	<12	<1	[illegible]3
7965	FSG-34C	5.00	3.08	<12	<1	[illegible]
7966	FSG-43A	5.66	1740	<12	<1	9
7967	FSG-43B	4.87	690	<12	<1	[illegible]
7968	FSG-43C	4.75	690	<12	<1	[illegible]
7969	FSG-51A	5.65	19,200	55.9	<1	[illegible]
7970	DSG-51A	6.18	22,700	42.2	<1	96
7971	FSG-51B	5.67	84,200	110	2.20	96
7972	FSG-51C	5.15	15,300	16.7	<1	[illegible]
7973	EPA-1	5.65	<1	<12	<1	NR
Prep Blank*	--	--	<0.005	--	--	--
7974*	SBB-06	6.37	<0.005	<0.06	<0.005	NR
7975*	FSR-05	1.40	1.95	<0.06	<0.005	NR

*mg/L

NR-Analysis Not Requested

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 10, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2571 RE: FM-2040

Sample Date: 11/4-5/86 Sampled By: E & E, Inc.

Date Received: 11/6/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Lead mg/kg as received	Solids %
7951	FSG-69B	5.35	11.0	87
7952	FSG-69C	5.88	7.66	85
7953	FSG-78A	5.92	59.0	89
7954	FSG-78B	5.70	75.6	86
7955	FSG-78C	5.71	59.2	87
7956	FSG-79A	5.60	<10	4
7957	FSG-79B	5.55	5.83	5
7958	FSG-79C	5.04	7.19	80
7959	DSG-79C	4.95	<5	83
7960	FSG-88A	5.00	46.7	83
7961	FSG-88B	5.10	45.5	90
7962	FSG-88C	6.17	5.35	85
Prep Blank*	--	--	<0.005	--

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 10, 19[illegible]

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U-2571

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	7962 R	<12	500	307	61
	7975 R	<60	500	547	109
Cadmium	7962 R	<1	50	49	98
	7975 R	<5	50	68.0	136
Lead	7952 R*	31.5	50	84.0	105
	7962 R*	35.3	50	49.6	29
	7975 R	1942	500	2276	67

*Results in ug/L because spiking performed during digestion procedure.

U-2571

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER AND SOIL SAMPLES

Analysis	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Solids	7942	88	87	1.1
	7952	85	81	4.8
	7962	86	86	0
	7972	83	84	1.2
pH	7941	4.83	5.01	3.6
	7949	5.01	5.11	2.0
	7960	5.00	4.92	1.6
Antimony	7973	<0.06	<0.06	--
	7975	<0.06	<0.06	--
Cadmium	7973	<0.005	<0.005	--
	7975	<0.005	<0.005	--
Lead	7952	7.66	6.18	21.4
	7962	5.35	7.28	30.6
	7973	<0.001	<0.001	--
	7975	1.95	1.94	0.5

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2601 RE: FM-2040

Sample Date: 11/6-8/85 Sampled By: E & E, Inc.

Date Received: 11/13/85 Delivered By: Federal Express

Sample Type: Soil and 4 Waters

E & E Lab Number 85-	Sample Identity	pH, S.U.	Antimony	Lead mg/kg as received	Cadmium	% Solids
8197	FSA-05A	5.93	142	41,000	<1	88
8198	FSA-05B	4.91	<12	111	<1	83
8199	DSA-05B	4.95	<12	113	<1	86
8200	FSA-05C	4.77	<12	74.8	<1	88
8201	FSA-05D	4.32	<12	41.7	<1	83
8202	FSA-05E	4.33	<12	29.1	<1	83
8203	FSA-06A	6.10	857	155,000	2.79	90
8204	FSA-06B	6.07	325	57,000	1.07	85
8205	FSA-06C	4.86	148	6560	<1	85
8206	FSA-06D	4.77	<12	330	<1	84
8207	FSA-06E	4.65	<12	928	<1	85
8208	FSA-07A	6.95	360	68,800	<1	84
8209	FSA-07B	5.05	208	45,900	<1	85
8210	FSA-07C	4.81	157	28,100	<1	79
8211	FSA-07D	4.43	71.2	4290	<1	85
8212	FSA-07E	4.53	<12	1160	2.69	81
8213	FSA-08A	6.79	148	30,100	<1	82
8214	FSA-08B	4.74	799	29,800	<1	79
8215	FSA-08C	4.11	74.8	12,300	<1	77
8216	DSA-08C	4.46	86.5	13,400	<1	77
Prep Blank 168*	--	--	<0.06	<0.1	<0.005	--

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: December 27, 1985

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U-2571

QUALITY CONTROL FOR ACCURACY:
PERCENT RECOVERY--
EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Recovery
Antimony	101.5	103.8	2.3
	101.5	101.1	0.39
Cadmium	39.0	40.8	4.6
	39.0	42.3	8.5
Lead	42.7	41.2	3.5
	42.7	42.1	1.4
	42.7	40.5	5.2
	42.7	39.1	8.4

NOTE: These results are within the 95% confidence interval for these parameters.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2601 RE: FM-2040

Sample Date: 11/6-8/85 Sampled By: E & E, Inc.

Date Received: 11/13/85 Delivered By: Federal Express

Sample Type: Soil and 4 Waters

E & E Lab Number 85-	Sample Identity	pH, S.U.	Antimony	Lead mg/kg as received	Cadmium	% Solids
8237	DSA-09A	7.03	49.9	12,500	<1	83
8238	FSA-09B	5.29	<12	536	<1	82
8239	FSA-09C	5.56	<12	367	<1	75
8240	FSA-09D	5.27	<12	9.33	<1	67
8241	FSA-09E	5.33	<12	10.6	<1	66
8242	FSA-10A	7.96	27.6	10,800	<1	83
8243	FSA-10B	7.46	16.8	86.4	<1	76
8244	FSA-10C	6.64	<12	54.0	<1	86
8245	FSA-10D	6.37	<12	54.9	<1	84
8246	FSA-10E	6.03	<12	48.2	<1	83
8247	FSA-11A	7.89	24.2	7710	<1	81
8248	FSA-11B	4.84	13.5	4750	<1	82
8249	FSA-11C	4.75	45.5	8140	<1	70
8250	FSA-11D	5.07	<12	547	<1	85
8251	FSA-11E	5.11	<12	190	<1	87
8252	FSE-04A	5.67	<12	62.9	<1	86
8253	FSE-04B	5.58	<12	7.13	<1	77
8254	FSE-04C	6.25	<12	6.86	<1	76
8255	FSE-05A	5.95	18.6	300	<1	76
8256	FSE-05B	6.19	<12	23.3	<1	84
8257	DSE-05B	6.22	<12	19.8	<1	82
Prep Blank 172*	--	--	<0.06	<0.1	<0.005	--
Prep Blank 173*	--	--	--	<5*	--	--

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

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Date: December 27, 1985

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FOR

Sapp Battery

Job No.: U-2601 RE: FM-2040

Sample Date: 11/6-8/85 Sampled By: E & E, Inc.

