Final Interim Report of

Site 03/Nike Source Area Characterization and Offsite Investigation

Naval Construction Battalion Center
Davisville, Rhode Island

Contract No. N62472-92-D-1296
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Department of the Navy
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10 Industrial Highway
Mail Stop No. 82
Lester, Pennsylvania 19113-2090

Prepared by

EA Engineering, Science, and Technology
175 Middlesex Turnpike, Third Floor
Bedford, MA 01730

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James A. Shultz — 21 October 1998
CTO Manager — Date

Charles R Flynn — 20 Oct 98
Charles Flynn — Date
Program Manager

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EA CTO Manager: James A. Shultz, CPG

In compliance with EA's Quality Procedures for review of deliverables outlined in the Program Quality Management Plan, this final deliverable has been reviewed for quality by the undersigned Senior Technical Reviewer. The information presented in this report/deliverable has been prepared in accordance with the approved Implementation Plan for the Contract Task Order (CTO) and reflects a proper presentation of the data and/or the conclusions drawn and/or the analyses or design completed during the conduct of the work. This statement is based upon the standards identified in the CTO and/or the standard of care existing at the time of preparation.

Senior Technical Reviewer

Charles W. Houlik, Ph.D., CPG — 19 OCT 98
Date

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LIST OF ACRONYMS

bg	below grade
bls	below land surface
BRAC	Base Closure and Realignment Act of 1988 and Defense Base Closure and Realignment Act of 1990, collectively
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CED	Construction Equipment Department
CLP	Contract Laboratory Procedure
cm	centimeter
COC	constituents of concern
CS	Confirmation Study
CVOC	Chlorinated Volatile Organic Compounds
DCA	1,1-Dichloroethane
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
DCE	1,2-Dichloroethene (total of cis-1,2-DCE and trans-1,2-DCE)
1,2-DCE [total]	1,2-Dichloroethene (total of cis-1,2-DCE and trans-1,2-DCE)
DANC	Decontaminating Agent Non-Corrosive
DNAPL	denser (than water) nonaqueous phase liquid
DO	dissolved oxygen
DUP	Duplicate
DV	Data Validation
E_H	Reduction-Oxidation Potential
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
ft	feet
GC	Gas Chromatograph
gm	gram
gpd/ft	gallons per day per foot
gpm	gallons per minute
HSA	Hollow-Stem Augers

LIST OF ACRONYMS (Continued)

IAS	Initial Assessment Study
ID	Inner Diameter
IDW	Investigation-Derived Waste
in	inch
IR	Installation Restoration
IRP	Department of Defense Installation Restoration Program
K	Hydraulic conductivity
LNAPL	Lighter (than Water) Non-Aqueous Phase Liquid
m	meter
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mS/cm	millisiemens per centimeter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MW	Monitoring Well
MSL	Mean Sea Level
n	Porosity
NAPL	Non-Aqueous Phase Liquid
NAS	Naval Air Station
NCBC	Naval Construction Battalion Center
NEESA	Naval Environmental and Energy Support Activity
NO_2^-	Nitrate
NO_3^-	Nitrite
NTU	Nephelometric Turbidity Units
°C	Degree Centigrade
OD	Outer Diameter
°F	Degree Fahrenheit
PAH	Poly Aromatic Hydrocarbons
PCA	Perchloroethane (1,1,2,2-Tetrachloroethane)
PCB	Poly Chlorinated Biphenyl
PCE	Perchloroethylene (Tetrachloroethene)
PID	Photo-Ionization Device
ppb	parts per billion
PVC	Polyvinyl Chloride

LIST OF ACRONYMS (Continued)

QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RIDOT	Rhode Island Department of Transportation
RIEDC	Rhode Island Economic Development Corporation
RIPA	Rhode Island Port Authority
RQD	Rock Quality Designation
TAL	Target Analyte List
1,1,1-TCA	1,1,1-Trichloroethane
TCA	1,1,2-Trichloroethane
TCE	Trichloroethylene (Trichloroethene)
TCL	Target Compound List
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
USGS	US Geological Survey
UST	Underground Storage Tank
VC	Vinyl Chloride
VOA	Volatile Organic Analyte
VOC	Volatile Organic Compounds
μg/L	micrograms per liter
μg/kg	micrograms per kilogram

1. INTRODUCTION

This report presents the result of the Installation Restoration (IR) Program Site 03/Nike Source Area Characterization, Offsite Investigation, and Natural Attenuation Investigation of the western portion of Zone 3 and adjacent areas to the north and south at the Naval Construction Battalion Center (NCBC) Davisville, Rhode Island. This area is located approximately between Newcomb Road on the west, Westcott Road on the east, Perimeter Road on the north, and Davisville Road on the south (Figures 1-1 and 1-2). Also, included is an update of the status of Site 02 (CED Battery Acid Disposal Area) and Study Area 04 (CED Asphalt Disposal Area). This report has been prepared in accordance with the scope of work for Contract Task Order (CTO) 0032, Contract N62472-92-D-1296. The findings and conclusions presented in this report will be incorporated into the draft final Comprehensive Phase III Remedial Investigation report for Sites 02 and 03 (CED Solvent Disposal Area) and Study Areas 01 (CED Drum Storage Area) and 04. The Nike Site (Nike Battery Site PR-58), currently owned by the Rhode Island Economic Development Corporation (RIEDC) (formerly the Rhode Island Port Authority [RIPA]), has been the subject of environmental investigations by the U.S. Army Corps of Engineers (ACOE) under the Formerly Used Defense Sites (FUDS) program. The current investigation of the former Nike Site by the Navy is to obtain a sufficient understanding of the subsurface conditions as it pertains to the chlorinated volatile organic compounds (CVOC) plume detected in ground water which extends from the site east under the adjacent Navy property. The Nike Source Area Characterization portion of the investigation is being performed with the support and cooperation of the ACOE. The Navy greatfully acknowledges the cooperation and permission for investigative access from: (1) the Carriage Hill Association for adjacent property north of the Navy property and the former Nike Site property, and (2) the RIEDC for adjacent property south of the Navy property and north of Davisville Road.

1.1 OBJECTIVES

Based upon the findings presented in the Draft Final Study Areas 01 and 04, IR Program Sites 02 and 03, and Nike Site Phase III RI Report dated February 1996, the main source area for the CVOC detected in ground-water samples was in the vicinity of monitoring well MW03-14D located west and upgradient from Navy property (Figure 1-3 shows the locations of the wells sampled in 1995). This resulted in the need for additional subsurface investigations with the following overall objectives: characterize the nature and extent of this CVOC source area and assess the north, west, and south extent of the CVOC plume in ground water. In August 1996, the Navy added an additional objective of assessing the potential for natural attenuation (intrinsic bioremediation) processes which may be occurring beneath the study area and to assess if these processes are remediating the CVOC detected in ground water. The field work to achieve these objectives was performed in three stages from April 1996 through March 1998, each with specific objectives:

The specific objectives of the Stage 1 (April - November 1996) field work were to:

1. Assess and characterize potential source (s) of CVOC/DNAPL detected at the deep Site 03 well MW03-14D;

2. Determine if CVOC is migrating offsite to the north and west; and
3. Assess the hydrogeological conditions beneath the Nike Site study area.

The specific objective of the Stage 2 (December 1996) field work was to:

1. Assess natural attenuation (intrinsic bioremediation) processes and their potential to remediate the CVOC detected in the deep (D) ground water.

The specific objectives of the Stage 3 (December 1997-March 1998) field work were to:

1. Assess the northern and southern extent of the CVOC plume detected in ground water from the former Nike Site;
2. Further investigate and confirm the natural attenuation (intrinsic bioremediation) processes and their potential to remediate the CVOC detected in the deep (D) ground water; and
3. Assess the hydrogeological conditions beneath the offsite study areas.

1.2 NCBC DESCRIPTION

NCBC-Davisville is located in the town of North Kingstown, Rhode Island, approximately 18 miles south of Providence. A significant portion of the NCBC Davisville is contiguous with the Narragansett Bay. NCBC Davisville is comprised of three areas including the Main Center, the West Davisville storage area, and Camp Fogarty, a training facility located approximately four miles west of the Main Center (Figure 1-1). Adjoining the NCBC Davisville Main Center's southern boundary is the decommissioned Naval Air Station (NAS) Quonset Point, which was transferred by the Navy to the then Rhode Island Port Authority (RIPA), now RIEDC, in April 1973 (TRC 1994). The physical boundaries of Sites 02 and 03, and Study Areas 01 and 04 as defined in previous studies (TRC 1994; Halliburton NUS 1994a, 1994b) are shown in Figure 1-2.

NCBC Davisville was primarily used for training naval seamen in construction operations, and as storage and freight yards for construction materials. As a result, the NCBC is comprised primarily of warehouse space and freight yards, most of which are currently empty. NCBC Davisville closed on 1 April 1994. Most of the staff and materials have been moved offsite. Currently, the Navy Caretaker remains onsite associated with base closure.

1.3 IR Program Site and Study Area History and Description

The Site 03/Nike Source Area Characterization, Offsite Investigation, and Natural Attenuation Investigation covers roughly the western half of Zone 3 and includes: Sites 02 and 03, Study Areas 01 and 04, the former Nike Site including the former Disaster Recovery Training Area, the area east of Building 224, and adjacent areas to the north and south of NCBC. The history of these sites is provided because an understanding of the activities which have or may have taken place at these sites is necessary to understand and evaluate them as potential sources of the CVOC detected in the ground water.

1.3.1 Study Area 01 - CED Drum Storage Area

Study Area 01 is the CED Drum Storage Area (Figure 1-2) and is located approximately 200 ft north of Building 224. It is currently a grassed, open field, a portion of which was converted into a leaching field in 1991. File information indicates that this system was operative only from December 1991 to April 1992 to dispose surface water runoff and storm water from a truck washing area located south of the site at Building 224 (Halliburton NUS 1994a). The leaching field was closed in accordance with the Rhode Island Department of Environment (RIDEM) Regulations. From the late 1960's to 1974, 55-gal drums of liquid waste, reportedly containing waste oil and solvent were stored in an open field north of Building 224. As many as 500 drums were stored there at one time. The drums were reported to be in deteriorating condition, and may have leaked liquids into the ground (Hart 1984). The drums were removed in 1974. No testing of the soil beneath the drums was performed following the drum removal.

1.3.2 IR Program Site 02 - CED Battery Acid Disposal Area

Site 02 is a paved, flat area bounded to the west by Sayers Street, to the south by Warren Street and to the north and east by Building 224 (Figure 1-2). Building 224 is not included in Site 02.

At the southwest corner of the CED Building 224, adjacent to the Battery Shop, is a dry well, and a suspected leaching field (Figure 1-2). A floor drain inside the battery shop discharged into the dry well and suspected leaching field in the northern portion of Site 02 (Hart 1984). It is estimated that approximately 18,000 gal of dilute sulfuric acid were disposed, at a rate of approximately 60 gallons per month between 1955 and 1980. Lead was reportedly contained in the acid (TRC 1991). In general, the drywell and associated leach field were removed by Foster Wheeler in June 1996 (See Close-Out Report for the Time-Critical Removal Action at Site 02, NCBC Davisville, Rhode Island, Foster Wheeler Environmental Corp., 6 September 1996). Closeout for Site 02 included removal of water and sediment from the dry well chamber, removal and demolition of the dry well chamber and associated piping, removal of piping from the adjacent leach field, excavation of lead contaminated soil, decommissioning of three monitoring wells, and cleanup of the battery rooms in Building 224 and Building A10CT. The following presents some additional detail regarding this removal action by Foster Wheeler.

Confirmatory soil sampling was performed at seven locations in the vicinity of the dry well. Lead and TPH were detected at concentrations below established site cleanup criteria. Five confirmatory soil samples were collected from the leach field location. Lead and TPH were detected at concentrations below established site criteria from soil samples collected in the former leaching field area.

One composited soil sample was collected from the stockpiled excavated dry well and leach field soils and analyzed for total lead, TPH, and TCLP lead. The concentrations detected in this sample were also below established cleanup criteria, and was determined to be non-hazardous as defined by the RCRA. It was determined that this soil was suitable for use as backfill. Another composited sample was collected from the asphalt and concrete debris contained during removal activities. This sample was analyzed only for TCLP lead. This sample was determined to be non-hazardous under RCRA, and therefore, the debris could be disposed as construction debris.

Five confirmatory samples were collected from the wheel alignment room discharge piping excavation and submitted for TPH analysis. TPH was detected at concentrations below established cleanup goal criteria. Two soil samples were collected from below the floor along the drain lines in the Battery Acid Room of Building 224. The concentrations detected in these samples were below the established criteria.

Wipe samples were collected from the floors and walls of the battery rooms in Buildings 224 and A10CT for total lead analysis. Four sampling events were performed to confirm lead cleanup efforts. The final sampling yielded concentrations below established criteria.

The excavated area was backfilled with the excavated material because as stated above, this material was determined to be below established criteria. Additional clean backfill was also used to finish backfilling of the excavated area. The area was paved on 4 September 1996 (Stone & Webster Environmental 1996).

During dry well and leach field removal, three monitoring wells were disturbed and subsequently abandoned. Monitoring wells MW02-07S and MW02-07D were identified as TRC Environmental Phase I and II monitoring wells. The third well reportedly did not have a designation labeled on it. These three wells were abandoned on 21 August 1996 in accordance with the RIDEM guidelines and procedures.

Further detail regarding the closure of IR Program Site 02 can be found in Closeout Report IR Program Site 02, NCBC Davisville, Rhode Island (Stone & Webster Environmental 1996).

1.3.3 IR Program Site 03 - CED Solvent Disposal Area

Site 03 is an unmarked, previously paved lot to the west of Sayers Road, north of Parade Road and south of Battalion Boulevard.

From 1955 to the late 1970s, paint thinners and unidentified solvents were disposed on the ground, west of Sayers Street and Building 224. Neither the exact manner of solvent disposal nor the precise limits of the disposal area are known; however, the solvent disposal activity is thought to have occurred in an area which borders Sayers Street as shown in Figure 1-2. An initial assessment study (IAS) performed by Fred C. Hart Associates, Inc. (Hart 1984) estimated that approximately 3,000 gallons of solvents were disposed at a rate of about 10 gallons per month. Part of Site 03 was also used to store heavy equipment (TRC 1991).

The area to the immediate west of Site 03, and extending north and west to Perimeter Road was the former Camp Thomas. During World War II, military personnel were temporarily housed here. The camp included 800 huts scattered over 130 acres. At that time, Building 224 served as a recreation hall, drill hall, bowling alley and pool (Ecology and Environment 1994).

Camp Thomas was demolished after World War II. Building 224 was converted into a truck/heavy equipment maintenance facility in the early 1950's, and was used in that capacity until base closure in 1994.

Aerial photographs from 1951, 1957, 1963 and 1970 show the area between Battalion Boulevard, Seabee Avenue and Parade Road was paved and used for vehicle and equipment storage. Vehicles awaiting maintenance were also temporarily stored in this area. The area to the north of Battalion Boulevard and extending north to Perimeter Road was also used as a storage area, but as early as 1970, the area was used as an equipment operator training area. There are no records of vehicle maintenance occurring in these areas. Building 378 which is located south east of the corner of the intersection of Battalion Boulevard and Seabee Avenue was built in 1968 for equipment operator training. All vehicle maintenance reportedly occurred in Building 224. Stained or darken surfaces suggesting disposal of waste oils on the ground were not observed on aerial photographs (dated 1951, 1957, 1963 and 1970) of the area to the west of Building 224, or during site inspections or field activities by the Navy in 1993, 1994, and 1995.

1.3.4 Study Area 04 - CED Asphalt Disposal Area

Study Area 04 is the CED Asphalt Disposal Area (Figure 1-2). It is located approximately 800 ft west of Building 224. Battalion Boulevard is located about 80-ft south of the study area. Sometime in the late 1960's, a black, pliable, solid, asphaltic material was placed in a trench. The source of this material is unknown (Halliburton NUS 1994b). This area was excavated by Foster Wheeler in November 1996 under contract with the Navy. Asphaltic material and effected soil were removed in during the excavation. Four excavation pits were dug to remove asphalt material and confirmatory sampling was performed on the sidewalls and bottom of excavation pits. Samples were analyzed for TPH and PCB. Excavations were backfilled with clean soil in December 1996 after confirmatory sampling yielded results below the RIDEM criteria of 10 ppm for PCB and 300 ppm for TPH. Details of the excavation can be found in Contractor's Close-Out Report for the Removal Action at Study Area 4, NCBC Davisville, Rhode Island (Foster Wheeler Environmental Corp 1997).

1.3.5 Former Nike Site/Disaster Training Area

The area bounded by Perimeter Road, Seabee Avenue, and Babcock Road, which was part of Camp Thomas, was not used after World War II until 1955-1956 when the U.S. Army constructed a Nike Missile battery at the far west end of the Navy property (Figure 1-2) (ESE 1984). The area between the Nike Site and Seabee Avenue has not been used since World War II as evidenced by the mature forest which this area now supports. Aerial photographs dated 1951, 1957, 1963, 1970 and 1976 show the area as vegetated and undeveloped.

The former Nike facility (Nike Battery Site PR-58) included three underground missile silos (Buildings 347, 348 and 349), a refueling area located to the south of Building 347, a missile assembly and test building (Building 344) with a UST, a generator building with a 4,000 gal UST (Building 345), and personnel quarters (Metcalf and Eddy, 1994). The facility was a Nike "Ajax" only site. It was constructed during the initial round of Nike Site construction in the mid-1950s, and was equipped, as were all sites of that vintage, with short-range, conventionally armed Nike Ajax missiles. The more powerful and sophisticated Nike Hercules missile was deployed at sites within the continental United States beginning 1958. Sites not converted to operate with this missile were closed within the next few years. The PR-58 facility was deactivated in 1962. In 1995, the Army placed holes in the bottom of each silo, backfilled the silos with clean sand, and the concrete pads around the silos were demolished.

Construction drawings of the Nike Site, maintained by RIEDC, were reviewed for this investigation. The drawings show a leaching field 250 ft east of Building 343 which was the Ready (personnel) Building (Figure 1-2). The building was later used by the Navy as classroom for training. The leaching field was used to dispose of sanitary wastewater. Each missile silo was equipped with a sump pit used to collect liquids which had accumulated in the bottom of each silo. The contents of the pit were pumped via pipe and discharged directly into a ditch which ran along the eastern edge of the silos. The concrete pad which surrounded the silos also drained into this ditch. An acid neutralization pit and drainage sump were reportedly located at the missile refueling area which was just south of the three former missile silos.

There is no site specific documentation regarding the use, storage or disposal of hazardous material at the former Nike Site. However, for Nike sites in general, a variety of chlorinated organic solvents such as carbon tetrachloride, tetrachloroethene (PCE), trichloroethane (TCA) and trichloroethene (TCE) were reportedly used for parts cleaning, cleaning of grease spills and overall cleaning in preparation of painting (ESE 1984). Typical quantities used ranged from 30 to 120 liters per month of TCE and 190 to 380 liters per month of other solvents (ESE 1984). Waste solvents and cleaners were typically disposed by pouring them onto the ground or into a sump, but some were drummed for off-site disposal. When large quantities were used for overall cleaning, residues were washed into a sump or onto the ground surface (ESE 1984; Law 1986).

At the time of deactivation of a Nike Site, fuels and other chemicals in excess of recorded inventory were generally dumped onsite into a ground sump or on the ground (ESE 1984).

The location of this sump / disposal area is not known. Discharges from sumps located in the bottom of each missile silo reportedly discharged into a drainage ditch located at the east edge of the concrete pad around the silos. This drainage ditch in turn emptied into a catch basin which was attached to the storm water drainage system shown in Figure 1-4. During dry weather periods, discharges from the sumps to the ditch probably infiltrated into the ground; however, during storm events, a portion of the discharge would be carried into the drainage system. Exfiltration from joints in the clay/cement pipes and catch basin bottoms could have released solvent-containing storm runoff to the environment downgradient of the Nike Site. The drainage system could transport VOC downgradient more quickly in an easterly direction than would be expected if it flowed in the subsurface with the ground water. As reported for Nike sites in general, some instances have been reported where excess material was transported offsite and dumped on open nearby areas (ESE 1984; LAW 1986).

The Navy used the area west of the missile silos as the Disaster Recovery Training Area (Figure 1-2) between 1964 and 1974 (SEC 1988). The training complex was comprised of 5 to 6 buildings constructed by the Navy, and was used to train Navy personnel for nuclear, chemical and biological warfare. The training consisted of two weeks of classroom instruction on the fundamentals of nuclear weapons and chemical and biological agents, and two weeks of hands-on training.

Available information about the uses of industrial chemicals for disaster training comes from a 1984 interview of Mr. Curt Fischer, Head of the Disaster Recovery Training Department at NCBC Davisville from 1964 to 1967. The interview was conducted as part of the preparation of the ISA (Hart 1984). According to Mr. Fischer tear gas grenades, smoke pots and biological agent simulants were used. Detonation cord, blasting caps and plastic explosives were also used in small quantities. All materials were considered to be consumed in use, and thus, no wastes were considered to have been generated. Mr. Fischer also recalled that dozens of 5-gal containers of DANC [Decontaminating Agent - Non-Corrosive, (DANC is a mixture of 1,1,2,2-tetrachloroethane (PCA) and 1,3-dichloro-5,5-dimethylhydantion)] were stored at the Disaster Recovery Training Area. He did not recall any training with DANC. (A single empty 5-gal container label "decontaminating agent" was found in the vicinity of the former Disaster Training Area by the Navy in May 1995.)

There are 30 4-in. diameter pipes which rise about 4 ft above grade that are located east of the missile silos and this area is referred to as the "pipe structure area"on Figure 1-2. The pipes were observed to be filled with sand and had the words "chemical agent" stenciled on them in 1988 (SEC 1988). Decontamination and/or disposal of toxic materials exercises may have been conducted utilizing the "pipe structure" for disposal simulations. However, it is not known if actual chemicals were used in the simulations (SEC 1988). The Navy has conducted interviews of former NCBC personnel to gather additional information about the pipe structure. No additional information was provided by these interviews.

In 1974, the land to the west of Seabee Avenue was transferred to the GSA. In 1978, the GSA transferred ownership to RIPA (now RIEDC). RIPA leased 2.2 acres of land to Peabody

Clean Industries between 1980 and 1982 for use as a hazardous waste tank farm (Figure 1-2). Estimates given indicate that at any one time, a maximum of 50,000 gallons of oil / water waste, 10,000 gallons of waste solvents, waste oil and sludge and 20 drums of various hazardous materials were on site (Halliburton NUS 1990). Three out of seven areas used by Peabody Clean Industries (A-3, A-4, and A-5) are located adjacent to the Nike Site. Four 20,000-gal, above ground storage tanks used to store water, oil and some solvent waste were located in Area A-3 as shown on Figure 1-2. A leaching field used for disposal of water phase of oily bilge waste was also located in this area. Two building used by Peabody Industries to store non-hazardous equipment and supplies were located in Area A-4, while Area A-5 was used to temporarily store drums of hazardous waste (SEC 1988; Metcalf and Eddy 1994). Peabody Clean Industries ceased operations in 1982 and conducted closure activities through 1983 (ERA 1984). In 1983, RIDEM directed Peabody Clean Industries in a cleanup of contaminated soil that had resulted from the Peabody Clean Industries activities at the site. RIPA (now RIEDC) removed the 4,000-gal UST at Building 345 and demolished many structures, including Building 345, as part of the cleanup/closure activities. The 500-gal #2 fuel oil UST at Building 344 was removed by Green Environmental, Inc under contract to the ACOE (RIDEM Closure Certificate, UST Facility ID 16920, dated 2 January 1995). Currently, RIEDC leases Building 344 to Marine Education Inc., who operates a marine repair training center (Metcalf and Eddy 1994).

1.3.6 Former Gravel Pit and Training Area

The area bounded by the Sanford Road, Westcott Road, Davisville Road and Allen Harbor (see Figures 1-1 & 1-2) was originally part of an old farm and homestead prior to NCBC Davisville. The farmhouse still exists (Building D272) and was used as a residential unit by the Navy.

Aerial photographs dated 1951 and 1963 indicate that a portion of this area was mined for construction/fill materials (gravel and/or sand) prior to 1951 with additional excavation and site work undertaken at some point between 1951 and 1963. Materials from this borrow pit (known as the "Snake Pit") were used to fill in low spots and wetlands in the area.

The area north and northeast of the Snake Pit was also converted into a heavy equipment operator training site at some point between 1951 and 1963. The original topography consisting of fields/farmland and coastal wetlands were leveled and altered during the training which took place until at least 1970. Aerial photographs (1970) indicate that some heavy equipment was stored here. The area has since revegetated itself with grass and shrubs.

1.4 REPORT ORGANIZATION

This report describes the field program conducted for the Offsite Investigation, and site characterization that has been developed using data from that investigation and the Phase III RI. Chapter 1 presents the introduction and objectives of the investigation, the site background, and organization of this report. Chapter 2 presents a description of the field and analytical activities performed. Chapter 3 presents the description of the physical characteristics of the site. Chapter 4 presents the nature and extent of the CVOC detected and the findings of the natural attenuation assessment. Chapter 5 presents the conclusions. Supporting documentation is contained in the appendices.

2. FIELD INVESTIGATION

2.1 INTRODUCTION

This chapter provides a summary of the field program conducted to further characterize subsurface and ground-water conditions beneath the Nike Site and Offsite study areas, and to assess natural attenuation processes that are degrading the detected CVOC plume in deep ground water.

The objectives of the Site 03/Nike Source Area Characterization, Offsite Investigation, and Natural Attenuation Investigation were addressed by performing three stages of field work: Stage 1 during April - November 1996, Stage 2 during December 1996, and Stage 3 during December 1997 - March 1998. The field work was performed in accordance with the following work plan and work plan addenda. The Phase III RI IR Program Work Plan (EA 1994) established the procedures that were used to conduct the drilling, monitoring well installation, and development during 1996. The Phase III RI Work Plan Addendum (EA 1996) including the updated FSP (Chapter 3) and revised QAPP (Chapter 4) established the procedures that were used to conduct the field sampling activities and laboratory analysis for: (1) the Nike Site Source Area Characterization Study and the Natural Attenuation Investigation sampling events of December 1996 and March 1998 (including low flow sampling of the ground water for both events and modification of the analytical parameter list in the March 1998 work plan addendum, EA 1998). A work plan addendum dated November 1997 established procedures for the offsite monitoring well installation and development performed from December 1997 through March 1998 (EA 1997). Figure 2-1 (Geophysical Survey, Hydroprobe, Soil Boring, and Monitoring Well Location Map) shows the location of current and previous site field investigation and subsurface sampling locations. The following sections present the field work performed.

2.2 STAGE 1

The results of the Draft Final RI report (EA 1996) continued to show that the highest concentrations of dissolved CVOC were detected in samples from the till and weathered bedrock zone that directly overlies the competent (coreable) bedrock. Because the upper surface of the competent bedrock continued to appear to be instrumental in the direction of migration of the CVOC plume, the Stage 1 work began with a geophysical seismic refraction study to extend the understanding of that interpreted surface and to aid in the selection of nine boring locations. Each of the locations was drilled and the soil sampled to assess the hydrogeology and the nature and extent of CVOC. Based upon field analyses, these borings were each completed as monitoring wells and developed. The following provides more detail of the Stage 1 field activities.

- A geophysical seismic refraction study was performed from 24 April to 3 May 1996 to further assess the depth to bedrock and configuration of the competent (coreable) bedrock surface beneath the Nike site (extending the geophysical interpretive data west from the extent of a related 1995 study). The work included a total of eight lines designated as Lines 1 through 8 on Figure 2-1, four trending approximately north/south and four trending approximately east/west. Lines 1, 2 and 3 were located along the northern, western and southern perimeters of the Nike Site area, respectively. Line 4 trended north-south to connect Line 3 with previous (1995) Line C-C'. Line 5 was an extension of Line B-B' from the previous (1995) seismic survey to the western edge of the site. Line 6 trended west to east across north central portion of the site. Lines 7 and 8 trended south to north through the central portion of the sites along the west and east sides of the former Nike Missile Silos, respectively. The geophysical methods used and the results of the survey are detailed in Appendix A1. The results were added to Figure 2-2 (Interpretive Map of the Upper Surface of Competent Bedrock).

- Based upon the results of the geophysical study, nine locations were selected and soil borings (EA-101 through EA-109) were drilled into the top of competent bedrock at each location during June 1996 as part of the Nike Site Source Area Characterization Study (Figures 1-2 and 2-1). The locations were selected as follows:

  EA-101 was installed northwest of MW03-14D between a drainage ditch east of the former missile silos and the Pipe Structure Area to assess impact of potential spent solvents that may have been disposed in the trench and migrated east with the ground-water flow.

  EA-102 was located west of MW03-14D and near the east edge of the former Peabody Clean temporary drum storage area (Figures 1-2 and 2-1) to aid in source area definition.

  EA-103 was located adjacent (east) to the Pipe Structure Area, northeast of MW03-14D, to evaluate suspected buried metallic objects identified in the Sirrine Report (1988) and to assess VOC potentially used in conjunction with this structure.

  EA-104 was located approximately 550 ft northeast of MW03-14D (toward MW-Z3-01 where low concentrations of CVOC had previously been detected) to evaluate potential CVOC migration from the site in a northeasterly direction along a low in the interpreted competent bedrock surface (Figure 2-2).

  EA-105 was located west of the former Nike Missile Silo area to evaluate the former Disaster Preparedness Training Area and ground-water conditions west from the former missile silo area (where an apparent ground-water divide appeared to be present).

  EA-106 was located near Perimeter Road to evaluate ground-water conditions north of the former Nike Site at the property boundary.

EA-107 was located southwest of EA-105, adjacent to Perimeter Road to evaluate ground-water conditions west of the former Nike Site area at the property boundary.

EA-108 was located south of the former missile silo area to evaluate ground-water conditions near the former Missile Fueling Area.

EA-109 is located near Battalion Boulevard on the eastern edge of the former Nike missile silo area to evaluate ground-water conditions adjacent to the former silo area.

Soil samples were collected continuously from the ground surface to the water table, and every 5 ft thereafter, and submitted to a field laboratory for onsite headspace analysis using a gas chromatograph (GC) to select the two samples per boring with the highest VOC concentration and submittal for laboratory analyses of VOC. Additionally, a sample of the ground water was collected from each boring from just above the top of competent bedrock for field GC analysis of VOC. The ground-water samples were collected using hydroprobe, bailer, and/or submersible 'whale' pump. The field and laboratory results are summarized in Tables 2-1 and 2-2.

The preliminary boring logs and the field results of the ground-water samples were used as screening data that was coordinated daily with the Base Closure Team (BCT) to determine whether or not a monitoring well would be installed. If VOC were detected, the boring was completed as a monitoring well, rather than being backfilled with grout. Because at least traces of VOC were detected in the ground-water samples collected from just above competent (coreable) bedrock from each of the nine borings, each boring was completed as a 2-in diameter PVC monitoring well (EA-101 through EA-109). The bottom of each well screen was set at the top of competent, coreable rock so that the overlying till and weathered bedrock (where present) interval was screened. The depth and elevation of each of the well screens is included in Table 2-3. The locations of these monitoring wells are shown on Figures 2-1 and 2-3. The boring logs and monitoring well diagrams are provided in Appendix B1 and C1, respectively. A summary of the monitoring well data is included in Table 2-3. The nine monitoring wells were developed in July 1996. The related well development logs are provided in Appendix D1 and a summary of the field analytical data is provided in Table 2-4. Slug tests were performed in each well to estimate the hydraulic conductivity (Appendix E1).

- On 7 June 1998 (at the request of the Navy), two of the southern pipes in the 'pipe structure' were pulled from the ground to assess their extent. As stated in Section 1.3.5, the 'pipe structure' is comprised of 30 4-in. diameter pipes which rise about 4 ft above grade (Figure 1-2). Based upon the field observations and the two removed steel pipes, the pipes are arranged in six rows of five pipes each. Each pipe was approximately 6-in in diameter, 4.5 ft in length, extended into the ground approximately 12 in., and was partially filled with sand. No odor or staining of the soil was observed where the two pipes were pulled from the ground. An Hnu measurement of 4 ppm was recorded in one of the shallow holes where a pipe had been pulled and 'ND' was measured in the other shallow hole. As stated above, monitoring well EA-103 was installed adjacent to the east perimeter of the 'pipe structure'.

- On 20 November 1996, the PVC well at MW03-14D was replaced with stainless steel because of the concern that the high concentrations of CVOC, detected at this location during the May 1995 sampling event, may degrade the PVC well. The replacement well screen was set in the same interval and to the same depth as the former PVC well, and was located within approximately 3 ft from the former PVC well. Prior to well replacement, a ground-water sample was collected from the PVC well using a disposable bailer and analyzed for VOC using the field GC. The results are included at the end of Table 2-1 and show the presence of relatively high concentrations of CVOC as had been detected previously in a sample collected in 1995.

2.3 STAGE 2

Stage 2 included the sampling of the nine monitoring wells installed during Stage 1, along with 28 other wells (Figure 2-3) to aid in assessment of the nature and extent of the CVOC plume and assessment of natural attenuation processes that are affecting the CVOC plume in the deep (D) zone.

- During December 1996, the following monitoring wells were low-flow sampled and analyzed for the evaluation of natural attenuation potential and the extent of VOC: EA-101 through EA-109, installed at the Nike Site study area in June 1996; MW-Z3-1, MW-Z3-2, MW-Z3-3, and MW-Z4-1, installed by Stone & Webster (January 1996); wells MW01-08D, MW01-09D, MW01-10D, MW01-11D, MW01-12D, MW01-13D, MW01-14D, and MW01-15D (at Study Area 01); MW02-03D, MW02-08D, MW02-10D, MW02-11D (at Site 02); MW03-02D, MW03-03D, MW03-05D, MW03-06D, MW03-07D, MW03-08D, MW03-09D, MW03-10D, MW03-12D, MW03-13D, MW03-14D (at Site 03); and Rhode Island Economic Development Corporation (RIEDC) installed wells RMW-01D and RMW-02D located east of Building 224 near the former gravel pit known as the "Snake Pit". Dedicated bladder pumps were installed in these wells prior to this sampling event. Figure 2-3 shows the location of these monitoring wells.

  The rationale for selection of these wells for the first round of the Natural Attenuation assessment were as follows:

  > Wells EA-101 to EA-109 were installed in June 1996 and had not been previously sampled. Ground-water sample data was required from these wells to better characterize the Nike Site CVOC source area and to assess potential intrinsic biodegradation (natural attenuation) processes.

Based upon the 1995 ground-water sample results, samples from eight deep monitoring wells located east of the Nike Site (MW03-03D, MW03-06D, MW03-08D, MW03-10D, MW03-12D, MW03-13D, MW03-14D and MW-Z3-1) had detected total CVOC concentrations above 100 μg/l during past sampling event(s). These wells were sampled to assess specific chemical zonations attributed to intrinsic biodegradation processes.

Based upon the 1995 ground-water sample results, samples from five deep wells (MW02-11D, MW03-02D, MW03-05D, MW03-09D, and MW-Z3-3) had detected total CVOC at ranges between 4 and 83 μg/l and were assumed to be near the edge of the plume. These wells were sampled to assess specific zonations attributed to intrinsic biodegradation processes.

Based upon the 1995 ground-water sample results, samples from four monitoring wells (MW01-09D, MW01-10D, MW01-13D, and MW01-14D), had ND (non detects) for total CVOC. These, in addition to MW-Z3-2 and MW-Z4-1, were anticipated to represent down gradient wells beyond the CVOC plume.

The remainder of the sampled wells were selected to provide additional data for assessment of potential natural attenuation beneath the western portion of Zone 3.

The analytical program is summarized on Table 2-5. The ground-water samples were laboratory analyzed for VOC (EPA Method 8260), alkalinity, sulfate, total bromide, total chloride, nitrate, nitrite, orthophosphate, biochemical oxygen demand (BOD),total calcium, total magnesium, total iron, total manganese, total sodium, total potassium, total ammonia, total Kjeldahl nitrogen (TKN), total organic carbon (TOC), total inorganic carbon (TIC), total phosphorus, chemical oxygen demand (COD), and hydrogen sulfide. One field-filtered sample for laboratory analyses of dissolved calcium, magnesium, iron, manganese, sodium and potassium was also collected from wells where the turbidity exceeded 10 NTU at the time of sample collection. The ground-water samples were field-analyzed for dissolved ferrous iron, dissolved hydrogen (except for MW03-14D and EA-102, which are stainless steel wells), methane, ethane, ethene, dissolved carbon dioxide, dissolved oxygen, pH, Eh, temperature, conductivity, and turbidity. Copies of the Field Sampling Forms are provided in Appendix F1. Table 2-6 provides a summary of the field analytical data obtained after purging and prior to collecting the samples. The analytical results were validated in accordance with EPA Region I Laboratory Data Validation, Functional Guidelines for Evaluating Organic and Inorganic Analyses (1 February 1988 and 13 June 1988, respectively). Refer to Chapter 4 for presentation of the results.

- Although public water is available to residences along Fletcher Road, Candlewood Road, and Quail Drive located north of the former Nike Site, some residences still use private well water for drinking. Based upon review of the above sample results, RIDEM coordinated with the Town of North Kingstown and the Rhode Island Department of Health (RIDOH) to identify residential properties in that area which use private well water for drinking. Eight such residences were identified along Fletcher Road. The addresses and approximate locations of these wells was received from RIDEM and is provided in Appendix G, along with a map that combines a Site 03/Nike study area map and the well location map provided by the Town. A summary of the locations is provided in Table 1-1. The five wells located closest to the former Nike Site are shown on Figure 2-2. In May 1997, RIDOH collected water from these nine wells for VOC analysis. VOC were not detected in the samples collected from the five nearby well locations shown on Figure 2-2. Documentation of the construction details for these eight residential wells, eg. total well depth and depth to the screened interval, was not available for inclusion in this report.

2.4 STAGE 3

Because of the low detected concentrations of CVOC in samples from monitoring wells MW-Z3-01 (near the north perimeter of NCBC) and MW-Z3-03 (near the southeast perimeter of NCBC Zone 3 with Zone 4), Stage 3 included assessment of the north and south edges (offsite) of the identified CVOC plume (refer to Figure 2-1 for well locations). The field work began with a geophysical seismic refraction study, followed by the installation of eight monitoring wells. Ground water was then collected and analyzed from the eight new wells, plus 13 additional selected wells to assess the nature and extent of the CVOC plume and to spot check and confirm the natural attenuation related results from Stage 2. The Navy received permission for access to the southern offsite area from RIEDC, dated 30 September 1997. The Navy received permission for access to the northern offsite area from the Carriage Hill Association, dated 23 October 1997.

- A seismic refraction geophysical survey was performed during October-November 1997 to further assess the depth to bedrock and configuration of the competent (coreable) bedrock surface along the northern and southern edges of the CVOC plume detected in ground water. As shown on Figure 2-1, a total of six lines were completed including, four lines to the south (FF', GG', HH' and JJ') and two lines to the north (KK' and LL'). To relate this data to the previous geophysical study results, selected lines intersected or extended a previous (1995) survey line. Line JJ' is a southerly extension of previous (1995) Line EE', and Line LL' intersected the north end of previous (1995) Line DD'. The geophysical methods used and the results of the survey are detailed in Appendix A2. The results were added to Figure 2-2 (Interpretive Map of the Upper Surface of Competent Bedrock).

- Based upon the results of the geophysical survey and interpreted direction of ground-water flow (December 1997 ground-water level data), eight locations were selected and monitoring wells (EA-106R, EA-110D/R, EA-111D/R, EA-112D/R, and EA-113D) were installed at each during December 1997 - February 1998. The rationale for the well locations are as follows beginning with the northern wells:

EA-113D was located northwest of MW-Z3-1, between MW-Z3-1 and the five residential water supply wells located north of the Nike Site.

EA-112D was located northeast of MW-Z3-1, along the trend of the apparent portion of the CVOC plume detected at EA-104 and MW-Z3-1, and along an apparent northeast trending low in the competent bedrock.

EA-112R is located within approximately 20 ft of EA-112D, to assess potential CVOC in the upper portion of the bedrock surface.

EA-106R is located within approximately 20 ft of EA-106, between the NIKE Site and the residential water supply wells, to evaluate the upper portion in the bedrock at this location.

EA-110D and EA-111D were located to assess the southern edge of the VOC plume, in the till and weathered bedrock (deep) zone near the border between NCBC Zones 3 and 4.

EA-110R and EA-111R were located to assess the southern edge of the VOC plume in the upper portion of the bedrock.

During the drilling of EA-111D, slightly elevated headspace was measured for a few soil samples using a PID. Therefore, soil samples were collected from the related intervals (44-46 ft bg, 49-51 ft bg, 54-56 ft bg, and 60-62 ft bg) during the drilling of adjacent EA-111R and submitted for VOC analysis. Refer to Chapter 4 for a presentation of the results.

The bottom of the deep (D) well screens were set at the top of or slightly into the top of competent (coreable) bedrock, screening the till and/or weathered rock zone. The rock (R) wells typically screen the upper approximately 25 ft of the competent bedrock. The wells were constructed of 2-in diameter PVC pipe and screen, except for EA-112R which due to drilling challenges in the weathered bedrock zone, was constructed of 1.5-in diameter PVC pipe and screen. The boring logs and monitoring well diagrams are provided in Appendices B2 and C2, respectively. A summary of the monitoring well data is included on Table 2-3.

These eight monitoring wells were developed from 3 - 12 February 1998. Additionally, monitoring wells MW02-12D and MW-Z3-03 were redeveloped to decrease the elevated turbidity observed during previous sampling events. The related Well Development Logs are provided in Appendix D2 and a summary of the field analytical data is provided in Table 2-7. Prior to installation of well at the rock (R) well locations, packer tests were performed in the cored bedrock interval of each related borehole (Appendix H). Slug tests were performed in each well to estimate the hydraulic conductivity (Appendix E2). Dedicated bladder pumps were then installed in these wells, except for EA-112R for which the well diameter was too small.

- The following interim sampling activity was performed prior to the completion of the northern offsite monitoring wells and prior to the installation of the dedicated bladder pumps. To provide preliminary data for input to the Navy's Draft Finding of Suitability for Transfer (FOST) for Zone 4 (located southeast and downgradient of a portion of the CVOC plume that originates in the vicinity of the former Nike Site), the following four monitoring wells (shown on Figure 2-1) were sampled from discrete zones on 17 - 18 February for VOC analysis only: EA-110D at a depth of 84 ft from grade (near top of bedrock), EA-110R at a depth of 98 ft from grade (fracture zone within bedrock), EA-111D, at a depth of 50 ft from grade (in a zone of elevated headspace within the overburden) also 63.5 ft (near top of bedrock), and EA-111R at a depth of 66 ft from grade (near top of bedrock), and at a depth of 82.5 ft from grade (in a fractured bedrock zone). These selected sample intervals were based upon review of the field sample headspace measurement data, boring logs, packer test results, and the rock cores. The selected sample intervals were discussed with the BCT and concurrence was received prior to sampling. The related Field Sampling Forms are provided in Appendix F2.

- Based upon the interim results of the first round of sampling (December 1996) to assess natural attenuation, the following 21 wells were low-flow sampled from 9 - 17 March 1998 for spot checking and confirmation of the December 1996 natural attenuation sample findings in the deep (D) zone (Figure 2-4):

  The newly installed monitoring wells EA-110D, EA-111D, EA-112D, and EA-113D;

  Upgradient well EA-105;

  Wells along the approximate centerline of the plume to confirm CVOC concentrations and geochemistry included MW03-14D (source area), MW03-08D, MW03-07D, MW03-03D, MW02-10D, and MW02-03D;

  Cross gradient wells MW-Z3-01 (northwestern) and MW-Z3-03 (southeastern); downgradient well MW01-14D; and

  Well MW01-12D (confirm methanogenesis zone).

  In general, the sample depth interval for the monitoring wells was approximately the middle of the screened interval. For the newly installed monitoring wells constructed with more than 10 ft of screen, the sample intervals were based upon review of the field sample headspace measurement data, boring logs, packer test results, and the rock cores.

