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MONITORED NATURAL ATTENUATION FINAL REPORT FOR CAST HIGH EXPLOSIVES FILL/BUILDING 146 SOLID WASTE MANAGEMENT UNIT 16 (SWMU 16) ROUND NUMBER 9 NSA CRANE IN

07/01/2010

TETRA TECH NUS INC

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888

Rev. 0
07/2010

Monitored Natural Attenuation Final Report
for
Cast High Explosives Fill/Building 146 (SWMU 16)

Round No. 9

Naval Surface Warfare Center Crane
Crane, Indiana

Contract Task Order 0377

July 2010

NAVFAC
Naval Facilities Engineering Command
Midwest
201 Decatur Avenue
Great Lakes, Illinois 60088

TETRA TECH NUS, Inc.

MONITORED NATURAL ATTENUATION
FINAL REPORT
FOR
CAST HIGH EXPLOSIVES FILL/BUILDING 146 (SWMU 16)

ROUND NO. 9

NAVAL SURFACE WARFARE CENTER, CRANE
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Midwest
201 Decatur Avenue
Great Lakes, Illinois 60088

Submitted by:
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0377

JULY 2010

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LIST OF ACRONYMS

amsl	above mean sea level
APE	Ammunition Peculiar Equipment
B146	Building 146
bgs	below ground surface
CD	Compact Disc
CMS	Corrective Measures Study
cm/s	centimeter per second
COPC	Contaminant of Potential Concern
DI	Deionized
DNX	Hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine
DO	Dissolved Oxygen
FOD	Frequency of Detection
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IDEM	Indiana Department of Environmental Management
MNA	Monitored Natural Attenuation
MNX	Hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NSA	Naval Surface Warfare Center
ORP	Oxidation Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
Plz	Pennsylvanian Lower Water-Bearing Zone
Pmz	Pennsylvanian Middle Water-Bearing Zone
Puz	Pennsylvania Upper Water-Bearing Zone
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RFI	RCRA Facility Investigation
RISC	Risk Integrated System of Closure
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound

SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TNT	2,4,6-Trinitrotoluene
TNX	Hexahydro-1,3,5-trinitroso-1,3,5-triazine
TOC	Total organic carbon
Tetra Tech	Tetra Tech NUS, Inc.
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
µg/L	microgram per liter
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 GENERAL

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) has been conducted at the Naval Surface Warfare Center (NSA) Crane Cast High Explosives Fill/Building 146 solid waste management unit (SWMU), also known as SWMU 16. The RFI was conducted at SWMU 16 in accordance with applicable RCRA corrective action requirements and provides data on the nature and extent of select explosives, metal, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and other miscellaneous parameter concentrations in surface soil, subsurface soil, sediment, surface water, and groundwater. The RFI showed there was excess risk as a result of explosives and VOCs in the groundwater.

A corrective measures study (CMS) will be conducted at SWMU 16. Among the remedial alternatives expected to be evaluated will be the potential for natural attenuation to reduce the concentrations of explosives and VOCs in the groundwater in a reasonable time frame. Monitored natural attenuation (MNA) relies on naturally occurring processes in the environment to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. A long-term groundwater monitoring program for explosives and trichloroethene (TCE) has been in progress at SWMU 16 since April 2003 to determine whether residual explosives and VOCs are naturally degrading. The program was developed on the basis of United States Environmental Protection Agency (USEPA) Region 5 framework guidelines specified in “Region 5 Framework for Monitored Natural Attenuation Decisions for Groundwater” (USEPA, 2000).

The purpose of this report is to provide an evaluation of MNA processes at SWMU 16 on the basis of nine rounds of groundwater and surface water sampling data. Section 1.0 includes a description of the site history, physical characteristics, and the conceptual flow and transport model for SWMU 16. Section 2.0 presents a description of SWMU 16, field investigation program. Section 3.0 presents the groundwater and surface water monitoring analytical data for all rounds of sampling, along with potentiometric surface maps for Round 9 sampling data. Section 4 presents an evaluation of analytical data using statistical analyses, temporal plotting, and spatial contouring. Section 5.0 presents conclusions and recommendations. Figures and tables are presented at the end of each section. All field documentation associated with Round 9 is provided in Appendices A through C on compact disc (CD). Groundwater and surface water analytical results for all nine rounds of sampling are provided in Appendix D. Appendix E presents potentiometric contour surface maps for previous Rounds 2 through 8.

1.2 SITE LOCATION AND DESCRIPTION

SWMU 16 is approximately 16 acres in size and is located in the north-central portion of NSA Crane within the Boggs and Turkey Creek Drainage Basin. This basin is one of five drainage basins that carry surface water off the installation, eventually draining into the East Fork of the White River, then into the Wabash River to the southwest. The location of SWMU 16 within NSA Crane and the drainage basins is shown on Figure 1-1. Figure 1-2 presents the site features associated with SWMU 16.

1.2.1 Site History

The Cast High Explosives Fill/Building 146 Incinerator consisted of Building 146 and three oil-fired, rotary kiln incinerators with fuel storage tanks. Building 146 is still in existence (see Figure 1-2); it was previously used as an explosives fill and pressure washout facility. The incinerators and fuel storage tanks have been removed. Munitions entered the kilns at one end and were exposed to flame combustion, resulting in the destruction of the energetics (propellants, explosives, pyrotechnics) contained within the munitions, thereby demilitarizing them through burning or detonation. During operation, ash from the incinerators was stored in waste piles adjacent to the incinerator. These ash piles have been removed. A degreaser was used in Building 146 during 1980s.

In previous investigations, exterior sumps receiving roof drain waters and process waters were found to contain TCE. These sumps discharged into ditches. At the time the TCE was found, the sump was not being used in Building 146 and cyclotrimethylenetrinitramine (RDX) and TCE related activities have not occurred in Building for several years. After this discovery, a remedial action was conducted in which an air stripper was used to remove VOCs from liquids within the sumps, while the roof drain waters were rerouted to a separate line discharging into a ditch. After TCE concentrations in the sump were reduced to acceptable levels, the sump drains were then routed to the sanitary sewer system.

1.2.2 Nature of Contamination and Chemicals of Concern

As discussed above, the RFI showed there was excess risk as a result of explosives and VOCs in the groundwater. TCE has been detected at high concentrations at the settling basins.

The major contaminants from Building 146 loading and washout activities were 2,4,6-trinitrotoluene (TNT), RDX, HBX (a mixture of RDX, TNT, aluminum, and wax), Composition A (contains RDX and beeswax), Composition B (composed of RDX, TNT, and wax), and ammonium picrate.

The primary metals of concern associated with the incinerator operations are the heavy metals lead, barium, cadmium, chromium, and mercury.

Potentially combustible fuels containing polychlorinated biphenyls (PCBs) and contamination from PCB oxidation products has been reported in the groundwater (Halliburton NUS, 1992). Polycyclic aromatic hydrocarbons (PAHs) and undetonated explosives have also been detected in ash from the Ammunition Peculiar Equipment (APE-1236) incinerators.

1.2.3 SWMU 16 Interim Measure Programs

Voluntary interim measures were conducted at SWMU 16 in 1995. The objectives of the interim measures were to sample, remove, and dispose of sludge contaminated with lead and TCE, respectively, from the east and west sumps; remove three aboveground storage tanks and associated diesel contaminated soils; clean the sumps; excavate and remove the slag/ash piles; sample the remaining soils; backfill; and restore the site. During the interim measures in 1995, it was discovered that high levels of TCE were entering the east and west sumps through the inlet piping.

Additional voluntary interim measures were conducted at SWMU 16 from 1996 to 1998. It was determined that the effluent from the sumps required treatment prior to discharge. The objective of the 1996 to 1998 interim measures was to sample and treat water that had drained into the east and west sumps containing elevated levels of TCE; conduct additional soil sampling; repair broken sewer piping sections; reroute Building 146 roof drains away from the sumps and grout floor drains; install sump pumps and new piping from the sumps to the sanitary sewers; and dispose of PCB contaminated soil. During rerouting of drain lines, trenches were dug through the asphalt cover and into the soil. Samples were collected from the soil/asphalt mixture, and low concentrations of PCBs were detected in the samples.

1.2.4 Physical Characteristics

1.2.4.1 Physiography and Topography

The Cast High Explosives Fill/Building 146 Incinerator area (SWMU 16) is located in the north-central portion of NSA Crane (Figure 1-1), on the southeast side of Highway 45, which is the main highway running through the facility. Highway 45 runs in a northeast-southwest direction along a ridge top that is also a drainage divide. It separates the Greenwood Lake drainage that lies on the northwest side of the highway from Turkey Creek watershed that lies on the southeast side. SWMU 16 lies on a flattened ridge

top that extends southward from the primary ridge along Highway 45, and has an elevation of approximately 765 feet above mean sea level (msl).

The elevations on top of the ridge range from 760 to 766 feet amsl. The land surface slopes to a low elevation of 577 feet above mean sea level (msl) in the Turkey Creek streambed at staff gauge 16SG09, located approximately 300 feet south of the SWMU boundary. The land surface slopes downward at a relatively even grade from the ridge top to the main drainage gullies and Turkey Creek. This slope is at an approximate 18 to 20 percent grade.

1.2.4.2 Geology

The bedrock underlying NSA Crane consists of sedimentary rocks from the Lower Pennsylvanian-age Mansfield Formation of the Raccoon Creek Group (Figure 1-3). The Pennsylvanian-age sandstones, siltstone, shales, coal beds, and thin limestone units of the Mansfield Formation can reach thicknesses of 250 to 300 feet at NSA Crane in the central and western portions of the facility. Below the Pennsylvanian rock lies Mississippian-age limestone and sandstone formations of the Stephensport Group, including the Glen Dean, Golconda, and Beech Creek Limestones, and the Big Clifty Sandstone (Figure 1-3).

NSA Crane is located on the eastern edge of the Illinois Structural Basin, where the Pennsylvanian- and Mississippian-age bedrock dips to the west-southwest at approximately 30 to 35 feet per mile (USACE WES, 1982; Kvale, 1992). Because the pre-Pennsylvanian bedrock is dipping to the southwest toward the center of the Illinois structural basin, the Mississippian-age rocks are closer to the surface and crop out along the stream valleys and lower slopes on the eastern side of NSA Crane (Figure 1-4). On the eastern side of NSA Crane, Pennsylvanian bedrock is confined to the uppermost portions of hills and ridges.

An erosional unconformity separates the Pennsylvanian strata above from the Stephensport strata below. Depending on the location at NSA Crane, pre-Pennsylvanian erosion has removed a significant portion of the Stephensport strata. At these locations, the paleovalleys are filled with shales and sandstones of Pennsylvanian age (see Figure 1-3). The Pennsylvanian/Mississippian unconformity at SWMU 16 is estimated to lie between 630 to 640 feet above msl (Barnhill, 1993), or roughly 126 to 136 feet below the top of the ridge. This places the base of the Pennsylvanian rock above the elevation of Turkey Creek. According to the base wide geology map (Figure 1-4), Upper Mississippian rock units crop out in Turkey Creek valley directly southeast of SWMU 16. Therefore, it is expected that sandstones, shales, and limestones of the Hardinsburg, Haney, Indian Springs, and Big Clifty formations may be present at the base of the ridge and near creek level.

SWMU 16 is located on a flattened ridge top with relatively steep slopes that lead down to stream channels on the western, southern, and eastern sides of the ridge. The geology and hydrogeology of SWMU 16 was first investigated in the early 1980s when the United States Army Corp of Engineers (USACE) installed five monitoring wells in the area (WES-14-01-83 through WES-14-05-83). Currently, a total of 23 monitoring wells exist on or near the top of the ridge, and two monitoring wells (16MWT19 and 16MWT20) have been installed on the lower southeastern slope of the ridge. These two monitoring wells have been screened in unconsolidated valley deposits, which consist of a mixture of alluvium, colluvium, and/or residual soil overlying Mississippian-age shale. The shale is presumed to be part of the Hardinsburg Formation or the Indian Springs Shale (see Figure 1-4).

The maximum depth of investigation to date for this SWMU was approximately 105 feet below the ridge top (16MWT18). Figure 1-5 illustrates the locations of the geologic cross sections, including select borings, through SWMU 16. Figure 1-6 shows geologic cross sections A - A' and B - B', and Figure 1-7 shows geologic cross section C - C'.

The bedrock found at the site consists of shales with discontinuous units of siltstone, sandstone, and coal seams. The layers of siltstone and sandstone encountered are discontinuous. A number of shallow, discontinuous, and weathered sandstone layers (5 to 10 feet thick) were encountered near the top of the ridge at elevations of 740 to 755 feet above msl (see Figures 1-6 and 1-7). The sandstones are presumably capping the ridge and are resistant to erosion. Groundwater was first encountered in these sandstones, so they have been grouped together and are referred to as the Pennsylvanian upper water bearing zone (Puz).

Shale layers are somewhat continuous and interlayered with the shallow sandstones. A continuous or nearly continuous layer of shale and siltstone, 5 to 10 feet thick, lies beneath the shallow sandstone lenses between elevations of 730 and 740 ft above msl (see Figures 1-6 and 1-7). The shale and siltstone unit is irregular in thickness, but appears to be an effective aquitard between the Puz and the sandstone lenses below.

Slightly deeper, intermediate-depth sandstone lenses are classified as the Pennsylvanian middle water bearing zone (Pmz) and are encountered at elevations of approximately 720 to 735 feet above msl. The location where the thickest intermediate-depth sandstone unit was encountered was in well 16MW01 (see cross section B-B' on Figure 1-6), which is located on the southwestern side of SWMU 16. This sandstone unit extends east to west across the northern end of SWMU 16 (see cross section A-A' of Figure 1-6) and is interpreted to extend south to well 16MW01. However, this sandstone is also discontinuous, based on its absence in well 16MWT05.

Between 35 to 50 feet of shale lies beneath the intermediate-depth sandstone lenses (Pmz) and is continuous across the site. The elevation of the shale ranges from 675 to 725 feet above msl (Figures 1-6 and 1-7). Because of its thickness, this shale is acting as an aquitard beneath the intermediate-depth sandstone lenses described above (Pmz) and the underlying interlayered sandstone and siltstone described below.

The interlayered sandstone and siltstone unit, located beneath the thick shale, also contains a coal seam near the top (see Figures 1-6 and 1-7). Four monitoring wells have penetrated into this sandstone/siltstone unit; however, none of them extend more than 12 feet into it. Therefore, it is not possible to determine how thick this sandstone is and how its lithologic properties might change at greater depth. This interlayered sandstone and siltstone is considered to be the Pennsylvanian lower water bearing zone (Plz).

The Pennsylvanian bedrock beneath SWMU 16 is estimated to be 122 to 134 feet in thickness. The Pennsylvanian/Mississippian unconformity at SWMU 16 is estimated to be at approximately 630 to 640 feet above msl, roughly 126 to 136 feet below ground surface (bgs) (Barnhill, 1993). This would place the Mississippian rock formation 20 to 30 feet below the deepest monitoring well located on the ridge top (see Figures 1-6 and 1-7).

Two monitoring wells were installed along the road near the base of the ridge on the southeast side of SWMU 16 (see Figures 1-5 and 1-6). These monitoring wells were installed to access the potential for contaminated groundwater to be migrating downhill on top of the bedrock-soil interface. While drilling these boreholes, 1 to 2 feet of shale was encountered in the bottom of each boring. This shale may be part of the Hardinsburg Formation or it may be part of the Indian Springs Shale. In either case, the shale unit should act as an additional aquitard that prevents migration of groundwater and contaminants vertically downward through the core of the ridge.

Drilling has not been performed at lower elevations near Turkey Creek because of accessibility problems (i.e., wet, swampy conditions), so it is not possible to estimate how thick the unconsolidated alluvium and colluvium might be near the center of the small valley.

1.2.4.3 Soils

Natural unconsolidated materials on the ridge top and sides of the ridge are residual soils formed as a result of weathering of the underlying Raccoon Creek Group. The residual soils consist predominantly of

fine-grained materials, including varying amounts of clay, silt, and sand. The maximum observed thickness of soils on top of the ridge was 13 feet (e.g., 16MWT07, 16MWT08, and 16MWT10, see Figure 1-6). Elsewhere, the residual soils were generally 10 feet thick or less.

1.2.4.4 Hydrogeology

While drilling through the overburden, no saturated conditions or flowing water was observed in the residual soils on the ridge top. Therefore, it is concluded that very little if any groundwater is perching on top of the ridge at the interface between the bedrock and overburden. Water elevations measured at staff gauges located in the upper drainage gullies indicate that water in these gullies is not hydraulically connected to the bedrock groundwater, and these elevations were not considered during preparation of the potentiometric surface maps. The surface water at these locations is believed to be perched on top of the clayey residual soils or on the bedrock surface. This is not the case for the soils and saturated conditions in the overburden down near the base of the ridge.

The Pennsylvanian bedrock encountered during the field investigations was divided into three water-bearing zones (Puz, Pmz, and Plz) based on stratigraphy, differences in water-yielding properties, and differences in hydraulic potential that were encountered in each of the three zones. Shale units and occasional siltstone lenses separate the three water-bearing zones and appear to act as aquitards. The upper, middle, and lower groundwater potentiometric surfaces and flow patterns were determined based on water levels measured in Round 2.

The results of slug tests performed on select monitoring wells at SWMU 16 are presented in Table 1-1. The average horizontal hydraulic conductivity (K_h) values for the Puz monitoring wells ranged from 0.267 to 26.7 feet per day [1.20E-4 to 9.42E-3 centimeters per second (cm/s)]. The geometric mean K for the shallow water-bearing zone was approximately 1.83 feet per day (5.9×10^{-4} cm/s). The horizontal hydraulic gradient for the Puz was calculated graphically from groundwater elevations measured in the northern area in Round 2. The calculated hydraulic gradient was estimated to be 0.0198. Assuming a fracture-related porosity of about 0.005 for the bedrock, the linear groundwater velocity was estimated to be 7.3 feet per day.

For the east-central area of SWMU 16, the average hydraulic gradient for the site was estimated to be 0.0727. The same horizontal hydraulic conductivity (1.83 feet per day) and porosity (0.005) were used to estimate the seepage velocity to be 26.6 feet per day.

A single horizontal hydraulic conductivity value (0.611 foot per day, 2.16E-4 cm/s) was measured for Pmz monitoring well 16MWT05 (Table 1-1). The horizontal hydraulic gradient for the Pmz was estimated to be 0.0048, based on groundwater potentials measured in Round 2 in the southern area of SWMU 16. Assuming a fracture-related porosity of about 0.005 for the bedrock, the groundwater velocity was approximated to be 0.61 foot per day. This lateral flow velocity is significantly less than the velocities estimated for the Puz.

The average horizontal hydraulic conductivity (0.0022 foot per day, 7.76E-7 cm/s) was measured in two Plz monitoring wells (see Table 1-1). The hydraulic gradient for the site was calculated graphically from groundwater elevations measured in the northeastern part of the site in Round 3. The average hydraulic gradient for this area was estimated to be 0.02. Assuming a fracture-related porosity of about 0.005 for the bedrock, the groundwater velocity was approximated to be 0.009 foot per day. This is much lower than the velocities estimated for the two monitoring zones above. The reduced lateral flow velocities in the deeper zones are due to the significant reduction of average hydraulic conductivity values with depth.

1.2.5 Conceptual Site Model

For SWMU 16, the building drain lines, the three sumps, the incinerator, and the ash pile were all potential sources of site-related contaminants. Past operations at the site resulted in the release of explosives residue [primarily RDX and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)] and chlorinated VOCs to surface and subsurface soils surrounding Building 146 and the three sumps located north, east, and west of Building 146. Current releases of contaminants are limited or nonexistent at the SWMU 16, because operations have changed and/or control measures have been instituted to eliminate releases. However, it is unclear whether release of RDX from the north sump is continuing to occur.

The original sources of contaminants have been removed or remediated. However, surface and subsurface soils are contaminated and there still exists potential for contaminants of potential concern (COPCs) to leach out of the soils and enter the surface water or groundwater transport systems. There is also potential for the soils to erode and be transported by surface runoff and affect surface waters and sediment in drainageways downhill from SWMU 16. Figure 1-8 presents a schematic diagram of potential pathways that contaminants may take as migration routes from the site. The contaminants originate in the overburden soil and sumps at SWMU 16 (Location A). The contaminants that are leached and/or eroded from the soils may enter the gullies that drain the site and transport surface water down the sideslopes of the ridge on which SWMU 16 is located (Pathway D).

Contaminants have been migrating downward and entering the shallow groundwater flow system (Pathway B), probably since the beginning of SWMU 16 operations in the 1940s. The majority of groundwater in the shallow sandstone (Puz) and the intermediate zone (Pmz) is moving southeastward or southwestward. The Puz and Pmz intercept the land surface (i.e., crop out) along the upper portions of the ridge between elevations of 730 and 760 feet above msl. The groundwater in the Puz and Pmz that reaches the outcrop area will theoretically travel in one of three pathways; the groundwater will either be taken up by vegetation and transpired (Pathway B1), seep into gullies at the ground surface and join surface water in the gullies traveling downhill (Pathway B2), or will migrate down the side of the hill along the bedrock/soil interface which lies 1 to 3 feet bgs (Pathway B3).

A small portion of the groundwater in the Pmz is migrating downward through a shale and siltstone aquitard and enters the deeper groundwater flow system in the Lower Pennsylvanian water-bearing zone (Plz). This deeper groundwater (Pathway C) is flowing primarily toward the nearest streams. However, the primary and secondary permeability of this water-bearing zone is less than the Puz and Pmz and the groundwater flow velocities are consequently lower in the deeper groundwater system.

During storms and high flow events, most of the surface water flowing down the hillside (Pathway D) probably enters Turkey Creek as overland flow in the drainageways (Pathway D1). As the surface water reaches the valley bottom it slows and some of the surface water infiltrates into the soils and alluvial deposits (Pathway D2) and continue to flow toward the creek as subsurface flow. This D2 groundwater will mix with the deep groundwater migrating from within the ridge (Pathway C) and groundwater moving downhill along the bedrock/soil interface and into surface fractures (Pathway B3). This mixing will likely occur in the valley bottom sediments and the creek channel.

Ultimately the creek, when flowing, will have water in it from several different sources: surface water from upvalley (i.e., upstream of sampling location 16SW/SD18), surface water discharge from the gullies (D1), and groundwater emanating from the valley floor deposits. This section of Turkey Creek is dry for a good portion of the year, but groundwater may still be traveling down the valley as underflow in the valley bottom deposits even when the creek bed is dry.

The following is a summary of the conceptualized aspects of contaminant migration, fate, and persistence at SWMU 16:

- Explosives, primarily RDX, and to lesser extent HMX and TNT were released to soils and sumps.

- Chlorinated solvents, primarily TCE, have been released to soils and sumps.

- Interim remedial actions were taken to plug off the east and west sumps, clean out the east and west sumps, and divert all flow from the Building 146 floor drains into the sanitary sewer.

- The upper zone of groundwater has been contaminated with explosives (primarily RDX, and to a lesser extent HMX and TNT degradation products) and chlorinated VOCs (primarily TCE and 1,1,2-trichloroethane, and their degradation products).

- Nearly all of the groundwater in the uppermost bedrock (i.e., the Puz) is flowing laterally toward the upper slopes of the ridge. Some of this groundwater seeps into the gullies on the side of the ridge, and some of the contaminated groundwater may be taken up by trees and other vegetation and transpired. Thus, natural phytoremediation may be playing a part in controlling and reducing the rate of contaminants reaching the base of the ridge and entering the tributary stream.

- Chlorinated solvents (TCE) in groundwater are degrading as evidenced by the presence of degradation products.

- Some of the explosives contaminants (mainly RDX and HMX), TCE, and cis-1,2-dichloroethene are reaching the gullies on the northwest side of the site, which is a tributary of Turkey Creek.

- Low to moderate concentrations of RDX, HMX, and TCE have reached the middle groundwater monitoring wells (i.e., Pmz). The siltstone and shale layers between the upper and middle water-bearing zones are a partially effective aquitard and prevent much of the shallow groundwater and contaminants from reaching the intermediate groundwater system in the ridge.

- No explosive compounds and minor concentrations of VOCs have been detected in the lower Pennsylvanian water-bearing zone or the valley bottom wells. The siltstone and shale layers between the middle and lower water-bearing zones are an effective aquitard and prevent shallow groundwater and contaminants from reaching the deeper groundwater system beneath the ridge.

- Contaminants continue to leach from the surface and near-surface soils and migrate downhill in steep gullies on the northwestern and southeastern sides of the ridge. Low to moderate concentrations of explosives and VOCs were detected, primarily in the gullies leading down the northwest side of the ridge.

- Turkey Creek is the recipient of all waters (surface or subsurface) that flow away from SWMU 16 and the ridge where SWMU 16 is located. Metals and HMX contained in runoff water from SWMU 16 are causing minor impacts to Turkey Creek.

- The overall concentrations of metals in groundwater appear to be higher in the middle (Pmz) and lower (Plz) water-bearing zones, and much lower in the upper water-bearing zone (Puz), which is the opposite of the site-related organic contaminants. Thus, the evidence suggests that the elevated metals concentrations in groundwater are not site-related, but are due to the natural oxidation, weathering, and leaching of the Pennsylvanian rock units.

TABLE 1-1

HYDRAULIC CONDUCTIVITIES OF GEOLOGIC MATERIALS BASED ON SLUG TESTS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
NSA CRANE
CRANE, INDIANA

Monitoring Zone Well Number	Screened Material	K (rising head, ft/day)	K (falling head, ft/day)
Pennsylvanian Upper Water-Bearing Zone (Puz)			
16MWT02	Silty sand, sand, and shale	3.37	5.09
16MWT04	3 ft of sandstone over 7 ft of shale	1.05	1.09
16MWT09	shale	0.413	0.267
16MWT10	fine-grained sandstone to sandy siltstone	26.7	NM
16MWT17	6 ft of sandstone over 4 ft of shale	0.509	0.501
Pennsylvanian Middle Water-Bearing Zone (Pmz)			
16MWT05	Shale and thin coal	0.584	0.638
Pennsylvanian Lower Water-Bearing Zone (Plz)			
16MWT15	sandy siltstone to medium sandstone	NM	0.0039
16MWT21	gray shaley siltstone	NM	0.00044

NM = Not measured
K = hydraulic conductivity
ft = feet

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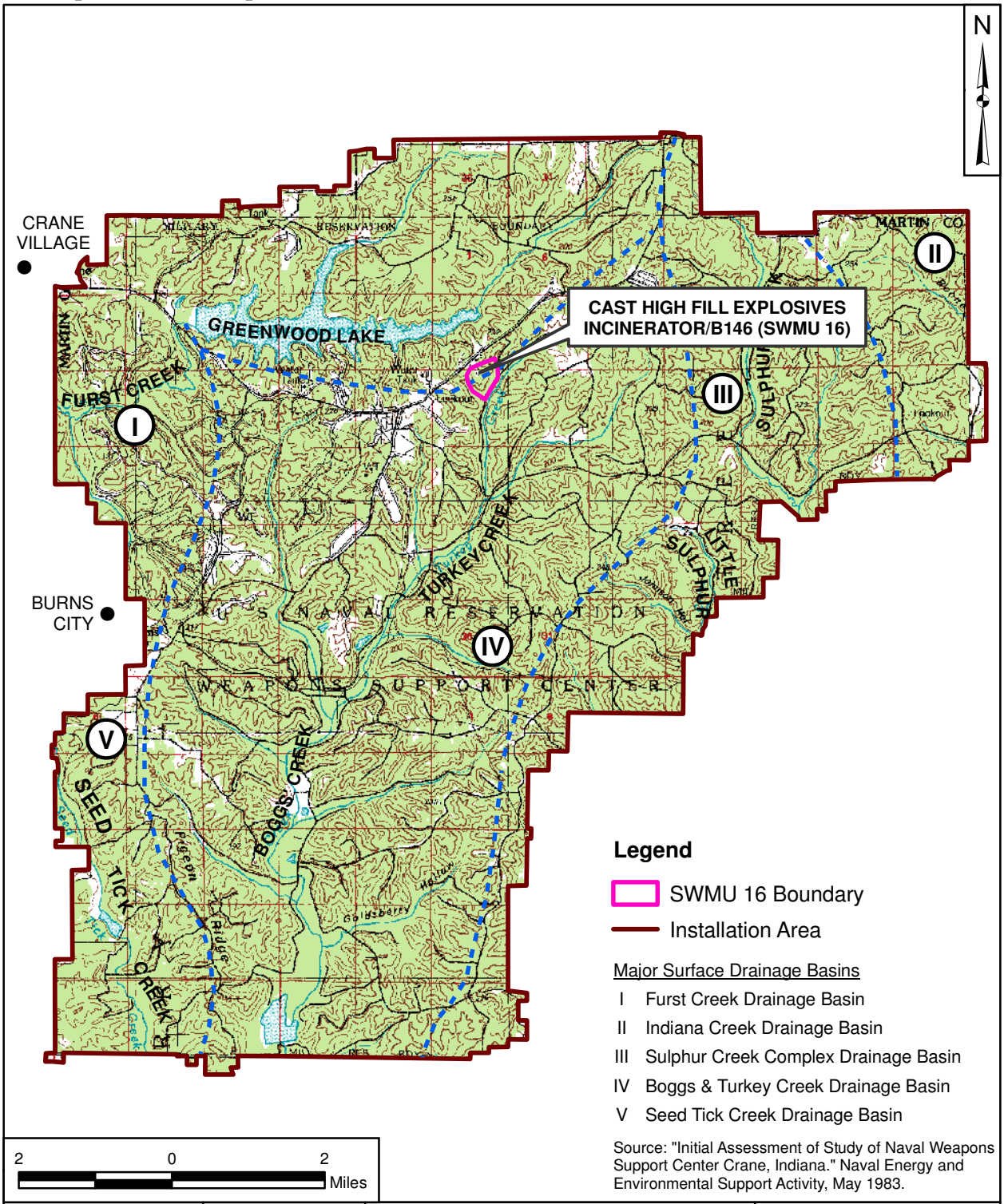

Source: "Initial Assessment of Study of Naval Weapons Support Center Crane, Indiana." Naval Energy and Environmental Support Activity, May 1983.

DRAWN BY S. STROZ	DATE 07/06/10	SWMU 16 CAST HIGH EXPLOSIVES FILL/ BUILDING 146 INCINERATOR LOCATION AND DRAINAGE BASINS NSA CRANE CRANE, INDIANA	CONTRACT NUMBER 00041
CHECKED BY J. LUCAS	DATE 07/06/10		OWNER NUMBER —
REVISED BY —	DATE —		APPROVED BY — DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 1-1 REV 0

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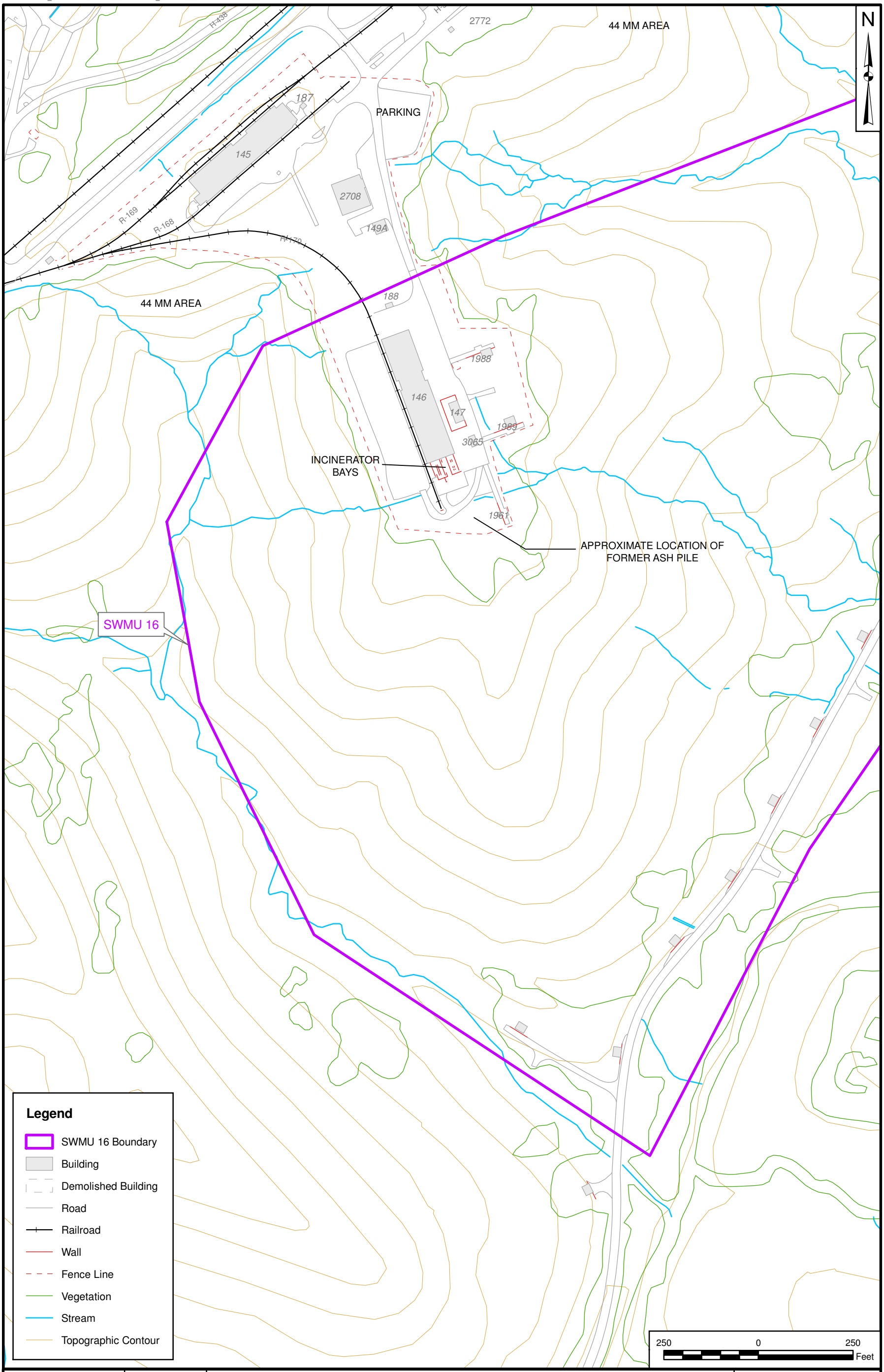


DRAWN BY: S. STROZ	DATE: 07/07/10
CHECKED BY: J. LUCAS	DATE: 07/07/10
REVISED BY: ___	DATE: ___
SCALE: AS NOTED	

NAVFAC

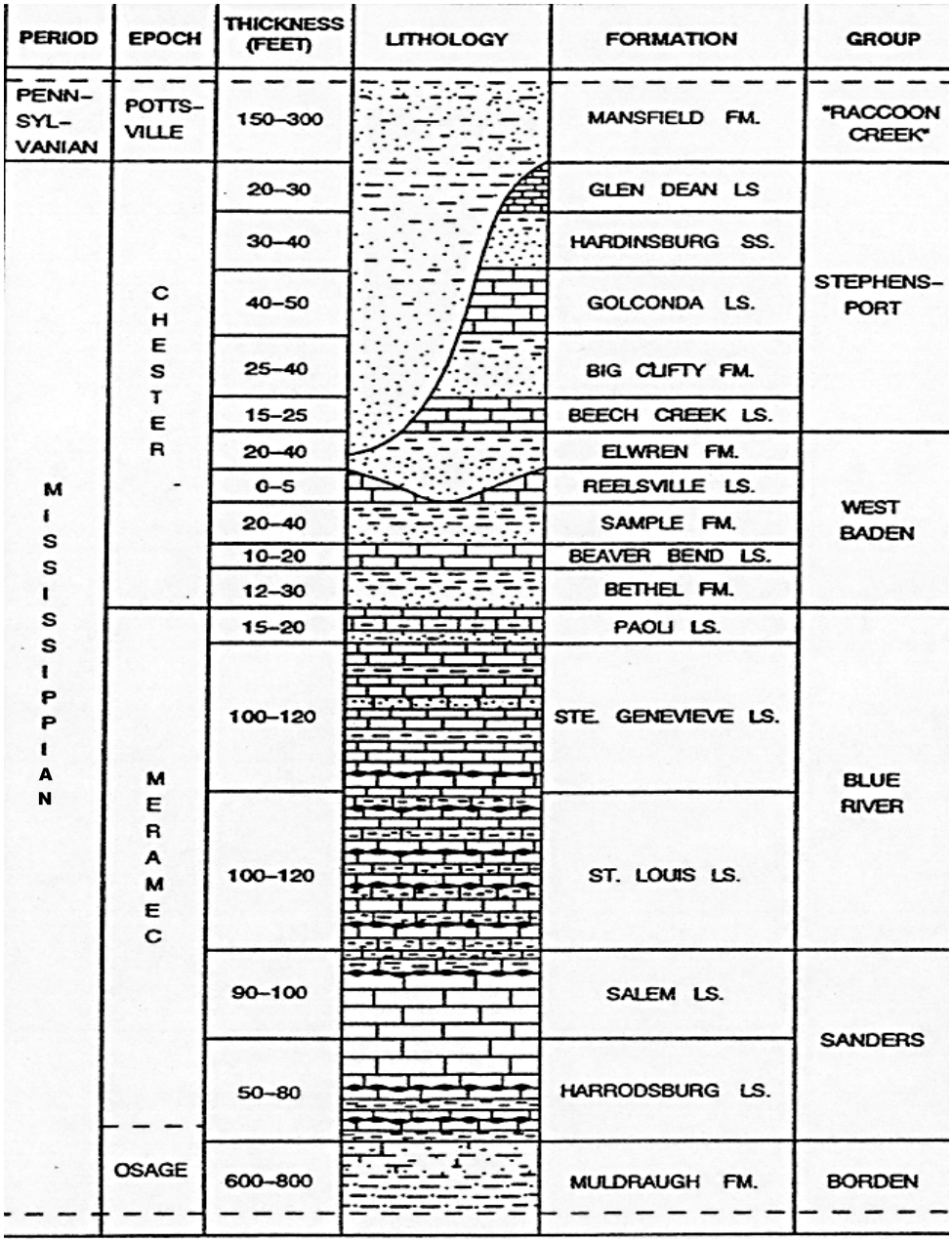
SITE FEATURES

SWMU 16 - CAST HIGH EXPLOSIVES FILL / B146 INCINERATOR

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER: 00041	
APPROVED BY: ___	DATE: ___
APPROVED BY: ___	DATE: ___
FIGURE NO.: 1-2	REV: 0



Source: Draft Report, RCRA Facility Investigation
Phase II Groundwater Release Assessment, SWMU 06/09
Demolition Area and Phase III Release
Characterization SWMU 07/09 Old Rifle Range
November 1995 - Figure 13
by William L. Murphy and Roy Wade

DRAWN BY: K. PEILA — DATE: 5/31/05		GENERALIZED STRATIGRAPHIC COLUMN SWMU 16 - CAST HIGH EXPLOSIVES FILL/ B146 INCINERATOR NSA CRANE CRANE, INDIANA	CONTRACT NUMBER: 00041 — OWNER NO.
CHECKED BY: J. LUCAS — DATE: 7/06/10			APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 1-3 — REV: 0

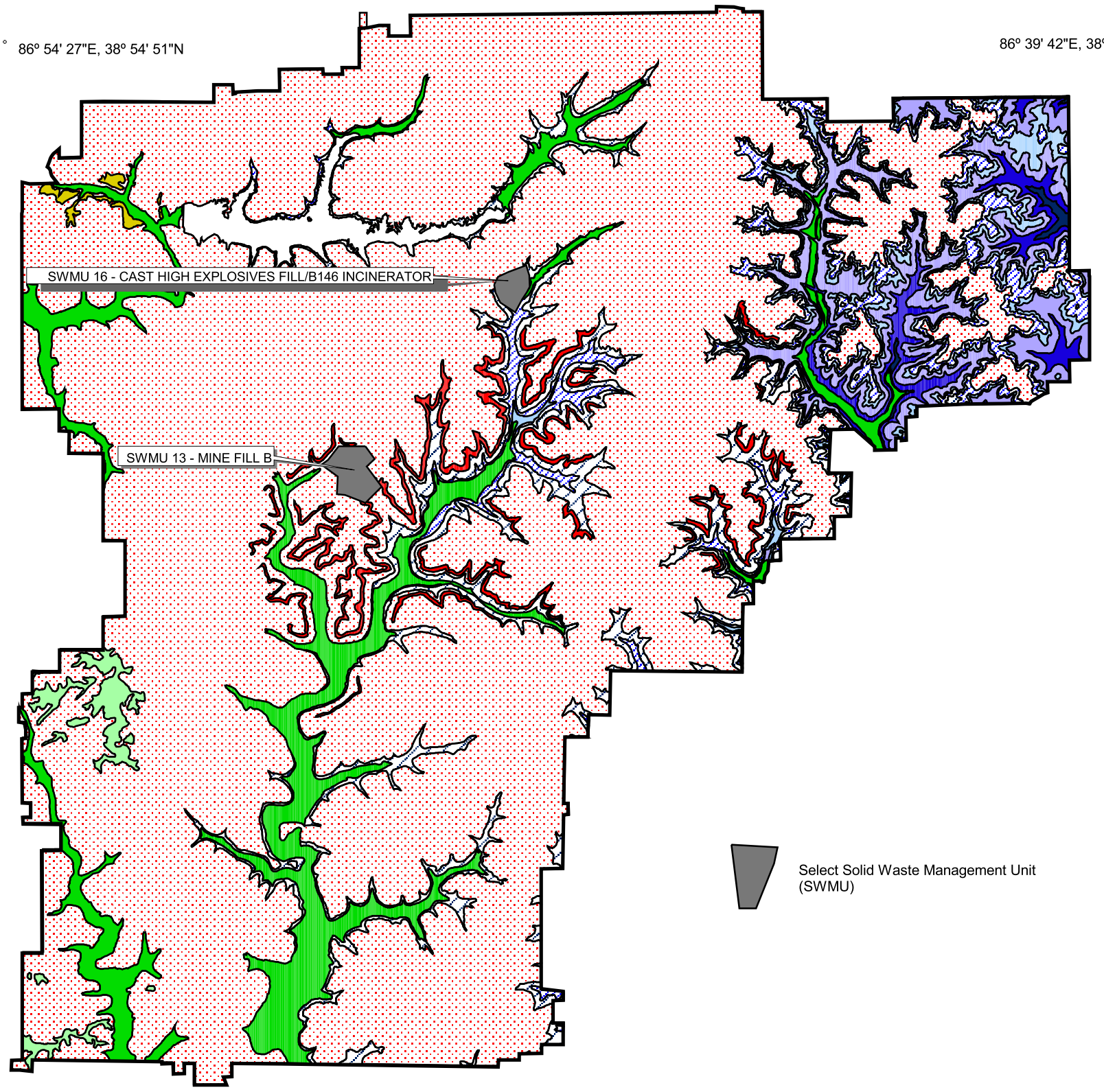
P:\GIS\CRANE_NSWC\MAPDOCS\APR\CRANE_REPORTFIGURES.APR STRATAGRAPHIC COLUMN SWMU16 SDIV 7/6/10 SS

P:\GIS\NSWC_CRANE\APR\SURFICIALGEO.APR SURFICIAL GEOLOGY - SWMU 13 & 16 LAYOUT 07/06/10 SS

N

° 86° 54' 27"E, 38° 54' 51"N

86° 39' 42"E, 38° 54' 49"N °



Select Solid Waste Management Unit (SWMU)

° 86° 54' 29"E, 38° 44' 8"N

° 86° 46' 4"E, 38° 44' 7"N

Inferred Depositional Environment		Explanation of Geology
Alluvium	Qal	*Alluvium*
Loess/Glacial Outwash	Ql	*Loess*
	Qo	*Glacial Outwash*
Residual Soil derived from Pennsylvanian bedrock/colluvium	P	*Raccoon Creek Group and undifferentiated*
	Ps	*Sandstone-dominated horizon of Lower Pennsylvanian*
Residual soil derived from Mississippian bedrock/colluvium	M6	*Glenn Dean Ls, Hardinsburg Fm, Haney Ls, Indian Springs Shale Mbr, and undifferentiated*
	M5	*Sandstone member of the Big Clifty Fm*
	M4	*Beech Creek Ls*
	M3	*Elwren Fm, Reelsville Ls, upper Sample Fm, and undifferentiated*
	M2	*Lower part of Sample Fm, Beaver Bend Ls, Bethel Fm, and undifferentiated*
	M1	*Paoli Ls, Ste Genevieve Ls, and undifferentiated*

Source: Background Soils Report. TtNUS 2001. (Modified from Blunck, 1995).

1.5 0 1.5 Miles

DRAWN BY: A. JANOCHA	DATE: 07/09/03
CHECKED BY: J. LUCAS	DATE: 07/06/10
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

SURFICIAL GEOLOGY MAP

SWMU 13 - MINE FILL B

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER: 00041	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 1-4	REV: 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU16_CROSS_SECTION.MXD 07/07/10 SS

N

16SW/SD14
16SW/SD21
A'
C'
16MW02
16MWT17
16MWT06
16MWT01
16MWT08
16MWT07
16MWT13
16MWT18
16MWT16
A
16SW/SD12
16MWT11
16MWT10
16MW03
16MWT05
B
16SW/SD27
16MW01
16MWT21
16MW04
C
16MWT20
16SW/SD16
16SW/SD25
B'

Legend

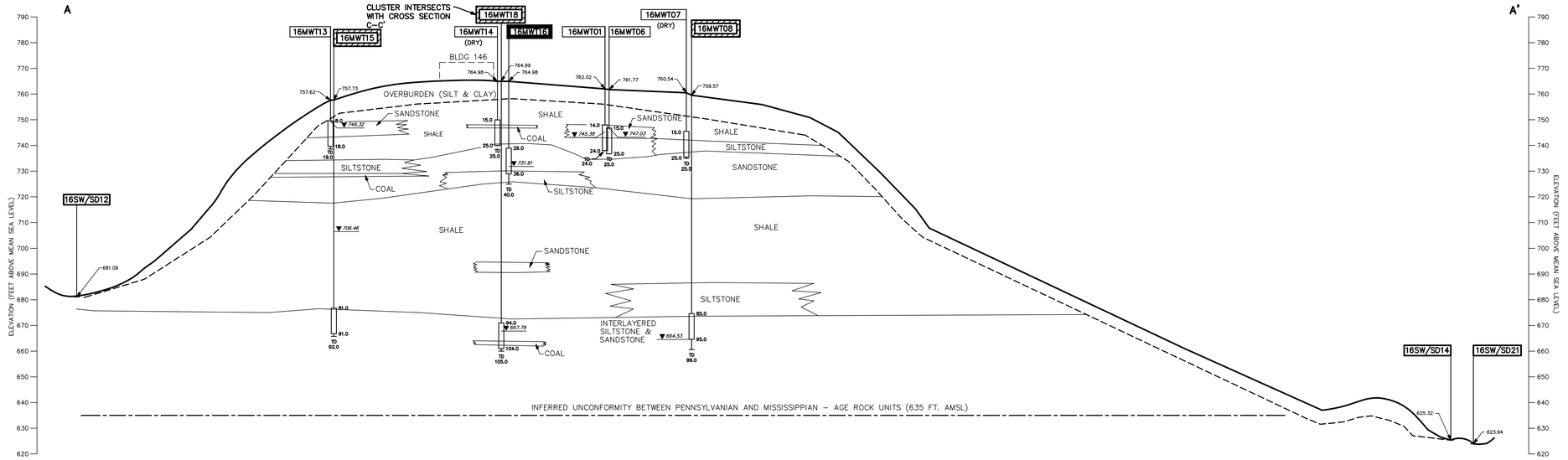
- Surface Water / Sediment Sample Location
- Plz Monitoring Well
- Puz and Pmz Monitoring Well
- Pmz Monitoring Well
- Site Boundary
- Cross Section
- Railroad
- Wall
- Road
- Fence Line
- Tree Line
- Stream
- Building
- Demolished Building

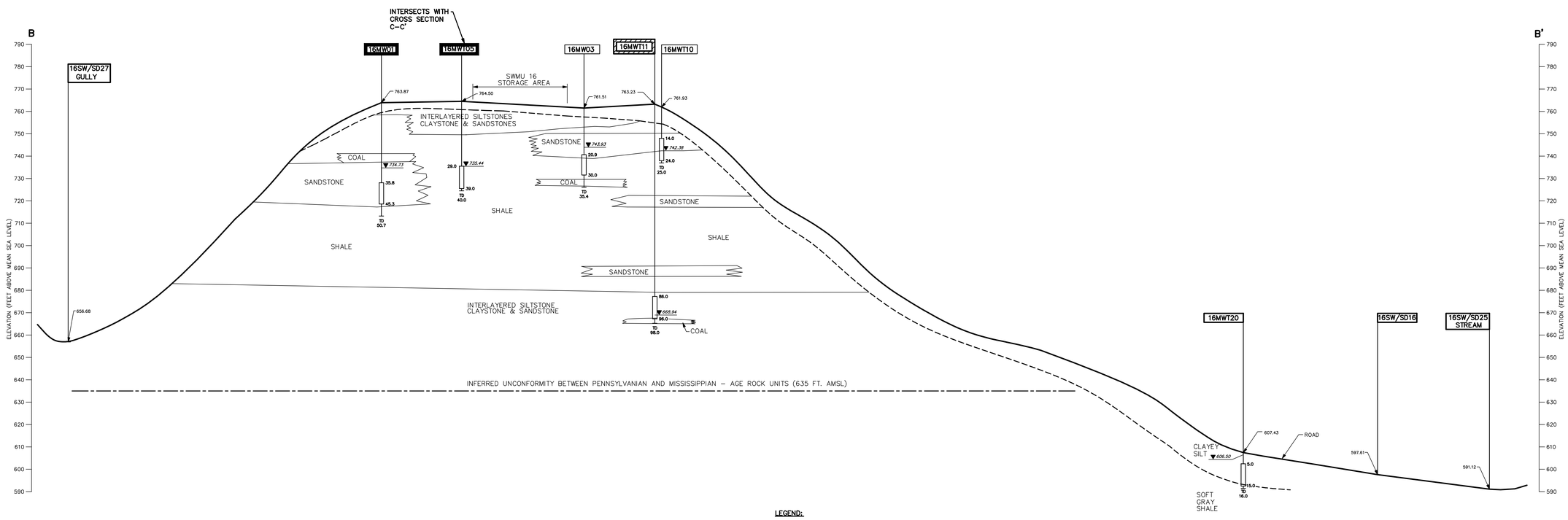
300 0 300
Feet

DRAWN BY S. STROZ	DATE 07/07/10	CONTRACT NUMBER 00041	
CHECKED BY J. LUCAS	DATE 07/07/10	APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___	APPROVED BY ___	DATE ___
SCALE AS NOTED	NAVFAC	FIGURE NO. FIGURE 1-5	REV 0

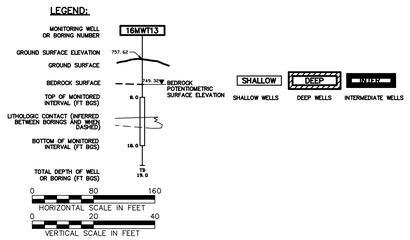
CROSS SECTION MAP
SWMU 16 - HIGH EXPLOSIVES FILL / BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

DRAWING NO. FIGURE 1–6 | REV. 0





LEGEND:



DRAWN BY HJB	DATE 2/9/05
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

NAVFAC

GEOLOGICAL CROSS SECTIONS A–A' AND B–B'
SWMU 16–CAST HIGH EXPLOSIVES
FILL/BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NO. 00041	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 1–6	REV. 0

FORM CADD NO. SSIV-C-STD3VG - REV 0 - 9/4/98

ACAD:7448GX10.dwg 07/01/10 OK PIT

ACAD: 7448GX11.dwg 07/01/10 CK PIT

C

C'

16MW02

16MWT17

16MWT14 (DRY)

16MWT18

16MWT16

CLUSTER INTERSECTS WITH CROSS SECTION A–A'

INTERSECTS WITH CROSS SECTION B–B'

16MWT05

16MW04

16MWT21

BLDG. 146 AREA

763.69

764.79

764.98

764.99

764.98

764.50

760.78

760.42

OVERBURDEN (CLAY AND SILT)

11.4 751.18 SAND STONE 20.4 TD 25.8

14.0 751.18 24.0 TD 24.0

15.0 SHALE 25.0 TD 25.0

COAL

25.0 28.0 731.81 38.0 TD 40.0

SANDSTONE

SILTSTONE

SHALE

29.0 735.44 39.0 TD 40.0

INTERLAYERED SILTSTONE CLAYSTONE AND SANDSTONE

SANDSTONE 734.60 31.4 COAL 40.5 TD 46.0

696.61

SHALE

FINE–GRAINED SANDSTONE 80.0 95.0 TD 97.0

SHALEY SILTSTONE

SANDSTONE

94.0 667.79 104.0 TD 105.0

INTERLAYERED SILTSTONE AND SANDSTONE

COAL

ELEVATION (FEET ABOVE MEAN SEA LEVEL)

790 780 770 760 750 740 730 720 710 700 690 680 670 660 650

LEGEND:

- MONITORING WELL OR BORING NUMBER — 16MWT17
- GROUND SURFACE ELEVATION — 764.79
- GROUND SURFACE
- WATER LEVEL — 751.18
- BEDROCK POTENTIOMETRIC SURFACE ELEVATION
- TOP OF MONITORED INTERVAL (FT BGS) — 14.0
- LITHOLOGIC CONTACT (INFERRED BETWEEN BORINGS AND WHEN DASHED)
- BOTTOM OF MONITORED INTERVAL (FT BGS) — 24.0
- TOTAL DEPTH OF WELL OR BORING (FT BGS) — TD 24.0

PUZ WELLS | PLZ WELLS | PMZ WELLS

0 80 160
HORIZONTAL SCALE IN FEET

0 20 40
VERTICAL SCALE IN FEET

DRAWN BY HJB	DATE 2/10/05
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

NAVFAC

GEOLOGICAL CROSS SECTION C–C'
SWMU 16–CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NO. 00041	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 1–7	REV. 0

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

ACAD: 7448CP13.dwg 07/01/10 CK PIT

LEGEND:

PATHWAY DISCRIPTIONS:

A – CONTAMINANT SOURCE AREAS (OVERBURDEN SOIL AND SUMPS)

B – SHALLOW GROUNDWATER SYSTEM

B1 – GROUNDWATER TAKEN UP BY VEGETATION AND TRANSPIRED

B2 – SEEP INTO GUILLIES AT THE SURFACE AND JOIN SURFACE WATERS

B3 – MIGRATION ALONG BEDROCK/SOIL INTERFACE (1–3" bgs) AND INTO SURFACE FRACTURES

C – DEEP GROUNDWATER

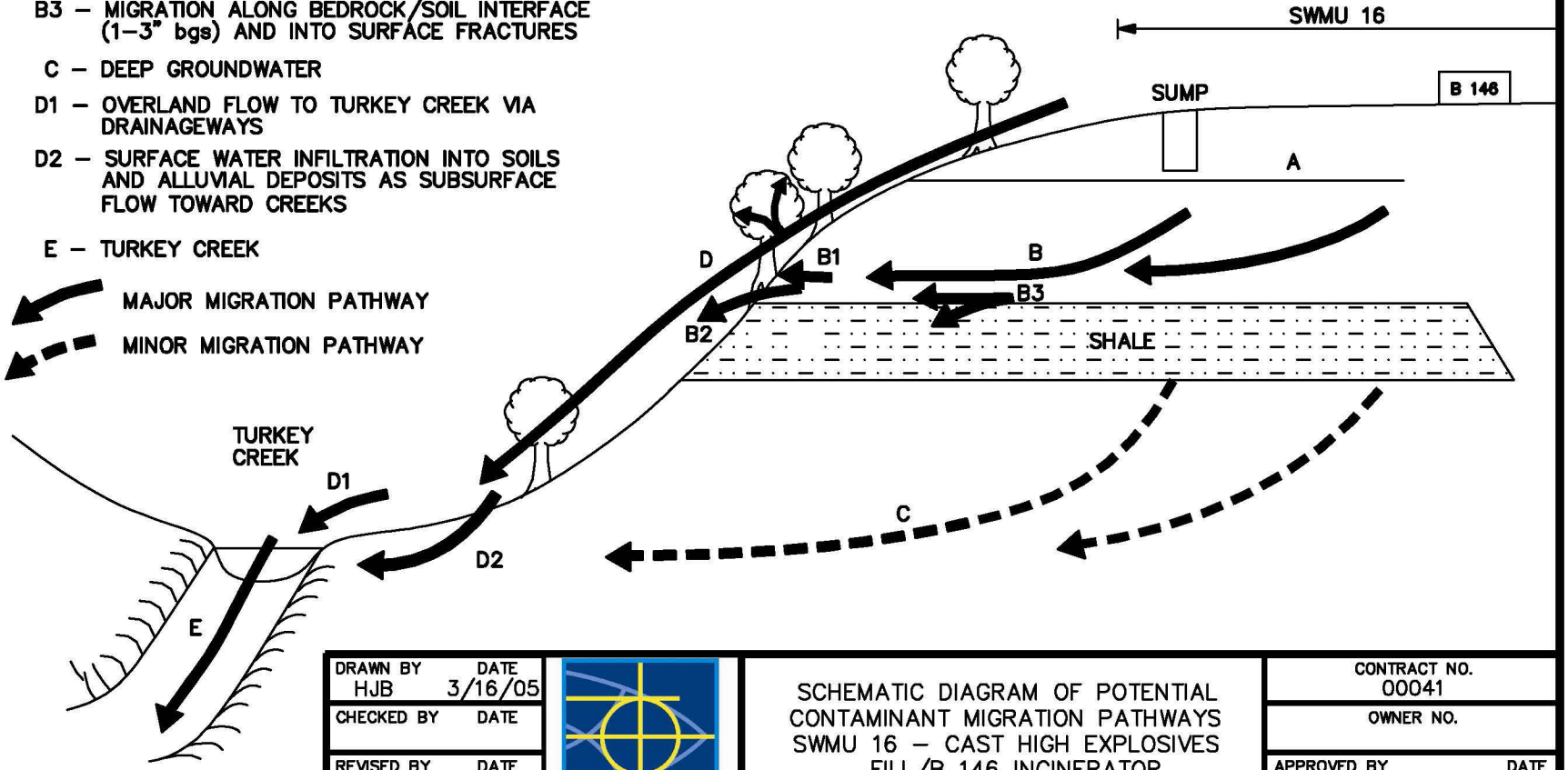
D1 – OVERLAND FLOW TO TURKEY CREEK VIA DRAINAGEWAYS

D2 – SURFACE WATER INFILTRATION INTO SOILS AND ALLUVIAL DEPOSITS AS SUBSURFACE FLOW TOWARD CREEKS

E – TURKEY CREEK

MAJOR MIGRATION PATHWAY

MINOR MIGRATION PATHWAY



DRAWN BY HJB	DATE 3/16/05	NAVFAC	SCHEMATIC DIAGRAM OF POTENTIAL CONTAMINANT MIGRATION PATHWAYS SWMU 16 – CAST HIGH EXPLOSIVES FILL/B 146 INCINERATOR NSA CRANE CRANE, INDIANA
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE NOT TO SCALE			

CONTRACT NO. 00041	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 1–8	REV. 0

FORM CADD NO. SDIV-AH.DWG – REV 1 – 9/10/98

2.0 FIELD INVESTIGATION

This section presents an overview of the long term monitoring program for explosives and VOCs at SWMU 16. The program consisted of nine rounds of groundwater and surface water sampling over a 4 year period (April 2003 through April 2007):

- Round 1 - April 22 through May 11, 2003
- Round 2 - October 26 through December 6, 2003
- Round 3 - August 15 through August 25, 2004
- Round 4 - February 4 through February 6, 2005
- Round 5 - May 6 through May 8, 2005
- Round 6 - August 12 through August 14, 2005
- Round 7 - January 7 through January 22, 2006
- Round 8 - May 4 through May 21, 2006
- Round 9 - April 16 through April 30, 2007

All field activities were conducted in accordance with the procedures and methodologies described in the USEPA-approved Quality Assurance Project Plan (QAPP) Addendum No. 2 to the approved QAPP (Tetra Tech, 2004). Standard operating procedures (SOPs) that governed the field work are included in Appendix C of Addendum No. 2 to the approved QAPP. Field activities were electronically recorded and copies of all field forms, records, daily activities, and health and safety documentation associated with the field investigation for Rounds 1 through 9 are provided in Appendices A through C.

