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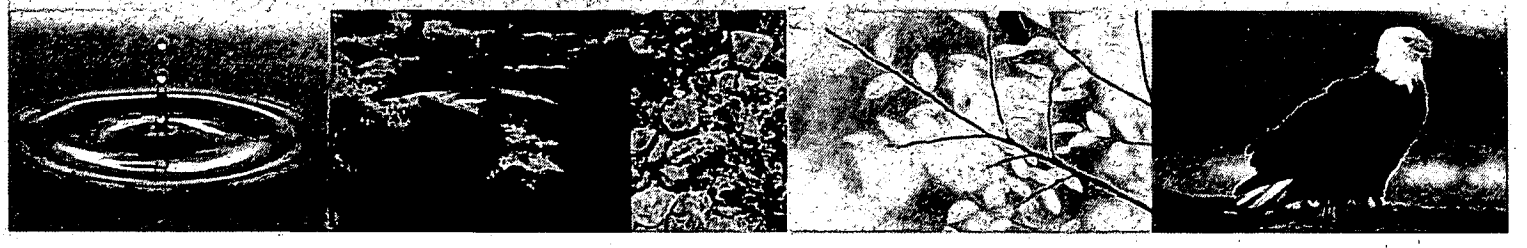

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Interim Measures Work Plan
for
SWMU 12 Battery Dump Site

Naval Surface Warfare Center Crane
Crane, Indiana

Contract Task Order F271

July 2009

NAVFAC
Naval Facilities Engineering Command
Midwest
201 Decatur Avenue
Building IA, Code EV
Great Lakes, Illinois 60088

TETRA TECH NUS, Inc.

INTERIM MEASURES WORK PLAN
FOR
SWMU 12 BATTERY DUMP SITE

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
Building 1A, Code EV
Great Lakes, Illinois 60088

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ACRONYMS

ASTM	American Society of Testing and Materials
bgs	below ground surface
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action Navy
CMS	Corrective Measures Study
COC	chemical of concern
CTO	Contract Task Order
cy	cubic yard
DNR	Department of Natural Resources
DRMO	Defense Reutilization Marketing Office
DRO	diesel range organics
EMAC	Environmental Multiple Award Contract
ESA	Endangered Species Act
GRO	gasoline range organics
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IDEM	Indiana Department of Environmental Management
IM	Interim Measure
IMWP	Interim Measures Work Plan
IR	Installation Restoration
LDPE	Low density polyethylene
MFA	Mine Fill A
mg/kg	milligram(s) per kilogram
MSDS	Material Safety Data Sheet
msl	mean sea level
NSWC	Naval Surface Warfare Center
OICC	Officer in Charge of Construction
PRG	preliminary remediation goal
PWD EV	Public Works Department Environmental
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation

SAP	Sampling and Analysis Plan
sf	square foot
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leachate Procedure
TPH	total petroleum hydrocarbon
Tt	Tetra Tech NUS, Inc.
UCLs	Upper confidence limits
µg/kg	micrograms/kilogram
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this document is to present the Interim Measures (IM) Work Plan (IMWP) for the portion of Solid Waste Management Unit (SWMU) 12 identified as the Battery Dump Site, at Naval Surface Warfare Center (NSWC) Crane located in Crane, Indiana. The IMWP provides requirements for the excavation and off-site disposal of inorganic-contaminated soil located south of the southern loop on Route H-17, South of Building 151. The IMWP was prepared for the United States Navy (Navy), Naval Facilities Engineering Command Midwest, by Tetra Tech NUS, Inc. (Tt) under Contract Task Order (CTO) F271 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) IV Contract Number N62472-03-D-0057.

This work is being performed under the Navy's Installation Restoration (IR) Program. The following are the five distinct phases of work conducted for IR sites:

- Phase 1 is the Preliminary Assessment [formerly known as the Initial Assessment Study (IAS)]
- Phase 2 is the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)
- Phase 3 is the RCRA Facility Investigation (RFI)/Corrective Measures Study (CMS)
- Phase 4 is the Corrective Measures Implementation
- Phase 5 is the Interim Remedial Action

This IMWP has been prepared under Phase 5 of the IR Program and defines activities associated with interim measures necessary to address the contaminated soil within the Battery Dump Site portion of SWMU 12.

1.2 FACILITY DESCRIPTION

NSWC Crane is located in the southern portion of Indiana, approximately 75 miles southwest of Indianapolis and 71 miles northwest of Louisville, Kentucky, immediately east of Crane Village and Burns City (Figure 1-1). NSWC Crane encompasses 62,463 acres (approximately 98 square miles), most of which are located in the northern portion of Martin County. Smaller portions of NSWC Crane are located in Greene, Daviess, and Lawrence Counties. NSWC Crane is located in a rural, sparsely populated area. Most of NSWC Crane is forested, and the surrounding area is wooded or farmed land. NSWC Crane provides material, technical, and logistical support to the Navy for equipment, shipboard weapons systems, and nonexpendable ordnance items. In addition, NSWC Crane supports the Crane Army

Ammunition Activity with production, renovation, storage, shipment, demilitarization, and disposal of conventional ammunition.

1.3 REGULATORY SUMMARY

1.3.1 NSWC Crane

Following promulgation of the RCRA hazardous waste regulatory program, NSWC Crane filed notification and application to operate as a RCRA hazardous waste treatment, storage, or disposal facility in October 1980. Interim status was granted subject to operating requirements and applicable technical standards found in Title 40 of the Code of Federal Regulations (CFR), Part 265.

Corrective action programs established as part of the 1984 RCRA Hazardous and Solid Waste Amendments (HSWA) required NSWC Crane to address past releases of hazardous waste or hazardous constituents at SWMUs. Accordingly, NSWC Crane completed a Hazardous Waste Management Report, and an RFI was conducted to characterize the potential for releases of hazardous waste or constituents from approximately 100 SWMUs identified during the RFA (Tt, 2008).

On December 23, 1989, the United States Environmental Protection Agency (USEPA) issued the federal portion of the final RCRA Part B Permit for NSWC Crane to the Navy. USEPA renewed the permit in 1995. The Indiana Department of Environmental Management (IDEM) now has responsibility for the Federal Corrective Action Permit. IDEM renewed the Corrective Action Permit on October 18, 2001. However, certain ongoing corrective actions, including corrective actions at SWMU 12, will continue under the USEPA/IDEM Work Sharing Agreement for Corrective Action Activities at NSWC Crane.

1.3.2 SWMU 12 Battery Dump Site

SWMU 12 consists of Mine Fill A (MFA) and the area surrounding MFA. SMWU 12 is located in the central portion of NSWC Crane as shown on Figure 1-1. SWMU 12 occupies approximately 200 acres, including the area located within the southern portion of the SWMU identified as the Battery Dump Site (Figure 1-2). The Battery Dump Site is the location of interest for this IMWP. MFA began operations when NSWC Crane was commissioned in December 1941. Core activities at MFA included the production of large mines, depth charges, rocket heads, aerial bombs, and projectiles. MFA continued to produce ordnance until 1975 when production was suspended. Production was resumed in 1980 for a short period of time. Most recently, MFA has been used for the production of 2,000-pound aerial bombs (Tt, 2008).

In the early 1990s, a battery disposal area was discovered at the southern end of MFA, approximately 140 feet outside of the perimeter fence (Figure 1-3). The battery disposal area consisted of two areas: (1) Battery Area – where batteries were dumped on the ground surface and (2) Soil Area – an area adjacent to the Battery Area where soil and construction debris were dumped forming small mounds. The Battery Area was composed of a large number of AA household type batteries with only the inner cores visible on the ground surface. The RFI presumed that these batteries contained metals such as lead, manganese, zinc, cadmium, and chromium. The Soil Area does not have any unusual characteristics, and the RFI presumed that these materials contained soil and debris generated from installation of road culverts at MFA (Tt, 2008).

1.4 REPORT ORGANIZATION

The following are the sections contained in the remainder of this document:

- Section 1.0 presents the introduction, purpose, and scope of this IMWP.
- Section 2.0 summarizes site characteristics including site description, environmental investigations, and nature and extent of contamination for the Battery Dump Site portion of SWMU 12.
- Section 3.0 presents the IMWP.
- Section 4.0 presents the erosion and sediment control plan.
- Section 5.0 presents the verification sampling and analysis plan.

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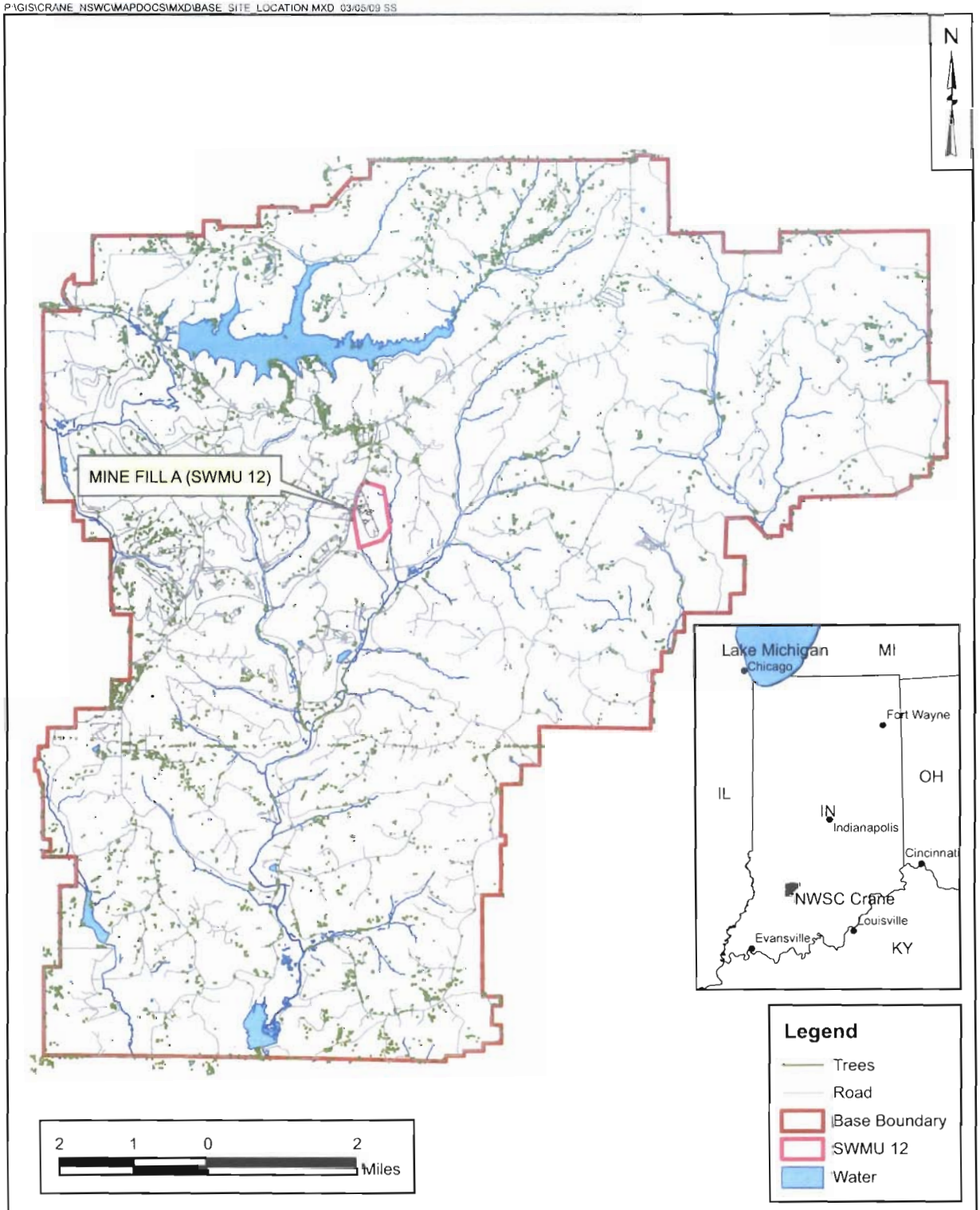

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CHECKED BY T. SMITH	DATE 0305/09	BASE AND SITE LOCATION MAP SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY — DATE —
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SCALE AS NOTED			FIGURE NO. FIGURE 1-1 / REV 0

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SITE LAYOUT - 2005 AERIAL PHOTOGRAPH
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

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2.0 SITE SUMMARY

2.1 SITE SUMMARY

This section describes the physical conditions of the area and surrounding areas addressed in the SWMU 12 Battery Dump Site IMWP. These descriptions are excerpts from the SWMU 12 RFI Report (Tt, 2008). For more details on the physical conditions of SWMU 12 and its surrounding areas, refer to the SWMU 12 RFI report.

2.1.1 Physiography and Topography

SWMU 12 (MFA) is located on a ridge that was flattened to some extent in the 1940s to prepare the area for development (roads, rail lines, buildings, and parking areas). The areas that lie between roads and buildings are mostly grass covered. As shown on Figure 1-2, Highway 45 and the facility's main railroad line run along the northern limits of MFA, Highway 17 circles the operations of MFA, and a railroad spur, running north to south, feeds into the MFA area.

Within MFA, most of the land area slopes to the southwest. Beyond the western and eastern sides of the MFA perimeter fence, the land slopes abruptly (15 to 20 percent slopes), and along the southern side of the MFA, the land slopes are less steep (6 to 12 percent). The Battery Dump Site portion of SWMU 12 is located outside the MFA perimeter fence on the SWMU 12 southern gradual slopes. Access to the Battery Dump Site from the MFA is through a perimeter fence gate.

2.1.2 Surface Water Hydrology

As indicated above, the topography at SWMU 12 consists of a ridge that runs north-northwest to south-southeast with steep slopes along the western and eastern sides of SWMU 12 and gentler slopes to the south. The predominant slope across the SWMU is to the southwest, and therefore the majority of the storm water runoff from SWMU 12 flows southwestward. However, due to the location of the Battery Dump Site within SWMU 12, storm water runoff from the Battery Dump Site flows south. Storm water runoff from SWMU 12 is collected in two unnamed tributaries. Each of these tributaries conveys flow southward to Turkey Creek, which lies approximately 3,600 feet south-southeast of SWMU 12. Although the tributary to the east of SWMU 12 (located 1,000 to 1,500 feet to the east of SWMU 12) is larger than the western tributary (located 200 to 800 feet to the west of SWMU 12), the western tributary collects the majority of the storm water runoff from SWMU 12 and all of the storm water runoff from the Battery Dump Site portion of SWMU 12. Within the limits of SWMU 12, the ground cover is grass between buildings,

roads, and parking facilities. Areas beyond the SWMU 12 perimeter fence are heavily wooded. The Battery Dump Site is located within a clearing with woods on all sides with the exception of the northern side, which provides access to the area.

2.1.3 Geology

A veneer of natural soil blankets the top of the side slopes of the MFA ridge. The soils are the result of Pennsylvanian-age rocks (mostly sandstone, shale, and siltstone) weathering in place. These residual soils are the most prevalent soils at NSWC Crane. The ridgetop containing SWMU 12 is blanketed with residual soils and reworked soils that range from 2.5 to 14.5 feet thick. The majority of the northern ridge is composed of Pennsylvanian bedrock, which consists of discontinuous layers of siltstones, sandstones, shales, and coal seams up to 140 feet thick near the center of the ridge.

2.1.4 Hydrogeology

Groundwater is present beneath NSWC Crane in both the natural unconsolidated materials and bedrock. The depth to groundwater ranges from less than 5 feet below ground surface (bgs) in low areas near surface water bodies to 25 feet bgs at higher elevations. While drilling through the overburden on top of the SWMU 12 ridge, saturated conditions were not observed in the overburden. Therefore, it was concluded that very little if any groundwater is stored in the overburden. In general, the ridgetop sandstone aquifer beneath the MFA is recharged by downward infiltration through the residual soil, and recharge occurs more readily where the soil is thin or disturbed.

Figure 2-1 presents the potentiometric contours for the uppermost sandstone unit measured in January 2005. Because there were no groundwater monitoring wells installed within the vicinity of the Battery Dump Site, the groundwater potentiometric contours are estimated in this area. Based on this estimation, groundwater occurs at approximately 15 feet bgs within the limits of the Battery Dump Site.

2.2 PREVIOUS INVESTIGATIONS

The followings environmental investigations have been conducted at SWMU 12:

- 1985 IAS
- 1992 Environmental Monitoring Reports

- 1997 through 2000 Bioremediation Interim Measure Activities for Buildings 151, 152, 153/154, 157, 158/159, and 160

- 2002 through 2004 Battery Dump Site Interim Measures

- 2004 through 2006 Post-Interim Measures Soil, Groundwater, Sediment, and Surface Water Sampling

The remainder of this sections summarizes the activities conducted within the Battery Dump Site portion of SWMU 12.

2.2.1 Pre-RFI Battery Dump Site Investigations

The Battery Dump Site was discovered in the early 1990s by the NSWC Crane Environmental Protection Department. At that time, the Battery Dump Site consisted of two areas, the Battery Area, where batteries were observed on the surface, and the Soil Area, where soil and construction debris had been dumped in small mounds. When the batteries were discovered, they were identified as household-type AA batteries. The origin and disposal date(s) of the batteries in this area are unknown. However, based on the deterioration of the batteries, it was estimated that the batteries must have been dumped on site in the mid-1980s. The soil and construction debris mounds are believed to have originated from the installation of road culverts within the MFA area (Tt, 2008).

2.2.1.1 Battery Dump Site Interim Measures

In October 2001 and June 2002, an interim measure action was conducted for the identification, removal, treatment, and/or disposal of contaminated soil from the SWMU 12 Battery Dump Site. The work was performed in conjunction with the requirements of the approved Final Interim Measures Work Plan for MFA Battery Dump Site. Prior to implementation of the interim measure action, pre-excavation soil samples were collected in February 2001. A report on the interim measure action was completed in December 2002 (Toltest, 2002).

As part of the IM a total of 11 pre-excavation samples were collected from the SWMU 12 Battery Dump Site, five samples from the Soil Area and six samples from the Battery Area (Toltest, 2002). Analysis of these samples indicated that contamination was present in both areas at concentrations greater than

IDEM Default Closure Levels for industrial receptors (IDEM, 2006). Explosives contamination was present in the Soil Area, and metals contamination was present in the Battery Area.

The IM removal action in the Soil Area included excavating 18 tons of explosives-contaminated soil, treating it in compost windrow N-214 at the NSWC Crane Bioremediation Facility to less than IDEM Default Closure Levels for residential receptors, and subsequent backfilling of the treated soil at Mine Fill B. Post-excavation sampling and analysis of the Soil Area indicate that remaining contamination concentrations were less than IDEM Default Closure Levels for industrial receptors. Based on the post-excavation analytical results, no further action was recommended for the Soil Area.

IM removal activities at the Battery Area included excavating 299 tons of metals-contaminated soil and disposing of it at the Waste Management Outer Loop Landfill in Louisville, Kentucky. Post-excavation sampling and analysis indicated that arsenic concentrations remaining at 15 sampling locations in the excavation area were greater than IDEM Default Closure Levels for industrial receptors. However, with the exception of one sample (CFS-013 at 16.7 milligrams per kilogram (mg/kg)), arsenic concentrations in these samples were less than the maximum detection of 10.2 mg/kg in the Basewide Background Soil Investigation Report (Tt, 2001). The average concentration of the 19 Battery Area post-excavation samples (5.6 mg/kg) is less than the average of all arsenic results and the average of all detected concentrations (6.1 mg/kg) from the Basewide Background Soil Investigation Report.

Post-excavation sampling at 19 locations in the Battery Area indicated that the level of cadmium in one sample (CFS-021) was greater than IDEM Default Closure Level for residential receptors but less than the IDEM Default Closure Level for industrial receptors and that concentrations of lead were greater than the IDEM Default Closure Level for industrial receptors. Analysis of these two metals performed on a leached extract indicated that cadmium did not exceed the toxic characteristic leaching procedure (TCLP) regulatory limit while lead did exceed the TCLP regulatory limit. Post-interim measure recommendations included further investigation of the lead contamination at the SWMU 12 Battery Area, including expansion of the investigation area and additional sampling.

In 2002, a follow-up interim measure action was performed at the Soil Area. The action was performed pursuant to the requirements of the approved Final Interim Measures Work Plan for the MFA Battery Dump Site (Toltest, 2002). Three pre-excavation samples (PES-013, PES-014, and PES-015) were collected on May 24, 2002. One sample (PES-013) was collected from the same location (base of the slope of the soil area) where 2002 confirmation sample CFS-021 was collected. The CFS-021 lead concentration was 58.8 mg/kg, which exceeded the regulatory limit for toxicity. All three pre-excavation samples analytical results indicated arsenic concentrations greater than the USEPA Region 9 industrial

Soil Screening Level (SSL). Cadmium concentrations were greater than the USEPA Region 9 PRG for residential SSL but less than industrial SSL. All three pre-excavation samples analytical results indicated lead concentrations greater than the USEPA Region 9 PRG for industrial SSL and at a concentration that could potentially exhibit toxic characteristics.

In September 2002, excavation began with the removal of small trees and boulders within the Soil Area (Toltest, 2002). Overburden soil and rock were removed from above the seam of contamination and placed to the side, which was followed by excavation of the vein of contamination. Excavation of the vein was started at the northern end of the slope and extended to the south. Excavation continued until about 20 tons of contaminated soil had been loaded into the dump trailer. The contaminated soil was then taken the Environmental Quality Company for disposal. The vein of contaminated soil was still visible in a trench on the southern end of the slope. The aerial extent of this contamination was not determined.

Four post-excavation soil samples were collected from of 0 to 2 feet bgs depth interval and analyzed for metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), herbicides, and explosive compounds. One sample was obtained from the vein of contamination in the trench that was dug at the southern end of the area of excavation. The analytical results (Tt, 2004) indicated that the southern most soil sample (12SS210002) had the highest concentrations of most energetic and inorganic contaminants. Soil sample 12SS210002 was the only sample of the four that had detectable concentrations of the energetics [RDX (6.1 mg/kg), HMX (1.7 mg/kg), and 1,3,5-trinitrobenzene (0.84 mg/kg)]. The 12SS210002 lead concentration was 429,000 mg/kg. The lead concentration for the other three soil samples ranged from 366 to 3,230 mg/kg. The antimony concentration was notably higher (3,610 mg/kg) at sample 12SS210002 in comparison to the other three samples which ranged from 11.4 to 213 mg/kg. The 12SS210002 mercury concentration (0.31 mg/kg) was higher in comparison to the other three locations, which had concentrations ranging from 0.034 to 0.069 mg/kg. The 12SS210002 tin concentration was 838 mg/kg, while concentrations at the other three locations ranged from 12.4 to 90.7 mg/kg.

Post-excavation sampling confirmed that contaminated soil is still present at the site. Results indicated that concentrations of antimony and lead at two sample locations (12SB21 and 12SB23) exceeded industrial clean-up goals. The level of arsenic in all four samples exceeded the industrial clean-up goal. Toltest recommended the excavation of additional exploration trenches to determine the horizontal extent of contamination.

2.2.2 Battery Dump Site RFI Sampling

RFI sampling was conducted at the SWMU 12 Battery Dump Site in three phases to delineate the horizontal and vertical extent of contamination remaining within the Battery Dump Site area following the 2001 and 2002 interim measure excavations. RFI sampling activities and sampling results are discussed below and tag maps for detected parameters with concentrations that exceeded screening levels are presented in Appendix A.

2.2.2.1 2004 RFI Sampling Event

The August and September 2004 RFI field event included the collection of 23 soil samples from eleven SWMU 12 Battery Dump Site locations. These samples were analyzed for explosives, metals (including mercury), SVOCs, and VOCs. A summary of the sampling is provided in Table 2-1, and the location of each 2004 RFI sample is identified on Figure 2-2. Analytical results from the 2004 RFI field investigation indicated that inorganic contamination was present beyond the limits sampled (horizontally and vertically). The analytical results from the 2004 RFI sampling event are presented in Table A-1 of Appendix A.

2.2.2.2 2005 RFI Sampling Event

The October and November 2005 RFI field event included the collection of 36 soil samples from 17 locations at the SWMU 12 Battery Dump Site. These samples were analyzed for metals (excluding mercury). A summary of the RFI sampling is provided in Table 2-1, and the location of each 2005 RFI sample is identified on Figure 2-3. The 2005 RFI field investigation analytical results indicated that inorganic contamination was present beyond the limits sampled (horizontally). The 2005 RFI field investigation analytical results are presented in Table A-2 of Appendix A.

2.2.2.3 2006 RFI Sampling Event

The October 2006 RFI field event included the collection of 19 soil samples from 11 locations at the SWMU 12 Battery Dump Site. These samples were analyzed for metals (excluding mercury). A summary of the sampling is provided in Table 2-1, and the location of each 2006 RFI sample is identified on Figure 2-4. The analytical results from the 2006 RFI field investigation are presented in Table A-3 of Appendix A.

Analytical results from the 2004, 2005, and 2006 RFI field events adequately delineated the horizontal and vertical extent of contamination at the SWMU 12 Battery Dump Site.

2.3 EXTENT OF CONTAMINATION

Using the analytical data obtained during the SWMU 12 Battery Dump Site RFI, Tt developed human health and ecological risk assessments presented in the RFI Report (Tt, 2008). The preliminary results of these risk assessments were used to develop a list of chemicals of concern (COCs) detected at concentrations that present unacceptable risks to human and ecological receptors. The COC detections were used to establish the locations that require excavation to reduce the site-associated risks to acceptable levels for these COCs. Figures provided in Appendix A present the locations of the COC detections and the concentrations of the COCs.

2.3.1 Human Health

The results of the RFI human health risk assessment (HHRA) identified four COCs as causing unacceptable human health risks under a potential future residential scenario. This scenario was evaluated to determine the ability to close the Battery Dump Site portion of SWMU 12. The COCs include antimony, arsenic, iron, and lead in surface soil (0 to 2 feet bgs) and subsurface soil (deeper than 2 feet bgs) (Tt, 2008). A summary of COC detections and residential cleanup goals are presented in Table 2-2.

Using average and 95 percent upper confidence limits (UCLs) cancer risk levels and non-cancer risk hazard indices (HI) were calculated and compared to the acceptable cancer risk level ($1x10^{-4}$) and acceptable non-cancer risk HI (1), respectively. Using this approach, sample locations with high concentrations of COCs were systematically removed (simulating location specific excavation) to determine the extent of excavation needed to reduce the human health risks associated with the SWMU 12 Battery Dump Site to acceptable levels. To meet residential criteria at the SWMU 12 Battery Dump Site, these calculations identified eight surface soil (0 to 2 feet bgs) sample locations (12SB21, 12SB22, 12SB23, 12SB25, 12SB26, 12SB28, 12SB30, and 12SB35 and one subsurface soil (4 to 6 feet bgs) sample location 12SB33 to be excavated (see Figure 2-5). Because sample locations 12SB24 and 12SB32 are located near surface soil sample locations being excavated to achieve acceptable human health risk, the IM will also include removal and disposal of surface soil at these sample locations. Additionally, during the excavation of subsurface soil at 12SB33, the 12SB21 surface soil will also be removed and disposed.

2.3.2 Ecological

In addition to human health risks, the RFI identified ecological risks. The preliminary ecological risk assessment identified nine COCs (antimony, arsenic, copper, chromium, lead, mercury, silver, tin, and zinc) (Tt, 2008). The positive detections of the ecological COCs are presented in Table 2-2. The human

health surface soil excavation area was reviewed to determine whether acceptable ecological risk be achieved with this soil removal. This review identified three additional locations that must be excavated to achieve acceptable ecological risks. These additional surface soil locations, identified in Figure 2-6, include 12SB34, 12SB36, and 12SB39.

2.3.3 Extent of Unacceptable Risk

A review of the results of the preliminary human health and ecological risk assessments indicates that remedial action is required for the SWMU 12 Battery Dump Site surface and subsurface soil to achieve acceptable risk levels and to achieve no further action at the SWMU 12 Battery Dump Site. Figure 2-7 presents the limits of excavation required to achieve acceptable human health risks. Table 2-3 presents the concentrations of the COCs remaining onsite following removal of the soil identified in Figure 2-7. To comply with USEPA guidance on the determination of human health risks, the COC concentrations remaining after excavation were calculated for antimony, lead, arsenic, and iron independently. To determine an acceptable risk for antimony the maximum remaining onsite antimony concentration following excavation and backfill is compared to the cleanup goals for antimony. To determine an acceptable risk for lead, the average of the remaining concentrations following excavation and backfill is compared to the cleanup goals for lead. Lastly, to determine acceptable risk for arsenic and iron, the 95 percent UCL of their concentrations that remain after excavation and backfill is calculated and compared to the cleanup goals for arsenic and iron.

Based on the post-excavation concentrations presented in Table 2-3, the remaining concentrations of:

- Lead and antimony meet all residential cleanup goals,
- Arsenic exceed the calculated human health risk cleanup level
- Arsenic exceed the IDEM default migration to groundwater level
- Arsenic is below the background value,
- Iron meet the residential human health risk cleanup level

Because the arsenic post-excavation concentration is below background, further excavation of arsenic to below the calculated human health risk cleanup and migration to groundwater levels is not required. Therefore, the post-excavation surface and subsurface soil concentrations, as presented in Figure 2-7 are adequate to achieve acceptable human health risks at SWMU 12 Battery Dump Site.

A similar approach was used to determine if remaining contaminant concentrations after excavation cause unacceptable ecological risks. Figure 2-8 presents the excavation limits associated with achieving

acceptable ecological risk levels that are outside the excavation limits associated with achieving acceptable human health risk. Table 2-4 presents the statistical data following the removal of the indicated locations in Figure 2-8. In order to determine whether the proposed soil excavation limits will reduce concentrations to levels that are protective of ecological receptors, screening criteria for plants, soil invertebrates, avian wildlife, and mammal wildlife were used for the COCs (antimony, arsenic, chromium, copper, lead, mercury, silver, tin, and zinc). These screening criteria are compared to the average post-excavation contaminant concentrations for each COC. In general, although concentrations of some COCs still remain above the screening criteria under post-excavation conditions, the average post-excavation concentrations over the relatively small area meet or only slightly exceed the screening criteria.

TABLE 2-1

SUMMARY OF RFI SAMPLING
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Location	Sample Number	Date Sampled	Depth Interval (ft bgs)	Analysis				
				VOCs	SVOCs	Exp.	Metals	Mercury
2004 RFI Sampling								
12SB12	12SS120002	8/13/2004	0 - 2	X	X	X	X	X
	12SB120204	8/13/2004	2 - 4	X	X	X	X	X
12SB13	12SS130002	8/13/2004	0 - 2	X	X	X	X	X
	12SB130204	8/13/2004	2 - 4	X	X	X	X	X
	12SB130607	8/13/2004	6 - 7	X	X	X	X	X
12SB14	12SS140002	8/13/2004	0 - 2	X	X	X	X	X
	12SB140204	8/13/2004	2 - 4	X	X	X	X	X
	12SB140607	8/13/2004	6 - 7	X	X	X	X	X
12SB15	12SS150002	8/13/2004	0 - 2	X	X	X	X	X
	12SB150204	8/13/2004	2 - 4	X	X	X	X	X
	12SB150607	8/13/2004	6 - 7	X	X	X	X	X
12SB18	12SS180002	8/15/2004	0 - 2	X	X	X	X	X
	12SB180204	8/15/2004	2 - 4	X	X	X	X	X
	12SB180608	8/15/2004	6 - 8	X	X	X	X	X
12SB19	12SS190002	8/15/2004	0 - 2	X	X	X	X	X
	12SB190204	8/15/2004	2 - 4	X	X	X	X	X
12SB20	12SS200002	8/15/2004	0 - 2	X	X	X	X	X
	12SB200204	8/15/2004	2 - 4	X	X	X	X	X
	12SB200608	8/15/2004	6 - 8	X	X	X	X	X
12SB21	12SS210002	9/21/2004	0 - 2	X	X	X	X	X
12SB22	12SS220002	9/21/2004	0 - 2	X	X	X	X	X
12SB23	12SS230002	9/21/2004	0 - 2	X	X	X	X	X
12SB24	12SS240002	9/21/2004	0 - 2	X	X	X	X	X
2005 RFI Sampling								
12SB22	12SB220204	11/1/2005	2 - 4				X	
12SB24	12SB240204	11/1/2005	2 - 4				X	
12SB25	12SS250001	10/31/2005	0 - 1				X	
	12SB250204	11/1/2005	2 - 4				X	
	12SB250405	11/1/2005	4 - 5				X	
12SB26	12SS260001	10/31/2005	0 - 1				X	
	12SB260204	11/1/2005	2 - 4				X	
12SB27	12SS270001	10/31/2005	0 - 1				X	
	12SB270103	11/1/2005	1 - 3				X	
12SB28	12SS280001	10/31/2005	0 - 1				X	
	12SB280204	11/1/2005	2 - 4				X	
	12SB280405	11/1/2005	4 - 5				X	
12SB29	12SS290001	10/31/2005	0 - 1				X	
	12SB290204	11/1/2005	2 - 4				X	
	12SB290405	11/1/2005	4 - 5				X	
12SB30	12SS300001	10/31/2005	0 - 1				X	
	12SB300204	11/1/2005	2 - 4				X	
	12SB300405	11/1/2005	4 - 5				X	
12SB31	12SS310001	10/31/2005	0 - 1				X	
	12SB310204	11/1/2005	2 - 4				X	
12SB32	12SS320001	10/31/2005	0 - 1				X	
	12SB320103	11/1/2005	1 - 3				X	

TABLE 2-1

SUMMARY OF RFI SAMPLING
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Location	Sample Number	Date Sampled	Depth Interval (ft bgs)	Analysis				
				VOCs	SVOCs	Exp.	Metals	Mercury
2005 RFI Sampling Continued								
12SB33	12SS330001	10/31/2005	0 - 1				X	
	12SB330204	11/1/2005	2 - 4				X	
	12SB330406	11/1/2005	4 - 6				X	
12SB34	12SS340001	10/31/2005	0 - 1				X	
	12SB340204	11/1/2005	2 - 4				X	
12SB35	12SS350001	10/31/2005	0 - 1				X	
	12SB350204	11/1/2005	2 - 4				X	
12SB36	12SS360001	10/31/2005	0 - 1				X	
	12SB360103	11/1/2005	1 - 3				X	
12SB37	12SS370001	10/31/2005	0 - 1				X	
	12SB370204	11/1/2005	2 - 4				X	
12SB38	12SS380001	10/31/2005	0 - 1				X	
12SB39	12SS390001	10/31/2005	0 - 1				X	
	12SB390103	11/1/2005	1 - 3				X	
2006 RFI Sampling								
12SB72	12SS720002	10/10/2006	0 - 2				X	
12SB74	12SS740002	10/10/2006	0 - 2				X	
12SB76	12SS760002	10/10/2006	0 - 2				X	
	12SB760204	10/18/2006	2 - 4				X	
	12SB760406	10/18/2006	4 - 6				X	
	12SB760608	10/18/2006	6 - 8				X	
12SB77	12SS770002	10/10/2006	0 - 2				X	
	12SB770204	10/17/2006	2 - 4				X	
12SB78	12SS780002	10/10/2006	0 - 2				X	
	12SB780204	10/17/2006	2 - 4				X	
12SB79	12SS790002	10/10/2006	0 - 2				X	
	12SB790204	10/18/2006	2 - 4				X	
12SB80	12SS800002	10/10/2006	0 - 2				X	
	12SB800204	10/18/2006	2 - 4				X	
12SB81	12SS810002	10/10/2006	0 - 2				X	
12SB82	12SS820002	10/10/2006	0 - 2				X	
	12SB820204	10/17/2006	2 - 4				X	
12SB84	12SS840002	10/10/2006	0 - 2				X	
12SB85	12SS850002	10/10/2006	0 - 2				X	

Exp. - Explosives
ft bgs - Feet below ground surface
SVOCs - semivolatile organic compounds
SWMU - Solid Waste Management Unit
VOCs - volatile organic compounds
X - Indicates Parameters were analyzed for this sample.