The ground-water samples were laboratory analyzed for VOC (EPA Method 8260), sulfate, total chloride, nitrate, nitrite, dissolved iron, dissolved manganese, total ammonia, total organic carbon, total inorganic carbon, and hydrogen sulfide (Table 2-8). In-line filters (0.45 micron) were used during the collection of the aliquots which were analyzed for dissolved iron and manganese. Samples were analyzed for dissolved hydrogen (except MW03-14D) and methane/ethane/ethene by an onsite mobile laboratory utilizing a GC. MW03-14D was not sampled for dissolved hydrogen analysis because it is a stainless steel well and, therefore, would yield erroneous results for hydrogen concentrations. The following parameters were field analyzed: dissolved ferrous iron, dissolved carbon dioxide, dissolved oxygen, pH, Eh, temperature, conductivity, and turbidity. The related Field Sampling Forms are provided in Appendix F3. Table 2-9 provides a summary of the field analytical data obtained after purging and prior to collecting the samples. The analytical results were validated in accordance with EPA Region I Laboratory Data Validation, Functional Guidelines for Evaluating Organic and Inorganic Analyses (1 February 1988 and 13 June 1988, respectively). Refer to Chapter 4 for a presentation of the results.

To further aid in assessment of the nature and extent of CVOC, the four new monitoring wells (EA-106R, EA-110R, EA-111R, EA-112R) screened in the upper portion of competent (coreable) bedrock, plus MW-Z4-01 and MW-Z4-02 (screened in the deep zone) were also sampled in March 1998. These wells were analyzed for VOC, DO, pH, Eh, temperature, conductivity, and turbidity only (Table 2-8). The related Field Sampling Forms are provided in Appendix F3. A summary of the field analytical data obtained after purging and prior to collecting the samples is included in Table 2-9. Refer to Chapter 4 for a presentation of the results.

3. PHYSICAL CHARACTERISTICS

3.1 Introduction

The following section provides a description of the site geology and hydrogeology based upon the results of the Site 03/Nike Source Area Characterization and Offsite Investigation, plus the previously developed site data from the Phase I, II, and III RIs.

3.2 Site Geology

The results of the Site 03/Nike Source Area Characterization and Offsite Investigation field work add to and support the geological findings reported in the Draft Final Report for the Study Areas 01 and 04, IR Program Sites 02 and 03, and Nike Site Phase III Remedial Investigation (EA 1996). These data show that the subsurface geology from the former Nike Site east to the Sites 01 and 02 area is characterized by Quaternary glacial deposits mantling the quartzitic and phyllitic bedrock (weathered and competent zones) of the Rhode Island Formation. In general, based upon logs of borings, the unconsolidated sedimentary (glacial) deposits consist of the following units presented in order from the ground surface downward: (1) glacio-fluvial deposits of sand with varying amounts of silt and/or gravel, (2) glacio-lacustrine deposits of silt to very fine sand and silt, and (3) sandy silty gravel to sandy gravelly silt (possibly till).

Figure 3-1 shows the location of four geologic cross-sections. Figures 3-2 through 3-5 are Geologic Cross Sections AA' through DD', respectively, which present the interpreted generalized distribution and thickness of the geological units from selected borings. These cross sections had been prepared to incorporate the geological data obtained from the eight monitoring wells installed during the 1997-98 Offsite Investigation. A summary of the geological data used to prepared these cross sections is provided in Table 3-1. All four cross sections begin in the vicinity of MW03-14D where the highest total CVOC has been detected in ground-water samples. Cross Section AA' extends approximately north through EA-106R and EA-113D located between the former Nike Site and the residential area. Cross Section BB' extends northeast to wells EA-112D/R along the trend of an apparent valley in the bedrock surface. Cross Section CC' extends southeast through well pairs EA-111D/R and EA-110D/R to the northwest corner of NCBC Zone 4 at MW-Z4-01. Cross Section DD' extends east along the approximate alignment of the CVOC in deep ground water beyond the Building 224 vicinity to MW01-14D. The interpreted geology shown on these cross sections was based on a reassessment of the geological information on logs of previously (Phase I, II, and III RI) installed wells and the new wells installed offsite in an attempt to achieve consistency in the interpretation of data collected during several different investigation stages. Specifically, this was done to better interpret the extent of the three deeper units by trying to make consistent use of the geological descriptions on the many boring logs i.e., (1) the sand and gravel, possibly till, unit was correlated to soil sample descriptions which included subrounded gravel; (2) weathered bedrock was correlated to sample descriptions which included subangular to blocky gravel and fissile gravel, and bedrock fragments; and (3) competent bedrock was correlated to intervals of coreable bedrock.

The glacio-fluvial deposits were encountered in all monitoring well borings at thicknesses ranging from approximately 5 ft at MW03-12D to over 50 ft at MW01-14D. Due to the nature of these deposits, individual beds or "layers" often pinch out and/or crossbed within a short distance. A general description of the deposits includes gray, brown, and olive poorly to well graded sand, sand and gravel and uniform fine sand with varying amounts of silt.

Glacio-lacustrine deposits underlie the glacio-fluvial deposits at and to the east of monitoring well MW03-07D and consist of dark gray to olive gray silt. Locally, these deposits contain varying amounts of sand (very fine to fine) interbedded in the silt (MW03-03D) (Figure 3-5). This silt deposit grades into a very fine sand and silt east of MW03-05D, and the silt is overlain by these deposits at MW03-03D and MW03-05D (Figure 3-5). Where present, the silt thickness ranges from approximately 13.5 ft at MW03-05D to 22 and 55 ft at MW01-14D and MW-Z4-01, respectively. Silt thickness adjacent to Building 224 and Site 02 range from 0 ft. to less than 5 ft. The silt and/or fine sand and silt units were not encountered at MW03-08D or wells further west.

The sandy silty gravel to sandy gravelly silt (possibly glacial till) was encountered mostly north of MW03-14 (Figure 3-2), east of MW03-14 between MW03-13 and -07 (Figure 3-5), southeast of MW03-14 from MW03-13 to MW-Z4-01 (Figure 3-4), and at MW01-14 (Figure 3-5). The unit underlies the glacio-fluvial and glacio-lacustrine deposits and overlies the bedrock. Where present, this unit ranges in thickness from approximately 5 ft (EA-103 and MW-Z3-03) to 15 ft (EA-106).

Bedrock was encountered in the monitoring well borings at depths ranging from approximately 20.5 ft bg (MW03-14) to 89 ft bg (MW01-14). Based on the results of the seismic refraction survey and the monitoring well borings, the bedrock surface has an irregular shape. Beneath much of the former Nike Site, the bedrock surface ranges from approximately +5 to -5 ft MSL. There is an interpreted high point of +20 ft above mean sea level (msl) southeast of the Nike Site (Figure 2-2). North of this area is an interpreted northeast trending valley in the rock surface which slopes down to below -40 ft MSL at MW-Z3-01. About 200 feet west of Sayers Street in the vicinity of MW03-06D and MW03-03D, there is a divide (high) in the bedrock surface. The surface slopes down to the north and south to below -30 ft msl, but continues to rise to the east beneath the Building 224 area to -3 ft msl at MW02-03D. Further east the bedrock surface drops off steeply to -47 ft msl at MW01-13D and -50 ft msl at MW01-14D.

Weathered bedrock separates the underlying competent (coreable) bedrock from the overlying unconsolidated glacial deposits mostly in the area beneath the former Nike Site and east to MW03-08D/R and MW03-10D (Figures 3-2 through 3-5). Weathered bedrock thickness ranges from 21 feet at MW03-12R to less than 2 feet adjacent to much of the CED (Building 224). The weathered bedrock is generally dark gray, platey, blocky and highly fractured.

Interbedded clay, silt and sand layers are often present within this zone and between fractured sections. Rock fragments obtained from samples in the weathered zone range from approximately 1 to 3-in. and break in planar blocky sections (typically phyllite) or angular fragments (typically quartzite). The depth to the top of competent bedrock can vary considerably over short distances. The largest such variation was encountered at well pair EA-112D/R which are located within approximately 15 ft of one another. The top of competent rock was approximately 82.0 ft bg at EA-112R and 97.0 ft bg at EA-112D.

The bedrock underlying the western portion of Zone 3 and the Nike Site is typically alternating layers of quartzite and phyllite which can vary considerably over short horizontal distances. This situation is best documented by findings at EA-112D and -112R. These two well borings have approximately 12 ft of core from a common depth interval below grade. However, the common interval was not comprised of the same sequence and thickness of rock types (quartzite and phyllite lenses were at different depths and thicknesses) (Figure 3-3). There appear to be either horizontal facies changes between quartzite and phyllite over relatively short distances, localized faulting, and/or the layers of this rock are sloping (tilted, not horizontal) and/or folded. This results in encountering the layers at different depths in wells located 10-20 ft apart. No apparently continuous layer of lower permeability material (e.g. a clay layer) was encountered through this material (zone just above coreable bedrock) that could subdivide this zone.

The quartzite bedrock displays significant amounts of quartz veins, with vertical to horizontal orientations, and contains near vertical and horizontal fractures. Where encountered, the quartzite is generally massive and the color ranges from light to dark gray with occasional banding and mottling. Fractures were typically healed and were observed to be filled with quartz, chlorite and pyrite. The phyllite is typically dark gray to black metamorphosed shale with fractures. Based upon the boring logs, the phyllite was observed to have a maximum thickness of at least 29 ft at EA-106D/R. Fractures in the phyllite are often open (not healed with mineralization), but filled with silt. Competent bedrock core recoveries were generally greater than 90 percent (Table 3-2). Rock Quality Designation (RQD) as a percentage of the length of core, that is longer than 4 in. each, ranged from 13 to 100 percent, with most RQD values falling between 50 and 100 percent (Table 3-2). Although originated for geotechnical use to aid in assessment of rock quality for construction, RQD provides an indication of how solid or massive versus broken, bedded, or fractured the rock core interval is. Ground-water flow through the rock types beneath the site is along interconnected natural openings in the rock, such as along bedding, fracture, or jointing planes. RQD provides a general idea of whether the rock core interval (typically 5 ft in length) is solid (high RQD) with little potential for ground-water flow through versus fractured/bedded (low RQD) with more potential for ground-water flow through. However, a low RQD only indicates the relatively higher potential for ground-water flow through, but not whether the openings are interconnected or are filled with silt or clay which could mitigate the actual flow through of ground water.

3.3 Site Hydrogeology

The previously described geological units underlying the site have been divided into the following three hydrogeological zones (beginning with the uppermost zone):

Shallow ground-water zone -- consists of the glacio-fluvial sand unit overlying the glacio-lacustrine silt and very fine sand unit (where present) or directly overlying the sandy silty gravel to sandy gravelly silt (possibly till) where the glacio-lacustrine deposits are not present. This zone occurs under unconfined conditions.

Deep ground-water zone -- consists of the sandy silty gravel to sandy gravelly silt (possibly till) unit and the weathered bedrock zone. These two units are considered as a single ground-water zone for the following reasons. No apparently continuous layer of lower permeability material (e.g. a clay layer) was encountered through this zone that could subdivide this zone. The weathered bedrock where quartzite (hard) and phyllite (soft) are interbedded, form a zone that is hydrogeologically similar because of the apparent horizontal and vertical variation observed which would allow for horizontal and vertical flow (hydraulic communication) through it. In other words, ground water could flow more readily through the softer, fractured phyllite and fractured quartzite, but less could flow through the more massive zones of quartzite and very weathered phyllite with fractures filled by silt and clay. The estimated hydraulic conductivity for the screened till and weathered rock zone ranged from approximately 1 to 50 ft/day. The weathered bedrock is in direct hydraulic communication with the overlying sandy silty gravel to sandy gravelly silt (possibly till) unit. Additionally, this zone is in direct hydraulic connection with the shallow ground-water zone, except in areas (generally east of MW03-08) were the glacio-lacustrine silt and very fine sand unit is present. The deep ground-water zone occurs primarily under unconfined conditions. Partially confined to confined conditions appear to be present adjacent to and east of Building 224.

Competent bedrock ground-water zone -- includes the upper approximately 25 ft of competent bedrock which was investigated, but may extend deeper. This zone is in direct hydraulic connection with the overlying deep ground-water zone. Data available indicates this unit occurs under unconfined conditions. The estimated hydraulic conductivity for screened intervals of competent (coreable) bedrock ranged from approximately 0.3 to 175 ft/day depending on the amount and interconnectedness of fracture/bedding planes and the presence of 'fines' filling the fracture/bedding planes. The highest hydraulic conductivity was estimated for the screened intervals of wells EA-106R and EA-112R. In comparison and as stated above, the estimated hydraulic conductivity for the overlying, screened till and weathered rock zone ranged from approximately 1 to 50 ft/day.

Depth to ground water was measured periodically at study area wells during the current and previous field work and are summarized in Table 3-3. Ground-water contour maps for the deep ground-water zone for December 1996 and February 1998 are presented in Figures 3-6 and 3-7, respectively. The December 1996 data set was selected as typical of the data obtained prior to 1998. Based upon Figure 3-6, the interpreted ground-water flow direction in the deep zone is east and southeast from the vicinity of the former Nike missile silos to the vicinity of Building 224 and then northeast. A slight ground-water mound beneath the former silos results in a west ground-water flow beneath a relatively small portion of the study area located west of the silos. The February 1998 data set is the most comprehensive and includes measurements from deep (D) monitoring wells installed for the current investigation, along with wells installed during Phases I, II, and III of the RI; wells and piezometers for the basewide background inorganics ground-water study; wells installed by RIPA (now RIEDC) in the old gravel pit area; and 2 background wells located in the northwestern portion of NCBC Zone 4. Based on these data, deep zone ground water is interpreted to flow southeast from the former Nike site and the residential area located north of the Nike Site, and then, east southeast across Site 03 to an area where a slight ground-water mound is present northeast of the intersection of Marine and Davisville Roads. This mound may be related to infiltration of rain during Winter 1998 that collected in the vicinity of the former gravel pit ('Snake Pit'). Because of this slight mound as interpreted from the February 1998 data, the ground-water flow east from the Nike Site appears to diverge in the vicinity of Building 224 to the northeast and southeast. There is also still a small portion of the study area, west of the former Nike missile silos, where deep ground water is interpreted to flow toward the west.

Based upon the February 1998 water level data, ground-water flow in the bedrock is interpreted to be approximately toward the southeast (Figure 3-8).

Vertical hydraulic heads and gradients are summarized in Table 3-4 for various well clusters in the study area. The data collected during 1996-98 generally support and confirm the vertical gradients report in the related draft final Phase II RI report (EA 1996a). The following summarizes the vertical gradients observed between the deep and competent bedrock zones. Generally, unconfined conditions (downward gradient) have been recorded at well clusters MW03-12D/R, MW03-13D/R, EA-110D/R, and EA-111D/R. Slightly confined conditions (upward gradient) have been recorded at well clusters MW03-08D/R, MW03-14D/R, EA-106D/R, and EA-112D/R.

Slug tests were performed in the offsite monitoring wells. Slug tests could not be performed in EA-113D due to high water levels around and within the well. The data were used to calculate estimated hydraulic conductivities for the material screened around each well. Table 3-5 summarizes the hydraulic conductivities along with the geologic unit(s) screened at each well. The estimated hydraulic conductivity for the screened till and weathered rock zone ranged from approximately 1 to 50 ft/day. In comparison, the estimated hydraulic conductivity for screened intervals of competent (coreable) bedrock ranged from approximately 0.3 to 175 ft/day depending on the amount and interconnectedness of fracture/bedding planes and the presence of 'fines' filling the fracture/bedding planes. The slug test data for the Site 03/Nike Source Area Characterization and Offsite Investigation wells are provided in Appendix E.

The ground water beneath Site 03/Nike is classified by RIDEM as GB (presumed to require treatment prior to drinking). The southern extent of class GA ground water is Perimeter Road (the northern boundary of the site). Class GA ground water is presumed not to require treatment prior to drinking.

4. NATURE AND EXTENT

4.1 INTRODUCTION

This section presents a summary of the nature and extent of VOC detected in subsurface soil and ground-water samples. Section 4.2 presents information on the ground-water supply wells in the vicinity of Site 03/Nike. Information on the water source used during the field activities is provided in Section 4.4. A presentation of the results of the VOC analysis of soil samples is presented in Section 4.5. The sample results are summarized on Figure 4-1. Section 4.5 also includes the field GC screening results of soil samples obtained during the drilling of monitoring wells EA-101 through EA-109 at the Nike Site during June 1996. The results of VOC detected in ground-water samples collected from monitoring wells screened in the deep (D) and bedrock (R) zones are presented in Section 4.6. This section also includes the field GC screening results of ground-water samples collected during the drilling of monitoring wells EA-101 through EA-109 installed at Nike site in June 1996. Ground-water sample results are summarized on Figures 4-2 through 4-9. Assessment of the natural attenuation of CVOC in deep ground water is presented in Section 4.7.

4.2 WATER SUPPLY WELLS

No Municipal wells were sampled during Site 03/Nike Source Area Characterization and Offsite Investigation activities. The nearest municipal supply well is located near the intersection of Frenchtown Road and U.S. Route 1 over 2.5 miles northwest of Site 03 (GZA, 1992). The Town of North Kingstown, RI, reviewed their water department records for the area north of Perimeter Road and identified eight possible locations of private wells (Appendix G). They confirmed these wells and on 6 May 1997, the RIDOH sampled these eight residential water supply wells for analysis of VOC (EPA Method 524). Table 1-1 lists the location of these private-use ground-water supply wells. Figure 3-1 shows the approximate locations of the 5 closest wells located along Fletcher Road north of the former Nike Site. None of the VOC analytes were detected in samples from these five wells, nor in samples from the northeasternmost 2 wells along Fletcher Road. Trace concentrations of PCE (0.7 μg/L) and 1,1,1-trichloroethane (1 μg/L) were detected in the sample collected from "Matoes" well, both of which are below the RIDEM standards (5 μg/L and 200 μg/L, respectively). This well is located more than 1500 ft beyond the north edge of Figure 2-2 (or more than 3000 ft from the former Nike Site) northeast along Fletcher Road.

4.3 BACKGROUND RESULTS

Background concentrations for inorganic analytes in ground water at NCBC Davisville have been established (Table 4-1).

4.4 Water Source

The RIEDC provides water to NCBC from wells located off base. During the Stage 1 and 3 field activities, water from this source was obtained from the hydrant (located in the southwest quadrant of the intersection of Sayers Street and Battalion Boulevard) for drilling and part of the decontamination process for drilling and reusable sampling equipment. Samples of this water were collected on 6 June 1996 and 17 February 1998 and analyzed for TCL VOC. Only trace concentrations of VOC were detected. Only methylene chloride (2 μg/L) and PCA (2 μg/L) were detected in the 1996 sample. Chloroform (0.5J μg/L), bromodichloromethane (0.5J μg/L), and chlorodibromomethane (0.8J μg/L) were detected in the 1998 sample. These detected trace concentrations of VOC are not expected to have had adverse impact on soil and ground-water samples collected for chemical analyses.

4.5 Volatile Organic Compounds Detected in Soil

This section summarizes the results of subsurface soil samples collected: (1) during the June 1996 monitoring well drilling activity, and (2) from well boring EA-111R in January 1998 during the Offsite Investigation. During the 1996 monitoring well drilling activity, the headspace of subsurface soil samples was screened for selected VOC using a GC located at NCBC. The results are summarized in Table 2-1. In addition, 20 subsurface soil samples were collected from the monitoring well borings (two from each boring, plus two duplicates) and submitted to CEIMIC for TCL VOC analysis. The results are summarized in Table 2-2.

During the Offsite Investigation, the headspace vapor of the collected soil samples was measured using a photoionization detector (PID). Because of slightly elevated measurements obtained for four samples from EA-111D, soil was collected from those intervals (44-46 ft bg, 49-51 ft bg, 54-56 ft bg, and 60-62 ft bg) during the drilling of adjacent well EA-111R and submitted to EA Laboratories for analysis for VOC. Only traces of acetone were detected in two of those samples and it is suspected to be a lab contaminant or from the field equipment decon process.

4.5.1 Field GC Headspace Analytical Results

Nine monitoring wells (EA-101 through EA-109) were drilled at the former Nike site in June 1996 (Figure 2-1). In general, soil samples were collected continuously from ground surface to ten ft bg, and then, at approximately 5-ft intervals from ten feet bg to the top of bedrock (bottom of the screened interval of the monitoring wells). Based upon the results of previous studies, the samples were analyzed (screened) using a field GC with purge and trap system for selected CVOC and BTEX. The results are summarized in Table 2-1. BTEX was not detected in the soil samples. Neither CVOC or BTEX were detected in the soil samples from EA-105. A key use of these screening data was to aid in the location of potential CVOC surface release/spill areas, ie. areas where CVOC detected in soil samples collected from above the water table. This only occurred at borings EA-101 and EA-102, where trace concentrations (1.2 μg/Kg to 5.4 μg/Kg) of 1,1-DCE, trans-1,2-DCE, trichloroethene, and/or PCA were detected. For the remaining borings/wells, CVOC were detected only in soil samples collected from below the water table, supporting the belief that the detected dissolved constituents are migrating with the ground water.

4.5.2 Laboratory Analytical Results for 1996 Samples

During Stage 1 of the Site 03/Nike Source Area Characterization and Offsite Investigation, 20 subsurface soil samples were collected during the drilling of EA-101 through EA-109 during June 1996 and submitted to CEIMIC. These samples were analyzed for TCL VOC for confirmation and comparison to the field GC results for related samples. The results are summarized in Table 2-2. Comparison of results in Table 2-2 with Table 2-1 indicate similar total CVOC detections at to slightly above the detection limits, except for the higher PCA concentration detected in the field and lab analysis of sample EA-102 (29-31 ft bg). Figure 4-1 illustrates the distribution of the detected VOC. As shown on Figure 4-1, traces of CVOC were detected in at least one of the two samples from each boring except for EA-105. The acetone detected in several of the samples is believed to be related to the use of isopropanol in the decon process for the split-barrel soil sampler.

4.5.3 Findings and Conclusions

1. Based upon the trace concentrations of CVOC detected in soil samples from above the water table, well borings EA-101 and EA-102 may be located near a potential historical surface or vadose zone spill/release (source) area containing CVOC. Boring/well EA-102 is located in the vicinity of a former Peabody Industries drum storage area (Figures 1-2 and 2-1). Additionally, these borings are located approximately up gradient from MW03-14D where the highest concentrations of total CVOC have been detected in ground-water samples.

2. Based upon the data from borings EA-101 through EA-109, the MW03-14D/EA-102 area appears to be the subsurface CVOC source area. Although the exact location of the original CVOC release/spill is not known, this subsurface area appears to now be where the source for the dissolved CVOC plume in ground-water is located. Residual CVOC DNAPL may be present on the soil, or as ganglia between the soil particles, in the vicinity of the MW03-14D screened interval. If present, residual CVOC DNAPL would serve as a source for dissolved CVOC in the ground water as the water flows through it.

4.6 Volatile Organic Compounds Detected in Ground Water

This section describes the results of ground-water samples collected for VOC analysis during the following three field activities under Stages 1, 2, and 3: (1) field GC screening analysis of ground-water samples collected in June 1996 during the drilling of EA-101 through EA-109 (Stage 1) , (2) laboratory analysis of samples collected in December 1996 from 38 deep (D) monitoring wells located in the western portion of Zone 3 (Stage 2), and (3) laboratory analysis of samples collected in March 1998 from 17 deep (D) and four rock (R) monitoring wells (Stage 3). No LNAPL or DNAPL was measured in the monitoring wells sampled during these three stages of field work, nor were they reportedly observed in previous investigations (EA 1996b, TRC 1991, 1994; Metcalf & Eddy, 1994; SEC, 1988).

4.6.1 Field GC Headspace Analytical Results

A ground-water sample was collected at each boring location (EA-101 through EA 109) from the interval just above competent (coreable) bedrock and field analyzed (screened) by GC. A summary of the results is included in Table 2-1. These screening data were used in the decision process for completion of each of these nine borings: if VOC were not detected, the boring would be backfilled with grout, but if VOC were detected, the boring would be completed as a monitoring well. Because at least traces of CVOC were detected in the ground-water samples from each of the borings, the nine borings were each completed as monitoring wells.

4.6.2 Deep Ground Water

This section presents the VOC detected in the deep ground water in two parts including summaries of VOC detected in the samples collected in December 1996 and March 1998, and conclusions based on the concentrations and distribution of the detected VOC in the deep ground water. The December 1996 sampling event obtained samples from nine new monitoring wells (located in the vicinity of the former Nike Site), plus 29 existing wells to provide data for assessment of potential natural attenuation of the CVOC plume. The March 1998 sampling event obtained samples from eight new monitoring wells (located along the northern and southern perimeter of the CVOC plume), plus 13 selected wells to spot check and confirm the 1996 natural attenuation sample results.

December 1996 Sample Results:

The location of the wells sampled in December 1996 are shown on Figure 2-3. The validated results of the VOC detected in the ground-water samples collected from 38 monitoring wells are summarized in Table 4-2. Figures 4-4 and 4-5 illustrate the distribution of total and individual (respectively) CVOC detected in the ground water samples collected from deep ground water in the western portion of Zone 3. VOC were detected in 27 of 38 ground water samples. In general, Figures 4-4 and 4-5 show that the highest total and individual (respectively) CVOC concentrations were detected in the sample from MW03-14D (423,000 μg/L) which was comprised of the following three CVOC: PCA (260,000 μg/L), TCE (150,000 μg/L), and cis-1,2-DCE (13,000 μg/L). Within a short distance north (EA-101, EA-103, and EA-106D), west (EA-105 and EA-107), and southwest (EA-108), the detected concentrations quickly decrease to between 'not detected' and 3 μg/L. The main detected total CVOC plume extended from the former Nike Site area (MW03-14) to beneath the adjacent and down gradient Navy property toward: (1) the northeast through EA-104 (899 μg/L) and MW-

Z3-01 (61 μg/L), and (2) east toward Building 224 with localized higher detected concentrations at MW03-06D (just west of Site 03), at MW01-12 (southwest of Site 01), and at MW02-07D (near Study Area 2). CVOC were not detected in the sample from EA-103 located along the eastern perimeter of the 'pipe structure' (reportedly used historically as a training area by the Navy, Section 1.3.5). CVOC were not detected in 5 of the 6 easternmost located monitoring wells (MW-Z3-02, MW01-13D, RMW-01D, RMW-02D, and MW-Z4-01) and only 2 μg/L was detected at MW01-14D. Therefore, these data indicate that the eastern extent of the monitoring well network is beyond or at the fringe of the CVOC plume in the deep ground water and appears to be at good locations to monitor current conditions in the deep zone.

Many of the monitoring wells located east from MW03-14D and sampled in December 1996, were previously sampled in 1995 (Figure 1-3). For ease of reference, the 1995 ground-water sample VOC results are included in Appendix I with the December 1996 and March 1998 sample results. Additionally, the total and individual CVOC detected in 1995 are presented on Figures 4-2 and 4-3, respectively. The 1996 sample results confirm the general CVOC plume location and the relative detected concentrations. However, the 1996 detected concentrations for several samples indicated a considerable decrease from 1995.

March 1998 Sample Results:

The location of the wells sampled in March 1998 are shown on Figure 2-4. The validated results of the VOC detected in the ground-water samples collected from 17 deep (D) monitoring wells are summarized in Table 4-3. Figures 4-6 and 4-7 illustrate the distribution of total and individual (respectively) CVOC detected in the samples collected from deep ground-water zone. VOC were detected in 13 of the 21 deep ground water samples. In general, Figures 4-4 and 4-5 show that the highest total and individual (respectively) CVOC concentrations were detected in the sample from MW03-14D (373,500 μg/L) which was comprised of the following six CVOC: PCA (210,000 μg/L), TCE (130,000 μg/L), and cis-1,2-DCE (13,000 μg/L), trans-1,2-DCE (7,800 μg/L), 1,1,2-TCA (4,800 μg/L), and PCE (2,900 μg/L). Within a short distance west (EA-105), the detected concentrations decrease to 'not detected'. The main detected total CVOC plume extends from the former Nike Site area (MW03-14) to beneath the adjacent and down gradient Navy property toward: (1) the northeast through MW-Z3-01 (1,181 μg/L) and EA-112D (42.8 μg/L), and (2) east toward Building 224. CVOC were not detected in the 3 southeastern monitoring well samples (EA-110D, MW-Z4-01, and MW-Z4-02) located near the border between NCBC Zones 3 and 4. Only 3.6 μg/L of total CVOC was detected in the sample from the easternmost well sampled (MW01-14D). Therefore, these data indicate that the southwestern and western (EA-105, -107, and -108), northern (EA-106D and -113D), eastern (MW-Z3-01; MW01-13D and -14D; and RMW-01D), and southeastern (EA-110D and -111D) extent of the monitoring well network appears to be beyond or at the fringe of the CVOC plume in the deep ground water and continues to appear to be at good locations to monitor current conditions in those deep zone areas. Monitoring wells EA-106D (located at the north edge of the site property) and EA-113D (located north, offsite on private property) were installed to assess the CVOC plume extent north between the former Nike Site (and northwest from the MW-Z3-01 vicinity) and the five nearest offsite residential water supply wells. Only 1 μg/L (EA-106D) and 1.5 μg/L (EA-113D) total CVOC were detected..

Conclusions:

The data indicate that the southwestern and western (EA-105, -107, and -108), northern (EA-106D and -113D), eastern (MW-Z3-01; MW01-13D and -14D; and RMW-01D), and southeastern (EA-110D and -111D) extent of the monitoring well network appear to be beyond or at the fringe of the CVOC plume ('not detected' to less than 4 μg/L total CVOC) in the deep ground water, and continue to appear to be at good locations to monitor current plume extent conditions in those deep zone areas. The exception is toward the northeast and offsite at EA-112D.

Based upon the 1995, 1996, and 1998 ground-water sample results, the highest concentration of total CVOC in deep ground water was detected in the samples from MW03-14D and the resultant dissolved CVOC plume appears to be migrating east and northeast. There appears to be only trace to no concentrations of CVOC migrating west and north toward the property boundary from the MW03-14 vicinity. However, toward the northeast from the MW03-14 vicinity, total CVOC was detected at 42.8 μg/L in the sample from EA-112D located offsite on private property. In general, the MW03-14D vicinity was the only main subsurface CVOC source area identified.

As shown in Appendix I where the available VOC data have been compiled for comparison and as summarized in Table 4-4, the following observations are apparent:

(1) Based upon 12 monitoring wells with 2 to 3 years of data, detected total CVOC concentrations are decreasing or remaining approximately the same for samples from beneath Study Area 01 (MW01-12D and -14D), Sites 02/03 (MW02-03D, -10D, and -11D; MW03-02D, -03D, and -10D; and MW-Z3-03), and the Nike source area (MW03-14D, and MW03-12D and -13D where substantial CVOC decreases were indicated);

(2) Detected CVOC concentrations decreased from 1995 to 1996, but increased from 1996 to 1998 (although not up to the 1995 values) at MW03-08D (3 yrs of data) located between the Nike source area and Site 03; and

(3) Detected concentrations of CVOC increased in samples from three wells each with 2 to 3 years of data (MW03-07D, MW03-09D, and MW-Z3-01) and located between Site 03 and the Nike source area.

4.6.3 Bedrock Ground Water

This section presents the CVOC detected in the samples collected from four wells screened within bedrock in 1998 and sampled during the March 1998 event. A summary of the sample results is included in Table 4-3. Figures 4-8 and 4-9 illustrate the distribution of total and individual (respectively) CVOC detected in the ground-water samples collected from these wells. These wells were installed to assess the potential presence of the CVOC plume in the bedrock near the southern (EA-110R and EA-111R) and northern perimeter (EA-106R and EA-112R) of the plume. During the December 1996 sampling event, no monitoring wells screened in bedrock were sampled.

Along the southern perimeter up gradient from NCBC Zone 4, CVOC were not detected in the sample from EA-110R; however, a trace of toluene (2 μg/L) was detected. Toluene is not a typically detected constituent of the CVOC plume that emanates from the MW03-14D vicinity. Traces of chloroform (1 μg/L) and PCE (1 μg/L) were detected in the sample from EA-111R, along with a trace (1 μg/L) of toluene. These data indicate that the southeastern extent of the monitoring well network is beyond or at the fringe of the CVOC plume in the ground water within bedrock and appears to be sufficient to monitor current conditions in this zone.

Along the northern perimeter, none of the VOC (CVOC or petroleum VOC) parameters were detected in the sample from EA-106R. This well is located between the former Nike Site and the five nearest identified residential water supply wells north of the site. Although no petroleum VOC were detected in the sample from EA-112R, the following five CVOC were detected: TCE (90J μg/L), PCA (18 μg/L), cis-1,2-DCE (44 μg/L), trans-1,2-DCE (12 μg/L), and TCA (4 μg/L). This well is located offsite and within the northeast trending valley in the bedrock surface that begins just east of MW03-14, along which a portion of the dissolved CVOC plume seems to be migrating. No residential water supply wells have been identified by the Town northeast from EA-112R along the apparent trend of this relatively small portion of the CVOC plume. Based upon these data, well EA-106R appears to be beyond the CVOC plume in the ground water within bedrock and appears to be at a good location to monitor current conditions in this zone between the site and the five nearest identified residential water supply wells north of the site.

4.7 NATURAL ATTENUATION ASSESSMENT

4.7.1 Introduction And Background

At one time, chlorinated solvents were believed to be persistent in the subsurface environment because they were found to be resistant to degradation. However, studies in the early 1980's indicated that chlorinated VOC biologically degraded in anaerobic environments by reductive dechlorination (Bouwer and McCarty, 1983, and Vogel and McCarty, 1985). Additional studies in the late 1980's indicated that certain CVOC were aerobically biodegradable, in the presence of certain substrates (due to cometabolism).(Wilson and Wilson, 1985, Little et al.,1987).

The rates of aerobic cometabolic chlorinated aliphatics degradation is generally faster than anaerobic dechlorination. However, the conditions necessary for aerobic degradation are rarely found in the subsurface. In the absence of conditions favorable to cometabolism, chlorinated aliphatics are unlikely to be oxidized because of the relatively high oxidative state of the carbon atoms. However, where appropriate subsurface anaerobic conditions exist (presence of electron acceptors such as NO_3^-, Fe^{3+}, and SO_4^{2-}, and/or methanogenic conditions) chlorinated aliphatic may naturally biodegrade.

The following is a summary evaluation of the results of the natural attenuation sampling that has been conducted at Site 03/Nike. The purpose of this evaluation is to provide a preliminary indication of the potential for biodegradation of chlorinated compounds detected at the site. The evaluation focuses on the deep (till and weathered bedrock) ground-water zone material where the majority of the CVOC have been detected.

An initial round of sampling for VOC was conducted in 1995 (refer to Figure 1-3 for the well locations). After the installation of nine new wells in the vicinity of the former Nike Site, the 38 wells shown in Figure 2-3 were sampled in 1996 for VOC and natural attenuation parameters. In March 1998, a subset of thirteen of these wells, plus eight new monitoring wells that were installed in January-February 1998 (Figure 2-4), were sampled. These samples were again analyzed for VOC and natural attenuation parameters.

The Site 03/Nike study is an assessment of the natural attenuation of the chlorinated aliphatic portion of the CVOC, not the chlorinated aromatic portion (eg, chlorinated benzene compounds). Therefore, where 'CVOC' is stated in this report, it refers to the chlorinated aliphatic portion. The chlorinated aliphatics detected in ground-water samples from the till and weathered bedrock zone include: tetrachloroethylene (PCE); 1,1,2,2-tetrachloroethane (PCA), trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), cis- and trans- 1,2 dichloroethylene (DCE), and dichloroethane (DCA);vinyl chloride (VC), chloroform, chloromethane and carbon tetrachloride . The more oxidized of these compounds (PCE, PCA, TCE) are the most favorable electron acceptors. They can be reductively dechlorinated to ethylene (Freedman and Gossett 1989). However, the microorganisms mediating the reduction require reducing conditions, an electron donor and a carbon source for cell growth. Evidence of intermediate daughter products, like TCE, DCE, and VC, can provide indirect evidence of biodegradation.

4.7.2 CONCEPTUAL MODEL

4.7.2.1 Geologic Conceptual Model

Till and weathered bedrock overlie the competent (coreable) bedrock (generally quartzite with some phyllite) beneath the site. Figure 2-2 shows the interpreted surface of the competent bedrock at the site. The competent bedrock surface appears to generally slope down toward the east.

Figure 3-7 shows hydraulic heads for the till and weathered bedrock as gauged in February 1998. This gauging round included a greater number of wells than did earlier gauging events. However, similar flow regimes were observed from gauging data in 1995, 1996 and 1997 with two main exceptions:

1.) in each of the previous two gauging events, there was insufficient resolution to clearly show the ground-water mound that appears in the vicinity of the gravel pit area; and

2.) ground-water levels appear to fluctuate by up to 6 ft. depending on the time of year and amounts of rainfall.

As shown in Figures 3-6 and 3-7, ground-water flow in the weathered bedrock and till material west of Building 224 is generally east to east southeast. Apparently as a result of localized ground-water mounding near the gravel pit, ground water east of Building 224 appears to flow northeasterly. Average ground-water velocities in the deep zone range from approximately 0.004 ft/day west of Building 224 to approximately 0.01 ft/day east of Building 224 (based on both 1996 and 1998 ground-water level data). Because of the localized ground-water mound in the vicinity of the old gravel pit, a small southern portion of the CVOC plume and ground water appear to flow toward the southeast.

4.7.2.2 Potential Source Areas Conceptual Model

Based on the 1996 ground-water sample analytical results, four potential source areas have been conceptually identified at the Site 3/Nike Site area (Figure 4-10). The main source area is apparently located immediately east of the former Nike missile silo area. Three smaller potential source areas (apparent localized increases in the total CVOC concentrations along the plume area) include: south of Study Area 1 in the vicinity of MW01-12D; west of Site 03 in the vicinity of MW03-06D; and south of Building 224 in the vicinity of MW02-07D. The distribution of CVOC indicates the presence of the main CVOC source area in the vicinity of MW03-14D and EA-102. Fewer wells were included in the March 1998 sampling effort, as a result it is not possible to delineate the smaller potential source areas with these data. The highest concentrations of total CVOC have been detected in the ground-water samples collected from MW03-14D (526,480 μg/L in May 1995, 423,000 μg/L in December 1996, and 373,500 μg/L in March 1998). CVOC detected in ground-water samples from MW03-14D and EA-102 include: PCA, PCE, TCE, TCA, DCE, DCA, chloroform, and carbon tetrachloride. However, the main constituents are PCA and TCE. Based upon the 1995, 1996, and 1998 sample data for MW03-14D as shown in Appendix I and Table 4-4, the total and individual detected CVOC have steadily decreased. Detected concentrations of CVOC increased (Table 4-4) in samples from MW03-07D, MW03-09D, and MW-Z3-01 which are located between Site 03 and the MW03-14D source area. This may represent a pulse of increased CVOC migrating from the MW03-14D area as the source concentration continues to decline.

The types of compounds reportedly stored, used and/or disposed at the sites could produce the pattern and distribution of CVOC detected in the ground-water samples. Solvents, including TCA and TCE, were reportedly used at the Nike Site and were disposed on the ground (ESE, 1984; Law, 1986). DANC, which contains PCA, was reportedly stored at the Disaster Recovery Training Area, and may have been "dumped" down the pipe structures or used during training exercises (Hart, 1984). However, CVOC were not detected in the December 1996 ground-water sample from EA-103 (located just east of the 'pipe structure') and does not support the 'pipe structure' as being a CVOC source area. CVOC were present in the soil and ground water beneath the Peabody Clean Industries Site (Metcalf & Eddy, 1994). The former vehicle wash rack located west of Building T16CT was eliminated as a potential VOC source based on GC headspace screening of soil samples collected from beneath the drainage pit and along the drain line leading south from the wash rack to a catch basin. The area west of Site 03 and east of Seabee Avenue (Figure 1-2) was used for storage of supplies and equipment, and no historical documentation is available to indicate the presence of a specific potential source location(s) in that area.

4.7.3 REDOX ZONATION

In general, microorganisms that use chlorinated aliphatics as electron acceptors must compete with microorganisms using other electron acceptors. Microorganisms utilizing more energy-producing electron acceptors, such as oxygen and nitrate, can typically out-compete chlorinated aliphatic-reducing organisms. Reductive dechlorination is most often reported under highly reducing conditions such as sulfate-reducing and methanogenic environments, however reductive dechlorination has also been observed under nitrate- and iron-reducing conditions (Bouwer 1994).

Figure 4-11 presents a conceptual model of the various redox zones that appear to be present beneath the site based on the sampling conducted in 1996. The conceptual model was developed from electron acceptors (like dissolved oxygen (DO), nitrate, sulfate, and carbon dioxide), biogenic products [iron (II), hydrogen sulfide, ammonia, etc.], redox potential, and hydrogen concentrations from each of the sampled deep(D) wells. Some field measured DO values did not correlate with values collected for other measured parameters. When evaluating in-situ conditions, the value for all parameters collected was considered and, in some instances, greater weight was given to Eh, other electron acceptor concentrations, and hydrogen concentrations in evaluating the dominant electron acceptor being utilized in the vicinity of a given well.

Only one area appeared to possibly be indicative of methanogenesis. This area corresponded to a region of higher total organic carbon (TOC) values and a potential source area southwest of Study Area 1. It is speculated that the higher TOC values in this area may be the result of a former leaching field which collected storm water runoff from a truck washing area near Building 224. No organics other than CVOC were detected in lab analyses of ground-water samples collected from monitoring wells in this area. The higher organic carbon concentrations are likely responsible for the more reducing conditions in this area and provide an electron donor for reductive dechlorination. Thus, this area is likely the most promising for microbial degradation of the CVOC.

A sulfate-reducing zone appears to be present outside of the methanogenic zone near Study Area 1 Another sulfate-reducing zone appears to exist in the source area south of Perimeter Road, near the Navy/RIEDC property boundary. The majority of the remainder of the site appears to be an iron-reducing zone, with nitrate-reducing zones potentially appearing at the fringes of plumes

Data collected in March 1998 generally support the conceptual redox zonation developed from the 1996 data. Using well EA-105 as a background well, it appears that most of the site remains iron reducing, especially the eastern portion of the site. Specifically, concentrations of various analytes reported in samples collected from wells EA-111D, EA-110D, MWZ3-03, MW02-10D, EA-113D and EA-112D appear to indicate iron is the dominant electron acceptor. Several wells appear to indicate the presence of both iron-reducing and aerobic microorganisms likely resulting from micro environments where one or the other dominates. Wells MW-03-14D, MW03-07D, MW03-03D, and MW02-03D fit within this group. A small methanogenic zone appears to persist in the vicinity of MW01-12D that may extend to MW01-14D. In addition, sulfate appears to continue to be the dominant electron acceptor in the vicinity of well MWZ3-01.

4.7.4 EVALUATION OF CHLORINATED ALIPHATIC DEGRADATION

As stated above, the electron acceptor conditions beneath the site appear to be amenable, although not optimal, for chlorinated aliphatic biodegradation. The majority of the site appears to be dominated by a combination of iron- and sulfate-reducing mechanisms with a small area of methanogenesis. While much of the ground water geochemistry, such as low dissolved oxygen and higher than normal dissolved hydrogen, indicate a reducing environment, the limiting factor which will control the rate of reductive dechlorination is mass of electron donor (carbon source). No significant levels of non-CVOC (potential electron donor) were detected in the December 1996 or March 1998 ground water samples, and reported TOC concentrations ranged from 1.2 mg/L in background wells to 29.1 mg/L beneath the area near Building 224. Therefore, the site conditions are conducive to reductive dechlorination, but, the rate at which it will occur is likely limited by the supply of electron donor in ground water.

