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TECHNICAL REPORT SOIL GAS SURVEY NAS WHITING FIELD FL
3/1/1993
ABB ENVIRONMENTAL

TECHNICAL REPORT
SOIL GAS SURVEY
NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

CONTRACT TASK ORDER NO. 050
NAVY CLEAN - DISTRICT I
CONTRACT NO. N62467-89-D-0317

MARCH 1993

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29419-9010

TECHNICAL REPORT
SOIL GAS SURVEY

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

PHASE II-A

NAVAL AIR STATION, WHITING FIELD
MILTON, FLORIDA

Contract No. N62467-89-D-0317

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March 1993

EXECUTIVE SUMMARY

This technical report describes the methodology and presents results of the soil gas survey investigation conducted at the Naval Air Station (NAS) Whiting Field, Milton, Florida. The soil gas survey was one of nine field investigative tasks that comprise the Remedial Investigation (RI). The objective of the RI is to address any identified risks posed by toxic or hazardous chemicals present as a result of past waste disposal practices or spills at the facility. The entire Remedial Investigation/ Feasibility Study (RI/FS) program is being conducted at NAS Whiting Field in accordance with the Navy's Installation Restoration Program.

Soil gas surveys were completed at seven NAS Whiting Field sites. The sites, grouped as follows, included:

- Sites 3 and 32, North Field Maintenance Hangar Area;
- Sites 5, 6, and 33, Midfield Maintenance Hangar Area; and
- Sites 29 and 30, South Field Maintenance Hangar Area.

The purpose of the passive soil gas survey at NAS Whiting Field was to identify potential source areas and to determine the areal extent of soil gas contamination at the above sites.

The scope of the soil gas survey included the placement, collection, and analysis of 220 Petrex™ passive soil gas samplers at the three site groupings presented above.

Interpretation of the analytical data generated by the soil gas survey at NAS Whiting Field has resulted in the delineation of the areal extent of soil gas contamination for the compounds BTEX, PCE, TCE, and cycloalkanes and naphthalenes at the North Field, South Field, and Midfield Maintenance Hangar Study Areas. Based on this information generalizations can be made concerning areas of soil and groundwater contamination.

Table ES-1 presents the summary of soil gas survey findings at NAS Whiting Field.

Table ES-1
Summary of Soil Gas Survey Findings

Technical Report
Soil Gas Survey, RI Phase II-A
NAS Whiting Field, Milton, Florida

Site Grouping	Compound Detected	Frequency of Detection	Ion Count Threshold	Location of Individual Sampling Points Exceeding the Threshold Ion Count				
Sites 3 and 32 North Field Maintenance Hangar Area				NFMH	WR	AUWOST	PLA	Building 2941
	BTEX	9 of 106	> 100,000	2	2	1	1	3
	PCE	9 of 106	> 100,000	4	3	1	--	1
	TCE	3 of 106	> 100,000	3	--	--	--	--
	Cycloalkanes and Naphthalenes	28 of 106	> 100,000	7	9	1	6	5
Sites 29 and 30 South Field Maintenance Hangar Area				SFMH	WR	AUWOST	PLA	Auto Hobby Shop
	BTEX	17 of 71	> 100,000	6	4	3	2	2
	PCE	12 of 71	> 100,000	3	2	2	2	3
	TCE	8 of 71	> 100,000	8	--	--	--	--
	Cycloalkanes and Naphthalenes	19 of 71	> 100,000	3	3	3	3	5
Sites 5, 6, and 33 Midfield Maintenance Hangar Area				MFMH		AUWOST	Drainage Ditch	
	BTEX	6 of 44	> 85,000	6		--	--	
	PCE	5 of 44	> 10,000	5		--	--	
	TCE	5 of 44	> 100,000	5		1	--	
		4 of 44	> 50,000	4		1	--	
	Cycloalkanes and Naphthalenes	7 of 44	> 100,000	7		--	--	

Notes:
NFMH = North Field Maintenance Hangar.
WR = Wash Rack Area.
AUWOST = Abandoned Underground Waste Oil Storage Tanks.
PLA = Parking Lot Area.
BTEX = benzene, toluene, ethylbenzene, and xylenes.
PCE = tetrachloroethene.
TCE = trichloroethene.
-- = none detected.
SFMH = South Field Maintenance Hangar.
MFMH = Midfield Maintenance Hangar.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AUWOST	Abandoned Underground Waste Oil Storage Tank
AVGAS	aviation gasoline
BTEX	benzene, toluene, ethylbenzene, and xylenes
°C	degrees Celsius
CpD-MS	Curie-point desorption - mass spectrometer
FID	Flame Ionization Detector
FS	Feasibility Study
MFMH	Midfield Maintenance Hangar
NAS	Naval Air Station
NERI	Northeast Research Institute
NFMH	North Field Maintenance Hangar
OVA	organic vapor analyzer
PCE	tetrachloroethene
PLA	Parking Lot Area
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
SFMH	South Field Maintenance Hangar
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SVOCs	semivolatile organic compounds
TCE	trichloroethene
TD-MS	thermal desorption-mass spectrometer
TD-GC/MS	thermal desorption-gas chromatograph/mass spectrometer
TRC	Tracer Research Corporation
VOCs	volatile organic compounds
WRA	Wash Rack Area

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), under contract to the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is conducting Phase II-A of a Remedial Investigation (RI) and Feasibility Study (FS) at Naval Air Station (NAS) Whiting Field located in Milton, Florida. The RI is being conducted under contract number N62467-89-D-0317.

NAS Whiting Field is located in Florida's northwest coastal area approximately 7 miles north of Milton and 20 miles northeast of Pensacola (Figure 1-1). NAS Whiting Field presently consists of two air fields separated by an industrial area and covers approximately 2,560 acres in Santa Rosa County, Florida. Figure 1-2 presents the installation layout.

A two-phased approach has been adopted for achieving the objectives of the RI. The Phase I field program was carried out by ABB-ES between December 1990 and May 1991. The Technical Memoranda that presented the findings and conclusions of Phase I and proposed exploration program for Phase II were submitted to the regulatory agencies in April 1992. The RI Phase II program is scheduled to be conducted in two parts: part A and part B. The Phase II-A RI field program was initiated in May 1992.

The soil gas survey was the second field task completed in a series of tasks scheduled for RI Phase II-A. This report summarizes the results and presents data gathered during the soil gas survey.

1.1 REMEDIAL INVESTIGATION (RI) PROGRAM.

1.1.1 Purpose The purpose of the NAS Whiting Field RI program is to identify remedial alternatives that address identified risks to public health and the environment posed by toxic or hazardous chemicals present as a result of past waste disposal practices or spills. To achieve this objective, the RI must collect data sufficient to assess the nature and distribution of chemicals that pose unacceptable risk. The data collected during the RI will be used to screen, evaluate, and select remedial alternatives to provide permanent, feasible remedial solutions to environmental contamination problems at NAS Whiting Field.

1.1.2 Scope of RI Phase II-A Exploration Program The RI Phase II-A exploration program includes the following:

- geophysical survey,
- soil gas survey,
- soil boring and test pit explorations,
- sampling of surface and subsurface soils,
- sampling of surface water and sediments,
- monitoring well installation and groundwater sampling,
- location survey, and
- ecological and public health surveys.

A summary of RI Phase II-A activities is presented in Section 7.0 of Technical Memorandum No. 6 (RI/FS Phase I, ABB-ES, 1992). Procedures for the RI Phase II-A field explorations, including sampling and analysis protocols, are found in

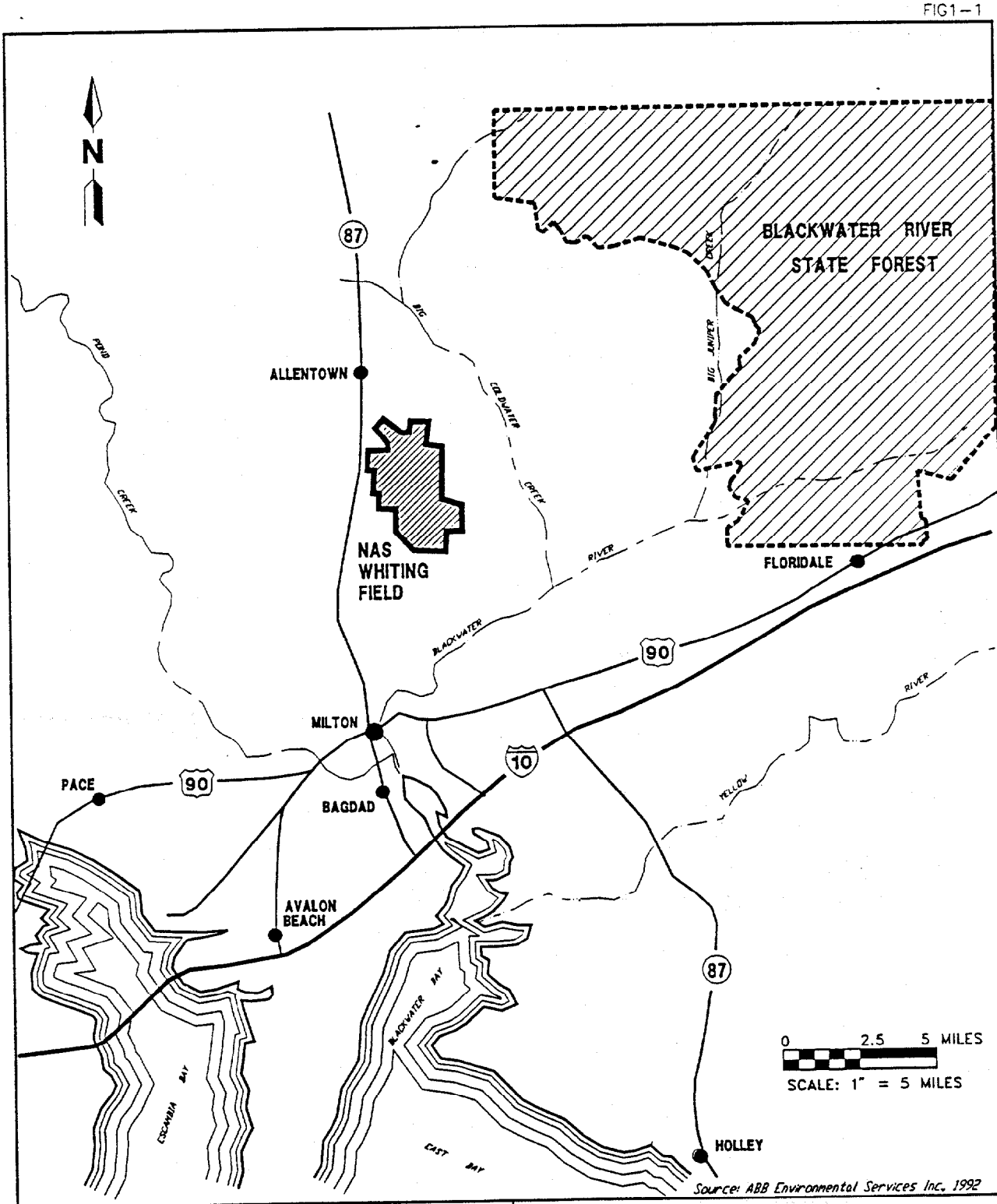

FIGURE 1-1
FACILITY LOCATION MAP

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SOIL GAS SURVEY

NAS WHITING FIELD
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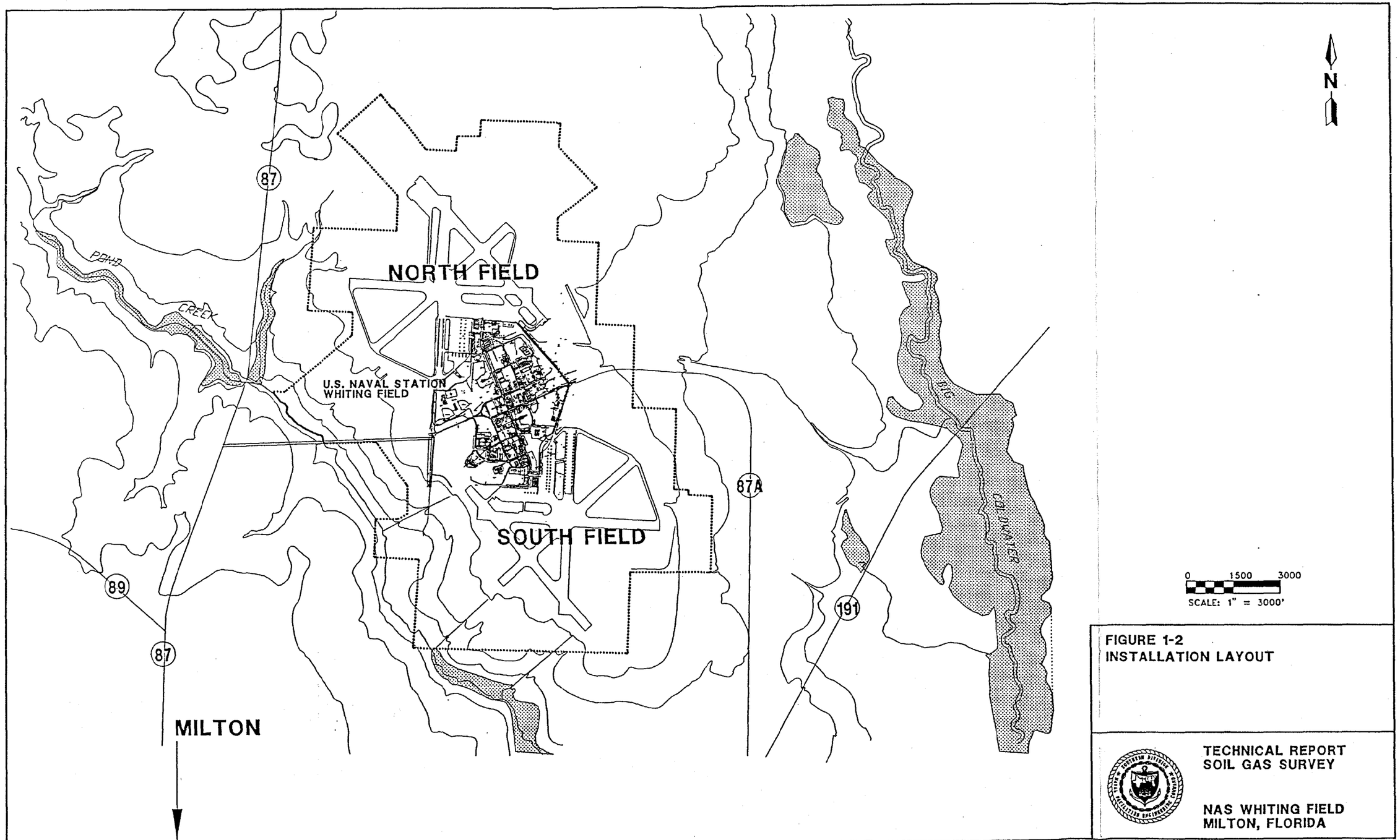

FIGURE 1-2
INSTALLATION LAYOUT

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Volumes I and II of the Phase I workplan (Jordan, 1990). Appendix A of Technical Memorandum No 6 presents the procedures for conducting a passive soil gas survey.

