Comprehensive Long-term Environmental Action Navy

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Interim Measures Work Plan
for
SWMU 8 – Building 106 Pond

Naval Surface Warfare Center Crane
Crane, Indiana

Contract Task Order 0020

June 2006

NAVFAC
Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

DEPARTMENT OF THE NAVY
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IN REPLY REFER TO:
5090/S4.7.3
Ser PRCR4/6165
5 JUN 2006

Indiana Department Of Environmental Management
Office Of Land Quality
Hazardous Waste Permits
100 North Senate Ave.
MC 64-45 IGCN 1101
Indianapolis, IN 46204-2251

Dear Mr. Griffin:

Crane Division, Naval Surface Warfare Center submits the Draft Interim Measures Work Plan (IMWP) for the Building 106 Pond (B106P), Solid Waste Management Unit 08. One copy is presented as enclosure (1) for your review. The permit required Certification Statement is provided as enclosure (2).

If you require any further information, my point of contact is Mr. Thomas J. Brent, Code PRCR4-TB, at 812-854-6160, email thomas.brent@navy.mil.

Sincerely,

J. M. Hunsicker
J. M. HUNSICKER
Environmental Site Manager
By direction of the Commanding Officer

Enclosures: 1. Draft IMWP for B106P
2. Certification Statement

Copy to:
ADMINISTRATIVE RECORD
SOUTHNAVFACENGCOM (Code ES31) (w/o encl)
USEPA (Pete Ramanauskas)
TTNUS (Ralph Basinski) (w/o encl)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

James Hausche

SIGNATURE

Manager, Environmental Protection

TITLE

6/05/06

DATE

050603/P

INTERIM MEASURES WORK PLAN
SWMU 8 – BUILDING 106 POND

NAVAL SURFACE WARFARE CENTER CRANE
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
Southeast
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North Charleston, South Carolina 29406

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CONTRACT TASK ORDER 0020

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LIST OF ACRONYMS

AS	Air stripper
BERA	Baseline ecological risk assessment
bgs	Below ground surface
CFR	Code of Federal Regulations
CFU	Colony-forming unit
CLEAN	Comprehensive Long-term Environmental Action Navy
CMP	Corrugated metal pipe
COPC	Chemical of potential concern
CTO	Contract Task Order
cy	Cubic yards
DCA	Dichloroethane
DCE	Dichloroethene
DO	Dissolved oxygen
DRMO	Defense Reutilization and Marketing Office
EEQ	Ecological effects quotient
EMAC	Environmental Multiple Award Contract
EP	Extraction Procedure
ESA	Endangered Species Act
gpm	Gallons per minute
HHRA	Human Health Risk Assessment
HI	Hazard index
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IDEM	Indiana Department of Environmental Management
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental lifetime cancer risk
IMR	Interim Measures Report
IMWP	Interim Measures Work Plan
IR	Installation Restoration
LDPE	Low density polyethylene
MCL	Maximum Contaminant Level
MSDS	Material Safety Data Sheet
msl	Mean sea level

NOAEL	No observable adverse effects level
NPDES	National Pollution Discharge Elimination System
NSA	To be defined
NSWC	Naval Surface Warfare Center
OICC	Officer in Charge of Construction
PAH	Polynuclear aromatic hydrocarbon
PCE	Tetrachloroethene
PCP	Pentachlorophenol
ppb	parts per billion
ppm	parts per million
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RME	Reasonable maximum exposure
SERA	Screening-level ecological risk assessment
sf	square feet
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total organic carbon
TSD	Treatment, storage, or disposal
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VCP	Vitrified clay pipe
VOC	Volatile organic compound
WWTP	Wastewater Treatment Plan

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this document is to present the Interim Measures Work Plan (IMWP) for the Building 106 Pond site at Solid Waste Management Unit (SWMU) 8, Naval Surface Warfare Center (NSWC) Crane located in Crane, Indiana. The IMWP includes dewatering the Building 106 pond, excavation of contaminated sediments and soils from within the pond, dewatering of excavated sediments and soils, treatment and discharge of all accumulated water to the NSWC Crane sanitary treatment plant, and off-site disposal of the contaminated sediments and soils. In conjunction with the removal of contaminated media from the Building 106 Pond, the IMWP also includes the removal of Building 2961, the former Industrial Water Treatment Facility located south of the Building 106 Pond. The IMWP was prepared for the United States Navy, Naval Facilities Engineering Command, Engineering Field Division South by Tetra Tech NUS, Inc. (TtNUS) under Contract Task Order (CTO) 0020 of the Comprehensive Long-term Environmental Action Navy (CLEAN) IV Contract Number N62467-04-D-0055.

This work is being performed under the Navy's Installation Restoration (IR) Program. The following identifies the four 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 Proposal
- Phase 4 is the Corrective Measures Implementation

This IMWP has been prepared under Phase 4 of the IR Program as part of an interim measure. The IMWP defines activities associated with corrective measures conducted to address trichloroethene (TCE) contaminated sediments and soils that serve as a continuing source of TCE contamination in groundwater. The IMWP does not include land use controls, which comprise the remainder of the limited action tentatively identified as Alternative S-2 in the draft Corrective Measures Proposal.

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 (TSD) 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 submitted a Hazardous Waste Management Report, and an RFA was conducted to characterize the potential for releases of hazardous waste or constituents from approximately 100 SWMUs identified during the RFA (TtNUS, 2006).

On December 23, 1989, 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 8, will continue under the USEPA/IDEM Work Sharing Agreement for Corrective Action Activities at NSWC Crane (TtNUS, 2006).

1.3.2 SWMU 8 – Building 106 Pond

SWMU 8 includes a surface pond located east of Building 106 (Figure 1-2). The pond has been studied extensively, and the nature and extent of contamination and associated risks at the pond are based on the results of these investigations. The reports generated from these investigations include the following:

- Naval Ammunition Depot, Crane Indiana, Pilot Test Final Report (Kent R., et al., 1973).
- Initial Assessment Study (Naval Energy and Environmental Support Activity, 1983).
- Preliminary Review/Site Inspection of NWSC Crane (A.T. Kearny, Inc., 1987).
- RFI Phase I Environmental Monitoring Reports, SWMUs 16/06, 14/10, and 16/16 (Halliburton NUS, 1992)
- RFI for Building 106 Pond (SWMU 8) (TtNUS, 2006)

A summary of the environmental investigations conducted at the Building 106 Pond is provided in Section 2.0.

1.4 REPORT ORGANIZATION

The following highlights the information contained in the remainder of this document:

- Section 2.0 summarizes site characteristics including site description, summary of environmental investigations conducted at SWMU 8, and nature and extent of contamination.

- Section 3.0 presents the interim measures design elements.

- Section 4.0 presents erosion and sediment control features proposed for the IMWP described in Section 3.0.

- Section 5.0 presents the sampling and analysis plan.

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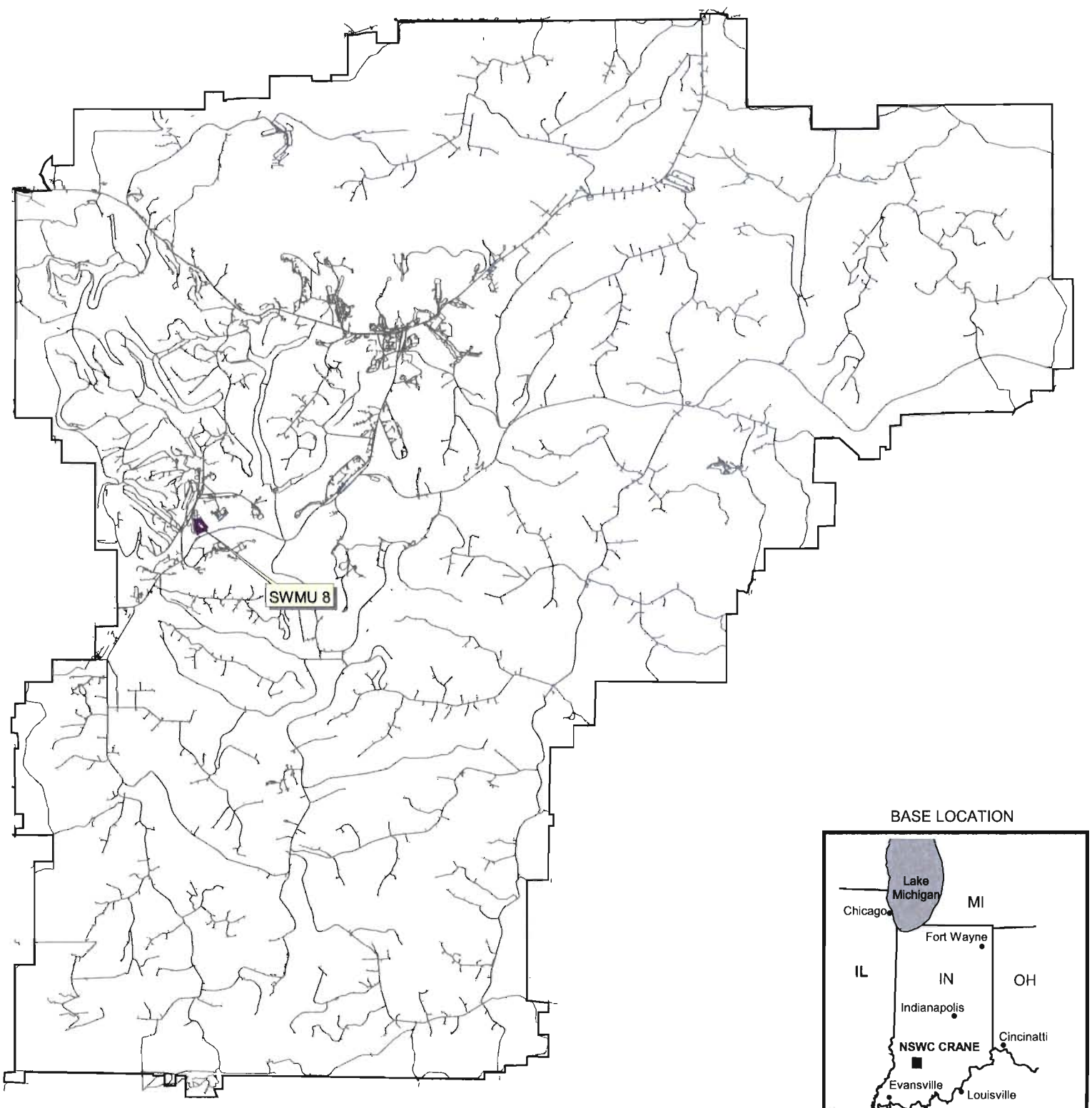

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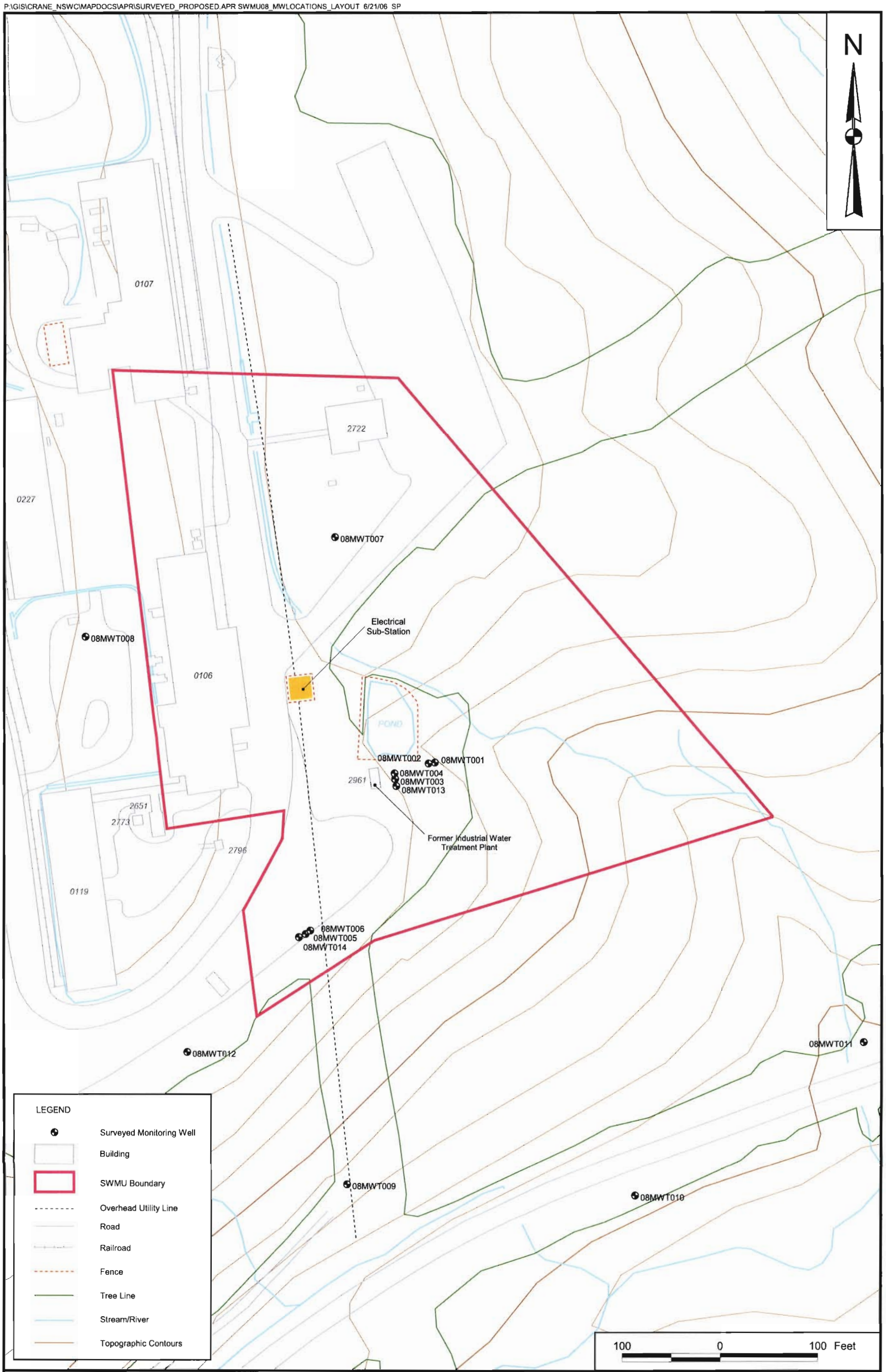

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SITE LAYOUT MAP
SWMU 8 - BUILDING 106 POND
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

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2.0 SITE SUMMARY

2.1 SITE SUMMARY

The following site description is from the RFI Report for Building 106 Pond - SWMU 8 (TtNUS, 2006).

2.1.1 Site Description

The Building 106 Pond [2,550 square feet (sf) in area] is located within SWMU 8, which occupies an area of 5.8 acres (Figure 1-2). Buildings 106 and 107 are located west and northwest of the pond. A deep drainage channel is located north and east of the pond, and a former Industrial Water Treatment Facility is located south of the pond. Currently the pond is surrounded by trees and a fence. The area east and northeast of the pond is wooded. South of the pond is an open grass area. In addition to these site features, an electrical sub-station, overhead electrical lines, and monitoring wells are located within the Building 106 Pond site (TtNUS, 2006). A detailed site map is provided as Figure 1-2.

Buildings 106 and 107 have historically been involved in the overhaul of projectile casings. Building 106 housed a cleaning process consisting of a caustic wash, a TCE degreaser, and a hydrochloric acid wash. During World War II, the ignition ends of smokeless powder bag charges were colored red in Building 106 using naphthalene sulfonic acid sodium salt dyes. In the mid 1970s, phosphatizing of steel was conducted in Building 106. The phosphatizing process involved applying a zinc phosphate coating to projectiles, and it also included a conditioning rinse step that used a dilute solution of either chromic acid or chromic and phosphoric acids (TtNUS, 2006).

Building 107 activities included refinishing of metal and wooden boxes. Metal boxes were first cleaned utilizing approximately 712 gallons of TCE per year. The metal boxes were then painted in booths equipped with water washes for particulate control. The amount of dust collected daily from the accumulator/baghouse associated with the paint booths was approximately 300 to 400 pounds. The process for refinishing wooden boxes was the same as for metal boxes with an additional step that included dipping the wooden boxes into a 5 percent pentachlorophenol (PCP) solution for 5 minutes followed by partial drying in a drip pan. Approximately 8,800 gallons of PCP were used annually (TtNUS, 2006).

Activities in Buildings 106 and 107 also included the application of coatings to Hawk missile containers in paint booths. One of the paint booths applied a zinc chromate coating containing 40 percent by weight of toluene, and another paint booth applied an olive drab coating containing 22 percent naphtha. Each of

the paint booths utilized approximately 500 gallons of coating material per year. Prior to coating, the Hawk missile containers were sandblasted with silica, which produced approximately 900 to 1,000 pounds of baghouse residue per day (TtNUS, 2006).

During industrial activities in Buildings 106 and 107, splash drag-out and overflows of wastewater from Buildings 106 and 107 were discharged to the unlined Building 106 Pond through floor drains via 6-inch diameter vitrified clay pipe (VCP) (TtNUS 2006). Drainage discharges may have contained TCE, PCP, paint residue, and heavy metals. In addition, oily wastewater from leaking compressors in Building 107 also drained to the Building 106 Pond (A.T. Kearny, 1987). Currently, repair operations are intermittently performed in Buildings 106 and 107 (TtNUS, 2006).

Prior to 1972, water discharged from the Building 106 Pond via a 15-inch diameter corrugated metal pipe (CMP) to a drainage ditch on the western side of the pond. The pond's discharge passed through a scum baffle to prevent floating oils and greases from entering the drainage ditch. Sometime after 1972, the pond began discharging through a new 4-inch polyvinyl chloride (PVC) pipe to the Industrial Water Treatment Facility (Building 2961). All discharges from the Industrial Water Treatment Facility flowed to the NSWC Crane sanitary sewer system (NEESA, 1983). With the addition of the new discharge pipe to the Industrial Water Treatment Facility, the 15-inch diameter CMP was filled with concrete to prevent continuing discharge to the drainage ditch, the pond's earthen berm crest elevation was increased by 1 foot, and the earthen berm crest width was increased to 5 feet (NSWC, 1972).

2.1.2 Physiography and Topography

Buildings 106 and 107, along with other buildings in the area of the Building 106 Pond, are located on a promontory of land that juts southward from a primary east-west trending ridgetop. The ridgetop was flattened in the 1940s to prepare the area for site development. SWMU 8 is surrounded by wooded slopes on the eastern, southern, and western sides. The area in the immediate vicinity of Buildings 106 and 107 slopes gently downward toward the outer edge of the ridgetop. Elevations on the SWMU 8 ridgetop range from 670 to 700 feet above mean sea level (msl). The maximum elevation within SWMU 8, approximately 700 feet above msl, occurs around Building 2722. Drainage ditches in the area that collect stormwater runoff drop approximately 100 feet to the unnamed tributaries that feed Boggs Creek (TtNUS, 2006).

2.1.3 Meteorology

NSWC Crane is located in a warm, temperate climate zone. In general, the summers are warm (average high temperature reaching 89 degrees Fahrenheit in the month of July), and the winters are mild with occasional cold periods (average January temperature drops to 26 degrees Fahrenheit). Precipitation is fairly evenly distributed throughout the year. The average annual precipitation at NSWC Crane is 44 inches. Long-term records indicate that the monthly prevailing wind direction is from the southwest from April through December and from the northwest from January through March.

2.1.4 Surface Water Hydrology

As indicated in Section 2.1.2, the topography in the area of the Building 106 Pond slopes gently along the top of the ridge line and drops dramatically on the western, southern, and eastern sides of the ridgetop. The ridgetop is currently developed, and the surface types include pavement, grassy areas, and wooded areas. Along the sides of the ridgetop, several drainage ditches collect surface water runoff during storm events. These drainage ditches convey runoff down the steep slopes to unnamed tributaries that feed Boggs Creek. Boggs Creek and Turkey Creek discharge to the Wabash River. Most of the stormwater runoff is conveyed to the drainage ditches via overland flow. However, limited storm drainage piping is provided along the ridge in the Buildings 106 and 107 area. Reportedly, one of these storm drains previously discharged to the Building 106 Pond, but was sealed to reduce surface water flow into the pond. The current sources of water into the pond include surface water runoff from the immediate area and seeps that could potentially discharge groundwater to the pond. There is no known discharge piping aside from the 4-inch PVC pipe to the Industrial Water Treatment Facility. At the time the SWMU 8 RFI field activities were conducted, it appeared that the water levels in the sump at the treatment facility and the pond were at equivalent elevations, indicating that the pond most likely remains hydraulically connected to the Industrial Water Treatment Facility.

2.1.5 Geology

Bedrock underlying NSWC Crane consists of sedimentary rocks from the Pennsylvanian age Mansfield Formation of the Raccoon Creek Group and the underlying rock formation consists of the Upper Mississippian-age Stephensport and West Baden Groups. In the area of SWMU 8, the ridgetop is blanketed with residual and reworked soils that range from 2 to 19 feet in thickness. This soil sits atop the Pennsylvanian bedrock, which consists of discontinuous layers of siltstone, sandstones, shales, and coal seams up to 180 feet in thickness (TtNUS, 2006). Figure 2-1 presents a layout of the SWMU 8 area with permanent features. This figure also identifies the location of a geologic cross-section specific to the

Building 106 Pond that is provided as Figure 2-2. Boring logs from the soil borings and monitoring wells installed within the vicinity of the Building 106 Pond are provided in Appendix A.

2.1.6 Hydrogeology

The maximum thickness of soil encountered on the ridgetop or ridge sideslopes of SWMU 8 was 19 feet. Depth to groundwater and groundwater elevations were measured on three different occasions. The measurement data are presented in Appendix A. Water levels were first measured in June 2005 before the 14 RFI wells were installed. Because of well recovery problems, it was determined that the groundwater level measurements in December 2005 were conducted too soon after the installation of some of the RFI monitoring wells, so a third round of groundwater measurements was conducted in March 2006. Figure 2-3 presents the potentiometric surface for the uppermost sandstone unit and overburden wells measured in March 2006. The highest groundwater elevations (686 to 688 feet above msl) were found near the center of the ridge. Groundwater elevations decrease to about 680 feet above msl on the eastern and southern sides of the Building 106 Pond. These groundwater elevations indicate that groundwater is seeping into the Building 106 Pond (TtNUS, 2006).

2.2 PREVIOUS INVESTIGATIONS

In 1972, approximately 47 samples were collected from effluent discharging from the Building 106 Pond. These samples were analyzed for water quality parameters [total organic carbon (TOC), turbidity, dissolved oxygen (DO), etc.], metals, and explosives. Analytical results indicated elevated metals concentrations with values as high as 20 parts per million (ppm) for lead, 3.5 ppm for chromium, 1 part per billion (ppb) for mercury, 20 ppm for zinc, and 0.2 ppm for cadmium (Kent, et al., 1973).

The IAS (NEESA, 1983) recommended two soil samples from the Building 106 Pond be collected and analyzed for mercury, chromium, phosphorus, and TCE. In 1985, two samples were analyzed for metals via the Extraction Procedure (EP) Toxicity Test and for oil/grease content. Measured concentrations were less than Toxic Characteristic Leaching Procedure (TCLP)/EP Toxicity Regulatory Action Levels. In 1987, a visual site inspection noted that the edges of the pond were oil-stained and that the surface of the pond exhibited an oily sheen (A.T. Kearny, 1987).

As part of the Phase I Environmental Monitoring Report (Halliburton NUS, 1992), background data and site observations were reviewed to determine the likelihood of a release posing a potential threat to human health and/or the environment. Data and observations pertinent to SWMU 8 were reviewed to assess the potential for contaminant releases to groundwater, surface water, air, and soil. Data were

interpreted and release determinations were made according to the approach described in the RCRA Facility Assessment Guidance (USEPA, 1986). Based on waste characteristics related to historical introduction of mobile compounds and locational and operational characteristics, potential releases to groundwater, soil, and air were deemed likely. Based on analytical records and reports, it was determined that releases to surface water have occurred.

The most recent investigation at SWMU 8 was the RFI conducted in 2004 and 2005. This investigation was conducted in three phases and included the installation of permanent and temporary monitoring wells, soil borings, and collection of subsurface soil, surface soil, sediment, surface water, and groundwater samples. The RFI Round 1 sampling event was conducted in December 2004 and January 2005, the RFI Round 2 sampling event was conducted in May and June 2005, and RFI Round 3 sampling event was conducted in September and October 2005. All work was conducted in accordance with the procedures and methodologies described in the USEPA- and IDEM-approved Quality Assurance Project Plan (QAPP) (TtNUS, 2004). The RFI also included the preparation of a human health and ecological risk assessment. The results of the RFI, along with the results of the previous investigations, adequately identified the extent of contamination associated with SWMU 8 and the environmental conditions within the Building 106 Pond area (TtNUS, 2006).

2.3 EXTENT OF CONTAMINATION - BUILDING 106 POND

The following paragraphs are excerpts from the 2006 RFI Report. These excerpts identify the extent of contamination and summarize the human health and ecological risks associated with contamination within the Building 106 Pond area.

2.3.1 Chemical Distribution

The degree and extent of contamination at SWMU 8 is rather limited and reasonably well bounded. The primary contaminants are chlorinated volatile organic compounds (VOCs) in pond sediments, pond water, and groundwater, and 1,4-dioxane in groundwater only. Groundwater contaminant distribution suggests that a source of VOC and 1,4-dioxane contamination, other than the Building 106 Pond, appears to exist in the area immediately south of Building 106. Any contaminant source area south of Building 106 is expected to be minor when compared to the Building 106 Pond source. The analytical data obtained during the 2006 RFI specific to the Building 106 Pond are presented in Appendix A

Several groundwater metals concentrations exceeded the Maximum Contaminant Levels (MCLs) and upgradient concentrations, but no link to SWMU 8 for the elevated metals concentrations was found.

Slightly elevated concentrations of some metals were detected in the Building 106 Pond, but the elevated concentrations were not nearly as high as the chlorinated VOC concentrations. Metals concentrations in the drainage ditch and tributary soil samples appear to reflect natural conditions. Therefore, metals do not appear to be significant site-related contaminants for SWMU 8 or the drainage ditches and tributaries.

Surface water and sediment contamination at SWMU 8 is limited and well bounded. Sample location 08SW/SD006 exhibited the highest surface water and sediment contamination. Surface water and sediment contamination at SWMU 8 is essentially limited to polynuclear aromatic hydrocarbons (PAHs) and metals near sample locations 08SW/SD006 and 08SW/SD015 through 08SW/SD017. Data indicate that surface water and sediment in the drainage ditches is relatively contaminant free, and that the surface water and sediment in the Building 106 Pond are by far the most contaminated media at SWMU 8. The greatest number of surface water screening value exceedances for metals occurred in a seep sample located southwest of the Building 106 Pond. At this location, groundwater from the seep is considered to be expressed as surface water. Except for this location, metals concentrations in surface water and sediment were comparable throughout the tributary system. Counts of colony-forming units (CFUs) for total coliform bacteria exceeded 2,400 units per 100 milliliters (mL) in surface water. Fecal coliform counts exceeded 5 CFUs per 100 mL in groundwater. A sanitary sewer line break was identified and repaired at about the same time as the RFI was prepared. Thus, the source of the fecal coliforms in surface water was identified and remediated.