4.7.4.1 Natural Attenuation Screen

A natural attenuation potential screen was conducted following a screening method described in the draft *Technical Protocol for Evaluating the Natural Attenuation of Chlorinated Solvents in Ground Water* (AFCEE 1996). In the screen, points are awarded for compound concentrations above certain screening criteria [e.g., three points are awarded if the iron (II) concentration exceeds 1 mg/L in the most contaminated zone]. Table 4-5 provides a summary of the scoring criteria for the various analytical parameters. A score greater than 20 points indicates that there is strong evidence for biodegradation of chlorinated organics; a score between 15 and 20 indicates that there is adequate evidence for biodegradation; and a score between 6 and 14 indicates that there is limited evidence for biodegradation.

In 1996, a screen was conducted using the source well MW03-14D which led to a score of 14. Using the 1998 data, a more comprehensive screen was conducted for six representative monitoring wells along the center line of the dissolved phase plume. Wells include: EA-105 (background), MW03-14D (source area), MW03-07D (downgradient), MW02-10D (downgradient), MW01-14D (downgradient), and EA-112D (cross gradient). Results of this natural attenuation screen are shown in Table 4-6. A rating of four was scored for the background well. Monitoring wells within the dissolved phase plume scored values ranging from 9 up to 19. Three wells scored above 15 and two scored below 15. Based on screens using both data sets, the site exhibits adequate to limited evidence for biodegradation of chlorinated organics.

4.7.4.2 Daughter Products Analysis

Based on the ground-water data from the May 1995, December 1996, and March 1998 sampling events, there appears to be evidence that daughter products are present at the site. For example, TCE, DCE, and TCA were detected in numerous wells onsite during each sampling event. In addition, the detected cis-1,2-DCE concentrations, the dominant microbially produced isomer, were significantly greater than detected trans-1,2-DCE concentrations (only observed in 1996 and 1998 as the 1995 analysis could not distinguish cis-1,2 DCE from trans-1,2-DCE and yielded a sum of the two isomers). Low concentrations of VC were detected in four of the 1995 ground-water samples (MW03-12D, MW03-09D, MW03-06D, and MW03-03D); however, VC was not detected in the aforementioned ground-water samples or any other of the December 1996 samples. During March 1998, low levels of VC were reported in samples from wells MW02-10D (1 μg/L), MWZ3-03 (0.8 μg/L), and MW02-03D (0.7 μg/L).

The distribution of PCE, TCE, 1,2-DCE (total), and VC is illustrated in Figure 4-12 for the 1995 and 1996 sample analyses. Similarly, Figure 4-13 presents the distribution of PCA, TCA, 1,1-DCE, and VC for the 1995 and 1996 sample analyses. These distribution maps show that the ratio of detected TCE concentrations to detected 1,2-DCE (total) concentrations and the ratio of detected PCA concentrations to detected TCA concentrations are similar for the 2 years. This trend suggests that conditions have remained relatively stable over the 1-year period, which is evidence against significant transformation of the parent compounds into daughter products over the relatively short study duration.

Figures 4-6 and 4-7 show the detected concentrations for detected CVOC from the March 1998 sampling event (refer to Section 4.6.2). In general concentrations are similar to those reported for 1995 and 1996. The TCE:DCE ratio increased for 3 wells (MW-02-10D, MW03-14D and MWZ3-03), decreased for 5 wells (MW01-12D, MW03-03D, MW03-07D, MW03-08D and MWZ3-01) and remained relatively constant for 3 wells (EA-105, MW01-14D, and MW02-03D); again suggesting no marked changes in the ratio of these compounds.

4.7.4.3 Evaluation of Extent of VOC Migration

The extent of VOC migration was evaluated based on an estimate of ground-water advection and retardation factors along ground-water flow pathways in two of the apparent source areas (MW03-14D to MW03-07-D and MW03-06D to MW03-05D) using 1996 data. Table 4-7 summarizes the calculated travel times. Based on this analysis, it can be seen that the PCE and TCE dissolved-phase plumes emanating from the former Nike Site source (MW03-14D) appear to have traveled as far as would have been expected for a 40-year-old plume (assuming release from the former Nike Site which was reportedly constructed in 1955-56 and deactivated in 1962).

Based on the analysis for a plume emanating from a potential source located west of Site 03 (MW03-06D) and assuming a 40-year-old plume (Site 03 disposal activity reportedly from 1955 to the late 1970s), it appears that the TCE and DCE dissolved-phase plumes have traveled as far as would be expected (i.e., to the vicinity near MW03-03D). As this evaluation assumed no degradation in the travel time estimates and the travel times appear to be consistent with observed spatial locations of the dissolved-phase plumes, biodegradation does not appear to be a significantly active attenuation process, although it may be occurring at a slow rate.

4.7.5 POTENTIAL RECEPTOR EVALUATION

Five domestic wells are present in a residential area located just north of the Nike site and appear to be the nearest potential receptors. However, these wells are apparently cross-gradient from the impacted area and use of these wells is unlikely to create a large enough radius of influence to change the natural direction of ground-water flow and plume migration. Monitoring wells EA-106D/R (located at the north edge of the site property) and EA-113D (located north, offsite on private property) were installed to assess the CVOC plume extent north between the former Nike Site (and northwest from the MW-Z3-01 vicinity and west from offsite well EA-112D/R) and the five nearest offsite residential water supply wells. Only 1 μg/L (EA-106D) and 1.5 μg/L (EA-113D) total CVOC were detected. CVOC were not detected in the sample collected from EA-106R. While three CVOC detected in samples from offsite well EA-112D/R exceed RIDEM GA standards, the trace CVOC detected in samples from onsite wells EA-106D and offsite well EA-113D do not exceed GA standards.

The closest surface water body downgradient of the site is Allen Harbor. The closest wells with detected total CVOC concentrations are wells MW01-15D (16 μg/L in 1996) and MW01-14D (3.6 μg/L in 1998), approximately 1800 and 1500 ft upgradient of Allen Harbor, respectively. However, between these wells and Allen Harbor is MW01-13D for which the December 1996 ground-water sample was 'not detected' for CVOC. Ground-water travel time estimates from wells MW01-15D (16 μg/L total CVOC in 1996) and MW01-14D (3.6 μg/L total CVOC in 1998) to Allen Harbor are approximately 17 and 14 years, respectively, if the average measured hydraulic conductivity for deep on-site wells (5.7 ft/d) is used (EA 1996)[2].

[2] Assumes K = 5.7 ft/d, hydraulic gradient = 0.01 ft/ft, porosity = 0.2 and distances as given in text.

Constituents in ground water would be expected to travel at a much slower rate than this because of retardation and biodegradation. Accounting for retardation, travel times for TCE are 22 and 18 years, respectively.[3] Using a more location-specific hydraulic conductivity from well MW02-03D of 6.3 ft/d (EA 1996a), the ground-water travel times are estimated to be 17 and 13 years, respectively. Accounting for retardation, travel times for TCE are estimated to be 20 and 16 years, respectively. It is hypothesized that a combination of abiotic and low rate biotic processes alone may reduce the CVOC concentrations to below risk-based levels prior to completion of this potential receptor pathway.

It should be noted that the potential receptor evaluation presented above does not account for possible future development of the NCBC and former Nike site properties. However, the ground water beneath Site 03/Nike is classified by RIDEM as GB (presumed to require treatment prior to drinking). It is unlikely to be used as a drinking water source. Deed restrictions would preclude the potential use of ground water at the NCBC and former Nike site properties. Ground water immediately north of the NCBC and former Nike site properties (offsite), ie. north of Perimeter Road, is classified by RIDEM as GA (presumed not to require treatment prior to drinking). The analytical results of samples from monitoring well cluster EA-112D/R (located in this area) show exceedences of the GA ground-water standards for TCE, PCE, and cis-1,2-DCE..

[3] Assumes a retardation factor of 1.3 based on soil bulk density of 2 g/mL (EA 1996), Koc of 137 mL/g (AFCEE 1996), foc of 0.02% (EA 1996) and porosity of 0.2 (EA 1996).

5. CONCLUSIONS

Based upon the boring and sample data and findings of this Site 03/Nike Source Area Characterization, Offsite Investigation, and Natural Attenuation Investigation of the western portion of Zone 3, the following conclusions are drawn:

1. The data support the findings reported in the Draft Final Phase III RI (EA 1996a) and show that the subsurface geology from the former Nike Site east to the Sites 01 and 02 area is characterized by Quaternary glacial deposits mantling the quartzitic and phyllitic bedrock (weathered and competent, coreable zones) of the Rhode Island Formation. In general, based upon logs of borings, the unconsolidated sedimentary (glacial) deposits consist of the following units presented in order from the ground surface downward: (1) glacio-fluvial deposits of sand with varying amounts of silt and/or gravel, (2) glacio-lacustrine deposits of silt to very fine sand and silt, and (3) sandy silty gravel to sandy gravelly silt (possibly till) (Figures 3-1 to 3-5).

2. The identified geological units have been divided into three hydrogeological zones (beginning with the uppermost zone): (1) shallow ground-water zone (typically the glacio-fluvial sand unit), (2) deep ground-water zone (the sandy silty gravel to sandy gravelly silt [possibly till] unit and the weathered bedrock zone), and (3) competent bedrock ground-water zone (the upper approximately 25 ft of competent bedrock). The sandy gravel / gravelly sand and weathered bedrock units are considered as a single ground-water zone (the deep zone) because: (1) no apparently continuous layer of lower permeability material (e.g. a clay layer) was encountered through this zone that could subdivide this zone, (2) the weathered bedrock where quartzite (hard) and phyllite (soft) are interbedded, forms a zone that is hydrogeologically similar because of the apparent horizontal and vertical variation observed which would allow for horizontal and vertical flow (hydraulic communication) through it, and (3) the two units are in direct hydraulic communication. All three of these ground-water zones are in direct hydraulic communication beneath the former Nike Site where the main subsurface CVOC source has been detected. Further east (down gradient) beneath the adjacent Navy property, the shallow and deep ground-water zones are separated by a layer of silt to sandy silt (Figures 3-4 and 3-5).

3. Based on the ground-water surface data (Figure 3-7), the deep zone ground water is interpreted to flow southeast from the former Nike site and the residential area located north of the Nike Site, and then, east southeast across Site 03 to an area where a slight ground-water mound is present northeast of the intersection of Marine Road and Davisville Road. This mound may be related to infiltration of rain during Winter 1998 that collected in the vicinity of the former gravel pit ('Snake Pit'). Because of this slight mound as interpreted from the February 1998 data, the ground-water flow east from the Nike Site appears to diverge in the vicinity of Building 224 to the northeast and southeast. There is also still a small portion of the study area, west of the former Nike missile silos, where deep ground water is interpreted to flow toward the west.

Based upon the February 1998 water level data, ground-water flow in the bedrock is interpreted to be approximately toward the southeast from the former Nike site and the residential area located north of the former Nike Site (Figure 3-8).

4. Based upon the trace concentrations of CVOC detected in soil samples from above the water table, well borings EA-101 and EA-102 may be located near a potential historical surface or vadose zone spill/release (source) area containing CVOC. Boring/well EA-102 is located in the vicinity of a former Peabody Industries drum storage area (Figures 1-2 and 2-1). Additionally, these borings are located approximately up gradient from MW03-14D where the highest concentrations of total CVOC have been detected in ground-water samples.

5. Based upon the available data, the MW03-14D/EA-102 area of the deep ground-water zone appears to be the subsurface source area of the CVOC remaining from a historical release(s)/spill(s). Although the exact location of the original CVOC release(s)/spill(s) is not known, this subsurface area appears to now be where the source for the dissolved CVOC plume in ground water is located. Residual CVOC DNAPL may be present on the soil, or as ganglia between the soil particles, in the vicinity of the MW03-14D screened interval. If present, residual CVOC DNAPL would serve as a source for dissolved CVOC in the ground water as the water flows through it.
CVOC was not detected in the ground-water sample from EA-103 (located adjacent to the 'pipe structure'). Based on this data, the 'pipe structure' (reportedly used historically as a training area by the Navy) does not appear to be a source for the CVOC plume.

6. Based upon the 1995, 1996, and 1998 ground-water sample results, the highest concentrations of total CVOC in deep and bedrock ground water were detected in the samples from MW03-14 (Figures 4-2, 4-4, 4-6, and 4-8). The resultant dissolved CVOC plume appears to be migrating with the interpreted direction of ground-water flow from the former Nike Site area toward the east (beneath the adjacent, down gradient Navy property) and toward the northeast. There appears to be only trace to no concentrations of CVOC migrating west and north toward the property boundary from the MW03-14 vicinity. This appears to be because the main subsurface CVOC source area is located in the eastern portion of the slight ground-water mound present beneath the former Nike missile silos where ground-water flow is generally southeast and eastward (Figures 3-6 and 3-7). Toward the northeast from the MW03-14 vicinity, total CVOC was detected at 42.8 μg/L in the sample from EA-112D located offsite on private property. The interpreted upper surface of competent bedrock appears to slope downward east and northeast from the MW03-14 area and may have aided in directing the flow of the original heavier-than-water, separate-phase (DNAPL) CVOC release(s)/spill(s) material which has since continued downward through fractures in the bedrock. In general, the MW03-14 vicinity was the only main subsurface CVOC source area identified. Further east beneath the adjacent down gradient Navy property are three localized slight increases in the detected total CVOC concentrations at MW03-06D (just west of Site 03), at MW01-12D (southwest of Site 01), and at MW02-07D (near Study Area 2). These data may indicate the presence of three small Navy source areas that contribute to the CVOC plume detected in deep ground water or they may represent the remains of historical periodic pulses

of increased CVOC concentration migrating from the MW03-14D area as the source concentration declines (refer to #8b below).

7. Based upon data from EA-106D/R and EA-113D (located between the former Nike Site [and the CVOC detected at offsite well cluster EA-112] and the five nearest identified residential water supply wells north of the site), total detected CVOC ranges from 'not detected' to 1.5 μg/L. The individual CVOC detected in samples from these three monitoring wells do not exceed RIDEM GA standards. Additionally, the interpreted direction of deep ground-water flow is southeast away from these residential water supply wells. However, higher concentrations of total CVOC were detected in monitoring wells EA-112D (42.8 μg/L) and EA-112R (168 μg/L). EA-112D/R are located offsite and within the northeast trending valley in the bedrock surface that begins just east of MW03-14, along which a portion of the dissolved CVOC plume seems to be migrating. Three CVOC detected in samples from offsite well cluster EA-112D/R exceed RIDEM GA standards. GA ground water is presumed not to require treatment prior to drinking

The Town of North Kingstown, RI, reviewed their water department records for the area north of Perimeter Road and identified eight possible locations of private wells (Appendix G). They confirmed these wells and, on 6 May 1997, the RIDOH sampled these eight residential water supply wells for analysis of VOC (EPA Method 524). Figure 3-1 shows the approximate locations of the 5 closest wells located along Fletcher Road north of the former Nike Site. The figure in Appendix G shows the approximate location of all eight of the private water wells identified by the Town. None of the VOC analytes were detected in samples from these five wells, nor in samples from the northeasternmost 2 wells along Fletcher Road. Trace concentrations of PCE (0.7 μg/L) and 1,1,1-trichloroethane (1 μg/L) was detected in the sample collected from "Matoes" well, both of which are below the RIDEM standards (5 μg/L and 200 μg/L, respectively). This well is located more than 1500 ft beyond the north edge of Figure 2-2 (or more than 3,000 ft from the former Nike Site) northeast along Fletcher Road.

8. Based upon the 1995, 1996, and 1998 ground-water sample results (Table 4-4 and Appendix I), the following observations are apparent:

(a) For 12 monitoring wells with 2 to 3 years of data (located in the eastern portion of the dissolved CVOC plume and in the vicinity of the subsurface CVOC source area), detected CVOC concentrations are decreasing or remaining approximately the same for samples from beneath Study Area 01 (MW01-12D and -14D); Sites 02/03 (MW02-03D, -10D, and -11D and MW03-02D, -03D, and -10D, and MW-Z3-03); and the Nike source area (MW03-14D, and MW03-12D and -13D where substantial CVOC decreases were indicated). This suggests that a large portion of the detected CVOC plume appears to be stabilizing or decreasing in nature.

(b) Detected concentrations of CVOC increased in samples from three wells each with 2 to 3 years of data (MW03-07D, MW03-09D, and MW-Z3-01) and located between Site 03 and the MW03-14 source area. This may represent a periodic pulse of increased

CVOC migrating from the MW03-14D area as the source concentration continues to decline (refer to #6 above).

9. Based upon the range of scores from the preliminary natural biodegradation screening, the site was on the border between adequate to limited evidence for biodegradation of CVOC. Biodegradation does not appear to be a significantly active attenuation process, although it may be occurring at a slow rate.

10. Based upon the available detected CVOC data, the southwestern and western (EA-105, -107, and -108), northern (EA-106D and -113D), eastern (MW-Z3-01; MW01-13D and -14D; and RMW-01D), and southeastern (EA-110D and -111D) extent of the monitoring well network appear to be beyond or at the fringe of the CVOC plume ('not detected' to less than 4 μg/L total CVOC) in the deep ground water, and continues to appear to be at good locations to monitor current plume extent conditions in those deep zone areas. The exception is toward the northeast and offsite at EA-112D/R. EA-112D/R is within the northeast trending valley in the bedrock surface that begins just east of MW03-14, along which a portion of the dissolved CVOC plume seems to be migrating. The analytical results of samples from monitoring well cluster EA-112D/R show exceedences of the GA ground-water standards for TCE, PCE, and cis-1,2-DCE. No residential water supply wells have been identified by the Town northeast from EA-112D/R along the apparent trend of this relatively small portion of the CVOC plume.

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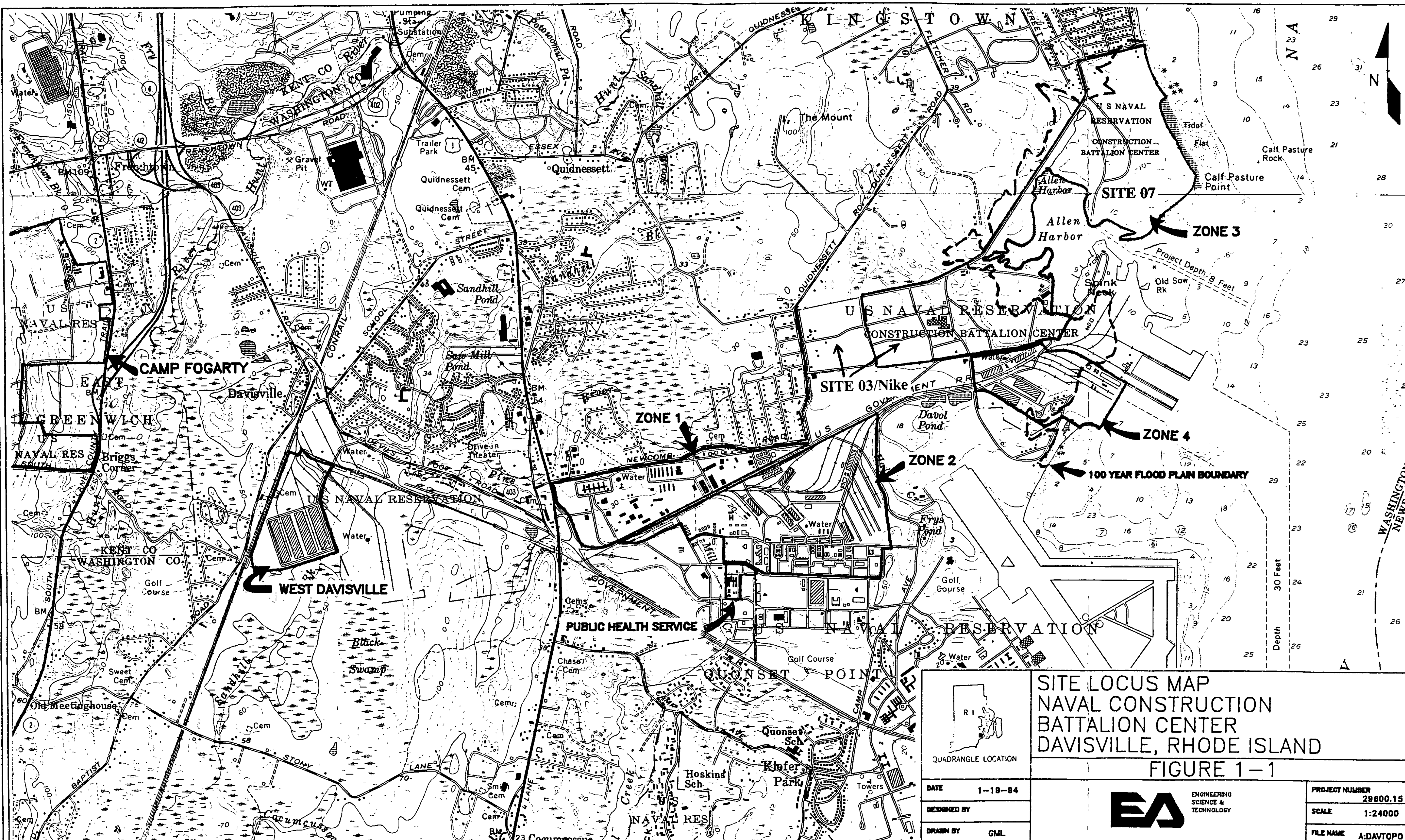


BASE MAP: U.S.G.S. EAST GREENWICH AND WICKFORD QUADRANGLE – RHODE ISLAND
7.5 MINUTE SERIES (TOPOGRAPHIC) 1942, PHOTOREVISED 1970 & 1975.

QUADRANGLE LOCATION

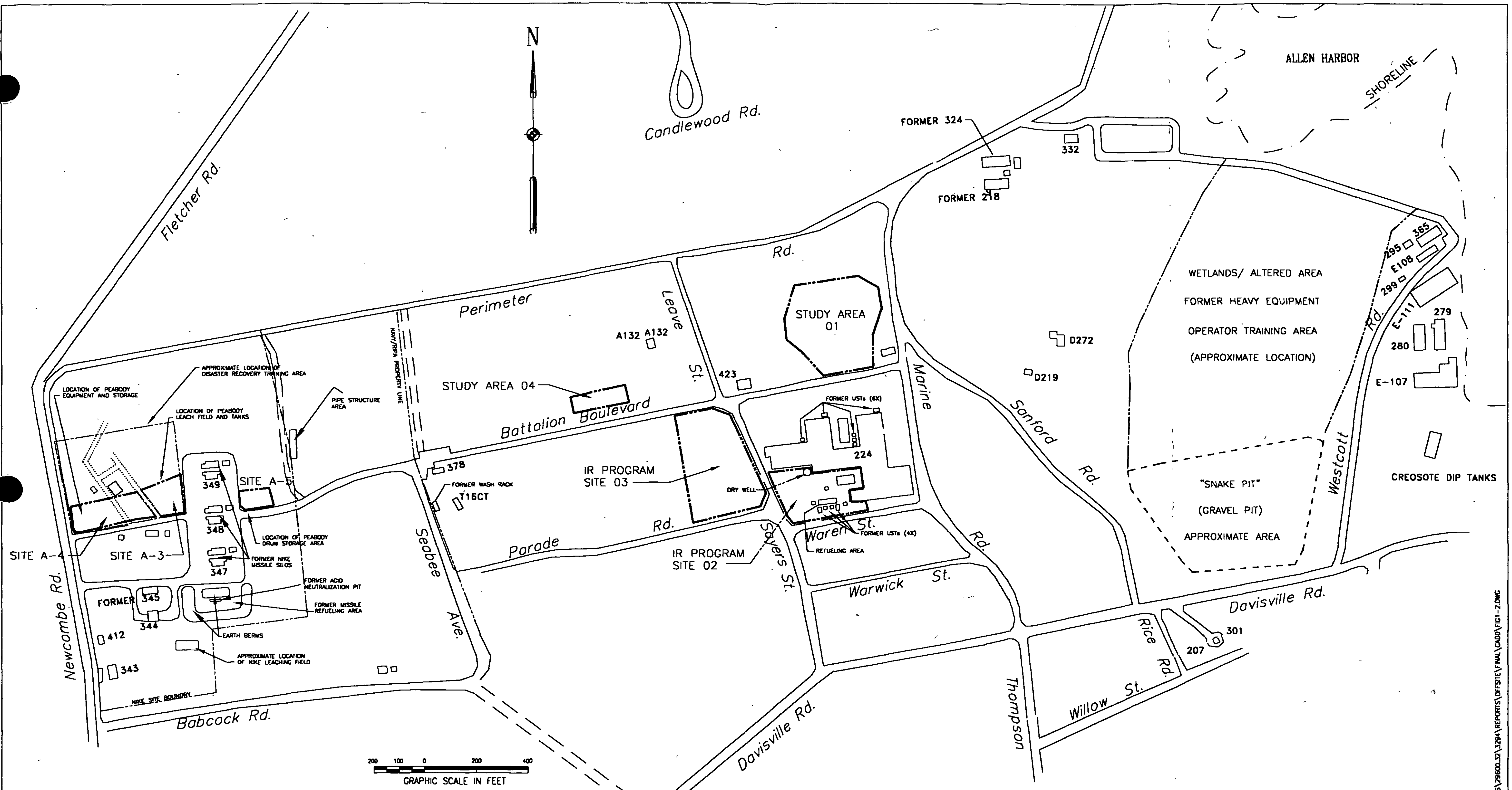
SITE LOCUS MAP
NAVAL CONSTRUCTION BATTALION CENTER
DAVISVILLE, RHODE ISLAND

FIGURE 1–1

DATE	1-19-94	PROJECT NUMBER	29600.15
DESIGNED BY		SCALE	1:24000
DRAWN BY	GML	FILE NAME	A:DAVTOPO
CHECKED BY	GML	DRAWING NUMBER	
PROJECT MANAGER	NAL	SHEET NUMBER	

EA ENGINEERING SCIENCE & TECHNOLOGY

SHARON COMMERCE CENTER
2 COMMERCIAL STREET, SUITE 106
SHARON, MASSACHUSETTS 02067
(617) 784-1767

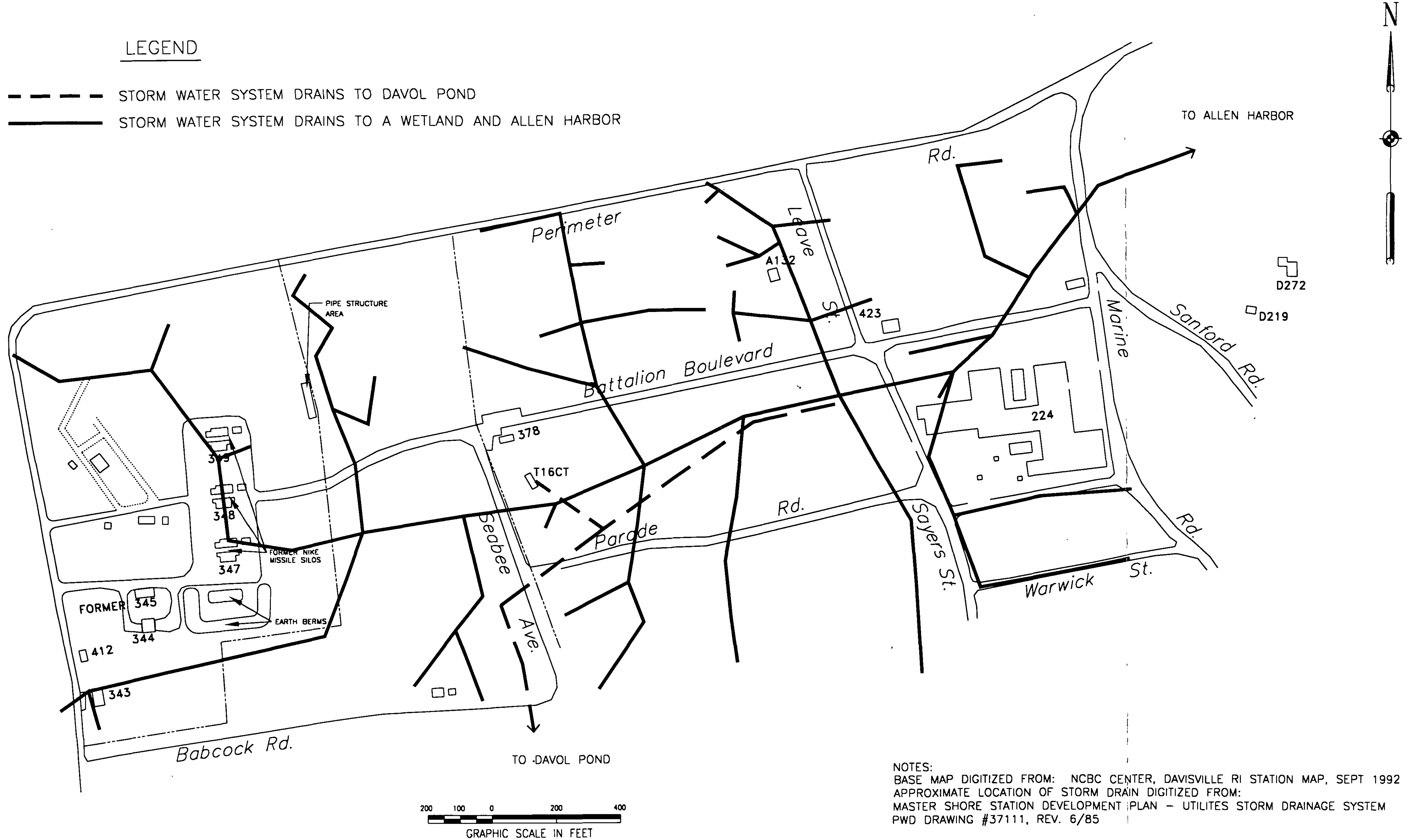


NOTES:
BASE MAP DIGITIZED FROM: NCBC CENTER DAVISVILLE RI STATION MAP SEPT 1992
MODIFIED FROM AERIAL PHOTO DATED 4/95

FILE NAME: F:\PROJECTS\29600.32\3294\REPORTS\OFFSITE\FINAL\CADD\FIG1-2.DWG

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY: NAL	DRAWN BY: JFW	DATE: 10/21/98	PROJECT NO.: 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	LOCATION MAP IR PROGRAM WESTERN PORTION OF ZONE 3
	CHECKED BY: JAS	PROJECT MGR.: JAS	SCALE: AS SHOWN	FILE NAME: FIG1-2.DWG		FIGURE 1-2

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	200 0 200 400 Feet	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	1995 SAMPLED WELL LOCATIONS FIGURE 1-3



NOTES:
BASE MAP DIGITIZED FROM: NCBC CENTER, DAVISVILLE RI STATION MAP, SEPT 1992
APPROXIMATE LOCATION OF STORM DRAIN DIGITIZED FROM:
MASTER SHORE STATION DEVELOPMENT PLAN – UTILITES STORM DRAINAGE SYSTEM
PWD DRAWING #37111, REV. 6/85

FILE NAME:F.\PROJECTS\29600.32\3994\REPORTS\OFFSITE\FIGURES\FIG1-7.DWG

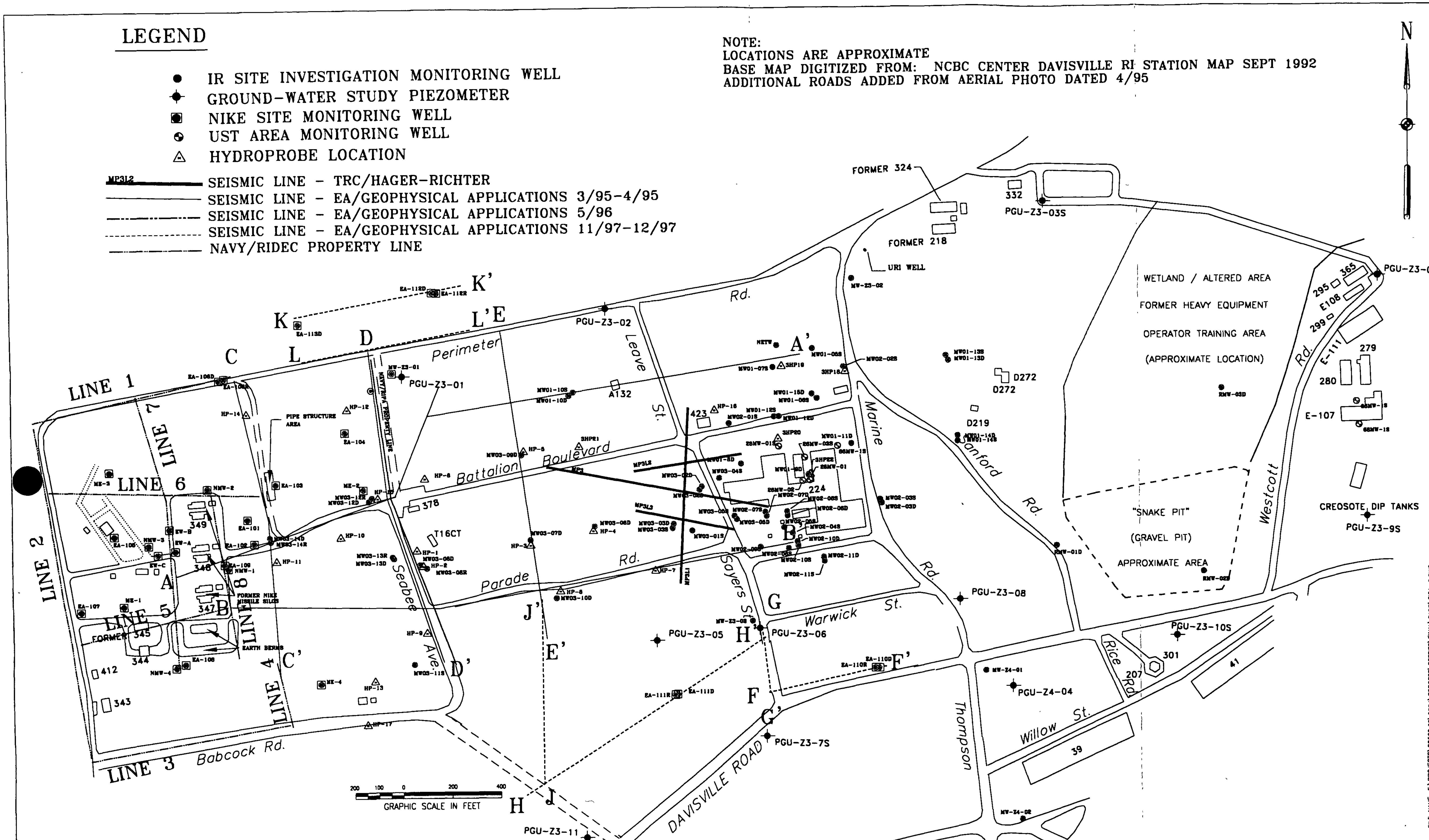
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.
NAL	JFW	1-21-96	29600.32
CHECKED BY	PROJECT MGR.	SCALE	FILE NAME
NAL	JAS	AS SHOWN	FIG5-1

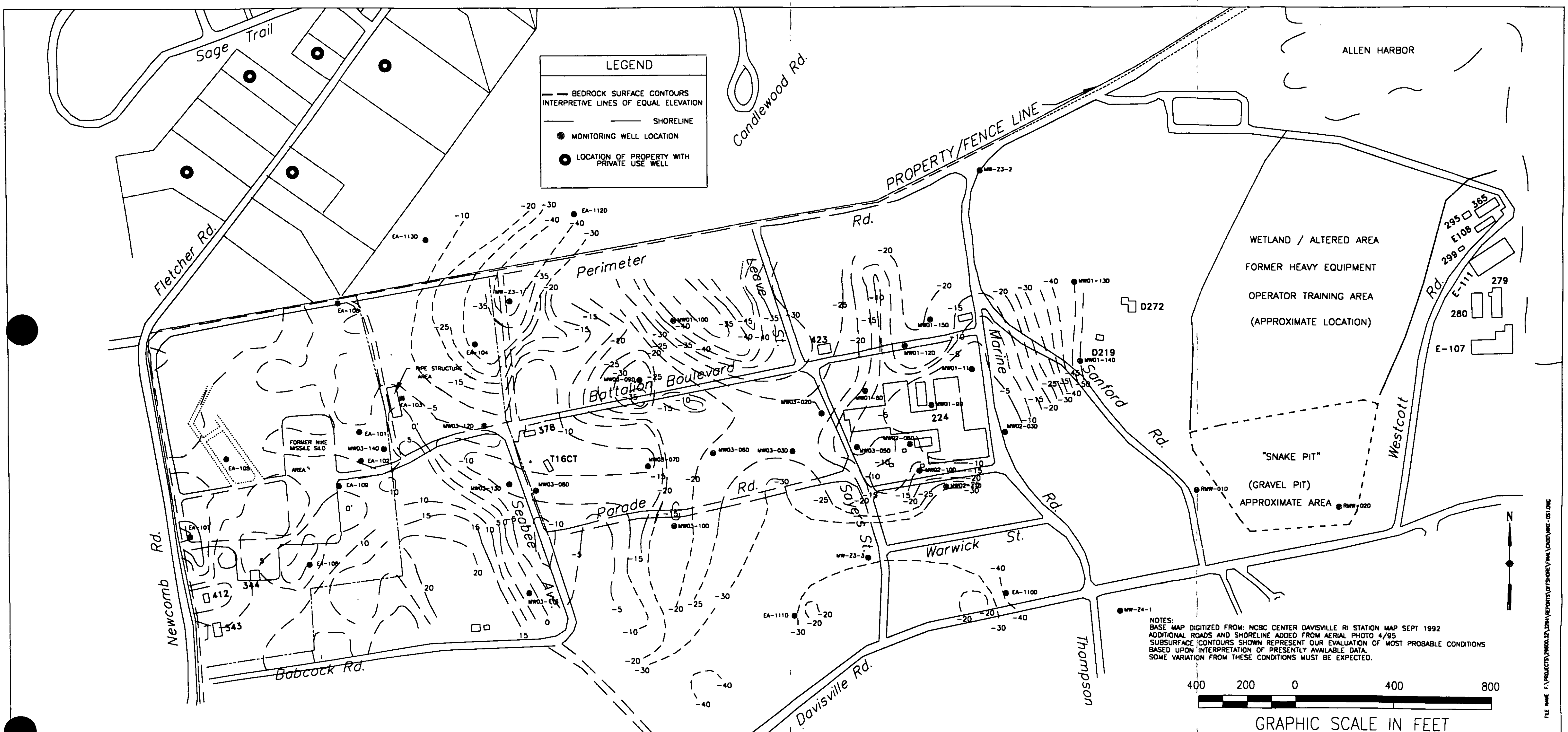
NORTHERN DIVISION
PHASE III RI REPORT
STUDY AREAS 01/04, SITES 02/03, AND NIKE SITE
NCBC DAVISVILLE, RHODE ISLAND

DRAINAGE LINE LOCATIONS

FIGURE 1-4



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY JAS	DRAWN BY RMC/JDR	DATE 10/19/98	PROJECT NO. 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GEOPHYSICAL SURVEY, HYDROPROBE, SOIL BORING AND MONITORING WELL LOCATIONS
	CHECKED BY JAS	PROJECT MGR. JAS	SCALE AS SHOWN	FILE NAME FIG1-3.DWG		FIGURE 2-1



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	INTERPRETIVE CONTOUR MAP OF THE UPPER SURFACE OF COMPETENT BEDROCK
	JAS	RWC/JDR	10/19/98	29600.32		
	CHECKED BY	PROJECT MGR.	SCALE	LAYER NAME		
	JAS	JAS	AS SHOWN	BEDROCK CONTOURS2		FIGURE 2-2

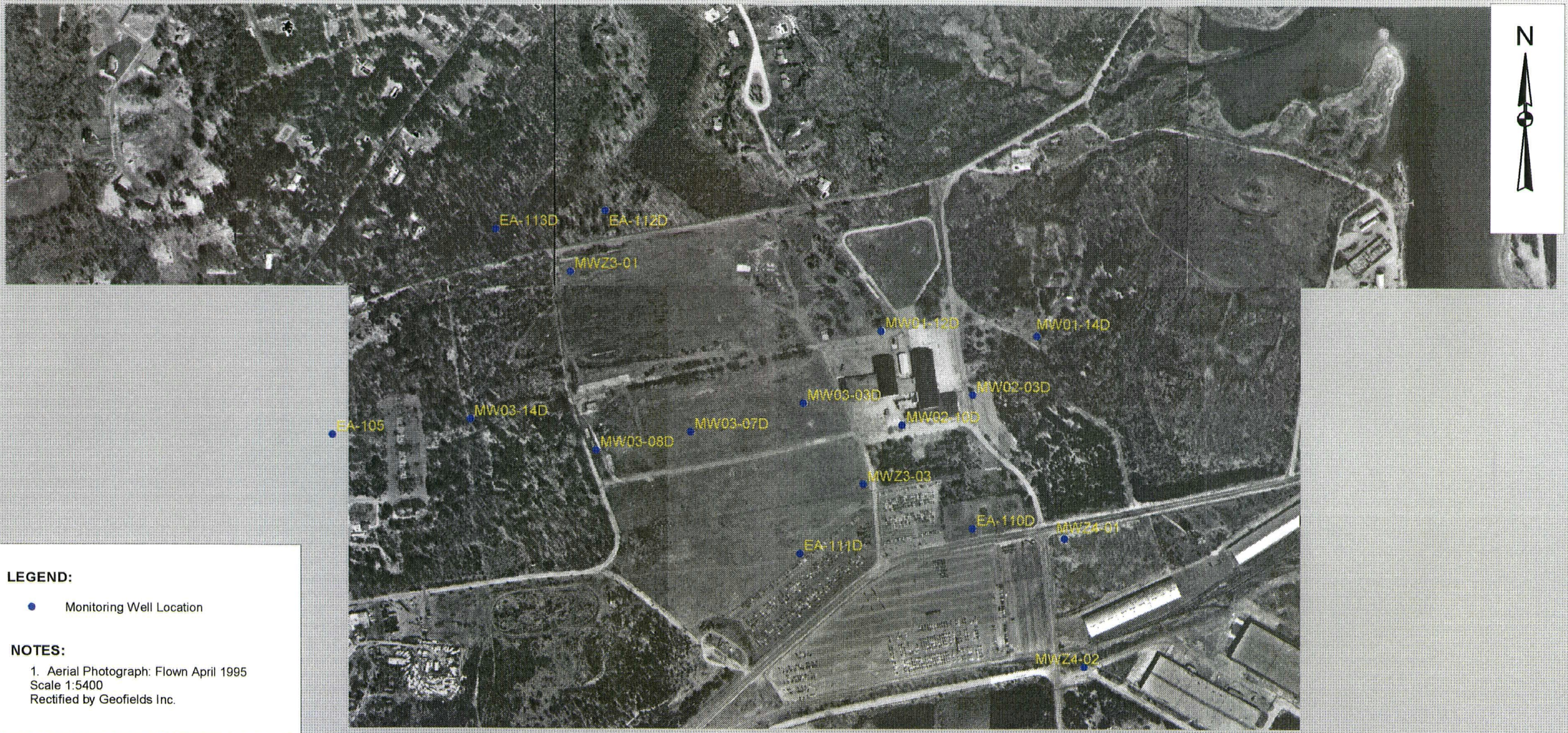
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION
AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1996 SAMPLED WELL LOCATIONS

FIGURE 2-3



LEGEND:

● Monitoring Well Location

NOTES:

1. Aerial Photograph: Flown April 1995
Scale 1:5400
Rectified by Geofields Inc.

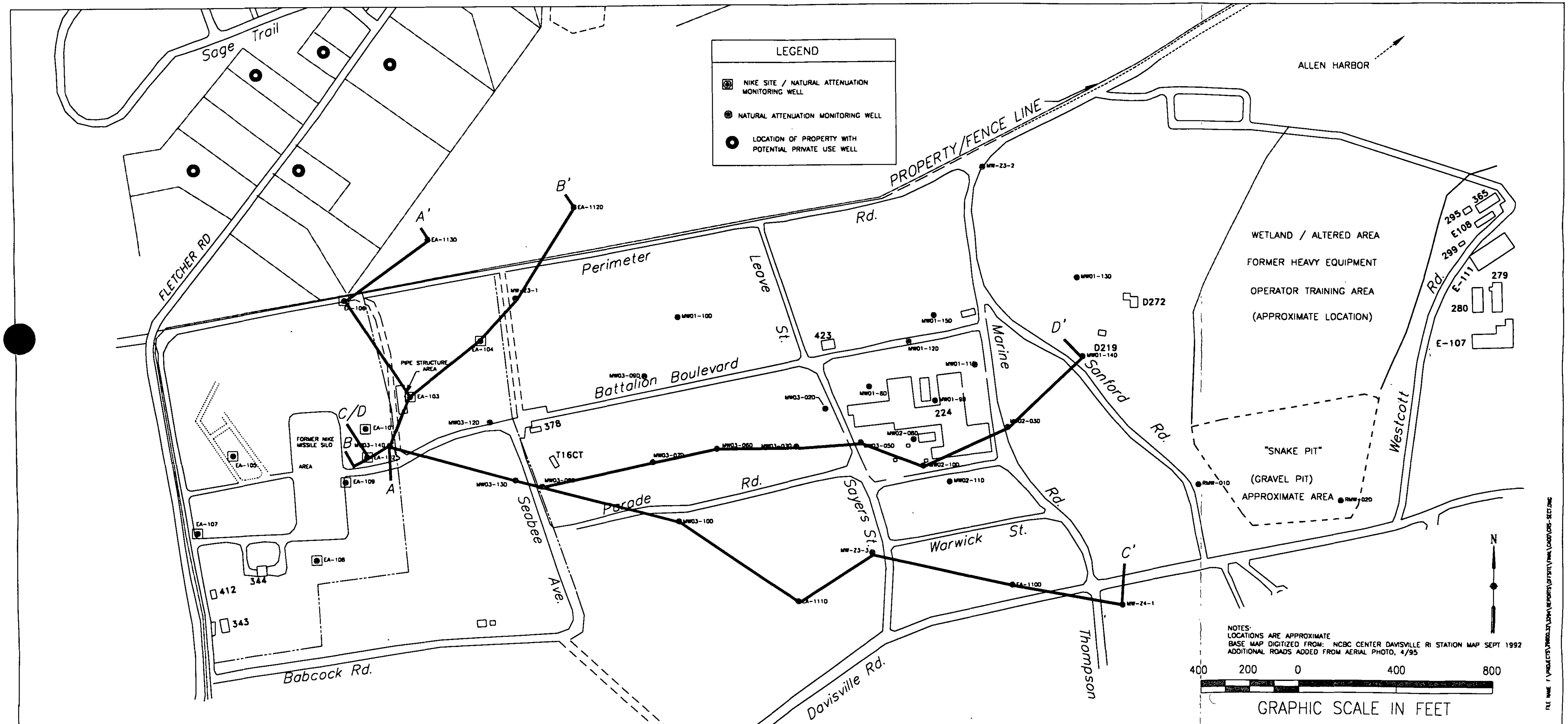
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

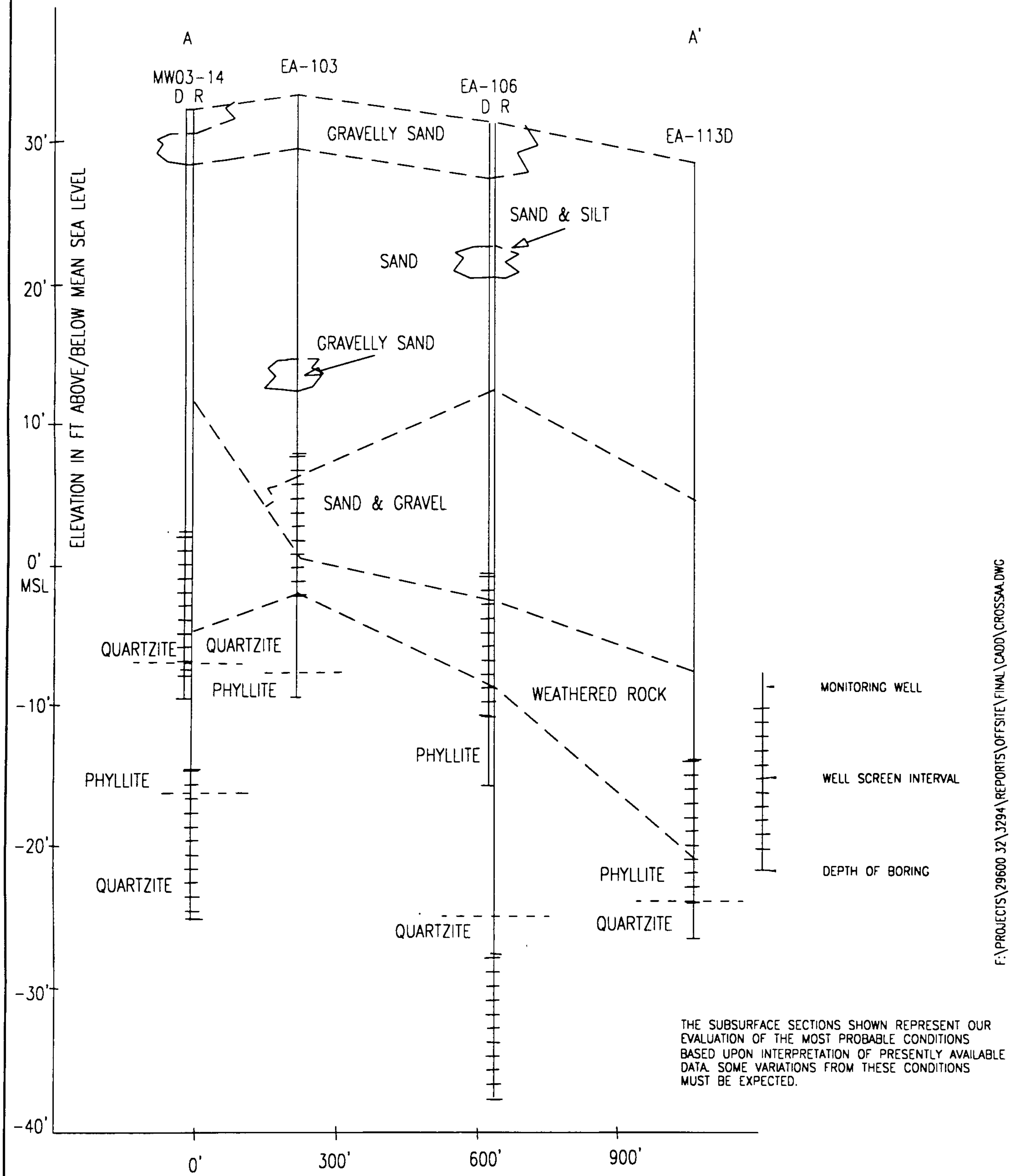
NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1998 SAMPLED WELL LOCATIONS

FIGURE 2-4



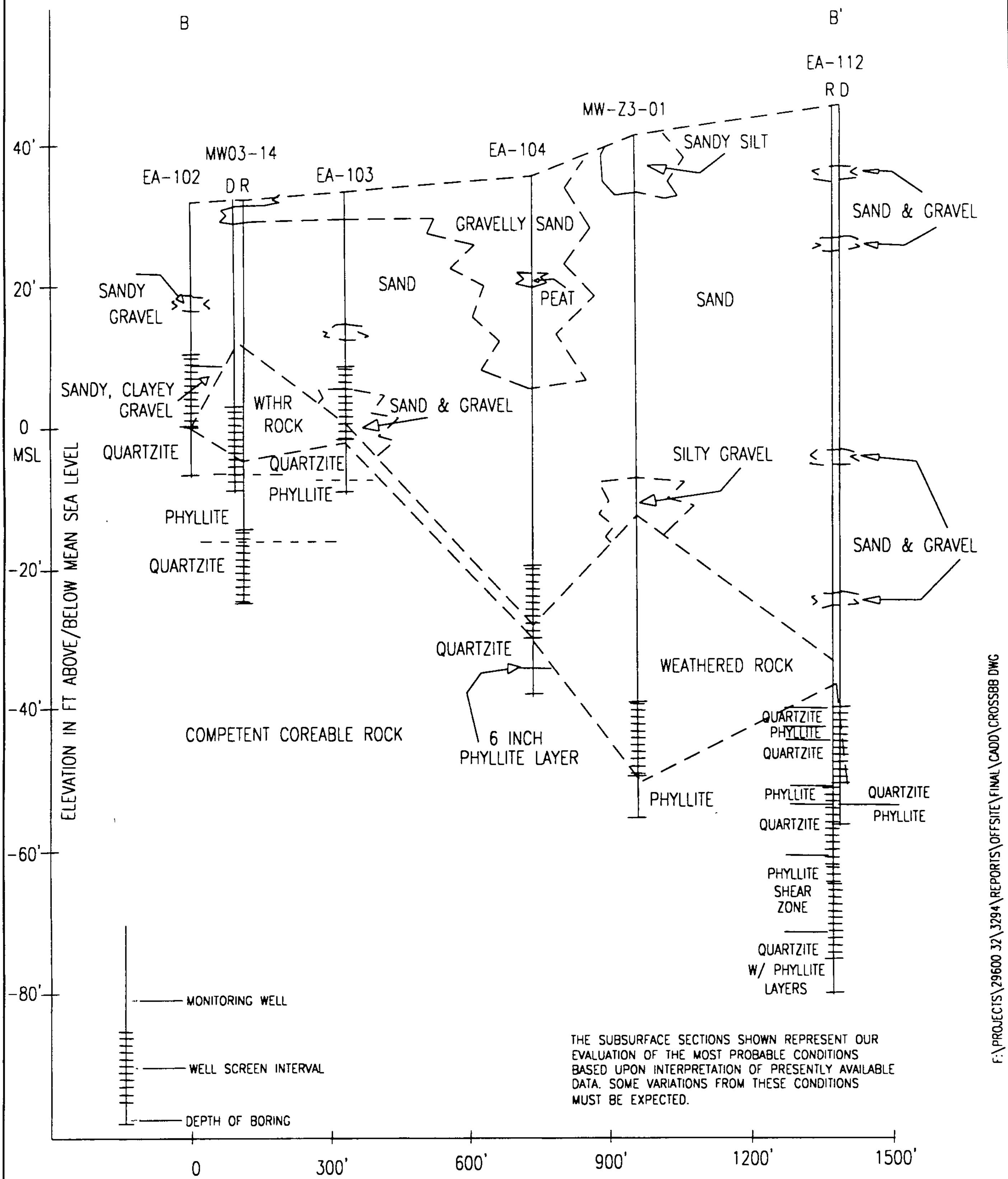
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY: JAS	DRAWN BY: RMC/JDR	DATE: 10/19/98	PROJECT NO.: 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	LOCATION OF GEOLOGICAL CROSS SECTIONS
	CHECKED BY: JAS	PROJECT MGR.: JAS	SCALE: AS SHOWN	LAYER NAME: 0 (RED)		FIGURE 3-1



THE SUBSURFACE SECTIONS SHOWN REPRESENT OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GEOLOGICAL CROSS SECTION A-A'

PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
JAS	JAS	RWC	JAS	AS SHOWN	10-20-98	29600.32	3-2



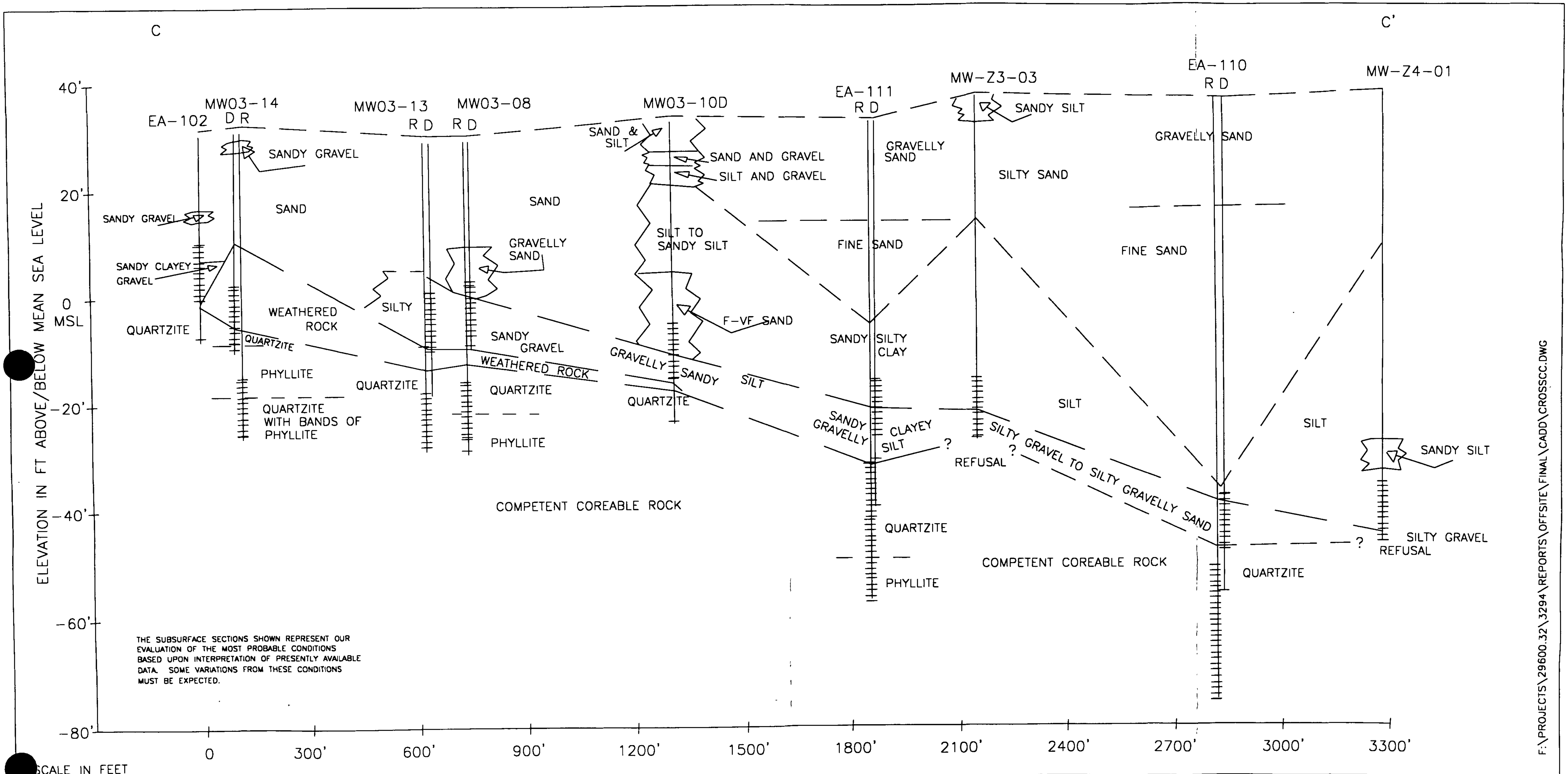
THE SUBSURFACE SECTIONS SHOWN REPRESENT OUR EVALUATION OF THE MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA. SOME VARIATIONS FROM THESE CONDITIONS MUST BE EXPECTED.

EA ENGINEERING, SCIENCE, AND TECHNOLOGY

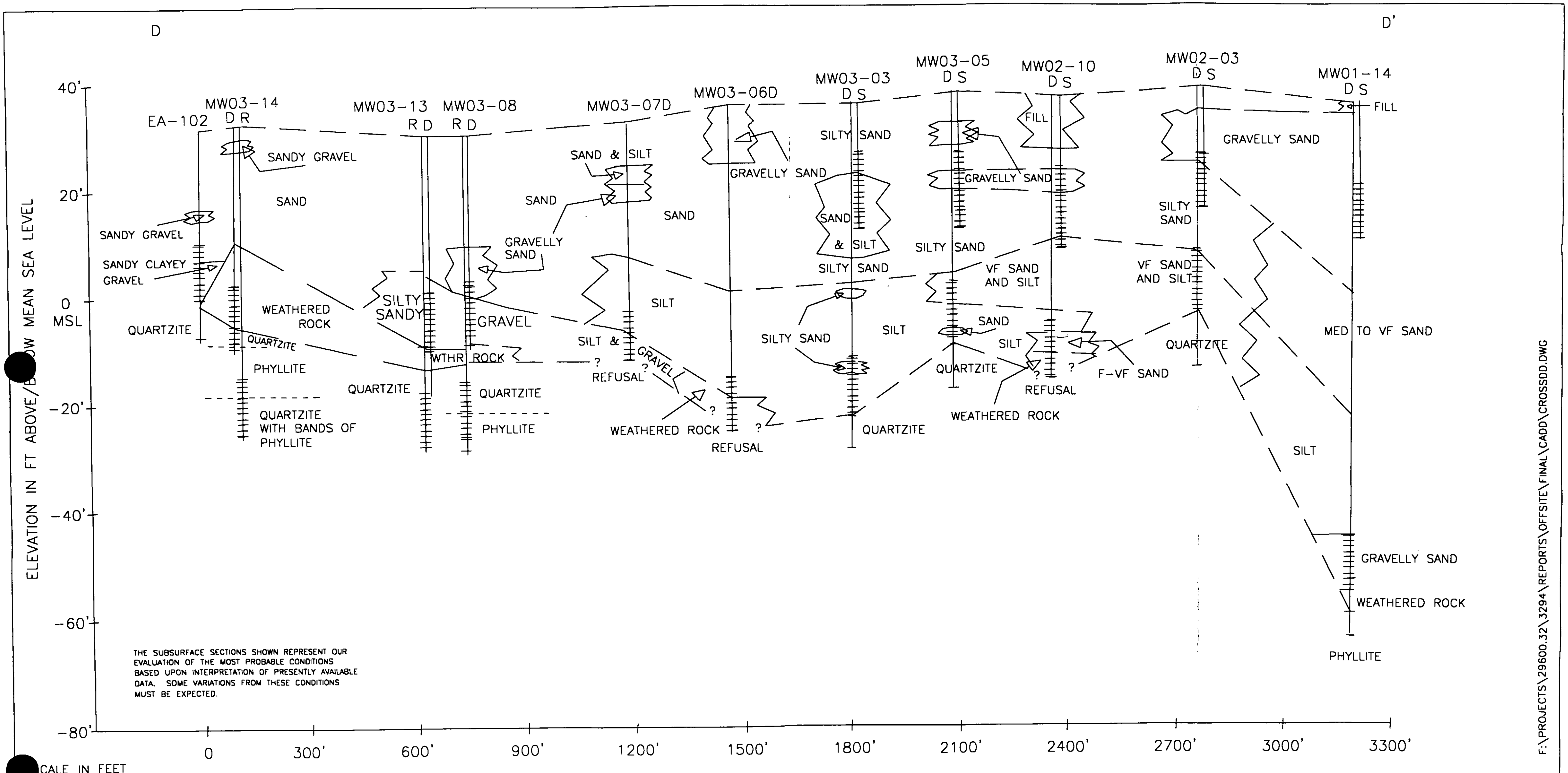
NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

GEOLOGICAL CROSS SECTION B-B'

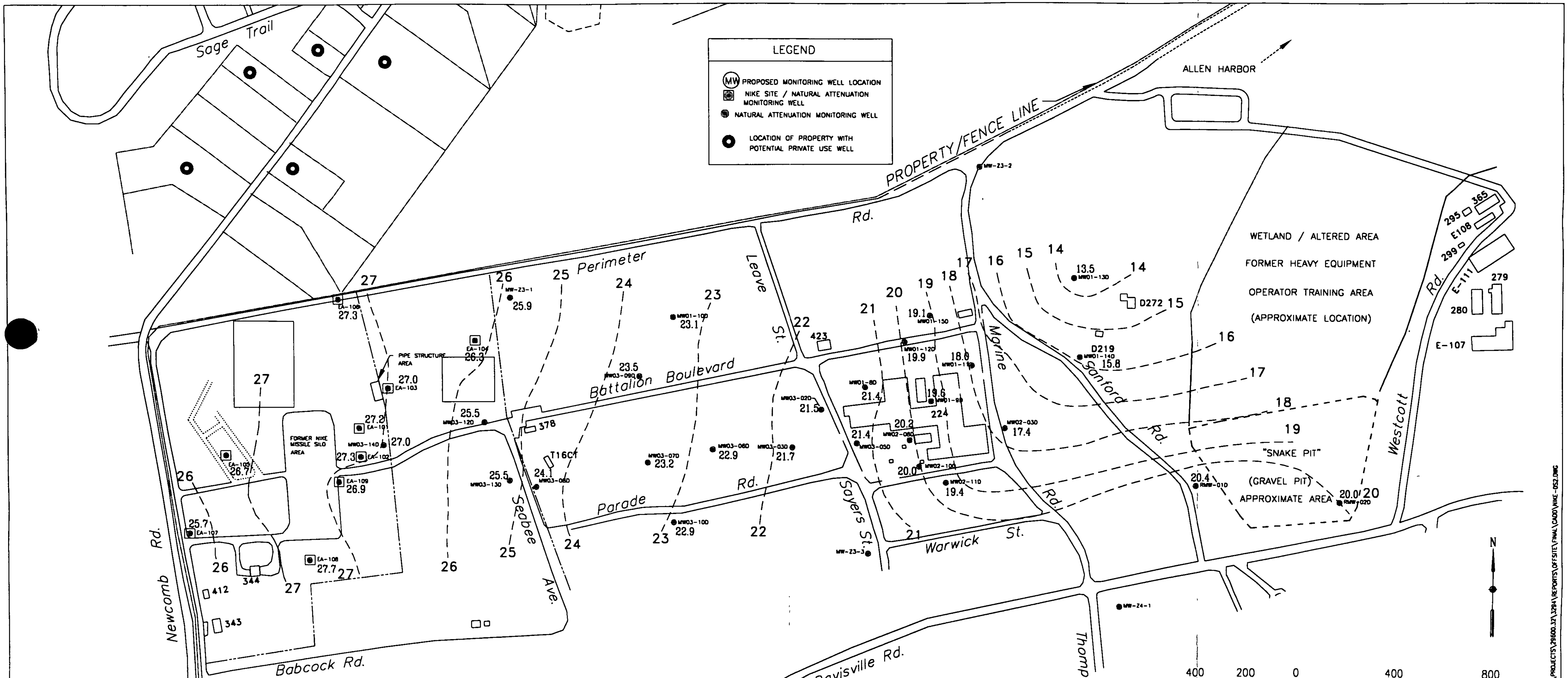
PROJECT MGR	DESIGNED BY	DRAWN BY	CHECKED BY	SCALE	DATE	PROJECT NO	FIGURE
JAS	JAS	RWC	JAS	AS SHOWN	10-20-98	29600.32	3-3



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY: JAS	DRAWN BY: RWC	DATE: 10-20-98	PROJECT NO.: 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GEOLOGIC CROSS SECTION C-C'
	CHECKED BY: JAS	PROJECT MGR.: JAS	SCALE: AS SHOWN	FILE NAME: CROSSCC		FIGURE 3-4



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY JAS	DRAWN BY RWC	DATE 10-20-98	PROJECT NO. 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GEOLOGIC CROSS SECTION D-D'
	CHECKED BY JAS	PROJECT MGR. JAS	SCALE AS SHOWN	FILE NAME CROSSDD		FIGURE 3-5



NOTES.
BASE MAP DIGITIZED FROM: NCBC CENTER DAVISVILLE RI STATION MAP SEPT 1992
ADDITIONAL ROADS ADDED FROM AERIAL PHOTO, 4/95
SUBSURFACE CONTOURS SHOWN REPRESENT OUR EVALUATION OF MOST PROBABLE CONDITIONS BASED UPON INTERPRETATION OF PRESENTLY AVAILABLE DATA.
SOME VARIATION FROM THESE CONDITIONS MUST BE EXPECTED.

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GROUND-WATER SURFACE CONTOURS DEEP WELLS DECEMBER 1996
	JAS	RWC/JDR	10-20-98	29600.32		
	CHECKED BY	PROJECT MGR.	SCALE	LAYER NAME		
	JAS	JAS	AS SHOWN	PIEZOMETRIC...		FIGURE 3-6

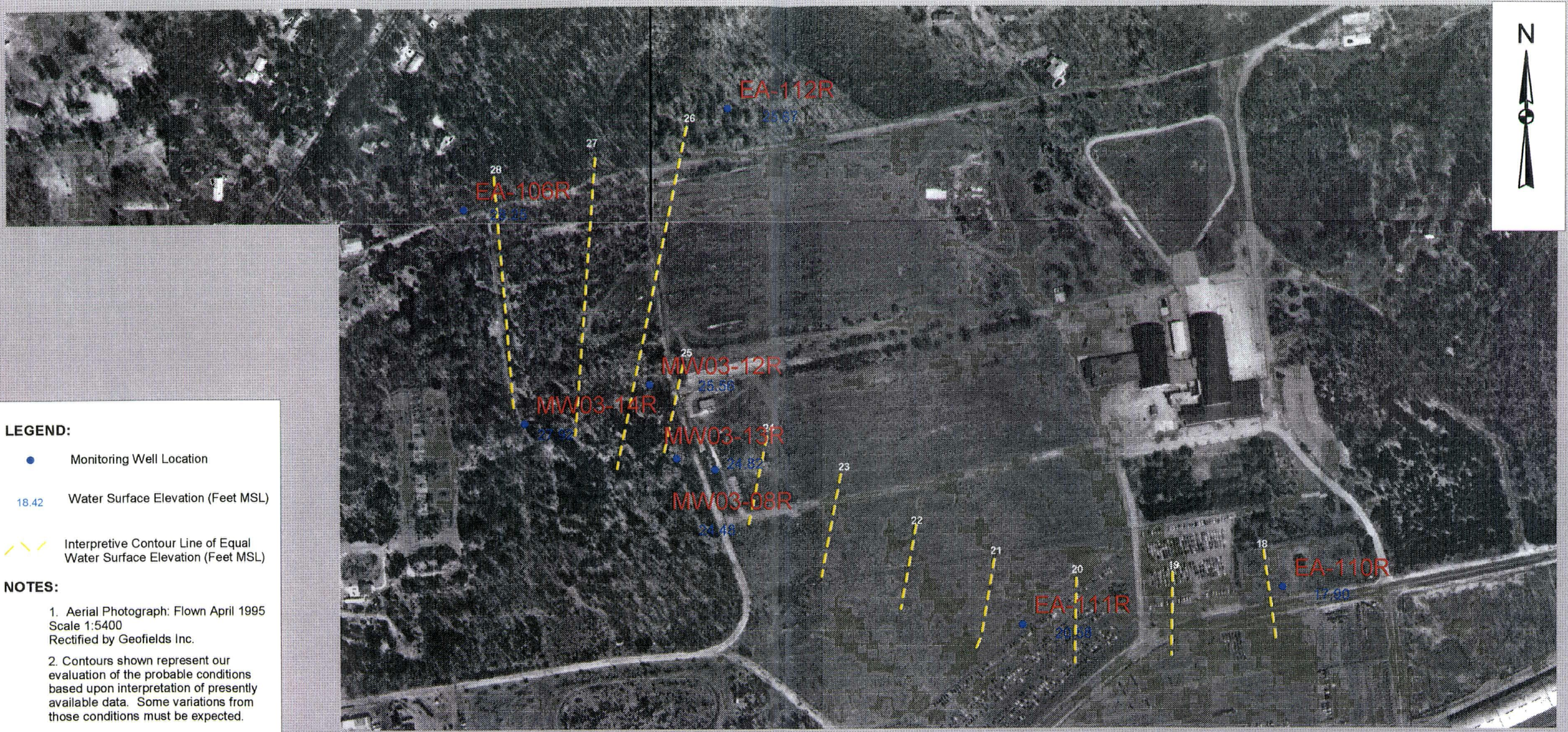
LEGEND:

- Monitoring Well Location
- 18.42 Water Surface Elevation (Feet MSL)
- Interpretive Contour Line of Equal Water Surface Elevation (Feet MSL)

NOTES:

1. Aerial Photograph: Flown April 1995
   Scale 1:5400
   Rectified by Geofields Inc.
2. Contours shown represent our evaluation of the probable conditions based upon interpretation of presently available data. Some variations from those conditions must be expected.

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	400 0 400 Feet	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GROUND-WATER SURFACE CONTOURS DEEP WELLS FEBRUARY 1998 FIGURE 3-7



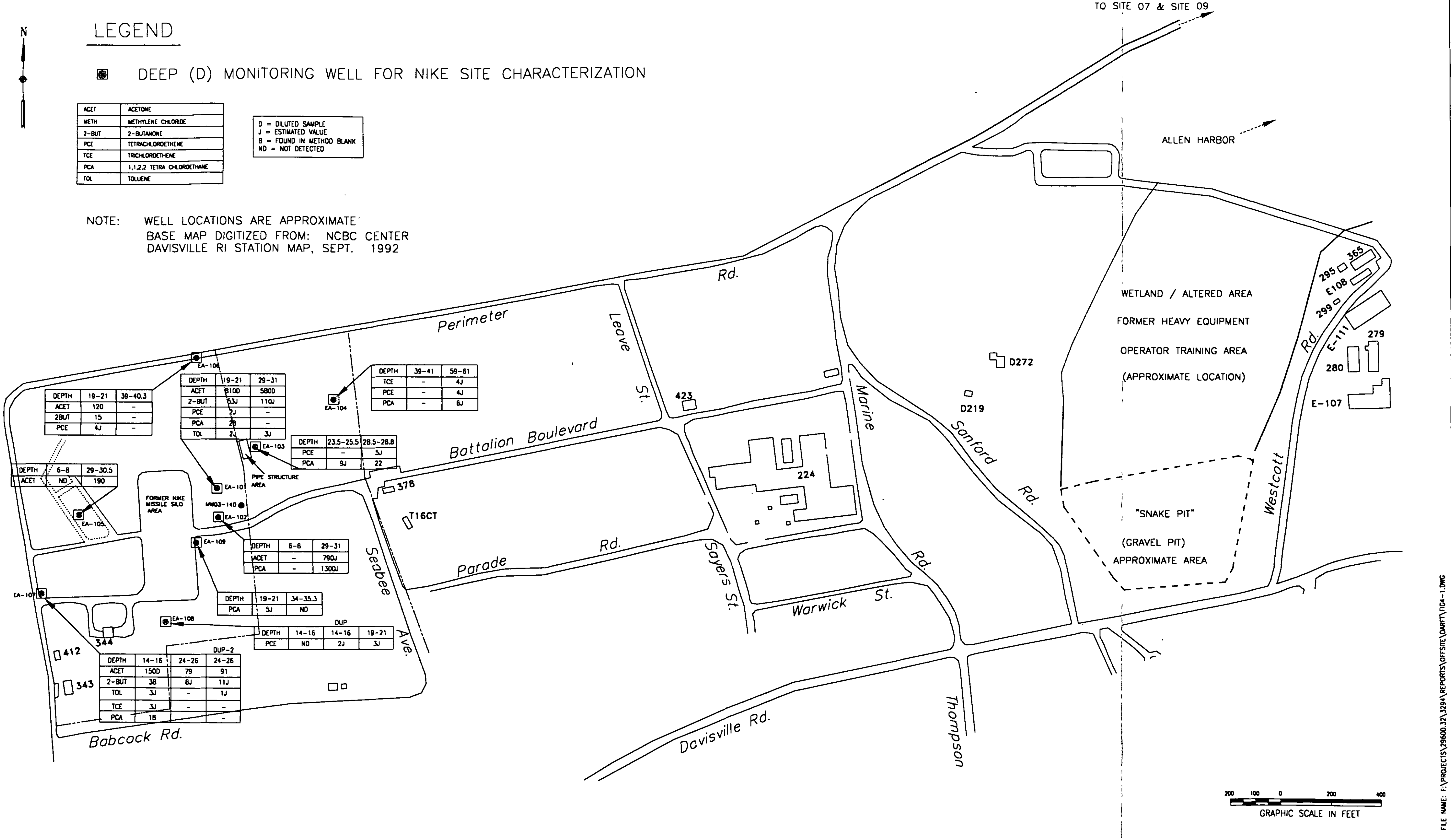
LEGEND:

- ● Monitoring Well Location
- 18.42 Water Surface Elevation (Feet MSL)
- Interpretive Contour Line of Equal Water Surface Elevation (Feet MSL)

NOTES:

1. Aerial Photograph: Flown April 1995
Scale 1:5400
Rectified by Geofields Inc.
2. Contours shown represent our evaluation of the probable conditions based upon interpretation of presently available data. Some variations from those conditions must be expected.

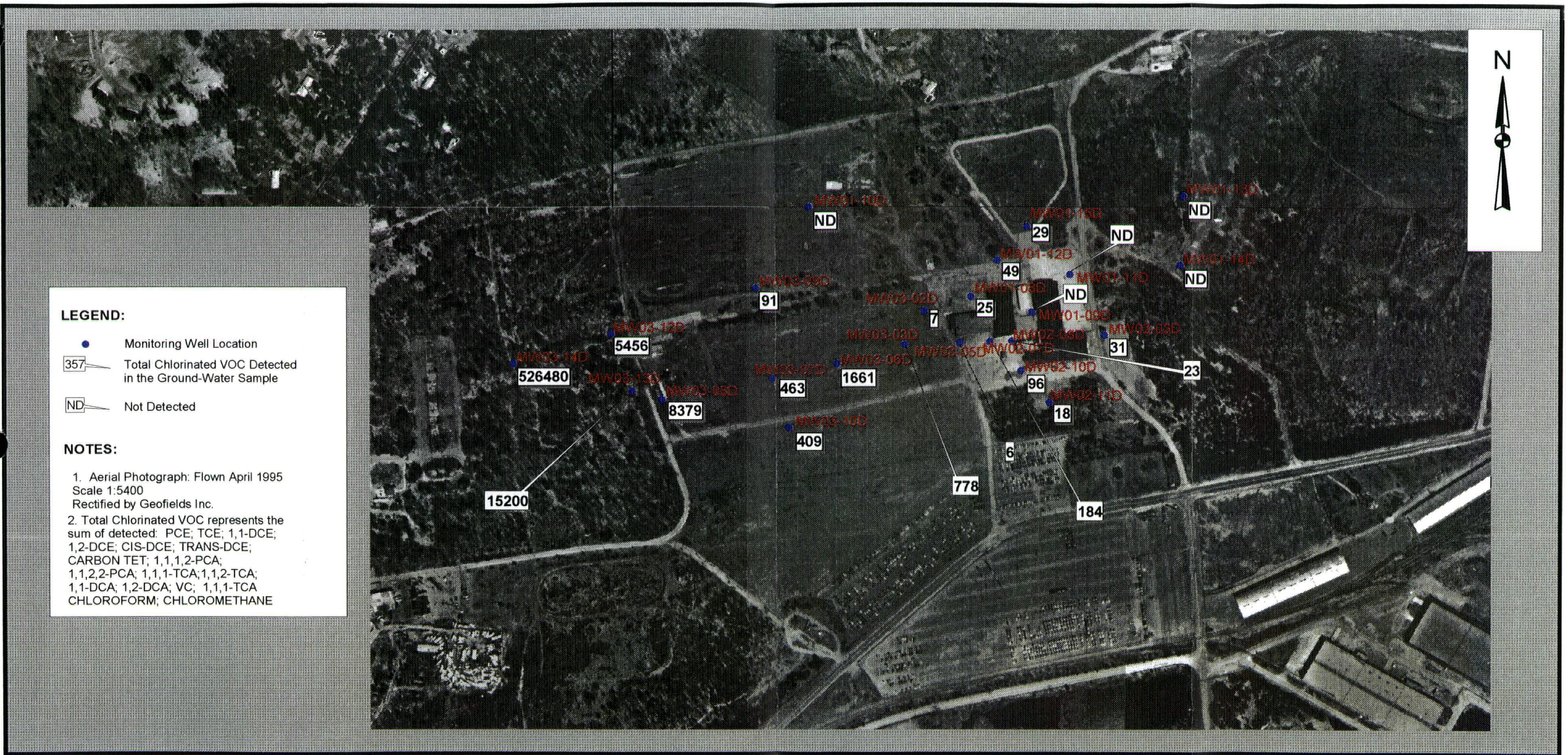
EA ENGINEERING, SCIENCE, AND TECHNOLOGY	400 0 400 Feet	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	GROUND-WATER SURFACE CONTOURS ROCK WELLS FEBRUARY 1998 FIGURE 3-8



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.	DESIGNED BY PWH	DRAWN BY JFW	DATE 7/31/98	PROJECT NO. 29600.32	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND
	CHECKED BY PWH	PROJECT MGR. JAS	SCALE AS SHOWN	LAYER NAME CHLOR-VOC	

VOC DETECTED IN SOIL SAMPLES (ug/Kg)
JUNE 1996

FIGURE 4-1



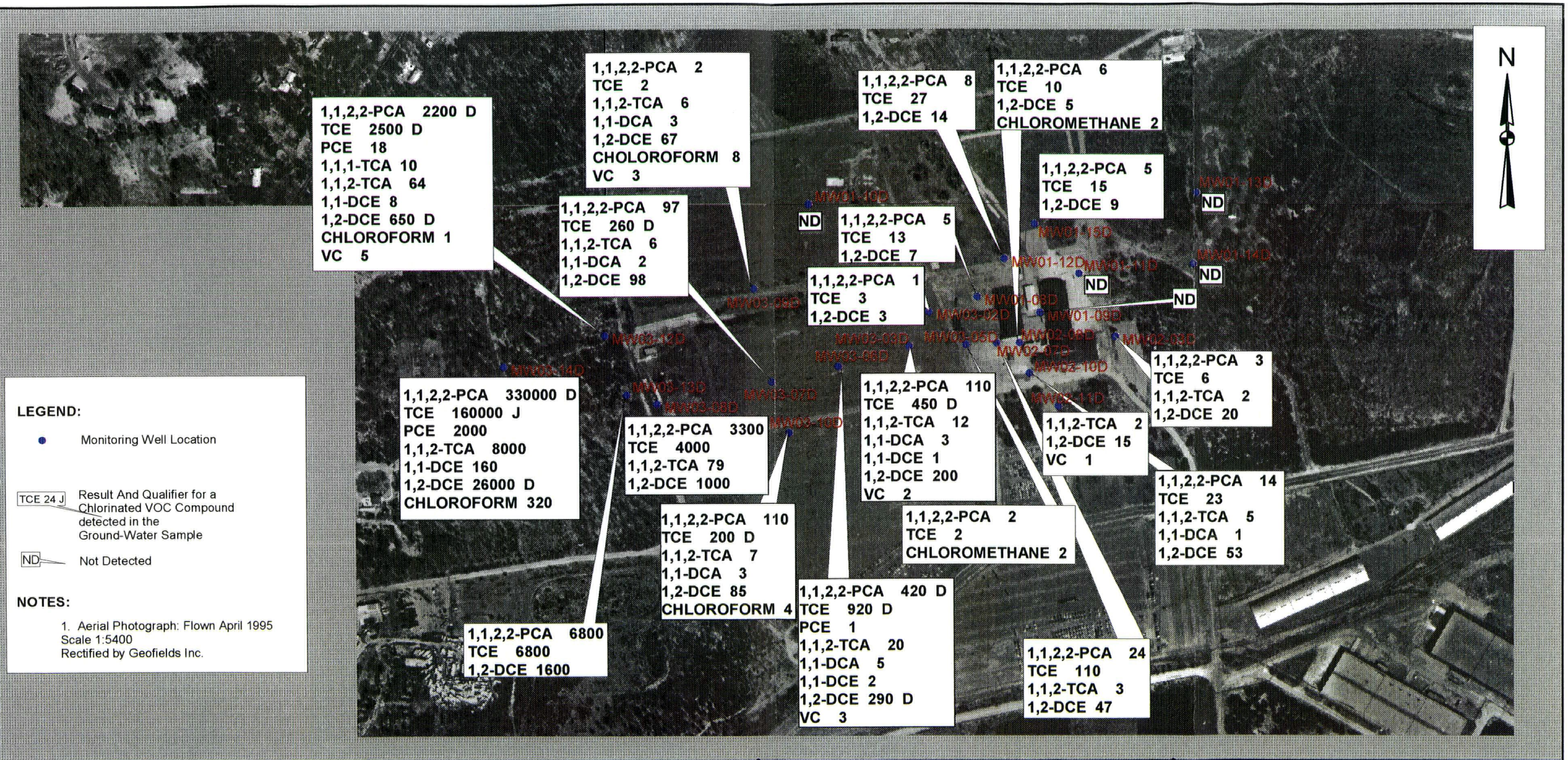
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1995 TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS

FIGURE 4-2



EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION
AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1995 CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS

FIGURE 4-3

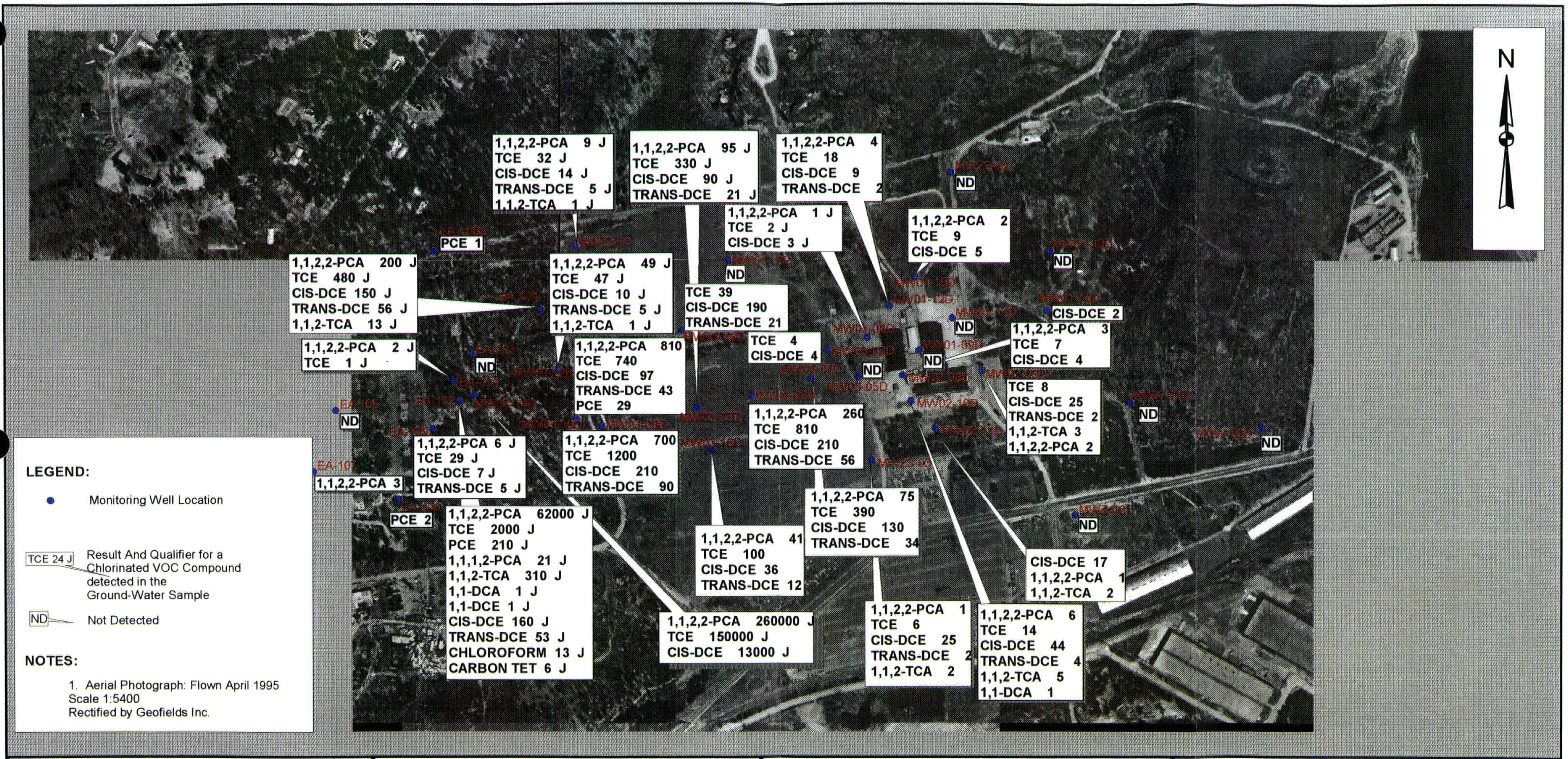
LEGEND:

- Monitoring Well Location
- 357 — Total Chlorinated VOC Detected in the Ground-Water Sample
- ND — Not Detected

NOTES:

1. Aerial Photograph: Flown April 1995
Scale 1:5400
Rectified by Geofields Inc.
2. Total Chlorinated VOC represents the sum of detected: PCE; TCE; 1,1-DCE; 1,2-DCE; CIS-DCE; TRANS-DCE; CARBON TET; 1,1,1,2-PCA; 1,1,2,2-PCA; 1,1,1-TCA;1,1,2-TCA; 1,1-DCA; 1,2-DCA; VC; 1,1,1-TCA CHLOROFORM; CHLOROMETHANE

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	200 0 200 400 Feet	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	1996 TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS FIGURE 4-4



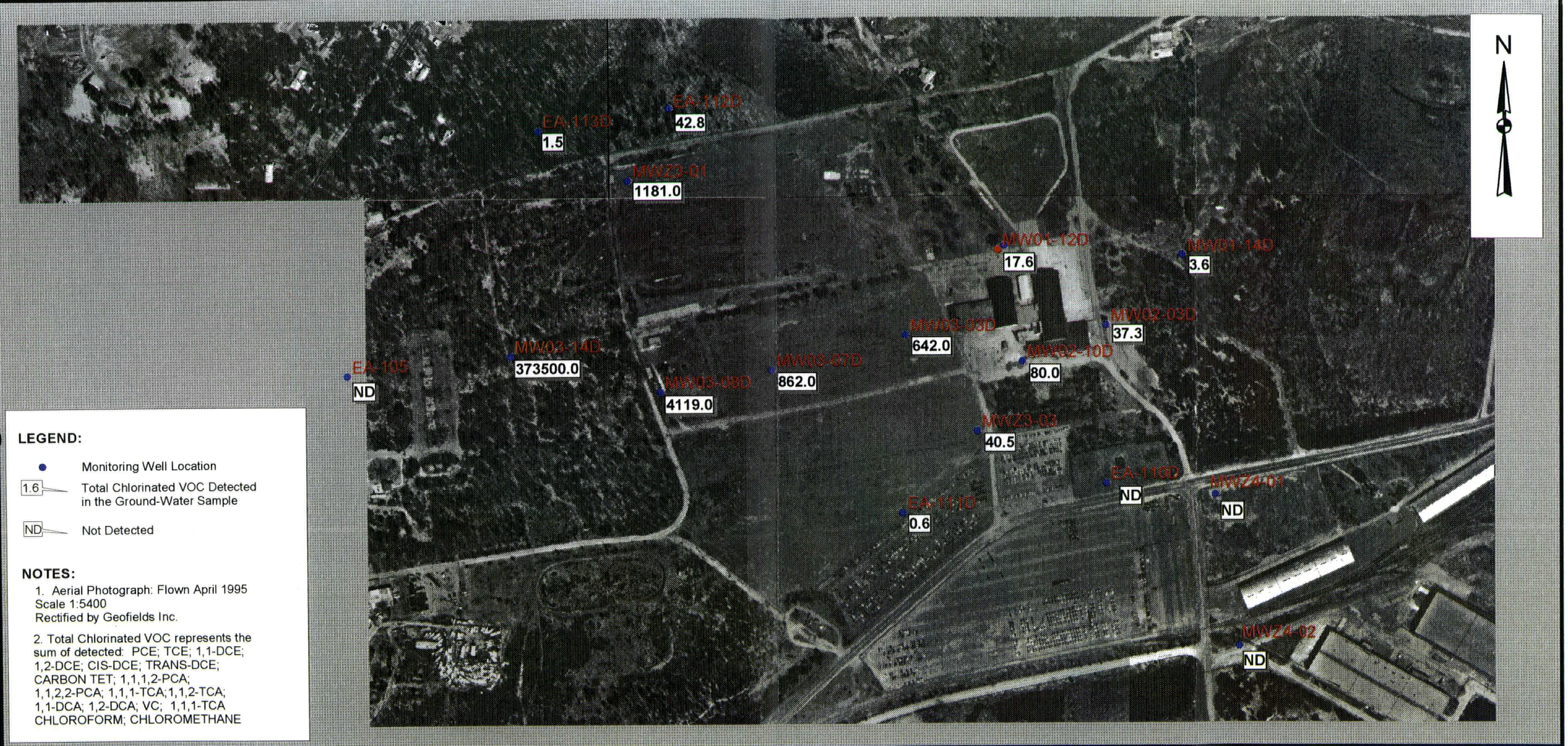
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION
AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1996 CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS

FIGURE 4-5



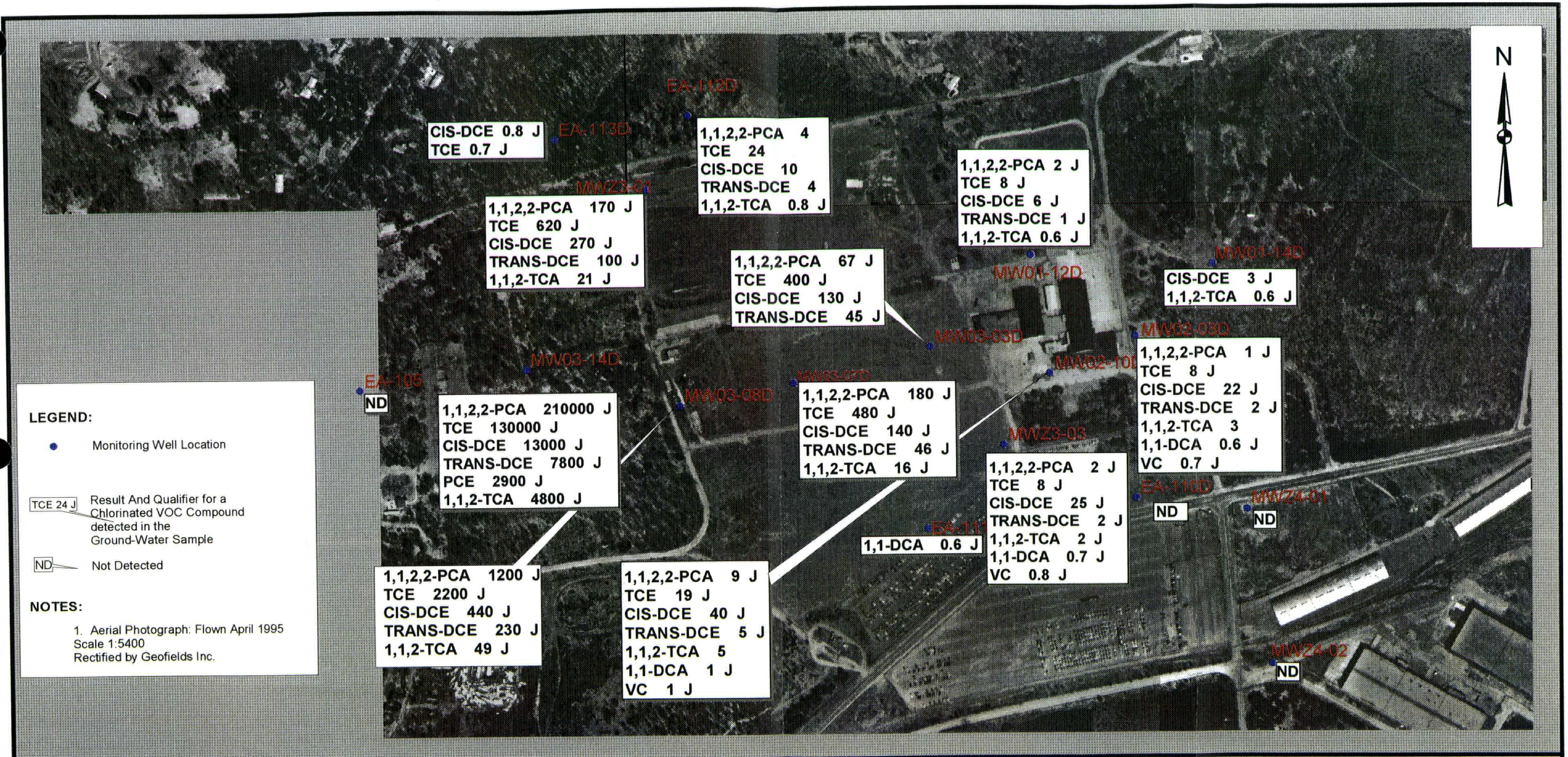
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1998 TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS

FIGURE 4-6



EA ENGINEERING, SCIENCE, AND TECHNOLOGY

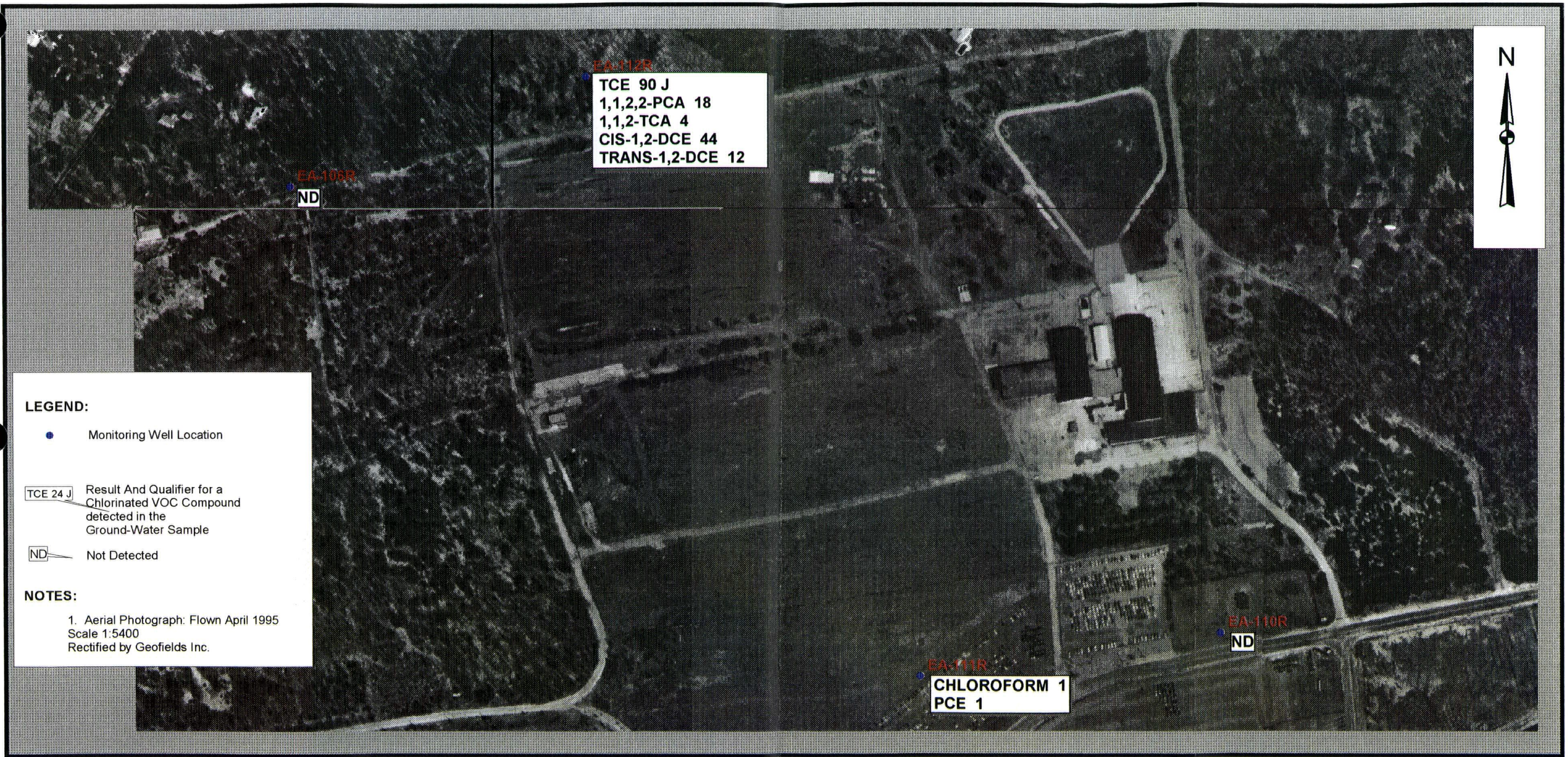
200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1998 CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM DEEP WELLS

FIGURE 4-7

EA ENGINEERING, SCIENCE, AND TECHNOLOGY	200 0 200 400 Feet	NORTHERN DIVISION SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION NCBC DAVISVILLE, RHODE ISLAND	1998 TOTAL CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM ROCK WELLS FIGURE 4-8



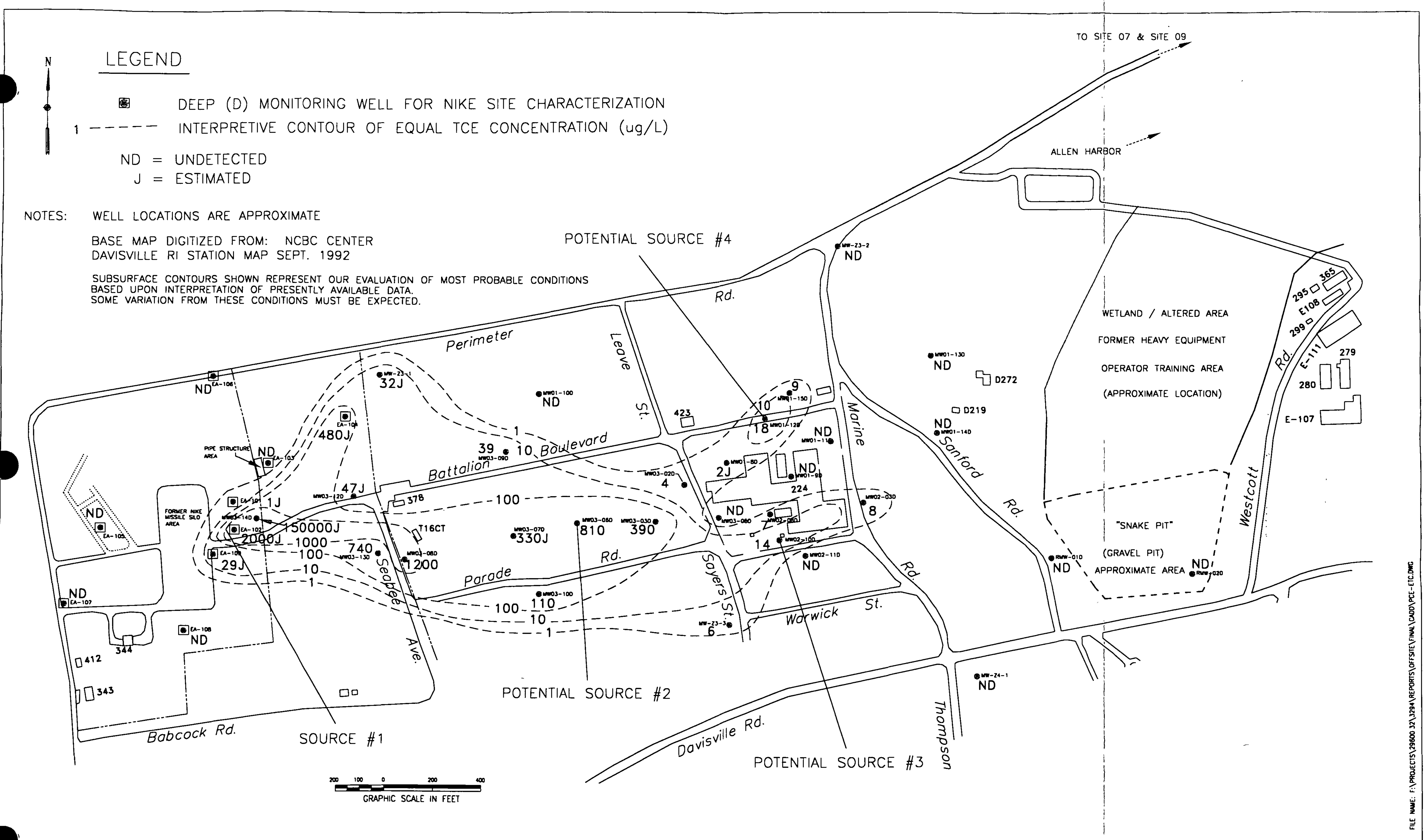
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

200 0 200 400 Feet

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION
AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

1998 CHLORINATED VOLATILE ORGANIC COMPOUNDS (ug/L) DETECTED IN GROUND-WATER SAMPLES FROM ROCK WELLS

FIGURE 4-9



EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

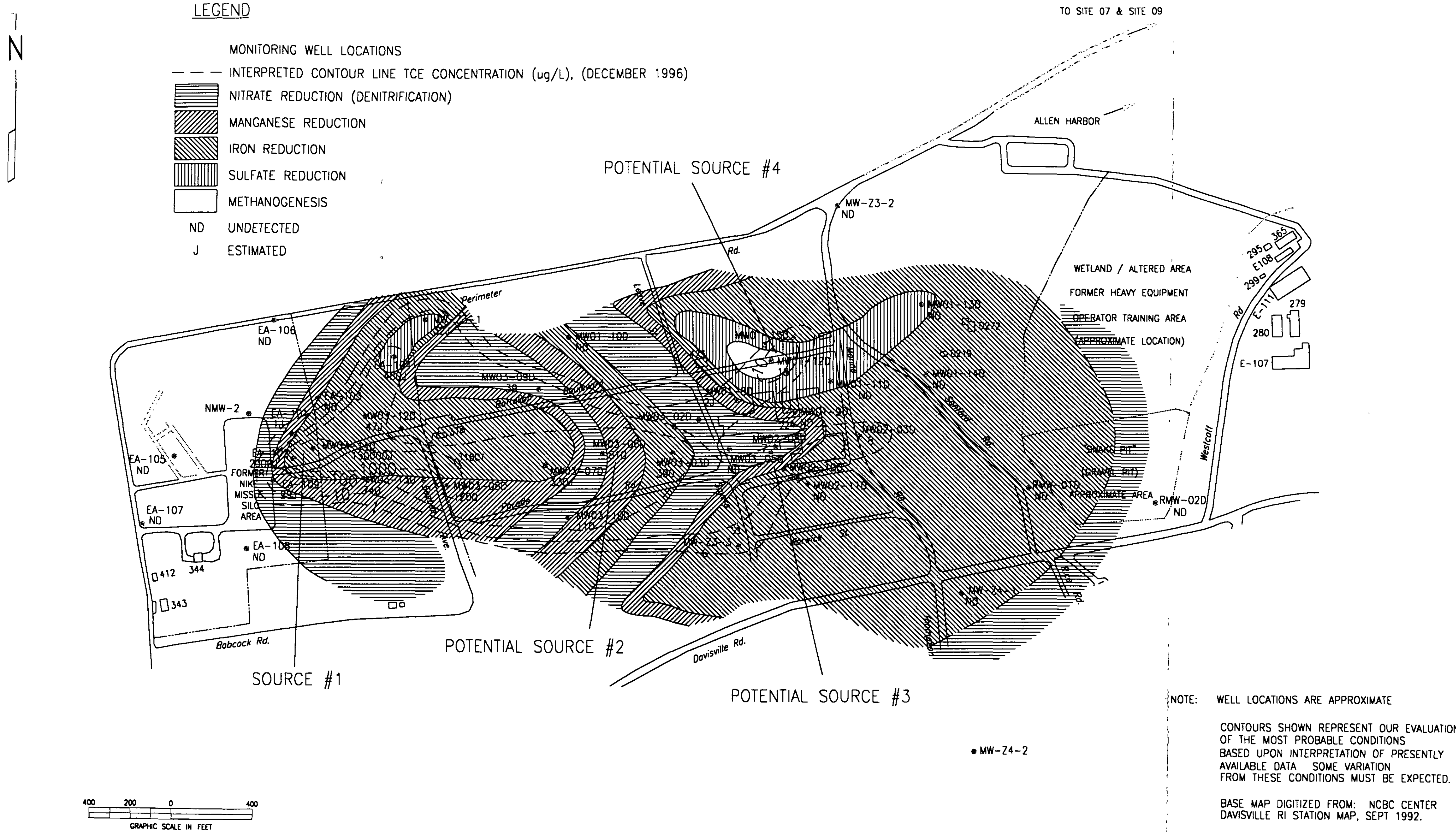
DESIGNED BY	DRAWN BY	DATE	PROJECT NO.
PWH	JFW	10-20-98	29600.32
CHECKED BY	PROJECT MGR.	SCALE	LAYER NAME
PWH	JAS	AS SHOWN	TCE

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

CHARACTERIZATION OF POTENTIAL CVOC SOURCE AREAS AND DETECTED CONCENTRATIONS OF TRICHLOROETHENE (TCE) (ug/L)

DECEMBER 1996

FIGURE 4-10



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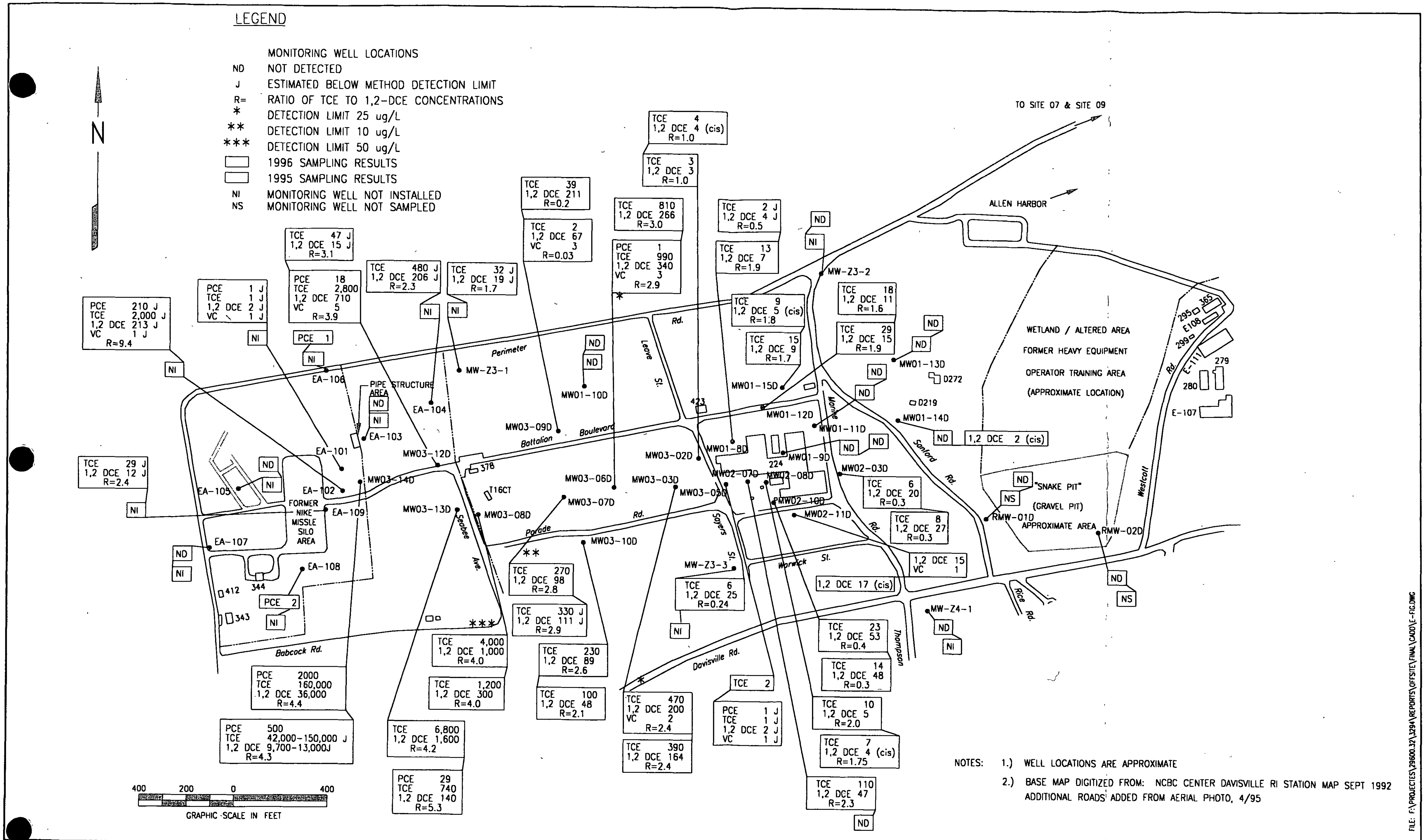
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	FILE NAME
ARB	JFW/PMH	10-20-98	29600.32	BASE9
CHECKED BY	PROJECT MGR.	SCALE	DRAWING NO.	FIGURE
ARB	JAS	AS SHOWN	-	4-11

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

NIKE SITE SOURCE AREA AND NATURAL ATTENUATION CHARACTERIZATION WITH THE DECEMBER 1996 TRICHLOROETHENE (TCE) VALUES (ug/L)

FIGURE 4-11



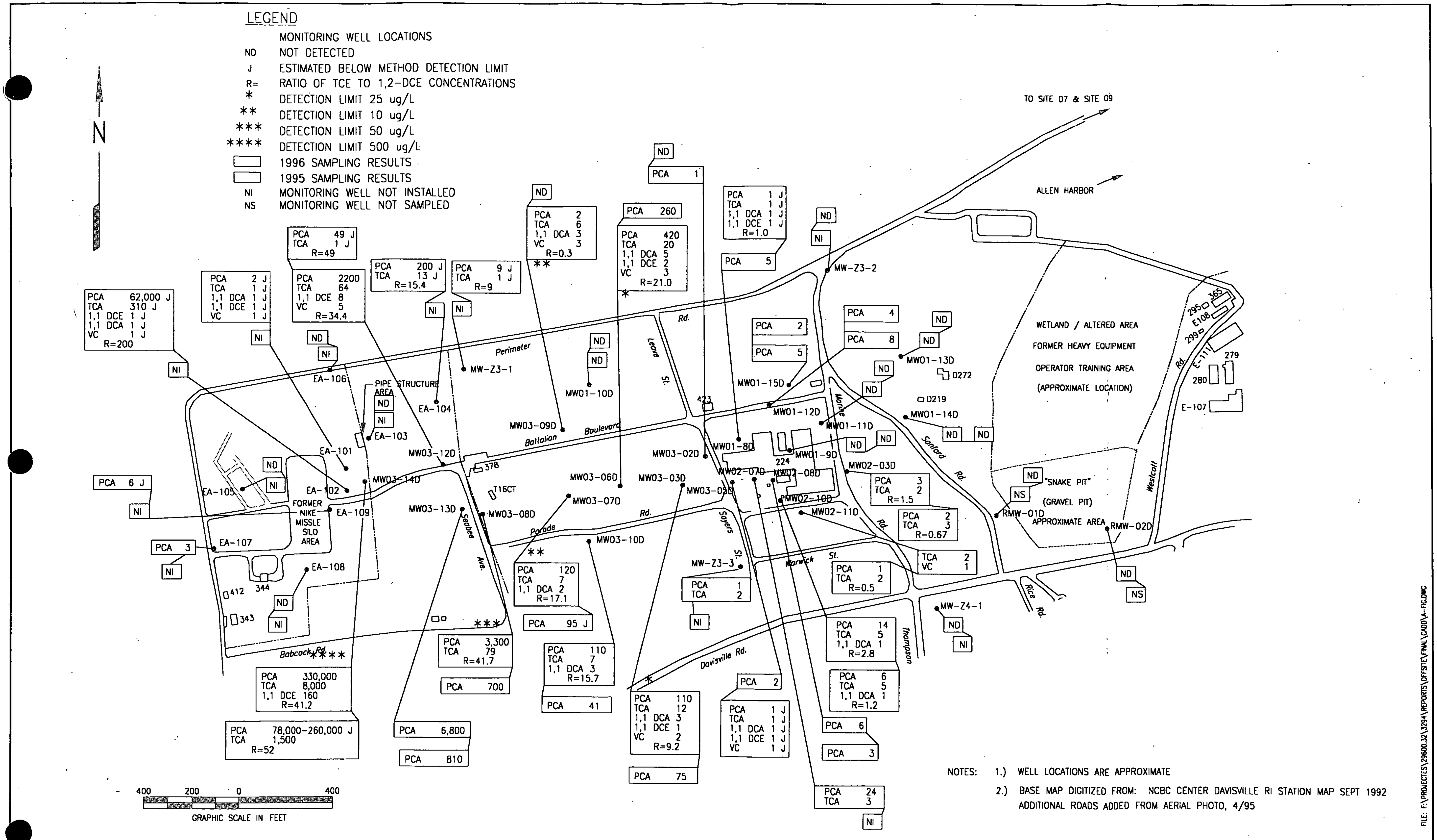
EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	FILE NAME
JEL	JFW/PMH	10-20-98	29600.32	E-FIG
CHECKED BY	PROJECT MGR.	SCALE	DRAWING NO.	FIGURE
ARB	JAS	AS SHOWN	-	4-12

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

DISTRIBUTION OF PCE, TCE, 1,2-DCE (TOTAL), AND VINYL CHLORIDE IN DEEP GROUND-WATER MONITORING WELLS (1995 AND 1996)

FIGURE 4-12



EA ENGINEERING, SCIENCE, AND TECHNOLOGY

DESIGNED BY	DRAWN BY	DATE	PROJECT NO.	FILE NAME
JEL	JFW/PMH	10-20-98	29600.32	A-FIG
CHECKED BY	PROJECT MGR.	SCALE	DRAWING NO.	FIGURE
ARB	JAS	AS SHOWN	-	4-13

NORTHERN DIVISION
SITE 03/NIKE CHARACTERIZATION AND OFFSITE INVESTIGATION
NCBC DAVISVILLE, RHODE ISLAND

DISTRIBUTION OF PCA, TCA, 1,1-DCE (TOTAL), 1,1-DCA, AND VINYL CHLORIDE IN DEEP GROUND-WATER MONITORING WELLS (1995 AND 1996)

FIGURE 4-13

TABLE 1-1
Location of Residential Water Supply Wells North of Site 03/Nike
NCBC Davisville, R.I.

Address		Property Owner	Location (Plat/Lot)
290	Fletcher Road	Eidson, William B.	165/003
469	Fletcher Road	McGuinness, Adelaide	162/011
550	Fletcher Road	Matoes Jr., Samuel J.	084/041
750	Fletcher Road	Petteruti, Ross A.	084/006
757	Fletcher Road	DeVecchio, Thomas J.	159/008
787	Fletcher Road	Morris, Eleanor G.	159/007
796	Fletcher Road	Soares, Carolyn V..	084/009
855	Fletcher Road	Michaelson, Jeffrey S.	159/005

Source: Town of North Kingstown

Table 2-1
Volatile Organic Compounds Detected in the June-July 1996 Soil and Ground-Water Samples via Field GC
Site 03/Nike
NCBC Davisville, RI

SAMPLE ID	EA-101	EA-101	EA-101	EA-101	EA-101	EA-101	EA-101	EA-101	EA-101
SAMPLE INTERVAL (ft bg)	0-2'	2-4'	4-6'	6-8'	9-11'	14-16'	19-21'	29-31'	--
DATE COLLECTED	6/13/96	6/13/96	6/13/96	6/13/96	6/13/96	6/13/96	6/13/96	6/13/96	6/14/96
DATE ANALYZED	6/13/96	6/13/96	6/13/96	6/13/96	6/13/96	6/17/96	6/17/96	6/14/96	6/14/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER
DILUTION FACTOR	--	--	--	--	--	--	--	--	10.0
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/L
Methylene Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<10
1,1-Dichloroethene	5.4	<1	<1	<1	<1	1	<1	<1	<10
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1	<1	<1	41.8
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	<10
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	6.9
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<1	<10
Trichloroethene	1.6	<1	<1	<1	1.1	<1	<1	2.1	35
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<10
Tetrachloroethene	<1	<1	<1	<1	1.2	<1	1.1	2.3	32
1,1,2,2-Tetrachloroethane	2.6	2.5	1.8	1.5	6.7	5.5	8.3	15	150
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<10
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<10
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<10
Xylenes (total)	<1	<1	<1	<1	2.2	<1	<1	<1	<10

NQ - Not Quantified

SAMPLE ID	EA-101	EA-102	EA-102	EA-102	EA-102	EA-102	EA-102	EA-102	EA-102
SAMPLE INTERVAL (ft bg)	--	0-2'	2-4'	4-6'	6-8'	8-10'	14-16'	19-21'	24-26'
DATE COLLECTED	6/14/96	6/10/96	6/10/96	6/10/96	6/10/96	6/10/96	6/10/96	6/10/96	6/10/96
DATE ANALYZED	6/14/96	6/10/96	6/10/96	6/10/96	6/10/96	6/10/96	6/11-12/96	6/10-11/96	6/10/96
SAMPLE MATRIX	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	1.0	--	--	--	--	--	--	--	--
COMPOUND	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	< 1	< 1	< 1	< 1	< 1	< 1	< 2	< 1	< 1
1,1-Dichloroethene	< 1	< 1	< 1	< 1	< 1	< 1	3.6	1.1	1.4
1,2-Dichloroethene (total)	6.9	1.2	1.2	1.1	< 1	1	2	1.2	1.5
Chloroform	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-Trichloroethane	5.7	< 1	< 1	< 1	< 1	< 1	1.8	2.5	< 1
Carbon Tetrachloride	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethene	21	< 1	< 1	< 1	< 1	< 1	3.8	5	3.9
1,1,2-Trichloroethane	2.9	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.7
Tetrachloroethene	NQ	< 1	< 1	< 1	< 1	< 1	7.4	4.7	3.8
1,1,2,2-Tetrachloroethane	NQ	< 1	< 1	< 1	< 1	< 1	3.3	< 1	23
Benzene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Xylenes (total)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

NQ - Not Quantified

SAMPLE ID	EA-102	EA-102	EA-102	EA-102	EA-102	EA-102	EA-103	EA-103	EA-103	EA-103	EA-103
SAMPLE INTERVAL (ft bg)	29-31'	--	--	--	--	--	0-2'	2-4'	4-6'	6-8'	8-10'
DATE COLLECTED	6/11/96	6/11/96	6/11/96	6/11/96	6/11/96	6/11/96	6/17/96	6/17/96	6/17/96	6/17/96	6/17/96
DATE ANALYZED	6/17-25/96	6/11/96	6/10/96	6/10/96	6/13/96	6/14/96	6/18/96	6/18/96	6/18/96	6/18/96	6/18/96
SAMPLE MATRIX	SOIL	WATER	WATER	WATER	WATER	WATER	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	--	10.0	50.0	100.0	200.0	250.0	--	--	--	--	--
COMPOUND	CONC ug/Kg	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
1,1-Dichloroethene	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	**57**	**170**	NQ	NQ	<200	<250	<1	<1	<1	<1	<1
Chloroform	<5	**30**	<50	<100	<200	<250	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
Carbon Tetrachloride	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
Trichloroethene	**160**	NQ	**1800**	**2000**	**4100**	**4500**	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	**42**	NQ	**960**	**740**	**1200**	**1400**	<1	<1	<1	<1	<1
Tetrachloroethene	**18**	NQ	**230**	**290**	**490**	**520**	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	**1200**	NQ	NQ	NQ	NQ	NQ	<1	<1	<1	<1	<1
Benzene	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
Toluene	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
Ethylbenzene	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1
Xylenes (total)	<5	<10	<50	<100	<200	<250	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-103	EA-103	EA-103	EA-103	EA-103	EA-103	EA-104	EA-104	EA-104	EA-104	EA-104
SAMPLE INTERVAL (ft bg)	14-16'	23.5-25.5'	28.5-28.8'	33.5-35.2'	--	--	0-2'	2-4'	4-6'	6-8'	8-10'
DATE COLLECTED	6/17/96	6/18/96	6/18/96	6/18/96	6/18/96	6/18/96	6/26/96	6/26/96	6/26/96	6/26/96	6/26/96
DATE ANALYZED	6/18/96	6/18/96	6/18/96	6/19/96	6/18/96	6/18/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	WATER	WATER	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	--	--	--	--	1.0	5.0	--	--	--	--	--
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/L	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	19.2	21	<1	<1	<1	<1	<1
Chloroform	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	3.6	<5	<1	<1	<1	<1	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
Trichloroethene	<1	3.5	3.8	<1	22	37	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	1.8	1.6	<1	1.7	<5	<1	<1	<1	<1	<1
Tetrachloroethene	<1	3.5	4.5	<1	30	21	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	17	16	2.7	NQ	70	<1	<1	<1	<1	<1
Benzene	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1
Xylenes (total)	<1	<1	<1	<1	<1	<5	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104	EA-104
SAMPLE INTERVAL (ft bg)	14-16'	19-21'	24-26'	29-31'	34-36'	39-41'	44-46'	49-51'	54-56'	59-61'	64-66'
DATE COLLECTED	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/28/96	6/28/96
DATE ANALYZED	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/27/96	6/28/96	6/28/96	6/28/96	6/28/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	--	--	--	--	--	--	--	--	--	--	--
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-Dichloroethene	1.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.9	4
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.8	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	<1	<1	<1	<1	<1	1.8	1.6	<1	1.1	9.9	10
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.2
Tetrachloroethene	<1	<1	<1	2.7	<1	4.2	4	<1	3.2	3.8	1.2
1,1,2,2-Tetrachloroethane	<1	<1	<1	9.8	<1	17	15	<1	13	24	9.6
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylenes (total)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-104	EA-104	EA-105	EA-105	EA-105	EA-105	EA-105	EA-105	EA-105	EA-105	EA-105
SAMPLE INTERVAL (ft bg)	--	--	0-2'	2-4'	4-6'	6-8'	8-10'	14-15'	24-26'	26-27.5'	29-30.5'
DATE COLLECTED	6/28/96	6/28/96	6/4/96	6/4/96	6/4/96	6/4/96	6/4/96	6/4/96	6/5/96	6/5/96	6/5/96
DATE ANALYZED	6/28/96	6/28/96	6/4/96	6/4/96	6/4/96	6/4/96	6/4/96	6/4/96	6/5/96	6/5/96	6/5/96
SAMPLE MATRIX	WATER	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	1.0	5.0	--	--	--	--	--	--	--	--	--
COMPOUND	**CONC ug/L**	**CONC ug/L**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**	**CONC ug/Kg**
Methylene Chloride	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-Dichloroethene	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	**2.6**
1,2-Dichloroethene (total)	**112**	**109**	<1	<1	<1	**1.1**	**1.2**	**1.3**	<1	<1	<1
Chloroform	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	**4.5**	**5.7**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon Tetrachloride	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	NQ	**120**	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	**6.9**	**6.5**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene	NQ	19	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	**53**	**93**	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzene	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylenes (total)	<1	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-105	EA-105	EA-105	EA-105	EA-105	EA-105	EA-106	EA-106	EA-106	EA-106	EA-106
SAMPLE INTERVAL (ft bg)	--	--	--	--	30-32.5'	30-32.5'	0-2'	2-4'	4-6'	6-8'	9-11'
DATE COLLECTED	6/4/96	6/4/96	6/4/96	6/4/96	6/5/96	6/5/96	6/21/96	6/21/96	6/21/96	6/21/96	6/21/96
DATE ANALYZED	6/4/96	6/4/96	6/4/96	6/4/96	6/5/96	6/5/96	6/25/96	6/25/96	6/25/96	6/21/96	6/21/96
SAMPLE MATRIX	WATER	WATER	WATER	WATER	WATER	WATER	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	1.0	1.0 (DUP)	5.0	5.0 (DUP)	1.0	5.0	--	--	--	--	--
COMPOUND	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
1,1-Dichloroethene	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	7.2	7.2	21.1	12.7	4.3	7.2	<1	<1	<1	<1	<1
Chloroform	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	6.3	5.7	8.2	7.9	4.6	6.1	<1	<1	<1	<1	<1
Carbon Tetrachloride	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
Trichloroethene	16	15	25	23	9.3	13	<1	<1	<1	<1	<1
1,1,2-Trichloroethane	<1	4.1	5.7	<5	<1	<5	<1	<1	<1	<1	<1
Tetrachloroethene	NQ	NQ	25	25	NQ	20	<1	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	2.2	1.7	<5	<5	1.4	<5	1.6	<1	<1	<1	<1
Benzene	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
Toluene	2.5	2.3	<5	<5	<1	<5	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1
Xylenes (total)	<1	<1	<5	<5	<1	<5	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-106	EA-106	EA-106	EA-106	EA-106	EA-106	EA-106	EA-106	EA-107	EA-107	EA-107
SAMPLE INTERVAL (ft bg)	14-16'	19-21'	24-26'	29-31'	34-36'	39-41'	--	--	0-2'	2-4'	4-6'
DATE COLLECTED	6/21/96	6/21/96	6/21/96	6/21/96	6/21/96	6/21/96	6/21/96	6/21/96	6/25/96	6/25/96	6/25/96
DATE ANALYZED	6/21/96	6/21/96	6/21/96	6/21/96	6/25/96	6/25/96	6/21/96	6/21/96	6/25/96	6/25/96	6/25/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	WATER	SOIL	SOIL	SOIL
DILUTION FACTOR	--	--	--	--	--	--	1.0	5.0	--	--	--
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/L	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	1.5
Chloroform	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1	1.6	<5	<1	<1	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
Trichloroethene	<1	<1	<1	<1	<1	<1	4.3	5.1	<1	<1	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
Tetrachloroethene	<1	1.6	<1	<1	<1	<1	4.6	8.7	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	2	<1	<1	<1	<1	15	21	<1	<1	<1
Benzene	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1
Xylenes (total)	<1	<1	<1	<1	<1	<1	<1	<5	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-107	EA-107	EA-107	EA-107	EA-107	EA-107	EA-107	EA-107	EA-107	EA-107	EA-108
SAMPLE INTERVAL (ft bg)	6-8'	9-11'	14-16'	19-21'	24-26'	29-31'	34-36'	39-41'	--	--	0-2'
DATE COLLECTED	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/6/96
DATE ANALYZED	6/25/96	6/25/96	6/25/96	6/25/96	6/25/96	6/27/96	6/27/96	6/27/96	6/25/96	6/25/96	6/6/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	WATER	SOIL
DILUTION FACTOR	--	--	--	--	--	--	--	--	1.0	5.0	--
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/L	CONC ug/L	CONC ug/Kg
Methylene Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,2-Dichloroethene (total)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	1.2
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	3.8	<5	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Trichloroethene	<1	<1	<1	<1	<1	<1	<1	<1	10	13	<1
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Tetrachloroethene	<1	<1	1.1	<1	<1	1.3	<1	<1	NQ	22	<1
1,1,2,2-Tetrachloroethane	<1	2.5	3.9	<1	2	4.4	<1	<1	37	65	<1
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Xylenes (total)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1

NQ - Not Quantified

SAMPLE ID	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108	EA-108
SAMPLE INTERVAL (ft bg)	2-4'	4-6'	6-8'	8-10'	14-16'	19-21'	24-26'	29-29.5'	CV	CV	BAILER
DATE COLLECTED	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96
DATE ANALYZED	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96	6/6/96
SAMPLE MATRIX	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	WATER	WATER	WATER
DILUTION FACTOR	--	--	--	--	--	--	--	--	1.0	5.0	1.0
COMPOUND	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/L	CONC ug/L	CONC ug/L
Methylene Chloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,1-Dichloroethene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,2-Dichloroethene (total)	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Chloroform	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	5.9	8	6.9
Carbon Tetrachloride	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Trichloroethene	<1	<1	<1	<1	<1	<1	<1	1.3	11	15	15
1,1,2-Trichloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Tetrachloroethene	<1	<1	<1	<1	1.4	1.6	2.5	5.9	NQ	31	NQ
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Benzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Toluene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	1.3
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1
Xylenes (total)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<5	<1