1.2 SOIL GAS SURVEY. The soil gas survey was conducted by Northeast Research Institute (NERI) Farmington, Connecticut, in June 1992. The passive soil gas technique was employed as a screening tool to aid delineation of areas of soil and groundwater contamination at Sites 3, 5, 6, 29, 30, 32, and 33. Table 1-1 presents a summary of the soil gas survey.

Table 1-1
Summary of Soil Gas Survey

Technical Report, Soil Gas Survey
RI/FS Phase II-A
NAS Whiting Field, Milton, Florida

Site Number	Location	Number of Sampling Points	
		Proposed	Actual
3 and 32	North Field Maintenance Hangar Area	120 Points	106 Points
29 and 30	South Field Maintenance Hangar Area and Auto Hobby Shop Area	50 Points	71 Points
5, 6, and 33	Midfield Maintenance Hangar Area	50 Points	44 Points

1.2.1 Purpose The purpose of the passive soil gas survey at NAS Whiting Field was to identify potential source areas and to determine the areal extent of soil gas contamination at the sites listed in Table 1-1.

The presence of soil gas in the pore space of the soil is indicative of the presence of soil or groundwater contamination. Based on the results of the soil gas survey, locations for soil samples, soil borings, and monitoring wells can be identified to determine the extent of soil and groundwater contamination.

1.2.2 Scope The scope of the soil gas survey included the placement, collection, and analysis of 220 Petrex™ passive soil gas samplers at the three site groupings presented in Table 1-1. The objectives of the soil gas survey were as follows.

- The presence of volatile and semivolatile organic vapors in the pore spaces of near surface or vadose zone soils was investigated. Specific compounds included for analysis being benzene, toluene, ethylbenzene, xylenes (BTEX), tetrachloroethene (PCE), trichloroethene (TCE), and cycloalkanes and naphthalenes.

- The areal distribution of relative ion counts was mapped (ion count is defined as the total count of the number of ions of a particular compound desorbed from the soil gas probe during the thermal desorption process), the potential sources were identified and possible migration pathways of contamination were tracked.

2.0 DESCRIPTION OF SOIL GAS SURVEY TECHNIQUE

2.1 THEORY. Volatile organic compounds (VOCs) volatilize from contaminated soils and groundwater into the soil gas and move through soil pore spaces by molecular diffusion and advection. Their tendency to volatilize from contaminated soils and groundwater into the pore space within soils is a function of chemical concentrations in the soil and groundwater and the chemical's aqueous solubility and vapor pressure.

Contaminated soils or groundwater act as a "source" for the VOC contaminants and the aboveground atmosphere acts as a "sink". A contaminant concentration gradient is established in the soil gas that accounts for the vertical flux of the contaminants from the contaminated zone to the ground surface.

The concentration gradient in the soil gas is affected or distorted by several hydrologic and geologic variables such as clay, perched water, or other impermeable materials. The primary parameters that impede the diffusive movement of volatile contaminants in soil are pore fluids and clay layers (Tracer Research Corporation [TRC], 1984).

Soil gas emissions are generally recorded in measurable quantities from most industrial organic solvents, fuels such as gasoline and diesel, a number of pesticide compounds, and military-specific chemical agents provided they exist as contaminants in soils or are dissolved in groundwater. In general, compounds with low boiling points (less than 110 degrees Celsius [°C]) and low water solubility are found in the soil gas (TRC, 1984). Henry's law constant is the best parameter to assess the tendency of the compound to volatilize to soil gas. Henry's Law constant represents the partitioning of the chemical between water and the atmosphere. It is the ratio of concentration in air to the concentration in water after equilibrium has been reached.

Soil gas analysis provides an indirect indication of soil or groundwater contamination, and the results may be affected significantly by the environmental conditions. Because the matrix itself is not directly analyzed during a soil gas survey, the results may be construed as indicators of subsurface contamination. Soil gas methods are most practical for investigations of unconsolidated soils having high permeability (such as sandy soils). A fluctuating water table may favor the distribution of contaminants through the vadose zone; however, precipitation events may temporarily render soil gas methods ineffective. The weather conditions during the field program at NAS Whiting Field were generally dry with the occurrence of intermittent, short duration precipitation being reported for 2 days.

2.2 PETREX™ PASSIVE SOIL-GAS TECHNIQUE. The Petrex™ passive soil gas technique provides a method to collect and detect trace quantities of a broad range of VOCs and semivolatile organic compounds (SVOCs) below the ground surface. The Petrex™ sampler will continually collect these volatile compounds for the period the sampler is in place below the ground surface. During the sampling period, VOCs and SVOCs are adsorbed onto a specially treated substrate coated on a sampler wire.

The Petrex™ sampler consists of two collectors, each a ferromagnetic wire (made of nichrome) coated with an activated carbon adsorbent. The sampler wires are

typically placed in a shallow hole, 14 to 18 inches deep, within a protective glass container. The hole is then backfilled and the location is marked. The sampler is left in the ground from 1 to 30 days, depending upon the VOC loading rates. It is then retrieved and sealed for transportation back to the laboratory for analysis. The length of time the sampler is left in the ground is determined by a time sequence Petrex™ test (see Section 2.3.1).

When compared with active soil gas methods including soil gas headspace and soil gas probes, the Petrex™ soil gas method tends to provide more constant and representative data. The relatively long sampling period and the integrative nature of the passive Petrex™ sampler tends to stabilize temporary variations (i.e., short-term rain events) that could affect the overall VOC dispersion rates.

2.2.1 Analysis The standard analytical system uses a Curie-Point desorption (CpD-MS) inlet interfaced to a quadruple mass spectrometer for fast, adequately reproducible analyses. Curie-Point is defined as "the temperature at which a material loses its ability to retain magnetism," that is, changes from ferromagnetic to paramagnetic behavior. Below this temperature atoms interact so that their magnetic moments become duplicated and substances behave paramagnetically. The Curie-Point of the activated carbon used as the active ingredient on the Petrex™ wire is 300 °C (TRC, 1984).

During each analysis, all VOCs and SVOCs identified in a mass range of 30 to 240 atomic mass units (Carbon 2 to Carbon 16) are desorbed, analyzed, and stored on a computer as a composite of the VOC and SVOC compounds collected at each sampling location. These data are then downloaded onto a graphical work station where data processing and interpretation are conducted (Viellenave and Hickey, 1990).

2.2.2 Data Interpretation

Compound identification. Compound identification, as applicable, is based on molecular weight, compound fragmentation into ions during analysis, and isotope distribution.

Mapping Ion Counts. The process of determining the ion counts of diagnostic indicator peaks for a compound is computerized. Sample locations on a base map are digitized as X-Y coordinates, and ion counts for the detected compounds are plotted at their respective locations. This VOC ion count map represents the total accumulation of ion count for the respective sampling time of the mapped area.

Trend Analysis. Ion count distributions are computed based on frequency distribution of counts and physicochemical factors affecting the diffusion and degradation process of various components of a compound. Thus, each flux map can broadly be divided into two categories: one representing the background relative ion count range and the other an anomaly, which is higher than the background ion count.

The reported ion counts are representative of a flux that is not a measure of concentration, but represents the components at a particular sample location.

2.3 FIELD PROCEDURE. The soil gas survey at NAS Whiting Field was conducted between June 14 and June 24, 1992. Petrex™ soil gas samplers were installed at the North Field Maintenance Hangar Area (Sites 3 and 32), the South Field Maintenance Hangar Area (Sites 29 and 30), and the Midfield Maintenance Hangar Area (Sites 5, 6, and 33) located at NAS Whiting Field in Milton, Florida.

Various ground surfaces encountered during the soil gas survey included grass, bare soil, asphalt, and concrete. In order to accommodate these varying surface conditions, the Petrex™ samplers were installed using the following two methods.

- A coring shovel was used for the placement of samplers in grassy or bare soil areas. The shovel was used to create a 12- to 14-inch deep, 2-inch-diameter core in the soil. Organic vapor readings were obtained using a Porta-FID™ organic vapor analyzer (OVA) prior to installing the Petrex™ sampler in the hole. The hole was then backfilled with the excavated soil. Locations were marked with biodegradable ribbon flagging, and noted in a field log book and on a field map.

- In the case of areas capped with hard surfaces (asphalt and concrete), an 18-inch deep, 1.5-inch-diameter hole was drilled through the capping surface using an electric rotary hammer drill. The sampler was then wrapped with a galvanized steel wire, to facilitate retrieval, and placed at the bottom of the hole. A small plug of aluminum foil was then inserted 2 to 3 inches below grade, and the hole was than capped to grade with a quick-setting hydraulic cement seal.

2.3.1 Time Sequence Test Time calibration samplers were used to determine the VOC adsorption rates to the sampler from the soil gas. A set of four time calibration samplers were installed at NAS Whiting Field. These samplers were exposed for a period of 72 hours before analysis. The loading rate of the samplers depended upon the concentration and depth of contaminants, as well as the media type of the contaminant (soil or groundwater). Based on the time of exposure of 'Time Sequence Test Samplers' and the reported ion counts for BTEX, TCE, PCE, and cycloalkanes and naphthalenes, the exposure time for the samplers at each site was determined.

2.3.2 Quality Assurance/Quality Control (QA/QC) QA/QC samples used for the soil gas survey included method blanks, trip blanks, ambient air samples, and duplicate analysis samples. No compounds other than the normal atmospherics (oxygen, carbon dioxide, nitrogen, water vapor, and argon) were detected in the blank QC samples.

Method Blank. Approximately 10 percent of the total Petrex™ survey samples were collected as method blank samples. Each of the method blank samples contained three sampler wires as opposed to the regular collector containing two wires. The individual uses of each wire are as follows.

- The first wire was used for mass spectrometer's operating constants including: operating conditions prior to sample collection and instrument sensitivity during analysis. In addition, this wire may also be used to compare reproducibility between wires of a single collector.

- The second wire was used for actual thermal desorption-mass spectrometry (TD-MS) analysis.

- The third wire was retained for thermal desorption gas-chromatography/ mass spectrometry (TD-GC/MS) analysis to differentiate naturally occurring compounds from contamination-related ones.

Trip Blank. The trip blank sampler contained a single wire to check for contamination introduced during travel with each shipment group. If compounds other than normal atmospherics (oxygen, carbon dioxide, nitrogen, water vapor, and argon) were detected, then the blank count was subtracted from the survey data.

Ambient Air Samples. One sampler for each site was dedicated to obtaining an ambient air count. The sampler was exposed to ambient air for a duration of 3 to 4 seconds representing the installation period and 60 seconds representative of the retrieval period, during which the samplers would be exposed to ambient atmosphere. The exposure times were determined to be representative of the actual amount of time each of the survey samplers were potentially exposed to ambient air conditions.

No contamination except for the common atmospheric gases (carbon dioxide, oxygen, hydrogen, and nitrogen) was detected in the ambient air blanks collected at NAS Whiting Field. Masspectrograms for the analysis of ambient air blanks are attached in Appendix A.

Duplicate Sampler. All the Petrex™ samplers were provided with a duplicate wire. The function of the two wires was as follows.

- The first wire was used for actual TD-MS analysis.
- The second wire was retained for TD-GC/MS analysis to classify naturally occurring compounds from contamination-related ones.

3.0 RESULTS AND INTERPRETATION

The three primary study areas included in the scope of the soil gas survey at NAS Whiting Field were:

- Site 3 and Site 32 (North Field Maintenance Hangar Area),
- Site 29 and Site 30 (South Field Maintenance Hangar Area), and
- Site 5, Site 6, and Site 33 (Midfield Maintenance Hangar Area).

Target compounds selected for analysis after critical screening and consideration of site-specific aspects (such as the release history, potential by-products of volatilization of released products, etc.) include the following:

- BTEX,
- PCE,
- TCE, and
- cycloalkanes and naphthalenes.

All the ion count numbers were multiplied with a constant scale factor to simplify the ion count number and the resulting ion count was defined as the relative ion count. There were three common relative ion count distribution features observed throughout the surveyed areas. These features were based on a distinct breakdown in the continuity of spatial distribution of the relative ion count of individual sampling points on a established sampling grid. This breakdown in the continuity of ion count distribution was statistically estimated as a relative ion count at either 10,000, 85,000, or 100,000 depending on the site-specific analysis results. Original ion count results for each sampler located at the various sites included under the soil gas survey are presented in Appendix B.

The three relative ion count features referred to in the following sections of this chapter include: single point hot spots, linear feature hot zones, and extended area hot zones, as described below.

Single point hot spot: discontinuity in the distribution of ion count is significant only at one grid point, in other words all the other grid points surrounding this point have relatively low ion counts.

This type of discontinuity indicates possible occurrences of isolated spills of contaminants in the subsurface soil under investigation.

Linear feature hot zone: discontinuity in the distribution of ion count is with distinct linear boundaries and undefined ends.

This type of discontinuity indicates potential zones of contamination in either subsurface soil or groundwater and possible migration pathways of contaminants.

Extended area hot zone: discontinuity in the distribution of ion count is over multiple grid points with lateral boundaries and distinct enclosed features. However all sides may not be defined because portions may extend outside of the grid area.

This type of discontinuity indicates potential zones of contamination in either subsurface soil or groundwater.

3.1 SITE 3 AND SITE 32 (NORTH FIELD MAINTENANCE HANGAR AREA). A total of 106 soil gas samplers were installed at the North Field Maintenance Hangar Area. These samplers were placed on approximately 80-foot centers surrounding the maintenance hangar buildings at sites 3 and 32. The sample locations and numbers are shown on Figure 3-1. At Site 32 the grid extended east of the North Field Maintenance Hangar to encompass the wash rack, an area of aboveground and abandoned underground waste oil storage tanks, the current fuel transfer station, and parking areas. Towards the west, the survey extended approximately 100 feet in the airfield area.

At Site 3, the grid extended approximately 200 feet south of Building 2941 and encompassed the abandoned underground waste oil tank, the paint locker, the former underground waste solvent storage tank area, and parking areas. The grid also surrounded Building 2941 as well as the eastern parking area.

Distribution of relative ion counts for BTEX, PCE, TCE, and cycloalkanes and naphthalenes are presented in the Figures 3-2, 3-3, 3-4, and 3-5 and discussed in the following subsections. Contour intervals for these four figures have been statistically estimated as the 100,000 ion count. Any ion count above this value was considered anomalous with respect to the background and classified under one of the three types of discontinuities explained in the previous section.

3.1.1 Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Figure 3-2 exhibits the distribution of relative ion count of BTEX, mapped for the North Field Maintenance Hangar Area survey.

Nine of the 106 sampling points at the North Field Maintenance Hangar Area showed ion counts greater than 100,000. The area covered by most of these sampling points was capped with 8- to 10-inch thick concrete. There are five single point hot spots, one linear feature hot zone, and one extended area hot zone at the North Field Maintenance Hangar Area.

Among the five single point hot spots, the two points with the greatest ion counts are located, one each, at the former underground waste solvent area and the aboveground and former underground waste oil storage tank area. The remaining single point hot spots are located on the eastern and western borders of the survey grid.

The linear feature hot zone is located east of Building 2941 (hangar building) trending west to east. The extended area hot zone is located near the wash rack east of the North Field Maintenance Hangar and west of the aboveground waste oil storage tank area.