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SS120002 12SB12 20040813 0 - 2 feet	12SB120204 12SB12 20040813 2 - 4 feet	12SS130002 12SB13 20040813 0 - 2 feet	12SB130204 12SB13 20040813 2 - 4 feet	12SB130607 12SB13 20040813 6 - 7 feet	12SS140002 12SB14 20040813 0 - 2 feet
Chemicals of Concern (mg/kg)								
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.20 U	0.10 U	0.26 U	0.19 U	0.31 J	0.12 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	2.8 J	0.95 J	4.1 J	1.9 J	2.8 J	2.6 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	22.4 J	18.6 J	40.3 J	33.4 J	38.0 J	36.1 J
COPPER [4]	NA	70 / 80 / 28 / 49	8.7 J	7.8 J	22.9 J	15.3 J	23.9 J	9.8 J
IRON [3]	55,000 / NC / 40,800	NA	7160 J	26600 J	65900 J	93300 J	60000 J	16700 J
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	10.6 J	20.4 J	30.7 J	25.4 J	19.7 J	8.3 J
MERCURY [4]	NA	NC / NC / NC / NC	0.007 U	0.007 U	0.02 J	0.007 U	0.068 J	0.007 U
SILVER [4]	NA	560 / NC / 4.2 / 14	0.042 U	0.043 U	0.042 U	0.044 U	0.26 U	0.045 U
TIN [4]	NA	NC / NC / NC / NC	0.77 U	0.26 U	2.3 U	0.42 U	0.52 U	0.46 U
ZINC [4]	NA	160 / 120 / 46 / 79	102 J	59.7 J	206 J	128 J	53.5 J	41.2 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB140204 12SB14 20040813 2 - 4 feet	12SB140607 12SB14 20040813 6 - 7 feet	12SS150002 12SB15 20040813 0 - 2 feet	12SB150204 12SB15 20040813 2 - 4 feet	12SB150607 12SB15 20040813 6 - 7	12SS180002 12SB18 20040815 0 - 2	12SB180204 12SB18 20040815 2 - 4
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.30 J	0.18 U	0.38 J	0.22 U	0.12 U	0.95 U	0.88 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	3.0 J	2.2 J	4.4 J	2.7 J	1.8 J	7.1 J	5.1 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	29.8 J	35.7 J	30.3 J	34.1 J	38.8 J	20.0 J	27.3 J
COPPER [4]	NA	70 / 80 / 28 / 49	7.3 J	5.4 J	9.9 J	8.1 J	22.5 J	10.6 J	7.4 J
IRON [3]	55,000 / NC / 40,800	NA	32000 J	6580 J	15900 J	81400 J	43500 J	16800 J	28700 J
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	14.0 J	14.2 J	8.2 J	17.4 J	19.4 J	15.6 J	14.3 J
MERCURY [4]	NA	NC / NC / NC / NC	0.007 U	0.007 U	0.009 J	0.008 J	0.014 J	0.014 J	0.007 UR
SILVER [4]	NA	560 / NC / 4.2 / 14	0.046 U	0.06 U	0.08 U	0.041 U	0.044 U	0.08 U	0.04 U
TIN [4]	NA	NC / NC / NC / NC	0.26 U	0.33 U	0.52 U	0.30 U	0.37 U	0.49 U	0.37 U
ZINC [4]	NA	160 / 120 / 46 / 79	54.8 J	36.1 J	31.0 J	61.0 J	63.3 J	52.1 J	17.9 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB180608 12SB18 20040815 6 - 8	12SS190002 12SB19 20040815 0 - 2	12SB190204 12SB19 20040815 2 - 4	12SS200002 12SB20 20040815 0 - 2	12SB200204 12SB20 20040815 2 - 4	12SB200608 12SB20 20040815 6 - 8
Chemicals of Concern (mg/kg)								
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.43 U	0.51 U	1.2 U	0.35 U	0.24 U	0.35 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	2.0 J	9.2 J	6.4 J	5.7 J	3.9 J	3.1 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	30.5 J	22.5 J	20.5 J	19.6 J	23.5 J	30.2 J
COPPER [4]	NA	70 / 80 / 28 / 49	18.7 J	15.8 J	10.6 J	9.1 J	8.2 J	10.8 J
IRON [3]	55,000 / NC / 40,800	NA	34000 J	23200 J	19400 J	16500 J	21300 J	46400 J
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	19.1 J	15.6 J	10.8 J	14.1 J	13.1 J	15.8 J
MERCURY [4]	NA	NC / NC / NC / NC	0.008 J	0.034 J	1.0 J	0.032 J	0.008 J	0.011 J
SILVER [4]	NA	560 / NC / 4.2 / 14	0.042 U	0.042 U	0.18 U	0.043 U	0.04 U	0.041 U
TIN [4]	NA	NC / NC / NC / NC	0.44 U	0.56 U	0.52 U	0.46 U	0.37 U	0.37 U
ZINC [4]	NA	160 / 120 / 46 / 79	61.6 J	63.9 J	30.9 J	35.5 J	17.8 J	46.4 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SS210002 (1) 12SB21 20040921 0 - 2	12SS220002 (1) 12SB22 20040921 0 - 2	12SB220204 12SB22 20051101 2 - 4	12SS230002 (1) 12SB23 20040921 0 - 2	12SS240002 (1) 12SB24 20040921 0 - 2	12SB240204 12SB24 20051101 2 - 4	12SS250001 (1) 12SB25 20051031 0 - 1
Chemicals of Concern (mg/kg)									
ANTIMONY (3,4)	31 / 140 /11.3	NC / 78 / NC / 0.27	3610 J	11.4 J	0.73 U	34.1 J	213 J	0.30 U	3.8 J
ARSENIC (3,4)	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	94.2 J	5.4 J	45.2 J	7.6 J	158 J	2 J	7.7 J
CHROMIUM (4)	NA	NC / NC / 26 / 34	48.5 J	50.2 J	49.5 J	18.3 J	51.7 J	25.4 J	122 J
COPPER (4)	NA	70 / 80 / 28 / 49	345 J	292 J	18.2 J	26.2 J	27.9 J	6.9 J	903 J
IRON (3)	55,000 / NC / 40,800	NA	29500 J	32200 J	67600 J	18700 J	51200 J	30200 J	61100 J
LEAD (3,4)	400 / 81 / 21.5	120 / 1,700 / 11 / 56	429000 J	506 J	23.5 J	3230 J	366 J	11.3 J	627 J
MERCURY (4)	NA	NC / NC / NC / NC	0.31	0.069 J	---	0.042 J	0.034 J	---	---
SILVER (4)	NA	560 / NC / 4.2 / 14	18.5 J	0.72 U	0.043 U	0.24 U	0.08 U	0.041 U	0.9
TIN (4)	NA	NC / NC / NC / NC	838 J	90.7 J	---	12.4 J	45.2 J	---	---
ZINC (4)	NA	160 / 120 / 46 / 79	2050 J	2490 J	96.8 J	156 J	206 J	58.8 U	5110 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB250204 12SB25 20051101 2 - 4	12SB250405 12SB25 20051101 4 - 5	12SS260001 [1] 12SB26 20051031 0 - 1	12SB260204 12SB26 20051101 2 - 4	12SS270001 12SB27 20051031 0 - 1	12SB270103 12SB27 20051101 1 - 3	12SS280001 [1] 12SB28 20051031 0 - 1
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.38 U	0.17 U	4.4 J	0.16 U	0.77 U	0.24 U	20.1 J
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	9 J	2.5 J	12.3 J	1.1 J	4.5 J	2.9 J	4 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	31.5 J	24.7 J	78.7 J	20 J	24.1 J	26.7 J	59.7 J
COPPER [4]	NA	70 / 80 / 28 / 49	14.5 J	11.7 J	1460 J	11.6 J	115 J	13.3 J	65.2 J
IRON [3]	55,000 / NC / 40,800	NA	39100 J	25400 J	59000 J	35000 J	23100 J	24000 J	26100 J
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	15 J	14.6 J	989 J	10.6 J	132 J	10.5 J	1410 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.045 U	0.042 U	1.8	0.044 U	0.14 J	0.044 U	0.24 J
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	35.5 J	34.4 J	23100 J	40.9 J	296 J	16.2 J	2780 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB280204 12SB28 20051101 2 - 4	12SB280405 12SB28 20051101 4 - 5	12SS290001 12SB29 20051031 0 - 1	12SB290204 12SB29 20051101 2 - 4	12SB290405 12SB29 20051101 4 - 5	12SS300001 [1] 12SB30 20051031 0 - 1	12SB300204 12SB30 20051101 2 - 4
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.38 U	0.11 U	0.41 U	0.45 U	0.13 U	11 J	0.38 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	9.4 J	1.2 J	5.1 J	17 J	0.71 J	11.3 J	5.4 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	32.1 J	25.6 J	18.5 J	31 J	22 J	50.2 J	33.3 J
COPPER [4]	NA	70 / 80 / 28 / 49	10.9 J	11.6 J	10.7 J	30.4 J	3.9 J	138 J	8.8 J
IRON [3]	55,000 / NC / 40,800	NA	125000 J	36400 J	13600 J	54300 J	15600 J	45800 J	27100 J
LEAD [3,4]	*400 / 81 / 21.5*	*120 / 1,700 / 11 / 56*	18.2 J	18.9 J	13.9 J	18 J	9.5 J	439 J	10 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.047 U	0.045 U	0.045 U	0.044 U	0.048 U	0.22 J	0.044 U
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	93.4 J	58.7 U	41.5 J	85.3 J	27.3 J	1590 J	12.2 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB300405 12SB30 20051101 4 - 5	12SS310001 12SB31 20051031 0 - 1	12SB310204 12SB31 20051101 2 - 4	12SS320001 (1) 12SB32 20051031 0 - 1	12SB320103 12SB32 20051101 1 - 3	12SS330001 (1) 12SB33 20051031 0 - 1	12SB330204 (1) 12SB33 20051101 2 - 4
Chemicals of Concern (mg/kg)									
ANTIMONY (3,4)	31 / 140 /11.3	NC / 78 / NC / 0.27	0.18 U	6.6 J	0.21 U	0.50 U	0.26 U	1.9 J	0.57 U
ARSENIC (3,4)	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	3 J	1.7 J	2.3 J	5.3 J	2.4 J	8.9 J	12.8 J
CHROMIUM (4)	NA	NC / NC / 26 / 34	33.4 J	27.9 J	33 J	24.8 J	21.7 J	28.7 J	20.3 J
COPPER (4)	NA	70 / 80 / 28 / 49	19 J	25.6 J	12.9 J	34.9 J	4.3 J	46.7 J	15.3 J
IRON (3)	55,000 / NC / 40,800	NA	45900 J	13600 J	90200 J	19000 J	11800 J	25800 J	30300 J
LEAD (3,4)	400 / 81 / 21.5	120 / 1,700 / 11 / 56	13.3 J	54.6 J	15 J	34.4 J	9.4 J	155 J	26.3 J
MERCURY (4)	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER (4)	NA	560 / NC / 4.2 / 14	0.046 U	0.044 U	0.044 U	0.10 J	0.044 U	0.08 J	0.04 U
TIN (4)	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC (4)	NA	160 / 120 / 46 / 79	22.3 J	498 J	131 J	155 J	8.7 J	303 J	255 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB330406 [1] 12SB33 20051101 4 - 6	12SS340001 [2] 12SB34 20051031 0 - 1	12SB340204 12SB34 20051101 2 - 4	12SS350001 [1] 12SB35 20051031 0 - 1	12SB350204 12SB35 20051101 2 - 4	12SS360001 [2] 12SB36 20051031 0 - 1	12SB360103 [2] 12SB36 20051101 1 - 3
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	8.1 J	1.4 J	0.27 U	4.2 J	0.42 U	1.2 U	0.22 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	7.6 J	15.1 J	2.3 J	11.2 J	7.4 J	4 J	3.3 J
CHROMIUM [4]	NA	NC / NC / 26 / 34	116 J	36.9 J	25.9 J	77 J	39.6 J	34.1 J	34.2 J
COPPER [4]	NA	70 / 80 / 28 / 49	1100 J	60 J	7.7 J	402 J	9.2 J	101 J	17.3 J
IRON [3]	55,000 / NC / 40,800	NA	33300 J	32000 J	44900 J	38400 J	39200 J	30900 J	66700 J
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	1440 J	142 J	13.6 J	690 J	10.9 J	210 J	22.7 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	1.3	0.12 J	0.05 J	1.2	0.045 U	0.15 J	0.041 U
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	2340 J	1080 J	40.6 J	1370 J	13.3 J	738 J	124 J

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SS370001 12SB37 20051031 0 - 1	12SB370204 12SB37 20051101 2 - 4	12SS380001 12SB38 20051031 0 - 1	12SS390001 [2] 12SB39 20051031 0 - 1	12SB390103 [2] 12SB39 20051101 1 - 3	12SS720002 12SB72 20061010 0 - 2	12SS740002 12SB74 20061010 0 - 2
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	1.1 U	0.27 U	1.9 J	1.5 J	0.15 U	2.2	1.5
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	2.4 J	9.4 J	6.6 J	5.1 J	2.5 J	12.2	10.3
CHROMIUM [4]	NA	NC / NC / 26 / 34	23.6 J	34.9 J	24.2 J	34.2 J	30.7 J	49.6	32.2
COPPER [4]	NA	70 / 80 / 28 / 49	59.2 J	8.8 J	45.6 J	174 J	14.9 J	46.3	34
IRON [3]	55,000 / NC / 40,800	NA	15200 J	57600 J	20800 J	23400 J	28100 J	39100	27100
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	84.6 J	12 J	134 J	295 J	24.3 J	143 J	82.7 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.06 J	0.044 U	0.08 J	0.45 J	0.041 U	0.186	0.219
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	441 J	58.8 J	306 J	1930 J	41.2 J	204	222

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SS760002 12SB76 20061010 0 - 2	12SB760204 12SB76 20061018 2 - 4	12SB760406 12SB76 20061018 4 - 6	12SB760608 12SB76 20061018 6 - 8	12SS770002 12SB77 20061010 0 - 2	12SB770204 12SB77 20061017 2 - 4	12SS780002 12SB78 20061010 0 - 2
Chemicals of Concern (mg/kg)									
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.67 U	0.28 U	0.049 U	0.19 U	0.73 U	1.7	0.15 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	2.47	1.59	0.973	3.23	2.12	17.4	1.76
CHROMIUM [4]	NA	NC / NC / 26 / 34	26.1	30.1 J	24.1 J	26.7 J	33.4	26.6 J	33.6
COPPER [4]	NA	70 / 80 / 28 / 49	28	16	8.23	11.6	16	14.5	16.9
IRON [3]	55,000 / NC / 40,800	NA	20100	58400	11800	72600	25900	15300	28600
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	105 J	13.5 J	8.01 J	25.6 J	71.6 J	17.7 J	20.5 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.25	0.0577 J	0.0426 J	0.0691 J	0.086	0.0564 J	0.0515
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	237	170	30.8	120	38.1	51.7	45.2

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SB780204 12SB78 20061017 2 - 4	12SS790002 12SB79 20061010 0 - 2	12SB790204 12SB79 20061018 2 - 4	12SS800002 12SB80 20061010 0 - 2	12SB800204 12SB80 20061018 2 - 4	12SS810002 12SB81 20061010 0 - 2
Chemicals of Concern (mg/kg)								
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.055 U	1.9	0.049 U	0.14 U	0.18 U	8.7
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	1.03	4.17	1.27	2.55	4.31	13.6
CHROMIUM [4]	NA	NC / NC / 26 / 34	28.8 J	37.4	33.0 J	27.4	29.1 J	69.5
COPPER [4]	NA	70 / 80 / 28 / 49	12.9	86.4	16.2	20.1	15.9	56.7
IRON [3]	55,000 / NC / 40,800	NA	15900	39400	44300	23900	40800	57500
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	9.03 J	75.4 J	17.7 J	12.6 J	46.3 J	165 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.0474 J	0.603	0.0606 J	0.0715	0.105 J	0.269
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	48.3	364	120	133	121	288

TABLE 2-2

SUMMARY OF DETECTED CONCENTRATIONS FOR CHEMICALS OF CONCERN
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Sample Number Sample Location Sample Date Depth Interval (ft bgs)	Human Health Cleanup Goals	Ecological Screening Criteria	12SS820002 12SB82 20061010 0 - 2	12SB820204 12SB82 20061017 2 - 4	12SS840002 12SB84 20061010 0 - 2	12SS850002 12SB85 20061010 0 - 2
Chemicals of Concern (mg/kg)						
ANTIMONY [3,4]	31 / 140 /11.3	NC / 78 / NC / 0.27	0.59 U	0.12 U	0.058 U	0.11 U
ARSENIC [3,4]	0.39 / 3.9 / 10.2	18 / NC / 43 / 46	3.23	1.91	1.33	1.23
CHROMIUM [4]	NA	NC / NC / 26 / 34	38.3	27.5 J	30.9	33
COPPER [4]	NA	70 / 80 / 28 / 49	57.7	9.19	16.1	16.7
IRON [3]	55,000 / NC / 40,800	NA	19800	34900	37900	22100
LEAD [3,4]	400 / 81 / 21.5	120 / 1,700 / 11 / 56	44.4 J	15.2 J	14.2 J	19.6 J
MERCURY [4]	NA	NC / NC / NC / NC	---	---	---	---
SILVER [4]	NA	560 / NC / 4.2 / 14	0.185	0.0853 J	0.0487	0.068
TIN [4]	NA	NC / NC / NC / NC	---	---	---	---
ZINC [4]	NA	160 / 120 / 46 / 79	761	61.7	75.2	136

(1) Sample locations that require excavation and replacement with 'clean fill' to achieve acceptable risk to human receptors.
(2) Sample locations that require excavation and replacement with 'clean fill' to achieve acceptable risk to ecological receptors.
(3) Human Health COC. Human Health Cleanup Goals indicate the lowest of calculated risk level for direct contact reported in the RFI (Oak Ridge National Laboratory Screening Level for Iron), the IDEM Direct Contact concentration, and the maximum background detection.
(4) Ecological COC. Ecological screening criteria are those presented in the ECO-SSLs prepared by the office of Solid Water and Emergency Response. The reported values represent screening levels for plants / soil invertebretes / avian wildlife / mammal wildlife.

U Indicates that the compound is not detected at the indicated detection limit.
J Indicates that the reported concentration is estimated.
NA Not Applicable
NC No Criteria
--- Parameter not analyzed for this sample.
When in data field, indicates that concentration exceeds a goal or screening criteria.

TABLE 2-3

COMPARISON OF POST-EXCAVATION CONCENTRATIONS TO HUMAN HEALTH PRGs
SWMU 12 - BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Parameter	PRG (mg/kg)		Maximum Detected Background Concentration	Concentrations Following Proposed Removal Action (mg/kg)		
	RFI Report Future Resident Direct Contact Cleanup Value	IDEM Default Closure Level for Migration to Groundwater		Surface and Subsurface Soil	Surface Soil	Subsurface Soil
Antimony (maximum concentration)	31	5.4	11.3	8.7	8.7	1.7
Arsenic[1] (95% UCL concentration)	0.39	5.8	10.2	6.0	6.6	6.3
Iron (95% UCL concentration)	55,000 [2]	NA	40,800	40,300	30,200	50,000
Lead (average concentration)	400	81	21.5	38.3	72.5	18.1

1 - Because the post-excavation arsenic concentration is below background, excavation of arsenic to below PRG concentrations is not required.

2 - USEPA Screening Level - Oak Ridge National Laboratory, Regional Screening Level for Chemical Contaminants at Superfund Sites, September 2008.

Concentration exceeds the RFI cleanup value and the IDEM Migration to Groundwater Criteria

IDEM - Indiana Department of Environmental Management
mg/kg - milligrams per kilogram

TABLE 2-4

SUMMARY OF ECOLOGICAL EVALUATION
SWMU 12 BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Parameters	Ecological Screening Criteria (1) (mg/kg)	Maximum Background Detection (mg/kg	Average Concentrations Following Proposed Removal Action (mg/kg) (2)
Inorganics (mg/kg)			
ANTIMONY	NC / 78 / NC / 0.27	11.3	1.01
ARSENIC	18 / NC / 43 / 46	10.2	4.97
CHROMIUM	NC / NC / 26 / 34	30.6	25.03
COPPER	70 / 80 / 28 / 49	23.8	22.55
LEAD	120 / 1,700 / 11 / 56	21.5	36.32
MERCURY	NC / NC / NC / NC	0.14	0.02
SILVER	560 / NC / 4.2 / 14	0.11	0.08
TIN	NC / NC / NC / NC	NA	0.37
ZINC	160 / 120 / 46 / 79	60.2	124.67

(1) Ecological screening criteria are those presented in the ECO-SSLs prepared by the office of Solid Water and Emergency Response. The reported values represent screening levels for plants / soil invertebrates / avian wildlife / mammal wildlife.

(2) Values were calculated using 1/2 the method detection limits for samples with a non-detect

(3) Values were calculated using the average background value as the anticipated parameter concentration in the backfill material used for the SWMU 12 Battery Dump Site

NA Not available
NC No criteria
ND Not detected

Concentration exceeds one or more of the indicated screening criteria.

The proposed excavation includes the removal of soil associated with the following list of samples:

12SB210002	12SB320001
12SB220002	12SB320103
12SB230002	12SB330001
12SB240002	12SB340001
12SB450001	12SB360001

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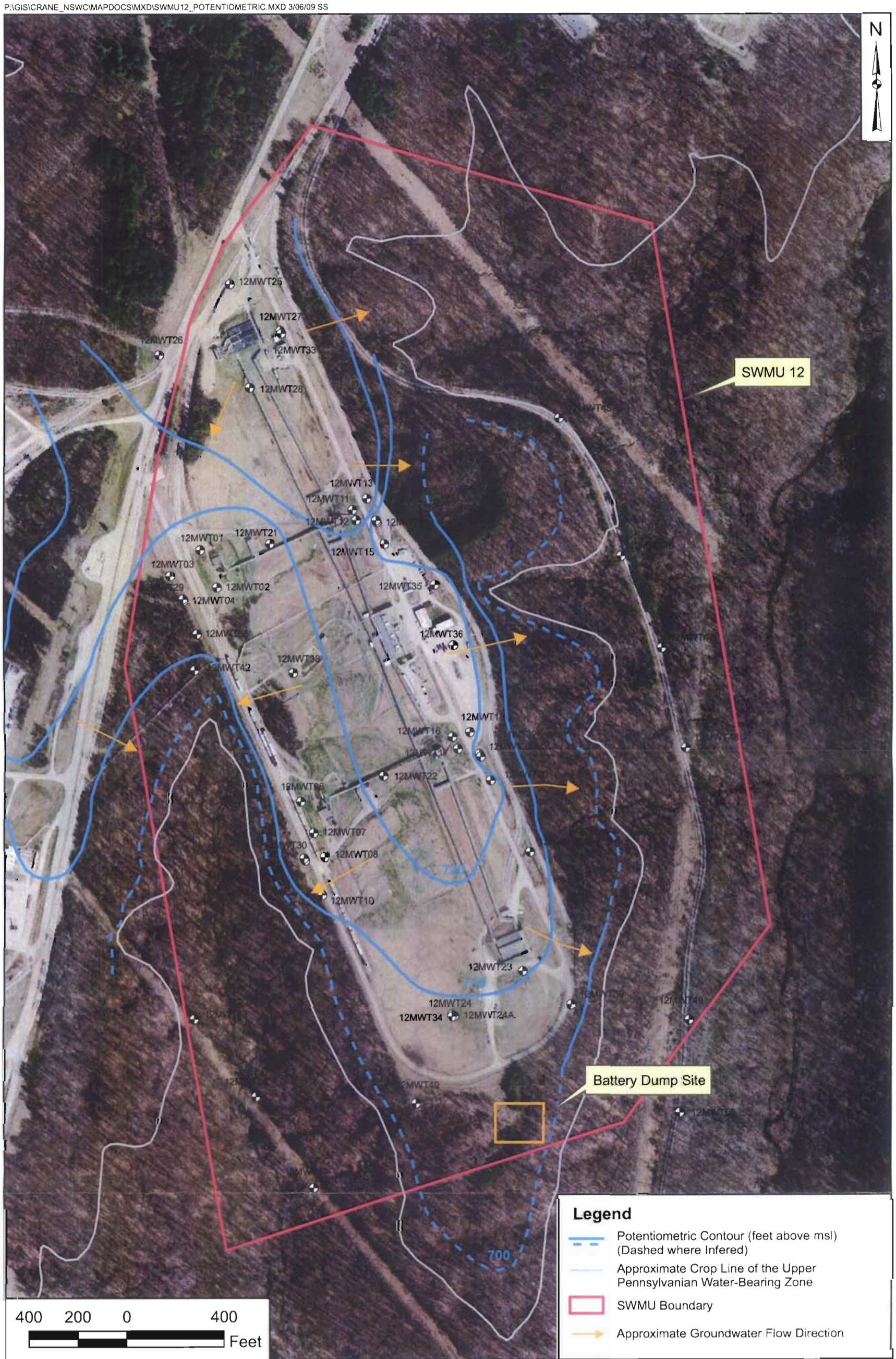


DRAWN BY	DATE
K. MOORE	6/25/08
CHECKED BY	DATE
T. SMITH	3/06/09
REVISED BY	DATE
—	—
SCALE	
AS NOTED	

NAVFAC

POTENTIOMETRIC SURFACE MAP FOR THE UPPER PENNSYLVANIA WATER-BEARING ZONE - JANUARY 18, 2005
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER	
112G0153	
OWNER NUMBER	
271	
APPROVED BY	DATE
—	—
FIGURE NO.	REV
FIGURE 2-1	0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU12_2004_SAMPLING_P.MXD 03/09/09 SS

DRAWN BY K. MOORE	DATE 10/18/07	Tetra Tech NUS, Inc.	CONTRACT NUMBER 112G01573
CHECKED BY T. SMITH	DATE 03/09/09	2005 RFI SAMPLING LOCATIONS SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2-2 / REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\REV_SWMU12_2005_SAMPLING_P.MXD 03/06/09 SS

DRAWN BY S. STROZ	DATE 03/06/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER 112G01573
CHECKED BY T. SMITH	DATE 03/06/09	2005 RFI SAMPLING LOCATIONS SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2-3 / REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\REV_SWMU12_2006_SAMPLING_P.MXD 03/06/09 SS

DRAWN BY S. STROZ	DATE 03/06/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER 112G01573
CHECKED BY T. SMITH	DATE 03/06/09	2006 RFI SAMPLING LOCATIONS SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NWSC CRANE CRANE, INDIANA	APPROVED BY — DATE —
COST/SCHEDULE AREA			APPROVED BY — DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 2-4 / REV 0

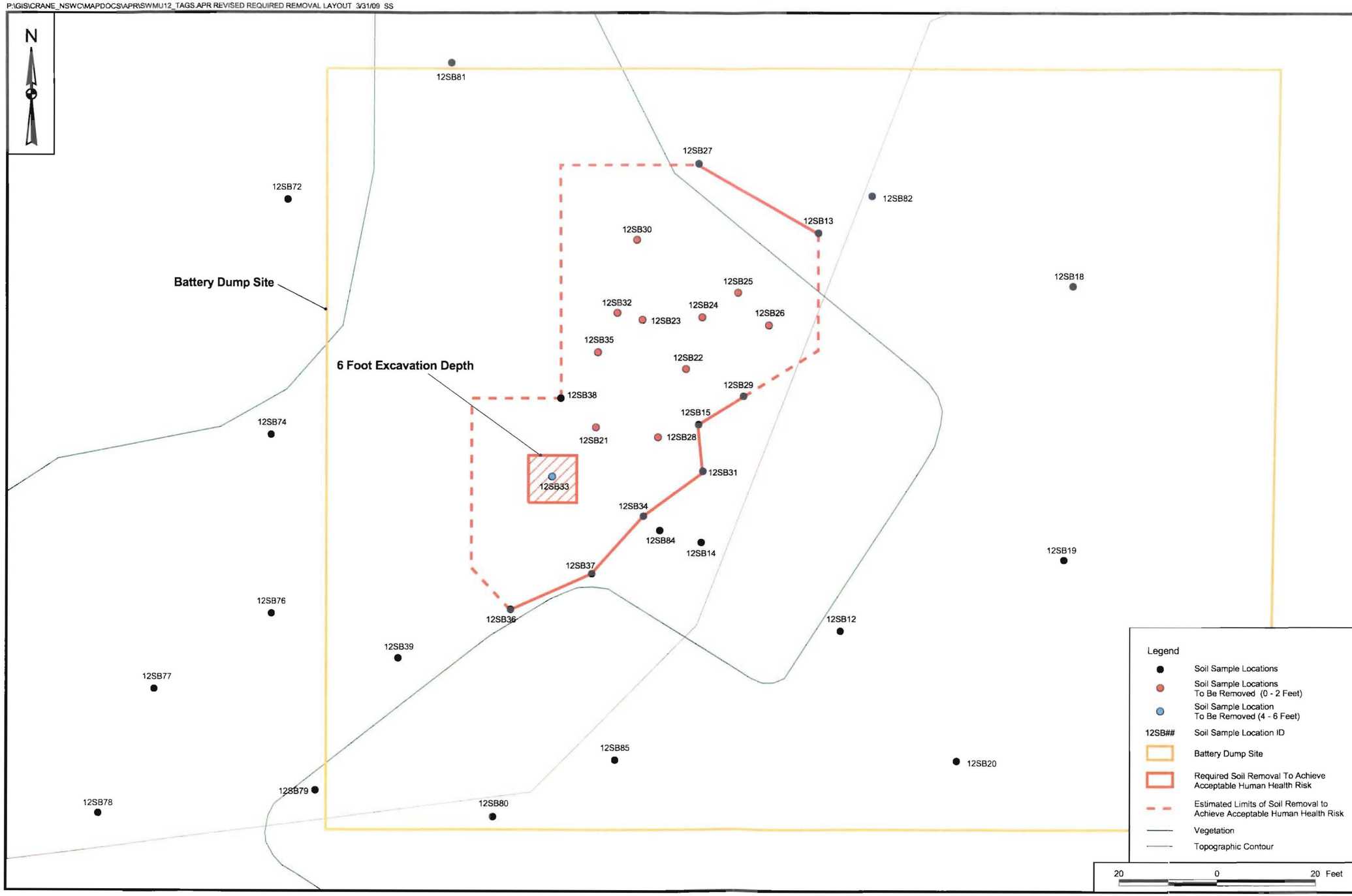
P:\GIS\CRANE_NSWC\MAPDOCS\MXD\REV_SWMU12_HUMAN_HEALTH_RISKS.MXD 3/06/09 SS

DRAWN BY S. STROZ	DATE 03/06/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER 112G01573
CHECKED BY T. SMITH	DATE 03/06/09	LOCATIONS CAUSING UNACCEPTBALE RISK TO HUMAN HEALTH (RESIDENTIAL DIRECT CONTACT) SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2-5 / REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\REV_SWMU12_ECOLOGICAL_RISKS_P.MXD 03/06/09 SS

DRAWN BY S. STROZ	DATE 03/06/09	Tetra Tech NUS, Inc.	CONTRACT NUMBER 112G01573
CHECKED BY T. SMITH	DATE 03/06/09	LOCATIONS CAUSING UNACCEPTABLE ECOLOGICAL RISKS SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY ___ DATE ___
COST/SCHEDULE AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2-6 / REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR REVISED REQUIRED REMOVAL LAYOUT 3/31/09 SS



CONTRACT NO.
CTO F271

APPROVED BY ____ DATE ____

APPROVED BY ____ DATE ____

DRAWING NO. FIGURE 2 - 7

REV 0

REQUIRED REMOVAL TO ACHIEVE
ACCEPTABLE HUMAN HEALTH RISKS
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

NAVFAC

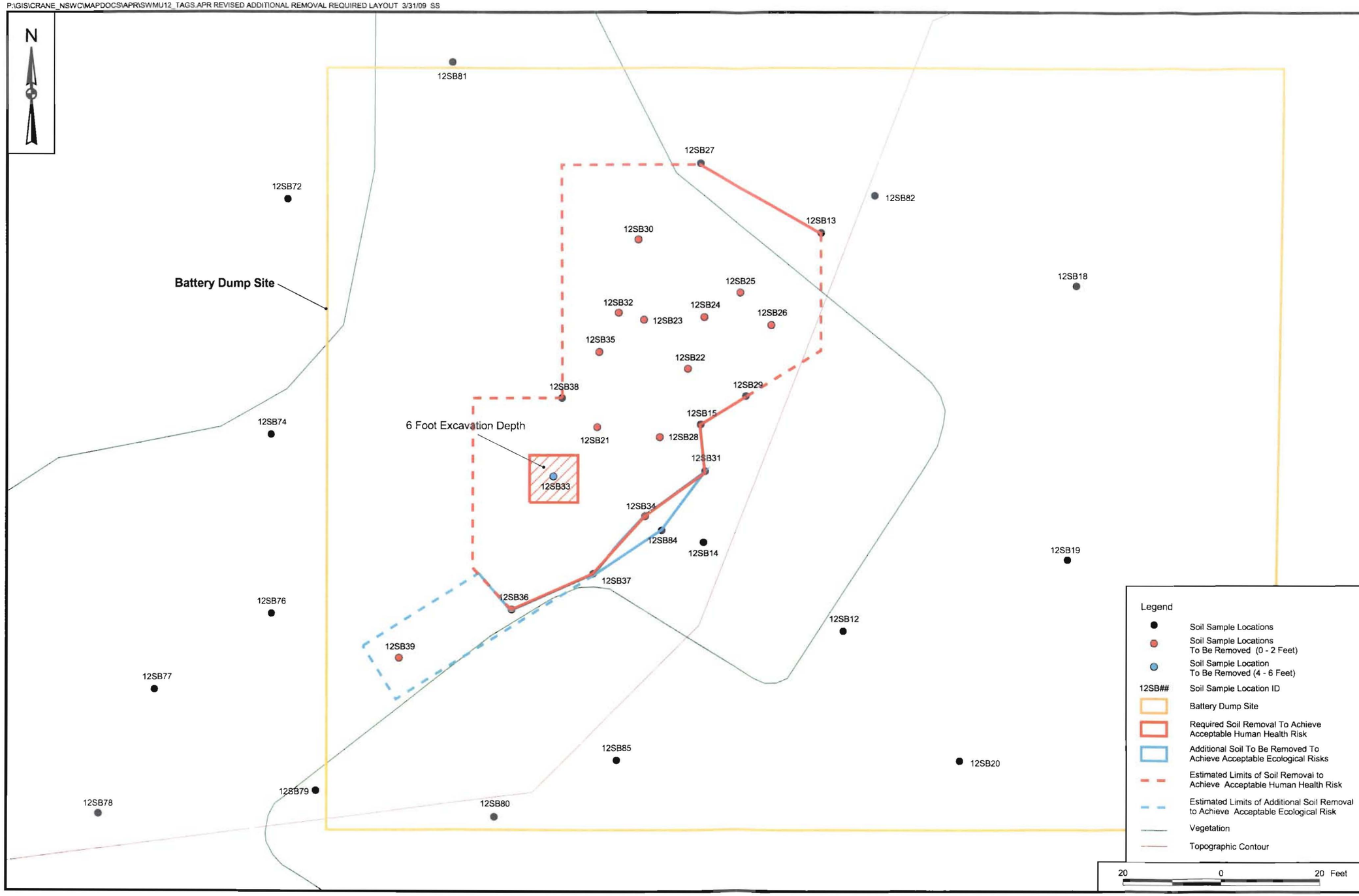
DRAWN BY S. STROZ DATE 3/31/09

CHECKED BY T. SMITH DATE 3/31/09

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR REVISED ADDITIONAL REMOVAL REQUIRED LAYOUT 3/31/09 SS



CONTRACT NO. CTO F271

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 2 - 8

REV 0

ADDITIONAL REQUIRED REMOVAL TO ACHIEVE ACCEPTABLE ECOLOGICAL RISKS
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

NAVFAC

DRAWN BY S. STROZ DATE 3/31/09

CHECKED BY T. SMITH DATE 3/31/09

COST/SCHED-AREA

SCALE AS NOTED

3.0 INTERIM MEASURES WORK PLAN

The intent of this IMWP is to remove surface and subsurface soil at the SWMU 12 Battery Dump Site that contains COCs at concentrations resulting in unacceptable risks to human health or ecological receptors. The remainder of this plan describes the remedial activities and soil volumes to be removed to satisfy human and ecological risk reduction requirements in SWMU 12 Battery Dump Site surface and subsurface soil.