NQ - Not Quantified

SAMPLE ID	EA-108	EA-109	EA-109	EA-109	EA-109	EA-109	EA-109	EA-109	EA-109	EA-109	EA-109
SAMPLE INTERVAL (ft bg)	BAILER	0-2'	2-4'	4-6'	6-8'	8-10'	14-16'	19-21'	24-26'	29-31'	34-35.3'
DATE COLLECTED	6/6/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/20/96	6/20/96	6/20/96	6/20/96
DATE ANALYZED	6/6/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/19/96	6/20/96	6/20/96	6/20/96	6/20/96
SAMPLE MATRIX	WATER	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
DILUTION FACTOR	5.0	--	--	--	--	--	--	--	--	--	--
COMPOUND	CONC ug/L	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg	CONC ug/Kg
Methylene Chloride	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1-Dichloroethene	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-Dichloroethene (total)	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,1,1-Trichloroethane	10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbon Tetrachloride	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene	22	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.1
1,1,2-Trichloroethane	<5	<1	<1	<1	<1	<1	<1	2.9	1.3	<1	<1
Tetrachloroethene	NQ	<1	<1	<1	<1	<1	<1	1.4	<1	1.1	<1
1,1,2,2-Tetrachloroethane	<5	1.1	<1	<1	<1	<1	1.8	5	1.4	4.7	5
Benzene	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylenes (total)	<5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

NQ - Not Quantified

SAMPLE ID	EA-109	EA-109	MW03-14D	MW03-14D
SAMPLE INTERVAL (ft bg)	--	--	--	--
DATE COLLECTED	6/20/96	6/20/96	7/1/96	7/1/96
DATE ANALYZED	6/20/96	6/20/96	7/3/96	7/3/96
SAMPLE MATRIX	WATER	WATER	WATER	WATER
DILUTION FACTOR	1.0	5.0	50.0	2,500.0
COMPOUND	CONC ug/L	CONC ug/L	CONC ug/L	CONC ug/L
Methylene Chloride	<1	<5	<50	<2500
1,1-Dichloroethene	<1	<5	150	<2500
1,2-Dichloroethene (total)	4.4	<5	31000	32000
Chloroform	<1	<5	320	<2500
1,1,1-Trichloroethane	4	4.4	<50	<2500
Carbon Tetrachloride	<1	<5	<50	<2500
Trichloroethene	14	19	NQ	78000
1,1,2-Trichloroethane	<1	<5	4700	7100
Tetrachloroethene	NQ	20	NQ	100000
1,1,2,2-Tetrachloroethane	28	54	NQ	<2500
Benzene	<1	<5	<50	<2500
Toluene	<1	<5	<50	<2500
Ethylbenzene	<1	<5	<50	<2500
Xylenes (total)	<1	<5	<50	<2500

NQ - Not Quantified

Table 2-2
Summary of Volatile Organic Conpounds Detected in 1996 Soil Samples (ug/Kg)
Site 03/Nike
NCBC Davisville, RI

Sample I.D.	EA-101	EA-101	EA-102	EA-102	EA-103	EA-103	EA-104	EA-104	EA-105	EA-105
Depth	19-21	29-31	6-8	29-31	23.5-25.5	28.5-28.8	39-41	59-61	6-8	29-30.5
Date Collected	06/13/96	06/13/96	06/10/96	06/11/96	06/18/96	06/18/96	06/27/96	06/28/96	06/04/96	06/05/96
ANALYTE										
* Chloromethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
Bromomethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Vinyl Chloride	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Chloroethane	13 U	12 U	12 UJ	1300 U	10 U	12 U	12 U	12 UJ	11 U	11 U
Methylene Chloride	28 U	24 U	33 B	1300 U	10 U	12 U	17 U	14 U	11 U	11 U
Acetone	810 D	580 D	12 U	790 J	10 U	12 U	12 UJ	12 U	17 U	190
Carbon Disulfide	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,1-Dichloroethene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,1-Dichloroethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,2-Dichloroethene (total)	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Chloroform	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,2-Dichloroethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
2-Butanone	53 J	110 J	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,1,1-Trichloroethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Carbon Tetrachloride	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
Bromodichloromethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
1,2-Dichloropropane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
cis-1,3-Dichloropropene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Trichloroethene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	4 J	11 U	11 U
Dibromochloromethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* 1,1,2-Trichloroethane	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
< Benzene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
trans-1,3-Dichloropropene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
Bromoform	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
4-Methyl-2-Pentanone	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
2-Hexanone	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Tetrachloroethene	2 J	12 U	12 U	1300 U	10 U	5 J	12 U	4 J	11 U	11 U
* 1,1,2,2-Tetrachloroethane	28	12 U	12 U	1300 J	9 J	22	12 U	6 J	11 U	11 U
< Toluene	2 J	3 J	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
* Chlorobenzene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
< Ethylbenzene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
Styrene	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
< Total Xylenes	13 U	12 U	12 U	1300 U	10 U	12 U	12 U	12 U	11 U	11 U
DILUTION FACTOR	1	1	1	1	1	1	1	1	1	1
% SOLIDS	75	85	84	90	97	82	82	80	91	90
< Total BTEX	2	3	ND	ND	ND	ND	ND	ND	ND	ND
* Total Chlorinated VOC	30	ND	ND	1300	9	27	ND	14	ND	ND

VALIDATED DATA

U=Undetected, B=found in method blank, J=Est value, D=diluted; *Site 03/Nike Source Area Characterization and Offsite Invest. Rpt*

Sample I.D. Depth Date Collected ANALYTE	EA-106 19-21 06/22/96	EA-106 39-40.3 06/22/96	EA-107 14-16 06/25/96	EA-107 24-26 06/25/96	EA-107/DUP2 24-26 06/25/96	EA-108 14-16 06/06/96	EA-108/DUP1 14-16 06/06/96	EA-108 19-21 06/06/96	EA-109 19-21 06/20/96
* Chloromethane	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
Bromomethane	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* Vinyl Chloride	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* Chloroethane	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
Methylene Chloride	11 U	11 U	17 U	13 U	13 U	12 U	12 U	12 U	12 U
Acetone	120	12 U	150 D	79	91	12 U	12 U	19 U	12 U
Carbon Disulfide	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* 1,1-Dichloroethene	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* 1,1-Dichloroethane	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* 1,2-Dichloroethene (total)	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* Chloroform	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
* 1,2-Dichloroethane	11 U	11 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U
2-Butanone	15	11 U	38	8 J	11 J	12 U	12 U	12 U	12 U
* 1,1,1-Trichloroethane	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
* Carbon Tetrachloride	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
Bromodichloromethane	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
1,2-Dichloropropane	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
cis-1,3-Dichloropropene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
* Trichloroethene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
Dibromochloromethane	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
* 1,1,2-Trichloroethane	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
< Benzene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
trans-1,3-Dichloropropene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
Bromoform	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
4-Methyl-2-Pentanone	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
2-Hexanone	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
* Tetrachloroethene	4 J	11 U	3 J	11 U	11 U	12 UJ	2 J	3 J	12 U
* 1,1,2,2-Tetrachloroethane	11 U	11 U	18	11 U	11 U	12 UJ	12 U	12 U	5 J
< Toluene	11 U	11 U	3 J	11 UJ	1 J	12 UJ	12 U	12 U	12 U
* Chlorobenzene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
< Ethylbenzene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
Styrene	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
< Total Xylenes	11 U	11 U	12 U	11 U	11 U	12 UJ	12 U	12 U	12 U
DILUTION FACTOR	1	1	1	1	1	1	1	1	1
% SOLIDS	92	90	85	87	88	82	86	86	86
< Total BTEX	ND	ND	3	ND	1	ND	ND	ND	ND
* Total Chlorinated VOC	4	ND	21	ND	ND	ND	2	3	5

VALIDATED DATA

Sample I.D.	EA-109	
Depth	34-35.3	
Date Collected	06/20/96	
ANALYTE		
* Chloromethane	11	U
Bromomethane	11	U
* Vinyl Chloride	11	U
* Chloroethane	11	U
Methylene Chloride	13	U
Acetone	13	UJ
Carbon Disulfide	11	U
* 1,1-Dichloroethene	11	U
* 1,1-Dichloroethane	11	U
* 1,2-Dichloroethene (total)	11	U
* Chloroform	11	U
* 1,2-Dichloroethane	11	U
2-Butanone	11	U
* 1,1,1-Trichloroethane	11	U
* Carbon Tetrachloride	11	U
Bromodichloromethane	11	U
1,2-Dichloropropane	11	U
cis-1,3-Dichloropropene	11	U
* Trichloroethene	11	U
Dibromochloromethane	11	U
* 1,1,2-Trichloroethane	11	U
< Benzene	11	U
trans-1,3-Dichloropropene	11	U
Bromoform	11	U
4-Methyl-2-Pentanone	11	U
2-Hexanone	11	U
* Tetrachloroethene	11	U
* 1,1,2,2-Tetrachloroethane	11	U
< Toluene	11	U
* Chlorobenzene	11	U
< Ethylbenzene	11	U
Styrene	11	U
< Total Xylenes	11	U
DILUTION FACTOR	1	
% SOLIDS	87	
< Total BTEX	ND	
* Total Chlorinated VOC	ND	

VALIDATED DATA

TABLE 2-3
Summary of Monitoring Well Data - Site 03/Nike
NCBC Davisville, R. I.

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
MW01-05S	6/18/93	194956.74	520705.25	32.8	35.26	10	20	22.77	12.77	(10')silty sand
MW01-06S	6/18/93	194819.04	520698.75	34.0	33.69	13	23	20.94	10.94	(10')silty sand and shale
MW01-07S	6/17/93	194905.59	520549.75	32.9	33.92	10	20	22.90	12.90	(10')silty sand
MW01-08D	10/6/95	194555.48	520460.59	38.08	37.50	35	45	3.08	-6.92	(10')silty sand
MW01-09D	10/12/95	194498.35	520719.25	39.72	39.18	37.5	41.5	2.22	-1.78	(4')till
MW01-10S	10/24/95	194871.09	519775.25	41.21	42.73	13	23	28.21	18.21	(10')f-c sand
MW01-10D	10/23/95	194868.80	519768.60	41.56	42.88	71	81	-29.44	-39.44	(10')till
MW01-11D	10/18/95	194629.67	520904.95	39.25	38.98	37	42	2.25	-2.75	(5')silt
MW01-12S	10/10/95	194729.88	520597.28	36.34	36.01	14	24	22.34	12.34	(5')silt, (5')silty f sand-f gravel
MW01-12D	10/10/95	194730.73	520602.20	36.37	35.96	48	53	-11.63	-16.63	(5')till
MW01-13S	10/12/95	194994.25	521376.12	24.65	25.99	8	18	16.65	6.65	(6')f-c sand, (4') silty vf sand w/little f gravel
MW01-13D	10/11/95	194988.78	521372.36	24.68	26.29	64	74	-39.32	-49.32	(10')till
MW01-14S	10/5/95	194684.87	521355.30	36.16	37.38	15	25	21.16	11.16	(10')gravelly sand
MW01-14D	10/4/95	194691.25	521358.93	36.25	37.62	81	89	-44.75	-52.75	(8')till
MW01-15D	10/13/95	194858.03	520699.72	32.76	32.39	46	51	-13.24	-18.24	(4')till, (1') weathered rock, schist, w/silty f sand
NETW	N/A	194710.67	520373.56	32.1	32.23	N/A	N/A	N/A	N/A	N/A
MW02-01S	10/18/89	194709.77	520373.96	37.6	39.80	15.00	25.00	22.86	12.86	N/A

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
MW02-02S	10/24/89	194920.14	520878.26	40.6	43.42	21.00	31.00	19.62	9.62	(9')gravelly sand, (1')silty sand
MW02-03S	10/24/89	194396.01	521031.94	39.5	42.61	13.00	23.00	26.54	16.54	(2')gravelly sand, (8')silty sand
MW02-03D	05/25/93	194389.69	521033.70	39.5	41.22	31.50	41.50	8.04	-1.96	(10')VF sand and silt
MW02-04S	10/24/89	194257.88	520658.62	38.5	38.19	16.00	26.00	22.48	12.48	(6')gravelly sand, (4')silty F sand
MW02-05S	10/24/89	194277.75	520620.95	38.5	38.17	16.50	26.50	21.96	11.96	(4')gravelly silty sand, (6')silty F sand
MW02-06S	10/25/89	194196.85	520644.23	37.4	36.98	16.00	26.00	21.41	11.41	(1')silty gravelly sand,(2')F sand, (7')silty F sand
MW02-07S	10/18/89	194367.26	520539.69	39.0	38.72	15.70	25.70	23.35	13.35	(1')silty gravelly sand, (9')N/A
MW02-07D	06/01/93	194361.31	520541.05	38.9	38.42	35.00	45.00	3.91	-6.09	(9')silty F sand, (1')silt and gravel
MW02-08S	05/21/93	194369.05	520634.63	38.9	38.64	11.80	26.80	27.09	12.09	(6') silt, (9') F-C sand
MW02-08D	05/21/93	194363.98	520636.48	39.0	38.63	35.90	45.90	3.10	-6.90	(10')VF sand
MW02-09S	05/20/93	194227.14	520528.54	38.5	37.93	12.00	27.00	26.51	11.51	(15')F sand
MW02-10S	05/20/93	194231.84	520677.63	37.6	37.01	13.00	28.00	24.64	9.64	(5')gravelly sand, (2')silty sand, (1')silt, (1')silty sand, (1')silt
MW02-10D	05/26/93	194236.43	520677.17	37.8	37.36	42.00	52.00	-4.20	-14.20	(2')silt, (4')F-VF sand, (4')weathered rock
MW02-11S	05/26/93	194090.70	520798.41	38.0	40.22	13.00	28.00	25.00	10.00	(15')F-C sand and gravel
MW02-11D	05/25/93	194097.67	520798.26	38.0	40.04	52.30	62.30	-14.30	-24.30	(4')sandy silt, (6')silty sand and weathered rock
MW03-01S	10/18/89	194313.02	520250.69	37.0	36.61	12.60	22.60	24.39	14.39	(4')sand, (6')silty sand
MW03-02S	05/26/93	194490.42	520255.22	36.2	38.37	8.50	23.50	27.72	12.72	(6.5')silty gravelly sand, (9.5')sand
MW03-02D	05/27/93	194492.96	520261.00	36.2	38.57	49.00	59.00	-12.78	-22.78	(5')gray silt, (5') gray silt w/rock fragments

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
MW03-03S	06/02/93	194343.26	520175.26	36.4	38.36	9.00	24.00	27.39	12.39	(5')sand, (10')sand and silt
MW03-03D	06/02/93	194347.61	520178.90	36.4	38.43	48	58	-11.61	-21.61	(1')silt, (2')silty sand, (7')silt
MW03-04S	05/26/93	194512.30	520341.81	37.7	37.24	10.00	25.00	27.70	12.70	(3')silt, (4') F-M sand, (8')F sand
MW03-05S	05/26/93	194358.59	520408.72	38.4	37.89	11.00	26.00	27.37	12.37	(4')silty sand, (4')gravelly sand, (7')silty sand
MW03-05D	05/27/93	194355.40	520414.41	38.3	37.87	35.50	45.50	2.81	-7.19	(5')sand and silt, (4')silt, (1')sand
MW03-06D	03/24/94	194264.63	519886.21	36.0	38.19	51.50	61.50	-15.51	-25.51	(4.5')silt, (5.5')weathered rock
MW03-07D	03/25/94	194200.67	519607.54	33.1	35.41	35.50	45.50	-2.44	-12.44	(4.5')gray silt, (5.5')silt and gravel
MW03-08D	03/29/94	194108.30	519132.28	30.6	32.74	28.30	38.30	2.28	-7.72	(2')sand, (8')weathered rock
MW03-08R	05/23/95	194108.15	519140.54	30.3	32.15	46.5	56.5	-16.17	-26.17	(10')bedrock
MW03-09D	05/11/95	194590.17	519533.77	41.2	43.40	51	61	-9.81	-19.81	(3')sandy silt, (1')silty sand, (6') silt
MW03-10D	05/12/95	193987.68	519678.50	34.0	35.94	39	49	-4.98	-14.98	(5')F-VF sand, (5')till
MW03-11S	05/19/95	193697.68	519082.33	29.6	31.02	5	15	24.57	14.57	(3')silty sand, (7')silty sand and silty gravel
MW03-12D	05/25/95	194395.07	518914.70	34.5	36.11	25	35	9.5	-0.5	(10')weathered rock, schist with lenses of clay, silt and sand
MW03-12R	05/26/95	194384.12	518911.97	34.2	36.21	45	55	-10.8	-20.8	(10')weathered rock, schist with lenses of sand, silt and clay
MW03-13D	05/24/95	194146.39	519003.92	30.2	32.56	29	39	1.21	-8.79	(10')sand and gravel
MW03-13R	05/31/95	194150.84	518998.79	30.1	32.38	47.2	57.2	-17.08	-27.08	(10')bedrock
MW03-14D	11/20/96◆	194265.30	518494.75	32.4	34.00	30	40	2.44	-7.56	(6')weathered rock, (4')bedrock
MW03-14R	05/23/95	194256.75	518495.96	32.3	33.98	47	57	-14.66	-24.66	(10')bedrock

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
EA-101	6/17/96	194341.03	518387.13	30.8	32.29	23.5	33.5	7.3	-2.7	(10')till
EA-102	6/12/96	194235.92	518418.90	32.0	33.37	21.9	31.9	10.1	0.1	(3')sand, (7')till
EA-103	6/19/96	194468.54	518483.87	33.5	35.13	25.5	35.5	8.0	-2.0	(2.5')sand, (4.5')till, (3')weathered rock
EA-104	6/28/96	194695.73	518826.24	35.93	37.40	56	66	-20.07	-30.07	(8')F-M sand, (2')weathered rock
EA-105	6/5/96	194186.17	517798.45	30.64	31.95	20	30	10.64	0.64	(10')till
EA-106D	6/24/96	194892.57	518325.63	31.87	33.17	32	42	-0.13	-10.13	(2')till, (6')weathered rock, (2')bedrock
EA-106R	1/7/98	194899.05	518334.20	31.5	33.84	59	69	-27.5	-37.5	(10')bedrock
EA-107	6/26/96	193879.83	517684.09	29.86	31.34	31	41	-1.14	-11.14	(9')till, (1')bedrock
EA-108	6/7/96	193739.59	518114.54	32.24	33.5	19.25	29.25	12.99	2.99	(8')till, (2')weathered rock
EA-109	6/20/96	194096.18	518286.57	31.9	33.39	26	36	5.9	-4.1	(8')till, (2')weathered rock
EA-110D	1/12/98	193711.81	521033.01	38.1	40.15	75	85	-36.9	-46.9	(1')silt, (9')till
EA-110R	1/22/98	193704.08	521028.56	37.5	39.71	88	113	-50.5	-75.5	(25')bedrock
EA-111D	1/23/98	193585.90	520162.80	33.9	35.91	49.5	64.5	-15.6	-30.6	(4.5')silty clay, (10.5')till
EA-111R	1/30/98	193577.94	520156.71	33.9	35.71	65	90	-31.1	-56.1	(25')bedrock
EA-112D	1/30/98	195321.62	519176.54	45.9	48.06	86	96	-40.1	-50.1	(10')weathered rock
EA-112R	2/13/98	195326.33	519191.48	46.0	48.52	96.5	121.5	-50.5	-75.5	(25')bedrock
EA-113D	2/18/98	195128.88	518645.89	28.7	31.42	42.5	52.5	-13.8	-23.8	(7')weathered rock, (3')bedrock
ME-1	10/04/93	193908.69	517878.94	30.8	32.27	4.7	14.7	26.08	16.08	(2')fill, (8')sand and gravel
ME-2	10/05/93	194419.89	518886.95	35.2	37.31	10	19.9	25.24	15.24	(10')sand and gravel

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
ME-3	10/12/93	194481.56	517758.23	33.4	34.90	8	18	25.39	15.39	(6')F-C sand, (4')sand, weathered rock
ME-4	10/06/93	193611.62	518757.11	33.0	34.63	10	19.9	23.01	13.01	(5')sand and gravel, (5')sand, silt and gravel
NMW-1	11/19/87	194090.79	518283.74	32.5	34.23	5.68	15.73	26.23	16.18	(10')sand
NMW-2	11/20/87	194417.49	518230.69	33.4	35.08	6.06	16.14	26.59	16.51	(10')sand
NMW-3	11/20/87	194161.79	517992.32	33.1	35.01	7.40	17.56	25.09	14.93	(10')silty sand
NMW-4	11/23/87	193662.17	518127.64	30.7	32.59	4.09	14.12	26.10	16.07	(10.03')silty sand and sand
25MW-01S	7/20/94	194626.89	520610.72	38.5	38.13	20	30	17.65	7.65	(5')silty gravelly sand, (5')silty sand
26MW-01S	7/50/94	194503.05	520721.88	39.8	39.48	19	29	20.03	10.03	(10')sand
26MW-02S	7/21/94	194499.96	520708.21	39.9	39.53	20	30	19.07	9.07	(6')sand and silt, (4')sand
26MW-03S	7/21/94	194607.10	520703.23	39.1	38.73	20	30	18.25	8.25	(6')sand, silt, gravel, (4')silty sand
66MW-01S	7/19/94			38.8	39.30	20	30	18.83	8.83	N/A
RMW-01S	11/19/91			38.6	38.2	15.61	25.61	22.94	12.94	(10')VF-M sand and silt
RMW-01I	11/19/91			37.4	38.2	32.00	42.00	5.4	-4.6	(10')VF sand and silt
RMW-01D	11/19/91			37.2	38.26	50.98	60.98	-13.8	-23.8	(10')VF sand and silt
RMW-02S	11/21/91			23.8	25.5	4.79	14.79	18.98	8.98	(10')silty sand
RMW-02D	11/21/91			23.7	25.55	19.7	29.7	4.03	-5.97	(10')VF sandy silt
RMW-03S	11/26/91			14.9	16.57	1.94	11.94	12.95	2.95	(10')F sand and silt
RMW-03D	11/26/91			14.8	16.82	23.8	33.8	-8.95	-18.95	(10')silty F sand
MW-Z3-01	12/22/95	194859.93	519008.51	41.5	43.80	81	91	-39.5	-49.5	(10')weathered rock
MW-Z3-02	12/29/95	195381.56	520879.35	37.2	36.67	50	60	-12.8	-22.8	(10')till

Well Number	Date Installed	Rhode Island Grid Coordinates		Ground Elevation (FAMSL)	Top of Riser Elevation (FAMSL)	Screen Depth (FBGS)		Screen Elevation (FAMSL)		Geological Unit Screened
		North	East			Top	Bottom	Top	Bottom	
MW-Z3-03	12/21/95	193937.32	520481.59	38.1	40.00	54	64	-15.9	-25.9	(5')silt, (5')till
MW-Z4-01	12/18/95	193661.88	521498.15	38.9	40.77	74.5	84.5	-35.6	-45.6	(9')silt, (1')till
MW-Z4-02	12/18/95	193011.77	521599.46	32.0	34.19	50	65	-18	-33	(15')till

Wells installed by:
NMW (all): Sirrine, 1987
ME (all): Metcalf & Eddy, 1993
RMW (all): RIPA, 1991
MW01-05 through 07, NETW: Halliburton NUS, 1993
MW02 (all) and MW03-01 through MW03-08D: TRC, 1989-1993
MW03-08R through MW03-14: EA, 1995
25-MW-1, 26-MW (all), 66-MW-1: Halliburton NUS, 1994
MW01-08D through MW01-15D: EA, 1995
EA 101 - EA 109: EA, 1996
EA-106R, EA 110 - EA 113: EA, 1998
MW-Z3-01 through MW-Z4-02, Stone and Webster, 1995

NOTES:
FBGS: feet below ground surface
FAMSL: feet above mean sea level
N/A: Not available
VF: Very Fine
F: Fine
M: Medium
C: Coarse
◆well replacement from PVC to stainless steel due to high CVOC detected 5/95

TABLE 2-4
Well Development Ground-Water Quality Field Data (July and November 1996)
Site 03/Nike
NCBC Davisville, R.I.

Well Number	Date	Total Gallons Pumped	Time	pH	Temp (°C)	Conductivity (mS/cm)	Eh (mV)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Salinity (%)	Observations, Initial depth to water
MW03-14D*	11/27/96	63	1628	7.44	12.14	0.221	561.5	23.5	94.1	0.0	Solvent odor detected, Depth to water = 9.03 ft from TOR
EA - 101	7/16/96	72	1815	6.00	12.1	0.214	48.9	14.5	0.11	0.00	Depth to water = 7.27 ft from TOR
EA - 102	7/17/96	60	1205	5.76	12.6	0.182	-231.5	7.45	0.52	0.00	Depth to water = 8.23 ft from TOR
EA - 103	7/16/96	74.5	1228	5.77	12.7	0.133	149.0	12.4	0.39	0.00	Depth to water = 10.40 ft from TOR
EA - 104	7/16/96	102	1314	5.48	12.2	0.124	127	9	1.50	0.1	Depth to water = 13.19 ft from TOR
EA - 105	7/10/96	72	1330	5.25	11.4	0.079	348.8	5.72	4.71	0.00	Depth to water = 8.58 ft from TOR
EA - 106	7/9/96	93.5	1831	5.88	12.1	0.138	214.0	18	6.40	0.00	Depth to water = 8.52 ft from TOR
EA - 107	7/11/96	110	1400	6.56	12.1	0.159	151.3	7.14	4.05	0.00	Depth to water = 8.93 ft from TOR
EA - 108	7/11/96	45.5	1115	5.82	12.8	0.173	142.8	6.53	1.94	0.00	Depth to water = 9.35 ft from TOR
EA - 109	7/15/96	67.5	1717	6.07	15.3	0.217	45.5	26.2	0.15	0.00	Depth to water = 8.15 ft from TOR

Notes:
Equipment used (EA-101 through EA-102): Horiba U-10 Water Quality Meter with flow through cell, Hach 2100P Turbidimeter, Orion 250A, and Grundfos pump with dedicated PE tubing.
NTU - Nephlometric Turbidity Units
mg/L - milligrams per liter
°C - degrees Celsius
mS/cm - millisiemens/centimeter
mV - millivolts
TOR = Top of inner PVC (or stainless steel) riser.
* = after well replacement of PVC with Stainless steel (11/96). Equipment used: Grundfos pump with dedicated teflon tubing,, YSI 3800 Water Quality Meter with flow through cell, and Hach 2100P Turbidimeter.
The MW03-14D original conductiviity value was recorded incorrectly as 221, but should be 0.221, as shown. Also, the DO value is believed to have been measured as %, but inadvertently recorded as mg/L.

TABLE 2-5
Analytical Program for Ground-Water Samples (December 1996)
Site 03/Nike
NCBC Davisville, RI

Description	Method	Instrument Detection limit
Volatile Organics by GC/MS	SW 8260	--
Alkalinity by Titration (pH 4.5)	EPA 310.1	2.0 mg/L
Sulfate (SO4) by IC	EPA 300.0	0.40 mg/L
Total Bromide by IC	EPA 300.0	0.50 mg/L
Total Chloride by IC	EPA 300.0	0.20 mg/L
Nitrate (NO_3) by IC	EPA 300.0	0.10 mg/L
Nitrite (NO_2) by IC	EPA 300.0	0.10 mg/L
Orthophosphate (PO_4) by IC	EPA 300.0	0.01 mg/L
BOD	EPA 405.1	4.0 mg/L
Total Calcium by ICP	EPA 200.7	0.20 mg/L
Total Magnesium by ICP	EPA 200.7	0.01 mg/L
Total Iron	EPA 200.7	0.20 mg/L
Total Manganese	EPA 200.7	0.010 mg/L
Total Sodium by ICP	EPA 200.7	0.50 mg/L
Total Potassium by ICP	EPA 200.7	0.50 mg/L
Total Ammonia NH_3	EPA 350.2	0.10 mg/L
Total Kjeldahl Nitrogen (TKN)	EPA 351.3	0.50 mg/L
Total Organic Carbon (TOC)	EPA 415.2	0.10 mg/L
Total Phosphorus	EPA 365.2	0.02 mg/L
COD	EPA 410.4	5.0 mg/L
Total Inorganic Carbon (TIC)	EPA 415.2	0.10 mg/L
Hydrogen Sulfide	EPA 376.2	0.05 mg/L
Dissolved Ferrous iron	Hach Kit DR/ 700 *Method 8146	Range 0-5 mg/L
Dissolved Hydrogen	GC with RGD	0.01 mg/L
Methane / Ethane / Ethene	GC with FID	methane- 0.001mg/L ethane- 0.001 mg/L ethene- 0.003 mg/L
Dissolved Carbon dioxide	Hach Digital Titrator *Method 8205	Range 10-1000 mg/L Inc - 0.1-2mg/L
	Hach Drop Count titr; color disc colorimetry	Range 5-100 mg/L; Inc - 5 mg/L
DO, pH, Eh, temperature, conductivity, *turbidity * not measured via Flow-Through Cell	EPA 150.1 YSI 3800 / Horiba U-10 or equivalent HACH Turbidimeter	DO: 0 to 20 mg/L pH: 0 to 14 Temp: -5 to 50C Turb:0-1000NTU Sp Cd: 0-100mS/cm

Note:* Standard Method for the Examination of Water and Wastewater, published by the American Public Health Association (APHA), the American Water Works Association (AWWA) and the Water Pollution Control Federation (WPCF).

TABLE 2-6
Ground-Water Quality Parameters Field-Measured Prior to Well Sampling (December 1996)
Site 03/Nike
NCBC Davisville, R.I.

Well Number	Date	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Salinity %	Eh (mV)
MW01-08D	12/15/96	12.8	5.84	0.126	1.118	9.1	NM	90
MW01-09D	12/11/96	12.79	6.01	72.00	0.61	18	NM	216.1
MW01-10D	12/13/96	11.4	6.58	0.172	1.95	11.9	0.1	-47
MW01-11D	12/13/96	10.0	6.94	0.072	9.02	45	NM	144.3
MW01-12D	12/10/96	13.8	6.18	0.208	1.56	185	0.1	-29
MW01-13D	12/13/96	9.72	6.50	194.1	1.17	55.4	NM	-84.1
MW01-14D	12/15/96	9.86	6.00	121.6	4.24	96.9	NM	-12.6
MW01-15D	12/10/96	12.35	5.81	120.0	46.3*	18.3	NM	-52.7
MW02-03D	12/10/96	14.0	4.85	0.182	1.36	76.6	0.1	56
MW02-08D	12/11/96	12.93	5.41	89.76	0.77	118.7	NM	229.2
MW02-10D	12/15/96	13.5	6.29	0.79	0.15	off scale	0.10	-35
MW02-11D	12/11/96	11.8	5.81	0.176	1.11	23.7	0.1	17
MW03-02D	12/10/96	9.93	5.94	148.6	1.2	39.1	NM	-53.4
MW03-03D	12/10/96	8.5	6.62	0.147	9.43	11	NM	64.8
MW03-05D	12/13/96	12.38	5.49	52.0	5.99	64.0	NM	345.1
MW03-06D	12/15/96	12.36	5.52	98.70	1.88	>200	NM	81.9
MW03-07D	12/12/96	9.8	6.08	0.084	9.00	273	NM	71.2
MW03-08D	12/12/96	10.8	3.36	0.086	1.49	22.6	0.0	252
MW03-09D	12/12/96	9.95	6.45	154.6	0.41	15.8	NM	-113.4
MW03-10D	12/11/96	12.5	5.08	0.122	1.16	9	0.1	-15

Well Number	Date	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Salinity %	Eh (mV)
MW03-12D	12/16/96	9.1	5.57	0.116	1.08	2.5	NM	183
MW03-13D	12/12/96	9.18	5.21	50.0	4.28	19	NM	339.5
MW03-14D	12/16/96	9.81	9.06	420	0.15	off scale	0.20	-323
MW-Z3-01	12/18/96	11.6	7.30	0.174	1.30	7.37	NM	-47
MW-Z3-02	12/9/96	12.0	5.34	0.158	1.46	>1000	0.1	-5
MW-Z3-03	12/15/96	11.08	6.05	123.0	0.42	>1000	NM	-95.5
MW-Z4-01	12/17/96	13.1	7.95	0.132	0.90	>1000	NM	-19
RMW-01D	12/15/96	10.4	6.70	0.110	1.10	>1000	NM	52
RMW-02D	12/16/96	10.7	5.65	0.112	1.76	>1000	NM	231
EA-101	12/16/96	10.30	5.33	118.9	2.78	6.0	NM	10.5
EA-102	12/16/96	9.71	5.32	68.0	0.40	37.1	NM	0.3
EA-103	12/17/96	11.24	5.22	88.46	0.85	9.0	NM	259.7
EA-104	12/17/96	11.2	5.45	0.82	1.04	7	0.0	304
EA-105	12/17/96	11.1	5.42	0.094	5.98	1	NM	258
EA-106	12/12/96	9.5	7.82	0.158	4.73	187	0.1	82
EA-107	12/13/96	10.76	5.89	81.0	3.87	4.05	NM	289.7
EA-108	12/13/96	11.9	6.39	0.178	1.68	2.82	0.1	-47
EA-109	12/17/96	12.52	5.63	103.0	0.67	7.87	NM	210

NOTES: This table shows the last set of parameters measured before removal of flow through cell just prior to sample collection.
NM=Not Measured °C = degrees Celsius mg/L = milligrams per litre
mS/cm = millisiemens/centimeter NTU = Nephlometric Turbidity Units mV = millivolt
* The DO value is believed to have been measured as %, but inadvertently recorded as mg/L

TABLE 2-7
Well Development Ground-Water Quality Field Data (February 1998)
Site 03/Nike
NCBC Davisville, RI

Well Number	Date	Total Gallons Pumped	Time	pH	Temp (°C)	Conductivity (mS/cm)	Eh (mV)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Salinity (%)	Observations, Notes
EA-106R	2/10/98	185	1335	7.68	10.6	0.190	2	2	0.98	0.1	Turbidity measured with YSI
EA-110D	2/6/98	1100	1350	6.09	12.2	0.186	90	12.9	3.37	0.1	Total gallons purged = 1115
EA-110R	2/4/98	355	1553	8.83	12.1	0.228	115	0.96	3.82	0.1	Final depth to water = 20.92 from TOR
EA-111D	2/10/98	665	1343	6.25	11.8	0.156	-0.1	2.37	0.73	0.1	Well bottom hard after development
EA-111R	2/3/98	55	1705	6.74	13.4	0.262	5	75	3.02	0.1	Purged dry once, turbididty measured with YSI
EA-112D	2/20/98	1220	1246	6.60	10.5	0.168	-19	0	0.25	0.1	Turbidity measured with YSI
EA-112R	2/20/98	3055	1617	6.31	11.4	0.170	9	0	3.90	0.1	Turbidity measured with YSI
EA-113D	2/23/98	106	1745	6.72	10.5	0.16	-21	0.58	3.91	0.1	Final depth to water = 9.01
MW02-10D	2/12/98	340	1605	6.40	14	0.182	-16	12.1	1.78	0.1	
MW-Z3-03	2/12/98	605	1505	6.44	12.6	0.134	-0.1	35.4	0.52	0.1	

Notes:
Equipment used Grant YSI 3800 Water Quality Meter, Hach 2100P Turbidimeter, and Grundfos pump with dedicated teflon lined PE tubing.
NTU - Nephlometric Turbidity Units
mg/L - milligrams per liter
°C - degrees Celsius
mS/cm - millisiemens/centimeter
mV - millivolts
TOR = Top of inner PVC riser.

TABLE 2-8
Analytical Program for Ground-Water Samples (March 1998)
Site 03/Nike
NCBC Davisville, RI

Description	Method	Instrument Detection limit
Volatile Organics by GC/MS	SW 8260	--
Sulfate (SO4) by IC	EPA 300.0	0.40 mg/L
Total Chloride by IC	EPA 300.0	0.20 mg/L
Nitrate (NO_3) by IC	EPA 300.0	0.10 mg/L
Nitrite (NO_2) by IC	EPA 300.0	0.10 mg/L
Dissolved Iron	EPA 200.7	0.20 mg/L
Dissolved Manganese	EPA 200.7	0.010 mg/L
Total Ammonia NH_3	EPA 350.2	0.10 mg/L
Total Organic Carbon (TOC)	EPA 415.2	0.10 mg/L
Total Inorganic Carbon (TIC)	EPA 415.2	0.10 mg/L
Hydrogen Sulfide	EPA 376.2	0.05 mg/L
Dissolved Ferrous iron	Hach Kit DR/ 700 *Method 8146	Range 0-5 mg/L
Dissolved Hydrogen	GC with RGD	0.01 mg/L
Methane / Ethane / Ethene	GC with FID	methane- 0.001mg/L ethane- 0.001 mg/L ethene- 0.003 mg/L
Dissolved Carbon dioxide	Hach Digital Titrator *Method 8205	Range 10-1000 mg/L Inc - 0.1-2mg/L
	Hach Drop Count titr; color disc colorimetry	Range 5-100 mg/L; Inc - 5 mg/L
DO, pH, Eh, temperature, conductivity, *turbidity * not measured via Flow-Through Cell	EPA 150.1 YSI 3800 / Horiba U-10 or equivalent HACH Turbidimeter	DO: 0 to 20 mg/L pH: 0 to 14 Temp: -5 to 50C Turb:0-1000NTU Sp Cd: 0-100mS/cm

Note: * Standard Method for the Examination of Water and Wastewater, published by the American Public Health Association (APHA), the American Water Works Association (AWWA) and the Water Pollution Control Federation (WPCF).

TABLE 2-9
Ground-Water Quality Parameters Field-Measured Prior to Well Sampling (February and March 1998)
Site 03/Nike
NCBC Davisville, R.I.

Well Number	Date	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Salinity %	Eh (mV)
EA-110D	2/17/98	11.4	7.04	0.21	0.40	25	0.1	-97
EA-110R	2/18/98	9.2	9.97	0.210	1.65	1.49	0.1	-160
EA-111D	2/18/98	9.7	6.56	0.200	0.33	0.93	0.1	-39
EA-111D	2/18/98	11.5	6.46	0.196	0.37	2.22	0.1	-33
EA-111R	2/17/98	8.7	6.93	0.16	0.11	6.88	0.1	-0.1
EA-111R	2/17/98	10.3	6.98	0.13	0.11	35.4	0.1	-0.1
MW01-12D	3/10/98	12.11	6.48	181.00	0.27	40	0.09	-106.6
MW01-14D	3/10/98	12.37	6.55	162.00	0.58	60	0.08	-77.9
MW02-03D	3/10/98	9.12	6.28	154.00	0.75	9.38	0.07	-38.3
MW02-10D	3/11/98	9.24	6.04	148.00	1.42	160	0.07	-27.5
MW03-03D	3/11/98	8.24	6.19	188.00	0.94	3.30	0.09	-37.0
MW03-07D	3/11/98	6.05	5.92	145.00	NA	11	0.07	53.8
MW03-08D	3/11/98	6.69	5.30	94.00	0.48	2.3	0.04	102.1
MW03-14D	3/12/98	6.63	6.77	441.00	2.12	75.5	0.21	129.6
MWZ3-01	3/12/98	7.64	6.44	144.00	0.46	13	0.07	-215.6
MWZ3-03	3/10/98	9.57	6.32	166.00	0.43	12	0.08	-88.8
MWZ4-01	3/13/98	10.58	6.72	114.00	0.43	>999[1]	0.05	-102.0
MWZ4-02	3/13/98	9.42	7.13	212.00	0.35	11.4	0.10	-182.8
EA-105	3/11/98	8.98	5.36	86.00	3.07	0.65	0.04	134.8

Well Number	Date	Temperature (°C)	pH	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Salinity %	Eh (mV)
EA-106R	3/13/98	8.37	7.44	146.00	1.02	7.9	0.07	-185.4
EA-110D	3/12/98	8.81	7.01	232.00	0.26	190	0.11	-251.3
EA-110R	3/17/98	10.68	9.50	199.00	-0.01	3.51	0.09	18.6
EA-111D	3/12/98	10.24	6.32	188.00	0.30	55	0.09	-185.1
EA-111R	3/13/98	7.46	6.51	237.00	1.60	28	0.11	-225.1
EA-112D	3/12/98	9.05	6.18	206.00	0.31	4.36	0.10	-14.1
EA-112R	3/13/98	7.18	6.22	183.00	0.63	2.85	0.09	-50.2
EA-113D	3/13/98	8.09	6.40	137.00	2.09	NA	0.06	-141.2

NOTES: This table shows the last set of parameters measured before removal of flow through cell just prior to sample collection.

NA = Data not available | °C = degrees Celsius | mg/L = milligrams per litre
mS/cm = millisiemens/centimeter | NTU = Nephlometric Turbidity Units | mV = millivolt

1. The MW-Z4-01 high turbidity value is because this well was a late addition to the sampling program after the well development activity for the newly installed wells had been completed. Therefore, this previously existing well could not be redeveloped.

TABLE 3-1 SUMMARY OF DEPTH TO and ELEVATION OF TOP OF GEOLOGICAL UNITS

Site 03/Nike

NCBC Davisville, RI

W ll Designation	El vation Ground Surface (ft MSL	Fill		Sand		Silt		Other*		Sand & Gravel		Rock: Weathered		Rock: Competent		Total Depth	
		Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	Depth (ft bg)	Elevation (ft MSL)	D pth (ft bg)	Elevation (ft MSL)
EA-101	30.8	0.0	30.8	2.5	28.3			14.0	16.8	19.0	11.8	21.0	9.8	33.5	-2.7	41.0	-10.2
EA-102	32.0			0.0	32.0					24.0	8.0			32.0	0.0	39.0	-7.0
EA-103	33.5			0.0	33.5					28.0	5.5	33.0	0.5	35.5	-2.0	43.0	-9.5
EA-104	35.9			0.0	35.9							64.0	-28.1	66.5	-30.6	74.0	-38.1
EA-105	30.6			0.0	30.6							24.0	6.6	30.5	0.1	37.5	-6.9
EA-106D	31.9			0.0	31.9					19.0	12.9	34.0	-2.1	40.3	-8.4	47.0	-15.1
EA-106R	31.5													42.1	-10.6	69.1	-37.6
EA-107	29.9			0.0	29.9					24.0	5.9			39.9	-10.0	47.0	-17.1
EA-108	32.2			0.0	32.2							24.0	8.2	29.5	2.7	36.0	-3.8
EA-109	31.9			0.0	31.9					24.0	7.9	34.0	-2.1	35.3	-3.4	41.0	-9.1
EA-110D	38.1			0.0	38.1	74.0	-35.9			76.0	-37.9			84.5	-46.4	93.0	-54.9
EA-110R	37.5													82.0	-44.5	113.0	-75.5
EA-111D	33.9			0.0	33.9	39.0	-5.1			54.0	-20.1			64.9	-31.0	73.0	-39.1
EA-111R	33.9													62.0	-28.1	90.0	-56.1
EA-112D	45.9			0.0	45.9							79.0	-33.1	97.0	-51.1	102.0	-56.1
EA-112R	46.0													82.0	-36.0	126.3	-80.3
EA-113D	28.7			0.0	28.7					24.0	4.7	36.0	-7.3	49.5	-20.8	55.0	-26.3
MW03-14D	32.4			0.0	32.4							20.5	11.9	37.0	-4.6	42.0	-9.6
MW03-14R	32.3															57.5	-25.2
MW03-13D	30.2			0.0	30.2			25.0	5.2			39.0	-8.8	42.5	-12.3	47.5	-17.3
MW03-13R	30.1															58.5	-28.4
MW03-10D	34.0			0.0	34.0	12.0	22.0	29.0	5.0	44.0	-10.0	50.0	-16.0	51.0	-17.0	57.0	-23.0
MW03-08D	30.6			0.0	30.6					30.0	0.6	39.0	-8.4	42.2	-11.6	39.0	-8.4
MW03-08R	30.3															59.0	-28.7
MW03-07D	33.1			0.0	33.1	25.3	7.8			40.0	-6.9			45.0	-11.9	45.0	-11.9
MW03-06D	36.0	0.0	36.0	2.0	34.0	35.0	1.0					55.0	-19.0	61.5	-25.5	61.5	-25.5
MW03-05D	38.3			0.0	38.3	34.0	4.3							47.5	-9.2	56.0	-17.7
MW03-03D	36.4			0.0	36.4	34.0	2.4							58.5	-22.1	64.5	-28.1
MW-Z3-1	41.5			0.0	41.5					49.0	-7.5	54.0	-12.5	97.0	-55.5	97.0	-55.5
MW-Z3-3	38.1			0.0	38.1	24.0	14.1			59.0	-20.9			64.5	-26.4	64.5	-26.4
MW-Z4-1	38.9			0.0	38.9	29.0	9.9			84.0	-45.1			85.0	-46.1	85.0	-46.1
MW02-03D	39.5			0.0	39.5	31.0	8.5							42.0	-2.5	52.5	-13.0
MW02-10D	37.8	0.0	37.8	10.0	27.8	29.0	8.8	44.0	-6.2			48.0	-10.2	53.5	-15.7	53.5	-15.7
MW01-14D	36.2	0.0	36.2	2.0	34.2	59.0	-22.8			81.0	-44.8	89.0	-52.8	95.0	-58.8	100.0	-63.8

NOTES: ft bg = feet below grade
MSL = Mean Sea Level
* Fine to very fine sand for EA-102, MW02-10D, and MW03-10D. Low blow count silty sandy gravel to gravelly sand for MW03-13D.

