N00164.AR.000292
NSWC CRANE
5090.3a

Environmental Data Assessment Memorandum

for

Solid Waste Management Units #03/10, #06/09, and #07/09

Naval Surface Warfare Center, Crane Division

Crane, Indiana

Northern Division
Naval Facilities Engineering Command

Contract No. GCPP-91-001-1298

Contract Task Order 0229

July 1997

Admin. Record

RUST Rust Environment & Infrastructure Inc.

A Rust international Company
4738 North 40th Street
Sheboygan, WI 53083-1883
P.O. Box 1067
Sheboygan, WI 53082-1067

Phone 414.458.8711
Fax 414.458.0537

July 28, 1997
RTSB/97-0006

Mr. Tom Brent
Commanding Officer
Naval Surface Warfare Center
Code 09510, Building 3260
Crane, IN 47522-5009

Re: Environmental Data Assessment Memorandum
Risk Assessment
NAVSURFWARCENDIV, Crane, IN
CTO No. 229
Rust Project No. 20626

Dear Mr. Brent:

Enclosed please find two copies of the final Environmental Data Assessment Memorandum (EDAM) for the Risk Assessment for the Ammunition Burning Ground (ABG), Old Rifle Range (ORR), and Demolition Range (DR) at NAVSURFWARCENDIV, Crane, Indiana. The final EDAM incorporates revisions discussed and agreed to at the July 21, 1997, meeting at USEPA Region V in Chicago, Illinois. Please review this revised document and contact me as soon as possible if you require changes. We plan to be in the field, sampling, no later than August 11, 1997.

If you should have any questions regarding the EDAM, please contact me at (414) 458-8711.

Sincerely,

Charlie Zeal

Charlie Zeal, P.E.
Project Manager

Enclosure: As Noted

c: Daryl Hutson, B&R w/2 copies
Lorrie Ransome, REI w/1 copy
Jeff Stevens, REI w/1 copy
Allan Hale, REI w/1 copy
Jeff Maletzke, REI w/1 copy
File, w/1 copy

L:\WORK\CTO22901\WP\EDA1\BRENT.CZ

Environmental Data Assessment Memorandum

for

Solid Waste Management Units #03/10, #06/09, and #07/09

Naval Surface Warfare Center, Crane Division

Crane, Indiana

Northern Division
Naval Facilities Engineering Command

Contract No. GCPP-91-001-1298

Contract Task Order 0229

July 1997

TABLE OF CONTENTS

SECTION **PAGE**

1.0 INTRODUCTION . . . 1
1.1 BACKGROUND/PURPOSE OF THIS MEMORANDUM . . . 1
1.2 ORGANIZATION OF THIS MEMORANDUM . . . 3

2.0 SITE BACKGROUND/HISTORY . . . 5
2.1 INTRODUCTION . . . 5
2.2 AMMUNITION BURNING GROUND (SWMU #03/10) . . . 5
2.3 DEMOLITION RANGE (SWMU #06/09) . . . 6
2.4 OLD RIFLE RANGE (SWMU #07/09) . . . 6

3.0 ENVIRONMENTAL SETTING . . . 8
3.1 INTRODUCTION . . . 8
3.2 SOIL . . . 8
3.3 GEOLOGY . . . 9
3.4 HYDROGEOLOGY . . . 10

4.0 SITE DATA ANALYSIS . . . 12
4.1 AMMUNITION BURNING GROUND . . . 12
4.1.1 Soil . . . 12
4.1.2 Surface Water/Sediment . . . 14
4.1.3 Springs . . . 16
4.1.4 Groundwater . . . 17
4.2 OLD RIFLE RANGE . . . 24
4.2.1 Soil . . . 24
4.2.2 Surface Water/Sediment . . . 25
4.2.3 Groundwater . . . 25
4.3 DEMOLITION RANGE . . . 27
4.3.1 Soil . . . 27
4.3.2 Groundwater . . . 27
4.4 FACILITY BACKGROUND DATA . . . 29
4.4.1 Soil . . . 29
4.4.2 Surface Water and Sediment . . . 30
4.4.3 Groundwater - ABG . . . 31
4.4.4 Groundwater - ORR . . . 32
4.4.5 Groundwater - DR . . . 33

5.0 RECOMMENDATIONS . . . 35
5.1 AMMUNITION BURNING GROUND . . . 35
5.2 OLD RIFLE RANGE . . . 36
5.3 DEMOLITION RANGE . . . 37

6.0 REFERENCES . . . 38

LIST OF TABLES

TABLE

4-1 ABS - Soil Sampling Data
4-2 ABG - Surface Water Sampling Data
4-3 ABG - Sediment Sampling Data
4-4 ABG - Spring Sampling Data
4-5 ABG - Beaver Bend Aquifer Sampling Data
4-6 ABG - Beech Creek Aquifer Sampling Data
4-7 ABG - Big Clifty Aquifer Sampling Data
4-8 ABG - Golconda Aquifer Sampling Data
4-9 ABG - Alluvial Aquifer Sampling Data
4-10 ORR - Soil Sampling Data
4-11 ORR/DR - Surface Water Sampling Data
4-12 ORR/DR - Sediment Sampling Data
4-13 ORR - Beech Creek Aquifer Sampling Data
4-14 ORR - Golconda Aquifer Sampling Data
4-15 ORR - Surficial Aquifer Sampling Data
4-16 DR - Soil Sampling Data
4-17 DR - Beech Creek Aquifer Sampling Data
4-18 DR - Intermediate Zone Aquifer Sampling Data
4-19 DR - Surficial Zone Aquifer Wells
5-1 ABG - Proposed Sampling for Soil
5-2 ABG - Proposed Sampling for Sediment and Surface Water
5-3 ABG - Proposed Sampling for Groundwater
5-4 ORR - Proposed Sampling for Soil
5-5 ORR/DR - Proposed Sampling for Surface Water and Sediment
5-6 ORR - Proposed Sampling for Groundwater
5-7 DR - Proposed Sampling for Soil
5-8 DR - Proposed Sampling for Groundwater
5-9 ABG/ORR/DR - Proposed Background Groundwater Sampling

LIST OF FIGURES

Figure	Description
2-1	General Location Map
2-2	SWMU Locations
4-1	ABG - Soil Sampling Locations
4-2	Jeep Trail - Soil Sampling Locations
4-3	ABG - Surface Water/Sediment Sampling Locations
4-4	ABG - Spring Sampling Locations
4-5	ABG - Groundwater Sampling: Beaver Bend Aquifer Wells
4-6	ABG - Groundwater Sampling: On-SWMU Beech Creek Aquifer Wells
4-7	Jeep Trail - Groundwater Sampling: On-SWMU Beech Creek Aquifer Wells
4-8	ABG - Groundwater Sampling: Off-SWMU Beech Creek Aquifer Wells
4-9	ABG - Groundwater Sampling: Big Clifty Aquifer Wells
4-10	ABG - Groundwater Sampling: Golconda Aquifer Wells
4-11	ABG - Groundwater Sampling: Downgradient Alluvium Aquifer Wells
4-12	Jeep Trail - Groundwater Sampling: Alluvium Aquifer Wells
4-13	ORR - Soil Sampling Locations
4-14	ORR/DR - Surface Water/Sediment Sampling Locations
4-15	ORR - Groundwater Sampling: Beech Creek Aquifer Wells
4-16	ORR - Groundwater Sampling: Golconda Aquifer Wells
4-17	ORR - Groundwater Sampling: Surficial Aquifer Wells
4-18	DR - Soil Sampling Locations
4-19	DR - Groundwater: Beech Creek Aquifer Wells
4-20	DR - Groundwater: Intermediate Zone Aquifer Wells
4-21	DR - Groundwater: Surficial Zone Aquifer Wells

TECHNICAL MEMORANDUM

1.0 INTRODUCTION

1.1 BACKGROUND/PURPOSE OF THIS MEMORANDUM

In 1992, Rust Environment & Infrastructure (Brown & Root Environmental Team) was tasked by Halliburton NUS under a Comprehensive Long-term Environmental Action Navy (CLEAN) Prime Contract with the Naval Facilities Engineering Command to conduct a Human Health and Environmental Risk Assessment on three Solid Waste Management Units (SWMUs) at the Naval Surface Warfare Center, Crane Division, Crane, Indiana (NAVSURFWARCENDIV). The three SWMUs are #03/10 (ABG; Ammunition Burning Ground, including the "Jeep Trail Area"), #07/09 (ORR; Old Rifle Range), and #06/09 (DR; Demolition Range). Waste explosive open burning activities occur at the first two SWMUs, while detonation activities occur at the Demolition Range. The risk assessment is intended to estimate the potential human health and ecological impacts of ABG, ORR, and DR to satisfy the requirements of both 40 CFR Part 264 Subpart X and the notice of deficiency issues that have been identified in NAVSURFWARCENDIV's RCRA Part B permit application.

In preparation for this risk assessment, a detailed risk assessment work plan (RAWP) was developed by the Halliburton NUS team in July 1995 (HNUS, 1995). The primary objectives of this RAWP were: (1) to develop site conceptual models for each SWMU, (2) to review and summarize the existing site data for each SWMU, and (3) to prepare a Sampling and Analysis Plan (SAP) that describes any supplemental data that would need to be collected at each SWMU for completion of the risk assessment.

The SAP was developed by Brown & Root Environmental Team and submitted along with the RAWP. After acceptance of the RAWP and the SAP, Brown & Root Environmental Team performed the necessary supplemental field work at the facility during 1995/6. The SAP was based on the existing RFI data at each SWMU, which originated from a variety of sources and regulatory programs. For example, the U.S. Army Corps of Engineer laboratory (WES) conducted a multi-phase Release Characterization Study at ABG (Murphy, 1992a), which entailed the identification of the nature and extent of hazardous constituents in soil at this SWMU. WES also conducted two other multi-phase Groundwater Release Characterization Studies at ABG that addressed contamination in surface water, sediment and groundwater (Murphy, 1992b; Murphy

and Wade, 1994a). As part of the risk assessment task, Brown & Root Environmental Team supplemented these existing databases with additional analytical data. These latter data were obtained using Southwest Laboratories. Historical groundwater data for ABG (pre-1990) were obtained using three other laboratories - Enseco (now called Quanterra), Anacon, and Synergic Analytics. Similar situations exist for ORR and DR.

One of the first tasks following the acceptance of the RAWP was the conductance of a trend analysis of the groundwater data obtained at each SWMU. The purpose of this trend analysis was to determine the methodology to be used to calculate the groundwater exposure point concentrations in the risk assessment. A trend analysis was completed by Brown & Root Environmental Team and submitted to the USEPA in 1996 (Brown & Root Environmental Team, 1996).

During the preparation of this trend analysis an issue of data validation of the facility's historical analytical data was raised. It was discovered that very little of the analytical data collected at these SWMUs in the past (pre - 1995) had undergone a data validation effort of sufficient rigor to produce results that met the minimum data useability standards for risk assessment purposes. This issue was brought to the attention of USEPA, whereupon a relatively detailed review of select data sets from each laboratory was performed by USEPA and their contractor (A.T. Kearney) (USEPA, 1997).

After the data review was completed, USEPA informed the Halliburton NUS team that not all of the historical data for these sites were acceptable for use in the risk assessment. Specifically, USEPA's recommendations were:

<u>Non-Explosives Target Parameters</u>

- Southwest Laboratory - VOC, SVOC, and metals data (with the exception of tin, which was not reported) should be considered useable for risk assessment purposes.

- Enseco Laboratory - nonexplosives data are recommended for use in assessing site risks.

- Anacon Laboratory - none of these data may be utilized for purposes of the human health risk assessment study.

- Synergic Analytics - it is not recommended that these data be utilized in a risk assessment study.

- WES (U.S. Army Corps of Engineers) Laboratory - these data shall be rejected from further risk assessment considerations due to a lack of QC documentation.

Explosives Target Parameters

- Anacon Laboratory - these data must be rejected.

- Synergic Analytics - these data must be rejected.

- WES (U.S. Army Corps of Engineers) Laboratory - data for only certain parameters will be considered (1990 - HMX, RDX, TNB, 1,3-DNB, Tetryl, TNT, 2,4-DNT, 2,6-DNT; 1993 - HMX, RDX, TNB, 1,3-DNB, Tetryl, TNT, 2,4-DNT, 2,6-DNT, 2-amino-DNT, 4-amino-DNT).

- Southwest Laboratory - these data are acceptable for use in defining human health risks.

- Enseco Laboratory - these data are acceptable for use in defining human health risks.

Consequent to this rejection of some of the analytical data available for these three SWMUs and because the original Brown & Root Environmental Team RAWP was developed assuming that all of these data would be useable, a reanalysis of the 'revised' analytical databases for these SWMUs must again be completed.

The purposes of this memorandum therefore are: (1) to recreate the databases detailing the currently acceptable (i.e. valid) data for each environmental medium at each of these three SWMUs in light of this latest QC review, and (2) to determine if significant data gaps exist. If datagaps are found to be present, specific recommendations are to be made to resolve the issue.

1.2 ORGANIZATION OF THIS MEMORANDUM

Following this introductory section, this memorandum has been organized to provide the reader with an initial brief background history of the activities at each of these SWMUs (Section 2.0) and the general environmental setting of the facility (Section 3.0). Then, a discussion on a SWMU-specific and environmental medium-specific basis is provided that documents any impacts that the rejected analytical data may have on the risk assessment (Section 4.0). The text of this memorandum concludes with Brown & Root Environmental Team's

recommendations as to the preferred technical disposition of any significant 'data gaps' (Section 5.0). Section 6.0 lists all of the published references cited in this memorandum.

2.0 SITE BACKGROUND/HISTORY

2.1 INTRODUCTION

In 1940, Congress authorized construction of a Naval Ammunition Depot (NAD) in southern Indiana (Figure 2-1). In late 1941, the Burns City Naval Ammunition Depot was commissioned. In 1943, NAD Burns City was renamed NAD Crane. NAD Crane's overall mission was to load, prepare, renovate, receive, store, and issue ammunition to the fleet.

During World War II, NAD Crane's mission expanded to include pyrotechnics production, mine filling, rocket assembly, field storage, torpedo storage, and ordnance spare parts and mobile equipment storage. During the 1950s, several new departments were created, the Ammunition Loading and Production Engineering Center (ALPEC) was transferred to Crane, and the Central Ammunition Supply Control Office (CASCO) was established. NAD Crane supplied ammunition to the fleet during the Korean and Vietnam conflicts.

In 1976, NAD Crane was designated Naval Weapons Support Center Crane (NWSCC). Its new mission was to provide support for ships and crafts equipment, shipboard weapons' systems and assigned ordnance items, and to perform additional functions as directed. Most recently in 1992, NWSCC was designated NAVSURFWARCENDIV.

Operations within the Ammunitions Burning Ground (ABG) and the Old Rifle Range (ORR) at NAVSURFWARCENDIV can be generalized as open burning of waste explosive and explosive-contaminated materials; operations within the Demolition Range (DR) can be characterized as ordnance detonation.

2.2 AMMUNITION BURNING GROUND (SWMU #03/10)

The Ammunition Burning Ground (ABG) covers approximately 20 acres in a remote area near the east center boundary of the facility in the valley of Little Sulphur Creek (Figure 2-2; Murphy, 1992a).

Ordnance and ordnance-contaminated materials from NAVSURFWARCENDIV production areas have been taken to the ABG for disposal by burning since the 1940s. The burning ground is used extensively for destroying unwanted materials contaminated with explosives, bare explosives, rocket motors, candles, flares, solvents, detonators, and fuse materials. Several separate burning areas are within the site. The largest

quantities of materials were destroyed from 1956 to 1960, when 15,000 pounds per day of smokeless powder were destroyed. In the same period, about 46,000 lbs per day of high explosives were burned. The area is also used for flashing the residue from bombs and projectiles after they have been subjected to melt-out or drill-out operations for removal of the bulk of the explosive (Murphy, 1992a). Powder flashing and bomb burn-out were also conducted at an area called "Jeep Trail Area", which is approximately one-half mile southeast of the ABG between Little Sulphur Creek and Jeep Trail 25.

2.3 DEMOLITION RANGE (SWMU #06/09)

The Demolition Range (DR) covers an area of 40 to 50 acres (A.T. Kearney, Inc., 1987) and lies on two steep-sided ridgetops (Figure 2-2). The east ridge is used by the U.S. Navy Explosive Ordnance Disposal (EOD) Detachment to detonate ordnance with an explosive limit of 500 pounds per detonation (Naval EOD, 1993). The south ridge is used by the U.S. Army to detonate ordnance. Most of the detonation activities at the DR are done by Army personnel on the south ridge.

NAVSURFWARCENDIV conducts detonation of munitions, compressed gas cylinders, suspect inert items, white phosphorus munitions, and lithium batteries at the DR. The DR began operations during the 1940s.

The existing detonation unit consists of 70 subunits (pits). Generally, 500 pounds of net explosive weight per pit are detonated between late spring and early fall, and 250 pounds of net explosive weight per pit are detonated between early fall and late spring. The maximum amount of material treated per week (seven days) is 245,000 pounds. On the average, material treated is 87,500 pounds per week (five days).

2.4 OLD RIFLE RANGE (SWMU #07/09)

The Old Rifle Range (ORR) is a 10-acre site near the center of the facility (Figure 2-2; A.T. Kearney, Inc., 1987). Open burning/flashing of explosive wastes is conducted at the ORR. The flashing operations were originally carried out in earthen containment structures or flash pits. Today, earth-filled steel pans are used (USACE, 1991). The area has also been used for "bomb cook-off" tests (A.T. Kearney, Inc., 1987).

Most of the open burning activity that takes place at the ORR is thermal treatment of projectiles loaded with ammonium picrate (also known as Composition D, Comp D, or "yellow D"). The remaining contamination is removed by providing an open fire under and around the projectiles.

Adjacent to the flash pits is a rifle range that had been used in the past on occasion for small arms practice by base personnel. Currently, this area is seldom used.

3.0 ENVIRONMENTAL SETTING

3.1 INTRODUCTION

NAVSURFWARCENDIV is located in southwestern Indiana, approximately 40 miles southwest of Bloomington, Indiana (Figure 2-1). The site encompasses more than 100 square miles. It is located in a rural sparsely populated area. Forest covers most of NAVSURFWARCENDIV with the surrounding acreage either wooded or farmed land.

The site is located in a temperate climate zone displaying a wide temperature range among seasons. The area receives an average of 44 inches of precipitation annually, with 42 inches of rainfall and 15 inches of snowfall (NEESA, 1983). The prevailing wind is from the South-Southwest (McElrath, 1988).

The topography at NAVSURFWARCENDIV consists of undulating terrain dissected by many small drainage ways (Figure 2-2). The elevation of the site ranges from 470 feet above mean sea level (MSL) at a southern drainage way to 860 feet above MSL on a ridge in the west-central portion of the site. V-shaped drainage ways in the north progress to 2,000-foot-wide flood plains in the south and rise to approximately 150 to 200 feet to the ridge lines (NEESA, 1983).

Six creeks receive drainage in five separate drainage basins at NAVSURFWARCENDIV (Figure 2-2). The six creeks are: Furst Creek, Sulphur Creek, Little Sulphur Creek, Boggs Creek, Turkey Creek, and Seed Tick Creek. Surface drainage from NAVSURFWARCENDIV eventually empties into the east fork of the White River, south of the facility. Situated within Crane are Lake Greenwood and several ponds. Lake Greenwood is the main source of water at NAVSURFWARCENDIV and is also used for recreation (NEESA, 1983). Each of the three SWMUs addressed in this memorandum is in a different drainage basin (separated by divides) from that of Lake Greenwood. Surface water flow within each of the three SWMUs is to the South, away from Lake Greenwood.

3.2 SOIL

Four soil units have been mapped at NAVSURFWARCENDIV in the Soil Survey of Martin County, Indiana (McElrath, 1988), including Wellston-Gilpin, Wellston-Berks-Gilpin, Wellston-Berks-Ebal, and Wakeland-

Wilbur-Haymond soils. These soils are primarily silt loams with permeabil ities ranging from 0.6 and 2.0 in/hr (McElrath, 1988).

Detailed soil mapping (McElrath, 1988) in the vicinity of the ABG shows the presence of primarily two soil units: Burnside loam and Wellston-Berks-Gilpin complexes (18 to 70 percent slopes).

Detailed soil mapping near the DR (McElrath, 1988) shows the area to be covered primarily by Zanesville-Udorthents complex soils and Wellston-Gilpin complex soils.

At the ORR, the northern portion of the site is covered with occasionally flooded Burnside loam, the western portion with Wellston silt loam, and the eastern portion with frequently flooded Haymond silt loam (McElrath, 1988).

3.3 GEOLOGY

NAVSURFWARCENDIV is located in the eastern flank of the Illinois Basin. Beneath unconsolidated colluvial and alluvial deposits, Paleozoic age sedimentary rocks underlying NAVSURFWARCENDIV have been deformed to yield a gentle dip of 50 feet per mile toward the west-southwest.

The bedrock surface at NAVSURFWARCENDIV is made up of Lower Pennsylvanian and Upper Mississippian-age sandstones, limestones, and shales.

In general, Mississippian-age Chester Series sandstones, shales, and limestones are exposed in the valley walls of eastern portions of NAVSURFWARCENDIV and in the lower elevations of deep valleys in the western portions. Pennsylvanian-age Mansfield Formation sandstone, siltstones, claystones, and shale are found at the crests of hills and ridges in eastern portions of NAVSURFWARCENDIV and as the surficial bedrock unit farther west. The contact between the Mississippian units and overlying Pennsylvanian units is an unconformity formed by the long-term erosion of the Mississippian surface (Murphy and Ciocco, 1990).

The bedrock surface beneath the ABG is composed of sandstone, shale, and limestone of the Pennsylvanian-age Raccoon Creek Group and the Upper Mississippian-age Stephensport Group.

Bedrock occurs between two and 13 feet below a ground surface at the DR (Dunbar, 1982). Borings completed by WES reveal that bedrock consists of interfingered and interbedded sandstone, shale, and coal

seams from the Mansfield Formation of the Pennsylvanian-age Raccoon Creek Group. The shale and sandstone are thinly interbedded in nearly equal proportions.

The ORR is situated next to the DR, but lower within the stratigraphic sequence than the DR. Bedrock underlying the ORR consists of the Mansfield Formation of the Pennsylvanian-age Raccoon Creek Group (as at the DR) and the Golconda/Haney Formation and Big Clifty Formation of the Mississippian-age Stephensport Group.

3.4 HYDROGEOLOGY

In the unglaciated southwest portion of Indiana, groundwater in general is contained in joint openings of limestone and sandstone aquifers. The following rock units are considered aquifers in the eastern portion of NAVSURFWARCENDIV: Golconda/Haney Formation (Upper Aquifer), Big Clifty Formation - Lower Member and Beech Creek Formation (Middle Aquifer), and Beaver Bend Formation (Lower Aquifer) (Hunt, 1988; Murphy and Ciocco, 1990). Although unit thicknesses may vary, the distribution of bedrock units at NAVSURFWARCENDIV suggests similar aquifer characteristics throughout the facility. Surficial unconsolidated aquifers are thin and have limited potential as water supplies.

Aquifers beneath NAVSURFWARCENDIV are considered vertically isolated from each other by interlayered shale beds that act as aquitards. Groundwater recharge occurs where aquifer units outcrop. After entering an aquifer outcrop, groundwater flows by gravity down the dip of the aquifer unit. Since the regional dip of rock units is to the Southwest, regional groundwater flow in all aquifers is directed toward the Southwest. Local variations in bedding, dip, aquifer and aquitard, incision by surface drainage, and karstic conditions cause local groundwater movement at NAVSURFWARCENDIV to differ from regional trends, however. Where erosion resulting from surface drainage has cut through aquifer units, springs and seeps are produced which locally complicate groundwater flow. Springs and seeps are prevalent at contacts between aquicludes and overlying aquifers. Groundwater flowing from springs and seeps into surface water can potentially re-enter the groundwater system as recharge to a lower aquifer outcropping downstream.

In the eastern portion of NAVSURFWARCENDIV, Hunt (1988) hypothesized that karstic conditions are present primarily in major drainage valleys where erosion has cut into permeable sandstones overlying the easily dissolved Beech Creek Limestone.

Groundwater from the Golconda/Haney flows into the ABG by seepage eastward along the top of the underlying Indian Springs Shale. Groundwater seeping from the Golconda/Haney eventually infiltrates the Big Clifty/Beech Creek aquifer at ABG (Hunt, 1988).

The Big Clifty sandstone is hydraulically connected to the Beech Creek Limestone. Surface water enters the Big Clifty Sandstone outcrop in the central part of the ABG and migrates to the Beech Creek Limestone aquifer.

Groundwater in the Beech Creek enters the ABG from the North-Northwest. Primary groundwater flow at the AGB is to the East and South down the Little Sulphur Creek drainage way. Secondary groundwater flow components are to the Southwest and South through Johnson Hollow.

Dye trace studies performed by WES (Murphy and Ciocco, 1990; Murphy, 1992b) showed that Spring A, located approximately 1.5 miles south of the ABG, and Little Sulphur Creek below Spring A are prime outlets for groundwater originating at the ABG.

Groundwater elevation data, obtained in 1991 at the DR, depict a water table that mirrors the surface topography. Flow in the Big Clifty-Beech Creek is generally to the South and Southwest, but locally flows southeast toward Turkey Creek near the Old Rifle Range. The shape of the water table in the northeast corner of the SWMU deviates from the regional trend. The deviation is caused by drainage of the part of the Big Clifty-Beech Creek aquifer close to near-surface flow. That near surface flow is through the alluvial soils at the Old Rifle Range (Murphy and Wade, 1994b).

The uppermost occurrence of groundwater over much of the ORR is within the alluvium. Groundwater elevations within the underlying Big Clifty-Beech Creek aquifer are similar to those in the alluvium. The two units are hydraulically connected at ORR and therefore considered one unconfined aquifer (Murphy and Wade, 1994b). Groundwater flow beneath the ORR is primarily to the East-Southeast, toward Turkey Creek. The occurrence and movement of groundwater are closely tied to the bedrock surface (U.S. Army, 1991).

4.0 SITE DATA ANALYSIS

4.1 AMMUNITION BURNING GROUND

4.1.1 Soil

As part of an RFI at NAVSURFWARCENDIV, a multi-phased Release Characterization Study was conducted by the USACE at ABG (Murphy, 1992a). The purpose of this particular study was to identify the nature, degree and extent of hazardous constituents in the soil at this SWMU.

In 1990, the Part I soil samples collected at ABG consisted of 12 borings throughout the SWMU (Figure 4-1). Soil samples were generally taken at the following depth intervals: 3-6 inches, 12-18 inches, 18-24 inches, 36-42 inches and 6 inches above the top of bedrock. Forty-one (41) soil samples were analyzed for explosives, inorganics, volatile, and semivolatile organics and pesticides/herbicides by the Corps of Engineers laboratory (Table 4-1). In general, the contaminants found in the highest concentrations were explosives (2,4-DNT, 2,6-DNT, TNT, Tetryl, DNB, TNB, RDX and HMX) and metals (Sb, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn, Al, Co, Mg, Mn, Sn). Other contaminants found at much lower concentrations included other inorganics, polycyclic aromatic hydrocarbons (PAHs), volatile organics, and pesticides/herbicides.

Then, in 1993, an additional 33 surface soil grab samples were taken and 32 soil borings were drilled at ABG by Corps of Engineers as part of the Part II study (U.S. Army, 1995) (Figure 4-1) to determine the extent of soil contaminants identified in the Part 1 RFI soils investigation (1990). Samples from the borings were taken at specified depths (0-30", 30-60", 60-90", and/or at refusal). These soil samples were analyzed for volatile organic chemicals, PAHs, explosives, and inorganics, principally metals, by the Corps of Engineers Laboratory.