A comparison of metals concentrations from filtered and unfiltered surface water samples reveals that the majority of the detected results for aluminum, arsenic, chromium, cobalt, copper, iron, lead, tin, vanadium, and zinc are associated with suspended solids within the surface water. A similar comparison for groundwater reveals that the majority of the detected results for aluminum, arsenic beryllium, cadmium, chromium, cobalt, copper, iron, lead, mercury, tin, vanadium, and zinc are also associated with suspended solids within the groundwater.

2.3.2 Human Health Risks

This section summarizes the results of the Human Health Risk Assessment (HHRA) performed for SWMU 8 (TtNUS, 2006).

The baseline HHRA for SWMU 8 was performed to characterize the potential risks to likely human receptors under current and potential future land use. Potential receptors under current land use scenarios are maintenance workers, occupational workers, and adolescent trespassers. Potential receptors under future land use scenarios are construction workers, child and adult recreational users,

and hypothetical child and adult residents. Although future land use is likely to be the same as current land use (military/industrial usage), the potential future receptors were evaluated in the baseline HHRA primarily for decision-making purposes.

The list of direct contact chemicals of potential concern (COPCs) evaluated in the HHRA for SWMU 8 is as follows:

- Surface soil in the vicinity of the Building 106 Pond - benzo(a)pyrene, aluminum, arsenic, iron, manganese, and vanadium.

- Subsurface soil in the vicinity of the Building 106 Pond - benzo(a)pyrene, aluminum, antimony, arsenic, iron, manganese, and vanadium.

- Surface soil in the grass and gravel areas around Buildings 106 and 107 - benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, aluminum, arsenic, iron, manganese, and vanadium.

- Subsurface soil in the grass and gravel areas around Buildings 106 and 107 - aluminum, arsenic, iron, manganese, thallium, and vanadium.

- Surface soil under Building 106 and surrounding pavement - benzo(a)pyrene, dibenzo(a,h)anthracene, aluminum, arsenic, iron, and vanadium.

- Subsurface soil under Building 106 and surrounding pavement - aluminum, arsenic, iron, and vanadium.

- Surface Soil under Building 107 and surrounding pavement - none.

- Subsurface Soil under Building 107 and surrounding pavement - none.

- Groundwater in Shallow Bedrock and Overburden Zones - 1,1,1-trichloroethane (TCA), 1,1,2-TCA, 1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), 1,2-DCA, benzene, chloroethane, cis-1,2-DCE, toluene, trans-1,2-DCE, TCE, vinyl chloride, 1,4-dioxane, 3- and 4-methylphenol, aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, thallium, and vanadium.

- Groundwater in Intermediate Zone - 1,1,1-TCA, 1,1,2-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCA, chloroform, cis-1,2 DCE, tetrachloroethene (PCE), trans-1,2-DCE, TCE, vinyl chloride, 1,4-dioxane, aluminum, arsenic, cobalt, iron, manganese, nickel.

- Groundwater in Deep Zone - 1,4-dioxane, aluminum, arsenic, iron, manganese, and vanadium.

- Surface Water in Building 106 Pond - 1,1-DCA, 1,1-DCE, 2-butanone, 4-methyl-2-pentanone, chloroethane, cis-1,2-DCE, toluene, TCE, vinyl chloride, xylenes, 2-methylnaphthalene, aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, vanadium, and zinc.

- Surface Water in Tributaries - cis-1,2-DCE, TCE, vinyl chloride, aluminum, arsenic, chromium, iron, lead, manganese, thallium, and vanadium.

- Surface Water in Main Stream - aluminum, iron, and manganese.

- Sediment in Building 106 Pond - 1,1,1-TCA, 1,1-DCA, 1,1-DCE, chloroethane, cis-1,2-DCE, trans-1,2-DCE, TCE, benzo(a)pyrene, arsenic, iron, vanadium, and perchlorate.

- Sediment in Tributaries - benzo(a)pyrene, aluminum, arsenic, iron, manganese, and vanadium.

- Sediment in Main Stream - aluminum, arsenic, iron, manganese, and vanadium.

In addition to the COPCs based on direct human contact listed above, COPCs were also identified for migration from soil to groundwater and from groundwater through building foundations into indoor air (see HHRA, Section 7.2.3 of the RFI).

2.3.2.1 Risk Assessment Results - Exposure to Soil

Quantitative estimates of noncarcinogenic and carcinogenic risks [hazard indices (HIs) and incremental lifetime cancer risk (ILCRs), respectively] were developed for potential human receptors. Target organ-specific HIs for all receptors assumed to be exposed to surface soil and subsurface soil under the reasonable maximum exposure (RME) scenario were less than or equal to unity (1).

ILCRs for all receptors assumed to be exposed to surface and subsurface soil were less than or within USEPA's target risk range of 1×10^{-4} to 1×10^{-6}.

2.3.2.2 Risk Assessment Results - Exposure to Surface Water and Sediment

Target organ-specific HIs for all receptors assumed to be exposed to surface water and sediment under the RME scenario were less than or equal to unity.

ILCRs for all receptors assumed to be exposed to surface water and sediment were less than or within USEPA's target risk range of 1×10^{-4} to 1×10^{-6}.

Although the risks calculated for direct contact with surface water and sediment in the Building 106 Pond were acceptable, the contamination from the pond, especially VOCs, has likely impacted other site media. The sediment in the pond is the likely source of the COPCs identified for groundwater and is the basis for initiating sediment removal activities at the pond.

2.3.2.3 Risk Assessment Results - Exposure to Groundwater

Shallow Bedrock and Overburden Zone - Target organ-specific HIs for the potable use of shallow groundwater by hypothetical child and adult residents exceeded unity. Aluminum, arsenic, iron, manganese, and vanadium were the major contributors to the HI for the hypothetical child resident. Aluminum, arsenic, iron, and manganese were the major contributors to the HI for the adult resident. High turbidity readings were reported for the sample on which the risks to shallow groundwater were based; the elevated concentrations of aluminum, arsenic, iron, and vanadium in the sample are likely due to the presence of elevated suspended solids concentrations.

The ILCRs for domestic use of shallow groundwater by hypothetical future residents exceeded USEPA's target risk range. Arsenic was the major contributor to the ILCRs for shallow groundwater (ILCR greater than 1×10^{-4}). Vinyl chloride (ILCR greater than 1×10^{-5}), TCE, and 1,4-dioxane (ILCRs between 1×10^{-5} and 1×10^{-6}) were minor contributors to the ILCRs. As stated above, the elevated concentration of arsenic used to estimate the risks was likely due to the presence of suspended matter in the unfiltered groundwater sample. The concentrations of arsenic in most shallow and overburden/bedrock groundwater samples were less than the MCL.

Intermediate Zone - HIs for the potable use of intermediate zone groundwater by the occupational worker, child recreational user, hypothetical child resident, and hypothetical adult resident exceeded unity. Manganese was the major contributor to the HIs for the occupational worker, child recreational user, and hypothetical adult resident. 1,1-DCE, TCE, iron, manganese, and nickel were the major contributors to the HI for hypothetical child resident.

ILCRs for domestic use of intermediate zone groundwater by the occupational worker and hypothetical future resident exceeded USEPA's target risk range. TCE was the major contributor to the ILCR for intermediate zone groundwater (ILCR greater than 1×10^{-4}). Several other VOCs, 1,4-dioxane, and arsenic (ILCRs less than 1×10^{-4} but greater than 1×10^{-6}) were minor contributors to the ILCRs.

Deep Zone - HIs for the potable use of deep zone groundwater by the hypothetical future child resident exceeded unity. Iron and manganese were the major contributors to the HI for the child resident.

ILCRs for domestic use of deep zone groundwater for all potential receptors evaluated were within USEPA's target risk range.

2.3.2.4 Risk Assessment Results - Exposure to Lead

Exposures to lead in surface water from the Building 106 Pond and tributaries and in shallow groundwater were evaluated using USEPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model. The IEUBK Model analysis indicated that blood-lead levels for children based on exposure to average concentrations at SWMU 8 did not exceed the USEPA goal that no more than 5 percent of exposed children should exceed the 10 micrograms per deciliter (µg/dL) blood-lead level of concern.

In summary, no significant potential human health risks are expected for exposures to surface soil, surface water, and sediment under current or future land use at SWMU 8. Noncarcinogenic and/or carcinogenic risks exceeded USEPA risk benchmarks for occupational workers, child and adult recreational users, and hypothetical child and adult residents using groundwater as a potable water supply. VOCs, 1,4-dioxane, and several metals were the major contributors to the risks for shallow and intermediate zone groundwater. Iron and manganese were the major contributors to the risks for deep zone groundwater. As discussed in the risk assessment, the risk estimates were subject to a number of significant uncertainties. Among these is the fact that comparisons to background concentrations were not used in the COPC screening process, concentrations of metals in some groundwater samples appear to be elevated because of suspended matter in the samples, and groundwater is not currently used nor is it expected to be used as a potable water source in the future at SWMU 8.

2.3.3 <u>Ecological Risks</u>

A screening-level ecological risk assessment (SERA) was performed for SWMU 8, Building 106 Pond area (TtNUS, 2006). Several chemicals were retained as COPCs as a result of the initial screening of

surface soil, sediment, and surface water sample results. These chemicals were further evaluated and data were scrutinized as a part of the SERA's Step 3a refinement.

In summary, the list of chemicals initially selected in the SERA as COPCs were further evaluated in Step 3a, the first step of the Baseline Ecological Risk Assessment (BERA). After a review of alternate toxicity information (based on soil invertebrates, plants, and aquatic receptors) was conducted, and maximum and average concentrations were compared to the alternate toxicity information. For the soil and gravel surface soil samples, no chemicals were retained as COPCs because all concentrations were less than alternate benchmarks or soil background values. For the pond surface soil samples, several concentrations were greater than the screening levels, but because the pond sediments will be excavated, these analytes were not retained as COPCs.

Similarly, the list of chemicals initially selected as COPCs in sediment and surface water were further evaluated in Step 3a. After a review of alternate toxicity information (based on aquatic organisms) and other Step 3a factors, maximum and average concentrations of COPCs were compared to the alternate toxicity information. No chemicals were retained as COPCs for further evaluation for benthic and aquatic organisms, mainly because concentrations were less than alternate screening levels and upgradient concentrations, concentrations in surface soil were not site-related, and concentrations were less than screening levels in filtered samples.

The chemicals selected as COPCs for risks to wildlife were also further evaluated in Step 3a. No chemicals were retained as COPCs for further evaluation for several reasons. For the woodcock, although the zinc NOAEL EEQ was greater than 1.0 for site soil concentrations, the NOAEL EEQ was also greater than 1.0 using background zinc concentrations. Also, the location of the maximum zinc concentration has poor habitat for insectivorous birds. For the mink, a site use factor of 10 percent was used, which is likely conservative. Also, the body weight scaling used for large mammals is conservative. Because the NOAEL EEQs are only slightly greater than 1.0 for the Tributary and Main Stream, risks are considered to be acceptable.

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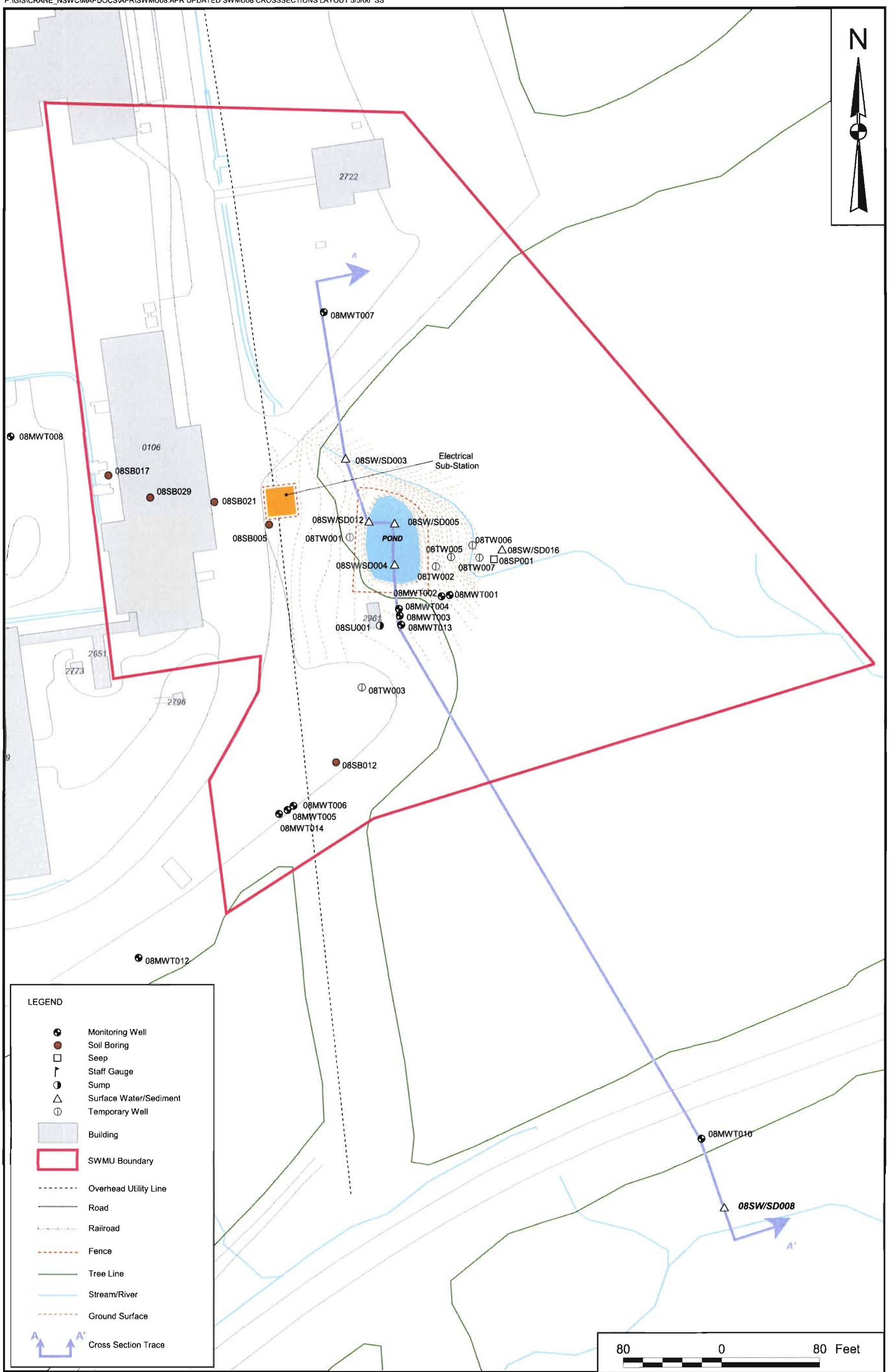

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CHECKED BY T. SMITH	DATE 5/5/06		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2 - 1 REV 0

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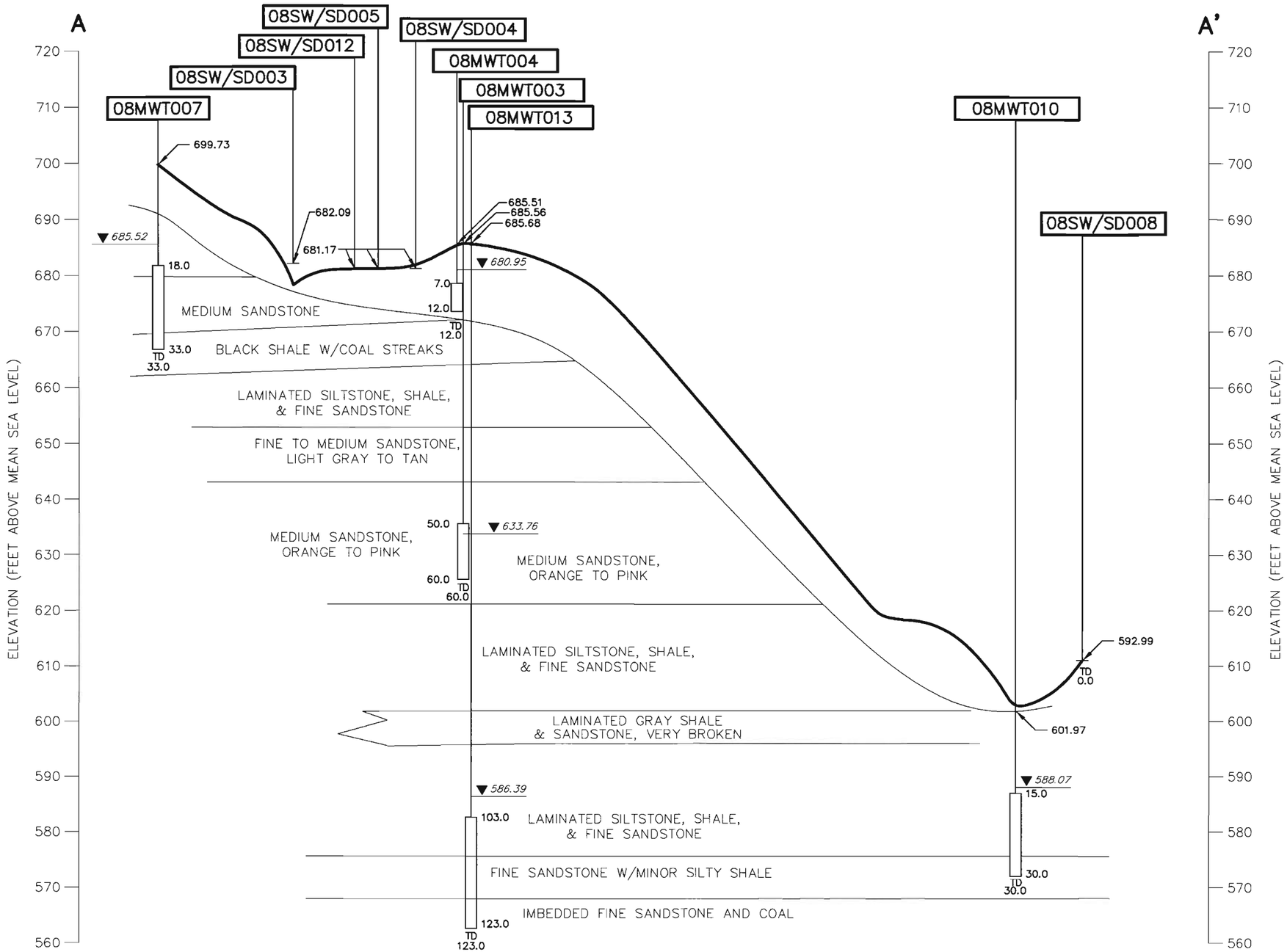

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CHECKED BY	DATE			OWNER NO. 0020
REVISED BY	DATE			APPROVED BY / DATE
SCALE AS NOTED				DRAWING NO. FIGURE 2-2 / REV. 0

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

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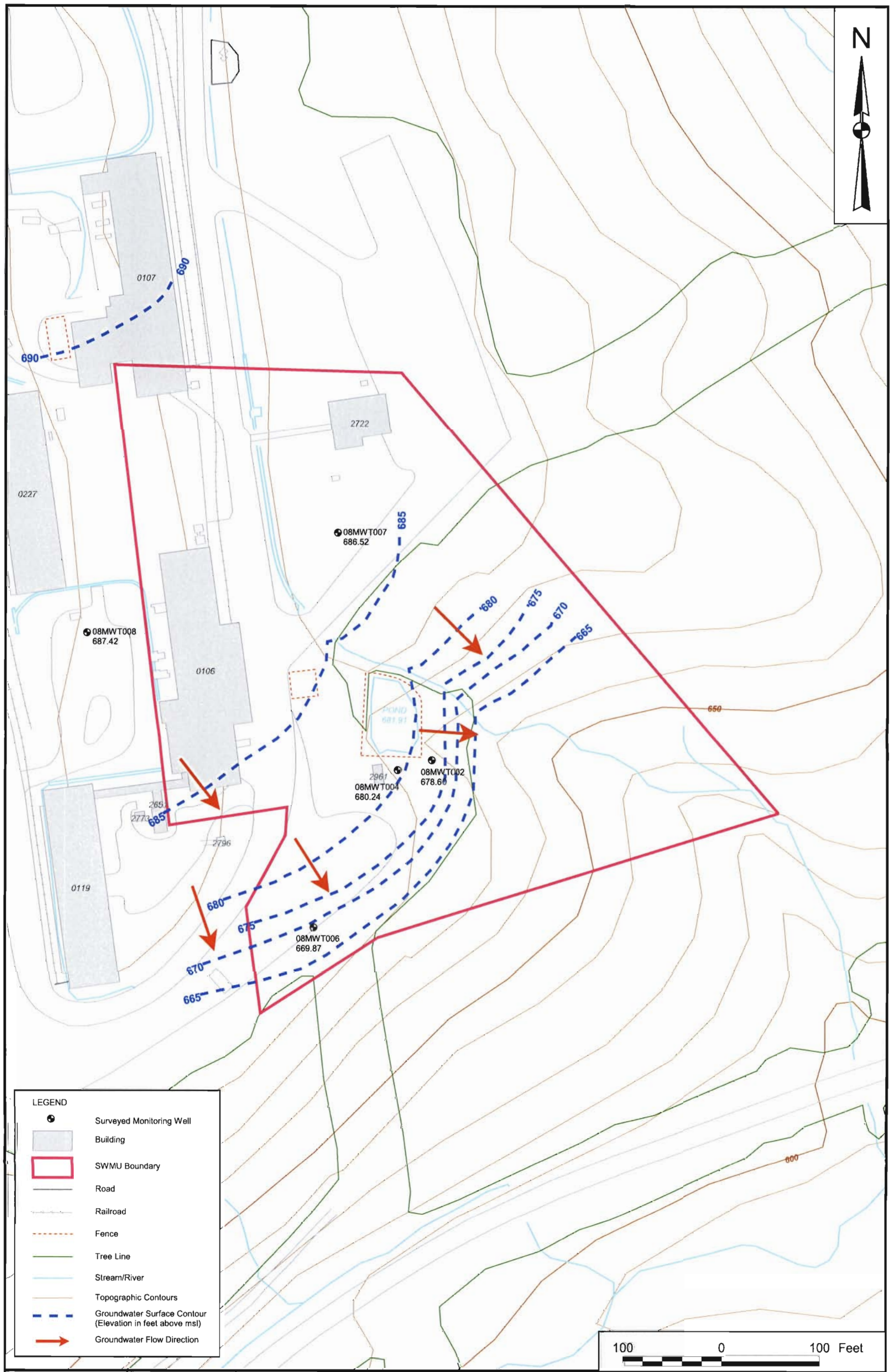

DRAWN BY K. PEILA	DATE 2/23/06	POTENTIOMETRIC SURFACE MAP - MARCH 1, 2006 SWMU 8 - BUILDING 106 POND INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER CTO 0020
CHECKED BY T. SMITH	DATE 5/4/06		APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2 - 3 REV 0

3.0 INTERIM MEASURES WORK PLAN

The intent of this interim measure is to remove an identified continuing source of contamination to SWMU 8 groundwater. The activities associated with this IMWP are not intended to result in the clean closure of SWMU 8.

3.1 DESCRIPTION OF THE INTERIM MEASURE

This IMWP specifies the removal of contaminated soils and sediments in the Building 106 Pond to the depth of bedrock. In addition, the IMWP specifies the demolition of Building 2961 the former Industrial Water Treatment Facility, located south of the Building 106 Pond. The contaminated soils and sediments have been identified as a source of VOC contamination in groundwater at SWMU 8. The volumes presented for the soils and sediments to be excavated in the IMWP are consolidated, in-place estimates. It is anticipated that these volumes will increase 20 to 30 percent after the soils and sediments are excavated and are in an unconsolidated state.

Specifically, the IMWP consists of the following major components:

- Dewatering the Building 106 Pond - The Building 106 Pond currently contains approximately 52,510 gallons of water (volume calculations are presented in Appendix B). This water must be removed from the pond to allow for the excavation of contaminated soils and sediments. The water will be pumped through a filter and air stripper (AS) water pretreatment system prior to being trucked to, and discharged at, the NSWC Crane Wastewater Treatment Plant (WWTP).

- Excavation of Soils and Sediments - Approximately 423 cubic yards (cy) of pond soils and sediments will be excavated (volume calculations provided in Appendix B). The area of excavation is approximately 2,550 sf and the excavation thickness averages 3.7 feet, ranging from 0.1-foot below ground surface (bgs) to 6-feet bgs. Figure 3-1 presents the area of excavation.

- Dewatering of Excavated Material - Prior to off-site disposal, excavated soils and sediments will be stockpiled within a soils dewatering pad located within the construction area. Water removed from the excavated soils and sediments will be pumped through the pretreatment system prior to being trucked to, and discharged at, the NSWC Crane WWTP. It is estimated that 29,590 gallons of water will be generated through dewatering of the excavated soils and sediments (volume calculations provided in Appendix B).

- Dewatering of the Excavation - During excavation activities, water is expected to accumulate within the excavation area due to groundwater inflow and sediment and soil leaching. This water will be pumped from the excavation and through the pretreatment system prior to being trucked to and discharged at the NSWC Crane WWTP. It is estimated that 10,500 gallons of water will need to be removed from the excavation and treated (volume calculations provided in Appendix B).

- Sampling and Analysis - Following the excavation of contaminated soils and sediments to the specified limits of excavation, the exposed surfaces of the excavation will be sampled for characterization. The Navy may require additional excavation of the pond sidewalls based on the characterization analytical results. At the completion of the project and following the removal of the support facilities (e.g., soils dewatering pad, decontamination pad, pretreatment system, etc.), the Navy will require soil verification samples to be taken to confirm that the liner systems of the support facilities did not fail during the implementation of interim measure activities. If it is determined that the lining system under any of the support facilities did fail, resulting in the contamination of the soils below the support facilities, the Environmental Multiple Award Contract (EMAC) contractor will be required to remove that contamination at their own expense. Refer to Section 5.0 for the sampling and analysis procedures.

- Off-Site Disposal of Soils and Sediments - Approximately 423 cy of soils and sediments at an off-site waste disposal facility (volume calculations provided in Appendix B). The volume to be disposed off site includes 117 cy of dewatered sediments, 172 cy of soils between the sediment and bedrock, and 134 cy of additional soil that will need to be removed to maintain stable excavation side slopes. It is expected that the excavated sediments and soils will be disposed at a non-hazardous waste disposal facility unless sampling and analysis of the dewatered materials indicates that disposal at a hazardous waste disposal facility is required.

- Former Industrial Water Treatment Facility Demolition - The former Industrial Water Treatment Facility located south of the Building 106 Pond will be demolished. Piping and conduits below grade will be sealed where appropriate and abandoned in place. It is assumed that the debris resulting from the demolition of the Former Industrial Water Treatment Facility will be disposed as solid waste at a solid waste disposal facility. Electrical components, motors, mixers, sheet metal, grading, and structural timber will be salvaged.

- Backfilling and Regrading - After the removal of soils and sediments from the Building 106 Pond and the demolition of the former Industrial Water Treatment Facility, the excavated areas will be backfilled and regraded to meet pre-construction grades for the pond area and to the levels of the undisturbed surrounding grades for the treatment facility. It is estimated that 482 cy of consolidated material will be required to backfill the Building 106 Pond. The excavation area left by the former Industrial Water Treatment Facility demolition will require an estimated 60 cy of consolidated backfill material. Backfill volume calculations are provided in Appendix B.