TABLE 3-2
Summary of Bedrock Field Data for Offsite Investigation
Site 03/Nike
NCBC Davisville, RI

Well Designation	Screened Interval (ft bg)	Cored Interval (ft bg)	% Core Recovery	Core RQD (%)	Pack Test Water Loss (gals) & Depth Interval (ft bg)
EA-106R	59-69	45.1-50.1	65	23	34.4 (45.2-50.5)
		50.1-55.1	99	35	12.3 (50.2-55.5)
		55.1-59.1	100	88	38.8 (55.2-60.5)
		60.1-63.1	100	83	48.4 (60.6-65.8)
		63.1-69.1	93	73	0.1 (60.6-69.2)
EA-110D	75-85	88-93	100	74	Not tested
EA-110R	88-113	88-93	97	86	2.0 (89.4-94.7')
		93-98	100	62	137.8 (94.4-99.7')
		98-103	100	92	100.6 (99.4-104.7')
		103-108	100	98	6.8 (104.4-109.7')
		108-113	100	84	4.0 (104'-113')
EA-111D	49.5-64.5	68-73	60	18	Not tested
EA-111R	65-90	65-70	80	13	3.8 (66-71.3')
		70-75	100	59	0.8 (71-76.3')
		75-80	100	52	0.9 (76-81.3')
		80-85	100	53	6.0 (81.3-86.6')
		85-90	100	47	7.8 (81.3-90')
EA-112D	86-96	97-102	80	17	Not tested

Well Designation	Screened Interval (ft bg)	Cored Interval (ft bg)	% Core Recovery	Core RQD (%)	Pack Test Water Loss (gals) & Depth Interval (ft bg)
EA-112R	96.5-121.5	85-90	100	37	Not tested
		90-93.5	100	74	Not tested
		96.3-101.3	100	90	Not tested
		101.3-106.3	100	57	106.4 (99.25-104.55)
		106.3-111.3	100	68	43.5 (104.25-109.55)
		111.3-116.3	100	73	37.6 (109.25-114.55)
		116.3-121.3	100	100	3.6 (114.55-119.8)
		121.3-126.3	100	92	1.7 (114.55-126.3)
EA-113D	42.5-52.5	50-55	100	50	Not tested

NOTES: ft bg = feet below grade
RQD = percentage of the core that is 4 inches or more in length.

TABLE 3-3
Summary of Ground-Water Elevations
Site 03/Nike
NCBC Davisville, RI

Well Number	Elev. Top of Riser (FAMSL)	Depth to Water (FTOR)									Elevation of Water Surface (FAMSL)								
		2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97	2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97
NETW	32.23	N.M.	16.68	14.13	N.M.	N.M.	15.95	N.M.	N.M.	N.M.	N.M.	15.55	18.10	N.M.	N.M.	16.28	N.M.	N.M.	N.M.
MW01-05S	35.26	N.M.	19.58	17.11	17.26	19.63	19.20	N.M.	N.M.	19.02	N.M.	15.68	18.15	18.00	15.63	16.06	N.M.	N.M.	16.24
MW01-06S	33.69	N.M.	17.58	15.03	15.12	17.65	17.21	N.M.	N.M.	N.M.	N.M.	16.11	18.66	18.57	16.04	16.48	N.M.	N.M.	N.M.
MW01-07S	33.92	N.M.	17.76	15.02	15.19	17.89	17.20	N.M.	N.M.	N.M.	N.M.	16.16	18.90	18.73	16.03	16.72	N.M.	N.M.	N.M.
MW01-08D	37.50	15.94	N.I.	N.I.	N.I.	N.I.	19.27	N.M.	16.08	N.M.	21.56	N.I.	N.I.	N.I.	N.I.	18.23	N.M.	21.42	N.M.
MW01-09D	39.18	19.36	N.I.	N.I.	N.I.	N.I.	21.88	N.M.	19.56	21.52	19.82	N.I.	N.I.	N.I.	N.I.	17.30	N.M.	19.62	17.66
MW01-10S	42.73	N.M.	N.I.	N.I.	N.I.	N.I.	23.37	N.M.	N.M.	22.89	N.M.	N.I.	N.I.	N.I.	N.I.	19.36	N.M.	N.M.	19.84
MW01-10D	42.88	19.46	N.I.	N.I.	N.I.	N.I.	23.63	20.86	19.76	23.30	23.42	N.I.	N.I.	N.I.	N.I.	19.25	22.02	23.12	19.58
MW01-11D	38.98	20.66	N.I.	N.I.	N.I.	N.I.	23.28	N.M.	21.00	22.94	18.32	N.I.	N.I.	N.I.	N.I.	15.70	N.M.	17.98	16.04
MW01-12S	36.01	N.M.	N.I.	N.I.	N.I.	N.I.	19.15	N.M.	N.M.	18.91	N.M.	N.I.	N.I.	N.I.	N.I.	16.86	N.M.	N.M.	17.10
MW01-12D	35.96	15.74	N.I.	N.I.	N.I.	N.I.	19.06	N.M.	16.02	18.77	20.22	N.I.	N.I.	N.I.	N.I.	16.90	N.M.	19.94	17.19
MW01-13S	25.99	N.M.	N.I.	N.I.	N.I.	N.I.	15.98	N.M.	N.M.	15.85	N.M.	N.I.	N.I.	N.I.	N.I.	10.01	N.M.	N.M.	10.14
MW01-13D	26.29	12.37	N.I.	N.I.	N.I.	N.I.	14.72	N.M.	12.80	14.59	13.92	N.I.	N.I.	N.I.	N.I.	11.57	N.M.	13.49	11.70
MW01-14S	37.38	N.M.	N.I.	N.I.	N.I.	N.I.	24.15	N.M.	N.M.	23.95	N.M.	N.I.	N.I.	N.I.	N.I.	13.23	N.M.	N.M.	13.43
MW01-14D	37.62	21.60	N.I.	N.I.	N.I.	N.I.	23.84	N.M.	21.80	23.75	16.02	N.I.	N.I.	N.I.	N.I.	13.78	N.M.	15.82	13.87
MW01-15D	32.39	12.70	N.I.	N.I.	N.I.	N.I.	15.96	N.M.	13.32	15.73	19.69	N.I.	N.I.	N.I.	N.I.	16.43	N.M.	19.07	16.66
MW02-01S	39.80	N.M.	21.88	19.21	19.26	21.70	22.60	N.M.	N.M.	21.28	N.M.	17.92	20.59	20.54	18.10	17.20	N.M.	N.M.	18.52
MW02-02S	43.42	N.M.	29.55	26.01	26.03	28.67	28.22	N.M.	N.M.	N.M.	N.M.	13.87	17.41	17.39	14.75	15.20	N.M.	N.M.	N.M.
MW02-03S	42.61	N.M.	27.14	25.27	25.31	27.19	27.50	N.M.	N.M.	26.71	N.M.	15.47	17.34	17.30	15.42	15.11	N.M.	N.M.	15.90
MW02-03D	41.23	23.34	25.71	23.87	23.91	25.77	25.66	N.M.	23.80	25.37	17.89	15.52	17.36	17.32	15.46	15.57	N.M.	17.43	15.86
MW02-04S	38.19	N.M.	19.74	18.47	18.42	20.54	19.60	N.M.	N.M.	19.13	N.M.	18.45	19.72	19.77	17.65	18.59	N.M.	N.M.	19.06
MW02-05S	38.17	N.M.	20.59	18.29	18.23	20.36	20.37	N.M.	N.M.	19.96	N.M.	17.58	19.88	19.94	17.81	17.80	N.M.	N.M.	18.21
MW02-06S	36.98	N.M.	19.45	17.20	17.11	N.M.	19.24	N.M.	N.M.	18.79	N.M.	17.53	19.78	19.87	N.M.	17.74	N.M.	N.M.	18.19
MW02-07S	38.72	DC	20.75	18.20	18.12	20.50	20.55	N.M.	N.M.	N.M.	DC	17.97	20.52	20.60	18.22	18.17	N.M.	N.M.	N.M.
MW02-07D	38.42	DC	20.48	17.96	17.90	20.25	20.28	N.M.	N.M.	N.M.	DC	17.94	20.46	20.52	18.17	18.14	N.M.	N.M.	N.M.
MW02-08S	38.64	N.M.	21.05	18.70	18.62	20.80	20.89	N.M.	N.M.	20.49	N.M.	17.59	19.94	20.02	17.84	17.75	N.M.	N.M.	18.15
MW02-08D	38.63	DC?	20.95	18.75	18.69	20.87	20.94	N.M.	18.41	20.55	DC?	17.68	19.88	19.94	17.76	17.69	N.M.	20.22	18.08
MW02-09S	37.93	N.M.	20.00	17.50	17.46	19.75	19.74	N.M.	N.M.	19.24	N.M.	17.93	20.43	20.47	18.18	18.19	N.M.	N.M.	18.69
MW02-10S	37.01	N.M.	19.62	17.38	17.32	19.41	19.45	N.M.	N.M.	19.04	N.M.	17.39	19.63	19.69	17.60	17.56	N.M.	N.M.	17.97
MW02-10D	37.36	18.21	20.09	17.80	17.77	19.85	19.86	N.M.	17.40	19.47	19.15	17.27	19.56	19.59	17.51	17.50	N.M.	19.96	17.89
MW02-11S	40.22	N.M.	23.30	21.27	21.26	23.11	23.18	N.M.	N.M.	22.75	N.M.	16.92	18.95	18.96	17.11	17.04	N.M.	N.M.	17.47
MW02-11D	40.04	20.27	22.94	20.87	20.88	22.78	22.80	N.M.	20.68	N.M.	19.77	17.10	19.17	19.16	17.26	17.24	N.M.	19.36	N.M.
MW03-01S	36.61	N.M.	18.20	15.30	15.30	17.88	17.47	N.M.	N.M.	N.M.	N.M.	18.41	21.31	21.31	18.73	19.14	N.M.	N.M.	N.M.
MW03-02S	38.37	N.M.	19.95	16.97	16.98	19.59	19.64	N.M.	N.M.	19.14	N.M.	18.42	21.40	21.39	18.78	18.73	N.M.	N.M.	19.23
MW03-02D	38.57	16.42	20.13	17.21	17.25	19.88	19.89	17.32	17.04	N.M.	22.15	18.44	21.36	21.32	18.69	18.68	21.25	21.53	N.M.
MW03-03S	38.36	N.M.	19.75	16.84	16.88	19.51	19.48	N.M.	N.M.	18.98	N.M.	18.61	21.52	21.48	18.85	18.88	N.M.	N.M.	19.38
MW03-03D	38.43	16.16	19.84	16.95	16.99	19.62	19.59	17.01	16.77	19.10	22.27	18.59	21.48	21.44	18.81	18.84	21.42	21.66	19.33
MW03-04S	37.24	N.M.	18.97	16.11	16.11	18.64	18.72	N.M.	N.M.	N.M.	N.M.	18.27	21.13	21.13	18.60	18.52	N.M.	N.M.	N.M.
MW03-05S	37.89	N.M.	19.58	16.92	16.91	19.35	19.38	N.M.	N.M.	18.86	N.M.	18.31	20.97	20.98	18.54	18.51	N.M.	N.M.	19.03
MW03-05D	37.87	16.32	19.68	16.94	16.95	19.38	19.44	N.M.	16.50	18.95	21.55	18.19	20.93	20.92	18.49	18.43	N.M.	21.37	18.92
MW03-06D	38.19	15.24	19.13	16.13	16.25	19.09	18.86	16.16	15.31	18.45	22.95	19.06	22.06	21.94	19.10	19.33	22.03	22.88	19.74
MW03-07D	35.41	11.99	16.07	12.90	13.07	16.10	N.M.	12.95	12.21	15.32	23.42	19.34	22.51	22.34	19.31	N.M.	22.46	23.20	20.09
MW03-08D	32.74	8.36	13.05	9.54	9.85	13.26	N.M.	N.M.	8.62	12.30	24.38	19.69	23.20	22.89	19.48	N.M.	N.M.	24.12	20.44
MW03-08R	32.15	7.67	N.I.	N.I.	9.31	12.57	N.M.	9.11	N.M.	11.61	24.48	N.I.	N.I.	22.84	19.58	N.M.	23.04	N.M.	20.54
MW03-09D	43.40	19.57	N.I.	N.I.	20.34	23.76	N.M.	20.60	19.89	N.M.	23.83	N.I.	N.I.	23.06	19.64	N.M.	22.80	23.51	N.M.

TABLE 3-3 (Continued)
Summary f Gr und-Water Elevations
Site 03/Nike
NCBC Davisville, RI

Well Number	Elev. Top of Riser (FAMSL)	Depth to Water (FTOR) 2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97	Elevation of Water Surface (FAMSL) 2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97
MW03-10D	35.94	12.81	N.I.	N.I.	13.96	16.79	N.M.	13.78	13.02	N.M.	23.13	N.I.	N.I.	21.98	19.15	N.M.	22.16	22.92	N.M.
MW03-11S	31.02	N.M.	N.I.	N.I.	8.57	11.88	N.M.	8.54	N.M.	10.78	31.02	N.I.	N.I.	22.45	19.14	N.M.	22.48	N.M.	20.24
MW03-12D	36.11	10.38	N.I.	N.I.	12.05	15.91	N.M.	12.34	10.62	15.42	25.73	N.I.	N.I.	24.06	20.20	N.M.	23.77	25.49	20.69
MW03-12R	36.21	10.65	N.I.	N.I.	12.40	16.22	N.M.	12.61	N.M.	15.16	25.56	N.I.	N.I.	23.81	19.99	N.M.	23.60	N.M.	21.05
MW03-13D	32.56	7.81	N.I.	N.I.	9.26	12.82	N.M.	9.28	7.92	11.86	24.75	N.I.	N.I.	23.30	19.74	N.M.	23.28	24.64	20.70
MW03-13R	32.38	7.56	N.I.	N.I.	9.34	12.71	N.M.	9.16	N.M.	11.76	24.82	N.I.	N.I.	23.04	19.67	N.M.	23.22	N.M.	20.62
MW03-14D	34.00	6.47	N.I.	N.I.	8.98	13.36	N.M.	9.27	7.05	11.95	27.53	N.I.	N.I.	25.02	20.64	N.M.	24.73	26.95	22.05
MW03-14R	33.98	6.06	N.I.	N.I.	8.95	13.37	N.M.	9.25	N.M.	11.86	27.92	N.I.	N.I.	25.03	20.61	N.M.	24.73	N.M.	22.12
ME-1	32.27	N.M.	N.M.	6.63	7.50	11.68	N.M.	7.59	N.M.	N.M.	N.M.	N.M.	25.64	24.77	20.59	N.M.	24.68	N.M.	N.M.
ME-2	37.31	N.M.	N.M.	12.69	13.04	16.95	N.M.	13.37	N.M.	N.M.	N.M.	N.M.	24.62	24.27	20.36	N.M.	23.94	N.M.	N.M.
ME-3	34.90	N.M.	N.M.	8.61	9.64	14.44	N.M.	10.08	N.M.	N.M.	N.M.	N.M.	26.29	25.26	20.46	N.M.	24.82	N.M.	N.M.
ME-4	34.63	N.M.	N.M.	9.51	10.36	15.17	N.M.	11.06	N.M.	N.M.	N.M.	N.M.	25.12	24.27	19.46	N.M.	23.57	N.M.	N.M.
NMW-1	34.23	N.M.	N.M.	7.00	8.66	13.05	N.M.	8.75	N.M.	11.27	N.M.	N.M.	N.M.	25.57	21.18	N.M.	25.48	N.M.	22.96
NMW-2	35.08	N.M.	N.M.	N.M.	9.54	14.00	N.M.	9.72	N.M.	12.77	N.M.	N.M.	N.M.	25.54	21.08	N.M.	25.36	N.M.	22.31
NMW-3	35.01	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.
NMW-4	32.59	N.M.	N.M.	6.30	7.11	11.62	N.M.	7.36	N.M.	N.M.	N.M.	N.M.	26.29	25.48	20.97	N.M.	25.23	N.M.	N.M.
25MW-01S	38.13	N.M.	21.24	N.M.	18.56	20.10	21.00	N.M.	N.M.	20.58	N.M.	16.89	N.M.	19.57	18.03	17.13	N.M.	N.M.	17.55
26MW-01S	39.48	N.M.	22.31	N.M.	19.87	22.05	22.15	N.M.	N.M.	21.75	N.M.	17.17	N.M.	19.61	17.43	17.33	N.M.	N.M.	17.73
26MW-02S	39.53	N.M.	22.38	N.M.	19.95	22.13	22.22	N.M.	N.M.	21.83	N.M.	17.15	N.M.	19.58	17.40	17.31	N.M.	N.M.	17.70
26MW-03S	38.73	N.M.	21.90	N.M.	19.32	21.71	21.69	N.M.	N.M.	21.29	N.M.	16.83	N.M.	19.41	17.02	17.04	N.M.	N.M.	17.44
66MW-01S	39.30	N.M.	22.08	N.M.	20.60	21.86	N.M.	N.M.	N.M.	N.M.	N.M.	17.22	N.M.	18.70	17.44	N.M.	N.M.	N.M.	N.M.
RMW-01S	38.20	N.M.	N.M.	N.M.	18.63	21.16	19.55	N.M.	N.M.	19.49	N.M.	N.M.	N.M.	19.57	17.04	18.65	N.M.	N.M.	18.71
RMW-01I	38.20	N.M.	N.M.	N.M.	18.69	20.96	19.23	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	19.51	17.24	18.97	N.M.	N.M.	N.M.
RMW-01D	38.26	17.65	N.M.	N.M.	19.34	21.41	19.81	N.M.	17.90	N.M.	20.61	N.M.	N.M.	18.92	16.85	18.45	N.M.	20.36	N.M.
RMW-02S	25.50	N.M.	N.M.	N.M.	8.48	11.15	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	17.02	14.35	N.M.	N.M.	N.M.	N.M.
RMW-02D	25.55	5.56	N.M.	N.M.	8.46	11.11	N.M.	N.M.	6.00	N.M.	19.99	N.M.	N.M.	17.09	14.44	N.M.	N.M.	19.55	N.M.
RMW-03S	16.67	N.M.	N.M.	N.M.	3.69	6.63	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	N.M.	12.98	10.04	N.M.	N.M.	N.M.	N.M.
RMW-03D	16.82	1.81	N.M.	N.M.	3.36	6.90	N.M.	N.M.	N.M.	N.M.	15.01	N.M.	N.M.	13.46	9.92	N.M.	N.M.	N.M.	N.M.
PGU-Z2-07	29.49	4.95	N.I.	N.I.	N.I.	N.M.	N.M.	N.M.	N.M.	N.M.	24.54	N.I.	N.I.	N.I.	N.M.	N.M.	N.M.	N.M.	N.M.
PGU-Z2-08D	27.70	8.22	N.I.	N.I.	N.I.	N.M.	N.M.	N.M.	N.M.	N.M.	19.48	N.I.	N.I.	N.I.	N.M.	N.M.	N.M.	N.M.	N.M.
PGU-Z3-1	43.49	17.29	N.I.	N.I.	N.I.	23.09	N.M.	19.65	N.M.	22.65	26.20	N.I.	N.I.	N.I.	20.40	N.M.	23.84	N.M.	20.84
PGU-Z3-2	42.35	18.81	N.I.	N.I.	N.I.	23.23	23.20	N.M.	N.M.	22.83	23.54	N.I.	N.I.	N.I.	19.12	19.15	N.M.	N.M.	19.52
PGU-Z3-3S	15.41	N.M.	N.I.	N.I.	N.I.	12.04	11.24	N.M.	N.M.	11.37	N.M.	N.I.	N.I.	N.I.	3.37	4.17	N.M.	N.M.	4.04
PGU-Z3-3D	15.19	9.70	N.I.	N.I.	N.I.	11.55	10.70	N.M.	N.M.	N.M.	5.49	N.I.	N.I.	N.I.	3.64	4.49	N.M.	N.M.	N.M.
PGU-Z3-4	12.45	5.51	N.I.	N.I.	N.I.	9.68	N.M.	N.M.	N.M.	7.49	6.94	N.I.	N.I.	N.I.	2.77	N.M.	N.M.	N.M.	4.96
PGU-Z3-5	37.52	15.51	N.I.	N.I.	N.I.	18.92	N.M.	N.M.	N.M.	18.17	22.01	N.I.	N.I.	N.I.	18.60	N.M.	N.M.	N.M.	19.35
PGU-Z3-6	40.73	20.22	N.I.	N.I.	N.I.	22.83	22.81	N.M.	N.M.	21.33	20.51	N.I.	N.I.	N.I.	17.90	17.92	N.M.	N.M.	19.40
PGU-Z3-7S	31.66	N.M.	N.I.	N.I.	N.I.	14.55	N.M.	N.M.	N.M.	N.M.	N.M.	N.I.	N.I.	N.I.	17.11	N.M.	N.M.	N.M.	N.M.
PGU-Z3-7D	31.89	12.65	N.I.	N.I.	N.I.	14.80	N.M.	N.M.	N.M.	N.M.	19.24	N.I.	N.I.	N.I.	17.09	N.M.	N.M.	N.M.	N.M.
PGU-Z3-8	40.49	22.46	N.I.	N.I.	N.I.	24.83	24.69	N.M.	N.M.	24.36	18.03	N.I.	N.I.	N.I.	15.66	15.80	N.M.	N.M.	16.13
PGU-Z3-9S	20.31	N.M.	N.I.	N.I.	N.I.	12.17	N.M.	N.M.	N.M.	10.56	N.M.	N.I.	N.I.	N.I.	8.14	N.M.	N.M.	N.M.	9.75
PGU-Z3-9D	20.21	8.27	N.I.	N.I.	N.I.	12.82	N.M.	N.M.	N.M.	N.M.	11.94	N.I.	N.I.	N.I.	7.39	N.M.	N.M.	N.M.	N.M.
PGU-Z3-10S	42.80	N.M.	N.I.	N.I.	N.I.	28.24	N.M.	N.M.	N.M.	N.M.	N.M.	N.I.	N.I.	N.I.	14.56	N.M.	N.M.	N.M.	N.M.
PGU-Z3-10D	42.79	25.07	N.I.	N.I.	N.I.	28.22	N.M.	N.M.	N.M.	N.M.	17.72	N.I.	N.I.	N.I.	14.57	N.M.	N.M.	N.M.	N.M.
PGU-Z3-11	27.43	7.90	N.I.	N.I.	N.I.	10.85	N.M.	N.M.	N.M.	N.M.	19.53	N.I.	N.I.	N.I.	16.58	N.M.	N.M.	N.M.	N.M.

TABLE 3-3 (Continued)
Summary of Ground-Water Elevations
Site 03/Nike
NCBC Davisville, RI

Well Number	Elev. Top of Riser (FAMSL)	Depth to Water (FTOR)									Elevation of Water Surface (FAMSL)								
		2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97	2/98	11/30/94-12/01/94	04/27/95	05/31/95-06/02/95	10/03/95	11/17/95	07/18/96	12/96	12/97
PGU-Z4-01	38.14	20.22	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	17.92	N.I.	N.I.	N.I.	N.I.	N.I.	38.14	38.14	38.14
PGU-Z4-02	31.44	13.62	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	17.82	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
PGU-Z4-03D	28.71	11.97	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	16.74	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-101	32.29	4.62	N.I.	N.I.	N.I.	N.I.	N.I.	7.39	5.10	10.20	27.67	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-102	33.37	N.M.	N.I.	N.I.	N.I.	N.I.	N.I.	8.32	6.07	N.M.	N.M.	N.I.	N.I.	N.I.	N.I.	N.I.	25.05	27.30	N.M.
EA-103	35.13	7.72	N.I.	N.I.	N.I.	N.I.	N.I.	10.46	8.15	13.45	27.41	N.I.	N.I.	N.I.	N.I.	N.I.	24.67	26.98	21.68
EA-104	37.40	10.81	N.I.	N.I.	N.I.	N.I.	N.I.	13.22	11.15	16.24	26.59	N.I.	N.I.	N.I.	N.I.	N.I.	24.18	26.25	21.16
EA-105	31.95	4.71	N.I.	N.I.	N.I.	N.I.	N.I.	7.66	5.22	9.39	27.24	N.I.	N.I.	N.I.	N.I.	N.I.	24.29	26.73	22.56
EA-106D	33.17	5.11	N.I.	N.I.	N.I.	N.I.	N.I.	8.33	5.80	11.59	28.06	N.I.	N.I.	N.I.	N.I.	N.I.	24.84	27.37	21.58
EA-106R	33.84	5.59	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	28.25	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-107	31.34	5.52	N.I.	N.I.	N.I.	N.I.	N.I.	7.96	5.66	9.13	25.82	N.I.	N.I.	N.I.	N.I.	N.I.	23.38	25.68	22.21
EA-108	33.50	5.64	N.I.	N.I.	N.I.	N.I.	N.I.	8.21	5.82	10.52	27.86	N.I.	N.I.	N.I.	N.I.	N.I.	25.29	27.68	22.98
EA-109D	33.39	5.62	N.I.	N.I.	N.I.	N.I.	N.I.	8.26	6.54	10.73	27.77	N.I.	N.I.	N.I.	N.I.	N.I.	25.13	26.85	22.66
EA-110D	40.15	22.23	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	17.92	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-110R	39.71	21.81	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	17.90	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-111D	35.91	15.21	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	20.70	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-111R	35.71	15.13	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	20.58	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-112D	48.06	22.58	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	25.48	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-112R	48.52	22.85	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	25.67	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
EA-113D	31.42	3.31	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	28.11	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.	N.I.
MW-Z3-01	43.80	N.M.	N.I.	N.I.	N.I.	N.I.	N.I.	19.98	17.88	22.92	43.80	N.I.	N.I.	N.I.	N.I.	N.I.	23.82	25.92	20.88
MW-Z3-02	36.67	19.63	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	20.67	N.M.	17.04	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	NS	NS
MW-Z3-03D	40.00	19.26	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	19.26	22.59	20.74	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	NS	NS
MW-Z4-01	40.77	22.35	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	22.76	23.82	18.42	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	NS	NS
MW-Z4-02	34.18	15.94	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	N.M.	N.M.	18.24	N.I.	N.I.	N.I.	N.I.	N.I.	N.M.	NS	NS

MONITORING WELL INSTALLATION:
- RMW - RIPA
- NMW - SIRRINE
- ME - METCALF & EDDY
- 25-MW-1, 26-MW-(all), 38-MW-(all), 66-MW-(all) - HALLIBURTON NUS
- MW01-05 through 07, NETW: Halliburton NUS
- MW02-(all), MW03-(01-08D) - TRC
- MW03-(08R-14) - EA ENGINEERING
- MW01-(08D-15D) - EA ENGINEERING
- EA 101 through EA-109 - EA ENGINEERING
- MW-Z3-01 through MW-Z4-01 - STONE & WEBSTER

PIEZOMETER INSTALLATION:
- P-GU-Z3-(all) - EA ENGINEERING

NOTES:
- N.I. - NOT INSTALLED; N.M. - NOT MEASURED
- N.A. - NOT ACCESSIBLE; WELL OBSTRUCTED
- FAMSL - FEET ABOVE MEAN SEA LEVEL
- FTOR - FEET FROM TOP OF RISER
- FBGS - FEET BELOW GROUND SURFACE
- APRIL 1994 DATA ARE FROM TRC (1994)
- DECEMBER 1996 FROM SAMPLING EVENT
- NS - NO SURVEY DATA AVAILABLE

TABLE 3-4
Summary of Vertical Hydraulic Gradients
Site 03/Nike
NCBC Davisville, RI

WELL CLUSTER NUMBER	DATE	VERTICAL DISTANCE* (ft)	HEAD DIFFERENCE** (ft)	GRADIENT (ft/ft)
MW01-10S/D	11/17/95	53.8	-0.11	-2.04E-03
	12/97	54.28	-0.26	-4.79E-03
MW01-12S/D	11/17/95	30.99	0.04	1.29E-03
	12/97	31.23	0.09	2.88E-03
MW01-13S/D	11/17/95	54.33	1.56	2.87E-02
	12/97	54.46	1.56	2.86E-02
MW01-14S/D	11/17/95	61.98	0.55	8.87E-03
	12/97	62.18	0.44	7.08E-03
MW02-03S/D	04/26/94	15.49	0.04	2.58E-03
	12/01/94	12.43	0.05	4.02E-03
	04/27/95	14.30	0.02	1.40E-03
	06/02/95	14.26	0.02	1.40E-03
	10/03/95	12.38	0.04	3.23E-03
	11/17/95	12.07	0.46	3.81E-02
	12/97	12.86	-0.04	-3.11E-03
MW02-07S/D	04/26/94	22.91	-0.04	-1.75E-03
	12/01/94	19.06	-0.03	-1.57E-03
	04/27/95	21.61	-0.06	-2.78E-03
	06/02/95	21.69	-0.08	-3.69E-03
	10/03/95	19.31	-0.05	-2.59E-03
	11/17/95	19.26	-0.03	-1.56E-03
MW02-08S/D	04/26/94	23.17	-0.25	-1.08E-02
	12/01/94	19.49	0.09	4.62E-03
	04/27/95	21.84	-0.06	-2.75E-03
	06/02/95	21.92	-0.08	-3.65E-03
	10/03/95	19.74	-0.08	-4.05E-03
	11/17/95	19.65	-0.06	-3.05E-03
	12/97	20.05	-0.07	-3.49E-03
MW02-10S/D	04/26/94	30.11	-0.10	-3.32E-03
	12/01/94	26.59	-0.12	-4.51E-03
	04/27/95	28.83	-0.07	-2.43E-03
	06/02/95	28.89	-0.10	-3.46E-03
	10/03/95	26.80	-0.09	-3.36E-03
	11/17/95	26.76	-0.06	-2.24E-03
	12/97	27.17	-0.08	-2.94E-03
MW02-11S/D	04/26/94	39.51	0.19	4.81E-03
	12/01/94	36.22	0.18	4.97E-03
	04/27/95	38.25	0.22	5.75E-03
	06/02/95	38.26	0.20	5.23E-03
	10/03/95	36.41	0.15	4.12E-03
	11/17/95	36.34	0.20	5.50E-03
MW03-02S/D	04/26/94	40.45	-0.01	-2.47E-04
	12/01/94	36.20	0.02	5.52E-04
	04/27/95	39.18	-0.04	-1.02E-03
	06/02/95	39.17	-0.07	-1.79E-03
	10/03/95	36.56	-0.09	-2.46E-03
	11/17/95	36.51	-0.05	-1.37E-03
MW03-03S/D	04/26/94	39.38	-0.04	-1.02E-03
	12/01/94	35.22	-0.02	-5.68E-04
	04/27/95	38.13	-0.04	-1.05E-03
	06/02/95	38.09	-0.04	-1.05E-03
	10/03/95	35.46	-0.04	-1.13E-03
	11/17/95	35.49	-0.04	-1.13E-03
	12/97	35.98	-0.05	-1.39E-03

TABLE 3-4
Vertical Hydraulic Gradients
Site 03/Nike
NCBC Davisville, RI

WELL CLUSTER NUMBER	DATE	VERTICAL DISTANCE* (ft)	HEAD DIFFERENCE** (ft)	GRADIENT (ft/ft)
MW03-05S/D	04/26/94	24.41	-0.03	-1.23E-03
	12/01/94	20.50	-0.12	-5.85E-03
	04/27/95	23.16	-0.04	-1.73E-03
	06/02/95	23.17	-0.06	-2.59E-03
	10/03/95	20.73	-0.05	-2.41E-03
	11/17/95	20.70	-0.08	-3.86E-03
	12/97	21.22	-0.11	-5.18E-03
MW03-08D/R	06/02/95	44.06	-0.05	-1.13E-03
	10/03/95	40.65	0.10	2.46E-03
	12/97	41.61	0.10	2.40E-03
	2/98	46.46	0.10	2.15E-03
MW03-12D/R	06/02/95	39.86	-0.25	-6.27E-03
	10/03/95	36.00	-0.21	-5.83E-03
	07/18/96	39.57	-0.17	-4.30E-03
	12/97	36.49	0.36	9.87E-03
	2/98	41.53	-0.17	-4.09E-03
MW03-13D/R	06/02/95	45.38	-0.26	-5.73E-03
	10/03/95	41.82	-0.07	-1.67E-03
	07/18/96	45.36	-0.06	-1.32E-03
	12/97	42.78	-0.08	-1.87E-03
	2/98	46.83	0.07	1.49E-03
MW03-14D/R	06/02/95	44.68	0.01	2.24E-04
	10/03/95	40.30	-0.03	-7.44E-04
	07/18/96	44.39	0.00	0.00E+00
	12/97	41.71	0.07	1.68E-03
	2/98	47.19	0.39	8.26E-03
RMW-01 S/D	05/31/95	38.37	-0.65	-1.69E-02
	10/03/95	35.84	-0.19	-5.30E-03
	11/17/95	37.45	-0.20	-5.34E-03
RMW-02 S/D	05/31/95	17.99	0.07	3.89E-03
	10/03/95	15.32	0.09	5.87E-03
RMW-03 S/D	05/31/95	26.93	0.48	1.78E-02
	10/03/95	23.99	-0.12	-5.00E-03
EA-106D/R	2/98	60.56	0.19	3.14E-03
EA-110D/R	2/98	80.92	-0.02	-2.47E-04
EA-111D/R	2/98	64.30	-0.12	-1.87E-03
EA-112D/R	2/98	88.48	0.19	2.15E-03

Note: 1994 data are from TRC (1994)

* - Vertical distance is the distance between the water level in the shallow monitoring well and the middle of the screened interval in the deep monitoring well.

** - Head Difference is the difference in the depth of water in shallow monitoring well and deep monitoring well. Negative sign indicates discharging of the shallow aquifer to the deeper aquifer.

TABLE 3-5
Summary of Hydraulic Conductivity Estimated From Slug Test Data
Site 03/Nike
NCBC Davisville, RI

Well Designation	Screen Internal (FBGS)		Hydraulic Conductivity K (ft/d)	Geologic Unit Screened
	TOP	BOTTOM		
MW01-08D	35	45	28.35/17.99†	(10')silty sand
MW01-09D	37.5	41.5	1.23/72.4‡	(4')till
MW01-11D	37	42	2.825/2.92	(5')silt
MW01-12S	14	24	250.272‡	(5')silt, (5')silty f sand-f gravel
MW01-12D	48	53	17.136/13.14	(5')till
MW01-13S	8	18	0.159/1.015	(6')f-c sand, (4') silty vf sand w/little f gravel
MW01-13D	64	74	1.395/1.127	(10')till
MW01-14D	81	89	0.506/0.592	(8')till
MW01-15D	46	51	6.96/17.09†	(4')till, (1') weathered rock, schist, w/silty f sand
MW02-03D	31.5	41.5	6.3	(10')VF silt and sand
MW02-07D	35	45	0.9	(9')silty fine sand, (1')silt and gravel
MW02-08S	11.8	26.8	26.1/25.9	(6') silt, (9') F-C sand
MW02-08D	35.9	45.9	1.7	(10')VF sand
MW02-09S	12	27	223/217.2	(15')F sand
MW02-10S	13	28	47.6/52.8	(15')VF-F sand
MW02-10D	42	52	2.9	(2')sandy silt, (4')silty sand, (4')sand
MW02-11S	13	28	38.8/43.9	(15')F-C sand
MW02-11D	52.3	62.3	15/10.3	(4')sandy silt, (6')silty sand
MW03-02S	8.5	23.5	93.9	(6.5')silty gravelly sand, (9.5')sand
MW03-02D	49	59	1.2	(5')silt, (5')silt with rock fragments
MW03-03S	9	24	16.1/18.8	(5')sand, (10')silty sand
MW03-03D	47.7	57.7	10.4/8.9	(1')silt, (4')F sand, (5')silt
MW03-04S	10	25	33.1/32.6	(3')silt, (4') F-M sand, (8')F sand
MW03-05S	11	26	185.6/193.8	(1')F sand, (7')gravelly sand, (7')F-M sand

Well Designation	Screen Internal (FBGS)		Hydraulic Conductivity K (ft/d)	Geologic Unit Screened
	TOP	BOTTOM		
MW03-05D	35.5	45.5	2.4	(10')sandy silt
MW03-06D	51.5	61.5	1.5/1.3	(4.5')silt, (5.5')gravelly silt
MW03-07D	35.5	45.5	1.2/1.7	(4.5')silt, (5.5')silt and gravel
MW03-08D	28.3	38.3	26.0/26.3	(7.2')gravelly sand, (2.8')sandy silt and gravel
MW03-08R	46.5	56.5	0.3	(10')rock
MW03-09D	51	61	12.6	(3')sandy silt, (1')silty sand, (6') silt
MW03-10D	39	49	2.9	(6')sandy silt, (4')gravelly silt
MW03-11D	5	15	2.9	(3')silty sand, (7')silty sand and gravel
MW03-12D	25	35	4.3	(10')sand, silt, and gravel
MW03-12R	45	55	0.4	(10')sand, silt and gravel
MW03-13D	29	39	>26.0	(2')F sand, (2')gravelly sand, (6')silty sand and gravel
MW03-14D	30	40	1.3	(10')sand, silt, and gravel
MW03-14R	47	57	1.4	(10')rock
ME-1*	4.7	14.7	10.3	(2')fill, (8')sand and gravel
ME-2*	10	19.9	105.0	(10')sand and gravel
ME-3*	8	18	111.2	(6')F-C sand, (4') sand and gravel
ME-4*	10	19.9	24.5	(5')sand and gravel, (5')sand, silt and gravel
NMW-1*	5.68	15.73	30.0	(10')sand
NMW-2*	6.06	16.14	36.5	(10')sand
NMW-3*	7.4	17.56	30.3	(10')silty sand
NMW-4*	4.09	14.12	105	(10.03')silty sand and sand
EA-101	23.5	33.5	14.26/18.54	(10')till
EA-102	21.9	31.9	9.98/17.11	(10')till
EA-103	25.5	35.5	4.28/7.13	(7')till, (3') weathered rock
EA-104	56	66	8.556/3.565	(8')f-m snd, (2')weathered rock
EA-105	20	30	4.278/9.982	(10')till
EA-106D	32	42	11.41/9.982	(2')till, (6.5')till/weathered rock, (1.5') bedrock
EA-106R	59	69	128.3/174.0	(10')bedrock

Well Designation	Screen Internal (FBGS)		Hydraulic Conductivity K (ft/d)	Geologic Unit Screened
	TOP	BOTTOM		
EA-107	31	41	9.982/15.69	(9')till, (1')bedrock
EA-108	19.25	29.25	6.417/4.991	(8')till, (2')weathered rock
EA-109	26	36	6.417/8.556	(8')till, (2')weathered rock
EA-110D	75	85	28.52/47.06	(6.5')till, (1')boulder, (2.5')weathered rock
EA-111D	49.5	64.5	24.24/18.54	(4.5')silty clay, (10.5')till
EA-112D	86	96	7.13	(10')bedrock

Notes: For wells where two slug tests were run, both results are presented.
Site 01 Slug tests were performed in November 1995.
Data for the Site 02 wells and wells MW03-02S through MW03-08D are from TRC (1994).
* - Slug test data for Nike Site wells from ME-1 through ME-4 are from Metcalf and Eddy (1993) and wells from NMW-1 through NMW-4 are from Sirrine Environmental (1987).
EA-101 through EA-109 (except EA-106R, installed in 1998) were slug tested in August 1996.
EA-106R, EA-110 through EA-112 were slug tested in April 1998.
† - The points on the plot between displacement and time of MW01-08DF and MW01-15DF/R were scattered (Appendix J).
‡ - The points on the plot between displacement and time of MW01-09DR and MW01-12SR were few (Appendix J).

FBGS = Feet below ground surface
ft/d = feet per day
VF = very fine
F = fine
M = medium
C = coarse

TABLE 4-1

BACKGROUND INORGANICS CONCENTRATIONS IN GROUND WATER NCBC DAVISVILLE, RI

Parameter	Background Value (μg/L)
Aluminum	5315
Antimony	6
Arsenic	6.4
Barium	80.5
Beryllium	1.3
Cadmium	3
Calcium	13,302
Chromium	214
Cobalt	24.9
Copper	25.8
Iron	25,500
Lead	4.8
Magnesium	5,126
Manganese	3,292
Mercury	ND (0.2)
Nickel	154
Potassium	3843
Selenium	2.2
Silver	1
Sodium	12,346
Thallium	4.1
Vanadium	24.4
Zinc	89.9

NOTE: Data is from Stone & Webster's Final Background Inorganics Ground Water Study Report dated September 1996 and the finalized (December 1996) Table 7-4 from that report.