The following table presents the PRGs for SWMU 12 Battery Dump Site required to establish acceptable human health and ecological risk.

Chemical of Concern	PRGs (mg/kg)
Antimony	31
Arsenic	10.2
Chromium	26
Copper	28
Iron	40,800
Lead	400
Mercury	2.1
Silver	4.2
Tin	10
Zinc	49

3.1 DESCRIPTION OF THE INTERIM MEASURES

The IMWP specifies the removal of contaminated surface and subsurface soil within the limits of the SWMU 12 Battery Dump Site that has been identified as containing COCs at concentrations that result in unacceptable human health or ecological risks. The excavation volumes presented in this IMWP are in-place estimates; in an unconsolidated state, it is expected that these volumes will increase based on an expansion factor of 5 to 10 percent.

A work assignment responsibility chart (Table 3-1) identifies the responsibilities of the Environmental Multiple Award Contract (EMAC) contractor, NSWC Crane, and Tt in the implementation of this IMWP.

Specifically, the IMWP consists of the following major components:

- Surface Soil Excavation – To achieve acceptable human health and ecological risks at the SWMU 12 Battery Dump Site, 13 sample locations must be removed. The designated area that includes the surface soil at these 13 locations will be excavated, characterized for disposal purposes, and transported and disposed off site at an approved facility. The required surface soil excavation area is identified on Figure 3-1. Figure 3-1 also identifies potential limits of excavation. The actual limit of excavation will be based on verification sampling.

- Subsurface Soil Excavation – To achieve acceptable human health risks at the SWMU 12 Battery Dump Site, one subsurface soil sample must be removed. Designated subsurface soil at this location will be excavated, characterized for disposal purposes, and transported and disposed off site at an approved facility. The subsurface soil excavation area is identified on Figure 3-1. Although potential excavation limits for subsurface soil excavation are not identified on Figure 3-1 the actual subsurface excavation limits will depend on verification sampling performed following the removal of the subsurface soil identified on Figure 3-1.

- Dewatering of Excavated Soil – All efforts will be made to avoid excavating in the rain. All excavations and excavated soils will be covered with plastic sheeting during rain events. However, in the event that excavated soil is saturated with groundwater or becomes saturated with rainwater, the excavated soil will be dewatered prior to offsite disposal to meet transportation and disposal requirements. The water drained from the stockpiled soil during dewatering will be containerized, filtered, and characterized. The EMAC contractor will arrange for off-site disposal or treatment of containerized water and filters. The volume of water collected through dewatering is not expected to be significant unless excavation/removal is performed during periods of heavy rain.

- Verification Sampling and Analysis – Following the excavation/removal of identified surface and subsurface soil, the exposed surfaces of the excavation areas will be sampled to verify contaminant removal. The Contracting Officer may require additional excavation based on the analytical results of verification sampling. In addition, at the completion of this IMWP and following the removal of the support facilities (e.g., dewatering pad, access road, decontamination pad, and material storage area), the Contracting Officer will require verification samples to confirm that the lining systems of the support facilities did not fail during implementation of this IMWP. If it is determined that the lining system under any of the support facilities did fail, potentially resulting in the contamination of the soil below a support facility, the EMAC contractor will be required to remove that contamination at their own expense. Section 5.0 presents verification sampling and analysis procedures. Because the verification sampling process consists of collecting samples, shipping samples to the laboratory,

laboratory analysis time, and receiving preliminary analytical results from the laboratory, this process can take up to 5 working days.

- Off-Site Disposal of Soils – Excavated soil will be disposed off site based on characterization sampling, including TCLP analysis. Based on the concentrations found in-situ, it is likely that some soil may require disposal as hazardous material. Characterization sampling is the responsibility of the EMAC contractor. Prior to excavation the EMAC Contractor's selected disposal facility must be approved by the Contracting Officer.

- Backfilling and Restoration – After verification that the contaminated surface and subsurface soil has been removed, and after receiving approval from the Contracting Officer, the excavated areas will be backfilled and regraded to match pre-construction grades and surrounding surfaces. In addition, the backfilled areas will be restored to pre-construction surface conditions using permanent stabilization practices that include vegetation.

- Detailed Characterization Sampling Plan – The EMAC contractor will prepare a characterization sampling plan as indicated in Table 3-1. This plan must describe sampling procedures for collection of soil and wastewater characterization samples. The sampling procedures and analytical methods must comply with acceptable methods and must comply with the requirements of the approved waste disposal facility. The EMAC contractor will also provide these waste characterization procedures to Tt for inclusion into the SWMU 12 Battery Dump Site Sampling and Analysis Plan (SAP).

3.2 PERFORMANCE STANDARDS

Performance standards for the IMWP are presented in the following sections.

3.2.1 Surface Soil Excavation

All SWMU 12 Battery Dump Site surface soil that is identified as having COCs at concentrations that result in unacceptable risks to human or ecological receptors will be removed, characterized, and disposed at a Contracting Officer approved, offsite hazardous or non-hazardous waste disposal facility(ies). Any root material found during excavation will be disposed in the same manner as the contaminated soil that surrounds the roots. The excavated soil and root material will be placed on a material handling pad located adjacent to the excavation area or at a central location. The material handling pad will be constructed in accordance with Section 3.2.11. Alternatively, excavated soil and root material may be placed directly in roll-off boxes or other approved containers located adjacent to the

excavation area or in a central location. When transporting soil and roots, appropriate measures such as lining the roll-off boxes or containers or providing sealed tailgates must be used to prevent loss of stored material during transportation. All excavated soil and root material will remain on the site and covered until waste characterization has been completed. Waste characterization is the responsibility of the EMAC contractor. If characterization of the proposed excavation can be acquired from the disposal facility(ies) prior to excavation, excavated soil can be directly loaded into trucks for transportation and offsite disposal.

The planned surface soil excavation (0 to 2 feet bgs) area is identified on Figure 3-1. The required excavation area includes approximately 245 cubic yards (cy) of soil. Based on lead concentrations, it is assumed that a portion of this soil will be a characteristic hazardous waste. However, TCLP analysis will be required to verify this. Northing and easting coordinates for the surface soil excavation area nodes are provided in Table 3-2. The estimated surface soil excavation volume is based on the area of the excavation and a 2-foot excavation depth, with no sloping of the excavation sides. The excavation will be covered with plastic sheeting until backfilled. Volume calculations are provided in Appendix B and summarized below:

Surface Soil Excavation				
Excavation Area	**Area**	**Depth of Excavation**	**Volume**	**Weight(2)**
Surface Soil	4,145 square feet (sf)	2 feet bgs	307 cy(1)	456 tons

1 Reported volume is expected to be Non-Hazardous; EMAC Contractor must verify this through TCLP testing prior to offsite disposal.
2 The weight is based on an assumed unit weight of 1.485 tons per cubic yard.

Physical features outside the limits of excavation will not be removed during the excavation of surface soil. Physical features include fencing, designated trees, and bituminous concrete paved roads. The NSWC Crane Officer in Charge of Construction (OICC) will clearly identify the physical features that are not to be removed or disturbed prior to implementation of this IMWP. The volume estimates presented in this IMWP assume that these physical features remain in place.

Sediment that accumulates in the erosion and sediment control devices (see Section 4.0) prior to verification that all contaminated soil has been removed from the associated surface soil excavation area will be disposed off site along with the excavated contaminated soil. Following verification of contaminant removal, sediment that accumulates in the erosion and sediment control devices will be placed in the

excavation as backfill material or spread across the disturbed ground surface of the associated soil excavation area.

3.2.2 Subsurface Soil Excavation

All SWMU 12 Battery Dump Site subsurface soil that is identified as having COCs at concentrations that result in unacceptable risks to ecological and human receptors will be removed, characterized, and disposed at a Contracting Officer approved off site disposal facility. Any root material found during excavation will be disposed in the same manner as the contaminated soil that surrounds the roots. The excavated soil and root material will be placed on a material handling pad located adjacent to the excavation area or at a central location. The material handling pad will be constructed in accordance with Section 3.2.11. Alternatively, excavated soil and root material may be placed in roll-off boxes or other approved containers placed adjacent to the excavation area or in a central location. When transporting soil and roots, appropriate measures such as lining the roll-off boxes or containers or providing sealed tailgates must be used to prevent loss of stored material during transportation. All excavated soil and root material will remain on site and covered until waste characterization has been completed. Waste characterization is the responsibility of the EMAC contractor. If characterization of the proposed excavation can be acquired from the disposal facility(ies) prior to excavation, excavated soil can be directly loaded into trucks for transportation and offsite disposal.

The planned subsurface soil excavation (2 to 6 feet bgs) area is identified on Figure 3-1. The excavation area includes approximately 22 cy of soil. Based on lead concentrations, it is assumed that a portion of this material will be a characteristic hazardous waste. However, TCLP analysis will be required to verify this. Northing and easting coordinates for the subsurface soil excavation area nodes are provided in Table 3-2. The EMAC is required to create a safe and stable excavation. The excavation will be covered with plastic sheeting until backfilled. Excavation volume calculations are provided in Appendix B and summarized below.

Subsurface Soil Excavation				
Excavation Area	**Area**	**Depth of Excavation**	**Volume**	**Weight(2)**
Subsurface Soil	100 sf	2 to 6 feet bgs	15 cy(1)	23 tons
Total Subsurface Soil to be Excavated			15 cy	23 tons

1 Reported volume is expected to be Non-Hazardous; EMAC Contractor must verify this through TCLP testing prior to offsite disposal.
2 The weight is based on an assumed unit weight of 1.485 tons per cubic yard.

Physical features outside the limits of excavation will not be removed during the excavation of subsurface soil. Physical features include fencing, designated trees, and bituminous concrete paved roads. The NSWC OICC will clearly identify the physical features that are not to be removed or disturbed prior to implementation of this IMWP. The volume estimates presented in this IMWP assume that these physical features remain in place.

Sediment that accumulates in the erosion and sediment control devices (see Section 4.0) prior to verification that all contaminated soil has been removed from the associated subsurface soil excavation area will be disposed off site along with the excavated contaminated subsurface soil. Following verification of contaminant removal, sediment that accumulates in the erosion and sediment control devices will be placed in the excavation as backfill material or spread across the disturbed ground surface of the associated soil excavation area.

3.2.3 Dewatering

It is not anticipated that excavated soil will require dewatering. However, in the event that excavation requires the removal of saturated soil, dewatering of the soil will be required prior to transportation and off-site disposal. Excavated soil that requires dewatering will be dewatered adjacent to the excavation area. This material will be placed on a material handling pad at a lift thickness no greater than 3 feet and allowed to drain by gravity. The material handling pad will be constructed in accordance with Section 3.2.11. Following dewatering, the EMAC contractor will collect the required soil disposal characterization samples (including moisture content), and if required, the EMAC contractor will mix the soil on the material handling pad to promote additional dewatering. It is estimated that following the second day of dewatering, the moisture content of the soil will have been sufficiently reduced and the soil will not require the addition of an absorbent agent to be suitable for transportation and disposal.

Water that has drained from the staged soil lifts and collected within the material handling pad, along with any standing water removed from excavations, will be containerized for characterization prior to off-site disposal or treatment.

Dewatering will be kept to a minimum by covering all excavations and all stockpiled and containerized soil with plastic sheeting.

3.2.4 Sampling and Analysis

Verification samples will be collected from the excavation floors and sidewalls to confirm the removal of COCs at concentrations that result in unacceptable human health or ecological risk. The collection of verification samples will be performed by Tt in accordance with the SAP. Additionally, the EMAC Contractor will be required to assist in the collection of the verification samples by using their decontaminated excavation equipment for verification sample soil retrieval. To guide excavation activities, these samples will be field tested with XRF (Tt personnel will follow XRF sampling and analysis procedures presented in the SAP). XRF sample results will be reviewed by the Navy along with historic correlation information between XRF and fixed base laboratory results to determine whether additional excavation is necessary or if the verification sample should be sent to a fixed-base laboratory for final determination of remaining COC concentrations. In addition to the collection of verification samples from the excavations, verification samples will be collected from the surface soil below the decontamination pad, material handling pad, gravel construction entrance, and any other support facility constructed by the EMAC Contractor. Although not required, the EMAC Contractor may want to collect samples from these proposed support facilities areas for comparison with support facilities verification samples. Verification sampling and analysis procedures and acceptable COC concentrations are provided in the SAP. Based on historic removal actions, the EMAC Contractor can expect a 5 business day delay between verification sample collection and availability of fix-based laboratory analytical results. While awaiting the results of verification samples, exposed soil must be covered with plastic sheeting.

3.2.5 Disposal

Excavated soil will be sampled and analyzed for waste disposal characterization per the approved characterization sampling plan provided by the EMAC contractor and in accordance with the methods required by the NSWC Crane-approved waste disposal facility. Waste characterization is the responsibility of the EMAC contractor. The soil will be sampled following the dewatering process, if dewatering is required. Any root material found during excavation will be disposed in the same manner as the contaminated soil that surrounds the roots. To prevent loss of material stored in containers or trucks, measures such as lining and covering containers and trucks or providing sealed tailgates on trucks will be implemented. The EMAC contractor is responsible for satisfying all transportation and disposal requirements (solid and liquid) and providing Tt with all disposal facility sampling requirements including (but not limited to) disposal facility name, contact information (including permit number), waste profile, and responsible parties. This information will then be incorporated into the SAP. The following is a summary of the in-place volumes expected to be disposed off site.

Location	Non-Hazardous (Volume)	Non-Hazardous (Weight)
SWMU 12 Battery Dump Site Surface Soil	307 cy	456 ton
SWMU 12 Battery Dump Site Subsurface Soil	15 cy	23 ton
Total Volume Disposed Off Site	322 cy	479 ton

Final disposal volumes and hazard classification will depend on the results of the verification sample analysis and the TCLP analysis.

3.2.6 Backfilling

Excavation areas will be backfilled to pre-construction grades. Plastic sheeting will be removed from the excavation prior to backfilling unless otherwise directed. The backfill soil obtained from an off-site borrow source will have properties similar to the native SWMU 12 Battery Dump Site soil. The backfill soil will come from a source where due diligence shows no evidence of a release of a regulated substance has occurred (i.e., clean fill). A certification must be provided regarding the origin of the clean fill, including a statement that, to the best of the provider's knowledge, the backfill soil has not been contaminated through the release of regulated substances. The backfill soil will be subject to analytical testing to assure that the material satisfies the following requirements:

- Total Petroleum Hydrocarbon (TPH), diesel range organics (DRO), USEPA Method SW-846 8015M DRO - less than 1 mg/kg.
- TPH, gasoline range organics (GRO), USEPA Method SW-846 8015M GRO - less than 1 mg/kg.
- Total Aroclors (Total PCBs), USEPA Method SW-846 8082 - less than 1 mg/kg.
- Sum of benzene, toluene, ethylbenzene, and xylenes, USEPA Method SW-846 5030/8021 - less than 1 mg/kg.
- Characteristic waste determination (ignitability, corrosivity, reactivity, and toxicity), USEPA Method SW-846 1311 - shall not fail the test for characteristic waste.
- Antimony, USEPA Method SW-846 6010B or 6020 – less than 0.27 mg/kg.
- Arsenic, USEPA Method SW-846 6010 or 6020 – less than 0.39 mg/kg.

- Chromium, USEPA Method SW-846 6010B or 6020 – less than 26 mg/kg.
- Copper, USEPA Method SW-846 6010B or 6020 – less than 28 mg/kg.
- Iron, USEPA Method SW-846 6010B or 6020 – less than 23,500 mg/kg.
- Lead, USEPA Method SW-846 6010B or 6020 – less than 11 mg/kg.
- Mercury, USEPA Method SW-846 7471A or 6020 – less than 0.5 mg/kg.
- Silver, USEPA Method SW-846 6010B or 6020 – less than 4.2 mg/kg.
- Tin, USEPA Method SW-846 6010B or 6020 – less than 1 mg/kg.
- Zinc, USEPA Method SW-846 6010B – less than 46 mg/kg.

Based on the Restoration Plan (Figure 3-2), two types of backfill material are required for site restoration, common fill and topsoil. The physical characteristics required for each type of backfill material are described below.

Common Fill – Common fill will be used to backfill all excavation areas to a depth of 6 inches below final grade. This material will be placed into the excavation in 1-foot-thick lifts and compacted by track-walking across 100 percent of the backfilled area with track-type equipment. When backfilling at depths greater than 2 feet bgs, compaction can be performed using the bucket of an excavator or hand-tamping equipment. Common fill will meet the following physical characteristics:

- American Society for Testing and Materials (ASTM) D 2487, group symbols GW, GP, GM, SW, SP, or SM
- ASTM D 4318, liquid limit, 35 maximum
- ASTM D 4318, plasticity index, 12 maximum
- Maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve
- Maximum particle size of 1 inch

Topsoil – The uppermost 6 inches of backfill used to establish final grades will be medium-textured loam suitable for establishing vegetation.

3.2.7 Restoration

To restore the excavation areas, backfilling will be performed to re-establish pre-construction grades using common fill and topsoil as indicated in Section 3.2.6. Based on the volumes excavated from the SWMU 12 Battery Dump Site, the estimated in-place volumes of backfill material required are as follows:

- Common fill 242 cy
- Topsoil 80 cy

Reported volumes will increase if verification sampling requires additional excavation.

Following backfilling, the entire limits of disturbance will be restored and stabilized using permanent stabilization practices. Restoration will consist of surface preparation, fertilizing, seeding, and mulching, across the entire limits of disturbance (Figure 3-2). Procedures for seeding and associated activities (fertilizing and mulching) are presented in detail in Section 4.4.

3.2.8 Erosion and Sediment Control

Before excavation activities begin, erosion and sediment controls will be established to prevent impacts to surface water downgradient of the disturbance areas, namely drainage channels and the unnamed streams and tributaries that discharge to Turkey Creek (see Section 4.0). During excavation, backfilling, and restoration operations and until vegetation is established, the erosion and sediment controls will be regularly inspected and maintained. Erosion and sediment control requirements to be complied with during IMWP implementation include those presented in the Indiana Handbook for Erosion Control in Developing Areas (IDEM, 1992).

3.2.9 Gravel Construction Entrance

Ingress to and egress from the disturbed areas will be controlled using a gravel construction entrance, which is described in detail in Section 4.0. The gravel construction entrance placement requirements may result in the use of temporary access trails. If this is the case, the EMAC contractor will be required to have a gravel construction entrance at the end of each temporary access trail that connects to NSWC Crane facility roads or parking areas, regardless of whether these areas are paved.

3.2.10 Decontamination Pad

A temporary decontamination pad will be set up to clean equipment used to excavate, load, and transport contaminated soil. The pad will be sized to accommodate all the equipment to be used at the site and will be constructed in a manner that contains all the contaminated materials removed from equipment and the liquids used to clean the equipment. Contaminated materials removed from the equipment will be disposed off site with the excavated soil. Wash water will be filtered, containerized, and characterized for offsite disposal or treatment. Additional decontamination pad requirements are presented in Section 4.5. Care will be taken to keep off-road transport equipment clean to minimize the spread of contaminated soil to areas adjacent to the excavations or the temporary access trails. Any soil removal from these areas and the associated disposal and restoration costs will be the responsibility of the EMAC contractor.

3.2.11 Material Handling Pad

A temporary material handling pad will be constructed to hold, and dewater if necessary, all excavated soil. The material handling pad will be sized to accommodate excavated soil and loading equipment as necessary. The material handling pad will be constructed in such a manner that it will retain all materials and allow the water that drains by gravity from the soil to be collected in a sump. At a minimum, the material handling pad will be constructed of an 20-mil-thick polyethylene geomembrane overlain by a gravel drainage layer. During rain events and downtime, stockpiled materials within the material handling pad must be covered with a minimum 8-mil-thick polyethylene geomembrane to prevent movement of material to surrounding areas and to minimize the collection of additional water. The geomembrane cover will be secured daily using sandbags and rope or equivalent methods. The material handling pad must be constructed so that water discharges to a containment system. Prior to off-site disposal, the containerized water will be filtered and characterization sample(s) will be collected.

3.2.12 Clearing

Clearing will be performed only within the limits of excavation shown on Figure 3-1. Clearing activities will be kept to a minimum to minimize impacts to natural habitat. Cleared vegetation will be chipped and disposed off site. Standing trees will not be removed between April 15 and September 15 to comply with Indiana bat regulations, which are further addressed in Section 3.5.3, unless approval is granted by the NSWC Crane Natural Resources Office. Prior to initiating clearing activities, the EMAC contractor will meet with the NWSC Crane Biologist to define the clearing activities and receive approval to proceed. Additionally, minor tree clearing (e.g., small areas of non-habitat value trees) must be approved by the NSWC Crane Natural Resources Office.

3.3 SEQUENCE OF IMWP IMPLEMENTATION

The following generalized sequence of construction activities is subject to change based on the EMAC contractor's Work Plan:

1. Hold a pre-IMWP implementation meeting with the OICC, Contracting Officer, EMAC contractor, and Tt representative, at a minimum. The EMAC contractor must provide a minimum of 7 days notice to OICC and Tt prior to the pre-IMWP implementation meeting.

2. Inspect the SWMU 12 Battery Dump Site to verify existing site conditions and overhead and underground utility locations and obtain all required permits as detailed in Table 3-1. The EMAC contractor must provide a minimum of 7 days notice to OICC and Tt prior to the start of construction activities.

3. Install perimeter controls for the gravel construction entrance, and construct the gravel construction entrance. Install the remaining perimeter controls as indicated in the Erosion and Sediment Control Plan (Section 4.0).

4. Clear areas for support features including, but not limited to, the decontamination pad, material handling pad, and materials storage area. Construct the support features.

5. Install utility protection systems as required.

6. Excavate/remove surface and subsurface soil from the defined limits of excavation. Place excavated soil in the material handling pad to dewater by gravity (if necessary) and for characterization. Following dewatering (if necessary), collect disposal characterization samples. Following disposal characterization, load and transport soil to the NSWC Crane-approved off-site disposal facility. During excavation, maintain erosion and sediment controls.

7. Following excavation, collect verification samples (Tt) as identified in Section 5.0 of this IMWP. Perform additional excavation (Implementation Sequence Item No. 6) if required by the Contracting Officer. Following verification that all contaminated soil is removed, restore the excavation areas as required.

8. Following transportation and disposal of all excavated soil, remove the material handling pad and decontamination pad, and collect verification samples from within the footprint of the support facilities

and from the temporary access trails as described in Section 5.0. Following verification that the temporary access trails and the ground below the support features were not impacted by construction activities, regrade as necessary and establish permanent stabilization.

9. Following permanent stabilization of all disturbed areas, and with the approval of the OICC, remove all remaining perimeter controls and immediately stabilize all remaining disturbed areas.

3.4 STORMWATER CONTROLS

The SWMU 12 Battery Dump Site ground surface hydrology, grading, and cover will not be altered due to IMWP implementation activities. Because pre- and post-construction runoff from the limits of disturbance will be the same, permanent stormwater detention capacity is not required, and pre- and post-construction storm water runoff calculations were not prepared.

The disturbed area will be approximately 0.5 acre in size; therefore, an IDEM Storm Water General Permit is not required (stormwater permits are required for disturbances greater than 1 acre). Additionally, because the IM activities do not include working in and around a water course, the IDEM 401 Permit and Department of Natural Resources (DNR) Construction in Floodway Permit are not required (refer to Table 3-1). IMWP implementation activities will require the use of best management practices for erosion and sediment control and stormwater pollution prevention as described in Section 4.0.

3.5 OTHER IMWP IMPLEMENTATION REQUIREMENTS

3.5.1 Utilities

The EMAC contractor is responsible for obtaining utility locations and adequately protecting any utilities located in the active work areas before any earth-disturbing activities begin. The EMAC contractor will provide appropriate temporary support or by-passes for any identified utility within the limits of disturbance during excavation as indicated in Section 3.2 (prior to installation, the proposed temporary support systems or by-passes must be approved by the OICC). To provide the EMAC contractor with the most up to date information on utility locations Tt has requested a utility location through Indiana Underground Plant Protection Services. This information will be provided in the final version of this document.

3.5.2 Groundwater Monitoring Wells

There are no existing groundwater monitoring wells located within the limits of excavation or within the vicinity of construction activities. However, there are several groundwater monitoring wells located along the access roads associated with SWMU 12. The EMAC contractor will protect these groundwater monitoring wells during construction activities. The groundwater monitoring wells associated with SWMU 12 are identified on Figure 2-1.

3.5.3 Protection of Natural Resources

Threatened and endangered species or species of special concern protected under Indiana or Federal regulations exist or may exist within the limits of the SWMU 12 Battery Dump Site and will, therefore, be protected. Protected bird species that may use the SWMU 12 Battery Dump Site as part of their home ranges include the bald eagle, osprey, sharp-shinned hawk, red-shouldered hawk, broad-winged hawk, black and white warbler, hooded warbler, and the worm-eating warbler (Halliburton NUS, 1992). Also, the Indiana bat, a federal endangered species, is known to forage at NSWC Crane. During the spring and summer, Indiana bats roost in trees and forage for insects primarily in riparian and upland forests. The most important characteristic of roost trees is thought to be structural-exfoliating bark with space for bats to roost between the bark and the bole of the tree. To a limited extent, tree cavities and crevices are also used for roosting.

In 1997, NSWC Crane received a letter from the United States Fish and Wildlife Service (USFWS) stating that, in their opinion, NSWC Crane had an abundance of Indiana bat habitat and that any activity that would result in the clearing of woody vegetation may affect the Indiana bat and would require consultation under the Endangered Species Act (ESA). The USFWS recommended interim guidelines for protecting Indiana bats and their habitat from silvicultural activities, and these recommendations were immediately implemented by NSWC Crane under the timber management program.

Because of the Indiana bat and its potential habitat, the cutting of trees at NSWC Crane is restricted to certain times during the year, and the cutting of shagbark hickory trees (potential Indiana bat habitat) is prohibited. A summary of Indiana bat-related restrictions prepared by the NSWC Crane Natural Resources Office (i.e., "bat primer") is as follows:

- Woody vegetation that is 5 inches in diameter or greater at 4.5 feet above the ground surface may not be removed between April 15 and September 15.

- Standing dead trees may not be removed between April 15 and September 15.

- Timber harvesting may occur between September 15 and April 15 without a case-by-case consultation, provided the interim guidelines for silvicultural treatment issued to the NSWC Crane Natural Resources Office by the USFWS are followed.

- During emergency situations, necessary and prudent tree removal is allowed at all times without consultation.

- Tree removal from residential settings and industrial areas for safety reasons is allowed between September 15 and April 15 without further consultation. This includes tree trimming.

- Tree removal within 25 feet of railroad tracks and within 50 feet of explosive storage and explosive operating buildings is allowed between September 15 and April 15 without further consultation.

- Brush clearing of woody vegetation less than 3 inches in diameter at 4.5 feet above the ground may occur at any time of the year without consultation.

- All other tree removal or clearing projects not covered above must be submitted to the USFWS for informal consultation on a case-by-case basis.

As noted in Section 3.2.12, approval for minor tree clearing can be obtained from the NSWC Crane Natural Resources Office between April 15 and September 15.

3.5.4 Traffic Control Plan

Access to NSWC Crane is via four gates: the Main Gate referred to as the Bloomington Gate (Gate House No. 1) in the north, Burns City Gate (Gate House No. 2) in the west, Bedford Gate (Gate House No. 3) in the east, and Crane Gate (Gate House No. 4) in the northwest. NSWC Crane will be accessed by the EMAC contractor only through the Crane Gate. All vehicles will pass through the Crane Gate via the traffic routing plan shown on Figure 3-3. The EMAC contractor is not permitted to travel within restricted areas of the facility. All waste-hauling vehicles will be weighed upon arrival and at time of departure using the certified weight scale located at the Defense Reutilization and Marketing Office (DRMO) (Building 1940). The DRMO scale is operated during normal business hours, and weight tickets are available. The DRMO scale is the preferred scale for EMAC contractors' use.

3.5.5 EMAC Contractor Requirements

The EMAC contractor will be required to perform all IMWP implementation activities in accordance with the EMAC Basic Contract, NSWC Crane Contractor's Operations Manual (NSWC Crane, 2002), and supplemental specifications provided in Appendix C.

The IWMP will be implemented by the EMAC contractor, NSWC Crane, and Tt, with work assignments as summarized in Table 3-1.

The EMAC contractor will be required to assist Tt with the collection of verification samples.

3.6 IMPLEMENTATION

The EMAC contractor will coordinate all field work through the OICC.

IMWP implementation may be impacted by NSWC Crane activities and the facility's "Protective Measures." NSWC Crane will implement a corresponding set of "Protective Measures" based on the warnings provided by the Homeland Security Advisory System in the form of graduated "Threat Conditions." The EMAC contractor will be subject to any implemented "Protective Measures."

The Navy will provide a full-time oversight representative during IMWP implementation. The EMAC contractor will provide a minimum of 7 days notification to the OICC and the Navy's oversight representative prior to mobilization.

The EMAC contractor will supply Tt with all required field notes and construction certifications, and any other documentation necessary to allow Tt to prepare the CTO Closure Report.

TABLE 3-1

WORK ASSIGNMENT RESPONSIBILITY CHART
INTERIM MEASURES WORK PLAN SWMU 12 – BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

Work Item	EMAC Contractor[1]	NSWC Crane	Tetra Tech
Pre-IMWP Implementation Meeting	X	X	X
Interim Measure Implementation	X		
EMAC Contractor Work Plan [1] [2]	X		
Pre-Construction Conditions [3]	X	X	X
Locations and Flagging of Excavation Limits (see Table 3-2)	X		
Site Specific Health and Safety Plan / Activity Hazard Analysis	X		
Project Quality Control Plan	X		
Environmental Conditions Report	X[3]		X
Permits			
- Safety & Building Availability Permit (ESO 8020/11)	X		
- Digging Permit (NWSCC 11000/3)	X[4]	X[4]	
- Flame Tool / Hot Work Permit (NWSCC 11320)	X		
- HERO Permit (approval for portable radios)	X		
- Tree Clearing Permit		X	
Field Work Reports and Submittals [5]	X		
Sampling and Analysis	X[6]		X[6]
Wastewater Disposal (Decontamination Water)	X	X[7]	
CTO Closure Report	X[8]		X

NOTES:

1. In addition to the listed items, the EMAC contractor is required to perform all IMWP implementation activities in accordance with the EMAC Basic Contract, NSWC Crane Contractor's Operations Manual (NSWC Crane, 2002), and supplemental specifications provided in Appendix C.
2. EMAC Contractor Work Plan includes, but is not limited to, an excavation and handling plan, waste management plan, environmental protection plan, erosion and sediment control plan, stormwater pollution prevention plan, characterization sampling plan, and transportation and disposal plan.
3. EMAC contractor will participate in documenting environmental conditions before, during, and after implementation of the interim measures.
4. EMAC contractor completes the permit form. NSWC Crane performs the utility clearance.
5. EMAC contractor will furnish items identified in the EMAC Basic Contract, NSWC Crane Contractor's Operations Manual, and the Supplemental Specifications provided in Appendix C.
6. EMAC contractor will be responsible for the collection of characterization samples required for off-site disposal of excavated surface soils and sediments. Tetra Tech will collect verification samples from the excavation areas and from the surface soils below the support facilities following the removal of the support facilities. Tetra Tech will also collect verification samples from the temporary access trails. The EMAC contractor will need to coordinate and accommodate Tetra Tech sampling and field activities.
7. EMAC Contractor will be responsible for collection, storage, characterization, and transportation to an off-site treatment and/or disposal facility per direction by NSWC Crane.
8. EMAC Contractor will furnish items identified in the Supplemental Specifications provided in Appendix C.

CTO - Contract Task Order
EMAC - Environmental Multiple Award Contract
HERO - Hazards of Electromagnetic Radiation to Ordnance
NSWC - Naval Surface Warfare Center
X – Indicates responsible party
IMWP - Interim Measures Work Plan

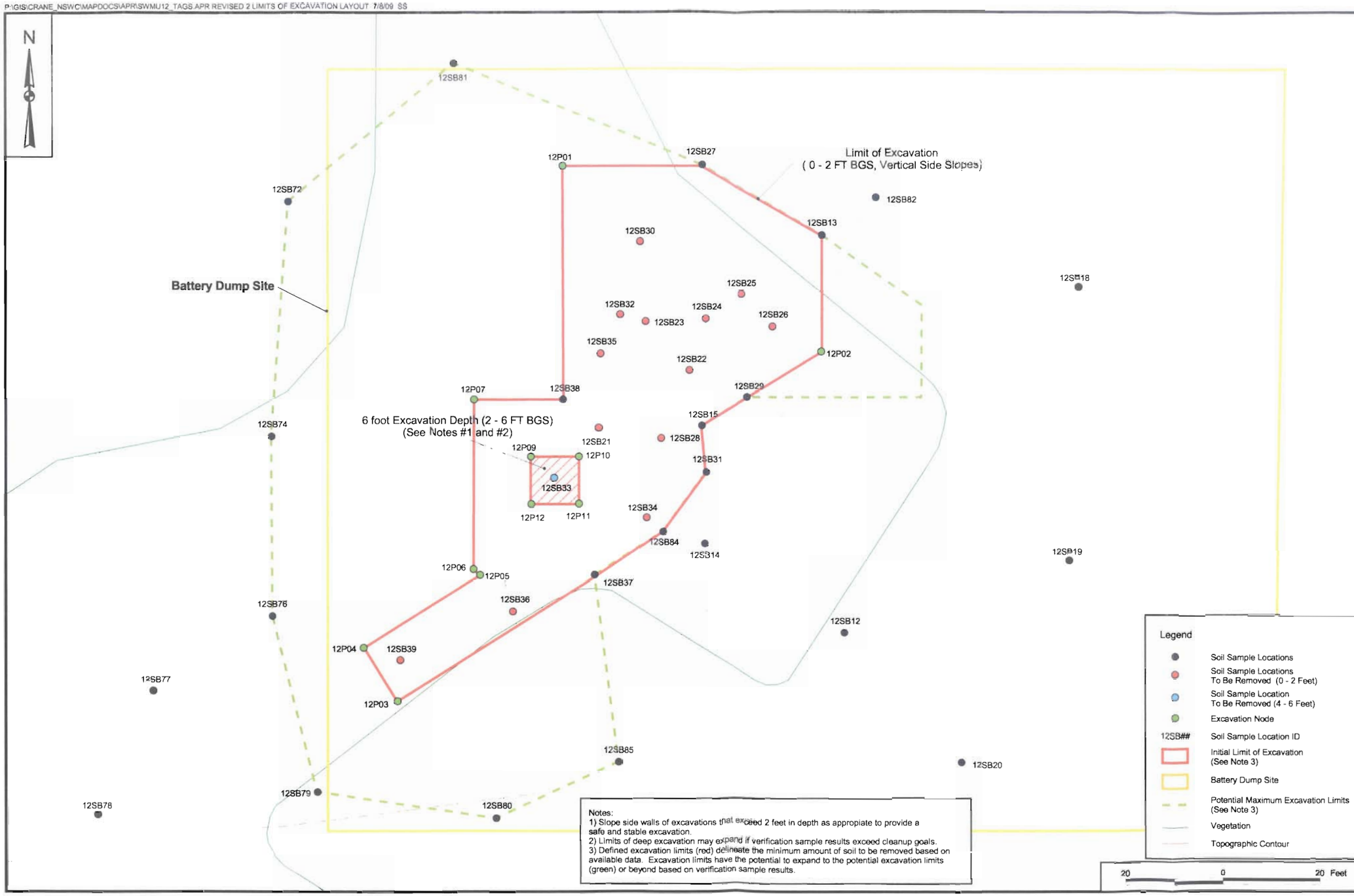
TABLE 3-2

SOIL EXCAVATION NORTHING AND EASTING COORDINATES
INTERIM MEASURES WORK PLAN SWMU 12 – BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

EXCAVATION NODE	EASTING	NORTHING
SOIL EXCAVATION NODES (Figure 3-1)		
12P01	3027407.17	1310596.71
12SB27	3027435.52	1310596.97
12SB13	3027459.99	1310582.77
12P02	3027459.80	1310558.87
12SB29	3027444.68	1310549.49
12SB15	3027435.52	1310543.67
12SB31	3027436.41	1310533.99
12SB84	3027427.64	1310521.80
12SB37	3027413.63	1310512.86
12P03	3027373.55	1310487.02
12P04	3027366.65	1310497.96
12P05	3027393.94	1310515.48
12P06	3027389.03	1310514.17
12P07	3027389.12	1310549.04
12SB38	3027407.23	1310549.06
12P08	3027400.71	1310537.28
12P09	3027410.52	1310537.34
12P10	3027410.55	1310527.66
12P11	3027400.80	1310527.57

Note: Excavation nodes identified in this table for Initial Excavation will be located and flagged in the field by the EMAC contractor (see Table 3-1). The locations of the excavation nodes are subject to Navy approval prior to excavation.