- Restoration - The backfilled and regraded areas, with the exception of the pond area below the normal water surface, will be revegetated.

3.2 PERFORMANCE STANDARDS

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

Water Treatment

Wastewater will be generated by pumping surface water out of the Building 106 Pond, dewatering the excavation during construction activities, dewatering the stockpiled materials, pumping water out of the former Industrial Water Treatment Facility, and decontaminating construction equipment. All of the water collected throughout the implementation of the IMWP will be pumped to one of three influent storage tanks at the pretreatment system. Water within the influent storage tanks will be pumped through the pretreatment system (bag filters and AS) to one of three treated water storage tanks. The water stored within the treated water storage tanks will be characterized prior to being trucked to, and discharged at, the NSWC Crane WWTP. A flow diagram of the water treatment system is presented in Figure 3-2.

After characterization samples are analyzed, the Officer in Charge of Construction (OICC) will direct the EMAC contractor to transport the treated water to the NSWC Crane WWTP or transport it off site for treatment/disposal. Based on the quality of the pond water and SWMU 8 groundwater, and the anticipated volume of contaminated water to be treated, it is anticipated that a single air stripper with a flowthrough capacity of approximately 20 gallons per minute (gpm) will be required.

During the course of the project, the following estimated contaminated water volumes will be generated from the listed sources:

- Building 106 Pond (52,510 gallons with low contaminant levels)
- Former Industrial Water Treatment Facility (3,035 gallons with low contaminant levels)
- Decontamination Pad (10,000 gallons with low contaminant levels)
- Dewatering Sediments and Pond Excavation (28,750 gallons with high contaminant levels)
- Dewatering Soils and Pond Excavation (11,340 gallons with moderate contaminant levels)

The concentrations of contaminants in water generated from dewatering sediments is assumed to be relatively high based on the sediment analytical results and the assumed organic carbon content of the sediments (see Appendix B.3 for contaminant loadings).

To accommodate variations in influent flowrate to the pretreatment system, influent storage tanks will be used. Three portable "frac" tanks (20,000 gallons each) will be used to provide a total of 60,000 gallons of storage. This volume will accommodate the initial dewatering of the pond. The tanks will be filled in sequence, and treatment will start when the first tank is about half full. The tanks also allow for some solids removal by quiescent settling.

The average water treatment rate is based on the time expected to treat the contents of one influent storage tank (20,000 gallons) in 24 hours, or 14 gpm. To allow for variations, the design treatment rate will be 20 gpm. The wastewater will be pumped at 20 gpm through the filtration and AS systems. The filtration system consists of two bag filters, each sized for the design flowrate of 20 gpm. One filter will be on-line and the other on standby. When the first filter bag is full of filtered solids (based on observations of flowrate and pressure drop), the filter will be taken off-line and the other filter brought on-line. The used filter bag will be disposed of off-site with the contaminated soils and sediments. Following filtration, the water will be treated using an AS system. An AS system that includes a stripper, air blower, and stripped water pump will be used. The treated water will be pumped to one of three effluent storage tanks.

Each effluent storage tank will be a 20,000-gallon frac tank, similar to the influent storage tank. Three tanks are provided so that flow through the system can be maintained while waiting for water sample analytical results from a full tank. After the analytical results indicate that the water quality is acceptable for discharge, the tank contents will be discharged at the NSWC Crane WWTP. In the unlikely event the analytical results indicate that the treated water is not acceptable for discharge, the EMAC contractor will inform the OICC and alternative disposal methods will be initiated. Acceptable contaminant concentration levels for discharging to the NSWC Crane WWTP are presented in Appendix B.3.

Discharging Pretreated Water

Treated water will be trucked to, and discharged at, the NSWC Crane WWTP 25,000 gallon surge tank (surge tank) (approximately 2.5 miles from the Building 106 Pond). This surge tank is used by the NSWC Crane WWTP as a holding tank during high flow periods. Because the NSWC Crane WWTP needs to be able to use the surge tank, it is assumed that the EMAC contractor will only be able to utilize 10,000 gallons of the surge tank capacity. This assumed utilization capacity may increase during dry periods and could decrease during wet periods. Once the pre-treated water is in the surge tank, the pre-treated water will be managed by the NSWC Crane Sanitary Authority.

As indicated above, in order to meet the requirements for discharge to the NSWC Crane WWTP, the results of the characterization sampling must meet the criteria presented in Appendix B.3. Pretreated water characterization samples will be collected at a rate of 1 sample per volume present in a single effluent storage tank prior to transportation and discharge at the NSWC Crane WWTP. Each characterization sample must be a representative sample of the stored tank volume. If water is added to an effluent storage tank following characterization and prior to emptying that particular effluent storage tank, an additional characterization sample will be required from that tank before additional discharge will be allowed from that effluent storage tank.

Following characterization and prior to transportation to the surge tank, the EMAC contactor must contact the National Pollutant Discharge Elimination System (NPDES) Water/Wastewater Programs Manager (Ms. Nannette Stone, or her designee) and provide that individual with the results of the characterization sampling. Following characterization sample approval from the NPDES Water/Wastewater Programs Manager, the EMAC contractor can begin trucking the pretreated water from the characterized tank to the surge tank. NPDES Water/Wastewater Programs Manager approval is required for each characterization volume of treated water prior to transport of pre-treated water to the NSWC Crane WWTP surge tank.

Because of expected contaminant levels in the SWMU 8 pre-treated water, the NSWC Crane Sanitary Authority has agreed to feed the pretreated water to the NSWC Crane WWTP at a maximum rate of 6,000 gallons per day. However, to allow the NSWC Crane WWTP to adjust to this new wastewater, for the first week of treatment, the flow rate will need to be gradually increased from 100 gallons per day to the maximum treatment rate of 6,000 gallons per day. Likewise, for the last week of treatment the flow rate will need to be gradually decreased from the maximum treatment rate of 6,000 gallons per day to zero. Because of these adjustment periods, the EMAC contractor must maintain constant communications with the NSWC Crane WWTP operator and cannot begin discharging until the volume of pretreated water is sufficient to provide the required first week flow increases, the required last week flow decreases, and a

constant 6,000 gallons per day between these adjustment periods. Failure to maintain the 6,000 gallon daily flow between adjustment periods may result in additional adjustment periods. Lastly, the EMAC contractor must notify the NPDES Water/Wastewater Programs Manager when beginning to transport the final 15,000 gallons of water to the NSWC Crane WWTP so that the gradual decrease in flow rates to the NSWC Crane WWTP can be initiated at the proper time.

Soil and Sediment Excavation

All soils excavated from the Building 106 Pond will be placed on a dewatering pad, dewatered, characterized, and disposed at an approved off-site waste disposal facility. Characterization sampling will be performed to satisfy the requirements of the NSWC Crane-approved waste disposal facility. The area identified on Figure 3-1 as the limit of required excavation is approximately 2,550 sf. Within this area of required excavation, the excavation will be advanced vertically to an average depth of 3.7 feet to the bedrock layer of the Pennsylvanian Mansfield Formation of the Raccoon Creek Group. TtNUS oversight will verify excavation to the bedrock layer. The vertical excavation will remove approximately 289 cy of consolidated soils and sediments.

During excavation, the sidewalls will be sloped to provide stable excavation walls. This layback of side slopes requires the removal of an additional 134 cy of consolidated soil from the excavated Building 106 Pond area, which will be disposed off site with the other excavated soils and sediments as non-hazardous waste. The limit of the excavation layback is identified in Figure 3-1 as the Limit of Excavation. The EMAC contractor must submit to the OICC stability calculations to support the slope stability plan for the proposed excavation. A total 423 cy of consolidated soils and sediments will be removed from the Building 106 Pond, dewatered, and transported to an off-site non-hazardous NSWC Crane-approved waste disposal facility, unless characterization of the dewatered materials indicates that disposal at a hazardous waste disposal facility is required. Figure 3-3 identifies the anticipated grading of the Building 106 Pond area following the removal of the soils and sediments, and Figure 3-4 presents a typical cross-section of the excavation.

To identify potential health and safety issues associated with excavation activities, TtNUS prepared an Occupational Health Evaluation of Data from the Building 106 Pond area (Appendix C). TtNUS's evaluation identifies that air monitoring within the workers' breathing zone is warranted. Air monitoring will be performed by the EMAC contractor. The EMAC contractor is required to perform an independent Occupational Health Evaluation for the proposed excavation.

Dewatering

Historical data indicate that the sediments within the Building 106 Pond have an average moisture content of 70 percent in the 0- to 12-inch bgs layer and an average moisture content of 53 percent in the 12- to 24-inch bgs layer. To dewater the sediments, excavated sediments shall be placed within the dewatering pad at a lift thickness no greater than 3 feet and gravity-drained. Following the first day of dewatering the EMAC contractor will mix the sediment lifts to promote additional dewatering. It is estimated that following the second day of dewatering, the sediments will require the addition of an absorbent agent to make the sediments suitable for transportation and disposal. It is estimated that absorbent agent will be added to the sediments at a rate of 2 cy for every 10 cy of sediments, resulting in for a total of 23 cy of absorbent agent being used.

Although historical moisture content data is not available for the soils to be excavated with the sediments, because of the soil types (clay and silty clay) it is also estimated that the soils will require the same lift depths, mixing procedures, and dewatering time period as the sediments. It is estimated that absorbent agent will be added to the soils at a rate of 1 cy for every 10 cy of soils, resulting in a total of 31 cy of absorbent agent being used.

Demolition

The former Industrial Water Treatment Facility (Building 2961), located south of the Building 106 Pond, will be demolished as part of the SWMU 8 interim measure. Appendix D contains the Building 2961 construction drawings and site plan. The former Industrial Water Treatment Facility consists of an underground concrete vault with divider walls to form three mixing chambers and a sump for lift pumps that discharged flow to the NSWC Crane sanitary sewer system. The vault walls are constructed of 10-inch thick reinforced concrete, the vault floor is constructed of 8-inch-thick reinforced concrete, the vault lid is constructed of steel grating, and the interior chamber walls are constructed of 6-inch-thick reinforced concrete. Adjacent to the vault is a 4-inch-thick reinforced concrete slab on grade and a manhole. The manhole consists of a 6-foot long section of a 48-inch-diameter reinforced concrete pipe that is on a 72-inch-diameter, 12-inch-thick concrete pad (no reinforcement indicated) and has a 48-inch-diameter, 6-inch-thick concrete cover (no reinforcement indicated). Field investigations indicated that the mixers and electrical equipment are still in place. Demolition will include the following activities:

- Electrical power appears to be supplied to Building 2961 from two separate locations in Building 106. The EMAC contractor will verify that all electrical supply to the former Industrial Water Treatment Facility is disconnected.

- All electrical equipment panels, mixers, wiring, and conduits within the concrete vault and adjacent manhole will be removed and salvaged.

- Steel grating will be removed and salvaged.

- The concrete vault, adjacent concrete pad, concrete headwall, and concrete manhole will be removed and disposed off site.

- The shelter located above the former Industrial Water Treatment Facility will be removed. The shelter is an 8-post metal roof structure constructed over the concrete vault and electrical equipment. The support posts are 4-inch by 4-inch pieces of treated lumber that are approximately 8 feet long. The metal roofing material and lumber will be salvaged unless indicated otherwise by the OICC.

- All exposed conduits and pipes that remain in the ground following removal of the concrete structures will be sealed using concrete. Electrical conduit and chemical feed lines that pass from Building 106 to Building 2961 will also be sealed within Building 106. Electrical wiring will remain within the sealed conduits unless otherwise directed by the OICC.

- Perimeter fencing located around the Building 106 Pond area is made of wire mesh with posts that were cut from creosote-impregnated utility poles. The perimeter fence will be removed (wire and posts) and disposed off site.

The total estimated volume of demolition material to be salvaged or disposed off site is approximately 37 cy.

Sampling and Analysis

Characterization samples will be collected from the excavated areas following excavation to provide the Navy, USEPA, and IDEM information on the environmental conditions of the soils remaining in the excavation area. The Navy may require additional excavation of the side walls of the pond based on the characterization analytical results. No characterization samples will be collected from within the demolition area. In addition, verification samples will be collected from the areas used as support facilities (dewatering pad, decontamination pad, water pretreatment system pad, access roads, and material storage area) to assure that these areas were not contarninated during interim measures

activities. In the event contamination does occur, the EMAC contractor will remove the contaminated soil at their own expense. Sampling and analysis procedures are provided in Section 5.0.

Disposal

Excavated soils and sediments will be sampled and analyzed for waste disposal characterization using the methods required by the NSWC Crane-approved waste disposal facility. The soils and sediments will be sampled following the dewatering process. All soils, sediments, and demolition debris will be disposed at NSWC Crane-approved waste disposal facilities. The EMAC contractor is responsible for satisfying all disposal requirements. The following is a summary of the consolidated volumes expected to be disposed off site.

- Dewatered Soils and Sediments 423 cy
- Absorption Agent 54 cy
- Demolition Material 37 cy
- Total Off-Site Disposal Volume 514 cy

Backfilling

The Building 106 Pond and the former Industrial Water Treatment Facility area will be backfilled to the elevations presented in Figure 3-5. The backfill soil obtained from an off site borrow source will be similar in texture to native SWMU 8 soils and will be subject to analytical testing to assure that the material satisfies the following requirements:

- Total Petroleum Hydrocarbon, diesel range organics, EPA SW-845 8015M DRO - less than 1 ppm
- Total Petroleum Hydrocarbon, gasoline range organics, EPA SW-845 8015M GRO - less than 1 ppm
- Sum of benzene, toluene, ethylbenzene, and xylenes, EPA SW-846 5030 / 8021 - less than 1 ppm
- Characteristic waste determination (ignitability, corrosivity, reactivity, and toxicity), EPA SW-846 1311 - shall not fail the test for characteristic waste

With the exception of the upper 2 feet of backfill within the pond area, backfill material shall meet the following physical characteristics:

- ASTM D 2487, Classifications CL, ML, 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

Backfill material for the top 2 feet of the restored pond area shall be a clay-type substance that satisfies the following physical characteristics:

- ASTM D 2487, Classifications CL, CH
- ASTM D 4318, Plasticity index, ≥10%
- ASTM D 1140, Percent passing No. 200 sieve ≥50%
- Maximum particle size of 2 inches
- Percent gravel ≥30%

The lower layers of the backfill soil for the Building 106 Pond area will be placed in 6- to 8-inch lifts and compacted to 90 percent Standard Proctor Test. To provide a pond-bottom surface that will retain water for the post-construction pond, the top 2-feet of soil backfill (clay material) will be placed in 6-inch lifts and compacted to 95 percent Standard Proctor Test. Backfill will be placed within the treatment facility demolition area in 6- to 8-inch lifts and compacted with a hand compactor. The hand compactor will be run across 100 percent of each lift. The EMAC contractor will be responsible for conducting the required compaction tests reporting the results to the OICC. TtNUS will provide oversight of the compaction test activities.

The topmost 4 inches of backfill placed around and above the edge of the post-excavation pond water surface will be a medium-textured loam suitable for establishment of vegetation (i.e., topsoil). The topsoil will be tacked in with a track-type tractor or equivalent.

Restoration

The disturbed areas that have been backfilled and regraded as part of the IMWP implementation will be restored/stabilized using permanent stabilization practices. Restoration will consist of surface preparation, fertilizing, seeding, and mulching. The restoration procedures are presented in detail in Section 4.4. The backfilled areas of the post-excavation pond will not require vegetation.

Erosion and Sediment Control

Before excavation activities begin, erosion and sediment controls will be established to prevent impacts to surface water bodies downgradient of the Building 106 Pond and former Industrial Water Treatment

Facility, namely Boggs Creek and its tributaries (see Section 4.0). During excavation, backfilling, and regrading 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 the Indiana Handbook for Erosion Control in Developing Areas (IDEM, 1992).

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.

Decontamination Pad

A temporary decontamination pad will be set up to clean equipment used to excavate and transport contaminated soils and clean out the influent storage tanks for the water treatment system. 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. The EMAC contractor may elect to decontaminate the influent storage tanks in place depending on the size of the storage tanks. Contaminated materials removed from the equipment will be disposed off site with the excavated soils. Wash water will be pumped to the pretreatment inflow storage tanks for on-site treatment prior to being discharged to the NSWC Crane sanitary sewer system. Additional decontamination pad requirements are discussed in Section 4.5.

Soils Dewatering Pad

A temporary soils dewatering pad will be set up to dewater soils and sediments excavated from the Building 106 Pond. The dewatering pad will be sized to accommodate excavated soils and sediments and loading equipment as necessary. The dewatering pad will be constructed in such a manner that the pad will either contain the water released from the stockpiled material or sloped so that the released water gravity-drains back into the excavation. In either case, the dewatering pad will be constructed to allow for the loading of trucks that will be used to transport the excavated soils and sediments to the NSWC Crane-approved off-site disposal facility. Collected water or water that is allowed to flow back into the excavation will be pumped to the pretreatment system influent tanks for on-site treatment prior to being discharged to the NSWC Crane sanitary sewer system. Additional soils dewatering pad requirements are discussed in Section 4.5.

Clearing

Clearing will be performed only within the limits of disturbance shown on Figure 4-1. Clearing activities will be kept to a minimum to minimize impacts to natural habitat. Cleared vegetation will become the property of, and be managed by, the EMAC contractor. Standing trees will not be removed between April 15 and September 15 to comply with Indiana bat regulations, which are further addressed Section 3.5.3. Prior to starting clearing activities the EMAC contractor must meet with the NSA Crane Biologist to review clearing in the area where clearing is required to completely define clearing activities.

Exposed Drainage Piping

During excavation of soils and sediments from within the limits of the Building 106 Pond it is anticipated that the EMAC contractor will encounter buried drainage piping. These pipes will need to be plugged using concrete/non-shrink grout material. Forms and/or other blocking materials shall be installed within the pipes in such a manner that will allow the installation of plugs that are two feet in length (minimum). It is reported that these pipes are no longer contributing flow to the Building 106 Pond. Appendix D contains a site plan used during the construction of the former Industrial Water Treatment Facility. This plan identifies 3 or 4 pipes that connect to the Building 106 Pond. The EMAC contractor will also survey the locations of the utility lines that are plugged and provide northings, eastings, and elevations of each plugged utility line location. In the event that flow in these pipes is encountered during the pond dewatering and excavation activities (beyond standing water), the EMAC contractor shall inform the OICC.

3.3 SEQUENCE OF IMWP IMPLEMENTATION

The time required to perform the proposed IMWP activities at the site is estimated to be approximately 5 weeks. The generalized sequence of construction activities is presented below. This sequence of construction is subject to change based on the EMAC contractor's Work Plan.

1. Hold a pre-IMWP implementation meeting with the NSWC Crane OICC, Contracting Officer, EMAC contractor, NPDES Water/Wastewater Programs Manager, and TtNUS representative, at a minimum.

2. Inspect the Building 106 Pond, former Industrial Water Treatment Facility, and surrounding land prior to IMWP implementation to verify existing site conditions and overhead and underground utility locations, and obtain all required permits as detailed in Table 3-1.

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, dewatering pad, water pretreatment system pad, materials storage area, etc. Construct and install the support features.

5. Pump the standing water from the Building 106 Pond to the water pretreatment system.

6. Excavate sediments and soils from the Building 106 Pond and place in the soils dewatering pad. Allow sediments and soils to dewater by gravity over a 2-day period, which includes mixing of the material lifts to promote additional dewatering. Following dewatering, collect characterization samples. Following characterization and blending with an absorbent agent, load and transport sediments and soils to the NSWC Crane- approved off-site treatment/disposal facility. During excavation, maintain a low point within the excavated area to allow for dewatering of the excavation, and continually pump accumulated excavation water to the water pretreatment system influent storage tanks.

7. Prior to backfilling excavation, TtNUS will collect characterization samples of the excavation floor and sidewalls.

8. Following characterization sampling and verification that no additional excavation is necessary, Building 106 Pond will be restored to pre-construction contours with backfill material in the excavated area and by establishing permanent stabilization for all disturbed areas. This will allow for the natural recharging of the pond.

9. Remove the soils dewatering pad and collect verification samples from within the footprint of the dewatering pad as described in Section 5.0. Following verification that the ground below the dewatering pad was not impacted by construction activities, regrade as necessary and establish permanent stabilization.

10. During excavation and restoration of the Building 106 Pond, begin demolition of Building 2961, the former Industrial Water Treatment Facility. Demolition activities are not restricted to a particular sequence. Demolition activities should be performed to fill downtime associated with characterization (soils, sediments, and water) and dewatering activities at the Building 106 Pond.

11. Following demolition of the former Industrial Water Treatment Facility, backfill the voids left by the removal of the facility's concrete structures, regrade the area to match surrounding ground surfaces, and establish permanent stabilization.

12. Following the demolition of the former Industrial Water Treatment Facility, removal of soils and sediments from the Building 106 Pond, and backfilling and regrading activities, remove the temporary access roads and other support features (e.g., decontamination pad, materials storage area, water pretreatment system pad, etc.). Following support features removal, perform verification sampling within the footprints of these features to verify that construction activities did not impact surface soils.

13. Following verification that construction activities did not impact the surface soils, regrade and vegetate these areas with permanent stabilization.

14. 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 EROSION AND SEDIMENT CONTROL

The ground surface hydrology, grading, and cover type in SWMU 8 will not be altered due to IMWP implementation activities. Pre- and post-development runoff from the limits of disturbance will be the same; therefore, additional stormwater detention capacity is not required.

The disturbed area will be approximately 0.3 acres; therefore, a stormwater permit is not required (stormwater permits are required for disturbances greater than 1 acre). However, the IMWP implementation activities include best management practices for erosion and sediment control that are described in Section 4.0.

Sediments accumulated along the erosion and sediment control devices (see Section 4.0) prior to completing the backfill of the excavation will be disposed off site with the excavated soils and sediments at the approved off-site waste disposal facility. Sediments accumulated along the erosion and sediment control devices during and following the backfilling of excavations will be spread out within the limits of disturbance and stabilized with permanent vegetation.

3.5 OTHER IMWP IMPLEMENTATION REQUIREMENTS

3.5.1 Utilities

Underground utilities are known to exist within the SWMU 8 area. The EMAC contractor will verify all utility locations and adequately protect any utilities located in the active work areas before any earth-disturbing activities begin. Electricity will be provided by NSWC Crane. Refer to Appendix E for the Supplemental Specification requirements.

Potable water for project personnel and equipment decontamination will be provided by NSWC Crane.

3.5.2 Groundwater Monitoring Wells

Groundwater monitoring wells and protective bollards exist throughout SWMU 8. The monitoring wells will be protected during IMWP implementation. Bollards damaged as part of EMAC contractor's activities will be replaced with new bollards. Groundwater monitoring well locations are shown on Figure 1-2.

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 in SWMU 8 and will therefore be protected. Protected bird species that may use SWMU 8 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 (B&RE, 1997). 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. Prior to starting clearing activities the EMAC contractor must meet with the NSA Crane Biologist on clearing in the area where clearing is required to completely define the clearing activities. 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.

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) to 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 3-6. 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 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 contractors' use. Alternatively, the Army scale (Building 2913) may be used. The Army scale is no longer manned and weight tickets are not available. However, a weight readout is available at the Army scale.

Due to the ongoing industrial and military activities conducted in Buildings 106, 107, and 2722 (Locker and Lunch Building located north of Building 106 Pond), the roads in the vicinity of, and that provide access to, the proposed excavation and demolition areas are heavily used. During periods when materials are being transported in and out of the areas of disturbance, traffic control, including flag persons, may be required.

As indicated in Section 3.2, the contractor is required to transport the pretreated water collected in the pretreatment system effluent tanks to the NSWC Crane WWTP and discharge the pretreated water into the NSWC Crane WWTP surge tank located adjacent to Building 3050 (equalization tank). The distance to the surge tank is approximately 2.5 miles. Figure 3-6 provides the location of the NSWC Crane WWTP.

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 E.

The IWMP will be implemented by the EMAC contractor, NSWC Crane, and TtNUS representative with work assignments summarized on Table 3-1.

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 facilities 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.

3.7 IMWP IMPLEMENTATION CONSIDERATIONS

The Navy has reviewed the air permitting requirements associated with the Building 106 Pond dewatering and sludge removal activities and has determined that the potential to emit will be less than 0.57 tons (see Appendix F). A source may operate under the IDEM authority of exemptions and registration when the potential to emit VOCs is less than 10 tons per year for sources not required to use air pollution control equipment to comply with the VOC emission rules or 5 tons per year for sources that are required to use air pollution control equipment to comply with the VOC emission rules (http://www.in.gov/idem/permits/guide/air/airoperatingpermits.html#operating).

The remediation activities are anticipated to take 3 weeks. Requirements for an operating permit do not apply to temporary operations when the total operational time (excluding mobilization) is less than thirty (30) days [326 Indiana Administrative Code 2-1.1-3(h)(2)(D)].

Therefore, the Building 106 Pond dewatering and sludge removal activities are exempt from IDEM operating permit requirements and registration as long as activities associated with dewatering the Building 106 Pond and excavation of the Building 106 Pond is kept to a 30-day duration.

TABLE 3-1

WORK ASSIGNMENT RESPONSIBILITY CHART
INTERIM MEASURES WORK PLAN FOR SWMU 8 – BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

WORK ITEM	EMAC CONTRACTOR[1]	NSWC CRANE	TtNUS
Pre-IMWP Implementation Meeting	X	X	X
Interim Measure Implementation	X		
EMAC Contractor Work Plan [2]	X		
- Excavation Stability Evaluation	X		
- Air Monitoring Plan (if required)	X		
Site Specific Health and Safety Plan / Activity Hazard Analysis	X		
Project Quality Control Plan	X		
Environmental Conditions Report	[3]		X
Permits			
- Safety & Building Availability Permit (ESO 8020/11)	X		
- Digging Permit (NWSCC 11000/3)	X	[4]	
- Confined Space Entry Permit (NWSCC 5100/26)			
- 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	X	[7]	
CTO Closure Report	[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 D.
2. EMAC Contractor Work Plan includes, but is not limited to, an excavation and handling plan, demolition plan, hazardous waste management plan, environmental protection plan, erosion and sediment control plan, stormwater pollution prevention 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 Basic Contract, NSWC Crane Contractor's Operations Manual, and the Supplemental Specifications provided in Appendix E.
6. EMAC contractor will be responsible for the collection of characterization samples required for off-site disposal of excavated soils. TtNUS will collect post excavation samples from the excavation and verification samples from the surface soils below the support facilities following the removal of the support facilities. The EMAC contractor will need to coordinate and accommodate TtNUS sampling and field activities.
7. EMAC Contractor will be responsible for collection, storage, pretreatment, and discharge of wastewater to the NSWC Crane wastewater treatment plant.
8. EMAC Contractor will furnish items identified in the Supplemental Specifications provided in Appendix E.