Date Received: 11/13/85 Delivered By: Federal Express

Sample Type: Soil and 4 Waters

E & E Lab Number 85-	Sample Identity	pH, S.U.	Antimony	Lead mg/kg as received	Cadmium	% Solids
8217	FSA-08D	4.81	16.8	4150	<1	79
8218	FSA-08E	4.49	<12	778	<1	84
8219	FSA-01D	5.40	<12	12.4	<1	83
8220	FSA-01E	5.74	<12	29.3	<1	82
8221	FSA-02A	4.49	<12	553	<1	81
8222	FSA-02B	4.65	<12	106	<1	76
8223	FSA-02C	4.60	<12	12.0	<1	87
8224	FSA-02D	4.76	<12	24.9	<1	84
8225	FSA-02E	4.87	<12	31.3	<1	86
8226	FSA-03A	4.88	<12	392	<1	80
8227	FSA-03B	4.45	<12	8.33	<1	82
8228	FSA-03C	4.65	<12	84.7	<1	79
8229	FSA-03D	4.72	<12	8.54	<1	83
8230	FSA-03E	4.24	<12	7.03	<1	83
8231	FSA-04A	6.94	<12	279	<1	85
8232	FSA-04B	5.35	<12	25.0	<1	81
8233	FSA-04C	5.57	<12	120	<1	77
8234	FSA-04D	5.09	<12	8.73	<1	85
8235	FSA-04E	5.17	<12	10.6	<1	85
8236	FSA-09A	6.75	42.7	9390	<1	85
Prep Blank 170*	--	--	<0.06	<0.1	<0.00[illegible]	--
Prep Blank 171*	--	--	--	<5	--	--

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 198[illegible].

Supervising Analyst [illegible]

Date: [illegible]

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: December 19, 1985

SUBEJCT: Sapp Battery Report; Job U-2575

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on thirt nine samples received at the Analytical Services Center on November 7,1985. Analysis was performed according to U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwi instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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LABORATORY REPORT

FOR
Sapp Battery

Job No.: U-2601 RE: FM-2040

Sample Date: 11/6-8/85 Sampled By: E & E, Inc.

Date Received: 11/13/85 Delivered By: Federal Express

Sample Type: Soil and 4 Waters

E & E Lab Number 85-	Sample Identity	pH, S.U.	Antimony	Lead mg/kg as received	Cadmium	% Solids
8258	FSE-05C	6.44	<12	61.7	<1	84
8259	FSE-06A	5.68	<12	283	<1	76
8260	FSE-06B	6.67	<12	9.80	<1	83
8261	FSE-06C	6.55	<12	6.25	<1	82
8262	FSL-01	6.89	14.4	3020	<1	78
8263	DSL-01	6.88	21.9	9670	<1	79
8264	FSL-02	6.88	51.0	27,500	<1	82
8265	FSE-03A	6.61	NR	174	NR	76
8266	FSE-03B	6.79	NR	6.39	NR	81
8267	FSE-03C	6.73	NR	<5	NR	80
8268	FSE-07A	5.68	NR	1110	NR	89
8269	FSE-07B	5.96	NR	46.1	NR	87
8270	FSE-07C	6.35	NR	4.81	NR	86
8271	DSE-07C	6.34	NR	3.89	NR	86
8272	FSE-08A	2.66	NR	216	NR	85
8273	FSE-08B	3.15	NR	170	NR	77
Prep Blank 174*	--	--	--	<0.1	--	--
Prep Blank 176*	--	--	--	<5	--	--
8274	FSE-08C	2.98	NR	26.3	NR	79
8275	SBB-07*	3.95	<0.06	<0.001	<0.005	NR
8276	FSR-07*	1.51	<0.06	1.77	0.007	NR
8277	FSR 08*	1.42	NR	0.059	NR	NR
8278	FSR-09*	1.53	<0.06	0.051	<0.005	NR
Prep Blank 175*	--	--	<0.06	<0.1	<0.005	--
Prep Blank 177*	--	--	--	<5	--	--

*mg/L

Analytical References:
U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984

Supervising Analyst: Gary Hahn / KGS

Date: December 27, 1985

F-75

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn, JH/KB

DATE: January 17, 1986

SUBJECT: Amended Sapp Battery Report; Job U-2575

CC: Lab File, QA/QC File

Attached is a amended laboratory report page of the analysis conducted on thirty- nine samples received at the Analytical Services Center on November 7,1985. Please replace the incorrect page with the attached amended page. We apologize for any inconvenience this may have caused. Analysis was performed according to U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of the original report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2575 RE: FM-2040

Sample Date: 11/5-6/85 Sampled By: E & E, Inc.

Date Received: 11/7/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Antimony	Lead	Cadmium	Solids %
			mg/kg as received			
7984	ESB 06A	6.73	NR	5300	NR	87
7985	ESB 06B	3.77	NR	3260	NR	86
7986	ESB 06C	3.90	NR	42.0	NR	86
7987	FSG 15A	5.41	NR	11.9	NR	90
7988	FSG 15B	5.39	NR	4.63	NR	88
7989	FSG 15C	5.11	NR	3.75	NR	[illegible]
7990	FSG 24A	4.67	NR	26.1	NR	[illegible]
7991	FSG 24B	5.21	NR	8.73	NR	[illegible]
7992	FSG 24C	5.23	NR	10.1	NR	[illegible]
7993	FSG 25A	5.13	NR	22.0	NR	[illegible]
7994	FSG 25B	5.11	NR	5.87	NR	88
7995	FSG 25C	5.04	NR	5.63	NR	[illegible]
7996	FSG 97A	7.03	NR	3640	NR	86
7997	FSG 97B	5.78	NR	29,600	NR	82
7998	FSG 97C	5.50	NR	5,010	NR	[illegible]
7999	FSC 01A	8.54	<12	257	<1.0	89
8000	FSC 01B	7.26	<12	20.6	<1.0	[illegible]
8001	DSC 01B	7.61	<12	16.6	<1.0	87
Prep Blank* 163	--	--	--	<0.005	--	--

*mg/L

NR-Analysis Not Requested

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: December 19, 1985

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QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER AND SOIL SAMPLES

Analysis	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
pH	7987	5.41	5.37	0.7
	8003	5.61	5.68	1.2
	8014	5.44	4.51	18.7
Solids	7993	86	85	1.2
	8004	89	88	1.1
	8014	88	89	1.1
Antimony	8014	<12	<12	--
Cadmium	8014	<1	<1	--
Lead	7990	26.1	23.8	9.2
	8014	3.98	3.47	14
	8021	7120	7210	1.2

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2575 RE: FM-2040

Sample Date: 11/5-6/85 Sampled By: E & E, Inc.