VOCs were detected in several surface and subsurface ABG soil samples. Highest concentrations of VOCs were the cis- and trans-isomers of 1,2-dichloroethylene (2.3 mg/kg and 0.29 mg/kg, respectively) and trichlorethylene (0.2 mg/kg). Maximum concentrations occurred at the depth of approximately 30 to 90 inches bgs. Surface VOCs were scattered among several locations. In deeper soil samples, VOCs occurred only in the area of the contaminated burn pads. Several explosives were detected in surface and subsurface soil samples. RDX, TNT and HMX were the most significant in terms of maximum concentrations determined. RDX and TNT occurred in concentrations greater than 1,000 mg/kg and HMX in concentrations greater than

100 mg/kg. The remaining explosives had maximum concentrations generally less than 10 mg/kg. PAHs were detected in surface and subsurface soils in concentrations that were generally less than 1 mg/kg total PAH (sum of all detectable PAHs).

Several inorganic constituents had consistently higher concentrations in site soil than in the background soil database collected by the Corps of Engineers. Constituents in surficial soil samples (samples taken at less than two feet deep) that were more than two orders of magnitude higher than their mean background concentrations were scattered widely across the ABG valley floor. These constituents include cadmium, copper, lead, zinc, and tin. If one order of magnitude is used as the criterion for comparison purposes, this site-related constituent list is expanded to include magnesium, mercury, nickel, and silver and most ABG sample locations are included.

Based on the original review of these data for the RAWP, Brown & Root Environmental Team recommended only limited supplemental soil sampling. It was noted that none of the soil samples previously collected were analyzed for chlorinated dioxins and furans (PCDD/PCDF), and that no soil samples had been collected from the Old Jeep Trail Area. Brown & Root Environmental Team, therefore, collected three surface soil samples from around the burn pans and pads in 1995 and analyzed these soils for PCDD/PCDF (Figure 4-1). Five surface soil samples were also collected in 1995 at the Old Jeep Trail Area (Figure 4-2). These samples were analyzed for explosives, inorganics and semivolatile organics. All of the 1995 samples were sent to Southwest Laboratories for analysis (Table 4-1).

Based on the data validation memorandum issued by USEPA (1997), all of the non-explosive data from the Corps of Engineers laboratory must be rejected due to incomplete QC documentation. With respect to this environmental medium at ABG, the only valid data remaining for the risk assessment are therefore the surface and subsurface explosives data from the 1990 and 1993 Corps of Engineers samples, the three Brown & Root Environmental Team surface dioxin/furan samples collected in 1995, and the five surface soil samples collected from the Jeep Trail Area. From a risk assessment perspective, this existing database is inadequate for the characterization of potential risks associated with the non-explosives contaminants in soil at this SWMU. There are now no data for contaminant concentrations in surface or subsurface soils at ABG proper with respect to inorganics, volatile and semivolatile organics, and pesticides/PCBs.

Our recommendation is to resample soil at this SWMU. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for this medium;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination; and
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found.

The sample locations selected and the analyses recommended for soil at ABG are provided in Section 5.1 of this memorandum.

4.1.2 Surface Water/Sediment

Surface water and sediment sampling in Little Sulphur Creek was also conducted near ABG as part of the RFI for ABG that was prepared by USACE (U.S. Army, 1992). The purpose of this sampling was to evaluate the degree and extent of potentially hazardous constituents in surface water and sediments related to past activities at ABG.

Eleven locations were selected by USACE for two sampling events (Figure 4-3). The 11 locations included three background (upstream) samples, three on-SWMU location samples and five locations situated progressively downstream of ABG (and ultimately downstream of the Jeep Trail Area) along Little Sulfur Creek. In general, the samples were analyzed for inorganic and organic constituents, explosives and pesticides/PCBs by the Corps of Engineers laboratory (Tables 4-2 and 4-3).

The results of the two sampling rounds indicated that potential contaminants were detected less frequently in surface water than in sediment, but that several inorganic constituents (Al, Ba, Mg, Mn, NO_4) were detected at most locations. Three explosives (2,4-DNT, HMX and RDX) were detected in the downstream surface water samples. The greatest frequency of surface water detections, as well as the highest parameter concentrations occurred in samples ABG-7 and ABG-8, at locations directly downstream of the Jeep Trail Area.

Upon review of these data for the RAWP, Brown & Root Environmental Team recommended that several additional surface water and sediment samples be taken. Specifically, that two new sampling locations be evaluated to address potential impacts near the Jeep Trail Area (ABG-12, ABG-13). In addition, three

additional upstream background samples were taken to expand this database for the risk assessment (resampling at/near ABG-1 and ABG-14, ABG-15). Inorganics, volatile and semi-volatile organics, explosives and pesticides were evaluated in all of these supplemental samples by Southwest Laboratories.

For the purposes of the RAWP, the site surface water and sediment data were subdivided into the following groups:

Upstream ABG	On-SWMU	Downstream ABG
ABG-1	ABG-4	ABG-7
ABG-2	ABG-5	ABG-8
ABG-3	ABG-6	
ABG-14		
ABG-15		

Jeep Trail Area	Downstream Little Sulphur Creek
ABG-12	ABG-9
ABG-13	ABG-10
	ABG-11

Based on the data validation memorandum issued by USEPA (1997), all of the non-explosives surface water and sediment analyses conducted by the Corps of Engineers laboratory must be rejected. With respect to these two environmental media at ABG, the only valid data now remaining for the risk assessment are the 1990 Corps of Engineers explosives data (11 sites), the six Brown & Root Environmental Team background (upstream) surface water and sediment samples (ABG-1, ABG-14, ABG-15 of Figure 4-3), and the four Brown & Root Environmental Team surface water and sediment samples collected in the Jeep Trail Area (ABG-12, ABG-13 of Figure 4-3). From a risk assessment perspective these existing two databases are inadequate for the characterization of potential risks associated with surface water/sediment exposure. There are no data for surface water and sediment contaminants at the ABG and downstream locations along Little Sulphur Creek (with the exception of the small region near the Jeep Trail Area) with respect to inorganics, volatile, and semi-volatile organics and pesticides/PCBs. The explosives data are now also four years old.

Our recommendation is to resample both surface water and sediment at this SWMU. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for these media;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination;
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found; and
- because two interconnected environmental media are involved, sampling locations are selected where both media are impacted (or not impacted).

4.1.3 Springs

Also as part of the USACE RFI for ABG (Murphy and Wade, 1994a), seven regional springs were sampled for water quality parameters on six occasions (Figure 4-4). One of these springs (Spring A) was sampled an additional seventh time. The springs were sampled in order to evaluate the potential for groundwater discharges (primarily from the Beech Creek aquifer) to surface water south of ABG and the Jeep Trail Area.

Springs A, B, and C are located along the southern portion of Little Sulphur Creek valley, south of ABG and the Jeep Trail Area. Springs D, E, F and Mountain Spring are located north of ABG. All samples were analyzed for explosives, inorganics, volatile and semivolatile organics, and water quality parameters by Anacon for the RFI (Table 4-4).

Since the RFI, Springs A, B and C have been sampled four additional times: by Anacon (once in 1993 and in 1994), by Enseco (once in 1993), and once by Synergic Analytics in 1995.

In general, the contaminants found in samples collected from the springs located south of ABG included TCE, RDX, TNT, and barium. Detections in the northern springs included TCE, di-n-butylphthalate, RDX, mercury and methoxychlor. Because dye tracer studies did not suggest a link between Beech Creek groundwater at ABG and the northern springs, the source of the contaminants detected in the northern springs is not likely ABG.

Brown & Root Environmental Team in the RAWP recommended that this database be supplemented to address current data deficiencies (e.g. certain metals, cyanide, and SVOCs). Spring A was selected for sampling for inorganics, volatile and semi-volatile organics and explosives. Springs B and C were selected

for sampling for metals, cyanide, semi-volatile organics and explosives. In addition, Brown & Root Environmental Team suggested sampling two off-facility springs, Spring 8 and Spring 10, since no analytical data currently existed for either of these two springs. All samples were taken in 1995 and analyzed by Southwest Laboratories for explosives, inorganics, volatile and semi-volatile organics. (Table 4-4).

Based on the data validation memorandum issued by USEPA (1997), all of the spring water data reported by Anacon must be rejected and all of the water quality data reported by Synergic Analytics must be rejected. With respect to this environmental medium at ABG, the only valid spring water data remaining for the risk assessment are the 1993 data by Enseco (Springs A, B and C) and the 1995 data by Brown & Root Environmental Team (Springs A, B, C, 8, 10). No data exist for the four upgradient springs (Mnt, D, E, F).

However, since none of the northern springs are believed to be hydraulically connected to ABG (Beech Creek aquifer), the loss of these data from the risk assessment database is not viewed as significant. Therefore, no additional confirmational sampling is recommended for this medium at ABG, as the remaining valid data (Brown & Root Environmental Team, 1995 data) are expected to adequately characterize the potential risks associated with site-related contaminants in the southern springs.

4.1.4 Groundwater

As part of the RFI for ABG, a multi-phase Groundwater Release Characterization Study was conducted by USACE (Murphy, 1992b). The purpose of this study was to evaluate the hydrogeology and the degree and extent of chemical release to groundwater at ABG. A total of 98 monitoring wells exist at ABG. Seventy-one (71) of these wells have been sampled on a semi-frequent basis since 1987. Analytical parameters selected were referred to as RCRA Group 1 parameters, RCRA Group 2 parameters, RCRA Group 3 parameters, explosives, organics and PCBs (see RAWP for list of chemicals included in each group). For the RAWP, Brown & Root Environmental Team noted that this database lacked cyanide and ten (10) metals (Al, Sb, Be, Co, Cu, Ni, Tl, Sn, V, Zn) and that only four SVOCs were included. In addition, only six pesticides and three explosives were being routinely monitored. Over this period of time, several laboratories have been contracted to perform the sampling and analysis. These included: Anacon, Enseco and Synergic Analytics.

With respect to the existing data, it appears that the Beech Creek aquifer is the most significantly impacted groundwater at ABG. It is also the most important hydrogeological unit in terms of off-site migration of contaminated groundwater. Consistently detected contaminants included: TCE, RDX, and barium.

As part of the RAWP, Brown & Root Environmental Team suggested supplemental sampling of groundwater at ABG. The RAWP grouped the ABG monitoring wells by aquifer and/or geologic unit and then evaluated the reported contamination in each of the groups individually. The four main aquifers and/or geologic units that have been identified at ABG are from the deepest to the shallowest:

- Beaver Bend limestone
- Big Clifty sandstone/Beech Creek limestone
- Golconda limestone
- Alluvium

Beaver Bend

The Beaver Bend aquifer is the deepest groundwater unit that is currently monitored at ABG. All five of the existing wells screened in this unit are on-SWMU (Figure 4-5). Beaver Bend sampling has occurred over an eight year period (Table 4-5). Anacon has been the primary laboratory that has conducted these water analyses. However, past data have been obtained from both Synergic Analytics and Enseco. The data collected by Enseco are acceptable for use in the risk assessment.

TCE has been detected in this aquifer on several occasions in most of these wells. The greatest reported TCE detections (and the highest level) occurs in well 03C09 (1-20 μg/L) prior to 1992, located north of the main activity area and upgradient from the SWMU. RDX was also reported in this well at 230 μg/L.

Brown & Root Environmental Team viewed these data in the RAWP and concluded that they were sufficient for the RA. Therefore, no additional Beaver Bend sampling was recommended.

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon and Synergic Analytics data must be rejected. With respect to this environmental medium at ABG, the valid data remaining for the risk assessment are the 1993 (one round for wells 03C03, 03C08A, 03C09) data obtained by Enseco. From a risk assessment perspective, these existing data should be supplemented with analytical data from well 03C01 due to its past detections of explosives.

Our recommendation is to resample this specific ABG well in the Beaver Bend aquifer (see Table 5-3).

Beech Creek

This groundwater unit has the most wells screened in it at ABG. For the purposes of the RAWP, the Beech Creek aquifer monitoring wells were grouped by general location relative to ABG. These nine groups are as follows:

On-SWMU (Figure 4-6)

North-Northwest Corner:	03C16, 03C09P2
Western Third:	03C14, 03C10, 03C01P2, 03C20. 03C21
Eastern Two-thirds:	03C03P2, 03C11, 03C04, 03C06, 03C07, 03C08AP2, 03-04, 03-06, 03-35, 03-37, 03C02P2, 03C12, 03C27, 03-36

Off-SWMU (Figures 4-6, 4-7, 4-8, 4-9, 4-10)

Jeep Trail/ Little Sulphur Creek:	03-10, 03-11, 03-12, 03-13, 03-14, 03-15, 03-16, 03-17, 03-18, 03-20, 03-21, 03-22, 03-23, 03-24, 03-25
Downgradient Perimeter/ Little Sulphur Creek	03C37, 03B10, 03C38
Downgradient East/ Southeast:	03C28, 03C05, 03C34, 03C35, 03C36
Downgradient Southwest:	03C15, 03C24, 03C25, 03C29, 03C30, 03C31, 03C33
Upgradient North:	03C26, 03C13, 03C17, 03C19, 03C32
Northeast:	02C10, 02C11, 02C12, 02C14, 02C20, 02C22

The North-Northwest Corner group is upgradient to ABG. The Western Third group includes the wells located in the area which is overlain by the Indian Springs Shale member of the Big Clifty Formation. The Eastern Two-thirds group includes the wells along the valley axis where the Indian Springs shale is absent. Sampling and analyses of all of these wells has been conducted frequently since 1987. The primary laboratory involved in the analysis prior to 1993 has been Anacon (Table 4-6). Enseco sampled select wells in these groups in 1993, and Synergic Analytic sampled wells in 1994 and 1995. Anacon also sampled in 1994.

Well 03C09P2 is located on the upgradient side of ABG. Historically, the highest TCE levels have been detected in this well for this side of the site. TCE has been detected consistently at concentrations of 51-136 μg/L. In addition, the explosive RDX has been frequently detected in this well, at levels of 20-70 μg/L.

Five wells located on-site seem to be the most representative of groundwater quality beneath the eastern two-thirds of ABG:

- 03C03P2
- 03C08AP2
- 03C11
- 03C20
- 03C02P2

Well 03C03P2 has demonstrated persistent and elevated detections of TCE (usually above 100 μg/L). Three explosives have also been detected in this well, including the highest RDX concentrations on-site (709 μg/L). Well 03C11 has demonstrated the second highest TCE detections after 03C20. Well 03C02P2 is located in the eastern-most portion of ABG, in an area believed to be characterized by a high gradient, high-flow velocity Karst conduit system. TCE and RDX have been consistently detected in this well, but at low concentrations.

Brown & Root Environmental Team did not recommend in the RAWP any supplemental sampling of these Beech Creek aquifer monitoring wells, except for well 03C17 (an upgradient background well) and wells in the Jeep Trail Area, since only a limited and incomplete database exists for this area. All wells in the Jeep Trail Area were first evaluated for integrity, and then those with established integrity were sampled in 1995 to develop a database for the risk assessment (Table 4-6). Southwest Laboratories conducted all of these analyses.

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon and Synergic Analytic data must be rejected. With respect to this environmental medium at ABG, the only valid data remaining for the risk assessment are the 1993 Enseco data (23 wells) and the 1995 Brown & Root Environmental Team

data (4 wells). From a risk assessment perspective, these existing data are inadequate to characterize current potential risks associated with groundwater due to their limited coverage of the SWMU.

Our recommendation is to resample specific ABG wells in the Beech Creek aquifer. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for this medium;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination; and
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found.

The well locations selected and the analyses recommended for these Beech Creek wells are provided in Section 5.1 of this memorandum.

Big Clifty

A limited number of Big Clifty wells are present at ABG (Figure 4-9). For some of these wells, the screened interval apparently includes the contact zone with the underlying Beech Creek limestone. Sampling and analyses of these wells has occurred since 1987 (Table 4-7). Anacon was the primary laboratory involved.

TCE has been consistently detected in several of these Big Clifty wells. RDX has also been detected on multiple occasions.

Brown & Root Environmental Team did not recommend any additional sampling of the Big Clifty wells in the RAWP.

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon data must be rejected. With respect to this environmental medium at ABG, no valid data remain for the risk assessment. However, due to the direct connection between the Big Clifty sandstone and the Beech Creek limestone, no additional wells in this aquifer were selected for resampling. The Beech Creek wells previously selected provide sufficient data to assess this combined aquifer unit.

Golconda

The Golconda limestone occurs near the northern, southern and western edges of ABG. This unit has been removed by erosional processes in the central portions of ABG and in the valleys of Little Sulphur Creek and Johnson Hollow.

Historical data exist for all the Golconda wells at ABG and for the three off-SWMU wells (Figure 4-10; Table 4-8). Anacon is the sole laboratory that has sampled these wells. TCE has been detected on multiple occasions in this unit, especially at well 03C22 (maximum = 300 μg/L.)

Brown & Root Environmental Team did not recommend any additional sampling of the Golconda wells in the RAWP.

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon data must be rejected. With respect to this environmental medium at ABG, no valid data remain for the risk assessment.

Our recommendation is to resample specific ABG wells in the Golconda aquifer. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for this medium;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination; and
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found.

The well locations selected and the analyses recommended for these Golconda wells are provided in Section 5.1 of this memorandum.

Alluvial Wells

All but one of these wells are located south of ABG and the Jeep Trail Area, at the confluence of Little Sulphur Creek and Johnson Hollow (Figure 4-11). The Jeep Trail Area has one alluvial well (03-07; Figure 4-12). As previously noted by USACE (Murphy and Wade, 1994a), groundwater from ABG (primarily within the Beech Creek aquifer) discharges downgradient to springs and to the Little Sulphur Creek alluvium. Therefore, these wells are used to monitor potential impacts to surficial groundwater at the facility boundary. These wells have been routinely sampled from 1987 to 1992 (Table 4-9). Since 1992 only a few select wells have been sampled. Anacon has been the primary laboratory involved, but other labs have sampled recently.

Brown & Root Environmental Team did not recommend any additional sampling of these alluvial wells in the RAWP.

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon and Synergic Analytic data must be rejected. With respect to this environmental medium at ABG, the only valid data remaining for the risk assessment are the 1993 well sample data (03B02) by Enseco and the 1995 Brown & Root Environmental Team sample (03-07). From a risk assessment perspective, these existing data are inadequate to characterize current potential risks associated with alluvial groundwater.

Our recommendation is to resample specific ABG wells in the Alluvium aquifer. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for this medium;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination; and
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found.

The well locations selected and the analyses recommended for these alluvium wells are provided in Section 5.1 of this memorandum.

4.2 OLD RIFLE RANGE

4.2.1 Soil

ORR is the other NAVSURFWARCENDIV open burning area (besides ABG). Flashing is carried out at this site in flash pits. The USACE conducted an RFI soil investigation at ORR (Murphy and Wade, 1994b) to: 1) describe the soil conditions at this SWMU, 2) identify and characterize the flashing operation residuals, and 3) determine if residues have impacted the environment around the flash pits.

As part of this RFI, thirteen (13) test borings were advanced at the ORR in 1990 to collect soil samples for physical characterization and chemical pollutant identification (Figure 4-13). Soil samples were taken from specific layers within the borings; 0.2 to 0.5 feet bgs, 3 to 6 feet bgs, 12 to 18 feet bgs, 18 to 24 feet bgs, and within 6 feet of the groundwater table. These samples were analyzed by the Corps of Engineers laboratory for explosives, inorganics, volatile and semivolatile organics (Table 4-10).

Some explosive compounds were detected in soil within the flash pits and in nearby areas. ORR soil also contained several VOCs.

Brown & Root Environmental Team recommended in the RAWP that some additional soil sampling at ORR be conducted for the risk assessment. Specifically, three surface soil samples (0-2 feet bgs) were recommended to be collected in the target practice area and analyzed for lead (Figure 4-13). Also, three new background surface soil samples were recommended for collection (Figure 4-13). All six of these samples were collected and analyzed for inorganics, explosives and semivolatile organics (Table 4-10).

Based on the data validation memorandum issued by USEPA (1997), all of the surface and subsurface non-explosive data from the Corps of Engineers laboratory must be rejected due to incomplete QC documentation. With respect to this environmental medium, the only remaining database for soil at ORR consists of the 1990 surface and subsurface explosives data by the Corps of Engineers laboratory (43 soil samples) and the six surface soil samples collected by Brown & Root Environmental Team in 1995.

From a risk assessment perspective, these existing data are inadequate for evaluating potential risks associated with possible non-explosive contamination at this SWMU.

Our recommendation is to resample specific soil locations at this SWMU. A sampling plan has been proposed to meet the following objectives:

- achieve at least a 20 percent confirmation database for this medium;
- select areas for contaminant confirmation where the highest concentrations of contaminants have been reported in the past;
- select areas for confirmation where little to no contamination was detected in the past so as to define the extent of contamination; and
- select a sufficiently representative number of samples for the risk assessment in case contaminant confirmation is not found.

The sample locations selected and the analyses recommended for soil at ORR are provided in Section 5.2 of this memorandum.

4.2.2 Surface Water/Sediment

At the time of the RAWP, no surface water or sediment sampling had been conducted at the ORR or at the DR. Therefore, Brown & Root Environmental Team developed a sampling plan to characterize potential contamination in these media as a result of past waste disposal activities at both of these SWMUs. Figure 4-14 shows the six locations of the surface water and sediment samples collected in 1995 by Brown & Root Environmental Team in Turkey Creek and Boggs Creek. The analytical parameters selected were VOCs, SVOCs, inorganics, explosives, and water quality parameters (Tables 4-11 and 4-12).

Based on the data validation memorandum issued by USEPA (1997), all of the Southwest Laboratories analytical data for this environmental medium at ORR/DR are valid and therefore acceptable for use in the risk assessment. This database is also judged to be adequate to assess the potential risks due to exposure to surface water and sediment in these two creeks.

4.2.3 Groundwater

A hydrogeologic investigation was also conducted by USACE as part of the ORR RFI (Murphy and Wade, 1994b). The purpose of this investigation was to evaluate subsurface conditions at this SWMU with respect to the degree and extent of chemical releases to groundwater from past ORR activities.

Eleven monitoring wells were installed at ORR by USACE in 1982-1984. An additional 19 monitoring wells were installed in 1990. USACE sampled 28 of these wells in four consecutive events in 1991-1992 for the RFI (Tables 4-13 through 4-15). The analytical parameter list was complete. Both Anacon and the Corps of Engineers laboratory conducted the majority of the analyses on these samples.

In general, contaminants detected in groundwater at ORR included metals (in both the Beech Creek limestone and the surficial zone), explosives and nitrate.

In the RAWP, Brown & Root Environmental Team grouped the ORR monitoring wells according to the formation in which they were screened. These groups were:

- Beech Creek limestone (10 wells; Figure 4-15)
- Golconda limestone (2 wells; Figure 4-16)
- Surficial aquifer (16 wells; Figure 4-17)

Brown & Root Environmental Team recommended in the RAWP sampling of seven select monitoring wells in the first two units (06C16, 06C12, 06C18, 06C16P2, 06-17, 06-22, 06C18P2) and the installation of two new wells in the surficial zone near Turkey Creek (06C19 wells; Figures 4-15 and 4-17). All nine wells were sampled in 1995. Analytical parameters included volatile and semi-volatile organics, inorganics, explosives and nitrate. Southwest Laboratories conducted all of the analyses.

Based on the data validation memorandum issued by USEPA (1997), all of the analytical data reported by Anacon and Synergic Analytic and all of the non-explosive data reported by the Corps of Engineers laboratory must be rejected. With respect to this environmental medium at ORR, the remaining data includes:

Beech Creek Aquifer -	1993 Enseco data (7 wells); 1995 Brown & Root Environmental Team data (4 wells); 1991, 1992 Corps explosives data (10 wells)
Golconda Aquifer -	1990, 1991, 1992 Corps explosives data (2 wells)
Surficial Aquifer -	1991, 1992 Corps explosives data (16 wells); 1993 Enseco data (4 wells); 1995 Brown & Root Environmental Team data (5 wells)

From a risk assessment perspective, these existing data are adequate for the surficial aquifer, but not for the other two units. For the Beech Creek aquifer, data are now missing for the potentially metal contaminated well 06C09.

For the Golconda aquifer, only the explosives data from the Corps of Engineers laboratory is valid. Thus, no contaminant information related to metals is available. Brown & Root Environmental Team suggests sampling both of the two wells in this aquifer, 06-21 and 06C16P3.

4.3 DEMOLITION RANGE

4.3.1 Soil

At the time of the RAWP there had been no soil investigation conducted at the DR. Brown & Root Environmental Team recommended eight (8) surface soil composite samples (0-2 feet bgs) be taken from the Army Detonation Area and three surface soil composite samples be taken from the Navy Detonation Area. In addition, three background surface soil samples were recommended. All 14 soil samples were taken in 1995 (Figure 4-18) and analyzed by Southwest Laboratories for explosives, inorganics and semivolatile organics (Table 4-16).

Based on the data validation memorandum issued by USEPA (1997), all of the analytical data for this environmental medium at DR are valid and therefore acceptable for use in the risk assessment.

4.3.2 Groundwater

As part of the USACE's RFI (Murphy and Wade, 1994b), a hydrogeologic investigation was conducted to evaluate subsurface conditions, and the degree and extent of chemical release to groundwater at DR.

Fifteen (15) monitoring wells were installed at DR in 1982, and an additional 14 wells were installed in 1989. USACE sampled 17 of these wells for four consecutive quarterly events in 1992 for the RFI. Wells excluded from the program were the seven wells in the Mansfield Formation located in the southern portion of DR (06-02, 06-03, 06-04, 06-05, 06-09, 06-10, 06-11). For the wells sampled, the analytical parameter list was complete. Anacon was the primary laboratory that conducted these analyses (Table 4-17).

The RAWP grouped these wells according to the geologic unit in which they are screened. These groups were:

- Beech Creek limestone (8 wells; Figure 4-19)
- Intermediate Zone (1 well; Figure 4-20)
- Surficial Zone (19 wells; Figure 4-21)

Anacon and the Corps of Engineers laboratory conducted the majority of sampling and analyses of these wells (Tables 4-17 through 4-19). However, Synergic Analytic and Enseco did provide some data in 1993 and 1995.

In general, the contaminants detected in groundwater at DR were metals (some of which were above MCLs).

Wells recommended for sampling by Brown & Root Environmental Team in the RAWP were selected to be representative of each of these well groupings and to confirm the existing data. Ten (10) wells in all were resampled at DR. These are:

Beech Creek:	06C01, 06C03, 06C06, 06C07
Surficial Zone:	06-01A, 06-07, 06C03P2, 06C04P2, 06C06P2, 06C08P2

Based on the data validation memorandum issued by USEPA (1997), all of the Anacon and Synergic Analytic data and all of the non-explosives data reported by the Corps of Engineers laboratory must be rejected. With respect to this environmental medium at DR, the existing database consists of:

Beech Creek:	1990, 1991 Corps explosives data (8 wells); 1993 Enseco data (7 wells); 1995 Brown & Root Environmental Team data (4 wells)
Intermediate zone:	None
Surficial Zone:	1990, 1991 Corps explosives data (10 wells); 1993 Enseco data (4 wells); 1995 Brown & Root Environmental Team data (6 wells)

From a risk assessment perspective, the four on-site Beech Creek wells are believed to adequately characterize this aquifer at this SWMU.

The one DR intermediate zone well, 06C01P2, has never been sampled since it has always been dry.

The surficial aquifer at DR has been recently sampled by Brown & Root Environmental Team. Six wells were sampled and analyzed in 1995, including 06C08P2 which is upgradient. The wells selected in 1995 are believed to be sufficient for characterizing impacts to this aquifer by this SWMU.