3.1.2 Tetrachloroethene (PCE) Figure 3-3 exhibits the distribution of the PCE relative ion count mapped for the North Field Maintenance Hangar Area survey. Ten of the 106 sampling points reported ion counts greater than 100,000. There are two single point hot spots and three extended area hot zones in this area. Among the two single point hot spots, the one with the greatest ion count is located on the border of the survey grid east of Building 2941 and the other is located west of the North Field Maintenance Hangar.

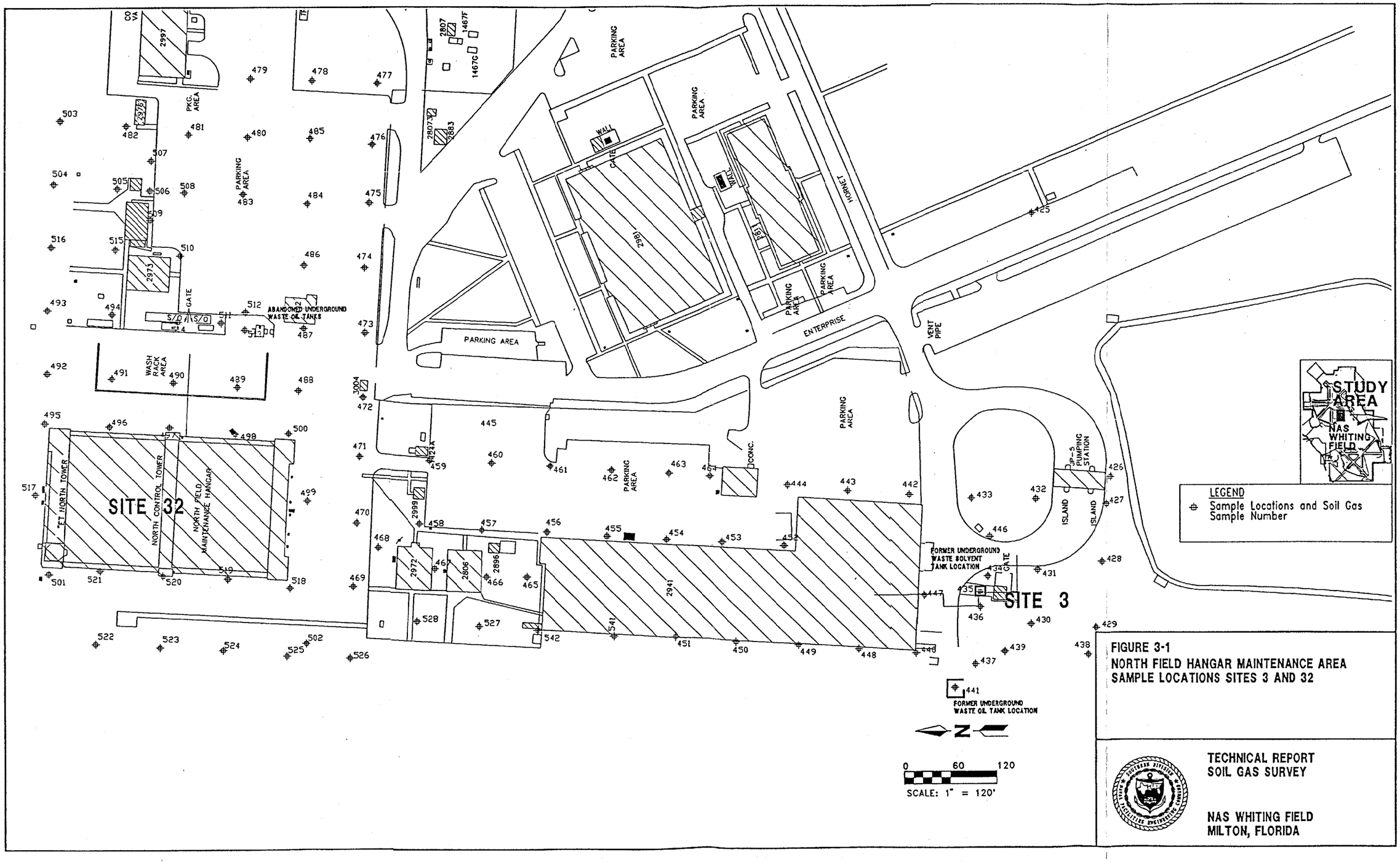

FIGURE 3-1
NORTH FIELD HANGAR MAINTENANCE AREA
SAMPLE LOCATIONS SITES 3 AND 32

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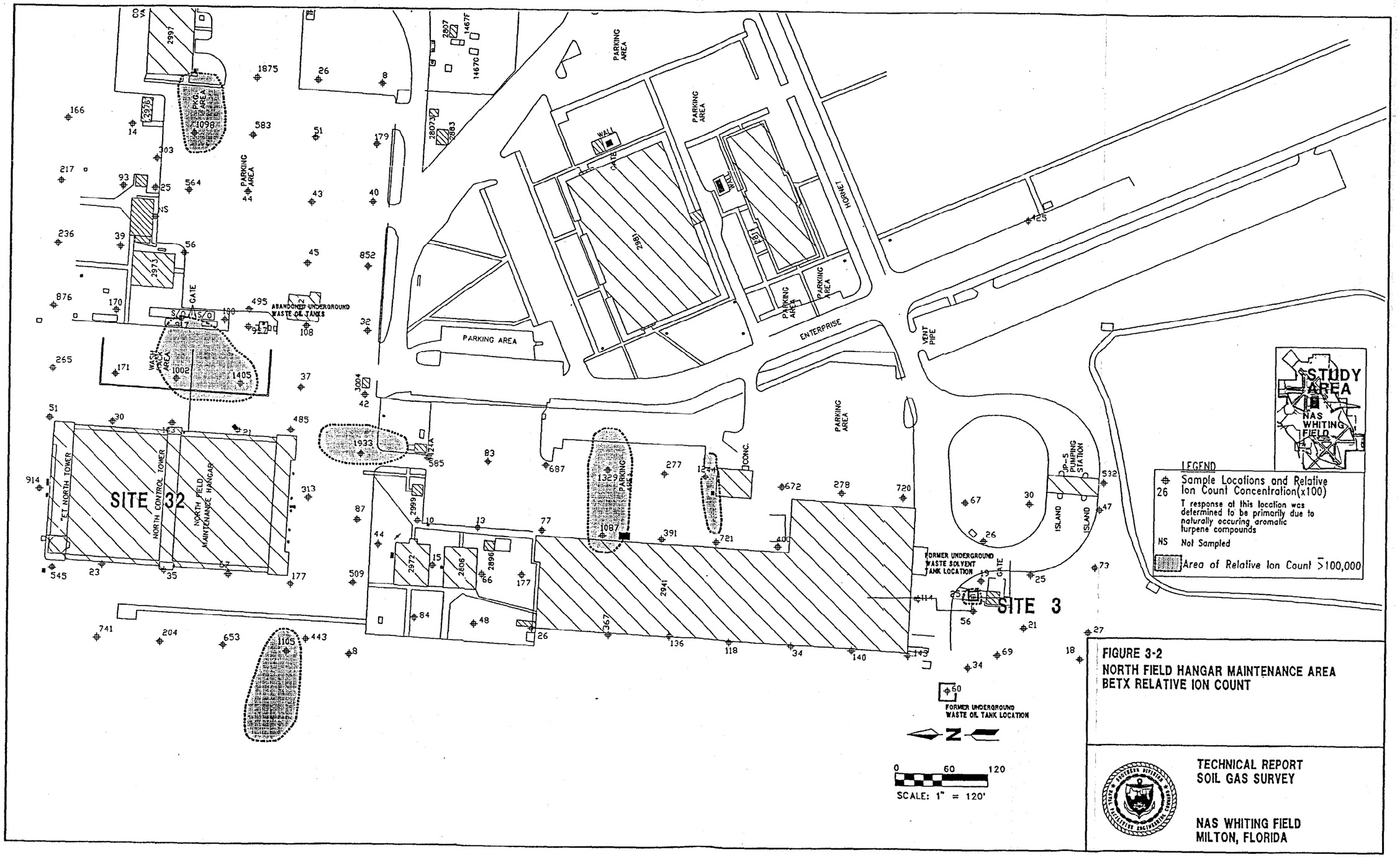

FIGURE 3-2
NORTH FIELD HANGAR MAINTENANCE AREA
BETX RELATIVE ION COUNT

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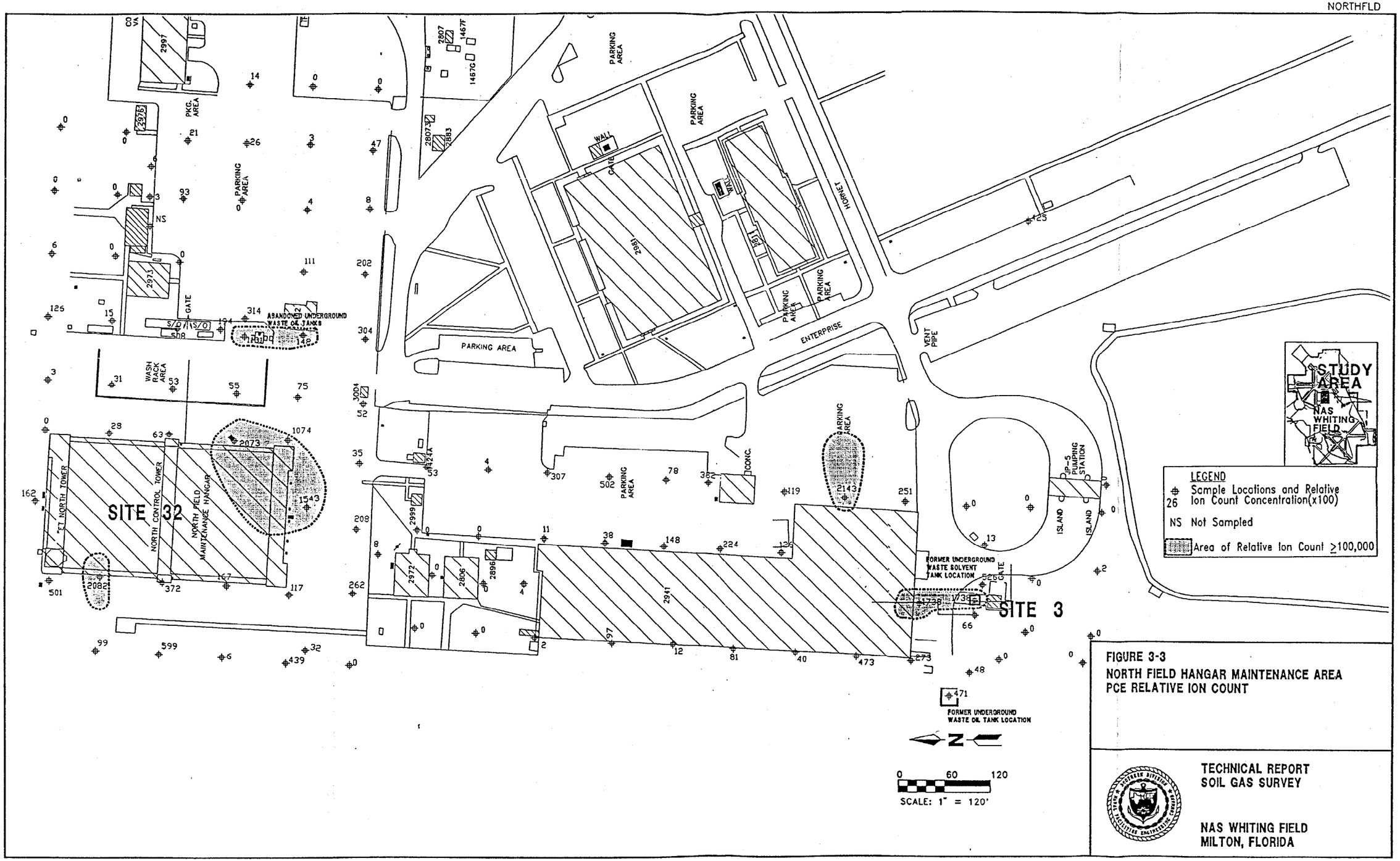

FIGURE 3-3
NORTH FIELD HANGAR MAINTENANCE AREA
PCE RELATIVE ION COUNT

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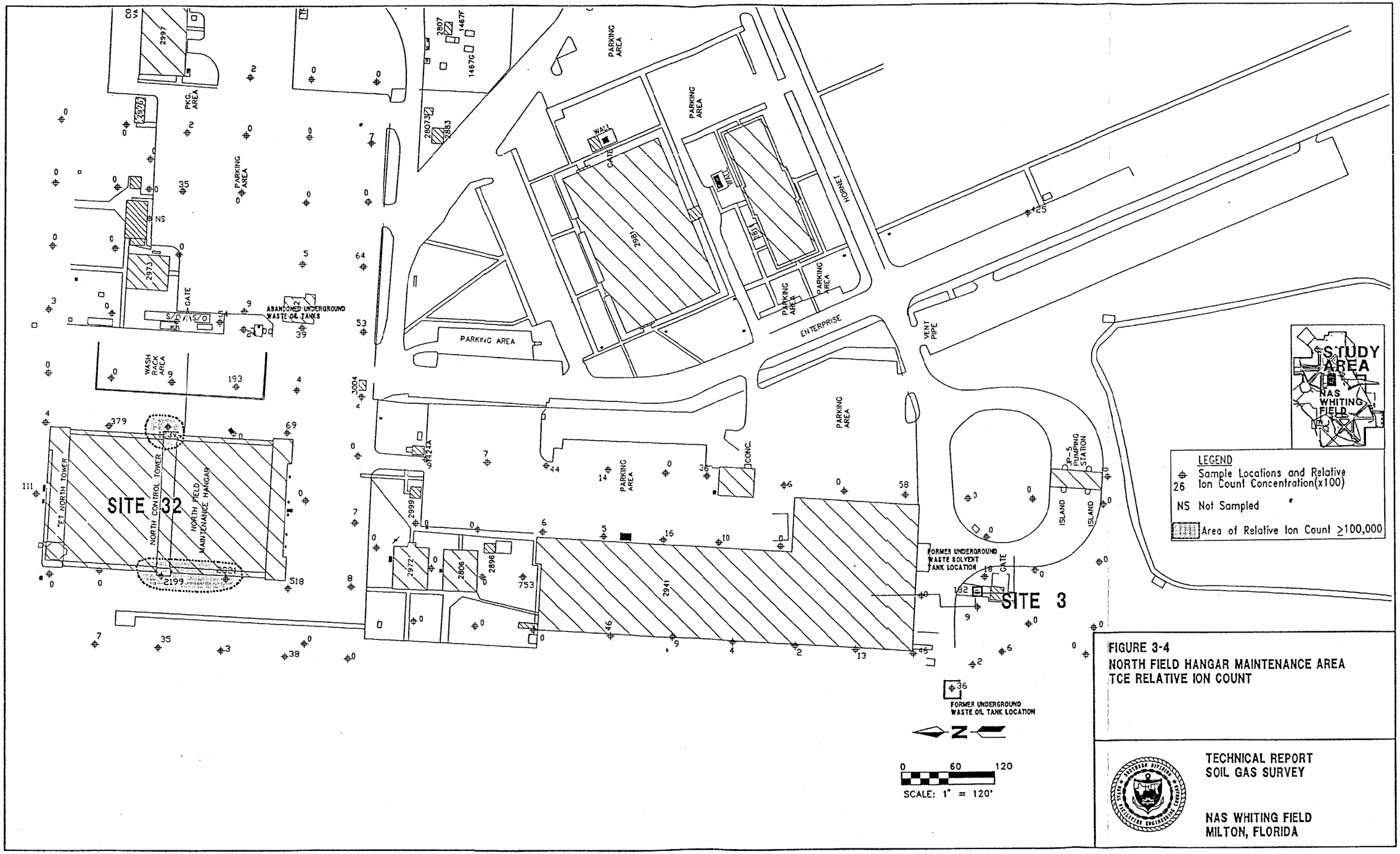