Date Received: 11/7/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number	Customer Number	pH, S.U.	Antimony mg/kg as received	Lead mg/kg as received	Cadmium mg/kg as received	Solids %
8002	FSC 01C	6.10	<12	6.54	<1	82
8003	FSC 02A	5.61	169	8810	3.18	92
8004	FSC 02B	4.20	<12	62.5	1.62	95
8005	FSC 02C	4.25	<12	24.0	1.10	90
8006	FSG 14A	5.25	<12	15.5	<1	85
8007	FSG 14B	5.52	<12	4.54	<1	84
8008	FSG 14C	5.32	<12	7.00	<1	85
8009	FSG 23A	5.75	<12	3060	<1	95
8010	FSG 23B	5.84	17.3	4790	<1	39
8011	FSG 23C	4.53	<12	5710	<1	[illegible]
8012	DSG 23C	4.49	<12	4710	<1	87
8013	FSG 33A	5.71	<12	81.4	1.56	89
8014	FSG 33B	5.44	<12	3.98	<1	89
Prep Blank 165*	--	--	<0.06	--	<0.005	
8015	DSG 33B	5.19	<12	5.50	<1	93
8016	FSG 33C	4.97	<12	4.81	<1	86
8017	FSA 01A	4.62	<12	51.0	<1	89
8018	DSA 01A	4.48	<12	78.6	<1	80
8019	FSA 01B	5.21	<12	6.46	<1	98
8020	FSA 01C	4.97	<12	4.86	<1	83
8021*	FSR 06	7.25	NR	7.12	NR	--
8022*	SBB 05	6.60	<0.06	<0.1	<0.005	--
Prep Blank 166*	--	--	--	<0.005	--	--
Prep Blank 167*	--	--	--	<0.005	--	--

*mg/L

NR-Analysis Not Requested

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible] Date: [illegible]

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QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Antimony	101.5	99.2	2.3
Cadmium	39.0	42.7	9.5
Lead	42.7	42.1	1.4
	42.7	38.9	8.9
	42.7	44.4	4.0

Note: These results are within the 95% confidence interval for these parameters.

QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER AND SOIL SAMPLES

Analysis	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	8014R	<60	500	263	52.6
Cadmium	8014R	<5	50	45.4	90.8
Lead	7990R	120	500	796	135
	8014R	5.1	50	50.1	90.0
	8021R	7210	500	7730	104

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MEMORANDUM

TO: Gerry Gallagher

FROM: Gary Hahn

DATE: February 4, 1986

SUBJECT: Sapp Battery Report; Job U-2817

CC: Lab File, QA/QC File

Attached is the amended laboratory report of the analysis conducted on fifty- three samples received at the Analytical Services Center on January 9 and 13, 1986. The original did not contain results for your sample labelled FSB-03D. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
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MEMORANDUM

TO: Gerry Gallagher

FROM: Gary Hahn

DATE: January 31, 1986

SUBJECT: Sapp Battery Report; Job U-2817

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on fifty-three samples received at the Analytical Services Center on January 9 and 13, 1986. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2817 RE: FM-2040

Sample Date: 10/31-11/5/85 Sampled By: E & E, Inc.

Date Received: 1/9,13/86 Delivered By: Federal Expre s

Sample Type: Soil

E & E Lab Number 86-	Customer Number	pH, S.U.	Solids, %	Lead, mg/kg as received
0256	FSG-65D	4.97	91	12.3
0257	FSG-65E	4.94	91	10.4
0258	FSG-66D	5.55	86	[illegible]
0259	FSG-66E	5.14	85	[illegible]
0260	FSG-67D	5.70	86	[illegible].00
0261	FSG-67E	5.44	82	[illegible].2
0262	FSG-75D	5.66	83	[illegible]25
0263	FSG-75E	5.70	83	15.6
0264	FSG-76D	5.15	88	[illegible]
0265	FSG-76E	6.30	91	200
0266	FSG-77D	5.21	86	574
0267	FSG-77E	5.22	82	[illegible]
0268	FSG-78D	5.35	84	[illegible]
Prep Blank*	--	--	--	[illegible].012
0269	FSG-78E	5.53	80	16.0
0270	FSG-86D	6.18	89	1[illegible],200
0271	FSG-86E	5.89	88	672
0272	FSG-87D	5.16	84	703
0273	FSG-87E	5.13	85	[illegible]4
0274	FSG-88D	5.54	89	[illegible].17

*mg L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 31, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2817 RE: FM-2040

Sample Date: 10/31-11/5/85 Sampled By: E & E, Inc.

Date Received: 1/9,13/86 Delivered By: Federal Express

Sample Type: Soil

E & E Lab Number 86-	Customer Number	pH, S.U.	Solids, %	Lead, mg/kg as received
Prep Blank*	--	--	--	<0.005
0241	FSB-02D	4.76	82	1.57
0242	FSB-02E	4.48	81	100
0242A	FSB-03D	4.58	87	1.28
0243	FSB-03E	4.80	90	57.0
0244	FSB-04D	4.93	89	278
0245	FSB-04E	4.22	90	34.9
0246	FSG-64D	4.85	90	1.10
0247	FSG-64E	4.95	78	35.1
0248	FSG-71D	4.93	95	1.48
0249	FSG-71E	4.70	97	16.3
0250	FSG-85D	5.15	86	50.2
0251	FSG-85E	4.89	84	94.0
0252	FSG-91D	4.85	82	20.2
0253	FSG-91E	4.99	86	10.0
0254	FSG-15D	4.70	78	7.29
0255	FSG-15E	4.69	76	7.73
Prep Blank*	--	--	--	0.006

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: [illegible]

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LABORATORY REPORT

FOR

Sapp Battery

Job No.:	U-2817	RE:	FM-2040
Sample Date:	10/31-11/5/85	Sampled By:	E & E, Inc.
Date Received:	1/9,13/86	Delivered By:	Federal Express
Sample Type:	Soil		

E & E Lab Number 86-	Customer Number	Antimony	Cadmium
		mg/kg as received	
Prep Blank*	--	<0.06	<0.001
0284	FSG-34D	<12	<1
0289	FSG-53D	<12	<1
0290	FSG-53E	<12	<1
0328	FSG-34E	<12	<1

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1981.

Supervising Analyst [illegible]

Date: [illegible]

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2817 RE: FM-2040

Sample Date: 10/31-11/5/85 Sampled By: E & E, Inc.

Date Received: 1/9,13/86 Delivered By: Federal Express

Sample Type: Soil

E & E Lab Number 86-	Customer Number	pH, S.U.	Solids, %	Lead, mg/kg as received
0275	FSG-88E	5.16	86	5.61
0276	FSG-95D	5.81	91	1[illegible]
0277	FSG-95E	5.49	89	31.3
0278	FSG-96D	6.19	91	[illegible]
0279	FSG-96E	6.32	90	2[illegible]1
0280	FSG-97D	5.04	87	4[illegible]1
0281	FSG-97E	5.21	88	5[illegible]1
0282	FSG-23D	5.40	69	[illegible]
0283	FSG-23E	5.51	68	[illegible]
0284	FSG-34D	5.55	93	2[illegible]52
0285	FSG-51D	5.42	88	21[illegible]0
0286	FSG-51E	6.21	91	518
0287	FSG-56D	5.79	91	4.[illegible]2
0288	FSG-56E	5.88	92	4.[illegible]8
0289	FSG-53D	5.40	87	6[illegible]
0290	FSG-53E	5.76	85	5[illegible]
0291	FSG-54D	5.48	77	211
0292	FSG-54E	5.29	80	1[illegible]5
0328	FSG-34E	5.18	93	8.[illegible]4