2.1 SAMPLING LOCATIONS

2.1.1 Monitoring Wells

A groundwater sampling program for SWMU 16 was established during the RFI. A total of 26 monitoring wells were installed at SWMU 16 at depths within the Puz, Pmz, and Plz water bearing zones. Of the 26 monitoring wells, 1 well (16MWT14) was installed; however, it was a dry well and was abandoned. Table 2-1 shows a listing of monitoring wells installed during RFI field activities at SWMU 16, along with the total well depth, water bearing zone, and groundwater elevations measured in Rounds 1 through 9.

The MNA groundwater monitoring program is being conducted at 12 select well locations across SWMU 16 (see Figure 2-1). These wells have been established in accordance with USEPA Region 5

MNA guidance (USEPA, 2000). The monitoring wells have a specific role in the monitoring program and represent locations within the plume and source area, leading edges of the plume, and from points located vertically (above and below) and horizontally (upgradient and downgradient) outside the area of groundwater contamination. In Rounds 4 through 9, these locations were being analyzed for explosives and VOCs. The selected wells are distributed as follows in the Puz, Pmz, and Plz Water Bearing Zones:

- One clean, laterally upgradient well (16MW02) in the Puz.
- Three source area wells (16MWT06, 16MWT13, 16MWT17) in the Puz.
- Four wells within the RDX and TCE plumes (16MW03, 16MWT04, 16MWT09, and 16MWT10) in the Puz.
- One well at the leading edge of the plume (16MW04) in the Pmz.
- One laterally downgradient well that is clean (16MWT12) in the Pmz.
- Two clean, deep wells below the plumes (16MWT11, 16MWT15) in the Plz.

2.1.2 Groundwater Level Measurements

Groundwater elevations were collected prior to sampling activities during each round and are summarized in Table 2-1. Measurements were taken with an electrical water level indicator (M-scope), using the top of the riser pipe as the reference point to determine water depth for monitoring wells and using a surveyed mark for staff gauge measurements. All measurements were taken in accordance with the specific SOP contained in the QAPP Addendum No. 2. Water level measurements and staff gauge measurements were recorded to the nearest 0.01 foot on groundwater level measurement forms, which are provided in Appendix A of this report.

2.1.3 Groundwater Purging and Sampling

All MNA groundwater wells were sampled using previously installed, dedicated bladder pumps. Groundwater quality parameters including pH, specific conductance, temperature, dissolved oxygen (DO), and oxidation reduction potential (ORP) were measured during purging at 5- to 10-minute intervals using a multi-parameter water quality meter and flow-through cell. Longer intervals were used for wells with slower pumping rates. Following purging, sample containers were filled by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence. All groundwater samples were analyzed for explosives, VOCs, and well stabilization parameters with occasional analyses for routine indicator MNA parameters, and RDX and TCE degradation by-products. See Figure 2-1 for all groundwater sampling locations in the MNA groundwater sampling program. A listing of all collected groundwater samples for Rounds 1 through 9, including analytical fractions are presented in Table 2-2.

2.1.4 Surface Water Sampling

Surface water samples were collected from four select locations (see Figure 2-2) in support of the MNA program. These locations include 16SW10, 16SW12, 16SW13, and 16SW30 and were analyzed for VOCs, which include degradation by-products, and explosives. The surface water samples were collected in accordance with Addendum No. 2 of the approved QAPP (Tetra Tech, 2004). All pertinent field data, including water quality parameters, sampling methods, and locations were recorded electronically on a surface water sample log sheet (see Appendix A).

A listing of all collected surface water samples for Rounds 1 through 9, which include analytical fractions are presented in Table 2-3.

2.1.5 Quality Control Samples

Quality assurance (QA)/quality control (QC) samples were generated and collected during all rounds of sampling activities to monitor both field and laboratory procedures. QA/QC samples collected in Rounds 1 through 9 included field duplicates, matrix spike/matrix spike duplicates (MS/MSD), and temperature blanks.

2.2 DECONTAMINATION

Any nondedicated, nondisposable equipment involved in field sampling activities was decontaminated before beginning work, during sampling activities, and at the completion of the field activities in accordance with SOP CTO166-16. Field analytical equipment such as pH, conductivity, and temperature probes were rinsed first with analyte-free water then with the sample prior to making measurements. Water level devices were rinsed with deionized (DI) water.

TABLE 2-1

MONITORING WELL CONSTRUCTION INFORMATION AND WATER LEVEL MEASUREMENTS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Well Number	Northing (NAD83)	Easting (NAD83)	Top of Riser Elevation	Total Depth[1]	Water-Bearing Zone	May 5, 2003		May 30, 2003		January 24, 2004		February 4, 2005		May 6, 2005		August 10, 2005		January 5, 2006		May 3, 2006		April 10, 2007	
						Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation
	(feet)	(feet)	(feet amsl)	(feet bgs)		(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)
16MWT01	1321193.49	3032881.29	764.50	24.00	Puz	25.19	739.31	22.70	741.80	19.12	745.38	15.88	748.62	15.55	748.95	14.49	750.01	15.83	748.67	15.59	748.91	15.98	748.52
16MWT02	1321146.42	3032559.16	760.36	18.00	Puz	6.55	753.81	12.18	748.18	10.94	749.42	12.61	747.75	11.68	748.68	13.1	747.26	8.15	752.21	6.83	753.53	9.92	750.44
16MWT03	1320946.97	3032644.29	764.41	35.00	Pmz	27.20	737.21	28.07	736.34	28.34	736.07	28.88	735.53	27.85	736.56	30.08	734.33	29.03	735.38	27.66	736.75	27.45	736.96
16MWT04	1321003.28	3032946.47	766.14	25.00	Puz	8.05	758.09	13.14	753.00	13.11	753.03	14.29	751.85	13.13	753.01	14.49	751.65	10.58	755.56	10.67	755.47	11.45	754.69
16MWT05	1320741.79	3032812.77	766.88	40.00	Pmz	29.77	737.11	30.39	736.49	31.44	735.44	32.11	734.77	31.10	735.78	33.06	733.82	32.63	734.25	30.98	735.90	30.56	736.32
16MWT06	1321199.52	3032883.37	764.44	25.00	Puz	22.33	742.11	15.92	748.52	17.41	747.03	17.79	746.65	16.69	747.75	17.93	746.51	19.40	745.04	17.58	746.86	17.75	746.69
16MWT07	1321176.93	3033001.57	762.87	25.50	Puz	NA	NA	NA	NA	Dry	NA	Dry	NA	Dry	NA	Dry	NA	Dry	NA	Dry	NA	27.11	735.76
16MWT08	1321179.45	3033009.24	761.56	99.00	Plz	NA	NA	NA	NA	97.03	664.53	96.60	664.96	96.16	665.40	95.81	665.75	95.33	666.23	95.05	666.51	94.25	667.31
16MWT09	1321068.49	3033041.44	764.28	25.00	Puz	NA	NA	NA	NA	13.88	750.40	15.25	749.03	13.82	750.46	15.49	748.79	13.52	750.76	13.21	751.07	12.65	751.63
16MWT10	1320936.05	3033074.74	764.43	25.00	Puz	NA	NA	NA	NA	22.05	742.38	22.30	742.13	21.07	743.36	23.4	741.03	21.49	742.94	21.12	743.31	20.25	744.18
16MWT11	1320934.64	3033062.79	765.24	98.00	Plz	NA	NA	NA	NA	96.30	668.94	96.41	668.83	96.10	669.14	95.92	669.32	Water level below pump	NA	95.95	669.29	95.93	669.31
16MWT12	1320729.14	3033074.92	755.45	26.50	Pmz	NA	NA	NA	NA	20.13	735.32	20.94	734.51	19.85	735.60	21.86	733.59	13.52	741.93	19.82	735.63	19.40	736.05
16MWT13	1321125.78	3032562.41	759.57	19.00	Puz	NA	NA	NA	NA	10.25	749.32	11.36	748.21	10.42	749.15	12.08	747.49	21.49	738.08	8.26	751.31	10.01	749.56
16MWT14	abd.	abd.	abd.	25.00	Puz	NA	NA	NA	NA	Dry, abd.	NA	abd.	NA	abd.	NA	abd.	NA	abd.	NA	abd.	NA	abd.	NA
16MWT15	1321120.81	3032563.53	759.69	92.00	Plz	NA	NA	NA	NA	53.23	706.46	54.99	704.70	56.57	703.12	58.95	700.74	59.43	700.26	59.34	700.35	59.68	700.01
16MWT16	1321059.41	3032814.52	764.74	40.00	Pmz	NA	NA	NA	NA	32.93	731.81	34.40	730.34	33.47	731.27	33.33	731.41	33.32	731.42	33.42	731.32	33.47	731.27
16MWT17	1321235.88	3032675.07	766.53	24.00	Puz	NA	NA	NA	NA	15.35	751.18	15.78	750.75	15.38	751.15	15.79	750.74	15.52	751.01	14.65	751.88	14.35	752.18
16MWT18	1321068.96	3032807.84	764.44	105.00	Plz	NA	NA	NA	NA	96.65	667.79	95.75	668.69	95.68	668.76	95.48	668.96	95.39	669.05	95.24	669.20	95.56	668.88
16MWT19	1320172.28	3033846.62	609.31	16.00	Valley deposits	NA	NA	NA	NA	NA	NA	3.25	606.06	3.36	605.95	8.18	601.13	3.11	606.20	3.11	606.20	3.28	606.03
16MWT20	1320532.68	3034030.68	609.93	16.00	Valley deposits	NA	NA	NA	NA	NA	NA	3.66	606.27	3.81	606.12	7.76	602.17	3.58	606.35	3.41	606.52	3.45	606.48
16MWT21	1320581.35	3032960.08	763.05	96.00	Plz	NA	NA	NA	NA	NA	NA	65.46	697.59	64.90	698.15	65.92	697.13	66.07	696.98	64.93	698.12	64.81	698.24
WES-14-01-83 (16MW01)	1320638.35	3032713.38	766.67	50.70	Pmz	31.00	735.67	31.00	735.67	31.94	734.73	32.33	734.34	31.62	735.05	33.07	733.60	3.52	763.15	31.65	735.02	31.44	735.23
WES-14-02-83 (16MW02)	1321319.90	3032647.27	766.54	25.80	Puz	14.23	752.31	14.56	751.98	15.36	751.18	15.94	750.60	15.40	751.14	15.76	750.78	15.50	751.04	14.72	751.82	14.48	752.06
WES-14-03-83 (16MW03)	1320816.00	3033018.50	763.93	35.40	Puz	18.80	745.13	19.83	744.10	20.00	743.93	20.45	743.48	19.44	744.49	20.69	743.24	19.22	744.71	19.14	744.79	18.78	745.15
WES-14-04-83 (16MW04)	1320572.35	3032960.96	762.99	46.00	Pmz	26.80	736.19	27.27	735.72	28.39	734.60	28.70	734.29	27.67	735.32	29.61	733.38	29.27	733.72	25.64	737.35	27.22	735.77
WES-14-05-83 (16MW05)	1320584.05	3032850.32	769.40	50.70	Pmz	32.59	736.81	33.05	736.35	34.18	735.22	34.88	734.52	33.80	735.60	35.72	733.68	35.41	733.99	33.78	735.62	33.35	736.05

TABLE 2-1

MONITORING WELL CONSTRUCTION INFORMATION AND WATER LEVEL MEASUREMENTS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Well Number	Northing (NAD83)	Easting (NAD83)	Top of Riser Elevation	Total Depth[1]	Water-Bearing Zone	May 5, 2003		May 30, 2003		January 24, 2004		February 4, 2005		May 6, 2005		August 10, 2005		January 5, 2006		May 3, 2006		April 10, 2007	
						Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation	Depth to Water	Water Elevation
	(feet)	(feet)	(feet amsl)	(feet bgs)		(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)	(feet btor)	(feet amsl)
STAFF GAUGES																							
16SG01	1321342.91	3032498.83	NA	NA	Puz	NA	NA	NA	NA	NM	NM	Dry	NA	Dry	NA	Dry	NA	Dry	NA	NM	NM	Dry	NA
16SG02	1321121.91	3032465.01	NA	NA	Puz	NA	NA	NA	NA	NM	NM	5.29	729.03	Dry	NA	Dry	NA	4.90	729.42	NM	NM	Dry	NA
16SG03	1320712.52	3032705.12	NA	NA	Puz	NA	NA	NA	NA	NM	NM	5.03	756.76	Dry	NA	Dry	NA	4.96	756.83	NM	NM	Dry	NA
16SG04	1320748.57	3033005.16	NA	NA	Puz	NA	NA	NA	NA	NM	NM	2.15	760.29	Dry	NA	Dry	NA	2.11	760.33	NM	NM	Dry	NA
16SG05	1320889.16	3032979.28	NA	NA	Puz	NA	NA	NA	NA	NM	NM	Dry	NA	Dry	NA	Dry	NA	1.45	761.76	NM	NM	Dry	NA
16SG06	1320930.80	3034364.52	NA	NA	Plz	NA	NA	NA	NA	NM	NM	3.51	600.02	3.67	599.86	Dry	NA	3.21	600.32	NM	NM	3.18	600.35
16SG07	1320765.76	3034582.61	NA	NA	Plz	NA	NA	NA	NA	NM	NM	5.99	595.54	Staff washed away	NA	Staff washed away	NA	6.39	595.14	NM	NM	5.89	595.64
16SG08	1318992.38	3033277.47	NA	NA	Plz	NA	NA	NA	NA	NM	NM	4.16	585.84	4.22	585.78	Dry	NA	4.11	585.89	NM	NM	4.10	585.90
16SG09	1318679.54	3033368.61	NA	NA	Plz	NA	NA	NA	NA	NM	NM	6.34	576.92	Dry	NA	Dry	NA	5.93	577.33	NM	NM	4.20	579.06

Notes:

1 = Total depth of boring; total depth of well may be less.
amsl = Above mean sea level (NAVD88).
abd. = well was grouted shut and abandoned
bgs = Below ground surface.
btor = Below top of riser/reference point.
NA = not applicable
NM = not measured
NAD83 = North American Datum of 1983
Puz = Pennsylvanian Upper water-bearing zone
Pmz = Pennsylvanian Middle water-bearing zone
Plz = Pennsylvanian Lower water-bearing zone

TABLE 2-2

SUMMARY OF GROUNDWATER SAMPLES AND LABORATORY ANALYSIS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Sample Number	Volatiles	Explosives		Miscellaneous		
	SW-846 8260B	Nitroaromatics and Nitramines SW-846 8330	RDX Degradation Products SW-846 8330, Modified	Nitrate + Nitrite (as N) EPA 353.2	Sulfate and Chloride	Methane, Ethane, Ethene
Ground Water (Round 1)						
16GW0201	X	X	X	X	X	X
16GW0202						
16GW0301	X	X	X	X	X	X
16GW0401	X	X	X	X	X	X
16GWT0401	X	X	X	X	X	X
16GWT0601	X	X	X	X	X	X
16GWT0601	X	X	X	X	X	X
Ground Water (Round 2)						
16GW0203	X	X	X	X	X	X
16GW0302	X	X	X	X	X	X
16GW0402	X	X	X	X	X	X
16GWT0402	X	X	X	X	X	X
16GWT0603	X	X	X	X	X	X
16GWT0901	X	X	X	X	X	X
16GWT1001	X	X	X	X	X	X
16GWT1101	X	X	X	O	O	O
16GWT1201	X	X	X	X	X	X
16GWT1301	X	X	X	X	X	X
16GWT1501	X	X	X	X	X	X
16GWT1701	X	X	X	X	X	X
Ground Water (Round 3)						
16GW0204	X	X	O	O	O	O
16GW0303	X	X	O	O	O	O
16GW0403	X	X	O	O	O	O
16GWT0403	X	X	O	O	O	O
16GWT0503	X	X	O	O	O	O
16GWT0604	X	X	O	O	O	O
16GWT0902	X	X	O	O	O	O
16GWT1002	X	X	O	O	O	O
16GWT1102	X	X	O	O	O	O
16GWT1202	X	X	O	O	O	O
16GWT1302	X	X	O	O	O	O
16GWT1502	X	X	O	O	O	O
16GWT1702	X	X	O	O	O	O
Groundwater (Round 4)						
16GW0204	X	X	X	X	X	X
16GW0304	X	X	X	X	X	X
16GW0404	X	X	X	X	X	X
16GWT0404	X	X	X	X	X	X
16GWT0605	X	X	X	X	X	X
16GWT0903	X	X	X	X	X	X
16GWT1003	X	X	X	X	X	X
16GWT1103	X	X	X	X	X	X
16GWT1203	X	X	X	X	X	X
16GWT1303	X	X	X	X	X	X
16GWT1503	X	X	X	X	X	X
16GWT1703	X	X	X	X	X	X

TABLE 2-2

SUMMARY OF GROUNDWATER SAMPLES AND LABORATORY ANALYSIS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Sample Number	Volatiles	Explosives		Miscellaneous		
	SW-846 8260B	Nitroaromatics and Nitramines SW-846 8330	RDX Degradation Products SW-846 8330, Modified	Nitrate + Nitrite (as N) EPA 353.2	Sulfate and Chloride	Methane, Ethane, Ethene
Groundwater (Round 5)						
16GW0205	X	X	O	O	O	O
16GW0305	X	X	O	O	O	O
16GW0405	X	X	O	O	O	O
16GWT0405	X	X	O	O	O	O
16GWT0606	X	X	O	O	O	O
16GWT0904	X	X	O	O	O	O
16GWT1004	X	X	O	O	O	O
16GWT1104	X	X	O	O	O	O
16GWT1204	X	X	O	O	O	O
16GWT1304	X	X	O	O	O	O
16GWT1504	X	X	O	O	O	O
16GWT1704	X	X	O	O	O	O
Groundwater (Round 6)						
16GW0206	X	X	X	X	X	X
16GW0306	X	X	X	X	X	X
16GW0406	X	X	X	X	X	X
16GWT0406	X	X	X	X	X	X
16GWT0607	X	X	X	X	X	X
16GWT0905	X	X	X	X	X	X
16GWT1005	X	X	X	X	X	X
16GWT1105	X	X	X	X	X	X
16GWT1205	X	X	X	X	X	X
16GWT1305	X	X	X	X	X	X
16GWT1505	X	X	X	X	X	X
16GWT1705	X	X	X	X	X	X
Groundwater (Round 7)						
16GW0207	X	X	O	O	O	O
16GW0307	X	X	O	O	O	O
16GW0407	X	X	O	O	O	O
16GWT0407	X	X	O	O	O	O
16GWT0608	X	X	O	O	O	O
16GWT0906	X	X	O	O	O	O
16GWT1006	X	X	O	O	O	O
16GWT1106	X	X	O	O	O	O
16GWT1206	X	X	O	O	O	O
16GWT1306	X	X	O	O	O	O
16GWT1506	X	X	O	O	O	O
16GWT1706	X	X	O	O	O	O
Groundwater (Round 8)						
16GW0209	X	X	O	X	X	O
16GW0308	X	X	O	X	X	O
16GW0408	X	X	O	X	X	O
16GWT0408	X	X	O	X	X	O
16GWT0609	X	X	O	X	X	O
16GWT0907	X	X	O	X	X	O
16GWT1007	X	X	O	X	X	O
16GWT1107	X	X	O	X	X	O
16GWT1207	X	X	O	X	X	O
16GWT1307	X	X	O	X	X	O
16GWT1507	X	X	O	X	X	O
16GWT1707	X	X	O	X	X	O

TABLE 2-2

SUMMARY OF GROUNDWATER SAMPLES AND LABORATORY ANALYSIS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Sample Number	Volatiles	Explosives		Miscellaneous		
	SW-846 8260B	Nitroaromatics and Nitramines SW-846 8330	RDX Degradation Products SW-846 8330, Modified	Nitrate + Nitrite (as N) EPA 353.2	Sulfate and Chloride	Methane, Ethane, Ethene
Groundwater (Round 9)						
16GW0210	X	X	O	O	O	O
16GW0309	X	X	O	O	O	O
16GW0409	X	X	O	O	O	O
16GWT0409	X	X	O	O	O	O
16GWT0610	X	X	O	O	O	O
16GWT0908	X	X	O	O	O	O
16GWT1008	X	X	O	O	O	O
16GWT1108	X	X	O	O	O	O
16GWT1208	X	X	O	O	O	O
16GWT1308	X	X	O	O	O	O
16GWT1508	X	X	O	O	O	O
16GWT1708	X	X	O	O	O	O

X = Analyzed.
O = Omitted or not analyzed

TABLE 2-3

SUMMARY OF SURFACE WATER SAMPLES AND LABORATORY ANALYSIS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Sample Number	Volatiles	Explosives		Miscellaneous	
	SW-846 8260B	Nitroaromatics and Nitramines SW-846 8330	RDX Degradation Products SW-846 8330, Modified	Nitrate + Nitrite (as N) EPA 353.2	cis-1,2-dichloroethene, vinyl chloride
Surface Water (Round 1)					
No Samples Collected at Surface MNA Locations					
Surface Water (Round 2)					
16SW1201	X	X	X	X	X
16SW1301	X	X	X	X	X
Surface Water (Round 3)					
16SW1001	O	O	O	O	O
16SW1202	X	X	O	X	X
16SW1302	X	X	O	X	X
16SW3001	X	X	O	O	X
Surface Water (Round 4)					
16SW1002	X	X	O	O	X
16SW1203	X	X	O	O	X
16SW1303	X	X	O	O	X
16SW3002	X	X	O	O	X
Surface Water (Round 5)					
16SW1003	X	X	O	O	X
16SW1204	X	X	O	O	X
16SW1304	X	X	O	O	X
16SW3003	X	X	O	O	X
Surface Water (Round 6)					
16SW1004	O	O	O	O	O
16SW1205	O	O	O	O	O
16SW1305	O	O	O	O	O
16SW3004	O	O	O	O	O
Surface Water (Round 7)					
16SW1004	X	X	O	O	X
16SW1205	X	X	O	O	X
16SW1305	X	X	O	O	X
16SW3004	X	X	O	O	X
Surface Water (Round 8)					
16SW1006	X	X	O	O	X
16SW1207	X	X	O	O	X
16SW1307	X	X	O	O	X
16SW3006	X	X	O	O	X

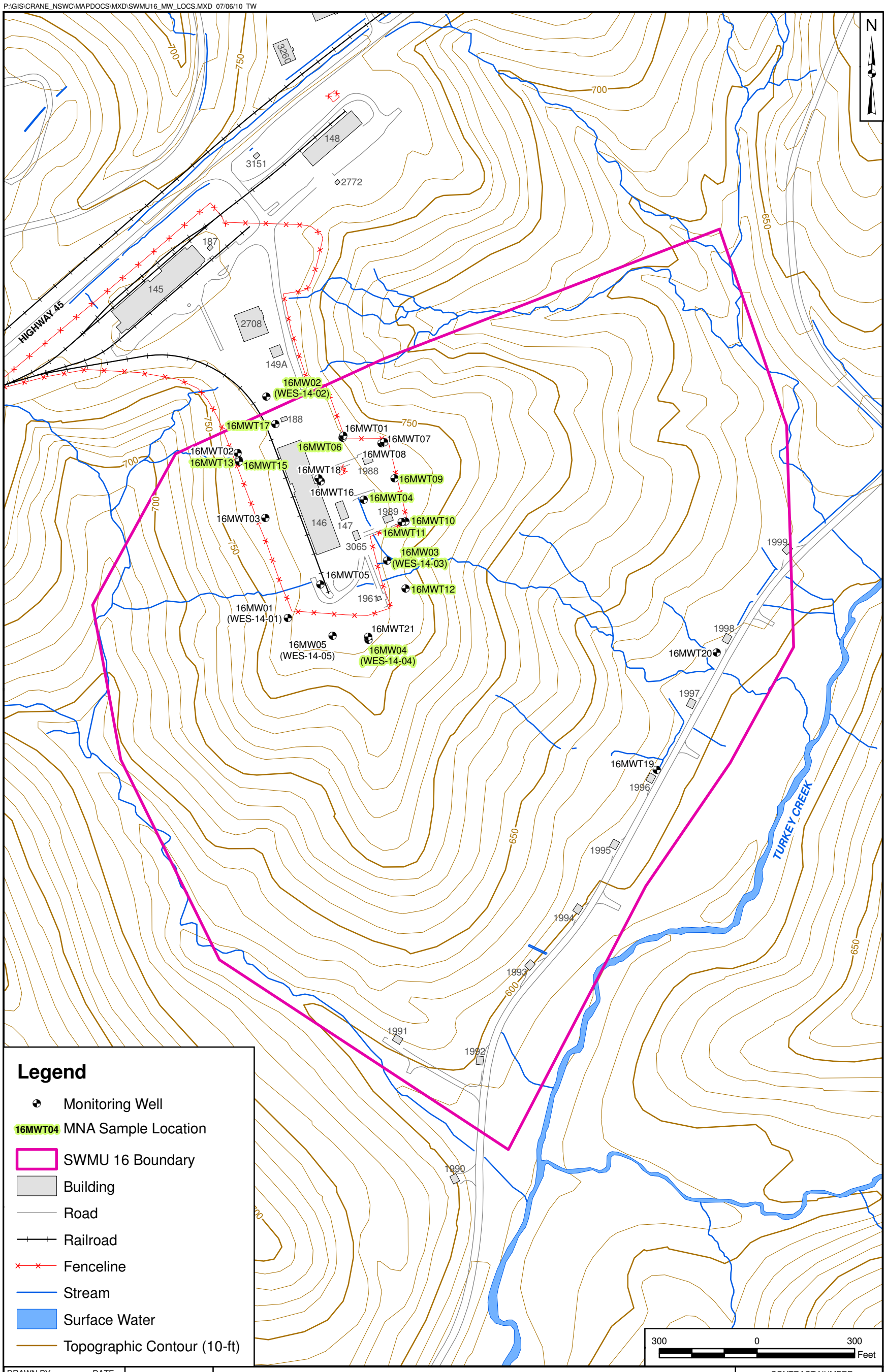
TABLE 2-3

SUMMARY OF SURFACE WATER SAMPLES AND LABORATORY ANALYSIS
SWMU 16 - CAST HIGH EXPLOSIVES FILL/B146 INCINERATOR
ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

Sample Number	Volatiles	Explosives		Miscellaneous	
	SW-846 8260B	Nitroaromatics and Nitramines SW-846 8330	RDX Degradation Products SW-846 8330, Modified	Nitrate + Nitrite (as N) EPA 353.2	cis-1,2-dichloroethene, vinyl chloride
Surface Water (Round 9)					
16SW1007	X	X	O	O	X
16SW1208	X	X	O	O	X
16SW1308	X	X	O	O	X
16SW3007	X	X	O	O	X

X = Analyzed.
O = Omitted or not analyzed

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU16_MW_LOCS.MXD 07/06/10 TW



Legend

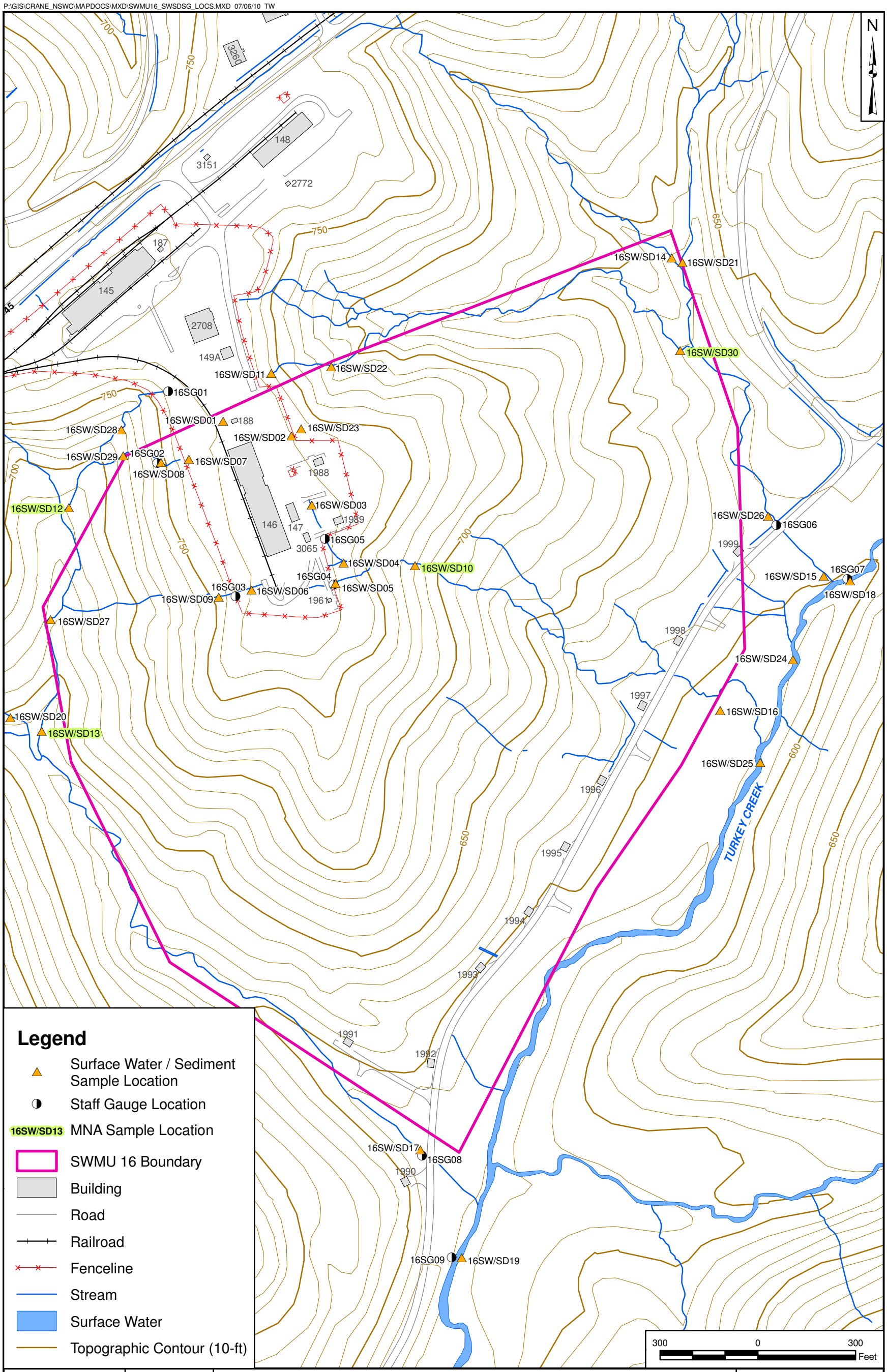
- Monitoring Well
- 16MWT04 MNA Sample Location
- SWMU 16 Boundary
- Building
- Road
- Railroad
- Fenceline
- Stream
- Surface Water
- Topographic Contour (10-ft)

DRAWN BY / DATE	T. WHEATON 07/06/10
CHECKED BY / DATE	J. LUCAS 07/06/10
REVISED BY / DATE	___ ___
SCALE	AS NOTED

MONITORING WELL LOCATIONS
SWMU 16 - CAST EXPLOSIVES FILL/
BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	00041
APPROVED BY / DATE	___ ___
APPROVED BY / DATE	___ ___
FIGURE NO.	FIGURE 2-1
REV	0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU16_SWSDSG_LOCS.MXD 07/06/10 TW



Legend

- Surface Water / Sediment Sample Location
- Staff Gauge Location
- 16SW/SD13 MNA Sample Location
- SWMU 16 Boundary
- Building
- Road
- Railroad
- Fenceline
- Stream
- Surface Water
- Topographic Contour (10-ft)

DRAWN BY	DATE
T. WHEATON	07/06/10
CHECKED BY	DATE
J. LUCAS	07/06/10
REVISED BY	DATE
___	___
SCALE	
AS NOTED	

NAVFAC

SURVEYED SURFACE WATER, SEDIMENT,
AND STAFF GAUGE LOCATIONS
SWMU 16 - CAST EXPLOSIVES FILL/
BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	
00041	
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
FIGURE 2-2	0

3.0 DATA PRESENTATION

This section presents data collected in Rounds 1 through 9 at SWMU 16. The data presented includes analytical results for groundwater and surface water, and field parameters. Groundwater elevation data given in Table 2-1 for Round 9 is also presented as potentiometic surface maps to indicate groundwater movement in the Puz, Pmz, and Plz Water Bearing Zones. The complete set of analytical results for all rounds of sampling is presented in Appendix D. The potentiometric surface maps for Rounds 2 through 8 are given in Appendix E.

As stated previously in Section 1.2.2, the RFI identified excess risk as a result of explosives (RDX) and VOCs (TCE). RDX was the most frequently detected explosive in groundwater. TCE was most frequently detected in subsurface soil and groundwater. As a result, RDX and TCE are considered as the primary compounds for evaluating the effectiveness of explosive and chlorinated compounds natural attenuation at SWMU 16. In the case of RDX, it is presumed to degrade to hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX), hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX), and Hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX). TCE is presumed to degrade to 1,2-cis-dichloroethene, vinyl chloride, ethane, and ethene. As a result, the presentation and interpretation of analytical results in Sections 3 and 4 of this report will focus on RDX and TCE, and their associated degradation products.

3.1 GROUNDWATER DATA

As indicated in Section 2.1.1, each well has a specific role in the monitoring program based on spatial locations within the plume source area, within the center and leading edges of the plume, and from points located vertically (above and below) and horizontally (upgradient and downgradient) outside the area of groundwater contamination. The 18 MNA monitoring wells locations for SWMU 16 are shown on Figure 1-5.

3.1.1 Pennsylvanian Upper Water Bearing Zone (Puz)

Eight wells are located in the Puz water bearing zone. The spatial location of each Puz well is indicated below:

- One, clean laterally upgradient well (16MW02)
- Three source area wells (16MWT06, 16MWT13, 16MWT17)
- Four wells within the RDX and TCE plumes (16MW03, 16MWT04, 16MWT09, and 16MWT10)

Table 3-1 shows the groundwater analytical results for the Puz wells for Rounds 1 through 9. The table shows summary listings by sampling round of explosives, VOCs, and degradation by-product concentrations, and field and miscellaneous parameters. Concentrations are presented in micrograms per liter (µg/L) along with data validation qualifiers, as applicable.

3.1.2 Pennsylvanian Middle Water Bearing Zone (Pmz)

There are two wells located in the Pmz water bearing zone. The spatial location of each well is indicated below:

- One well at the leading edge of the plume (16MW04)
- One laterally downgradient well that is clean (16MWT12)

Table 3-2 shows the groundwater analytical results for the Pmz wells for Rounds 1 through 9. The table shows summary listings by sampling round of explosives, VOCs, and degradation by-product concentrations, and miscellaneous field parameters. Concentrations are presented in µg/L along with data validation qualifiers, as applicable.

3.1.3 Pennsylvanian Lower Water Bearing Zone (Plz)

There are two clean wells (16MWT11, 16MWT15) in the Plz wells to monitor if contamination is migrating to the lower water bearing zone. Table 3-3 shows analytical results in micrograms per liter (µg/L) by sampling round for explosives, VOCs, degradation products, and miscellaneous field parameters, along with data validation qualifiers, as applicable.

3.2 SURFACE WATER DATA

Surface water samples were collected at four select locations at SWMU16 during Rounds 1 through 9 (see Figure 2-2). These locations included 16SW10, 16SW12, 16SW13, and 16SW30. All samples were analyzed for explosives, VOCs, TCE degradation by-products, and miscellaneous field parameters.

Table 3-4 shows the surface water analytical results and miscellaneous field parameters for Rounds 1 through 9 at the four locations. Concentrations are presented in µg/L along with data validation qualifiers, as applicable.

3.3 POTENTIOMETRIC SURFACES

The Round 9 potentiometric surface maps for the Puz, Pmz, and Plz water-bearing zones are shown on Figures 3-1, 3-2, 3-3, respectively, and are based on groundwater measurements presented in Table 2-1. The potentiometric contours for Rounds 2 through 8 are presented in Appendix E.

In Round 9, Puz groundwater elevations ranged from 744.18 feet above above msl at 16MWT10 to 754.69 feet above msl at 16MWT04. These measurements are very similar to results obtained in Round 8 for wells 16MWT04 and 16MWT10. For the first time, water measurements were obtained from 16MWT07 in Round 9. This well was installed in November 2003. Because this well has been dry since it was initially sampled in Round 3, it was originally assumed that the Puz was absent in this area.

The Puz groundwater flow directions shown on Figure 3-1 remained essentially the same in Round 9 in comparison to previous rounds. The groundwater to the west of the SWMU 16 centerline flows to the west, ultimately discharging into gullies that drain surface water and groundwater westward toward a tributary of Turkey Creek. The availability of a water level measurement at 16MWT07 in Round 9 confirmed that groundwater flow on the eastern side of SWMU16 in the Puz is flowing east towards gullies on the eastern side of the site. Shallow groundwater is also present in the east-central portion of the site and flows in a southeasterly direction toward gullies on the southeastern side of the site that convey water eastward and southeastward toward Turkey Creek.

In Round 9, Pmz groundwater elevations ranged from 731.27 feet above msl at well 16MWT16 to 736.96 feet above msl at well 16MWT03. In comparison, the maximum Pmz groundwater elevation in Round 8 was reported at 16MW04, which is approximately 500 feet southeast of 16MWT03. As indicated on Figure 3-2, the groundwater in the Pmz flows in a radial pattern from the ridge to the west, south, and east.

As indicated on Figure 3-3, the Plz groundwater flow direction on the eastern side of the site continues to flow towards the northeast. The elevations ranged from 667.31 feet asml at 16MWT08 to 700.01 feet above msl at well 16MWT15. Monitoring wells 16MWT15 and 16MWT21 were not used in developing the potentiometric surface map for the Plz because the potentiometric elevations were approximately 32 feet higher than the average water level measured in the other three wells screened in the Plz. This may indicate that these wells are in an area of increased vertical fracturing and enhanced leakage from the overlying intermediate flow zone.

TABLE 3-1

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER ROUNDS 1 THROUGH 9 PENNSYLVANIAN UPPER WATER BEARING ZONE NSWC CRANE CRANE, INDIANA

LOCATION		16MW02									16MW03								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		04/24/2003	10/26/2003	08/25/2004	02/04/2005	05/06/2005	08/14/2005	01/08/2006	05/04/2006	04/26/2007	05/11/2003	11/08/2003	08/24/2004	02/05/2005	05/06/2005	08/13/2005	01/07/2006	05/06/2006	04/30/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L	0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
1,3-DINITROBENZENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 U	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.48 U									0.5 U							
2,4,6-TRINITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
2,4-DIAMINO-6-NITROTOLUENE			0.24 U		0.278 U		0.26 U					0.25 U		0.258 U		0.25 U			
2,4-DINITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
2,6-DIAMINO-4-NITROTOLUENE			0.24 U		0.278 U		0.26 U					0.25 U		0.258 U		0.25 U			
2,6-DINITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
2-AMINO-4,6-DINITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.48 J	0.62 J	0.89	0.52 J	0.45 J	0.41 J	0.52 J	0.25 U	0.38 J
2-NITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
3,5-DINITROANILINE			0.24 U		0.278 U		0.26 U					0.25 U		0.258 U		0.25 U			
3-NITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
4,4'-TN-AZOXY					0.555 U		0.52 U							0.515 U		0.5 U			
4-AMINO-2,6-DINITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.86 J	1.1	1 J	0.91	0.76	0.72	0.94	0.84	0.24 U
4-NITROTOLUENE		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	0.45 U	0.25 UJ	0.242 U	0.258 U	0.271 U	0.25 U	0.27 U	0.25 U	0.24 U
RDX		0.195 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	52	71	50	55	51	51	57	51	41
DNX			0.24 U		0.278 U		0.26 U					0.25 U		0.258 U		0.25 U			
MNX			0.24 U		0.278 U		0.26 U					0.82		0.36 J		0.32 J			
HMX		0.21 U	0.24 U	0.27 U	0.278 U	0.26 U	0.26 U	0.27 U	0.25 U	0.24 U	5.7	7.5	6.1	5.7	5	5.4	6.2 J	5.9	3.9
TNX			0.24 U		0.278 U		0.26 U					0.25 U		0.258 U		0.25 U			
VOLATILES																			
TRICHLOROETHENE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U		1 U	0.3 U	0.33 J	5.6	5	4.3	5	4.5	4.8	5.2	5.7	3.8
CIS-1,2-DICHLOROETHENE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U		1 U	0.3 U	0.3 U	0.4 J	0.5 J	0.6 J	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
ETHANE			0.062		0.078		0.093		0.074					0.005 U		0.016 J		0.017 J	
ETHENE			0.018		0.005 U		0.007 J		0.039					0.026		0.052		0.051	
METHANE			15		72		75		96					0.87		0.42		2.8	
VINYL CHLORIDE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U		1 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C	11.8	15.27	17.24	13.04	15.84	16.63	11.53			14.17	13.62	18.66	14.69	14.85	17.14	9.76		
ALKALINITY	MG/L		300									10 U							
CARBON DIOXIDE			105									130							
DISSOLVED OXYGEN			0.2	0.12	4.68			1.47				1	0.1	13.83			1.21		
DISSOLVED OXYGEN - METER		0.64	6.3			1.53	0.95				1.63	0.74			0.81	1.5			
HYDROGEN SULFIDE (H2S)			0									0							
IRON(+2)			3.3 >									0.54							
MANGANESE(+2)			1.5									2.1							
NITRITE-N			0.003									0.007							
SULFIDE			0									0.01							
SPECIFIC CONDUCTANCE	MS/CM	0.568	1.75	0.502	0.479	0.446	402	0.707			0.483	0.355	0.43	0.323	0.359	339	0.472		
OXIDATION REDUCTION POTENTIAL	MV	7.1	-0.8	124	28.2	641	527.4	3			154.2	350	438.1	266	335.8	566.9	322		
TURBIDITY	NTU	2.2	0.8	0	1.1	0.2	0	8			2.8	1.06	15.5	7.9	8.7	8.4	4.1		
PH	S.U.	6.65	6.54	5.75	6.59	5.2	5.91	6.82			5.84	4.82	5.28	5	5.13	5	5		
MISCELLANEOUS PARAMETERS																			
AMMONIA-N	MG/L	0.04									0.02								
CHLORIDE			14		25 J		22		18			5		5 J		4		3.8	
NITRITE/NITRATE-N		0.02 U	0.05 U		0.45		0.025 U		0.025 U		0.54	0.7		0.75		0.36		0.59	
SULFATE			270		8700		59		55			170		150		200		250	
TOTAL ORGANIC CARBON			1.7				1.1									1.2			

TABLE 3-1

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER ROUNDS 1 THROUGH 9 PENNSYLVANIAN UPPER WATER BEARING ZONE NSWC CRANE CRANE, INDIANA

LOCATION		16MWT04									16MWT06								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		04/22/2003	11/08/2003	08/15/2004	02/05/2005	05/07/2005	08/13/2005	01/21/2006	05/08/2006	04/16/2007	04/28/2003	11/08/2003	08/24/2004	02/05/2005	05/07/2005	08/12/2005	01/08/2006	05/08/2006	04/26/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L	0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	1.8	2	3.4	1.9	2.3	7.4	9.6 J
1,3-DINITROBENZENE		0.55 U	0.255 U	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 U	0.25 U	0.24 U	0.264 UJ	0.28 U	0.25 U	0.25 U	0.24 UJ
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.51 U									0.5 U							
2,4,6-TRINITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	4.8	6.2	12	4.1	6.1	21	33 J
2,4-DIAMINO-6-NITROTOLUENE			0.255 U		0.25 U		0.28 U					0.27 J		0.31 J		1.3			
2,4-DINITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	0.8	1.2	1 J	0.68	1.1	3.3	4.6 J
2,6-DIAMINO-4-NITROTOLUENE			0.255 U		0.25 U		0.28 U					0.25 U		0.24 U		0.28 U			
2,6-DINITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	0.25 U	0.92 J	1.3 J	0.52 J	0.25 U	2.3 J	2.5 J
2-AMINO-4,6-DINITROTOLUENE		0.55 U	0.47 J	0.27 U	0.3 J	0.269 U	0.34 J	0.26 U	0.25 U	0.24 U	0.34 U	4.2 J	29 J	34	60 J	28 J	38	130 J	150 J
2-NITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	0.25 U	0.24 U	0.264 UJ	0.28 U	0.25 U	0.25 U	0.24 UJ
3,5-DINITROANILINE			0.255 U		0.25 U		0.28 U					0.25 U		0.24 U		0.28 U			
3-NITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	0.25 U	0.24 U	0.264 UJ	0.28 U	0.47 J	1.25 U	2.9 J
4,4'-TN-AZOXY					0.5 U		0.55 U							0.48 U		0.56 U			
4-AMINO-2,6-DINITROTOLUENE		0.55 U	1 J	0.56	0.75	0.44 J	0.75	0.38 J	0.25 U	0.51	0.34 U	1.5	14	18	31	13	15	43	70 J
4-NITROTOLUENE		0.55 U	0.255 UJ	0.27 U	0.25 U	0.269 U	0.28 U	0.26 U	0.25 U	0.24 U	0.34 U	0.25 UJ	0.25 U	0.24 U	0.264 UJ	0.28 U	0.25 U	0.25 U	0.24 UJ
RDX		77	200	70	68	59	130	120	130	140	4	1.8	8.8	7.3	11	13	4.6	18	18 J
DNX			0.63 J		0.25 U		0.28 U					0.25 U		0.24 U		0.28 U			
MNX			4.1		1.2		2.5					0.25 U		0.24 U		0.33 J			
HMX		7.8	21	8.6	8.2	6.4	8.8	7.1	8	6.4	0.34 U	0.27 J	0.93 J	0.72 J	0.64 J	1.6	1 J	2.5	2.8 J
TNX			0.255 U		0.25 U		0.28 U					0.25 U		0.24 U		0.28 U			
VOLATILES																			
TRICHLOROETHENE		2.2	3.9	2.1	5	2.4	3.7	1.8	1.4	0.87 J	35000	250000	330000	440000	510000	480000	370000	150000	740000
CIS-1,2-DICHLOROETHENE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	600	4200	4100	5200	5600	4600	4800	3100	10000
ETHANE			0.013		0.0088 J		0.004 J		0.005 J			7.7		2.3		1.5		1	
ETHENE			0.027		0.014 J		0.016 J		0.015 J			65		29		22		22	
METHANE			0.93		9.2 J		0.25		1.9 J			280		440		260		190	
VINYL CHLORIDE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	65 J	340 J	390 J	660	610	350 J	450	360	1100
FIELD PARAMETERS																			
TEMPERATURE	C	12.41	15.73	19.45	15.09	15.93	19.6	13.34			15	14.55	18.77	15.57	17.46	20.27	14.26		
ALKALINITY	MG/L		75									200							
CARBON DIOXIDE			19									40							
DISSOLVED OXYGEN			2	1.81	7.25			4.32				1.5	0.39	2.64			1.33		
DISSOLVED OXYGEN - METER		5.41	0.89			0.39	2.02				0.48	1.67			2.69	3.06			
HYDROGEN SULFIDE (H2S)			0									0							
IRON(+2)			5.19									0.03							
MANGANESE(+2)			1									3.8							
NITRITE-N			0.004									0.016							
SULFIDE			0									0.07							
SPECIFIC CONDUCTANCE	MS/CM	0.225	0.582	0.232	0.18	0.16	0.168	0.209			0.516	1.216	1.219	0.889	0.762	862	1.6		
OXIDATION REDUCTION POTENTIAL	MV	79.7	152	54	231	286.3	168	175			-106	188.6	402	14.5	497	729	151		
TURBIDITY	NTU	9.2	2.2	5.13	2.3	7.8	0.7	2.9			8.8	1.99	29	17.9	15	5.2	29		
PH	S.U.	6.28	5.84	5.6	5.5	6.32	6.1	6.57			7.7	6.49	4.69	5.96	6	6	6.26		
MISCELLANEOUS PARAMETERS																			
AMMONIA-N	MG/L	0.03									0.57								
CHLORIDE			10		11 J		7		4.1			47		54 J		58			
NITRITE/NITRATE-N		0.6	0.49		0.88		0.025 U		0.34		0.5	0.025 U		0.025 U		0.025 U			
SULFATE			70		32		24		23			520		480		490			
TOTAL ORGANIC CARBON			1.4				2.6									4.1			

TABLE 3-1

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER ROUNDS 1 THROUGH 9 PENNSYLVANIAN UPPER WATER BEARING ZONE NSWC CRANE CRANE, INDIANA

LOCATION		16MWT09									16MWT10								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		No Sample	11/22/2003	08/17/2004	02/06/2005	05/07/2005	08/14/2005	01/07/2006	05/04/2006	04/24/2007	No Sample	11/21/2003	08/17/2004	02/06/2005	05/07/2005	08/13/2005	01/09/2006	05/05/2006	04/24/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L		0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
1,3-DINITROBENZENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.543 U									0.575 U							
2,4,6-TRINITROTOLUENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
2,4-DIAMINO-6-NITROTOLUENE			0.272 U		0.24 U		0.26 U					0.287 U		0.255 U		0.27 U			
2,4-DINITROTOLUENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
2,6-DIAMINO-4-NITROTOLUENE			0.272 U		0.24 U		0.26 U					0.287 U		0.255 U		0.27 U			
2,6-DINITROTOLUENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
2-AMINO-4,6-DINITROTOLUENE			0.31 J	0.27 U	0.26 J	0.269 U	0.27 J	0.25 J	0.25 U	0.4 J		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
2-NITROTOLUENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
3,5-DINITROANILINE			0.272 UJ		0.24 U		0.26 U					0.287 U		0.255 U		0.27 U			
3-NITROTOLUENE			0.272 U	1.5 J	1.8 J	0.269 U	1.1 J	1.5 J	1.2 J	0.24 UJ		0.287 U	2.1 J	1.8 J	0.248 U	0.34 J	0.24 U	0.25 U	0.24 UJ
4,4'-TN-AZOXY					0.48 U		0.52 U							0.51 U		0.54 U			
4-AMINO-2,6-DINITROTOLUENE			0.69 J	0.27 U	0.61 J	0.269 U	0.68	0.63	1.1	0.24 UJ		0.287 U	0.27 U	0.42 J	0.248 U	0.47 J	0.5 J	0.25 U	0.24 UJ
4-NITROTOLUENE			0.272 U	0.27 U	0.24 U	0.269 U	0.26 U	0.25 U	0.25 U	0.24 UJ		0.287 U	0.27 U	0.255 U	0.248 U	0.27 U	0.24 U	0.25 U	0.24 UJ
RDX			110	79	92	98	100	110	100	85 J		55	55	50	51	58	52	47	53 J
DNX			0.272 U		0.24 U		0.26 U					0.287 U		0.255 U		0.27 U			
MNX			1.1		0.43 J		0.46 J					0.5 J		0.3 J		0.27 U			
HMX			11	8.1	9.3	9.3	11	12 J	9.9	8.3 J		6.7	5.2	5.1	4.8	5.8	5.3 J	4.5	5 J
TNX			0.272 U		0.24 U		0.26 U					0.287 U		0.255 U		0.27 U			
VOLATILES																			
TRICHLOROETHENE			7.6	7.1	10	6.9	9.1	8.7	6.3	4.9		1.9	1.9	2.4	1.6	1.4	2	1.5	1.4
CIS-1,2-DICHLOROETHENE			0.2 J	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U		0.2 J	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
ETHANE					0.074		0.044		0.038			0.33		0.082		0.054		0.058	
ETHENE					0.081		0.079		0.06			0.16		0.03		0.036		0.11	
METHANE					1.9		0.64		9.4			19		1		0.62		4.5	
VINYL CHLORIDE			0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C		16.56	19.68	12.18	14.1	17.77	12.4				14.77	16.75	14.1	15.88	17.85	12.8		
ALKALINITY	MG/L											10 U							
CARBON DIOXIDE												280							
DISSOLVED OXYGEN				0.37	1.41			1.31				0.35	0.14	7.14			1.83		
DISSOLVED OXYGEN - METER			2.33			1.51	1.09					1.28			1.1	220			
HYDROGEN SULFIDE (H2S)												0							
IRON(+2)												3.3 >							
MANGANESE(+2)												22 >							
NITRITE-N												0.002							
SULFIDE												0.02							
SPECIFIC CONDUCTANCE	MS/CM		0.502	0.937	0.456	0.432	522	0.655				1.178	1.284	1.168	0.867	854	1.63		
OXIDATION REDUCTION POTENTIAL	MV		329.8	199.7	169.4	525	664.8	232				328.9	501.2	315.2	337	890.5	315		
TURBIDITY	NTU		4.82	2.32	0	1	0	0.95				5.56	6.31	4.3	7.4	6.9	6.5		
PH	S.U.		4.1	4.7	4.82	5	4.11	4.61				3.72	3.21	3.31	3.59	3	3.57		
MISCELLANEOUS PARAMETERS																			
AMMONIA-N	MG/L																		
CHLORIDE			14 U		13 J		12		8.8			8 J		9 J		7		6.9	
NITRITE/NITRATE-N			0.05 U		0.56		0.025 U		0.51			0.27 J		0.72		0.27		0.43	
SULFATE			210 U		290		240		190			980 J		1100		880		690	
TOTAL ORGANIC CARBON							1									1.7			