FIGURE 3-4
NORTH FIELD HANGAR MAINTENANCE AREA
TCE RELATIVE ION COUNT

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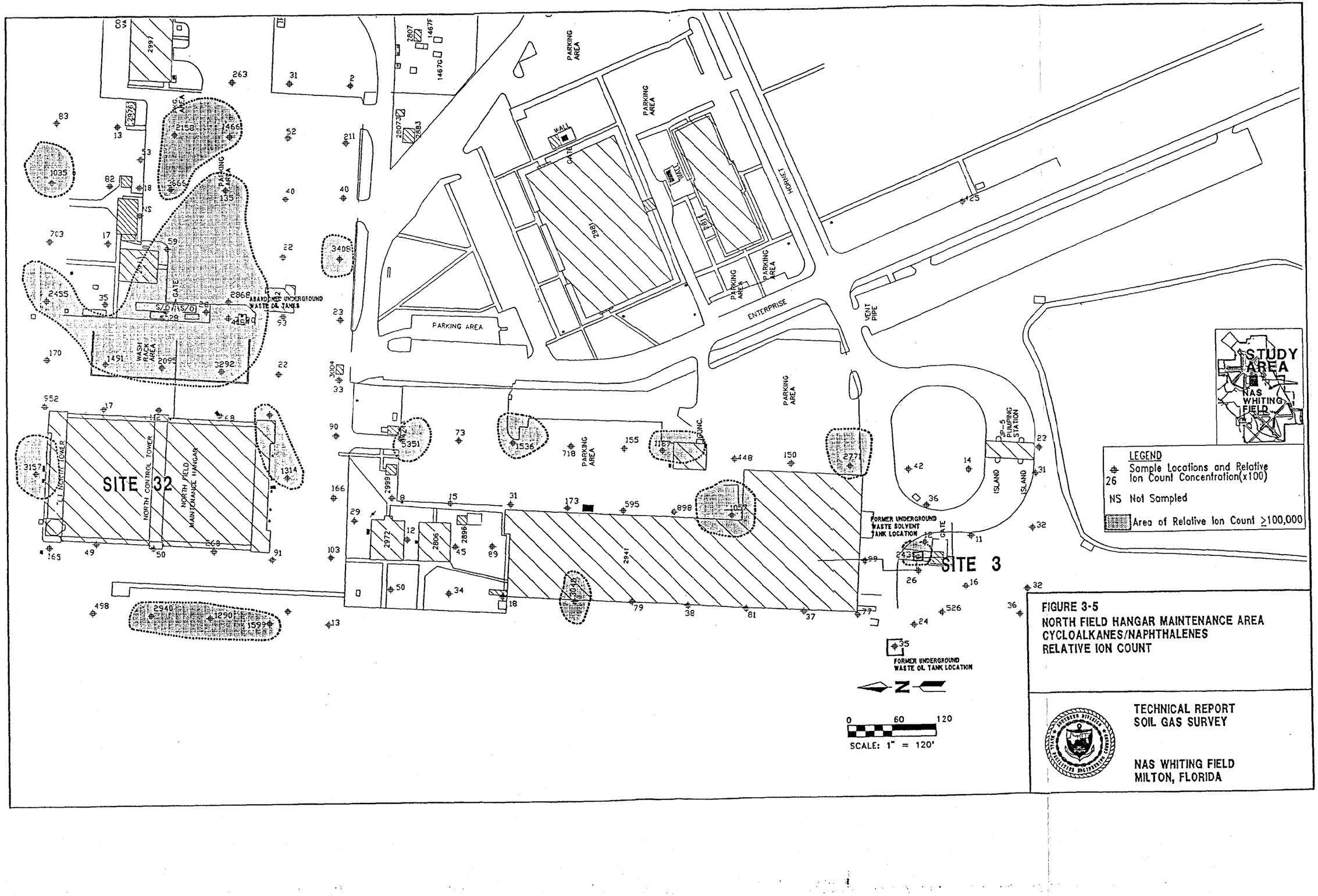

FIGURE 3-5
NORTH FIELD HANGAR MAINTENANCE AREA
CYCLOALKANES/NAPHTHALENES
RELATIVE ION COUNT

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Among the three extended area hot zones, two are with undefined boundaries, whereas the third has been fully delineated. The boundaries of all features were not fully delineated due to the locations of onsite structures that limited sampler placement during the soil gas survey. The two undefined zones are located at the southeast corner of the North Field Maintenance Hangar and south of Building 2941 (hangar building). The zone with defined boundaries is located on the southeast corner of the wash rack and north of the aboveground and abandoned underground waste oil storage tank area.

3.1.3 Trichloroethene (TCE) Figure 3-4 exhibits the distribution of TCE relative ion count mapped for the North Field Maintenance Hangar Area. Three of 106 sampling points were reported to contain ion counts greater than 100,000. High ion count locations were indicated along the central portion of the east and west walls of the North Field Maintenance Hangar.

3.1.4 Cycloalkanes and Naphthalenes Figure 3-5 exhibits the distribution of cycloalkanes and naphthalenes relative ion count mapped for the North Field Maintenance Hangar Area. Twenty-eight of the 106 sampling point locations reported relative ion counts greater than 100,000. There are ten single point hot spots and five extended area hot zones in this area.

The single point hot spots are well distributed throughout the site; however, approximately half of them are located at the corners of facility buildings.

Among the four extended area hot zones, two zones have definite boundaries. The longest zone with the greatest ion count encompasses the wash rack area, trending north to south. The northern end of this zone is not defined. The second zone is located in the parking lot east of the wash rack. The two remaining extended area hot zones are located south and west, respectively, of the North Field Maintenance Hangar. The boundaries of zones have not been delineated due to the presence of the hangar building, which limited placement of the soil gas samplers.

3.2 SITE 29 AND SITE 30 (SOUTH FIELD MAINTENANCE HANGAR AREA). A total of 71 soil gas samplers were installed at the South Field Maintenance Hangar Area. This survey area consisted of two neighboring sites: the Auto Hobby Shop Area, Site 29; and the South Field Maintenance Hangar, Site 30. All sample locations and numbers are shown on Figures 3-6 and 3-7.

At Site 29, 11 samplers were placed within the enclosed parking area and outside perimeter of facility buildings 1404, 2945, and 2975. Four additional samplers (two in a grassy area and two through asphalt) were placed specifically at the aboveground and former underground waste oil storage tank area southwest of the parking area.

At Site 30, 56 samplers were placed on approximately 80 foot centers surrounding the South Field Maintenance Hangar and South Control Tower, Building 1406. This grid extended approximately 120 feet east of the South Control Tower Building onto the airfield, and encompassed the wash rack and the Hazardous waste storage area, located west of the South Field Maintenance Hangar. In addition, aboveground and abandoned underground waste oil tanks located west of Building 1406 and the underground diesel tank located south of the same building were also included in the grid.

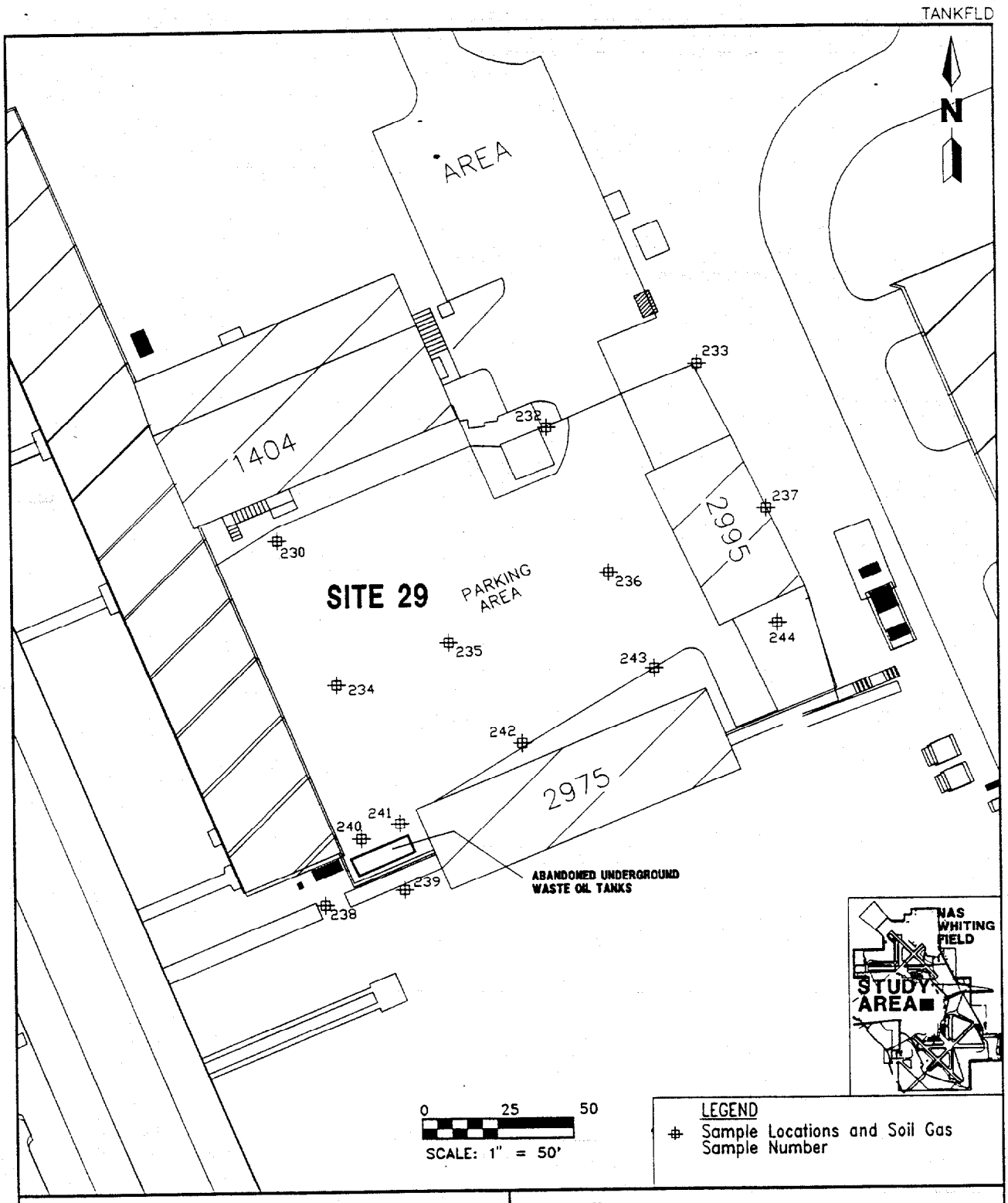

FIGURE 3-6
AUTO HOBBY SHOP - SITE 29
SAMPLE LOCATIONS

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

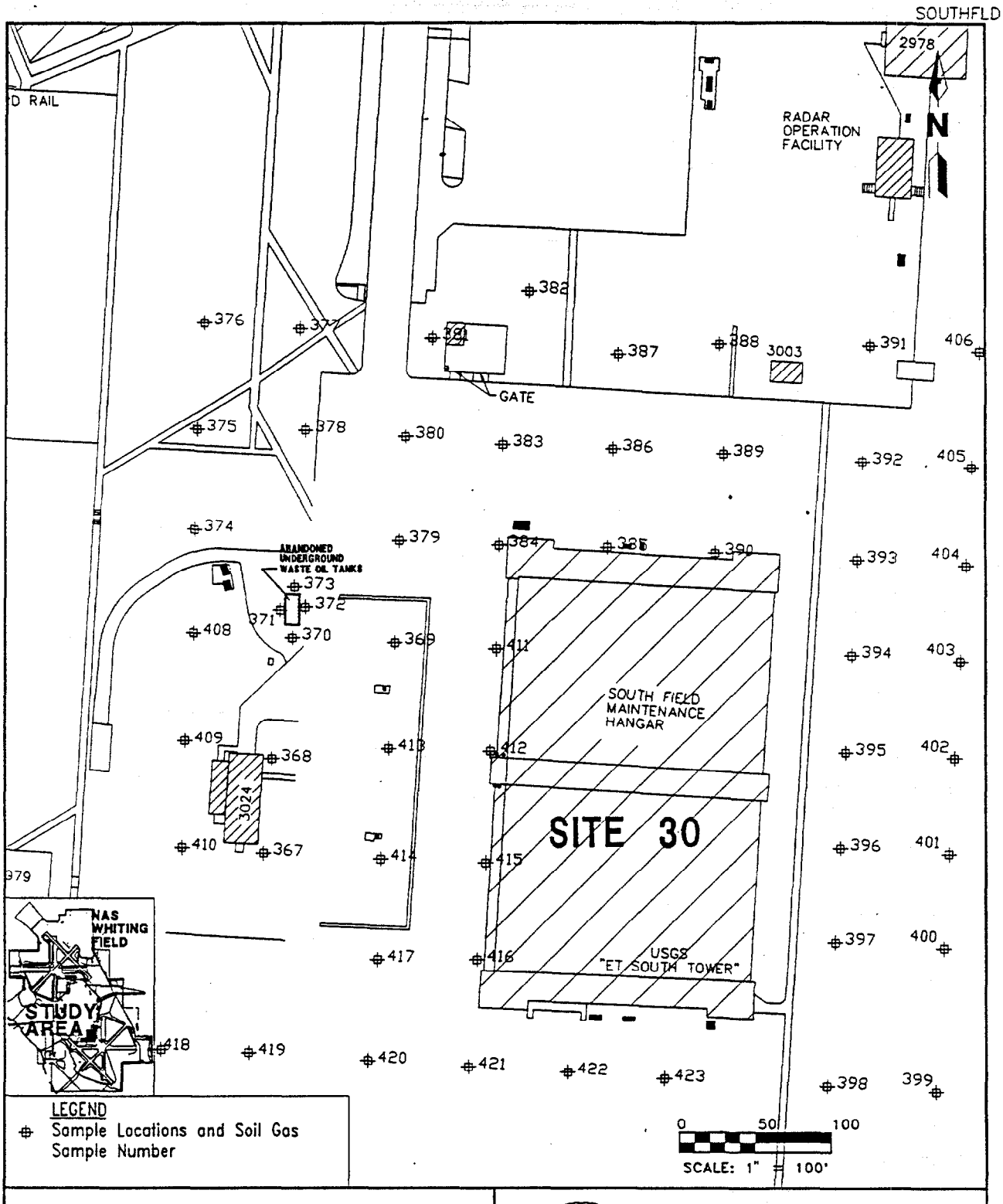

FIGURE 3-7
SOUTH FIELD HANGAR MAINTENANCE AREA
SAMPLE LOCATIONS
SITE 30

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

3.2.1 Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Figures 3-8 and 3-9 exhibit the distribution of the BTEX relative ion count, mapped for Site 29, the Auto Hobby Shop, and Site 30, the South Field Maintenance Hangar. Fifteen of the 71 sampling points at the South Field Maintenance Hangar area have shown ion counts greater than 100,000. Most of these sampling points are located in an area capped with concrete. There are two single point hot spots and three extended area hot zones in this area.