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [illegible]

Date: January 31, 19[illegible]

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	0328*	<60	500	469	93.8
Lead	0251*	48.4	25	76.7	113
	0262*	64.0	25	87.5	94.0
	0277*	15.8	25	41.0	101
	0292*	49.8	25	72.4	90.4
	0279*	1.17	0.5	1.71	108
	0328*	46.4	25	72.4	104

*Results in ug/L because spiking was performed during digestion procedure.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

Analysis	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
pH	0245	4.22	4.20	0.5
	0249	4.70	4.75	1.0
	0270	6.18	6.23	0.8
	0280	5.04	5.05	0.2
	0290	5.76	5.77	0.2
Solids	0241	82	84	2.4
	0260	86	86	0
	0270	89	90	1.1
	0280	87	87	0
	0250	86	87	1.2
	0292	80	80	0
Lead	0249	16.3	9.98	48.1
	0260	7.00	9.40	29.3
	0288	4.78	4.45	7.2
	0279	234	195	18.2
	0328	8.84	4.17	71.8
Antimony	0279	<12	<12	--
	0328	<12	<12	--
Cadmium	0279	<1	<1	--
	0328	<1	<1	--

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SEDIMENT SAMPLE
ANALYTICAL DATA

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Antimony	101	104	3.0
Cadmium	3.30	3.45	4.5
Lead	42.7	42.1	1.4
	42.7	42.6	0.2

Note: These results are within the 95% confidence interval for these parameters.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2680 RE: FM-2080

Sample Date: 11/15-26/85 Sampled By: E & E, Inc.

Date Received: 12/2/85 Delivered By: Federal Express

Sample Type: Soil and Rinsate

E & E Lab Number 85-	Sample Identity	Antimony mg/kg as received	Cadmium mg/kg as received	Lead mg/kg as received	pH, S.U.	% Solids
8745	FMK-06A	<12	<1	24.2	5.61	67
8746	FMK-06B	<12	<1	18.2	4.78	71
8747	FMK-06C	<12	<1	2.16	3.92	21
8748	FMK-07A	146	1.33	6660	5.09	52
8749	DMK-07A	131	1.34	6410	5.33	53
8750	FMK-07B	<12	<1	31.4	4.75	83
8751	FMK-07C	<12	<1	2.57	5.12	84
8752	FMK-08A	216	1.39	34,700	5.27	55
8753	FMK-08B	<12	<1	953	5.3[illegible]	81
8754	FMK-08C	<12	<1	110	5.06	84
8755	FMK-09A	<12	<1	25.1	6.3[illegible]	79
8756	FMK-09B	<12	<1	<1	6.4[illegible]	81
8757	FMK-09C	<12	<1	6.75	5.93	78
8758*	FRS-16	<0.06	<0.005	1.23	NR	NR
Prep Blank*	--	<0.06	<0.005	<0.1	--	--

*mg/L

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984

Supervising Analyst [signature]

Date: January 4, 1986

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GHHAHN

DATE: January 4, 1985

SUBJECT: Sapp Battery Report; Job No. U-2680

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on fourteen samples received at the Analytical Services Center on December 2, 1985. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED SOIL SAMPLES

Element	E & E Laboratory No. 85-	Original Value	Amount Added	Amount Determined	Percent Recovery
		(ug/L)			
Antimony	8755R*	7.0	500	426	83.8
Cadmium	8755R*	<1	50	51.3	103
Lead	8755R*	107	500	615	102

*Results in ug/L. Spiking performed during the digestion procedure.

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER AND SOIL

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Antimony	8755	<12	<12	--
Cadmium	8755	<1	<1	--
Lead	8755	25.1	21.2	16.8
pH	8746	4.78	4.87	1.9
% Solids	8754	84	83	1.2

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn GH/LAS

DATE: January 6, 1986

SUBJECT: Sapp Battery Report, Job No. U-2688

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on nineteen samples received at the Analytical Services Center on December 3, 1985. Analysis was performed according to the procedures set forth in U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
enclosure

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Antimony	101.5	122.2	20.3
Lead	42.7	40.9	4.2

Note: These results are within the 95% confidence interval for these parameters.

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ecology and environment

U-2688

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF SOIL SAMPLES

Compound	E & E Laboratory No. 85-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Antimony	8798	<12	<12	--
	8801	<12	<12	--
Cadmium	8798	<1	<1	--
	8801	<1	<1	--
Lead	8801	238	394	49.4
pH	8796	4.30	4.30	0
Solids	8791	67	71	5.8
	8802	83	83	0

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International Specialists in the Environment

LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2688 RE: FM-2080

Sample Date: 11/26,27/85 Sampled By: E & E, Inc.

Date Received: 12/3/85 Delivered By: Federal Express

Sample Type: Soil and Water

E & E Lab Number 85-	Customer Number	pH, S.U.	Antimony	Cadmium	Lead	% Solids
			mg/kg as received			
Prep Blank*	--	--	<0.06	<0.005	<0.005	--
217						
8787	FMK-01A	7.05	36.2	1.15	10,900	70
8788	FMK-01B	6.00	77.4	1.51	12,500	68
8789	FMK-01C	4.35	<12	<1	7.80	83
8790	FMK-02A	5.10	<12	<1	139	80
8791	FMK-02B	5.50	27.5	<1	1280	67
8792	FMK-02C	4.45	<12	<1	12.3	88
8793	FMK-03A	4.30	<12	<1	115	72
8794	FMK-03B	4.35	<12	<1	81.6	76
8795	DMK-03B	4.55	<12	<1	65.7	77
8796	FMK-03C	4.30	<12	<1	60.2	79
8797	FMK-04A	4.50	69.7	<1	1270	64
8798	FMK-04B	4.05	<12	<1	115	79
8799	FMK-04C	4.25	<12	<1	2.51	84
8800	DMK-04C	4.30	<12	<1	3.78	83
8801	FMK-05A	4.05	<12	<1	238	77
8802	FMK-05B	4.05	<12	<1	5.28	83
8803	FMK-05C	4.00	<12	<1	3.84	82
8804*	FSR-17	NR	<0.06	<0.005	<0.005	NR
8805*	FSR-18	NR	<0.06	<0.005	0.036	NR

*mg/L

NR-Analysis Not Requested

Analytical References:

U.S. EPA Contract Laboratory Program, Inorganic Statement of Work, 1984.

Supervising Analyst [signature]

Date: January 6, 1986

F-99

C36114

JOE HUNT

ENVIRONMENTAL PROTECTION SYSTEMS, INC.

P O Box 20382/160 Upton Dr./Jackson, Ms 39209/601-922-8242/800-523-0659
7215 Pine Forest Rd./Pensacola, Fl. 32506/904-944-0301/800-874-0272

INCLUDES SEDIMENTS ANALYZED BY EPS, AND FSA12, FSA13.