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

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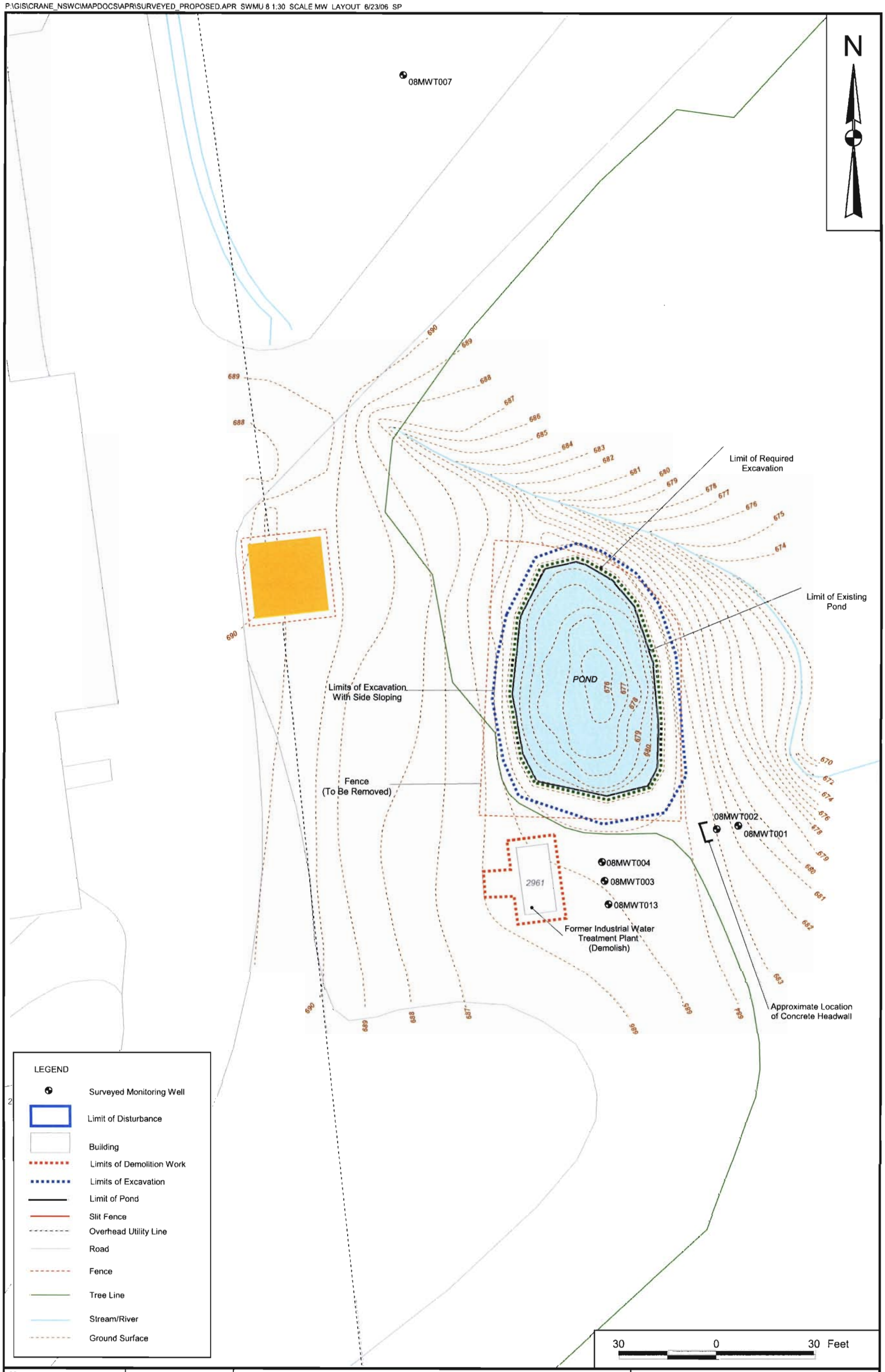

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S. STROZ	5/5/06
CHECKED BY	DATE
T. SMITH	6/23/06
COST/SCHEDULE-AREA	
SCALE	AS NOTED

NAVFAC

EXCAVATION AND DEMOLITION PLAN
SWMU 8 - BUILDING 106 POND
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER	
CTO 0020	
APPROVED BY	DATE
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—	—
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FIGURE 3 - 1	0

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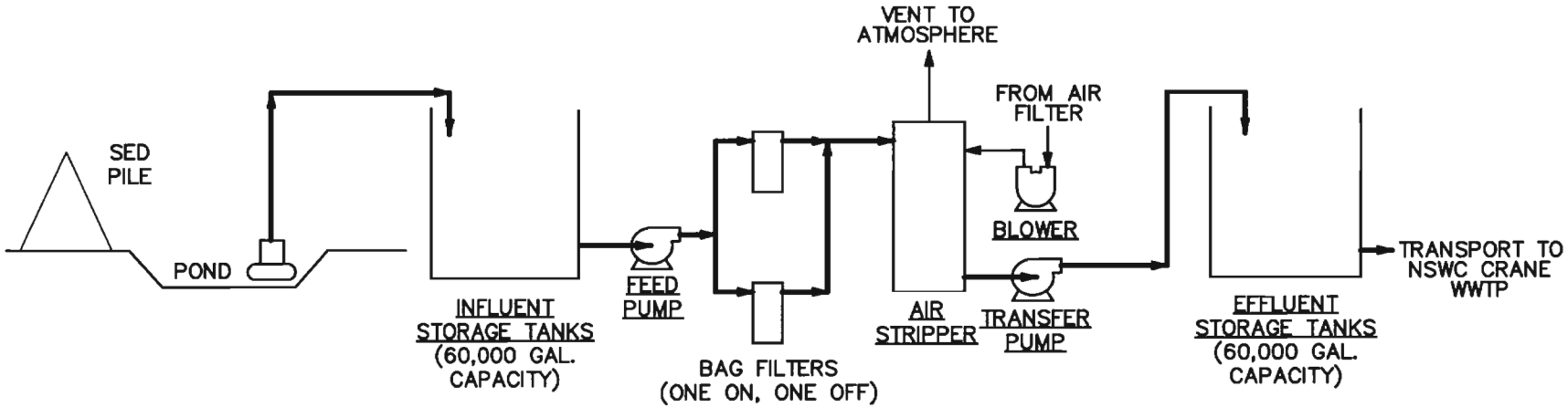

WATER TREATMENT SYSTEM

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CHECKED BY	DATE		OWNER NO. 0020
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-2 / REV. 0

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

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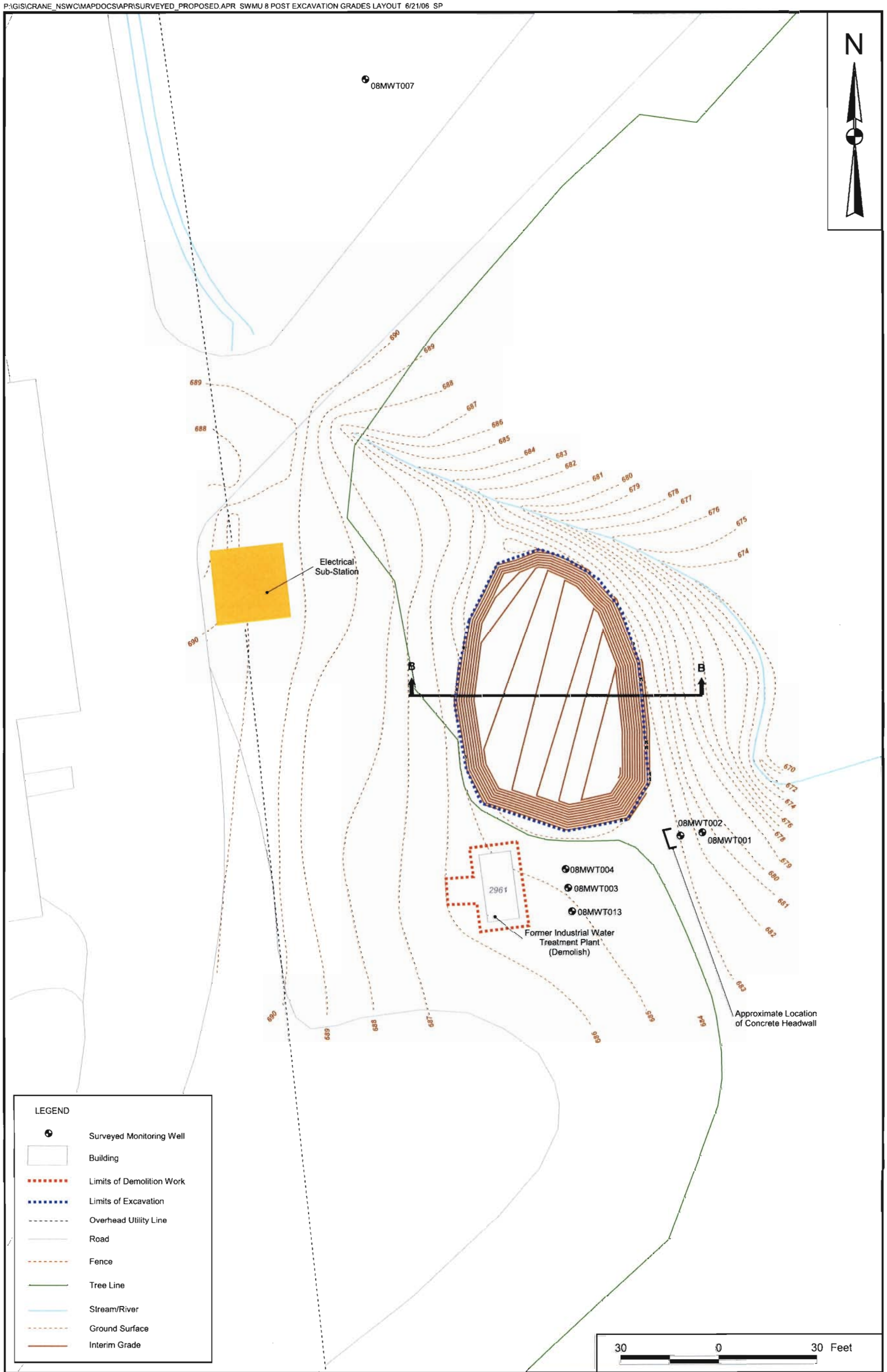

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T. SMITH	6/21/06
COST/SCHEDULE-AREA	
SCALE AS NOTED	

NAVFAC

POST - EXCAVATION GRADES
SWMU 8 - BUILDING 106 POND
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER CTO 0020	
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APPROVED BY —	DATE —
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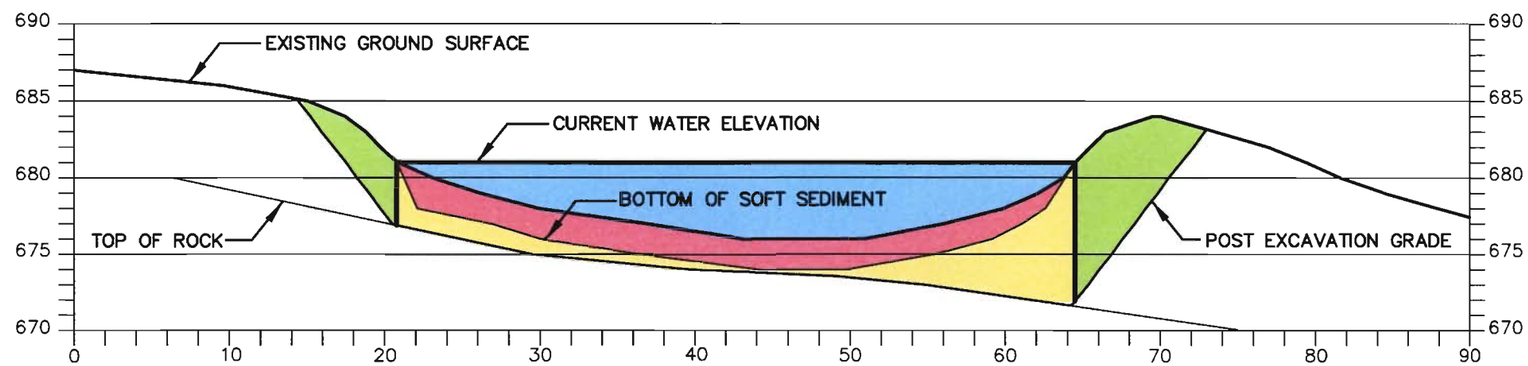

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GRAPHIC SCALE IN FEET

LEGEND

- OVER EXCAVATION FOR STABILITY
- POND WATER
- CONTAMINATED SOILS
- CONTAMINATED SEDIMENT

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REVISED BY	DATE			APPROVED BY / DATE
SCALE AS NOTED				DRAWING NO. FIGURE 3-4 / REV. 0

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

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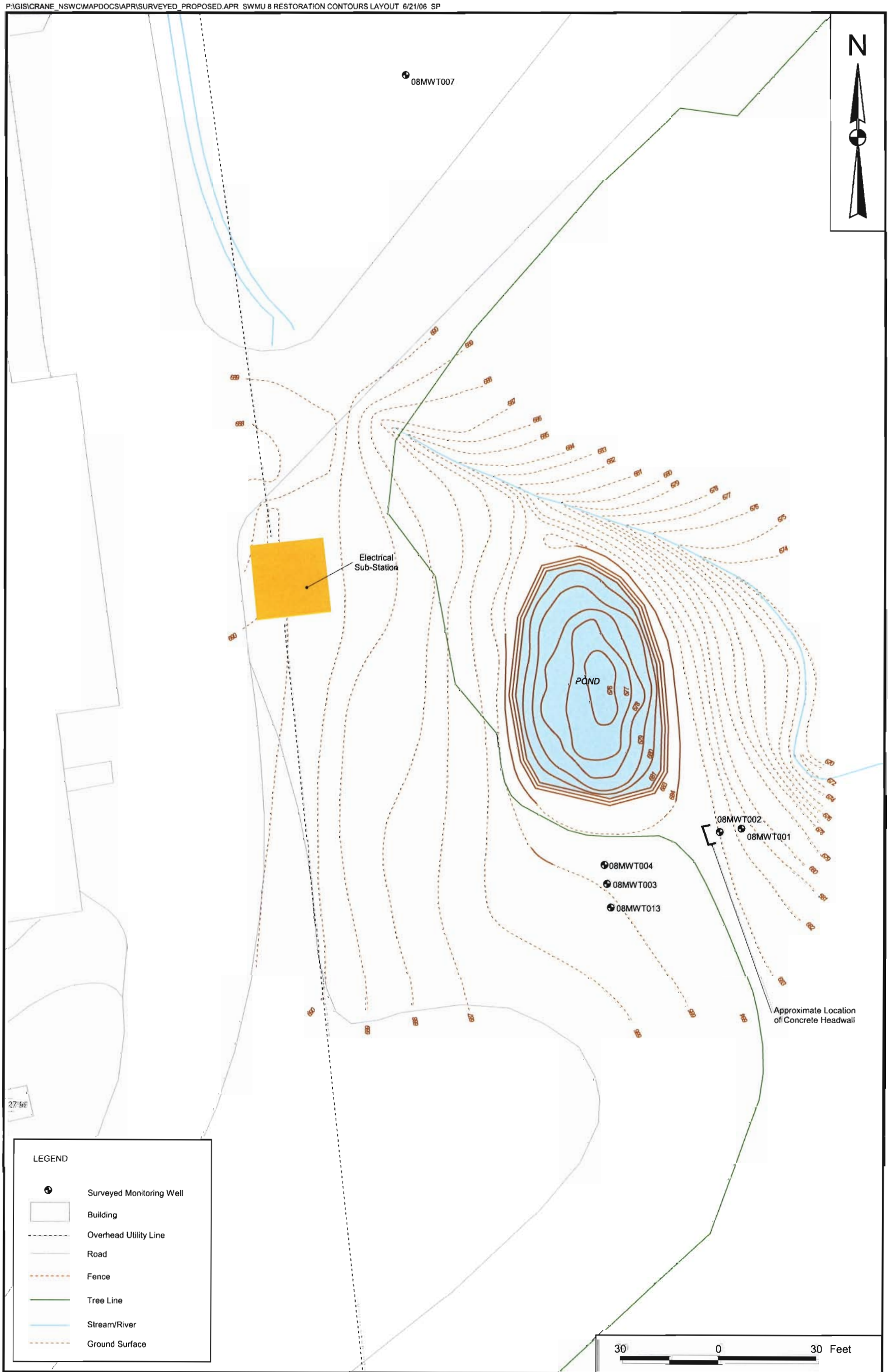

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CHECKED BY	DATE		SWMU 8 - BUILDING 106 POND	APPROVED BY / DATE
T. SMITH	6/21/06	NAVFAC	INTERIM MEASURES WORK PLAN	APPROVED BY / DATE
COST/SCHEDULE-AREA			NSWC CRANE	DRAWING NO. / REV
SCALE AS NOTED			CRANE, INDIANA	FIGURE 3 - 5 / 0

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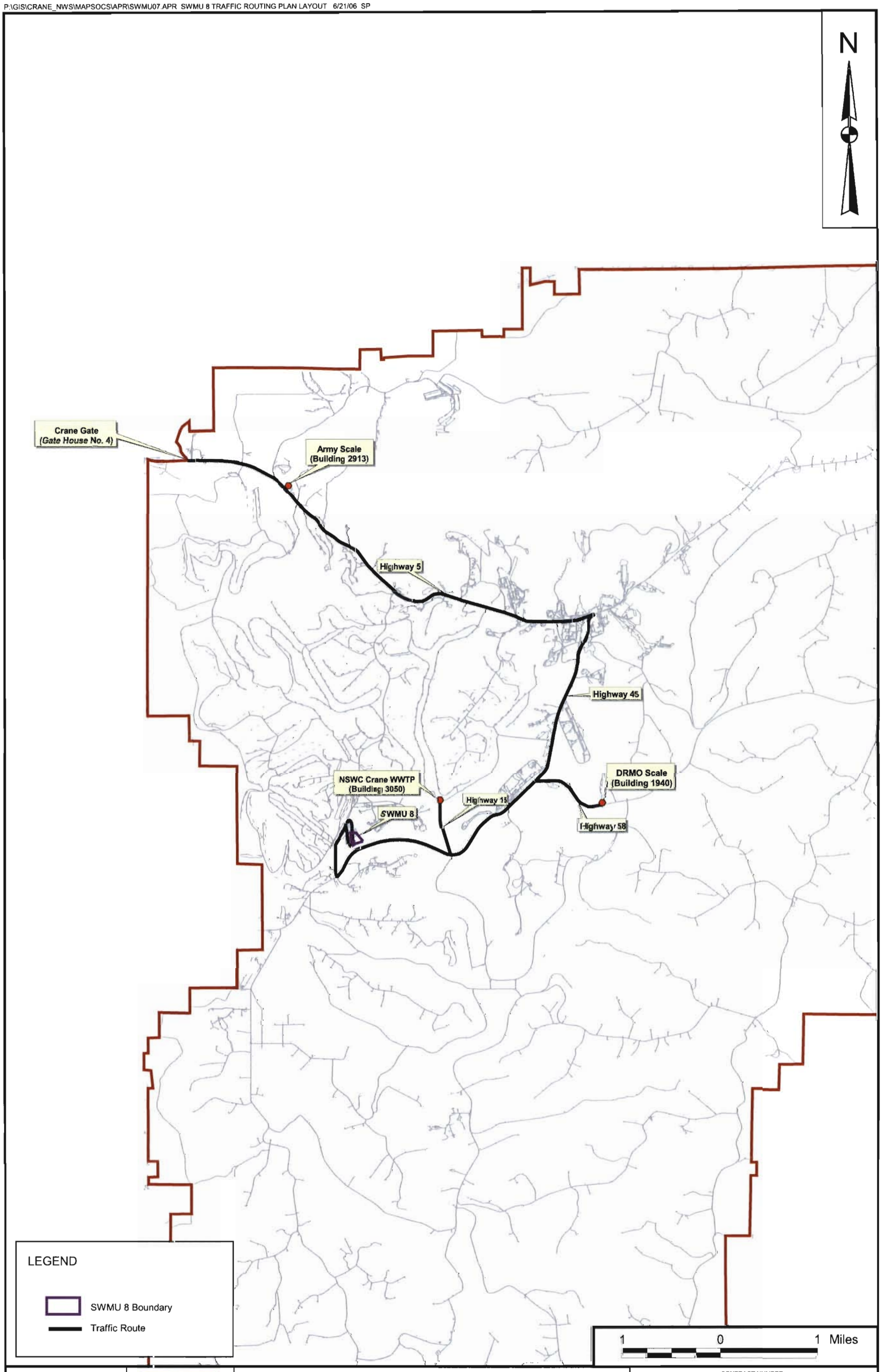


DRAWN BY S. STROZ DATE 5/4/06	NAVFAC	TRAFFIC ROUTING PLAN SWMU 8 - BUILDING 106 POND INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	CONTRACT NUMBER CTO 0020
CHECKED BY T. SMITH DATE 6/21/06			APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 3-6 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 the implementation of the IMWP. 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 G. The erosion and sediment control devices described in this text 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 Work Plan. After the Erosion and Sediment Control Plan is approved, no changes can be made without approval by the OICC and the State of Indiana.

4.2 EROSION AND SEDIMENT CONTROL REQUIREMENTS

Erosion and sediment control measures are implemented to reduce or eliminate erosion and sedimentation of soils that would be detrimental to surface water quality. The Building 106 Pond is bordered to the north and east by a deeply encised drainage channel that feeds a series of unnamed tributaries to Boggs Creek located downstream of the Building 106 Pond. Boggs Creek discharges to the Wabash River.

IMWP implementation activities at the Building 106 Pond consist of dewatering, excavation, off-site disposal of contaminated sediments and soils, removal of the former Industrial Water Treatment Facility (Building 2961), backfilling of excavation areas, and restoration of disturbed areas. Soils and sediments will be excavated from the bottom and sides of the Building 106 Pond and the former Industrial Water Treatment Facility located south of the Building 106 Pond. Because of site conditions, temporary roads will need to be constructed to allow access to the excavation and demolition areas.

Considering the type of IMWP activities and access issues, the proposed erosion and sediment control measures include the following:

- Silt Fence - Placed along the downslope sides of the excavation area, the demolition area, soil dewatering pad, and the length of the access road to provide a temporary sediment barrier consisting of synthetic filter fabric.

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

- Dust Control - Utilized to prevent surface and air movement of dust from exposed soil surfaces and to reduce the amount of airborne substances that may present health hazards, traffic safety problems, or harm plant/animal life.

- Permanent Seeding - Utilized to establish 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 limits of disturbance along with the locations of the proposed erosion and sediment control devices. Figure 4-2 presents typical details of the erosion and sediment control devices proposed for the IMWP implementation (i.e., silt fence, gravel construction entrance, and temporary access roads). 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. 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:

- The stone construction entrance will be maintained in a condition that will minimize tracking sediment onto facility or public roads.

- Silt fences 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.

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

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 log

book of all erosion and sediment control device inspections and maintenance. This log book will be available at the site at all times for inspection by duly authorized officials including NSWC Crane personnel and the IDEM.

4.4 SITE RESTORATION

All areas disturbed by the IMWP implementation activities (excavation, demolition, and support facility areas) will be restored/stabilized using permanent stabilization practices. Activities to establish permanent stabilization (i.e., preparing the area for seeding and seed application) will be implemented as soon as possible following the establishing of final grades. Permanent stabilization includes site/seed bed preparation, seeding, and mulching. The procedures and requirements for these activities are presented in Section 3.12 of the Handbook. The seed mixture recommended for use at the site is a standard Indiana seed mixture for steep banks and cuts receiving low maintenance. The seed mixture includes Smooth bromegrass, Tall fescue, Orchardgrass, and Crownvetch. Planting rates and optimum soil pH for this mixture are presented in Exhibit 3.12-C of the Handbook (included in Appendix G).

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. Therefore, 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 G.

4.5 RESPONSE PROCEDURES FOR SPILL MITIGATION

Potential non-stormwater discharges anticipated during IMWP implementation activities include wash water resulting from decontamination of field equipment and vehicles, wastewaters collected in the excavation dewatering and treatment activities, fuel and lubricant spills from vehicle fueling, lubrication, and maintenance, and spills of fertilizers and other flammable substances used in general construction activities. The devices used in this project to contain these materials are described below.

Decontamination Pad - All decontamination wash water will be collected in a lined decontamination and equipment wash pad area. All waters generated from decontamination and/or other washing activities will

be collected, characterized, and pumped to the nearest NSWC Crane sanitary sewer collection system manhole, if approved by NSWC Crane, or transported to an approved off-site treatment facility. The decontamination pad location shown in Figure 4-1 is presented to provide a typical arrangement for this type of project. The construction, location, and size of the decontamination pad will be determined by the EMAC contractor to best accommodate site access and equipment usage. Following the removal of the decontamination pad, verification samples will be collected from the footprint of the decontamination pad to verify that no leaks or spill occurred during construction activities. Verification sampling procedures are discussed in Section 5.

Dewatering Pad - The IMWP for the Building 106 Pond requires the use of a soils dewatering pad. The soils dewatering pad will be bermed and lined with a 60-mil low-density polyethylene (LDPE) geomembrane and will be sized to contain the anticipated volumes of stockpiled soils and sediments and provided adequate area for dewatering. The construction, location, and size of the dewatering pad will be determined by the EMAC contractor to best accommodate site access, equipment usage, and the materials handling plan. Following the removal of the dewatering pad, verification samples will be collected from the soils dewatering pad footprint to verify that no leaks or spill occurred during construction activities. Verification sampling procedures are discussed in Section 5.

Water Pretreatment System Pad - The water pretreatment system will be constructed within a bermed area that is lined with a 60-mil LDPE geomembrane. The bermed area will be sized to contain the three inflow storage tanks and the pretreatment system and to contain the volume of one of the three storage tanks. It is not required to construct the bermed area to contain the three treated water storage tanks. Following the removal of the water pretreatment pad, verification samples will be collected from the underlying surface soils to verify that no leaks or spill occurred during construction activities. Verification sampling procedures are discussed in Section 5.

Materials Storage Area - The activities associated with the IMWP implementation require a materials storage area. The materials storage area will contain all vehicle fuels and maintenance lubricants (oil, grease, antifreeze, hydraulic fluid, etc.). The materials storage area will be bermed and lined with a 60-mil LDPE geomembrane and will be sized to contain 110 percent of the volume 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. Following the removal of the materials storage area at the end of the project, verification samples will be collected from the footprint of the materials storage area to verify that no leaks or spill occurred during construction activities. Verification sampling procedures are discussed in Section 5.

Good housekeeping procedures will be followed to reduce spill risks associated with these materials. 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 and regularly inspecting the fuels and lubricants stored within the materials storage area to ensure that stored containers are not leaking and that the lining system is functioning properly. Accidental spills that may occur will be contained as appropriate for the spilled medium (liquid or solid) and collected and containerized immediately after discovery of the spill. Containerized material will be characterized for off-site transportation and disposal. The following spill mitigation equipment should 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 NSWC Crane Environmental Department.