4.4 FACILITY BACKGROUND DATA

4.4.1 Soil

ABG

During the Part 1 RFI Phase III Soils investigation at ABG, three borings were installed in background locations in the southwest portion of the site (borings 01, 02, and 03; see Figure 4-1). The Corps of Engineers laboratory did the sample analyses. No explosives, VOCs, or SVOCs were detected in soil samples from these borings. Several pesticides were detected, but their presence was interpreted to be related to general use of pesticides in the area rather than ABG-specific activities. The samples were therefore considered acceptable to use as ABG soil background. Since these samples were not analyzed for dioxins/furans, background samples collected in 1995 at the DR will serve as dioxin/furan background for ABG. The Corps of Engineers non-explosives database was not considered acceptable for use in this risk assessment. Therefore, it is recommended that three new background surface soil samples (0-2 feet bgs) be taken at ABG (see Table 5-1).

ORR

Soil samples collected from three "control" locations during the 1990 soils investigation contained the highest levels of some metals of all samples collected at the ORR. There was some question, therefore, as to whether or not these samples were truly representative of background conditions at the site. For this reason, Brown & Root Environmental Team collected three new background surface soil samples north (upgradient) of the ORR within the same soil type (Wellston Silt Loam; Figure 4-13). These samples (from locations designated A01 through A03) were analyzed for explosives, metals, and SVOCs. This database is viewed as complete and adequate for the risk assessment.

DR

No soil investigation had been carried out at the DR at the time of the development of the RAWP. Three grab surface soil samples were therefore collected in 1995 by Brown & Root Environmental Team (Figure 4-18; locations A01 through A03) and analyzed for explosives, metals, SVOCs, and dioxins/furans. These three surface soil samples will also serve as the background dioxin/furan samples for ABG. This database is viewed as complete and adequate for the risk assessment.

4.4.2 Surface Water and Sediment

Ammunition Burning Ground

Three background locations (upstream from ABG) were selected for collection of surface water and sediment samples by USACE in 1992 (Figure 4-14; locations ABG1 through ABG3). Two rounds of samples were analyzed for VOCs, SVOCs, metals, and explosives. Only the second round of samples was analyzed for pesticides/PCBs. Brown & Root Environmental Team recommended that the 1992 samples be supplemented with three additional samples. In 1995 location ABG1 was resampled, and samples were also taken from two new locations - ABG14 and ABG15, which are located upstream from ABG1 (Figure 4-3). These most recent background sediment and surface water samples were analyzed for metals, explosives, SVOCs, and VOCs by Southwest Laboratories. These data were judged to be valid and adequate for risk assessment purposes.

ORR/DR

No investigation of surface water or sediment had been carried out at the Old Rifle Range or the Demolition Range at the time of the development of the RAWP. The sampling plan developed by Brown & Root Environmental Team recommended an upstream (background) sample site for Boggs Creek (DR) and for Turkey Creek (ORR). These upstream sample locations are shown in Figure 4-14. One background sediment sample and one background surface water sample were collected from each creek. These samples were analyzed for explosives, metals, SVOCs, and VOCs. These databases are considered complete and adequate for the risk assessment.

4.4.3 Groundwater - ABG

Background wells for each of the four aquifers/geologic units at ABG were preliminarily selected based on their location relative to ABG in consideration of groundwater flow direction.

Beaver Bend

For the Beaver Bend aquifer (Figure 4-5), two existing wells are potential candidate background wells - 03C01 (which is side-gradient to ABG) and 03C09 (which is upgradient to ABG). Both of these wells, however, have exhibited contamination in the past, particularly explosives and volatile organic compounds. Therefore, neither well qualifies as a background well for risk assessment purposes.

However, given the limited contamination in this aquifer, Brown & Root Environmental Team's recommendation is not to install an additional Beaver Bend well at ABG and sample at this location for the purposes of obtaining background aquifer data.

Beech Creek/Big Clifty

For the Beech Creek aquifer (Figure 4-6), three existing wells are potential candidate background wells - 03C17 (upgradient to ABG), 03C09P2 (upgradient to ABG), and 03C07 (side-gradient to ABG). Two of these wells (03C09P2 and 03C07), however, have been found to be contaminated with explosives, volatile and semi-volatile organic chemicals in the past. These wells therefore do not qualify as background wells for risk assessment purposes. Well 03C17, though, has never shown explosives, volatile or semi-volatile contamination. The inorganic concentrations detected are therefore likely to be naturally occurring. Thus, this well can serve as a background water source for the Beech Creek aquifer at ABG, and valid Enseco data are available.

For the Big Clifty aquifer (Figure 4-9), four existing wells are potential candidate background wells - 03-09, 03-38, 03-01 and 03-30 (all upgradient to ABG). Three of these four wells (03-09, 03-38 and 03-01), however, have shown past contamination by explosives and volatile organic chemicals. Well 03-30, although it has been sampled, has never had a sample analyzed for explosives, volatile and semi-volatile organic contaminants. Thus, none of these four wells currently qualify as a background well for the Big Clifty aquifer

at ABG. However, since the Big Clifty aquifer and the Beech Creek aquifer are in direct contact, the Beech Creek background well can serve as background for this aquifer as well.

Our recommendation is to sample well 03-30 and to analyze for the full suites of chemicals for the purpose of obtaining background data for this aquifer at this SWMU (Table 2-4).

Golconda

For the Golconda aquifer (Figure 4-10 in the prior memorandum), five existing wells are potential candidate background wells - 03C18, 03-02, 03C15P3, 03C16, 03C19P3 (all upgradient to ABG). Only one of these wells, 03C16, has a past history of contaminant detections. Well 03-02, however, has not been monitored. Both of these wells thus do not meet the qualification of background wells for the risk assessment of this site. The other three wells, 03C19P3, 03C15P3, 03C18, can serve as the background locations for this aquifer.

Brown & Root Environmental Team, therefore, recommends sampling one of these three wells (03C19P3) for the purpose of obtaining a background database for the Golconda aquifer at ABG (Table 5-9).

Alluvium

All of the monitoring wells except one in the alluvium unit associated with ABG are located at the juncture of Little Sulphur Creek and Johnson Hollow. The other well is located in the middle of the Jeep Trail Area. None of these wells can be considered background wells, and nowhere on the facility is there a location that could serve as a background sampling location for this unit.

Therefore, Brown & Root Environmental Team does not recommend any additional sampling of the groundwater present in the alluvium aquifer near ABG for the purpose of obtaining background information.

4.4.4 Groundwater - ORR

As discussed in Section 4.2.3 of this memorandum, the U.S. Army Corps of Engineers conducted an RFI at ORR which included the sampling of groundwater at 28 locations at this SWMU (Figures 4-13 through 4-15). The Corps of Engineers laboratory and Anacon both conducted analyses on the samples. The analytical parameter list included explosives, inorganics, volatile and semi-volatile organics, and pesticides.

In the RAWP, Brown & Root Environmental Team grouped the ORR monitoring wells according to the geologic formation in which they were screened. Three well groupings were devised:

- Beech Creek limestone (Figure 4-15 in prior memo)
- Golconda limestone (Figure 4-16 in prior memo)
- Surficial aquifer (Figure 4-17 in prior memo)

Brown & Root Environmental Team recommended in the RAWP sampling of seven of these 28 wells, as well as the installation of two new wells in the surficial zone near Turkey Creek. All nine wells were sampled in 1995, and the water analyzed for explosives, inorganics, VOCs and SVOCs by Southwest Laboratory.

For each of these three units, the 06C16 well nest (three wells) is situated upgradient of the SWMU and thus potential background wells. All three of these wells were sampled by Brown & Root Environmental Team in 1995, and all three were found not to contain any explosives, semi-volatile and volatile contamination. Thus, these three wells and the 1995 data associated with them can serve as the background dataset for these aquifers at this SWMU.

Brown & Root Environmental Team, therefore, does not recommend any additional groundwater sampling at ORR for the purposes of obtaining background groundwater information.

4.4.5 Groundwater - DR

As discussed in the prior memorandum (Section 4.3.2), the U.S. Army Corps of Engineers conducted an RFI at DR which included the sampling of groundwater at 17 well locations at this SWMU (Figures 4-19 through 4-21). Anacon laboratory conducted most of the analyses on these samples.

The RAWP also grouped these wells according to the geologic unit in which they were screened. These three groupings were:

- Beech Creek limestone
- Intermediate Zone
- Surficial Zone

Brown & Root Environmental Team recommended in the RAWP that ten (10) of these wells be sampled. All of the recommended wells were sampled in 1995, and the water analyzed for explosives, inorganics, volatile and semi-volatile organics by Southwest laboratory.

For the Beech Creek and surficial zone aquifers, the 06C08 well nest (two wells) is situated upgradient of the SWMU and thus potential background wells. 06C08P2 was sampled by Brown & Root Environmental Team in 1995 and found to be clean (no explosives, VOCs, or SVOCs). Thus, this well and its associated data can serve as background information for the surficial aquifer at DR. Well 06C08 has valid data from Enseco sampling in 1993 that can be used as background information for the Beech Creek aquifer at DR. Its past history has shown this well to be clean.

Only one well has been installed in the intermediate zone at DR, 06C01P2. This well has never been sampled since it has always been dry. Thus, no site data exist for this zone.

5.0 RECOMMENDATIONS

5.1 AMMUNITION BURNING GROUND

Based on Brown & Root Environmental Team's assessment of the valid analytical data remaining, it was concluded that specific supplemental sampling would be needed for soil, surface water, sediment, and groundwater at ABG. The spring data were judged to be complete and adequate.

Soil

The proposed sampling plan for surface soil at ABG involved an initial determination of significant hot spot locations (from the historical data). This determination was conducted by first sorting the analytical data by contaminant and then listing the data for each chemical according to concentration. The maximum concentration reported was then compared to USEPA Region IX's residential PRGs, when available. All locations where exceedances were noted were identified. In the cases where no PRG was available, the locations of the highest contaminant concentrations were identified. This information provided the locations of 'hits' for confirmation.

Also used in this analysis were two additional criteria. First, to confirm low levels of contamination and/or locations where no contamination was identified, additional sampling spots were selected. Secondly, after graphically displaying all the previously sampled locations, any areas at the site where no sampling was selected were located, and the location was recommended for sampling.

Analyte groups selected for each sampling point were based on the past reported chemical contaminants present, and in select instances, full suites of analyses were recommended for completeness.

Table 5-1 presents the recommended sampling for ABG surface and subsurface soil.

Surface Water and Sediment

The proposed sampling plan for surface water and sediment at ABG involved an initial determination of the highest contaminated areas (from the historical data). Then, spacial characteristics were examined for these sites using Figure 4-3.

Analyte groups selected for each medium were based on the past reported chemical contaminants, and in some instances full suites of analytes were recommended.

Table 5-2 presents the recommended sampling for ABG surface water and sediment in Little Sulphur Creek.

Groundwater

The proposed sampling plan for groundwater at ABG involved an initial determination of significant hot spot locations (from the historical data). This determination was conducted similarly to that performed for soil, except that MCLs were utilized instead of USEPA Region IX's PRGs.

Each of the six aquifers at ABG were evaluated independently. Table 5-3 (site wells) and 5-9 (background well) present the recommended sampling for ABG groundwater wells.

5.2 OLD RIFLE RANGE

Based on Brown & Root Environmental Team's assessment of the valid analytical data remaining, it was concluded that specific supplemental sampling would be needed at ORR for soil and groundwater. Both the surface water and sediment databases are assessed to be complete (Table 5-5).

Soil

The proposed sampling plan for soil at ORR involved an identical procedure to that used for soil at ABG. Table 5-4 presents the recommended sampling for ORR surface and subsurface soil.

Groundwater

The proposed sampling plan for groundwater at ORR involved an identical procedure to that used for groundwater at ABG. Table 5-6 presents the recommended sampling for ORR groundwater.

5.3 DEMOLITION RANGE

Based on Brown & Root Environmental Team's assessment of the valid analytical data remaining, it was concluded that no supplemental sampling would be needed for groundwater at DR (Table 5-8). The soil database (Table 5-7) and the surface water and sediment databases (Table 5-5) were also judged to be complete.

6.0 REFERENCES

Brown & Root Environmental Team. 1996. Technical Memorandum; Groundwater Trend Analysis: Ammunition Burning Ground, Demolition Range, and Old Rifle Range. January.

Dunbar, J.B. 1982. Hydrogeologic Investigation of Waste Disposal Sites at the Naval Weapons Support Center, Crane, Indiana. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

HNUS (Halliburton NUS Corporation). 1995. Risk Assessment Work Plan for Solid Waste Management Units #03/10, #06/09 and #07/09 Naval Surface Warfare Center, Crane Division. July.

Hunt, R.W. 1988. Geology and Hydrogeology of the Ammunition Burning Ground, Crane Naval Weapons Support Center. Technical Report GL-88-27. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

A.T. Kearney, Inc. 1987. Preliminary Review/Site Inspection Report of NWSCC, Indiana; submitted to EPA Region V.

McElrath, G. 1988. Soil Survey of Martin County, Indiana. United States Department of Agriculture, Soil Conservation Service.

Murphy, W.L. and J. Ciocco. 1990. Dye Trace of Beech Creek Aquifer-Ammunition Burning Ground, Naval Weapons Support Center, Crane, Indiana. Technical Report GL-90-21. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Murphy, W.L. 1992a. Draft Part 1 RFI Phase III Soils Report for SWMU #03/10 ABG, NSWCC, Crane, Indiana.

Murphy, W.L. 1992b. Draft RCRA Facility Investigation, Phase III Groundwater Release Characterization Report, SWMU #03/10 ABG, NSWCC, Crane, Indiana.

Murphy, W.L. and R. Wade. 1994a. Draft RCRA Facility Investigation, Phase II Release Assessment for Surface Water, SWMU #03/10 Ammunition Burning Ground. U.S. Army Corps of Engineers Waterways Experimental Station, Vicksburg, MS.

Murphy, W.L. and R. Wade. 1994b. Draft RCRA Facility Investigation, Phase II Groundwater Release Assessment, SWMU #06/09 Demolition Area and Phase III Release Characterization Report SWMU #07/09 Old Rifle Range. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Naval EOD (U.S. Navy Explosive Ordnance Department). 1993. Fax of two pages of EOD DR Standard Operating Procedure.

NEESA (Naval Energy and Environmental Support Agency). 1983. Initial Assessment Study, Naval Weapons Support Center, Crane, Indiana.

U.S. Army. 1991. Groundwater Quality Data for Quarterly Sampling Events at ORR/DR. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

U.S. Army. 1992. Surface Water and Sediment Analytical Data for March 1992. ABG and Jeep Trail Area. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

U.S. Army. 1995. Part 2 RFI Phase III Soils Report: Ammunition Burning Ground, SWMU #03/10, Naval Surface Warfare Center, Crane, Indiana. U.S. Army Corps of Engineers Wilmington, N. Carolina.

USACE (U.S. Army Corps of Engineers). 1991. RFI Phase II, ORR Report for SWMU #07/09. Vol. I of II, NWSCC, Crane, Indiana.

USEPA (United States Environmental Protection Agency). 1997. Internal Memorandum to Carol Witt-Smith from Allen A. Debus, RCRA QAPP Coordinator. Historical Data Review for U.S. Navy Crane - 5 Laboratories (Southwest, Enseco, Anacon, Synergic, WES). June 24.

TABLES

Aquifer/Surface Water/Springs Tables Legend

Column Headers=Sampling Event (e.g. 95-09 is September 1995 Event)
Row Headers=Site and Well/Sample Location Name

Sites:
ABG=Ammunition Burning Ground
ORR=Old Rifle Range
DR=Demolition Range

Table Entries=Lab Code:Analyte Group Code (e.g. Sw:E,M,S,V,W)
Shaded Entries will not be used for Risk Assessment purposes

Lab Codes:
An:=Anacon
El:=Waterways Experiment Station Laboratory
En:=Enseco
Sw:=Southwest
Sy:=Synergic
Un:=Unknown Early Lab

Analyte Group Codes:
E=Explosives
M=Inorganics
C=PCBs
P=Pesticides
R=Radionuclides
S=SVOCs
V=VOCs
W=Water Quality Parameters

Other Entries:
N.D.=No Data Available
Destroyed=Well Was Destroyed
Damaged=Well Was Damaged
Dry=Well Was Dry
Not Sampled=Well Was Not Sampled

Table 4-1
Summary of Soil Sample Data
SWMU #03/10 - Ammunition Burning Ground
Naval Surface Warfare Center

Soil Sample ID	Laboratory/Date; Number and Depth of Samples; Analytes
03/10-1-90-1 through 03/10-12-90-1 03/10-1-90-2 through 03/10-08-90-2; 03/10-10-90-2; 03/10-12-90-2 03/10-10-90-3; 03/10-12-90-3	EI/1990 24 Surface samples from 12 borings E,M,V,S,P
03/10-9-90-2; 03/10-11-90-2 03/10-2-90-3 through 03/10-6-90-3; 03/10-9-90-3; 03/10-11-90-3 03/10-2-90-4; 03/10-4-90-4; 03/10-6-90-4; 03/10-7-90-4; 03/10-10-90-4; 03/10-12-90-4 03/10-6-90-5; 03/10-10-90-5	EI/1990 17 Subsurface samples from 12 borings E,M,V,S,P
003/10-1-93-1 through 003/10-3-93-1 003/10-5-93-1 through 003/10-17-93-1 003/10-19-93-1 003/10-21-93-1 through 003/10-25-93-1 003/10-28-93-1; 003/10-29-93-1 003/10-31-93-1 through 003/10-38-93-1	EI/1993; 30 Surface samples from 32 borings E,M,V,S
003/10-39-93-1 through 003/10-71-93-1	EI/1993; 33 Grab surface samples E,M,V,S
003/10-5-93-2 through 003/10-7-93-2 003/10-10-93-2 through 003/10-14-93-2 003/10-17-93-2; 003/10-19-93-2 003/10-21-93-2 through 003/10-23-93-2 003/10-25-93-2; 003/10-28-93-2; 003/10-29-93-2; 003/10-34-93-2 003/10-35-93-2; 003/10-38-93-2 003/10-12-93-3; 003/10-17-93-3; 003/10-19-93-3; 003/10-21-93-3 through 003/10-23-93-3 003/10-28-93-3	EI/1993; 25 Subsurface samples from borings E,M,V,S

Table 4-1
Summary of Soil Sample Data
SWMU #03/10 - Ammunition Burning Ground
Naval Surface Warfare Center

Soil Sample ID	Laboratory/Date; Number and Depth of Samples; Analytes
CR95-03-SS-A06-01 through CR95-03-A08-01	Sw/1995 3 Grab surface samples Dioxins/Furans
ABG - Old Jeep Trail Area	
CR95-03SS-A01-01 through CR95-03SS-A05-01	Sw/1995 5 Grab surface samples E,M,S

Notes: E = Explosives; S = SVOCs; V = VOCs; M = Metals; P = Pesticides/PCBs

Table 4-2: ABG - Surface Water Sampling Data

Site	Sample	96-05	95-09	92-07	92-04
\BG	03-SURFWTR-01	Sw:E,M,S,V,W		El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-02			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-03			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-04			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-05			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-06			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-07			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-08			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-09			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-10			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-11			El:E, M,C,P,S,V,W	El:E, M,P,S,V,W
ABG	03-SURFWTR-12	Sw:E,M,S,V,W			
ABG	03-SURFWTR-13	Sw:E,M,S,V,W			
ABG	03-SURFWTR-14		Sw:E,M,S,V,W		
ABG	03-SURFWTR-15	Sw:E,M,S,V,W			

I:\CRANEDAT\SUMTABLS\TP4-2.WK4

Table 4-3
Summary of Sediment Sample Data
SWMU #03/10 Ammunition Burning Ground
Naval Surface Warfare Center

Sediment Sample ID	Laboratory/Date; Number of Samples; Analytes
ABG Proper	
ABG-4 through ABG-6 - On-SWMU sample locations ABG-7 and ABG-8 - Downstream ABG (Off-SWMU)	El/March 1992 (Round 1); July 1992 (Round 2) 5 Samples each round (10 total) M,V,S,E,P
ABG - Jeep Trail Area	
ABG-12; ABG-13	Sw/1995 2 Samples E,M,S,V
ABG - Little Sulphur Creek	
ABG-9 through ABG-11	El/March 1992 (Round 1); July 1992 (Round 2) 3 Samples each round (6 total) M,V,S,E,P
ABG - Background (Upstream)	
ABG-1 through ABG-3	El/March 1992 (Round 1); July 1992 (Round 2) 3 Samples each round (6 total) M,V,S,E,P
ABG-1 - Sulphur Creek ABG-14; ABG-15	Sw/1995 3 Samples E,M,S,V

Notes: E = Explosives; S = SVOCs; V = VOCs; M = Metals; P = Pesticides/PCBs

Table 4-4: ABG - Spring Sampling Data

Site	Well	95-09	95-01/02	94-03	93-08/09	93-01	92-10	92-07	92-04	92-01	91-10
ABG	03-MT-SPRING							An:E,M,P,R,S,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-A	Sw:E,M,S,V,W	Sy:E,M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-B	Sw:E,M,S,V,W	Sy:E,M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,C,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-C	Sw:E,M,S,V,W	Sy:E,M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-D							An:E,M,P,R,S,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-E							An:E,M,P,R,S,W	An:E,M,P,S,V,W	An:E,M,P,R,S,V,W	
ABG	03-SPRING-F							An:E,M,P,R,S,W	An:E,M,P,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-SPRING-G										
ABG	03-SPRING-08	Sw:E,M,S,V,W									
ABG	03-SPRING-10	Sw:E,M,S,V,W									

Site	Well	91-04	90-02	89-10	89-07	87-12	87-11
ABG	03-MT-SPRING	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-A	An:E,M,P,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-B	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-C	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-D	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-E	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V		An:E,M,P,R,S,V,W
ABG	03-SPRING-F	An:E,M,P,S,V,W		An:E,S,V,W	An:E,S,V	An:E,M,P,R,S,V,W	
ABG	03-SPRING-G						An:E,M,P,R,S,V,W
ABG	03-SPRING-08						
ABG	03-SPRING-10						

I:\CRAWDAT\SUMTABLS\TF4-4.WK4

Table 4-5: ABG - Beaver Bend Aquifer Wells

Site	Well	95-01/02	94-07	94-03	93-08/09	93-01	92-10	92-07	92-04	92-01	91-10
ABG	03C01							An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C02							An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C03	Sy:E,M,P,S,V,W	Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C08A	Sy:E,M,P,S,V,W	Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C09	Sy:E,M,P,S,V,W	Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W

Site	Well	91-07	91-04	91-01	90-10	90-07	90-04	90-02	89-10	89-07	89-04
ABG	03C01	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C02	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C03	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C08A	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C09	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W

Site	Well	89-01	88-10	88-07	88-04	88-02	87-11	87-10
ABG	03C01	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C02	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C03	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C08A	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C09	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W

I:\CRANEDAT\SUMTABLS\TP4-5.WK4

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	95-09	95-01/02	94-09	94-07	94-03	93-08/09	93-01	92-10	92-07	92-04	92-01
ABG	02C09											
ABG	02C10											
ABG	02C11											
ABG	02C12	N.D.										
ABG	02C14											
ABG	02C20	N.D.										
ABG	02C22	N.D.-dry										
ABG	03-04									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-06									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-08	N.D.-Destroyed										
ABG	03-10			Sy:E,M,V,W								
ABG	03-11			Sy:E,M,V,W								
ABG	03-12	Sw:E,M,S,V,W		Sy:E,M,V,W								
ABG	03-13			Sy:E,M,V,W								
ABG	03-14			Sy:E,M,V,W								
ABG	03-15	Sw:E,M,S,V,W		Sy:E,M,V,W								
ABG	03-16			Sy:E,M,V,W								
ABG	03-17			Sy:E,M,V,W								
ABG	03-18			Sy:E,M,V,W								
ABG	03-19	N.D.-Destroyed										
ABG	03-20			Sy:E,M,V,W								
ABG	03-21			Sy:E,M,V,W								
ABG	03-22			Sy:E,M,V,W								
ABG	03-23			Sy:E,M,V,W								
ABG	03-24	Sw:E,M,S,V,W		Sy:E,M,V,W								
ABG	03-25			Sy:E,M,V,W								
ABG	03-35									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-36	N.D.-Not Sampled										
ABG	03-37									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B10		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W		En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	
ABG	03C01P2									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C02P2		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	
ABG	03C03P2		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C04		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C05		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C06		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C07				Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C08AP2		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C09P2		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C10		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,S,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C11		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C12		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C13									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C14		Sy:E,M,P,S,V,W		Sy:M,P,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C15		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W		An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C16									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C17	Sw:E,M,S,V,W	Sy:E,M,P,S,V,W			An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C19									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C20		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C21									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C24									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C25		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C26		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	95-09	95-01/02	94-09	94-07	94-03	93-08/09	93-01	92-10	92-07	92-04	92-01
ABG	03C27		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C28		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C29									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C30		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W		An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C31		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C32									An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C33		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W			An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C34	Sw:E,M,S,V,W							An:E,M,V,W			
ABG	03C35	N.D.-dry									An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C36	N.D.-dry										
ABG	03C37		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	An:E,M,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W			
ABG	03C38	N.D.-dry									An:E,M,P,S,V,W	An:E,M,P,R,S,V,W

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	91-10	91-07	91-06	91-04	91-01	90-10	90-07	90-04	90-02	89-10
ABG	02C09										
ABG	02C10			El:E, M,C,P,S,V,W							
ABG	02C11			El:E, M,C,P,S,V,W							
ABG	02C12			El:E, M,V,W							
ABG	02C14										
ABG	02C20			El:E, M,C,P,S,V,W							
ABG	02C22										
ABG	03-04	An:E,M,S,V,W	An:E,M,S,V,W		An:M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-06	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-08										
ABG	03-10										
ABG	03-11										
ABG	03-12										
ABG	03-13										
ABG	03-14										
ABG	03-15										
ABG	03-16										
ABG	03-17										
ABG	03-18										
ABG	03-19										
ABG	03-20										
ABG	03-21										
ABG	03-22										
ABG	03-23										
ABG	03-24										
ABG	03-25										
ABG	03-35	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-36										
ABG	03-37	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B10	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C01P2	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C02P2	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C03P2	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C04	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C05	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C06	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C07	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C08AP2	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C09P2	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C10	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C11	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C12	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C13	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C14	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C15	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C16	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C17	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C19	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C20	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C21	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C24	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C25	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C26	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	91-10	91-07	91-06	91-04	91-01	90-10	90-07	90-04	90-02	89-10
ABG	03C27	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C28	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C29	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C30	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C31	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C32	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C33										
ABG	03C34	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,P,R,S,V,W	
ABG	03C35										
ABG	03C36										
ABG	03C37	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,P,R,S,V,W	
ABG	03C38										

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	89-07	89-04	89-01	88-10	88-07	88-04	88-02	87-11	87-10
ABG	02C09									
ABG	02C10									
ABG	02C11									
ABG	02C12									
ABG	02C14									
ABG	02C20									
ABG	02C22									
ABG	03-04	An:E,M,S,V,W		An:E,M,S,V,W		An:E,W		An:E,M,S,V,W		
ABG	03-06	An:E,S,V,W		An:E,M,S,V,W		An:E,W		An:E,M,S,V,W		
ABG	03-08									
ABG	03-10									
ABG	03-11									
ABG	03-12									
ABG	03-13									
ABG	03-14									
ABG	03-15									
ABG	03-16									
ABG	03-17									
ABG	03-18									
ABG	03-19									
ABG	03-20									
ABG	03-21									
ABG	03-22									
ABG	03-23									
ABG	03-24									
ABG	03-25									
ABG	03-35	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03-36									
ABG	03-37	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03B10	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	
ABG	03C01P2	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C02P2	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C03P2	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C04	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C05	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C06	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C07	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C08AP2	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C09P2	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C10	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C11	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C12	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C13	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C14	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C15	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C16	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C17	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C19	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C20	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C21	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C24	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C25	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C26	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W