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR REVISED 2 LIMITS OF EXCAVATION LAYOUT 7/8/09 SS



Notes:
1) Slope side walls of excavations that exceed 2 feet in depth as appropiate to provide a safe and stable excavation.
2) Limits of deep excavation may expand if verification sample results exceed cleanup goals.
3) Defined excavation limits (red) delineate the minimum amount of soil to be removed based on available data. Excavation limits have the potential to expand to the potential excavation limits (green) or beyond based on verification sample results.

CONTRACT NO. CTO F271

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 3-1

REV 0

LIMITS OF EXCAVATION
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

NAVFAC

DRAWN BY S. STROZ DATE 3/31/09

CHECKED BY T. SMITH DATE 7/8/09

COST/SCHED-AREA

SCALE AS NOTED

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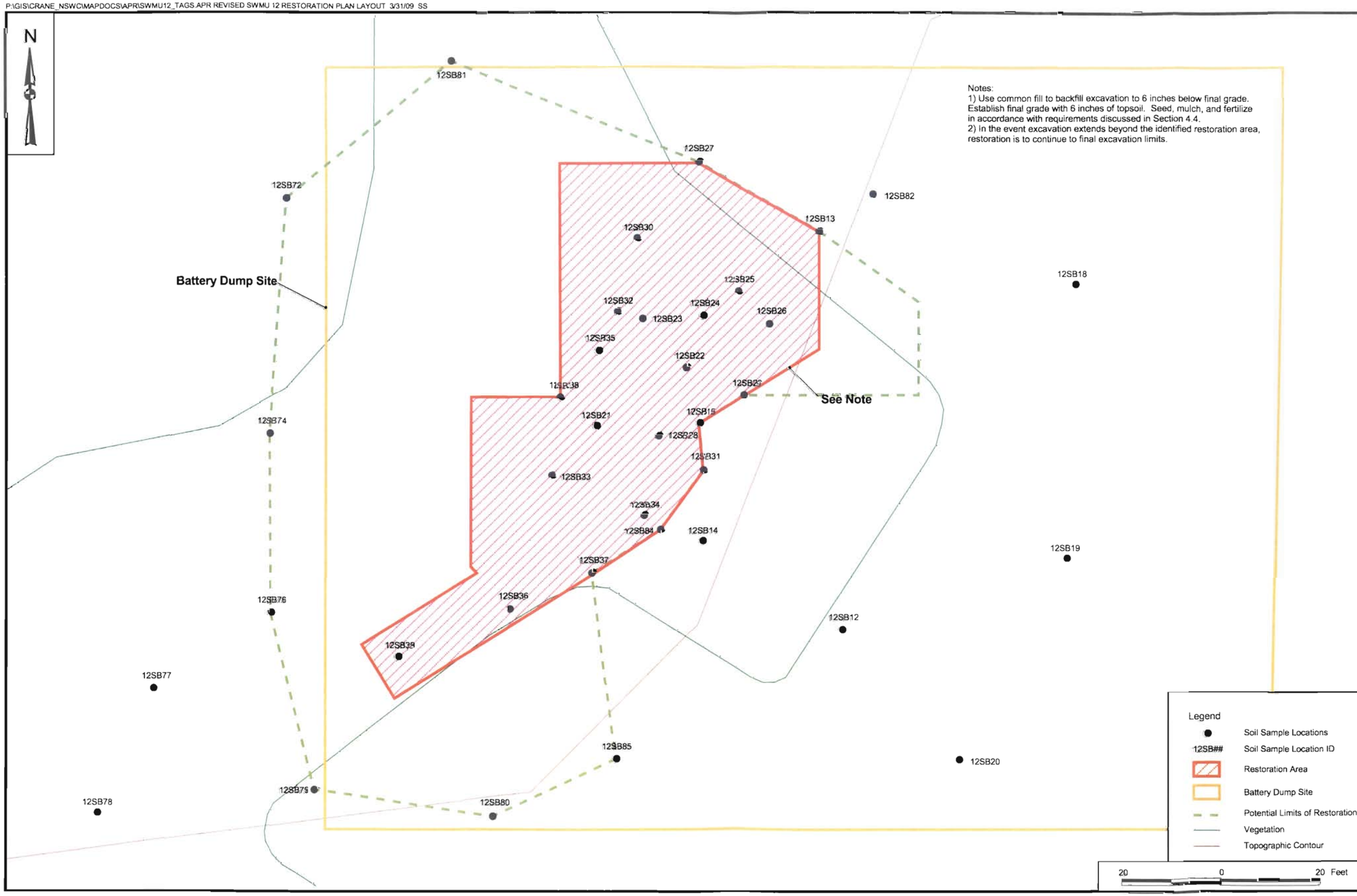

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APPROVED BY ___ DATE ___

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DRAWING NO. FIGURE 3 - 2

REV 0

RESTORATION PLAN
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

NAVFAC

DRAWN BY S. STROZ DATE 3/31/09

CHECKED BY T. SMITH DATE 3/31/09

COST/SCHED-AREA

SCALE AS NOTED

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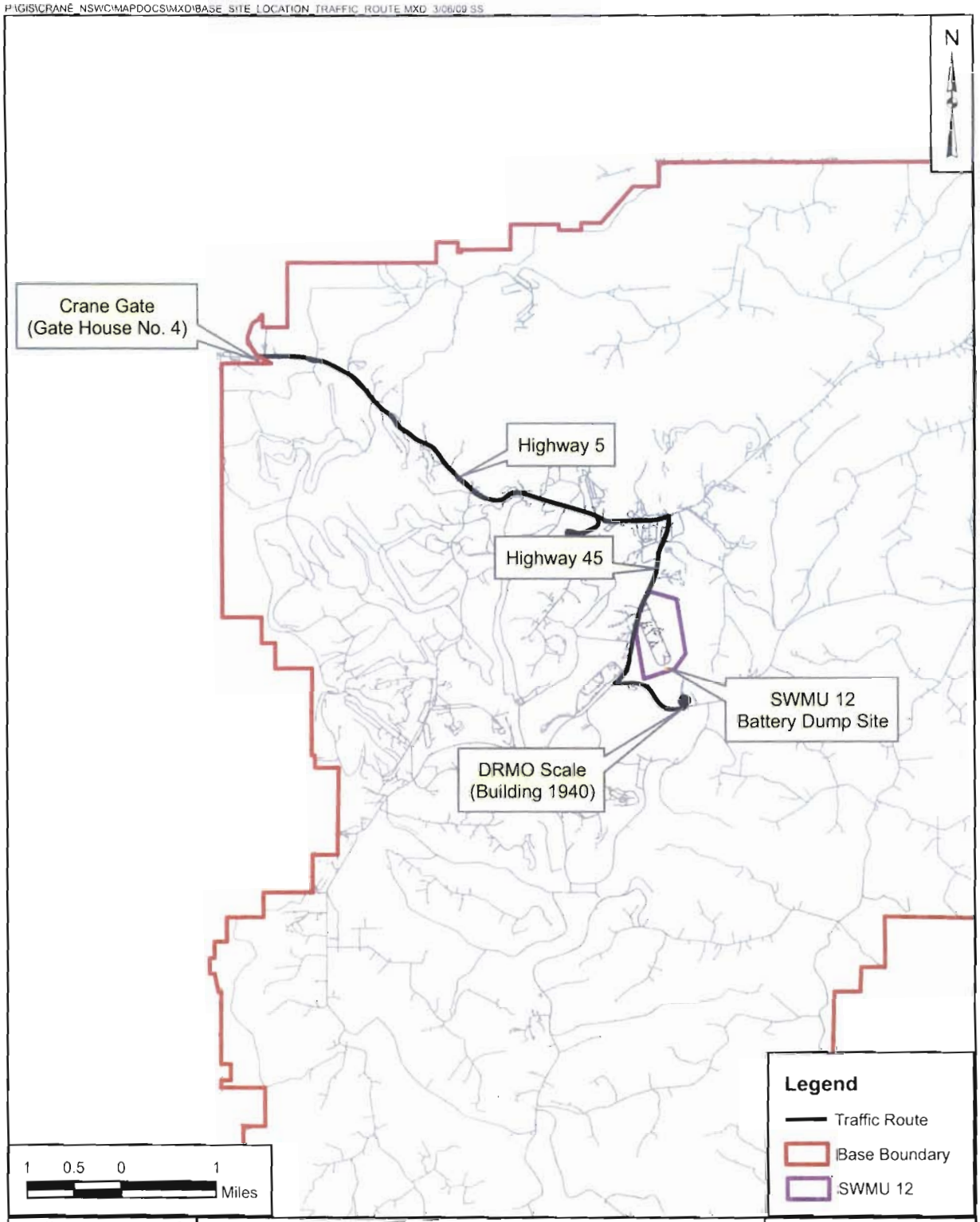

DRAWN BY S. STROZ	DATE 7/14/08	Tetra Tech NUS, Inc.	CONTRACT NUMBER 271
CHECKED BY T. SMITH	DATE 3/06/09	BASE AND SITE LOCATION MAP SWMU 12 - BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	APPROVED BY — DATE —
REVISED BY —	DATE —		APPROVED BY — DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 3-3 / REV 0

4.0 EROSION AND SEDIMENT CONTROL PLAN

4.1 PURPOSE

The purpose of this section is to provide the steps that will be taken to minimize and/or eliminate erosion and sedimentation during implementation of the IMWP at the SWMU 12 Battery Dump Site. The erosion and sediment control plan has been developed in accordance with the guidelines defined in the Indiana Handbook for Erosion Control in Developing Areas (Handbook) (IDEM, 1992). Relevant standards and specifications from the Handbook are included in this section and Appendix D. The erosion and sediment control devices described in this section can be modified based on construction equipment and techniques presented in the EMAC contractor's Work Plan. Selected erosion and sediment control devices must be identified in the Erosion and Sediment Control Plan submitted with the EMAC contractor's Work Plan. After the Erosion and Sediment Control Plan is approved, no changes can be made without the approval of the OICC and IDEM.

4.2 EROSION AND SEDIMENT CONTROL REQUIREMENTS

Erosion and sediment control measures are implemented to reduce or eliminate erosion and sedimentation of soil that would be detrimental to surface water quality. The SWMU 12 Battery Dump Site does not contain any drainage channels; however, surface water runoff from the site collects in the local drainage ditches located southwest and southeast of the site. The ditches lead to larger drainageways and gullies that flow down the western and eastern sides of the ridge to unnamed tributaries. These tributaries flow in the southwesterly direction and discharge to Turkey Creek. The locations at which the unnamed tributary discharges to Turkey Creek is located approximately 3,600 feet downstream of the SWMU 12 Battery Dump Site.

IMWP implementation activities for the SWMU 12 Battery Dump Site consist of excavation and off-site disposal of contaminated surface and subsurface soil, backfilling the excavations, and restoration of disturbed areas. Because of site conditions, temporary access trails may need to be constructed to allow access to all excavation areas.

Based on the type of field activities being implemented in the SWMU 12 Battery Dump Site IMWP, the proposed erosion and sediment control measures include the following:

- Silt Fence - Placed along the downslope sides of the excavation areas, gravel construction entrance, decontamination pad, and dewatering pad. The silt fence will provide a temporary sediment barrier and consist of synthetic filter fabric and wooden posts.

- Gravel Construction Entrance - Placed as controlled site entrance to reduce the amount of sediment transported by construction vehicles onto facility and public roads.

- Dust Control - Utilized to prevent the movement of airborne dust particles from exposed soil surfaces that may present human health hazards, traffic safety problems, or ecological impacts.

- Permanent Seeding - Utilized to establish permanent stabilization (perennial vegetation) on disturbed areas by planting seeds of native grasses.

The construction, implementation, and maintenance of these erosion and sediment control devices will be in accordance with the Handbook. Figure 4-1 presents the proposed excavation areas along with the limits of disturbance and locations of the proposed erosion and sediment control devices. In the event that verification sample results require excavation expansion, erosion and sediment control features may need to be adjusted. Figure 4-2 presents typical details of the erosion and sediment control devices proposed for IMWP implementation (i.e., silt fence and gravel construction entrance). Permanent seeding is discussed in Section 4.4. Dust control will be addressed in the EMAC contractor's Work Plan. All erosion and sediment controls will remain in place until all upstream areas have been stabilized. Completion of stabilization will be determined by the OICC.

4.3 INSPECTION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROLS

In general, all erosion and sediment control measures will be checked daily and after each runoff-producing rainfall event. Any required repairs will be made immediately. The following items will be checked during each inspection:

- Silt fence will be checked for undermining or deterioration of the fabric. Sediment will be removed when the level of sediment causes bulging or reaches one-half of the fabric height.

- Gravel construction entrance will be maintained in conditions that will minimize tracking of sediment onto facility or public roads.

- Seeded areas will be checked regularly to ensure that a good growth of vegetation is maintained, and these areas will be fertilized and reseeded, as needed.

- The fuel and lubricant materials storage area will be checked to ensure that stored containers are not leaking and that the lining system is functioning properly.

All erosion and sediment control devices will be inspected and maintained until the OICC has formally accepted the permanent stabilization of the disturbed areas. The EMAC contractor will maintain a logbook of all erosion and sediment control device inspections and maintenance. This logbook will be available at the site at all times for inspection by NSWC Crane personnel and IDEM.

4.4 SITE RESTORATION

All areas disturbed by IMWP implementation activities (i.e., excavation areas and support facility areas) will be restored/stabilized using appropriate soil and permanent seeding. Activities to establish permanent stabilization will be implemented as soon as possible following the construction of final grades. Permanent vegetation activities include site/seed bed preparation, seeding, and mulching of the restored excavation areas and the surface soil located under support facilities.

The procedures and requirements for permanent seeding activities are presented in Section 3.12 of the Handbook. The seed mixture recommended for use at the SWMU 12 Battery Dump Site is a standard Indiana seed mixture for open and disturbed areas. The seed mixture includes perennial ryegrass and tall fescue. Planting rates and optimum soil pH for this mixture are presented in Exhibit 3.12-C of the Handbook (provided in Appendix D). Following seeding, the seeded areas will be covered with temporary erosion control matting (e.g., coconut fiber matting) to provide additional stabilization until vegetation is established. In the event that disturbed areas are brought to final grade outside of the optimal growing season for the permanent seed mixture, the disturbed areas will be temporarily stabilized using a temporary seed mixture. The procedures and requirements for establishing temporary stabilization are presented in Section 3.11 of the Handbook. As indicated in the Handbook, erosion and sediment control devices will remain in place until permanent stabilization is established over the disturbed areas. Erosion and sediment control devices will not be removed by the EMAC contractor until directed by the OICC.

Sections 3.11 through 3.15 (Temporary Seeding, Permanent Seeding, Dormant and Frost Seeding, and Mulching) of the Handbook are provided in Appendix D.

4.5 RESPONSE PROCEDURES FOR SPILL MITIGATION

Potential non-stormwater discharges anticipated during IMWP implementation activities include wash water resulting from decontamination efforts associated with field equipment; spills from vehicle fueling, lubrication, and maintenance; and spills of fertilizers, laboratory chemicals used in sample collection, and other flammable substances.

All decontamination wash water will be collected in a lined decontamination pad. All waters generated from decontamination and/or other washing activities will be collected, characterized, and transported to an approved off-site treatment facility. All vehicle fueling, lubrication, and maintenance will be performed utilizing drip pans or within the decontamination pad. Containers of detergents and vehicle maintenance fluids (e.g., oil, grease, antifreeze, hydraulic fluid, etc.) will be stored within an enclosed, lined, diked area along with equipment fuel, which will be stored in tanks. This area, referred to as the materials storage area, will be bermed and lined with a 60-mil low-density polyethylene (LDPE) geomembrane and will be sized to contain 110 percent of the volume of material stored within the area. A small sump or low point in the liner will be designed to serve as a collection and monitoring point for any leaks or spills from the containers stored within the materials storage area. When not in use, chemicals, paints, and other flammable substances will be stored in a flammable storage cabinet located within the EMAC contractor's equipment trailer.

Good housekeeping procedures will be followed to reduce risks associated with construction materials and chemicals. These procedures include, but are not limited to, keeping materials in their original containers whenever possible, maintaining original labels and Material Safety Data Sheets (MSDSs), and using proper disposal methods for surplus materials. Accidental spills that may occur will be reported to the OICC and Public Works Department Environmental (PWD EV), immediately contained as appropriate for the spilled medium (liquid or solid), and collected and containerized immediately after discovery of the spill to the satisfaction of the OICC and PWD EV. Containerized material will be characterized for off-site transportation and disposal. The following spill mitigation equipment will be available on site during construction activities:

- Drip pans
- Oil-dry or similar compound
- Absorbent socks
- Shovels
- 55-gallon drums or storage tank (for containerization)
- Labels for contents identification

Following spill cleanup, the cause of the spill will be investigated, and material storage and handling procedures will be reviewed and revised where appropriate. All spills will be reported to the PWD EV. The cleanup of the any spills or other chemical releases will be the responsibility of the EMAC contractor under the direction of the OICC.

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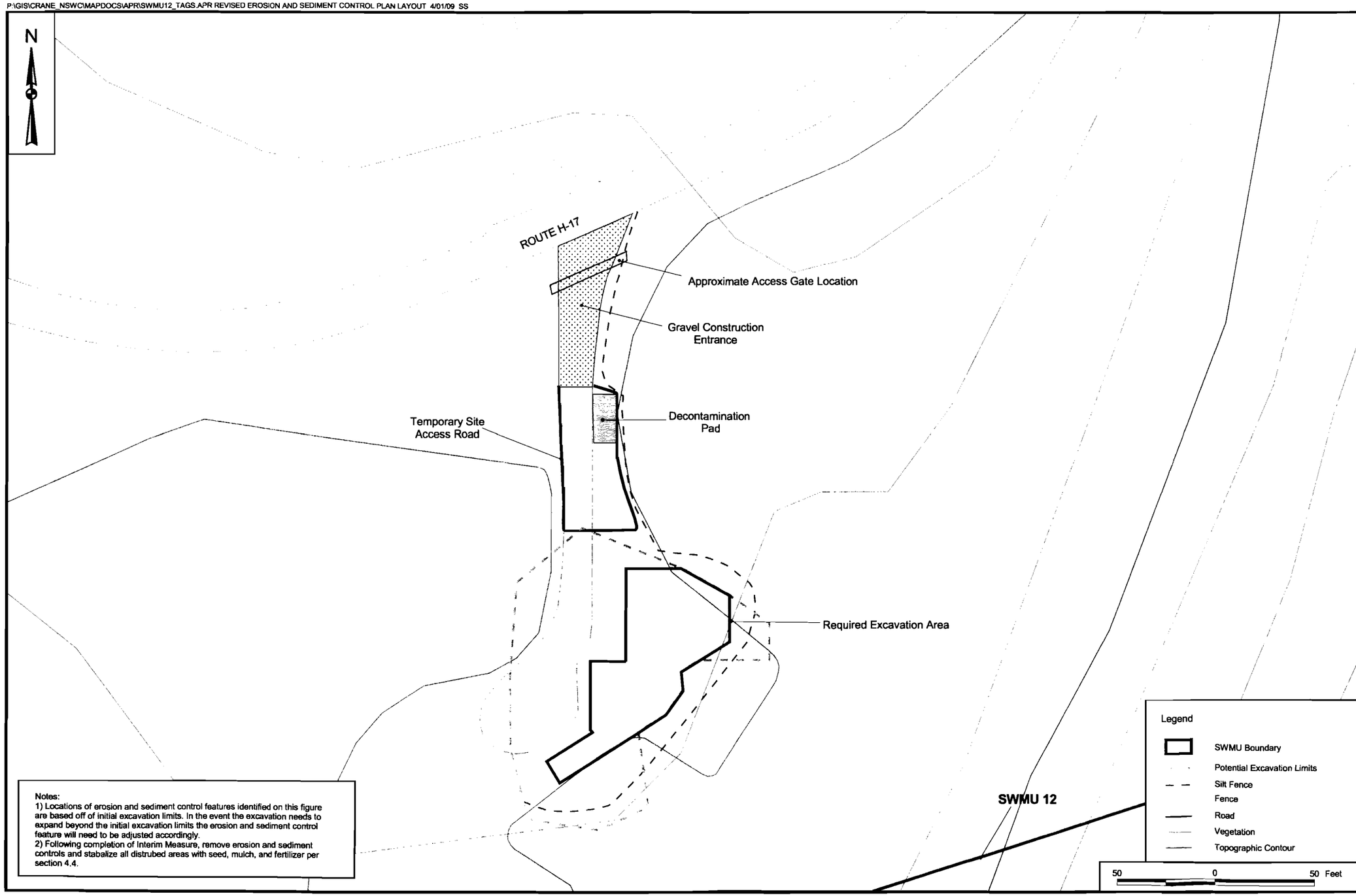

Notes:
1) Locations of erosion and sediment control features identified on this figure are based off of initial excavation limits. In the event the excavation needs to expand beyond the initial excavation limits the erosion and sediment control feature will need to be adjusted accordingly.
2) Following completion of Interim Measure, remove erosion and sediment controls and stabalize all distrubed areas with seed, mulch, and fertilizer per section 4.4.

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EROSION AND SEDIMENT CONTROL PLAN
SWMU 12 - BATTERY DUMP SITE
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

NAVFAC

DRAWN BY S. STROZ DATE 4/01/09

CHECKED BY T. SMITH DATE 4/01/09

COST/SCHED-AREA

SCALE AS NOTED

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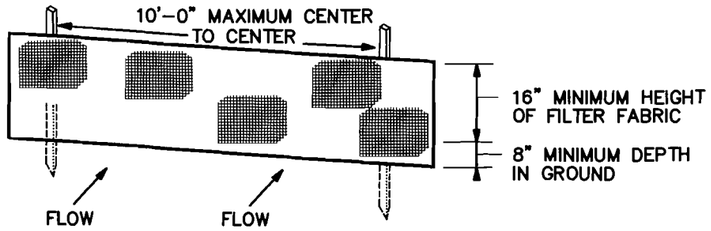
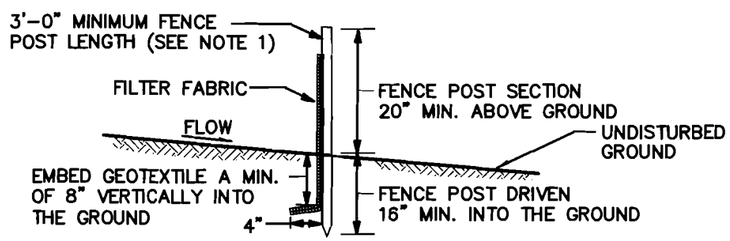
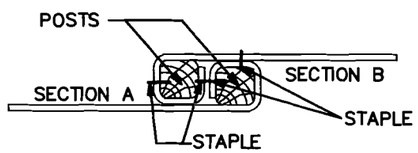


PERSPECTIVE VIEW



CROSS SECTION

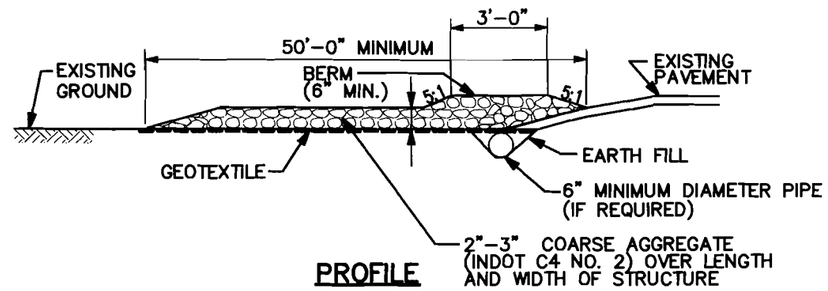


TOP VIEW – JOINING TWO
ADJACENT SILT FENCE SECTIONS

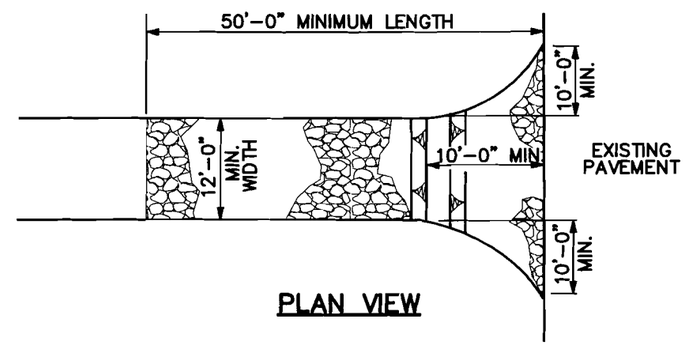
NOTES:

1. WOOD POSTS SHALL BE 1.5" BY 1.5" SQUARE (MIN) CUT OR 1.75" DIAMETER (MIN) ROUND AND SHALL BE OF SOUND QUALITY HARDWOOD. STEEL POSTS WILL BE STANDARD T OR U SECTION WEIGHING NOT LESS THAN 1.00 POUND PER LINEAR FOOT.
2. FILTER FABRIC SHALL BE FASTENED SECURELY TO EACH FENCE POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
3. INSTALL SILT FENCE PARALLEL TO THE CONTOUR OF THE LAND.

SILT FENCE



PROFILE

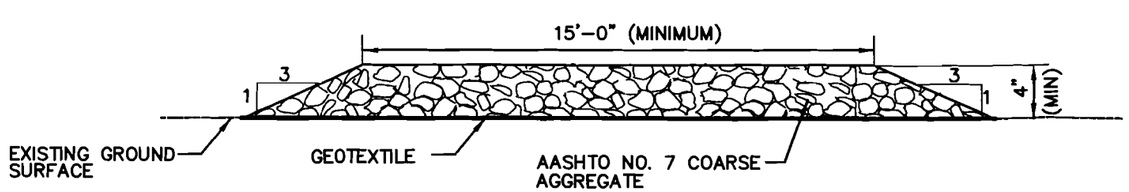


PLAN VIEW

NOTES:

1. ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED THROUGH THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE.
2. IF REQUIRED PIPE SHOULD BE SIZED ACCORDING TO THE AMOUNT OF RUNOFF TO BE CONVEYED. A 6" MINIMUM DIAMETER WILL BE REQUIRED.

GRAVEL CONSTRUCTION ENTRANCE



TEMPORARY SITE ACCESS ROAD

NOT TO SCALE

DRAWN BY CK DATE 3/10/09	NAVFAC	EROSION AND SEDIMENT CONTROL DEVICES SWMU 12 – BATTERY DUMP SITE INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	CONTRACT NO. 01573
CHECKED BY DATE			OWNER NO. F271
REVISED BY DATE			APPROVED BY DATE
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5.0 VERIFICATION SAMPLING PLAN

5.1 PURPOSE

The purpose of this section is to present the two types of verification samples to be collected during and following implementation of the SWMU 12 Battery Dump Site IMWP. The two types of verification samples include the samples collected from within the excavation areas to verify the removal of soil with COCs at concentrations causing unacceptable human health and ecological risks and the samples collected from surface soil located beneath the support facilities (i.e., decontamination pad, dewatering pad, material storage areas, construction entrance, and access trails) to ensure that contamination was not spread during construction. The verification samples collected to confirm the removal of unacceptable contamination will be collected following excavation. The verification samples collected to confirm that there were no contamination impacts to surface soil located below the footprints of the support facilities will be collected after IMWP implementation is complete. This section also presents criteria and procedures used to evaluate verification sample data. Verification samples will be collected by Tt. The sampling procedures, sample locations, and fixed-base laboratory analytical methods will be addressed in the SAP (to be provided under separate cover).

5.2 VERFICATION SAMPLING OF EXCAVATION AREAS

IMWP implementation activities include the excavation and off-site disposal of surface and subsurface soil containing contaminants at concentrations causing unacceptable human health and ecological risks. These excavation areas are shown on Figure 3-1. Verification samples will be collected from the excavation floors and sidewalls to determine if all the IMWP soil cleanup goals have been reached. In general, as indicated in the SAP, excavation floor samples will be collected at a rate of one composite sample for every 1,000 sf of exposed surface area, with a minimum of one verification sample collected from each depth interval. Additionally, sidewall samples will be collected at a rate of one composite sample for every 25 linear feet of exposed sidewall, with a minimum of one sample collected from each directionally facing sidewall. The verification samples will be analyzed for the COCs, which are all metals. All of the verification samples collected will be composite samples. The following paragraphs describe the verification sampling procedures to be performed for each of the excavation area.

- Soil Excavation Areas - Verification samples will be collected from the excavation sidewalls and excavation floors shown on Figure 3-1 at the frequency indicated above. Based on the estimated extent of excavation at the SWMU 12 Battery Dump Site, 5 excavation floor samples will be collected, and 19 excavation sidewall samples will be collected. Each verification sample will be a composite

sample made up of soil collected from six grab locations located within the designated verification sample area. The verification samples will be analyzed for the COCs. The analytical results of the verification samples will be directly compared to the COC site cleanup goals. The following table presents the COCs and site cleanup goals.

Chemical of Concern	Site Cleanup Goal (mg/kg)
Antimony	31
Arsenic	10.2
Chromium	26
Copper	28
Iron	40,800
Lead	400
Mercury	2.1
Silver	4.2
Tin	10
Zinc	49

In the event that verification sample results indicate that COC concentrations remaining in an excavated area still pose unacceptable human health or ecological risks (COC concentrations exceed site cleanup goals), the Navy may direct the EMAC contractor to extend the excavation in the appropriate direction(s). The extent of additional excavation will depend on the location and concentrations of the COCs that still pose risks to human or ecological receptors. Following the additional excavation effort, additional verification samples will be collected by Tt. Excavation expansion may continue, at the discretion of the Contracting Officer, until all verification sample results indicate that all COC concentrations within the excavated area are less than the site cleanup goals.

- Support Facility Areas - The frequency of verification sampling collected from the soil located beneath the support facilities after IMWP implementation has been completed is the same as that for excavation floor sampling (one verification sample for every 1,000 square feet of area disturbed). Sidewall samples are not included in the support facility verification sampling program because no excavation will occur at the support facility areas. Based on the anticipated footprints of the support facilities, it is estimated that 7 verification samples will be collected from the support facility areas (minimum of 1 sample from each support facility). The verification samples will be analyzed for the COCs listed above. In the event that a verification sample result exceeds the acceptable site cleanup levels, 6 inches of soil will be removed from the impacted support facility footprint (the support facility

footprint equals the actual footprint plus an additional 10 feet in all directions). Following the additional excavation activities, additional verification samples will be collected by Tt. Excavation expansion may continue until no unacceptable risks remain in surface soil at the site (COC concentrations less than the COC site cleanup goals).

To minimize EMAC contractor downtime associated with waiting for sampling results from a fixed-base laboratory, verification samples will be analyzed for lead using XRF to guide the excavation. When the XRF sample results indicate that lead is below its cleanup goal, the sample will be sent to a fix-based laboratory for result confirmation. The fixed-base laboratory sample will be analyzed for the COCs listed above and the sample results will then be used to determine if excavation is complete. For scheduling purposes the EMAC contractor should be aware that the turn around time for the XRF sample results is 1 day. Meaning, samples collected on day 1 will be prepared and analyzed following the collection of all required samples and the results of these samples will be made available the morning of day 2. Additionally, the EMAC contractor should be aware that the turnaround time for fixed-base laboratory sample results is expected to take 4 to 5 working days, which includes time for sample shipment and results evaluation.

In the event that fixed-base laboratory results exceed the site cleanup goals, the Navy may or may not direct the EMAC contractor to perform additional excavation. If the Navy directs the EMAC contractor to perform additional excavation, Tt will collect additional verification samples following that excavation and the analysis process will be repeated.

5.3 SAMPLING LOCATIONS

The numbers and locations of verification samples for the excavation areas and support facilities will be identified in SAP that will be provided under separate cover.