The two single point hot spots located at Site 30 are on the border of the survey grid to the east of the South Field Maintenance Hangar.

Among the three extended area hot zones, one is located at Site 29 in the parking lot of the Auto Hobby Shop and the other two are located at Site 30. At Site 29 the zone of high ion count is located north of Building 2975 with an undefined boundary near the building (distribution is not known beneath the building). At Site 30, the largest zone is located north and east of the South Field Maintenance Hangar extending at least 100 feet beyond the hangar foundation. However, this zone of high ion count is not defined beneath the floor of the hangar. The second zone at Site 30 is a north to south trending feature with defined boundaries at the aboveground and abandoned underground waste oil storage tank area.

3.2.2 Tetrachloroethene (PCE) Figures 3-10 and 3-11 exhibit the distribution of the PCE relative ion count, mapped for Sites 29 and 30. Eight of the 71 sampling points at these two sites were reported to contain relative PCE ion counts greater than 100,000. There are two linear feature hot zones and two extended area hot zones in this area.

The longest linear feature hot zone is located at Site 29, extending from the western edge to the eastern edge of the parking area parallel to Building 2975 (Figure 3-10). The linear feature hot zone's boundary to the west is undefined.

Among the three zones located at Site 30, the largest zone is an extended area hot zone located west of the South Field Maintenance Hangar trending northeast from the wash rack towards the maintenance hangar. This zone is not defined to the northeast near the South Field Maintenance Hangar (Figure 3-11). The second zone is a extended area hot zone located near the aboveground and abandoned underground waste oil storage tank area. The third zone is a linear feature hot zone, defined by two points, located east of the South Field Maintenance Hangar. This zone is undefined on both ends.

3.2.3 Trichloroethene (TCE) Figures 3-12 and 3-13 exhibit the distribution of TCE relative ion count mapping for Sites 29 and 30. Eight of the 71 sampling points at these two sites were reported to contain relative ion count values greater than 100,000. A single extended area hot zone was identified trending from the southwest to the northeast beneath the South Field Maintenance Hangar. This zone is not defined beneath the building.

3.2.4 Cycloalkanes and Naphthalenes Figures 3-14 and 3-15 exhibit distribution of cycloalkanes and naphthalenes relative ion count mapping for Sites 29 and 30. Twenty-one of the surveyed points from these two sites were reported to contain relative ion counts greater than 100,000. The data indicate a total of one single point hot spot, one linear feature hot zone, and three extended area hot zones at Sites 29 and 30 (Figures 3-14 and 3-15).

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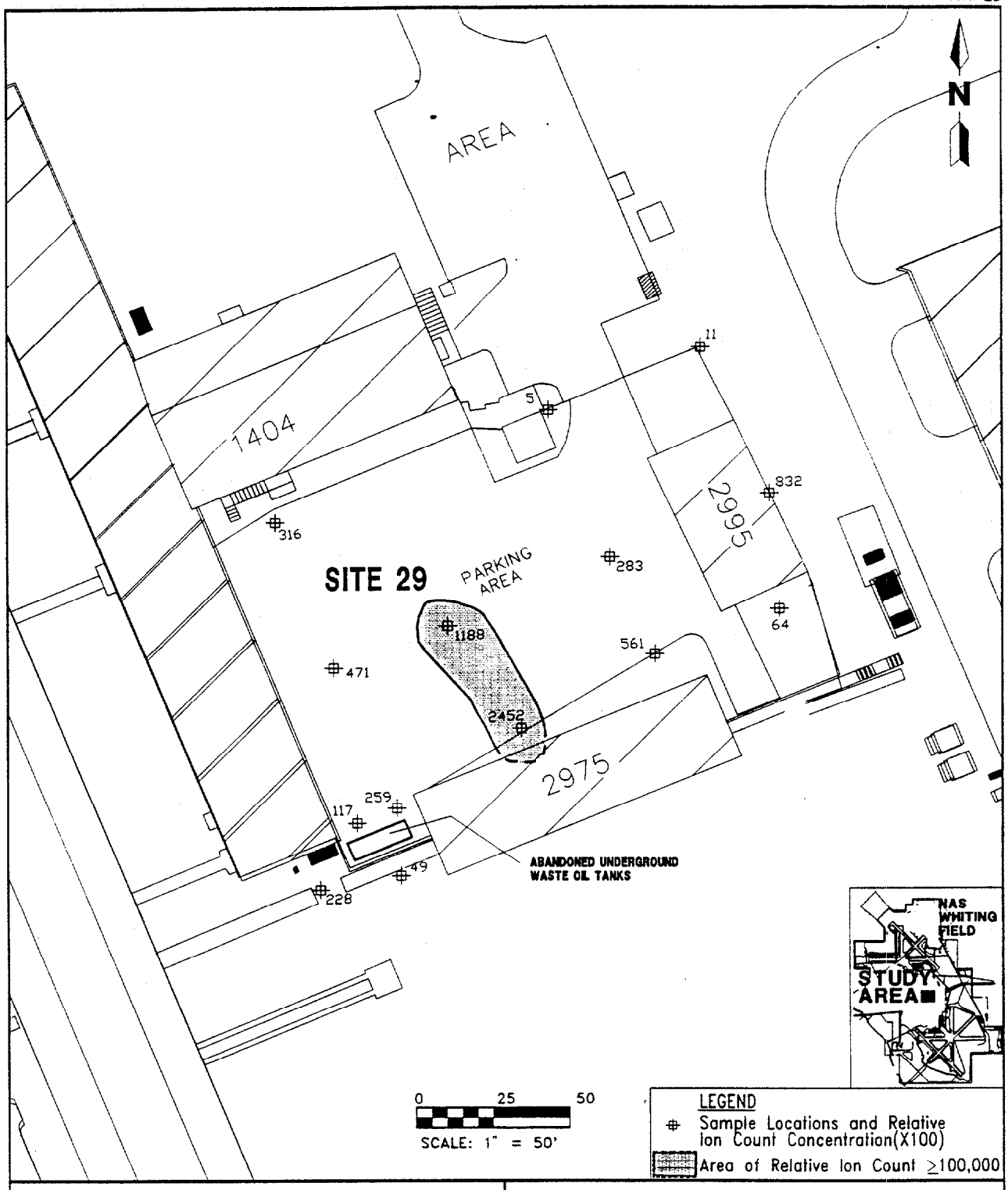