Table 4-6: ABG - Beech Creek Aquifer Wells

Site	Well	89-07	89-04	89-01	88-10	88-07	88-04	88-02	87-11	87-10
ABG	03C27	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C28	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C29	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C30	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C31	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C32	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W				
ABG	03C33									
ABG	03C34									
ABG	03C35									
ABG	03C36									
ABG	03C37									
ABG	03C38									

I:\CRANEDAT\SUMTABLS\TF4-6.WX4

Table 4-7: ABG - Big Clifty Aquifer Wells

Site	Well	92-07	92-04	92-01	91-10	91-07	91-04	91-01	90-10	90-07	90-04
ABG	03-01	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-09	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-26	N.D.-Damaged									
ABG	03-27	N.D.-Damaged									
ABG	03-29										
ABG	03-30									An:M,W	
ABG	03-31	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-32	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-33	An:E,M,P,R,S,V,W	An:E,M,S,V,W				An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-34	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03-38	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W

Site	Well	90-02	89-10	89-07	89-04	89-01	88-10	88-07	88-04	88-02	87-11
ABG	03-01	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W		An:E,W		An:E,M,S,V,W	
ABG	03-09	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W		An:E,W		An:E,M,S,V,W	
ABG	03-26										
ABG	03-27										
ABG	03-29							An:E,W		An:E,M,S,V,W	
ABG	03-30										
ABG	03-31	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W							An:E,S,V
ABG	03-32	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W						An:E,M,S,V,W	An:E,S,V
ABG	03-33	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W						An:E,M,S,V,W	An:E,S,V
ABG	03-34	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03-38	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W

I:\CRANEDAT\SUMTABLS\TF4-7.WK4

Table 4-8: ABG - Golconda Aquifer Wells

Site	Well	92-07	92-04	92-01	91-10	91-07	91-04	91-01	90-10
ABG	03-02	N.D.-Never Sampled							
ABG	03-28	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C01P3	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C08AP3	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C15P3	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C18	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C19P3	An:E,M,P,R,S,W	An:E,M,S,V,W			An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W
ABG	03C21P3	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C22	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03C23	An:E,M,P,R,S,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W

Site	Well	90-07	90-04	90-02	89-10	89-07	89-04	89-01	88-10
ABG	03-02								
ABG	03-28	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W			
ABG	03C01P3	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C08AP3	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C15P3	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C18	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C19P3	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W		An:E,M,P,R,S,V,W		
ABG	03C21P3	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W			
ABG	03C22		An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03C23	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	

Site	Well	88-07	88-04	88-02	87-11	87-10
ABG	03-02					
ABG	03-28			An:W		
ABG	03C01P3	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C08AP3	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C15P3	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C18	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C19P3			An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C21P3		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W
ABG	03C22	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	
ABG	03C23	An:E,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	

I:\CRANEDAT\SUMTABLS\TP4-8.WK4

Table 4-9: ABG - Alluvial Aquifer Wells

Site	Well	95-09	95-01/02	94-09	94-07	93-08/09	93-01	92-10	92-07	92-04
ABG	03-07	Sw:E,M,S,V,W		Sy:E,M,V,W					An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B01								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B02		Sy:E,M,P,S,V,W		Sy:M,P,S,V,W	En:E,M,C,P,S,V,W	An:E,M,V,W	An:E,M,V,W	An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B03								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B04								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B05								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B06								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B07		Sy:E,M,P,S,V,W						An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B08								An:E,M,P,R,S,W	An:E,M,S,V,W
ABG	03B09								An:E,M,P,R,S,W	An:E,M,S,V,W

Site	Well	92-01	91-10	91-07	91-04	91-01	90-10	90-07	90-04	90-02
ABG	03-07	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B01	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B02	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B03	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B04	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B05	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B06	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B07	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B08	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W
ABG	03B09			An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W	An:E,M,S,V,W		An:E,M,S,V,W	An:E,M,S,V,W

Site	Well	89-10	89-07	89-04	89-01	88-10	88-07	88-04	88-02	87-10
ABG	03-07	An:E,M,S,V,W	An:E,M,S,V,W						An:E,M,S,V,W	
ABG	03B01	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B02	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B03	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B04	An:E,M,S,V,W	An:E,M,P,R,S,V,W		An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B05	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B06	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B07	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B08	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W
ABG	03B09	An:E,M,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W	An:E,M,P,R,S,V,W

I:\CRANEDAT\SUMTABLS\TF4-9.WK4

Table 4-10
Summary of Soil Sample Data
SWMU #07/09 Old Rifle Range
Naval Surface Warfare Center

Soil Sample ID	Laboratory/Date; Number and Depth of Samples; Analytes
07/09-1-90-1 through 07/09-12-90-1 07/09-1-90-2 through 07/09-08-90-2; 07/09-10-90-2; 07/09-12-90-2 07/09-7-90-3; 07/09-10-90-3; 07/09-12-90-3 Note: Borings 12, 11, and 1 labeled "control" locations	El/1990 25 Surface samples from borings M,E,V,S
07/09-9-90-2; 07/09-11-90-2 07/09-2-90-3 through 07/09-6-90-3; 07/09-9-90-3; 07/09-11-90-3; 07/09-12-90-3 07/09-2-90-4; 07/09-4-90-4; 07/09-6-90-4; 07/09-7-90-4; 07/09-10-90-4; 07/09-12-90-4 07/09-6-90-5; 07/09-10-90-5 Note: Borings 12, 11, and 1 labeled "control" locations **Note: Boring 13 mentioned in text, but not results in tables.**	El/1990 18 Subsurface samples from borings M,E,V,S
Target Area	
A04 through A06	Sw/1995 3 Grid composite surface samples E,M,S
Background	
A01 through A03	Sw/1995 3 Grab surface samples E,M,S

Notes: E = Explosives; S = SVOCs; V = VOCs; M = Metals; P = Pesticides/PCBs

Table 4-11: ORR/DR - Surface Water Sampling Data

Site	Well	95-09
ORR/DR	07-SURFWTR-T1	Sw:E,M,S,V,W
ORR/DR	07-SURFWTR-T2	Sw:E,M,S,V,W
ORR/DR	06-SURFWTR-T3	Sw:E,M,S,V,W
ORR/DR	06-SURFWTR-B1	Sw:E,M,S,V,W
ORR/DR	06-SURFWTR-B2	Sw:E,M,S,V,W
ORR/DR	06-SURFWTR-B3	Sw:E,M,S,V,W

I:\CRANEDAT\SUMTABLS\TF4-11.WK4

Table 4-12
Summary of Sediment Sample Data
Demolition Range/Old Rifle Range
Naval Surface Warfare Center

Sediment Sample ID	Laboratory/Date; Number of Samples; Analytes
Boggs Creek	
CR95-06SD-B-2-01 and CR95-06SD-B-3-01	Sw/1995 2 Samples E,M,S,V
Boggs Creek Background (Upstream)	
CR95-06SD-B-1-01	Sw/1995 1 Sample E,M,S,V
Turkey Creek	
CR95-06SD-T-2-01 and CR95-06SD-T-3-01	Sw/1995 2 Samples E,M,S,V
Turkey Creek Background (Upstream)	
CR95-06SD-T-1-01	Sw/1995 1 Sample E,M,S,V

Notes: E = Explosives; S = SVOCs; V = VOCs; M = Metals; P = Pesticides/PCBs

Table 4-13: ORR - Beech Creek Aquifer Wells

Site	Well	95-09	95-01/02	94-07	94-03	93-07/08	93-01	92-10	92-04	91-11	91-06
ORR	06C09								El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C10								El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C11		Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
ORR	06C12	Sw:E,M,S,V,W	Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
ORR	06C13		Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C14		Sy:E,M,W		An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C15		Sy:E,M,W	Sy:M,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C16	Sw:E,M,S,V,W	Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C17								El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C18	Sw:E,M,S,V,W	Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W
ORR	06C19	Sw:E,M,S,V,W							El:E, M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W

Site	Well	91-03	90-11
ORR	06C09		El:E, M,C,P,S,V,W
ORR	06C10	El:E, M,C,P,S,V,W	
ORR	06C11	El:E, M,C,P,S,V,W	
ORR	06C12	El:E, M,C,P,S,V,W	
ORR	06C13		El:E, M,C,P,S,V,W
ORR	06C14		El:E, M,C,P,S,V,W
ORR	06C15		El:E, M,C,P,S,V,W
ORR	06C16		El:E, M,C,P,S,V,W
ORR	06C17		El:E, M,C,P,S,V,W
ORR	06C18		El:E, M,C,P,S,V,W
ORR	06C19		

I:\CRANEDAT\SUMTABLS\TF4-13.WK4

Table 4-14: ORR - Golconda Aquifer Wells

Site	Well	92-04	92-01	91-11	91-06	91-01	90-11	90-07	90-02	89-07	85-01
ORR	06-21	El:E, M,W	An:E,M,S,W		El:E, M,C,P,S,V,W	An:H,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
ORR	06C16P3	El:E, M,W		El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W		El:E, M,C,P,S,V,W				

I:\CRANEDAT\SUMTABLS\TF4-14.WK4

Table 4-15: ORR - Surficial Aquifer Wells

Site	Well	95-09	95-01/02	94-07	94-03	93-07/08	93-01	92-10	92-04	92-01	91-11	91-07
ORR	06-14A											
ORR	06-15								El:E, M,W	An:E,M,S,W	El:E, M,C,P,S,V,W	
ORR	06-16								El:E, M,W			
ORR	06-17	Sw:E,M,S,V,W							El:E, M,W	An:E,M,S,W	El:E, M,C,P,V,W	
ORR	06-18								El:E, M,W	An:E,M,S,W	El:M, V,W	
ORR	06-19								El:E, M,W	An:E,M,S,W	El:E, M,C,P,S,V,W	
ORR	06-20								El:E, M,W	An:E,M,S,W	El:E, M,P,S,V,W	
ORR	06-22	Sw:E,M,S,V,W							El:E, M,W	An:E,M,S,W	El:E, M,C,P,S,V,W	
ORR	06-23								El:E, M,W	An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W
ORR	06C10P2								El:E, M,W	An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W
ORR	06C11P2		Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W		El:E, M,C,P,S,V,W	
ORR	06C12P2								El:E, M,W		El:E, M,C,P,V,W	
ORR	06C13P2		Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W		El:E, M,C,P,V,W	
ORR	06C14P2		Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W		El:E, M,C,P,S,V,W	
ORR	06C15P2								El:E, M,W		El:E, M,C,P,S,V,W	
ORR	06C16P2	Sw:E,M,S,V,W							El:E, M,W		El:E, M,C,P,S,V,W	
ORR	06C18P2	Sw:E,M,S,V,W	Sy:E,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:E, M,W		El:E, M,C,P,S,V,W	
ORR	06C19P2	Sw:E,M,S,V,W							El:E, M,W		El:E, M,C,P,V,W	

Site	Well	91-07	91-06	91-03	91-01	90-11	90-07	90-02	89-07	86-06	86-02	85-01
ORR	06-14A		El:E, M,C,P,S,V,W		An:E,M,S,W				An:E,M,S,W		Un:E,M	Un:E,M
ORR	06-15		El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W			Un:E,M
ORR	06-16		El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W			Un:E,M
ORR	06-17		El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W		Un:E,M	Un:E,M
ORR	06-18		El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W		Un:E,M	Un:E,M
ORR	06-19		El:E, M,C,P,S,V,W		An:E,M,S,W		An:E,M,W	An:E,M,S,W	An:E,M,S,W		Un:E,M	Un:E,M
ORR	06-20		El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W		Un:E,M	Un:E,M
ORR	06-22	An:E,M,W	El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W		An:E,M,S,W	An:E,M,S,W	Un:E		Un:E,M
ORR	06-23	An:E,M,W	El:E, M,C,P,S,V,W		An:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W			Un:E,M
ORR	06C10P2		El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W								
ORR	06C11P2		El:E, M,C,P,S,V,W	El:E, M,C,P,V,W								
ORR	06C12P2		El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W								
ORR	06C13P2		El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W						
ORR	06C14P2		El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W						
ORR	06C15P2		El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W						
ORR	06C16P2		El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W						
ORR	06C10P2		El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W						
ORR	06C19P2											

Site	Well	84-02	83-08	83-03	83-01	82-11	82-09	82-07	82-06	82-03	82-01	81-11
ORR	06-14A	Un:E,M,S,W										
ORR	06-15											
ORR	06-16	Un:E,M,S,W	Un:E,W	Un:E,M,S,W								
ORR	06-17	Un:E,M,S,W	Un:E,W	Un:E,M,S,W	Un:W	Un:W	Un:M,P,S,W	Un:W	Un:M,P,S,W	Un:M,P,S,W		Un:M,P,S,W
ORR	06-18	Un:E,M,S,W	Un:E,W	Un:E,M,S,W	Un:W	Un:M,W	Un:M,P,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W		Un:M,P,S,W
ORR	06-19	Un:E,M,S,W	Un:E,W	Un:E,M,S,W	Un:W	Un:M,W	Un:M,P,S,W	Un:W	Un:W	Un:M,P,S,W	Un:M,P,S,W	
ORR	06-20	Un:E,M,S,W	Un:E,W	Un:E,M,S,W		Un:M	Un:M,P,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W	Un:M,P,S,W	
ORR	06-22						Un:M,P,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W	Un:M,P,S,W	
ORR	06-23											
ORR	06C10P2											
ORR	06C11P2											
ORR	06C12P2											
ORR	06C13P2											
ORR	06C14P2											
ORR	06C15P2											
ORR	06C16P2											
ORR	06C18P2											
ORR	06C19P2											

I:\CRAWDAT\SUMTABLS\TP4-15.WK4

Table 4-16
Summary of Soil Sample Data
SWMU #06/09 Demolition Range
Naval Surface Warfare Center

Soil Sample ID	Laboratory/Date; Number and Depth of Samples; Analytes
Army Detonation Area	
A07 through A14	Sw/1995 8 grid composite samples E,M,S
Navy Detonation Area	
A04 through A06	Sw/1995 3 Grid composite surface samples E,M,S
Background	
A01 through A03	Sw/1995 3 Grab surface samples E,M,S,Dioxins/Furans

Notes: E = Explosives; S = SVOCs; V = VOCs; M = Metals; P = Pesticides/PCBs

Table 4-17: DR - Beech Creek Aquifer Wells

Site	Well	95-09	95-01/02	94-07	94-03	93-07/08	93-01	92-10	92-04	91-11	91-06
DR	06C01	Sw:E,M,S,V,W							El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C02		Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C03	Sw:E,M,S,V,W	Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C04		Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C05		Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C06	Sw:E,M,S,V,W	Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C07	Sw:E,M,S,V,W	Sy:M,W	Sy:M,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W
DR	06C08		Sy:B,M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W

Site	Well	91-03	90-11
DR	06C01		El:E, M,C,P,S,V,W
DR	06C02	El:E, M,C,P,S,V,W	
DR	06C03	El:E, M,C,P,S,V,W	
DR	06C04	El:E, M,C,P,S,V,W	
DR	06C05	El:E, M,C,P,S,V,W	
DR	06C06	El:E, M,C,P,S,V,W	
DR	06C07	El:E, M,C,P,S,V,W	
DR	06C08		El:E, M,C,P,S,V,W

I:\CRANEDAT\SUMTABLS\TF4-17.MK4

Table 4-18: DR - Intermediate Zone Aquifer Wells

Site	Well	95-09
DR	06C01P2	N.D.-Never Sampled

I:\CRANEDAT\SUMTABLS\TF4-18.WK4

Table 4-19: DR - Surficial Zone Aquifer Wells

Site	Well	95-09	95-01/02	94-07	94-03	93-07/08	93-01	92-10	92-04	92-01
DR	06-01A	Sw:E,M,S,V,W							El:M,W	An:E,M,S,W
DR	06-01B	N.D.-Destroyed								
DR	06-01C	Later Destroyed								
DR	06-02									
DR	06-03									
DR	06-04									
DR	06-05									
DR	06-06								El:M,W	An:E,M,S,W
DR	06-07	Sw:E,M,S,V,W							El:M,W	An:E,M,S,W
DR	06-08									
DR	06-09									
DR	06-10									An:E,M,S,W
DR	06-11									An:E,M,S,W
DR	06-12								El:M,W	An:E,M,S,W
DR	06-13									
DR	06C01P3								El:M,W	
DR	06C02P2								El:M,W	
DR	06C03P2	Sw:E,M,S,V,W	Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	
DR	06C04P2	Sw:E,M,S,V,W	Sy:M,W	Sy:M,W		En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	
DR	06C06P2	Sw:E,M,S,V,W	Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	
DR	06C08P2	Sw:E,M,S,V,W	Sy:M,W	Sy:M,S,V,W	An:M	En:E,M,C,P,S,V,W	An:E,M,W	An:E,M,W	El:M,W	

Site	Well	91-11	91-06	91-03	91-01	90-11	90-07	90-02	89-07	86-02
DR	06-01A	El:M,V,W	El:E, M,C,P,S,V,W		Un:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-01B									
DR	06-01C									
DR	06-02									
DR	06-03									Un:E,M
DR	06-04									
DR	06-05									
DR	06-06	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W		Un:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-07	El:E, M,C,P,V,W	El:E, M,C,P,S,V,W		Un:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-08									Un:E,M
DR	06-09				Un:E,M,S,W		An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-10				Un:E,M,S,W		An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-11				Un:E,M,S,W		An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-12	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W		Un:E,M,S,W	El:E, M,C,P,S,V,W	An:E,M,W	An:E,M,S,W	An:E,M,S,W	Un:E,M
DR	06-13									Un:E,M
DR	06C01P3	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W				
DR	06C02P2	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W						
DR	06C03P2	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W						
DR	06C04P2	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W						
DR	06C06P2	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W	El:E, M,C,P,S,V,W						
DR	06C08P2	El:E,M,C,P,V,W	El:E, M,C,P,S,V,W			El:E, M,C,P,S,V,W				

Table 4-19: DR - Surficial Zone Aquifer Wells

Site	Well	85-01	84-02	83-11	83-09	83-08	83-03	83-01	82-11	82-07
DR	06-01A	Un:E,M	Un:E,M,S,W		Un:M	Un:E,W				
DR	06-01B									
DR	06-01C									
DR	06-02	Un:E,M	Un:E,M,S,W						Un:W	Un:M,P,S,W
DR	06-03	Un:E,M	Un:E,M,S,W	Un:W		Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,R,S,W	Un:M,P,R,S,W
DR	06-04	Un:M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,R,S,W	Un:M,P,R,S,W
DR	06-05					Un:E,W	Un:E,M,S,W	Un:W	Un:M,P,R,S,W	Un:M,P,R,S,W
DR	06-06	Un:E,M	Un:E,M,S,W				Un:E,M,S,W	Un:M	Un:M,P,S,W	Un:M,P,S,W
DR	06-07	Un:E,M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,R,S,W	Un:M,P,S,W
DR	06-08	Un:E,M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,R,S,W	Un:M,P,R,S,W
DR	06-09	Un:E,M	Un:E,M,S,W		Un:E,W	Un:E	Un:E,M,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,R,S,W
DR	06-10	Un:E,M	Un:E,M,S,W			Un:E	Un:E,M,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W
DR	06-11	Un:E,M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W
DR	06-12	Un:E,M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,R,S,W	Un:M,P,R,S,W
DR	06-13	Un:E,M	Un:E,M,S,W			Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,R,S,W
DR	06C01P3					Un:E,W	Un:E,M,S,W	Un:M,W	Un:M,P,S,W	Un:M,P,S,W
DR	06C02P2									
DR	06C03P2									
DR	06C04P2									
DR	06C06P2									
DR	06C08P2									

Site	Well	82-06	82-03	82-01	81-11
DR	06-01A				
DR	06-01B				
DR	06-01C				
DR	06-02		Un:M,P,S,W		Un:M,P,S,W
DR	06-03		Un:M,P,S,W		Un:M,P,S,W
DR	06-04		Un:M,P,R,S,W		Un:M,P,S,W
DR	06-05		Un:M,P,S,W		Un:M,P,S,W
DR	06-06		Un:M,P,R,S,W		Un:M,P,S,W
DR	06-07		Un:M,P,R,S,W	Un:R,W	Un:M,P,S,W
DR	06-08		Un:M,P,S,W		Un:M,P,S,W
DR	06-09		Un:M,P,S,W		Un:M,P,S,W
DR	06-10		Un:M,P,R,S,W		Un:M,P,S,W
DR	06-11		Un:M,P,R,S,W		Un:M,P,S,W
DR	06-12		Un:M,P,R,S,W		Un:M,P,S,W
DR	06-13	Un:M,P,S,W	Un:M,P,S,W	Un:R,W	Un:M,P,R,S,W
DR	06C01P3				
DR	06C02P2				
DR	06C03P2				
DR	06C04P2				
DR	06C06P2				
DR	06C08P2				

I:\CRANEDAT\SUMTABLS\TF4-19.WK4

TABLE 5-1
ABG - PROPOSED SAMPLING FOR SOIL
PAGE 1 OF 2

Proposed Location[A]	Parameters[B]	Rationale
		ABG Proper
Surface Soil		
1990 Boring 4	MSVP	High inorganics; complete analytical suites
1990 Boring 7	MSVP	High inorganics; complete analytical suites
1990 Boring 12	M	High inorganics
1993 Boring 1	MSVP	Background; complete analytical suites
1993 Boring 2	MP	Background
1993 Boring 3	MSVP	Background; complete analytical suites
1993 Boring 5	M	Low/no contamination
1993 Boring 6	M	Areal coverage
1993 Boring 7	MSVP	Low/no contamination; complete analytical suites
1993 Boring 13	M	Areal coverage
1993 Boring 14	MSVP	Low/No contamination; complete analytical suites
1993 Boring 17	M,V	Highest TCE
1993 Boring 19	M	Areal coverage
1993 Boring 22	M	High inorganics
1993 Boring 25	M	Areal coverage
1993 Boring 31	M	High inorganics
1993 Boring 33	M	Low/no contamination
1993 Boring 37	M	Low/no contamination

TABLE 5-1
ABG - PROPOSED SAMPLING FOR SOIL
PAGE 2 OF 2

Proposed Location[A]	Parameters[B]	Rationale
Surface Soil (cont'd)		
1993 Surface 40	M	High inorganics
1993 Surface 49	M	High inorganics
1993 Surface 61	M	High inorganics
Subsurface Soil		
1990 Boring 4 (3-3.5 ft; 5.5-6.5 ft)	MSVP	High inorganics; complete analytical suites
1990 Boring 12 (2.5-3 ft)	M	High inorganics
1993 Boring 22 (2.5-4.5 ft; 4.5-7 ft)	M	High inorganics
		Jeep Trail
None	None	Database complete

[A] Sample locations are shown in Figure 4-1.
[B] Parameters:

M = Inorganics
S = Semivolatile organics
V = Volatile organics
P = Pesticides

TABLE 5-2
ABG - PROPOSED SAMPLING FOR SEDIMENT AND SURFACE WATER

Proposed Location[A]	Parameters[B]	Rationale
		ABG
ABG 8	EMSVP	Most explosives hits; full analytical suites
ABG 11	EMSVP	High metals; full analytical suites
ABG 5	EM	High metals
ABG 6	EMP	High metals, explosives

[A] Sample locations shown in Figure 4-3.
[B] Parameters:

E = Explosives; sediment analysis only
M = Inorganics
S = Semivolatile organics
V = Volatile organics
P = Pesticides

TABLE 5-3
ABG - PROPOSED SAMPLING FOR GROUNDWATER

Monitoring Well[A]	Parameters[B]	Rationale
A. Beaver Bend Aquifer		
03C01	E,V	Past hits of RDX, TNT
B. Beech Creek/Big Clifty Aquifer		
03C15	E	TNT hit
03-16	E	Hits of RDX
03-21	E,M,S,V,P	Hits of RDX, HMX; complete analytical suites
03-13	E	Hits of RDX, HMX
03C20	E,V	Hits of explosives, volatiles
C. Golconda Aquifer		
03C23	M	Hits of barium
03C08AP3	E,M,P,S,V	No contamination; complete analytical suites
D. Alluvial Aquifer		
03B05	E,M	Hits of metals
03B07	E,M	Hits of RDX

[A] Well locations shown in Figure 4-5 (Beaver Bend), 4-6 and 4-7 (Beech Creek/Big Clifty), 4-10 (Golconda), and 4-11 (alluvium).
[B] Parameters:

E = Explosives
M = Inorganics
S = Semivolatile organics
V = Volatile organics
P = Pesticides

TABLE 5-4
ORR - PROPOSED SAMPLING FOR SOIL

Proposed Location[A]	Parameters[B]	Rationale
Surface Soil		
1990 Boring 1	MSVP	No contamination; complete analytical suites
1990 Boring 5	M	Moderate contamination (explosives)
1990 Boring 9	MP	High inorganics
1990 Boring 12	M	Moderate contamination (inorganics)
Subsurface Soil		
1990 Boring 5 (3-3.5 ft)	M	Moderate contamination (explosives); high inorganics
1990 Boring 12 (3-3.5 ft)	M	Moderate contamination (inorganics)

[A] Sample locations shown in Figure 4-13.
[B] Parameters:

M = Inorganics
S = Semivolatile organics
V = Volatile organics
P = Pesticides

TABLE 5-5
ORR/DR - PROPOSED SAMPLING FOR SURFACE WATER AND SEDIMENT

Location	Sample Type	Parameters	Rationale
Turkey Creek	Surface Water	None	Database complete.
Turkey Creek	Sediment	None	Database complete.
Boggs Creek	Surface Water	None	Database complete.
Boggs Creek	Sediment	None	Database complete.