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APPENDIX A

SWMU 12 BATTERY DUMP SITE
RFI ANALYTICAL DATA

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB12	12SB12	12SB13	12SB13	12SB13	12SB14	12SB14	12SB14
Sample Number	12SS120002	12SB120204	12SS130002	12SB130204	12SB130607	12SS140002	12SB140204	12SB140607
Sample Date	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04
Sample Interval (feet)	0 - 2	2 - 4	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 7
Volatile Organics (ug/kg)								
1,1,1,2-TETRACHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,1,1-TRICHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,1,2,2-TETRACHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,1,2-TRICHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,1-DICHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,1-DICHLOROETHENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,2,3-TRICHLOROPROPANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,2-DIBROMO-3-CHLOROPROPANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,2-DIBROMOETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,2-DICHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,2-DICHLOROPROPANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
1,4-DIOXANE	94.8 U	87.2 U	88.8 U	88.9 U	88.8 U	105 U	93.2 U	92.4 U
2-BUTANONE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
2-HEXANONE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
3-CHLOROPROPENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
4-METHYL-2-PENTANONE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
ACETONE	4 U	4 U	0.921 UJ	2 U	5 U	6 U	4 BU	5 U
ACETONITRILE	37.9 U	34.9 U	35.5 U	35.5 U	35.5 U	42 U	37.3 U	37 U
ACROLEIN	0.994 UR	0.973 UR	0.921 UR	0.945 UR	1.03 UR	1.05 UR	0.976 UR	0.912 UR
ACRYLONITRILE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 UR	0.912 U
BENZENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
BROMODICHLOROMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
BROMOFORM	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
BROMOMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CARBON DISULFIDE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CARBON TETRACHLORIDE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLOROBENZENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLORODIBROMOMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLOROETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLOROFORM	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLOROMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CHLOROPRENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CIS-1,2-DICHLOROETHENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
CIS-1,3-DICHLOROPROPENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
DIBROMOMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
DICHLORODIFLUOROMETHANE	14 J	3 J	3 J	5 J	6 J	6 J	4	4 J
ETHYL METHACRYLATE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
ETHYLBENZENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
ISOBUTANOL	37.9 U	34.9 U	35.5 U	35.5 U	35.5 U	42 U	37.3 U	37 U
METHACRYLONITRILE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
METHYL IODIDE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
METHYL METHACRYLATE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
METHYLENE CHLORIDE	0.994 UJ	0.973 UJ	0.921 UJ	0.945 UJ	1.03 UJ	1.05 UJ	0.976 UJ	0.912 UJ

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB12	12SB12	12SB13	12SB13	12SB13	12SB14	12SB14	12SB14
Sample Number	12SS120002	12SB120204	12SS130002	12SB130204	12SB130607	12SS140002	12SB140204	12SB140607
Sample Date	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04
Sample Interval (feet)	0 - 2	2 - 4	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 7
PROPIONITRILE	37.9 U	34.9 U	35.5 U	35.5 U	35.5 U	42 U	37.3 U	37 U
STYRENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TETRACHLOROETHENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TOLUENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TOTAL XYLENES	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TRANS-1,2-DICHLOROETHENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TRANS-1,3-DICHLOROPROPENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TRANS-1,4-DICHLORO-2-BUTENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TRICHLOROETHENE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
TRICHLOROFLUOROMETHANE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
VINYL ACETATE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
VINYL CHLORIDE	0.994 U	0.973 U	0.921 U	0.945 U	1.03 U	1.05 U	0.976 U	0.912 U
Semivolatile Organics (ug/kg)								
1,2,4,5-TETRACHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,2,4-TRICHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,2-DICHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,3-DICHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,4-DICHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,4-NAPHTHOQUINONE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1,4-PHENYLENEDIAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
1-NAPHTHYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,2'-OXYBIS(1-CHLOROPROPANE)	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,3,4,6-TETRACHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,4,5-TRICHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,4,6-TRICHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,4-DICHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,4-DIMETHYLPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2,4-DINITROPHENOL	77.5 UR	74.9 UR	74.4 UR	75.4 UR	76.3 UR	76.4 UR	75.2 UR	77.4 UR
2,6-DICHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-ACETYLAMINOFLUORENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-CHLORONAPHTHALENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-CHLOROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-METHYLNAPHTHALENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
2-METHYLPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-NAPHTHYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-NITROANILINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-NITROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
2-PICOLINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
3&4-METHYLPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
3,3'-DICHLOROBENZIDINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
3,3'-DIMETHYLBENZIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
3-METHYLCHOLANTHRENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
3-NITROANILINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4,6-DINITRO-2-METHYLPHENOL	77.5 UR	74.9 UR	74.4 UR	75.4 UR	76.3 UR	76.4 UR	75.2 UR	77.4 UR

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NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB12	12SB12	12SB13	12SB13	12SB13	12SB14	12SB14	12SB14
Sample Number	12SS120002	12SB120204	12SS130002	12SB130204	12SB130607	12SS140002	12SB140204	12SB140607
Sample Date	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04
Sample Interval (feet)	0 - 2	2 - 4	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 7
4-AMINOBIPHENYL	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-BROMOPHENYL PHENYL ETHER	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-CHLORO-3-METHYLPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-CHLOROANILINE	77.5 UR	74.9 UR	74.4 UR	75.4 UR	76.3 UR	76.4 UR	75.2 UR	77.4 UR
4-CHLOROPHENYL PHENYL ETHER	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-NITROANILINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-NITROPHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
4-NITROQUINOLINE-1-OXIDE	77.5 UR	74.9 UR	74.4 UR	75.4 UR	76.3 UR	76.4 UR	75.2 UR	77.4 UR
5-NITRO-O-TOLUIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
A,A-DIMETHYLPHENETHYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ACENAPHTHENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
ACENAPHTHYLENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
ACETOPHENONE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ANILINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ANTHRACENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
ARAMITE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
BENZO(A)ANTHRACENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	8
BENZO(A)PYRENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
BENZO(B)FLUORANTHENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	16
BENZO(G,H,I)PERYLENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
BENZO(K)FLUORANTHENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
BENZYL ALCOHOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
BIS(2-CHLOROETHOXY)METHANE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
BIS(2-CHLOROETHYL)ETHER	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
BIS(2-ETHYLHEXYL)PHTHALATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	440 J
BUTYL BENZYL PHTHALATE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
CHLOROBENZILATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
CHRYSENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	14
DI-N-BUTYL PHTHALATE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DI-N-OCTYL PHTHALATE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DIALLATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DIBENZO(A,H)ANTHRACENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
DIBENZOFURAN	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DIETHYL PHTHALATE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DIMETHYL PHTHALATE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
DIPHENYLAMINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ETHYL METHANE SULFONATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
FLUORANTHENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	11
FLUORENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
HEXACHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
HEXACHLOROBUTADIENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
HEXACHLOROCYCLOPENTADIENE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
HEXACHLOROETHANE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ

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SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB12	12SB12	12SB13	12SB13	12SB13	12SB14	12SB14	12SB14
Sample Number	12SS120002	12SB120204	12SS130002	12SB130204	12SB130607	12SS140002	12SB140204	12SB140607
Sample Date	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04
Sample Interval (feet)	0 - 2	2 - 4	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 7
HEXACHLOROPROPENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
INDENO(1,2,3-CD)PYRENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
ISODRIN	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ISOPHORONE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
ISOSAFROLE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
KEPONE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
METHAPYRILENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
METHYL METHANE SULFONATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSO-DI-N-BUTYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSO-DI-N-PROPYLAMINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSODIETHYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSODIMETHYLAMINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSODIPHENYLAMINE	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSOMETHYLETHYLAMINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSOMORPHOLINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSOPIPERIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
N-NITROSOPYRROLIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
NAPHTHALENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
O,O,O-TRIETHYL PHOSPHOROTHIOATE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
O-TOLUIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
P-(DIMETHYLAMINO)AZOBENZENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PENTACHLOROBENZENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PENTACHLOROETHANE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PENTACHLORONITROBENZENE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PHENACETIN	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PHENANTHRENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
PHENOL	77.5 UJ	74.9 UJ	74.4 UJ	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PRONAMIDE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
PYRENE	3.82 U	3.69 U	3.66 U	3.71 U	3.76 U	3.76 U	3.7 U	3.81 U
PYRIDINE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	75.2 UJ
SAFROLE	77.5 UJ	74.9 UJ	74.4 U	75.4 UJ	76.3 UJ	76.4 UJ	75.2 UJ	77.4 UJ
Explosives (mg/kg)								
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parar[illegible] not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB12	12SB12	12SB13	12SB13	12SB13	12SB14	12SB14	12SB14
Sample Number	12SS120002	12SB120204	12SS130002	12SB130204	12SB130607	12SS140002	12SB140204	12SB140607
Sample Date	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04	08/13/04
Sample Interval (feet)	0 - 2	2 - 4	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 7
RDX	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Herbicides (ug/kg)								
HEXACHLOROPHENE	0.983 U	0.951 U	0.943 U	0.956 U	0.968 U	0.969 U	0.954 U	0.982 U
PENTACHLOROPHENOL	0.52 U	0.503 U	0.499 U	0.506 U	0.513 U	0.513 U	0.505 U	0.52 U
Inorganics (mg/kg)								
ALUMINUM	15300 J	12700 J	15300 J	16300 J	20100 J	20000 J	15400 J	24700 J
ANTIMONY	0.20 U	0.10 U	0.26 U	0.19 U	0.31 J	0.12 U	0.30 J	0.18 U
ARSENIC	2.8 J	0.95 J	4.1 J	1.9 J	2.8 J	2.6 J	3.6 J	2.2 J
BARIUM	76.5 J	49.6 J	54.1 J	32.0 J	40.8 J	104 J	53.8 J	109 J
BERYLLIUM	1.1 J	1.1 J	1.5 J	1.4 J	1.6 J	1.5 J	1.7 J	1.4 J
CADMIUM	0.23 U	0.12 U	0.47 U	0.29 U	0.32 U	0.23 U	0.20 U	0.17 U
CALCIUM	644 J	557 J	877 J	492 J	726 J	859 J	578 J	713 J
CHROMIUM	22.4 J	18.6 J	40.3 J	33.4 J	38.0 J	36.1 J	29.8 J	35.7 J
COBALT	5.8 J	10.8 J	7.2 J	24.2 J	4.6 J	7.7 J	8.6 J	4.3 J
COPPER	8.7 J	7.8 J	22.9 J	15.3 J	23.9 J	9.8 J	7.3 J	5.4 J
IRON	7160 J	26600 J	65900 J	93300 J	60000 J	16700 J	32000 J	6580 J
LEAD	10.6 J	20.4 J	30.7 J	25.4 J	19.7 J	8.3 J	14.0 J	14.2 J
MAGNESIUM	1280 J	824 J	940 J	904 J	1150 J	1660 J	946 J	1550 J
MANGANESE	68.7 J	299 J	200 J	796 J	65.1 J	157 J	191 J	22.6 J
MERCURY	0.007 U	0.007 U	0.02 J	0.007 U	0.068 J	0.007 U	0.007 U	0.007 U
NICKEL	25.4 J	39.7 J	44.6 J	72.6 J	25.0 J	31.7 J	32.0 J	24.0 J
POTASSIUM	2940 J	2340 J	2210 J	2640 J	3520 J	4370 J	2930 J	5130 J
SELENIUM	0.13 U	0.25 U	0.40 U	0.54 U	2.3 J	0.24 U	0.88 U	0.71 U
SILVER	0.042 U	0.043 U	0.042 U	0.044 U	0.26 U	0.045 U	0.046 U	0.06 U
SODIUM	153 U	191 U	109 U	140 U	235 U	136 U	155 U	246 U
THALLIUM	0.17 U	0.15 U	0.15 U	0.20 U	0.42 U	0.24 U	0.21 U	0.34 U
TIN	0.77 U	0.26 U	2.3 U	0.42 U	0.52 U	0.46 U	0.26 U	0.33 U
VANADIUM	21.6 J	23.0 J	33.5 J	23.9 J	20.6 J	26.0 J	25.3 J	26.9 J
ZINC	102 J	59.7 J	206 J	128 J	53.5 J	41.2 J	54.8 J	36.1 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB15	12SB15	12SB15	12SB18	12SB18	12SB18	12SB19	12SB19	12SB20
Sample Number	12SS150002	12SB150204	12SB150607	12SS180002	12SB180204	12SB180608	12SS190002	12SB190204	12SS200002
Sample Date	08/13/04	08/13/04	08/13/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04
Sample Interval (feet)	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 8	0 - 2	2 - 4	0 - 2
Volatile Organics (ug/kg)									
1,1,1,2-TETRACHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,1,1-TRICHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,1,2,2-TETRACHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,1,2-TRICHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,1-DICHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,1-DICHLOROETHENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,2,3-TRICHLOROPROPANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 UJ	1.08 U	1.14 U
1,2-DIBROMO-3-CHLOROPROPANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 UJ	1.08 U	1.14 U
1,2-DIBROMOETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,2-DICHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,2-DICHLOROPROPANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
1,4-DIOXANE	96.1 U	92.2 U	97.6 U	112 U	100 U	94.4 U	111 U	99.4 U	110 U
2-BUTANONE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
2-HEXANONE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
3-CHLOROPROPENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
4-METHYL-2-PENTANONE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
ACETONE	4 U	7 U	4 U	2 BU	3 BU	0.865 UJ	21 BU	3 BU	2 U
ACETONITRILE	38.4 U	36.9 U	39.1 U	44.9 U	40 U	37.8 U	44.5 U	39.7 U	44 U
ACROLEIN	0.961 UR	0.967 UR	1.01 UR	1.25 UR	1.13 UR	0.865 UR	1.14 UR	1.08 UR	1.14 UR
ACRYLONITRILE	0.961 U	0.967 U	1.01 U	1.25 UR	1.13 UR	0.865 UR	1.14 UR	1.08 UR	1.14 U
BENZENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
BROMODICHLOROMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
BROMOFORM	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
BROMOMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CARBON DISULFIDE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CARBON TETRACHLORIDE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLOROBENZENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLORODIBROMOMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLOROETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLOROFORM	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLOROMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CHLOROPRENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CIS-1,2-DICHLOROETHENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
CIS-1,3-DICHLOROPROPENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
DIBROMOMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
DICHLORODIFLUOROMETHANE	7 J	6 J	4 J	1.25 U	1.13 U	0.865 U	2 J	3 J	1.14 UJ
ETHYL METHACRYLATE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
ETHYLBENZENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
ISOBUTANOL	38.4 U	36.9 U	39.1 U	44.9 U	40 U	37.8 U	44.5 U	39.7 U	44 U
METHACRYLONITRILE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
METHYL IODIDE	0.961 U	0.967 U	1.01 U	1.25 UJ	1.13 UJ	0.865 UJ	1.14 UJ	1.08 UJ	1.14 UJ
METHYL METHACRYLATE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
METHYLENE CHLORIDE	0.961 UJ	0.967 UJ	1.01 UJ	1.25 UJ	1.13 UJ	0.865 UJ	1.14 UJ	1.08 UJ	1.14 UJ

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB15	12SB15	12SB15	12SB18	12SB18	12SB18	12SB19	12SB19	12SB20
Sample Number	12SS150002	12SB150204	12SB150607	12SS180002	12SB180204	12SB180608	12SS190002	12SB190204	12SS200002
Sample Date	08/13/04	08/13/04	08/13/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04
Sample Interval (feet)	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 8	0 - 2	2 - 4	0 - 2
PROPIONITRILE	38.4 U	36.9 U	39.1 U	44.9 U	40 U	37.8 U	44.5 U	39.7 U	44 U
STYRENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TETRACHLOROETHENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TOLUENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TOTAL XYLENES	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TRANS-1,2-DICHLOROETHENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TRANS-1,3-DICHLOROPROPENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TRANS-1,4-DICHLORO-2-BUTENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TRICHLOROETHENE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
TRICHLOROFLUOROMETHANE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
VINYL ACETATE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
VINYL CHLORIDE	0.961 U	0.967 U	1.01 U	1.25 U	1.13 U	0.865 U	1.14 U	1.08 U	1.14 U
Semivolatile Organics (ug/kg)									
1,2,4,5-TETRACHLOROBENZENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,2,4-TRICHLOROBENZENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,2-DICHLOROBENZENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,3-DICHLOROBENZENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,4-DICHLOROBENZENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,4-NAPHTHOQUINONE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1,4-PHENYLENEDIAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
1-NAPHTHYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,2'-OXYBIS(1-CHLOROPROPANE)	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,3,4,6-TETRACHLOROPHENOL	77.5 U	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,4,5-TRICHLOROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,4,6-TRICHLOROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,4-DICHLOROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,4-DIMETHYLPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UR	72.4 U	73.6 U
2,4-DINITROPHENOL	77.5 UR	75.4 UR	78.8 UR	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2,6-DICHLOROPHENOL	77.5 U	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-ACETYLAMINOFLUORENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-CHLORONAPHTHALENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-CHLOROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-METHYLNAPHTHALENE	3.82 U	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
2-METHYLPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UJ	72.4 U	73.6 U
2-NAPHTHYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-NITROANILINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-NITROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
2-PICOLINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
3&4-METHYLPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UJ	72.4 U	73.6 U
3,3'-DICHLOROBENZIDINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UR	72.4 U	73.6 U
3,3'-DIMETHYLBENZIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
3-METHYLCHOLANTHRENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
3-NITROANILINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UR	72.4 U	73.6 U
4,6-DINITRO-2-METHYLPHENOL	77.5 UR	75.4 UR	78.8 UR	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB15	12SB15	12SB15	12SB18	12SB18	12SB18	12SB19	12SB19	12SB20
Sample Number	12SS150002	12SB150204	12SB150607	12SS180002	12SB180204	12SB180608	12SS190002	12SB190204	12SS200002
Sample Date	08/13/04	08/13/04	08/13/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04
Sample Interval (feet)	0 - 2	2 - 4	5 - 7	0 - 2	2 - 4	6 - 8	0 - 2	2 - 4	0 - 2
4-AMINOBIPHENYL	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-BROMOPHENYL PHENYL ETHER	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-CHLORO-3-METHYLPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-CHLOROANILINE	77.5 UR	75.4 UR	78.8 UR	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-CHLOROPHENYL PHENYL ETHER	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-NITROANILINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-NITROPHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
4-NITROQUINOLINE-1-OXIDE	77.5 UR	75.4 UR	78.8 UR	73.7 UR	72.9 UR	76.2 UR	74.6 UR	72.4 UR	73.6 UR
5-NITRO-O-TOLUIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
A,A-DIMETHYLPHENETHYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
ACENAPHTHENE	4 J	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
ACENAPHTHYLENE	19	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
ACETOPHENONE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
ANILINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
ANTHRACENE	21	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
ARAMITE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
BENZO(A)ANTHRACENE	98	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
BENZO(A)PYRENE	110	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
BENZO(B)FLUORANTHENE	150	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
BENZO(G,H,I)PERYLENE	93	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
BENZO(K)FLUORANTHENE	90	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
BENZYL ALCOHOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
BIS(2-CHLOROETHOXY)METHANE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
BIS(2-CHLOROETHYL)ETHER	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
BIS(2-ETHYLHEXYL)PHTHALATE	1300	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
BUTYL BENZYL PHTHALATE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
CHLOROBENZILATE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
CHRYSENE	100	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
DI-N-BUTYL PHTHALATE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DI-N-OCTYL PHTHALATE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DIALLATE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DIBENZO(A,H)ANTHRACENE	21	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
DIBENZOFURAN	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DIETHYL PHTHALATE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DIMETHYL PHTHALATE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
DIPHENYLAMINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UR	72.4 U	73.6 U
ETHYL METHANE SULFONATE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
FLUORANTHENE	140	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
FLUORENE	4 J	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
HEXACHLOROBENZENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
HEXACHLOROBUTADIENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
HEXACHLOROCYCLOPENTADIENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 UJ	72.9 UJ	76.2 UJ	74.6 UJ	72.4 UJ	73.6 UJ
HEXACHLOROETHANE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB15	12SB15	12SB15	12SB18	12SB18	12SB18	12SB19	12SB19	12SB20
Sample Number	12SS150002	12SB150204	12SB150607	12SS180002	12SB180204	12SB180608	12SS190002	12SB190204	12SS200002
Sample Date	08/13/04	08/13/04	08/13/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04
Sample Interval (feet)	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 8	0 - 2	2 - 4	0 - 2
HEXACHLOROPROPENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
INDENO(1,2,3-CD)PYRENE	80	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
ISODRIN	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
ISOPHORONE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
ISOSAFROLE	77.5 U	75.4 U	78.8 UJ	8400	690	76.2 U	2300	260 J	73.6 U
KEPONE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 UJ	72.9 UJ	76.2 UJ	74.6 UJ	72.4 UJ	73.6 UJ
METHAPYRILENE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
METHYL METHANE SULFONATE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSO-DI-N-BUTYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSO-DI-N-PROPYLAMINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSODIETHYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSODIMETHYLAMINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSODIPHENYLAMINE	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 UR	72.4 U	73.6 U
N-NITROSOMETHYLETHYLAMINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSOMORPHOLINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSOPIPERIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
N-NITROSOPYRROLIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
NAPHTHALENE	4 J	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
O,O,O-TRIETHYL PHOSPHOROTHIOATE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
O-TOLUIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
P-(DIMETHYLAMINO)AZOBENZENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PENTACHLOROBENZENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PENTACHLOROETHANE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PENTACHLORONITROBENZENE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PHENACETIN	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PHENANTHRENE	30	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
PHENOL	77.5 UJ	75.4 UJ	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PRONAMIDE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
PYRENE	180	3.71 U	3.88 U	3.63 U	3.59 U	3.75 U	3.67 U	3.56 U	3.63 U
PYRIDINE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
SAFROLE	77.5 U	75.4 U	78.8 UJ	73.7 U	72.9 U	76.2 U	74.6 U	72.4 U	73.6 U
Explosives (mg/kg)									
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U

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R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB15	12SB15	12SB15	12SB18	12SB18	12SB18	12SB19	12SB19	12SB20
Sample Number	12SS150002	12SB150204	12SB150607	12SS180002	12SB180204	12SB180608	12SS190002	12SB190204	12SS200002
Sample Date	08/13/04	08/13/04	08/13/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04	08/15/04
Sample Interval (feet)	0 - 2	2 - 4	6 - 7	0 - 2	2 - 4	6 - 8	0 - 2	2 - 4	0 - 2
RDX	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
TETRYL	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Herbicides (ug/kg)									
HEXACHLOROPHENE	0.984 U	0.956 U	1 U	0.935 U	0.925 U	0.967 U	0.947 U	0.918 U	0.934 U
PENTACHLOROPHENOL	0.521 U	0.506 U	0.529 U	0.495 U	0.49 U	0.512 U	0.501 U	0.486 U	0.495 U
Inorganics (mg/kg)									
ALUMINUM	18000 J	16200 J	24200 J	17300	18700	17300	23700	18700	15200
ANTIMONY	0.38 J	0.22 U	0.12 U	0.95 U	0.88 U	0.43 U	0.51 U	1.2 U	0.35 U
ARSENIC	4.4 J	2.7 J	1.8 J	7.1 J	5.1 J	2.0 J	9.2 J	6.4 J	5.7 J
BARIUM	71.6 J	33.7 J	96.8 J	166 J	47.3 J	44.8 J	112 J	67.7 J	86.0 J
BERYLLIUM	0.97 J	1.4 J	1.6 J	0.77 J	0.75 J	1.6	0.80 J	0.51 J	0.72 J
CADMIUM	0.26 U	0.19 U	0.17 U	0.30 U	0.19 U	0.19 U	0.32 U	0.31 U	0.20 U
CALCIUM	17800 J	658 J	902 J	1800 J	439 J	1160 J	883 J	645 J	299 J
CHROMIUM	30.3 J	34.1 J	38.8 J	20.0 J	27.3 J	30.5 J	22.5 J	20.5 J	19.6 J
COBALT	5.0 J	13.1 J	11.3 J	11.5 J	3.9 J	13.1 J	9.1 J	4.4 J	10.4 J
COPPER	9.9 J	8.1 J	22.5 J	10.6 J	7.4 J	18.7 J	15.8 J	10.6 J	9.1 J
IRON	15900 J	81400 J	43500 J	16800 J	28700 J	34000 J	23200 J	19400 J	16500 J
LEAD	8.2 J	17.4 J	19.4 J	15.6 J	14.3 J	19.1 J	15.6 J	10.8 J	14.1 J
MAGNESIUM	2050 J	896 J	1490 J	1930 J	1450 J	1550 J	2430 J	1910 J	1630 J
MANGANESE	90.6 J	397 J	205 J	938 J	81.4 J	56.8 J	352 J	143 J	717 J
MERCURY	0.009 J	0.008 J	0.014 J	0.014 J	0.007 UR	0.008 J	0.034 J	1.0 J	0.032 J
NICKEL	19.8 J	48.3 J	43.6 J	16.4 J	10.7 J	34.8 J	18.1 J	11.7 J	14.0 J
POTASSIUM	3570 J	2520 J	4550 J	1540 J	1280 J	3250 J	1730 J	1490 J	1090 J
SELENIUM	0.56 U	0.33 U	0.43 U	0.45 U	0.18 U	0.67 J	0.45 U	0.30 U	0.28 U
SILVER	0.08 U	0.041 U	0.044 U	0.08 U	0.04 U	0.042 U	0.042 U	0.18 U	0.043 U
SODIUM	132 U	141 U	229 U	37.0 U	56.8 J	361 J	31.6 U	37.4 U	20.5 U
THALLIUM	0.23 U	0.20 U	0.28 U	0.33 U	0.21 U	0.23 U	0.34 U	0.31 U	0.23 U
TIN	0.52 U	0.30 U	0.37 U	0.49 U	0.37 U	0.44 U	0.56 U	0.52 U	0.46 U
VANADIUM	29.3 J	25.2 J	30.0 J	35.9 J	33.3 J	25.5 J	42.8 J	34.0 J	30.9 J
ZINC	31.0 J	61.0 J	63.3 J	52.1 J	17.9 J	61.6 J	63.9 J	30.9 J	35.5 J

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Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB20	12SB20	12SB21	12SB22	12SB23	12SB24
Sample Number	12SB200204	12SB200608	12SS210002	12SS220002	12SS230002	12SS240002
Sample Date	08/15/04	08/15/04	09/21/04	09/21/04	09/21/04	09/21/04
Sample Interval (feet)	2 - 4	6 - 8	0 - 2	0 - 2	0 - 2	0 - 2
Volatile Organics (ug/kg)						
1,1,1,2-TETRACHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,1,1-TRICHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,1,2,2-TETRACHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,1,2-TRICHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,1-DICHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,1-DICHLOROETHENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,2,3-TRICHLOROPROPANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,2-DIBROMO-3-CHLOROPROPANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,2-DIBROMOETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,2-DICHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,2-DICHLOROPROPANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
1,4-DIOXANE	105 U	98.2 U	76.7 UJ	94.9 U	151 U	135 U
2-BUTANONE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
2-HEXANONE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
3-CHLOROPROPENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
4-METHYL-2-PENTANONE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
ACETONE	6 U	2 BU	1.6 U	1.04 U	1.3 U	2 U
ACETONITRILE	42.1 U	39.3 U	30.7 UJ	38 U	60.2 U	54 U
ACROLEIN	0.92 UR	0.971 UR	1.6 U	1.04 U	1.3 U	0.918 U
ACRYLONITRILE	0.92 U	0.971 UR	1.6 U	1.04 U	1.3 U	0.918 U
BENZENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
BROMODICHLOROMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
BROMOFORM	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
BROMOMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CARBON DISULFIDE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CARBON TETRACHLORIDE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLOROBENZENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLORODIBROMOMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLOROETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLOROFORM	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLOROMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CHLOROPRENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CIS-1,2-DICHLOROETHENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
CIS-1,3-DICHLOROPROPENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
DIBROMOMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
DICHLORODIFLUOROMETHANE	0.92 UJ	4	15	10	14	5
ETHYL METHACRYLATE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
ETHYLBENZENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
ISOBUTANOL	42.1 U	39.3 U	30.7 UJ	38 U	60.2 U	54 U
METHACRYLONITRILE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
METHYL IODIDE	0.92 UJ	0.971 UJ	1.6 U	1.04 U	1.3 U	0.918 U
METHYL METHACRYLATE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
METHYLENE CHLORIDE	0.92 UJ	0.971 UJ	1.6 UJ	2 J	2 J	1 J

U - Parameter not detected at identified concentration.
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R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB20	12SB20	12SB21	12SB22	12SB23	12SB24
Sample Number	12SB200204	12SB200608	12SS210002	12SS220002	12SS230002	12SS240002
Sample Date	08/15/04	08/15/04	09/21/04	09/21/04	09/21/04	09/21/04
Sample Interval (feet)	2 - 4	6 - 8	0 - 2	0 - 2	0 - 2	0 - 2
PROPIONITRILE	42.1 U	39.3 U	30.7 UJ	38 U	60.2 U	54 U
STYRENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TETRACHLOROETHENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TOLUENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TOTAL XYLENES	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TRANS-1,2-DICHLOROETHENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TRANS-1,3-DICHLOROPROPENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TRANS-1,4-DICHLORO-2-BUTENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TRICHLOROETHENE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
TRICHLOROFLUOROMETHANE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
VINYL ACETATE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
VINYL CHLORIDE	0.92 U	0.971 U	1.6 U	1.04 U	1.3 U	0.918 U
Semivolatile Organics (ug/kg)						
1,2,4,5-TETRACHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,2,4-TRICHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,2-DICHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,3-DICHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,4-DICHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,4-NAPHTHOQUINONE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1,4-PHENYLENEDIAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
1-NAPHTHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,2'-OXYBIS(1-CHLOROPROPANE)	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,3,4,6-TETRACHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,4,5-TRICHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,4,6-TRICHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,4-DICHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,4-DIMETHYLPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,4-DINITROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2,6-DICHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-ACETYLAMINOFLUORENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-CHLORONAPHTHALENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-CHLOROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-METHYLNAPHTHALENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
2-METHYLPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-NAPHTHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-NITROANILINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-NITROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
2-PICOLINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
3&4-METHYLPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
3,3'-DICHLOROBENZIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
3,3'-DIMETHYLBENZIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
3-METHYLCHOLANTHRENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
3-NITROANILINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4,6-DINITRO-2-METHYLPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ

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Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB20	12SB20	12SB21	12SB22	12SB23	12SB24
Sample Number	12SB200204	12SB200608	12SS210002	12SS220002	12SS230002	12SS240002
Sample Date	08/15/04	08/15/04	09/21/04	09/21/04	09/21/04	09/21/04
Sample Interval (feet)	2 - 4	6 - 8	0 - 2	0 - 2	0 - 2	0 - 2
4-AMINOBIPHENYL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-BROMOPHENYL PHENYL ETHER	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-CHLORO-3-METHYLPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-CHLOROANILINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-CHLOROPHENYL PHENYL ETHER	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-NITROANILINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-NITROPHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
4-NITROQUINOLINE-1-OXIDE	73.4 UR	75.6 UR	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
5-NITRO-O-TOLUIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
A,A-DIMETHYLPHENETHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ACENAPHTHENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
ACENAPHTHYLENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
ACETOPHENONE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ANILINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ANTHRACENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
ARAMITE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
BENZO(A)ANTHRACENE	3.61 U	3.72 U	5 J	14	16	8
BENZO(A)PYRENE	3.61 U	3.72 U	3.47 U	14	17	12
BENZO(B)FLUORANTHENE	3.61 U	3.72 U	54	13	17	19
BENZO(G,H,I)PERYLENE	3.61 U	3.72 U	13	14	13	25
BENZO(K)FLUORANTHENE	3.61 U	3.72 U	6 J	11	10	4 J
BENZYL ALCOHOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
BIS(2-CHLOROETHOXY)METHANE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
BIS(2-CHLOROETHYL)ETHER	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
BIS(2-ETHYLHEXYL)PHTHALATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
BUTYL BENZYL PHTHALATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
CHLOROBENZILATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
CHRYSENE	3.61 U	3.72 U	110	14	16	12
DI-N-BUTYL PHTHALATE	73.4 U	75.6 U	170 J	75.7 UJ	76.4 UJ	74.1 UJ
DI-N-OCTYL PHTHALATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
DIALLATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
DIBENZO(A,H)ANTHRACENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
DIBENZOFURAN	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
DIETHYL PHTHALATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
DIMETHYL PHTHALATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
DIPHENYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ETHYL METHANE SULFONATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
FLUORANTHENE	3.61 U	3.72 U	45	13	23	11
FLUORENE	3.61 U	3.72 U	3.47 U	3.73 U	3.76 U	3.65 U
HEXACHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
HEXACHLOROBUTADIENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
HEXACHLOROCYCLOPENTADIENE	73.4 UJ	75.6 UJ	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
HEXACHLOROETHANE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ

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J - Reported concentration estimated.
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NA - Parameter not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB20	12SB20	12SB21	12SB22	12SB23	12SB24
Sample Number	12SB200204	12SB200608	12SS210002	12SS220002	12SS230002	12SS240002
Sample Date	08/15/04	08/15/04	09/21/04	09/21/04	09/21/04	09/21/04
Sample Interval (feet)	2 - 4	6 - 8	0 - 2	0 - 2	0 - 2	0 - 2
HEXACHLOROPROPENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
INDENO(1,2,3-CD)PYRENE	3.61 U	3.72 U	11	11	11	17
ISODRIN	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ISOPHORONE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
ISOSAFROLE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
KEPONE	73.4 UJ	75.6 UJ	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
METHAPYRILENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
METHYL METHANE SULFONATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSO-DI-N-BUTYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSO-DI-N-PROPYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSODIETHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSODIMETHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSODIPHENYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSOMETHYLETHYLAMINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSOMORPHOLINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSOPIPERIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
N-NITROSOPYRROLIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
NAPHTHALENE	3.61 U	3.72 U	38	7 J	3.76 U	3.65 U
O,O,O-TRIETHYL PHOSPHOROTHIOATE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
O-TOLUIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
P-(DIMETHYLAMINO)AZOBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PENTACHLOROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PENTACHLOROETHANE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PENTACHLORONITROBENZENE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PHENACETIN	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PHENANTHRENE	3.61 U	3.72 U	140 J	9 J	15 J	11 J
PHENOL	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PRONAMIDE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
PYRENE	3.61 U	3.72 U	22	22	36	19
PYRIDINE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
SAFROLE	73.4 U	75.6 U	70.4 UJ	75.7 UJ	76.4 UJ	74.1 UJ
Explosives (mg/kg)						
1,3,5-TRINITROBENZENE	0.25 U	0.25 U	0.84	0.25 U	0.25 U	0.25 U
1,3-DINITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4,6-TRINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-AMINO-4,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
3-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-AMINO-2,6-DINITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-NITROTOLUENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	0.25 U	0.25 U	1.7	0.25 U	0.25 U	0.25 U
NITROBENZENE	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U

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NA - Param[illegible] not analyzed for identified sample.