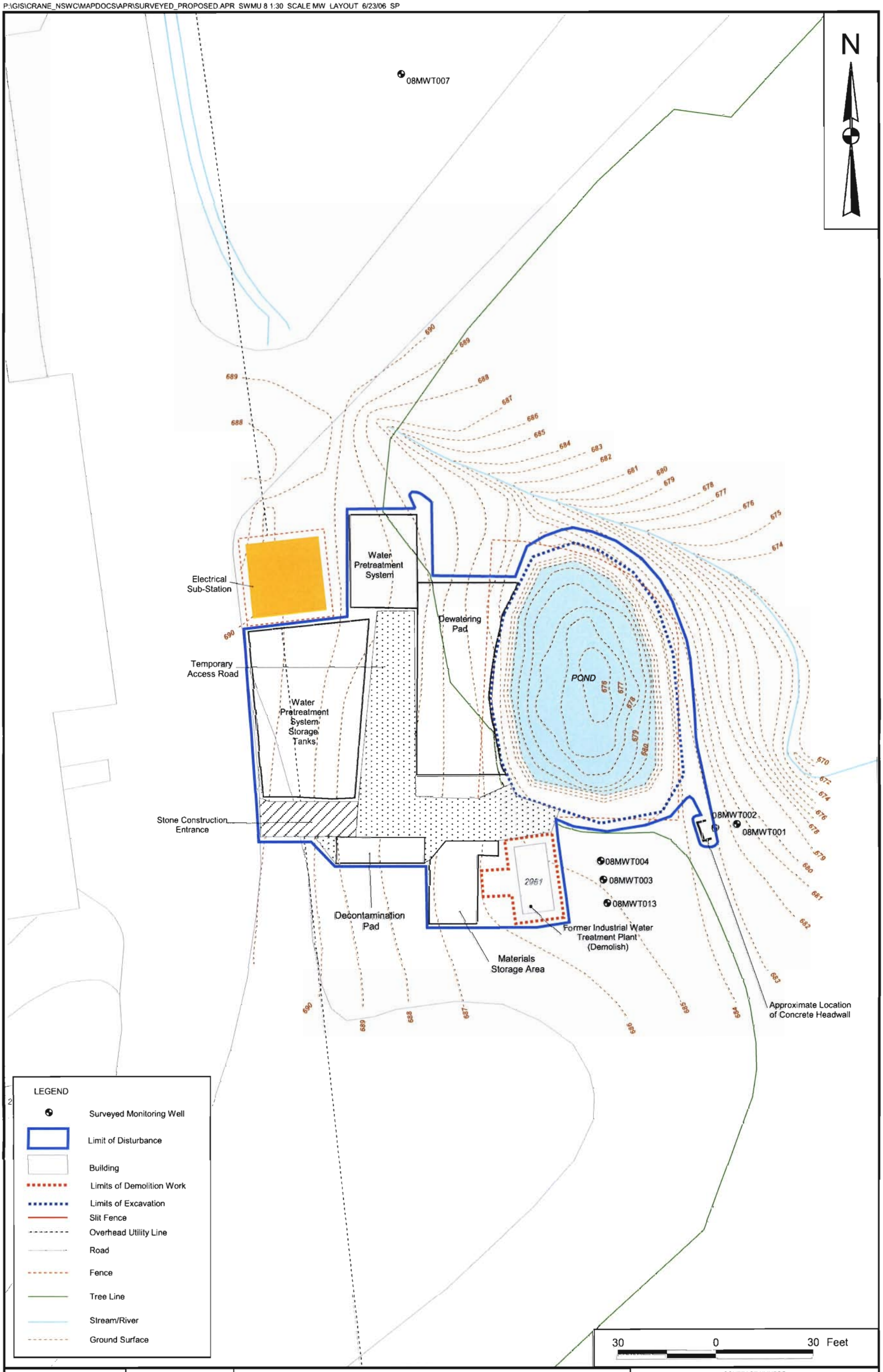
To further reduce the risk of spills, the following practices should be adopted:

- 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.

- All vehicle fueling, lubrication, and maintenance will be performed utilizing drip pans to contain any spills that may occur or within the decontamination pad to contain spills.

- Containers of detergents and vehicle maintenance fluids (oil, grease, antifreeze, hydraulic fluid, etc.) will be stored within an enclosed, lined, diked materials storage area along with the equipment fuel, which is stored in tanks.

P:\GIS\CRANE_NSWC\MAPDOCS\APR\SURVEYED_PROPOSED.APR SWMU 8 1:30 SCALE MW LAYOUT 6/23/06 SP



DRAWN BY	DATE
S. STROZ	5/5/06
CHECKED BY	DATE
T. SMITH	6/23/06
COST/SCHEDULE-AREA	
SCALE AS NOTED	

NAVFAC

EXCAVATION AND DEMOLITION PLAN
SWMU 8 - BUILDING 106 POND
INTERIM MEASURES WORK PLAN
NSWC CRANE
CRANE, INDIANA

CONTRACT NUMBER	
CTO 0020	
APPROVED BY	DATE
—	—
APPROVED BY	DATE
—	—
DRAWING NO. FIGURE 4 - 1	REV 0

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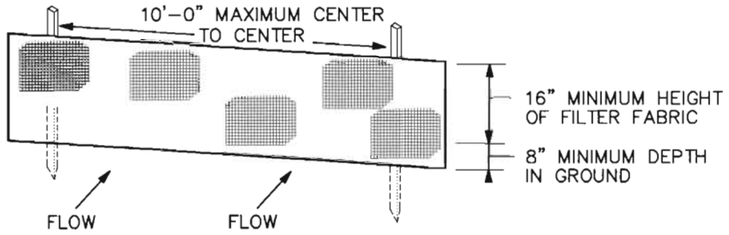
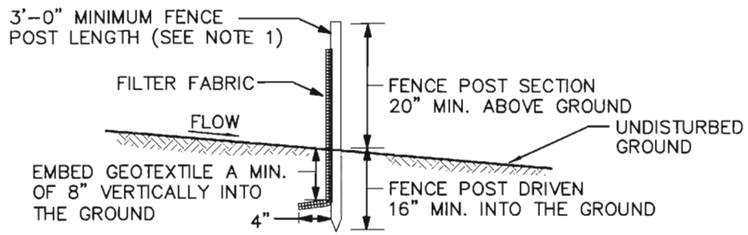
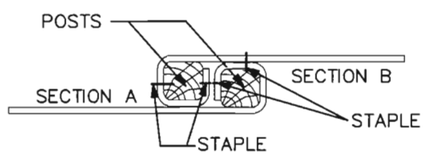


PERSPECTIVE VIEW



CROSS SECTION

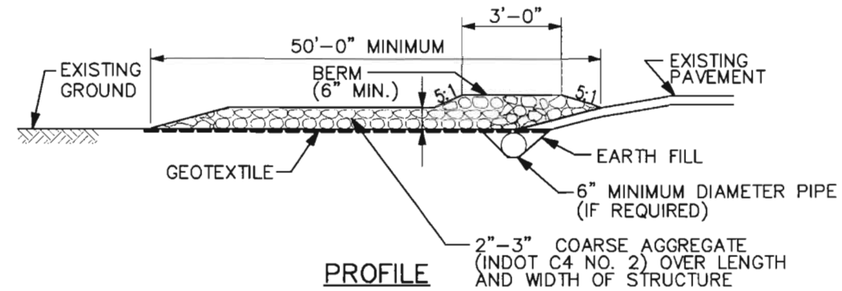


TOP VIEW – JOINING TWO
ADJACENT SILT FENCE SECTIONS

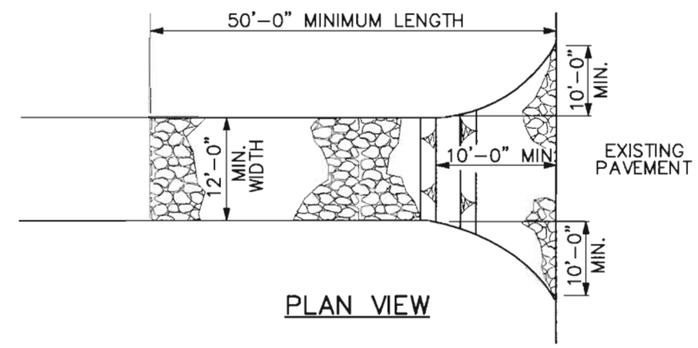
NOTES:

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

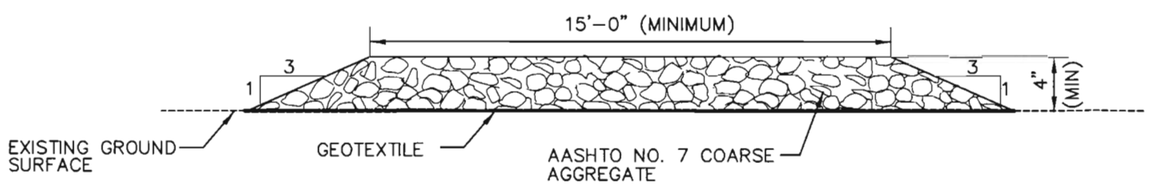


PLAN VIEW

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 MF	DATE 4/6/06	EROSION AND SEDIMENT CONTROL DEVICES SWMU 8 - BUILDING 106 POND INTERIM MEASURES WORK PLAN NSWC CRANE CRANE, INDIANA	CONTRACT NO. 0352
CHECKED BY	DATE		OWNER NO. 0020
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 4-2 / REV. 0

NAVFAC

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

5.0 SAMPLING AND ANALYSIS PLAN

5.1 PURPOSE

The purpose of this section is to discuss the three types of soil samples and one type of water sample that will be collected during and following the implementation of the IMWP. Disposal facility characterization samples will be collected from stockpiled sediments and soils to satisfy the requirements of the NSWC Crane-approved waste disposal facility. Post-excavation characterization samples will be collected to provide information for use in the RFI Report on residual contaminant levels following the excavation of sediments and soils from the Building 106 Pond to the limits identified in Section 3.0. The data will also be used in the IMR to document site conditions after remediation Verification samples will be collected to verify that contaminants were not transferred to surface soils below the decontamination pad, soils dewatering pad, materials storage area, water pretreatment system pad, and access roads used to haul contaminated soils and sediments. Lastly, water samples will be collected from the water treated by the pretreatment system to confirm that water quality satisfies NSWC Crane sanitary system pretreatment requirements.

This section also presents criteria and procedures used to evaluate the analytical data from the verification samples to determine the acceptability of residual soil contamination, if present. Post-excavation characterization and verification samples will be collected by TtNUS. Disposal facility characterization soil samples and water samples will be collected by the EMAC contractor. The sampling procedures, sample locations, and fixed-base laboratory analytical methods for the post-excavation characterization samples and verification samples will be addressed in the QAPP Addendum (to be provided under separate cover). These same requirements for the disposal characterization soil samples and water samples will be established by the NSWC Crane-approved disposal facility and the NSWC Crane Sanitary Authority.

5.2 SAMPLING AND SAMPLE EVALUATION

The IMWP implementation includes the excavation and off-site disposal of soils and sediments from the Building 106 Pond contaminated with VOCs, and the demolition of the former Industrial Water Treatment Facility. The limits of the Building 106 Pond excavation and the demolition area are shown on Figure 3-1. Following excavation and demolition activities, the exposed soil on the excavation sidewalls will be sampled to identify the concentrations of any remaining VOCs. These characterization samples will be collected at a rate of one grab sample for every 25 linear feet of exposed excavation sidewall. The grab samples will be collected at random locations within an identified grid pattern to be laid out following

excavation and demolition activities. As indicated in Section 5.1, these samples are characterization samples collected for use in the RFI and IMR.

The activities associated with the implementation of the IMWP include transportation of contaminated sediments and soils across access roads, storing hazardous liquids on-site, decontaminating equipment that has come in contact with contaminated materials, and stockpiling contaminated soils on-site for dewatering purposes. To verify that the activities have not spread contamination beyond the identified excavation and demolition areas, verification samples will be collected from below the footprints of the decontamination pad, soils dewatering pad, materials storage area, water pretreatment pad, and temporary access roads used by on-site excavation and hauling equipment. Because the contaminants associated with the IMWP are predominantly VOCs, the verification samples will be analyzed for VOCs in a fixed-base laboratory. These samples will be collected at a rate of one grab sample for every 900 sf of exposed support facility footprint. The footprint of a support facility is considered to be the actual support facility footprint extended 10 feet in all directions. Therefore, an actual support facility footprint of 15 feet by 30 feet is considered 35 feet by 50 feet for verification sampling purposes. The analytical results of these samples will be compared to IDEM surface soil direct contact criteria and the analytical results from previously collected SWMU 8 surface soil samples.

To minimize EMAC contractor down time associated with waiting for verification sample analytical results from fixed-base laboratory, TtNUS will inform the OICC and EMAC contractor of the verification sampling results within 24 hours of sample delivery if hand-delivered to a local laboratory, or within 48 hours of sample shipment if samples need to be shipped to a laboratory. TtNUS anticipates that a local laboratory will be available to perform the required VOC analyses.

If the results of the verification samples indicate that VOCs are not detected, or are detected at concentrations less than the State surface soil direct contact criteria, the EMAC contractor will be informed that no additional excavation in the area of the support facilities is required. However, in the event that a verification sample identifies VOCs at concentrations exceeding the State surface soil direct contact criteria, the sample result will be compared to the results of surface soil samples collected from the nearest historical soil boring location. If the verification sample result appears to be in line with or less than the historical sample result, the EMAC contractor will be informed that no additional excavation within the support facility area is required. If the verification sample result appears to be in excess of the historical sample result, the EMAC contractor will be informed to excavate an additional 6-inches from the verification sampling footprint and the exposed surface will be resampled. TtNUS will inform the Navy and IDEM of such sample results and the Navy and IDEM will determine whether current verification sample results are in line with or are in excess of local historical sample results. If removal of impacted

soils below support facilities is required, the excavation, handling, and disposal of that material at a NSWC Crane-approved disposal facility will be done at the expense of the EMAC contractor.

The EMAC contractor will be required to collect soil characterization samples of the dewatered stockpiled materials be transported off site to the NSWC Crane-approved disposal facility. The sample requirements will be identified by the approved disposal facility. In addition, the EMAC contractor will be required to sample and provide analysis for the water that has been treated by the water pretreatment system prior to discharge at the NSWC Crane WWTP. The sampling and analysis requirements will be identified by the NSWC Crane Sanitary Authority.

5.3 SAMPLING LOCATIONS

The numbers and locations of post-excavation characterization and verification samples will be identified in a QAPP Addendum that will be provided under separate cover.

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B&RE (Brown and Root Environmental), 1997. Brown and Root Environmental, Current Contamination Conditions Risk Assessment. SWMU #03/10 (Ammunition Burning Ground), SWMU #07/09 (Old Rifle Range), SWMU #06/09 (Demolition Range). November.

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Kent, 1973. Naval Ammunition Depot, Crane Indiana, Pilot Test Final Report, Kent, R., Reid, G.H., and Jeffrey M. Stone, Naval Civil Engineering Laboratory, Port Hueneme, CA.

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TtNUS, 2006. Resource Conservation and Recovery Act Facility Investigation Report Building 106 Pond (SWMU 8), Naval Surface Warfare Center, Crane, Indiana, March.

USEPA (United States Environmental Protection Agency), 1986. RCRA Facility Assessment Guidance, OSWER Directive 9502.00-95.

APPENDIX A

MARCH 2006 BUILDING 106 POND RFI DATA

A.1 BUILDING 106 POND FIELD FORMS
A.2 SWMU 8 GROUNDWATER ELEVATION MEASUREMENTS
A.3 BUILDING 106 POND ANALYTICAL DATA

Information obtained from document titled RCRA Facility Investigation Report (SWMU 8), Naval Surface Warfare Center Crane, Crane, Indiana. Prepared by Tetra Tech NUS, Inc. and dated March 2006.

A.1 BUILDING 106 POND FIELD FORMS

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: N1245
DRILLING COMPANY: EFS, INC.
DRILLING RIG: DPT RIG

BORING No.: 08SB004
DATE: 12-11-04
GEOLOGIST: CONTI
DRILLER: MC FALL

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e	0		2/2		M	GRAY	3" ASPHALT GRAVEL TO SILTY CLAY -TR	CL	MOIST [08SS004 0002]	0			
1430	2				STIFF	BRN	ROCK FRAGS			0			
							TO SANDY CLAY -TR	SC	MOIST	0			
S-2 e							GRAVEL AND ROCK FRAGS			0			
1435			3/4	5'±	SOFT		? (FILL)		MOIST → WET [08SB004 0206]	0			
	6			6'	M DENSE	TAN BRN	CLAY AND SANDSTONE FRAGS	CL		0			
				REF & BOTM									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: N1245
DRILLING COMPANY: EFS, INC.
DRILLING RIG: DPT RIG

BORING No.: 08SB006
DATE: 12/12/04
GEOLOGIST: CONTI
DRILLER: McFALL

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1	0		2/2		M STIFF	BRN	CLAYEY SAND - TR ROOTS	SC	LOOKS NAT MOIST	0			
09/05	2						TO		[08SS0060002]	0			
				3			SANDY CLAY	SC	MOIST	0			
S-2 @			3/4	4				CL		0			
09/10					LOOSE	YELLOW BRN	SILTY SAND - SOME	SM	MOIST [08SB0060206]	0			
	6					TO ORANG	WEATH ROCK FRAGS		WET ≈ 5 TO 6	0			
S-3			3/4		TO	GRAY BRN			MOIST	0			
@ 09/15	8			8'	DENSE				[08SB0060610]	0			
				REF @ BOTM									
									SET TW				
									3-8' SCREEN				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No ___ Well I.D. #: ~~08TW006~~ 08TW001

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: N1245
DRILLING COMPANY: EFS, INC.
DRILLING RIG: DPT RIG

BORING No.: 08SB007
DATE: 12-12-04
GEOLOGIST: CONTI
DRILLER: McFAU

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e	0		2/2		STIFF	BRN	SANDY CLAY/CLAYEY	SC	MOIST [08SS0070002]	0			
1045	2						SAND-TR ROOTS AND ROCK FRAGS		FILL ?	0			
									POOR REC	0			
S-2 e			2/4						HIT ROCK FR IN SHOE	0			
1050									[08SB0070206]	0			
	6				M STIFF	BRN	CLAYEY SAND/	CL	MOIST	0			
							SANDY CLAY-TR ROOTS, GRAVEL	/SC		0			
S-3 e			4/4	7			ROCK FRAGS		TR STAINS (DARK) @ 8'± SAMPLE	0			
1055									TAKEN HERE [08SB0070610]	0			
	10						(FILL)?		COULD BE FILL TO 10'±	0			
					SOFT/	GRAY	SILTY/SANDY CLAY	SC	10→14 WET GRAY W/ODOR	0			
S-4 e			4/4	Sample zone	LOOSE		TR ROCK FRAGS W/ ODOR	"	"SEWAGE" TYPE ODOR	0			
1100							TR ROOTS			0			
				14						0			
	15			15'±	STIFF	RED BRN	SANDY CLAY - TR ROCK FRAGS	SC	[08SB0071013]	0			
S-5 e			2/2		LOOSE/ STIFF	ORANG BRN	WEATHERED SHALY			0			
1105	17					GRAY	SANDSTONE			0			
				17' REF & BOTM					SET TW 007 SCREEN 7-17				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No ____ Well I.D. #: ~~08TW007~~ 08TW002

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: N1245
DRILLING COMPANY: EFS, INC.
DRILLING RIG: DPT RIG

BORING No.: 08SB008
DATE: 12-13-04
GEOLOGIST: CONTI
DRILLER: MCFALL

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 e	0		2/2		M STIFF	BRN	SANDY CLAY-TR	SC	MOIST	0			
1020	2						ROOTS-TR ROCK		[08SS0080002]	0			
							SANDY CLAY - SILTY	CL	MOIST	0			
S-2 e			4/4				CLAY	SC		0			
1025							5' PCS ORGANICS (WOOD) FILL.		[08SB0080206]	0			
	6				SOFT	BRN	SANDY CLAY TR	3"	WET ZONE ~5.5 NAT ≈ 6'.	0			
					TO M	BRN	ROOTS			0			
S-3 e			4/4		STIFF	GRAY	SANDY CLAY-TR	SC	MOIST	0			
1030					TO STIFF		ROOTS			0			
	10			10'			TR GRAY SS FRAG IN SHOE		[08SB0080610]	0			
				REF & BOTM									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE
PROJECT NUMBER: N1245
DRILLING COMPANY: EFS, INC.
DRILLING RIG: DPT RIG

BORING No.: 08SB009
DATE: 12-12-04
GEOLOGIST: CONTI
DRILLER: McFAUL

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 @ 0925	0		2/2		M STIFF	BRN	SANDY CLAY-TR ASH	SC	MOIST (FILL)	0			
	2						ROCK FRAGS TR ROOTS		[08SS009 0002]	0			
								SC		0			
S-2 @			4/4	± 4					MOIST	0			
0930					M DENSE	GRAY	SILTY SAND-TR	SM	[08SB0090206]	0			
	6					BRN	ROCK FRAGS			0			
S-3			2/2.5						MOIST	0			
@ 0935						TR	TO		[08SB0090610]	0			
	8.5			8.5		GRAY	SANDSTONE FRAGS			0			
				REF @ BOTM									
									TOOK MS/MSD 0610				
									ALSO DUP01 0610				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No ✓ Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC Crane SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT003
DATE: 5/12-16/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	1									0	0	0	0
							see logs for						
	5						08MWT004 for						
							0-12 feet						
							interval						
							(overburden)						
	10												
	12												
							augered from 12 feet down to						
			0				20 feet bgs through soft						
							weathered rock. Included						
							black shale ~~and~~ between 14 and						
							18 feet bgs. Came up auger as						
							black, very sticky mud						
	20			20'			Set 20' of 6" diameter black steel						
							casing in hole on 5/12/05. Started coring						
							from 20 to 60' bgs on 5/16/05.						
			4.0/										
C1		70%	5.0				fine sandstone interbedded with						
							thin layers of sandy siltstone						
	25			25'			and sandy shale						
							tan to light gray, laminated						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT003

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT003
DATE: 5/12-16/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler B2	Borehole**	Driller B2**
	26						same as above but rock			0	0	0	0
			3'				more broken, weathered,						
C2			5'				orange to dark orange						
		10%											
	30			30'									
							lt. gray to tan fine to med						
C3				med			grained sandstone; very						
		90%	5'	hard			few thin shale partings;						
			5'				thin zones of orange						
	35						iron coloration that are						
							not along fractures						
C4													
							same as above but progressively						
							more orange iron staining						
	40			40'									
							orange to pink medium						
							sandstone, bedding laminations						
C5							dipping at 20-30° angle						
	45												
C6													
	50												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No ____ Well I.D. #: 08MWT003

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
BORING No.: 08MWT003
PROJECT NUMBER: N1245
DATE: 5/12-16/05
DRILLING COMPANY: Bowser Morner
GEOLOGIST: Jeff Schubert
DRILLING RIG: CME 850X-ATV
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	51									0	0	0	0
C7		80%	5'/5'				Same as above						
	55												
C8		75%	5'/5'										
	60												
					total depth of boring = 60 feet								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT003

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT004
DATE: 5/12/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
SS1	1	2/4	6"/	6"			topsoil with limestone gravel (moist - dry)			0	0	0	0
	2	4/4	24"										
SS2	3	3/4	22"/				orange-brown to olive-gray mottled silty clay (moist)						
	4	4/5	24"	4'									
SS3	5	2/2	22"/				orange-gray mottled silty clay, plastic, moist						
	6	3/3	24"	6'									
SS4	7	2/2	8"/				olive brown silty clay (very moist)						
	8	3/4	24"	8½'									
SS5	9	3/7	22"/				olive-orange silty clay with some fine sand (moist)						
	10	10/13	24"	10'									
SS6	11	9/20	24"/				weathered fine sandstone						
	12	20/26	24"										
							total depth of boring = 12.0 feet bgs						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT004

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8 BORING No.: 08MWT012
PROJECT NUMBER: N1245 DATE: 10/8-9/05
DRILLING COMPANY: Bowser Morner GEOLOGIST: Jeff Schubert
DRILLING RIG: CME 550X-ATV DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS.	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
SS1	1	3/4	12"	6"			brown silty sandy topsoil			0	0	0	0
	2	4/5	24"										
SS2	3	3/4	18"				brown to orange mottled silty clay, moist, dense						
	4	5/6	24"										
SS3	5	3/4	20"										
	6	6/5	24"	6'									
SS4	7	6/13	20"				orange to tan to olive gray mottled clayey silt to sandy silt						
	8	24/18	24"	8'									
SS5	9	8/9	4"				weathered siltstone, orange to tan, mottled, moist, med. dense, dark brown staining on laminations						
	10	8/13	24"										
SS6	11	8/17	20"										
	12	29/40	24"										
SS7	13	48/83	12"	13'			top of bedrock						
	14		24"										
			0				weathered, orange, sandy siltstone, very dry, based on chips blown from hole						
	17			17									
C1			1½' / 5'				gray shaly siltstone interlayered with tan fine sandstone						
	22												
				22.5									
C2							black carbonaceous shale very finely bedded						
	25												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No ____ Well I.D. #: 08MWT012

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT012
DATE: 10/8-9/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
C2	26						Same as above			0	0	0	0
				27.5'									
			2'/5'				silty shale and fine sandstone, interbedded						
C3	30			29.5			finely laminated						
				31'			black carbonaceous						
	32						shale						
C4			5'/5'				laminated siltstone,						
	35						shale, and fine sandstone						
							dark gray to tan, wavy						
							bedding; broken near						
C5							38' and 43' bgs;						
	40	80%	2.5'/5'				rest of section has						
							high RQD						
	42												
C6		80%											
	50			50'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm): 0

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT012

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT012
DATE: 10/8-9/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
C6	51						laminated fine sandstone			0	0	0	0
	52						and siltstone with small						
							streaks of coal along						
							bedding planes;						
	55			55'			more coaly near bottom						
							siltstone very lt gray						
C7							contains small streaks of						
				58			shale and coal on partings						
							shale with interbedded						
	60						siltstone, finely laminated						
				61									
	62			61.3			thin coal seam						
							shaly siltstone interbedded						
							with fine sandstone;						
							carbonaceous on laminations						
C8													
	70												
	72												
					72 feet = bottom of boring								

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No ____ Well I.D. #: 08MWT012

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT 13
DATE: 10/6-11/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
							augered down to bedrock at about 12' bgs and set 10" diameter temporary casing			0	0	0	0
				12'									
							roller bit used down to 79' bgs (see logs for 08MWT03 and 08MWT04 for this section); installed 6" steel casing to 79'						
	79'			79'									
C1	80	80%	3.5 / 3.5				fine sandstone and siltstone, interbedded; lt. gray to med. gray						
	82			83'									
	85						med. gray shale and interbedded siltstone very broken						
C2		40%	9' / 10'	87'									
	90						siltstone and fine sandstone with shale laminations lt. gray to dark gray						
				92.5									
C3													
	95												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT013

Tetra Tech NUS, Inc.