TABLE 5-6
ORR - PROPOSED SAMPLING FOR GROUNDWATER

Monitoring Well[A]	Parameters[B]	Rationale
A. Beech Creek Aquifer		
06C09	M	Hits of zinc
B. Golconda Aquifer		
06-21	M	No data available
06C16P3	M	Metal contamination
C. Surficial Aquifer		
None	None	Database complete

[A] Sample locations shown in Figures 4-15 (Beech Creek) and 4-16 (Golconda).
[B] Parameters:

M = Inorganics

TABLE 5-7
DR - PROPOSED SAMPLING FOR SOIL

Location	Parameters	Rationale
Demolition Range	None	Database Complete

TABLE 5-8
DR - PROPOSED SAMPLING FOR GROUNDWATER

Monitoring Well	Parameters	Rationale
A. Beech Creek Aquifer		
None	None	Database complete
B. Intermediate Zone		
None	None	Dry well
C. Surficial Zone		
None	None	Database complete

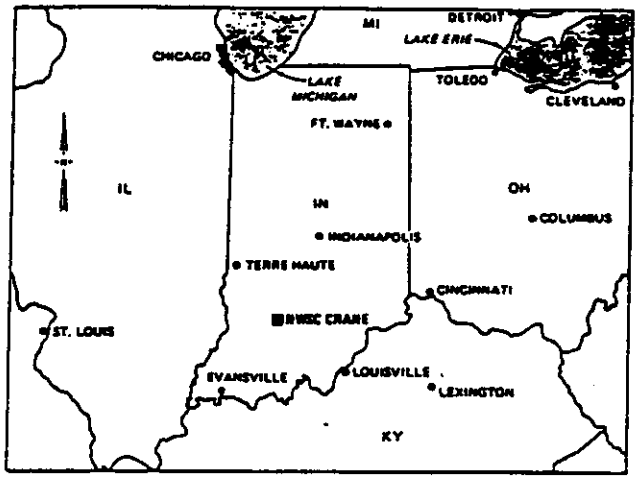
TABLE 5-9
ABG/ORR/DR - PROPOSED BACKGROUND GROUNDWATER SAMPLING

Monitoring Well[A]	Parameters[B]	Rationale
		ABG Proper
03C19P3	E,M,V,S,P	Golconda aquifer background well
		ORR
None	None	Database complete
		DR
None	None	Database complete

[A] Sample location shown in Figure 4-10.
[B] Parameters:

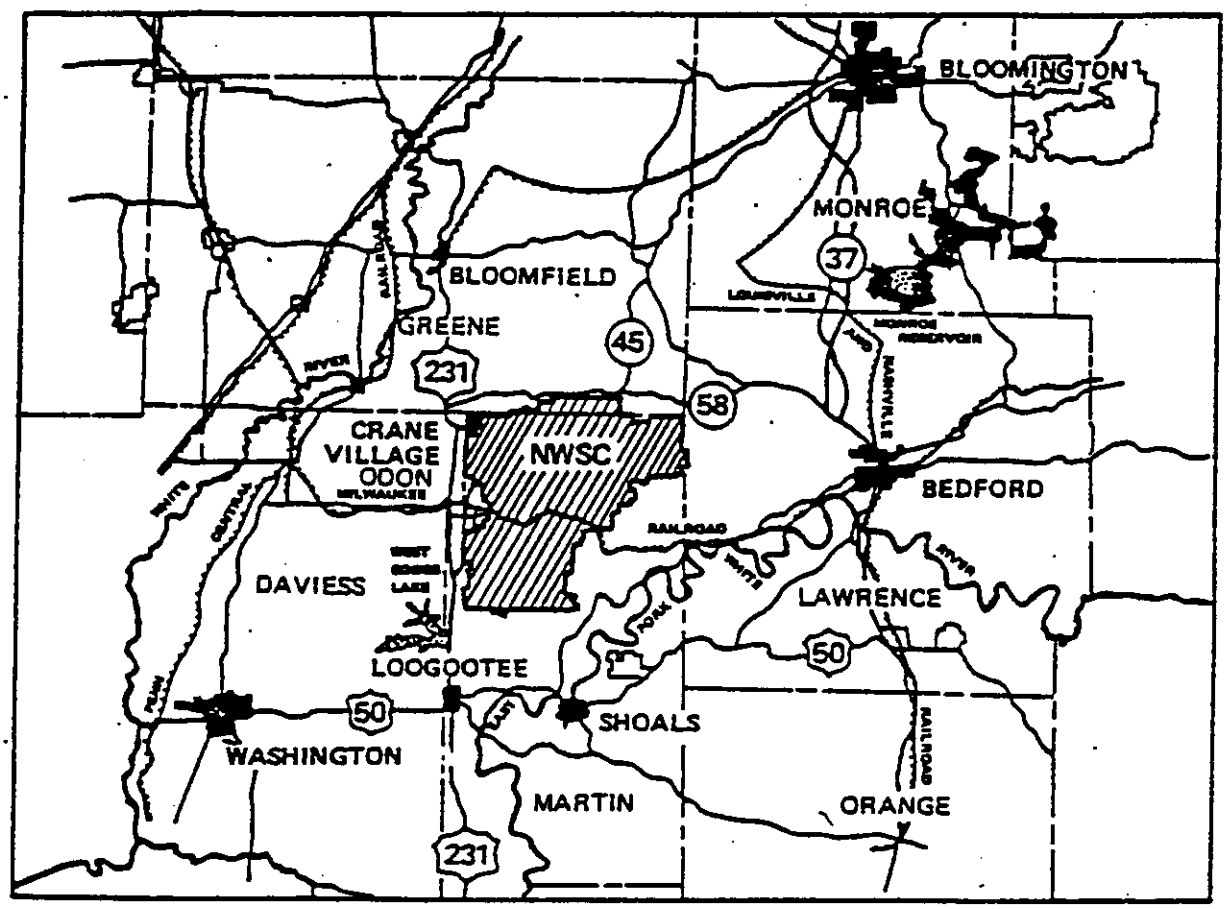
E = Explosives
M = Inorganics
S = Semivolatile organics
V = Volatile organics
P = Pesticides

FIGURES



N

NO SCALE



SOURCES: CHESAPEAKE DIVISION, NAVAL FACILITIES ENGINEERING COMMAND, 1979 AND NAVAL ENERGY AND ENVIRONMENTAL SUPPORT AGENCY, 1983.

DATE

DGN -f:\132. \genmpp.dgn

RUST

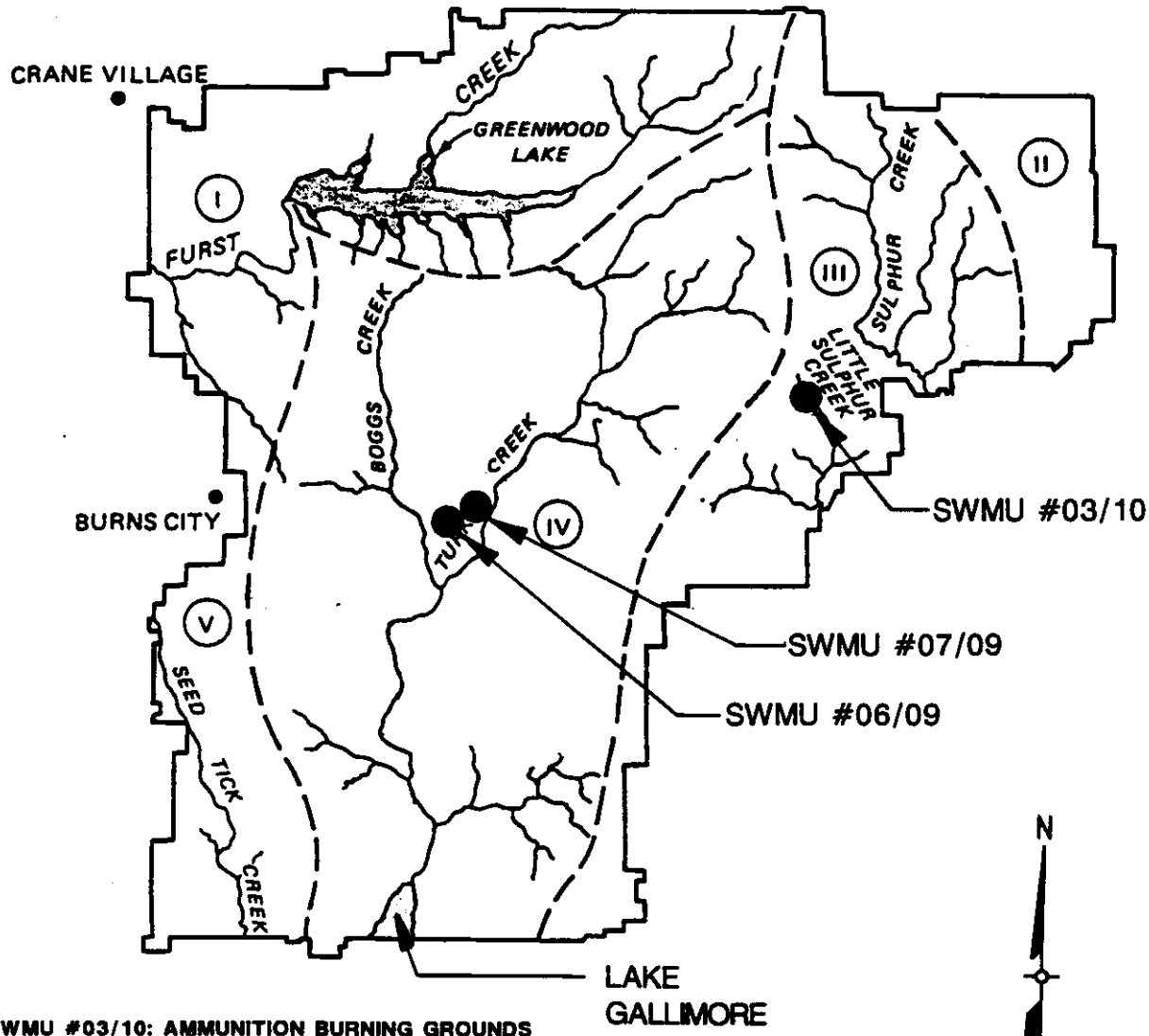
Rust Environment & Infrastructure Inc.

FIGURE 2-1
GENERAL LOCATION MAP

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



SWMU #03/10: AMMUNITION BURNING GROUNDS
SWMU #06/09: DEMOLITION RANGE
SWMU #07/09: OLD RIFLE RANGE

SOURCE: CHESAPEAKE DIVISION NAVAL FACILITIES COMMAND, 1979

SCALE

2 0 2 4 MI

DATE

DGN -F:\132 2\SWMFMAP.DGN

RUST

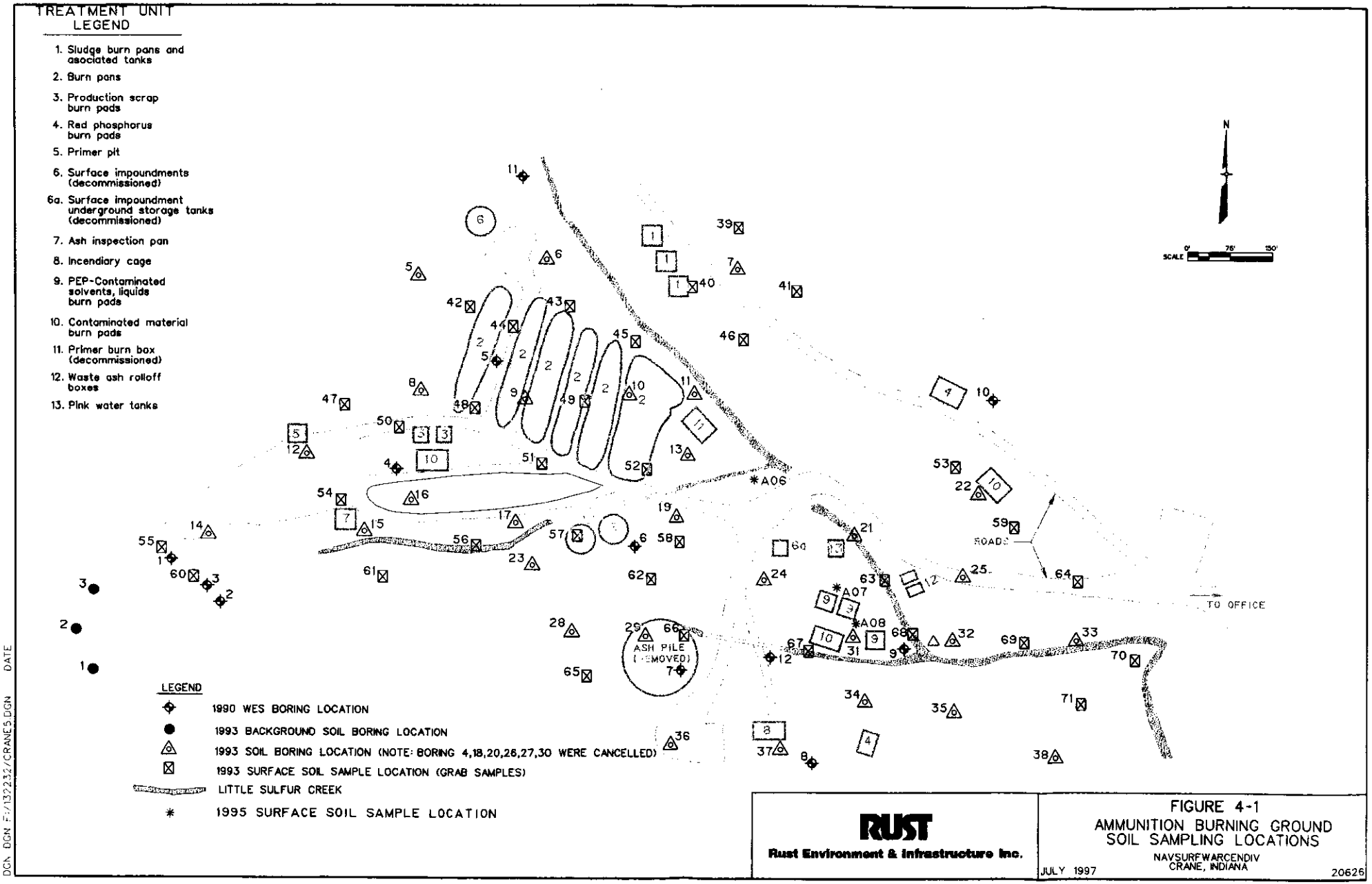
Rust Environment & Infrastructure Inc.

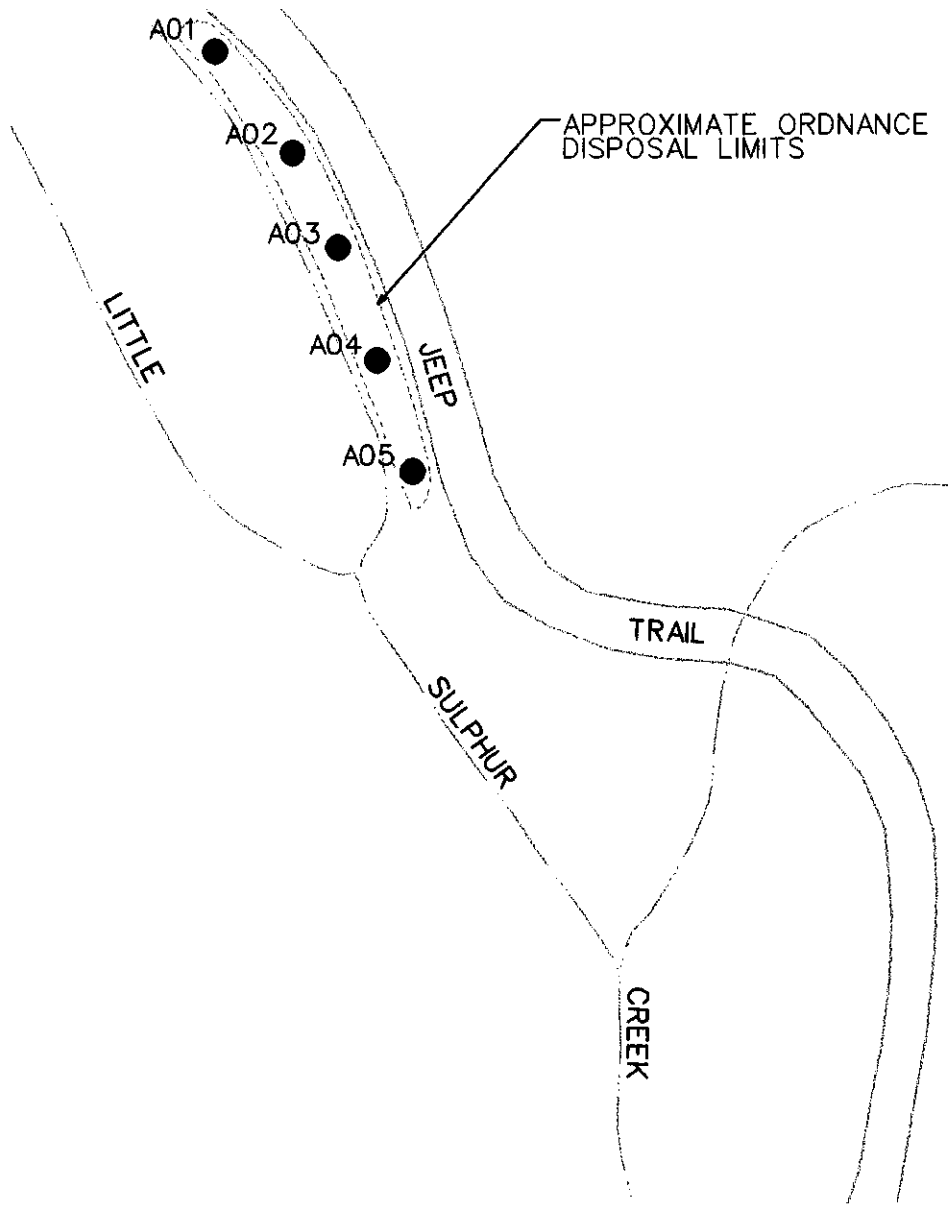
FIGURE 2-2
SWMU LOCATIONS

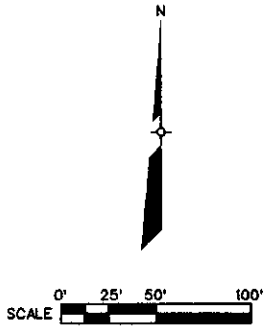
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626


TREATMENT UNIT LEGEND
1. Sludge burn pans and asociated tanks
2. Burn pans
3. Production scrap burn pads
4. Red phosphorus burn pads
5. Primer pit
6. Surface impoundments (decommissioned)
6a. Surface impoundment underground storage tanks (decommissioned)
7. Ash inspection pan
8. Incendiary cage
9. PEP-Contaminated solvents, liquids burn pads
10. Contaminated material burn pads
11. Primer burn box (decommissioned)
12. Waste ash rolloff boxes
13. Pink water tanks
N
SCALE 0' 75' 150'
ROADS
TO OFFICE
ASH PILE (REMOVED)
A06
A07
A08
LEGEND
1990 WES BORING LOCATION
1993 BACKGROUND SOIL BORING LOCATION
1993 SOIL BORING LOCATION (NOTE: BORING 4,18,20,26,27,30 WERE CANCELLED)
1993 SURFACE SOIL SAMPLE LOCATION (GRAB SAMPLES)
LITTLE SULFUR CREEK
1995 SURFACE SOIL SAMPLE LOCATION
RUST
Rust Environment & Infrastructure Inc.
FIGURE 4-1
AMMUNITION BURNING GROUND
SOIL SAMPLING LOCATIONS
NAVSURFWARCENDIV
CRANE, INDIANA
JULY 1997
20626
DGN: DGN F:/139232/CRANE5.DGN DATE





LEGEND

● SURFACE SOIL SAMPLING LOCATION

DATE

DGN/132232/JEEP2.DGN

RUST

Rust Environment & Infrastructure Inc.

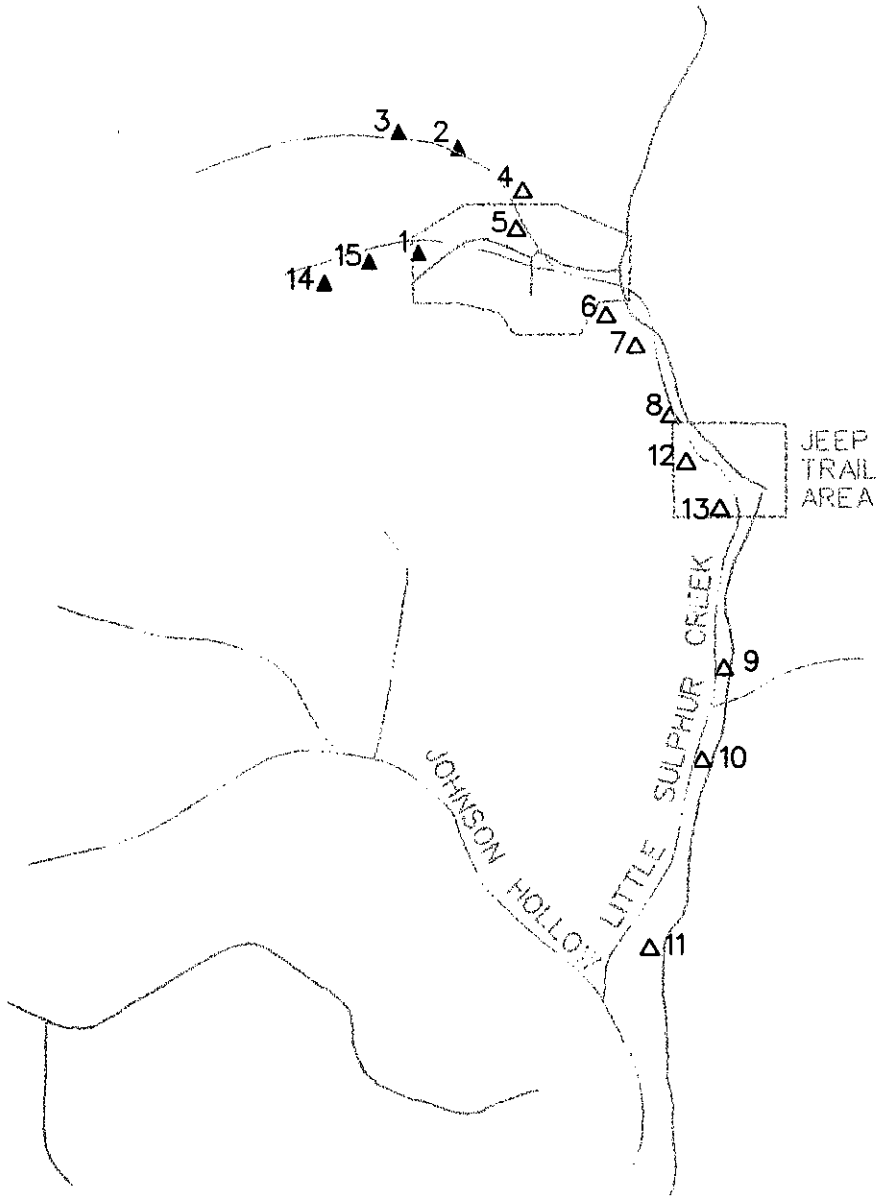
FIGURE 4-2

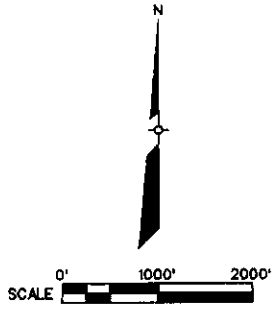
JEEP TRAIL
SOIL SAMPLING LOCATIONS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626





LEGEND

▲ UPSTREAM SURFACE WATER/SEDIMENT SAMPLE

△ DOWNSTREAM SURFACE WATER/SEDIMENT SAMPLE

RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-3
AMMUNITION BURNING GROUND
SURFACE WATER/SEDIMENT
SAMPLING LOCATIONS

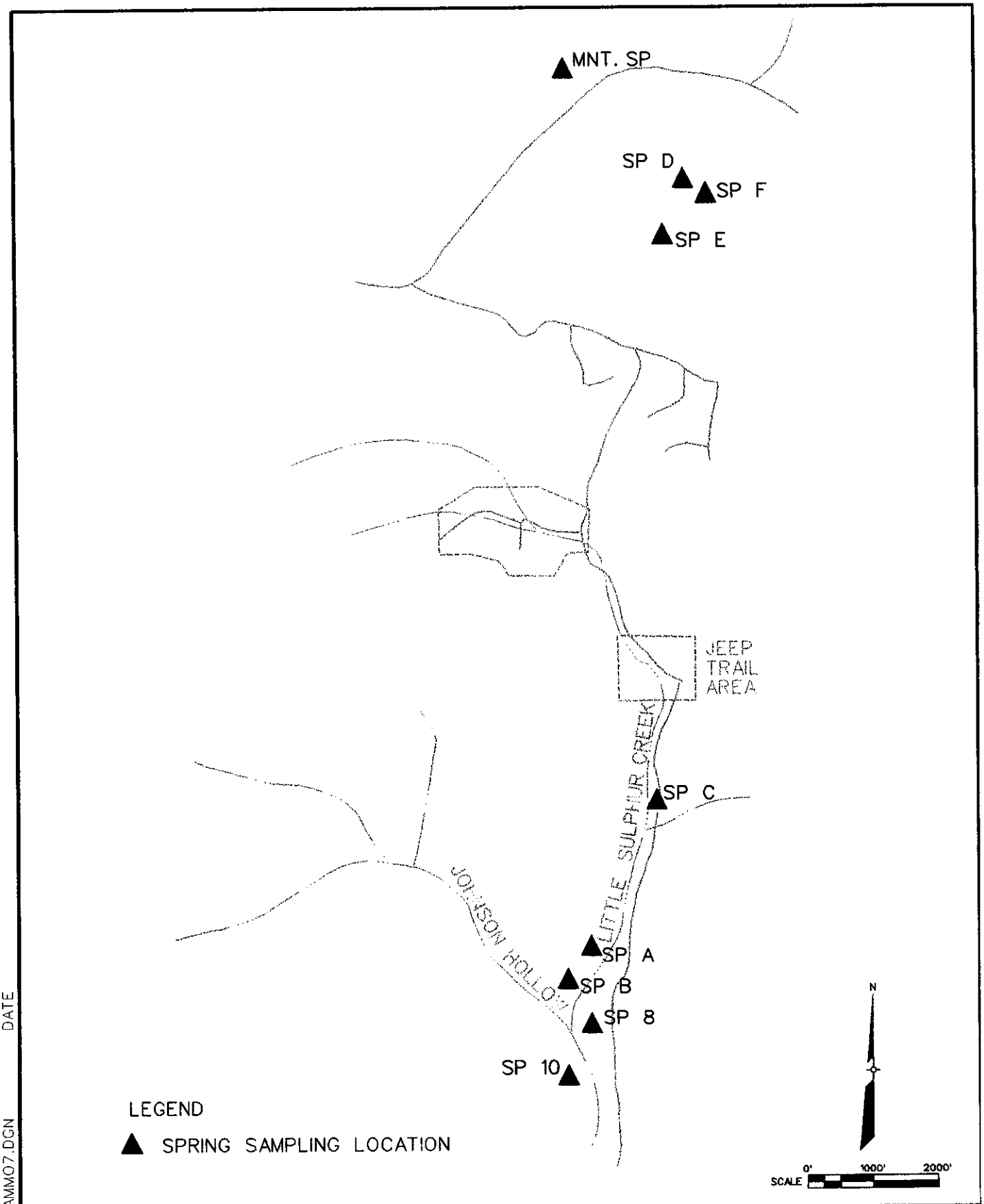
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DATE