Table A-1
2004 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB20	12SB20	12SB21	12SB22	12SB23	12SB24
Sample Number	12SB200204	12SB200608	12SS210002	12SS220002	12SS230002	12SS240002
Sample Date	08/15/04	08/15/04	09/21/04	09/21/04	09/21/04	09/21/04
Sample Interval (feet)	2 - 4	6 - 8	0 - 2	0 - 2	0 - 2	0 - 2
RDX	0.25 U	0.25 U	6.1	0.25 U	0.25 U	0.25 U
TETRYL	0.25 U	0.25 U	0.25 UJ	0.25 UJ	0.25 UJ	0.25 UJ
Herbicides (ug/kg)						
HEXACHLOROPHENE	0.931 U	0.959 U	0.893 U	0.96 U	0.969 U	0.94 U
PENTACHLOROPHENOL	0.493 U	0.508 U	0.473 U	0.508 U	0.513 U	0.498 U
Inorganics (mg/kg)						
ALUMINUM	14900	13400	8780 J	13200 J	18700 J	19600 J
ANTIMONY	0.24 U	0.35 U	3610 J	11.4 J	34.1 J	213 J
ARSENIC	3.9 J	3.1 J	94.2 J	5.4 J	7.6 J	158 J
BARIUM	792 J	57.1 J	505 J	313 J	147 J	97.3 J
BERYLLIUM	0.53 J	1.3	0.35 U	0.96 U	0.96 U	1 U
CADMIUM	0.16 U	0.24 U	5.8 J	6.3 J	0.81 U	0.75 U
CALCIUM	287 J	539 J	5400 J	9150 J	2550 J	7590 J
CHROMIUM	23.5 J	30.2 J	48.5 J	50.2 J	18.3 J	51.7 J
COBALT	3.3 J	16.0 J	6.2 J	13.6 J	12.9 J	12 J
COPPER	8.2 J	10.8 J	345 J	292 J	26.2 J	27.9 J
IRON	21300 J	46400 J	29500 J	32200 J	18700 J	51200 J
LEAD	13.1 J	15.8 J	429000 J	506 J	3230 J	366 J
MAGNESIUM	1310 J	1460 J	1720 J	2750 J	1580 J	1710 J
MANGANESE	88.6 J	174 J	516	1340	1400	451
MERCURY	0.008 J	0.011 J	0.31	0.069 J	0.042 J	0.034 J
NICKEL	10.7 J	51.4 J	17.3 J	30.5 J	15.9 J	23.9 J
POTASSIUM	1010 J	2110 J	558 J	2000 J	1160 J	1980 J
SELENIUM	0.13 U	0.32 U	0.29 U	0.37 U	0.49 J	0.61 J
SILVER	0.04 U	0.041 U	18.5 J	0.72 U	0.24 U	0.08 U
SODIUM	65.7 J	505 J	298 J	370 J	51 U	78.2 J
THALLIUM	0.18 U	0.19 U	6.4 J	0.18 U	0.29 U	0.23 U
TIN	0.37 U	0.37 U	838 J	90.7 J	12.4 J	45.2 J
VANADIUM	30.0 J	30.0 J	16.8 J	23.5 J	31.4 J	42.7 J
ZINC	17.8 J	46.4 J	2050 J	2490 J	156 J	206 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-2
2005 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB22	12SB24	12SB25	12SB25	12SB25	12SB26	12SB26	12SB27	12SB27
Sample Number	12SB220204	12SB240204	12SS250001	12SB250204	12SB250405	12SS260001	12SB260204	12SS270001	12SB270103
Sample Date	11/01/05	11/01/05	10/31/05	11/01/05	11/01/05	10/31/05	11/01/05	10/31/05	11/01/05
Sample Interval (feet)	2 - 4	2 - 4	0 - 1	2 - 4	4 - 5	0 - 1	2 - 4	0 - 1	1 - 3
Inorganics (mg/kg)									
ALUMINUM	16000	14400	12500 J	12200 J	12000	12700 J	10900	13100	9350
ANTIMONY	0.73 U	0.30 U	3.8 J	0.38 U	0.17 U	4.4 J	0.16 U	0.77 U	0.24 U
ARSENIC	45.2 J	2 J	7.7 J	9 J	2.5 J	12.3 J	1.1 J	4.5 J	2.9 J
BARIUM	45.1 J	40.9 J	263 J	47.9 J	30.5 J	217 J	41.6 J	63.9 J	47.9 J
BERYLLIUM	2.3 J	1.5 J	0.71 J	1.6 J	0.98 J	0.80 J	1 J	0.47 J	0.79 J
CADMIUM	0.10 J	0.05 J	20.2 J	0.23 U	0.18 U	49.3 J	0.16 U	0.8	0.07 J
CALCIUM	645 J	672 J	5730 J	612 J	685 J	2710 J	616 J	3040 J	370 J
CHROMIUM	49.5 J	25.4 J	122 J	31.5 J	24.7 J	78.7 J	20 J	24.1 J	26.7 J
COBALT	4.7 J	5.6 J	14.3 J	59.1 J	6.2 J	14 J	4 J	3 J	1.5 J
COPPER	18.2 J	6.9 J	903 J	14.5 J	11.7 J	1460 J	11.6 J	115 J	13.3 J
IRON	67600 J	30200 J	61100 J	39100 J	25400 J	59000 J	35000 J	23100 J	24000 J
LEAD	23.5 J	11.3 J	627 J	15 J	14.6 J	989 J	10.6 J	132 J	10.5 J
MAGNESIUM	1010 J	924 J	1610 J	976 J	939 J	1500 J	803 J	1010 J	717 J
MANGANESE	227 J	123 J	1650 J	519 J	108 J	9680 J	77.4 J	239 J	25.4 J
NICKEL	38 J	31.5 J	27.6	33.6	24.9 J	30.7	30.1 J	12.8 J	12.1 J
POTASSIUM	2730 J	2290 J	1300 J	2570 J	2270 J	1570 J	1880 J	943 J	1550 J
SELENIUM	1.9	0.52	0.54	0.6	0.51	0.74	0.42 J	0.31 J	0.19 J
SILVER	0.043 U	0.041 U	0.9	0.045 U	0.042 U	1.8	0.044 U	0.14 J	0.044 U
SODIUM	170 U	208 U	165 U	175 U	182 J	119 U	171 J	34.5 U	20.6 U
THALLIUM	0.22 U	0.18 U	0.27 U	0.29 U	0.23 U	0.26 U	0.23 U	0.16 U	0.15 U
VANADIUM	28.3 J	18.9 J	23.8 J	29.4 J	16.6 J	26 J	21.7 J	23 J	18.5 J
ZINC	96.8 J	58.8 U	5110 J	35.5 J	34.4 J	23100 J	40.9 J	296 J	16.2 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-2
2005 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB28	12SB28	12SB28	12SB29	12SB29	12SB29	12SB30	12SB30	12SB30
Sample Number	12SS280001	12SB280204	12SB280405	12SS290001	12SB290204	12SB290405	12SS300001	12SB300204	12SB300405
Sample Date	10/31/05	11/01/05	11/01/05	10/31/05	11/01/05	11/01/05	10/31/05	11/01/05	11/01/05
Sample Interval (feet)	0 - 1	2 - 4	4 - 5	0 - 1	2 - 4	4 - 5	0 - 1	2 - 4	4 - 5
Inorganics (mg/kg)									
ALUMINUM	14600	15700	9230	12700	13400	14500	22700	19200	14100
ANTIMONY	20.1 J	0.38 U	0.11 U	0.41 U	0.45 U	0.13 U	11 J	0.38 U	0.18 U
ARSENIC	4 J	9.4 J	1.2 J	5.1 J	17 J	0.71 J	11.3 J	5.4 J	3 J
BARIUM	154 J	95.2 J	26 J	79.6 J	45.9 J	42.3 J	119 J	40.1 J	47.3 J
BERYLLIUM	1.2 J	2.9 J	2 J	0.40 J	1.7 J	0.87 J	0.67 J	0.50 J	0.99 J
CADMIUM	1.7	0.17 J	0.21 U	0.37 J	0.14 J	0.17 U	2	0.13 J	0.18 U
CALCIUM	2850 J	503 J	427 J	182000 J	496 J	499 J	4510 J	192 J	333 J
CHROMIUM	59.7 J	32.1 J	25.6 J	18.5 J	31 J	22 J	50.2 J	33.3 J	33.4 J
COBALT	13 J	22 J	14.1 J	3.2 J	9.5 J	13.2 J	4.7 J	1.7 J	2.4 J
COPPER	65.2 J	10.9 J	11.6 J	10.7 J	30.4 J	3.9 J	138 J	8.8 J	19 J
IRON	26100 J	125000 J	36400 J	13600 J	54300 J	15600 J	45800 J	27100 J	45900 J
LEAD	1410 J	18.2 J	18.9 J	13.9 J	18 J	9.5 J	439 J	10 J	13.3 J
MAGNESIUM	1410 J	836 J	602 J	13200 J	871 J	907 J	1630 J	1160 J	893 J
MANGANESE	752 J	831 J	326 J	231 J	243 J	136 J	642 J	12.7 J	81.2 J
NICKEL	32.9 J	78 J	54.4 J	11.5 J	36.3 J	17 J	24.1 J	9 J	14.5 J
POTASSIUM	2810 J	2160 J	1720 J	1300 J	2150 J	2510 J	1050 J	1500 J	2010 J
SELENIUM	0.41 J	0.85	0.34 J	0.30 J	0.95	0.30 J	0.41 J	0.19 J	0.36 J
SILVER	0.24 J	0.047 U	0.045 U	0.045 U	0.044 U	0.048 U	0.22 J	0.044 U	0.046 U
SODIUM	126 U	67.2 U	102 J	113 U	95.7 U	151 J	59.3 U	22.7 U	108 J
THALLIUM	0.22 U	0.21 U	0.17 U	0.18 U	0.22 U	0.21 U	0.24 U	0.24 U	0.20 U
VANADIUM	24.3 J	43.5 J	17.6 J	25.7 J	27.8 J	18 J	48.3 J	39.6 J	22.3 J
ZINC	2780 J	93.4 J	58.7 U	41.5 J	85.3 J	27.3 J	1590 J	12.2 J	22.3 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-2
2005 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB31	12SB31	12SB32	12SB32	12SB33	12SB33	12SB33	12SB34	12SB34
Sample Number	12SS310001	12SB310204	12SS320001	12SB320103	12SS330001	12SB330204	12SB330406	12SS340001	12SB340204
Sample Date	10/31/05	11/01/05	10/31/05	11/01/05	10/31/05	11/01/05	11/01/05	10/31/05	11/01/05
Sample Interval (feet)	0 - 1	2 - 4	0 - 1	1 - 3	0 - 1	2 - 4	4 - 6	0 - 1	2 - 4
Inorganics (mg/kg)									
ALUMINUM	12400	13300	23600	12700	21300	16800	28100	13900	12800
ANTIMONY	6.6 J	0.21 U	0.50 U	0.26 U	1.9 J	0.57 U	8.1 J	1.4 J	0.27 U
ARSENIC	1.7 J	2.3 J	5.3 J	2.4 J	8.9 J	12.8 J	7.6 J	15.1 J	2.3 J
BARIUM	54.1 J	29.6 J	97.7 J	208 J	111 J	91.1 J	281 J	104 J	34.2 J
BERYLLIUM	1.2 J	2 J	0.66 J	0.32 J	0.82 J	0.85 J	0.69 J	1.7 J	1.5 J
CADMIUM	0.40 J	0.16 J	0.59	0.08 J	0.88	0.45	73.2 J	1.2	0.15 J
CALCIUM	1090 J	446 J	18600 J	330 J	4980 J	1790 J	5010 J	1740 J	523 J
CHROMIUM	27.9 J	33 J	24.8 J	21.7 J	28.7 J	20.3 J	116 J	36.9 J	25.9 J
COBALT	4.8 J	23.4 J	5.7 J	1.3 J	8.6 J	13.7 J	7.7 J	13.8 J	6.1 J
COPPER	25.6 J	12.9 J	34.9 J	4.3 J	46.7 J	15.3 J	1100 J	60 J	7.7 J
IRON	13600 J	90200 J	19000 J	11800 J	25800 J	30300 J	33300 J	32000 J	44900 J
LEAD	54.6 J	15 J	34.4 J	9.4 J	155 J	26.3 J	1440 J	142 J	13.6 J
MAGNESIUM	1130 J	773 J	2180 J	901 J	2230 J	2060 J	2090 J	1070 J	945 J
MANGANESE	140 J	520 J	551 J	13.9 J	637 J	844 J	552 J	525 J	181 J
NICKEL	22.4 J	83.2 J	15.2 J	5.8 J	22.4 J	19.2 J	254 J	33.6 J	30.6 J
POTASSIUM	2660 J	2070 J	1180 J	830 J	1520 J	1370 J	1650 J	2570 J	2250 J
SELENIUM	0.29 J	1.1	0.31 J	0.12 J	0.46 J	0.31 J	0.31 J	0.54	0.55
SILVER	0.044 U	0.044 U	0.10 J	0.044 U	0.08 J	0.04 U	1.3	0.12 J	0.05 J
SODIUM	64.3 U	93.1 U	53.6 U	3.36 U	65.2 U	3.09 U	556 J	65.9 U	71.5 U
THALLIUM	0.16 U	0.18 U	0.29 U	0.16 U	0.28 U	0.24 U	0.28 U	0.23 U	0.23 U
VANADIUM	19.9 J	23.5 J	35.3 J	23.6 J	35.7 J	30.1 J	30 J	26 J	20 J
ZINC	498 J	131 J	155 J	8.7 J	303 J	255 J	2340 J	1080 J	40.6 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-2
2005 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB35	12SB35	12SB36	12SB36	12SB37	12SB37	12SB38	12SB39	12SB39
Sample Number	12SS350001	12SB350204	12SS360001	12SB360103	12SS370001	12SB370204	12SS380001	12SS390001	12SB390103
Sample Date	10/31/05	11/01/05	10/31/05	11/01/05	10/31/05	11/01/05	10/31/05	10/31/05	11/01/05
Sample Interval (feet)	0 - 1	2 - 4	0 - 1	1 - 3	0 - 1	2 - 4	0 - 1	0 - 1	1 - 3
Inorganics (mg/kg)									
ALUMINUM	23500	13200	10500	12500	9530	18800	18400 J	11000 J	12800
ANTIMONY	4.2 J	0.42 U	1.2 U	0.22 U	1.1 U	0.27 U	1.9 J	1.5 J	0.15 U
ARSENIC	11.2 J	7.4 J	4 J	3.3 J	2.4 J	9.4 J	6.6 J	5.1 J	2.5 J
BARIUM	230 J	23.4 J	101 J	125 J	81 J	60.6 J	113 J	134 J	148 J
BERYLLIUM	0.75 J	0.53 J	1 J	2.4 J	0.84 J	2.3 J	0.58 J	0.60 J	1.4 J
CADMIUM	5.7	0.11 J	1.6	0.18 J	0.58	0.20 J	1.1 J	3.6 J	0.18 U
CALCIUM	7740 J	418 J	2850 J	406 J	1080 J	567 J	50200 J	2790 J	631 J
CHROMIUM	77 J	39.6 J	34.1 J	34.2 J	23.6 J	34.9 J	24.2 J	34.2 J	30.7 J
COBALT	6.6 J	1.6 J	11.1 J	29.6 J	10.6 J	12.2 J	7.3 J	8.4 J	19.6 J
COPPER	402 J	9.2 J	101 J	17.3 J	59.2 J	8.8 J	45.6 J	174 J	14.9 J
IRON	38400 J	39200 J	30900 J	66700 J	15200 J	57600 J	20800 J	23400 J	28100 J
LEAD	690 J	10.9 J	210 J	22.7 J	84.6 J	12 J	134 J	295 J	24.3 J
MAGNESIUM	2320 J	916 J	936 J	913 J	822 J	1230 J	3990 J	1010 J	1040 J
MANGANESE	676 J	16.1 J	769 J	1780 J	522 J	275 J	648 J	491 J	990 J
NICKEL	21.2 J	7.8 J	28.7 J	63.2 J	19 J	48 J	15.6	21.2	24.1 J
POTASSIUM	1680 J	941 J	1450 J	1980 J	1740 J	3040 J	1370 J	1080 J	2650 J
SELENIUM	0.45 J	0.37 J	0.44 J	0.42 J	0.27 J	0.91	0.39 J	0.29 J	0.41 J
SILVER	1.2	0.045 U	0.15 J	0.041 U	0.06 J	0.044 U	0.08 J	0.45 J	0.041 U
SODIUM	199 U	21.6 U	55 U	45.1 U	58.5 U	130 U	97.5 U	72.8 U	145 J
THALLIUM	0.27 U	0.18 U	0.14 U	0.33 U	0.14 U	0.22 U	0.30 U	0.17 U	0.32 U
VANADIUM	47.5 J	35.7 J	20.9 J	32.8 J	16.5 J	30.7 J	32.2 J	21.6 J	26.7 J
ZINC	1370 J	13.3 J	738 J	124 J	441 J	58.8 J	306 J	1930 J	41.2 J

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-3
2006 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB72	12SB74	12SB76	12SB76	12SB76	12SB76	12SB77	12SB77	12SB78
Sample Number	12SS720002	12SS740002	12SS760002	12SB760204	12SB760406	12SB760608	12SS770002	12SB770204	12SS780002
Sample Date	10/10/06	10/10/06	10/10/06	10/18/06	10/18/06	10/18/06	10/10/06	10/17/06	10/10/06
Sample Interval (feet)	0 - 2	0 - 2	0 - 2	2 - 4	4 - 6	6 - 8	0 - 2	2 - 4	0 - 2
Inorganics (mg/kg)									
ALUMINUM	20900	16800	8430	9400	11900	10400	9960	11100	9910
ANTIMONY	2.2	1.5	0.67 U	0.28 U	0.049 U	0.19 U	0.73 U	1.7	0.15 U
ARSENIC	12.2	10.3	2.47	1.59	0.973	3.23	2.12	17.4	1.76
BARIUM	108 J	119 J	62.1 J	51.2 J	50.8 J	71.6 J	43.8 J	175 J	167 J
BERYLLIUM	0.615	0.819	0.473	2.66 J	1.03 J	1.83 J	0.773	1.14 J	1.03
CADMIUM	1.25	0.89	0.874	0.478	0.221	0.274	0.393	0.286	0.367
CALCIUM	4400 J	8780 J	206000 J	491 U	672 U	852 U	8790 J	655 U	736 J
CHROMIUM	49.6	32.2	26.1	30.1 J	24.1 J	26.7 J	33.4	26.6 J	33.6
COBALT	7.23	8.17	6.95	36.8 J	30.1 J	19.4 J	3.58	43.4 J	17.9
COPPER	46.3	34	28	16	8.23	11.6	16	14.5	16.9
IRON	39100	27100	20100	58400	11800	72600	25900	15300	28600
LEAD	143 J	82.7 J	105 J	13.5 J	8.01 J	25.6 J	71.6 J	17.7 J	20.5 J
MAGNESIUM	1950 J	1670 J	5530 J	1050	1460	901	965 J	1310	831 J
MANGANESE	825	302	244	741	411	671	129	1340	1130
NICKEL	16.3	22.9	28.1	68.2 J	26.2 J	60.1 J	15.9	27.6 J	31.2
POTASSIUM	1630	1660	1580	2180	2160	1350	1690	2000	2220
SELENIUM	0.398	0.327	0.47	0.674	0.512	1.04	0.247	0.741	0.403
SILVER	0.186	0.219	0.25	0.0577 J	0.0426 J	0.0691 J	0.086	0.0564 J	0.0515
SODIUM	53.6 U	105 U	119 U	212 U	254 U	251 U	57.3 U	296 U	101 U
THALLIUM	0.256	0.219	0.105	0.128 J	0.131 J	0.259 J	0.113	0.179 J	0.292
TITANIUM	313 J	219 J	43.4 J	23.9 J	19.1 J	15.4 J	23.3 J	17.1 J	23.4 J
VANADIUM	53	34	20.5	33.8 J	17.2 J	27.2 J	20.4	17.6 J	21.6
ZINC	204	222	237	170	30.8	120	38.1	51.7	45.2

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-3
2006 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

Sample Location	12SB78	12SB79	12SB79	12SB80	12SB80	12SB81	12SB82	12SB82	12SB84
Sample Number	12SB780204	12SS790002	12SB790204	12SS800002	12SB800204	12SS810002	12SS820002	12SB820204	12SS840002
Sample Date	10/17/06	10/10/06	10/18/06	10/10/06	10/18/06	10/10/06	10/10/06	10/17/06	10/10/06
Sample Interval (feet)	2 - 4	0 - 2	2 - 4	0 - 2	2 - 4	0 - 2	0 - 2	2 - 4	0 - 2
Inorganics (mg/kg)									
ALUMINUM	12900	9940	14000	9250	12400	20000	16700	13700	9620
ANTIMONY	0.055 U	1.9	0.049 U	0.14 U	0.18 U	8.7	0.59 U	0.12 U	0.058 U
ARSENIC	1.03	4.17	1.27	2.55	4.31	13.6	3.23	1.91	1.33
BARIUM	50.3 J	135 J	47.0 J	44.8 J	227 J	118 J	98.0 J	33.3 J	41.1 J
BERYLLIUM	1.45 J	1.16	1.88 J	0.992	2.09 J	1.43	1.31	1.06 J	1.24
CADMIUM	0.299	2.33	0.427	0.543	0.464	1.27	1.4	0.496	0.322
CALCIUM	634 U	1430 J	783 U	1260 J	747 U	22200 J	1750 J	519 U	953 J
CHROMIUM	28.8 J	37.4	33.0 J	27.4	29.1 J	69.5	38.3	27.5 J	30.9
COBALT	18.2 J	10.4	27.6 J	3.84	82.7 J	12.4	10.5	11.1 J	14.5
COPPER	12.9	86.4	16.2	20.1	15.9	56.7	57.7	9.19	16.1
IRON	15900	39400	44300	23900	40800	57500	19800	34900	37900
LEAD	9.03 J	75.4 J	17.7 J	12.6 J	46.3 J	165 J	44.4 J	15.2 J	14.2 J
MAGNESIUM	1440	687 J	1660	749 J	1310	6020 J	1390 J	1260	776 J
MANGANESE	326	372	794	333	3310	677	323	243	392
NICKEL	25.4 J	31.7	61.8 J	22.8	103 J	19.2	21.5	42.2 J	33.3
POTASSIUM	2270	1580	2320	2080	1960	1450	3660	2170	2370
SELENIUM	0.477	0.368	0.675	0.41	0.957	0.648	0.271	0.736	0.252 U
SILVER	0.0474 J	0.603	0.0606 J	0.0715	0.105 J	0.269	0.185	0.0853 J	0.0487
SODIUM	239 U	66.0 U	267	111 U	198 U	136 U	118 U	272 U	65.2 U
THALLIUM	0.179 J	0.111	0.161 J	0.0967	0.537 J	0.254	0.209	0.154 J	0.127
TITANIUM	17.3 J	33.3 J	34.8 J	26.1 J	26.5 J	212 J	39.3 J	23.0 J	21.3 J
VANADIUM	23.3 J	24	25.1 J	22.6	29.3 J	56.6	35.8	23.9 J	21.9
ZINC	48.3	364	120	133	121	288	761	61.7	75.2

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

Table A-3
2006 RFI Analytical Data
SWMU 12 - Battery Site IMWP
NWSC Crane

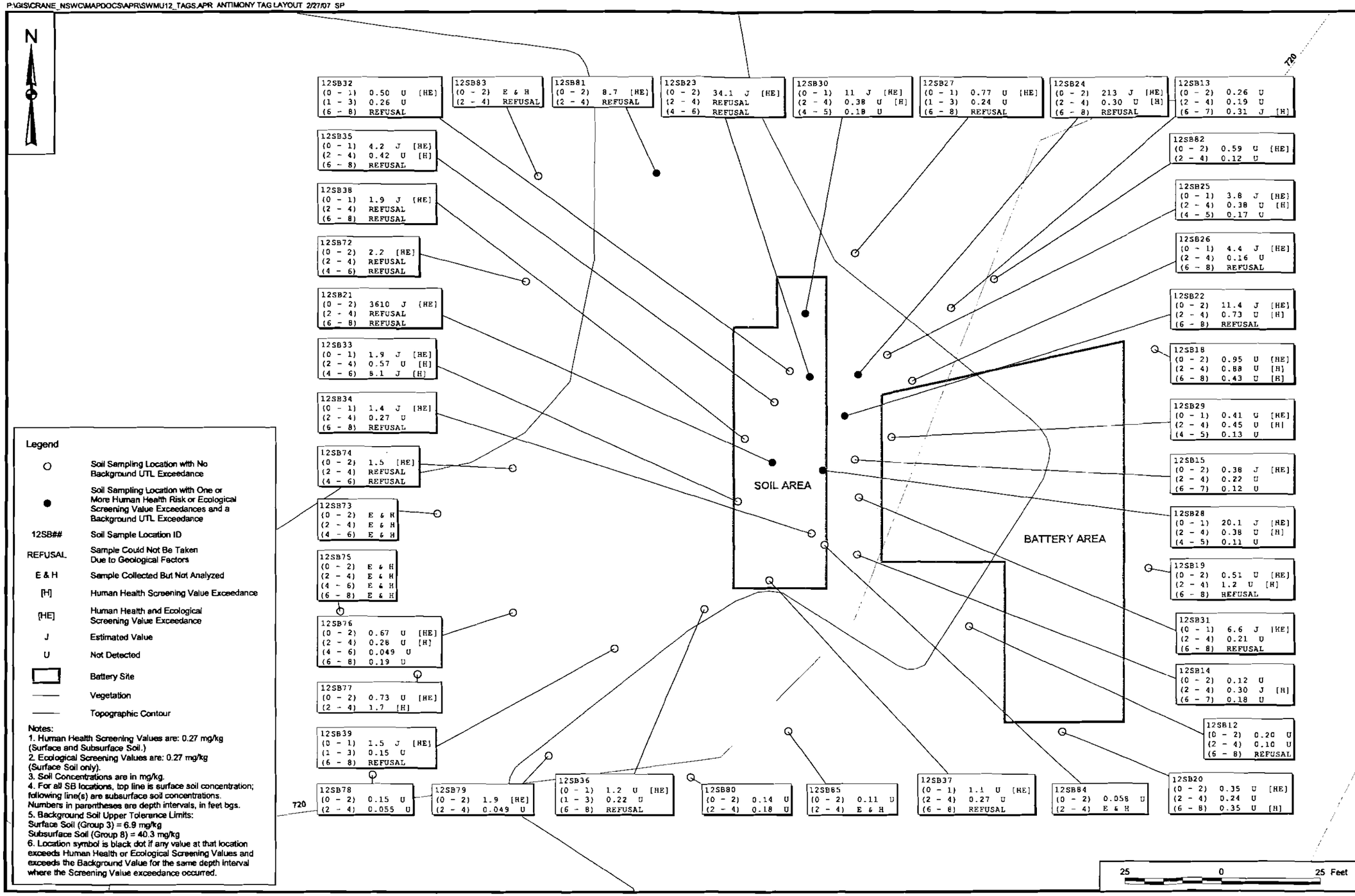
Sample Location	12SB85
Sample Number	12SS850002
Sample Date	10/10/06
Sample Interval (feet)	0 - 2

Inorganics (mg/kg)

ALUMINUM	12600
ANTIMONY	0.11 U
ARSENIC	1.23
BARIUM	65.9 J
BERYLLIUM	1.3
CADMIUM	0.522
CALCIUM	1080 J
CHROMIUM	33
COBALT	22.6
COPPER	16.7
IRON	22100
LEAD	19.6 J
MAGNESIUM	1120 J
MANGANESE	708
NICKEL	38.5
POTASSIUM	3050
SELENIUM	0.249 U
SILVER	0.068
SODIUM	121 U
THALLIUM	0.144
TITANIUM	26.1 J
VANADIUM	26.1
ZINC	136

U - Parameter not detected at identified concentration.
J - Reported concentration estimated.
R - Reported concentration rejected.
NA - Parameter not analyzed for identified sample.

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR ANTIMONY TAG LAYOUT 2/27/07 SP



Legend

○	Soil Sampling Location with No Background UTL Exceedance
●	Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
12SB##	Soil Sample Location ID
REFUSAL	Sample Could Not Be Taken Due to Geological Factors
E & H	Sample Collected But Not Analyzed
[H]	Human Health Screening Value Exceedance
[HE]	Human Health and Ecological Screening Value Exceedance
J	Estimated Value
U	Not Detected
▭	Battery Site
——	Vegetation
——	Topographic Contour

Notes:
1. Human Health Screening Values are: 0.27 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 0.27 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 6.9 mg/kg
Subsurface Soil (Group 8) = 40.3 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 5 - 5

REV 0

TOTAL ANTIMONY CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE
SWMU 12 MINE FILL A
NSWC CRANE
CRANE, INDIANA

NAVFAC

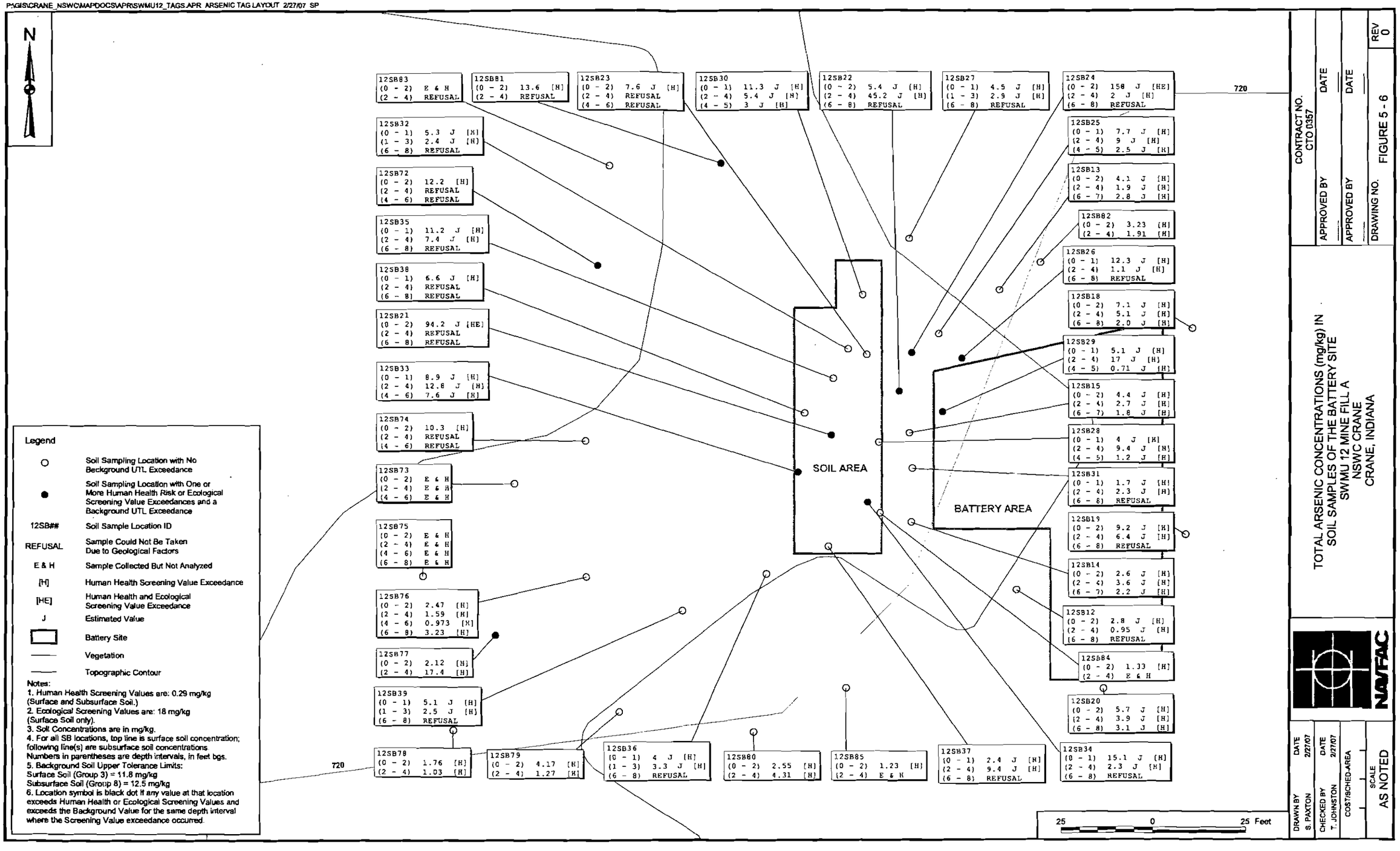
DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR ARSENIC TAG LAYOUT 2/27/07 SP



Legend

- ○ Soil Sampling Location with No Background UTL Exceedance
- ● Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
- 12SB## Soil Sample Location ID
- REFUSAL Sample Could Not Be Taken Due to Geological Factors
- E & H Sample Collected But Not Analyzed
- [H] Human Health Screening Value Exceedance
- [HE] Human Health and Ecological Screening Value Exceedance
- J Estimated Value
- Battery Site
- Vegetation
- Topographic Contour

Notes:
1. Human Health Screening Values are: 0.29 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 18 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 11.8 mg/kg
Subsurface Soil (Group 8) = 12.5 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 5 - 6

REV 0

TOTAL ARSENIC CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE
SWMU 12 MINE FILL A
NSWC CRANE
CRANE, INDIANA

NAVFAC

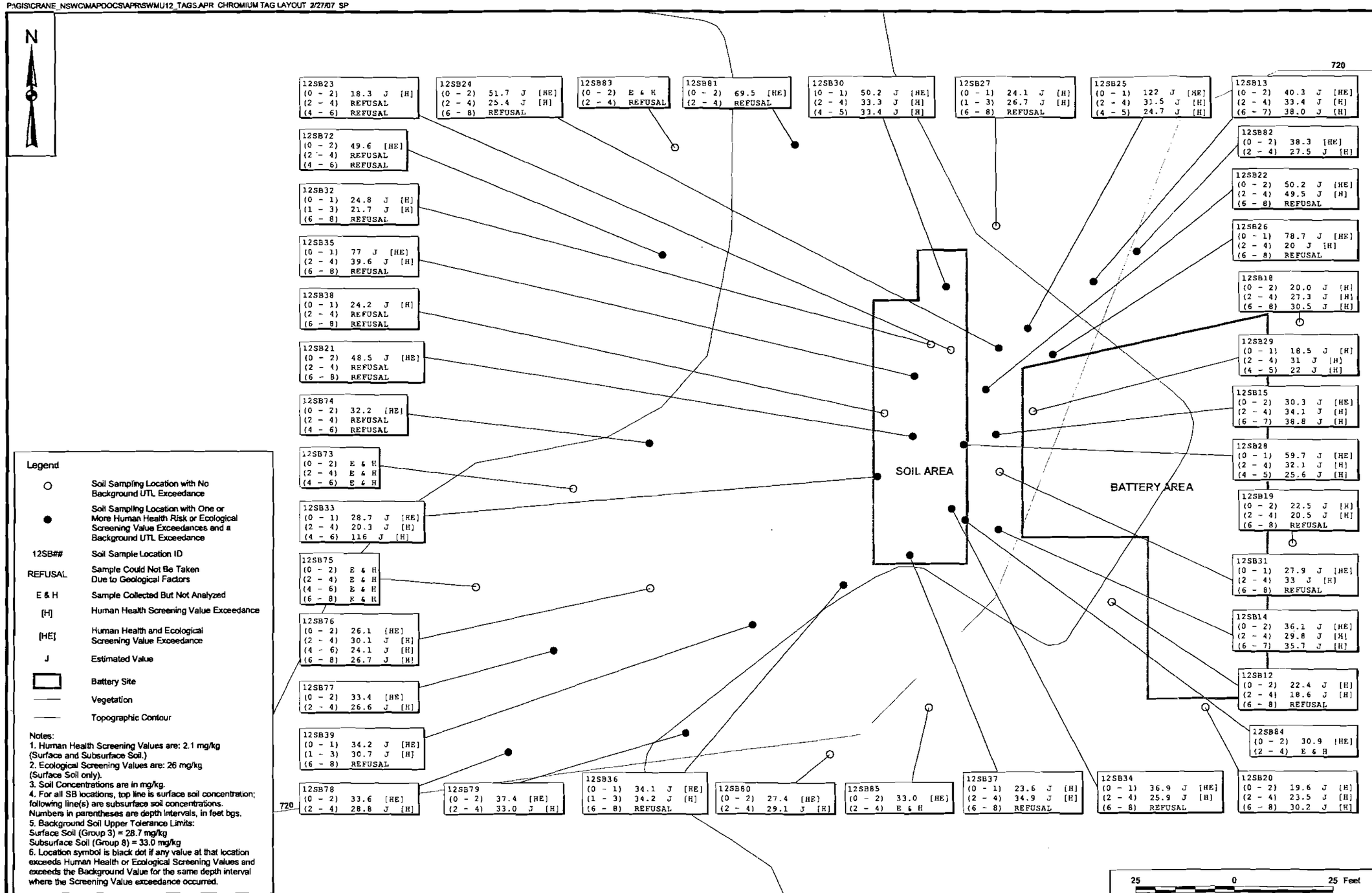
DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR CHROMIUM TAG LAYOUT 2/27/07 SP



Legend

- ○ Soil Sampling Location with No Background UTL Exceedance
- ● Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
- 12SB## Soil Sample Location ID
- REFUSAL Sample Could Not Be Taken Due to Geological Factors
- E & H Sample Collected But Not Analyzed
- [H] Human Health Screening Value Exceedance
- [HE] Human Health and Ecological Screening Value Exceedance
- J Estimated Value
- Battery Site
- Vegetation
- Topographic Contour

Notes:
1. Human Health Screening Values are: 2.1 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 26 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 28.7 mg/kg
Subsurface Soil (Group 8) = 33.0 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 5 - 8

REV 0

TOTAL CHROMIUM CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE
SWMU 12 MINE FILL A
NSWC CRANE
CRANE, INDIANA

NAVFAC

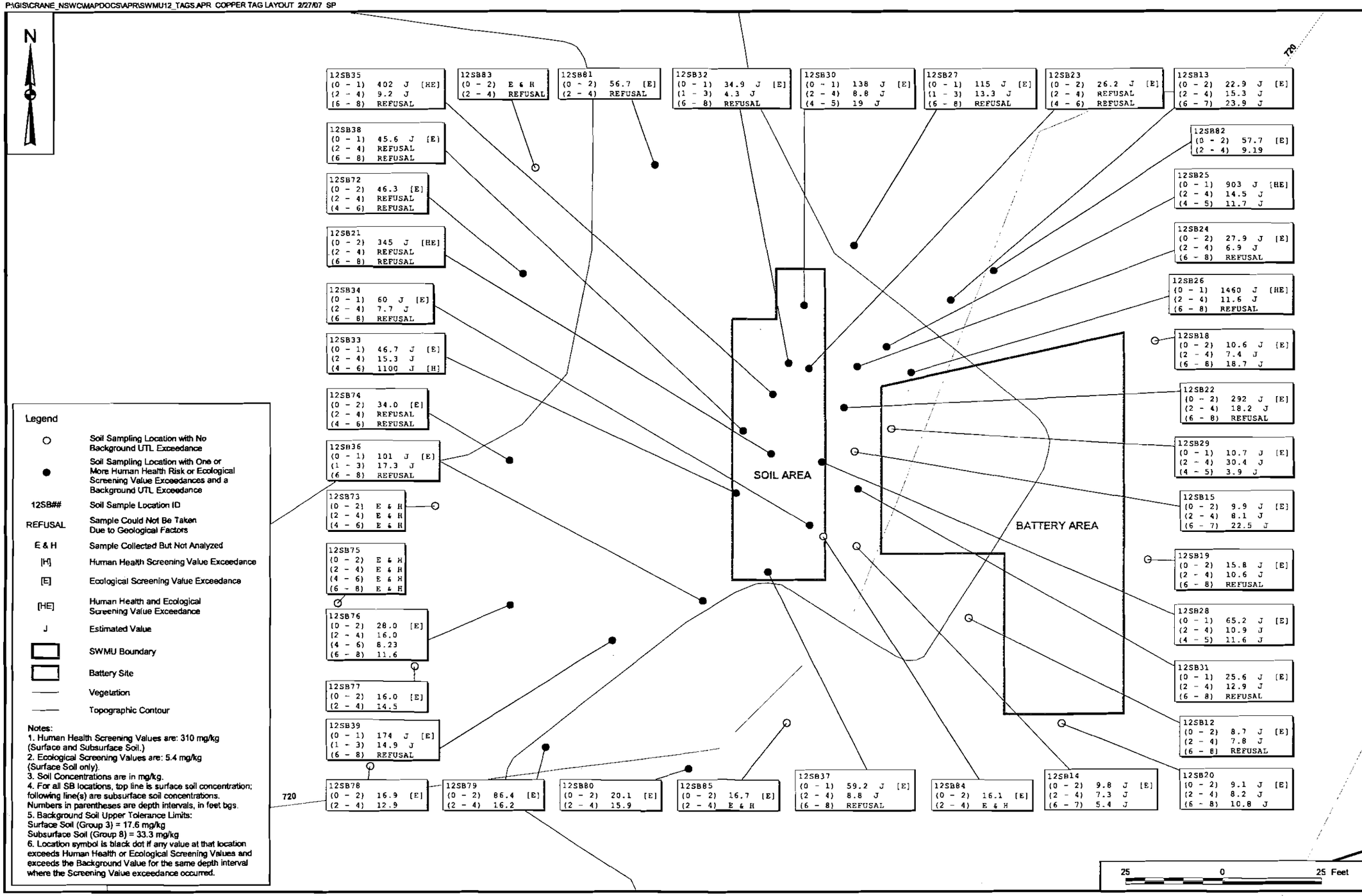
DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR COPPER TAG LAYOUT 2/27/07 SP