TABLE 3-1

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER
ROUNDS 1 THROUGH 9
PENNSYLVANIAN UPPER WATER BEARING ZONE
NSWC CRANE
CRANE, INDIANA

LOCATION		16MWT13									16MWT17								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		No Sample	11/22/2003	08/18/2004	02/05/2005	05/08/2005	08/14/2005	01/22/2006	05/05/2006	04/17/2007	No Sample	12/05/2003	08/25/2004	02/05/2005	05/07/2005	08/14/2005	01/22/2006	05/08/2006	04/17/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L		0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
1,3-DINITROBENZENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.549 U									0.538 U							
2,4,6-TRINITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
2,4-DIAMINO-6-NITROTOLUENE			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
2,4-DINITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
2,6-DIAMINO-4-NITROTOLUENE			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
2,6-DINITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
2-AMINO-4,6-DINITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
2-NITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
3,5-DINITROANILINE			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
3-NITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.33 J		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
4,4'-TN-AZOXY					0.528 U		0.59 U							0.48 U		0.53 U			
4-AMINO-2,6-DINITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
4-NITROTOLUENE			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.269 U	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.24 U
RDX			6.7	1.1	0.264 U	0.298 U	0.29 U	0.42 J	0.25 U	0.24 U		4.3	5.2	4.9	4.9	4.5	4.5	5.8	5.5
DNX			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
MNX			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
HMX			0.275 U	0.271 U	0.264 U	0.298 U	0.29 U	0.25 U	0.25 U	0.24 U		0.43 J	0.27 U	0.24 U	0.281 U	0.27 U	0.26 U	0.28 U	0.35 J
TNX			0.275 U		0.264 U		0.29 U					0.269 U		0.24 U		0.27 U			
VOLATILES																			
TRICHLOROETHENE			62000	28000	1900	2200	130	5100	160	470		11000	19000	18000	19000	19000	22000	25000	24000 J
CIS-1,2-DICHLOROETHENE			280	140	8.2	12	1.5	20	1.5	3.8		210	290	310	260	290	340	260	300
ETHANE			0.45		0.065		0.03		0.07					0.6		0.74		0.45	
ETHENE			0.67		0.035		0.1		0.11					0.17		0.2		0.1	
METHANE			0.032		84		170		190					75		95		88	
VINYL CHLORIDE			30 U	0.8 J	0.3 U	0.3 U	0.3 U	0.6 U	0.3 U	0.3 U		2.1	60 U	3.8	6 U	3 U	3 U	30 U	2.1 J
FIELD PARAMETERS																			
TEMPERATURE	C		21.88	18.44	13.12	16.23	21.63	12.04				11.63	18.56	13.97	13.78	18.29	11.48		
ALKALINITY	MG/L		10 U																
CARBON DIOXIDE			140																
DISSOLVED OXYGEN			6	0.08	3.22			0.52					0.18	0.89			0.66		
DISSOLVED OXYGEN - METER			7.27			0	0.41					0.63			-17.04	20.43			
HYDROGEN SULFIDE (H2S)			0																
IRON(+2)			3.3 >																
MANGANESE(+2)			4.1																
NITRITE-N			0.008																
SULFIDE			0.02																
SPECIFIC CONDUCTANCE	MS/CM		0.433	0.42	0.299	0.232	0.234	0.326				0.649	0.786	0.595	0.474	0.658	1.24		
OXIDATION REDUCTION POTENTIAL	MV		264.8	541	12	100.1	108.3	110				111.5	274.3	100.9	173.2	92.3	108		
TURBIDITY	NTU		8.67	105	380	30	5.8	0				5.92	9.1	3.27	4.6	2.5	7.4		
PH	S.U.		4.72	5.42	5.99	5.18	6.82	5.82				5.58	4.59	5.17	5.4	6.31	5.24		
MISCELLANEOUS PARAMETERS																			
AMMONIA-N	MG/L																		
CHLORIDE			17 U		21 J		23		21			120		110 J		120		110	
NITRITE/NITRATE-N			0.19 J		0.025 U		0.025 U		0.025 U			0.05 UJ		0.025 U		0.025 U		0.025 U	
SULFATE			180 U		50		37		44			150		190		260		120	
TOTAL ORGANIC CARBON							1.3									1.7			

A blank cell indicates that no sample was collected or analysis was conducted for the parameter.
U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.
UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.
J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.
> - Indicates that the true value is probably greater than the reported value. This "qualifier flag" is used to identify reported values that exceed the calibration range of field measurements but could not be re-analyzed for various reasons.
UG/L - micrograms per liter
C - degrees centigrade
MG/L - milligrams per liter
MS/CM - millisiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units

TABLE 3-2

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER ROUNDS 1 THROUGH9 PENNSYLVANIAN MIDDLE WATER BEARING ZONE NSWC CRANE CRANE, INDIANA

LOCATION		16MW04									16MWT12								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		04/23/2003	10/26/2003	08/25/2004	02/06/2005	05/06/2005	08/13/2005	01/07/2006	05/06/2006	04/25/2007	No Sample	1/21/2003	8/24/2004	2/6/2005	5/7/2005	8/13/2005	1/7/2006	5/6/2006	4/28/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L	0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
1,3-DINITROBENZENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.5 U									0.538 U							
2,4,6-TRINITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
2,4-DIAMINO-6-NITROTOLUENE			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
2,4-DINITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
2,6-DIAMINO-4-NITROTOLUENE			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
2,6-DINITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
2-AMINO-4,6-DINITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
2-NITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
3,5-DINITROANILINE			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
3-NITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
4,4'-TN-AZOXY					0.528 U		0.5 U							0.52 U		0.51 U			
4-AMINO-2,6-DINITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
4-NITROTOLUENE		0.165 U	0.25 U	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.24 UJ		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
RDX		1.7	1.9	0.66	0.58	0.59	0.64	0.85	0.25 U	0.59 J		0.269 U	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.24 U
DNX			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
HMX		0.39	0.45 J	0.264 U	0.264 U	0.269 U	0.25 U	0.24 U	0.25 U	0.38 J		1.3 J	0.264 U	0.26 U	0.266 U	0.26 U	0.25 U	0.25 U	0.25 J
MNX			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
TNX			0.25 U		0.264 U		0.25 U					0.269 U		0.26 U		0.26 U			
VOLATILES																			
TRICHLOROETHENE	UG/L	0.5 J	0.3 U	0.7 J	1.4	0.7 J	0.9 J	1 U	1 J	1.2		0.3 U	0.3 U	0.5 J	0.3 U	0.3 U	1 U	0.3 U	0.3 U
CIS-1,2-DICHLOROETHENE		0.3 J	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
ETHANE					0.005 U		0.01 J		0.015 J			0.37 J		0.17		0.13		0.15	
ETHENE					0.005 U		0.018 J		0.048			0.031 J		0.12		0.028		0.066	
METHANE					1.1		0.34		2.3			11		1.6		0.88		2.9	
VINYL CHLORIDE		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	1 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C	13.31	13.21	15.03	12.87	14.13	15.79	11.82				16.04	17.81	12.28	16.46	16.75	12.41		
DISSOLVED OXYGEN	MG/L				5.79			0.55											
DISSOLVED OXYGEN - METER		0.29	0.54			1.57	2.01					0.64			-1.57	0.36			
SPECIFIC CONDUCTANCE	MS/CM	0.72	0.735	0.838	0.672	0.738	0.703	1.29											
OXIDATION REDUCTION POTENTIAL	MV	207.4	328.7	124	319	274.3	340	277				306.8	220.7	134.6	230.2	155.9	191		
TURBIDITY	NTU	0.5	0.13	8.9	0.05	0.49	0.5	0.4				4.11	7.63	1.7	1.7	0	2.2		
PH	S.U.	3.68	3.65	4.1	4.5	4.06	3.33	3.92				4.27	4.64	4.89	4.65	6.68	4.88		
MISCELLANEOUS PARAMETERS																			
AMMONIA-N	MG/L	0.08																	
CHLORIDE			12		15 J		14		13			15 U		15 J		13		12	
NITRITE/NITRATE-N		0.02 U	0.05 U		0.025 U		0.025 U		0.025 U			0.025 U		0.025 U		0.025 U		0.025 U	
SULFATE			430		660		650		560			260 J		1300		980		1100	
TOTAL ORGANIC CARBON							1									1			

A blank cell indicates that no sample was collected or analysis was conducted for the parameter.

U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.

UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.

J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.

UG/L - micrograms per liter
C - degrees centigrade
MG/L - milligrams per liter
MS/CM - millisiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units

TABLE 3-3

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARAMETERS FOR SWMU 16 GROUNDWATER
ROUNDS 1 THROUGH 9
PENNSYLVANIAN LOWER WATER BEARING ZONE
NSWC CRANE
CRANE, INDIANA

LOCATION		16MWT11									16MWT15								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		No Sample	12/06/2003	08/25/2004	02/04/2005	05/06/2005	08/12/2005	01/22/2006	05/21/2006	04/28/2007	No Sample	12/06/2003	08/17/2004	02/05/2005	05/07/2005	08/14/2005	01/21/2006	05/08/2006	04/17/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L		0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
1,3-DINITROBENZENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.495 UJ									0.495 U							
2,4,6-TRINITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
2,4-DIAMINO-6-NITROTOLUENE			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
2,4-DINITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
2,6-DIAMINO-4-NITROTOLUENE			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
2,6-DINITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
2-AMINO-4,6-DINITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
2-NITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
3,5-DINITROANILINE			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
3-NITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
4,4'-TN-AZOXY					0.632 U		0.59 U							0.532 U		0.52 U			
4-AMINO-2,6-DINITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
4-NITROTOLUENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
RDX			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
DNX			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
MNX			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
TNX			0.248 UJ		0.316 U		0.29 U					0.248 U		0.266 U		0.26 U			
HMX			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.32 J		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
NITROBENZENE			0.248 UJ	0.242 U	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
TETRYL			0.248 UJ	0.242 UJ	0.316 U	0.266 U	0.29 U	0.26 U	0.25 UJ	0.24 UJ		0.248 U	0.26 U	0.266 U	0.271 U	0.26 U	0.25 U	0.25 U	0.24 U
VOLATILES																			
TRICHLOROETHENE			0.3 U	0.3 U	0.3 U	52 U	0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.6 J	0.3 U	0.3 U	0.3 U	1.4	0.3 U
CIS-1,2-DICHLOROETHENE			0.3 U	0.3 U	0.3 U	30 U	0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
ETHANE					0.34		0.44		1.2			1		2.5		0.99		1.8	
ETHENE					0.075		0.074		0.06			0.22		0.26		0.41		0.14	
METHANE					540		1700		5100			4500		9400		5400		9200	
VINYL CHLORIDE			0.3 U	0.3 U	0.3 U	30 U	0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C		7.29	24.93	11.82							12.78	15.85	13.89	16.87	19.23	13.73		
ALKALINITY	MG/L											250							
CARBON DIOXIDE												10 U							
DISSOLVED OXYGEN				0.87	9.72							3.5	1.77	1.36			0.6		
DISSOLVED OXYGEN - METER			4.51									2.57			-0.04	1.09			
HYDROGEN SULFIDE (H2S)												0							
IRON(+2)												0							
MANGANESE(+2)												0.3							
NITRITE-N												0.007							
SULFIDE												0.01							
SPECIFIC CONDUCTANCE	MS/CM		0.256	1.004	0.756							0.392	0.411	0.354	0.301	0.326	0.439		
OXIDATION REDUCTION POTENTIAL	MV		188	95	-43.9							174.1	143.1	-21.7	238.4	61	103		
TURBIDITY	NTU		650	4.7	2.8							22.5	2	0.6	0	0.65	4.6		
PH	S.U.		7.35	5.47	6.98							7.99	6.15	7.43	7.06	6.95	7.52		
MISCELLANEOUS PARAMETERS																			
CHLORIDE	MG/L				5		5		4.3			4		3 J		2		2.1	
NITRITE/NITRATE-N					0.025 U		0.025 U		0.15			0.05 UJ		0.025 U		0.025 U		0.025 U	
SULFATE					4		4		2.6			8		0.5 U		0.5 U		0.5 U	
TOTAL ORGANIC CARBON							1 U					2.6				1 U			

A blank cell indicates that no sample was collected or analysis was conducted for the parameter.
U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.
UJ – Indicates that the chemical was not detected; however, the detection limit (sample-specific detection limit) is considered to be estimated based on problems encountered during laboratory analysis. The associated numerical detection limit is regarded as inaccurate or imprecise.
J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.
UG/L - micrograms per liter
C - degrees centigrade
MG/L - milligrams per liter
MS/CM - millisiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units

TABLE 3-4

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARMETERS IN SURFACE WATER AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

LOCATION		16SW/SD10									16SW/SD12								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		No Sample	No Sample	11/11/2004	02/03/2005	05/08/2005	No Sample	01/05/2006	05/03/2006	05/01/2007	No Sample	10/25/2003	11/02/2004	02/03/2005	05/08/2005	No Sample	01/05/2006	05/04/2006	05/01/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L				0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
1,3-DINITROBENZENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE												0.5 U							
2,4,6-TRINITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
2,4-DIAMINO-6-NITROTOLUENE												0.25 U							
2,4-DINITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
2,6-DIAMINO-4-NITROTOLUENE												0.25 U							
2,6-DINITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
2-AMINO-4,6-DINITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
2-NITROTOLUENE					0.242 U	0.6		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
3,5-DINITROANILINE												0.25 U							
3-NITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
4-AMINO-2,6-DINITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
4-NITROTOLUENE					0.242 U	0.25 U		0.24 U	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
RDX					0.242 U	0.25 U		0.77	0.25 U	0.25 U		0.25 U	0.255 U	0.24 U	0.25 U		0.248 U	0.25 U	0.28 U
DNX												0.25 U							
MNX												0.25 U							
TNX												0.25 U							
VOLATILES																			
TRICHLOROETHENE					0.3 U	0.3 U		0.3 U	0.3 U	0.3 U		15	5.6	20	6.7		11	8.7	8.5
CIS-1,2-DICHLOROETHENE					0.3 U	0.3 U		0.3 U	0.3 U	0.3 U		1.4	0.3 U	1.3	0.3 U		0.3 U	0.6 J	0.63 J
VINYL CHLORIDE					0.3 U	0.3 U		0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C			10.74	5.44	13.71		5.93	22.4			13.24	16.24	5.95	13.92		6.05	19.3	
DISSOLVED OXYGEN	MG/L			6.02	8.95			8.78	9.14				9.38	10.07			9.65	9.53	
DISSOLVED OXYGEN - METER						10.04						6			10.49				
SPECIFIC CONDUCTANCE	MS/CM			0.066	0.126	0.135		0.182	0.25			0.204	0.1	0.164	0.164		0.239	0.217	
OXIDATION REDUCTION POTENTIAL	MV			120	218	213		180	-9999			195.4	51.4	218	211		182	-9999	
TURBIDITY	NTU			46.7	6.9	1.5		11	0			4.06	38.4	3	3.5		2.2	11	
PH	S.U.			7.26	3.65	6.96		7.28	5.28			7.21	7.16	3.75	6.76		7.29	6.62	
MISCELLANEOUS PARAMETERS																			
NITRITE/NITRATE-N	MG/L											0.11	0.43						

A blank cell indicates that no sample was collected or analysis was conducted for the parameter.
U – Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted. Non-detected results from the laboratory are reported in this manner. This qualifier is also added to a positive result (reported by the laboratory) if the detected concentration is determined to be attributable to contamination introduced during field sampling or laboratory analysis.
J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.
UG/L - micrograms per liter
C - degrees centigrade
MG/L - milligrams per liter
MS/CM - millisiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units
-9999 : Data not available

TABLE 3-4

SUMMARY OF CHEMICALS DETECTED, FIELD PARAMETERS, AND MISCELLANEOUS PARMETERS IN SURFACE WATER AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

LOCATION		16SW/SD13									16SW/SD30								
ROUND		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
DATE		No Sample	10/25/2003	11/02/2004	02/03/2005	05/08/2005	No Sample	01/05/2006	05/04/2006	05/01/2007	No Sample	No Sample	10/26/2004	02/03/2005	05/08/2005	No Sample	01/05/2006	05/04/2006	05/01/2007
EXPLOSIVES	**UNITS**																		
1,3,5-TRINITROBENZENE	UG/L		0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
1,3-DINITROBENZENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
2,2',6,6'-TETRANITRO-4,4'-AZOXYTOLUENE			0.5 U																
2,4,6-TRINITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
2,4-DIAMINO-6-NITROTOLUENE			0.25 U																
2,4-DINITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
2,6-DIAMINO-4-NITROTOLUENE			0.25 U																
2,6-DINITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
2-AMINO-4,6-DINITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.29 J	0.245 U	0.39 J		0.28 J	0.25 U	0.26 U
2-NITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
3,5-DINITROANILINE			0.25 U																
3-NITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
4-AMINO-2,6-DINITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.63	0.44 J	0.76		0.55	0.94	0.26 U
4-NITROTOLUENE			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			0.24 U	0.245 U	0.25 U		0.266 U	0.25 U	0.26 U
RDX			0.25 U	0.25 U	0.24 U	0.245 U		0.242 U	0.25 U	0.27 U			24	14	13		19	18	0.26 U
DNX			0.25 U																
MNX			0.25 U																
TNX			0.25 U																
VOLATILES																			
TRICHLOROETHENE			0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U			0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U
CIS-1,2-DICHLOROETHENE			0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U			0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U
VINYL CHLORIDE			0.3 U	0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U			0.3 U	0.3 U	0.3 U		0.3 U	0.3 U	0.3 U
FIELD PARAMETERS																			
TEMPERATURE	C		13.68	16.03	5.25	12.66		5.46	18.7				13.28	3.12	14.56		5.45		
DISSOLVED OXYGEN	MG/L			9.18	10.93			9.67	10.27				8.9	11.15			9.92		
DISSOLVED OXYGEN - METER			2.94			8.45									10.44				
SPECIFIC CONDUCTANCE	MS/CM		0.168	0.84	0.175	0.166		0.247	0.254				0.159	0.14	0.133		0.22		
OXIDATION REDUCTION POTENTIAL	MV		68.3	49.4	203	203		175	-9999				53.6	188	207		162		
TURBIDITY	NTU		15.9	22.8	2.2	3.3		4.8	15				9.49	3.1	9		8.4		
PH	S.U.		6.4	7.64	3.83	6.48		7.45	6.57				7.37	4.16	7.07		7.44		
MISCELLANEOUS PARAMETERS																			
NITRITE/NITRATE-N	MG/L		0.27	0.55															

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J – Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually present in the sample. The laboratory reported concentration is considered to be an estimate of the true concentration.
UG/L - micrograms per liter
C - degrees centigrade
MG/L - milligrams per liter
MS/CM - millisiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units
-9999 : Data not available

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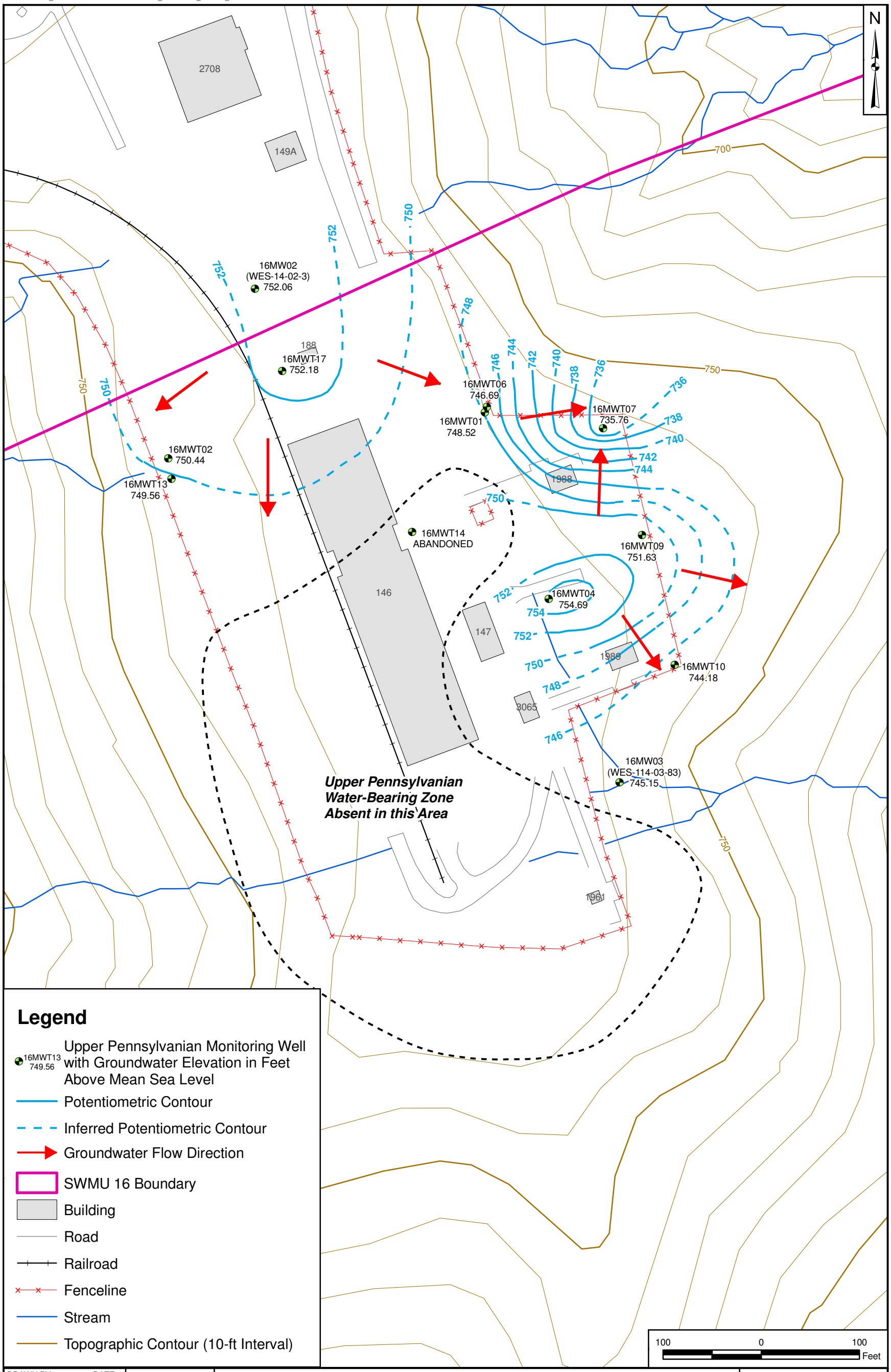

DRAWN BY T. WHEATON	DATE 07/06/10	POTENTIOMETRIC SURFACE MAP FOR THE PENNSYLVANIAN UPPER WATER-BEARING ZONE - APRIL 10, 2007 ROUND 9 SWMU 16 - CAST EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSA CRANE CRANE, INDIANA	CONTRACT NUMBER 00041
CHECKED BY J. LUCAS	DATE 07/06/10		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 3-1 REV 0

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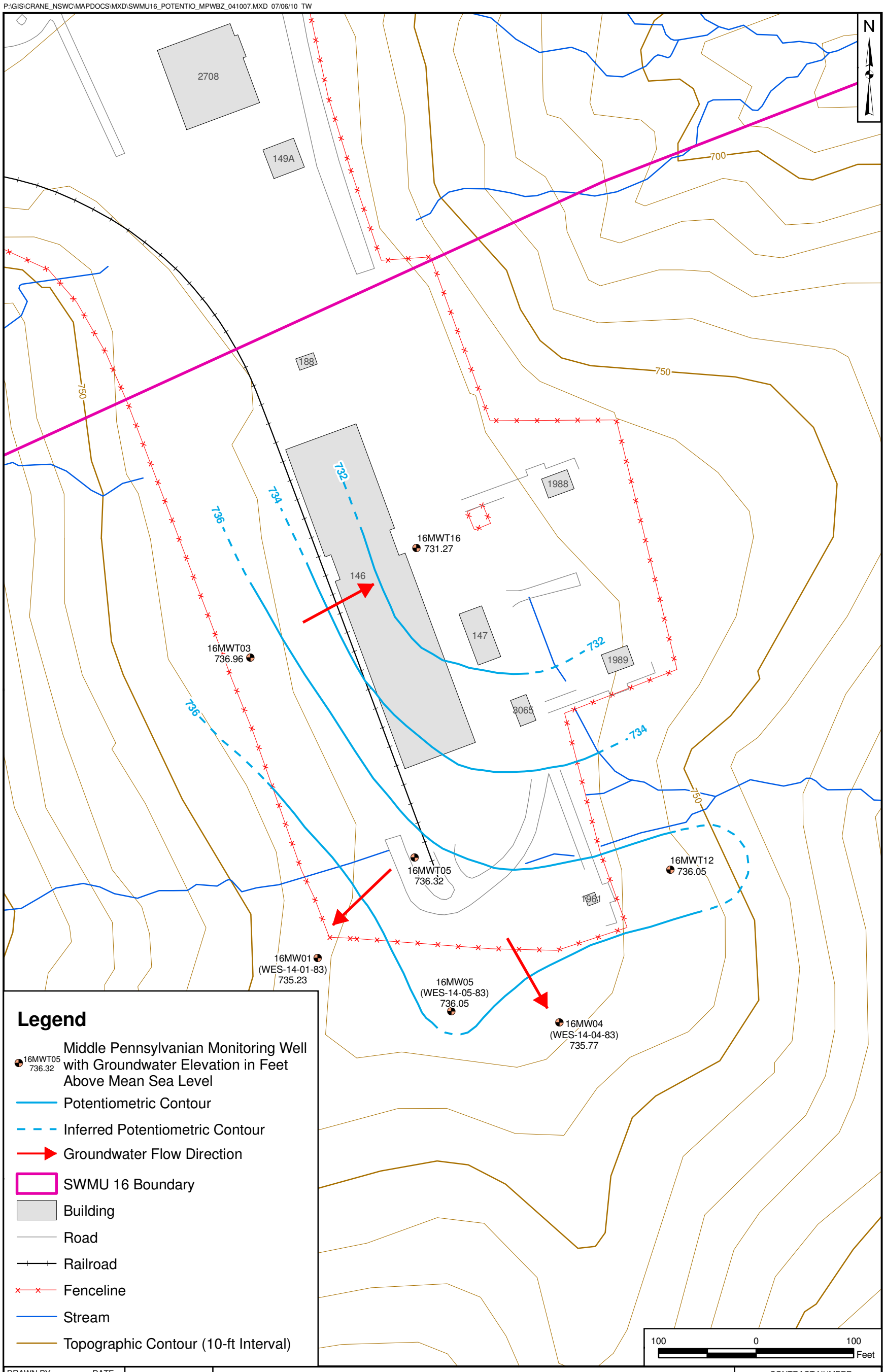

Legend

- 16MWT05 736.32 — Middle Pennsylvanian Monitoring Well with Groundwater Elevation in Feet Above Mean Sea Level
- Potentiometric Contour
- Inferred Potentiometric Contour
- Groundwater Flow Direction
- SWMU 16 Boundary
- Building
- Road
- Railroad
- Fenceline
- Stream
- Topographic Contour (10-ft Interval)

DRAWN BY	T. WHEATON
DATE	07/06/10
CHECKED BY	J. LUCAS
DATE	07/06/10
REVISED BY	___
DATE	___
SCALE	AS NOTED

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR THE
PENNSYLVANIAN MIDDLE WATER-BEARING ZONE - APRIL 10, 2007
ROUND 9
SWMU 16 - CAST EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	00041
APPROVED BY	___
DATE	___
APPROVED BY	___
DATE	___
FIGURE NO.	FIGURE 3-2
REV	0

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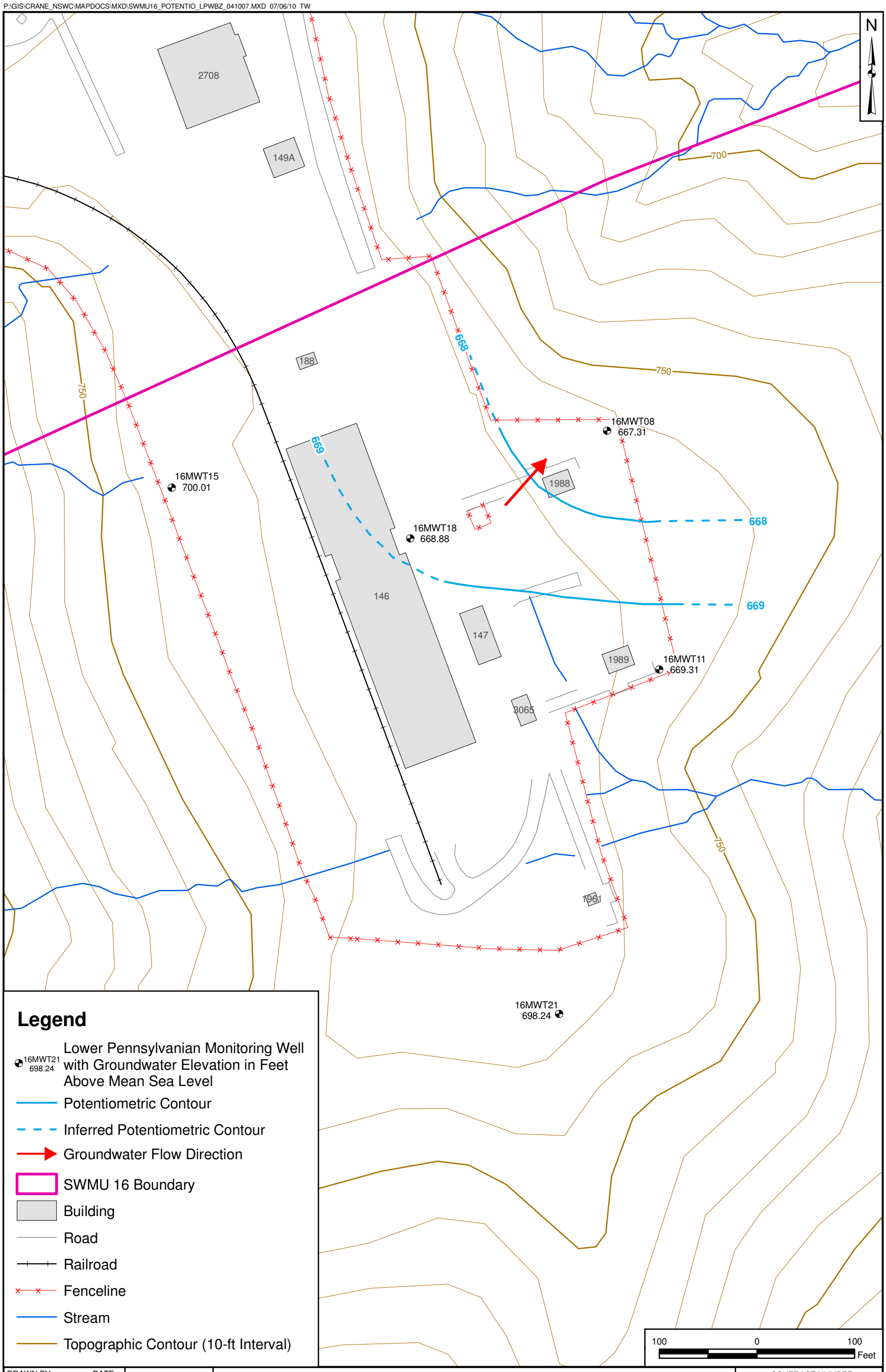


Legend

- 16MWT21 698.24 — Lower Pennsylvanian Monitoring Well with Groundwater Elevation in Feet Above Mean Sea Level
- Potentiometric Contour
- Inferred Potentiometric Contour
- Groundwater Flow Direction
- SWMU 16 Boundary
- Building
- Road
- Railroad
- Fenceline
- Stream
- Topographic Contour (10-ft Interval)

DRAWN BY	T. WHEATON
DATE	07/06/10
CHECKED BY	J. LUCAS
DATE	07/06/10
REVISED BY	___
DATE	___
SCALE	AS NOTED

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR THE
PENNSYLVANIAN LOWER WATER-BEARING ZONE - APRIL 10, 2007
ROUND 9
SWMU 16 - CAST EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	00041
APPROVED BY	___
DATE	___
APPROVED BY	___
DATE	___
FIGURE NO.	FIGURE 3-3
REV	0

4.0 DATA EVALUATION

This section presents an evaluation of groundwater and surface water monitoring data presented in Section 3. The objective of the evaluation is to determine if the monitoring data demonstrates whether residual RDX and TCE in SWMU 16 groundwater may be naturally degrading. The primary source of information for demonstrating MNA includes historical groundwater monitoring data that exhibits a clear and meaningful decreasing trend of contaminant mass and concentration. The historical groundwater MNA data presented in Section 3 has been analyzed for trends using basic statistics, appropriate statistical tests, and graphical presentations of contaminant concentrations using temporal plotting, color spatial contouring, and lateral cross-sections.

4.1 STATISTICAL ANALYSIS

4.1.1 Groundwater Descriptive Statistics

The descriptive statistics for groundwater and surface water concentration data collected during the SWMU 16 MNA program is presented in Tables 4-1 through 4-7 for each spatial location group (source area, RDX/TCE plume, edge of the plume, below the RDX/TCE plume, upgradient, and downgradient). Table 4-7 presents the statistics for three surface water sample locations that were used to monitor the migration of RDX, TCE and their associated degradation by-products. The statistics presented in this report include frequency of detection (FOD), minimum, maximum, and mean concentration, and the round in which the maximum concentration occurred. A discussion of the statistical parameters for RDX, TCE, and degradation by-products in each spatial group of monitoring wells is presented below. Statistical results for surface water are presented in Section 4.1.3.

4.1.1.1 RDX and Degradation By-products

Source Area Wells

There are three wells (16MWT06, 16MWT13, and 16MWT17) located in the RDX source area within the Puz. As shown in Table 4-1, RDX was detected at 16MWT06 and 16MWT17 during all rounds of sampling. RDX was only detected in three of eight samples at well 16MWT13. The maximum RDX concentration (18 µg/L) was detected in well 16MWT06 in Rounds 8 and 9. The second highest RDX concentration for this group (6.7 µg/L) was reported in well 16MWT13 in Round 1. The maximum RDX concentration for well 16MWT17 was 5.8µg/L, which occurred in Round 8.

There was only one detection of RDX degradation by-products in source areas wells. The single detection of MNX was 0.33J µg/L at 16MWT06 in Round 6. There were no other detections of RDX degradation products in source area wells.

RDX Plume Wells

There are four wells (16MWT03, 16MWT04, 16MWT09, and 16MWT10) located within the RDX plume within the Puz. Table 4-2 indicates RDX was detected at all wells in all rounds. The maximum RDX concentrations for this group were measured in well 16MWT04. The highest reported concentration at well 16MWT04 was 200 µg/L in Round 2. The maximum concentrations measured in the other plume wells were 110 µg/L, 71 µg/L, and 58 µg/L, respectively, at wells 16MWT09, 16MW03, and 16MWT10.

RDX degradation by-products were detected in all RDX plume area wells. MNX was the most frequently detected degradation by-product. Average MNX concentrations were highest (2.60 µg/L) at the same well (16MWT04) that reported the highest RDX concentrations. The average MNX concentrations at the other wells were 0.66 µg/L or less. DNX (0.63J µg/L) was the only other detected RDX degradation by-product at well 16MWT04 in Round 2. There were no detections of TNX.

Leading Edge of the RDX Plume Well

There is one well (16MW04) located at the edge of the RDX plume in the Pmz. Table 4-3 indicates RDX was detected in all rounds with the exception of Round 8. RDX concentrations were in the range of 0.58 µg/L to 1.9 µg/L. The maximum RDX concentration occurred in Round 2.

There were no detections of RDX degradation by-products at well 16MW04.

Laterally Downgradient Well

As shown in Table 4-4, there were no detections of RDX or degradation by-products at well 16MWT12 located in the Puz.

Upgradient

Table 4-5 indicates there were no detections of RDX or degradation by-products at the Puz upgradient well 16MW02 through Round 9.

Wells Below the RDX Plume

There are two wells (16MWT11 and 16MWT15) located below the RDX plume in the Plz. Table 4-6 indicates there have no detections of RDX or degradation products in Plz wells.

4.1.1.2 TCE and Degradation By-products

Source Area Wells

TCE was detected in all source area wells in Rounds 1 through 9. Table 4-1 indicates the highest TCE concentrations were measured at 16MWT06. The highest concentration was 740,000 µg/L in Round 9. The maximum average TCE concentration for the source area wells was also reported at 16MWT06 (367,222 µg/L). The average TCE concentrations measured at 16MWT06 were at least one order of magnitude higher that at source wells 16MWT13 and 16MWT17. The maximum concentrations reported at wells 16MWT13 and 16MWT17 were 62,000 µg/L and 25,000 µg/L, respectively, although 16MWT17 had a higher average concentration than 16MWT13 (19,625 µg/L versus 12,495 µg/L).

TCE degradation by-products were detected at all source area wells. The highest average by-product concentrations were reported for cis-1,2-dichloroethene (4,689 µg/L) in well 16MWT06.

TCE Plume Wells

Table 4-2 indicates TCE was detected at all TCE plume wells in all rounds. The maximum TCE concentration (10µg/L) for this group was measured in well 16MWT09 in Round 4. The maximum TCE concentrations measured in the other plume wells were 5.7 µg/L, 5 µg/L, and 2.4 µg/L, respectively, at wells 16MW03, 16MWT04, and 16MWT10.

All TCE degradation by-products, with the exception of vinyl chloride, were detected in all TCE plume area wells. Ethane and ethene were the most frequently detected degradation by-products. Average ethane and ethene concentrations were both highest at well 16MWT10 (0.131 µg/L and 0.084 µg/L, respectively). The average ethane concentrations at the other wells were 0.052 µg/L or less. The average ethene concentration at other wells was 0.073 µg/L or less. Cis-1,2-dichloroethene was detected at least once in all TCE plume wells, with the exception of 16MWT04, and was most frequently detected at well 16MW03. The average concentration of cis-1,2-dichloroethene was highest (0.500 µg/L) at 16MW03. The average concentration of cis-1,2-dichloroethene at wells 16MWT09 and 16MWT10 was 0.200 µg/L. There were no detections of vinyl chloride.

Leading Edge of the TCE Plume Well

Table 4-3 presents the statistics for the leading edge well 16MW04. TCE was detected in seven of the nine MNA monitoring events. The maximum TCE concentration was 1.4 µg/L in Round 4. The average concentration of TCE at 16MW04 was 0.914 µg/L.

Ethane and ethene were the most frequently detected degradation by-products at the leading edge well. The maximum concentrations reported for ethane and ethene were 0.015J µg/L and 0.048 µg/L, respectively, and were both reported in Round 8. Average concentrations were higher for ethane (0.033 µg/L.) in comparison to ethene (0.013 µg/L). Cis-1,2-dichlororethene was detected only once in Round 1 at an estimated concentration of 0.3J µg/L. There were no detections of vinyl chloride.

Laterally Downgradient Well

The descriptive statistics for the lateral downgradient well 16MWT12 are presented in Table 4-4. TCE was detected only in Round 3 at an estimated concentration of 0.5 J µg/L.

Ethane and ethene were the only detected degradation by-products. The maximum concentration of ethane was estimated to be 0.37J µg/L in Round 1. The average concentration of ethane, based on four detections, was 0.205 µg/L. The maximum ethene concentration was measured in Round 3 at 0.12 µg/L. The average concentration of ethene, also based on four detections, was an order of magnitude lower at 0.061 µg/L.

Upgradient

Table 4-5 presents descriptive statistics for the upgradient well 16MW02. There was a single TCE detection (0.33J µg/L) at the upgradient well in Round 9.

The only detected degradation by-products at 16MW02 were ethane and ethene. Ethane was the most frequently detected by-product and averaged 0.077 µg/L, on the basis of four detections. The maximum ethane concentration was 0.093 µg/L in Round 7, and the average was 0.077 µg/L. The maximum ethene concentration (0.039 µg/L) was reported in Round 9. The average ethene concentration was 0.021 µg/L. There were no detections of cis-1,2-dichoroethene or vinyl chloride at the upgradient well.

Wells Below the TCE Plume

Table 4-6 shows the descriptive statistics for wells 16MWT11 and 16MWT15, which are located below the TCE plume in the Plz. TCE was detected only at well 16MWT15 in Round 4 (0.6 J µg/L) and Round 8 (1.4 µg/L). However, the degradation by-products, ethane and ethane, were detected at both Plz wells. The maximum (2.5 µg/L) and highest average (1.573 µg/L) ethane concentrations were reported at well 16MWT15. The maximum (0.41 µg/L) and highest average (0.258 µg/L) ethene concentrations also occurred at well 16MWT15. There were no detections of cis-1,2-dichoroethene or vinyl chloride at either well located below the TCE plume.

4.1.2 Surface Water Descriptive Statistics

The descriptive statistcs for RDX, TCE, and associated degradation by-products in surface water at locations 16SW10, 16SW12, and 16SW30 are presented in Table 4-7. There were no detections of RDX, TCE or degradation by-products at 16SW13. RDX was detected most frequently at location 16SW30. The maximum detected concentration at 15SW30 was 24 µg/L, which occurred in Round 1. RDX (0.77 µg/L) was only detected once at location 16SW10 in Round 4. There were no detections for RDX degradation by-products at the three surface water locations.

TCE was not detected at locations 16SW10, 16SW12, and 16SW30. The only TCE degradation by-product detected during the MNA program was cis-1,2-dichloroethene in four rounds and only at location 16SW12. The maximum dectected concentration was 1.4 µg/L, which occurred in Round 1.

4.1.3 Mann-Kendal Statistical Trend Analysis

The Mann-Kendall statistical test was used to determine if there are indications of temporal trends at the SWMU 16 Puz and Pmz monitoring wells where RDX, TCE and their associated degradation by-products have been detected. RDX and degradation by-products have not been detected in the Plz wells. The Mann-Kendall test involves computing a statistic S, which is the difference between the number of pairwise differences that are positive minus the number that are negative. If S is a large positive number, then there is evidence of an increasing trend in the data. If S is a large negative value, then there is evidence of a decreasing trend in the data. The null hypothesis or baseline condition for this test is that there is no temporal trend in the data values. The alternative hypothesis is that of either an upward or a downward trend. The Mann-Kendall test is particularly useful since missing values are allowed and the data need not conform to any particular distribution. One half the detection limits is used for all non-detected values.

The number of samples for each Puz and Pmz well was less than 10. If the number of samples is less than 10 then the following procedure is used in the statistical analysis.

The first step is to list the data in the order in which they were collected over time: $x_1, x_2 \ldots x_n$, where x is the observation at time i. Then determine the sign of all n(n-1)/2 possible differences $x_j - x_k$, where $j > k$. These differences are $x_2 - x_1, x_3 - x_1, \ldots, x_n - x_1, x_3 - x_2, x_4 - s_2, \ldots, x_n - x_{n-2}, x_n - x_{n-1}$. A convenient way of arranging the calculations is as follows:

Data Values Listed in Order Collected Over Time							**No. of + Signs**	**No. of – Signs**
x_1	x_2	x_3	x_4	. . .	x_{n-1}	x_n		
	$x_2 - x_1$	$x_3 - x_1$	$x_4 - x_1$	. . .	$x_{n-1} - x_1$	$x_n - x_1$		
		$x_3 - x_2$	$x_4 - x_2$	. . .	$x_{n-1} - x_2$	$x_n - x_2$		
			$x_4 - x_3$	. . .	$x_{n-1} - x_3$	$x_n - x_3$		
					. . .	. . .		
					$x_{n-1} - x_{n-2}$	$x_n - x_{n-2}$		
						$x_n - x_{n-1}$		
						S =	$\left(\begin{matrix}\text{sum of} \\ +\text{ signs}\end{matrix}\right) +$	$\left(\begin{matrix}\text{sum of} \\ -\text{ signs}\end{matrix}\right)$

The next step is to use Table 4-8 to find the critical value and Table 4-9 to find the p-value. The null hypothesis of no trend is rejected:

- if the absolute value of S is greater than or equal to the critical value, and
- if the p-value is less than the significance level, α.

The results of the Mann-Kendall statistical test for RDX and TCE concentration data are presented in Tables 4-10 and 4-11, respectively, for alpha values (significance levels) of 0.20, 0.10, and 0.05. The

Indiana Department of Environmental Management (IDEM) Risk Integrated System of Closure (RISC) guidance (IDEM, 2001 RISC) typically recommends using alpha values of 0.10 or 0.05.

RDX Trends

The test results shown in Table 4-10 for RDX, using the case of the least conservative significance level (0.20), indicate four wells are potentially showing a combination of significant upward or downward trends in concentrations in the Puz. Significant upward trends were found at source area wells 16MWT06 and 16MWT17; whereas, source area well 16MWT13 indicated a significant downward trend. A significant downward trend was also indicated for well 16MW03 (within RDX plume). In the Pmz, monitoring well 16MW04 indicated a significant downward trend in RDX concentrations.
In the case of the more conservative significance level (0.10 and 0.05) tests, potential trends were identified for two wells in the Puz. The source area well 16MWT06 indicated a significant upward trend in RDX concentration at the 0.10 and 0.05 significance levels. Conversely, the RDX plume well 16MWT13 indicated a downtrend in concentrations at both the 0.10 and 0.05 significance levels.

TCE Trends

Table 4-11 presents trend test results for detections of TCE in Puz and Pmz wells. At the least conservative significance level (0.20), seven wells in the Puz are showing a combination of significant upward or downward trends in TCE concentrations. The upgradient well 16MW02 reported an upward trend in TCE concentrations, but only on the basis of detections in Rounds 8 and 9. Significant upward trends are also indicated at source area wells 16MWT06 and 16MWT17 and TCE plume wells, but a downward trend at source area well 16MWT13. Three of the four wells located in the TCE plume indicated significant downward trends for TCE concentrations.

In the case of the 0.10 significance level, six wells in the Puz indicated a combination of significant upward or downward trends. Significant upward trends were indicated at two source area wells (16MWT06 and 16MWT17) located in the TCE plume. Significant downward trends are indicated at the source area well 16MWT13 and at four TCE plume wells 16MWT04, 16MWT09, 16MWT10, and 16MWT13.

4.2 GROUNDWATER TEMPORAL PLOTS

Temporal plots of RDX, TCE and their associated degradation by-product concentrations are presented in this section to illustrate the variance of concentrations through 9 rounds of groundwater and surface water sampling at SWMU 16. The temporal plots presented on Figures 4-1 through 4-8 are arranged in

columns by monitoring well or surface water location showing the concentration plot for RDX or TCE followed by the temporal plots for each parameter's corresponding degradation by-product. The data points shown in each plot represent the parameter concentration by round and the data validation qualifier as presented for groundwater and surface water, respectively. The absence of a data point in a round indicates that no sample was collected or no analysis was conducted for a specific parameter.

A discussion of potential temporal trends at groundwater wells and surface water locations are discussed below.

4.2.1 RDX and Degradation By-Products

4.2.1.1 Puz Group Wells

Source Area

Temporal plots for the RDX source area wells 16MWT06, 16MWT13 and 16MWT17 are shown on Figure 4-1. RDX has been detected in all nine rounds of sampling at well 16MWT06. RDX concentrations have generally shown an upward trend since the lowest concentration was measured in Round 2. In Rounds 8 and 9, RDX concentrations remained steady. RDX at well 16MWT13 has shown a downward trend since Round 1 and has been not been detected in Rounds 4 through 9. RDX sampling began in Round 2 at well 16MWT17 and RDX has been detected in all rounds. The measured concentrations have exhibited an oscillating trend in the narrow range of 4 to 6 µg/L. This indicates RDX concentrations are steady and no trend is discernible after 9 rounds of sampling. There have been no detections of RDX degradation by-products at the source area wells.

RDX Plume

Temporal plots for RDX plume wells 16MWT03, 16MWT04, 16MWT09, and 16MWT10 are shown on Figure 4-1. The trend in RDX concentrations at wells 13MWT13 and 13MWT09 has fluctuated from round to round, but more recently both wells have exhibited a downward trend in concentrations since Round 7.

RDX concentrations at wells 16MWT04 and 16MWT10 have also exhibited fluctuating trends and most recently have shown an upward trend in Rounds 8 and 9. The range of RDX concentrations has been much larger at 16MWT04 in comparison to 16MWT10.

The most frequently detected RDX degradation by-product in all RDX plume wells has been MNX. Based on limited sampling in Rounds 2, 4 and 6, MNX concentrations have exhibited a downtrend at wells 16MWT03, 16MWT09, and 16MWT10 where concentrations have been less than 1.2 µg/L. Slightly higher concentrations of MNX, in the range of 1.2 to 4.1 µg/L, have been detected at well 16MWT04, but indicate no trend. The only other RDX degradation by-product detected in RDX plume wells was DNX (0.63 J µg/L) in Round 2 at well 16MWT04.

Upgradient Wells

Temporal plots for the upgradient well 16MW02 are shown on Figure 4-1. There have been no detections of RDX or associated degradation by-products at the upgradient well in Rounds 1 through 9.

4.2.1.2 Pmz Group Wells

Leading Edge

Temporal plots for the leading edge well 16MWT12 are shown on Figure 4-2. RDX has been detected in all rounds with the exception of Round 8. RDX concentrations peaked at 1.9 µg/L in Round 2 then trended downward and remained steady at about 0.6 µg/L through Round 6. RDX was detected again in Round 9 at 0.6 µg/L, which indicates no apparent trend in concentrations. There have been no detections of RDX degradation by-products at the leading edge well.

Downgradient

Temporal plots for the downgradient well 16MWT12 are provided on Figure 4-2. Through nine rounds of sampling, there have been no detections of RDX or associated degradation by-products at the downgradient well.

4.2.1.3 Plz Group Wells

Temporal plots for monitoring wells 16MWT11 and 16MWT15 located in the Plz are shown on Figure 4-3. There have been no detections of RDX or degradation by-products at either well in Rounds 2 through 9.

4.2.2 TCE and Degradation By-Products

4.2.2.1 Puz Group Wells

TCE Source Area

Temporal plots for the TCE source area wells 16MWT06, 16MWT13 and 16MWT17 are shown on Figure 4-4. The highest concentrations of TCE have been measured at well 16MWT06. Between Rounds 1 and 5, TCE concentrations demonstrated a significant upward trend, followed by a similar downward trend in Rounds 6 through 8. In Round 9, the TCE concentration at 16MWT06 markedly increased and negated the downtrend shown in Rounds 6 through 8. TCE concentrations at well 16MWT13 have trended downward significantly between Rounds 2 and 4, and then have shown a combination of up and down trends between Rounds 5 and 9. Although TCE concentrations at well 16MWT13 have dropped significantly since Rounds 2 and 3, there is no discernible trend in later rounds. TCE concentrations at well 16MWT17 have shown a steady trend upward since the first sample was collected in Round 2.

TCE degradation by-products have generally been detected in all nine rounds at all source area wells. Groundwater concentrations of cis-1,2-dichloroethene have been highest at well 16MWT06 and have followed an upward and downward trend between Rounds 2 through 8, followed by a significant increase in Round 9. Cis-1,2-dichloroethene concentrations at well 16MWT13 have shown a downward trend between Rounds 2 and 4, then have shown fluctuating trends between Rounds 5 through 9. At well 16MWT17, cis-1,2-dichloroethene concentrations have fluctuated between 200 and 350 µg/L and show no definitive trend.

The highest concentrations of ethene and ethane have occurred at well 16MWT06 and show a downward trend for samples collected between Rounds 2 and 8. Ethene and ethane concentrations at wells 16MWT13 and 16MWT17 have all been less than 1 µg/L. Vinyl chloride has been most frequently detected at high concentrations in well 16MWT06 and exhibited a general upward trend through Round 9.

TCE Plume

Temporal plots for TCE plume wells 16MWT03, 16MWT04, 16MWT09, and 16MWT10 are shown on Figure 4-4. TCE has been detected in all plume wells in all rounds. Between Rounds 6 and 9, TCE concentrations in wells 16MWT04 and 16MWT09 have shown a downward trend. Between Rounds 7 and 9, TCE concentrations in wells 16MWT10 has shown a downward trend. TCE concentrations in well

16MWT03 have generally remained in the range of 4 and 5.6 µg/L in Rounds 1 through 9 and shown no definitive trend.

Cis-1,2-dichloroethene was detected at low concentrations (less than 0.7 µg/L) in Rounds 1 through 3 at wells 16MWT03, 16MWT09, and 16MWT10, but was not detected in Rounds 4 through 9. There have been no detections of cis-1,2-dichloroethene at well 16MWT04. Ethane and ethene have been detected at all plume wells in Rounds 2, 4, 6, and 8 at low concentrations, and have generally shown a downward trend at wells 16MWT04, 16MWT09, and 16MWT10. Conversely, low concentrations of ethane and ethene at well 16MWT03 have shown no trend in later rounds of sampling. Vinyl chloride has not been detected in the TCE plume wells.

Upgradient Well

Temporal plots for the upgradient well 16MW02 are shown on Figure 4-4. There have been no detections of TCE at the upgradient well in Rounds 1 through 8. In Round 9, TCE was detected at an estimated concentration of 0.33 µg/L. Low concentrations of ethane and ethene (less than 0.1 µg/L) have been the only degradation by-products detected at the upgradient well and have not shown a discernible trend.

4.2.2.2 Pmz Group Wells

Leading Edge

Temporal plots for the leading edge well 16MWT12 are shown on Figure 4-5. TCE has been detected at concentrations less than 1.5 µg/L in all rounds except 2 and 7. Over nine rounds, TCE concentrations have generally shown an upward trend between Rounds 5 and 9. Ethene and ethane have been detected at low concentrations only in Rounds 6 and 8. There have been no detections of cis-1,2-dichloroethene or vinyl chloride at the leading edge well.

Downgradient

Temporal plots for the downgradient well 16MWT12 are given on Figure 4-5. TCE has only been detected in Round 4 at an estimated concentration of 0.5 J µg/L. Ethane and ethene have been the only detected degradation by-products in the downgradient well and have shown a general downward trend between Rounds 4 and 8.

4.2.2.3 Plz Group Wells

Temporal plots for monitoring wells 16MWT11 and 16MWT15 located in the Plz are shown on Figure 4-6. The only detections at well 16MWT11 have been associated with the degradation by-products ethane and ethene. Between Rounds 4 and 8, ethane concentrations increased, whereas, ethene concentrations decreased.

4.3 SURFACE WATER TEMPORAL PLOTS

The temporal plots for the four surface water locations 16SW10, 16SW12, 16SW13, and 16SW30 are shown on Figures 4-7 and 4-8 for RDX and TCE, respectively. As shown on Figure 4-7. RDX has been detected most frequently at 16SW30, has generally exhibited a downward trend since Round 3, and was not detected in Round 9. There was only one detection of RDX (0.77 µg/L) at 16SW10 in Round 7. Sampling for RDX degradation by-products was limited to locations 16SW12 and 16SW13 and resulted in no detections.

Table 4-8 indicates that TCE has only been detected at location 16SW12 in Rounds 2 through 9. Between Rounds 4 and 9, TCE concentrations have shown a general downward trend. Cis-1,2-dichloroethene has been the only TCE degradation by-product detected in surface water at 16SW12 in early and late rounds. Since Round 2, concentrations have shown a general downward trend.