FIGURE 3-8
AUTO HOBBY SHOP - SITE 29
BTEX RELATIVE ION COUNT

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

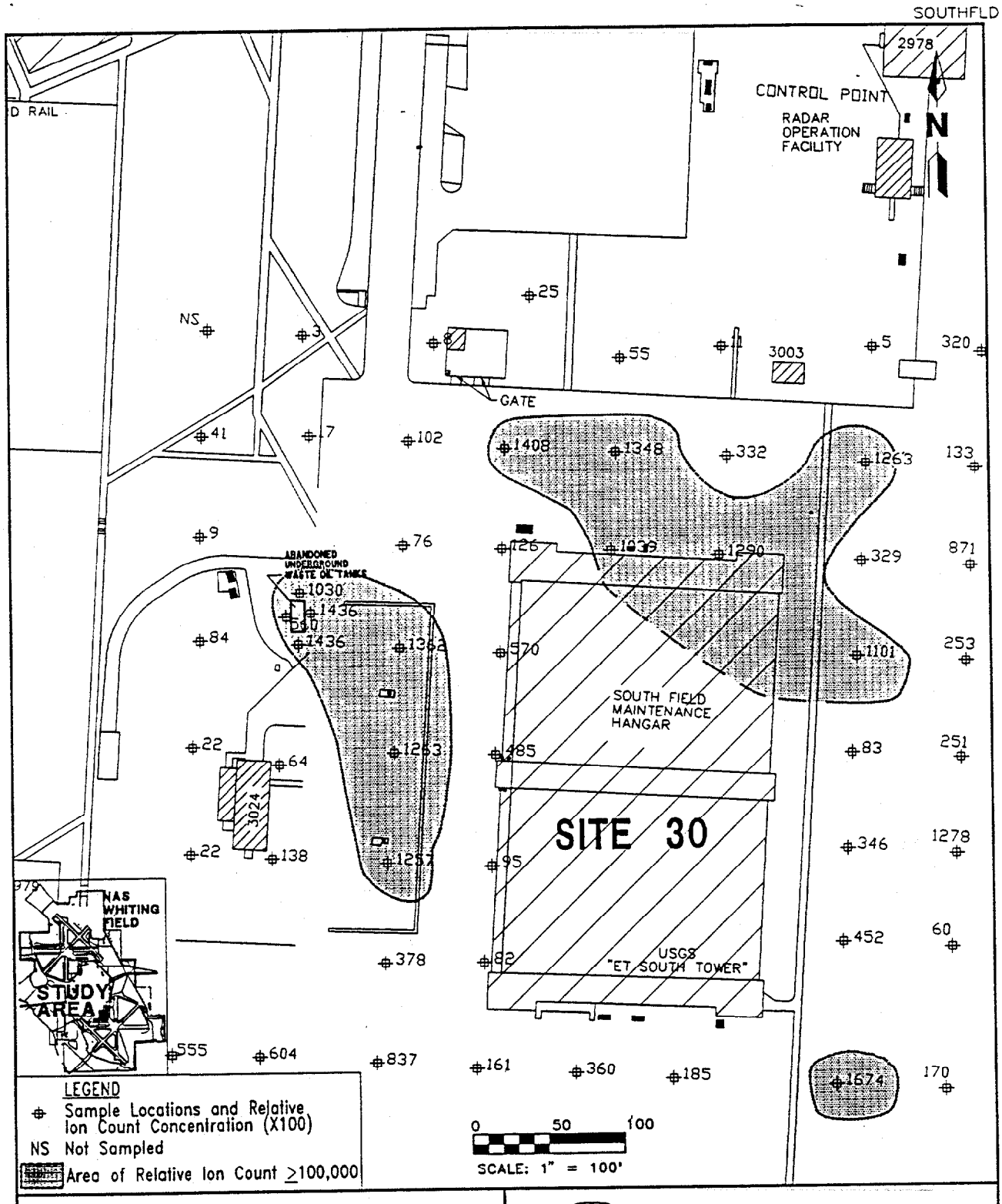

FIGURE 3-9
SOUTH FIELD HANGAR MAINTENANCE AREA
BTEX RELATIVE ION COUNT
SITES 30

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

TANKFLD

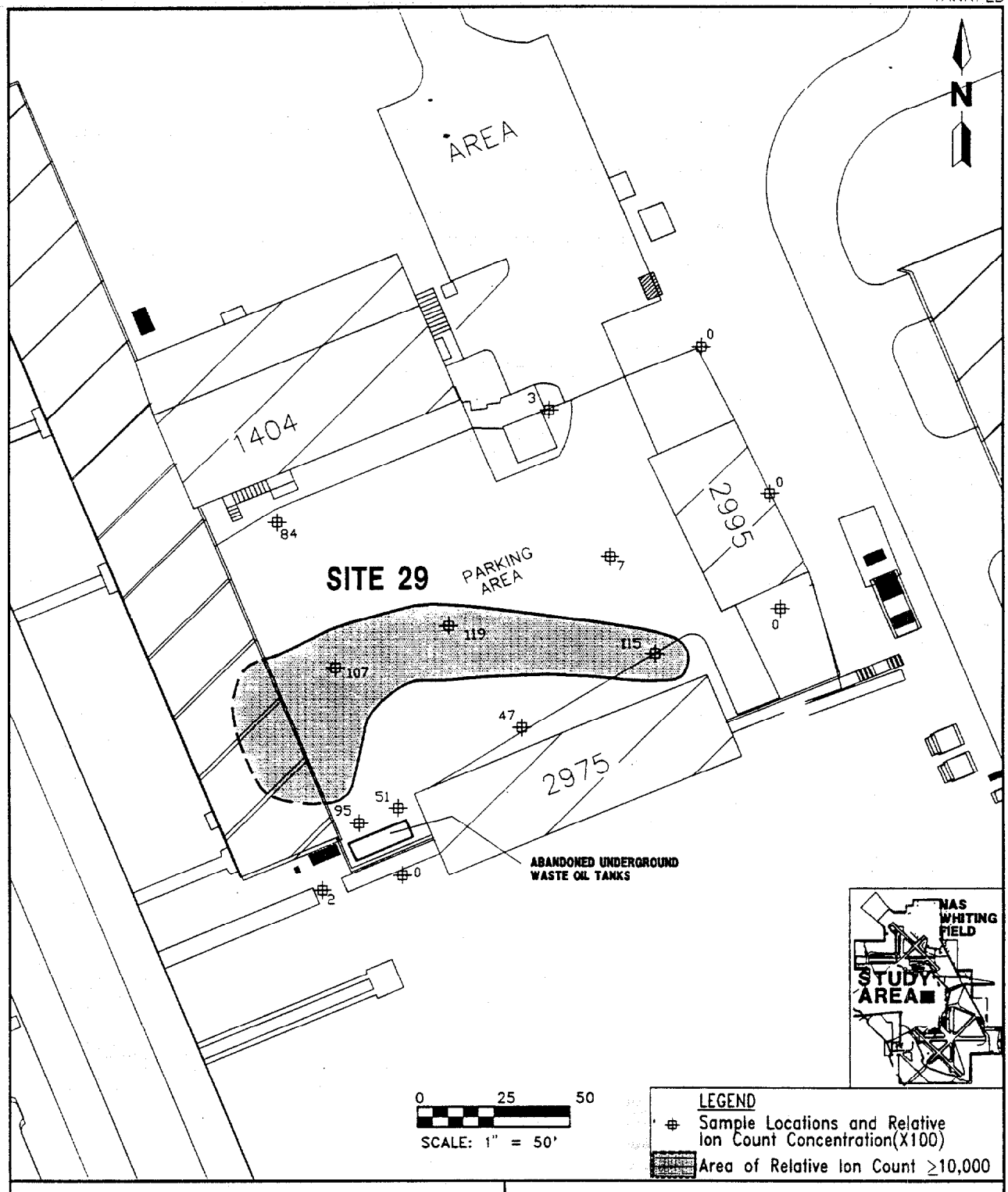

FIGURE 3-10
AUTO HOBBY SHOP - SITE 29
PCE RELATIVE ION COUNT

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

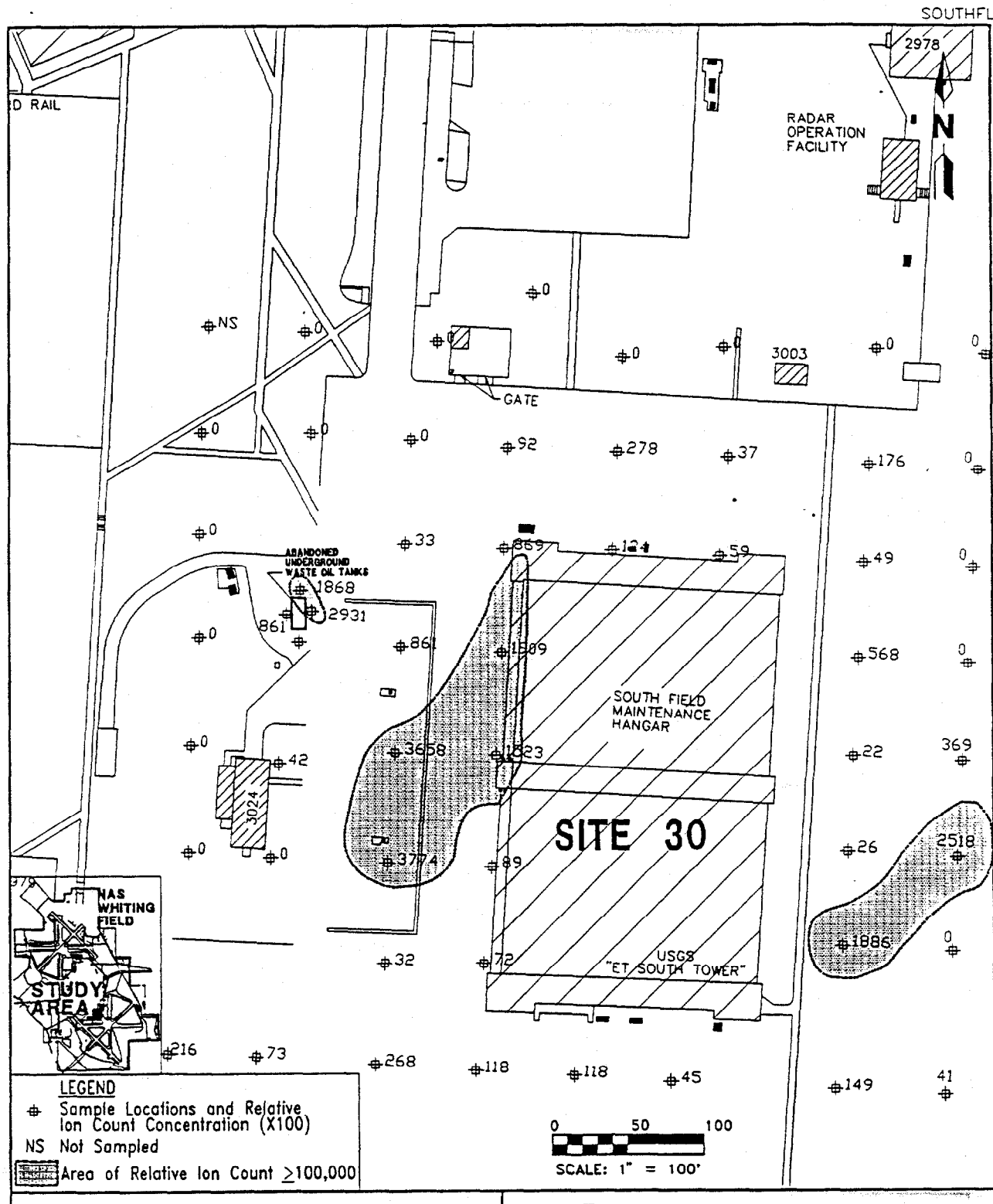

FIGURE 3-11
SOUTH FIELD HANGAR MAINTENANCE AREA
PCE RELATIVE ION COUNT
SITE 30

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

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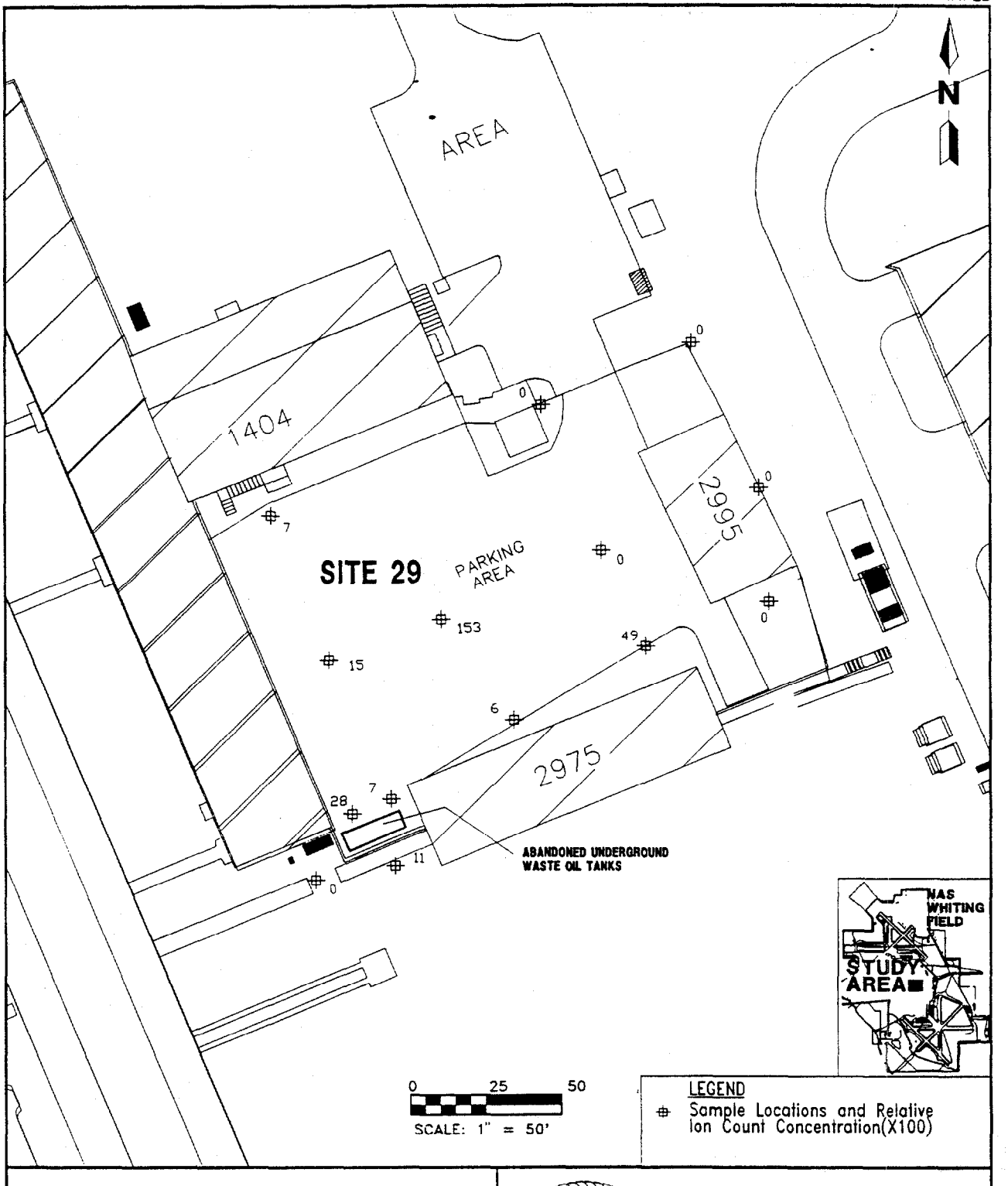

FIGURE 3-12
AUTO HOBBY SHOP - SITE 29
TCE RELATIVE ION COUNT

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

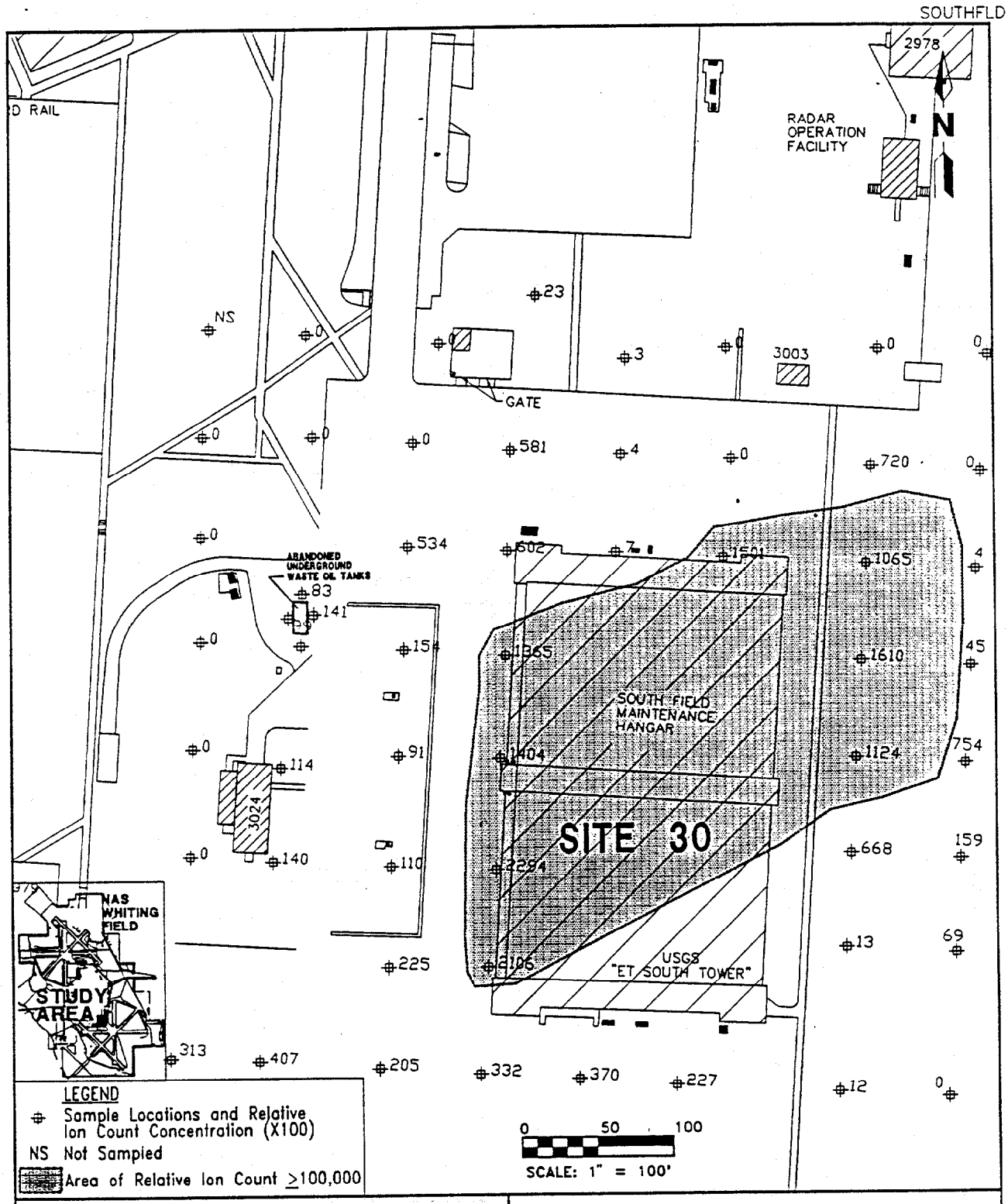

FIGURE 3-13
SOUTH FIELD HANGAR MAINTENANCE AREA
TCE RELATIVE ION COUNT
SITE 30

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

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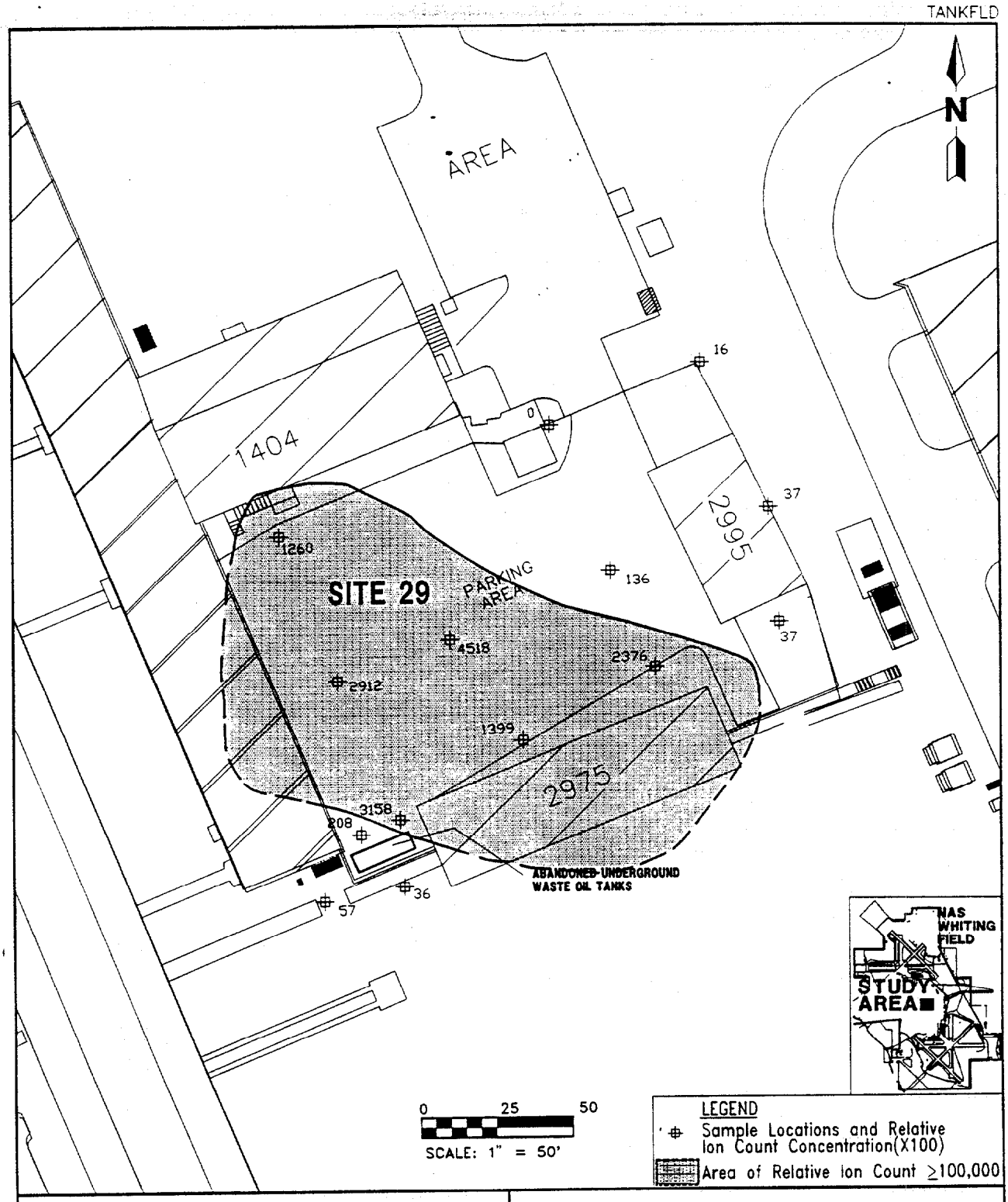