DGN F:/ 132232/AMMO6.DGN



DATE

DGN F:/132232/AMMO7.DGN

RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-4

AMMUNITION BURNING GROUND
SPRING SAMPLING LOCATION

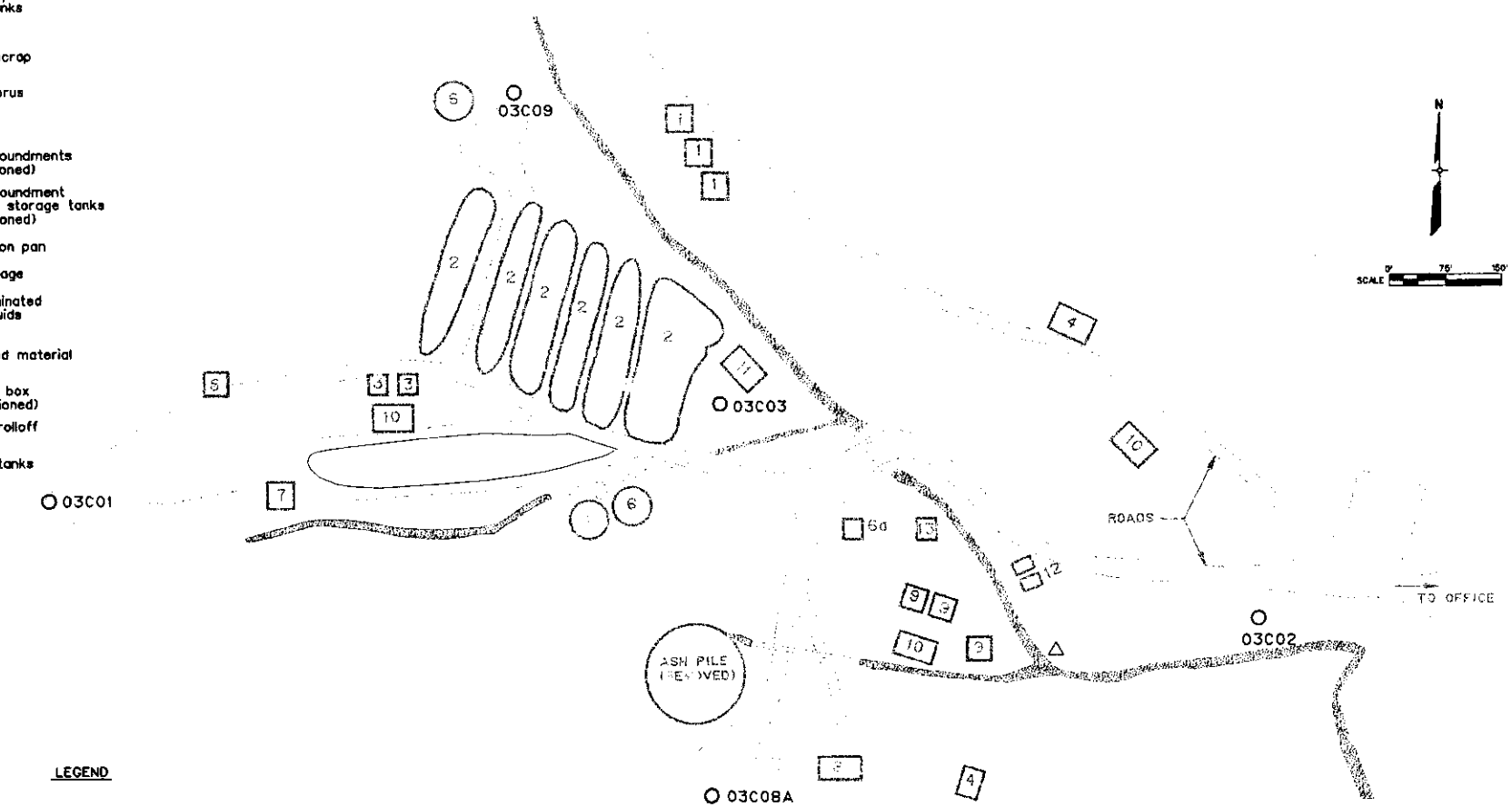
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

TREATMENT UNIT LEGEND

1. Sludge burn pans and asociated tanks
2. Burn pans
3. Production scrap burn pads
4. Red phosphorus burn pads
5. Primer pit
6. Surface impoundments (decommissioned)
6a. Surface impoundment underground storage tanks (decommissioned)
7. Ash inspection pan
8. Incendiary cage
9. PEP-Contaminated solvents, liquids burn pads
10. Contaminated material burn pads
11. Primer burn box (decommissioned)
12. Waste ash rolloff boxes
13. Pink water tanks



LEGEND

EXISTING MONITORING WELL

LITTLE SULFUR CREEK

RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-5
AMMUNITION BURNING GROUND
BEAVER BEND AQUIFER WELLS

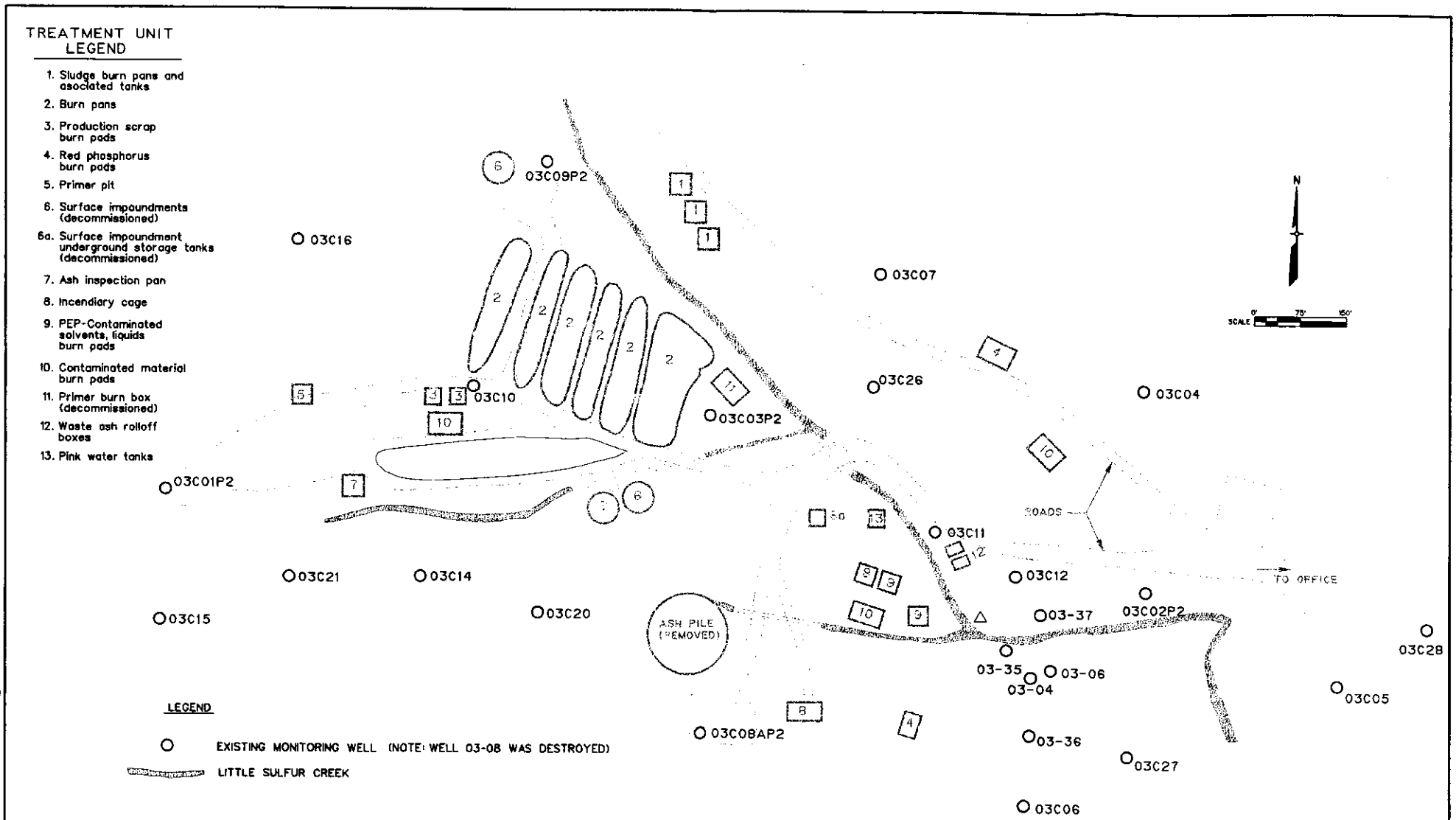
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DATE

DGN F:/132232/CRANEA1.DGN



RUST

Rust Environment & Infrastructure Inc.

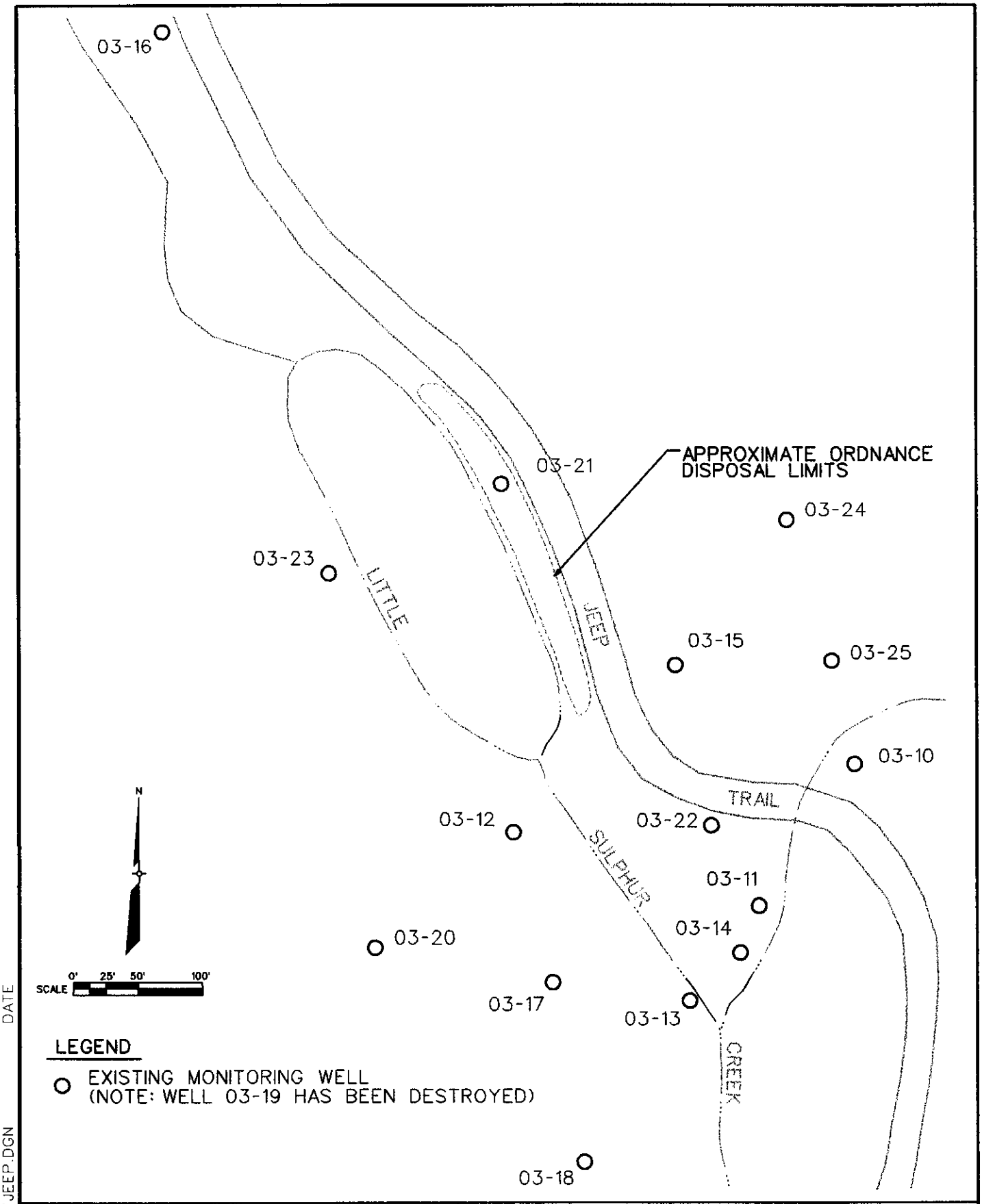
FIGURE 4-6
AMMUNITION BURNING GROUND
ON-SWMU BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DGN F:/132232/CRANEA2.DGN DATE



DATE

DGN F:/132232/JEEP.DGN

Rust Environment & Infrastructure Inc.

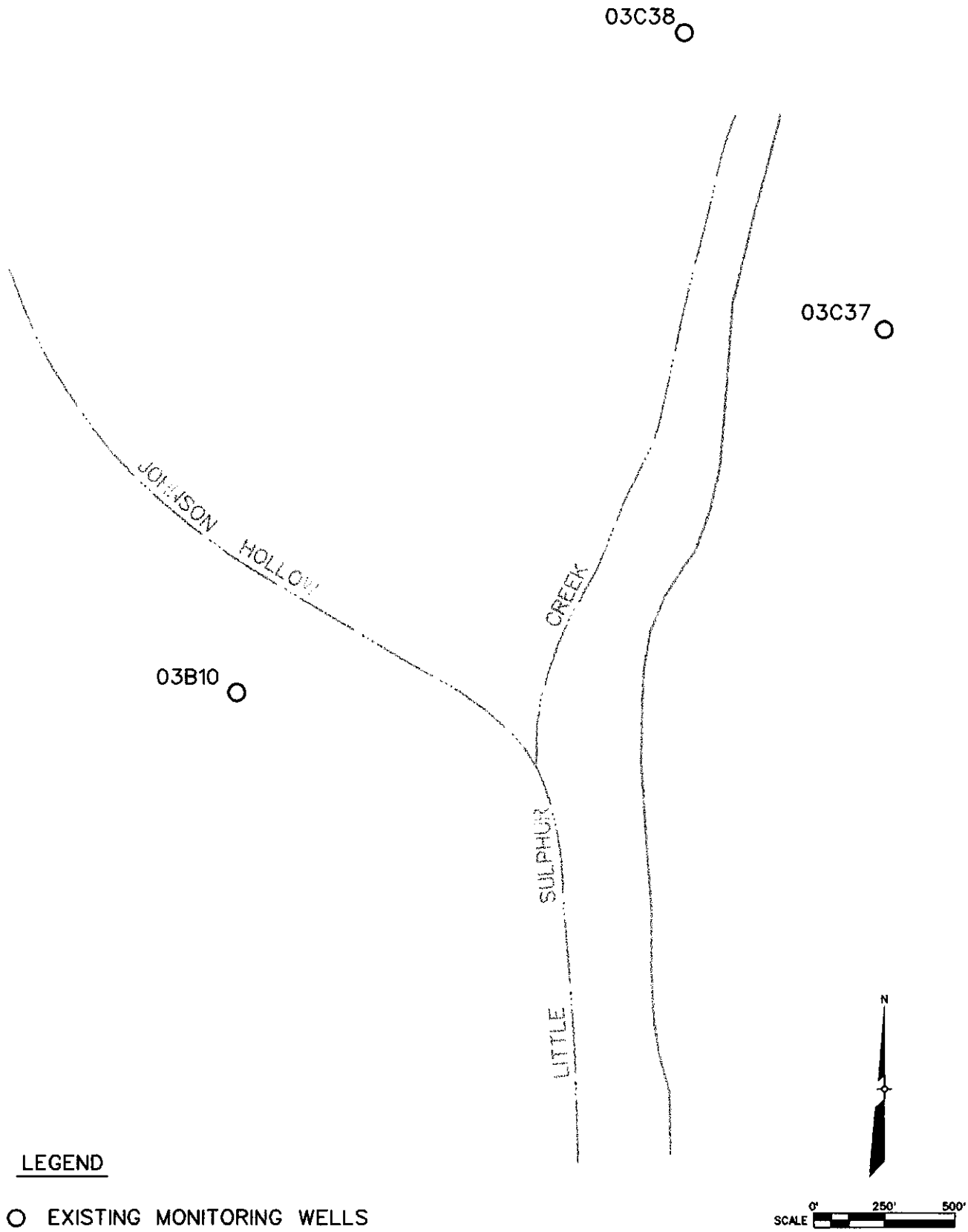
FIGURE 4-7

JEEP TRAIL
ON-SWMU BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-8A
JEEP TRAIL
OFF-SWMU BEECH CREEK
AQUIFER WELLS

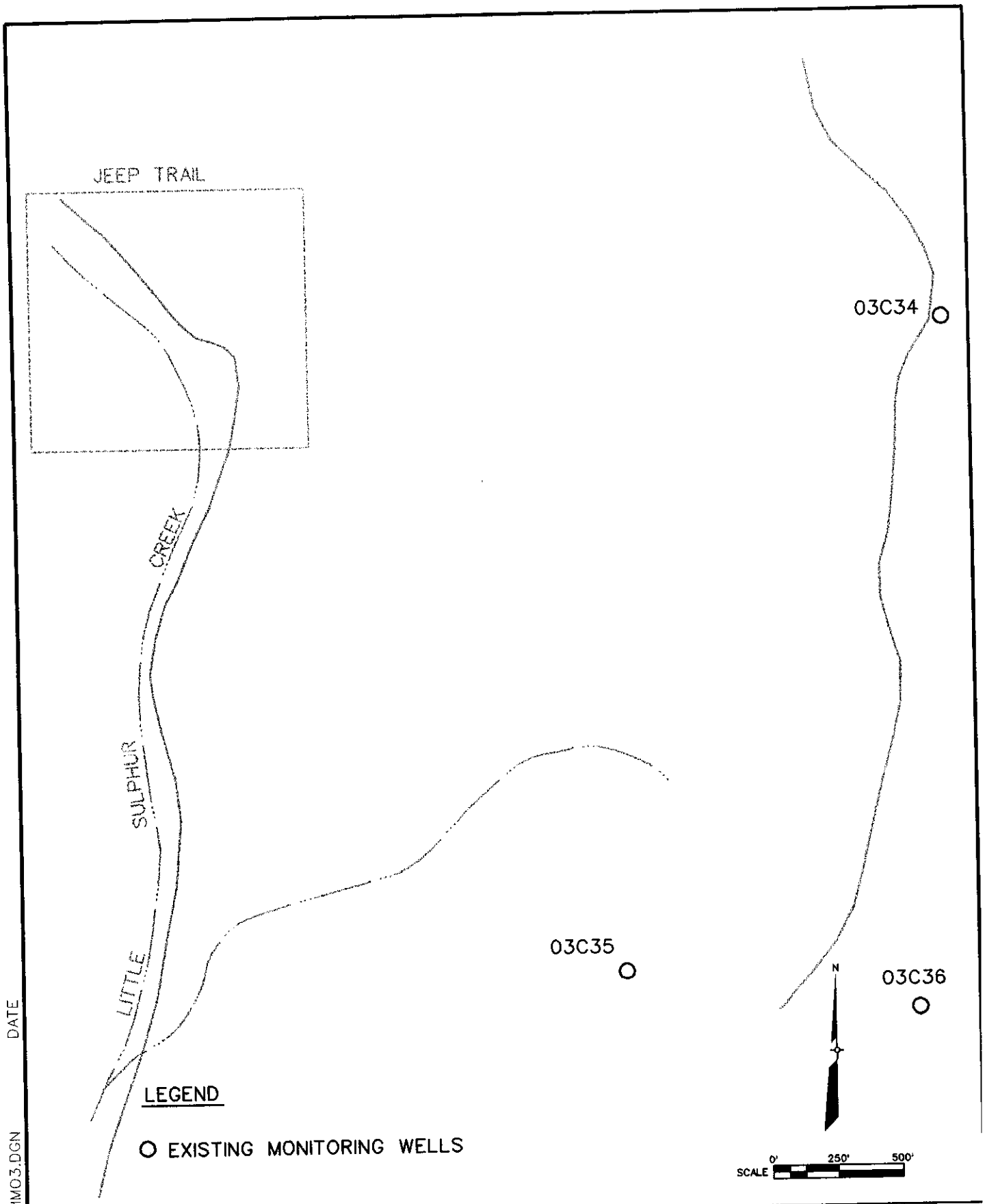
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DGN F:/132232/AMMO5.DGN

DATE



DATE

DGN/F: 132232/AMMO3.DGN

RUST

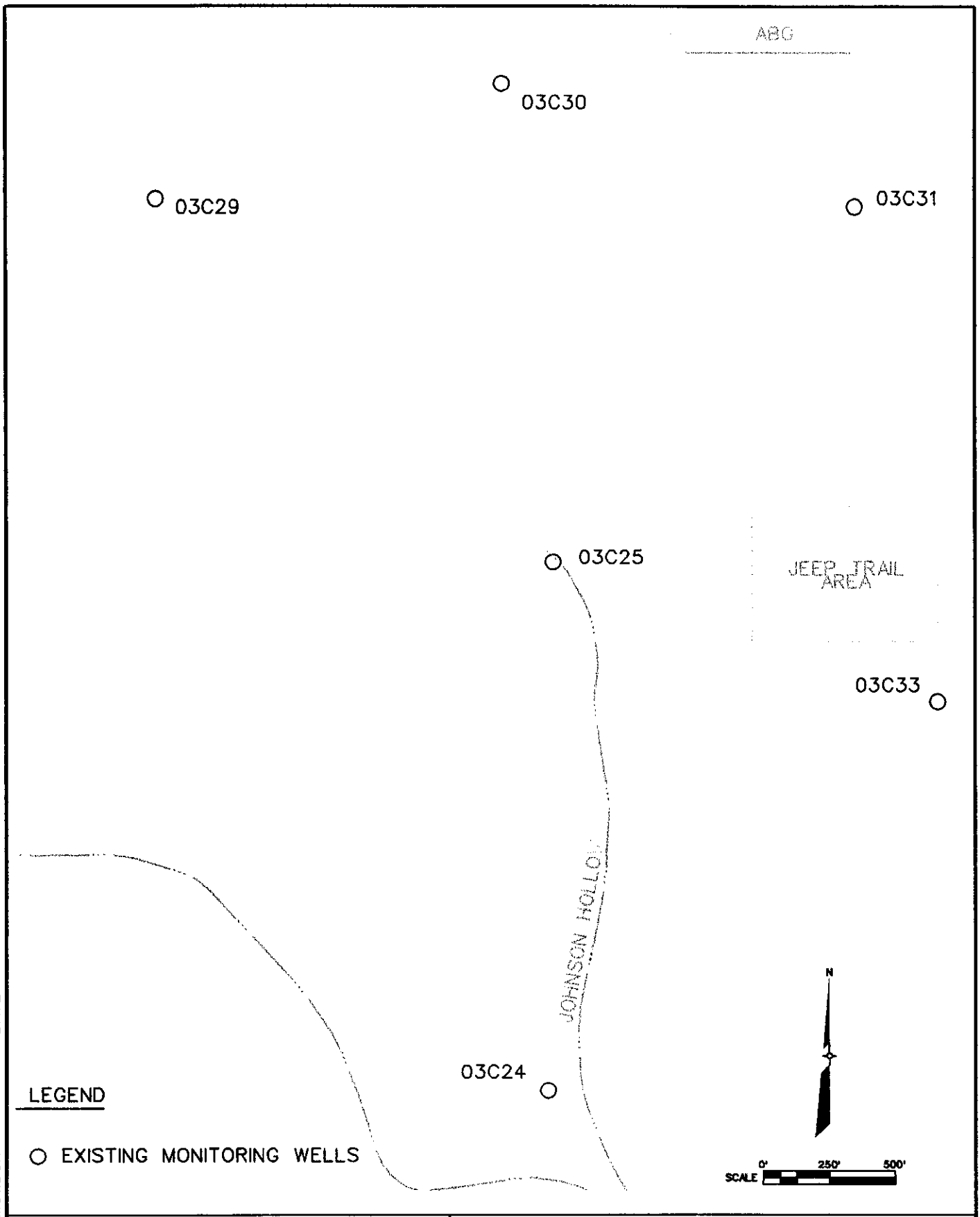
Rust Environment & Infrastructure Inc.

FIGURE 4-8B
AMMUNITION BURNING GROUND
OFF-SWMU BEECH CREEK AQUIFER WELLS

JULY 1997

NAVSURFWARCENDIV
CRANE, INDIANA

20626



DATE

DGN/132232/AMMO1.DGN

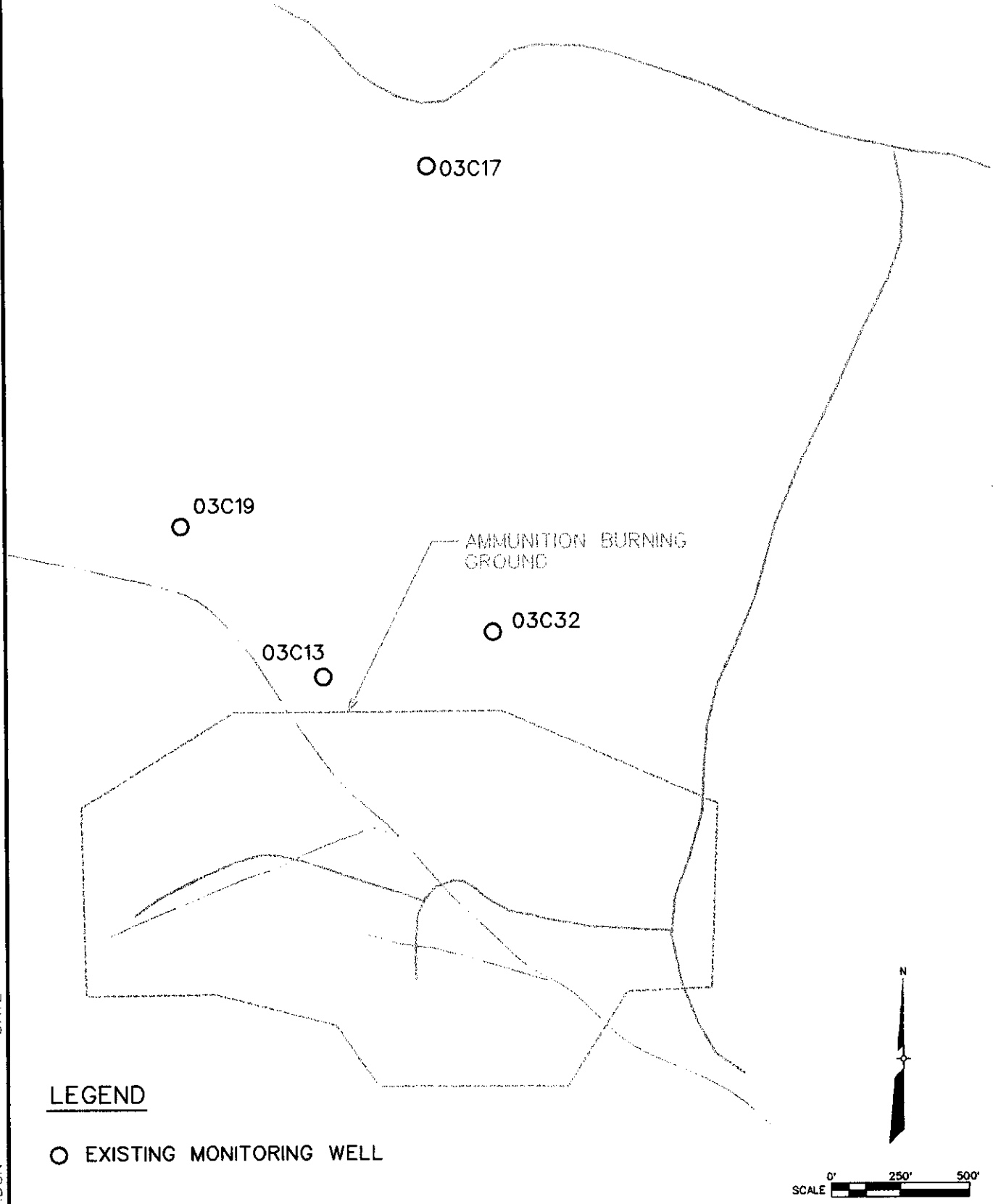
Rust Environment & Infrastructure Inc.