TABLE 4-1

DESCRIPTIVE STATISTICS FOR SOURCE AREA WELLS
IN THE PENNSYLVANIAN UPPER WATER-BEARING ZONE
AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE INDIANA

16MWT06							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	8/9	0.27 J	2.8 J	0.25 - 0.28	1.20	1.31	16GWT0610
MNX	1/3	0.33 J	0.33 J	- - -	0.273	0.330	16GWT0607
RDX	9/9	1.8	18 J	- - -	9.61	9.61	16GWT0609, 16GWT0610
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	9/9	600	10000	- - -	4689	4689	16GWT0610
Ethane	4/4	1	7.7	- - -	3.13	3.13	16GWT0603
Ethene	4/4	22	65	- - -	34.5	34.5	16GWT0603
Trichloroethene	9/9	35000	740000	- - -	367222	367222	16GWT0610
Vinyl Chloride	9/9	65 J	1100	- - -	481	481	16GWT0610
16MWT13							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
RDX	3/8	0.42 J	6.7	0.24 - 0.298	1.20	2.74	16GWT1301
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	8/8	1.5	280	- - -	58.4	58.4	16GWT1301
Ethane	4/4	0.03	0.45	- - -	0.154	0.154	16GWT1301
Ethene	4/4	0.035	0.67	- - -	0.229	0.229	16GWT1301
Trichloroethene	8/8	130	62000	- - -	12495	12495	16GWT1301
Vinyl Chloride	1/8	0.8 J	0.8 J	0.3 - 30	4.11	0.800	16GWT1302
16MWT17							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	2/8	0.35 J	0.43 J	0.24 - 0.281	0.298	0.390	16GWT1701
RDX	8/8	4.3	5.8	- - -	4.95	4.95	16GWT1707
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	8/8	210	340	- - -	283	283	16GWT1706
Ethane	3/3	0.45	0.74	- - -	0.597	0.597	16GWT1705
Ethene	3/3	0.1	0.2	- - -	0.157	0.157	16GWT1705
Trichloroethene	8/8	11000	25000	- - -	19625	19625	16GWT1707
Vinyl Chloride	3/8	2.1	3.8	3 - 60	13.8	2.67	16GWT1703

TABLE 4-2

DESCRIPTIVE STATISTICS FOR WELLS WITHIN THE PLUME
IN THE PENNSYLVANIAN UPPER WATER-BEARING ZONE
AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE INDIANA

Parameter	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Nondetects	Mean Concentration	Average of Positive Detects	Sample of Maximum Detect
16MW03							
Explosives (ug/L)							
HMX	9/9	3.9	7.5	3.9 - 7.5	5.71	5.71	16GW0302
MNX	3/3	0.32 J	0.82	0.32 - 0.82	0.500	0.500	16GW0302
RDX	9/9	41	71	41 - 71	53.2	53.2	16GW0302
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	3/9	0.4 J	0.6 J	0.4 - 0.6	0.444	0.500	16GW0303
Ethane	2/3	0.016 J	0.017 J	0.016 - 0.017	0.013	0.017	16GW0308
Ethene	3/3	0.026	0.052	0.026 - 0.052	0.043	0.043	16GW0306
Trichloroethene	9/9	3.8	5.7	3.8 - 5.7	4.88	4.88	16GW0308
16MWT04							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
DNX	1/3	0.63 J	0.63 J	0.25 - 0.28	0.387	0.630	16GWT0402
HMX	9/9	6.4	21	- - -	9.14	9.14	16GWT0402
MNX	3/3	1.2	4.1	- - -	2.60	2.60	16GWT0402
RDX	9/9	59	200	- - -	110	110	16GWT0402
Volatile Organic Compounds (ug/L)							
Ethane	4/4	0.004 J	0.013	- - -	0.008	0.008	16GWT0402
Ethene	4/4	0.014 J	0.027	- - -	0.018	0.018	16GWT0402
Trichloroethene	9/9	0.87 J	5	- - -	2.60	2.60	16GWT0404
16MWT09							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	8/8	8.1	12 J	- - -	9.86	9.86	16GWT0906
MNX	3/3	0.43 J	1.1	- - -	0.663	0.663	16GWT0901
RDX	8/8	79	110	- - -	96.8	96.8	16GWT0901, 16GWT0906
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	1/8	0.2 J	0.2 J	0.3 - 1	0.375	0.200	16GWT0901
Ethane	3/3	0.038	0.074	- - -	0.052	0.052	16GWT0903
Ethene	3/3	0.06	0.081	- - -	0.073	0.073	16GWT0903
Trichloroethene	8/8	4.9	10	- - -	7.58	7.58	16GWT0903

TABLE 4-2

DESCRIPTIVE STATISTICS FOR WELLS WITHIN THE PLUME
IN THE PENNSYLVANIAN UPPER WATER-BEARING ZONE
AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE INDIANA

16MWT10							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	8/8	4.5	6.7	- - -	5.30	5.30	16GWT1001
MNX	2/3	0.3 J	0.5 J	0.27 - 0.27	0.357	0.400	16GWT1001
RDX	8/8	47	58	- - -	52.6	52.6	16GWT1005
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	1/8	0.2 J	0.2 J	0.3 - 1	0.375	0.200	16GWT1001
Ethane	4/4	0.054	0.33	- - -	0.131	0.131	16GWT1001
Ethene	4/4	0.03	0.16	- - -	0.084	0.084	16GWT1001
Trichloroethene	8/8	1.4	2.4	- - -	1.76	1.76	16GWT1003

TABLE 4-3

DESCRIPTIVE STATISTICS FOR LEADING EDGE WELL
IN THE PENNSYLVANIAN MIDDLE WATER-BEARING ZONE
AT SWMU 16 IN ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

16MW04							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	3/9	0.38 J	0.45 J	3.9 - 7.5	0.306	0.407	16GW0402
RDX	8/9	0.58	1.9	0.32 - 0.82	0.862	0.939	16GW0402
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	1/9	0.3 J	0.3 J	0.4 - 0.6	0.378	0.300	16GW0401
Ethane	2/3	0.01 J	0.015 J	0.016 - 0.017	0.010	0.013	16GW0408
Ethene	2/3	0.018 J	0.048	0.026 - 0.052	0.024	0.033	16GW0408
Trichloroethene	7/9	0.5 J	1.4	3.8 - 5.7	0.856	0.914	16GW0404

TABLE 4-4

DESCRIPTIVE STATISTICS FOR LATERALLY DOWNGRADIENT WELL
IN THE PENNSYLVANIAN MIDDLE WATER-BEARING ZONE
AT SWMU 16 IN ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA

16MWT12							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	1/8	1.3 J	1.3 J	0.24 - 0.266	0.386	1.30	16GWT1201
Volatile Organic Compounds (ug/L)							
Ethane	4/4	0.13	0.37 J	- - -	0.205	0.205	16GWT1201
Ethene	4/4	0.028	0.12	- - -	0.061	0.061	16GWT1203
Trichloroethene	1/8	0.5 J	0.5 J	0.3 - 1	0.413	0.500	16GWT1203

TABLE 4-5

**DESCRIPTIVE STATISTICS FOR THE UPGRADIENT WELL
IN THE PENNSYLVANIAN UPPER WATER-BEARING ZONE
AT SWMU 16 FOR ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA**

16MW02							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Volatile Organic Compounds (ug/L)							
Ethane	4/4	0.062	0.093	- - -	0.077	0.077	16GW0207
Ethene	3/4	0.007 J	0.039	0.005	0.017	0.021	16GW0209
Trichloroethene	1/8	0.33 J	0.33 J	0.3 - 1	0.391	0.330	16GW0210

TABLE 4-6

**DESCRIPTIVE STATISTICS FOR WELLS BELOW THE PLUME
IN THE PENNSYLVANIAN LOWER WATER-BEARING ZONE
AT SWMU 16 IN ROUNDS 1 THROUGH 9
NSA CRANE
CRANE, INDIANA**

16MWT11							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
HMX	1/8	0.32 J	0.32 J	0.242 - 0.316	0.27	0.32	16GWT1108
Volatile Organic Compounds (ug/L)							
Ethane	2/2	0.34	0.44	- - -	0.4	0.4	16GWT1105
Ethene	2/2	0.074	0.075	- - -	0.1	0.1	16GWT1103
16MWT15							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Volatile Organic Compounds (ug/L)							
Ethane	4/4	0.99	2.5	- - -	1.573	1.573	16GWT1503
Ethene	4/4	0.14	0.41	- - -	0.258	0.258	16GWT1505
Trichloroethene	2/8	0.6 J	1.4	0.3	0	1	16GWT1507

TABLE 4-7

DESCRIPTIVE STATISTICS FOR SURFACE WATER LOCATIONS
16SW/SD10, 16SW/SD12, AND 16SW/SD30
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)
NSA CRANE
CRANE, INDIANA

16SW/SD10							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Explosives (ug/L)							
RDX	1/5	0.77	0.77	0.242 - 0.25	0.352	0.770	16SW1004

16SW/SD12							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Volatile Organic Compounds (ug/L)							
cis-1,2-Dichloroethene	4/7	0.6 J	1.4	0.3	0.690	0.983	16SW1201

16SW/SD30							
Parameter	**Frequency of Detection**	**Minimum Concentration**	**Maximum Concentration**	**Range of Nondetects**	**Mean Concentration**	**Average of Positive Detects**	**Sample of Maximum Detect**
Volatile Organic Compounds (ug/L)							
RDX	5/6	13	24	0.26	14.7	17.6	16SW3001

TABLE 4-8

CRITICAL VALUES FOR THE MANN-KENDALL STATISTICAL TEST
FOR TREND ANALYSIS AT SWMU 16
NSA CRANE
CRANE, INDIANA

Significance Level α	Sample Size (n)																
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.20	4	6	7	7	8	10	11	13	14	16	17	19	20	22	25	27	28
0.10	6	8	9	11	12	14	17	19	20	24	25	29	30	34	35	39	42
0.05	6	8	11	13	16	18	21	23	26	28	31	35	38	42	45	49	52
0.01	-	10	13	17	20	24	27	31	34	40	43	47	52	58	63	67	72

TABLE 4-9

PROBABILITIES (P) FOR THE SMALL-SAMPLE
MANN-KENDALL TEST FOR GROUNDWATER TREND ANALYSIS AT SWMU 16
NSA CRANE
CRANE, INDIANA

S	n				S	n		
	4	5	8	9		6	7	10
0	0.625	0.592	0.548	0.54	1	0.5	0.5	0.5
2	0.375	0.408	0.452	0.46	3	0.36	0.386	0.431
4	0.167	0.242	0.36	0.381	5	0.235	0.281	0.364
6	0.042	0.117	0.274	0.306	7	0.136	0.191	0.3
8		0.042	0.199	0.238	9	0.068	0.119	0.242
10		0.0083	0.138	0.179	11	0.028	0.068	0.19
12			0.089	0.13	13	0.0083	0.035	0.146
14			0.054	0.09	15	0.0014	0.015	0.108
16			0.031	0.06	17		0.0054	0.078
18			0.016	0.038	19		0.0014	0.054
20			0.0071	0.022	21		0.0002	0.036
22			0.0028	0.012	23			0.023
24			0.00087	0.0063	25			0.014
26			0.00019	0.0029	27			0.0083
28			0.000025	0.0012	29			0.0046
30				0.00043	31			0.0023
32				0.00012	33			0.0011
34				0.000025	35			0.00047
36				0.0000028	37			0.00018
					39			0.000058
					41			0.000015
					43			0.0000028
					45			0.00000028

TABLE 4-10

MANN-KENDALL TREND TEST RESULTS FOR RDX - GROUNDWATER
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)
NSWC CRANE

Location	N	S	p-value	Test Statistic	Alpha = 0.2		Alpha = 0.1		Alpha = 0.05	
					Critical Value	Trend?	Critical Value	Trend?	Critical Value	Trend?
PENNSYLVANIA UPPER WATER BEARING ZONE										
16MW02	RDX was not detected in any round of sampling.									
16MW03	9	-11	0.155	-11	10	Significant Downward Trend	14	No Trend	18	No Trend
16MWT04	9	7	0.272	7	10	No Trend	14	No Trend	18	No Trend
16MWT06	9	23	0.009	23	10	Significant Upward Trend	14	Significant Upward Trend	18	Significant Upward Trend
16MWT09	8	2	0.452	2	8	No Trend	12	No Trend	16	No Trend
16MWT10	8	-5	0.317	-5	8	No Trend	12	No Trend	16	No Trend
16MWT13	8	-18	0.016	-18	8	Significant Downward Trend	12	Significant Downward Trend	16	Significant Downward Trend
16MWT17	8	8	0.199	8	8	Significant Upward Trend	12	No Trend	16	No Trend
PENNSYLVANIA MIDDLE WATER BEARING ZONE										
16MW04	9	-15	0.075	-15	10	Significant Downward Trend	14	Significant Downward Trend	18	No Trend
16MWT12	RDX was not detected in any round of sampling.									
PENNSYLVANIA LOWER WATER BEARING ZONE										
16MWT11	RDX was not detected in any round of sampling.									
16MWT15	RDX was not detected in any round of sampling.									

Notes:
-- Indicates that there were an insufficient number of samples to run the test.

Null Hypothesis: Ho: There is no trend.
Alternative Hypothesis: HA: There is an upward trend (indicated by a positive value of S).
HA: There is a downward trend (indicated by a negative value of S).

If p-value is less than alpha then reject null hypothesis of no trend.
If absolute value of the test statistic is greater than or equal to the critical value then reject null hypothesis of no trend.
Source: Data Quality Assessment: Statistical Methods for Practitioners EPA QA/G-9S, EPA/240/B-06/003. February 2006.

TABLE 4-11

MANN-KENDALL TREND TEST RESULTS FOR TRICHLOROETHENE (TCE) - GROUNDWATER
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)
NSWC CRANE

Location	N	S	p-value	Test Statistic	Alpha = 0.2		Alpha = 0.1		Alpha = 0.05	
					Critical Value	Trend?	Critical Value	Trend?	Critical Value	Trend?
PENNSYLVANIA UPPER WATER BEARING ZONE										
16MW02	8	9	0.169	9	8	Significant Upward Trend	12	No Trend	16	No Trend
16MW03	9	-3	0.421	-3	10	No Trend	14	No Trend	18	No Trend
16MWT04	9	-18	0.038	-18	10	Significant Downward Trend	14	Significant Downward Trend	18	Significant Downward Trend
16MWT06	9	16	0.060	16	10	Significant Upward Trend	14	Significant Upward Trend	18	No Trend
16MWT09	8	-12	0.089	-12	8	Significant Downward Trend	12	Significant Downward Trend	16	No Trend
16MWT10	8	-12	0.089	-12	8	Significant Downward Trend	12	Significant Downward Trend	16	No Trend
16MWT13	8	-14	0.054	-14	8	Significant Downward Trend	12	Significant Downward Trend	16	No Trend
16MWT17	8	21	0.005	21	8	Significant Upward Trend	12	Significant Upward Trend	16	Significant Upward Trend
PENNSYLVANIA MIDDLE WATER BEARING ZONE										
16MW04	9	16	0.060	16	10	Significant Upward Trend	14	Significant Upward Trend	18	No Trend
16MWT12	8	0	0.548	0	8	No Trend	12	No Trend	16	No Trend
PENNSYLVANIA LOWER WATER BEARING ZONE										
16MWT11	TCE was not detected in any round of sampling.									
16MWT15	8	3	0.406	3	8	No Trend	12	No Trend	16	No Trend

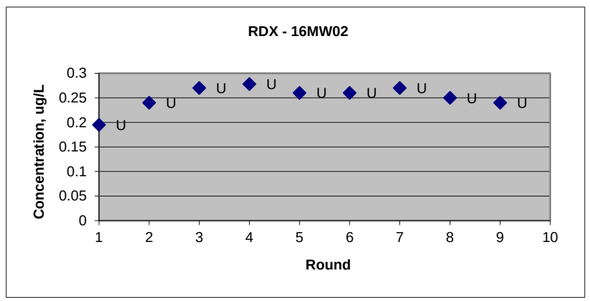
Notes:
-- Indicates that there were an insufficient number of samples to run the test.

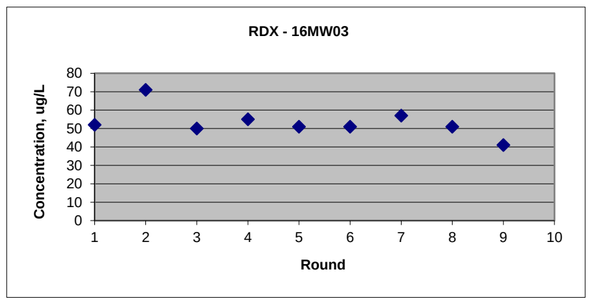
Null Hypothesis: Ho: There is no trend.
Alternative Hypothesis: HA: There is an upward trend (indicated by a positive value of S).
HA: There is a downward trend (indicated by a negative value of S).

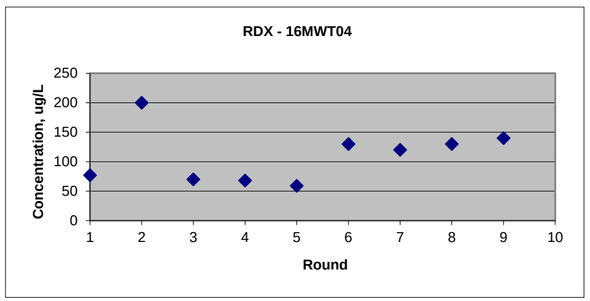
If p-value is less than alpha then reject null hypothesis of no trend.
If absolute value of the test statistic is greater than or equal to the critical value then reject null hypothesis of no trend.
Source: Data Quality Assessment: Statistical Methods for Practitioners EPA QA/G-9S, EPA/240/B-06/003. February 2006.

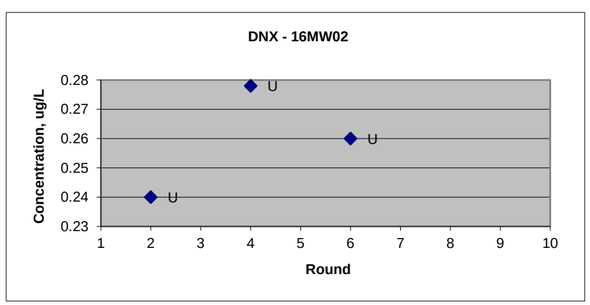
FIGURE 4-1

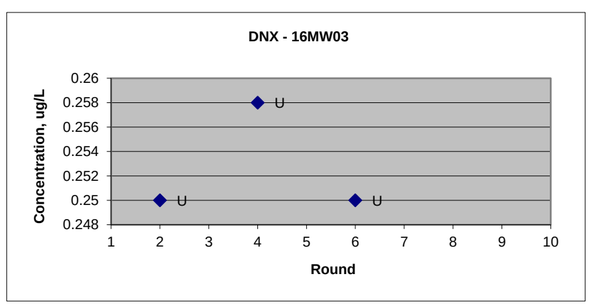
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE, CRANE, INDIANA

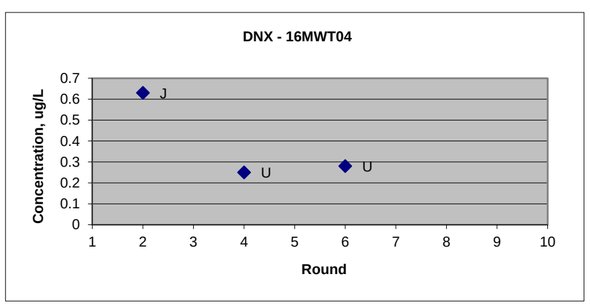


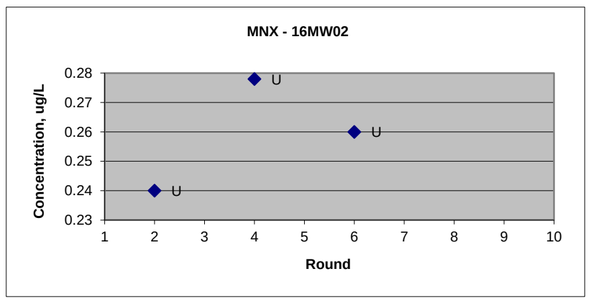


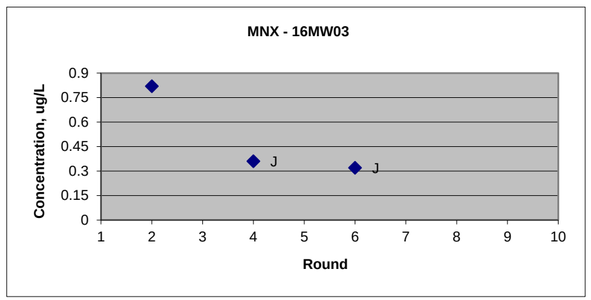


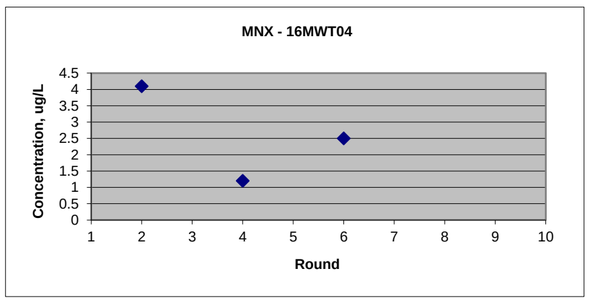


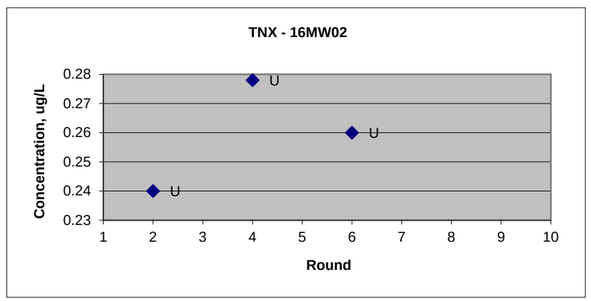


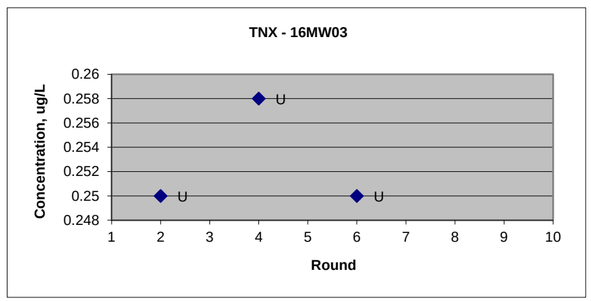












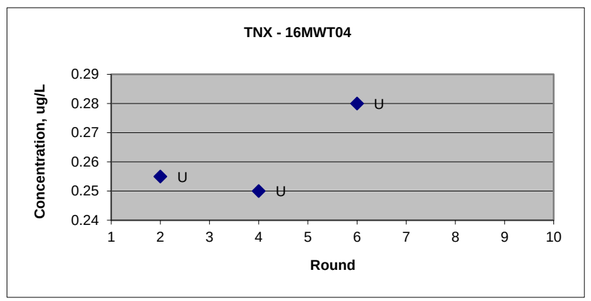
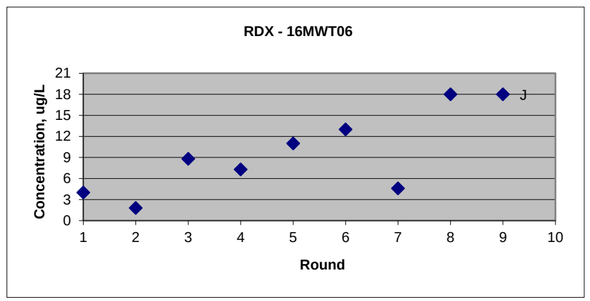
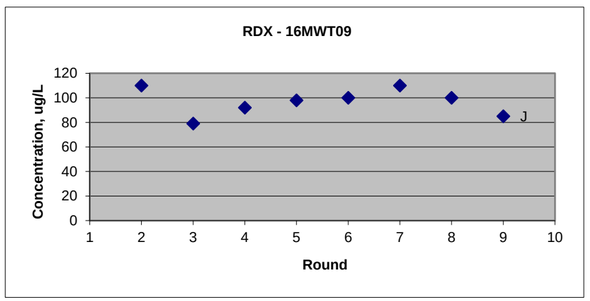
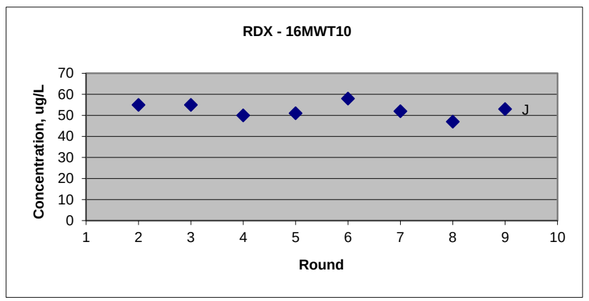


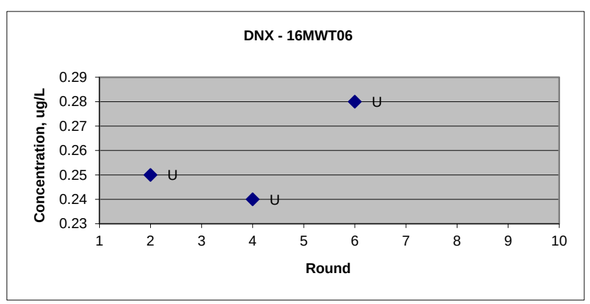
FIGURE 4-1

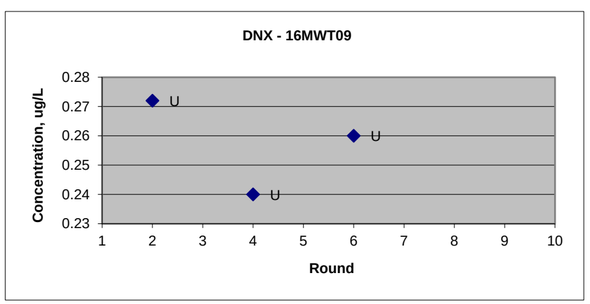
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE, CRANE, INDIANA

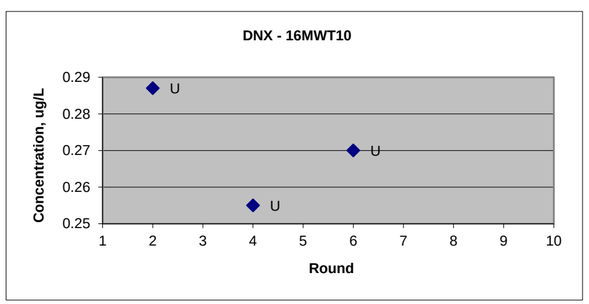


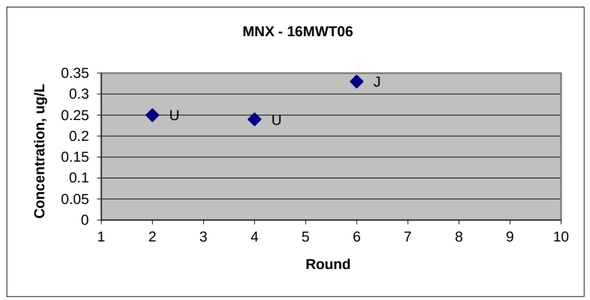


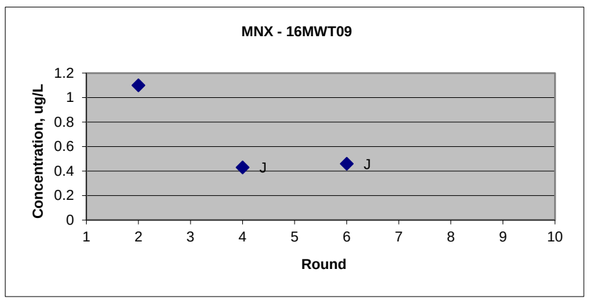


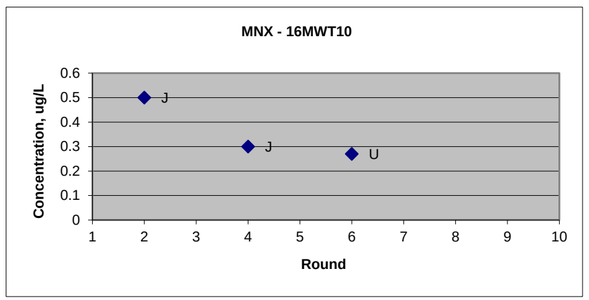


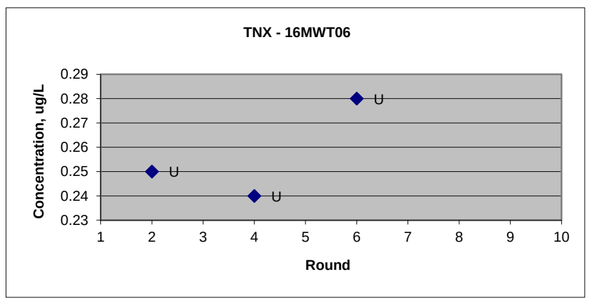


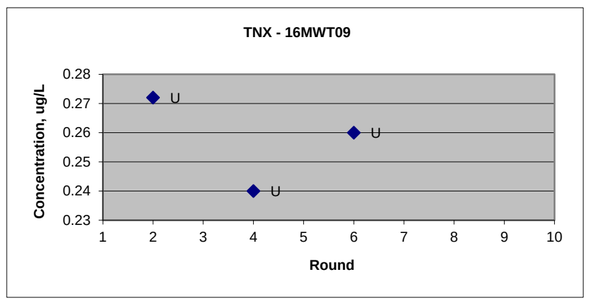












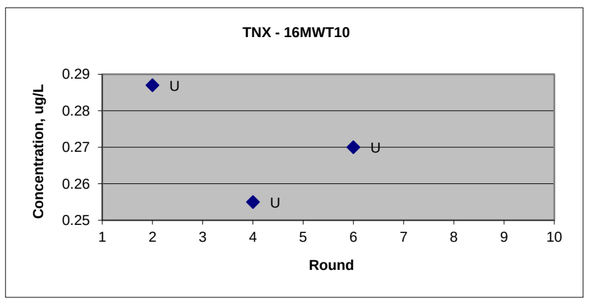
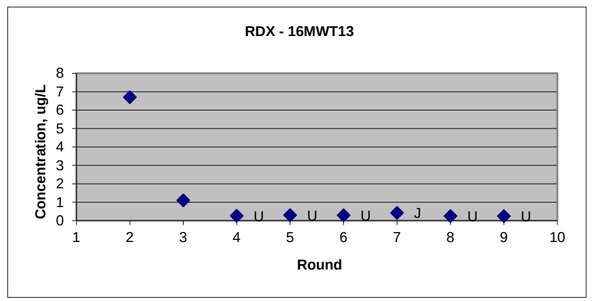
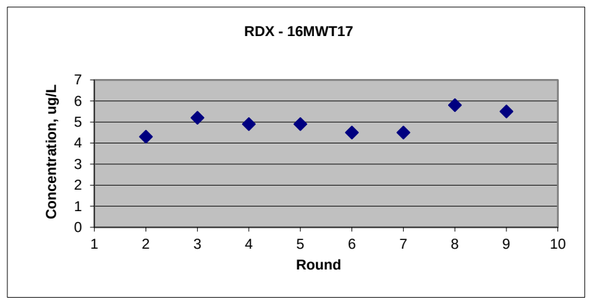
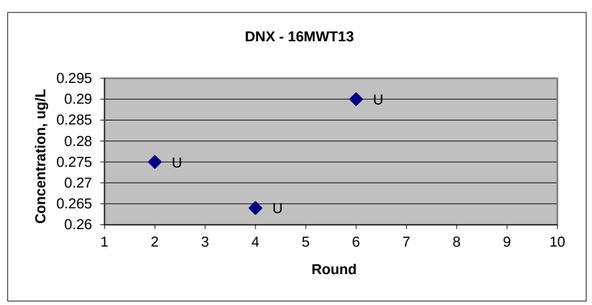


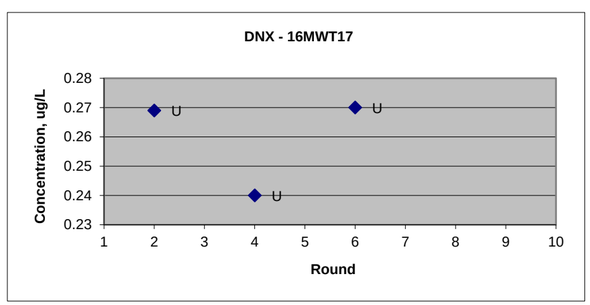
FIGURE 4-1

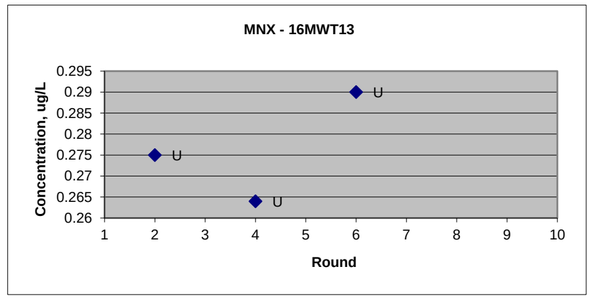
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE, CRANE, INDIANA

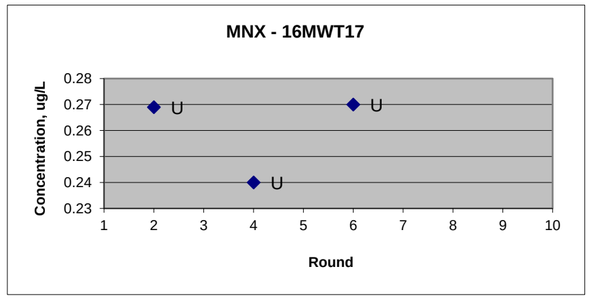


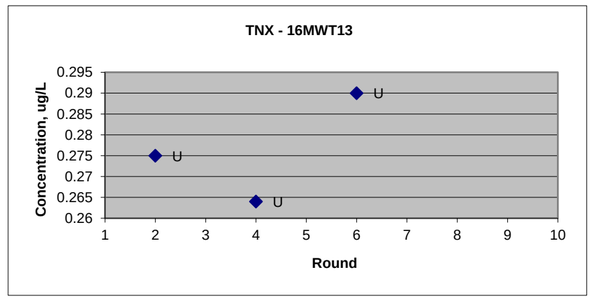












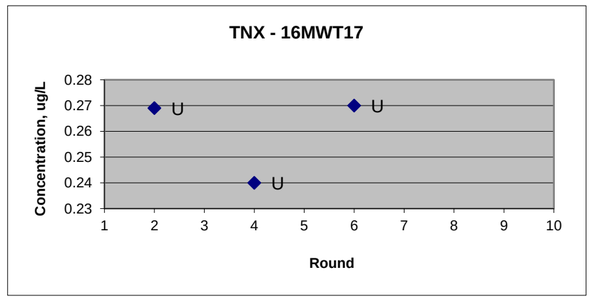
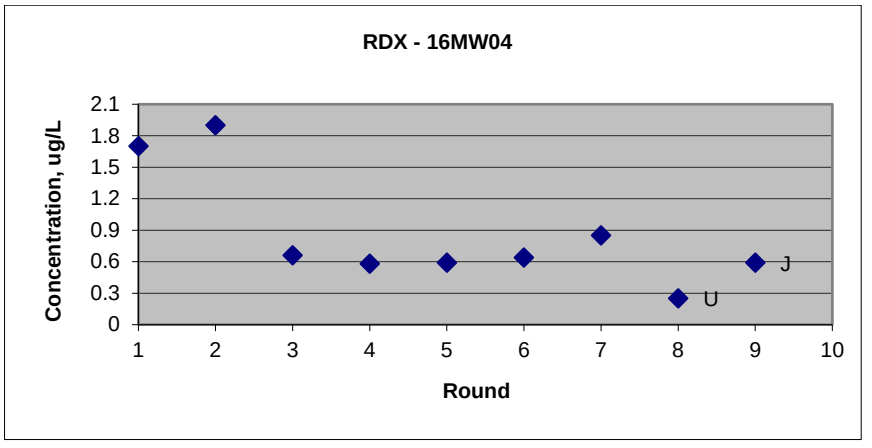
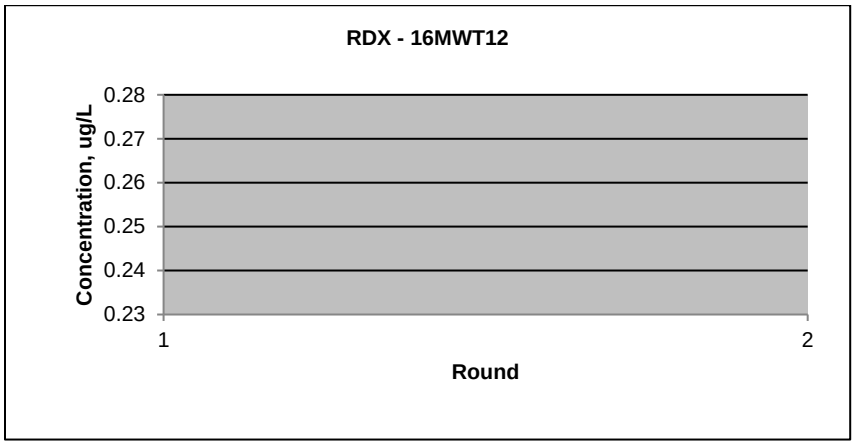
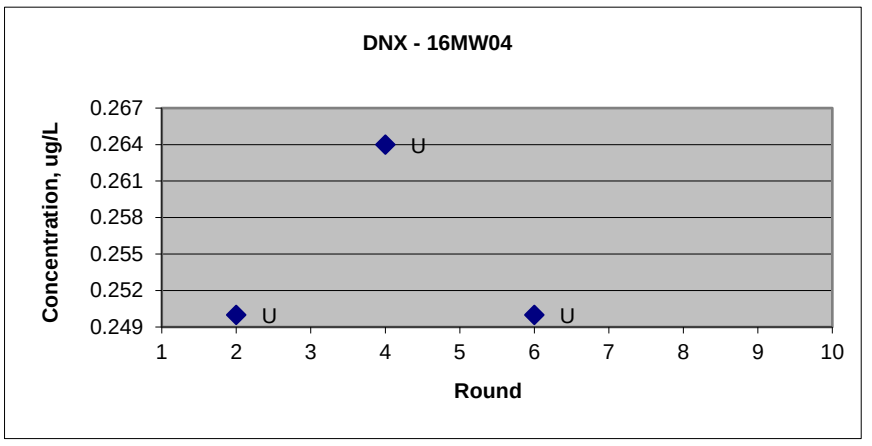


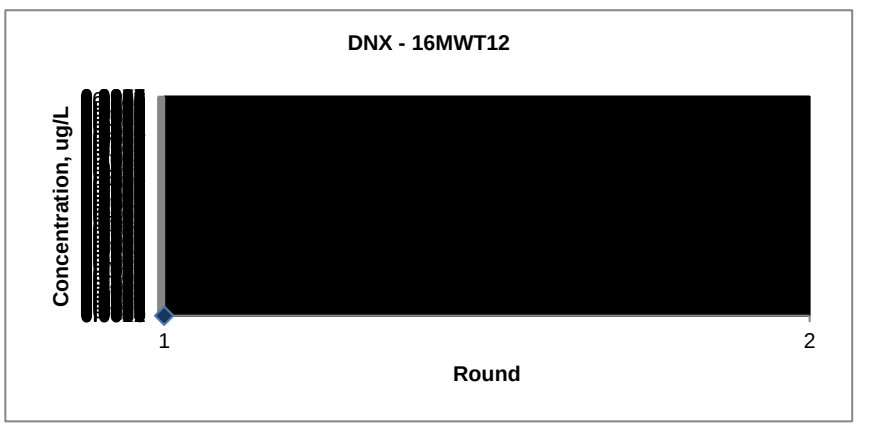
FIGURE 4-2

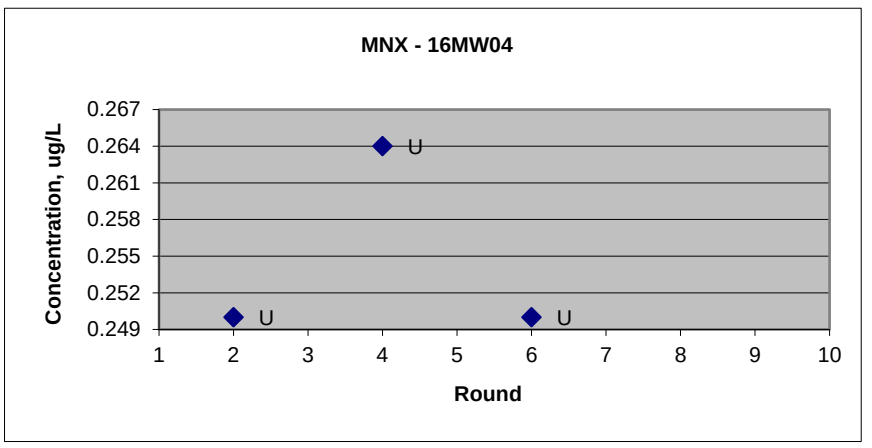
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN MIDDLE WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

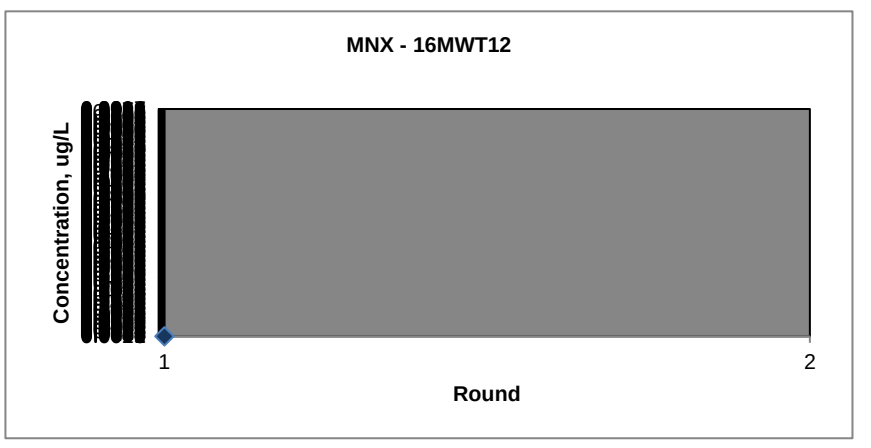


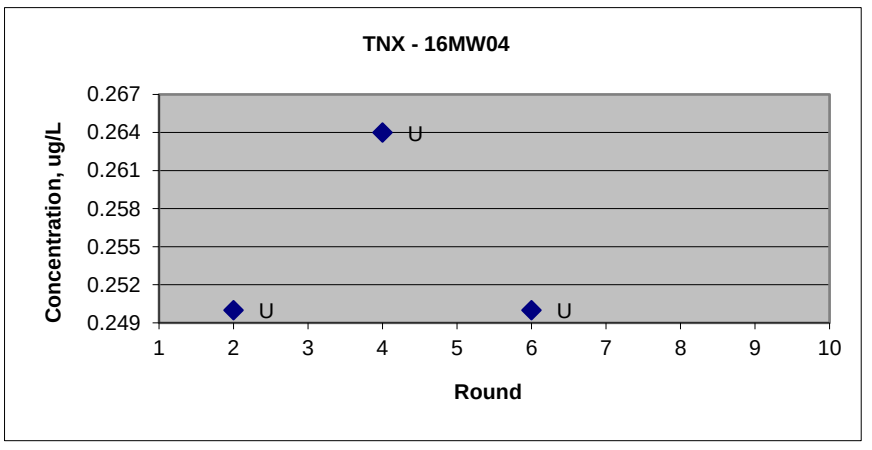












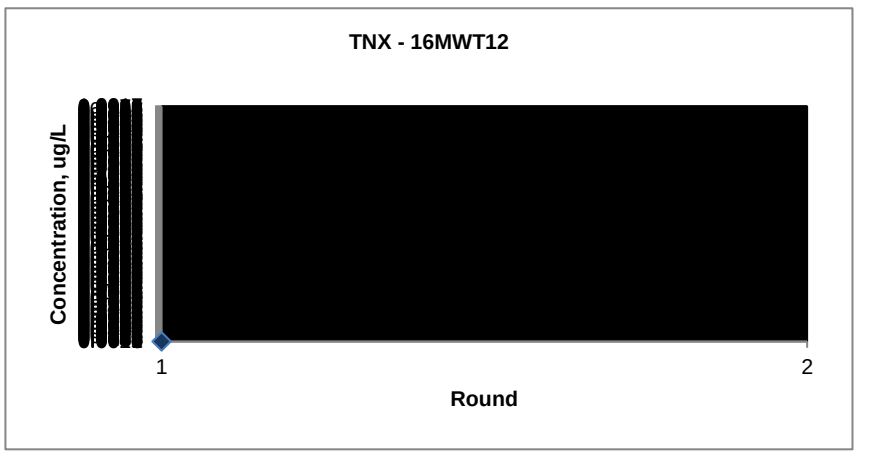
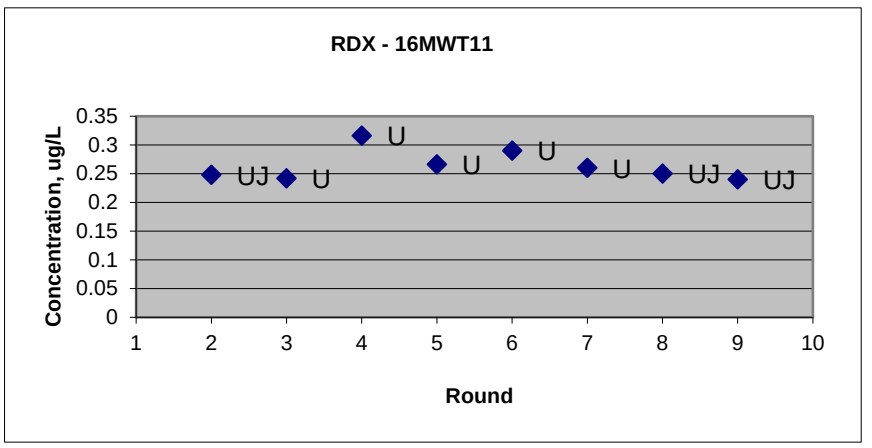
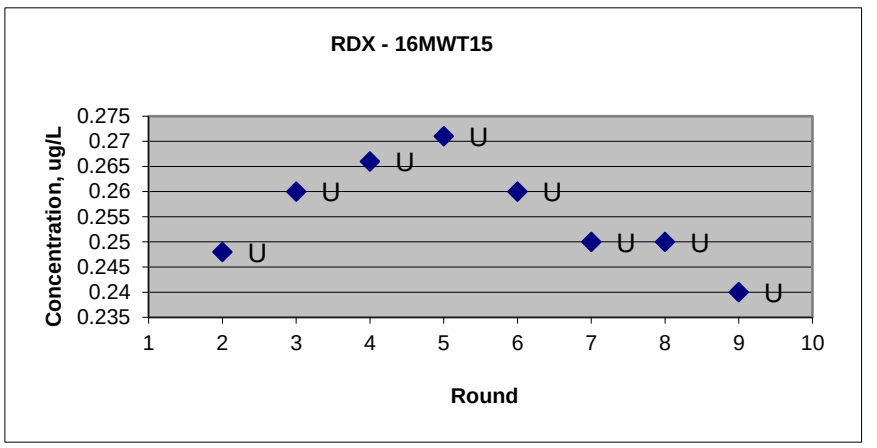
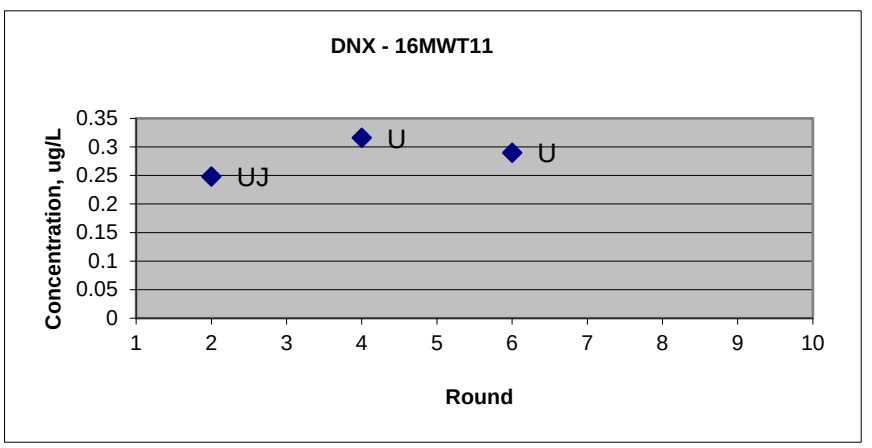


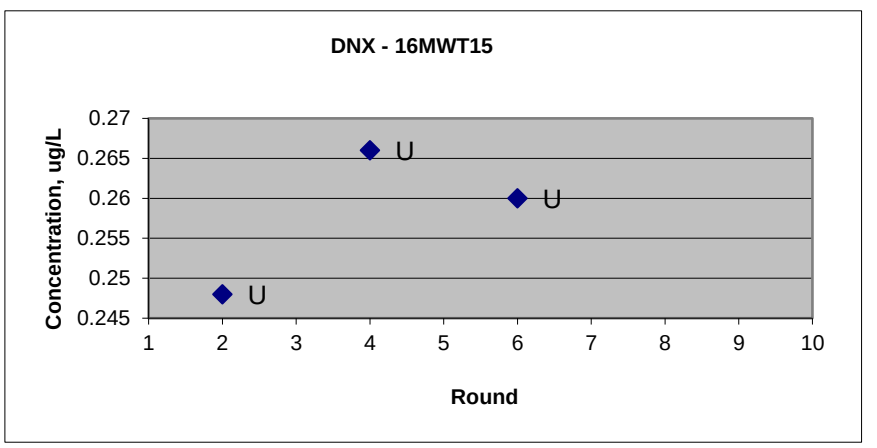
FIGURE 4-3

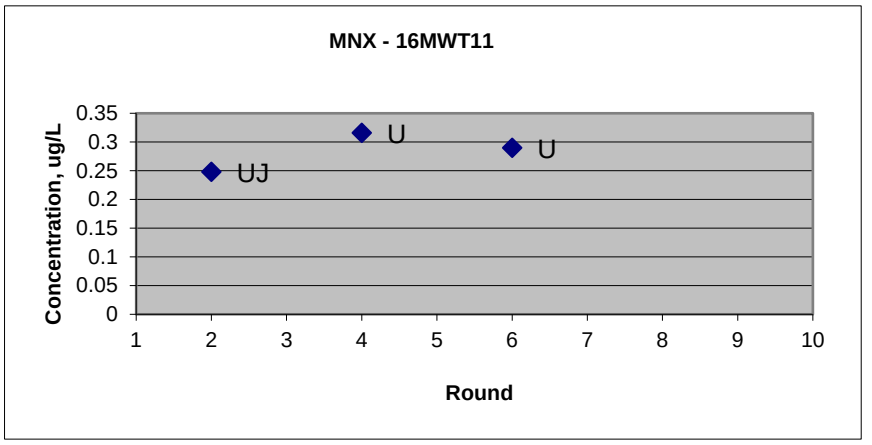
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIA LOWER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

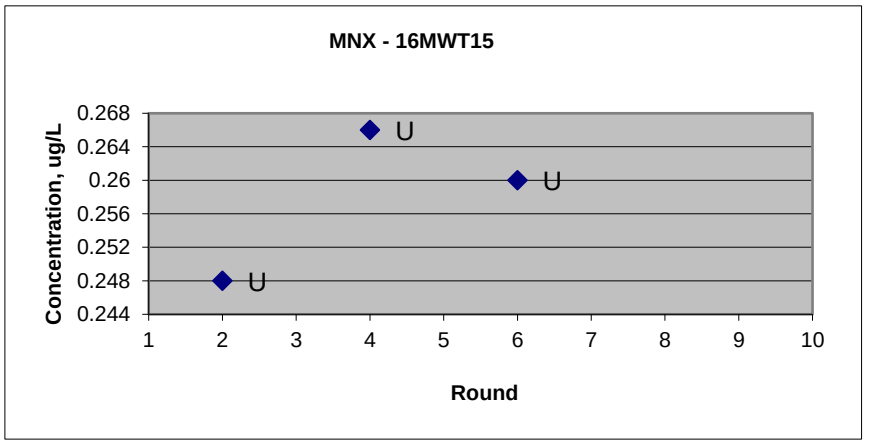


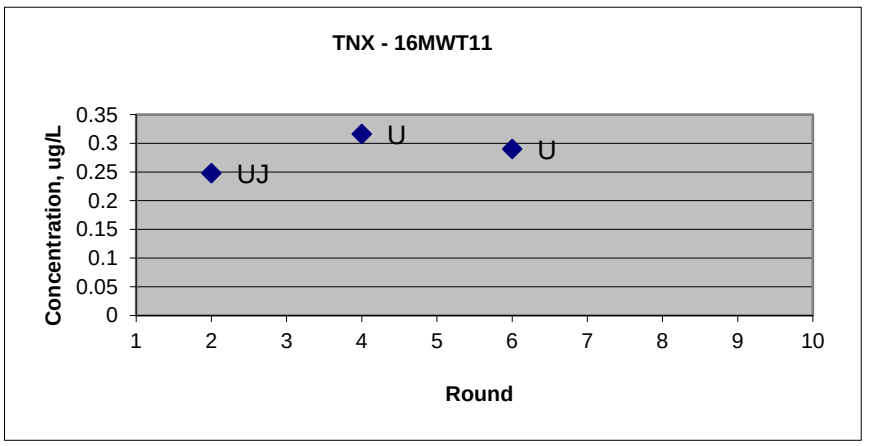












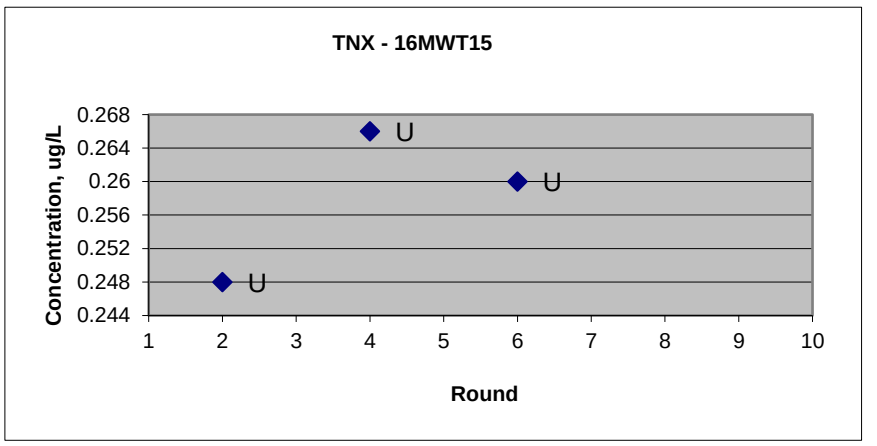
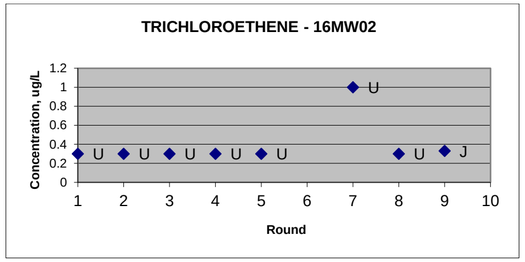
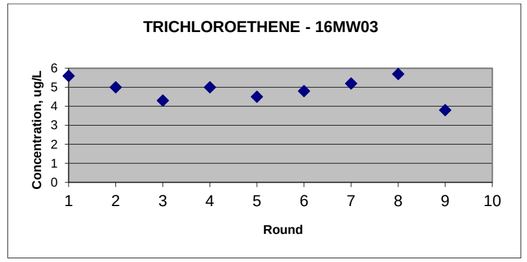
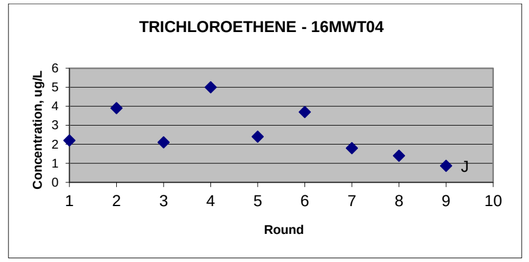