January 9, 1986
File No. 3.86.3.026

Mr. Andy Clifton
Ecology and Environment, Inc.
196 Sugg Road
Buffalo, NY 14225

Dear Mr. Clifton:

Subject: EPS Project No. 3.85.1588.01
EPS Laboratory Report No. 3.85.1098 and 1114

Enclosed are the corrected and completed analytical results for the soil samples submitted to our Pensacola laboratory on November 15 and 19, 1985.

* Please disregard all previous reports. We extend our apology for the errors in the previous reports, and hope that this has not caused any inconvenience.

We appreciate your business and hope you will keep us in mind for any future analytical needs. Should you have any questions regarding this report or require further information or assistance, please call me a 904-944-0301.

Sincerely,

ENVIRONMENTAL PROTECTION SYSTEMS, INC.

Dave Knothe
Manager of Analytical Services

DK/ch

Enclosures

cc: Ms. Kim Burton

U-2688

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Antimony	101.5	104.1	2.6
Cadmium	39.0	46.5	19.2
Lead	42.7 435	42.0 489	1.6 12.4

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola Fl. 32506
Telephone (904) 944 0301

LABORATORY REPORT

85-1098 2/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/0[illegible]/85

LABORATORY SAMPLE IDENTIFICATION

1098-05 - DSA12D
1098-06 - FSA12E
1098-07 - FSA13A
1098-08 - FSA13B

ANALYSES	IDENTIFICATION NUMBER 1098-05	1098-06	1098-07	1098-08
Percent Solids	78.2	84.1	90.9	83.1
pH	3.45	3.44	3.86	3.30
Lead, mg/kg (WL=220.353)	68.4	60.3	98.6	>2,249
Lead, mg/kg (WL=405.783)	--	--	--	4,735
Cadmium, mg/kg (WL=226.502)	<1.8*	<1.6*	<.56	<2.9*
Cadmium, mg/kg (WL=228.802)	<.50	<.58	<.56	0.67
Antimony, mg/kg	<.20	<.23	0.22	13.9

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, Fl 32506
Telephone (904) 944-0361

LABORATORY REPORT

85-1098 | 1/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-01 - FSA12A
1098-02 - FSA12B
1098-03 - FSA12C
1098-04 - FSA12D

ANALYSES	IDENTIFICATION NUMBER 1098-01	1098-02	1098-03	1098-04
Percent Solids	82.0	85.2	67.4	71.8
pH	7.28	6.04	3.46	3.43
Lead, mg/kg (WL=220.353)	>2,043	426	661	64.2
Lead, mg/kg (WL=405.783)	2716	402	691	--
Cadmium, mg/kg (WL=226.502)	<3.1*	<1.0*	<1.4*	<1.6*
Cadmium, mg/kg (WL=228.802)	<.60	<.65	<.87	<.57
Antimony, mg/kg	6.25	0.52	15.4	0.23

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

F-103

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola FL 32506
Telephone (904) 944 0301

LABORATORY REPORT

85-1098 | 4/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-13 - DSA13E
1098-14 - FSR10
1098-15 - FMT13A
1098-16 - FMT13B

ANALYSES	IDENTIFICATION NUMBER 1098-13	1098-14	1098-15	1098-16
Percent Solids	77.9	Liquid	64.3	85.9
pH	3.33	1.31	5.58	4.30
Lead, mg/kg (WL=220.353)	151	<.05	20.1	26.3
Lead, mg/kg (WL=405.783)	150	--	--	--
Cadmium, mg/kg (WL=226.502)	<2.1*	<.005	<.42*	<.62*
Cadmium, mg/kg (WL=228.802)	0.92	<.005	<.35	<.44
Antimony, mg/kg	0.46	<.002	<.14	<.18

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

F-106

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone (904) 944-0301

LABORATORY REPORT

85-1098 3/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION.	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-09 - DSA13B
1098-10 - FSA13C
1098-11 - FSA13D
1098-12 - FSA13E

ANALYSES	IDENTIFICATION NUMBER 1098-09	1098-10	1098-11	1098-12
Percent Solids	84.8	79.0	62.3	80.5
pH	3.23	3.10	3.12	3.29
Lead, mg/kg (WL=220.353)	>2,194	>2,482	217	254
Lead, mg/kg (WL=405.783)	8,842	6,317	200	210
Cadmium, mg/kg (WL=226.502)	<.77*	<4.0*	5.52	<1.9*
Cadmium, mg/kg (WL=228.802)	0.78	<.50	4.82	1.27
Antimony, mg/kg	13.6	20.1	0.56	0.64

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hodges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

F-105

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola F 32506
Telephone (904) 944-0301

LABORATORY REPORT

85-1098 6/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-21 - DMT11B
1098-22 - FMT10A
1098-23 - FMT10B
1098-24 - FMT09A

ANALYSES	IDENTIFICATION NUMBER 1098-21	1098-22	1098-23	1098-24
Percent Solids	81.9	27.9	71.9	23.1
pH	4.78	4.15	3.54	4.38
Lead, mg/kg (WL=220.353)	5.4	212	28.9	99.7
Lead, mg/kg (WL=405.783)	--	191	--	--
Cadmium, mg/kg (WL=226.502)	<.43	<1.56*	<.47	<1.53*
Cadmium, mg/kg (WL=228.802)	<.43	1.21	<.47	<1.10
Antimony, mg/kg	<.17	0.87	<.19	<.44

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

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7215 Pine Forest Road • Pensacola F 32506
Telephone (904) 944-0301

LABORATORY REPORT

85-1098 15/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-17 - FMT12A
1098-18 - FMT12B
1098-19 - FMT11A
1098-20 - FMT11B

ANALYSES	IDENTIFICATION NUMBER 1098-17	1098-18	1098-19	1098-20
Percent Solids	73.4	77.7	66.8	81.2
pH	4.15	3.70	5.48	4.71
Lead, mg/kg (WL=220.353)	10.1	57.0	34.0	10.7
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<.63	<1.05*	<.80*	<.57*
Cadmium, mg/kg (WL=228.802)	<.63	<.66	<.31	<.40
Antimony, mg/kg	<.25	<.16	0.36	0.16

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone (601) 922-8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone (904) 944 030

LABORATORY REPORT

85-1098 8/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-29 - DMT08A
1098-30 - FMT08B
1098-31 - FMH15A
1098-32 - DMH15A

ANALYSES	IDENTIFICATION NUMBER 1098-29	1098-30	1098-31	1098-32
Percent Solids	60.0	76.2	15.5	14.2
pH	4.12	4.02	4.20	4.21
Lead, mg/kg (WL=220.353)	34.3	33.2	137.6	183.8
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<.56*	<.69*	<2.04	<2.62
Cadmium, mg/kg (WL=228.802)	<.31	<.29	<2.04	<2.62
Antimony, mg/kg	<.12	<.11	2.04	4.19

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone. (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone. (904) 944-0301

LABORATORY REPORT

85-1098 7/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY:	Client (1588)
LOCATION:	Buffalo, NY	DATE COLLECTED:	11/14-18/85
DATE:	01/08/86	DATE RECEIVED:	11/15&19/85
INVOICE NO.:	6705/ch	DATE ANALYZED:	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-25 - FMT09B
1098-26 - FMT07A
1098-27 - FMT07B
1098-28 - FMT08A