FIGURE 4-8C
AMMUNITION BURNING GROUND
OFF-SWMU BEECH CREEK
AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



DATE

DGN/132232/AMMO.DGN

RUST

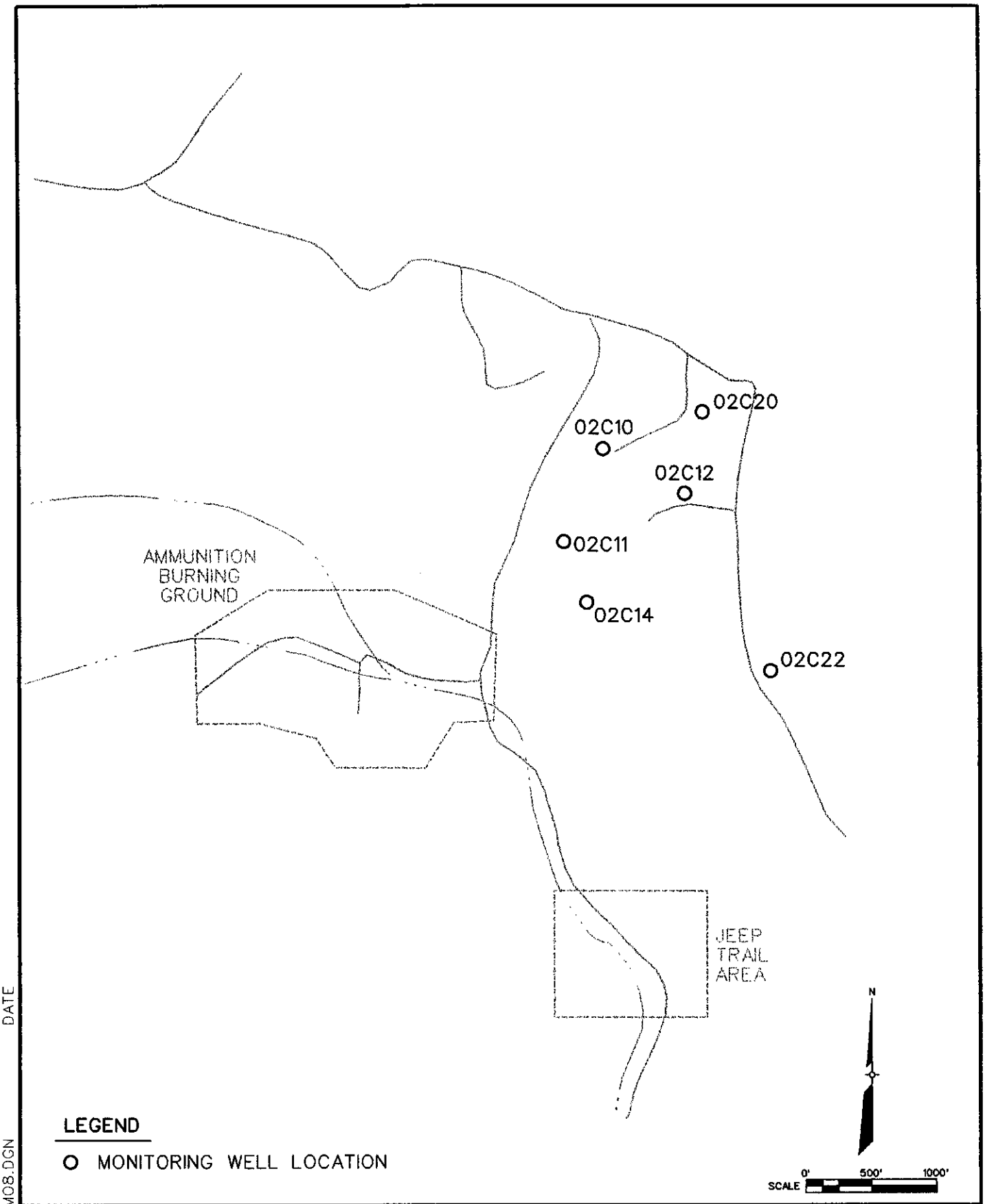
Rust Environment & Infrastructure Inc.

FIGURE 4-8D
AMMUNITION BURNING GROUND
OFF-SWMU BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



DATE

DGN/132232/AMM08.DGN

RUST

Rust Environment & Infrastructure Inc.

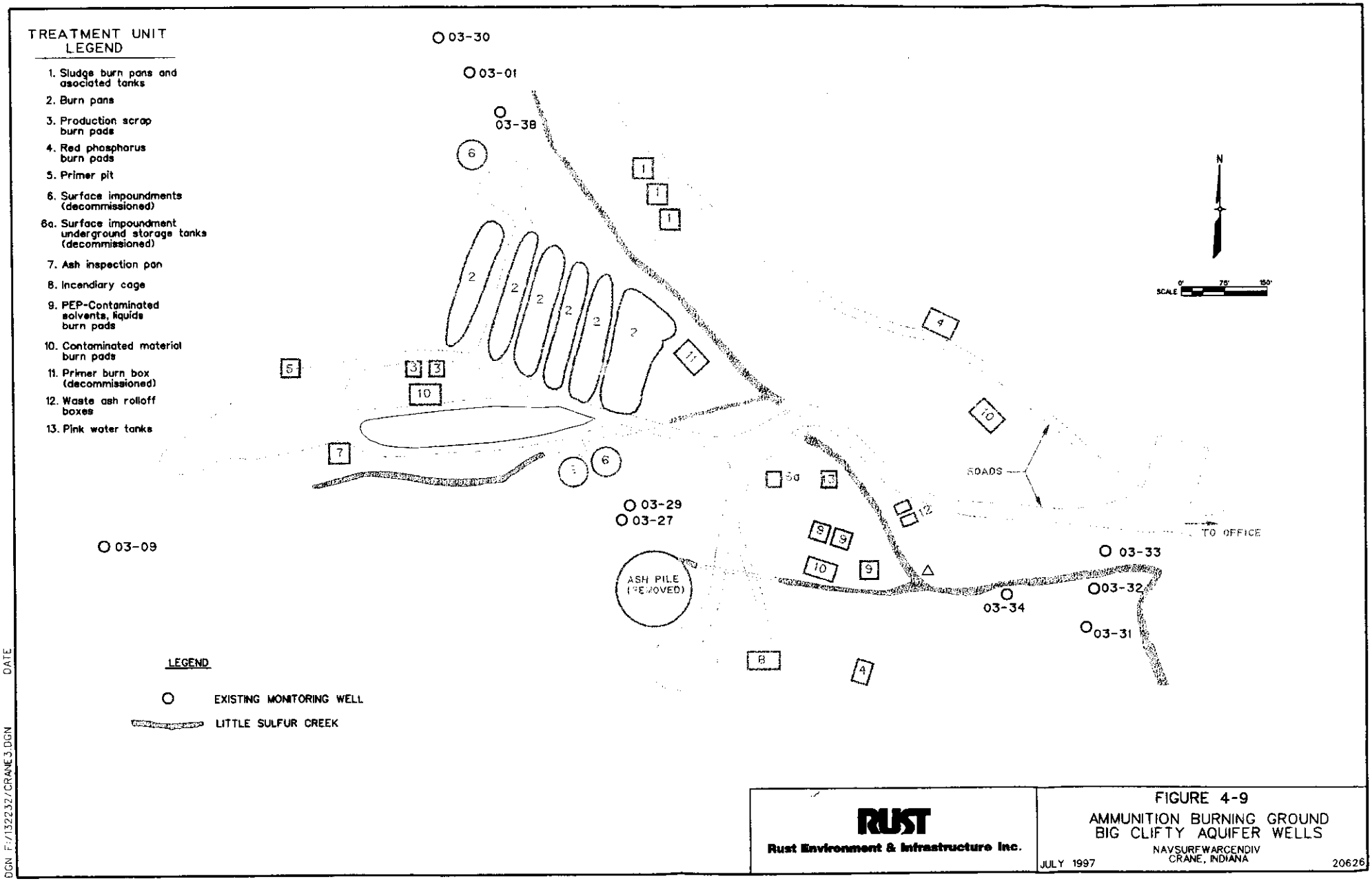
FIGURE4-8E

AMMUNITION BURNING GROUND
OFF-SWMU BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



RUST

Rust Environment & Infrastructure Inc.

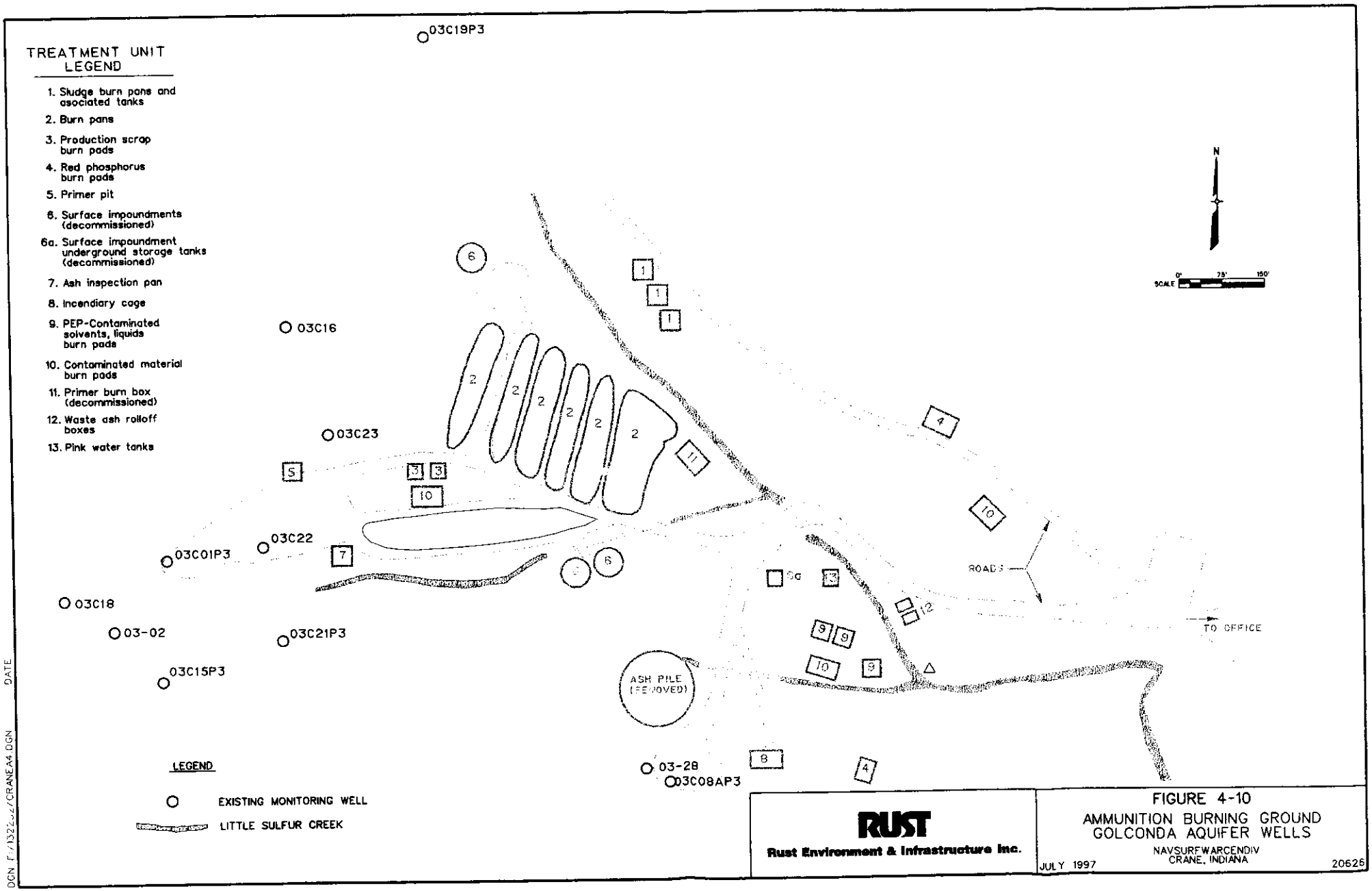
FIGURE 4-9

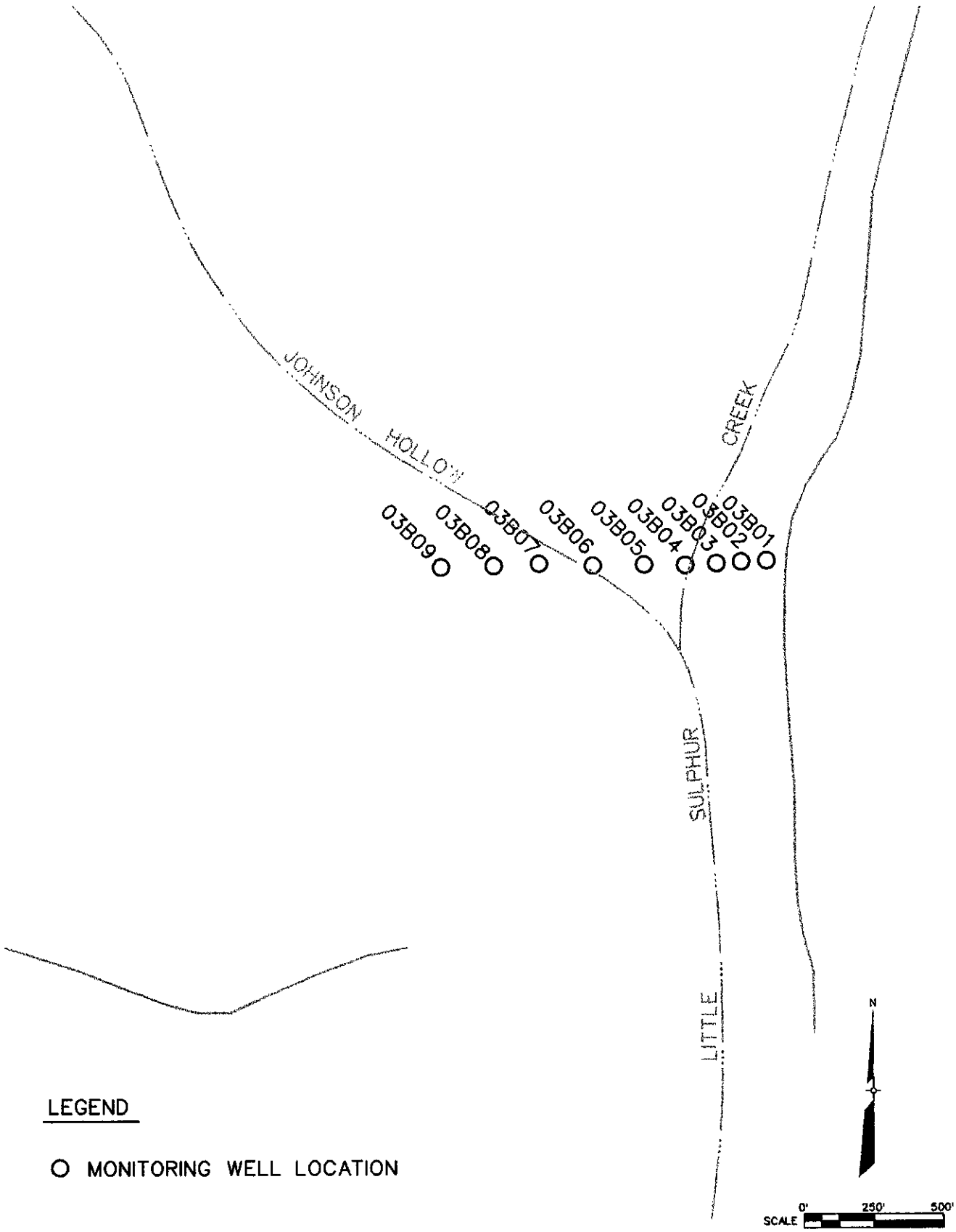
AMMUNITION BURNING GROUND
BIG CLIFTY AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626


TREATMENT UNIT LEGEND
1. Sludge burn pans and asociated tanks
2. Burn pans
3. Production scrap burn pads
4. Red phosphorus burn pads
5. Primer pit
6. Surface impoundments (decommissioned)
6a. Surface impoundment underground storage tanks (decommissioned)
7. Ash inspection pan
8. Incendiary cage
9. PEP-Contaminated solvents, liquids burn pads
10. Contaminated material burn pads
11. Primer burn box (decommissioned)
12. Waste ash rolloff boxes
13. Pink water tanks
03C19P3
03C16
03C23
03C22
03C01P3
03C18
03-02
03C21P3
03C15P3
03-28
03C08AP3
ASH PILE (REMOVED)
ROADS
TO OFFICE
N
SCALE 0' 75' 150'
LEGEND
EXISTING MONITORING WELL
LITTLE SULFUR CREEK
RUST
Rust Environment & Infrastructure Inc.
FIGURE 4-10
AMMUNITION BURNING GROUND
GOLCONDA AQUIFER WELLS
NAVSURFWARCENDIV
CRANE, INDIANA
JULY 1997
20626
DATE
DGN F:/1322..../CRANEA4.DGN



DATE

DGN F:/13_32/AMMO4.DGN

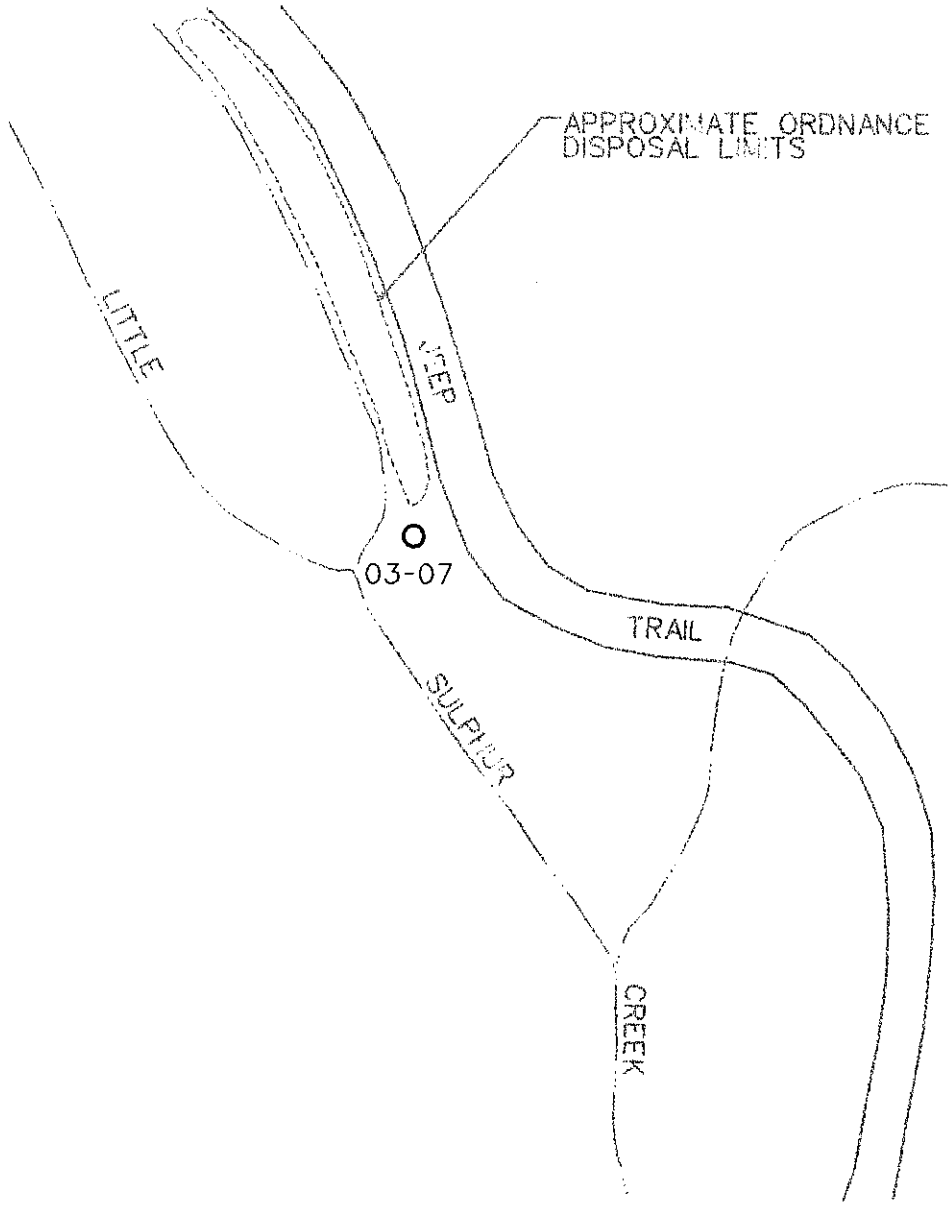
Rust Environment & Infrastructure Inc.

FIGURE 4-11
AMMUNITION BURNING GROUND
ALLUVIUM AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

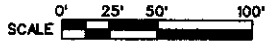
JULY 1997

20626



LEGEND

O EXISTING MONITORING WELL



RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-12

JEEP TRAIL
ALLUVIUM AQUIFER WELLS

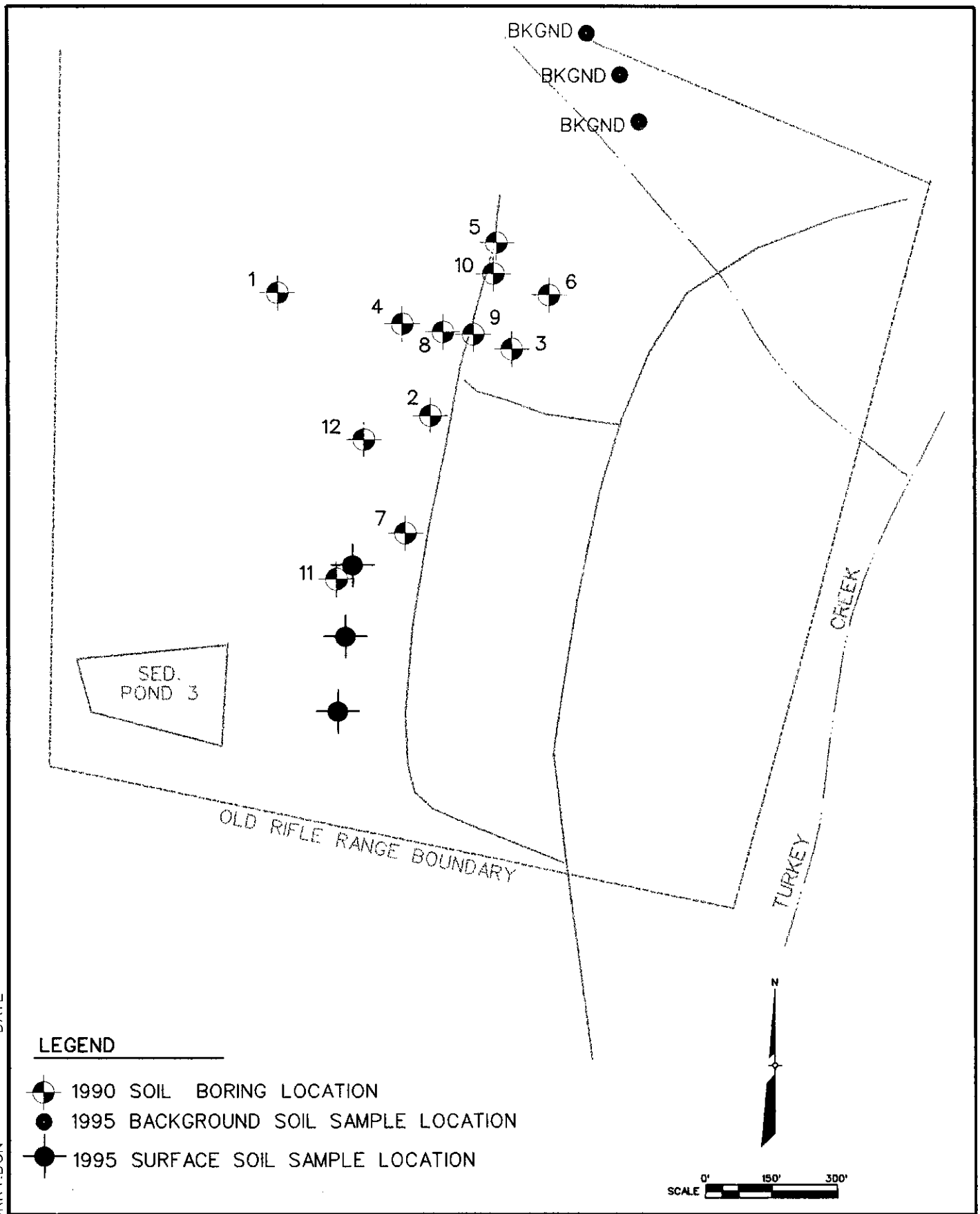
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DATE

DGN F:/132232/JEEP1.DGN



DATE

DGNF:/132232/ORR4.DGN

RUST

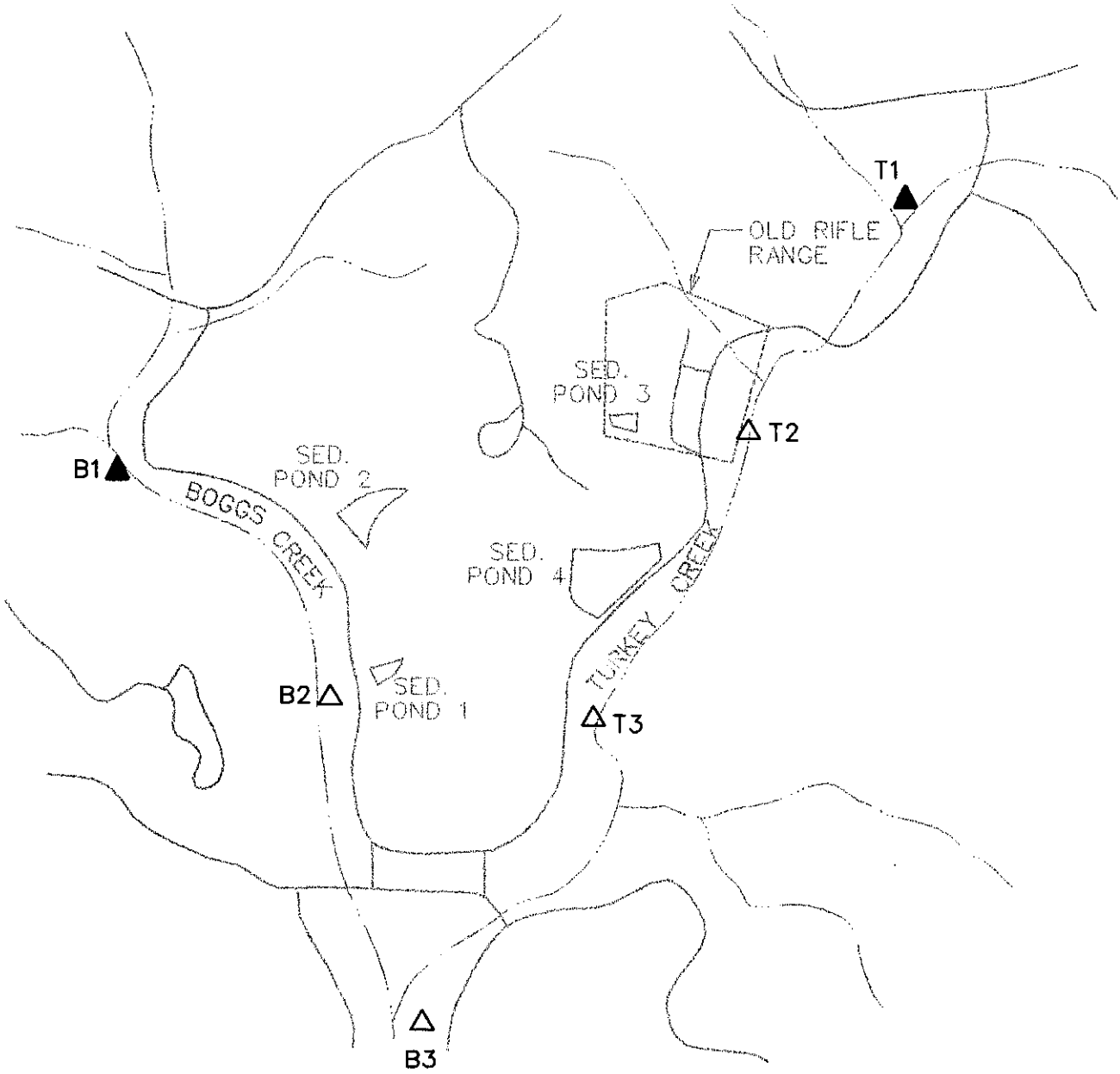
Rust Environment & Infrastructure Inc.