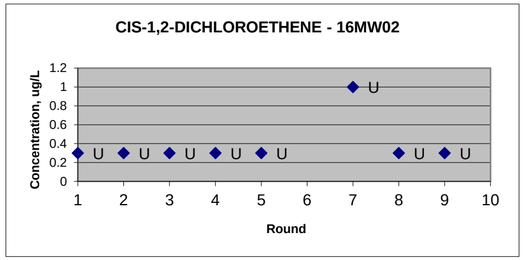
FIGURE 4-4

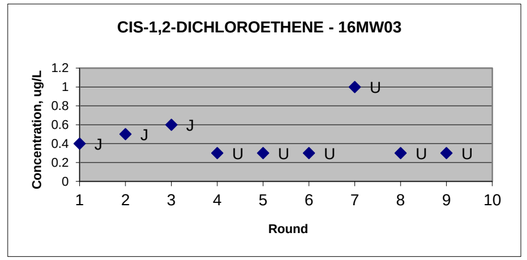
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

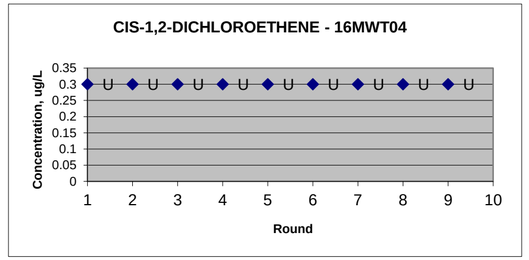


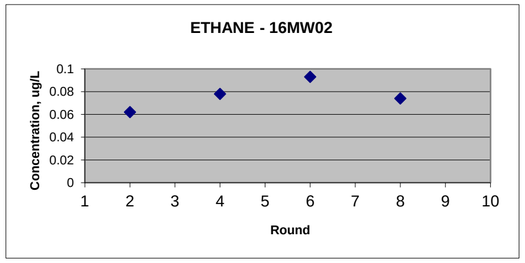


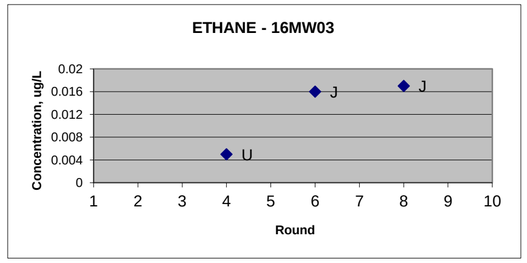


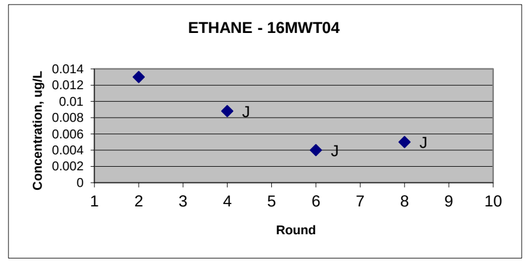


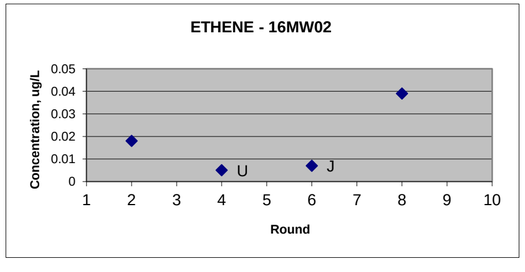


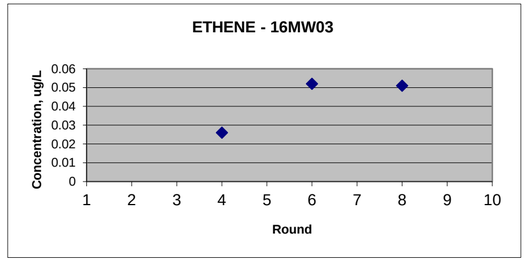


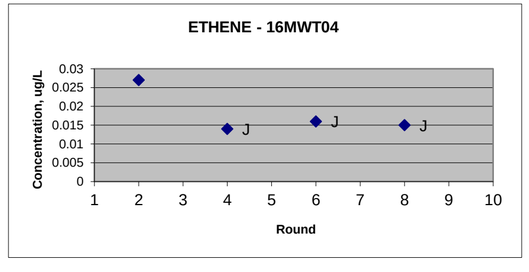


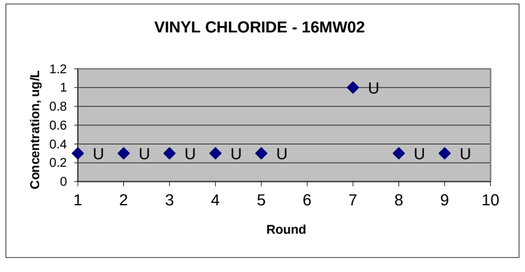


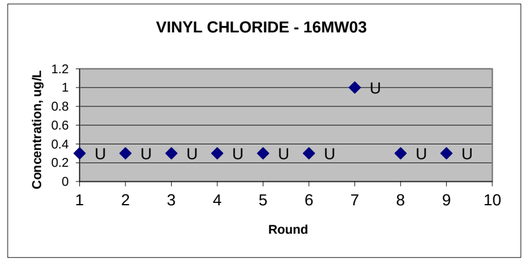












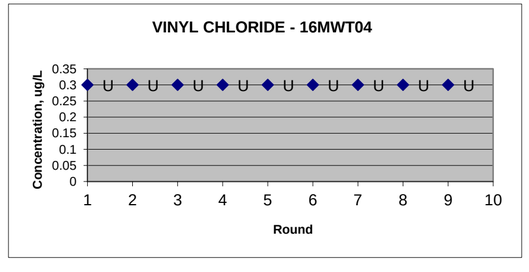
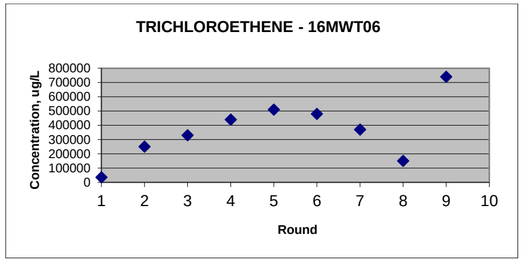
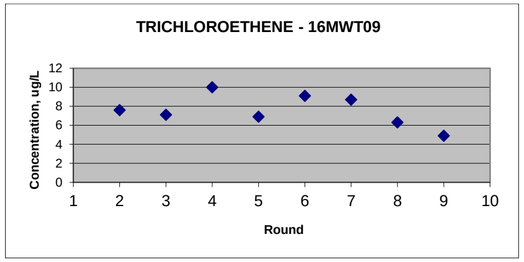
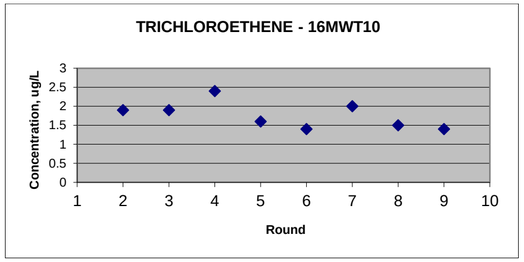


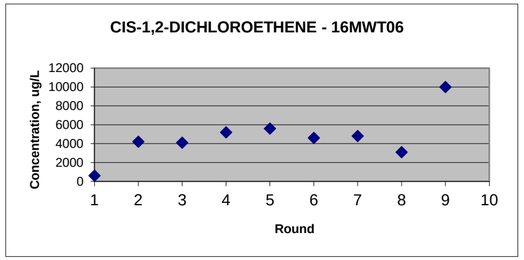
FIGURE 4-4

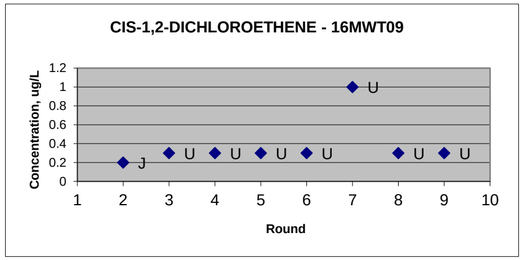
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

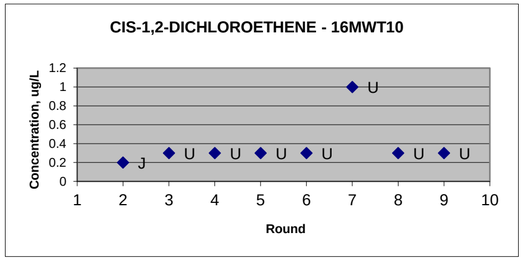


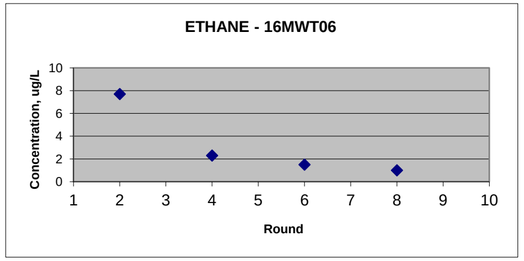


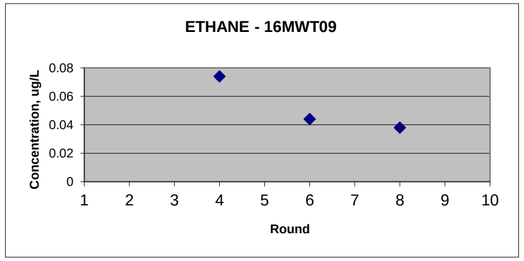


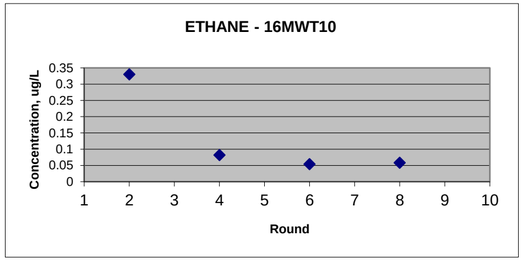


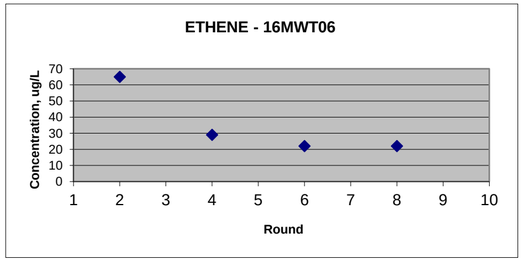


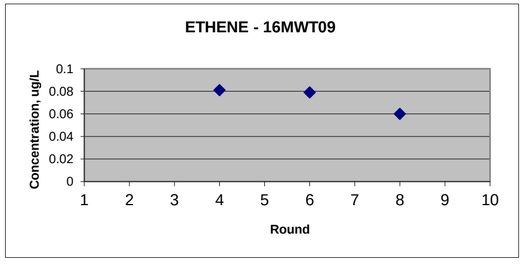


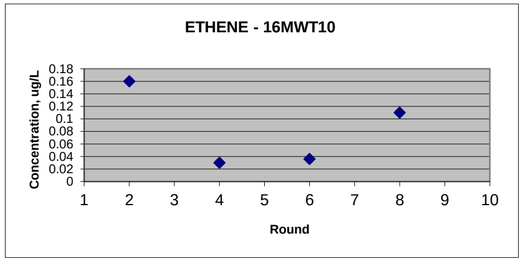


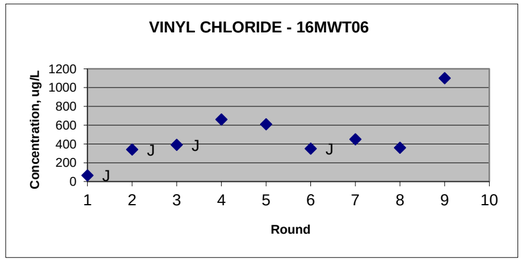


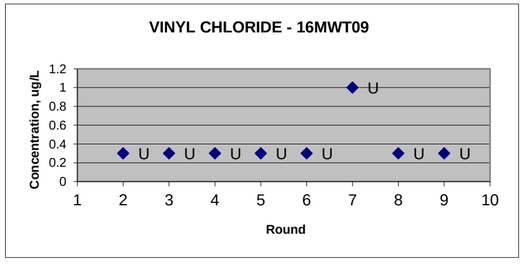












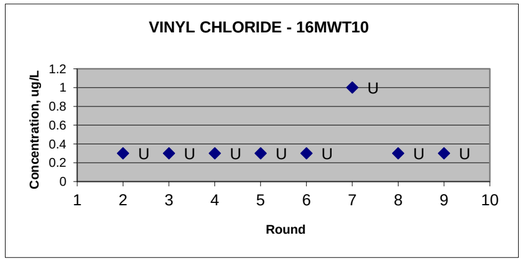
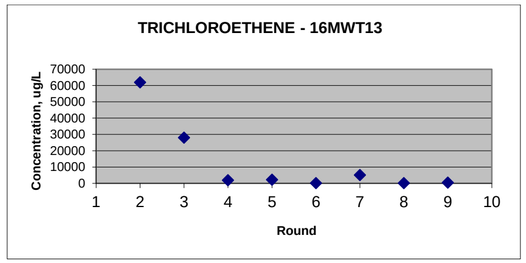
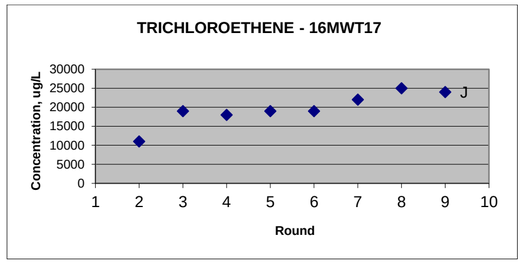
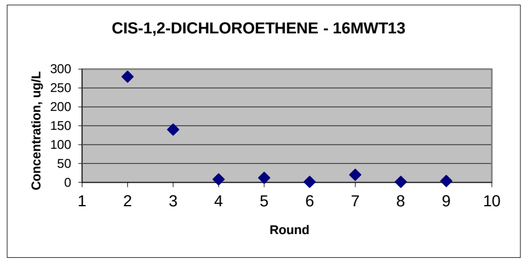


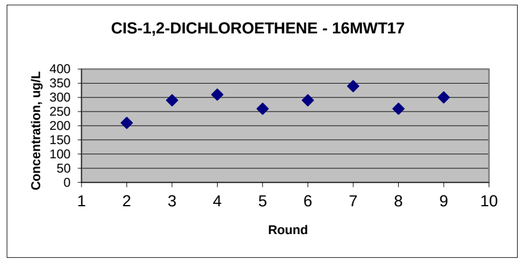
FIGURE 4-4

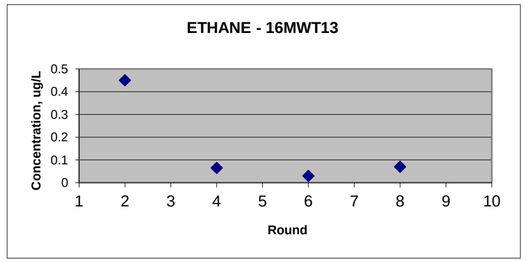
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN UPPER WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

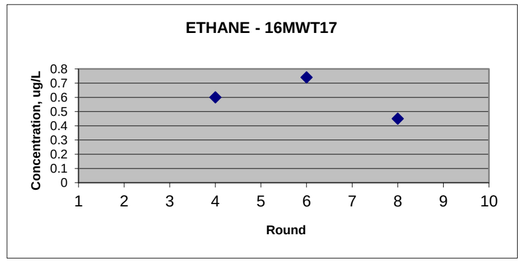


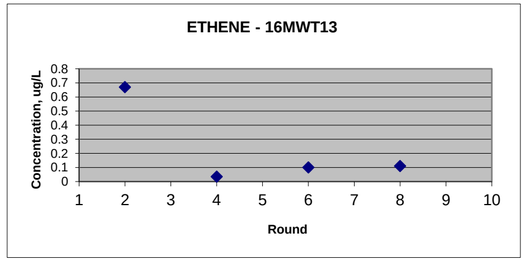


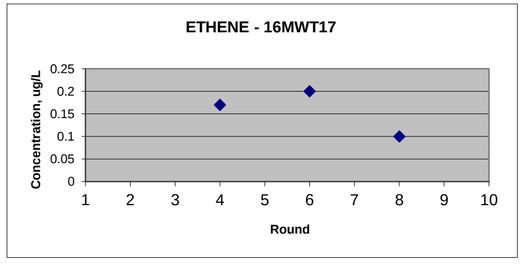


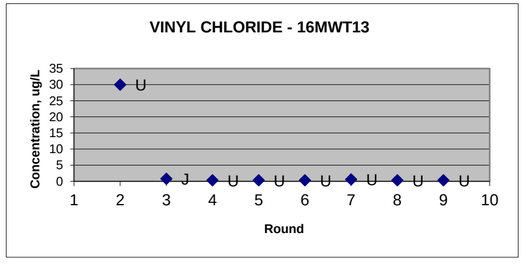












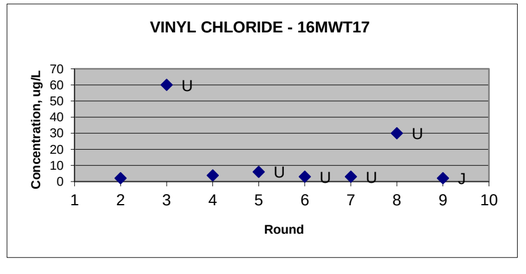
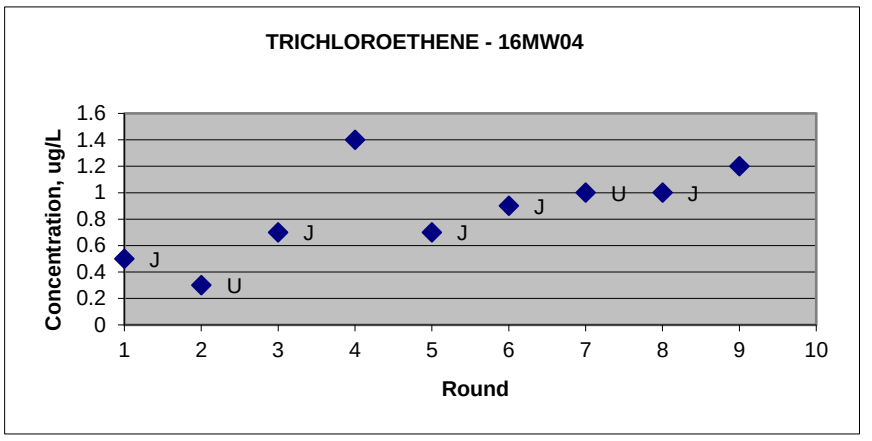
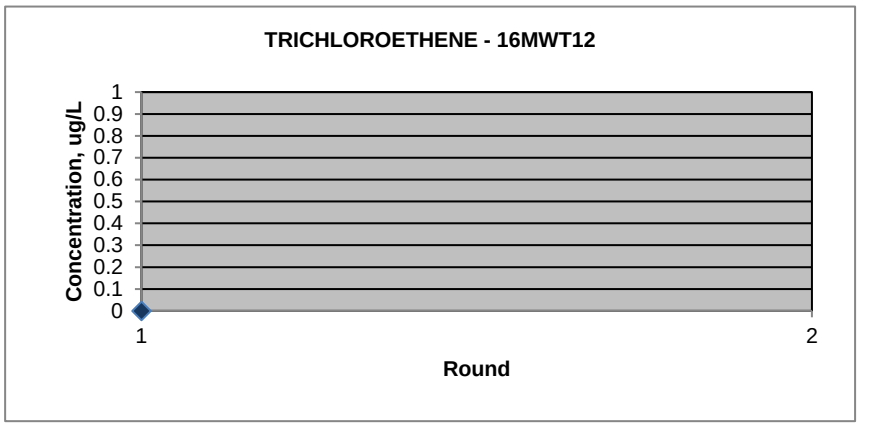
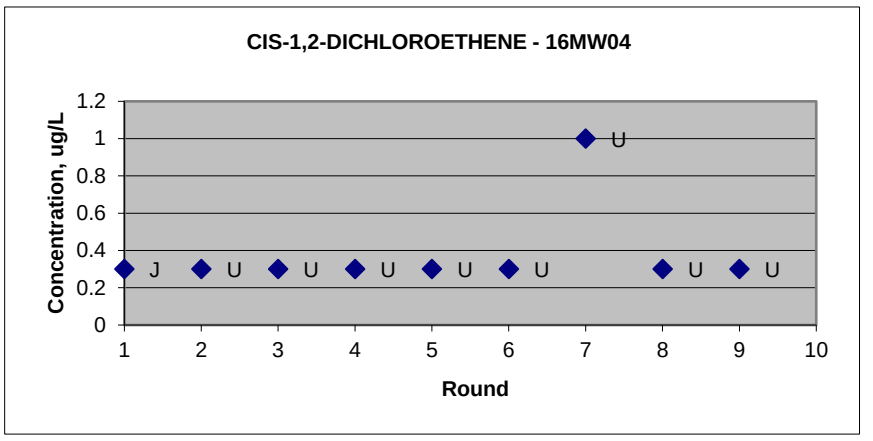


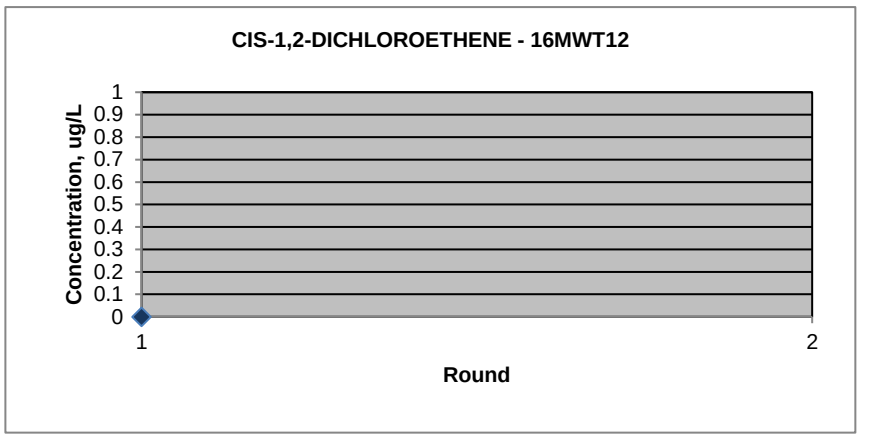
FIGURE 4-5

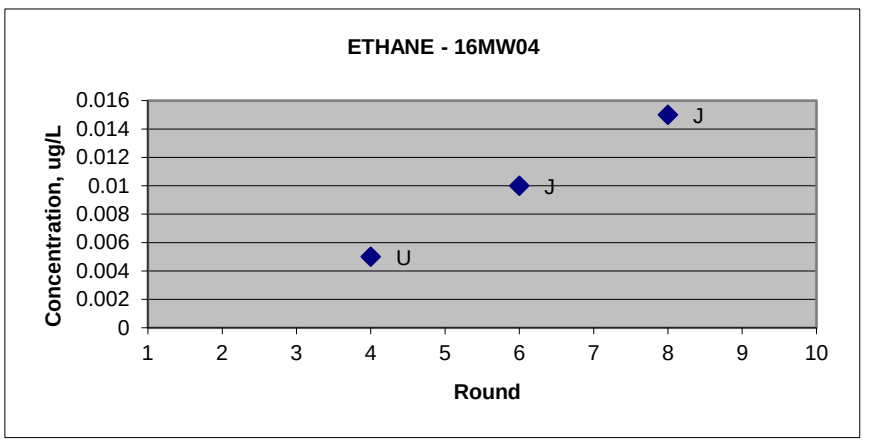
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN MIDDLE WATER BEARING ZONE AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

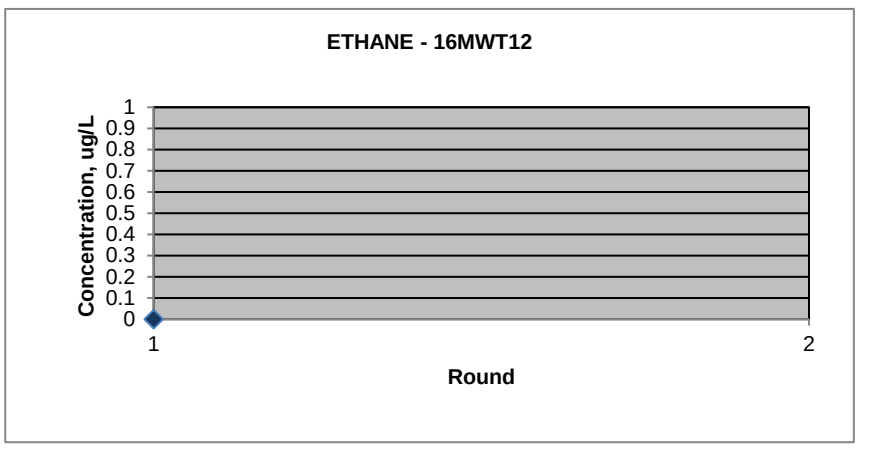


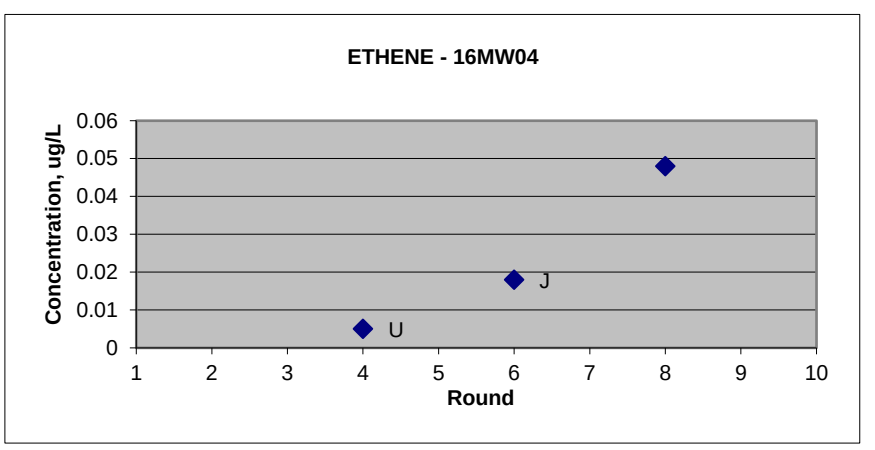


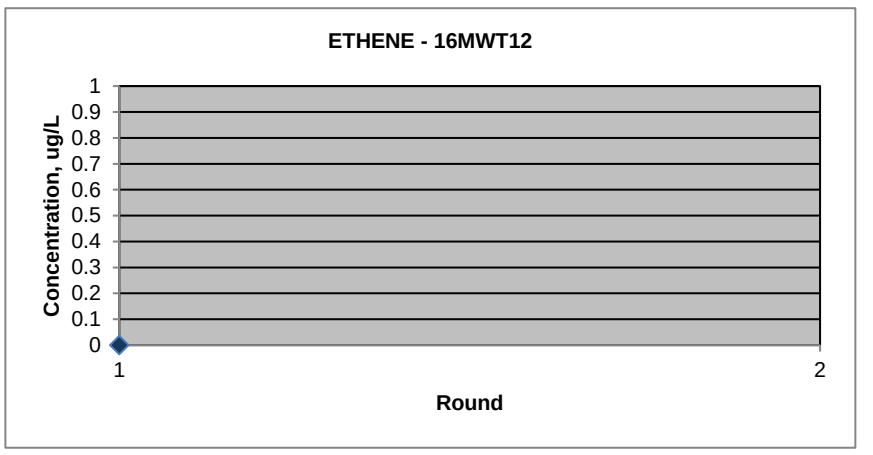


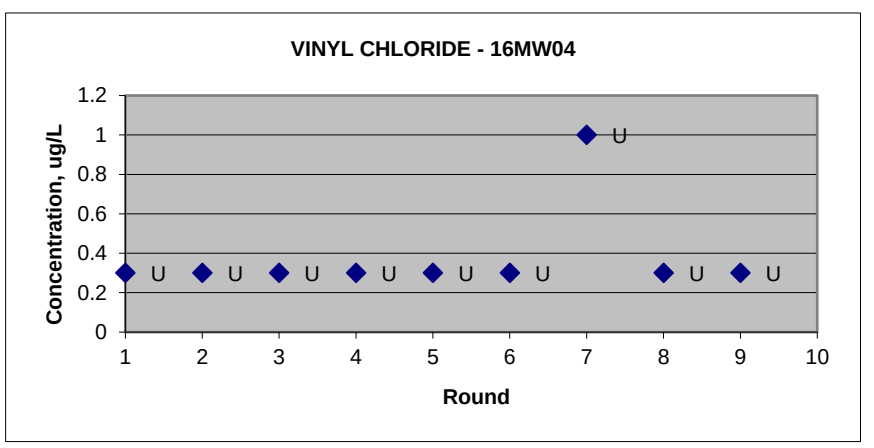












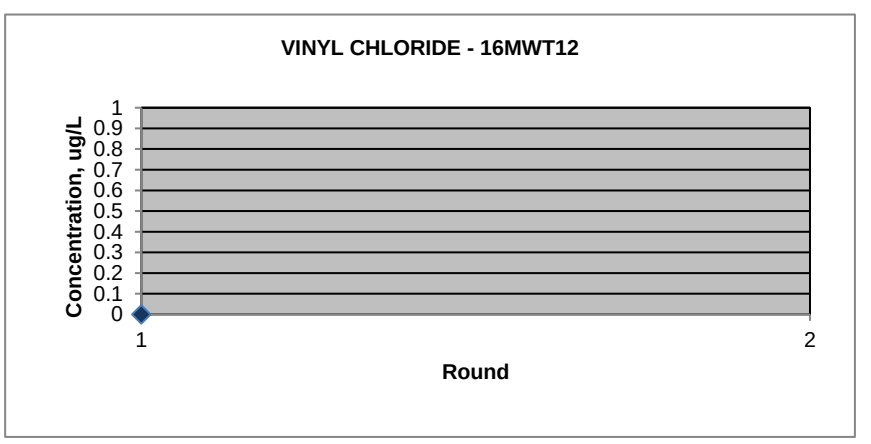
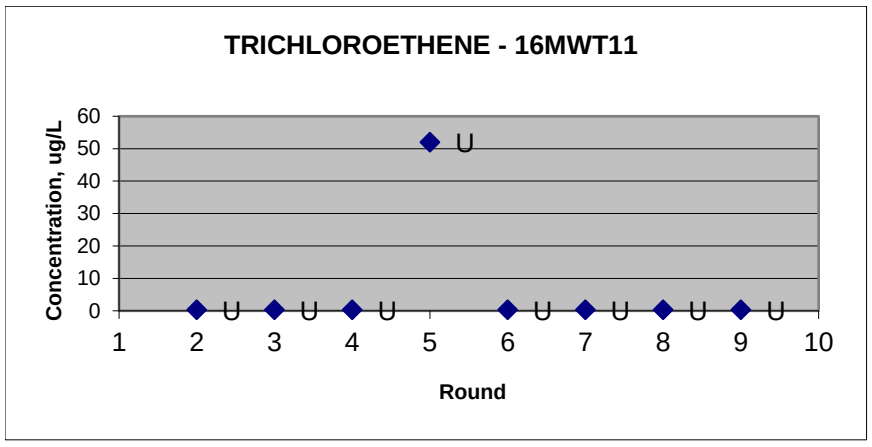
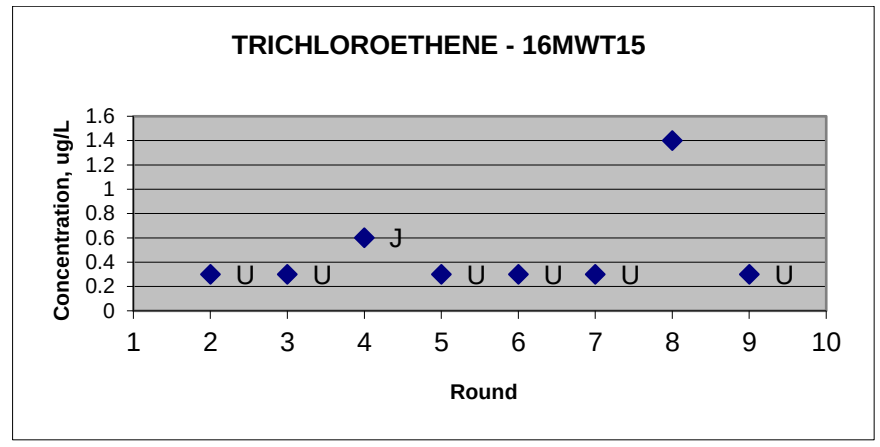
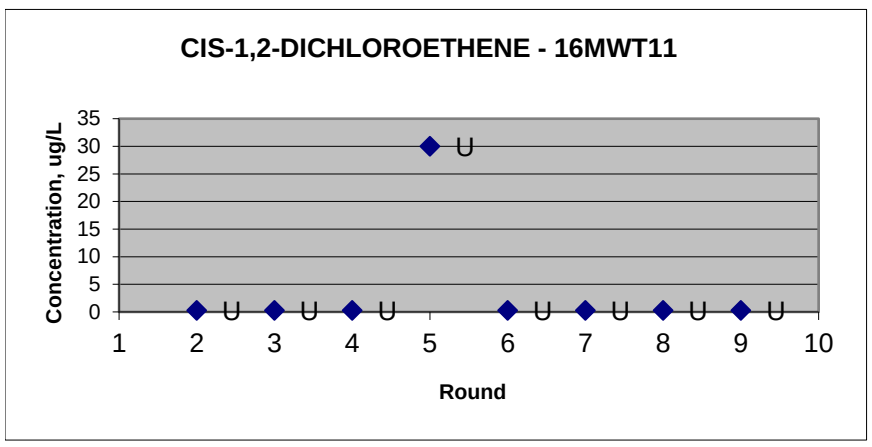


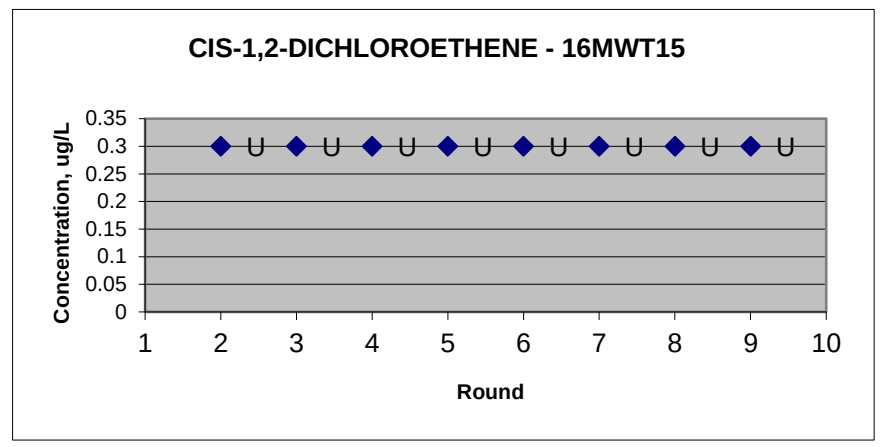
FIGURE 4-6

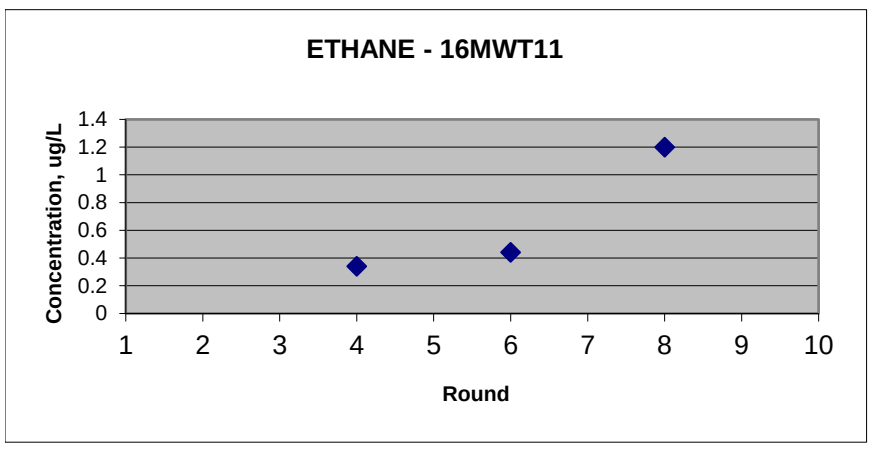
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN THE PENNSYLVANIAN LOWER WATER BEARING ZONE AT SWMU 16 ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

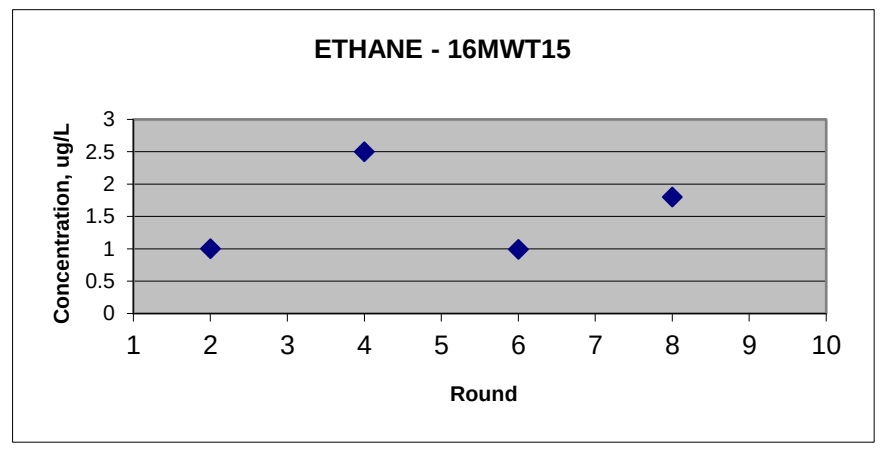


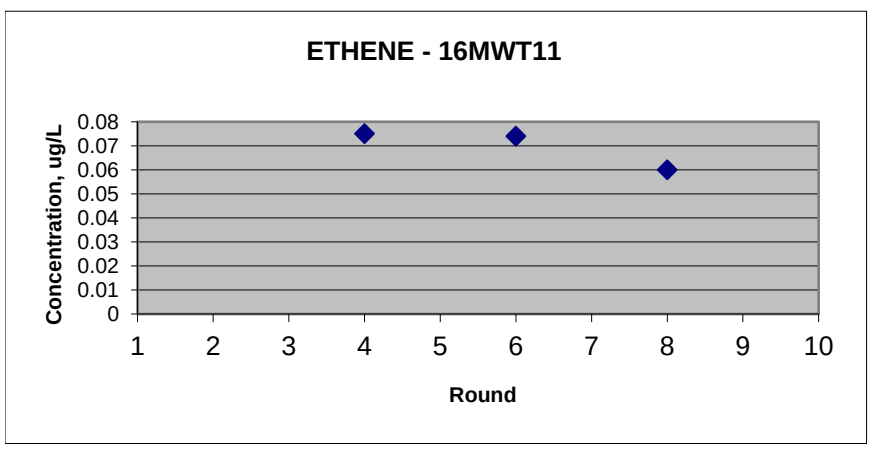


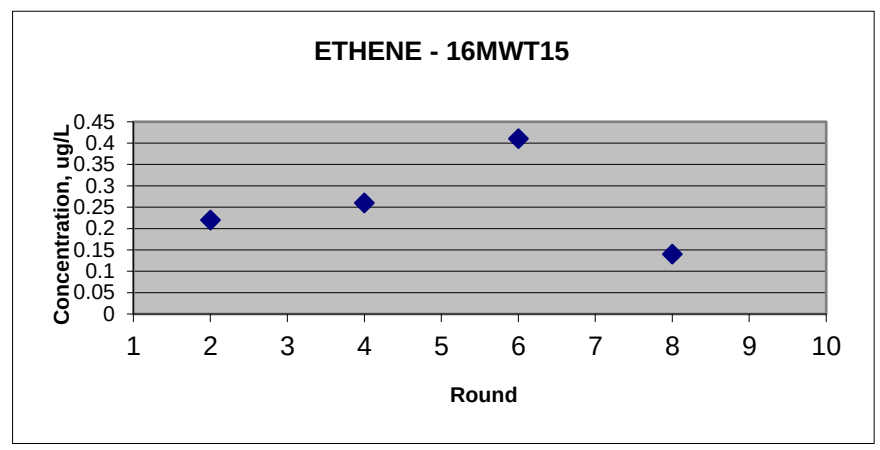


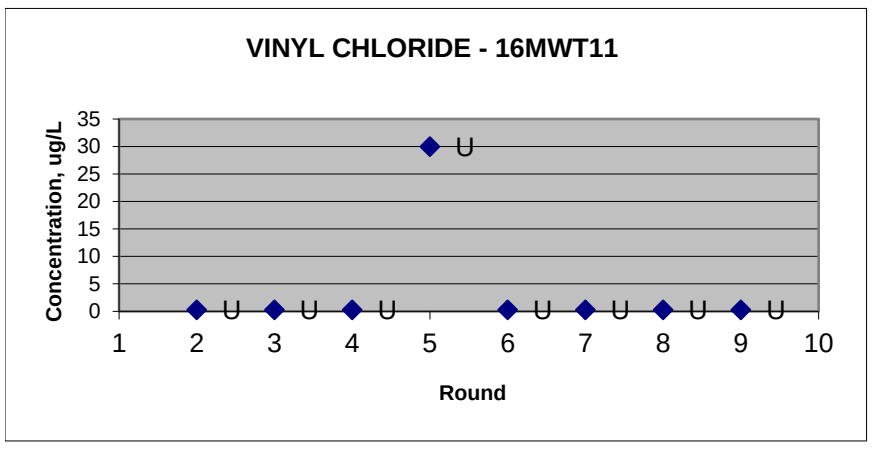












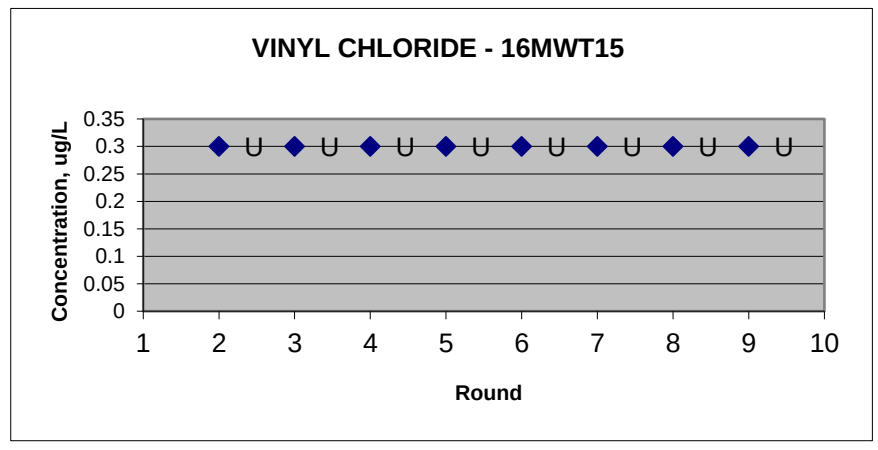
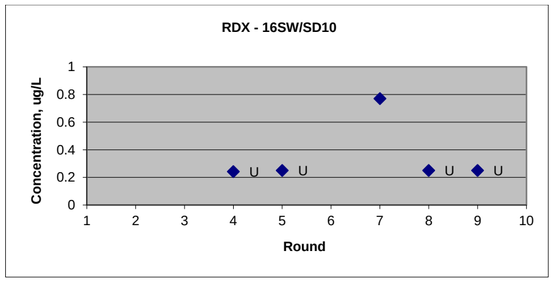
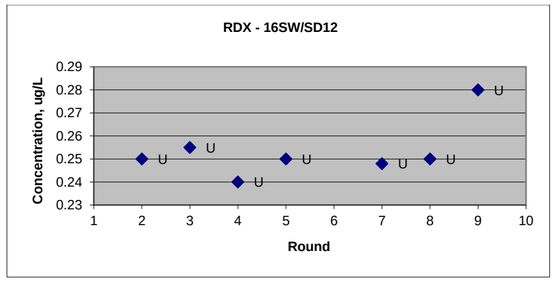
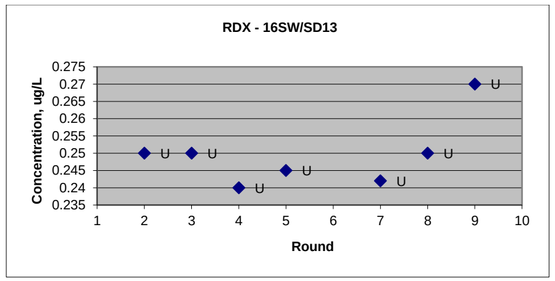


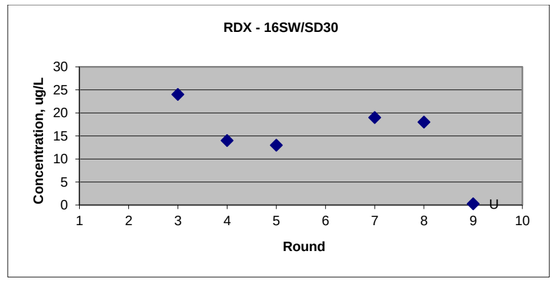
FIGURE 4-7

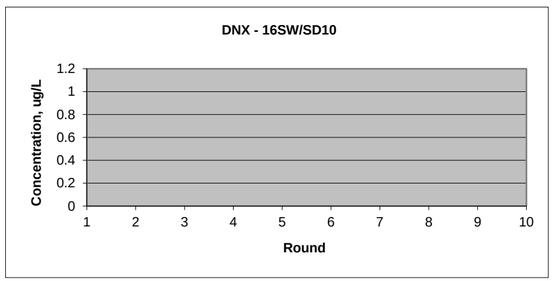
TEMPORAL PLOTS OF RDX AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN SURFACE WATER AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

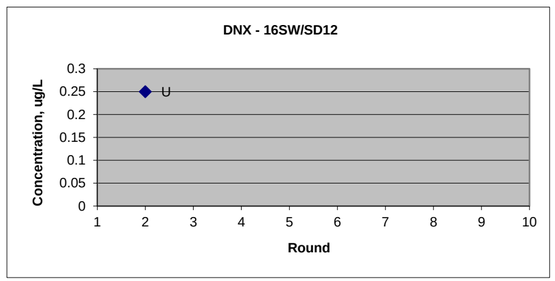


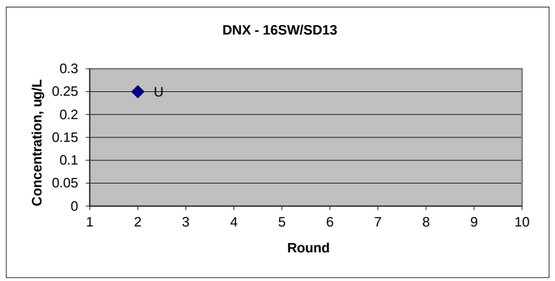


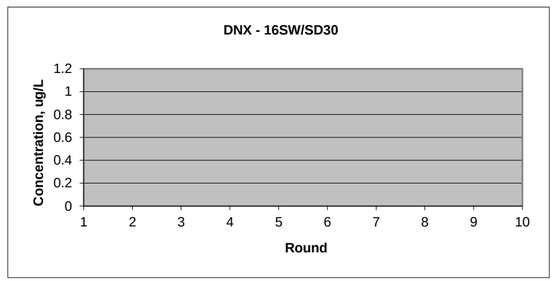


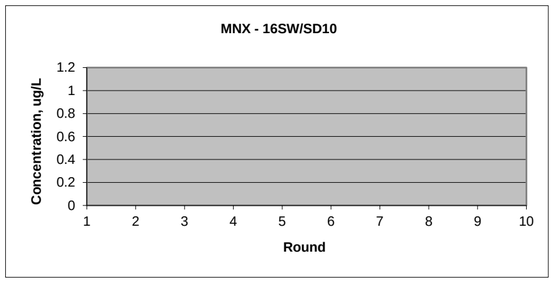


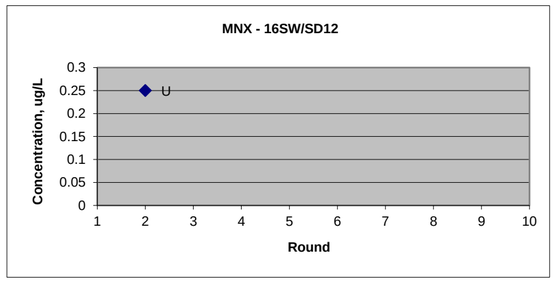


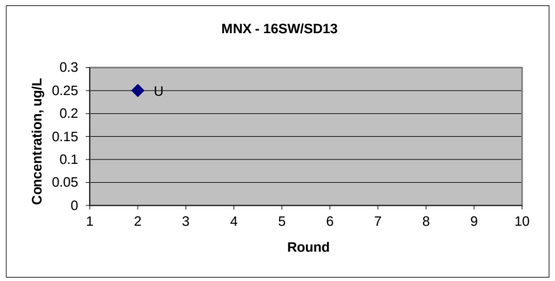


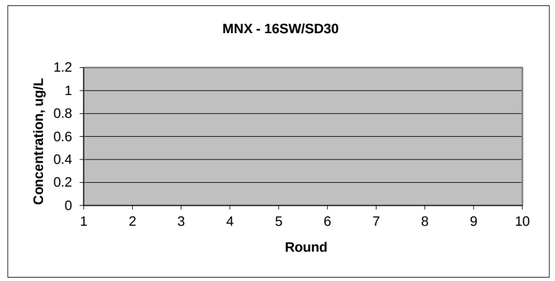


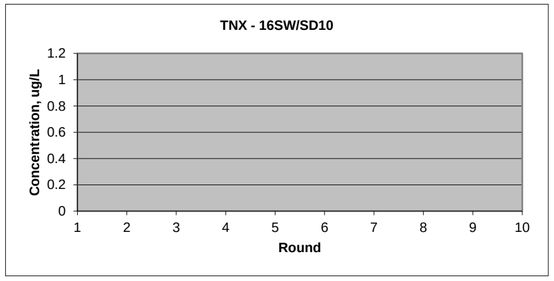


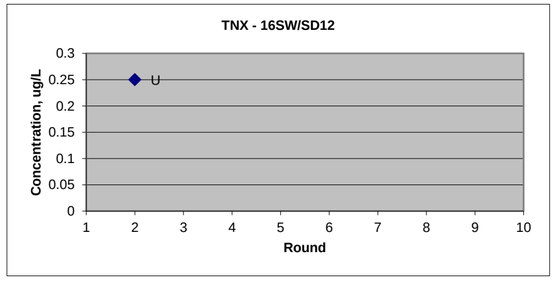


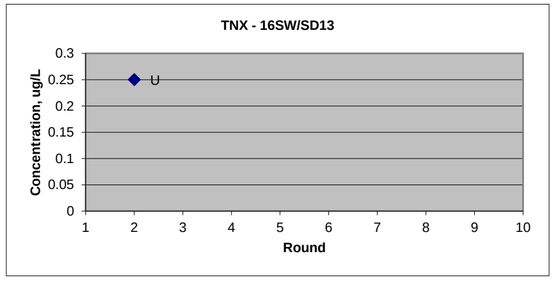












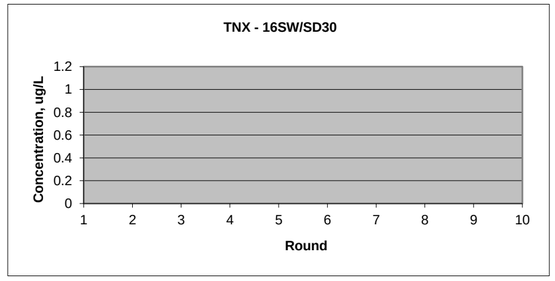
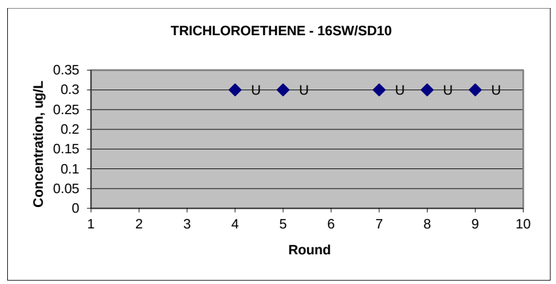
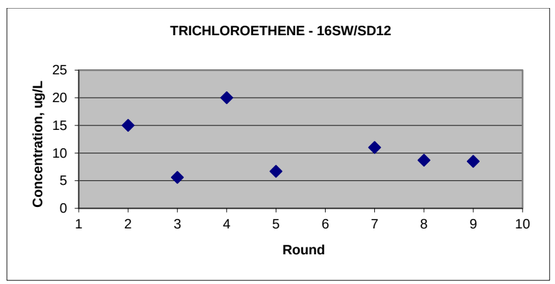
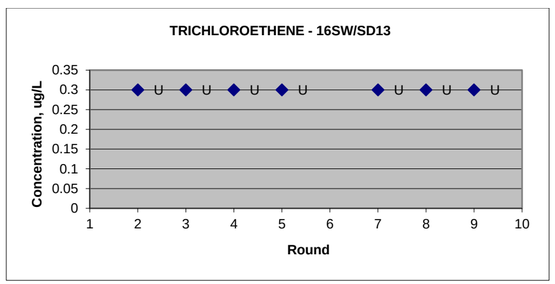


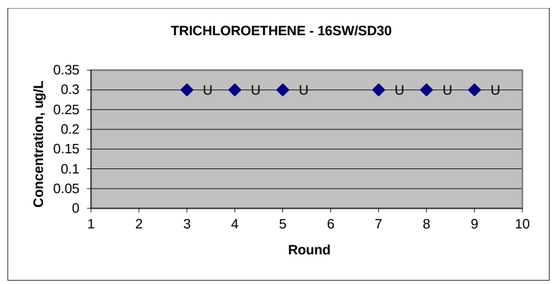
FIGURE 4-8

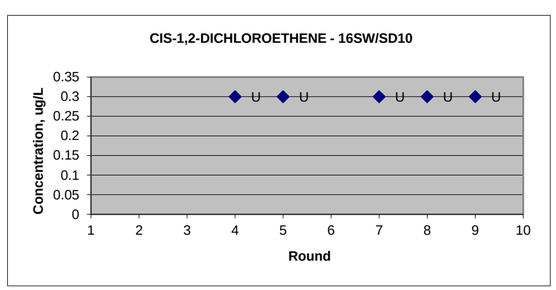
TEMPORAL PLOTS OF TRICHLOROETHENE AND DEGRADATION BY-PRODUCT CONCENTRATIONS IN SURFACE WATER AT SWMU 16 FOR ROUNDS 1 THROUGH 9 NSA CRANE CRANE, INDIANA

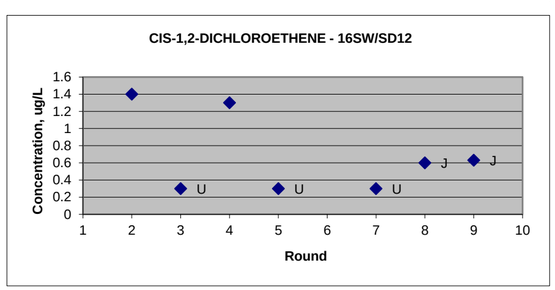


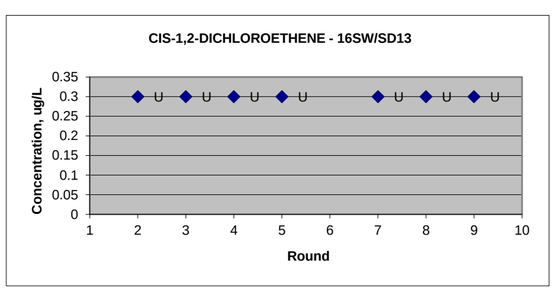


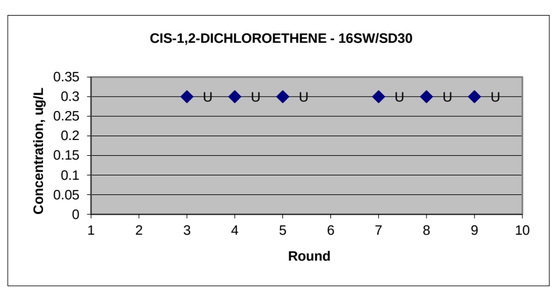


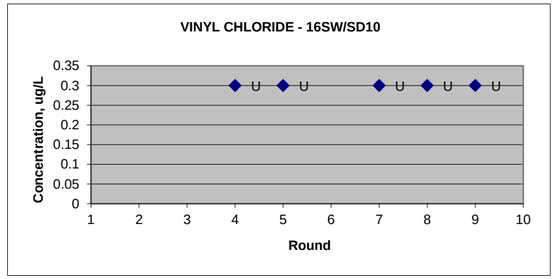


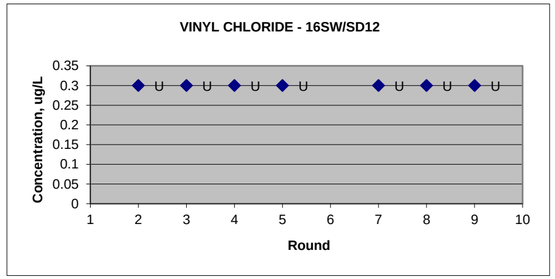


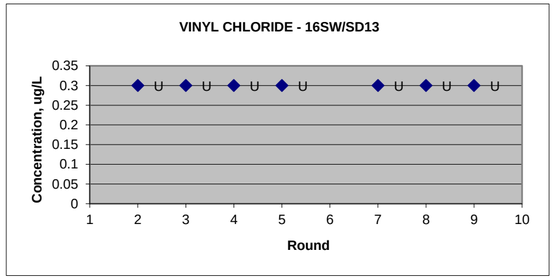


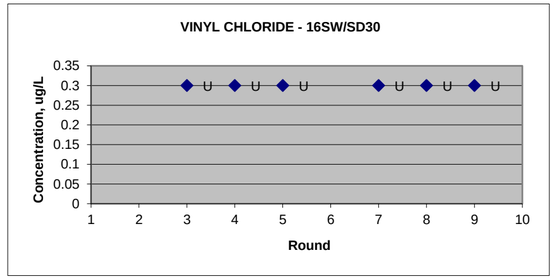












5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 PLUME STABILITY

The RDX concentrations are greatest on the top of the ridge near the well on the eastern side of the SWMU 16 operational area. From there, the concentrations decrease in downgradient directions away from the ridge top and down the hillsides. The groundwater data presented in this MNA evaluation suggest that the RDX plume within the Puz is relatively stable and has not spread to the downgradient well in the Pmz. RDX degradation by-products have been consistently detected where RDX concentrations exceeded 50 µg/L. This demonstrates that some RDX degradation is occurring. For the most part, RDX has only been detected at one surface water location east of SWMU 16 in the valley and concentrations have generally decreased since the maximum value was reported in Round 3.