Legend

- ○ Soil Sampling Location with No Background UTL Exceedance
- ● Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
- 12SB## Soil Sample Location ID
- REFUSAL Sample Could Not Be Taken Due to Geological Factors
- E & H Sample Collected But Not Analyzed
- [H] Human Health Screening Value Exceedance
- [E] Ecological Screening Value Exceedance
- [HE] Human Health and Ecological Screening Value Exceedance
- J Estimated Value
- SWMU Boundary
- Battery Site
- Vegetation
- Topographic Contour

Notes:
1. Human Health Screening Values are: 310 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 5.4 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 17.6 mg/kg
Subsurface Soil (Group 8) = 33.3 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 5 - 9 REV 0

TOTAL COPPER CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE SWMU 12 MINE FILL A NSWC CRANE CRANE, INDIANA

NAVFAC

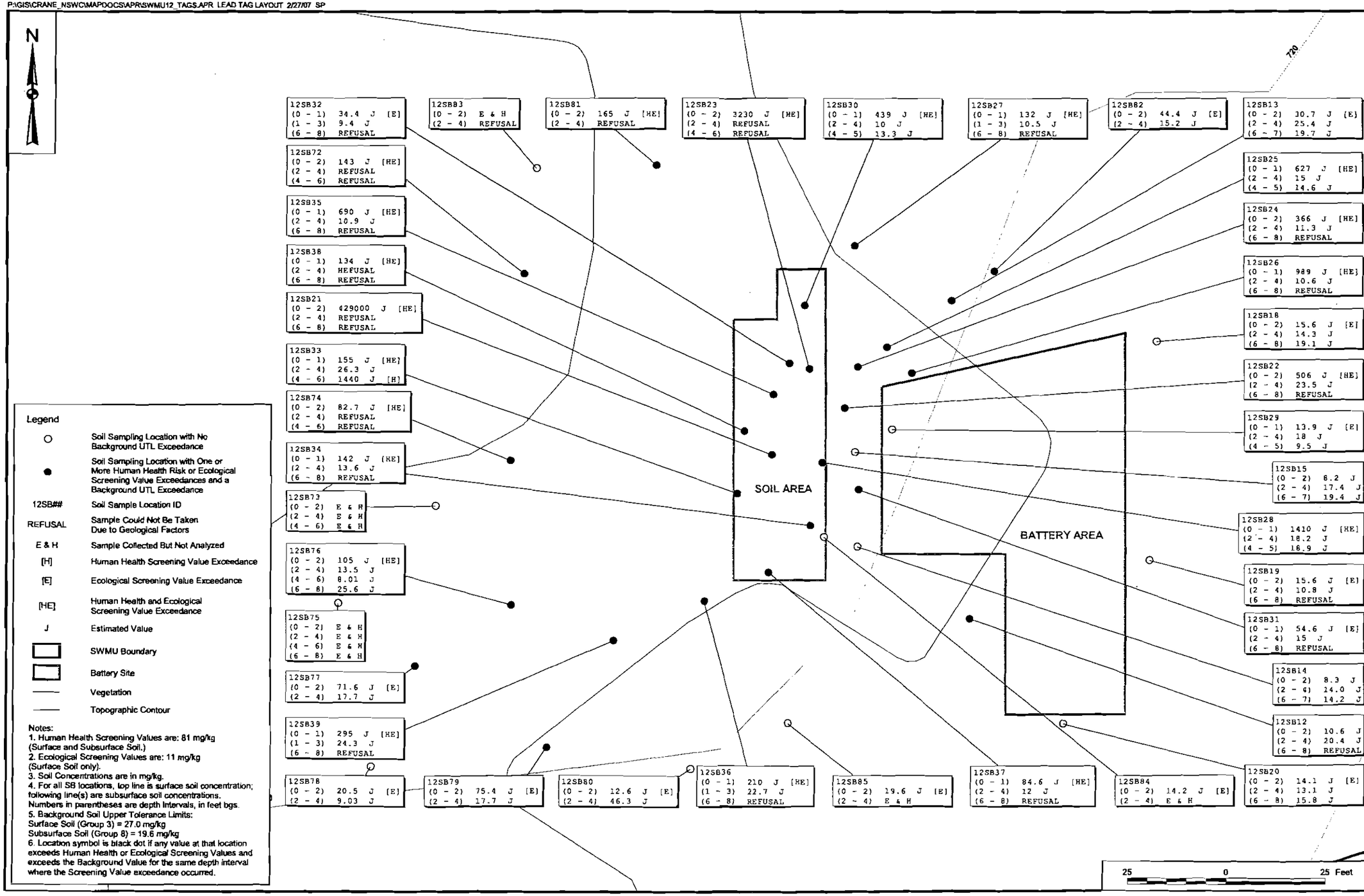
DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR LEAD TAG LAYOUT 2/27/07 SP



Legend

○	Soil Sampling Location with No Background UTL Exceedance
●	Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
12SB##	Soil Sample Location ID
REFUSAL	Sample Could Not Be Taken Due to Geological Factors
E & H	Sample Collected But Not Analyzed
[H]	Human Health Screening Value Exceedance
[E]	Ecological Screening Value Exceedance
[HE]	Human Health and Ecological Screening Value Exceedance
J	Estimated Value
▭	SWMU Boundary
▭	Battery Site
——	Vegetation
——	Topographic Contour

Notes:
1. Human Health Screening Values are: 81 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 11 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 27.0 mg/kg
Subsurface Soil (Group 8) = 19.6 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ____ DATE ____

APPROVED BY ____ DATE ____

DRAWING NO. FIGURE 5 - 10

REV 0

TOTAL LEAD CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE
SWMU 12 MINE FILL A
NSWC CRANE
CRANE, INDIANA

NAVFAC

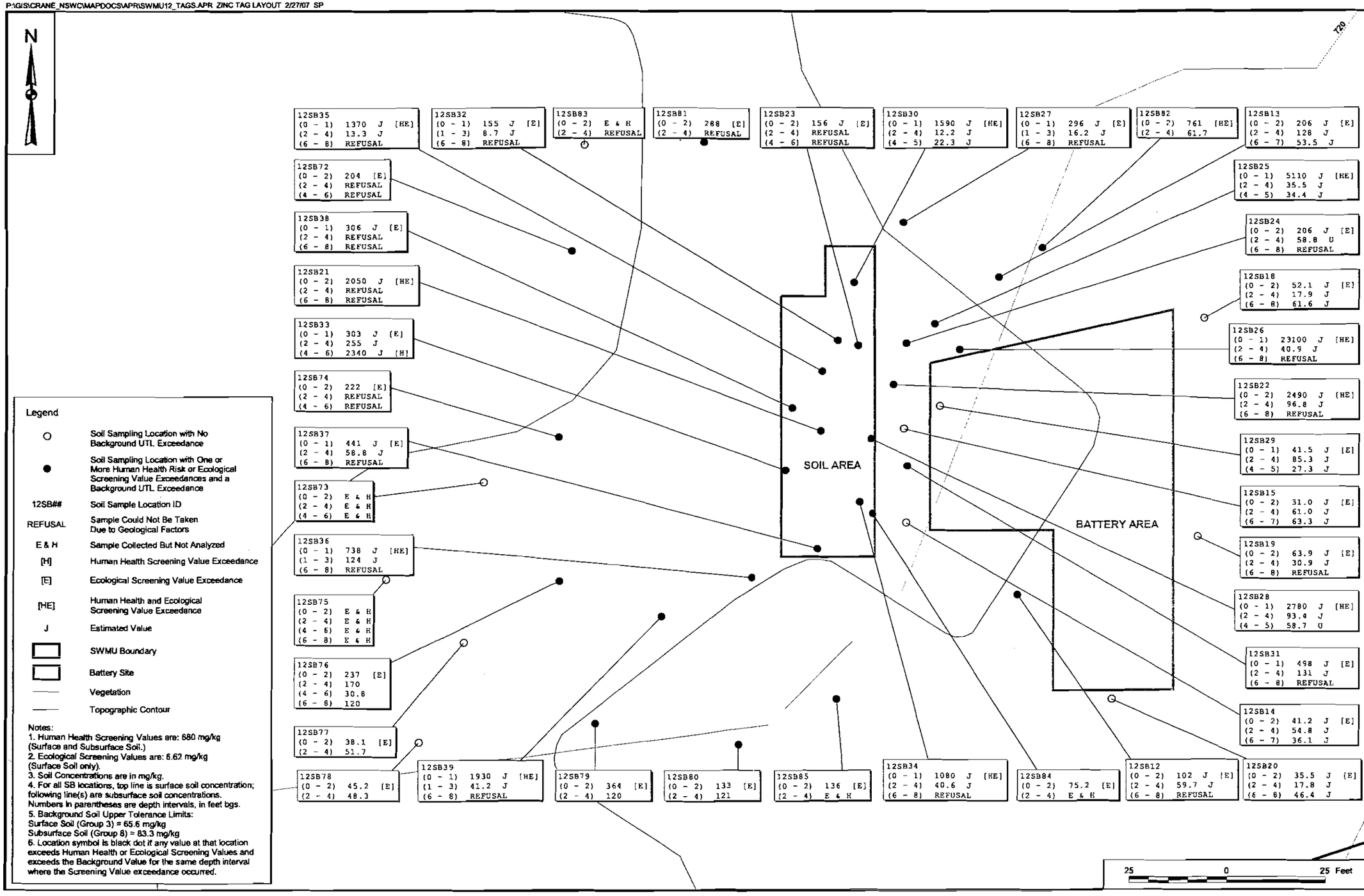
DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SWMU12_TAGS.APR ZINC TAG LAYOUT 2/27/07 SP



Legend

- Soil Sampling Location with No Background UTL Exceedance
- Soil Sampling Location with One or More Human Health Risk or Ecological Screening Value Exceedances and a Background UTL Exceedance
- 12SB## Soil Sample Location ID
- REFUSAL Sample Could Not Be Taken Due to Geological Factors
- E & H Sample Collected But Not Analyzed
- [H] Human Health Screening Value Exceedance
- [E] Ecological Screening Value Exceedance
- [HE] Human Health and Ecological Screening Value Exceedance
- J Estimated Value
- SWMU Boundary
- Battery Site
- Vegetation
- Topographic Contour

Notes:
1. Human Health Screening Values are: 680 mg/kg (Surface and Subsurface Soil.)
2. Ecological Screening Values are: 6.62 mg/kg (Surface Soil only).
3. Soil Concentrations are in mg/kg.
4. For all SB locations, top line is surface soil concentration; following line(s) are subsurface soil concentrations. Numbers in parentheses are depth intervals, in feet bgs.
5. Background Soil Upper Tolerance Limits:
Surface Soil (Group 3) = 65.6 mg/kg
Subsurface Soil (Group 8) = 83.3 mg/kg
6. Location symbol is black dot if any value at that location exceeds Human Health or Ecological Screening Values and exceeds the Background Value for the same depth interval where the Screening Value exceedance occurred.

CONTRACT NO. CTO 0357

APPROVED BY ___ DATE ___

APPROVED BY ___ DATE ___

DRAWING NO. FIGURE 5 - 12

REV 0

TOTAL ZINC CONCENTRATIONS (mg/kg) IN SOIL SAMPLES OF THE BATTERY SITE
SWMU 12 MINE FILL A
NSWC CRANE
CRANE, INDIANA

NAVFAC

DRAWN BY S. PAXTON DATE 2/27/07

CHECKED BY T. JOHNSTON DATE 2/27/07

COST/SCHED-AREA

SCALE AS NOTED

APPENDIX B

EXCAVATION VOLUME CALCULATIONS

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G01573 - 0000.0802
SUBJECT:	SWMU 12 BATTERY DUMP SITE		
BASED ON:	Limits of Excavation Drawings	DRAWING NUMBER:	IMWP Figure 3-1
BY: BC Date: 4/2/09	CHECKED BY: Date: 4/2/09	APPROVED BY:	DATE:

OBJECTIVE:

The purpose of this calculation is to estimate the volume of soil to be excavated from the SWMU 12 Battery Dump Site surface and subsurface soil excavation areas identified in the SWMU 12 Battery Dump Site Interim Measures Work Plan. Following the calculation of excavation, the calculations determine the disposal volume and the volume of backfill materials needed to restore SWMU 12 Battery Dump Site to pre-construction conditions.

APPROACH:

1. Using the historic surface and subsurface soil sample information from the previous investigations to establish the size of the surface soil excavation area and subsurface excavation area for the SWMU 12 Battery Dump Site.

2. Calculate the volume of soil to be removed from the identified excavation areas provided in Figure 3-1.

3. Calculate the volume of soil to be disposed from the identified excavation areas provided in Figure 3-1.

4. Calculate the required backfill volume for the restoration area identified in Figure 3-2.

REFERENCES:

TtNUS (Tetra Tech NUS, Inc.), 2008. Interim Measures Work Plan SWMU 12 Battery Dump Site, NSWC Crane, Crane, Indiana.

CALCULATIONS

1) Volume of Soil to Be Removed to Achieve Acceptable Human Health and Ecological Risk Goals

Using Figure 3-1, calculate the surface soil excavation volume using the area of the surface excavation times the depth of the excavation.

Area of Surface Excavation =	4,145 sf
Depth of Excavation =	2 ft
Volume of Excavation =	8,290 cf
Volume of Excavation =	307 cy

Using Figure 3-1, calculate the subsurface soil excavation volume using the area of subsurface excavation times the depth of the subsurface excavation.

Area of Subsurface Excavation (2 ft elevation) =	100 sf

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G01573 - 0000.0802
SUBJECT:	SWMU 12 BATTERY DUMP SITE		
BASED ON:	Limits of Excavation Drawings	DRAWING NUMBER:	IMWP Figure 3-1
BY: BE Date: 4/2/09	CHECKED BY: TNB Date: 4/2/09	APPROVED BY:	DATE:

Depth of Excavation =	4 ft
Volume of Excavation =	400 cf
Volume of Excavation =	15 cy
Total Excavation Volume to Achieve Acceptable Human Health and Ecological Risk Goals =	**322 cy**

2) Volume of Material to be Disposed

The volume of material to be disposed is equal to the volume of material removed from the site. Based on in-situ concentrations, it is estimated that 10% of the total material excavated will require hazardous disposal.

Total Volume of Material Excavated =	322 cy
Volume of Material Requiring Hazardous Disposal =	32 cy
Volume of Material Requiring Non-Hazardous Disposal =	290 cy
Total Volume of Material to be Disposed =	**322 cy**

3) Volume of Backfill Material Needed to Restore the Site

The volume of backfill material needed to restore the site is equal to the volume of material to be disposed. Per the IMWP, the backfill material is made up of topsoil (6-inch thickness) and common fill (thickness varies).

Total Volume of Backfill Material Needed =	322 cy
Area to Receive Topsoil =	4145 sf
Depth of Topsoil =	0.5 ft
Volume of Topsoil =	2073 cf
Volume of Topsoil =	**80 cy**
Volume of Common Fill =	**242 cy**

APPENDIX C

SUPPLEMENTAL SPECIFICATIONS

SUPPLEMENTAL SPECIFICATIONS
INTERIM MEASURES WORK PLAN
SWMU 12 – BATTERY DUMP SITE
NSWC CRANE
CRANE, INDIANA

EMAC Contractor Requirements

The Environmental Multiple Award Contract (EMAC) contractor will be responsible for performing the following work:

1. Attend pre-IMWP implementation conference.
2. Submit documentation in accordance with the EMAC 'Basic Contract' 30 days prior to beginning work to allow the Navy sufficient time to review and comment. The EMAC contractor will then incorporate Navy comments into the documents. These documents include the following:
    - Work Plan
        - Excavation and Handling Plan
        - Hazardous/Waste Management Plan
        - Environmental Protection Plan
        - Erosion and Sediment Control Plan
        - Stormwater Pollution Prevention Plan
        - Transportation and Disposal Plan
    - Site Specific Health and Safety Plan (SSHSP) and Activity Hazard Analysis
    - Project Quality Control Plan (QCP)
3. Acquire Facility-specific permits, including but not limited to the following:
    - Safety & Building Availability Permit (ESO 8020/11)
    - Digging Permit (NWSCC 11000/3)
    - Flame Tool/Hot Work Permit (NWSCC 11320)
    - Hazards of Electromagnetic Radiation to Ordnance (HERO) (approval for portable radios)
4. Mobilize required equipment and personnel to excavate the indicated contaminated soil.
5. Construct and maintain the required erosion and sediment control devices for the duration of the project.
6. Construct required support facilities including, but not limited to, temporary gravel construction entrance, temporary access trails, dewatering pad, decontamination pad(s), and material storage areas.
7. Excavate, transport, and dispose contaminated surface and subsurface soils.
8. Restore surface soil excavation area to pre-construction elevations meeting surrounding grades.
9. Remove all temporary support facilities, leaving perimeter erosion and sediment controls in place until revegetation is complete and as instructed by the Navy.
10. Restore areas used for temporary support facilities (regrading and revegetation).
11. Demobilize equipment and personnel.

In addition to the QC submittals and Safety and Health submittals required by the NSWC Crane Contractor's Operations Manual and the Basic Contract, the EMAC contractor shall submit the following to the Navy:

- Field work reports in accordance with Part 6.4 Section C of the Basic Contract.
- Contractor 40 CFR 1910.120 Employee Training Certificates for all Contractor employees scheduled to be on-site.
- Erosion and Sediment Control installation and inspection logs.
- Copies of NSWC Crane specific permits.
- Certification and sampling results for backfill material and topsoil. A minimum of one sample per borrow source is required.
- Waste transportation subcontractor name, address, contact name, telephone number, and USDOT number.
- Hazardous waste disposal facility name, address, contact name, telephone number, and USEPA and State identification numbers, if required.

- Solid waste disposal facility name, address, contact name, telephone number, USEPA and State identification numbers.
- Copies of Treatment/Disposal Facility Permits.
- Waste profiles, complete waste characterization results, and any waste disposal facility pre-approval or approval documentation.
- Work Site Decontamination Certificates (verification that all vehicles, equipment, and containers were properly decontaminated prior to leaving the work site).
- Disposal Site Decontamination Certificates (verification that vehicles and containers were decontaminated prior to leaving the disposal facility).
- Shipment Manifests (manifests and other documents required to ship waste).
- Delivery Certificates (verification that waste was received at identified waste disposal facility).
- Treatment and Disposal Certificates (verification that waste was successfully received and disposed).
- Decontamination Log.

The EMAC contractor-provided information will be compiled in the Construction Completion Report and the project CTO Closure Report to be prepared by the Navy. The EMAC contractor shall provide the Navy, or their representative, all documentation within 30 days of Demobilization from the Site.

Supplemental Specifications

In addition to the performance specifications presented in the NSWC Crane Contractor's Operation Manual and in the Basic Contract, the EMAC contractor shall perform the activities in accordance with the supplemental specifications provided below.

General Requirements

The EMAC contractor is advised that this project is subject to Federal, State, and local regulatory agency inspections and review for compliance with environmental laws and regulations. The EMAC contractor shall fully cooperate with any representative from any Federal, State, or local regulatory agency who may visit the job site and shall provide immediate notification to the Officer in Charge of Construction (OICC), who shall accompany them on any subsequent site inspections. The EMAC contractor shall complete, maintain, and make available to the OICC, Facility, or regulatory agency personnel all documentation relating to environmental compliance under applicable Federal, State, and local laws and regulations. The EMAC contractor shall immediately notify the OICC if a Notice of Violation, Notice of Deficiency, or similar regulatory notice is issued to the EMAC contractor.

The EMAC contractor shall be responsible for all damages to persons or property resulting from EMAC contractor fault or negligence as well as for the payment of any civil fines or penalties which may be assessed by any Federal, State, or local regulatory agency as a result of the EMAC contractor's or any subcontractor's violation of an applicable Federal, State, or local environmental law or regulation. Should a Notice of Violation, Notice of Noncompliance, Notice of Deficiency, or similar regulatory agency notice be issued to the Government or Facility owner/operator on account of the actions or inactions of the EMAC contractor or one if its subcontractors in the performance of work under this contract, the EMAC contractor shall fully cooperate with the Government in defending against regulatory assessment of any civil fines or penalties arising out of such actions or inactions.

After approval of the EMAC contractor's Work Plan and before commencement of work, the EMAC contractor shall submit to the OICC the required certifications. As requested by the OICC, the Navy Representative for this project may review and provide surveillance for the OICC to determine if EMAC contractor's submittals comply with the contract requirements.

The EMAC contractor shall be required to commence work on the approved EMAC contractor's Work Plan within 5 calendar days after receiving the notice to proceed and to prosecute the work diligently after receiving the notice to proceed.

NSWC Crane will remain in operation during the entire construction period. The EMAC contractor shall schedule the work as to cause the least amount of interference with the Facility. Work schedules shall be subject to the approval of the OICC. Permission to interrupt Facility road services shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. The OICC shall be notified 48 hours prior to starting excavation activities.

Regular work hours shall consist of an 8-1/2 hour daily period established by the OICC, Monday through Friday, excluding Government holidays. The EMAC contractor should assume an 8-1/2 hour daily period. Working outside of the 8-1/2 hour daily period will require approval by the OICC. Work hours shall be established during the pre-IMWP implementation conference.

On-site storage, laydown, material handling, and decontamination activities shall be limited to areas approved by the OICC.

During the progress of construction activities, the work area and adjacent areas shall be kept clean and free of rubbish, surplus materials, and unneeded construction equipment. No material or debris shall be allowed to flow or wash into watercourses, ditches, gutters, drains, or pipes. Upon completion of the work, the EMAC contractor shall sweep paved areas and rake clean landscaped areas, and remove waste and surplus materials, rubbish, and construction facilities from the site.

Work Restrictions

EMAC contractor personnel employed at the Facility shall become familiar with and obey Facility regulations and keep within the limits of the work and avenues of ingress and egress as directed. EMAC contractor and subcontractor personnel shall not enter any restricted areas unless required to do so and until cleared for such entry. The EMAC contractor's equipment shall be clearly marked for identification.

The EMAC contractor shall indicate on the construction schedule any activity that could potentially interrupt Facility operations. The EMAC contractor shall notify the OICC in writing 15 calendar days prior to the required interruption.

Facilities and Services

The EMAC contractor shall provide utility permits in accordance with Part 4.13 Section C of the Basic Contract.

NSWC Crane shall make all reasonably required amounts of utilities available to the EMAC Contractor from existing outlets and supplies, as indicated. The amount of each utility service consumed shall be charged to or paid for by the EMAC Contractor at the prevailing rates charged to NSWC Crane or shall be furnished at no charge at the discretion of the Facility. The EMAC Contractor shall carefully conserve any utilities furnished.

The location(s) at which NSWC Crane will deliver such utilities or services and the quantity available will be identified by NSWC Crane.

The EMAC contractor, at its expense and in a workman-like manner satisfactory to the OICC, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the EMAC Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

Electric – Electrical power available: primary voltage is 2400 volt, 3 phase, 3 wire, 60 cycle AC; secondary voltages may be 120/208 or 120/240 volts. Final taps and tie-ins to the NSWC Crane utility grid will be made by the NSWC Crane electric shop.

Potable Water – Potable water shall be made available to the EMAC contractor at the discretion of the Facility. The EMAC contractor shall provide backflow preventor devices on connections to potable water supplies. Under no circumstances will taps to NSWC Crane fire hydrants be allowed for obtaining water. The OICC shall identify available potable water supply locations.

Telephone – Facility telephone service is not available to the EMAC contractor.

Sanitary Facilities – The EMAC contractor shall provide temporary sanitary facilities for use by all personnel in accordance with Part 3.10 Section C of the Basic Contract.

Municipal Waste – Facility municipal waste storage and disposal is not available to the EMAC contractor.

Sewer – Wastewater resulting from personnel and equipment decontamination, excavation dewatering, and water collected in the materials handling pad(s) may be discharged to the NSWC Crane sanitary sewer system, subject to the approval of NSWC Crane based on characterization of the water to be discharged.

Site Personnel Qualifications

Site Superintendent - The EMAC contractor shall designate a Site Superintendent who shall have responsibility and authority to direct work performed. The Site Superintendent shall be responsible for the management and execution of all site activities in accordance with the IMWP, approved EMAC contractor's Work Plan, and all Federal, State, and local laws and regulations. The Site Superintendent may not also serve as the Project Quality Control (QC) Manager or Site Health and Safety Specialist (SHSS). The Site Superintendent shall have, as a minimum, the following qualifications:

- A minimum of six years site superintendent experience.
- A minimum of three years experience on hazardous, toxic, and radioactive waste (HTRW) projects.
- Familiar with the requirements of the U.S. Army Corps of Engineers Safety and Health Requirements (EM 385-1-1).
- Experience in the areas of hazard identification and safety compliance.

Project Quality Control Manager - The EMAC contractor shall designate a Project QC Manager who shall assist and represent the QC Program Manager in continued implementation and enforcement of the approved Project QC Plan. The QC Program Manager or Project QC Manager shall be physically present at the project site whenever work is in progress. The Project QC Manager may also serve as the SHSS, if qualified. The Project QC Manager shall have, as a minimum, the following qualifications:

- A minimum two years experience as a Project QC Manager.
- A minimum of ten years combined experience in the following positions: project superintendent, QC manager, project manager, project engineer or construction manager on similar size and type of construction contracts that included the major trades that are part of this IM.
- Alternatively, the above ten year combined experience requirement may be satisfied by a professional engineer registered in the State of Indiana that has at least two years experience as a Project QC Manager.
- Familiarity with the requirements of the U.S. Army Corps of Engineers Safety and Health Requirements (EM 385-1-1).
- Experience in the areas of hazard identification and safety compliance.

Site Health and Safety Specialist - The EMAC contractor shall designate a SHSS who shall assist and represent the EMAC contractor's Health and Safety (H/S) Manager in continued implementation and enforcement of the approved Site Health and Safety Plan (SSHSP). The SHSS shall have the on-site responsibility and authority to modify and stop work, or remove personnel from the site if working conditions change which may affect on-site and off-site health and safety. The SHSS shall be physically present at the project site at all times. The SHSS may be dual hatted with the Project QC Manager. The SHSS shall have, as a minimum, the following qualifications:

- A minimum of five years safety work experience on similar projects.
- A 30-hour OSHA construction safety class or equivalent within the last five years.
- An average of at least 24 hours of formal safety training each year for the last five years.
- Competent person status for at least the following:
    - excavation
    - health hazard recognition, evaluation and control of chemical, physical and biological agents

- personal protective equipment and clothing to include selection, use, and maintenance
- First aid and cardiopulmonary resuscitation (CPR) qualified.

Quality Control

Approval of the QC Plan is required prior to the start of construction. The OICC reserves the right to require changes in the QC Plan and operations as necessary to ensure the specified quality of work. The IOCC reserves the right to interview the QC Manager at any time in order to verify his/her submitted qualifications.

The OICC shall be notified in writing of any proposed changes to the QC Plan, at a minimum of seven calendar days prior to the implementation of the proposed change. Proposed changes must be approved by the OICC.

Combined Contractor Production Report/Contractor Quality Control Report (CPR/CQCR) is required for each day that work is performed. CPR/CQCRs are to be prepared, signed, and dated by the Project QC Manager.

Safety and Occupational Health Requirements

The SHSS and EMAC contractor representatives who have a responsibility or significant role in accident prevention shall attend the pre-IMWP implementation conference. The purpose of the conference is for the EMAC contractor and the OICC to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project before the initiation of work. The EMAC contractor shall discuss the details of the work identified in the approved EMAC contractor's Work Plan and discuss which construction phases will require significant or additional activity hazard analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of additional hazard analysis shall be established to preclude project delays. Lastly, deficiencies in the submitted accident prevention report will be brought to the attention of the EMAC contractor at the conference. The EMAC contractor shall revise the plan to correct deficiencies and resubmit the plan for acceptance.

New project employees (prime or subcontractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

If unforeseen materials hazardous to human health are encountered during operations, that portion of the work shall be stopped and the OICC shall be notified immediately. Within 14 days, the Navy will determine if the material is hazardous. If the material is not hazardous or poses no danger, the OICC will direct the EMAC contractor to proceed without change. If the material is determined to be hazardous or to pose danger, and handling of the material is necessary to accomplish the work, the Contracting Officer will issue modifications to the proposed work.

Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review. Manufacturer's specifications or owner's manuals for the equipment shall be on site and reviewed for additional safety precautions or requirements. Such additional safety precautions or requirements shall be incorporated into the activity hazard analysis. Mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operations by a competent person prior to being placed into use. Daily checks or tests shall be conducted and documented on mechanized equipment by designated competent persons.

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly.

Environmental Controls

An Erosion and Sediment Control Plan is included in the IMWP. The Erosion and Sediment Control Plan describes the location and description of all erosion and sediment control measures, a sequence of

construction to be followed, graphic details of all erosion and sediment control measures to be used, and an approval sign-off block containing the names of the Facility and EMAC contractor contacts, whose signatures indicate plan acceptance/approval.

The EMAC contractor shall strictly follow the Erosion and Sediment Control Plan and maintain all measures used during construction. Modifications to the Erosion and Sediment Control Plan shall be submitted to the OICC and the Indiana Department of Environmental Management (IDEM) for approval. No modifications to the Erosion and Sediment Control Plan will be allowed until these changes have been approved by the OICC and IDEM and three copies of the approved modifications have been submitted to the OICC and one copy of the approved modifications have been submitted to IDEM.

Transportation and Disposal of Contaminated Material

The EMAC contractor shall be solely responsible for complying with all Federal, State, and local requirements for decontamination of vehicles, equipment, and containers and shall bear all responsibility and cost for any noncompliance. In addition to these requirements, the EMAC contractor shall perform the following:

- Visually inspect all vehicles, equipment, and containers leaving the work site for proper decontamination.
- Prepare and maintain a written decontamination log.

The EMAC contractor shall be solely responsible for complying with all Federal, State, and local requirements for transporting contaminated materials through the applicable jurisdictions and shall bear all responsibility and cost for any noncompliance. In addition to these requirements, the EMAC contractor shall perform the following:

- Inspect and document all vehicles and containers for proper operation and covering.
- Inspect all vehicles and containers for proper markings, manifest documents, and other requirements for waste shipment.

All contaminated materials removed from the site shall be disposed in a treatment/disposal facility permitted to accept such material and with the approval of the OICC.

The EMAC contractor shall properly dispose of investigation derived waste, personnel protective equipment, and miscellaneous wastes associated with implementation of the IMWP, including sampling and analysis wastes that are generated by the Navy representatives.

APPENDIX D

IDEM STABILIZATION SPECIFICATIONS

Practice 3.11
Temporary Seeding

Purpose
(Exhibit 3.11-A)

* To reduce erosion and sedimentation damage by stabilizing disturbed areas where additional work (e.g., grading) is not scheduled for a period of 2 mo. to 1 yr.
* To reduce problems associated with mud or dust from bare soil surfaces during construction.
* To reduce sediment runoff to downstream areas.
* To improve visual aesthetics of the construction areas.

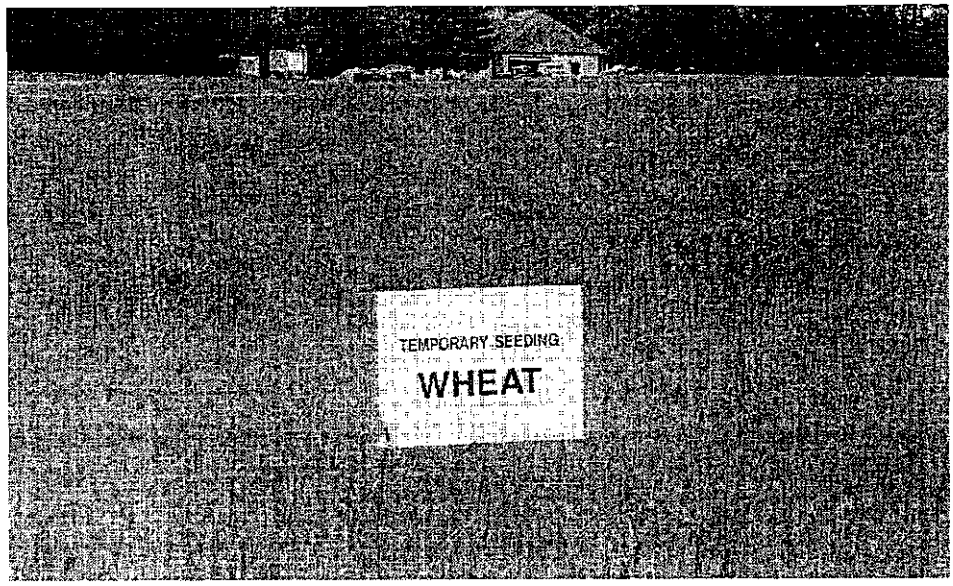


Exhibit 3.11-A. A temporary seeding of wheat to reduce erosion on a future home lot.

Requirements

Site and seedbed preparation: Graded and fertilizer applied.
Plant species: Selected on the basis of quick germination, growth, and time of year to be seeded (see *Exhibit 3.11-B*).
Mulch: Clean grain straw, hay, wood fibre, etc., to protect seedbed and encourage plant growth.
Seeding frequency: As often as possible following construction activity. Daily seeding of rough graded areas when the soil is loose and moist is usually most effective.

Application
(Exhibit 3.11-B)

SITE PREPARATION:

1. Install practices needed to control erosion, sedimentation, and water runoff, such as temporary and permanent diversions, sediment traps or basins, silt fences, and straw bale dams (Practices 3.21, 3.22, 3.72, 3.73, 3.74, and 3.75).
2. Grade the site as specified in the construction plan.

SEEDBED PREPARATION:

1. Test soil to determine its nutrient levels. (Contact your county SWCD or Cooperative Extension office for assistance and soils information, including available soil testing services.)
2. Fertilize as recommended by the soil test. If testing is not done, consider applying 400-600 lbs./acre of 12-12-12 analysis, or equivalent, fertilizer.
3. Work the fertilizer into the soil 2-4 in. deep with a disk or rake operated across the slope.

SEEDING:

1. Select a seeding mixture and rate from *Exhibit 3.11-B*, and plant at depth and on dates shown.
2. Apply seed uniformly with a drill or cultipacker-seeder or by broadcasting, and cover to the depth shown in *Exhibit 3.11-B*.

3. If drilling or broadcasting, firm the seedbed with a roller or cultipacker.
4. Mulch seeded areas to increase seeding success. Anchor all mulch by crimping or tackifying. Use of netting or erosion control blankets is possible, but may not be cost-effective for temporary seedings.

Exhibit 3.11-B. Temporary Seeding Recommendations.

Seed species*	Rate/acre	Planting depth	Optimum dates**
Wheat or rye	150 lbs.	1 to 1½ in.	9/15 to 10/30
Spring oats	100 lbs.	1 in.	3/1 to 4/15
Annual ryegrass	40 lbs.	1/4 in.	3/1 to 5/1 8/1 to 9/1
German millet	40 lbs.	1 to 2 in.	5/1 to 6/1
Sudangrass	35 lbs.	1 to 2 in.	5/1 to 7/30

* Perennial species may be used as a temporary cover, especially if the area to be seeded will remain idle for more than a year (Practice 3.12).

** Seeding done outside the optimum dates increases the chances of seeding failure.

Maintenance

* Inspect periodically after planting to see that vegetative stands are adequately established; re-seed if necessary.
* Check for erosion damage after storm events and repair; reseed and mulch if necessary.
* Topdress fall seeded wheat or rye seedings with 50 lbs./acre of nitrogen in February or March if nitrogen deficiency is apparent. (*Exhibit 3.11-B* shows only wheat/rye fall seeded.)