FIGURE 3-14
AUTO HOBBY SHOP - SITE 29
CYCLOALKANES/NAPHTHALENES
RELATIVE ION COUNT

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

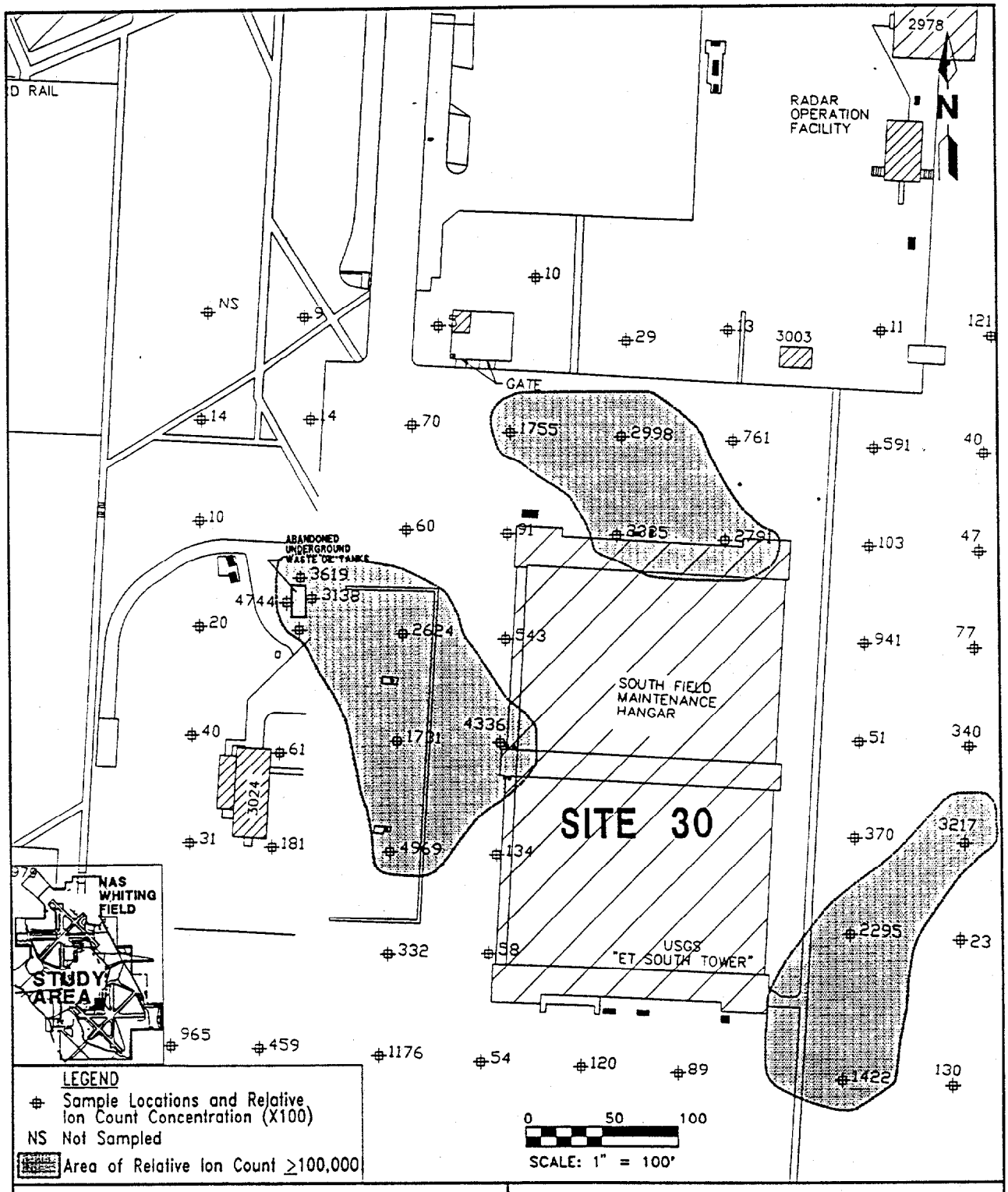

FIGURE 3-15
SOUTH FIELD HANGAR MAINTENANCE AREA
CYCLOALKANES/NAPHTHALENES
RELATIVE ION COUNT

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

The only single point hot spot is located at Site 30 on the southern border of the survey grid, southwest of the South Field Maintenance Hangar.

Among the four non-single point hot zones, the largest hot zone area is located at Site 29, trending northwest to the southeast. This large linear feature hot zone is undefined on both ends (Figure 3-14).

The remaining three zones are located at Site 30. Among these three zones, one is an extended area hot zone located near the wash rack trending southeast, away from the abandoned underground waste oil tank area. The other two have undefined boundaries. One is an extended area hot zone located north of the South Field Maintenance Hangar, which is undefined beneath the hangar. The other is a linear feature hot zone, trending southwest to northeast, located southeast of the South Field Maintenance Hangar (Figure 3-15).

3.3 SITES 5, 6, AND 33 (MIDFIELD MAINTENANCE HANGAR AREA). Sites within the boundary of the Midfield Maintenance Hangar Area soil gas grid included Site 5 (Battery Acid Shop), Site 6 (South Transformer Oil Disposal Area), and Site 33 (Midfield Maintenance Hangar). Although Sites 5 and 6 are within the soil gas survey grid, the focus of the survey was on Site 33 because of the nature of the associated wastes (i.e., solvents and fuels).

A total of 44 soil gas samplers were installed at the Midfield Maintenance Hangar Area (Figure 3-16). These samplers were placed at specific locations surrounding the Midfield Maintenance Hangar Area as well as the buildings, the installation water supply well, the former aviation gas (AVGAS) storage tank location, the abandoned underground waste oil tanks, and the drainage ditch located to the southwest. Samplers were installed with approximately 80 feet centers throughout the survey area. Sampling density was increased surrounding the aboveground and abandoned underground waste oil tanks and an area south of the hangar.

3.3.1 Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Figure 3-17 exhibits the distribution of BTEX relative ion count mapped for the Midfield Maintenance Hangar Area survey. Six of the 44 sampling points have shown ion counts greater than 85,000. All these points were located in an area capped with concrete. There are two single point hot spots and one extended area hot zone in this area.

Among the two single point hot spots, one is located on the western border of the survey grid west of the Midfield Maintenance Hangar and the other is located northeast of the hangar building. The extended zone hot spot has defined boundaries and is located along the eastern wall of the Midfield Maintenance Hangar Area.

3.3.2 Tetrachloroethene (PCE) Figure 3-18 exhibits the distribution of PCE relative ion count mapping for the Midfield Maintenance Hangar Area survey. Seven of the 44 sampling points have shown ion counts greater than 10,000. Distribution of high ion counts is similar to that of the BTEX ion count; however, there is an additional zone of high ion counts located on the southeast corner of the Midfield Maintenance Hangar with undefined boundaries to the north and south.

3.3.3 Trichloroethene (TCE) Figure 3-19 exhibits the relative distribution of TCE ion count mapping for the Midfield Maintenance Hangar Area survey. Six of the 44 sampling points reported relative ion counts in the range of 50,000 to