The highest VOC concentrations have been reported at the source well 16MWT06 near the location of the eastern sump and at source wells located north and northwest of Building 146. TCE concentrations decrease significantly in the downgradient directions toward the valleys below and to the southern end of the SWMU 16 operational area. Source area wells located north and northeast of Building 146 show an upward trend in concentrations, which indicates TCE contamination is continuing to migrate from soil to groundwater. MNA data indicate that concentrations in the northern portion of the TCE plume area are decreasing, but have been stable in the southern portion of the plume. TCE degradation by-product concentrations have been detected at all Puz wells and demonstrate that TCE degradation is occurring, particularly at the source area wells. TCE and degradation by-products have only been detected at one surface water location in the valley east of Building 146 and TCE concentrations indicate a downtrend since Round 7.

5.2 TEMPORAL TRENDS

Source Area Wells

A potential decreasing trend in RDX concentrations was noted at the higher confidence levels (90 and 95 percent) at two source area wells. A potential decreasing concentration trend for RDX was indicated at source area well 16MWT13 and has not been detected in Rounds 4 through 9. Conversely, a potential increasing trend in RDX concentrations was noted at source area well 16MWT06 since Round 2, but appears to have stabilized in Rounds 8 and 9. RDX concentrations at source well 16MWT17 have remained stable and show no apparent trend. RDX degradation by-products have not been detected in all source area wells.

The highest concentrations of TCE have been measured at source well 16MWT06. TCE concentrations displayed a significant upward trend to a maximum of 500,000 µg/L in Rounds 1-5, then abruptly declined in Rounds 6-8 to 150,000 µg/L. Unexpectedly in Round 9, TCE increased dramatically to over 700,000 µg/L. In addition, TCE concentrations at source well 16MWT17 have shown a steady trend upward from 11,000 µg/L in Round 2 to 25,000 to 24,000 µg/L, which indicates that TCE is still migrating to groundwater in the source area.

TCE degradation by-products have generally been detected at all source area wells. The maximum concentrations for all by-products have been detected in well 16MWT06. Cis-1,2-dichloroethene concentrations have been consistently at least two to three orders of magnitude larger in comparison to other degradation by-products measured in the MNA program. The trend of cis-1,2-dichloroethene concentrations at all source area wells have followed the same trend as TCE described above. Ethane and ethene concentrations have remained below 1 µg/L and are exhibiting a potential downward trend. Vinyl chloride has been most frequently detected in well 16MWT06 and is showing an upward trend.

Plume Wells

Within the RDX plume, concentrations have shown no trends at the higher confidence levels (90 and 95 percent). The highest RDX concentration (200 µg/L) has been reported at well 16MWT04, which also has shown the largest range of RDX concentrations. The most frequently detected RDX degradation by-product in all RDX plume wells has been MNX. The highest concentration of MNX (4.0 µg/L) has also occurred at well 16MWT04, but shows no trend. MNX concentrations have exhibited a downtrend at wells 16MWT03, 16MWT09, and 16MWT10 where concentrations have been less than 1.2 µg/L.

With the exception of well 16MWT03, TCE concentrations in the plume have shown a downward trend since Round 4. TCE concentrations in plume wells have ranged from 1 µg/L at 16MWT04 to 10 µg/L at 16MWT09. Detections of TCE degradation by-products have been sporadic, with ethene and ethane being the most frequently detected at all four plume wells. There have been no detections of vinyl chloride in the plume wells.

Plume Leading Edge Well

RDX has been detected in eight of nine rounds at the leading edge well 16MWT12. Since Round 2, RDX concentrations have trended downward from a maximum of 1.9 µg/L in Round 2 to 0.6 µg/L in Round 6 and shown no definitive trend in subsequent rounds. There have been no detections of RDX degradation products at the leading edge well.

Temporal plots for the leading edge well 16MWT12 are shown on Figure 4-5. TCE concentrations at well 16MWT12 have been less than 1.5 µg/L and have shown oscillating trends over nine rounds of sampling, with no detections in Rounds 2 and 7. Detections of degradation by-products at the leading edge well have been limited to only ethane and ethene at concentrations less than 0.05 µg/L.

Surface Water

RDX has been detected most frequently and solely at location 16SW30 at concentrations less than 25 µg/L and have shown a downward trend since the first sample was collected in Round 3. RDX was not detected in Round 9. There has been very limited sampling for RDX degradation products in surface water and has resulted in no detections.

TCE has been detected in the range of 5 to 20 µg/L at only one location (16SW12) and is showing no apparent trend in concentrations. Cis-1,2-dichloroethene was detected in the early and later rounds at 16SW12 at concentrations less than 0.15 µg/L.

5.3 RECOMMENDATIONS

Due to an increasing trend in RDX groundwater concentrations at two of the three source area wells, it appears that RDX is possibly still being released from or near the north sump. The highest RDX concentrations in groundwater are in the RDX plume on the eastern side of the operational area and have essentially remained stable.

Although intermediate remedial actions were taken to plug off and clean out the east and west sumps, TCE concentrations in the source area are showing an upward trend indicating potential sources of TCE in the Puz. TCE concentrations at most plume wells are showing a downtrend in concentrations.

Based on the SWMU 16 MNA evaluation, the groundwater plumes for RDX and TCE are relatively stable. Statistical and temporal plots indicate that RDX and TCE concentrations in some source and plume area wells are decreasing with time. In addition, degradation by-products of both RDX and TCE have been detected at several wells to indicate that natural attenuation processes are occurring in the groundwater. However, some wells continue to show steady or increasing concentrations of RDX and TCE that may be a result of continuing impacts from contaminated soil areas near these wells.

Based on this evaluation, it is recommended that the natural attenuation monitoring program at SWMU 16 be continued on an annual or semi-annual basis to evaluate MNA as an alternative remedy for RDX and

TCE contaminated groundwater. Due to the fact that some wells are reporting an upward trend in RDX and TCE concentrations, the corrective measure process should also consider further soil remediation at SWMU 16 as an alternative measure to reduce RDX and TCE concentrations in groundwater.

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APPENDIX A

SAMPLE LOG SHEETS AND OTHER FIELD FORMS

APPENDIX A.1

GROUNDWATER SAMPLE LOG SHEETS

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GW0210
TtNUS Project #	112G00041	**Well ID**	16MW02
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	14.50	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	25.80	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**	2	**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	Y	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID	16FD04260701				

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/26/07	09:15	14.50	110	Clear	6.89	0.659	6.57	0.25	12.67	136	N/A		0
4/26/07	09:25	14.80	110	Clear	6.94	0.661	5.19	0.00	12.95	110	N/A		1100
4/26/07	09:35	14.80	110	Clear	6.88	0.666	4.05	0.00	13.12	69	N/A		1100
4/26/07	09:45	14.85	160	Clear	6.78	0.629	3.75	0.00	12.66	73	N/A		1600
4/26/07	09:55	14.85	160	Clear	6.71	0.600	3.52	0.00	12.52	76	N/A		1600
4/26/07	10:05	14.95	160	Clear	6.69	0.584	3.49	0.00	12.43	78	N/A		1600
4/26/07	10:15	14.95	160	Clear	6.64	0.568	3.14	0.00	12.38	80	N/A		1600
4/26/07	10:25	14.95	160	Clear	6.63	0.562	2.91	0.00	12.35	80	N/A		1600

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/26/07	10:35	14.95	160	Clear	6.62	0.555	3.34	0.00	12.32	82	N/A		1600
4/26/07	10:45	14.95	160	Clear	6.62	0.554	3.60	0.00	12.14	83	N/A		1600
4/26/07	10:55	14.95	160	Clear	6.62	0.551	2.88	0.00	12.10	83	N/A		1600
4/26/07	11:05	14.95	160	Clear	6.61	0.548	2.55	0.00	12.13	83	N/A		1600
4/26/07	11:10	14.95	160	Clear	6.61	0.548	2.53	0.00	12.11	83	N/A		800
4/26/07	11:15	14.95	160	Clear	6.61	0.547	2.51	0.00	12.14	83	N/A		800

Final Purge / Sample Data

One Casing Volume	6.98	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.51
Total Vo. Purge (L)	18.2	**Waterlevel (ft.)**	14.95	**Turbidity (NTUs)**	0.00
Start Purge (hrs.)	10:15:00 AM	**Flowrate (mL/min)**	160	**Temp (C)**	12.14
End Purge (hrs.)	12:15:00 PM	**Color**	Clear	**ORP (mV)**	83
Total Purge Time (min.)	120	**pH (S.U.)**	6.61	**Salinity**	N/A
		Conductivity (mS/cm)	0.547	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/26/07	11:15	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4302007-3
✓	4/26/07	11:15	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4302007-3

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GW0309
TtNUS Project #	112G00041	**Well ID**	16MW03
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	19.05	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	35.40	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**	2	**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/30/07	08:45	19.05	200	Slightly Turbid	4.75	0.413	6.19	29	13.79	360	N/A		0
4/30/07	08:55	21.10	130	Slightly Turbid	4.73	0.416	4.84	32	13.76	357	N/A		1300
4/30/07	09:05	21.90	130	Slightly Turbid	4.65	0.431	3.92	38	13.87	361	N/A		1300
4/30/07	09:15	22.45	130	Slightly Turbid	4.63	0.439	3.52	31	14.03	364	N/A		1300
4/30/07	09:25	22.65	120	Slightly Turbid	4.62	0.447	3.23	24	14.19	367	N/A		1200
4/30/07	09:35	22.75	120	Clear	4.60	0.451	3.20	21	14.37	369	N/A		1200
4/30/07	09:45	22.83	110	Clear	4.61	0.450	3.63	19	14.55	370	N/A		1100
4/30/07	09:55	22.85	110	Clear	4.60	0.453	3.85	18	14.73	370	N/A		1100

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/30/07	10:05	22.90	110	Clear	4.60	0.455	3.75	15	14.68	369	N/A		1100
4/30/07	10:15	22.93	110	Clear	4.57	0.458	2.99	13	14.76	369	N/A		1100
4/30/07	10:25	22.95	110	Clear	4.57	0.454	2.85	14	14.60	368	N/A		1100
4/30/07	10:35	23.00	110	Clear	4.59	0.448	2.84	14	14.78	365	N/A		1100
4/30/07	10:45	23.03	110	Clear	4.57	0.447	2.95	12	14.77	365	N/A		1100
4/30/07	10:55	23.05	110	Clear	4.58	0.444	2.93	12	15.25	363	N/A		1100
4/30/07	11:05	23.05	110	Clear	4.57	0.446	2.92	11	15.29	364	N/A		1100
4/30/07	11:15	23.05	110	Clear	4.56	0.446	2.85	11	15.39	363	N/A		1100
4/30/07	11:25	23.05	110	Clear	4.54	0.445	2.89	9.8	15.58	363	N/A		1100
4/30/07	11:30	23.05	110	Clear	4.53	0.445	2.86	9.2	15.61	363	N/A		550
4/30/07	11:35	23.05	110	Clear	4.53	0.444	2.90	9.2	15.58	362	N/A		550

Final Purge / Sample Data

One Casing Volume	10.1	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.90
Total Vo. Purge (L)	19.5	**Waterlevel (ft.)**	23.05	**Turbidity (NTUs)**	9.2
Start Purge (hrs.)	9:45:00 AM	**Flowrate (mL/min)**	110	**Temp (C)**	15.58
End Purge (hrs.)	12:35:00 PM	**Color**	Clear	**ORP (mV)**	362
Total Purge Time (min.)	170	**pH (S.U.)**	4.53	**Salinity**	N/A
		Conductivity (mS/cm)	0.444	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/30/07	11:35	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4302007-3
✓	4/30/07	11:35	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4302007-3

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT0409
TtNUS Project #	112G00041	**Well ID**	16MWT04
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	10.20	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	25.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/16/07	08:55	10.20	90	Clear	5.88	0.292	12.41	12	12.27	317	N/A		0
4/16/07	09:05	10.60	90	Clear	5.80	0.297	8.73	18	12.14	308	N/A		900
4/16/07	09:15	10.61	90	Clear	5.83	0.292	7.45	4.2	12.08	301	N/A		900
4/16/07	09:25	10.65	90	Clear	5.89	0.283	5.11	7.6	12.12	294	N/A		900
4/16/07	09:35	10.91	130	Clear	6.00	0.264	4.62	5.4	12.14	290	N/A		1300
4/16/07	09:45	10.91	130	Clear	6.06	0.248	4.59	4.1	12.14	288	N/A		1300
4/16/07	09:55	11.25	200	Clear	6.15	0.233	4.69	4.0	12.14	285	N/A		2000
4/16/07	10:05	11.40	200	Clear	6.20	0.222	4.81	3.4	12.14	283	N/A		2000

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/16/07	10:15	11.40	200	Clear	6.24	0.216	4.96	3.6	12.12	281	N/A		2000
4/16/07	10:25	11.40	200	Clear	6.28	0.210	5.01	4.1	12.20	278	N/A		2000
4/16/07	10:35	11.40	200	Clear	6.29	0.209	4.96	4.5	12.19	275	N/A		2000
4/16/07	10:45	11.40	200	Clear	6.29	0.209	5.02	2.8	12.26	272	N/A		2000
4/16/07	10:55	11.40	200	Clear	6.31	0.207	5.07	2.5	12.23	268	N/A		2000
4/16/07	11:05	11.40	200	Clear	6.31	0.208	5.05	2.2	12.27	269	N/A		2000
4/16/07	11:15	11.40	200	Clear	6.31	0.207	5.08	1.9	12.26	269	N/A		2000
4/16/07	11:25	11.40	200	Clear	6.32	0.207	5.09	1.5	12.28	266	N/A		2000
4/16/07	11:45	11.40	200	Clear	6.32	0.207	5.10	1.3	12.28	263	N/A		4000
4/16/07	11:45	11.40	200	Clear	6.33	0.206	5.09	1.1	12.27	262	N/A		0
4/16/07	11:55	11.40	200	Clear	6.33	0.206	5.08	1.1	12.25	263	N/A		2000
4/16/07	12:05	11.40	200	Clear	6.33	0.207	5.05	1.0	12.27	263	N/A		2000
4/16/07	12:15	11.40	200	Clear	6.33	0.206	5.05	1.1	12.25	263	N/A		2000
4/16/07	12:35	11.40	200	Clear	6.34	0.206	5.07	1.0	12.28	261	N/A		4000

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	5.07
Total Vo. Purge (L)	39.3	**Waterlevel (ft.)**	11.40	**Turbidity (NTUs)**	1.0
Start Purge (hrs.)	9:55:00 AM	**Flowrate (mL/min)**	200	**Temp (C)**	12.28
End Purge (hrs.)	1:35:00 PM	**Color**	Clear	**ORP (mV)**	261
Total Purge Time (min.)	220	**pH (S.U.)**	6.34	**Salinity**	N/A
		Conductivity (mS/cm)	0.206	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/16/07	12:35	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4192007-1
✓	4/16/07	12:35	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4192007-1

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GW0409
TtNUS Project #	112G00041	**Well ID**	16MW04
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	27.10	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	46.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**	2	**Turbidity Meter**	1757-1800
MS/MSD Collected?	MS/MSD	**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/25/07	12:40	27.10	130	Clear	3.99	0.968	7.77	7.2	14.69	328	N/A		0
4/25/07	12:50	27.20	130	Clear	3.96	0.970	3.57	1.1	14.54	319	N/A		1300
4/25/07	13:00	27.21	130	Clear	3.95	0.973	3.04	0.00	14.44	309	N/A		1300
4/25/07	13:10	27.21	130	Clear	3.95	0.975	2.82	0.00	14.31	302	N/A		1300
4/25/07	13:20	27.21	130	Clear	3.95	0.977	2.87	0.00	14.31	298	N/A		1300
4/25/07	13:30	27.21	130	Clear	3.95	0.979	3.17	0.00	14.33	295	N/A		1300
4/25/07	13:40	27.21	130	Clear	3.95	0.975	2.54	0.00	14.61	293	N/A		1300
4/25/07	13:50	27.21	130	Clear	3.95	0.977	2.38	0.00	14.38	290	N/A		1300

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/25/07	14:00	27.21	130	Clear	3.95	0.977	2.33	0.00	14.38	290	N/A		1300
4/25/07	14:10	27.21	130	Clear	3.95	0.977	2.34	0.00	14.39	288	N/A		1300
4/25/07	14:20	27.21	130	Clear	3.95	0.977	2.33	0.00	14.36	286	N/A		1300

Final Purge / Sample Data

One Casing Volume	11.68	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.33
Total Vo. Purge (L)	13	**Waterlevel (ft.)**	27.21	**Turbidity (NTUs)**	0.00
Start Purge (hrs.)	1:40:00 PM	**Flowrate (mL/min)**	130	**Temp (C)**	14.36
End Purge (hrs.)	3:20:00 PM	**Color**	Clear	**ORP (mV)**	286
Total Purge Time (min.)	100	**pH (S.U.)**	3.95	**Salinity**	N/A
		Conductivity (mS/cm)	0.977	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/25/07	14:20	SW-846 8330	Nitroaromatics and Nitramines	4°C	6	Glass - Amber	1L		112G00041-4262007-2
✓	4/25/07	14:20	SW-846 8260B	Volatiles	4°C/HCL	9	Glass - Clear	40ml vials		112G00041-4262007-2

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT0610
TtNUS Project #	112G00041	**Well ID**	16MWT06
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	17.95	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	25.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/25/07	08:10	17.95	110	Clear	6.09	0.975	11.98	13	14.08	242	N/A		0
4/25/07	08:20	19.00	110	Clear	6.08	0.955	9.19	3.4	13.91	244	N/A		1100
4/25/07	08:30	19.20	90	Clear	6.06	0.939	7.72	0.65	13.97	250	N/A		900
4/25/07	08:40	19.50	90	Clear	6.08	0.939	7.32	1.1	13.86	251	N/A		900
4/25/07	08:50	19.75	90	Clear	6.09	0.933	7.02	1.1	13.97	251	N/A		900
4/25/07	09:00	20.03	90	Clear	6.08	0.920	6.79	3.9	13.87	252	N/A		900
4/25/07	09:10	20.30	90	Clear	6.10	0.912	6.40	6.9	13.84	253	N/A		900
4/25/07	09:20	20.52	90	Clear	6.12	0.910	6.11	8.5	14.11	249	N/A		900

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/25/07	09:30	20.81	90	Clear	6.12	0.915	5.96	11	14.21	248	N/A		900
4/25/07	09:40	21.15	90	Clear	6.12	0.912	5.74	12	14.22	248	N/A		900
4/25/07	09:50	21.41	90	Clear	6.12	0.915	5.18	16	14.08	249	N/A		900
4/25/07	10:00	21.75	90	Clear	6.13	0.917	4.99	17	14.20	247	N/A		900
4/25/07	10:10	21.90	90	Clear	6.14	0.921	4.76	15	14.25	246	N/A		900
4/25/07	10:20	22.18	90	Clear	6.15	0.924	4.57	17	14.52	241	N/A		900
4/25/07	10:30	22.40	90	Clear	6.16	0.927	4.42	17	14.69	240	N/A		900
4/25/07	10:40	22.70	90	Clear	6.17	0.933	4.24	19	14.56	238	N/A		900
4/25/07	10:50	22.85	90	Clear	6.18	0.937	3.96	19	14.57	234	N/A		900
4/25/07	11:00	23.10	90	Clear	6.18	0.950	3.88	23	14.75	226	N/A		900
4/25/07	11:10	23.30	90	Clear	6.19	0.955	3.47	25	14.90	207	N/A		900
4/25/07	11:20	23.60	90	Clear	6.19	0.957	3.36	38	14.82	181	N/A		900
4/25/07	11:30	23.80	90	Clear	6.20	0.962	3.28	40	14.72	164	N/A		900
4/25/07	11:40	Dry	90	Clear	6.21	0.962	3.20	50	14.86	161	N/A		900

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	3.20
Total Vo. Purge (L)	19.1	**Waterlevel (ft.)**	Dry	**Turbidity (NTUs)**	50
Start Purge (hrs.)	9:10:00 AM	**Flowrate (mL/min)**	90	**Temp (C)**	14.86
End Purge (hrs.)	12:40:00 PM	**Color**	Clear	**ORP (mV)**	161
Total Purge Time (min.)	210	**pH (S.U.)**	6.21	**Salinity**	N/A
		Conductivity (mS/cm)	0.962	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/26/07	08:30	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4302007-3
✓	4/26/07	08:30	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4302007-3

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT0908
TtNUS Project #	112G00041	**Well ID**	16MWT09
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	13.25	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	25.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/24/07	08:45	13.25	150	Clear	5.08	1.45	6.38	1.2	12.55	152	N/A		0
4/24/07	08:55	14.25	150	Clear	4.89	1.03	4.51	3.3	12.09	174	N/A		1500
4/24/07	09:05	14.45	150	Clear	4.62	0.595	4.40	0.00	12.01	223	N/A		1500
4/24/07	09:15	14.55	150	Clear	4.63	0.544	3.95	0.00	12.07	226	N/A		1500
4/24/07	09:25	14.60	150	Clear	4.64	0.516	3.92	0.00	12.12	228	N/A		1500
4/24/07	09:35	14.65	150	Clear	4.63	0.494	3.90	0.00	12.11	230	N/A		1500
4/24/07	09:45	14.65	150	Clear	4.62	0.475	3.91	0.00	12.12	233	N/A		1500
4/24/07	09:55	14.70	150	Clear	4.61	0.462	3.94	0.00	12.21	236	N/A		1500

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/24/07	10:05	14.75	150	Clear	4.61	0.451	3.96	0.00	12.16	236	N/A		1500
4/24/07	10:15	14.75	150	Clear	4.61	0.439	3.90	0.00	12.08	237	N/A		1500
4/24/07	10:25	14.80	150	Clear	4.61	0.429	3.94	0.00	12.15	238	N/A		1500
4/24/07	10:35	14.80	150	Clear	4.62	0.422	3.95	0.00	12.16	239	N/A		1500
4/24/07	10:45	14.80	150	Clear	4.61	0.415	3.91	0.00	12.32	240	N/A		1500
4/24/07	10:50	14.80	150	Clear	4.61	0.413	3.90	0.00	12.37	240	N/A		750
4/24/07	10:55	14.80	150	Clear	4.61	0.414	3.91	0.00	12.35	240	N/A		750

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	3.91
Total Vo. Purge (L)	19.5	**Waterlevel (ft.)**	14.80	**Turbidity (NTUs)**	0.00
Start Purge (hrs.)	9:45:00 AM	**Flowrate (mL/min)**	150	**Temp (C)**	12.35
End Purge (hrs.)	11:55:00 AM	**Color**	Clear	**ORP (mV)**	240
Total Purge Time (min.)	130	**pH (S.U.)**	4.61	**Salinity**	N/A
		Conductivity (mS/cm)	0.414	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/24/07	10:55	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4262007-2
✓	4/24/07	10:55	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4262007-2

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1008
TtNUS Project #	112G00041	**Well ID**	16MWT10
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	21.05	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	25.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/24/07	12:30	21.05	50	Clear	3.21	1.82	9.41	1.7	15.03	421	N/A		0
4/24/07	12:40	21.15	50	Clear	3.20	1.82	4.80	3.9	15.03	413	N/A		500
4/24/07	12:50	21.15	50	Clear	3.30	1.68	4.00	2.6	14.89	383	N/A		500
4/24/07	13:00	21.20	130	Clear	3.44	1.53	4.04	1.7	14.36	360	N/A		1300
4/24/07	13:10	21.20	130	Clear	3.51	1.48	4.45	1.4	14.30	345	N/A		1300
4/24/07	13:20	21.20	130	Clear	3.55	1.47	4.79	1.7	14.65	338	N/A		1300
4/24/07	13:30	21.20	130	Clear	3.57	1.43	4.91	1.3	14.64	332	N/A		1300
4/24/07	13:40	21.20	130	Clear	3.56	1.42	4.41	1.2	14.64	328	N/A		1300

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/24/07	13:50	21.20	130	Clear	3.55	1.41	4.43	1.7	14.63	328	N/A		1300
4/24/07	14:00	21.20	130	Clear	3.56	1.40	4.43	1.4	14.63	328	N/A		1300

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	4.43
Total Vo. Purge (L)	10.1	**Waterlevel (ft.)**	21.20	**Turbidity (NTUs)**	1.4
Start Purge (hrs.)	1:30:00 PM	**Flowrate (mL/min)**	130	**Temp (C)**	14.63
End Purge (hrs.)	3:00:00 PM	**Color**	Clear	**ORP (mV)**	328
Total Purge Time (min.)	90	**pH (S.U.)**	3.56	**Salinity**	N/A
		Conductivity (mS/cm)	1.40	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/24/07	14:00	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4262007-2
✓	4/24/07	14:00	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4262007-2

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1108
TtNUS Project #	112G00041	**Well ID**	16MWT11
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	95.70	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	98.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	NA		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/27/07	08:55	95.70	100	Clear	6.90	1.13	5.96	19	13.08	4	N/A		0
4/27/07	09:00	97.60	100	Clear	6.66	1.15	4.58	1.3	12.95	73	N/A		500
4/27/07	09:05	97.80	100	Clear	6.94	1.12	5.43	15	12.61	6	N/A		500
4/27/07	09:10	98.00	100	Slightly Turbid	6.90	1.13	4.93	35	12.83	4	N/A		500
4/27/07	09:20	98.25	100	Cloudy	6.85	1.13	5.19	160	12.60	9	N/A		1000
4/27/07	09:30	Dry	100	Cloudy	6.87	1.13	5.30	200	12.65	8	N/A		1000

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	
Total Vo. Purge (L)	3.5	**Waterlevel (ft.)**		**Turbidity (NTUs)**	
Start Purge (hrs.)	9:55:00 AM	**Flowrate (mL/min)**		**Temp (C)**	
End Purge (hrs.)	10:30:00 AM	**Color**		**ORP (mV)**	
Total Purge Time (min.)	35	**pH (S.U.)**		**Salinity**	
		Conductivity (mS/cm)		**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/28/07	08:45	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4302007-3
✓	4/28/07	08:45	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4302007-3

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1208
TtNUS Project #	112G00041	**Well ID**	16MWT12
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	19.25	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	26.5	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/26/07	13:00	19.25	150	Clear	3.86	3.29	6.56	1.9	12.77	312	N/A		0
4/26/07	13:10	19.70	150	Clear	3.89	3.40	4.03	0.40	12.74	311	N/A		1500
4/26/07	13:20	19.95	150	Clear	3.89	3.43	3.45	0.00	12.50	308	N/A		1500
4/26/07	13:30	20.15	150	Clear	3.90	3.39	4.80	0.00	12.44	305	N/A		1500
4/26/07	13:40	20.15	110	Clear	3.92	3.27	2.75	0.00	12.65	302	N/A		1100
4/26/07	13:50	20.15	110	Clear	3.93	3.08	2.60	0.00	13.32	301	N/A		1100
4/26/07	14:00	20.15	110	Clear	3.96	2.93	2.49	0.00	13.48	299	N/A		1100
4/26/07	14:10	20.15	110	Clear	3.97	2.77	2.52	0.00	13.99	298	N/A		1100

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/26/07	14:20	20.15	110	Clear	4.02	2.60	2.48	0.00	14.37	295	N/A		1100
4/26/07	14:30	20.20	110	Clear	4.04	2.48	2.33	0.00	14.02	293	N/A		1100
4/26/07	14:40	20.20	110	Clear	4.05	2.38	2.30	0.00	13.99	293	N/A		1100
4/26/07	14:50	20.20	110	Clear	4.06	2.28	2.32	0.00	14.00	292	N/A		1100
4/26/07	14:55	20.20	110	Clear	4.07	2.26	2.30	0.00	14.00	291	N/A		550
4/26/07	15:00	20.20	110	Clear	4.08	2.27	2.32	0.00	14.00	290	N/A		550

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.32
Total Vo. Purge (L)	14.4	**Waterlevel (ft.)**	20.20	**Turbidity (NTUs)**	0.00
Start Purge (hrs.)	2:00:00 PM	**Flowrate (mL/min)**	110	**Temp (C)**	14.00
End Purge (hrs.)	4:00:00 PM	**Color**	Clear	**ORP (mV)**	290
Total Purge Time (min.)	120	**pH (S.U.)**	4.08	**Salinity**	N/A
		Conductivity (mS/cm)	2.27	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/26/07	15:00	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4302007-3
✓	4/26/07	15:00	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4302007-3

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1308
TtNUS Project #	112G00041	**Well ID**	16MWT13
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	9.20	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	19.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/16/07	13:45	9.20	50	Clear	5.60	0.276	6.53	6.2	13.97	131	N/A		0
4/16/07	13:55	10.45	50	Clear	5.50	0.268	4.77	9.5	14.31	131	N/A		500
4/16/07	14:05	10.80	50	Clear	5.44	0.263	4.00	3.8	14.24	134	N/A		500
4/16/07	14:15	11.15	50	Clear	5.41	0.259	3.80	2.2	14.08	138	N/A		500
4/16/07	14:25	11.40	50	Clear	5.35	0.256	4.68	6.0	14.03	150	N/A		500
4/16/07	14:35	11.70	50	Clear	5.31	0.254	4.98	11	13.77	164	N/A		500
4/16/07	14:45	11.93	50	Clear	5.35	0.252	3.97	11	13.79	165	N/A		500
4/16/07	14:55	12.60	50	Clear	5.45	0.258	3.46	9.4	13.79	149	N/A		500

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/16/07	15:05	12.54	50	Clear	5.66	0.275	3.13	6.1	13.67	97	N/A		500
4/16/07	15:15	12.85	50	Clear	5.73	0.280	2.91	4.4	13.37	78	N/A		500
4/16/07	15:25	13.10	50	Clear	5.73	0.282	2.88	5.2	13.06	72	N/A		500
4/16/07	15:35	13.40	50	Clear	5.74	0.284	2.72	7.9	12.97	69	N/A		500
4/16/07	15:45	13.60	50	Clear	5.73	0.286	2.71	9.8	12.93	68	N/A		500
4/16/07	15:55	13.80	50	Clear	5.72	0.283	2.57	11	13.00	70	N/A		500
4/16/07	16:05	14.00	50	Clear	5.65	0.277	2.52	10	12.84	81	N/A		500
4/16/07	16:15	14.20	130	Clear	5.59	0.272	2.47	11	12.58	94	N/A		1300
4/16/07	16:25	14.50	130	Clear	5.56	0.268	2.41	14	12.45	103	N/A		1300
4/16/07	16:35	14.90	130	Clear	5.60	0.274	2.32	14	12.43	94	N/A		1300
4/16/07	16:45	15.30	130	Slightly Turbid	5.65	0.284	2.34	26	12.43	80	N/A		1300
4/16/07	16:55	15.65	130	Slightly Turbid	5.68	0.290	253	39	12.45	73	N/A		1300
4/16/07	17:05	Dry	130	Slightly Turbid	5.66	0.292	2.31	45	12.41	75	N/A		1300

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.31
Total Vo. Purge (L)	14.8	**Waterlevel (ft.)**	Dry	**Turbidity (NTUs)**	45
Start Purge (hrs.)	2:45:00 PM	**Flowrate (mL/min)**	130	**Temp (C)**	12.41
End Purge (hrs.)	6:05:00 PM	**Color**	Slightly Turbid	**ORP (mV)**	75
Total Purge Time (min.)	200	**pH (S.U.)**	5.66	**Salinity**	N/A
		Conductivity (mS/cm)	0.292	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/17/07	13:20	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4192007-1
✓	4/17/07	13:20	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4192007-1

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1508
TtNUS Project #	112G00041	**Well ID**	16MWT15
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	59.60	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	92.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/17/07	08:45	59.60	120	Clear	7.13	0.466	8.49	0.50	13.89	2	N/A		0
4/17/07	08:55	61.25	120	Clear	7.25	0.470	6.32	0.00	13.90	-28	N/A		1200
4/17/07	09:05	63.55	120	Clear	7.26	0.458	3.69	0.00	13.84	-75	N/A		1200
4/17/07	09:15	65.90	120	Clear	7.25	0.453	3.19	0.00	13.94	-67	N/A		1200
4/17/07	09:25	67.50	80	Clear	7.24	0.453	3.12	0.00	14.00	-66	N/A		800
4/17/07	09:35	68.95	80	Clear	7.23	0.453	2.91	0.00	14.10	-68	N/A		800
4/17/07	09:45	70.40	80	Clear	7.23	0.451	2.97	0.00	14.19	-69	N/A		800
4/17/07	09:55	71.60	80	Clear	7.21	0.450	2.85	0.00	14.29	-72	N/A		800

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/17/07	10:05	73.20	80	Clear	7.22	0.450	2.83	0.00	14.36	-74	N/A		800
4/17/07	10:15	74.20	80	Clear	7.23	0.450	2.77	0.00	14.48	-74	N/A		800
4/17/07	10:25	75.40	80	Clear	7.21	0.450	2.75	0.00	14.41	-72	N/A		800
4/17/07	10:35	76.30	80	Clear	7.21	0.450	2.75	0.00	14.57	-70	N/A		800
4/17/07	10:45	77.30	80	Clear	7.22	0.448	2.70	0.00	14.58	-72	N/A		800
4/17/07	10:55	77.60	50	Clear	7.21	0.450	2.71	0.00	15.26	-68	N/A		500
4/17/07	11:05	78.40	50	Clear	7.21	0.448	2.74	0.00	14.91	-70	N/A		500
4/17/07	11:15	79.15	50	Clear	7.21	0.450	2.71	0.00	14.96	-78	N/A		500
4/17/07	11:25	79.95	50	Clear	7.21	0.450	2.67	0.00	14.96	-82	N/A		500
4/17/07	11:35	80.78	50	Clear	7.20	0.450	2.65	0.00	15.16	-86	N/A		500
4/17/07	11:45	81.45	50	Clear	7.21	0.450	2.75	0.00	15.42	-94	N/A		500
4/17/07	11:55	82.10	50	Clear	7.21	0.449	2.70	0.00	15.19	-90	N/A		500
4/17/07	12:05	82.80	50	Clear	7.20	0.450	2.67	0.00	15.48	-97	N/A		500
4/17/07	12:15	83.35	50	Clear	7.21	0.446	2.67	0.00	16.03	-98	N/A		500
4/17/07	12:25	83.60	50	Clear	7.22	0.449	2.58	0.00	17.12	-94	N/A		500
4/17/07	12:35	83.90	50	Clear	7.21	0.448	2.70	0.00	17.20	-87	N/A		500
4/17/07	12:45	84.10	50	Clear	7.20	0.448	2.72	0.00	17.29	-88	N/A		500

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	2.72
Total Vo. Purge (L)	16.8	**Waterlevel (ft.)**	84.10	**Turbidity (NTUs)**	0.00
Start Purge (hrs.)	9:45:00 AM	**Flowrate (mL/min)**	50	**Temp (C)**	17.29
End Purge (hrs.)	1:45:00 PM	**Color**	Clear	**ORP (mV)**	-88
Total Purge Time (min.)	240	**pH (S.U.)**	7.20	**Salinity**	N/A
		Conductivity (mS/cm)	0.448	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/17/07	12:45	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4192007-1
✓	4/17/07	12:45	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4192007-1

General Observations and Notes

None

- End of Report -

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

Created By	James Goerdt	**Modified By**	James Goerdt	**Printed By**	James Goerdt
Created Date	4/3/07	**Modified Date**	5/11/07	**Printed Date**	5/14/07

Project Information

MNA Sampling - SWMU 16 - CRANE NSWC

Facility Name	CRANE NSWC	**Sample ID #**	16GWT1708
TtNUS Project #	112G00041	**Well ID**	16MWT17
Task/Contract #	CTO 0377	**Well Type**	Monitoring Well
WBS Code #		**Sampled By**	Walt Pryor
Status	Complete	**Concentration**	Low concentration

Well and Sample Data

Date		**Static Water Level (ft.)**	14.30	**Water Quality Meter**	4143008
Purge Method	Low flow - bladder	**Total Well Depth (ft.)**	24.00	**Pump Control Box**	MP10-2191
Sampling Method	Low flow - bladder	**Well Riser Diameter (in.)**		**Turbidity Meter**	1757-1800
MS/MSD Collected?		**Well Volumes Req.**	1		
Duplicate Sample Collected?	N	**Monitor Reading (ppm)**	N/A		
Corresponding Duplicate Sample ID					

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/17/07	14:15	14.30	80	Clear	5.05	1.43	8.85	0.55	14.21	113	N/A		0
4/17/07	14:25	14.60	80	Clear	4.78	1.27	6.73	1.4	14.05	177	N/A		800
4/17/07	14:35	14.65	80	Clear	4.49	1.12	5.11	2.8	14.36	250	N/A		800
4/17/07	14:45	14.65	80	Clear	4.43	1.06	5.07	1.5	14.11	264	N/A		800
4/17/07	14:55	14.75	120	Clear	4.45	0.970	6.08	1.1	13.61	261	N/A		1200
4/17/07	15:05	14.75	120	Clear	4.48	0.940	6.03	1.4	13.67	258	N/A		1200
4/17/07	15:15	14.85	180	Clear	4.46	0.832	5.07	1.0	13.55	262	N/A		1800
4/17/07	15:25	14.90	180	Clear	4.47	0.810	4.04	1.1	13.22	261	N/A		1800

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Purge Entries

Date	Time	Water Level (ft.)	Flow Rate (mL/min)	Color	pH (S.U.)	S.C. (mS/cm)	DO (mg/L)	Turbidity (NTUs)	Temp °C	ORP (mV)	Salinity (%)	Other	Incremental Volume (mL)
4/17/07	15:35	14.95	180	Clear	4.46	0.781	3.76	0.65	13.23	265	N/A		1800
4/17/07	15:45	14.95	180	Clear	4.48	0.763	3.76	0.35	13.25	260	N/A		1800
4/17/07	15:55	14.95	180	Clear	4.49	0.748	3.63	0.30	13.22	259	N/A		1800
4/17/07	16:05	14.95	180	Clear	4.50	0.747	3.62	0.25	13.24	255	N/A		1800
4/17/07	16:15	14.95	180	Clear	4.51	0.746	3.60	0.20	13.22	252	N/A		1800

Final Purge / Sample Data

One Casing Volume	0	**Method**	Low flow - bladder	**Dissolved Oxygen (mg/L)**	3.60
Total Vo. Purge (L)	17.4	**Waterlevel (ft.)**	14.95	**Turbidity (NTUs)**	0.20
Start Purge (hrs.)	3:15:00 PM	**Flowrate (mL/min)**	180	**Temp (C)**	13.22
End Purge (hrs.)	5:15:00 PM	**Color**	Clear	**ORP (mV)**	252
Total Purge Time (min.)	120	**pH (S.U.)**	4.51	**Salinity**	N/A
		Conductivity (mS/cm)	0.746	**Other**	

Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Preservative	Count	Type	Requirements	Comments	Chain#
✓	4/17/07	16:15	SW-846 8330	Nitroaromatics and Nitramines	4°C	2	Glass - Amber	1L		112G00041-4192007-1
✓	4/17/07	16:15	SW-846 8260B	Volatiles	4°C/HCL	3	Glass - Clear	40ml vials		112G00041-4192007-1

General Observations and Notes

None

- End of Report -

APPENDIX A.2

SURFACE WATER SAMPLE LOG SHEETS

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLING LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/14/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Sample ID Number	16SW3007	**Status**	Complete	**Printed By**	James Goerdt
Sample Location ID				**Printed Date**	5/14/07

Sample Collection Records

Date	5/1/07	**Color**	clear	**Temp (C)**	15.6
Time	10:50	**pH (S.U.)**	6.33	**ORP (mV)**	288
Depth (ft.)	.5	**S.C. (mS/cm)**	0.153	**Salinity (%)**	NA
Method		**DO (mg/L)**	9.66		
MS/MSD Collected	MS/MSD	**Turbidity (NTUs)**	10.0		
Duplicate Collected	N				
Duplicate ID					

Laboratory Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Count	Type	Requirements	Preservative	Comments	Chain of Custody #
✓	5/1/07	10:50	Volatiles	SW-846 8260B	9	Glass - Clear	40ml vials	4°C/HCL	MS/MSD	112G00041-532007-4
✓	5/1/07	10:50	Nitroaromatics and Nitramines		2	Glass - Amber	1L	4°C		112G00041-532007-4

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLING LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/14/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Sample ID Number	16SW1207	**Status**	Complete	**Printed By**	James Goerdt
Sample Location ID				**Printed Date**	5/14/07

Sample Collection Records

Date	5/1/07	**Color**	clear	**Temp (C)**	15.6
Time	10:00	**pH (S.U.)**	6.19	**ORP (mV)**	301
Depth (ft.)	.25	**S.C. (mS/cm)**	0.245	**Salinity (%)**	NA
Method		**DO (mg/L)**	9.62		
MS/MSD Collected		**Turbidity (NTUs)**	6.8		
Duplicate Collected	N				
Duplicate ID					

Laboratory Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Count	Type	Requirements	Preservative	Comments	Chain of Custody #
✓	5/1/07	10:00	Volatiles	SW-846 8260B	3	Glass - Clear	40ml vials	4°C/HCL		112G00041-532007-4
✓	5/1/07	10:00	Nitroaromatics and Nitramines		2	Glass - Amber	1L	4°C		112G00041-532007-4

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLING LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/14/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Sample ID Number	16SW1307	**Status**	Complete	**Printed By**	James Goerdt
Sample Location ID				**Printed Date**	5/14/07

Sample Collection Records

Date	5/1/07	**Color**	clear	**Temp (C)**	16.4
Time	09:45	**pH (S.U.)**	6.79	**ORP (mV)**	265
Depth (ft.)	.5	**S.C. (mS/cm)**	0.246	**Salinity (%)**	NA
Method		**DO (mg/L)**	8.45		
MS/MSD Collected		**Turbidity (NTUs)**	6.0		
Duplicate Collected	N				
Duplicate ID					

Laboratory Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Count	Type	Requirements	Preservative	Comments	Chain of Custody #
✓	5/1/07	09:45	Volatiles	SW-846 8260B	3	Glass - Clear	40ml vials	4°C/HCL		112G00041-532007-4
✓	5/1/07	09:45	Nitroaromatics and Nitramines		2	Glass - Amber	1L	4°C		112G00041-532007-4

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLING LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/14/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Sample ID Number	16SW1006	**Status**	Working	**Printed By**	James Goerdt
Sample Location ID				**Printed Date**	5/14/07

Sample Collection Records

Date	5/1/07	**Color**	clear	**Temp (C)**	17.7
Time	10:20	**pH (S.U.)**	6.42	**ORP (mV)**	282
Depth (ft.)	.4	**S.C. (mS/cm)**	0.177	**Salinity (%)**	NA
Method		**DO (mg/L)**	10.23		
MS/MSD Collected		**Turbidity (NTUs)**	4.9		
Duplicate Collected	Y				
Duplicate ID					

Laboratory Analysis Records

Collected	Date	Time	Analysis / Method	Description of Analysis	Count	Type	Requirements	Preservative	Comments	Chain of Custody #
✓	5/1/07	10:20	Volatiles	SW-846 8260B	3	Glass - Clear	40ml vials	4°C/HCL		112G00041-532007-4
✓	5/1/07	10:20	Nitroaromatics and Nitramines		2	Glass - Amber	1L	4°C		112G00041-532007-4

General Observations and Notes

No Notes

- End of Report -

APPENDIX A.3

CHAIN OF CUSTODY RECORDS

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	Walt Pryor
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/19/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Chain of Custody ID	112G00041-4192007-1	**Carrier**	Federal Express	**Printed By**	James Goerdt
		Carrier/Waybill No.	849419216213	**Printed Date**	5/14/07

Chain of Custody Information

Chain of Custody #	**112G00041-4192007-1**	**Lab Name**	Laucks Testing Laboratories, Inc.	**Relenquished By**	Walt Pryor
Carrier	Federal Express	**Address**	940 South Harney Street	**Date**	04/19/2007
Carrier/Waybill No.	849419216213	**City, State, Zip**	Seattle, Washington 98108	**Time**	17:11
		Lab Contact	Hugh Prentice	**Received By:**	Federal Express
		Lab Telephone	206-767-5060	**Date**	4/19/07
				Time	18:11

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
4/16/07	16GWT0409	12:35	SW-846 8330	Nitroaromatics and Nitramines	16MWT04	GW	4°C	2	Glass - Amber	1L	
4/16/07	16GWT0409	12:35	SW-846 8260B	Volatiles	16MWT04	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/17/07	13FD04170701	01:00	SW-846 6850	Perchlorate	QC	SW	4°C	1	Plastic - PP	250ml	
4/17/07	13SW1408	10:47	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	
4/17/07	13SW1508	10:59	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	
			SW-								

4/17/07	13SW1608	10:31	846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	
4/17/07	13SW1907	14:32	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	
4/17/07	13SW2007	14:13	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
4/17/07	13SW2207	11:22	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	MS/MSD
4/17/07	13SW3008	10:03	SW-846 6850	Perchlorate		SW	4°C	1	Plastic - PP	250ml	
4/17/07	16GWT1308	13:20	SW-846 8330	Nitroaromatics and Nitramines	16MWT13	GW	4°C	2	Glass - Amber	1L	
4/17/07	16GWT1308	13:20	SW-846 8260B	Volatiles	16MWT13	GW	4° C/HCL	3	Glass - Clear	40ml vials	Vocs are hot.
4/17/07	16GWT1508	12:45	SW-846 8330	Nitroaromatics and Nitramines	16MWT15	GW	4°C	2	Glass - Amber	1L	
4/17/07	16GWT1508	12:45	SW-846 8260B	Volatiles	16MWT15	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/17/07	16GWT1708	16:15	SW-846 8330	Nitroaromatics and Nitramines	16MWT17	GW	4°C	2	Glass - Amber	1L	
4/17/07	16GWT1708	16:15	SW-846 8260B	Volatiles	16MWT17	GW	4° C/HCL	3	Glass - Clear	40ml vials	Vocs are hot

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/26/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Chain of Custody ID	112G00041-4262007-2	**Carrier**	Federal Express	**Printed By**	James Goerdt
		Carrier/Waybill No.	849419216246	**Printed Date**	5/14/07

Chain of Custody Information

Chain of Custody #	**112G00041-4262007-2**	**Lab Name**	Laucks Testing Laboratories, Inc.	**Relenquished By**	Dave Hickey
Carrier	Federal Express	**Address**	940 South Harney Street	**Date**	04/26/2007
Carrier/Waybill No.	849419216246	**City, State, Zip**	Seattle, Washington 98108	**Time**	17:00
		Lab Contact	Hugh Prentice	**Received By:**	Federal Express
		Lab Telephone	206-767-5060	**Date**	4/26/07
				Time	17:00

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
4/24/07	16GWT0908	10:55	SW-846 8330	Nitroaromatics and Nitramines	16MWT09	GW	4°C	2	Glass - Amber	1L	
4/24/07	16GWT0908	10:55	SW-846 8260B	Volatiles	16MWT09	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/24/07	16GWT1008	14:00	SW-846 8330	Nitroaromatics and Nitramines	16MWT10	GW	4°C	2	Glass - Amber	1L	
4/24/07	16GWT1008	14:00	SW-846 8260B	Volatiles	16MWT10	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/25/07	16GW0409	14:20	SW-846 8330	Nitroaromatics and Nitramines	16MW04	GW	4°C	6	Glass - Amber	1L	MS/MSD was collected at this well.
4/25/07	16GW0409	14:20	SW-846	Volatiles	16MW04	GW	4° C/HCL	9	Glass - Clear	40ml vials	MS/MSD was collected

			8260B								at this well.

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	Walt Pryor
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	4/30/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Chain of Custody ID	112G00041-4302007-3	**Carrier**	Federal Express	**Printed By**	James Goerdt
		Carrier/Waybill No.		**Printed Date**	5/14/07

Chain of Custody Information

Chain of Custody #	**112G00041-4302007-3**	**Lab Name**	Laucks Testing Laboratories, Inc.	**Relenquished By**	Walt Pryor
Carrier	Federal Express	**Address**	940 South Harney Street	**Date**	04/30/2007
Carrier/Waybill No.		**City, State, Zip**	Seattle, Washington 98108	**Time**	18:03
		Lab Contact	Hugh Prentice	**Received By:**	Federal Express
		Lab Telephone	206-767-5060	**Date**	4/30/07
				Time	19:03

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
4/26/07	16FD042607	01:00	SW-846 8260B	Volatiles	QC	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/26/07	16FD042607	01:00	SW-846 8330	Nitroaromatics and Nitramines	QC	GW	4°C	2	Glass - Amber	1L	
4/26/07	16GW0210	11:15	SW-846 8330	Nitroaromatics and Nitramines	16MW02	GW	4°C	2	Glass - Amber	1L	
4/26/07	16GW0210	11:15	SW-846 8260B	Volatiles	16MW02	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/26/07	16GWT0610	08:30	SW-846 8330	Nitroaromatics and Nitramines	16MWT06	GW	4°C	2	Glass - Amber	1L	
4/26/07	16GWT0610	08:30	SW-846 8260B	Volatiles	16MWT06	GW	4° C/HCL	3	Glass - Clear	40ml vials	Vocs are hot.
			SW-	Nitroaromatics					Glass -		

4/26/07	16GWT1208	15:00	846 8330	and Nitramines	16MWT12	GW	4°C	2	Amber	1L	
4/26/07	16GWT1208	15:00	SW-846 8260B	Volatiles	16MWT12	GW	4° C/HCL	3	Glass - Clear	40ml vials	

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
4/28/07	16GWT1108	08:45	SW-846 8330	Nitroaromatics and Nitramines	16MWT11	GW	4°C	2	Glass - Amber	1L	
4/28/07	16GWT1108	08:45	SW-846 8260B	Volatiles	16MWT11	GW	4° C/HCL	3	Glass - Clear	40ml vials	
4/30/07	16GW0309	11:35	SW-846 8330	Nitroaromatics and Nitramines	16MW03	GW	4°C	2	Glass - Amber	1L	
4/30/07	16GW0309	11:35	SW-846 8260B	Volatiles	16MW03	GW	4° C/HCL	3	Glass - Clear	40ml vials	

General Observations and Notes

No Notes

- End of Report -

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Project Manager (PM)**	Ralph Basinski	**Created By**	James Goerdt
TtNUS Project #	112G00041	**PM Telephone**		**Created Date**	5/3/07
Task/Contract #	CTO 0377	**Field Op Leader (FOL)**	James Goerdt	**Modified By**	
WBS Code #	TP0050125	**FOL Phone**		**Modified Date**	
Chain of Custody ID	112G00041-532007-4	**Carrier**	Federal Express	**Printed By**	James Goerdt
		Carrier/Waybill No.	8494 1921 7551	**Printed Date**	5/14/07

Chain of Custody Information

Chain of Custody #	**112G00041-532007-4**	**Lab Name**	Laucks Testing Laboratories, Inc.	**Relenquished By**	James Goerdt
Carrier	Federal Express	**Address**	940 South Harney Street	**Date**	05/03/2007
Carrier/Waybill No.	8494 1921 7551	**City, State, Zip**	Seattle, Washington 98108	**Time**	17:00
		Lab Contact	Hugh Prentice	**Received By:**	Federal Express
		Lab Telephone	206-767-5060	**Date**	5/3/07
				Time	17:00

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
5/1/07	12FD05010701	01:00		Nitroaromatics and Nitramines	QC	SW	4°C	2	Glass - Amber	1L	
5/1/07	12FD05010701	01:00	SW-846 8260B	Volatiles	QC	SW	4°C/HCL	3	Glass - Clear	40ml vials	
5/1/07	16SW1006	10:20	SW-846 8260B	Volatiles		SW	4°C/HCL	3	Glass - Clear	40ml vials	
5/1/07	16SW1006	10:20		Nitroaromatics and Nitramines		SW	4°C	2	Glass - Amber	1L	
5/1/07	16SW1207	10:00	SW-846 8260B	Volatiles		SW	4°C/HCL	3	Glass - Clear	40ml vials	
5/1/07	16SW1207	10:00		Nitroaromatics and Nitramines		SW	4°C	2	Glass - Amber	1L	
5/1/07	16SW1307	09:45	SW-846 8260B	Volatiles		SW	4°C/HCL	3	Glass - Clear	40ml vials	
5/1/07	16SW1307	09:45		Nitroaromatics and Nitramines		SW	4°C	2	Glass - Amber	1L	

Tetra Tech NUS, Inc.