ANALYSES	IDENTIFICATION NUMBER 1098-25	1098-26	1098-27	1098-28
Percent Solids	73.6	14.3	14.3	60.1
pH	4.20	3.90	3.49	4.04
Lead, mg/kg (WL=220.353)	62.0	269	<26.1	22.7
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<1.19*	<2.72	<2.61	<.49
Cadmium, mg/kg (WL=228.802)	<.54	<2.72	<2.61	<.49
Antimony, mg/kg	<.22	8.71	1.04	<.20

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone (904) 944 030

LABORATORY REPORT

85-1098 10/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (15[illegible])
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-37 - FMH13B
1098-38 - FMH12A
1098-39 - FMH12B
1098-40 - FSR11

ANALYSES	IDENTIFICATION NUMBER 1098-37	1098-38	1098-39	1098-40
Percent Solids	15.3	23.2	37.5	Liquid
pH	3.18	3.60	3.73	1.29
Lead, mg/kg (WL=220.353)	82.4	366	108	<.05
Lead, mg/kg (WL=405.783)	--	250	--	--
Cadmium, mg/kg (WL=226.502)	<3.22	<1.76	<1.96*	<.005
Cadmium, mg/kg (WL=228.802)	<3.22	<1.76	<.89	<.005
Antimony, mg/kg	3.86	5.98	0.71	0.004

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hodges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone. (904) 944-0301

LABORATORY REPORT

35-1098 9/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1098-33 - FMH15B
1098-34 - FMH14A
1098-35 - FMH14B
1098-36 - FMH13A

ANALYSES	IDENTIFICATION NUMBER 1098-33	1098-34	1098-35	1098-36
Percent Solids	16.1	13.3	18.4	15.6
pH	4.02	3.59	3.26	3.43
Lead, mg/kg (WL=220.353)	32.2	692	72.8	410
Lead, mg/kg (WL=405.783)	--	820	100	510
Cadmium, mg/kg (WL=226.502)	<2.51	<2.74	<2.49	4.05
Cadmium, mg/kg (WL=228.802)	<2.51	<2.74	2.99	5.07
Antimony, mg/kg	1.01	42.3	2.99	16.2

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola FL 32506
Telephone (904) 944-0301

LABORATORY REPORT

85-1114 2/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588'
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-05 - FMT05A
1114-06 - FMT05B
1114-07 - FMT04A
1114-08 - FMT04B

ANALYSES	IDENTIFICATION NUMBER 1114-05	1114-06	1114-07	1114-08
Percent Solids	63.7	78.6	60.2	77.9
pH	4.22	3.85	4.21	3.95
Lead, mg/kg (WL=220.353)	587	25.2	324	69.7
Lead, mg/kg (WL=405.783)	520	--	250	70
Cadmium, mg/kg (WL=226.502)	<2.54*	<1.22*	<.74*	<.50
Cadmium, mg/kg (WL=228.802)	<.55	<.47	<.53	<.50
Antimony, mg/kg	0.55	<.19	<.21	<.20

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hodges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone. (601) 922 8242
7215 Pine Forest Road • Pensacola, Fl. 32506
Telephone (904) 944-0301

LABORATORY REPORT

35-1114 1/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1583)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-01 - FSR12
1114-02 - FSR13
1114-03 - FSR14
1114-04 - FSR15

ANALYSES	IDENTIFICATION NUMBER 1114-01	1114-02	1114-03	1114-04
Percent Solids	Liquid	Liquid	Liquid	Liquid
pH	0.80	1.15	1.16	1.18
Lead, mg/kg (WL=220.353)	<.050	<.050	<.050	1.94
Lead, mg/kg (WL=405.783)	--	--	--	1.90
Cadmium, mg/kg (WL=226.502)	<.005	<.005	<.005	<.005
Cadmium, mg/kg (WL=228.802)	<.005	<.005	<.005	<.005
Antimony, mg/kg	<.002	<.002	<.002	.005

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ecology and environment

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20282 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone (904) 944 0301

LABORATORY REPORT

85-1114 4/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED.	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-13 - FMH10A
1114-14 - FMH10B
1114-15 - FMH11A
1114-16 - FMH11B

ANALYSES	IDENTIFICATION NUMBER 1114-13	1114-14	1114-15	1114-16
Percent Solids	50.8	85.4	46.6	70.3
pH	3.69	3.60	4.35	3.39
Lead, mg/kg (WL=220.353)	31.8	8.9	191.3	19.6
Lead, mg/kg (WL=405.783)	--	--	180	--
Cadmium, mg/kg (WL=226.502)	<.78	<.39	<4.20*	<.56
Cadmium, mg/kg (WL=228.802)	<.78	<.39	1.93	<.56
Antimony, mg/kg	2.33	<.16	10.69	<.23

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone: (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone (904) 944-0301

LABORATORY REPORT

85-1114 3/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED.	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-09 - FMT03A
1114-10 - FMT03B
1114-11 - FMH09A
1114-12 - FMH09B

ANALYSES	IDENTIFICATION NUMBER 1114-09	1114-10	1114-11	1114-12
Percent Solids	59.3	80.2	67.6	82.6
pH	4.69	3.97	3.44	3.52
Lead, mg/kg (WL=220.353)	593	57.5	136	31.2
Lead, mg/kg (WL=405.783)	560	60	100	--
Cadmium, mg/kg (WL=226.502)	<.76*	<.61	<.54	<.38
Cadmium, mg/kg (WL=228.802)	0.66	<.61	<.54	<.38
Antimony, mg/kg	0.66	<.24	0.76	<.15

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola Fl 32506
Telephone (904) 944-030

LABORATORY REPORT

85-1114 6/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-21 - FMH03A
1114-22 - FMH03B
1114-23 - FMH04A
1114-24 - FMH04B

ANALYSES	IDENTIFICATION NUMBER 1114-21	1114-22	1114-23	1114-24
Percent Solids	64.8	81.6	75.4	79.6
pH	3.72	3.38	3.44	3.40
Lead, mg/kg (WL=220.353)	46.7	6.3	16.7	19.7
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<.62	<.45	0.49	<.52*
Cadmium, mg/kg (WL=228.802)	<.62	<.45	0.49	<.43
Antimony, mg/kg	3.00	<.18	<.20	<.17

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone. (904) 944-0301

LABORATORY REPORT

35-1114 5/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588
LOCATION.	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE.	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED.	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-17 - FMH01A
1114-18 - FMH01B
1114-19 - FMH02A
1114-20 - FMH02B

ANALYSES	IDENTIFICATION NUMBER 1114-17	1114-18	1114-19	1114-20
Percent Solids	42.0	46.6	60.7	84.0
pH	4.79	3.07	3.34	3.45
Lead, mg/kg (WL=220.353)	1,966	61.8	96.1	51.4
Lead, mg/kg (WL=405.783)	1,860	--	60	--
Cadmium, mg/kg (WL=226.502)	<3.44*	<1.51*	<2.27*	<1.17*
Cadmium, mg/kg (WL=228.802)	1.78	1.21	2.13	<.53
Antimony, mg/kg	7.82	1.06	0.71	<.21