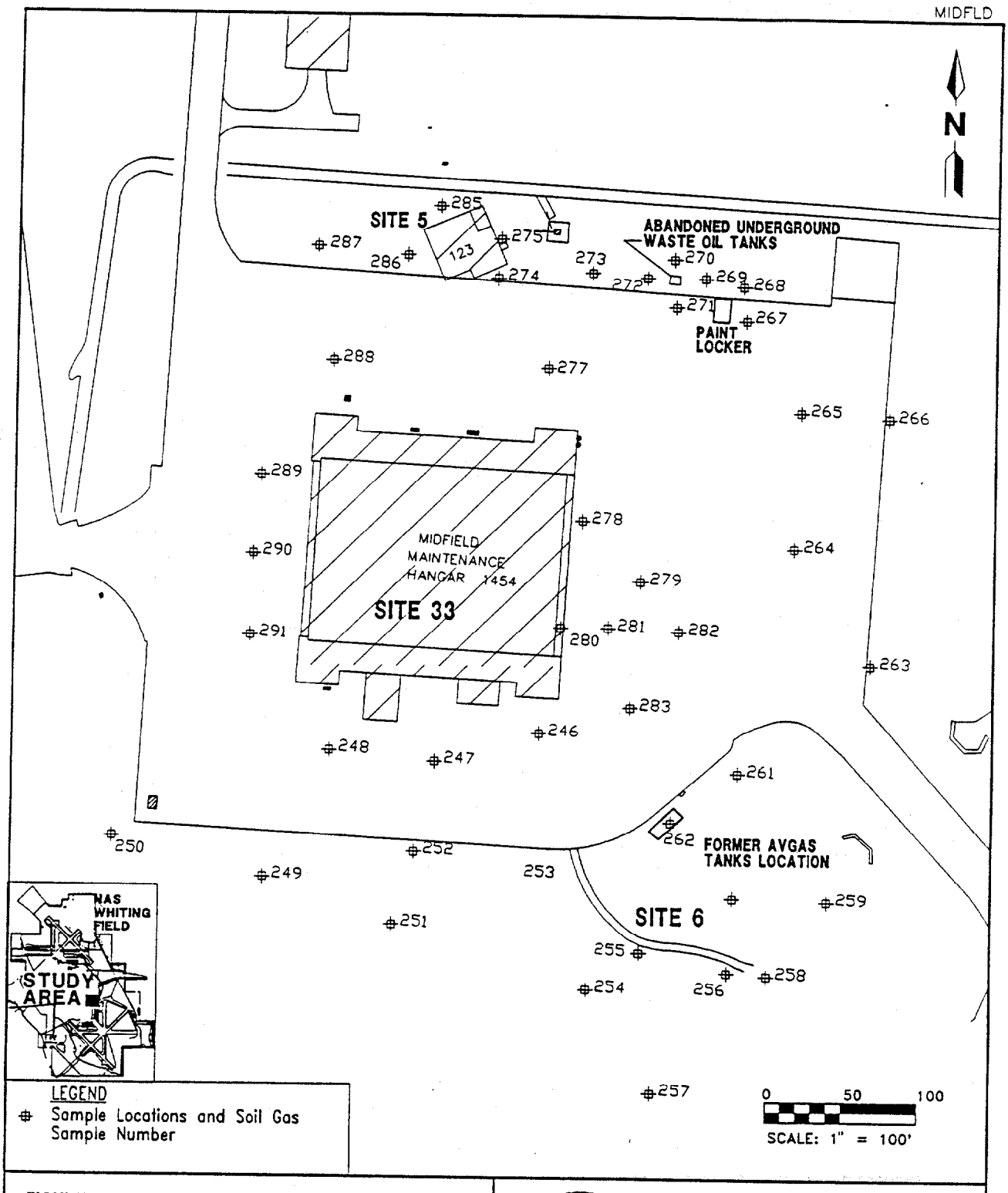

FIGURE 3-16
MIDFIELD HANGAR MAINTENANCE AREA SAMPLING LOCATIONS SITES 5,6, AND 33

TECHNICAL REPORT SOIL GAS SURVEY

NAS WHITING FIELD MILTON, FLORIDA

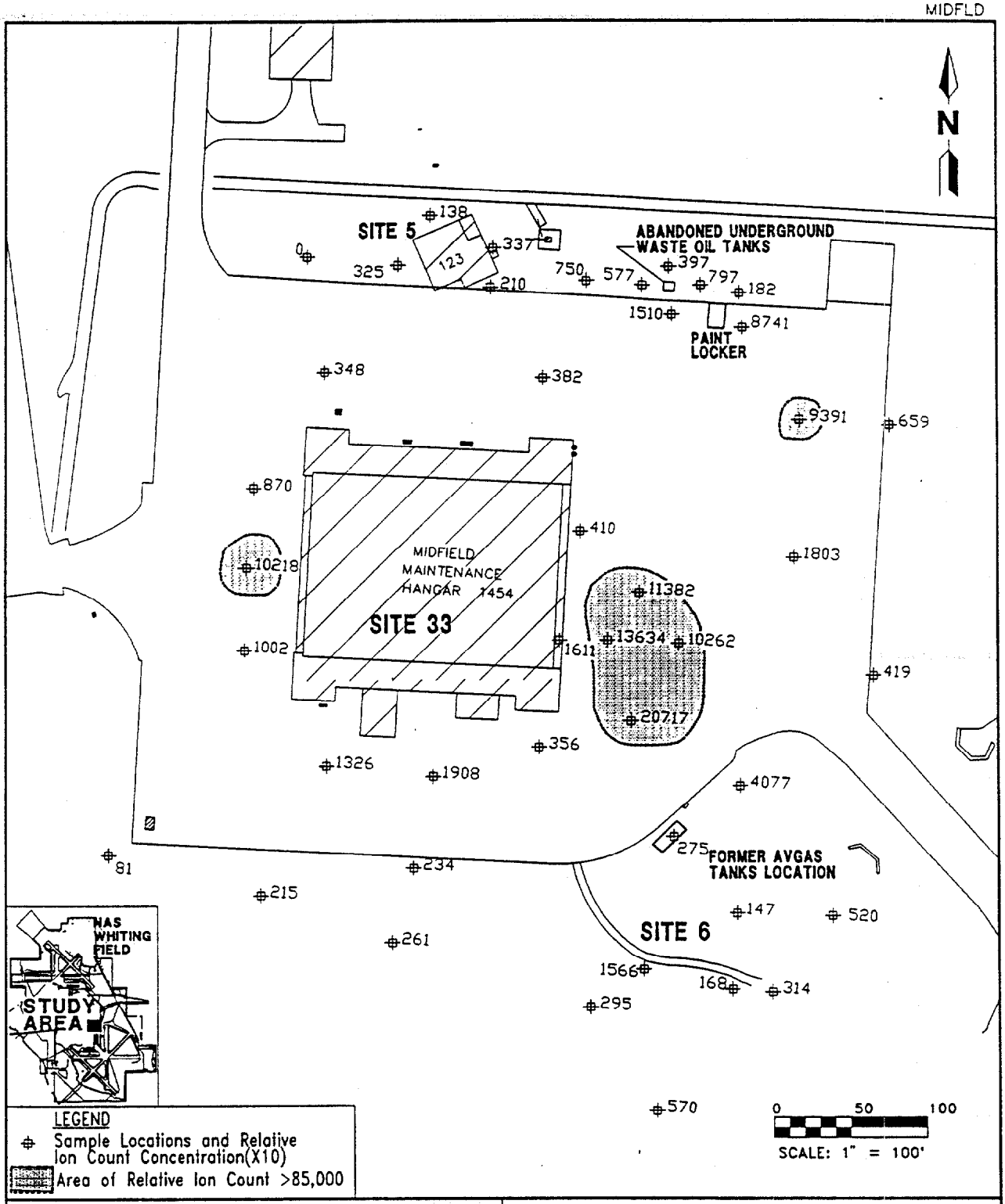

FIGURE 3-17
MIDFIELD HANGAR MAINTENANCE AREA
BTEX RELATIVE ION COUNT
SITES 5,6, AND 33

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

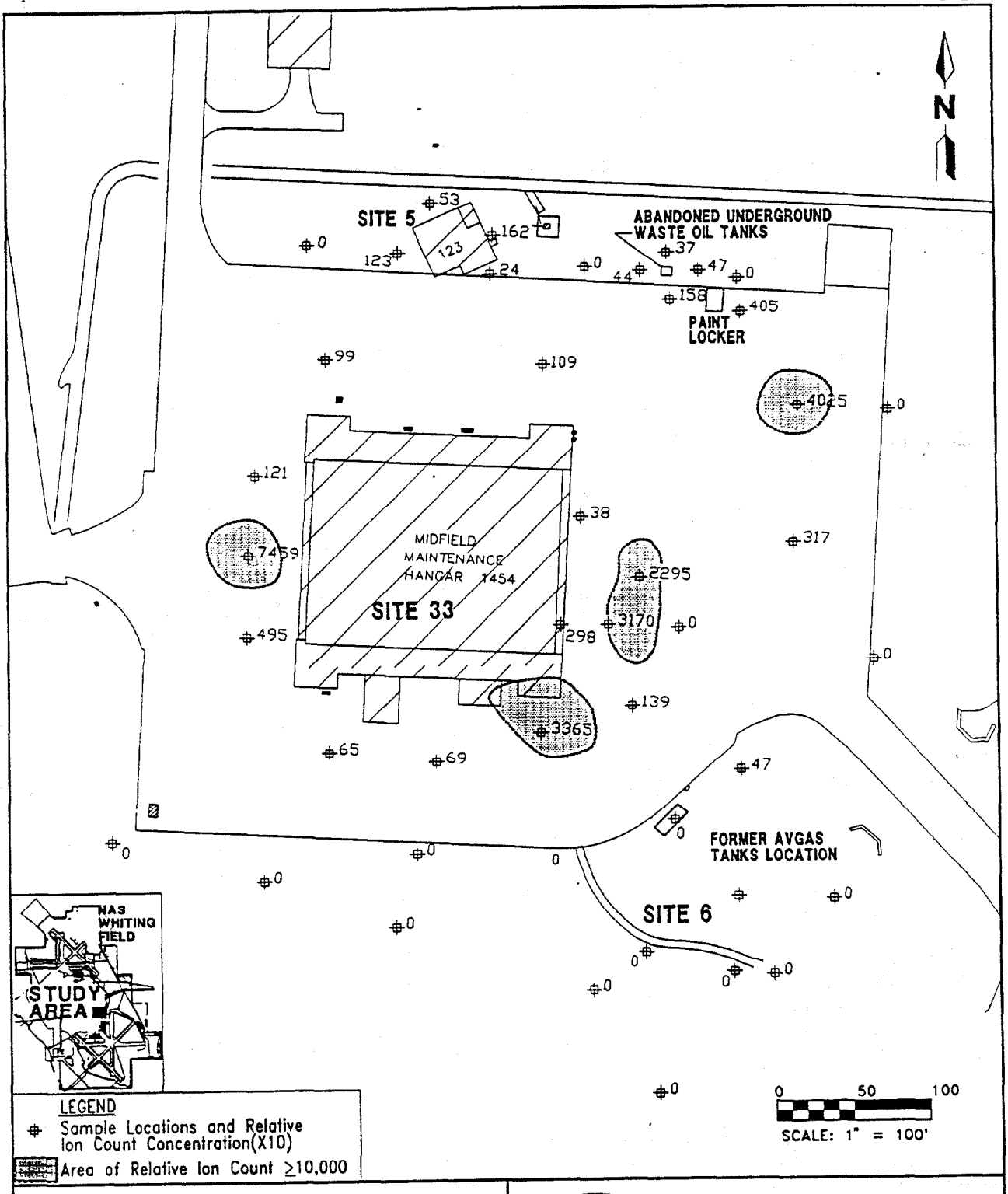

FIGURE 3-18
MIDFIELD HANGAR MAINTENANCE AREA
PCE RELATIVE ION COUNT
SITES 5,6, AND 33

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

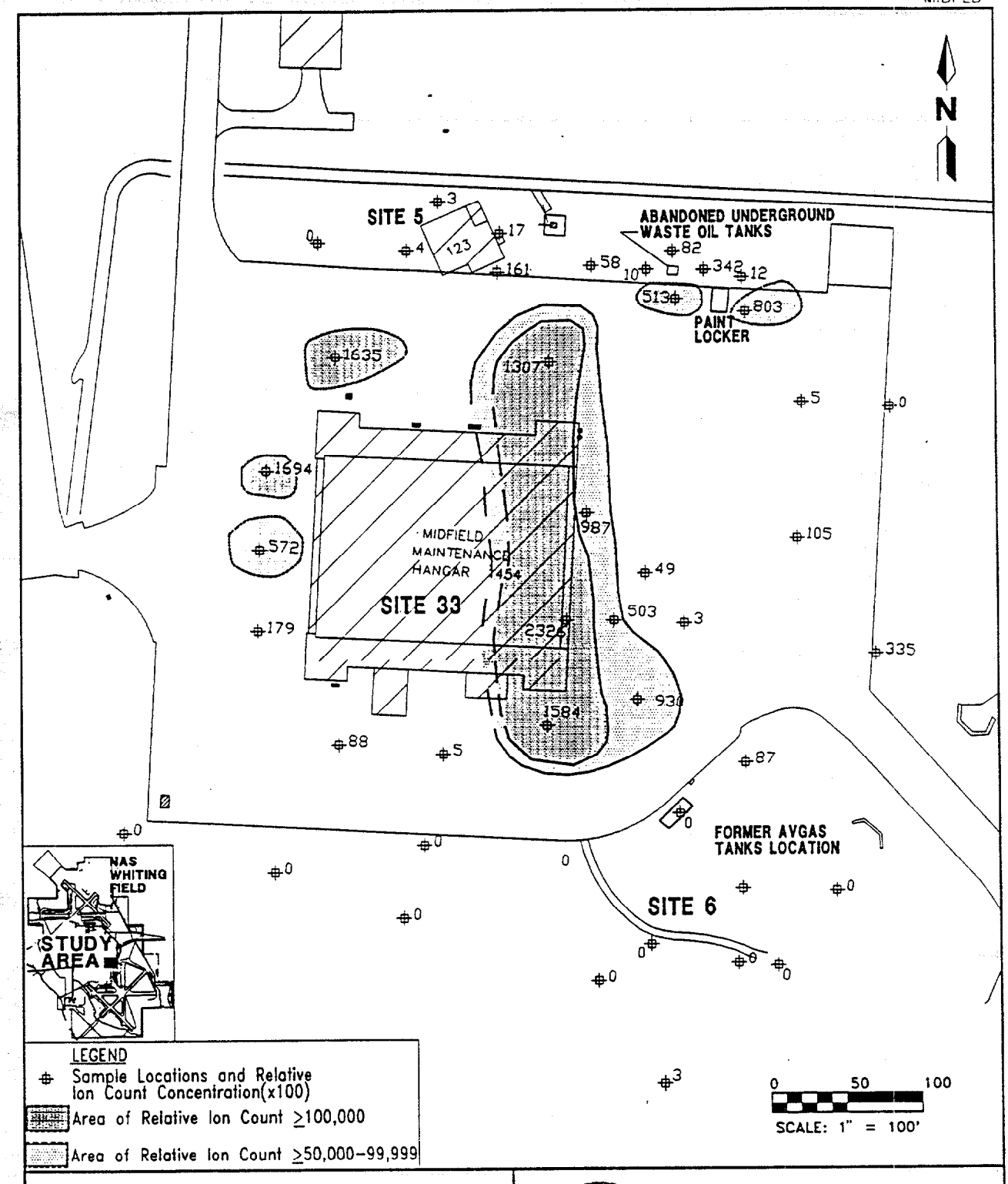

FIGURE 3-19
MIDFIELD HANGAR MAINTENANCE AREA
TCE RELATIVE ION COUNT
SITES 5,6, AND 33

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

100,000 and an additional five sampling points report relative ion counts of greater than 100,000.

The highest relative ion counts were reported at sampling locations along the east wall of the Midfield Maintenance Hangar from the southeast corner to the northeast corner. Additional single point high ion counts were documented along the west wall of the Midfield Maintenance Hangar. Although the relative ion count distribution is undefined beneath the Midfield Maintenance Hangar floor, the single point high ion count zones located west of the building and the extended area hot zone located east of the building may indicate an extended plume located beneath the entire building. There are two single point high ion count hot spots in the range of 50,000 to 100,000 near the abandoned underground waste oil tanks northeast of the Midfield Maintenance Field Hangar.

3.3.4 Cycloalkanes and Naphthalenes Figure 3-20 exhibits the distribution of cycloalkanes and naphthalenes relative ion count mapping for the Midfield Maintenance Hangar Area. Seven of 44 sampling points have shown ion counts greater than 100,000. The distribution of ion counts is similar to that of BTEX and PCE; however, there is an additional single point hot spot located in the grassy area southeast of the Midfield Maintenance Hangar.

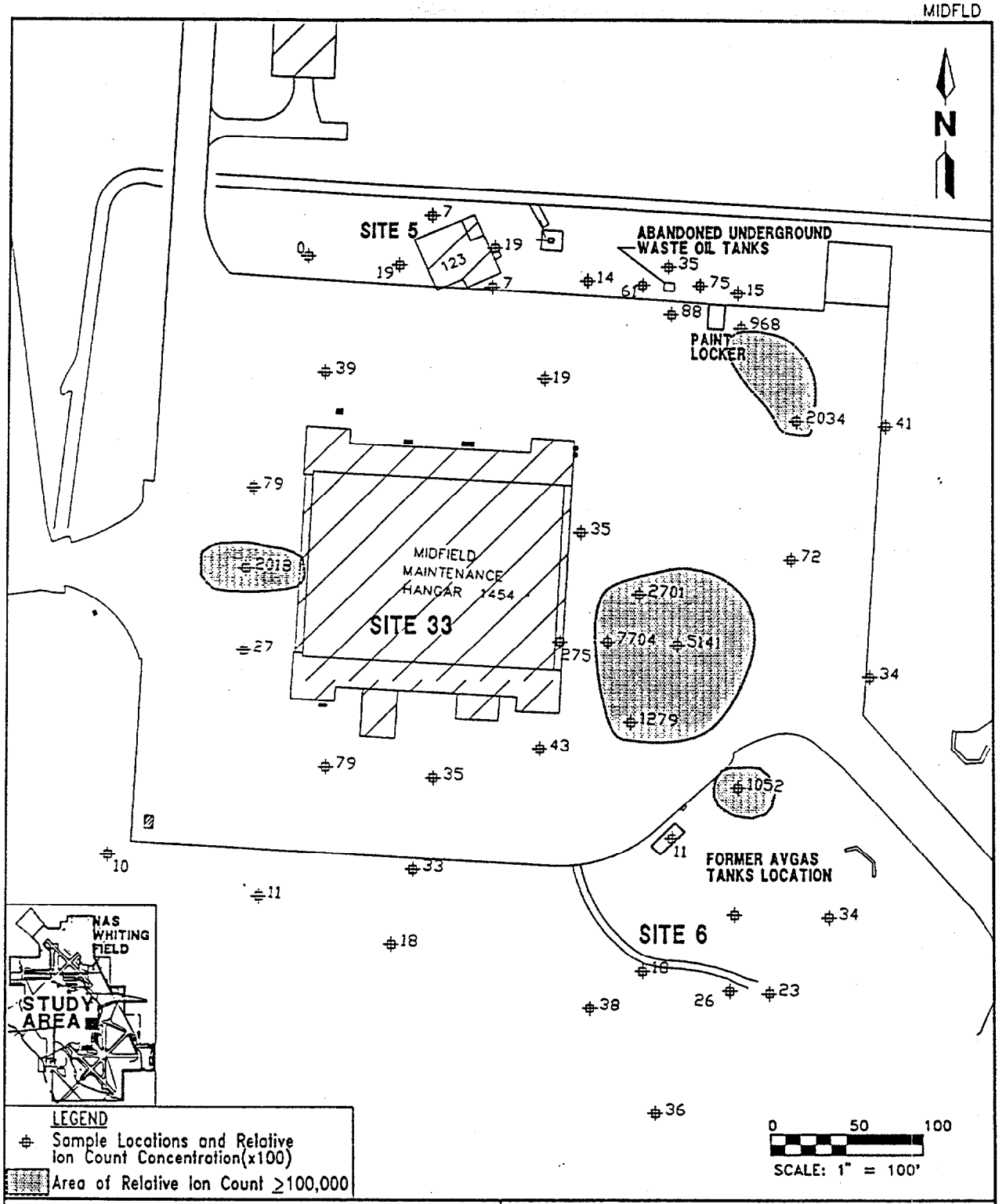

FIGURE 3-20
MIDFIELD HANGAR MAINTENANCE AREA
CYCLOALKANES/NAPHTHALENES
RELATIVE ION COUNT
SITES 5,6, AND 33

TECHNICAL REPORT
SOIL GAS SURVEY

NAS WHITING FIELD
MILTON, FLORIDA

4.0 SUMMARY

Interpretation of the analytical data generated by the Soil Gas Survey at NAS Whiting Field has resulted in the delineation of the aerial extent of soil gas contamination for the compounds BTEX, PCE, TCE, and cycloalkanes and naphthalenes at the North Field, South Field, and Midfield Maintenance Hangar Study Areas. Based on this information generalizations can be made concerning areas of soil and groundwater contamination. Although definitive contaminant concentrations and precise plume boundaries have not been identified due to the screening nature of the investigation, the result of this investigation will be used for determining preferred locations for subsurface soil borings and monitoring wells to be installed during later investigative phases.

Table 4-1 presents the summary of soil gas survey findings at NAS Whiting Field.

Table 4-1
Summary of Soil Gas Survey Findings

Technical Report
Soil Gas Survey, RI Phase II-A
NAS Whiting Field, Milton, Florida

Site Grouping	Compound Detected	Frequency of Detection	Ion Count Threshold	Location of Individual Sampling Points Exceeding the Threshold Ion Count				
Sites 3 and 32 North Field Maintenance Hangar Area				NFMH	WR	AUWOST	PLA	Building 2941
	BTEX	9 of 106	> 100,000	2	2	1	1	3
	PCE	9 of 106	> 100,000	4	3	1	–	1
	TCE	3 of 106	> 100,000	3	–	–	–	–
	Cycloalkanes and Naphthalenes	28 of 106	> 100,000	7	9	1	6	5
Sites 29 and 30 South Field Maintenance Hangar Area				SFMH	WR	AUWOST	PLA	Auto Hobby Shop
	BTEX	17 of 71	> 100,000	6	4	3	2	2
	PCE	12 of 71	> 100,000	3	2	2	2	3
	TCE	8 of 71	> 100,000	8	–	–	–	–
	Cycloalkanes and Naphthalenes	19 of 71	> 100,000	3	3	3	3	5
Sites 5, 6, and 33 Midfield Maintenance Hangar Area				MFMH		AUWOST	Drainage Ditch	
	BTEX	6 of 44	> 85,000	6		–	–	
	PCE	5 of 44	> 10,000	5		–	–	
	TCE	5 of 44	> 100,000	5		1	–	
		4 of 44	> 50,000	4		1	–	
	Cycloalkanes and Naphthalenes	7 of 44	> 100,000	7		–	–	

Notes: NFMH = North Field Maintenance Hangar.
WR = Wash Rack Area.
AUWOST = Abandoned Underground Waste Oil Storage Tanks.
PLA = Parking Lot Area.
BTEX = benzene, toluene, ethylbenzene, and xylenes.
PCE = tetrachloroethene.
TCE = trichloroethene.
– = none detected.
SFMH = South Field Maintenance Hangar.
MFMH = Midfield Maintenance Hangar.

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