CHAIN OF CUSTODY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Sample Records

Date	Sample ID#	Time	Analysis	Description	Loc ID	Matrix	Preservative	No.	Type	Requirements	Comments
5/1/07	16SW3007	10:50	SW-846 8260B	Volatiles		SW	4°C/HCL	9	Glass - Clear	40ml vials	MS/MSD
5/1/07	16SW3007	10:50		Nitroaromatics and Nitramines		SW	4°C	2	Glass - Amber	1L	

General Observations and Notes

QC ID 12FD05010701 should be 16FD05010701

- End of Report -

APPENDIX A.4

EQUIPMENT CALIBRATION FORMS

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

MNA Sampling - SWMU 12 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Instrument**	2020	**Created By**	James Goerdt
TtNUS Project #	112G00041	**Manufacturer**	LaMotte	**Created Date**	4/12/07
Task/Contract #	CTO 0377	**Serial Number**	1157-1899	**Modified By**	James Goerdt
WBS Code #	TP0050125			**Modified Date**	5/9/07
Client				**Printed By**	James Goerdt
Status	Complete			**Printed Date**	5/9/07

Calibration Records

Date	Calibrator	Turbidity (0 NTU)	Turbidity (10 NTU)	Comments
4/30/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: 11 Post: 10 Std: Exp:	
4/30/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 9.96 Post: 10.01 Std: Exp:	
4/29/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 9.97 Post: 10.01 Std: Exp:	
4/28/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 10.14 Post: 9.98 Std: Exp:	
4/27/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 9.73 Post: 10.0 Std: Exp:	
4/26/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 9.79 Post: 10.0 Std: Exp:	
4/25/07	David Hickey	Pre: 0 Post: 0 Std: Exp:	Pre: 9.82 Post: 10.0 Std: Exp:	
4/24/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: 9.69 Post: 10 Std: Exp:	

4/17/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: 10.42 Post: 10 Std: Exp:	
4/16/07	Walt Pryor	Pre: 0.14 Post: 0 Std: Exp:	Pre: 9.84 Post: 10 Std: Exp:	
4/15/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: 9.87 Post: 10 Std: Exp:	
4/15/07	James Goerdt	Pre: 0.0 Post: 0.0 Std: Exp:	Pre: 9.64 Post: 9.99 Std: Exp:	
4/14/07	Walt Pryor	Pre: 0.07 Post: 0 Std: Exp:	Pre: 10.05 Post: 10 Std: Exp:	None
4/14/07	James Goerdt	Pre: 0.0 Post: 0.0 Std: Exp:	Pre: 11.0 Post: 9.94 Std: Exp:	
4/13/07	James Goerdt	Pre: 0.0 Post: 0.0 Std: Exp:	Pre: 9.90 Post: 10.03 Std: Exp:	
4/12/07	James Goerdt	Pre: 0.0 Post: 0.0 Std: Exp:	Pre: 9.16 Post: 10.02 Std: Exp:	
4/11/07	James Goerdt	Pre: 0.0 Post: 0.0 Std: Exp:	Pre: 9.62 Post: 10.01 Std: Exp:	

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

MNA Sampling - SWMU 12 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Instrument**	2020	**Created By**	James Goerdt
TtNUS Project #	112G00041	**Manufacturer**	Photovac	**Created Date**	4/12/07
Task/Contract #	CTO 0377	**Serial Number**	PPXJ0015	**Modified By**	James Goerdt
WBS Code #	TP0050125			**Modified Date**	5/9/07
Client				**Printed By**	James Goerdt
Status	Complete			**Printed Date**	5/9/07

Calibration Records

Date	Calibrator	Isobutylene (100 ppm)	Comments
5/10/07	Walt Pryor	Pre: 90 Post: 100 Std: Exp:	

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

MNA Sampling - SWMU 12 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Instrument**	U-22	**Created By**	James Goerdt
TtNUS Project #	112G00041	**Manufacturer**	Horiba	**Created Date**	4/12/07
Task/Contract #	CTO 0377	**Serial Number**	4103008	**Modified By**	James Goerdt
WBS Code #	TP0050125			**Modified Date**	5/9/07
Client				**Printed By**	James Goerdt
Status	Complete			**Printed Date**	5/9/07

Calibration Records

Date	Calibrator	pH (4 SU)	Conductivity (mS/cm)	DO (mg/L)	Temperature (°C)	Temperature (°C)	Comments
4/30/07	Walt Pryor	Pre: 4.28 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.72 Post: 4.48 Std: 5480 Exp: 11/03/2007	Pre: 9.30 Post: 9.17 Std: 5480 Exp: 11/03/2007	Pre: 19.4 Post: 19.4 Std: NA Exp:	Pre: 314 Post: 297 Std: 5480 Exp: 11/03/2007	
4/27/07	Walt Pryor	Pre: 4.27 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.37 Post: 4.48 Std: 5480 Exp: 11/03/2007	Pre: 9.39 Post: 9.29 Std: 5480 Exp: 11/03/2007	Pre: 18.7 Post: 18.7 Std: NA Exp:	Pre: 333 Post: 318 Std: 5480 Exp: 11/03/2007	
4/24/07	Walt Pryor	Pre: 3.52 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.46 Post: 4.49 Std: 5480 Exp: 11/03/2007	Pre: 9.60 Post: 9.17 Std: 5480 Exp: 11/03/2007	Pre: 19.4 Post: 19.4 Std: NA Exp:	Pre: 328 Post: 327 Std: 5480 Exp: 11/03/2007	
4/17/07	Walt Pryor	Pre: 4.02 Post: 3.99 Std: 5480 Exp: 11/03/2007	Pre: 4.65 Post: 4.50 Std: 5480 Exp: 11/03/2007	Pre: 9.74 Post: 9.62 Std: 5480 Exp: 11/03/2007	Pre: 17.0 Post: 16.9 Std: NA Exp:	Pre: 291 Post: 284 Std: 5480 Exp: 11/03/2007	
4/16/07	Walt Pryor	Pre: 4.00 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.55 Post: 4.49 Std: 5480 Exp: 11/03/2007	Pre: 9.77 Post: 9.68 Std: 5480 Exp: 11/03/2007	Pre: 16.7 Post: 16.7 Std: NA Exp:	Pre: 333 Post: 324 Std: 5480 Exp: 11/03/2007	
4/15/07	Walt Pryor	Pre: 4.23 Post: 3.99 Std: 5480 Exp: 11/03/2007	Pre: 4.50 Post: 4.49 Std: 5480 Exp: 11/03/2007	Pre: 9.20 Post: 9.59 Std: 5480 Exp: 11/03/2007	Pre: 16.2 Post: 16.1 Std: NA Exp:	Pre: 322 Post: 316 Std: 5480 Exp: 11/03/2007	None
4/14/07	Walt Pryor	Pre: 3.99 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.43 Post: 4.46 Std: 5480 Exp: 11/03/2007	Pre: 8.81 Post: 9.46 Std: 5480 Exp: 11/03/2007	Pre: 17.5 Post: 17.4 Std: NA Exp:	Pre: 329 Post: 315 Std: 5480 Exp: 11/03/2007	None
		Pre: 4.08	Pre: 4.53	Pre: 9.53		Pre: 307	

4/13/07	Walt Pryor	Post: 4.00 Std: 5480 Exp: 11/03/2007	Post: 4.49 Std: 5480 Exp: 11/03/2007	Post: 9.59 Std: 5480 Exp: 11/03/2007	Pre: 16.8 Post: 16.8 Std: NA Exp:	Post: 296 Std: 5480 Exp: 11/03/2007	
4/12/07	James Goerdt	Pre: 4.02 Post: 4.00 Std: 5480 Exp: 11/03/2007	Pre: 4.54 Post: 4.49 Std: 5480 Exp: 11/03/2007	Pre: 9.60 Post: 9.59 Std: 5480 Exp: 11/03/2007	Pre: 16.9 Post: 16.9 Std: NA Exp:	Pre: 319 Post: 313 Std: 5480 Exp: 11/03/2007	
4/11/07	James Goerdt	Pre: 3.96 Post: 4.00 Std: 5480 Exp:	Pre: 4.45 Post: 4.49 Std: 5480 Exp:	Pre: 9.59 Post: 9.88 Std: 5480 Exp:	Pre: 16.7 Post: 16.7 Std: Exp:	Pre: 330 Post: 321 Std: 5480 Exp:	

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

MNA Sampling - SWMU 12 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Instrument**	U-22	**Created By**	James Goerdt
TtNUS Project #	112G00041	**Manufacturer**	Horiba	**Created Date**	4/12/07
Task/Contract #	CTO 0377	**Serial Number**	4143008	**Modified By**	James Goerdt
WBS Code #	TP0050125			**Modified Date**	5/9/07
Client				**Printed By**	James Goerdt
Status	Complete			**Printed Date**	5/9/07

Calibration Records

Date	Calibrator	pH (4 SU)	Conductivity (mS/cm)	DO (mg/L)	Temperature (°C)	Temperature (°C)	Comments
4/30/07	Walt Pryor	Pre: 4.07 Post: 4.00 Std: 5480 Exp:	Pre: 4.53 Post: 4.49 Std: 5480 Exp:	Pre: 8.91 Post: 9.04 Std: 5480 Exp:	Pre: 19.81 Post: 19.82 Std: NA Exp:	Pre: 289 Post: 285 Std: Exp:	
4/29/07	Walt Pryor	Pre: 4.04 Post: 4.00 Std: 5480 Exp:	Pre: 4.51 Post: 4.49 Std: 5480 Exp:	Pre: 9.98 Post: 9.15 Std: 5480 Exp:	Pre: 18.78 Post: 18.80 Std: NA Exp:	Pre: 290 Post: 289 Std: Exp:	
4/28/07	Walt Pryor	Pre: 4.28 Post: 4.00 Std: 5480 Exp:	Pre: 4.59 Post: 4.49 Std: 5480 Exp:	Pre: 8.38 Post: 9.19 Std: 5480 Exp:	Pre: 18.71 Post: 18.70 Std: NA Exp:	Pre: 300 Post: 297 Std: Exp:	
4/27/07	Walt Pryor	Pre: 4.02 Post: 4.00 Std: 5480 Exp:	Pre: 4.42 Post: 4.49 Std: 5480 Exp:	Pre: 9.74 Post: 9.11 Std: 5480 Exp:	Pre: 19.15 Post: 19.16 Std: NA Exp:	Pre: 293 Post: 286 Std: Exp:	
4/26/07	Walt Pryor	Pre: 4.01 Post: 4.00 Std: 5480 Exp:	Pre: 4.49 Post: 4.49 Std: 5480 Exp:	Pre: 8.85 Post: 8.92 Std: 5480 Exp:	Pre: 20.39 Post: 20.39 Std: NA Exp:	Pre: 318 Post: 311 Std: Exp:	
4/25/07	Walt Pryor	Pre: 3.86 Post: 4.00 Std: 5480 Exp:	Pre: 4.57 Post: 4.48 Std: 5480 Exp:	Pre: 9.13 Post: 8.71 Std: 5480 Exp:	Pre: 21.27 Post: 21.24 Std: NA Exp:	Pre: 296 Post: 286 Std: Exp:	
4/24/07	Walt Pryor	Pre: 4.02 Post: 4.00 Std: 5480 Exp:	Pre: 4.61 Post: 4.49 Std: 5480 Exp:	Pre: 9.55 Post: 9.12 Std: 5480 Exp:	Pre: 19.48 Post: 19.49 Std: NA Exp:	Pre: 362 Post: 346 Std: Exp:	
4/17/07	Walt Pryor	Pre: 3.95 Post: 3.99 Std: 5480 Exp:	Pre: 4.36 Post: 4.49 Std: 5480 Exp:	Pre: 9.66 Post: 9.68 Std: 5480 Exp:	Pre: 16.29 Post: 16.31 Std: NA Exp:	Pre: 291 Post: 289 Std: Exp:	
4/16/07	Walt Pryor	Pre: 4.01 Post: 4.00 Std: 5480	Pre: 4.64 Post: 4.49 Std: 5480	Pre: 9.84 Post: 9.42 Std: 5480	Pre: 17.22 Post: 17.20 Std: NA	Pre: 356 Post: 339 Std:	

		Exp:	Exp:	Exp:	Exp:	Exp:	
4/15/07	Walt Pryor	Pre: 4.09 Post: 4.00 Std: 5480 Exp:	Pre: 4.32 Post: 4.49 Std: 5480 Exp:	Pre: 8.42 Post: 9.66 Std: 5480 Exp:	Pre: 16.49 Post: 16.52 Std: NA Exp:	Pre: 367 Post: 340 Std: Exp:	None
4/14/07	Walt Pryor	Pre: 3.95 Post: 4.01 Std: 5480 Exp:	Pre: 4.44 Post: 4.49 Std: 5480 Exp:	Pre: 10.89 Post: 9.18 Std: 5480 Exp:	Pre: 17.40 Post: 17.41 Std: NA Exp:	Pre: 301 Post: 301 Std: Exp:	None
4/13/07	Walt Pryor	Pre: 4.05 Post: 3.99 Std: 5480 Exp:	Pre: 4.68 Post: 4.49 Std: 5480 Exp:	Pre: 10.95 Post: 9.10 Std: 5480 Exp:	Pre: 17.40 Post: 17.40 Std: NA Exp:	Pre: 301 Post: 300 Std: Exp:	
4/12/07	James Goerdt	Pre: 4.01 Post: 4.00 Std: 5480 Exp:	Pre: 4.44 Post: 4.49 Std: 5480 Exp:	Pre: 8.85 Post: 9.34 Std: 5480 Exp:	Pre: 17.62 Post: 17.64 Std: NA Exp:	Pre: 304 Post: 304 Std: Exp:	
4/11/07	James Goerdt	Pre: 4.24 Post: 4.01 Std: 5480 Exp:	Pre: 4.50 Post: 4.49 Std: 5480 Exp:	Pre: 10.47 Post: 9.67 Std: 5480 Exp:	Pre: 16.76 Post: 16.77 Std: NA Exp:	Pre: 306 Post: 304 Std: Exp:	

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

MNA Sampling - SWMU 12 - CRANE NSWC

Project Information

Facility Name	CRANE NSWC	**Instrument**	2020	**Created By**	Walt Pryor
TtNUS Project #	112G00041	**Manufacturer**	LaMotte	**Created Date**	4/13/07
Task/Contract #	CTO 0377	**Serial Number**	1757-1800	**Modified By**	James Goerdt
WBS Code #	TP0050125			**Modified Date**	5/9/07
Client				**Printed By**	James Goerdt
Status	Complete			**Printed Date**	5/9/07

Calibration Records

Date	Calibrator	Turbidity (0 NTU)	Turbidity (1 NTU)	Turbidity (10 NTU)	Comments
4/30/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/29/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/28/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/27/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/26/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/25/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/24/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/17/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/16/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	

4/15/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	
4/14/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: Delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	None
4/13/07	Walt Pryor	Pre: 0 Post: 0 Std: Exp:	Pre: delete Post: Std: Exp:	Pre: 10 Post: 10 Std: Exp:	

APPENDIX B

DAILY ACTIVITIES RECORD

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/4/07	**Weather/Temp**	NA	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	J Goerdt (JG)	**Created Date**	4/4/07
TtNUS Project #	112G00041	**Subcontractor Personnel**	NA	**Modified By**	James Goerdt
Task/Contract #	CTO 0377	**Visitors**	NA	**Modified Date**	5/11/07
WBS Code #	TP0050125	**Status**	Complete	**Printed By**	James Goerdt
Client				**Printed Date**	5/14/07

Daily Activity

Date	Time	Author	Notes
4/4/07	11:49	James Goerdt	**NOTE: Activities are occurring simultaneously at SWMUs 12, 13, and 16 during the course of these Rounds of MNA sampling. Data gaps in the SWMU 16 daily activity reports indicates activity at a different SWMU. All equipment calibration logs for all field activities at SWMUs 12, 13, and 16 will be located under SWMU 12.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/10/07	**Weather/Temp**	AM: PC upper 20's / PM: PC upper 50's	**Created By**	James Goerdt
Facility Name	CRANE NSWC			**Created Date**	4/10/07
TtNUS Project #	112G00041	**TtNUS Personnel**	JG = Jim Goerdt;WP = Walt Pryor	**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Subcontractor Personnel**	NA	**Printed By**	James Goerdt
Client				**Printed Date**	5/14/07
		Visitors	NA		
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/10/07	06:45	James Goerdt	JG and WP arrived at Building 3245. Calibrated PIDs and checked bottleware. Completed Health & Safety Meeting. Completed Med data sheets and OSHA requirements.
4/10/07	16:25	James Goerdt	JG and WP measured water levels in all SWMU 16 GW monitoring wells.
4/10/07	17:30	James Goerdt	Left Crane.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/16/07	**Weather/Temp**	AM: Sun mid 40's / PM: Sun upper 50's	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt;WP = Walt Pryor	**Created Date**	4/16/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Subcontractor Personnel**		**Printed By**	James Goerdt
Client		**Visitors**		**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/16/07	13:26	James Goerdt	JG arrived at SWMU 16 to measure staff gauges. WP returning to sample additional wells.
4/16/07	15:02	James Goerdt	JG finished measuring staff gauges at SWMU 16. Enroute to SWMU 12 to measure staff gauges.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/17/07	**Weather/Temp**	AM: Sunny low 40's	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt;WP = Walt Pryor	**Created Date**	4/17/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377	**Subcontractor Personnel**		**Modified Date**	5/11/07
WBS Code #	TP0050125			**Printed By**	James Goerdt
Client		**Visitors**		**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/17/07	06:40	James Goerdt	JG stopped at WalMart to purchase strapping tape.
4/17/07	07:20	James Goerdt	JG arrived at Crane. WP already on-site. WP calibrating equipment and selecting wells at SWMU 16 to purge/sample. JG updating E-Data and preparing to sample surface waters at SWMUs 12, 13, and 16. JG called in to update Joe Lucas on yesterdays highlights.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/18/07	**Weather/Temp**	NA	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt;WP = Walt Pryor;DH = Dave Hickey	**Created Date**	4/27/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Subcontractor Personnel**	NA	**Printed By**	James Goerdt
Client		**Visitors**	NA	**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/18/07	00:00	James Goerdt	JG and WP demob from NSWC Crane back to respective office locations. DH remains on-site to continue with sampling.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/20/07	**Weather/Temp**	NA	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	DH = Dave Hickey	**Created Date**	4/27/07
TtNUS Project #	112G00041	**Subcontractor Personnel**	NA	**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Visitors**	NA	**Printed By**	James Goerdt
Client		**Status**	Complete	**Printed Date**	5/14/07

Daily Activity

Date	Time	Author	Notes
4/20/07	00:00	James Goerdt	DH demobs from NSWC Crane.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/23/07	**Weather/Temp**	NA	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	WP = Walt Pryor;DH = Dave Hickey	**Created Date**	4/27/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377	**Subcontractor Personnel**	NA	**Modified Date**	5/11/07
WBS Code #	TP0050125			**Printed By**	James Goerdt
Client		**Visitors**	NA	**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/23/07	00:00	James Goerdt	DH and WP return to NSWC Crane for start of 10-day shift.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	5/1/07	**Weather/Temp**	AM: Hazy 70 PM: Hazy 85	**Created By**	Walt Pryor
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt;WP = Walt Pryor	**Created Date**	5/1/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Subcontractor Personnel**	NA	**Printed By**	James Goerdt
Client		**Visitors**	NA	**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
5/1/07	07:15	Walt Pryor	JG arrived at NSWC Crane. WP on-site. JG and WP preparing COCs and finalizing samples for shipment. JG phoned Fed Ex for sample pick up. WP calibrating field equipment and preparing for surface water sampling. JG syncing toughbooks and other misc office work.
5/1/07	09:30	Walt Pryor	JG and WP enroute to SWMU 16 to collect all four surface water samples. Field duplicate (VOCs) was collected at 16SWSD10 and MS/MSD collected at 16SWSD30. A lot of clearing of the land has taken place at SWMU 16 near surface water locations 16SWSD12 and 13 and some

			near 16SWSD30.
5/1/07	11:10	Walt Pryor	Completed sampling surface waters at SWMU 16. JG and WP return to Building 3245 to process samples. WP also completed packing up most of the equipment to return to rental company.
5/1/07	14:10	Walt Pryor	JG talked with Tom Brent regarding additional sampling at SWMU 17. JG updating field logs for SWMUs 12, 13, and 16.
5/1/07	14:26	Walt Pryor	Fed Ex at Field Office to pick up 5 coolers of samples (4 to Laucks and 1 to Data Chem).
5/1/07	17:30	James Goerdt	JG left Crane.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	4/30/07	**Weather/Temp**	NA	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt;WP = Walt Pryor;DH = Dave Hickey	**Created Date**	5/3/07
TtNUS Project #	112G00041			**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Subcontractor Personnel**	Na	**Printed By**	James Goerdt
Client		**Visitors**	NA	**Printed Date**	5/14/07
		Status	Complete		

Daily Activity

Date	Time	Author	Notes
4/30/07	13:00	James Goerdt	AM travel to site for JG. JG arrives on-site at Crane. Checked in at Bldg 3245, and doors to field office locked. Headed to SWMU 13 to look for DH and/or WP.
4/30/07	13:45	James Goerdt	JG met up with DH. WP on RR tracks at SWMU 12 sampling well. DH returning to Bldg 3245 to start processing samples for shipment while JG enroute to check on things at SWMU 8.
			JG arrives back at Bldg 3245. WP and DH on-site prepping samples. JG informed that syncing of toughbooks is taking a very long time with no progress. Decision made that DH and WP would

4/30/07	16:20	James Goerdt	generate COCs for each individual toughbook. Having additional trouble getting WP's toughbook to print COC. Running out of time to make the 19:00 cut off time at Fed Ex in Bloomington, so since the samples are already on heavy ice the decision was made to hold samples and contact Fed Ex in the morning and have them pick up the samples.
4/30/07	18:00	James Goerdt	JG, WP, and DH leave Crane.

- End of Report -

Tetra Tech NUS, Inc.

DAILY ACTIVITY LOG

MNA Sampling - SWMU 16 - CRANE NSWC

Project Information

Activity Date	5/3/07	**Weather/Temp**	AM: cloudy 60	**Created By**	James Goerdt
Facility Name	CRANE NSWC	**TtNUS Personnel**	JG = James Goerdt	**Created Date**	5/3/07
TtNUS Project #	112G00041	**Subcontractor Personnel**	NA	**Modified By**	James Goerdt
Task/Contract #	CTO 0377			**Modified Date**	5/11/07
WBS Code #	TP0050125	**Visitors**	NA	**Printed By**	James Goerdt
Client		**Status**	Complete	**Printed Date**	5/14/07

Daily Activity

Date	Time	Author	Notes
5/3/07	08:00	James Goerdt	JG on-site and began prep of shipping items back to rental companies and enroute to SWMU 8.
5/3/07	10:00	James Goerdt	JG stopped to fuel vehicle on base, and then returned to Bldg 3245 to continue with updating daily activity logs, preparing samples and equipment for shipping.
5/3/07	18:00	James Goerdt	All Round 9 sampling complete

- End of Report -

APPENDIX C

HEALTH AND SAFETY DOCUMENTATION

TETRA TECH NUS

CERTIFICATE OF TRAINING

THIS CERTIFIES THAT

Walter Pryor III

has successfully completed an 8-hour course of instruction in

OSHA 29 CFR 1910.120

GENERAL SITE WORKER
REFRESHER TRAINING

prepared and instructed by
Tetra Tech NUS, Inc.
Pittsburgh, Pennsylvania

January 23, 2007

Date of Award

Matthew M. Soltis, CIH, CSP
Manager
Health and Safety

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: **Periodic Examination**

EMPLOYEE:	**Pryor, Walter III E**	**COMPANY:**	**TT/NUS**
SSN:	**XXX-XX-7288**	**POSITION:**	**Ground Water Sampling**
DATE OF EXAM:	**12/22/2006**	**LOCATION:**	**TT/NUS-Germantown**
EXPIRATION DATE:	**12/22/2008**	**SITE:**	**Germantown**

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒	☐

STATUS

1. ☒ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

2. ☐ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

3. ☐ **NOT QUALIFIED**

4. ☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS: ***Pending completion of pulmonary function test.***

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 12/29/06

Signature: Peter P Greaney MD

WorkCare
300 S. Harbor Blvd., Suite 600, Anaheim, CA 92805
(714) 978-7488 • (800) 455-6155 • FAX (714) 456-2154

TETRA TECH NUS

CERTIFICATE OF TRAINING

THIS CERTIFIES THAT

Jim Goerdt

has successfully completed an 8-hour course of instruction in

OSHA 29 CFR 1910.120

GENERAL SITE WORKER
REFRESHER TRAINING

prepared and instructed by
Tetra Tech NUS, Inc.
Pittsburgh, Pennsylvania

February 2, 2007

Date of Award

Matthew M. Soltis, CIH, CSP
Manager
Health and Safety

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: **Periodic Examination**

EMPLOYEE:	**Goerdt, James**	**COMPANY:**	**TT/NUS**
SSN:	**XXX-XX-2691**	**POSITION:**	**Environmental Scientist**
DATE OF EXAM:	**11/22/2005**	**LOCATION:**	**TT/NUS-Pittsburgh**
EXPIRATION DATE:	**11/22/2007**	**SITE:**	**Pittsburgh**

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	☒	☐

STATUS

1. ☒ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

2. ☐ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

3. ☐ **NOT QUALIFIED**

4. ☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS:

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 11/29/05

Signature: Peter P Greaney MD

WorkCare
300 S. Harbor Blvd., Suite 600, Anaheim, CA 92805
(714) 978-7488 • (800) 455-6155 • FAX (714) 456-2154

GERAGHTY & MILLER, INC.
Environmental Services

Certificate of Completion

Presented To

David A. Hickey Jr.

In Recognition of Having Successfully Completed
the Prescribed Course of Study for

Hazardous Waste Site Activities
40-Hour Initial Health and Safety Training

Orlando, Florida — **January 7-11, 1991**

Richard M. Miller
President
American Ecology Services, Inc.

Course Director
Geraghty & Miller, Inc

WORK STATUS REPORT

Employer Copy

TYPE OF EXAMINATION: **Periodic Examination** **UPDATE**

EMPLOYEE:	**Hickey, David**	**COMPANY:**	**TT/NUS**
SSN:	**XXX-XX-9715**	**POSITION:**	**Geologist**
DATE OF EXAM:	**11/22/2005**	**LOCATION:**	**TT/NUS-Oak Ridge**
EXPIRATION DATE:	**11/22/2007**	**SITE:**	**Oak Ridge**

The following recommendations are based on a review of one or all of the following: a base history questionnaire, supporting diagnostic tests, physical examination, and the essential functions of the position applied for or occupied by the individual named above.

	Yes	No	Undecided
Has the employee any detected medical conditions that would increase his/her risk of material health impairment from occupational exposure in accordance with 29 CFR §1910.120?	☐	☒	☐
Does the employee have any limitations in the use of respirators in accordance with 29 CFR §1910.134?	☐	☒	☐

STATUS

1. ☒ **QUALIFIED** The examination indicates no significant medical condition. Employee can be assigned any work consistent with skills and training.

2. ☐ **QUALIFIED - WITH LIMITATIONS** The examination indicates that a medical condition currently exists that limits work assignments on the following basis:

3. ☐ **NOT QUALIFIED**

4. ☐ **DEFERRED** The examination indicated that additional information is necessary. The employee has been given the following instructions.

COMMENTS: ***Approved for biennial status.***

I have reviewed the medical data of the above named employee, and informed the employee of the results of the medical examination and any medical conditions that require follow-up examination or treatment.

Name of Physician: Peter P. Greaney, M.D. Date: 11/13/06

Signature: Peter P Greaney MD

WorkCare
300 S. Harbor Blvd., Suite 600, Anaheim, CA 92805
(714) 978-7488 • (800) 455-6155 • FAX (714) 456-2154

Date Completed:

1/20/2006

Receipt # 97780

International Union of Operating Engineers
Hazmat Training Program

Local DOE

This is to certify that

David Hickey, Jr

has successfully completed the required annual 8-hour refresher class specifically designed for workers in accordance with OSHA at 29 CFR 1910.120.

Jeff Henderson
Certified Instructor

FIGURE 8-2

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing investigation activities at NSWC Crane, and that I have received site-specific training that included the elements presented below:

- Names of personnel and alternates responsible for site safety and health
- Safety, health and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- The contents of the health and safety plan including Table 5-1 and 6-1
- Emergency response procedures (evacuation and assembly points)
- Review contents of relevant Material Safety Data Sheets
- Review of Safe Work Permits

I have been given the opportunity to ask questions and that my questions have been answered to my satisfaction. The dates of my training and my medical surveillance requirements are accurate and correct to the best of my knowledge.

Name (Printed and Signature)	Site-Specific Training Date	40-Hour Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Medical Exam
Jim Goerdt	4/10/07	12/91	1/07	NA	11/05
Walter Payon	4/10/07	9/97	1/07	9/97	12/07

APPENDIX D

ANALYTICAL DATA - ROUNDS 1 THROUGH 9

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR
AOC	PUZ	PUZ	PUZ	PUZ	PUZ
SWMU	16	16	16	16	16
PHASE	9	9	9	9	9
LOCATION	16MW02	16MW02	16MW03	16MWT04	16MWT06
NSAMPLE	16GW0210	16GW0210-D	16GW0309	16GWT0409	16GWT0610
MATRIX	GW	GW	GW	GW	GW
SACODE	ORIG	DUP	NORMAL	NORMAL	NORMAL
SAMPLE DATE	20070426	20070426	20070430	20070416	20070426
Explosives (ug/L)					
1,3,5-Trinitrobenzene	0.24 U	0.24 U	0.24 U	0.24 U	9.6 J
1,3-Dinitrobenzene	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
2,4,6-Trinitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	33 J
2,4-Dinitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	4.6 J
2,6-Dinitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	2.5 J
2-Amino-4,6-Dinitrotoluene	0.24 U	0.24 U	0.38 J	0.24 U	150 J
2-Nitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
3-Nitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	2.9 J
4-Amino-2,6-Dinitrotoluene	0.24 U	0.24 U	0.24 U	0.51	70 J
4-Nitrotoluene	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
HMX	0.24 U	0.24 U	3.9	6.4	2.8 J
Nitrobenzene	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
RDX	0.24 U	0.24 U	41	140	18 J
Tetryl	0.24 U	0.24 U	0.24 U	0.24 U	0.24 UJ
Volatile Organic Compounds (ug/L)					
1,1,1,2-Tetrachloroethane	0.30 U	0.30 U	0.30 U	0.30 U	0.99 J
1,1,1-Trichloroethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
1,1,2,2-Tetrachloroethane	0.30 U	0.30 U	0.30 U	0.30 U	6.5
1,1,2-Trichloroethane	0.30 U	0.30 U	0.30 U	0.30 U	360 J
1,1-Dichloroethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
1,1-Dichloroethene	0.30 U	0.30 U	0.30 U	0.30 U	310 J
1,2,3-Trichloropropane	0.30 U	0.30 U	0.30 U	0.30 U	1.1
1,2-Dibromo-3-Chloropropane	0.30 U	0.30 U	0.30 U	0.30 UJ	0.30 U
1,2-Dibromoethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
1,2-Dichloroethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
1,2-Dichloropropane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
2-Butanone	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
2-Hexanone	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
3-Chloropropene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
4-Methyl-2-Pentanone	0.50 U	0.50 U	0.50 U	0.50 U	33

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR
AOC	PUZ	PUZ	PUZ	PUZ	PUZ
SWMU	16	16	16	16	16
PHASE	9	9	9	9	9
LOCATION	16MW02	16MW02	16MW03	16MWT04	16MWT06
NSAMPLE	16GW0210	16GW0210-D	16GW0309	16GWT0409	16GWT0610
MATRIX	GW	GW	GW	GW	GW
SACODE	ORIG	DUP	NORMAL	NORMAL	NORMAL
SAMPLE DATE	20070426	20070426	20070430	20070416	20070426
Acetone	0.50 U	0.50 U	0.50 U	0.50 U	33
Acrolein	0.50 UR	0.50 UR	0.50 UR	0.50 UR	0.50 UR
Acrylonitrile	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.30 U	0.30 U	0.30 U	0.30 U	4.3
Bromodichloromethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Bromoform	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Bromomethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Carbon Disulfide	0.30 U	0.30 U	0.30 U	0.30 U	2.5
Carbon Tetrachloride	0.30 U	0.30 U	11	0.30 U	3.4
Chlorobenzene	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Chlorodibromomethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Chloroethane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.30 U	0.30 U	3.7	0.30 U	21
Chloromethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Chloroprene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	0.30 U	0.30 U	0.30 U	0.30 U	10000
cis-1,3-Dichloropropene	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Dibromomethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Dichlorodifluoromethane	0.30 U	0.30 U	0.30 UJ	0.30 U	0.30 U
Ethyl Methacrylate	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.30 U	0.30 U	0.30 U	0.30 U	7.2
Methacrylonitrile	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Methyl Iodide	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methyl Methacrylate	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methyl Tert-Butyl Ether	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Styrene	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Tetrachloroethene	0.30 U	0.30 U	0.30 U	0.30 U	330 J
Toluene	0.30 U	0.30 U	0.30 U	0.30 U	690
Total Xylenes	0.30 U	0.30 U	0.30 U	0.30 U	12
trans-1,2-Dichloroethene	0.30 U	0.30 U	0.30 U	0.30 U	26

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	**B146 INCINERATOR**	**B146 INCINERATOR**	**B146 INCINERATOR**	**B146 INCINERATOR**	**B146 INCINERATOR**
AOC	**PUZ**	**PUZ**	**PUZ**	**PUZ**	**PUZ**
SWMU	**16**	**16**	**16**	**16**	**16**
PHASE	**9**	**9**	**9**	**9**	**9**
LOCATION	**16MW02**	**16MW02**	**16MW03**	**16MWT04**	**16MWT06**
NSAMPLE	**16GW0210**	**16GW0210-D**	**16GW0309**	**16GWT0409**	**16GWT0610**
MATRIX	**GW**	**GW**	**GW**	**GW**	**GW**
SACODE	**ORIG**	**DUP**	**NORMAL**	**NORMAL**	**NORMAL**
SAMPLE DATE	**20070426**	**20070426**	**20070430**	**20070416**	**20070426**
trans-1,3-Dichloropropene	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
trans-1,4-Dichloro-2-Butene	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	0.33 J	0.33 J	3.8	0.87 J	740000
Trichlorofluoromethane	0.30 U	0.30 U	0.30 U	0.30 U	0.30 U
Vinyl Acetate	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.30 U	0.30 U	0.30 U	0.30 U	1100

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR
AOC	PUZ	PUZ	PUZ	PLZMGD
SWMU	16	16	16	16
PHASE	9	9	9	9
LOCATION	16MWT09	16MWT10	16MWT13	16MWT17
NSAMPLE	16GWT0908	16GWT1008	16GWT1308	16GWT1708
MATRIX	GW	GW	GW	GW
SACODE	NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE	20070424	20070424	20070417	20070417
Explosives (ug/L)				
1,3,5-Trinitrobenzene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
1,3-Dinitrobenzene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
2,4,6-Trinitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
2,4-Dinitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
2,6-Dinitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
2-Amino-4,6-Dinitrotoluene	0.40 J	0.24 UJ	0.24 U	0.24 U
2-Nitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
3-Nitrotoluene	0.24 UJ	0.24 UJ	0.33 J	0.24 U
4-Amino-2,6-Dinitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
4-Nitrotoluene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
HMX	8.3 J	5.0 J	0.24 U	0.35 J
Nitrobenzene	0.24 UJ	0.24 UJ	0.24 U	0.24 U
RDX	85 J	53 J	0.24 U	5.5
Tetryl	0.24 UJ	0.24 UJ	0.24 U	0.24 U
Volatile Organic Compounds (ug/L)				
1,1,1,2-Tetrachloroethane	0.30 U	0.30 U	0.30 U	0.30 U
1,1,1-Trichloroethane	0.30 U	0.30 U	0.30 U	0.30 U
1,1,2,2-Tetrachloroethane	0.30 U	0.30 U	0.30 U	0.30 U
1,1,2-Trichloroethane	0.30 U	0.30 U	0.96 J	41 J
1,1-Dichloroethane	0.30 U	0.30 U	0.30 U	0.30 U
1,1-Dichloroethene	0.30 U	0.30 U	0.30 U	5.7 J
1,2,3-Trichloropropane	0.30 U	0.30 U	0.30 U	0.30 U
1,2-Dibromo-3-Chloropropane	0.30 U	0.30 U	0.30 UJ	0.30 UJ
1,2-Dibromoethane	0.30 U	0.30 U	0.30 U	0.30 U
1,2-Dichloroethane	0.30 U	0.30 U	0.30 U	0.30 U
1,2-Dichloropropane	0.30 U	0.30 U	0.30 U	0.30 U
2-Butanone	0.50 U	0.50 U	0.50 U	0.50 U
2-Hexanone	0.50 U	0.50 U	0.50 U	0.50 U
3-Chloropropene	0.50 U	0.50 U	0.50 U	0.50 U
4-Methyl-2-Pentanone	0.50 U	0.50 U	0.50 U	0.50 U

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR	B146 INCINERATOR
AOC	PUZ	PUZ	PUZ	PLZMGD
SWMU	16	16	16	16
PHASE	9	9	9	9
LOCATION	16MWT09	16MWT10	16MWT13	16MWT17
NSAMPLE	16GWT0908	16GWT1008	16GWT1308	16GWT1708
MATRIX	GW	GW	GW	GW
SACODE	NORMAL	NORMAL	NORMAL	NORMAL
SAMPLE DATE	20070424	20070424	20070417	20070417
Acetone	0.50 U	0.50 U	1.5 J	0.50 U
Acrolein	0.50 UR	0.50 UR	0.50 UR	0.50 UR
Acrylonitrile	0.50 U	0.50 U	0.50 U	0.50 U
Benzene	0.30 U	0.30 U	0.30 U	1.0 J
Bromodichloromethane	0.30 U	0.30 U	0.30 U	0.30 U
Bromoform	0.30 U	0.30 U	0.30 U	0.30 U
Bromomethane	0.30 U	0.30 U	0.30 U	0.30 U
Carbon Disulfide	0.30 U	0.30 U	0.30 U	0.30 U
Carbon Tetrachloride	0.30 U	0.30 U	0.30 U	0.30 U
Chlorobenzene	0.30 U	0.30 U	0.30 U	0.30 U
Chlorodibromomethane	0.30 U	0.30 U	0.30 U	0.30 U
Chloroethane	0.50 U	0.50 U	0.50 U	0.50 U
Chloroform	0.74 J	1.8	0.30 U	2.6 J
Chloromethane	0.30 U	0.30 U	0.30 U	0.30 U
Chloroprene	0.50 U	0.50 U	0.50 U	0.50 U
cis-1,2-Dichloroethene	0.30 U	0.30 U	3.8	300
cis-1,3-Dichloropropene	0.30 U	0.30 U	0.30 U	0.30 U
Dibromomethane	0.30 U	0.30 U	0.30 U	0.30 U
Dichlorodifluoromethane	0.30 U	0.30 U	0.30 U	0.30 U
Ethyl Methacrylate	0.50 U	0.50 U	0.50 U	0.50 U
Ethylbenzene	0.30 U	0.30 U	0.30 U	0.30 U
Methacrylonitrile	3.0 U	3.0 U	3.0 U	3.0 U
Methyl Iodide	0.50 U	0.50 U	0.50 U	0.50 U
Methyl Methacrylate	0.50 U	0.50 U	0.50 U	0.50 U
Methyl Tert-Butyl Ether	0.50 U	0.50 U	0.50 U	0.50 U
Methylene Chloride	0.30 U	0.30 U	0.30 U	0.30 U
Styrene	0.30 U	0.30 U	0.30 U	0.30 U
Tetrachloroethene	0.30 U	0.30 U	0.30 U	4.5 J
Toluene	0.30 U	0.30 U	0.30 U	0.30 U
Total Xylenes	0.30 U	0.30 U	0.30 U	0.30 U
trans-1,2-Dichloroethene	0.30 U	0.30 U	0.30 U	4.8 J

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA UPPER WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	**B146 INCINERATOR**	**B146 INCINERATOR**	**B146 INCINERATOR**	**B146 INCINERATOR**
AOC	**PUZ**	**PUZ**	**PUZ**	**PLZMGD**
SWMU	**16**	**16**	**16**	**16**
PHASE	**9**	**9**	**9**	**9**
LOCATION	**16MWT09**	**16MWT10**	**16MWT13**	**16MWT17**
NSAMPLE	**16GWT0908**	**16GWT1008**	**16GWT1308**	**16GWT1708**
MATRIX	**GW**	**GW**	**GW**	**GW**
SACODE	**NORMAL**	**NORMAL**	**NORMAL**	**NORMAL**
SAMPLE DATE	**20070424**	**20070424**	**20070417**	**20070417**
trans-1,3-Dichloropropene	0.30 U	0.30 U	0.30 U	0.30 U
trans-1,4-Dichloro-2-Butene	0.50 U	0.50 U	0.50 U	0.50 U
Trichloroethene	4.9	1.4	470	24000 J
Trichlorofluoromethane	0.30 U	0.30 U	0.30 U	0.30 U
Vinyl Acetate	0.50 U	0.50 U	0.50 U	0.50 U
Vinyl Chloride	0.30 U	0.30 U	0.30 U	2.1 J

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR
AOC	PUZ	PUZ
SWMU	16	16
PHASE	9	9
LOCATION	16MW04	16MWT12
NSAMPLE	16GW0409	16GWT1208
MATRIX	GW	GW
SACODE	NORMAL	NORMAL
SAMPLE DATE	20070425	20070426
Explosives (ug/L)		
1,3,5-Trinitrobenzene	0.24 UJ	0.24 U
1,3-Dinitrobenzene	0.24 UJ	0.24 U
2,4,6-Trinitrotoluene	0.24 UJ	0.24 U
2,4-Dinitrotoluene	0.24 UJ	0.24 U
2,6-Dinitrotoluene	0.24 UJ	0.24 U
2-Amino-4,6-Dinitrotoluene	0.24 UJ	0.24 U
2-Nitrotoluene	0.24 UJ	0.24 U
3-Nitrotoluene	0.24 UJ	0.24 U
4-Amino-2,6-Dinitrotoluene	0.24 UJ	0.24 U
4-Nitrotoluene	0.24 UJ	0.24 U
HMX	0.38 J	0.24 U
Nitrobenzene	0.24 UJ	0.24 U
RDX	0.59 J	0.24 U
Tetryl	0.24 UJ	0.24 U
Volatile Organic Compounds (ug/L)		
1,1,1,2-Tetrachloroethane	0.30 U	0.30 U
1,1,1-Trichloroethane	0.30 U	0.30 U
1,1,2,2-Tetrachloroethane	0.30 U	0.30 U
1,1,2-Trichloroethane	0.30 U	0.30 U
1,1-Dichloroethane	0.30 U	0.30 U
1,1-Dichloroethene	0.30 U	0.30 U
1,2,3-Trichloropropane	0.30 U	0.30 U
1,2-Dibromo-3-Chloropropane	0.30 U	0.30 U
1,2-Dibromoethane	0.30 U	0.30 U

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	**B146 INCINERATOR**	**B146 INCINERATOR**
AOC	**PUZ**	**PUZ**
SWMU	**16**	**16**
PHASE	**9**	**9**
LOCATION	**16MW04**	**16MWT12**
NSAMPLE	**16GW0409**	**16GWT1208**
MATRIX	**GW**	**GW**
SACODE	**NORMAL**	**NORMAL**
SAMPLE DATE	**20070425**	**20070426**
1,2-Dichloroethane	0.30 U	0.30 U
1,2-Dichloropropane	0.30 U	0.30 U
2-Butanone	0.50 U	0.50 U
2-Hexanone	0.50 U	0.50 U
3-Chloropropene	0.50 U	0.50 U
4-Methyl-2-Pentanone	0.50 U	0.50 U
Acetone	1.3 J	0.50 U
Acrolein	0.50 UR	0.50 UR
Acrylonitrile	0.50 U	0.50 U
Benzene	0.30 U	0.30 U
Bromodichloromethane	0.30 U	0.30 U
Bromoform	0.30 U	0.30 U
Bromomethane	0.30 U	0.30 U
Carbon Disulfide	0.30 U	0.30 U
Carbon Tetrachloride	0.30 U	0.30 U
Chlorobenzene	0.30 U	0.30 U
Chlorodibromomethane	0.30 U	0.30 U
Chloroethane	0.50 U	0.50 U
Chloroform	0.30 U	0.30 U
Chloromethane	0.30 U	0.30 U
Chloroprene	0.50 U	0.50 U
cis-1,2-Dichloroethene	0.30 U	0.30 U
cis-1,3-Dichloropropene	0.30 U	0.30 U
Dibromomethane	0.30 U	0.30 U
Dichlorodifluoromethane	0.30 U	0.30 UJ

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	**B146 INCINERATOR**	**B146 INCINERATOR**
AOC	**PUZ**	**PUZ**
SWMU	**16**	**16**
PHASE	**9**	**9**
LOCATION	**16MW04**	**16MWT12**
NSAMPLE	**16GW0409**	**16GWT1208**
MATRIX	**GW**	**GW**
SACODE	**NORMAL**	**NORMAL**
SAMPLE DATE	**20070425**	**20070426**
Ethyl Methacrylate	0.50 U	0.50 U
Ethylbenzene	0.30 U	0.30 U
Methacrylonitrile	3.0 U	3.0 U
Methyl Iodide	0.50 U	0.50 U
Methyl Methacrylate	0.50 U	0.50 U
Methyl Tert-Butyl Ether	0.50 U	0.50 U
Methylene Chloride	0.30 U	0.30 U
Styrene	0.30 U	0.30 U
Tetrachloroethene	0.30 U	0.30 U
Toluene	0.30 U	0.30 U
Total Xylenes	0.30 U	0.30 U
trans-1,2-Dichloroethene	0.30 U	0.30 U
trans-1,3-Dichloropropene	0.30 U	0.30 U
trans-1,4-Dichloro-2-Butene	0.50 U	0.50 U
Trichloroethene	1.2	0.30 U
Trichlorofluoromethane	0.30 U	0.30 U
Vinyl Acetate	0.50 U	0.50 U
Vinyl Chloride	0.30 U	0.30 U

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR
AOC	PLZMGD	PMZ
SWMU	16	16
PHASE	9	9
LOCATION	16MWT11	16MWT15
NSAMPLE	16GWT1108	16GWT1508
MATRIX	GW	GW
SACODE	NORMAL	NORMAL
SAMPLE DATE	20070428	20070417
Explosives (ug/L)		
1,3,5-Trinitrobenzene	0.24 UJ	0.24 U
1,3-Dinitrobenzene	0.24 UJ	0.24 U
2,4,6-Trinitrotoluene	0.24 UJ	0.24 U
2,4-Dinitrotoluene	0.24 UJ	0.24 U
2,6-Dinitrotoluene	0.24 UJ	0.24 U
2-Amino-4,6-Dinitrotoluene	0.24 UJ	0.24 U
2-Nitrotoluene	0.24 UJ	0.24 U
3-Nitrotoluene	0.24 UJ	0.24 U
4-Amino-2,6-Dinitrotoluene	0.24 UJ	0.24 U
4-Nitrotoluene	0.24 UJ	0.24 U
HMX	0.32 J	0.24 U
Nitrobenzene	0.24 UJ	0.24 U
RDX	0.24 UJ	0.24 U
Tetryl	0.24 UJ	0.24 U
Volatile Organic Compounds (ug/L)		
1,1,1,2-Tetrachloroethane	0.30 U	0.30 U
1,1,1-Trichloroethane	0.30 U	0.30 U
1,1,2,2-Tetrachloroethane	0.30 U	0.30 U
1,1,2-Trichloroethane	0.30 U	0.30 U
1,1-Dichloroethane	0.30 U	0.30 U
1,1-Dichloroethene	0.30 U	0.30 U
1,2,3-Trichloropropane	0.30 U	0.30 U
1,2-Dibromo-3-Chloropropane	0.30 U	0.30 U
1,2-Dibromoethane	0.30 U	0.30 U

NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	B146 INCINERATOR	B146 INCINERATOR
AOC	PLZMGD	PMZ
SWMU	16	16
PHASE	9	9
LOCATION	16MWT11	16MWT15
NSAMPLE	16GWT1108	16GWT1508
MATRIX	GW	GW
SACODE	NORMAL	NORMAL
SAMPLE DATE	20070428	20070417
1,2-Dichloroethane	0.30 U	0.30 U
1,2-Dichloropropane	0.30 U	0.30 U
2-Butanone	0.50 U	0.50 U
2-Hexanone	0.50 U	0.50 U
3-Chloropropene	0.50 U	0.50 U
4-Methyl-2-Pentanone	0.50 U	0.50 U
Acetone	0.50 U	0.50 U
Acrolein	0.50 UR	0.50 UR
Acrylonitrile	0.50 U	0.50 U
Benzene	0.30 U	0.30 U
Bromodichloromethane	0.30 U	0.30 U
Bromoform	0.30 U	0.30 U
Bromomethane	0.30 U	0.30 U
Carbon Disulfide	0.30 U	0.30 U
Carbon Tetrachloride	0.30 U	0.30 U
Chlorobenzene	0.30 U	0.30 U
Chlorodibromomethane	0.30 U	0.30 U
Chloroethane	0.50 U	0.50 U
Chloroform	0.30 U	0.30 U
Chloromethane	0.30 U	0.30 U
Chloroprene	0.50 U	0.50 U
cis-1,2-Dichloroethene	0.30 U	0.30 U
cis-1,3-Dichloropropene	0.30 U	0.30 U
Dibromomethane	0.30 U	0.30 U
Dichlorodifluoromethane	0.30 UJ	0.30 U

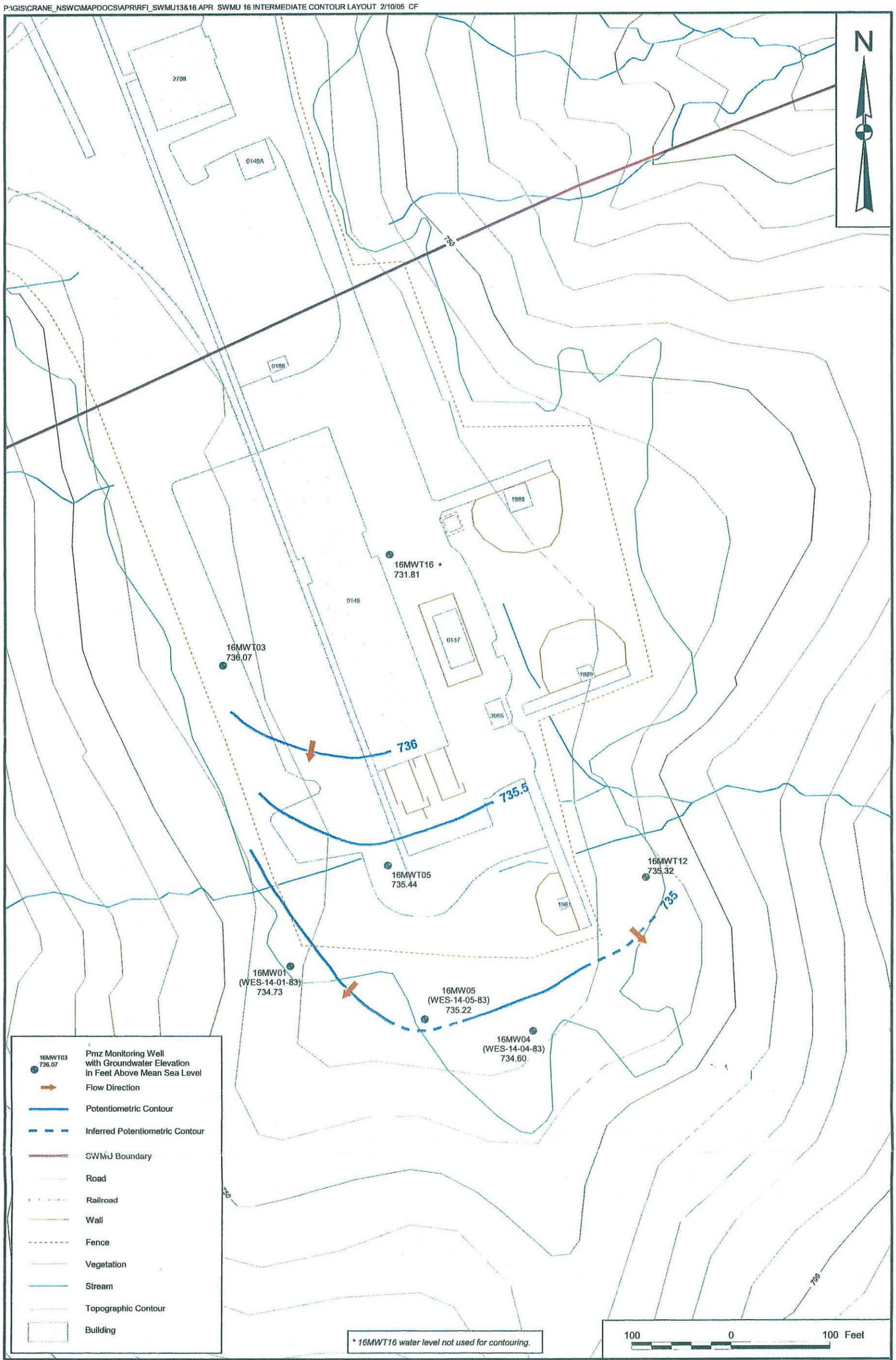
NSWC CRANE
SUMMARY OF ANALYTIC RESULTS - GROUNDWATER ROUND 9
PENNSYLVANIA MIDDLE WATER BEARING ZONE
SWMU 16 (CAST HIGH EXPLOSIVES FILL/BUILDING 146)

SITE	**B146 INCINERATOR**	**B146 INCINERATOR**
AOC	**PLZMGD**	**PMZ**
SWMU	**16**	**16**
PHASE	**9**	**9**
LOCATION	**16MWT11**	**16MWT15**
NSAMPLE	**16GWT1108**	**16GWT1508**
MATRIX	**GW**	**GW**
SACODE	**NORMAL**	**NORMAL**
SAMPLE DATE	**20070428**	**20070417**
Ethyl Methacrylate	0.50 U	0.50 U
Ethylbenzene	0.30 U	0.30 U
Methacrylonitrile	3.0 U	3.0 U
Methyl Iodide	0.50 U	0.50 U
Methyl Methacrylate	0.50 U	0.50 U
Methyl Tert-Butyl Ether	0.50 U	0.50 U
Methylene Chloride	0.30 U	0.30 U
Styrene	0.30 U	0.30 U
Tetrachloroethene	0.30 U	0.30 U
Toluene	0.30 U	0.30 U
Total Xylenes	0.30 U	0.30 U
trans-1,2-Dichloroethene	0.30 U	0.30 U
trans-1,3-Dichloropropene	0.30 U	0.30 U
trans-1,4-Dichloro-2-Butene	0.50 U	0.50 U
Trichloroethene	0.30 U	0.30 U
Trichlorofluoromethane	0.30 U	0.30 U
Vinyl Acetate	0.50 U	0.50 U
Vinyl Chloride	0.30 U	0.30 U

APPENDIX E

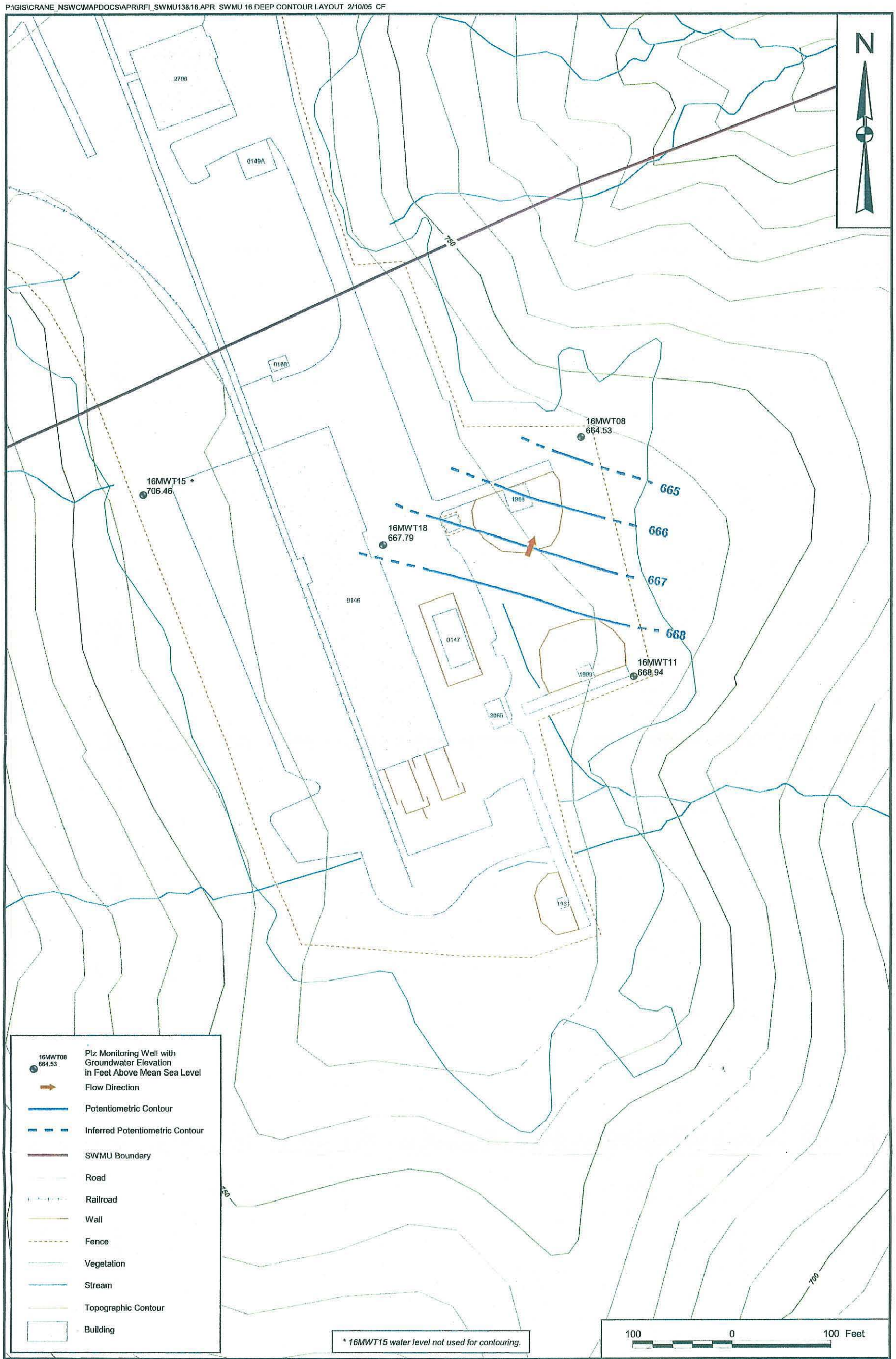
POTENTIOMETRIC SURFACE MAPS FOR ROUNDS 2 THROUGH 8