BORING LOG

PROJECT NAME: NSWC CRANE SWMU 8
PROJECT NUMBER: N1245
DRILLING COMPANY: Bowser Morner
DRILLING RIG: CME 550X-ATV
BORING No.: 08MWT013
DATE: 10/6-11/05
GEOLOGIST: Jeff Schubert
DRILLER: Jim Walsh

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler B2	Borehole**	Driller B2**
	95									0	0	0	0
C3		15%	8'/10'		soft		interbedded shale and sandy siltstone; lt. gray to med. gray; very broken mostly shale						
	100												
	105												
C4		10%	8'/10'										
	110												
	115			115'									
C5		20%	10'/10'				fine sandstone interbedded with some silty shale, lt. - med. gray more competant than rock above						
				119'									
	120			119-123			interlayered fine ss. and coal						

123 feet = bottom of boring

highly bro

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

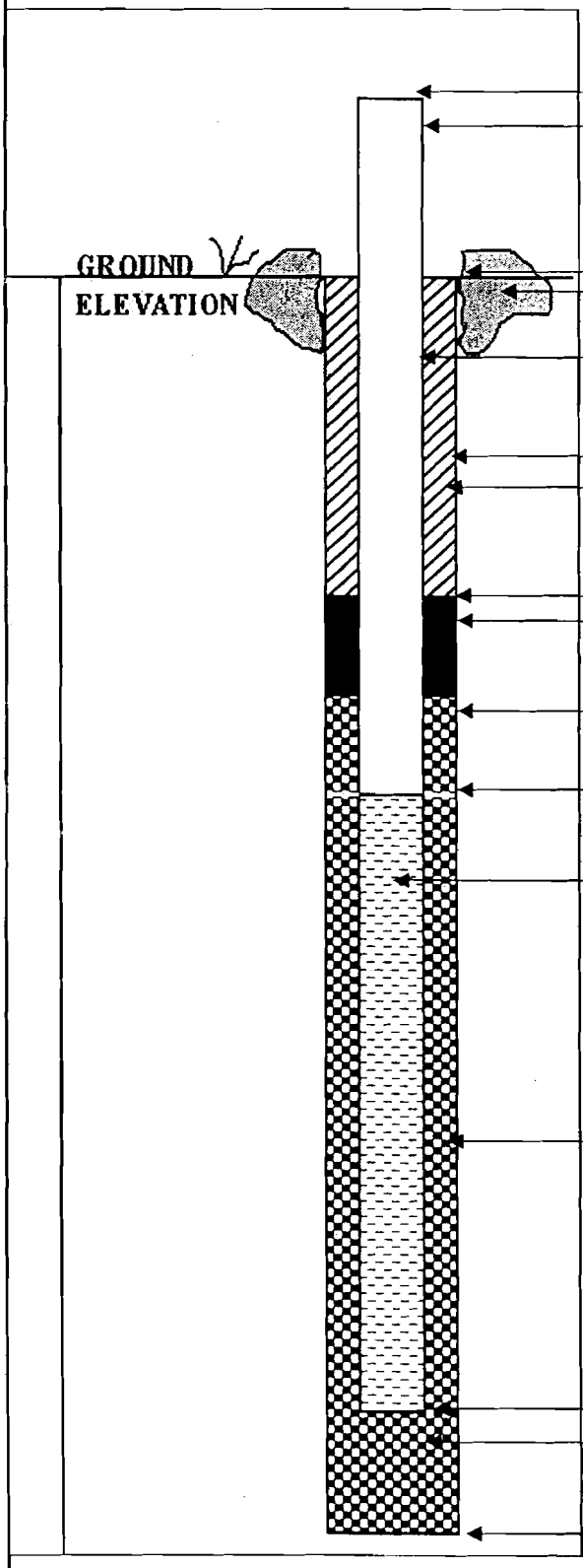
Remarks:

Converted to Well: Yes ✓ No _____ Well I.D. #: 08MWT013

BORING NO.: 08TW013

Tetra Tech NUS, Inc. **TEMPORARY MONITORING WELL SHEET**

PROJECT:	NSWC Crane	DRILLING Co.:	EFS	BORING No.:	08TW013
PROJECT No.:	N1245	DRILLER:	McFAU	DATE COMPLETED:	12/12/04
SITE:	8	DRILLING METHOD:	DPT	NORTHING:	1306446.71
GEOLOGIST:	Conti	DEV. METHOD:	NA	EASTING:	3014961.65



ELEVATION OF TOP OF RISER PIPE: NA

RISER STICK-UP ABOVE GROUND SURFACE:

GROUND ELEVATION: 685.46 NA

TYPE OF SURFACE SEAL: NA

RISER PIPE I.D.: 3/4"

TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 3"

TYPE OF SEAL: NA

ELEVATION / DEPTH OF SEAL: / NA

TYPE OF SEAL: NA

ELEVATION / DEPTH TOP OF FILTER PACK: / NA

ELEVATION / DEPTH TOP OF SCREEN: 676.46 / 9

TYPE OF SCREEN: PVC

SLOT SIZE X LENGTH: 10SL x 10'

I.D. OF SCREEN: 3/4"

TYPE OF FILTER PACK: NA.

ELEVATION / DEPTH BOTTOM OF SCREEN: 666.46 / 19

ELEVATION / DEPTH BOTTOM OF FILTER PACK: / NA

TYPE OF BACKFILL BELOW WELL: NA

ELEVATION / DEPTH OF BOREHOLE: 666.46 / 19

WELL NO.: 08MWT003

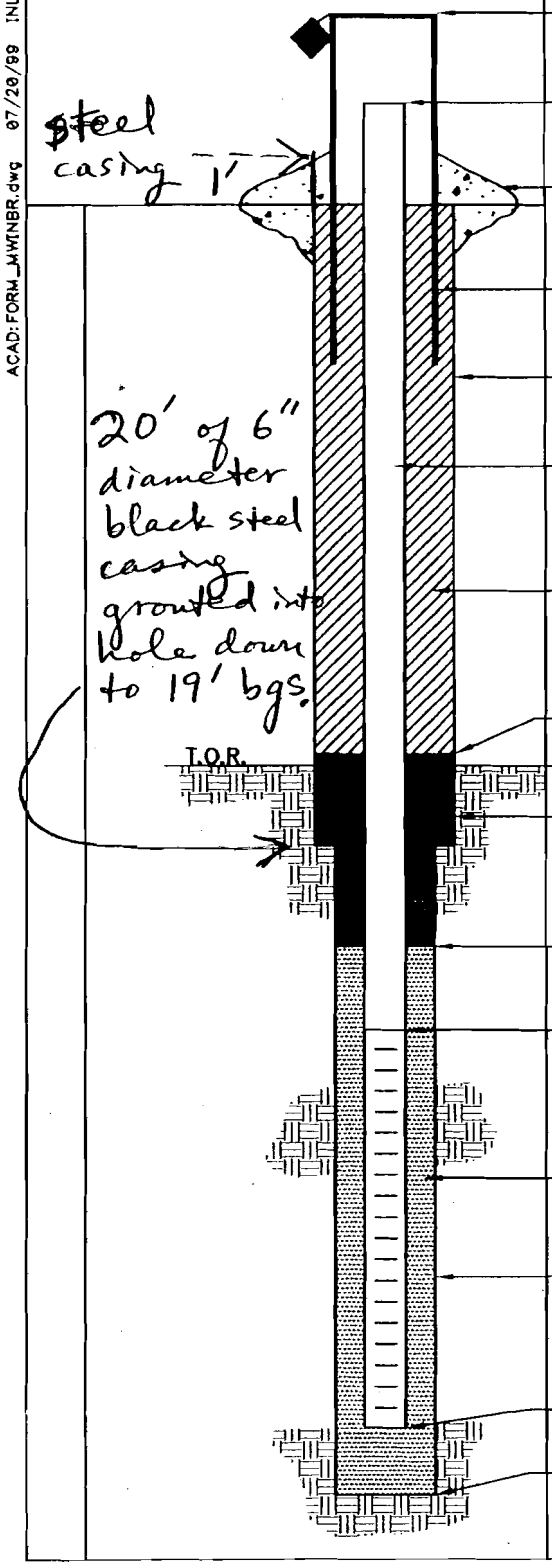
Tetra Tech NUS, Inc.

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NSWC CRANE
PROJECT NO. N1245
DATE BEGUN 5-12-05
FIELD GEOLOGIST Jeff Schubert
GROUND ELEVATION 685.56

LOCATION SWMU 8
BORING 08MWT003
DATE COMPLETED 5-16-05
DATUM NAVD 88

DRILLER Bowser Morr
DRILLING METHOD HSA/AR
DEVELOPMENT METHOD



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: 687.82/2.26

ELEVATION/HEIGHT TOP OF RISER: 687.66/2.10

TYPE OF SURFACE SEAL: 4' x 4' x 6" concrete pad with 4 barrier posts

I.D. OF SURFACE CASING: 4" x 4" square steel protective casing with hinged top

DIAMETER OF HOLE: 8 inch diameter from 0 to 19 feet bgs

RISER PIPE I.D.: 2 inch
TYPE OF RISER PIPE: PVC

TYPE OF BACKFILL: cement-bentonite grout

ELEVATION/DEPTH TOP OF SEAL: 649.56/36.0

ELEVATION/DEPTH TOP OF BEDROCK: 674.16/11.5

TYPE OF SEAL: bentonite chips, medium

ELEVATION/DEPTH TOP OF SAND: 639.56/46.0

ELEVATION/DEPTH TOP OF SCREEN: 635.56/50.0
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 0.010 inch/10 feet
I.D. SCREEN: 2 inches

TYPE OF SAND PACK: Silica Sand, No. 10-20 U.S. Standard Sieve Size

DIAMETER OF HOLE IN BEDROCK:
CORE/REAM: 2"/6" from 19 to 60 ft bgs

ELEVATION/DEPTH BOTTOM SCREEN: 625.56/60.0
ELEVATION/DEPTH BOTTOM OF SAND: 625.56/60.0
ELEVATION/DEPTH BOTTOM OF HOLE: 625.56/61
BACKFILL MATERIAL BELOW SAND: None

ACAD: FORM_MWNBR.dwg 07/20/99 INL

08MWT004

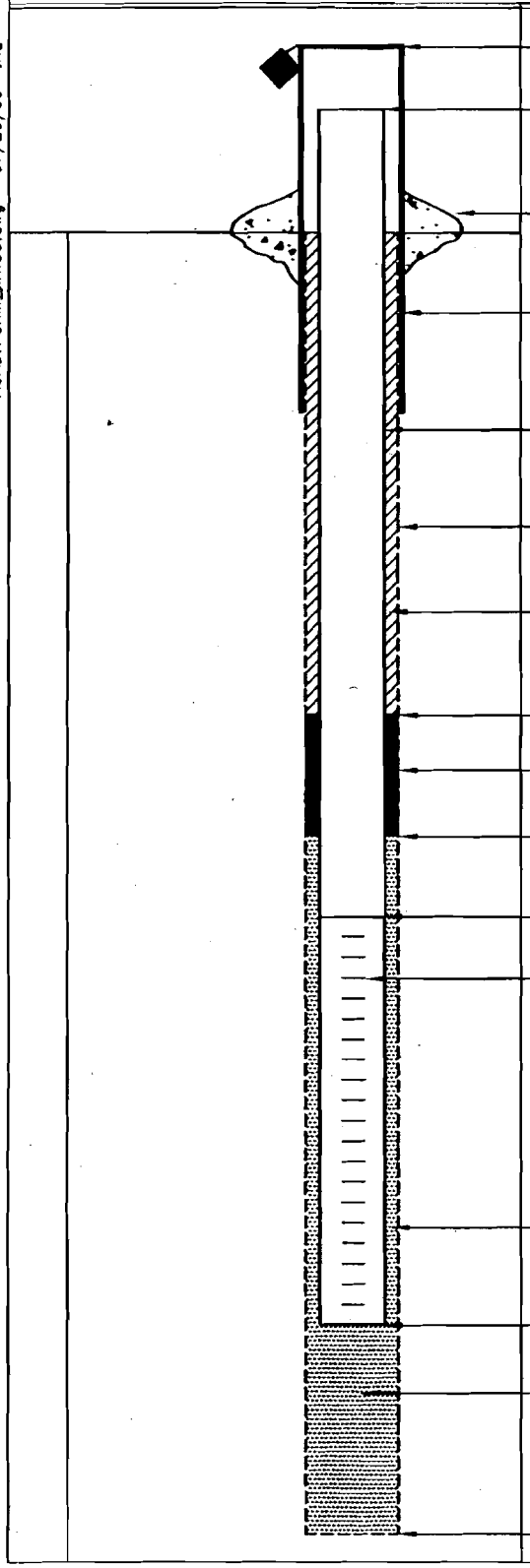
Tetra Tech NUS, Inc.

OVERBURDEN MONITORING WELL SHEET STICK-UP

PROJECT NSWC CRANE
PROJECT NO. N1245
DATE BEGUN 5-12-05
FIELD GEOLOGIST Jeff Schubert
GROUND ELEVATION 685.51

LOCATION SWMU 8
BORING 08MWT004
DATE COMPLETED 5-12-05
DATUM NAVD 88

DRILLER Bowser-Morner
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: 688.29 / 2.78

ELEVATION/HEIGHT OF TOP OF RISER PIPE: 688.14 / 2.63

TYPE OF SURFACE SEAL: 4' x 4' x 6" concrete pad with 4 barrier posts

I.D. OF SURFACE CASING: 4" x 4" square
TYPE OF SURFACE CASING: Steel with hinged top

RISER PIPE I.D.: 2 inches
TYPE OF RISER PIPE: PVC

BOREHOLE DIAMETER: 6 inches

TYPE OF BACKFILL: cement-bentonite grout

ELEVATION/DEPTH TOP OF SEAL: 682.51 / 3.0

TYPE OF SEAL: bentonite chips, medium

DEPTH TOP OF SAND PACK: 680.51 / 5.0
ELEVATION/

ELEVATION/DEPTH TOP OF SCREEN: 678.51 / 7.0

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 0.010 inches / 5 feet

I.D. OF SCREEN: 2 inches

TYPE OF SAND PACK: Silica Sand No. 10-20 U.S. Standard Sieve Size

ELEVATION/DEPTH BOTTOM OF SCREEN: 673.51 / 12

ELEVATION/DEPTH BOTTOM OF SAND PACK: 673.51 / 12
BACKFILL MATERIAL BELOW SAND: None

ELEVATION/DEPTH OF HOLE: 673.51 / 12

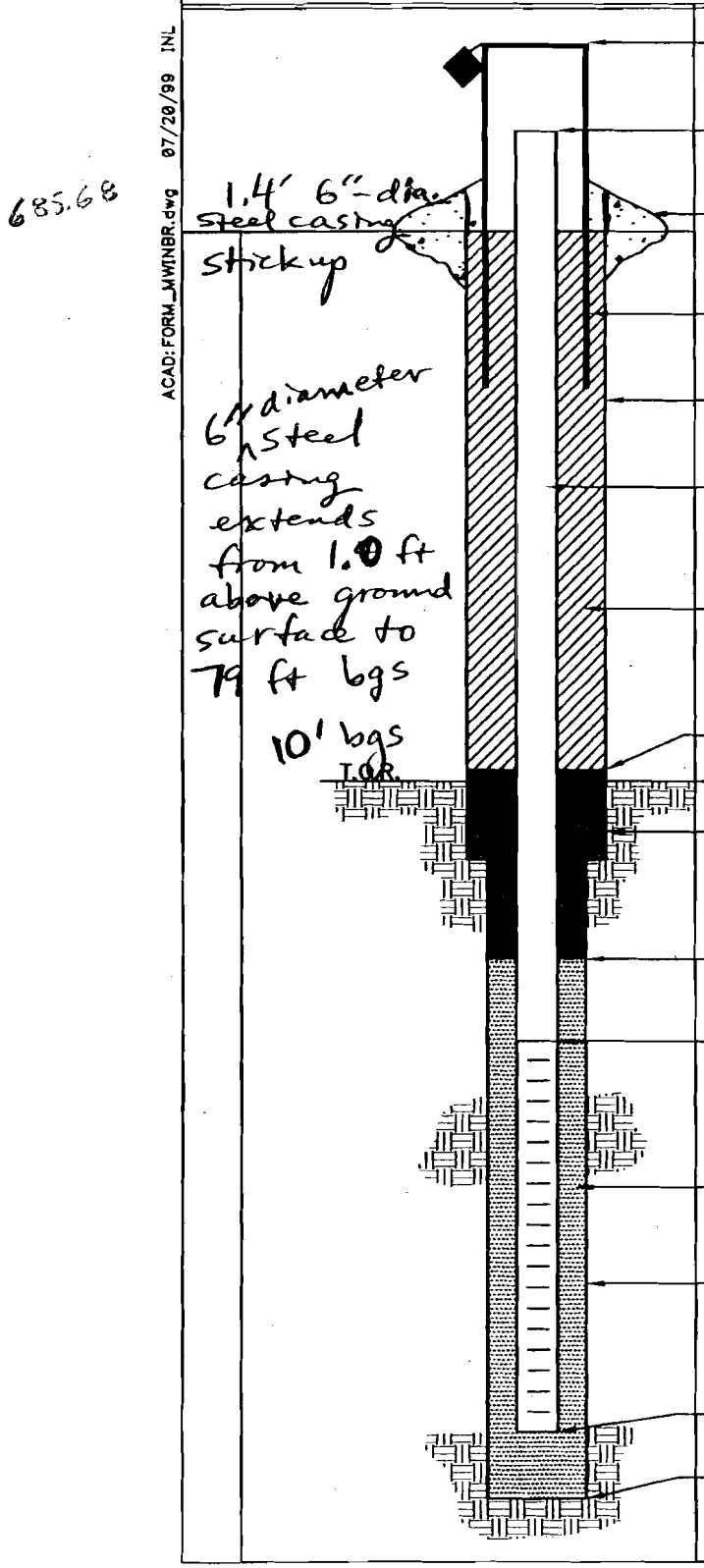
ACAD:FORM_MWSU.dwg 07/20/99 INL

WELL NO.: 08MW1013

Tetra Tech NUS, Inc.

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT NSWC CRANE	LOCATION SWMU 8	DRILLER Bowser Morner
PROJECT NO. N1245	BORING 08MWT013	DRILLING METHOD HSA/AR
DATE BEGUN 10-6-05	DATE COMPLETED 10-11-05	DEVELOPMENT METHOD
FIELD GEOLOGIST Jeff Schubert		
GROUND ELEVATION 685.68	DATUM NAVD 88	



ELEVATION/HEIGHT OF TOP OF SURFACE CASING: 688.23 / 2.55

ELEVATION/HEIGHT TOP OF RISER: 688.~~53~~ 25 / 2.~~95~~ 57

TYPE OF SURFACE SEAL: 4' x 4' x 6" cement pad with 4 barrier posts

I.D. OF SURFACE CASING: 4" x 4" square steel with hinged top

DIAMETER OF HOLE: 8" from 0 to 79 feet bgs

RISER PIPE I.D.: 2 inches

TYPE OF RISER PIPE: PVC

TYPE OF BACKFILL: cement/bentonite grout

ELEVATION/DEPTH TOP OF SEAL: 592.68 / 93

ELEVATION/DEPTH TOP OF BEDROCK: 675.68 / 10.0

TYPE OF SEAL: bentonite chips, medium

ELEVATION/DEPTH TOP OF SAND: 584.68 / 101.0

ELEVATION/DEPTH TOP OF SCREEN: 582.68 / 103.0

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 0.020 inch / 20 feet

I.D. SCREEN: 2 inches

TYPE OF SAND PACK: Silica Sand No. 10-20 U.S. Standard Sieve Size

DIAMETER OF HOLE IN BEDROCK:

CORE/REAM: 2" core 6" reaming

ELEVATION/DEPTH BOTTOM SCREEN: 562.68 / 123

ELEVATION/DEPTH BOTTOM OF SAND: 562.68 / 123

ELEVATION/DEPTH BOTTOM OF HOLE: 562.68 / 123

BACKFILL MATERIAL BELOW SAND: 0 None

ACAD: FORM_MWINBR.dwg 07/20/99 INL

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU8
Project No.: N1245, CTO 0331

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 08SD 004 0012
Sample Location: 08SW/SD 004
Sampled By: CD / TR
C.O.C. No.: 3662

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1/10/05 Time: 1145 Method: WildCo Monitor Reading (ppm):	0-12" ~~0-6"~~ TR	dark reddish-brown to tan	silt to clay, saturated

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA	NA	NA	NA	NA
Method: NA				
Monitor Readings (Range in ppm): NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Volatiles 8260B	(3) Encore sampler	Yes	
SVOCs w/ PAHs	(1) 4oz Jar	Yes/No	
SVOCs w/ PAHs & PCBs	(1) 4oz Jar	Yes/No	
Energetics - Nitroaromatics, Nitramines & Perchlorates	(1) 4oz Jar	Yes	

OBSERVATIONS / NOTES:

Waste odor

Bottom of pond

MAP:

See Figures 3-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU8
Project No.: N1245, CTO 0331

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 08SD 004 1224
Sample Location: 08SW/SD 004
Sampled By: CD / TK
C.O.C. No.: 3662

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1/10/05 Time: 1200 Method: Wildco Monitor Reading (ppm):	12" - 24" ~~06"~~ CO	dark reddish-brown to black	clay, saturated more stiff material resembling organics with distinct odor.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA	NA	NA	NA	NA
Method:				
NA				
Monitor Readings				
(Range in ppm):				
NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Volatiles 8260B	(3) Encore sampler	Yes	
SVOCs w/ PAHs	(1) 4oz Jar	Yes/No	
SVOCs w/ PAHs & PCBs	(1) 4oz Jar	Yes/No	
Energetics - Nitroaromatics, Nitramines & Perchlorates	(1) 4oz Jar	Yes	

OBSERVATIONS / NOTES:

Strong fuel oil odor

Bottom of pond

MAP:

See Figures 3-1

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): Colin Dolan

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU8
Project No.: N1245, CTO 0331

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 08SD005 0012
Sample Location: 08SW/SD 005
Sampled By: TR/CD
C.O.C. No.: 3662

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1/10/05	0-12"	dark reddish-brown to greenish grey	Clay, Saturated
Time: 1220			
Method: Wildco			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA	NA	NA	NA	NA
Method: NA				
Monitor Readings (Range in ppm): NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Volatiles 8260B	(3) Encore sampler	Yes	
SVOCs w/ PAHs	(1) 4oz Jar	Yes/No	
SVOCs w/ PAHs & PCBs	(1) 4oz Jar	Yes/No	
Energetics - Nitroaromatics, Nitramines & Perchlorates	(1) 4oz Jar	Yes	

OBSERVATIONS / NOTES:

faint waste odor

Bottom of pond

MAP:

See Figures 3-1

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU8
Project No.: N1245, CTO 0331

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 08SD 005 1224
Sample Location: 08SW/SD 005
Sampled By: CD / TK
C.O.C. No.: 3662

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 1/10/05	12"-24" ~~06"~~ CO	reddish-brown to greenish-brown	Silty clay to clay, saturated trace gravels and pebbles
Time: 1235			
Method: Wildco			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA	NA	NA	NA	NA
Method:				
NA				
Monitor Readings				
(Range in ppm):				
NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Volatiles 8260B	(3) Encore sampler	Yes	
SVOCs w/ PAHs	(1) 4oz Jar	Yes/No	
SVOCs w/ PAHs & PCBs	(1) 4oz Jar	Yes/No	
Energetics - Nitroaromatics, Nitramines & Perchlorates	(1) 4oz Jar	Yes	

OBSERVATIONS / NOTES:

no distinct odors

Bottom of pond

MAP:

See Figures 3-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU8
Project No.: N1245, CTO 0331

[] Surface Soil
[] Subsurface Soil
[X] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: 08SD01201
Sample Location: 08SW/SD012
Sampled By: CD
C.O.C. No.: 3251

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 6-5-05 Time: 1515 Method: disposable trowel Monitor Reading (ppm): —	0-6"	tannish to black	v fine sand to silt, trace pebbles, abundant organics, saturated, organic odor

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
NA	NA	NA	NA	NA
Method: NA				
Monitor Readings (Range in ppm): NA				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Semivolatiles 8270C	(2) ~~(1)~~ 4oz Jar	Yes	
Volatiles 8260B	~~(3) Encore sampler or~~ 4oz Jar (2)	Yes/No	
Total Metals + Tin (TAL)	(2) ~~(1)~~ 4oz Jar	Yes/No	

OBSERVATIONS / NOTES:

B-106 POND
PHOTOS 1650-52
AIU. supplemental sheet (POND)
SEE photos

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	08FD060505-02

Signature(s): Chris Dunlap

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU08
Project No.: N1245 CTO 0331

[] Stream
[] Spring
[X] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 08SW 00401
Sample Location: 08SW/SD 004
Sampled By: T. Rojas
C.O.C. No.: 3658

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA

Date: 1-10-05	Color (Visual)	pH (S. U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Other NA
Time: 1115								
Depth: surface								
Method: peristaltic	clear	7.19	0.310	5.92	11	~~3.74~~ CD 6.34	-76	—

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Energetics - Perchlorates	4°C	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	(1) (2) L Glass Amber	Yes
Total Metals	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals	4°C/HNO_3	(1) L HDPE	Yes
SVOCs	4°C	(2) L Glass Amber	Yes
PAHs	4°C	(2) L Glass Amber	Yes
PCBs	4°C	(2) L Glass Amber	Yes/No

OBSERVATIONS / NOTES

Filtered Sample Collected Yes [X] No [ ] 08SW 00401 -F

Sheen on water surface at various locations.

Bldg 106 Pond.

MAP

See Figure 3-1

Circle if Applicable:

MS/MSD ✓ | Duplicate ID No.: —

Signature(s): T. Rojas

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU08
Project No.: N1245 CTO 0331

[] Stream
[] Spring
[X] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 08SW 00402
Sample Location: 08SW/SD 004
Sampled By: T. Rojahn
C.O.C. No.: 3658

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA

Date: 1-10-05	Color (Visual)	pH (S. U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Other NA
Time: 1045								
Depth: 5'								
Method: peristaltic	clear	7.10	0.420	6.34	18	2.64	-103	—

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Energetics - Perchlorates	4°C	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	(1) (2) L Glass Amber	Yes
Total Metals	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals	4°C/HNO_3	(1) L HDPE	Yes
SVOCs	4°C	(2) L Glass Amber	Yes
PAHs	4°C	(2) L Glass Amber	Yes
PCBs	4°C	(2) L Glass Amber	Yes/No

OBSERVATIONS/NOTES

Filtered Sample Collected Yes[X] No[ ] 08SW 00402-F

Sheen on water surface at various locations.

Bldg 106 Pond

MAP

See Figure 3-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): T. Rojahn

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU08
Project No.: N1245 CTO 0331

[] Stream
[] Spring
[X] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 08SW 00501
Sample Location: 08SW/SD 005
Sampled By: T. Rojahn
C.O.C. No.: 3658

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA

Date: 1-10-05	Color (Visual)	pH (S. U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Other NA
Time: 1020								
Depth: Surface								
Method: Peristaltic	Clear	7.22	.300	5.85	13	6.61	-91	—

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Energetics - Perchlorates	4°C	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	(1) (2) L Glass Amber	Yes
Total Metals	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals	4°C/HNO_3	(1) L HDPE	Yes
SVOCs	4°C	(2) L Glass Amber	Yes
PAHs	4°C	(2) L Glass Amber	Yes
PCBs	4°C	(2) L Glass Amber	Yes No

OBSERVATIONS / NOTES

Filtered Sample Collected Yes [X] No [ ] 08SW00501 -F

Bldg 106 Pond

Sheen on water surface at various locations

MAP

See Figure 3-1

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Project Site Name: NSWC CRANE, SWMU08
Project No.: N1245 CTO 0331

[] Stream
[] Spring
[X] Pond
[] Lake
[] Other:
[] QA Sample Type:

Sample ID No.: 08SW 00502
Sample Location: 08SW/SD 005
Sampled By: T. Rojahn
C.O.C. No.: 3658

Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA

Date: 1-10-05	Color (Visual)	pH (S. U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Other NA
Time: 1000								
Depth: 5'								
Method: peristaltic	Clear	7.12	.348	6.15	21	8.27	120.9	—

SAMPLE COLLECTION INFORMATION

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Energetics - Perchlorates	4°C	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	(1) (2) L Glass Amber	Yes
Total Metals	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals	4°C/HNO_3	(1) L HDPE	Yes
SVOCs	4°C	(2) L Glass Amber	Yes
PAHs	4°C	(2) L Glass Amber	Yes
PCBs	4°C	(2) L Glass Amber	Yes No

OBSERVATIONS/NOTES

Filtered Sample Collected Yes [X] No [ ] 08SW 00502-F

Bldg. 106 Pond
Sheen on water surface at various locations.