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW01-08D	MW01-09D	MW01-10D	MW01-11D	MW01-12D	MW01-13D	MW01-13D/dup 2	MW01-14D	MW01-15D	MW02-03D
Date Collected	12/15/96	12/11/96	12/13/96	12/13/96	12/10/96	12/13/96	12/13/96	12/15/96	12/10/96	12/10/96
ANALYTE										
Chloromethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	1 UJ	2 U	2 U	2 U	1 U	3 U	2 U	1 U	1 U	1 U
1,1-Dichloroethene *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene *	3 J	1 U	1 U	1 U	9	1 U	1 U	2	5	25
Trans-1,2-Dichloroethene *	1 UJ	1 U	1 U	1 U	2	1 U	1 U	1 U	1 U	2
Bromochloromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene *	2 J	1 U	1 U	1 U	18	1 U	1 U	1 U	9	8
Dibromochloromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3
Benzene <	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane *	1 J	1 U	1 U	1 U	4	1 U	1 U	1 U	2	2
Toluene < #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene * #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene < #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylenes < #	2 UJ	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
o-Xylene < #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromomethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1,2-Tetrachloroethane *	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

continued next pg.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW01-08D	MW01-09D	MW01-10D	MW01-11D	MW01-12D	MW01-13D	MW01-13D/dup 2	MW01-14D	MW01-15D	MW02-03D
Date Collected	12/15/96	12/11/96	12/13/96	12/13/96	12/10/96	12/13/96	12/13/96	12/15/96	12/10/96	12/10/96
ANALYTE										
1,2,3-Trichloropropane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,2-Dichloropropane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloropropene	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichloropropane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromobenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Propylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Chlorotoluene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Chlorotoluene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
tert-Butylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
sec-Butylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Isopropyltoluene	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
n-Butylbenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Naphthalene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene #	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
DILUTION FACTOR	1	1	1	1	1	1	1	1	1	1
measured in field GC										
ethane (mg/L)	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	NA	<.01 U	<.01 U	<.01 U
ethene (mg/L)	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	NA	<.01 U	<.01 U	<.01 U
Total VOC	6	ND	ND	ND	33	ND	ND	2	16	40
Total Chlorinated VOC*	6	ND	ND	ND	33	ND	ND	2	16	40
Total BTEX <	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Aromatic Hydrocarbons #	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

U= undetected, =Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW02-08D	MW02-10D	MW02-11D	MW03-02D	MW03-03D	MW03-05D	MW03-06D	MW03-06D/dup 3	MW03-07D	MW03-08D
Date Collected	12/11/96	12/15/96	12/11/96	12/10/96	12/10/96	12/13/96	12/15/96	12/15/96	12/12/96	12/12/96
ANALYTE										
Chloromethane *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Bromomethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Vinyl Chloride *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Chloroethane *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Methylene Chloride	1 U	1 U	3 U	2 U	25 U	2 UJ	25 U	25 U	10 U	50 U
1,1-Dichloroethene *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1-Dichloroethane *	1 U	1	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
cis-1,2-Dichloroethene *	4	44	17	4	130	1 UJ	210	170	90 J	210
Trans-1,2-Dichloroethene *	1 U	4	1 U	1 U	34	1 UJ	56	53	21 J	90
Bromochloromethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Chloroform *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2-Dichloroethane *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1,1-Trichloroethane *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Carbon Tetrachloride *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Bromodichloromethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2-Dichloropropane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Trichloroethene *	7	14	1 U	4	390	1 UJ	810	660	330 J	1200
Dibromochloromethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1,2-Trichloroethane *	1 U	5	2	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Benzene <	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Bromoform	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2-Dibromo-3-chloropropane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Tetrachloroethene *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1,2,2-Tetrachloroethane *	3	6	1	1 U	75	1 UJ	260	220	95 J	700
Toluene < #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Chlorobenzene * #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Ethylbenzene < #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Styrene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
m,p-Xylenes < #	2 U	2 U	2 U	2 U	50 U	2 UJ	50 U	50 U	20 U	100 U
o-Xylene < #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,4-Dichlorobenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Dibromomethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2-Dibromoethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1,1,2-Tetrachloroethane *	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U

continued next pg.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW02-08D	MW02-10D	MW02-11D	MW03-02D	MW03-03D	MW03-05D	MW03-06D	MW03-06D/dup 3	MW03-07D	MW03-08D
Date Collected	12/11/96	12/15/96	12/11/96	12/10/96	12/10/96	12/13/96	12/15/96	12/15/96	12/12/96	12/12/96
ANALYTE										
1,2,3-Trichloropropane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
2,2-Dichloropropane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,1-Dichloropropene	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,3-Dichloropropane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Isopropylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Bromobenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
n-Propylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
2-Chlorotoluene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,3,5-Trimethylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
4-Chlorotoluene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
tert-Butylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2,4-Trimethylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Trichlorofluoromethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Dichlorodifluoromethane	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
sec-Butylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
4-Isopropyltoluene	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
n-Butylbenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2,4-Trichlorobenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Hexachlorobutadiene	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
Naphthalene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
1,2,3-Trichlorobenzene #	1 U	1 U	1 U	1 U	25 U	1 UJ	25 U	25 U	10 U	50 U
DILUTION FACTOR	1	1	1	1	25	1	25	25	10	50
measured in field GC										
ethane (mg/L)	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	NA	<.01 U	<.01 U
ethene (mg/L)	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	<.01 U	NA	<.01 U	<.01 U
Total VOC	14	74	20	8	629	ND	1336	1103	536	2200
Total Chlorinated VOC*	14	74	20	8	629	ND	1336	1103	536	2200
Total BTEX<	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Aromatic Hydrocarbons #	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW03-09D	MW03-10D	MW03-10D/dup 1	MW03-12D	MW03-13D	MW03-14D	MW03-14D	MW-Z3-1	MW-Z3-2	MW-Z3-3
Date Collected	12/12/96	12/11/96	12/11/96	12/16/96	12/12/96	11/18/96 **	12/16/96	12/17/96	12/09/96	12/15/96
ANALYTE										
Chloromethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Bromomethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Vinyl Chloride *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Chloroethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Methylene Chloride	10 U	5 U	5 U	1 U	25 U	530	6200 U	1 U	2 U	1 U
1,1-Dichloroethene *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,1-Dichloroethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
cis-1,2-Dichloroethene *	190	36	38	10 J	97	6500	13000 J	14 J	1 U	25
Trans-1,2-Dichloroethene *	21	12	11	5 J	43	3200	6200 U	5 J	1 U	2
Bromochloromethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Chloroform *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2-Dichloroethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,1,1-Trichloroethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Carbon Tetrachloride *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Bromodichloromethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2-Dichloropropane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Trichloroethene *	39	100	110	47 J	740	42000	150000 J	32 J	1 U	6
Dibromochloromethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,1,2-Trichloroethane *	10 U	5 U	5 U	1 J	25 U	1500	6200 U	1 J	1 U	2
Benzene <	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Bromoform	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	10 U	5 U	5 U	1 UR	25 U	500 U	6200 UR	1 UR	1 U	1 U
Tetrachloroethene *	10 U	5 U	5 U	1 U	29	500	6200 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane *	10 U	41	44	49 J	810	78000	260000 J	9 J	1 U	1
Toluene < #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Chlorobenzene * #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Ethylbenzene < #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Styrene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
m,p-Xylenes < #	20 U	10 U	10 U	2 U	50 U	1000 U	12000 U	2 U	2 U	2 U
o-Xylene < #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,3-Dichlorobenzene	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,4-Dichlorobenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2-Dichlorobenzene	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Dibromomethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2-Dibromoethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,1,1,2-Tetrachloroethane *	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U

continued next pg.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW03-09D	MW03-10D	MW03-10D/dup 1	MW03-12D	MW03-13D	MW03-14D	MW03-14D	MW-Z3-1	MW-Z3-2	MW-Z3-3
Date Collected	12/12/96	12/11/96	12/11/96	12/16/96	12/12/96	11/18/96 **	12/16/96	12/17/96	12/09/96	12/15/96
ANALYTE										
1,2,3-Trichloropropane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
2,2-Dichloropropane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,1-Dichloropropene	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,3-Dichloropropane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Isopropylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Bromobenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
n-Propylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
2-Chlorotoluene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
4-Chlorotoluene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
tert-Butylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Trichlorofluoromethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Dichlorodifluoromethane	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
sec-Butylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
4-Isopropyltoluene	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
n-Butylbenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Hexachlorobutadiene	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
Naphthalene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene #	10 U	5 U	5 U	1 U	25 U	500 U	6200 U	1 U	1 U	1 U
DILUTION FACTOR	10	5	5	1	25	500	6250	1	1	1
measured in field GC										
ethane (mg/L)	<.01 U	<.01 U	NA	<.01 U	<.01 U	NA	0.02	<.01 U	<.01 U	<.01 U
ethene (mg/L)	<.01 U	<.01 U	NA	<.01 U	<.01 U	NA	0.12	<.01 U	<.01 U	<.01 U
Total VOC	250	189	203	112	1719	132230	423000	61	ND	36
Total Chlorinated VOC*	250	189	203	112	1719	131700	423000	61	ND	36
Total BTEX<	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Aromatic Hydrocarbons #	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

** = this sample was collected from original PVC well prior to replacement on 11/18/96 with a stainless steel well.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW-Z4-1	RMW-01D	RMW-02D	EA-101	EA-102	EA-103	EA-103/dup 4	EA-104	EA-105	EA-106	EA-107
Date Collected	12/17/96	12/15/96	12/16/96	12/16/96	12/16/96	12/17/96	12/17/96	12/17/96	12/17/96	12/12/96	12/13/96
ANALYTE											
Chloromethane *	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Bromomethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Vinyl Chloride *	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Chloroethane *	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Methylene Chloride	1 U	2 U	2 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	3 U	1 U
1,1-Dichloroethene *	1 U	1 U	1 U	1 UJ	1 J	1 U	1 U	12 U	1 U	1 U	1 U
1,1-Dichloroethane *	1 U	1 U	1 U	1 UJ	1 J	1 U	1 U	12 U	1 U	1 U	1 U
cis-1,2-Dichloroethene *	1 U	1 U	1 U	1 UJ	160 J	1 U	1 U	150 J	1 U	1 U	1 U
Trans-1,2-Dichloroethene *	1 U	1 U	1 U	1 UJ	53 J	1 U	1 U	56 J	1 U	1 U	1 U
Bromochloromethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Chloroform *	1 U	1 U	1 U	1 UJ	13 J	1 U	1 U	12 U	1 U	1 U	1 U
1,2-Dichloroethane *	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,1,1-Trichloroethane *	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Carbon Tetrachloride *	1 U	1 U	1 U	1 UJ	6 J	1 U	1 U	12 U	1 U	1 U	1 U
Bromodichloromethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2-Dichloropropane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Trichloroethene *	1 U	1 U	1 U	1 J	2000 J	1 U	1 U	480 J	1 U	1 U	1 U
Dibromochloromethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,1,2-Trichloroethane *	1 U	1 U	1 U	1 UJ	310 J	1 U	1 U	13 J	1 U	1 U	1 U
Benzene <	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Bromoform	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane	1 UR	1 U	1 U	1 UJ	1 UJ	1 UR	1 UR	12 UR	1 UR	1 U	1 U
Tetrachloroethene *	1 U	1 U	1 U	1 UJ	210 J	1 U	1 U	12 U	1 U	1	1 U
1,1,2,2-Tetrachloroethane *	1 U	1 U	1 U	2 J	62000 J	1 U	1 U	200 J	1 U	1 U	3
Toluene < #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Chlorobenzene * #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Ethylbenzene < #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Styrene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
m,p-Xylenes < #	2 U	2 U	2 U	2 UJ	2 UJ	2 U	2 U	25 U	2 U	2 U	2 U
o-Xylene < #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,4-Dichlorobenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2-Dichlorobenzene	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Dibromomethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2-Dibromoethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,1,1,2-Tetrachloroethane *	1 U	1 U	1 U	1 UJ	21 J	1 U	1 U	12 U	1 U	1 U	1 U

continued next pg.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	MW-Z4-1	RMW-01D	RMW-02D	EA-101	EA-102	EA-103	EA-103/dup 4	EA-104	EA-105	EA-106	EA-107
Date Collected	12/17/96	12/15/96	12/16/96	12/16/96	12/16/96	12/17/96	12/17/96	12/17/96	12/17/96	12/12/96	12/13/96
ANALYTE											
1,2,3-Trichloropropane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
2,2-Dichloropropane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,1-Dichloropropene	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,3-Dichloropropane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Isopropylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Bromobenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
n-Propylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
2-Chlorotoluene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,3,5-Trimethylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
4-Chlorotoluene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
tert-Butylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Trichlorofluoromethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Dichlorodifluoromethane	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
sec-Butylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
4-Isopropyltoluene	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
n-Butylbenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
Hexachlorobutadiene	1 U	1 U	1 U	1 UJ	2 J	1 U	1 U	12 U	1 U	1 U	1 U
Naphthalene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	2
1,2,3-Trichlorobenzene #	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U	12 U	1 U	1 U	1 U
DILUTION FACTOR	1	1	1	1	1	1	1	12.5	1	1	1
measured in field GC											
ethane (mg/L)	.01 U	<.01 U	<.01 U	.01 U	<.01 U	<.01 U	<.01 U	<.01 U	.01 U	.01 U	<.01 U
ethene (mg/L)	.01 U	<.01 U	<.01 U	.01 U	<.01 U	<.01 U	<.01 U	<.01 U	.01 U	.01 U	<.01 U
Total VOC	ND	ND	ND	3	64777	ND	ND	899	ND	1	5
Total Chlorinated VOC*	ND	ND	ND	3	64775	ND	ND	899	ND	1	3
Total BTEX<	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Aromatic Hydrocarbons #	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	EA-108		EA-109	
Date Collected	12/13/96		12/17/96	
ANALYTE				
Chloromethane *	1	U	1	U
Bromomethane	1	U	1	U
Vinyl Chloride *	1	U	1	U
Chloroethane *	1	U	1	U
Methylene Chloride	2	U	1	U
1,1-Dichloroethene *	1	U	1	U
1,1-Dichloroethane *	1	U	1	U
cis-1,2-Dichloroethene *	1	U	7	J
Trans-1,2-Dichloroethene *	1	U	5	J
Bromochloromethane	1	U	1	U
Chloroform *	1	U	1	U
1,2-Dichloroethane *	1	U	1	U
1,1,1-Trichloroethane *	1	U	1	U
Carbon Tetrachloride *	1	U	1	U
Bromodichloromethane	1	U	1	U
1,2-Dichloropropane	1	U	1	U
Trichloroethene *	1	U	29	J
Dibromochloromethane	1	U	1	U
1,1,2-Trichloroethane *	1	U	1	U
Benzene <	1	U	1	U
Bromoform	1	U	1	U
1,2-Dibromo-3-chloropropane	1	U	1	UR
Tetrachloroethene *	2		1	U
1,1,2,2-Tetrachloroethane *	1	U	6	J
Toluene < #	1	U	1	U
Chlorobenzene * #	1	U	1	U
Ethylbenzene < #	1	U	1	U
Styrene #	1	U	1	U
m,p-Xylenes < #	2	U	2	U
o-Xylene < #	1	U	1	U
1,3-Dichlorobenzene	1	U	1	U
1,4-Dichlorobenzene #	1	U	1	U
1,2-Dichlorobenzene	1	U	1	U
Dibromomethane	1	U	1	U
1,2-Dibromoethane	1	U	1	U
1,1,1,2-Tetrachloroethane *	1	U	1	U

continued next pg.

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-2 Volatile Organic Compounds Detected in the December 1996 Ground-Water Samples (ug/L)

Site03/Nike SourceCharacterization
NCBC Davisville

Sample I.D.	EA-108		EA-109	
Date Collected	12/13/96		12/17/96	
ANALYTE				
1,2,3-Trichloropropane	1	U	1	U
2,2-Dichloropropane	1	U	1	U
1,1-Dichloropropene	1	U	1	U
1,3-Dichloropropane	1	U	1	U
Isopropylbenzene #	1	U	1	U
Bromobenzene #	1	U	1	U
n-Propylbenzene #	1	U	1	U
2-Chlorotoluene #	1	U	1	U
1,3,5-Trimethylbenzene #	1	U	1	U
4-Chlorotoluene #	1	U	1	U
tert-Butylbenzene #	1	U	1	U
1,2,4-Trimethylbenzene #	1	U	1	U
Trichlorofluoromethane	1	U	1	U
Dichlorodifluoromethane	1	U	1	U
sec-Butylbenzene #	1	U	1	U
4-Isopropyltoluene	1	U	1	U
n-Butylbenzene #	1	U	1	U
1,2,4-Trichlorobenzene #	1	U	1	U
Hexachlorobutadiene	1	U	1	U
Naphthalene #	1	U	1	U
1,2,3-Trichlorobenzene #	1	U	1	U
DILUTION FACTOR	1		1	
measured in field GC				
ethane (mg/L)	<.01	U	<.01	U
ethene (mg/L)	<.01	U	<.01	U
Total VOC	2		47	
Total Chlorinated VOC*	2		47	
Total BTEX <	ND		ND	
Total Aromatic Hydrocarbons #	ND		ND	

U= undetected, J=Estimated Value, B=Found in Method Blank, D=Diluted Ananlysis, E=Outside Calibration Range

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	MW01-12D	MW01-14D	MW02-03D	MW02-10D	MW03-03D	MW03-07D	MW03-08D	MW03-08D-DUP
Date Collected	3/10/98	3/10/98	3/10/98	3/11/98	3/11/98	3/11/98	3/11/98	3/11/98
ANALYTE								
1,1,1,2-TETRACHLOROETHANE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,1,1-TRICHLOROETHANE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,1,2,2-TETRACHLOROETHANE*	2 J	1 UJ	1 J	9 J	67 J	180 J	1200 J	1300 J
1,1,2-TRICHLOROETHANE*	0.6 J	0.6 J	3	5	25 UJ	16 J	49 J	49 J
1,1-DICHLOROETHANE*	1 UJ	1 UJ	0.6 J	1 J	25 UJ	25 UJ	50 UJ	50 UJ
1,1-DICHLOROETHENE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,1-DICHLOROPROPENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2,3-TRICHLOROBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2,3-TRICHLOROPROPANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2,3-TRIMETHYLBENZENE	2 R	2 R	2 R	4 R	50 R	50 R	100 R	100 R
1,2,4-TRICHLOROBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2,4-TRIMETHYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2-DIBROMO-3-CHLOROPROPANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2-DIBROMOETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2-DICHLOROBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2-DICHLOROETHANE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,2-DICHLOROPROPANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,3,5-TRIMETHYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,3-DICHLOROBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,3-DICHLOROPROPANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
1,4-DICHLOROBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
2,2-DICHLOROPROPANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
2-CHLOROTOLUENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
4-CHLOROTOLUENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BENZENE <	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BROMOBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BROMOCHLOROMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BROMODICHLOROMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BROMOFORM	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
BROMOMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	MW01-12D	MW01-14D	MW02-03D	MW02-10D	MW03-03D	MW03-07D	MW03-08D	MW03-08D-DUP
Date Collected	3/10/98	3/10/98	3/10/98	3/11/98	3/11/98	3/11/98	3/11/98	3/11/98
CARBON TETRACHLORIDE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
CHLOROBENZENE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
CHLOROETHANE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
CHLOROFORM*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
CHLOROMETHANE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
CIS-1,2-DICHLOROETHENE*	6 J	3 J	22 J	40 J	130 J	140 J	440 J	460 J
DIBROMOCHLOROMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
DIBROMOMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
DICHLORODIFLUOROMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
ETHYLBENZENE<	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
HEXACHLOROBUTADIENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
ISOPROPYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
M/P-XYLENE<	2 UJ	2 UJ	2 UJ	4 UJ	50 UJ	50 UJ	100 UJ	100 UJ
METHYLENE CHLORIDE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	84 J	50 J
N-BUTYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
N-PROPYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
NAPHTHALENE	1 UJ	1 UJ	1 UJ	1 J	25 UJ	25 UJ	50 UJ	50 UJ
O-XYLENE<	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
P-ISOPROPYLTOLUENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
SEC-BUTYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
STYRENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
TERT-BUTYLBENZENE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
TETRACHLOROETHENE*	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
TOLUENE<	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
TRANS-1,2-DICHLOROETHENE*	1 J	1 UJ	2 J	5 J	45 J	46 J	230 J	240 J
TRICHLOROETHENE*	8 J	1 UJ	8 J	19 J	400 J	480 J	2200 J	2300 J
TRICHLOROFLUOROMETHANE	1 UJ	1 UJ	1 UJ	2 UJ	25 UJ	25 UJ	50 UJ	50 UJ
VINYL CHLORIDE*	1 UJ	1 UJ	0.7 J	1 J	25 UJ	25 UJ	50 UJ	50 UJ
total Chlorinated VOC*	17.6	3.6	37.3	80	642	862	4119	4349
Total BTEX<	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	MW03-14D	MWZ3-01	MWZ3-03	MWZ4-1	MWZ4-1-DUP	MWZ4-2	EA-105	EA-106R	EA-110D
Date Collected	3/12/98	3/12/98	3/10/98	3/13/98	3/13/98	3/13/98	3/11/98	3/13/98	3/12/98
ANALYTE									
1,1,1,2-TETRACHLOROETHANE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1,1-TRICHLOROETHANE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1,2,2-TETRACHLOROETHANE*	210000 J	170 J	2 J	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1,2-TRICHLOROETHANE*	4800 J	21 J	2 J	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1-DICHLOROETHANE*	5000 UJ	25 UJ	0.7 J	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1-DICHLOROETHENE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,1-DICHLOROPROPENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2,3-TRICHLOROBENZENE	5000 UJ	25 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U
1,2,3-TRICHLOROPROPANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2,3-TRIMETHYLBENZENE	10000 R	50 R	2 R	2 R	2 R	2 R	2 R	2 R	2 R
1,2,4-TRICHLOROBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2,4-TRIMETHYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-DIBROMO-3-CHLOROPROPANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-DIBROMOETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-DICHLOROBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-DICHLOROETHANE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,2-DICHLOROPROPANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,3,5-TRIMETHYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,3-DICHLOROBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,3-DICHLOROPROPANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
1,4-DICHLOROBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
2,2-DICHLOROPROPANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
2-CHLOROTOLUENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
4-CHLOROTOLUENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BENZENE <	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BROMOBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BROMOCHLOROMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BROMODICHLOROMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BROMOFORM	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
BROMOMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	MW03-14D	MWZ3-01	MWZ3-03	MWZ4-1	MWZ4-1-DUP	MWZ4-2	EA-105	EA-106R	EA-110D
Date Collected	3/12/98	3/12/98	3/10/98	3/13/98	3/13/98	3/13/98	3/11/98	3/13/98	3/12/98
CARBON TETRACHLORIDE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
CHLOROBENZENE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
CHLOROETHANE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
CHLOROFORM*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
CHLOROMETHANE*	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
CIS-1,2-DICHLOROETHENE*	13000 J	270 J	25 J	1 U	1 U	1 U	1 UJ	1 U	1 U
DIBROMOCHLOROMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
DIBROMOMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
DICHLORODIFLUOROMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
ETHYLBENZENE<	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
HEXACHLOROBUTADIENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
ISOPROPYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
M/P-XYLENE<	10000 UJ	50 UJ	2 UJ	2 U	2 U	2 U	2 UJ	2 U	2 U
METHYLENE CHLORIDE	5000 UJ	25 UJ	1 J	1 U	1 U	1 U	1 UJ	1 U	1 U
N-BUTYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
N-PROPYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
NAPHTHALENE	4500 J	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ
O-XYLENE<	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
P-ISOPROPYLTOLUENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
SEC-BUTYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
STYRENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
TERT-BUTYLBENZENE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
TETRACHLOROETHENE*	2900 J	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
TOLUENE<	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
TRANS-1,2-DICHLOROETHENE*	7800 J	100 J	2 J	1 U	1 U	1 U	1 UJ	1 U	1 U
TRICHLOROETHENE*	130000 J	620 J	8 J	1 U	1 U	1 U	1 UJ	1 U	1 U
TRICHLOROFLUOROMETHANE	5000 UJ	25 UJ	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U
VINYL CHLORIDE*	5000 UJ	25 UJ	0.8 J	1 U	1 U	1 U	1 UJ	1 U	1 U
total Chlorinated VOC*	368500	1181	40.5	ND	ND	ND	ND	ND	ND
Total BTEX<	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	EA-110R	EA-110R-DUP	EA-111D	EA-111D-DUP	EA-111R	EA-112D	EA-112R	EA-113D
Date Collected	3/17/98	3/17/98	3/12/98	3/12/98	3/13/98	3/12/98	3/13/98	3/13/98
ANALYTE								
1,1,1,2-TETRACHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-TRICHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-TETRACHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	4	18	1 U
1,1,2-TRICHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	0.8 J	4	1 U
1,1-DICHLOROETHANE*	1 U	1 U	0.6 J	0.6 J	1 U	1 U	1 U	1 U
1,1-DICHLOROETHENE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-DICHLOROPROPENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-TRICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-TRICHLOROPROPANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-TRIMETHYLBENZENE	2 R	2 R	2 R	2 R	2 R	2 R	2 R	2 R
1,2,4-TRICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-TRIMETHYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMO-3-CHLOROPROPANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DIBROMOETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-DICHLOROPROPANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3,5-TRIMETHYLBENZENE	1 R	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-DICHLOROPROPANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-DICHLOROBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2,2-DICHLOROPROPANE	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 UJ	1 U
2-CHLOROTOLUENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-CHLOROTOLUENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BENZENE<	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BROMOBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BROMOCHLOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BROMODICHLOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BROMOFORM	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BROMOMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

TABLE 4-3 Volatile Organic Compounds Detected in the March 1998 Ground-Water Samples (ug/L)

Site 03/Nike Offsite and Natural Atten
NCBC Davisville

Sample I.D.	EA-110R	EA-110R-DUP	EA-111D	EA-111D-DUP	EA-111R	EA-112D	EA-112R	EA-113D
Date Collected	3/17/98	3/17/98	3/12/98	3/12/98	3/13/98	3/12/98	3/13/98	3/13/98
CARBON TETRACHLORIDE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CHLOROBENZENE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CHLOROETHANE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CHLOROFORM*	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
CHLOROMETHANE*	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 UJ	1 U
CIS-1,2-DICHLOROETHENE*	1 U	1 U	1 U	1 U	1 U	10	44	0.8 J
DIBROMOCHLOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
DIBROMOMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
DICHLORODIFLUOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
ETHYLBENZENE<	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
HEXACHLOROBUTADIENE	1 UJ	1 UJ	1 U	1 U	1 UJ	1 U	1 UJ	1 U
ISOPROPYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
M/P-XYLENE<	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
METHYLENE CHLORIDE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-BUTYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-PROPYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
NAPHTHALENE	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
O-XYLENE<	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
P-ISOPROPYLTOLUENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
SEC-BUTYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
STYRENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TERT-BUTYLBENZENE	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TETRACHLOROETHENE*	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U
TOLUENE<	2	2	1 U	1 U	1	1 U	1 U	1 U
TRANS-1,2-DICHLOROETHENE*	1 U	1 U	1 U	1 U	1 U	4	12	1 U
TRICHLOROETHENE*	1 U	1 U	1 U	1 U	1 U	24	90 J	0.7 J
TRICHLOROFLUOROMETHANE	1 U	1 U	1 U	1 U	1 U	1 J	1 U	1 U
VINYL CHLORIDE*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
total Chlorinated VOC*	ND	ND	0.6	0.6	2	42.8	168	1.5
Total BTEX<	2	2	ND	ND	1	ND	ND	ND

TABLE 4-4. SUMMARY OF THE 1995, 1996, AND 1998 TOTAL CVOC RESULTS IN GROUND WATER SITE 03/NIKE, NCBC DAVISVILLE, RI

MW	1995 Total CVOC (ug/l)	1996 Total CVOC (ug/l)	1998 Total CVOC (ug/l)
1. Detected CVOC concentrations decreasing or remaining approximately the same			
MW01-12D	49	33	17.6
MW01-14D	ND	2	3.6
MW02-03D	31	40	37.3
MW02-10D	96	74	80
MW02-11D	18	20	--
MW03-02D	7	8	--
MW03-03D	778	629	642
MW03-10D	409	189	--
MW03-12D	5,456	112	--
MW03-13D	15,200	1,719	--
MW03-14D	526,480	423,000	373,500
MW-Z3-03	--	36	40.5
2. MW03-08D condition			
MW03-08D	8379	2200	4119
3. Apparent total CVOC increasing trends			
MW03-07D	463	536	862
MW03-09D	91	250	--
MWZ3-01	--	61	1181

CVOC - Chlorinated Volatile Organic Compounds
ND - Not Detected

TABLE 4-5. ANALYTICAL PARAMETERS AND WEIGHTING FOR PRELIMINARY SCREENING[a]

Analysis	Concentration in Most Contaminated Zone	Interpretation	Value
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	3
Oxygen*	>1 mg/L	VC may be oxidized aerobically	-3
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	2
Iron II*	>1 mg/L	Reductive pathway possible	3
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	2
Sulfide*	>1 mg/L	Reductive pathway possible	3
Methane*	<0.5 mg/L >0.5 mg/L	VC oxidizes Ultimate reductive daughter product, VC accumulates	0 3
Oxidation Reduction Potential (ORP)	<50 millivolts (mV) <-100 mV	Reductive pathway possible Reductive pathway likely	1 2
pH*	5<pH<9 5>pH>9	Optimal range for reductive pathway Outside optimal range for reductive pathway	0 -2
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2
Temperature*	>20°C	At T >20°C biochemical process is accelerated	1
Carbon Dioxide	>2X background	Ultimate oxidative daughter product	1
Alkalinity	>2X background	Results from interaction of carbon dioxide with aquifer minerals	1
Chloride*	>2X background	Daughter product of organic chlorine	2
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	3
Hydrogen	<1 nM	VC oxidized	0
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	2
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	2
PCE*		Material released	0
TCE*		Material released Daughter product of PCE	0 2[a]
DCE*		Material released Daughter product of TCE If cis is greater than 80% of total DCE, it is likely a daughter product of TCE	0 2[a]
VC*		Material released Daughter product of DCE	0 2[a]
Ethene/Ethane	>0.01 mg/L >0.1 mg/L	Daughter product of VC/ethene	2 3
Chloroethane*		Daughter product of VC under reducing conditions	2
1,1,1-trichloroethane*		Material released	0
1,2-dichlorobenzene*		Material released	0
1,3-dichlorobenzene*		Material released	0
1,4-dichlorobenzene*		Material released	0
chlorobenzene*		Material released or daughter product of dichlorobenzene	2[a]
1,1-DCE*		Daughter product of TCE or chemical reaction of 1,1,1-TCA	2[a]

* Required analysis.

(a) Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

Source: Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater, November 1996.

TABLE 4-6. PRELIMINARY BIODEGRADATION SCREENING RESULTS BASED ON THE 1998 GROUND-WATER SAMPLE RESULTS SITE 03/NIKE, NCBC DAVISVILLE, RI

Indicator Parameters	EA-105 (Background)	Weight	MW03-14D (NAPL Source Area)	Weight	MW03-07D (Downgradient)	Weight	Interpretation
Dissolved Oxygen (mg/L)	3.11	-3	2.1	-3	0.88	0	Tolerated at concentrations <0.5 mg/l, suppresses reductive pathway at concentrations >0.5 mg/l.
Nitrate (mg/L)	ND	2	0.52	2	ND	2	May compete with reductive pathway at concentrations >1 mg/L.
Iron II (µg/L)	168	0	10,800	3	4,380	3	Reductive pathway possible at concentrations >1 mg/L.
Sulfate (mg/L)	9.47	2	9.41	2	15.1	2	May compete with reductive pathway at concentrations > 20 mg/L.
Methane (mg/L)	<0.01	0	<0.01	0	<0.01	0	<0.5 mg/L VC oxidizes, >0.5 mg/l VC accumulates.
ORP (mV)	135	0	-130	0[2]	55	1	<50 mV reductive pathway possible, <-100 mV reductive pathway likely
pH	5.36	0	6.8	0	5.9	0	Optimal range for reductive pathway is 5< pH <9.
Temperature °C	9	0	6.5	0	8	0	Biochemical processes are accelerated at temperatures >20°C.
Hydrogen (nM)	2.51	3	NA[1]	-	1.11	3	>1 nM reductive pathway possible, <1 nM VC oxidized.
PCE (µg/L)	ND	0	2,900 J	0	ND	0	
TCE (µg/L)	ND	0	130,000	0	480	0	Likely release material.
trans 1,2-DCE (µg/L)	ND	-	7,800	-	46	-	
cis 1,2-DCE (µg/L)	ND	0	13,000	2	140	2	Concentration of cis DCE greater than 80% of total DCE is indicative of reductive dechlorination.
Vinyl Chloride (µg/L)	ND	0	ND	0	ND	0	Likely daughter product of reductive dechlorination.
Ethene/ethane (µg/L)	<0.01	0	0.1	3	<0.01	0	Daughter product of vinyl chloride.
Screening Value		4		9		13	*

Source: AFCEE, Draft Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. November 1996.
[1] Hydrogen was not sampled because Well MW03-14D is steel cased.
[2] ORP does not correlate with Dissolved Oxygen, weight assigned only to DO reading.
ND - Not Detected
J - Estimated Value

Indicator Parameters	MW02-10D (Downgradient)	Weight	MW01-14D (Downgradient)	Weight	EA-112D (Crossgradient)	Weight	Interpretation
Dissolved Oxygen (mg/L)	0.45	3	0.58	3	0.34	3	Tolerated at concentrations <0.5 mg/l, suppresses reductive pathway at concentrations >0.5 mg/l.
Nitrate (mg/L)	ND	2	ND	2	ND	2	May compete with reductive pathway at concentrations >1 mg/L.
Iron II (µg/L)	14,100	3	11,300	3	11,400	3	Reductive pathway possible at concentrations >1 mg/L.
Sulfate (mg/L)	15.4	2	12.2	2	20.1	2	May compete with reductive pathway at concentrations > 20 mg/L.
Methane (mg/L)	<0.01	0	0.06	3	<0.01	0	<0.5 mg/L VC oxidizes, >0.5 mg/l VC accumulates.
ORP (mV)	-35	1	-77	1	-15.6	1	<50 mV reductive pathway possible, <-100 mV reductive pathway likely
pH	6.31	0	6.54	0	6.2	0	Optimal range for reductive pathway is 5< pH <9.
Temperature °C	11	0	12.5	0	9.2	0	Biochemical processes are accelerated at temperatures >20°C.
Hydrogen (nM)	10.22	3	1.98	3	2.74	3	>1 nM reductive pathway possible, <1 nM VC oxidized.
PCE (µg/L)	ND	0	ND	0	ND	0	
TCE (µg/L)	19	0	ND	0	24	0	Likely release material.
trans 1,2-DCE (µg/L)	5	-	ND	-	4	-	
cis 1,2-DCE (µg/L)	40	2	3	2	10	2	Concentration of cis DCE greater than 80% of total DCE is indicative of reductive dechlorination.
Vinyl Chloride (µg/L)	1 J	2	ND	0	ND	0	Likely daughter product of reductive dechlorination.
Ethene/ethane (µg/L)	<0.01	0	<0.01	0	<0.01	0	Daughter product of vinyl chloride.
Screening Value		18		19		16	*

Source: AFCEE, Draft Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. November 1996.

ND - Not Detected
J - Estimated Value

* - As a preliminary assessment of biodegradation, data from 6 representative wells was evaluated and scored in accordance with the Draft AFCEE Protocol. The average score for the 6 wells is 13.2. Per the Draft AFCEE Protocol a score of 6 to 14 indicates limited evidence for biodegradation of chlorinated organics.

TABLE 4-7
Estimated Time Taken by PCE, PCA, TCE, 1,1,2-TCA, and 1,2-DCE (total) to Travel from Nike Site to Site 02 — Calculated using Retardation Factor
Site 03/Nike
NCBC Davisville, RI

(A) PCE Travel Time in the Deep Unconsolidated Soil Ground-Water Zone

Deep Wells	Average K, ft/day	Distance Between Wells (D), ft	Hydraulic Gradient, ft/ft	Velocity (V) ft/day	R_f	$V_c = V/R_f$ ft/day	$t = D/V_c$, day	Cumulative Time T, years
MW03-14D to MW03-13D	13.65	525	2.50e-03	1.71e-01	1.728	9.87e-02	5,317	15
MW03-13D to MW03-08D	26.08	135	2.52e-03	3.29e-01	1.728	1.90e-01	710	17
MW03-08D to MW03-07D	13.8	490	1.04e-03	7.18e-02	1.728	4.15e-02	11,799	49
MW03-06D to MW03-03D	5.53	310	1.54e-03	4.25e-02	4.276	9.95e-03	31,158	85
MW03-03D to MW03-05D	6.03	235	1.94e-03	5.85e-02	4.276	1.37e-02	17,180	132
EA-104 to MW-Z3-1	36.5							

(B) PCA Travel Time in the Deep Unconsolidated Soil Ground-Water Zone

Deep Wells	Average K, ft/day	Distance Between Wells (D), ft	Hydraulic Gradient, ft/ft	Velocity (V) ft/day	R_f	$V_c = V/R_f$ ft/day	$t = D/V_c$, day	Cumulative Time T, years
MW03-14D to MW03-13D	13.65	525	2.50e-03	1.71e-01	1.236	1.38e-01	3,803	10
MW03-13D to MW03-08D	26.08	135	2.52e-03	3.29e-01	1.236	2.66e-01	508	12
MW03-08D to MW03-07D	13.8	490	1.04e-03	7.18e-02	1.236	5.81e-02	8,440	35
MW03-06D to MW03-03D	5.53	310	1.54e-03	4.25e-02	2.062	2.06e-02	15,025	41
MW03-03D to MW03-05D	6.03	235	1.94e-03	5.85e-02	2.062	2.84e-02	8,285	64
EA-104 to MW-Z3-1	36.5							

TABLE 4-7 (continued)

(C) TCE Travel Time in the Deep Unconsolidated Soil Ground-Water Zone

Deep Wells	Average K, ft/day	Distance Between Wells (D), ft	Hydraulic Gradient, ft/ft	Velocity (V) ft/day	R_f	$V_c = V/R_f$ ft/day	$t = D/V_c$, day	Cumulative Time T, years
MW03-14D to MW03-13D	13.65	525	2.50e-03	1.71e-01	1.252	1.36e-01	3,852	11
MW03-13D to MW03-08D	26.08	135	2.52e-03	3.29e-01	1.252	2.62e-01	514	12
MW03-08D to MW03-07D	13.8	490	1.04e-03	7.18e-02	1.252	5.73e-02	8,549	35
MW03-06D to MW03-03D	5.53	310	1.54e-03	4.25e-02	2.134	1.99e-02	15,550	43
MW03-03D to MW03-05D	6.03	235	1.94e-03	5.85e-02	2.134	2.74e-02	8,574	66
EA-104 to MW-Z3-1	36.5							

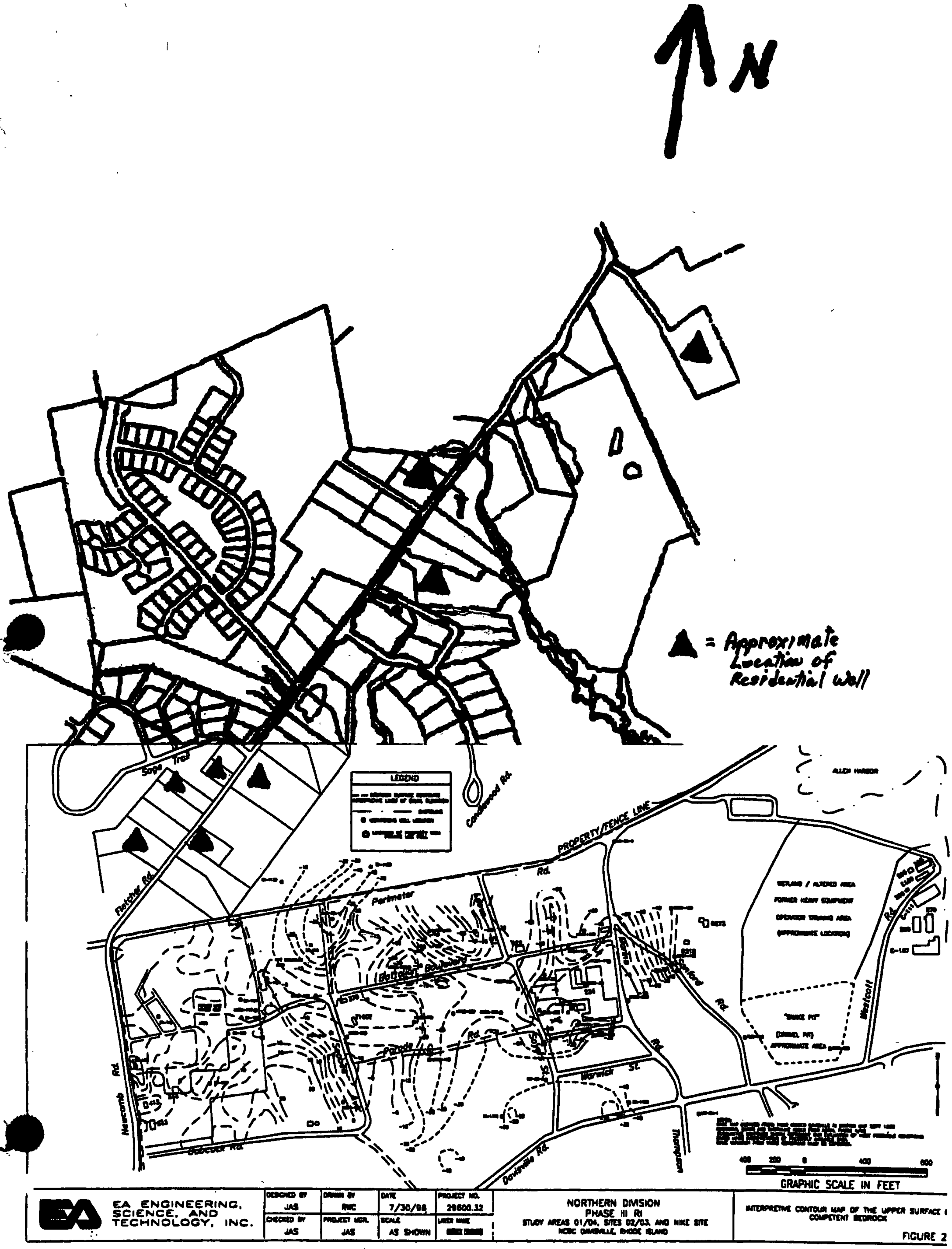
(D) 1,1,2-TCA Travel Time in the Deep Unconsolidated Soil Ground-Water Zone

Deep Wells	Average K, ft/day	Distance Between Wells (D), ft	Hydraulic Gradient, ft/ft	Velocity (V) ft/day	R_f	$V_c = V/R_f$ ft/day	$t = D/V_c$, day	Cumulative Time T, years
MW03-14D to MW03-13D	13.65	525	2.50e-03	1.71e-01	1.112	1.53e-01	3,422	9
MW03-13D to MW03-08D	26.08	135	2.52e-03	3.29e-01	1.112	2.95e-01	457	11
MW03-08D to MW03-07D	13.8	490	1.04e-03	7.18e-02	1.112	6.45e-02	7,593	31
MW03-06D to MW03-03D	5.53	310	1.54e-03	4.25e-02	1.504	2.83e-02	10,959	30
MW03-03D to MW03-05D	6.03	235	1.94e-03	5.85e-02	1.504	3.89e-02	6,043	47
EA-104 to MW-Z3-1	36.5							

TABLE 4-7 (continued)

(E) 1,2-DCE (total) Travel Time in the Deep Unconsolidated Soil Ground-Water Zone

Deep Wells	Average K, ft/day	Distance Between Wells (D), ft	Hydraulic Gradient, ft/ft	Velocity (V) ft/day	R_f	$V_c = V/R_f$ ft/day	$t = D/V_c$, day	Cumulative Time T, years
MW03-14D to MW03-13D	13.65	525	2.50e-03	1.71e-01	1.108	1.54e-01	3,409	9
MW03-13D to MW03-08D	26.08	135	2.52e-03	3.29e-01	1.108	2.97e-01	455	11
MW03-08D to MW03-07D	13.8	490	1.04e-03	7.18e-02	1.108	6.48e-02	7,566	31
MW03-06D to MW03-03D	5.53	310	1.54e-03	4.25e-02	1.486	2.86e-02	10,828	30
MW03-03D to MW03-05D	6.03	235	1.94e-03	5.85e-02	1.486	3.94e-02	5,970	46
EA-104 to MW-Z3-1	36.5							


N
= Approximate Location of Residential Well
Sage Trail
Fletcher Rd.
Candlewood Rd.
LEGEND
PROPERTY/FENCE LINE
ALLEN HARBOR
Perimeter Rd.
Battalion Boulevard
Parade Rd.
Warwick St.
Newcomb Rd.
Babcock Rd.
Davisville Rd.
Thompson
Westcott Rd.
WETLAND / ALTERED AREA
FORMER HEAVY EQUIPMENT
OPERATOR TRAINING AREA
(APPROXIMATE LOCATION)
GRAPHIC SCALE IN FEET
400 200 0 400 800
EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.
DESIGNED BY JAS
DRAWN BY RWC
DATE 7/30/98
PROJECT NO. 29600.32
CHECKED BY JAS
PROJECT MGR. JAS
SCALE AS SHOWN
LAYER NAME
NORTHERN DIVISION
PHASE III RI
STUDY AREAS 01/04, SITES 02/03, AND NIKE SITE
NCBC DAVISVILLE, RHODE ISLAND
INTERPRETIVE CONTOUR MAP OF THE UPPER SURFACE OF COMPETENT BEDROCK
FIGURE 2