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

F-117

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P.O. Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 6242
7215 Pine Forest Road • Pensacola FL 32506
Telephone (904) 944 0301

LABORATORY REPORT

85-1114 8/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-29 - FMH07A
1114-30 - FMH07B
1114-31 - DMH07B
1114-32 - FMH08A

ANALYSES	IDENTIFICATION NUMBER 1114-29	1114-30	1114-31	1114-32
Percent Solids	48.5	66.2	69.8	52.6
pH	3.49	3.47	3.50	3.48
Lead, mg/kg (WL=220.353)	109	39.3	31.4	61.0
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	1.20	<1.12*	<.91*	<1.64*
Cadmium, mg/kg (WL=228.802)	1.35	0.7	0.81	0.70
Antimony, mg/kg	10.5	<.22	<.20	1.29

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R. Holsey
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, F 32506
Telephone: (904) 944-0301

LABORATORY REPORT

85-1114 7/10

CLIENT: Ecology and Environment, Inc.
LOCATION: Buffalo, NY
DATE: 01/08/86
INVOICE NO: 6705/ch

COLLECTED BY: Client (1588)
DATE COLLECTED: 11/14-18/85
DATE RECEIVED: 11/15&19/85
DATE ANALYZED: 11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-25 - FMH05A
1114-26 - FMH05B
1114-27 - FMH06A
1114-28 - FMH06B

ANALYSES	IDENTIFICATION NUMBER 1114-25	1114-26	1114-27	1114-28
Percent Solids	50.4	72.9	14.9	19.1
pH	3.38	3.44	3.71	2.79
Lead, mg/kg (WL=220.353)	103	19.8	251	<20.4
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<.75	0.88	3.21	3.26
Cadmium, mg/kg (WL=228.802)	<.75	<.55	3.74	2.85
Antimony, mg/kg	10.7	0.22	47.1	1.63

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

Frank R. Hedges
MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

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ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson, MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola FL 32506
Telephone (904) 944 0301

LABORATORY REPORT

85-1114 10/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE	01/08/86	DATE RECEIVED	11/15&19/85
INVOICE NO.	6705/ch	DATE ANALYZED	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-37 - FMT02A
1114-38 - FMT02A

ANALYSES	IDENTIFICATION NUMBER 1114-37	1114-38		
Percent Solids	81.2	71.4		
pH	5.37	4.19		
Lead, mg/kg (WL=220.353)	111.4	47.2		
Lead, mg/kg (WL=405.783)	110	--		
Cadmium, mg/kg (WL=226.502)	<.27	1.57*		
Cadmium, mg/kg (WL=228.802)	<.27	<.46		
Antimony, mg/kg	<.11	<.18		

COMMENT

alyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis Water and Wastes, March 1979.

'ses performed in compliance with procedures specified for the Contract Laboratory am.

'ot used due to background interference (AL > 50ppm).

CERTIFICATION

CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

ENVIRONMENTAL PROTECTION SYSTEMS, INC.
P O Box 20382 • 160 Upton Drive • Jackson MS 39209
Telephone (601) 922 8242
7215 Pine Forest Road • Pensacola, FL 32506
Telephone: (904) 944-0301

LABORATORY REPORT

85-1114 9/10

CLIENT	Ecology and Environment, Inc.	COLLECTED BY	Client (1588)
LOCATION	Buffalo, NY	DATE COLLECTED	11/14-18/85
DATE:	01/08/86	DATE RECEIVED:	11/15&19/85
INVOICE NO:	6705/ch	DATE ANALYZED:	11/16 - 12/04/85

LABORATORY SAMPLE IDENTIFICATION

1114-33 - FMH08B
1114-34 - DMH08B
1114-35 - FMT01A
1114-36 - FMT01B

ANALYSES	IDENTIFICATION NUMBER 1114-33	1114-34	1114-35	1114-36
Percent Solids	71.0	72.5	47.8	76.2
pH	3.46	3.33	4.33	4.17
Lead, mg/kg (WL=220.353)	53.6	32.8	443	27.3
Lead, mg/kg (WL=405.783)	--	--	--	--
Cadmium, mg/kg (WL=226.502)	<.86*	<.74*	<.72*	<.59*
Cadmium, mg/kg (WL=228.802)	<.54	<.53	<.72	<.49
Antimony, mg/kg	<.21	<.21	<.29	<.20

COMMENT

Analyses conducted in accordance with EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1979.

Analyses performed in compliance with procedures specified for the Contract Laboratory Program.

*Data not used due to background interference (AL > 50ppm).

CERTIFICATION

MANAGER, CHEMICAL LABORATORY

DIRECTOR, ANALYTICAL SERVICES

F-121

MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: January 17, 1986

SUBJECT: Sapp Battery Report; Job No. U-2722

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on fifteen samples received at the Analytical Services Center on December 7, 1985. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, "SW-846, Second Edition, U.S. EPA, 1982.

All samples, on which this report is based, will be retained by E&E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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ANALYTICAL DATA

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LABORATORY REPORT
FOR
Sapp Battery

Job No.: U-2722

Sample Date: 11/20/85 Sampled By: E & E, Inc.

Date Received: 12/7/85 Delivered By: Federal Express

Sample Type: Soil

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

				mg/L				Maximum Allowable Concentration (mg/L)
E & E Lab Number	85-	8931G	8932A	8932B	8932C	8932D	8932F	
Customer Number		FSF 03	FSF 04	FSF 04	FSF 04	FSF 04	FSF 04	
Sample Identity		0.75 ash 0.75 lime 1 soil	straight	0.5 concrete 1 soil	1 concrete 1 soil	1.5 concrete 1 soil	0.25 ash 0.25 lime 1 soil	
Arsenic		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Barium		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	100.0
Cadmium		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.0
Chromium		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Lead		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0
Mercury		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.2
Selenium		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1.0
Silver		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.0

Analytical References:

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW-846 Second Edition, U.S. EPA, 1982

Supervising Analyst Gary Hale

Date: January 17, 1986

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2722

Sample Date: 11/20/85 Sampled By: E & E, Inc.

Date Received: 12/7/85 Delivered By: Federal Expr[illegible]

Sample Type: Soil

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

				mg/L				Maximum Allowable Concentratio (mg/L)
E & E Lab Number 85-	8931A	8931B	8931C	8931D	8931E	8931F		
ustomer Number	FSF 03	FSF 03	FSF 03	FSF 03	FSF 03	FSF 03		
Sample Identity	straight	0.5 concrete 1 soil	1 concrete 1 soil	1.5 concrete 1 soil	0.25 ash 0.25 lime 1 soil	0.5 ash 0.5 lime 1 soil		
Arsenic	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		5.0
Barium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0		100.0
Cadmium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		1.0
Chromium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		5.0
Lead	2.62	<0.5	<0.5	<0.5	<0.5	<0.5		5.0
Mercury	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		1.0
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		5.0

Analytical References:

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW-846 Second Edition, U.S. EPA. 1982

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Supervising Analyst [illegible]

Date: January 17, 1986

F-125

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Arsenic	26.7	29.4	10.1
Barium	119,600	123,780	3.5
Cadmium	1130	1170	3.5
Chromium	6500	6580	1.2
Lead	8000	8150	18.8
Mercury	8.73 8.73	9.10 8.32	4.2 4.7
Selenium	10.9	9.50	12.8
Silver	6000	6320	5.3

Note: These results are within the 95% confidence interval for these parameters.