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 INTERMEDIATE CONTOUR LAYOUT 2/10/05 CF



DRAWN BY: A. JANOCHA	DATE: 2/23/04	POTENTIOMETRIC SURFACE MAP FOR	CONTRACT NUMBER: 7448
CHECKED BY: J. LUCAS	DATE: 5/13/04	MIDDLE PENNSYLVANIAN WATER-BEARING ZONE - JANUARY 24, 2004	APPROVED BY: — DATE: —
COST/SCHEDULE-AREA		SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR	APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC	NSWC CRANE CRANE, INDIANA	DRAWING NO.: FIGURE 4 - 8 REV: 0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 DEEP CONTOUR LAYOUT 2/10/05 CF



DRAWN BY: A. JANOCHA	DATE: 2/23/04	POTENTIOMETRIC SURFACE MAP FOR LOWER PENNSYLVANIAN WATER-BEARING UNIT - JANUARY 24, 2004 SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: 7448
CHECKED BY: J. LUCAS	DATE: 3/17/04		APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 9 REV: 0

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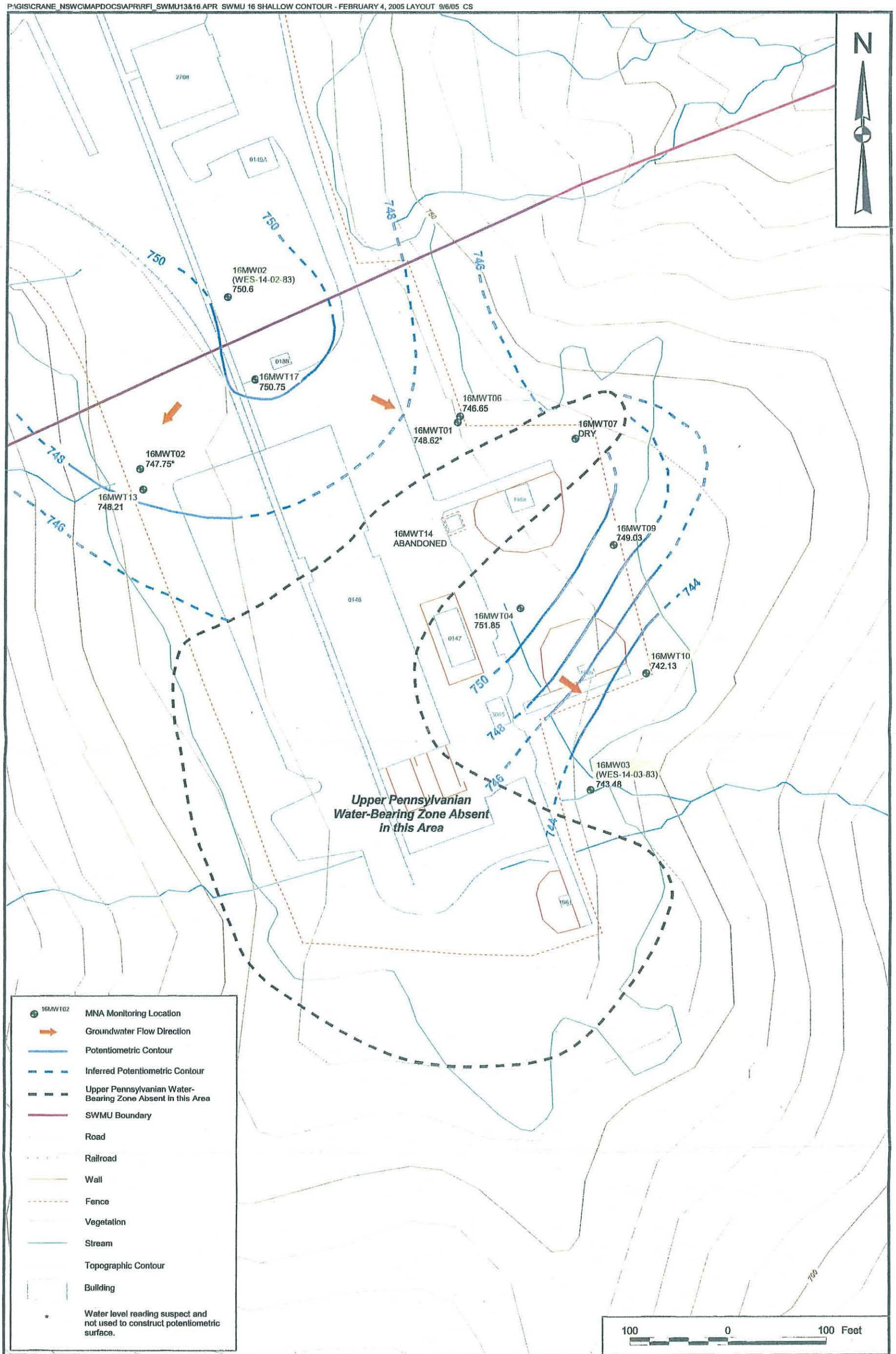


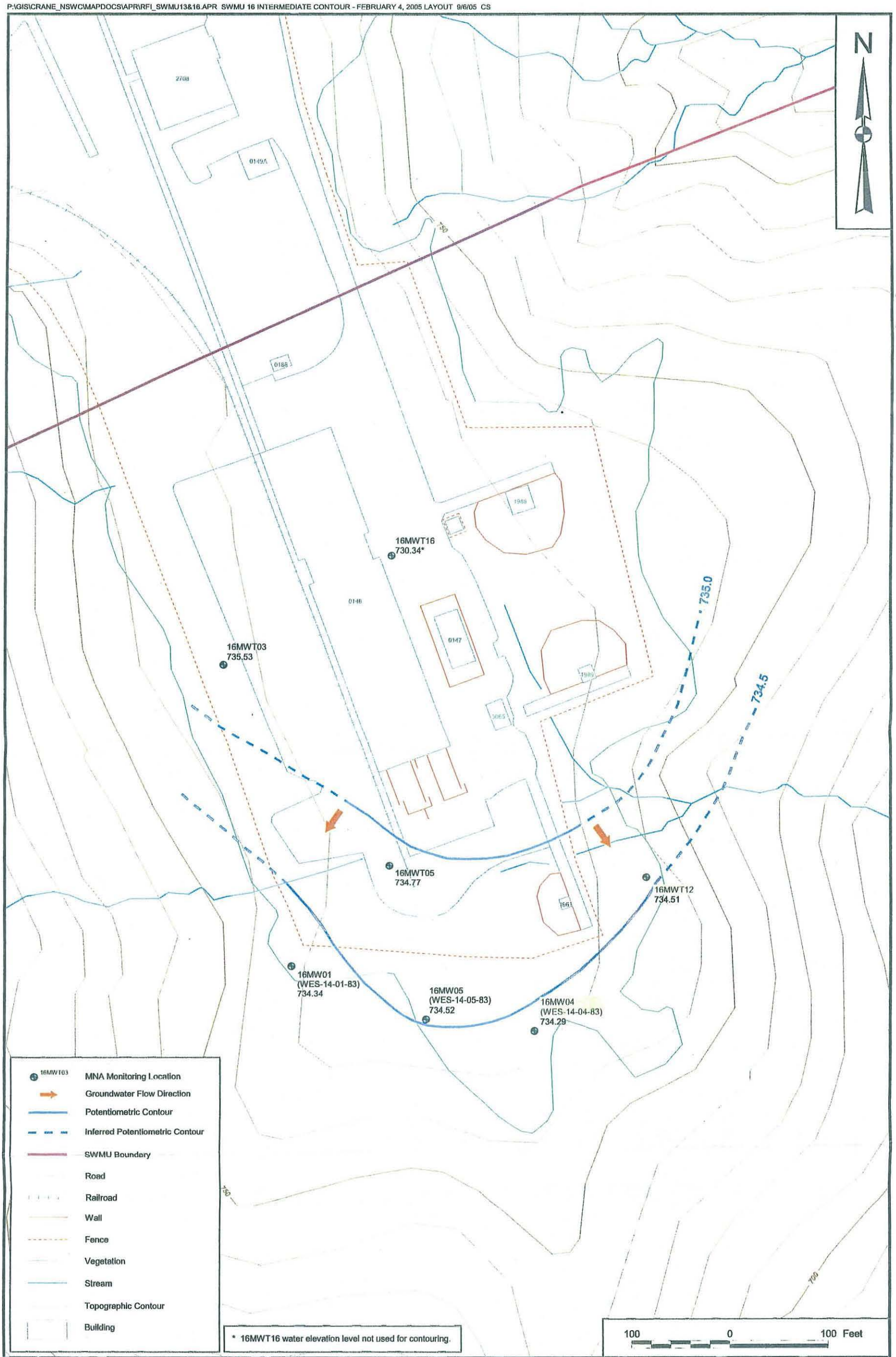
DRAWN BY	A. JANOCHA
DATE	8/21/05
CHECKED BY	J. LUCAS
DATE	8/31/05
COST/SCHEDULE-AREA	
SCALE	AS NOTED

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
UPPER PENNSYLVANIAN WATER-BEARING ZONE - FEBRUARY 4, 2005 (ROUND 4)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER	7448
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO.	FIGURE 4 - 1
REV	0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 INTERMEDIATE CONTOUR - FEBRUARY 4, 2005 LAYOUT 9/6/05 CS



DRAWN BY: A. JANOCHA	DATE: 8/21/05
CHECKED BY: J. LUCAS	DATE: 8/31/05
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
MIDDLE PENNSYLVANIAN WATER-BEARING ZONE - FEBRUARY 4, 2005 (ROUND 4)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER: 7448	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 4 - 2	REV: 0

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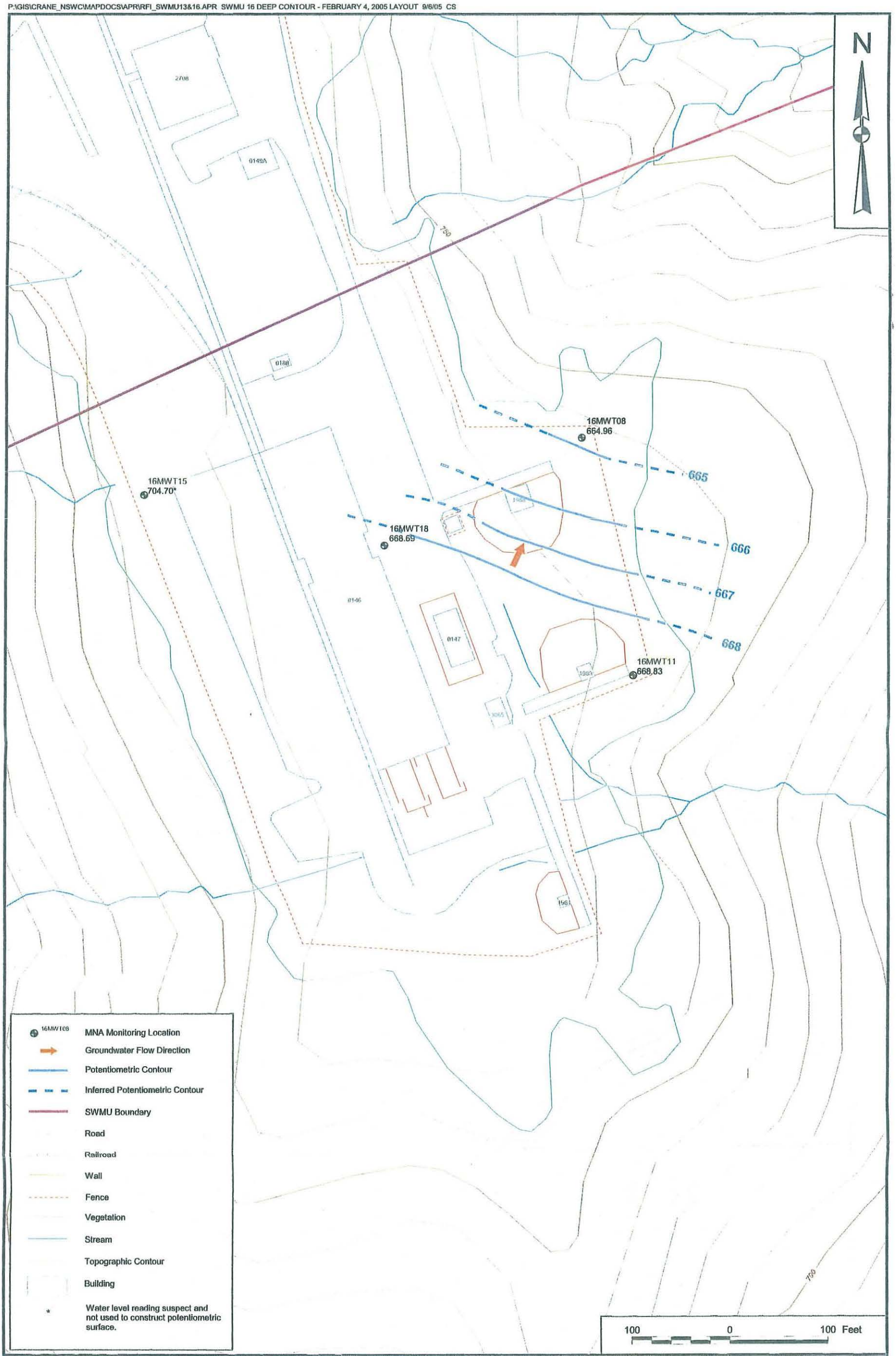


DRAWN BY: A. JANOCHA	DATE: 8/21/05
CHECKED BY: J. LUCAS	DATE: 8/31/05
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
LOWER PENNSYLVANIAN WATER-BEARING UNIT - FEBRUARY 4, 2005 (ROUND 4)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER: 7448	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 4 - 3	REV: 0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 SHALLOW CONTOUR - MAY 5, 2005 LAYOUT 1/25/06 KMP

N

16MW02
(WES-14-02-83)
751.14

16MWT17
751.15

16MWT06
747.75

16MWT01
748.95

16MWT07
DRY

16MWT02
748.68

16MWT13
749.15

16MWT14
ABANDONED

16MWT09
750.46

16MWT04
753.01

16MWT10
743.36

16MW03
(WES-14-03-83)
744.49

Upper Pennsylvanian Water-Bearing Zone Absent in this Area

16MWT02	MNA Monitoring Location
	Groundwater Flow Direction
	Potentiometric Contour
	Inferred Potentiometric Contour
	Upper Pennsylvanian Water-Bearing Zone Absent in this Area
	SWMU Boundary
	Road
	Railroad
	Wall
	Fence
	Vegetation
	Stream
	Topographic Contour
	Building

100 0 100 Feet

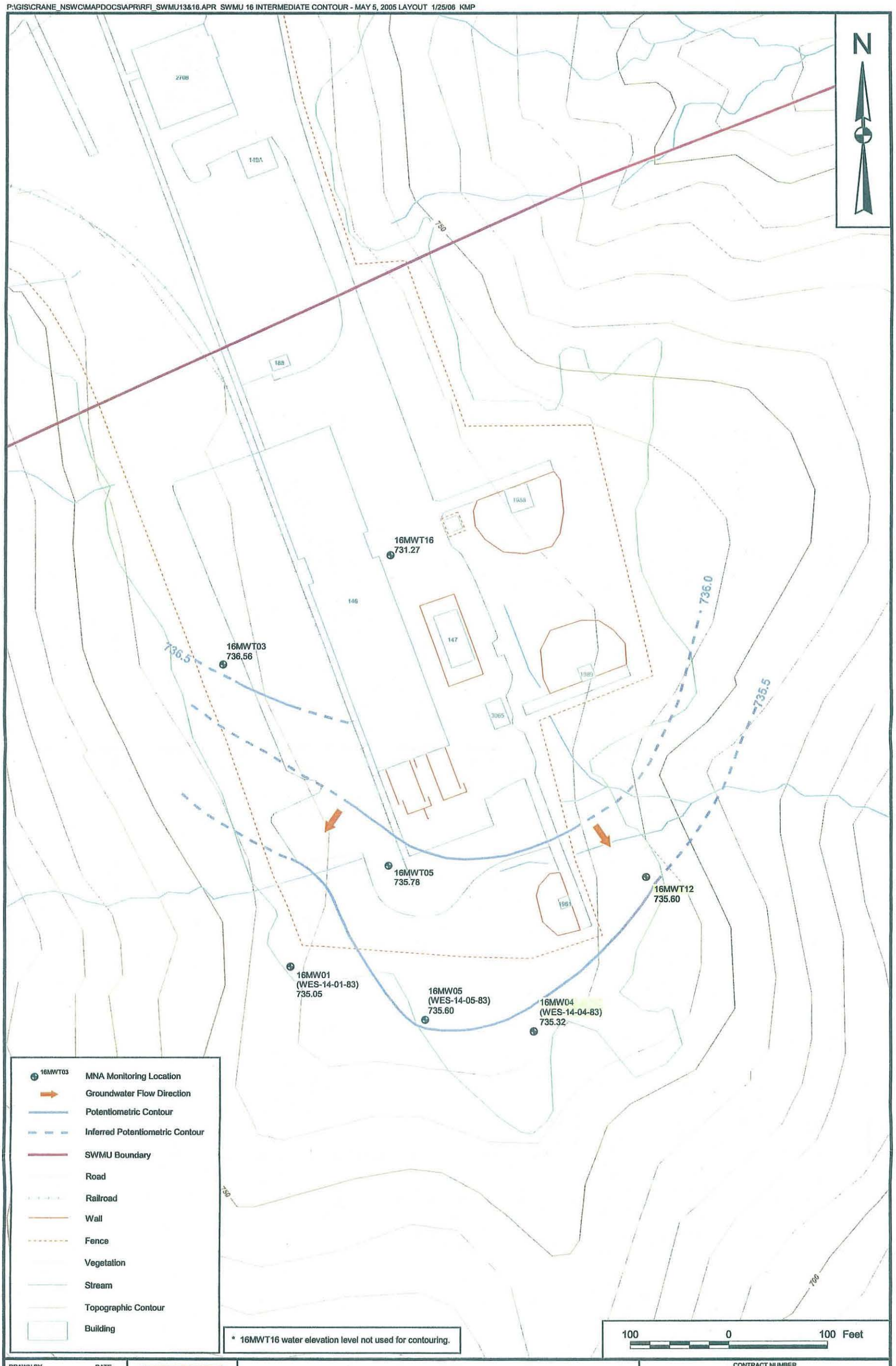
DRAWN BY	DATE
K. PEILA	1/25/06
CHECKED BY	DATE
J. LUCAS	1/25/06
COST/SCHEDULE-AREA	
SCALE	AS NOTED

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
UPPER PENNSYLVANIAN WATER-BEARING ZONE - MAY 5, 2005 (ROUND 5)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

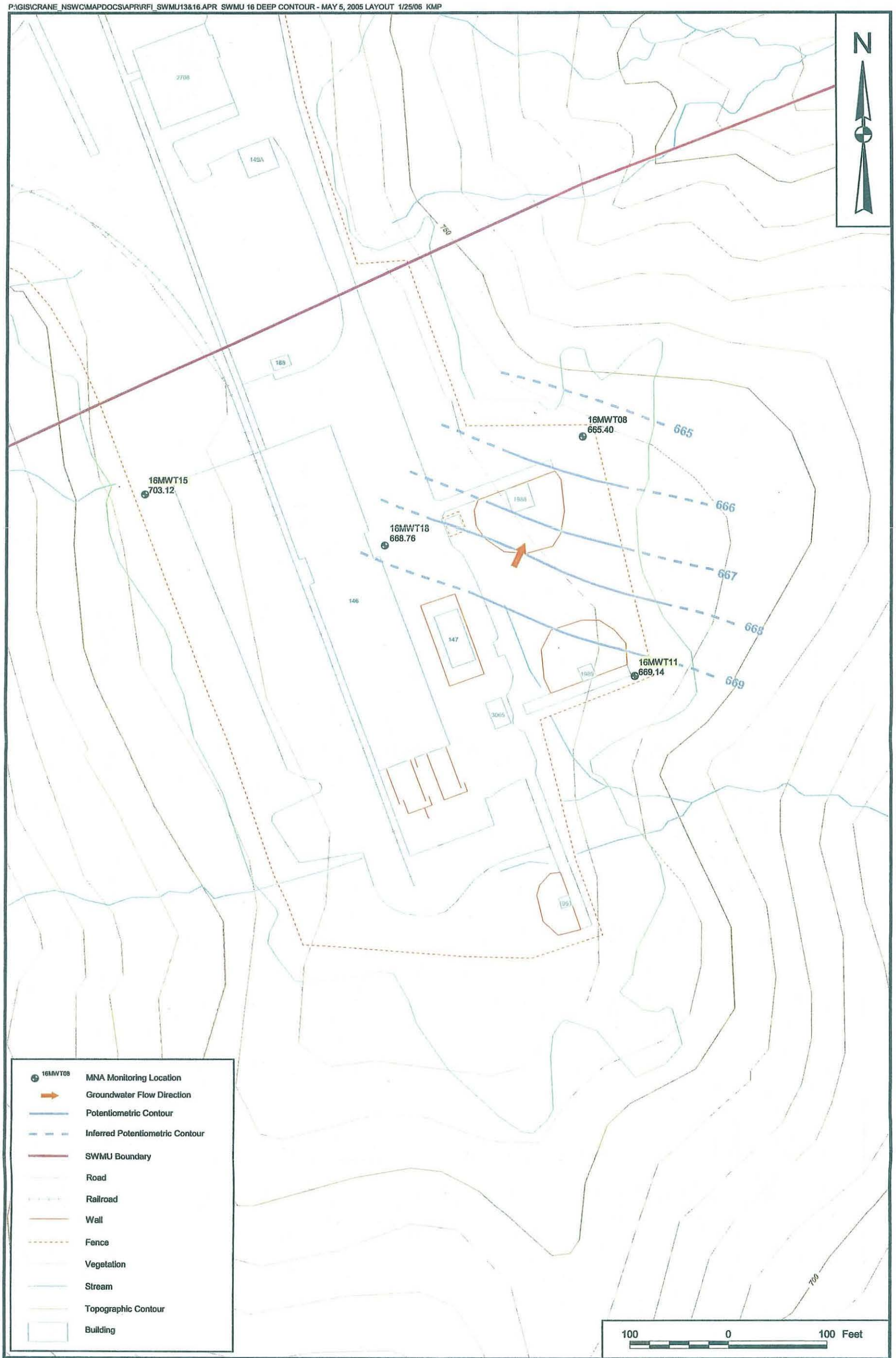
CONTRACT NUMBER	00041
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
DRAWING NO.	FIGURE 4 - 1
REV	0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 INTERMEDIATE CONTOUR - MAY 5, 2005 LAYOUT 1/25/06 KMP



DRAWN BY: K. PEILA — DATE: 1/25/06	NAVFAC	POTENTIOMETRIC SURFACE MAP FOR MIDDLE PENNSYLVANIAN WATER-BEARING ZONE - MAY 5, 2005 (ROUND 5) SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: 00041
CHECKED BY: J. LUCAS — DATE: 1/25/06			APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED			DRAWING NO.: FIGURE 4 - 2 — REV: 0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 DEEP CONTOUR - MAY 5, 2005 LAYOUT 1/25/06 KMP



DRAWN BY: K. PEILA	DATE: 1/25/06	POTENTIOMETRIC SURFACE MAP FOR LOWER PENNSYLVANIAN WATER-BEARING ZONE - MAY 5, 2005 (ROUND 5) SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: 00041
CHECKED BY: J. LUCAS	DATE: 1/25/06		APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 3 REV: 0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\RFI_SWMU13&16.APR SWMU 16 SHALLOW CONTOUR - AUGUST 10, 2005 LAYOUT 4/17/06 SS

N

16MW02
(WES-14-02-83)
750.78

16MWT17
750.74

16MWT06
746.51

16MWT01
750.00

16MWT07
DRY

16MWT02
747.26

16MWT13
747.49

16MWT14
ABANDONED

16MWT09
748.79

16MWT04
751.65

16MWT10
741.03

16MW03
(WES-14-03-83)
743.24

Upper Pennsylvanian Water-Bearing Zone Absent in this Area

16MWT02 MNA Monitoring Location
Groundwater Flow Direction
Potentiometric Contour
Inferred Potentiometric Contour
Upper Pennsylvanian Water-Bearing Zone Absent in this Area
SWMU Boundary
Road
Railroad
Wall
Fence
Vegetation
Stream
Topographic Contour
Building

100 0 100 Feet

DRAWN BY: K. PEILA	DATE: 1/25/06
CHECKED BY: J. LUCAS	DATE: 4/17/06
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
UPPER PENNSYLVANIAN WATER-BEARING ZONE - AUGUST 10, 2005 (ROUND 6)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER: 00041	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 4 - 4	REV: 0

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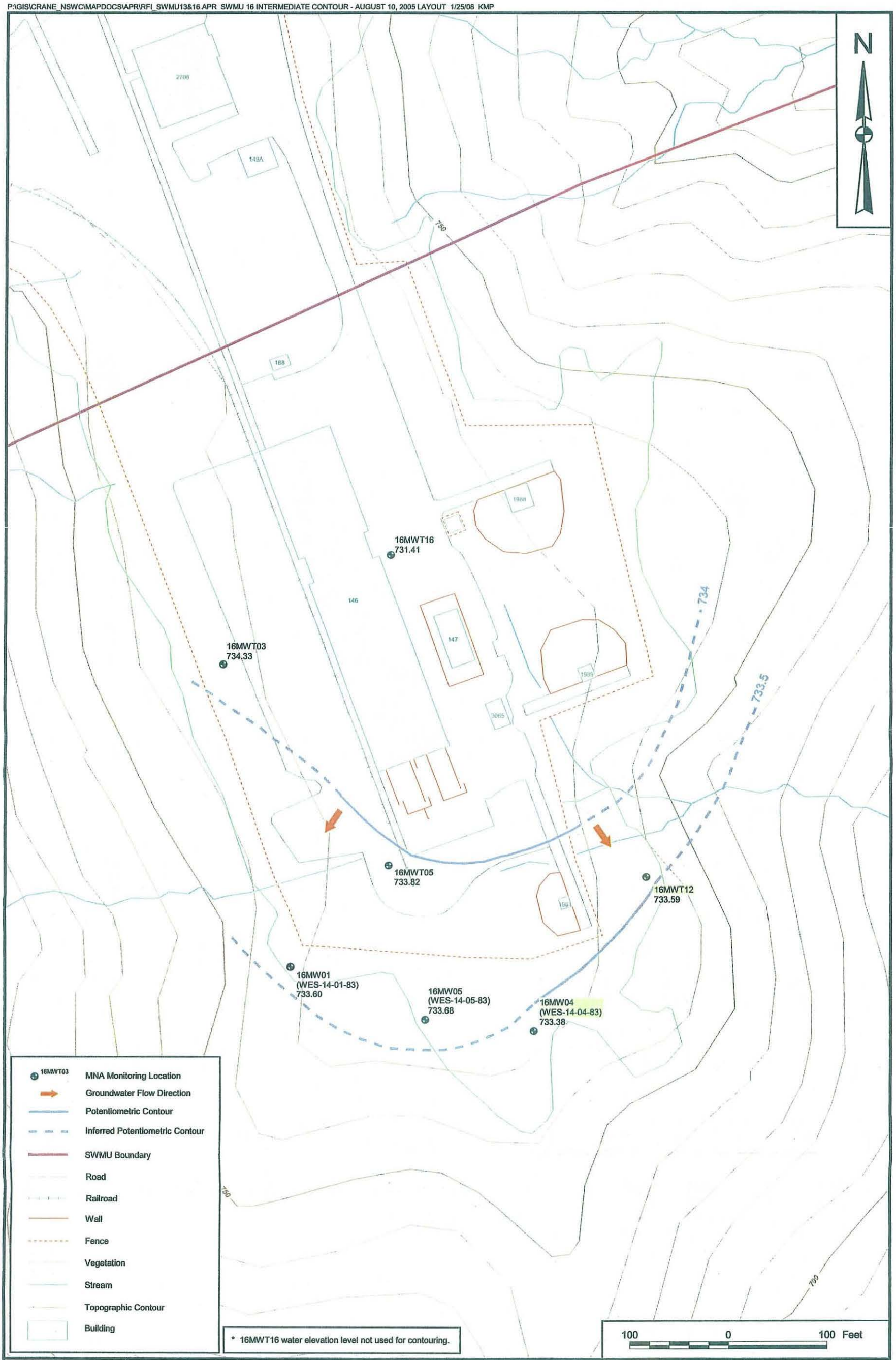

DRAWN BY: K. PEILA	DATE: 1/25/06
CHECKED BY: J. LUCAS	DATE: 1/25/06
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
MIDDLE PENNSYLVANIAN WATER-BEARING ZONE - AUGUST 10, 2005 (ROUND 6)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER: 00041	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 4 - 5	REV: 0

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DRAWN BY	DATE
K. PEILA	1/25/06
CHECKED BY	DATE
J. LUCAS	4/17/06
COST/SCHEDULE-AREA	
SCALE	AS NOTED

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
LOWER PENNSYLVANIAN WATER-BEARING ZONE - AUGUST 10, 2005 (ROUND 6)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER	00041	
APPROVED BY	DATE	
—	—	
APPROVED BY	DATE	
—	—	
DRAWING NO.	FIGURE 4 - 6	REV 0

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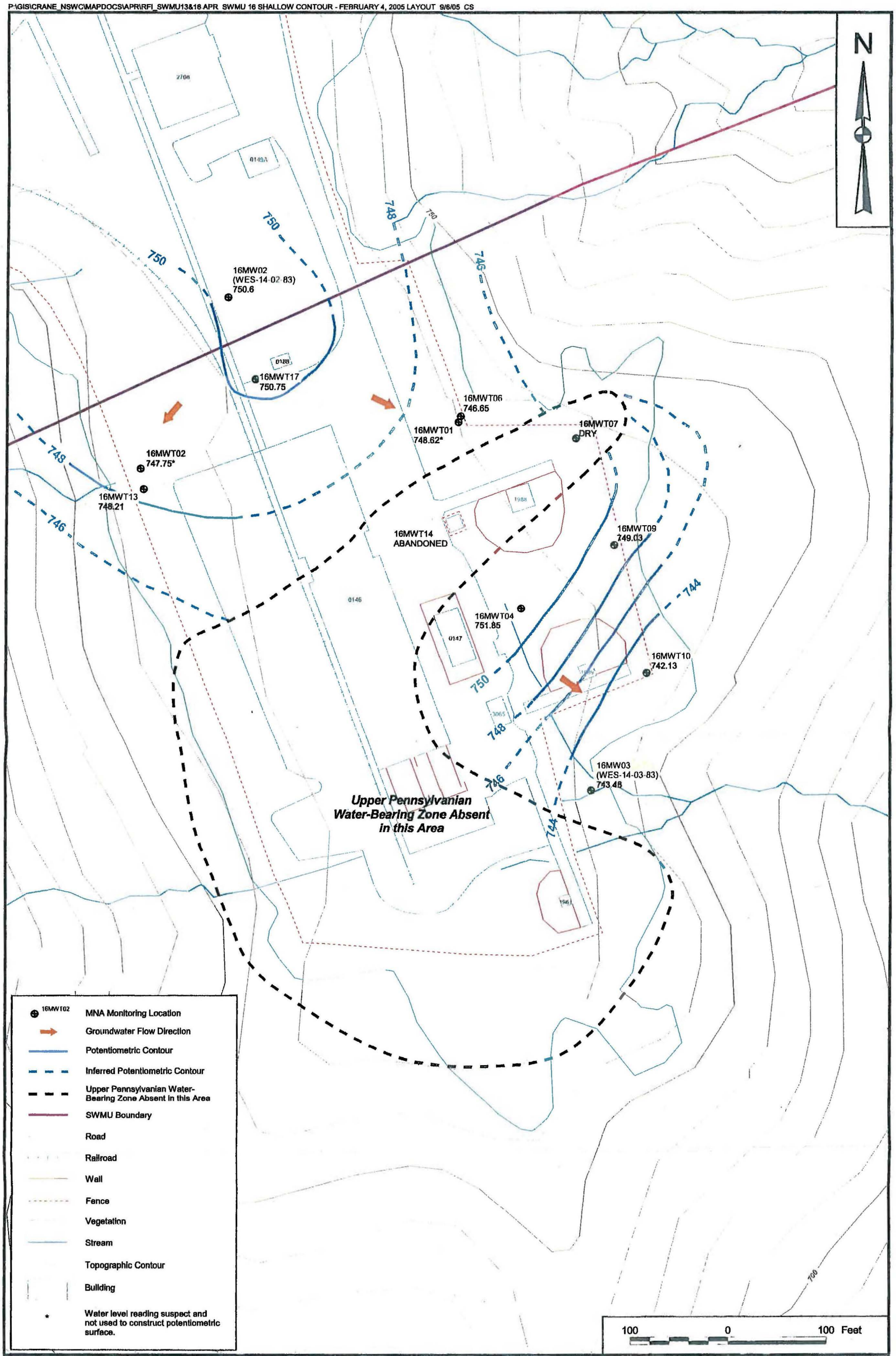

DRAWN BY: A. JANOCHA	DATE: 8/21/05
CHECKED BY: J. LUCAS	DATE: 8/31/05
COST/SCHEDULE-AREA	
SCALE: AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR
UPPER PENNSYLVANIAN WATER-BEARING ZONE - FEBRUARY 4, 2005 (ROUND 4)
SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER: 7448	
APPROVED BY: —	DATE: —
APPROVED BY: —	DATE: —
DRAWING NO.: FIGURE 4 - 1	REV: 0

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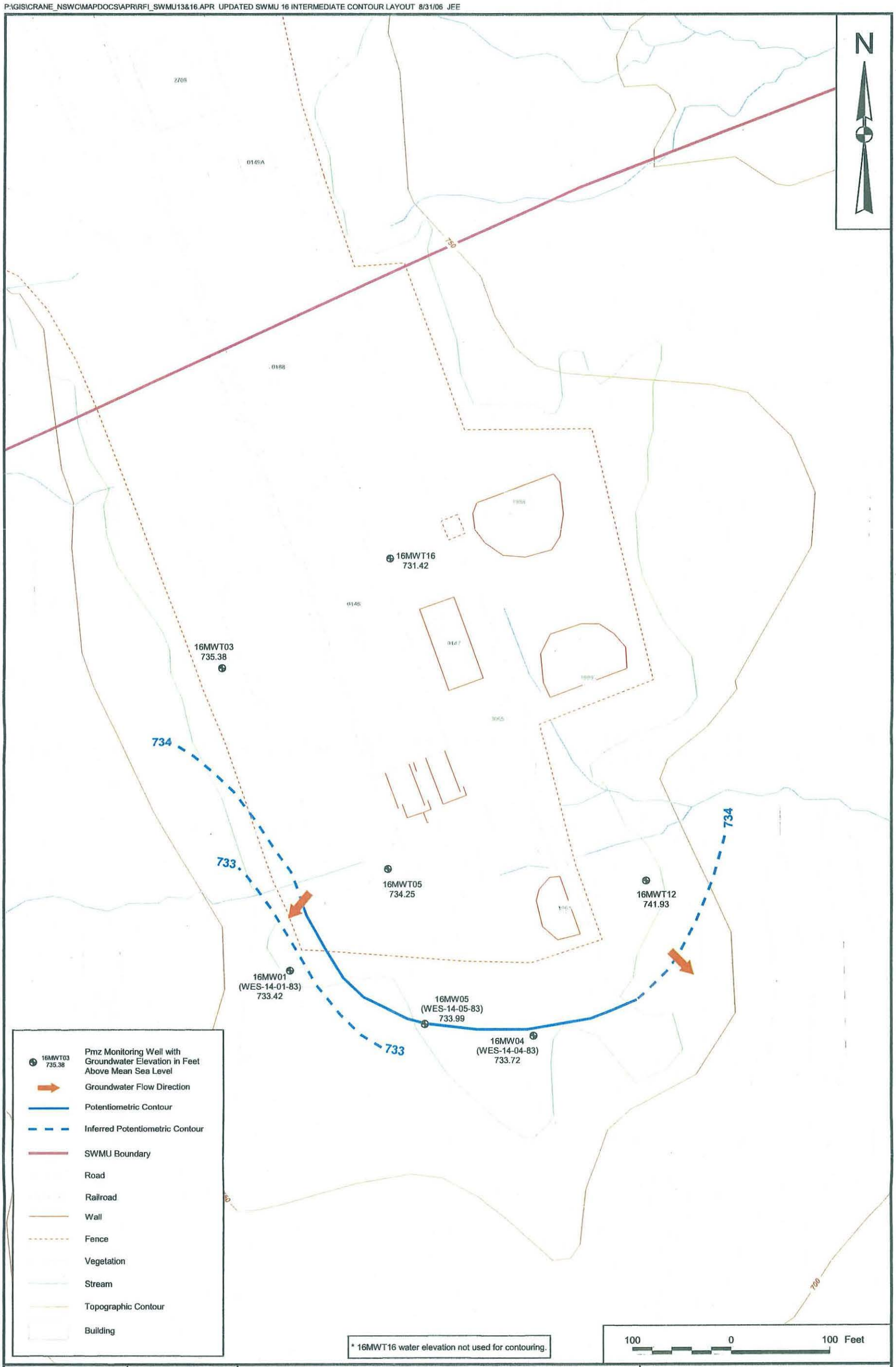

DRAWN BY: S. STROZ	DATE: 8/18/06	POTENTIOMETRIC SURFACE MAP FOR MIDDLE PENNSYLVANIAN WATER-BEARING ZONE - JANUARY 25, 2006 SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: CTO 0377
CHECKED BY: J. LUCAS	DATE: 8/31/06		APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 2 / REV: 0

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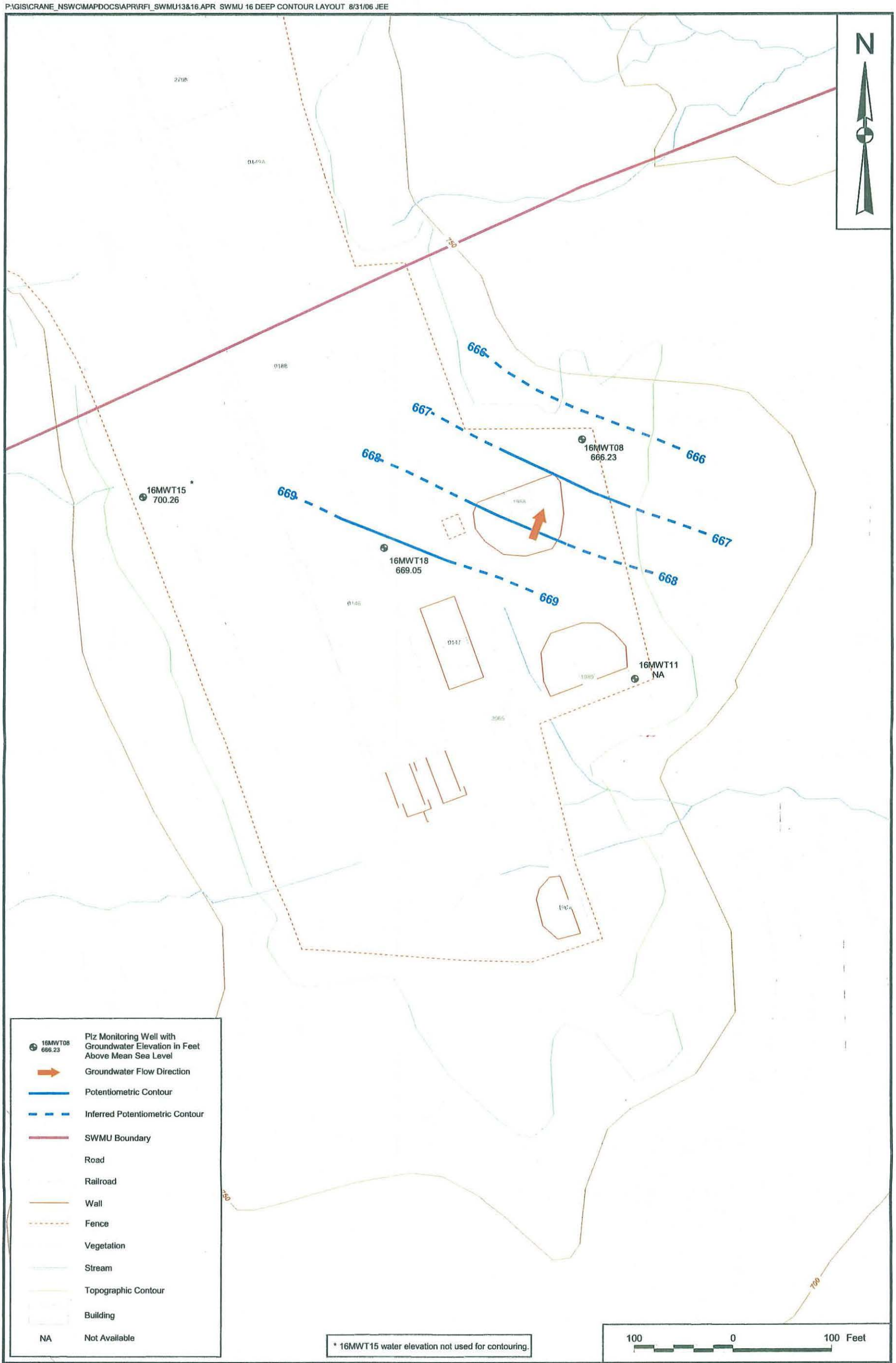

DRAWN BY: S. STROZ	DATE: 8/18/06	POTENTIOMETRIC SURFACE MAP FOR LOWER PENNSYLVANIAN WATER-BEARING UNIT - JANUARY 25, 2006 SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: CTO 0377
CHECKED BY: J. LUCAS	DATE: 8/31/06		APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 3 REV: 0

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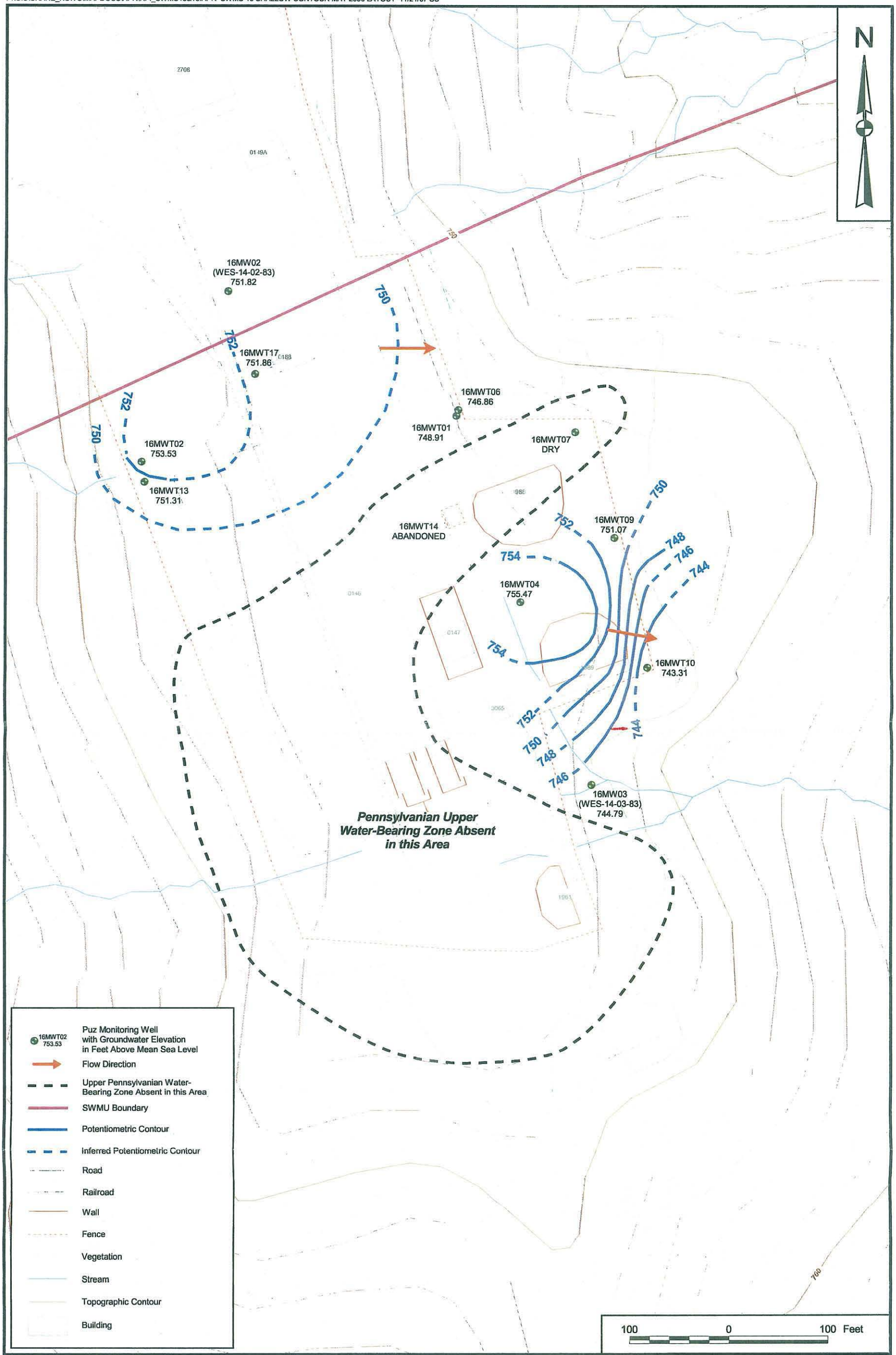

DRAWN BY: S. STROZ	DATE: 11/19/07	POTENTIOMETRIC SURFACE MAP FOR	CONTRACT NUMBER: 00041
CHECKED BY: J. LUCAS	DATE: 11/21/07	PENNSYLVANIAN UPPER WATER-BEARING ZONE - MAY 3, 2006	APPROVED BY: — DATE: —
COST/SCHEDULE-AREA		ROUND 8	APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC	SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	DRAWING NO.: FIGURE 4 - 1 REV: 0

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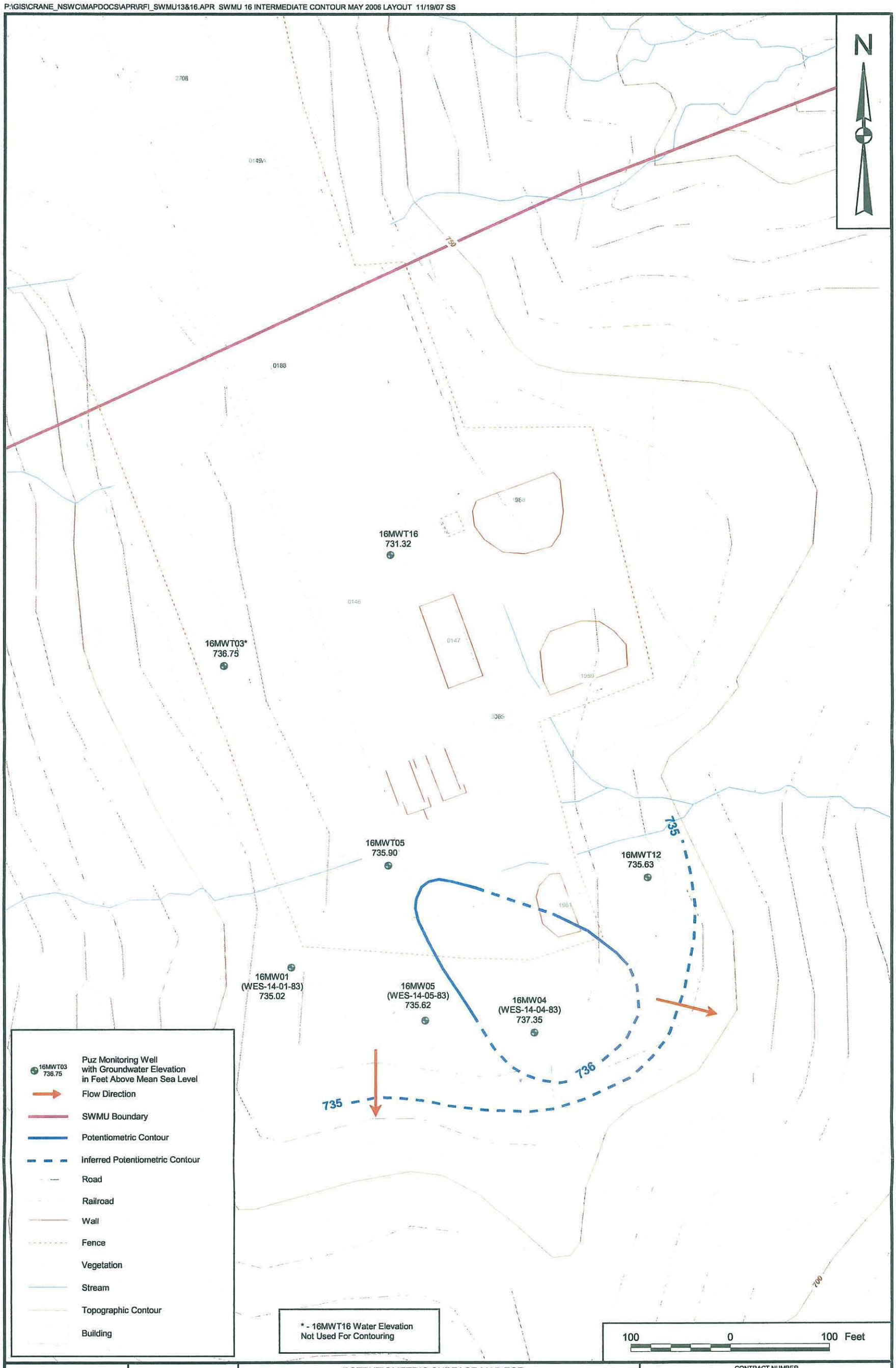

DRAWN BY: S. STROZ	DATE: 11/19/07	POTENTIOMETRIC SURFACE MAP FOR	CONTRACT NUMBER: 00041
CHECKED BY: J. LUCAS	DATE: 11/19/07	PENNSYLVANIAN MIDDLE WATER-BEARING ZONE - MAY 3, 2006	APPROVED BY: — DATE: —
COST/SCHEDULE-AREA		ROUND 8	APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC	SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	DRAWING NO.: FIGURE 4 - 2 REV: 0

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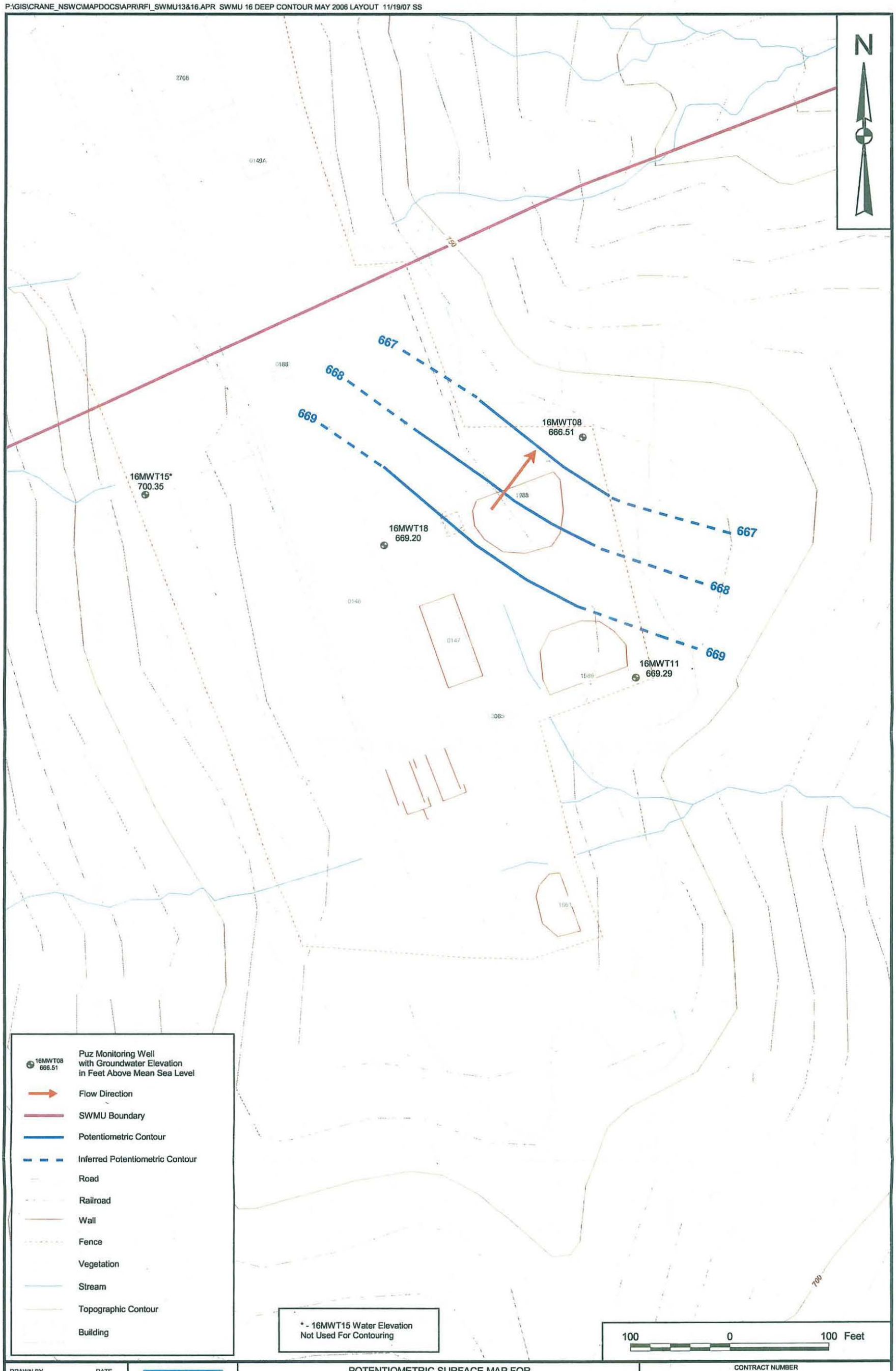

DRAWN BY: S. STROZ	DATE: 11/19/07	POTENTIOMETRIC SURFACE MAP FOR PENNSYLVANIAN LOWER WATER-BEARING UNIT - MAY 3, 2006 ROUND 8 SWMU 16 - CAST HIGH EXPLOSIVES FILL/BUILDING 146 INCINERATOR NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER: 00041
CHECKED BY: J. LUCAS	DATE: 11/19/07		APPROVED BY: — DATE: —
COST/SCHEDULE-AREA			APPROVED BY: — DATE: —
SCALE: AS NOTED	NAVFAC		DRAWING NO.: FIGURE 4 - 3 REV: 0