MAP

See Figure 3-1

Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s):

Tony Rojahn

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[] Monitoring Well Data
[X] Other Well Type: Temporary Well
[] QA Sample Type:

Sample ID No.: 08GWTW 001
Sample Location: 08TW 001 / 58006
Sampled By: Goerdt / TR
C.O.C. No.: 3655
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	NA	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV
Date: 1-6-05								
* Time: See below 1440								
Method: peristaltic	Brn	-	7.27	.120	7.94	>1000	7.79	22.7

PURGE DATA:

Date: 1-6-05	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Method: peristaltic								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 1" pvc		SEE LOW FLOW DATA SHEET						
Total Well Depth (TD): 9.92								
Static Water Level (WL): 5.18								
One Casing Volume(gal/L): 2.9								
Start Purge (hrs): 1325								
End Purge (hrs): 1351								
Total Purge Time (min): 16								
Total Vol. Purged (gal/L): 2.25								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	* Container Requirements		Collected
Volatiles 8260B	4°C/HCl	1625	(3) 40ml Vials	Yes
Energetics - Perchlorates & pH	4°C	1505	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	1440	(1) (2) L Glass Amber	Yes
Total Metals plus Tin	4°C/HNO_3	1555	(1) L HDPE	Yes
Dissolved Metals plus Tin	4°C/HNO_3	1620	(1) L HDPE	Yes/No
SVOCs	4°C	1640	(1) (2) L Glass Amber	Yes
PAHs	4°C	1655	(1) (2) L Glass Amber	Yes
Fecal Coliform	4°C	1/07 @ 0745	(1) HDPE ~~or Whirl~~ Bag	Yes
	Sodium thiosulfate			

1/7/05

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes [X] No [ ] 08GWTW 001 -F

Converted Boring 08SB 006

Well dried out. Giving time to recharge, then pulling minimal volume. Well continually dries out.

9.92
5.18
4.74 (.163) = 0.77 gal
= 2.86 L

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08TW001
DATE: 1-6-05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (L)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments (Color, etc)
1335	5.18	-	-	-	-	-	-	-	-	Start purge
1345	7.55	1.5	150	7.27	.120	-	7.79	7.94	22.7	Brn
1351	-	2.25	150	-	-	-	-	-	-	Dry - stop purge

Water Quality Meter (SN) 99K1014 AG
Control Box type (SN) NA
Turbidity Meter (SN) 4536 3303

Pump Intake 9.85'

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 08GWT0101
Sample Location: 08MWT01
Sampled By: CD
C.O.C. No.: 3248
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	NA	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV
Date: 6-2-05								
Time: 1920								
Method: ~~peristaltic~~ CD bladder	clear	—	4.24	0.592	14.12	9.9	9.61	297.8

PURGE DATA:

Date: 6-2-05	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Method: ~~peristaltic~~ CD bladder								
Monitor Reading (ppm): —								
Well Casing Diameter & Material								
Type: 2" PVC								
Total Well Depth (TD): 57.71'								
Static Water Level (WL): 50.00'								
One Casing Volume(gal/L): 4.76								
Start Purge (hrs): 17:25								
End Purge (hrs): 19:15								
Total Purge Time (min): 120								
Total Vol. Purged (gal/L): 14.4								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Semivolatiles 8270C (1,4-dioxane only)	4°C	(2) L Glass Amber	Yes
Total Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes/No

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes[ ] No[✓] 08GWT_____-F

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08MW101
DATE: 6-2-05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (mL/Min.)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1715 ~~1625~~ (0)	50.00									start purge.
1725	50.15	1.20	120	4.34	0.549	550	6.64	15.02	240.9	cloudy
1735	50.22	2.40	120	4.16	0.541	500	7.08	14.46	253.4	cloudy
1745	50.25	3.60	120	4.07	0.541	340	7.45	14.34	260.2	cloudy
1755	50.26	4.80	120	4.06	0.542	190	7.85	14.37	266.7	slightly cloudy
1805	50.27	6.00	120	4.11	0.540	150	8.19	14.28	273.3	slightly cloudy
1815	50.28	7.20	120	4.11	0.554	110	8.52	14.21	278.6	slightly cloudy
1825	50.28	8.40	120	4.10	0.578	60	8.92	14.11	284.8	v. slightly cloudy
1835	50.29	9.60	120	4.11	0.587	45	9.11	14.14	287.5	v. slightly cloudy
1845	50.29	10.80	120	4.17	0.594	30	9.31	14.20	290.1	clear
1855	50.29	12.00	120	4.22	0.594	20	9.45	14.08	293.2	clear
1905	50.30	13.20	120	4.26	0.593	14	9.52	14.10	295.3	clear
1910	50.30	13.80	120	4.27	0.593	13	9.56	14.14	296.8	clear
1915	50.30	14.40	120	4.24	0.592	9.9	9.61	14.12	297.8	clear, end purge
1920										start sample

Water Quality Meter (SN) 04C3884 AB
Control Box type (SN) ~~Geopump 2 #947~~ MP10 -1600
Turbidity Meter (SN) 1728-1600

Pump Intake 56.5' TOC

SIGNATURE(S): Alin Dodson

Tetra Tech NUS, INC.

edit cancel print switchboard

GROUNDWATER SAMPLE LOG SHEET

Created by James Goerdt on 10/13/2005
Last Updated by James Goerdt on 01/16/2006

Last Revision: 11/01/2005

eData Read-Only

Project Site Name:	CRANE NSWC	Sample ID No	08GWT00102
TtNUS Project No.:	112GN1245	Well ID	08MWT001
Task/Contract No.	CTO 0331	Sampled By:	James Goerdt
WBS Code:	Open	Concentration:	Low Concentration
Well Type:	Monitoring Well Data	Log Completed:	Y
QA SampleType:			

WELL DATA

Date: [Set Today]	10/13/2005	Water Quality Meter	Yes
Purge Method:	Low flow - Peristaltic	Enter Serial#:	04C2866 AB
Sampling Method:		Pump Control Box	Yes
Monitor Reading (ppm)	NA	Enter Serial#:	MP10 1843
Well Casing Diameter	2"	Turbidity Meter	Yes
Well Material Type:	PVC	Enter Serial#:	4079 1103
Total Well Depth (TD)	57.71		
Static Water Level (ML)	50.14		

ADD PURGE COLLECTION

Read Only Mode - Click Edit to Add New Data

PURGE COLLECTION DATA

All Purge Collections

Date	Time	Method	Level	Rate	Color	pH	S.C.	DO	Turbidity	Temp(C)	ORP	Salinity	Other	Tot vol
10/13/2005	12:55	Low flow	**50.41**	100	Other	NA	NA	NA	NA	NA	NA	NA	NA	0
10/13/2005	13:05	Low flow	**50.51**	100	Slightly Turbid	5.66	.853	9.10	*	16.06	236.6	NA	NA	1000
10/13/2005	13:15	Low flow	**50.51**	100	Slightly Turbid	5.70	.855	9.04	278	16.31	236.2	NA	NA	1000
10/13/2005	13:25	Low flow	**50.51**	100	Slightly Turbid	5.80	.862	8.85	*	16.50	240.1	NA	NA	1000
10/13/2005	13:35	Low flow	**50.51**	100	Slightly Turbid	5.76	.870	8.80	104.4	16.79	246.6	NA	NA	1000
10/13/2005	13:45	Low flow	**50.51**	100	Slightly Turbid	5.75	.865	8.85	87.5	16.45	258.1	NA	NA	1000
10/13/2005	13:55	Low flow	**50.51**	100	Slightly Turbid	5.71	.880	8.79	64.2	16.93	263.8	NA	NA	1000
10/13/2005	14:05	Low flow	**50.51**	100	Slightly Turbid	5.70	.885	8.83	54.6	17.16	268.4	NA	NA	1000
10/13/2005	14:15	Low	**50.51**	100	Slightly	5.73	.893	8.73	43.2	17.31	268.1	NA	NA	1000

FINAL PURGE DATA

Calculate Final Purge Data

calc

One Casing Volume:	4.6L	color	Clear	salinity	NA
Total Vo. Purge (L):	L	ph	5.62	other	NA

Start Purge (hrs.)		sc	.894	orp	267.9
Endt Purge (hrs.)		temp	17.28	waterlevel	50.51
Total Purge Time (min.)	0	turbidity	8.7	flowrate	100
		do	8.78		

ANALYSIS DATA

Read Only Mode - Click Edit to Add New Data

ANALYSIS DATA

All GW Analyses

Collected	Date	Time	Description	Analysis	Preservative	#	Type	Requirements	Comments	Chain#
✓	10/13/2005	**15:10**	Volatile Organic Compounds	SW-846 8260B	4° C / HCL	**3**	Glass	40ml vials		112GN1245-10142005-9
✓	10/13/2005	**15:10**	SVOC	SW-846	4° C	**2**	Glass	1L Amber		112GN1245-

GENERAL OBSERVATIONS AND NOTES

FOOTER

MS/MSD: N	Duplicate ID No. N	Signature: James Goerdt

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[] Monitoring Well Data
[X] Other Well Type: Temporary Well
[] QA Sample Type:

Sample ID No.: 08GWTW002
Sample Location: 08TW002 / SB007
Sampled By: CD & TR
C.O.C. No.: 3652 & 3653
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	NA	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV
Date: 1/6/05								
Time: 1315								
Method: peristaltic	Lt BRN	—	7.00	1.577	9.16	980	2.29	-109.1

PURGE DATA:

	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Date: 1/6/05								
Method: Peristaltic								
Monitor Reading (ppm): —								
Well Casing Diameter & Material Type: 1" PVC		SEE LOW FLOW DATA SHEET						
Total Well Depth (TD): 19.8								
Static Water Level (WL): 10.14								
One Casing Volume(gal/L): 1.0								
Start Purge (hrs): 1047								
End Purge (hrs): 1204								
Total Purge Time (min): 77								
Total Vol. Purged (gal/L): 5.9								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Energetics - Perchlorates & pH	4°C	(1) L HDPE	Yes
Energetics - Nitroaromatics and Nitramines	4°C	1 (2) L Glass Amber	Yes
Total Metals plus Tin	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals plus Tin	4°C/HNO_3	(1) L HDPE	Yes No
SVOCs	4°C	1 (2) L Glass Amber	Yes
PAHs	4°C	1 (2) L Glass Amber	Yes
Fecal Coliform	4°C & Sodium thiosulfate	1/07@0735 (1) HDPE ~~or Whirl Bag~~	Yes

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes [X] No [ ] 08GWTW 002 F

Converted Boring 08SB 007

19.8
10.14
9.74
1.0

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	08FD010705-01 (Fecal Coliform only)

Signature(s): Chris Dalton

Terry Rogers

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08TW002
DATE: 1/6/05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (L)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments (Color, etc)
1047	10.14	0	—	—	—	—	—	—	—	Start Purge
1057	14.16	1020	100	7.12	1150	>1000	2.94	8.52	-111.9	
1107	13.10	1720	70	7.26	1233	>1000	2.98	7.66	-121.7	
1117	13.72	2320	60	7.39	1432	910	2.44	7.65	-112.4	
1127	14.20	3.020	70	7.64	1616	435	2.24	7.81	-127.7	Pump stopped [illegible]
1139	16.84	4.720	120	7.07	1670	880	0.90	8.82	-129.4	
1209	dry	5.920	120	7.00	1577	[illegible]	2.29	9.16	-109.1	dry
1215	11.98	—	—	—	—	—	—	—	—	Start Sampling

Water Quality Meter (SN) 0100956 AA
Control Box type (SN) 419
Turbidity Meter (SN) 1175-1503

Pump Intake 19.65'

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 08GWT0201
Sample Location: 08MWT02
Sampled By: CD
C.O.C. No.: 3248
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6-2-05	Color	NA	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1515	Visual		Standard	mS/cm	°C	NTU	mg/l	mV
Method: peristaltic	clear	–	3.55	0.197	14.34	1.2	7.79	248.9

PURGE DATA:

Date: 6-2-05	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Method: peristaltic								
Monitor Reading (ppm): –								
Well Casing Diameter & Material								
Type: 2" PVC								
Total Well Depth (TD): 17.31'								
Static Water Level (WL): 9.90'								
One Casing Volume(gal/L): 4.57								
Start Purge (hrs): 1110								
End Purge (hrs): 1510								
Total Purge Time (min): 240								
Total Vol. Purged (gal/L): 20.1								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Semivolatiles 8270C (1,4-dioxane only)	4°C	(2) L Glass Amber	Yes
Total Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes/No

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes[ ] No[✓] 08GWT_____-F

Circle if Applicable:

MS/MSD	Duplicate ID No.:
–	FD060205-01

Signature(s): [illegible]

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08MWT02
DATE: 6-2-05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (mL/Min.)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1110	9.90									clear, Start purge
1120	10.29	1.00	100	8.27	0.273	5.5	4.22	13.54	146.9	clear
1130	10.54	2.00	100	8.30	0.238	3.1	6.44	13.41	165.9	clear
1140	10.82	3.00	100	8.09	0.213	4.1	7.53	13.59	175.9	clear
1150	11.11	4.00	100	7.53	0.205	3.6	7.58	13.55	193.8	clear
1200	11.40	4.90	90	7.28	0.208	3.3	7.54	13.85	195.3	clear
1210	11.66	5.70	80	7.20	0.208	4.2	7.57	13.95	202.0	clear
1220	11.88	6.50	80	7.09	0.207	4.8	7.57	14.01	210.7	clear
1230	12.10	7.30	80	6.95	0.206	3.5	7.60	14.05	220.7	clear
1240	12.25	8.10	80	6.76	0.207	3.2	7.55	14.10	218.4	clear
1250	12.44	8.90	80	6.65	0.206	4.3	7.58	14.19	222.4	clear
1300	12.62	9.70	80	6.57	0.202	3.5	7.60	14.12	229.6	clear
1310	12.87	10.50	80	6.43	0.198	4.1	7.64	14.04	237.4	clear
1320	13.06	11.30	80	6.10	0.195	5.7	7.65	13.99	242.3	clear
1330	13.18	12.10	80	5.95	0.188	3.7	7.63	14.15	243.4	clear
1340	13.35	12.90	80	5.83	0.188	2.3	7.65	14.35	236.6	clear
1350	13.53	13.70	80	5.70	0.186	2.6	7.70	14.24	238.8	clear
1400	13.68	14.50	80	4.02	0.184	4.1	7.74	14.26	242.6	clear
1410	13.88	15.30	80	3.68	0.184	2.9	7.71	14.36	240.9	clear
1420	14.04	16.10	80	3.55	0.182	2.5	7.74	14.34	249.9	clear
1430	14.25	16.90	80	3.50	0.181	1.7	7.74	14.28	250.4	clear
1440	14.43	17.70	80	3.45	0.183	1.4	7.78	14.26	254.1	clear
1450	14.58	18.50	80	3.46	0.187	0.50	7.76	14.26	250.9	clear
1500	14.76	19.30	80	3.55	0.191	2.5	7.76	14.32	250.0	clear
1510	14.95	20.10	80	3.55	0.197	1.2	7.79	14.34	248.9	clear, end purge
1515										Start sample

Water Quality Meter (SN) 04C3884 AB
Control Box type (SN) Geopump 2 # 347
Turbidity Meter (SN) 1728 - 1600

Pump Intake 16.81' bTOR

SIGNATURE(S): [illegible]

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 08GWT00701
Sample Location: 08MWT07
Sampled By: T. Rojahn
C.O.C. No.: 3248
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	NA	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP mV
Date: 6-02-05								
Time: 1450								
Method: SAME	Clear	–	5.69	0.173	14.89	47.9	2.90	+195

PURGE DATA:

Date: 6-2-05	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Method: Peristaltic								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type: 2"Ø, PVC								
Total Well Depth (TD): 34.90								
Static Water Level (WL): 14.43								
One Casing Volume(gal/L) 12.6								
Start Purge (hrs): 1045								
End Purge (hrs): 1445								
Total Purge Time (min): 240								
Total Vol. Purged (gal/L) 30.2								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	MS/MSD	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	9	(3) 40ml Vials	Yes
Semivolatiles 8270C (1,4-dioxane only)	4°C	4	(2) L Glass Amber	Yes
Total Metals plus Tin (TAL)	4°C/HNO_3	3	(1) L HDPE	Yes
Dissolved Metals plus Tin (TAL)	4°C/HNO_3	3	(1) L HDPE	Yes/No

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes[X] No[ ] 08GWT 00701-F 20.47' x 0.163 = 3.3 gal or 12.6 L

Circle if Applicable:

MS/MSD YES

Duplicate ID No.: —

Signature(s): Terry Rojahn

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08MW/T07
DATE: 6-2-05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (mL/Min.)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
1045	14.43	—	—	—	—	—	—	—	—	START PURGE
1055	14.58	1300	130	6.07	0.237	+1000	4.64	14.47	+175	LT. BRN
1105	14.61	2600	130	5.94	0.223	+1000	4.10	14.41	+186	LT. BRN
1115	14.63	3900	130	5.87	0.218	+1000	3.99	14.39	+189	LT. BRN
1125	14.64	4200	130	5.81	0.214	914	3.87	14.37	+191	LT. BRN
1135	14.64	5500	130	5.79	0.208	704	3.68	14.40	+191	Cloudy
1145	14.64	6800	130	5.78	0.203	487	3.53	14.41	+191	Cloudy
1155	14.64	8100	130	5.79	0.198	298	3.41	14.33	+187	Cloudy
1205	14.64	9400	130	5.79	0.195	270	3.34	14.34	+189	CLOUDY
1215	14.64	10,700	130	5.78	0.189	215	3.23	14.37	+186	SL Cloudy
1225	14.64	12000	130	5.77	0.185	166	3.14	14.46	+186	SL Cloudy
1235	14.64	13,300	130	5.75	0.182	155	3.36	14.55	+192	SL Cloudy
1245	14.64	14,600	130	5.72	0.178	137	3.11	14.53	+191	SL Cloudy
1255	14.62	15,900	130	5.77	0.178	114	3.02	14.77	+190	SL Cloudy
1305	14.61	17,200	130	5.77	0.178	102	3.01	14.83	+190	SL Cloudy
1315	14.60	18,500	130	5.70	0.175	94.8	2.97	14.77	+195	V SL Cloudy
1325	14.60	19,800	130	5.72	0.174	88.5	2.95	14.82	+194	V SL Cloudy
1335	14.60	21100	130	5.72	0.173	83.9	2.93	14.79	+194	V SL Cloudy
1345	14.60	22,400	130	5.74	0.175	81.5	2.97	14.93	+194	V SL Cloudy
1355	14.60	23,700	130	5.75	0.176	79.0	3.00	14.87	+194	V SL Cloudy
1405	14.59	25,000	130	5.71	0.175	62.7	2.93	15.01	+196	V SL Cloudy
1415	14.59	26,300	130	5.69	0.174	59.1	2.85	15.07	+197	V SL Cloudy
1425	14.59	27,600	130	5.67	0.173	61.2	2.90	14.98	+199	V SL Cloudy
1435	14.59	28,900	130	5.67	0.172	58.0	2.85	14.97	+200	V SL Cloudy
1445	14.59	30,200	130	5.69	0.173	47.9	2.90	14.93	+198	CLEAR
1450	—	—	—	—	—	—	—	—	—	START SAMPLING

Water Quality Meter (SN) 01L0702 4F
Control Box type (SN) 328
Turbidity Meter (SN) 2843-4501

Pump Intake 27'

SIGNATURE(S): Terry Rogers

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NSWC Crane, SWMU 8
Project No.: N1245

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: 08GWT 008 01
Sample Location: 08MWT 08
Sampled By: T. Roshan
C.O.C. No.: 3250
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 6/9/05	Color	NA	pH	S.C.	Temp.	Turbidity	DO	ORP
Time: 1135	Visual		Standard	mS/cm	°C	NTU	mg/l	mV
Method: SAME	CLEAR	–	5.52	0.308	18.41	2.32	4.10	+297

PURGE DATA:

Date: 6/4/05	Volume	Time	pH	S.C.	Temp. (C)	Turbidity	DO	ORP
Method: Peristaltic								
Monitor Reading (ppm): –								
Well Casing Diameter & Material								
Type: 2" Φ PVC								
Total Well Depth (TD): 32.60								
Static Water Level (WL): 11.35								
One Casing Volume(gal/L): 13.1								
Start Purge (hrs): 0850								
End Purge (hrs): 1130								
Total Purge Time (min): 160								
Total Vol. Purged (gal/L): 14.8								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles 8260B	4°C/HCl	(3) 40ml Vials	Yes
Semivolatiles 8270C (1,4-dioxane only)	4°C	(2) L Glass Amber	Yes
Total Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes
Dissolved Metals plus Tin (TAL)	4°C/HNO_3	(1) L HDPE	Yes/No

OBSERVATIONS / NOTES:

Filtered Sample Collected Yes[ ] No[X] 08GWT ——— -F

21.25' × 0.163 = 3.5 gal or 13.1L

15' SCREEN 32.60
−15.00
17.60 Top of screen

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Ty Hogan

Tetra Tech NUS, Inc.

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NSWC CRANE
PROJECT NUMBER: 1245

WELL ID.: 08MW108
DATE: 6-04-05

Time (Hrs.)	Water Level (Ft. below TOC)	Volume (mL/Min.)	Flowrate (mL/Min.)	pH (S.U.)	Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celsius)	ORP (mV)	Comments
0850	11.35	—	—	—	—	—	—	—	—	START PURGE
0900	12.40	1400	140	5.73	0.286	22.1	4.58	16.97	+198	CLEAR
0910	12.53	2400	100	5.68	0.277	10.18	4.48	17.05	207	CLEAR
0920	12.63	3400	100	5.58	0.266	7.78	4.40	17.22	229	CLEAR
0930	12.71	4400	100	5.55	0.267	9.61	4.33	17.35	235	CLEAR
0940	12.79	5400	100	5.57	0.276	10.75	4.26	17.52	247	CLEAR
0950	12.85	6400	100	5.60	0.281	13.2	4.19	17.61	256	CLEAR
1000	12.99	7600	120	5.50	0.284	6.58	4.13	17.90	275	CLEAR
1010	12.88	8400	80	5.75	0.289	5.43	4.09	18.45	268	CLEAR
1020	12.83	9200	80	5.75	0.292	4.83	4.13	18.59	270	CLEAR
1030	12.81	10000	80	5.73	0.295	4.19	4.11	18.67	272	CLEAR
1040	12.81	10800	80	5.67	0.299	3.48	4.11	18.77	277	CLEAR
1050	12.81	11600	80	5.66	0.302	3.08	4.12	18.73	283	CLEAR
1100	12.81	12400	80	5.60	0.303	3.06	4.12	18.70	288	CLEAR
1110	12.84	13200	80	5.58	0.304	3.01	4.13	18.50	309	CLEAR
1115	12.82	13600	80	5.69	0.308	2.90	4.12	18.54	292	CLEAR
1120	12.81	14000	80	5.58	0.307	2.72	4.11	18.50	295	CLEAR
1125	12.82	14400	80	5.50	0.307	2.51	4.13	18.25	295	CLEAR
1130	12.82	14800	80	5.52	0.308	2.32	4.10	18.41	297	CLEAR
1135	—	—	—	—	—	—	—	—	—	START SAMPLING

Water Quality Meter (SN) 0120702 AF
Control Box type (SN) 328
Turbidity Meter (SN) 2843-4501

Pump Intake 25'

SIGNATURE(S): [signature]

A.2 GROUNDWATER ELEVATION MEASUREMENTS

TABLE 2-2

MONITORING WELL CONSTRUCTION INFORMATION AND WATER LEVEL MEASUREMENTS
ROUNDS 1, 2, AND 3
SWMU 8 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Well or Gauge Number	Installation Date[1]	Northing (feet) (NAD27)	Easting (feet) (NAD27)	Ground Elevation (feet amsl) (NAVD88)	Top of Riser or Reference Point Elevation (feet amsl)	Total Depth (feet bgs)[2]	Screened Interval				Water-Bearing Zone	June 2-4, 2005		December 17, 2005		March 1, 2006	
							Top (feet bgs)	Bottom (feet bgs)	Top (feet amsl)	Bottom (feet amsl)		Depth to Water (feet btor)	Water Elevation (feet amsl)	Depth to Water (feet btor)	Water Elevation (feet amsl)	Depth to Water (feet btor)	Water Elevation (feet amsl)
Permanent Monitoring Wells																	
08MWT001	5/15/05	1306612.22	3015096.71	682.84	684.62	55.0	35.00	55.00	647.84	627.84	Pmz	50.00	634.62	50.71	633.91	50.26	634.36
08MWT002	5/11/05	1306611.21	3015090.07	683.76	685.88	14.5	4.50	14.50	679.26	669.26	OB	9.90	675.98	7.24	678.64	7.28	678.60
08MWT003	5/16/05	1306595.51	3015055.82	685.56	687.66	60.0	50.00	60.00	635.56	625.56	Pmz	53.22	634.44	53.9	633.76	53.27	634.39
08MWT004	5/12/05	1306601.17	3015055.05	685.51	688.14	12.0	7.00	12.00	678.51	673.51	OB	8.15	679.99	7.19	680.95	7.9	680.24
08MWT005	5/16/05	1306438.87	3014963.79	685.85	687.82	60.0	50.00	60.00	635.85	625.85	Pmz	52.00	635.82	55.35	632.47	54.77	633.05
08MWT006	5/12/05	1306442.25	3014968.67	686.00	688.36	18.0	8.00	18.00	678.00	668.00	OB	18.21	670.15	18.81	669.55	18.49	669.87
08MWT007	5/13/05	1306840.18	3014993.62	699.73	701.31	33.0	18.00	33.00	681.73	666.73	Puz	14.43	686.88	15.79	685.52	14.79	686.52
08MWT008	5/15/05	1306739.74	3014736.53	695.60	697.59	30.0	15.00	30.00	680.60	665.60	Puz	11.35	686.24	9.2	688.39	10.17	687.42
08MWT009	5/17/05	1306185.27	3015006.81	635.49	637.61	30.0	15.00	30.00	620.49	605.49	Pmz	18.86	618.75	20.34	617.27	18.04	619.57
08MWT010	5/24/05	1306174.25	3015302.10	601.97	604.22	30.0	15.00	30.00	586.97	571.97	Plz	15.44	588.78	16.15	588.07	15.52	588.70
08MWT011	5/23/05	1306329.81	3015534.85	600.55	602.91	30.0	15.00	30.00	585.55	570.55	Plz	9.16	593.75	7.52	595.39	7.26	595.65
08MWT012	10/09/05	1306319.65	3014841.62	683.33	685.86	72	52.00	72.00	631.33	611.33	Pmz	NA	NA	53.51	632.35	52.29	633.57
08MWT013	10/11/05	1306588.38	3015057.03	685.68	688.25	123	103.00	123.00	582.68	562.68	Plz	NA	NA	101.86	586.39	101.46	586.79
08MWT014	10/10/05	1306435.64	3014956.87	685.86	688.53	115	100.00	115.00	585.86	570.86	Plz	NA	NA	108.25	580.28	99.05	589.48
Temporary Monitoring Wells																	
08TW001	12/12/04	1306658.71	3015014.79	685.93	NM	8.0	3.00	8.00	682.93	677.93	OB	NM	NM	NM	NM	Abd.	NA
08TW002	12/12/04	1306635.29	3015085.32	683.17	NM	17.0	7.00	17.00	676.17	666.17	OB	NM	NM	NM	NM	Abd.	NA
08TW003	12/12/04	1306537.90	3015024.73	687.56	NM	17.5	7.00	17.00	680.56	670.56	OB	NM	NM	NM	NM	Abd.	NA
08TW004	12/12/04	1306446.71	3014961.65	685.46	NM	19.0	9.00	19.00	676.46	666.46	OB	NM	NM	NM	NM	Abd.	NA
08TW005	5/24/05	1306642.86	3015097.96	678.49	680.54	8.0	5.00	8.00	673.49	670.49	OB	Dry	NA	NM	NM	9.7	670.84
08TW006	5/24/05	1306652.51	3015115.42	670.46	672.72	6.0	1.00	6.00	669.46	664.46	OB	NM	NM	NM	NM	5.4	667.32
08TW007	5/25/05	1306642.36	3015121.14	666.37	667.92	1.5	0.80	1.50	665.57	664.87	OB	Dry	NA	NM	NM	Dry	NA
Staff Gauges																	
08SG001	6/4/05	1305356.06	3014589.12	NM	629.38	NA	NA	NA	NA	NA	Plz	NM	NM	5.00	624.38	5.02	624.36
08SG002	6/4/05	1305718.11	3014599.61	NM	621.90	NA	NA	NA	NA	NA	Plz	NM	NM	4.58	617.32	4.54	617.36
08SG003	6/4/05	1306182.83	3015170.28	NM	609.23	NA	NA	NA	NA	NA	Plz	NM	NM	1.98	607.25	2.00	607.23
08SG004	6/4/05	1306309.48	3015518.64	NM	598.80	NA	NA	NA	NA	NA	Plz	NM	NM	2.08	596.72	Dry	-
08SG005	6/4/05	1306762.44	3014957.35	NM	688.08	NA	NA	NA	NA	NA	NA	NM	NM	Dry	-	Dry	-
08SG006	6/4/05	1306678.68	3017413.97	NM	551.64	NA	NA	NA	NA	NA	Plz	NM	NM	9.47	542.17	9.52	542.12
08SG007	6/4/05	1306625.46	3015034.80	681.22	683.62	NA	NA	NA	NA	NA	Plz	NM	NM	2.45	681.17	1.71	681.91

Notes:

1 - Represents the date when the well was completed.
2 - Total depth of boring, total depth of well may be less.
Abd. = Abandoned
amsl = Above mean sea level (NAVD88).
bgs = Below ground surface.
btor = Below top of riser/reference point.
NA = Not applicable.
NAD83 = North American Datum of 1983.
NAVD88 = 1988 North American Vertical Datum.
NM = Not measured.
OB = Overburden Soil.
Plz = Lower Pennsylvanian water-bearing zone.
Pmz = Middle Pennsylvanian water-bearing zone.
Puz = Upper Pennsylvanian water-bearing zone.