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2722

Sample Date: 11/20/85 Sampled By: E & E, Inc.

Date Received: 12/7/85 Delivered By: Federal Express

Sample Type: Soil

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	mg/L		Maximum Allowable Concentration (mg/L)
E & E Lab Number 85-	8932F	8932G	
Customer Number	FSF 04	FSF 04	
ample Identity	0.5 ash	0.75 ash	
	0.5 lime	0.75 lime	
	1 soil	1 soil	
Arsenic	<0.5	<0.5	5.0
Barium	<5.0	<5.0	100.0
Cadmium	<0.1	<0.1	1.0
Chromium	<0.5	<0.5	5.0
Lead	<0.5	<0.5	5.0
Mercury	<0.02	<0.02	0.2
Selenium	<0.2	<0.2	1.0
Silver	<0.5	<0.5	5.0

Analytical References:

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW-846 Second Edition, U.S. EPA, 1982

Supervising Analyst [illegible]

Date: January 17, 1986

F-127

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LABORATORY REPORT

FOR

Sapp Bettery

Job No.:	U-2933	RE:	FM-2130
Sample Date:	12/20/85	Sampled By:	E & E, Inc.
Date Received:	2/18/86	Delivered By:	Federal Express
Sample Type:	Water		

E & E Lab Number 85-	1053	1054	1055	Prep
Customer Number	FNW-9B Resample	FNW-12A Resample	Alford Fire House	Blank
	results in mg/L			
Aluminum	132	0.725	<0.10	<0.10
Antimony	<0.06	<0.06	<0.06	<0.06
Arsenic	<0.005	<0.005	<0.005	<0.005
Cadmium	0.003	0.003	<0.001	<0.001
Lead	0.045	0.123	0.013	<0.005
Manganese	0.048	0.006	0.032	<0.005
Selenium	<0.005	<0.005	<0.005	<0.005

Analytical References:

"Methods for the Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983.

Supervising Analyst [illegible]

Date: [illegible]

MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: March 4, 1986

SUBJECT: Sapp Battery Report; Job No. U-2933

CC: Lab File, QA/QC File

Attached is the laboratory report of the analysis conducted on three samples received at the Analytical Services Center on February 18, 1986. Analysis was performed according to the procedures set forth in "Methods for the Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983.

All samples, on which this report is based, will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

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QUALITY CONTROL FOR ACCURACY: PERCENT RECOVERY
FOR SPIKED WATER SAMPLES

Element	E & E Laboratory No. 86-	Original Value	Amount Added	Amount Determined	Pe cent Re:overy
		(ug/L)			
Aluminum	1055R	<100	2000	1992	'6
Antimony	1054R	<60	120	120	100
Arsenic	1054R	<5.0	25	25	100
Cadmium	1054R	3.3	2.5	5.65	'4
Lead	1055R	6.1	25	30.8	'9
Manganese	1055R	36	200	231	:8
Selenium	1054R	<5.0	25	28.8	115

QUALITY CONTROL FOR ACCURACY:
PERCENT DIFFERENCE--EPA QUALITY ASSURANCE MATERIALS

	Concentrations in ug/L		
Element	Known	Determined	Percent Difference
Aluminum	729	753	3.3
Antimony	101	108	6.9
Arsenic	26.7	30.4	14
Cadmium	3.30	3.37	2.1
Lead	42.7	41.9	1.9
Manganese	348	366	5.2
Selenium	10.9	10.2	6.4

Note: These results are within the 95% confidence interval for these parameters.

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MEMORANDUM

TO: Rick Rudy

FROM: Gary Hahn

DATE: March 6, 1986

SUBJECT: Sapp Battery Report; Job U-2940

CC: Lab File, QA/QC File, P. Brodzik

Attached is the laboratory report of the analysis conducted on one sample received at the Analytical Services Center on February 19, 1986. Analysis was performed according to the procedures set forth in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, "SW 846, Second Edition, U.S. EPA, 1982.

This composite sample will be used for the fixation study. The leachate from the EP Toxicity test on the "fixed" samples will be analyzed for lead only.

All samples, on which this report is based, will be retained by E & E for a period of 30 days from the date of this report, unless otherwise instructed by the client. If additional storage of samples is requested by the client, a storage fee of $1.00/sample container per month will be charged for each sample, with such charges accruing until destruction of the samples is authorized by the client.

GH/cp
enclosure

U-2933

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF WATER SAMPLES

Element	E & E Laboratory No. 86-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Aluminum	1055	<0.10	<0.10	--
Antimony	1054	<0.06	<0.06	--
Arsenic	1054	<0.005	<0.005	--
Cadmium	1054	0.003	0.003	0
Lead	1055	0.013	0.006	74
Manganese	1055	0.032	0.036	12
Selenium	1054	<0.005	<0.005	--

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U-2940

QUALITY CONTROL FOR PRECISION
RESULTS OF ANALYSIS OF REPLICATE
ANALYSES OF E.P. TOXICITY EXTRACTS

Element	E & E Laboratory No. 86-	Original Analysis	Replicate Analysis	Relative Percent Difference RPD
Arsenic	1126	<0.5	<0.5	--
Barium	1126	<5.0	<5.0	--
Cadmium	1126	<0.1	<0.1	--
Chromium	1126	<0.5	<0.5	--
Lead	1126	59.4	51.8	14
Selenium	1126	<0.5	<0.5	--
Silver	1126	<0.5	<0.5	--

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LABORATORY REPORT

FOR

Sapp Battery

Job No.: U-2940

Date Received: 2/19/86 Sampled By: E & E, Inc.

Sample Type: Soil Comp.

RESULTS OF CHEMICAL ANALYSIS OF EXTRACTS FROM EP TOXICITY TESTS

	mg/L		Maximum Allowable Concentration (mg/L)
E & E Lab Number 86-	1126	Prep	
Customer Number	FSG-53A 76A 87A 53B 76B 87B 53C 76C 87C	Blank	
Sample Identity			
Arsenic	<0.5	<0.5	5.0
Barium	<5.0	<5.0	100.0
Cadmium	<0.1	<0.1	1.0
Chromium	<0.5	<0.5	5.0
Lead	59.4	<0.5	5.0
Mercury	<0.02	<0.02	0.2
Selenium	<0.5	<0.5	1.0
Silver	<0.5	<0.5	5.0

Analytical References:

"Test Methods for Evaluating Solid Waste Physical/Chemical Methods", SW-846 Second Edition, U.S. EPA, 1982

Supervising Analyst [illegible]

Date: March 6, 1986

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