FIGURE 4-13
OLD RIFLE RANGE
SOIL SAMPLING LOCATIONS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



LEGEND

▲ UPSTREAM SURFACE WATER/SEDIMENT SAMPLES

△ DOWNSTREAM SURFACE WATER/SEDIMENT SAMPLES

N

SCALE 0' 1000' 2000'

RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-14
OLD RIFLE RANGE/DEMO.RANGE
SURFACE WATER/SEDIMENT SAMPLING
LOCATIONS

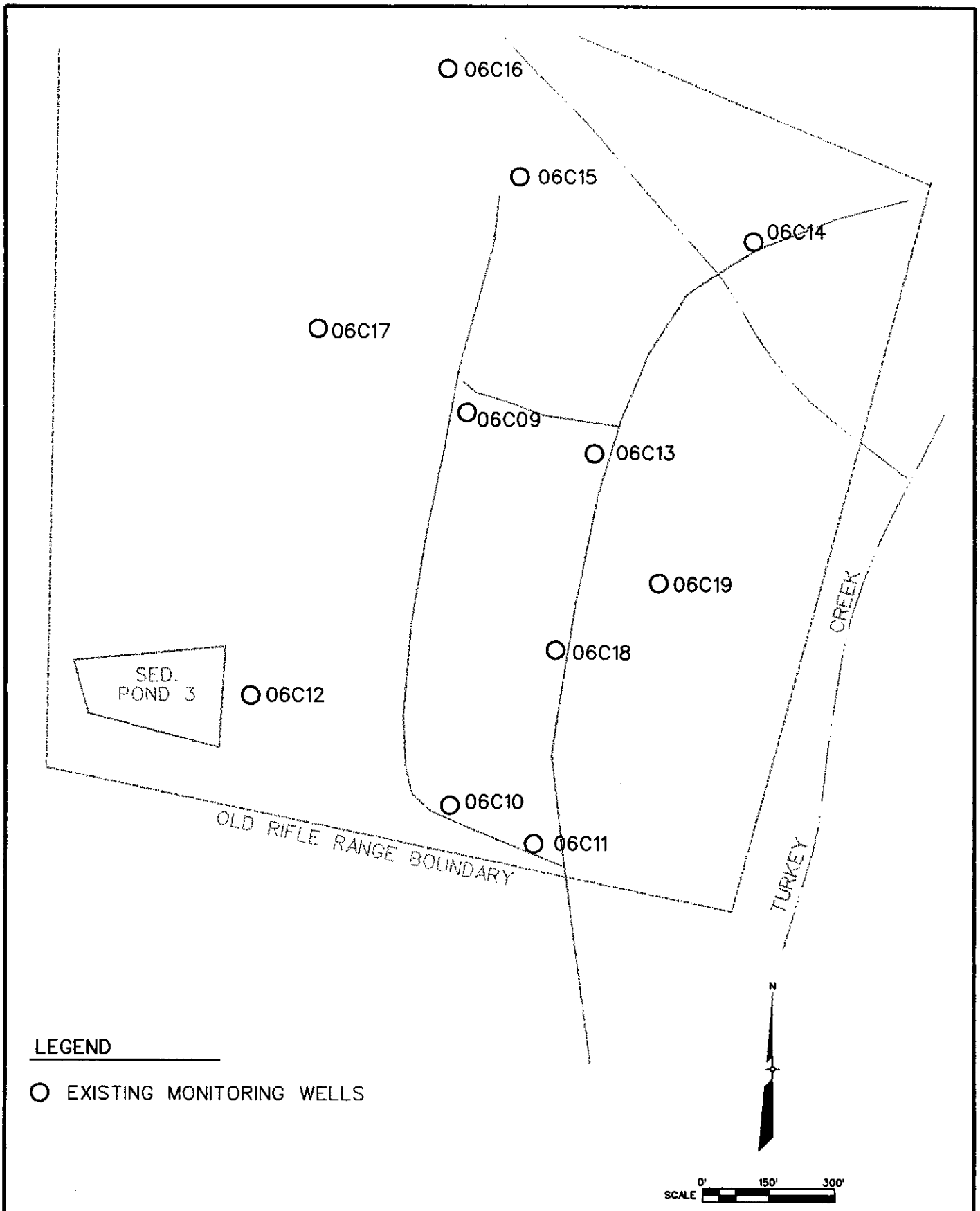
NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DATE

DGN/132232/AMMO2.DGN



DATE

DGN/132232/ORR3.DGN

RUST

Rust Environment & Infrastructure Inc.

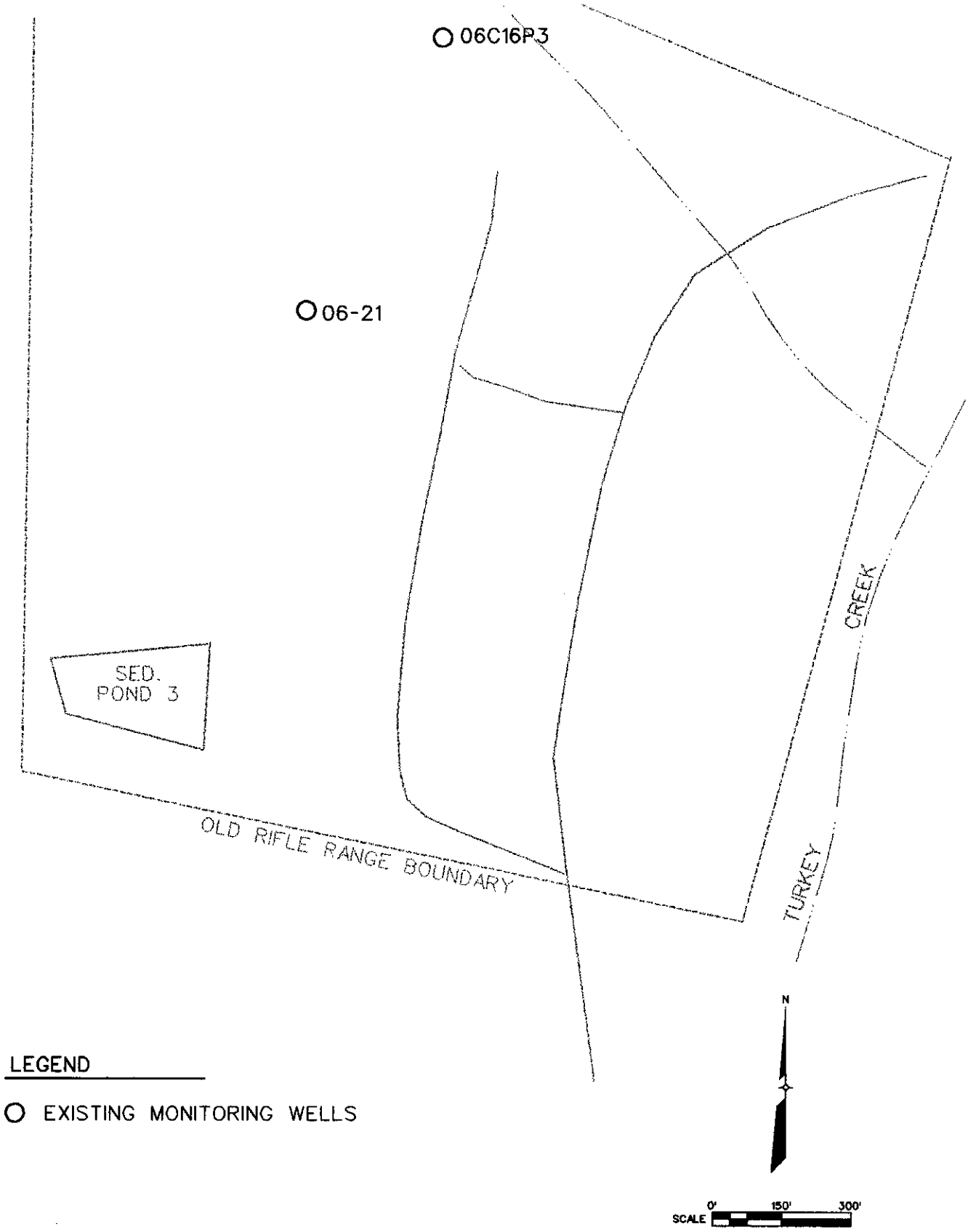
FIGURE 4-15

OLD RIFLE RANGE
BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



DATE

DGN/132232/ORR2.DGN

RUST

Rust Environment & Infrastructure Inc.

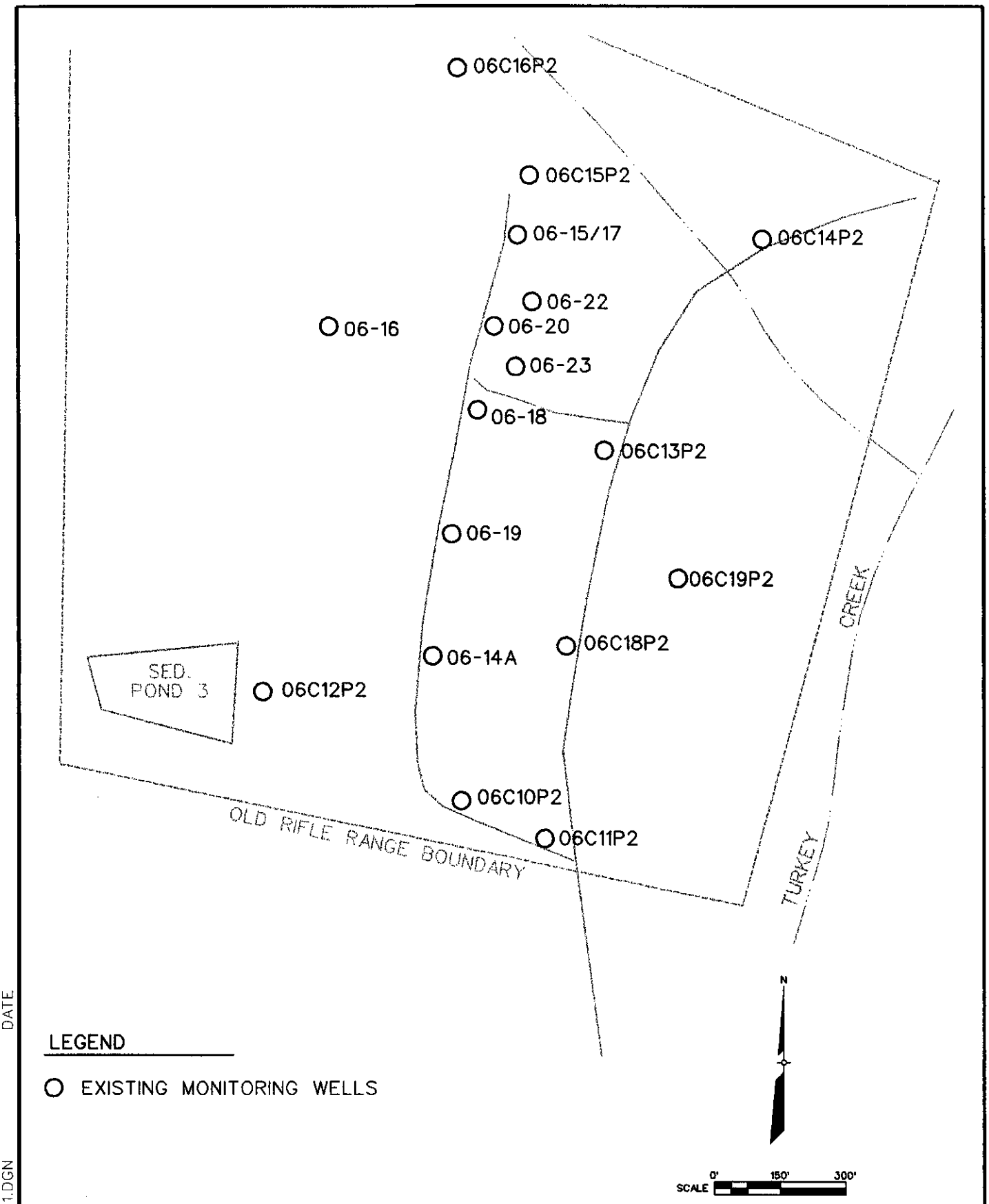
FIGURE 4-16

OLD RIFLE RANGE
GOLCONDA AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



DATE

DGN/132232/ORR1.DGN

RUST

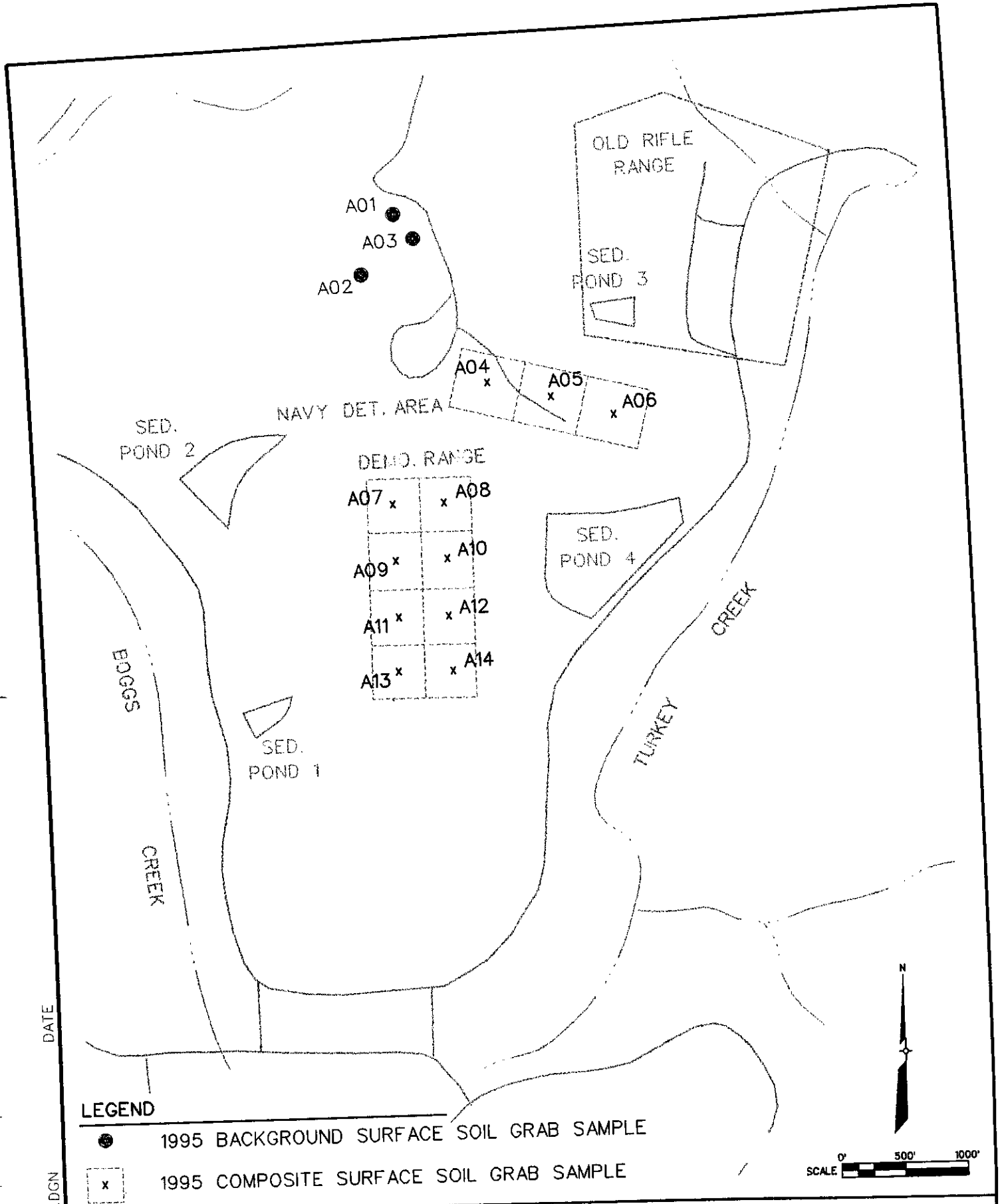
Rust Environment & Infrastructure Inc.

FIGURE 4-17
OLD RIFLE RANGE
SURFICIAL AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



DATE

DGN/132232/DR3.DGN

RUST

Rust Environment & Infrastructure Inc.

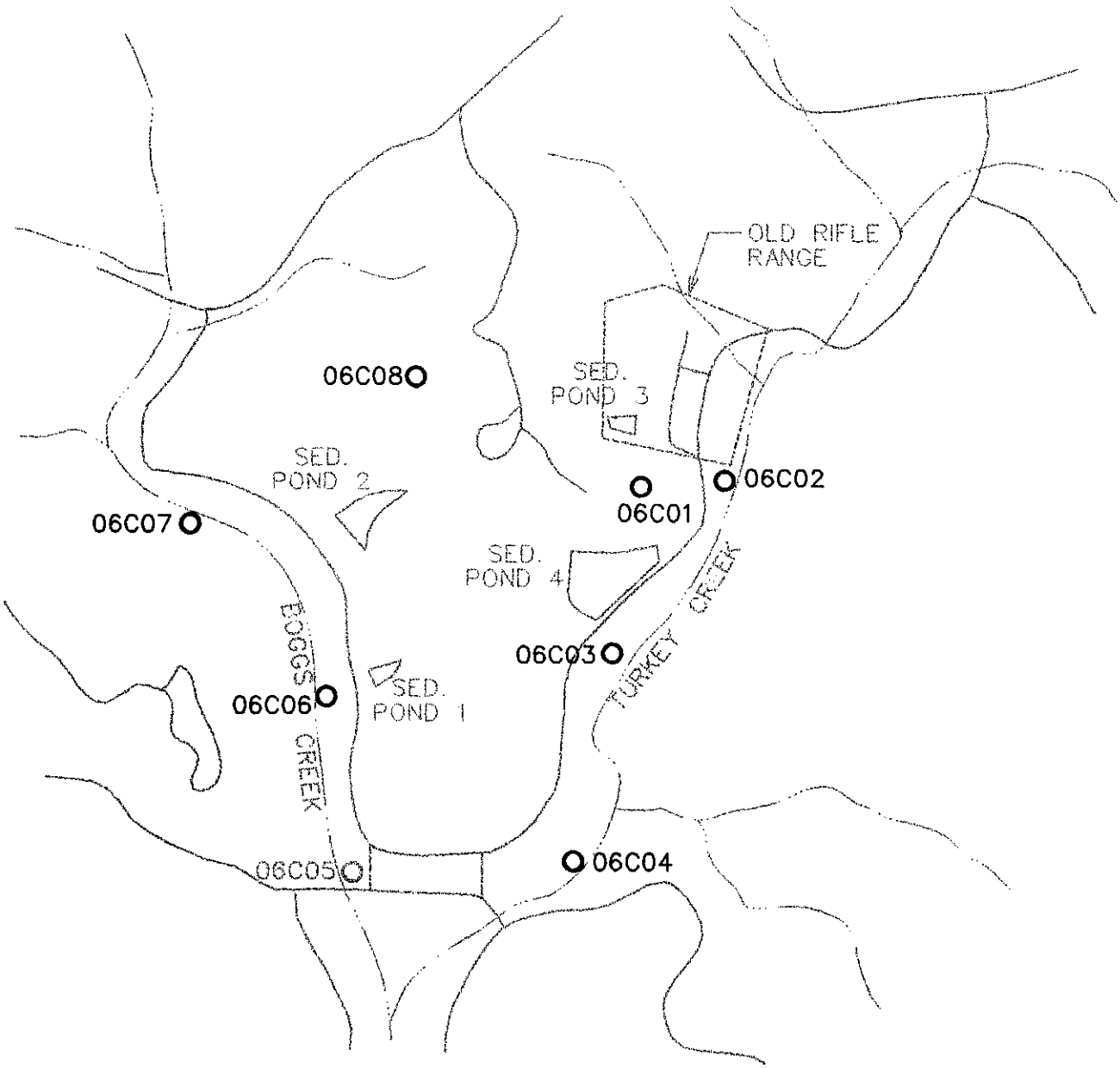
FIGURE 4-18

DEMOLITION RANGE
SOIL SAMPLING LOCATIONS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



LEGEND

O EXISTING MONITORING WELL

DATE

DGN/132232/DR2.DGN

RUST

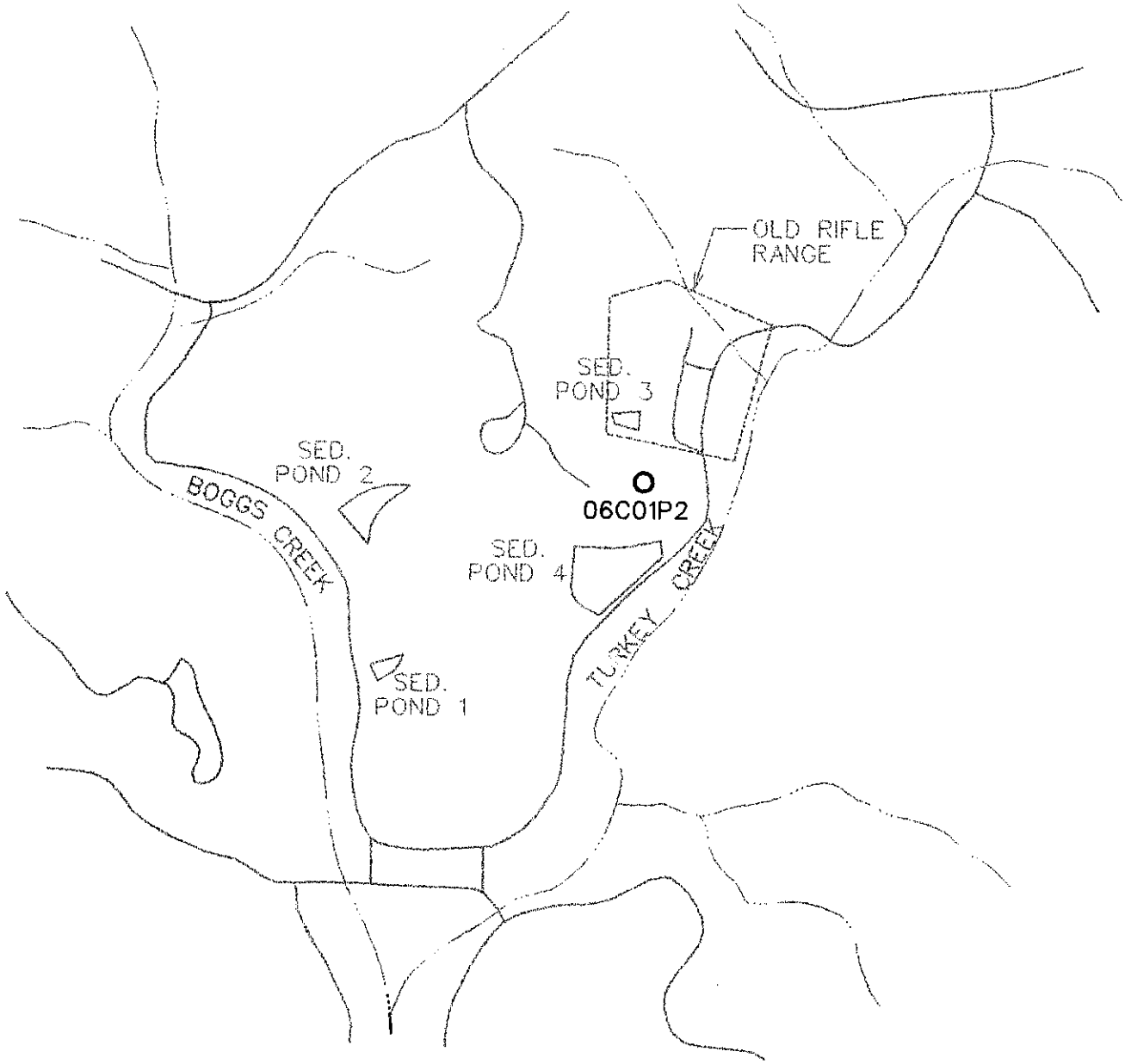
Rust Environment & Infrastructure Inc.

FIGURE 4-19
DEMOLITION RANGE
BEECH CREEK AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



LEGEND

○ EXISTING MONITORING WELL

N

SCALE 0' 1000' 2000'

DATE

DGN/1322-32/DR1.DGN

RUST

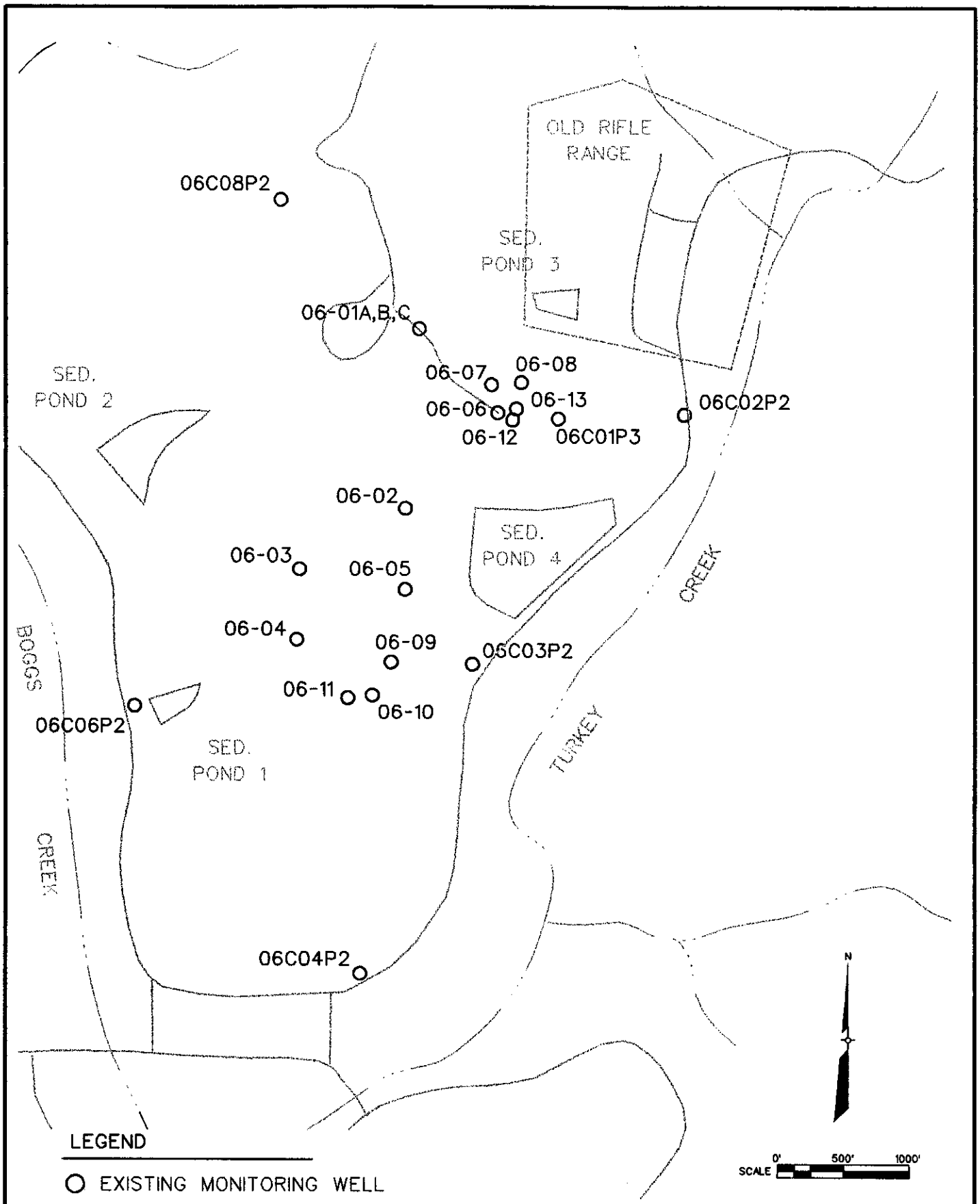
Rust Environment & Infrastructure Inc.

FIGURE 4-20
DEMOLITION RANGE
INTERMEDIATE ZONE AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626



RUST

Rust Environment & Infrastructure Inc.

FIGURE 4-21
DEMOLITION RANGE
SURFICIAL AQUIFER WELLS

NAVSURFWARCENDIV
CRANE, INDIANA

JULY 1997

20626

DATE

DGN F:/132232/DR4.DGN