Common concern

Fertilizer not incorporated at least 2 in. deep—may be lost in runoff or remain concentrated near the surface to inhibit germination.

Mulch rate inadequate—results in poor germination and failure.

Seeding uneven or rate too low—results in patchy growth and erosion.

Practice 3.12
Permanent Seeding

Purposes
(Exhibit 3.12-A)

* To reduce erosion and sedimentation damage by stabilizing exposed areas where additional work (e.g., grading) is not scheduled for a period of more than a year or areas where final grading has been completed.
* To reduce problems associated with mud or dust from bare soil surfaces during construction.
* To reduce sediment runoff to downstream areas.
* To improve the visual aesthetics of the construction area.

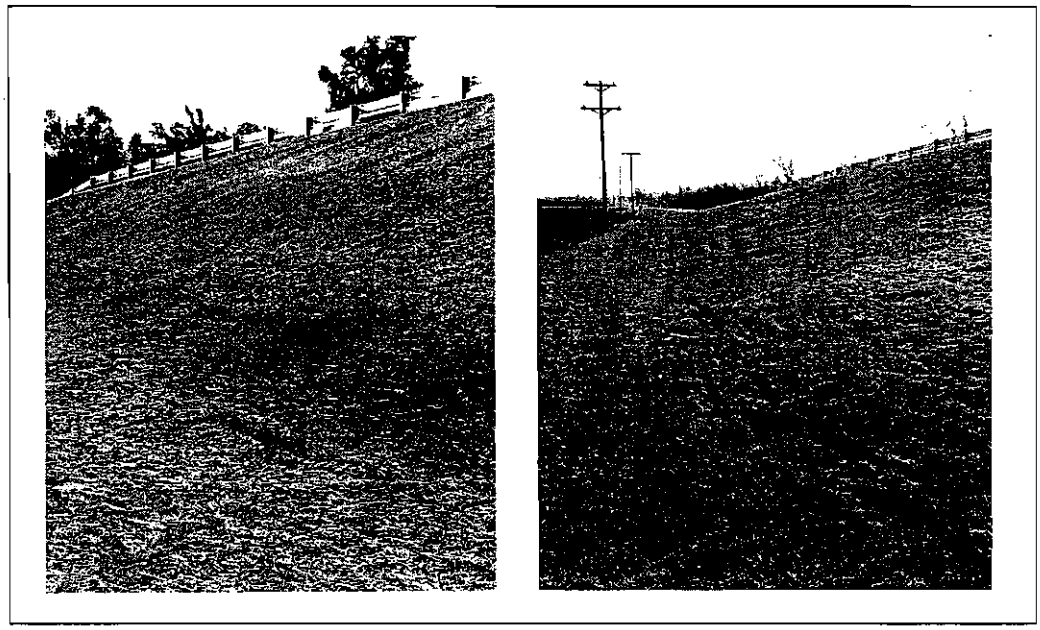


Exhibit 3.12-A. A road right-of-way (left) newly permanent seeded and mulched and (right) 6 mo. later.

Requirements

Site and seedbed preparation: Graded, and lime and fertilizer applied.

Plant species: Selected on the basis of soil type, soil pH, region of the state, time of year, and planned use of the area to be seeded (see *Exhibit 3.12-C*).

Mulch: Clean grain straw, hay, wood fibre, etc., to protect seedbed and encourage plant growth. The mulch may need to be anchored to reduce removal by wind or water, or erosion control blankets may be considered.

Application
(Exhibits 3.12-B, C, and D)

Permanently seed all final grade areas (e.g., landscape berms, drainage swales, erosion control structures, etc.) as each is completed and all areas where additional work is not scheduled for a period of more than a year.

SITE PREPARATION:

1. Install practices needed to control erosion, sedimentation, and runoff prior to seeding. These include temporary and permanent diversions, sediment traps and basins, silt fences, and straw bale dams (Practices 3.21, 3.22, 3.72, 3.73, 3.74, and 3.75).
2. Grade the site and fill in depressions that can collect water.
3. Add topsoil to achieve needed depth for establishment of vegetation (Practice 3.02).

SEEDBED PREPARATION:

1. Test soil to determine pH and nutrient levels. (Contact your county SWCD or Cooperative Extension office for assistance and soils information, including available testing services.)
2. If soil pH is unsuitable for the species to be seeded, apply lime according to test recommendations.

3. Fertilize as recommended by the soil test. If testing was not done, consider applying 400-600 lbs./acre of 12-12-12 analysis, or equivalent, fertilizer.
4. Till the soil to obtain a uniform seedbed, working the fertilizer and lime into the soil 2-4 in. deep with a disk or rake operated across the slope *(Exhibit 3.12-B)*.

SEEDING:

Optimum seeding dates are Mar. 1-May 10 and Aug. 10-Sept. 30. Permanent seeding done between May 10 and Aug. 10 may need to be irrigated. As an alternative, use temporary seeding (Practice 3.11) until the preferred date for permanent seeding.

1. Select a seeding mixture and rate from *Exhibit 3.12-C*, based on site conditions, soil pH, intended land use, and expected level of maintenance.
2. Apply seed uniformly with a drill or cultipacker-seeder *(Exhibit 3.12-D)* or by broadcasting, and cover to a depth of 1/4-1/2 in.
3. If drilling or broadcasting, firm the seedbed with a roller or cultipacker.
4. Mulch all seeded areas (Practice 3.15). Consider using erosion control blankets on sloping areas (Practice 3.17). (NOTE: If seeding is done with a hydroseeder, fertilizer and mulch can be applied with the seed in a slurry mixture.)

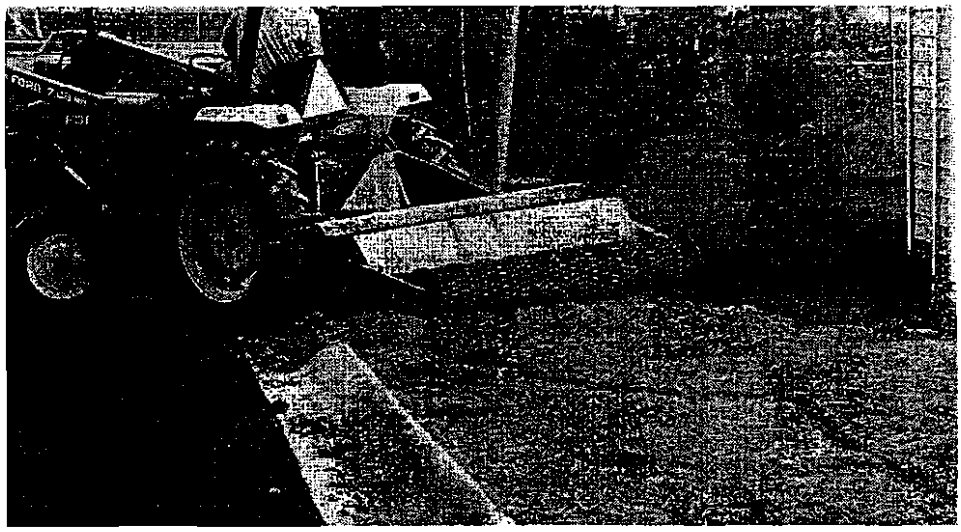


Exhibit 3.12-B. Preparing the seedbed with a combination roto-tiller and cultipacker.

Exhibit 3.12-C. Permanent Seeding Recommendations.

This table provides several seeding options. Additional seed species and mixtures are available commercially. When selecting a mixture, consider site conditions, including soil properties (e.g., soil pH and drainage), slope aspect and the tolerance of each species to shade and droughtiness.

Seed species and mixtures	Rate per acre	Optimum soil pH
OPEN AND DISTURBED AREAS (REMAINING IDLE MORE THAN 1 YR.)		
1. Perennial ryegrass	35 to 50 lbs.	5.6 to 7.0
+ white or ladino clover*	1 to 2 lbs.	
2. Kentucky bluegrass	20 lbs.	5.5 to 7.5
+ smooth bromegrass	10 lbs.	
+ switchgrass	3 lbs.	
+ timothy	4 lbs.	
+ perennial ryegrass	10 lbs.	
+ white or ladino clover*	1 to 2 lbs.	

Exhibit 3.12-C. Continued.

Seed species and mixtures	Rate per acre	Optimum soil pH
3. Perennial ryegrass	15 to 30 lbs.	5.6 to 7.0
+ tall fescue**	15 to 30 lbs.	
4. Tall fescue**	35 to 50 lbs.	5.5 to 7.5
+ ladino or white clover*	1 to 2 lbs.	
STEEP BANKS AND CUTS, LOW MAINTENANCE AREAS (NOT MOWED)		
1. Smooth bromegrass	25 to 35 lbs.	5.5 to 7.5
+ red clover*	10 to 20 lbs.	
2. Tall fescue**	35 to 50 lbs.	5.5 to 7.5
+ white or ladino clover*	1 to 2 lbs.	
3. Tall fescue**	35 to 50 lbs.	5.5 to 7.5
+ red clover*	10 to 20 lbs.	
(Recommended north of US 40)		
4. Orchardgrass	20 to 30 lbs.	5.6 to 7.0
+ red clover*	10 to 20 lbs.	
+ ladino clover*	1 to 2 lbs.	
5. Crownvetch*	10 to 12 lbs.	5.6 to 7.0
+ tall fescue**	20 to 30 lbs.	
(Recommended south of US 40)		
LAWNS AND HIGH MAINTENANCE AREAS		
1. Bluegrass	105 to 140 lbs.	5.5 to 7.0
2. Perennial ryegrass (turf-type)	45 to 60 lbs.	5.6 to 7.0
+ bluegrass	70 to 90 lbs.	
3. Tall fescue (turf-type)**	130 to 170 lbs.	5.6 to 7.5
+ bluegrass	20 to 30 lbs.	
CHANNELS AND AREAS OF CONCENTRATED FLOW		
1. Perennial ryegrass	100 to 150 lbs.	5.6 to 7.0
+ white or ladino clover*	1 to 2 lbs.	
2. Kentucky bluegrass	20 lbs.	5.5 to 7.5
+ smooth bromegrass	10 lbs.	
+ switchgrass	3 lbs.	
+ timothy	4 lbs.	
+ perennial ryegrass	10 lbs.	
+ white or ladino clover*	1 to 2 lbs.	
3. Tall fescue**	100 to 150 lbs.	5.5 to 7.5
+ ladino or white clover*	1 to 2 lbs.	
4. Tall fescue**	100 to 150 lbs.	5.5 to 7.5
+ Perennial ryegrass	15 to 20 lbs.	
+ Kentucky bluegrass	15 to 20 lbs.	

* For best results: (a) legume seed should be inoculated; (b) seeding mixtures containing legumes should preferably be spring-seeded, although the grass may be fall-seeded and the legume frost-seeded (Practice 3.13); and (c) if legumes are fall-seeded, do so in early fall.

** Tall fescue provides little cover for, and may be toxic to, some species of wildlife. The IDNR rec-ognizes the need for additional research on alternatives to tall fescue, such as buffalograss, orchard-grass, smooth brome-grass, and switch-grass. This research, in conjunction with demonstration areas, should focus on erosion control characteristics, wildlife toxicity, turf durability, and drought resistance.

NOTE: An oat or wheat companion or nurse crop may be used with any of the above permanent seeding mixtures. If so, it is best to seed during the fall seeding period, especially after Sept. 15, and at the following rates: spring oats--1/4 to 3/4 bu./acre; wheat--no more than 1/2 bu./acre.

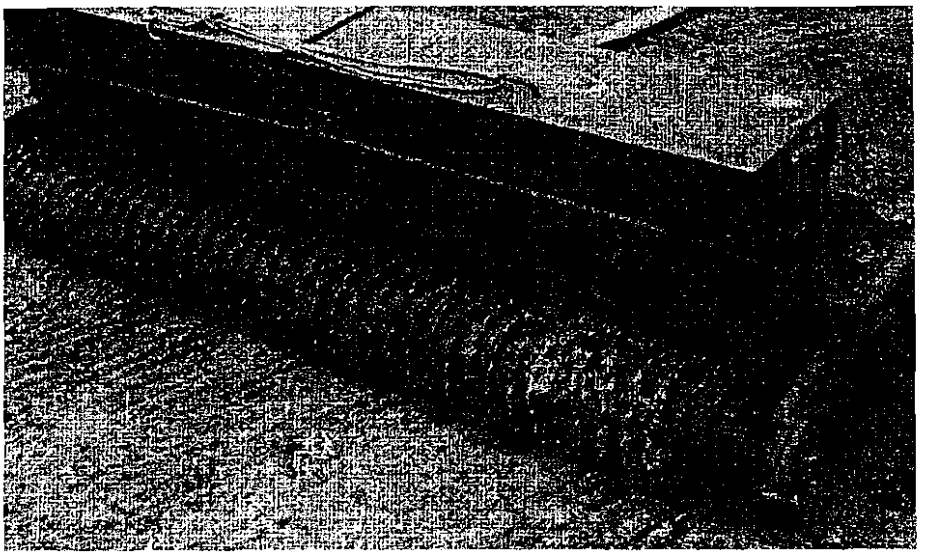


Exhibit 3.12-D. A cultipacker-seeder.

Maintenance

* Inspect periodically, especially after storm events, until the stand is successfully established. (Characteristics of a successful stand include: vigorous dark green or bluish-green seedlings; uniform density with nurse plants, legumes, and grasses well inter-mixed; green leaves; and the perennials remaining green throughout the summer, at least at the plant base.)
* Plan to add fertilizer the following growing season according to soil test recommendations.
* Repair damaged, bare, or sparse areas by filling any gullies, re-fertilizing, over- or re-seeding, and mulching.
* If plant cover is sparse or patchy, review the plant materials chosen, soil fertility, moisture condition, and mulching; then repair the affected area either by over-seeding or by re-seeding and mulching after re-preparing the seedbed.
* If vegetation fails to grow, consider soil testing to determine acidity or nutrient deficiency problems. (Contact your SWCD or Cooperative Extension office for assistance.)
* If additional fertilization is needed to get a satisfactory stand, do so according to soil test recommendations.

Common concerns

Insufficient topsoil or inadequately tilled, limed, and/or fertilized seedbed—results in poor establishment of vegetation.

Unsuitable species or seeding mixture—results in poor establishment of vegetation.

Nurse crop rate too high in the mixture—results in competition with the perennials.

Seeding done at the wrong time of year—results in poor establishment of vegetation, also plant hardiness is significantly decreased.

Mulch rate inadequate—results in poor germination and failure.

Practice 3.13
Dormant and Frost Seeding

Dormant seeding is a temporary or permanent seeding application at a time when soil temperatures are too low for germination to occur (less than 50°F). *Frost seeding* is a temporary or permanent seeding application in early spring when soils are in the freeze-thaw stage. (This practice can be used to repair or enhance areas having thin or declining cover or to re-vegetate an area.)

Purposes
(Exhibit 3.13-A)

* To provide early germination and soil stabilization in the spring.
* To reduce sediment runoff to downstream areas.
* To improve the visual aesthetics of the construction area.
* To repair previous seedings.

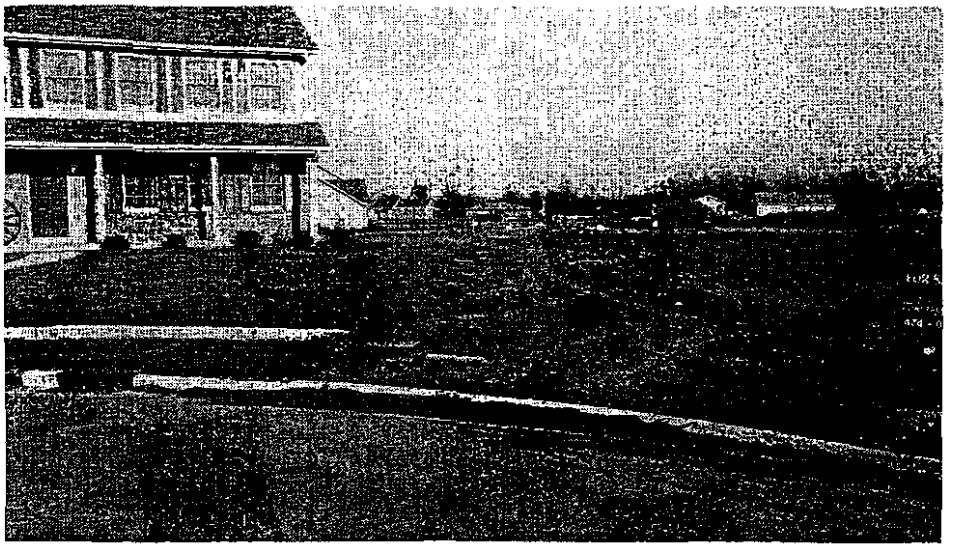


Exhibit 3.13-A. Use of dormant seeding could have reduced excessive early spring erosion on this site.

Requirements

Site and seedbed preparation: Graded as needed, and lime and fertilizer applied.
Plant species: Selected on the basis of soil type, adaptability to the region, and planned use of the area (see *Exhibits 3.13-B* and *3.13-C*).

Application
(Exhibits 3.13-B and C)

SITE PREPARATION:

1. Grade the area to be seeded.
2. Install needed erosion/water runoff control practices, such as temporary or permanent diversions, sediment basins, silt fences, or straw bale dams (Practices 3.21, 3.22, 3.72, 3.74, or 3.75).

FOR DORMANT SEEDING:

Site and seedbed preparation and mulching can be done months ahead of actual seeding; or if the existing ground cover is adequate, seeding can be done directly into it.

Seeding dates: Dec. 1-Feb. 28 (north of U.S. 40), Dec. 10-Jan. 15 (south of U.S. 40).

1. Broadcast fertilizer as recommended by a soil test; or if testing was not done, consider applying 400-600 lbs./acre of 12-12-12 analysis, or equivalent, fertilizer.
2. Apply mulch upon completion of grading (Practice 3.15).
3. Select an appropriate seed species or mixture from *Exhibit 3.13-B* for temporary seeding or *Exhibit 3.13-C* for permanent seeding, and broadcast on top of the mulch and/or into existing ground cover at the rate shown. (If site preparation occurs within the recommended dates, fertilize and lime, seed, and mulch at that time.)

FOR FROST SEEDING:

Seed is broadcast over the prepared seedbed and incorporated into the soil by natural freeze-thaw action.

Seeding dates: Feb. 28-Mar. 28 (north of U.S. 40), Feb. 15-Mar. 15 (south of U.S. 40).

1. Broadcast fertilizer as recommended by a soil test; or if testing was not done, consider applying 400-600 lbs./acre of 12-12-12 analysis, or equivalent, fertilizer.
2. Select an appropriate seed species or mixture from *Exhibit 3.13-B* for temporary seeding or *Exhibit 3.13-C* for permanent seeding, and broadcast on to the seedbed or into the existing ground cover at the rate shown. (Do not work the seed into the soil.)

Exhibit 3.13-B. Temporary Dormant or Frost Seeding Recommendations.

Seed species*	Rate per acre
Wheat or rye	150 lbs.
Spring oats	150 lbs.
Annual ryegrass	60 lbs.

* Perennial species may be used as a temporary cover, especially if the area to be seeded will remain idle for more than a year (Practice 3.12).

Exhibit 3.13-C. Permanent Dormant or Frost Seeding Recommendations.

This table provides several seeding options. Additional seed species and mixtures are available commercially. When selecting a mixture, consider site conditions, including soil properties (e.g., soil pH and drainage), slope aspect and the tolerance of each species to shade and droughtiness.

Seed species and mixtures	Rate per acre	Optimum soil pH
OPEN AND DISTURBED AREAS (REMAINING IDLE MORE THAN 1 YR.)		
1. Perennial ryegrass	50 to 75 lbs.	5.6 to 7.0
+ white or ladino clover*	1½ to 3 lbs.	
2. Kentucky bluegrass	30 lbs.	5.5 to 7.5
+ smooth bromegrass	15 lbs.	
+ switchgrass	5 lbs.	
+ timothy	6 lbs.	
+ perennial ryegrass	15 lbs.	
+ white or ladino clover*	1½ to 3 lbs.	
3. Perennial ryegrass	22 to 45 lbs.	5.6 to 7.0
+ tall fescue**	22 to 45 lbs.	
4. Tall fescue**	50 to 75 lbs.	5.5 to 7.5
+ ladino or white clover*	1½ to 3 lbs.	
STEEP BANKS AND CUTS, LOW MAINTENANCE AREAS (NOT MOWED)		
1. Smooth bromegrass	35 to 50 lbs.	5.5 to 7.5
+ red clover*	15 to 30 lbs.	
2. Tall fescue**	50 to 75 lbs.	5.5 to 7.5
+ white or ladine clover*	1½ to 3 lbs.	
3. Tall fescue**	50 to 75 lbs.	5.5 to 7.5
+ red clover*	15 to 30 lbs.	
(Recommended north of US 40)		
4. Orchardgrass	30 to 45 lbs.	5.6 to 7.0
+ red clover*	15 to 30 lbs.	
+ ladino clover*	1½ to 3 lbs.	
5. Crownvetch*	15 to 18 lbs.	5.6 to 7.0
+ tall fescue**	30 to 45 lbs.	
(Recommended south of US 40)		

Exhibit 3.13-C. Continued.

Seed species and mixtures	Rate per acre	Optimum soil pH
LAWNS AND HIGH MAINTENANCE AREAS		
1. Bluegrass	160 to 210 lbs.	5.5 to 7.0
2. Perennial ryegrass (turf-type)	70 to 90 lbs.	5.6 to 7.0
+ bluegrass	105 to 135 lbs.	
3. Tall fescue (turf-type)**	195 to 250 lbs.	5.6 to 7.5
+ bluegrass	30 to 45 lbs.	
CHANNELS AND AREAS OF CONCENTRATED FLOW		
1. Perennial ryegrass	150 to 225 lbs.	5.6 to 7.0
+ white or ladino clover*	1½ to 3 lbs.	
2. Kentucky bluegrass	30 lbs.	5.5 to 7.5
+ smooth bromegrass	15 lbs.	
+ switchgrass	5 lbs.	
+ timothy	6 lbs.	
+ perennial ryegrass	15 lbs.	
+ white or ladino clover*	1½ to 3 lbs.	
3. Tall fescue**	150 to 225 lbs.	5.5 to 7.5
+ ladino or white clover*	1½ to 3 lbs.	
4. Tall fescue**	150 to 225 lbs.	5.5 to 7.5
+ Perennial bluegrass	22 to 30 lbs.	
+ Kentucky bluegrass	22 to 30 lbs.	

* For best results: (a) legume seed should be inoculated; (b) seeding mixtures containing legumes should preferably be spring-seeded, although the grass may be fall-seeded and the legume frost-seeded; and (c) if legumes are fall-seeded, do so in early fall.

** Tall fescue provides little cover for, and may be toxic to, some species of wildlife. The IDNR recognizes the need for additional research on alternatives to tall fescue, such as buffalograss, orchardgrass, smooth bromegrass, and switch-grass. This research, in conjunction with demonstration areas, should focus on erosion control characteristics, wildlife toxicity, turf durability, and drought resistance.

NOTE: If using mixtures other than those listed here, increase the seeding rate by 50% over the conventional rate.

Maintenance

* Apply 200-300 lbs./acre of 12-12-12 or equivalent fertilizer between Apr. 15 and May 10 or during periods of vigorous growth.
* Re-seed and mulch any areas that have inadequate cover by mid- to late-April. For best results, re-seed within the recommended dates shown in Practices 3.11 for temporary seeding or 3.12 for permanent seeding.

Common concerns

Seeding done at wrong time of year--results in poor seed germination and vegetative stands.
Seeding on too steep a slope--results in seed loss and poor stands.
Seeding failure due to late freeze, killing germinated seedlings.
Mulch rate inadequate--results in poor germination and failure of dormant seeding.
Unsuitable choice of seed species or seeding mixture--results in poor vegetative stands or vegetation that does not serve the intended purpose.
Poor soil and seed contact--results in poor seed germination and vegetative stands.
Dormant seeding over mulch or frost seeding in concentrated flow areas--can result in seed being washed away before seed-soil contact and germination can occur.

Exhibit 3.13-C. Continued.

Seed species and mixtures	Rate per acre	Optimum soil pH
LAWNS AND HIGH MAINTENANCE AREAS		
1. Bluegrass	160 to 210 lbs.	5.5 to 7.0
2. Perennial ryegrass (turf-type)	70 to 90 lbs.	5.6 to 7.0
+ bluegrass	105 to 135 lbs.	
3. Tall fescue (turf-type)**	195 to 250 lbs.	5.6 to 7.5
+ bluegrass	30 to 45 lbs.	
CHANNELS AND AREAS OF CONCENTRATED FLOW		
1. Perennial ryegrass	150 to 225 lbs.	5.6 to 7.0
+ white or ladino clover*	1½ to 3 lbs.	
2. Kentucky bluegrass	30 lbs.	5.5 to 7.5
+ smooth bromegrass	15 lbs.	
+ switchgrass	5 lbs.	
+ timothy	6 lbs.	
+ perennial ryegrass	15 lbs.	
+ white or ladino clover*	1½ to 3 lbs.	
3. Tall fescue**	150 to 225 lbs.	5.5 to 7.5
+ ladino or white clover*	1½ to 3 lbs.	
4. Tall fescue**	150 to 225 lbs.	5.5 to 7.5
+ Perennial bluegrass	22 to 30 lbs.	
+ Kentucky bluegrass	22 to 30 lbs.	

* For best results: (a) legume seed should be inoculated; (b) seeding mixtures containing legumes should preferably be spring-seeded, although the grass may be fall-seeded and the legume frost-seeded; and (c) if legumes are fall-seeded, do so in early fall.

** Tall fescue provides little cover for, and may be toxic to, some species of wildlife. The IDNR recognizes the need for additional research on alternatives to tall fescue, such as buffalograss, orchardgrass, smooth bromegrass, and switch-grass. This research, in conjunction with demonstration areas, should focus on erosion control characteristics, wildlife toxicity, turf durability, and drought resistance.

NOTE: If using mixtures other than those listed here, increase the seeding rate by 50% over the conventional rate.

Maintenance

* Apply 200-300 lbs./acre of 12-12-12 or equivalent fertilizer between Apr. 15 and May 10 or during periods of vigorous growth.
* Re-seed and mulch any areas that have inadequate cover by mid- to late-April. For best results, re-seed within the recommended dates shown in Practices 3.11 for temporary seeding or 3.12 for permanent seeding.

Common concerns

Seeding done at wrong time of year--results in poor seed germination and vegetative stands.
Seeding on too steep a slope--results in seed loss and poor stands.
Seeding failure due to late freeze, killing germinated seedlings.
Mulch rate inadequate--results in poor germination and failure of dormant seeding.
Unsuitable choice of seed species or seeding mixture--results in poor vegetative stands or vegetation that does not serve the intended purpose.
Poor soil and seed contact--results in poor seed germination and vegetative stands.
Dormant seeding over mulch or frost seeding in concentrated flow areas--can result in seed being washed away before seed-soil contact and germination can occur.

Practice 3.15
Mulching

Purposes
(Exhibit 3.15-A)

* To prevent erosion by protecting the soil from wind and water impact.
* To provide temporary surface stabilization.
* To prevent soil from crusting.
* To conserve moisture thereby promoting seed germination and seedling growth.

Exhibit 3.15-A. Applying straw mulch with a chopper-blower on freshly seeded soil adjacent to a road.

Requirements
(Exhibits 3.15-B and C)

Material: Straw, hay, wood fiber, cellulose, or excelsior (see *Exhibit 3.15-B*), or erosion control blankets or turf reinforcement mats (Practices 3.17 and 3.18), as specified in the erosion and sediment control plan.

Coverage: At least 75% of the soil surface.

Anchoring: Required for straw or hay mulch and sometimes excelsior to prevent displacement by wind and/or water (see *Exhibit 3.15-C*).

Exhibit 3.15-B. Mulch Materials, Rates, and Comments.

Material	Rate	Comments
Straw or hay	1½-2 tons/acre	Should be dry, unchopped, free of undesirable seeds. Spread by hand or machine. Must be crimped or anchored (see *Exhibit 3.15-D*).
Wood fiber or cellulose	1 ton /acre	Apply with a hydromulcher and use with tacking agent.
Long fiber wood (excelsior)	1/2-3/4 ton/acre	Anchor in areas subject to wind.

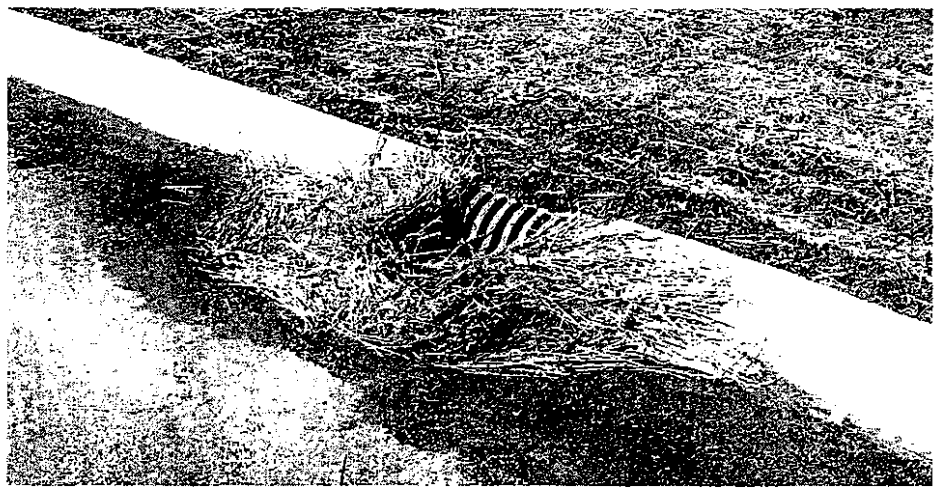


Exhibit 3.15-C. This unanchored straw mulch flowed with runoff to the storm drain. While acting somewhat as an inlet protection filter, it would have been more effective keeping soil from eroding off the site.

Application and anchoring

(Exhibits 3.15-D, E, and F)

1. Apply mulch at the recommended rate.
2. Spread uniformly by hand, hay fork, mulch blower, or hydromulcher. After spreading, no more than 25% of the ground surface should be visible.
3. If straw or hay is used, anchor it immediately one of the following ways (see *Exhibit 3.15-D*):
   - Crimp with a mulch anchoring tool, a weighted farm disk with dull serrated blades set straight (see *Exhibit 3.15-E*), or track cleats of a bulldozer; OR
   - Hydromulch with short cellulose fibers (see *Exhibit 3.15-F*); OR
   - Apply a liquid tackifier; OR
   - Cover with netting secured by metal staples.

Exhibit 3.15-D. Mulch Anchoring Methods.

Anchoring method	How to apply
Mulch anchoring tool OR Farm disk (dull, serrated, and set straight)	Crimp or punch the straw or hay into the soil 2-4 in. Operate machinery on the contour of the slope.
Cleating with dozer tracks	Operate dozer up and down slope, not across, or else the tracks will form rills.
Wood hydromulch fibers	Apply 1-2 tons/acre using a hydromulcher at a rate of 750 lbs./acre with a tacking agent (or according to contractor specifications). Do not use in areas of concentrated flow.
Asphalt emulsion	Emulsified asphalt should conform to the requirements of ASTM Spec. #977. Apply with suitable equipment at a rate of 0.05 gal./sq. yd. Do not use in areas of concentrated flow.
Synthetic tackifier, binder or soil stabilizer	Apply according to manufacturer's recommendation.
Biodegradable netting (polypropylene or similar material)*	Apply over mulch and staple with 6-8 in. wire staples. Follow manufacturer's recommendations for installation. Best suited to slope application.

* Install the netting immediately after applying the mulch. In areas of concentrated water flow, lay it parallel to the direction of flow; on other slopes, lay it either parallel or perpendicular to direction of flow. Edges of adjacent netting strips should overlap 4-6 in., with the strip on the upgrade side of any lateral water flow on top. Installation details are site specific, so follow manufacturer's directions.

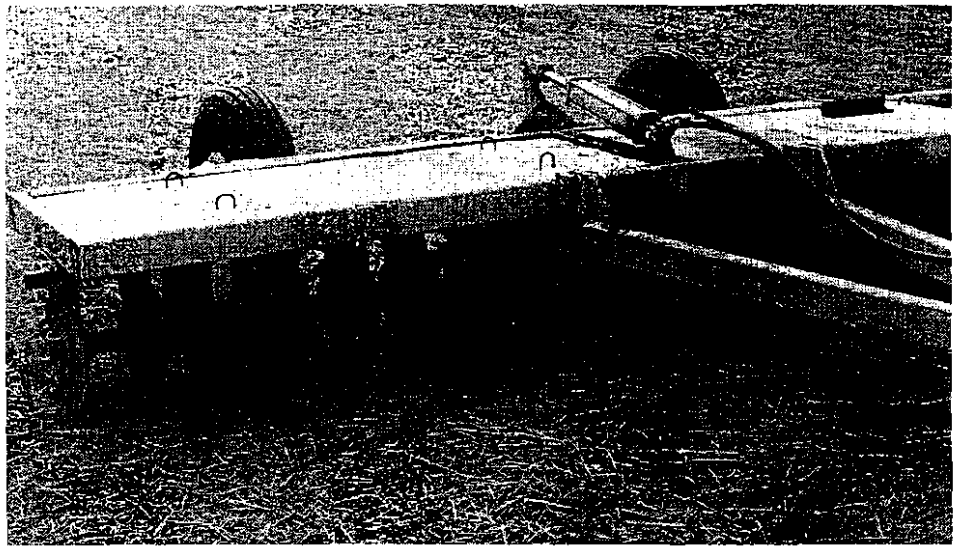


Exhibit 3.15-E. A crimper can be used to anchor mulch into the soil more securely.

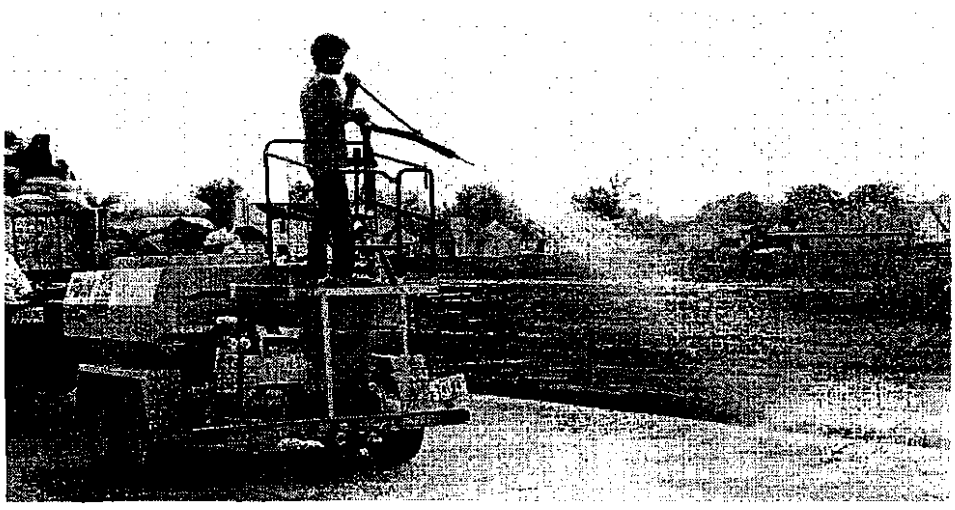


Exhibit 3.15-F. Hydroseeding the roadside in a new subdivision.

Maintenance

* Inspect after storm events to check for movement of mulch or for erosion.
* If washout, breakage, or erosion is present, repair the surface, then re-seed, re-mulch and, if applicable, install new netting.
* Continue inspections until vegetation is firmly established.

Common concerns

Inadequate coverage—results in erosion, washout, and poor plant establishment.

Appropriate tacking agent not applied or applied in insufficient amount—results in mulch being lost to wind and runoff.

Flow too concentrated to use straw mulch—results in erosion in channel; consider use of erosion control blankets and/or a diversion until vegetation is established.

Hydromulch applied in winter—results in deterioration of mulch before plants can become established.

Netting washed away—because insufficient number of staples used.