A.3 BUILDING 106 POND ANALYTICAL DATA

TABLE 3-5

DESCRIPTIVE STATISTICS FOR POND SURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criterion	ERA Criterion	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Non-Detects	Mean Concentration	Average of Positive Detects	Sample with Maximum Detection
Volatile Organics (µg/kg)									
ACETONE	6600	2500	2/4	2 J	5 J	0.993 - 1.06	2.01	3.5	08SS0080002
Semivolatile Organics (µg/kg)									
ACENAPHTHYLENE	370000	682000	1/4	22	22	3.76 - 4.01	6.96	22	08SS0090002
ANTHRACENE	650000	1480000	1/4	7 J	7 J	3.76 - 4.01	3.21	7	08SS0090002
BENZO(A)ANTHRACENE	160	5210	3/4	4 J	44	4.01	14.5	18.7	08SS0090002
BENZO(A)PYRENE	62	1520	3/4	6 J	91	4.01	27	35.3	08SS0090002
BENZO(B)FLUORANTHENE	490	59800	3/4	7 J	94	4.01	27.8	36.3	08SS0090002
BENZO(G,H,I)PERYLENE	230000	119000	2/4	16 J	140 J	3.76 - 4.01	40	78	08SS0090002
BENZO(K)FLUORANTHENE	490	148000	2/4	8	55	3.76 - 4.01	16.7	31.5	08SS0090002
CHRYSENE	160	4730	3/4	6 J	65	4.01	19.8	25.7	08SS0090002
DIBENZO(A,H)ANTHRACENE	62	18400	1/4	37 J	37 J	3.76 - 4.01	10.7	37	08SS0090002
FLUORANTHENE	230000	122000	2/4	9	29	3.91 - 4.01	10.5	19	08SS0090002
INDENO(1,2,3-CD)PYRENE	620	109000	2/4	10 J	91 J	3.76 - 4.01	26.2	50.5	08SS0090002
PHENANTHRENE	230000	45700	2/4	8	16	3.91 - 4.01	6.99	12	08SS0090002
PYRENE	230000	78500	2/4	8	42	3.91 - 4.01	13.5	25	08SS0090002
Inorganics (mg/kg)									
ALUMINUM	8.3	NA	4/4	17600 J	24500 J	---	20350	20350	08SS0060002
ARSENIC	0.29	18	4/4	5.8 J	8 J	---	6.43	6.43	08SS0060002
BARIUM	82	330	4/4	65.3 J	130 J	---	87.2	87.2	08SS0060002
BERYLLIUM	3.2	21	4/4	0.53 J	0.89 J	---	0.673	0.673	08SS0060002
CADMIUM	0.38	0.36	2/4	0.46 J	0.67 J	0.21 - 0.35	0.353	0.565	08SS0090002
CALCIUM	NA	NA	4/4	1550 J	15700 J	---	5345	5345	08SS0090002
CHROMIUM	2.1	26	4/4	17.9 J	21.4 J	---	19.4	19.4	08SS0090002
COBALT	0.17	13	4/4	6.8 J	11.5 J	---	8.2	8.2	08SS0060002
COPPER	310	5.4	4/4	11.7 J	27.9 J	---	17.2	17.2	08SS0090002
IRON	2300	NA	4/4	16700 J	24300 J	---	19400	19400	08SS0060002
LEAD	400	11	4/4	12.8 J	87.7 J	---	36.6	36.6	08SS0090002
MAGNESIUM	NA	NA	4/4	1650 J	2290 J	---	2008	2008	08SS0060002
MANGANESE	110	NA	4/4	201 J	412 J	---	271	271	08SS0060002
MERCURY	2.3	0.1	4/4	0.017 J	0.029 J	---	0.0248	0.0248	08SS0070002
NICKEL	14	13.6	4/4	12.6 J	15.4 J	---	14.5	14.5	08SS0080002
POTASSIUM	NA	NA	4/4	1190 J	1700 J	---	1440	1440	08SS0060002
SODIUM	NA	NA	1/4	81.3 J	81.3 J	48.6 - 51.3	39	81.3	08SS0080002
VANADIUM	7.8	7.8	4/4	28.6 J	36.8 J	---	32.2	32.2	08SS0060002
ZINC	680	6.62	4/4	36.9 J	68.5 J	---	47.7	47.7	08SS0090002

Data qualifiers (e.g., U, J) are defined in Appedix H.
ERA - Ecological risk assessment.
HHRA - Human health risk assessment.
mg/kg - Milligrams per kilogram.
NA - No applicable criterion.
µg/kg - Micrograms per kilogram.

TABLE 3-9

ANALYTICAL RESULTS FOR CHEMICALS DETECTED IN POND SURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Sampling Round Location Sample Number Sample Code Sample Classification Depth Range Sample Date	HHRA Criterion	ERA Criterion	01 08SB006 08SS0060002 NORMAL 3 0 - 2 12/12/2004	01 08SB007 08SS0070002 NORMAL 3 0 - 2 12/12/2004	01 08SB008 08SS0080002 NORMAL 3 0 - 2 12/12/2004	01 08SB009 08SS0090002 NORMAL 3 0 - 2 12/12/2004
Volatile Organics (µg/kg)						
ACETONE	6600	2500	1.06 UJ	2 J	5 J	0.993 UJ
Semivolatile Organics (µg/kg)						
ACENAPHTHYLENE	370000	682000	4.01 U	3.76 U	3.91 U	22
ANTHRACENE	650000	1480000	4.01 U	3.76 U	3.91 U	7 J
BENZO(A)ANTHRACENE	160	5210	4.01 U	8	4 J	44
BENZO(A)PYRENE	62	1520	4.01 U	6 J	9	91
BENZO(B)FLUORANTHENE	490	59800	4.01 U	8	7 J	94
BENZO(G,H,I)PERYLENE	230000	119000	4.01 UJ	3.76 UJ	16 J	140 J
BENZO(K)FLUORANTHENE	490	148000	4.01 U	3.76 U	8	55
CHRYSENE	160	4730	4.01 U	6 J	6 J	65
DIBENZO(A,H)ANTHRACENE	62	18400	4.01 UJ	3.76 UJ	3.91 UJ	37 J
FLUORANTHENE	230000	122000	4.01 U	9	3.91 U	29
INDENO(1,2,3-CD)PYRENE	620	109000	4.01 UJ	3.76 UJ	10 J	91 J
PHENANTHRENE	230000	45700	4.01 U	8	3.91 U	16
PYRENE	230000	78500	4.01 U	8	3.91 U	42
Inorganics (mg/kg)						
ALUMINUM	8.3	NA	24500 J	17600 J	21200 J	18100 J
ARSENIC	0.29	18	8 J	6 J	5.8 J	5.9 J
BARIUM	82	330	130 J	68.9 J	84.5 J	65.3 J
BERYLLIUM	3.2	21	0.89 J	0.53 J	0.73 J	0.54 J
CADMIUM	0.38	0.36	0.21 U	0.46 J	0.35 U	0.67 J
CALCIUM	NA	NA	1550 J	2040 J	2090 J	15700 J
CHROMIUM	2.1	26	18.8 J	17.9 J	19.6 J	21.4 J
COBALT	0.17	13	11.5 J	6.8 J	7.4 J	7.1 J
COPPER	310	5.4	11.7 J	13.8 J	15.2 J	27.9 J
IRON	2300	NA	24300 J	16700 J	18200 J	18400 J
LEAD	400	11	12.8 J	28.8 J	17 J	87.7 J
MAGNESIUM	NA	NA	2290 J	1650 J	2000 J	2090 J
MANGANESE	110	NA	412 J	228 J	201 J	243 J
MERCURY	2.3	0.1	0.017 J	0.029 J	0.025 J	0.028 J
NICKEL	14	13.6	15.1 J	12.6 J	15.4 J	14.9 J
POTASSIUM	NA	NA	1700 J	1350 J	1520 J	1190 J
SODIUM	NA	NA	49.3 U	48.6 U	81.3 J	51.3 U
VANADIUM	7.8	7.8	36.8 J	28.6 J	34.2 J	29.2 J
ZINC	680	6.62	46.8 J	38.7 J	36.9 J	68.5 J

Data qualifiers (e.g., U, J) are defined in Appendix H.
ERA - Ecological risk assessment.
HHRA - Human health risk assessment.
mg/kg - Milligrams per kilogram.
NA - No applicable criterion.
µg/kg - Micrograms per kilogram.
Black background indicates values that exceed at least one of the criteria.

TABLE 3-13

DESCRIPTIVE STATISTICS FOR POND SUBSURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criterion	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Non-Detects	Mean Concentration	Average of Positive Detects	Sample with Maximum Detection
Volatile Organics (µg/kg)								
1,1,1-TRICHLOROETHANE	97	2/9	15	23 J	0.886 - 0.974	4.58	19	08SB0071013
1,1-DICHLOROETHANE	2100	2/9	35	210 J	0.886 - 0.974	27.6	123	08SB0071013
1,2-DICHLOROETHANE	1.2	1/9	6 J	6 J	0.886 - 0.974	1.08	6	08SB0071013
2-BUTANONE	4400	1/9	100 J	100 J	0.886 - 0.974	11.5	100	08SB0071013
ACETONE	6600	9/9	2 J	140 J	---	25.1	25.1	08SB0071013
CHLOROETHANE	3000	1/9	380	380	0.886 - 0.974	42.6	380	08SB0071013
CIS-1,2-DICHLOROETHENE	20	3/9	2 J	3 J	0.886 - 0.974	1.08	2.33	08SB0071013
ETHYLBENZENE	670	1/9	2 J	2 J	0.886 - 0.974	0.633	2	08SB0071013
METHYLENE CHLORIDE	1.2	8/9	2 J	67 J	0.94	22.3	25	08SB0071013
TOLUENE	590	1/9	120 J	120 J	0.886 - 0.974	13.7	120	08SB0071013
TOTAL XYLENES	7100	1/9	13 J	13 J	0.886 - 0.974	1.86	13	08SB0071013
TRANS-1,2-DICHLOROETHENE	34	1/9	5 J	5 J	0.886 - 0.974	0.967	5	08SB0071013
TRICHLOROETHENE	2.8	4/9	1 J	36	0.886 - 0.974	4.92	10.5	08SB0060610
TRICHLOROFLUOROMETHANE	8000	5/9	1 J	4 J	0.894 - 0.947	1.54	2.4	08SB0071013
Semivolatile Organics (µg/kg)								
2-METHYLNAPHTHALENE	5600	1/9	4 J	4 J	3.61 - 4.04	2.14	4	08SB0070206
ACENAPHTHYLENE	370000	2/9	17	23	3.61 - 4	5.91	20	08SB0071013
ANTHRACENE	650000	2/9	12	15	3.61 - 4	4.47	13.5	08SB0070206
BENZO(A)ANTHRACENE	160	3/9	10	89	3.61 - 4	17.1	47.7	08SB0071013
BENZO(A)PYRENE	62	3/9	8	110	3.61 - 4	26.6	76	08SB0070206, 08SB0071013
BENZO(B)FLUORANTHENE	490	3/9	11	200	3.61 - 4	35.8	104	08SB0071013
BENZO(G,H,I)PERYLENE	230000	3/9	13 J	170 J	3.61 - 4	32.5	93.7	08SB0071013
BENZO(K)FLUORANTHENE	490	3/9	7 J	88	3.61 - 4	17.6	49	08SB0071013
BIS(2-ETHYLHEXYL)PHTHALATE	35000	1/9	180 J	180 J	73.3 - 82	54.1	180	08SB0080206
CHRYSENE	160	3/9	12	190	3.61 - 4	31.4	90.3	08SB0071013
DIBENZO(A,H)ANTHRACENE	62	2/9	29 J	60 J	3.61 - 4	11.4	44.5	08SB0071013
FLUORANTHENE	230000	3/9	11	83	3.61 - 4	18	50.3	08SB0070206
FLUORENE	41000	2/9	6 J	8 J	3.61 - 4	3.02	7	08SB0071013
INDENO(1,2,3-CD)PYRENE	620	3/9	9 J	120 J	3.61 - 4	23.8	67.7	08SB0071013
NAPHTHALENE	3100	3/9	4 J	8	3.61 - 4	3.03	5.35	08SB0070206
PHENANTHRENE	230000	3/9	37	67	3.61 - 4	19.1	53.7	08SB0071013
PYRENE	230000	3/9	11	120	3.61 - 4	25	71.3	08SB0070206
Inorganics (mg/kg)								
ALUMINUM	8.3	9/9	6140 J	23700 J	---	15763	15763	08SB0070610
ANTIMONY	0.27	1/9	13.3 J	13.3 J	0.07 - 0.49	1.57	13.3	08SB0070610
ARSENIC	0.29	9/9	3 J	8.4 J	---	5.23	5.23	08SB0071013
BARIUM	82	9/9	20.9 J	96.7 J	---	63.9	63.9	08SB0070206
BERYLLIUM	3.2	5/9	0.57 J	0.75 J	0.32 - 0.39	0.427	0.628	08SB0070206
CADMIUM	0.38	3/9	0.51 J	0.79 J	0.1 - 0.22	0.262	0.647	08SB0070610
CALCIUM	NA	9/9	94.9 J	21100 J	---	4850	4850	08SB0070610
CHROMIUM	2.1	9/9	12.2 J	43.4 J	---	19.2	19.2	08SB0071013
COBALT	0.17	9/9	1 J	11.3 J	---	5.58	5.58	08SB0070206
COPPER	310	9/9	4 J	24.4 J	---	13.1	13.1	08SB0070610

TABLE 3-13

DESCRIPTIVE STATISTICS FOR POND SUBSURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criterion	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Non-Detects	Mean Concentration	Average of Positive Detects	Sample with Maximum Detection
Inorganics (mg/kg)								
IRON	2300	9/9	4610 J	21800 J	---	15090	15090	08SB0071013
LEAD	400	9/9	6.1 J	234 J	---	42.5	42.5	08SB0070610
MAGNESIUM	NA	9/9	344 J	2370 J	---	1535	1535	08SB0070610
MANGANESE	110	9/9	18.9 J	451 J	---	159	159	08SB0080206
MERCURY	2.3	8/9	0.008 J	0.049 J	0.006	0.0246	0.0273	08SB0070206
NICKEL	14	9/9	3.2 J	17.6 J	---	11.6	11.6	08SB0070206
POTASSIUM	NA	9/9	866 J	1720 J	---	1235	1235	08SB0070206
SODIUM	NA	4/9	67.6 J	1350 J	32.6 - 58.3	194	410	08SB0071013
TIN	4700	2/9	18.7 J	3010 J	0.22 - 3	337	1514	08SB0070610
VANADIUM	7.8	9/9	13.5 J	37.1 J	---	26.2	26.2	08SB0070206
ZINC	680	9/9	9.9 J	63.2 J	---	31	31	08SB0071013

Data qualifiers (e.g., U, J) are defined in Appendix H.
HHRA - Human health risk assessment.
mg/kg - Milligrams per kilogram.
NA - No applicable criterion.
µg/kg - Micrograms per kilogram.

TABLE 3-17

ANALYTICAL RESULTS FOR CHEMICALS DETECTED IN POND SUBSURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Sampling Round		01	01	01	01	01	01	01	01	01	01
Location		08SB006	08SB006	08SB007	08SB007	08SB007	08SB008	08SB008	08SB009	08SB009	08SB009
Sample Number	HHRA	08SB0060206	08SB0060610	08SB0070206	08SB0070610	08SB0071013	08SB0080206	08SB0080610	08SB0090206	08SB0090610	08SB0090610-D
Sample Code	Criterion	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
Sample Classification		9	9	9	9	8	8	8	9	9	9
Depth Range		2 - 6	6 - 10	2 - 6	6 - 10	10 - 13	2 - 6	6 - 10	2 - 6	6 - 10	6 - 10
Sample Date		12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004
Volatile Organics (µg/kg)											
1,1,1-TRICHLOROETHANE	97	0.89 UJ	0.939 U	0.886 U	15	23 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
1,1-DICHLOROETHANE	2100	0.89 UJ	0.939 U	0.886 U	35	210 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
1,2-DICHLOROETHANE	1.2	0.89 UJ	0.939 U	0.886 U	0.94 U	6 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
2-BUTANONE	4400	0.89 UJ	0.939 U	0.886 U	0.94 U	100 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
ACETONE	6600	9 J	3 J	5 J	2 J	140 J	4 J	31 J	26 J	6 J	4 J
CHLOROETHANE	3000	0.89 UJ	0.939 U	0.886 U	0.94 U	380	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
CIS-1,2-DICHLOROETHENE	20	0.89 UJ	2 J	0.886 U	2 J	3 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
ETHYLBENZENE	670	0.89 UJ	0.939 U	0.886 U	0.94 U	2 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
METHYLENE CHLORIDE	1.2	22 J	3 J	13 J	0.94 UJ	67 J	9 J	61 J	23	2 J	36 J
TOLUENE	590	0.89 UJ	0.939 U	0.886 U	0.94 U	120 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
TOTAL XYLENES	7100	0.89 UJ	0.939 U	0.886 U	0.94 U	13 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
TRANS-1,2-DICHLOROETHENE	34	0.89 UJ	0.939 U	0.886 U	0.94 U	5 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
TRICHLOROETHENE	2.8	1 J	36	0.886 U	2 J	3 J	0.947 U	0.974 U	0.931 UJ	0.894 U	0.934 U
TRICHLOROFLUOROMETHANE	8000	2 J	0.939 U	1 J	0.94 U	4 J	0.947 U	3	2 J	0.894 U	2 J
Semivolatile Organics (µg/kg)											
2-METHYLNAPHTHALENE	3100	3.77 U	3.78 U	4 J	3.88 U	4.04 U	4 U	3.61 U	3.66 U	3.69 U	3.71 U
ACENAPHTHYLENE	370000	3.77 U	3.78 U	17	3.88 U	23	4 U	3.61 U	3.66 U	3.69 U	3.71 U
ANTHRACENE	650000	3.77 U	3.78 U	15	3.88 U	12	4 U	3.61 U	3.66 U	3.69 U	3.71 U
BENZO(A)ANTHRACENE	160	3.77 U	3.78 U	44	10	89	4 U	3.61 U	3.66 U	3.69 U	3.71 U
BENZO(A)PYRENE	62	3.77 U	3.78 U	110	8	110	4 U	3.61 U	3.66 U	3.69 U	3.71 U
BENZO(B)FLUORANTHENE	490	3.77 U	3.78 U	100	11	200	4 U	3.61 U	3.66 U	3.69 U	3.71 U
BENZO(G,H,I)PERYLENE	230000	3.77 UJ	3.78 UJ	98 J	13 J	170 J	4 UJ	3.61 UJ	3.66 UJ	3.69 UJ	3.71 UJ
BENZO(K)FLUORANTHENE	490	3.77 U	3.78 U	52	7 J	88	4 U	3.61 U	3.66 U	3.69 U	3.71 U
BIS(2-ETHYLHEXYL)PHTHALATE	35000	76.5 U	76.7 U	78.1 U	78.7 U	82 UJ	180 J	73.3 U	74.3 U	74.9 U	75.4 UJ
CHRYSENE	160	3.77 U	3.78 U	69	12	190	4 U	3.61 U	3.66 U	3.69 U	3.71 U
DIBENZO(A,H)ANTHRACENE	62	3.77 UJ	3.78 UJ	29 J	3.88 UJ	60 J	4 UJ	3.61 UJ	3.66 UJ	3.69 UJ	3.71 UJ
FLUORANTHENE	230000	3.77 U	3.78 U	83	11	57	4 U	3.61 U	3.66 U	3.69 U	3.71 U
FLUORENE	41000	3.77 U	3.78 U	6 J	3.88 U	8 J	4 U	3.61 U	3.66 U	3.69 U	3.71 U
INDENO(1,2,3-CD)PYRENE	620	3.77 UJ	3.78 UJ	74 J	9 J	120 J	4 UJ	3.61 UJ	3.66 UJ	3.69 UJ	3.71 UJ
NAPHTHALENE	3100	3.77 U	3.78 U	8	4 J	4.04 J	4 U	3.61 U	3.66 U	3.69 U	3.71 U
PHENANTHRENE	230000	3.77 U	3.78 U	57	37	67	4 U	3.61 U	3.66 U	3.69 U	3.71 U
PYRENE	230000	3.77 U	3.78 U	120	11	83	4 U	3.61 U	3.66 U	3.69 U	3.71 U
Inorganics (mg/kg)											
ALUMINUM	8.3	10100 J	8530 J	20900 J	23700 J	21800 J	22600 J	15300 J	12800 J	6140 J	7830 J
ANTIMONY	0.27	0.12 U	0.08 U	0.34 U	13.3 J	0.49 U	0.22 U	0.07 U	0.14 U	0.14 U	0.12 U
ARSENIC	0.29	4.1 J	3 J	7.5 J	4.5 J	8.4 J	6 J	4.1 J	4.8 J	4.7 J	3.9 J
BARIUM	82	42.9 J	29.2 J	96.7 J	94.3 J	90.2 J	88.2 J	72.1 J	40.3 J	20.9 J	31 J
BERYLLIUM	3.2	0.39 U	0.34 U	0.75 J	0.64 J	0.61 J	0.57 J	0.57 J	0.32 U	0.36 U	0.38 U

TABLE 3-17

ANALYTICAL RESULTS FOR CHEMICALS DETECTED IN POND SUBSURFACE SOIL SAMPLES
SWMU 08 - BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

Sampling Round		01	01	01	01	01	01	01	01	01	01
Location		08SB006	08SB006	08SB007	08SB007	08SB007	08SB008	08SB008	08SB009	08SB009	08SB009
Sample Number	HHRA	08SB0060206	08SB0060610	08SB0070206	08SB0070610	08SB0071013	08SB0080206	08SB0080610	08SB0090206	08SB0090610	08SB0090610-D
Sample Code	Criterion	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
Sample Classification		9	9	9	9	8	8	8	9	9	9
Depth Range		2 - 6	6 - 10	2 - 6	6 - 10	10 - 13	2 - 6	6 - 10	2 - 6	6 - 10	6 - 10
Sample Date		12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004	12/12/2004
Inorganics (mg/kg) (Continued)											
CADMIUM	0.38	0.1 U	0.12 U	0.51 J	0.79 J	0.64 J	0.22 U	0.15 U	0.13 U	0.11 U	0.11 U
CALCIUM	NA	415 J	94.9 J	2400 J	21100 J	16900 J	1330 J	207 J	986 J	218 J	449 J
CHROMIUM	2.1	12.2 J	13.9 J	20.5 J	19.2 J	43.4 J	19.7 J	17 J	14.4 J	12.3 J	13.6 J
COBALT	0.17	2.3 J	1.5 J	11.3 J	7.6 J	8 J	9 J	6.8 J	2.7 J	1 J	1.4 J
COPPER	310	4 J	5.4 J	17.1 J	24.4 J	20.6 J	14.7 J	15.2 J	10.2 J	6.3 J	5 J
IRON	2300	10500 J	4610 J	20200 J	18800 J	21800 J	20000 J	13700 J	15100 J	11100 J	12400 J
LEAD	400	6.7 J	11.7 J	29.6 J	234 J	67.2 J	12 J	7.6 J	7.2 J	6.1 J	6.8 J
MAGNESIUM	NA	769 J	489 J	2220 J	2370 J	2160 J	2300 J	1850 J	1310 J	344 J	439 J
MANGANESE	110	27.4 J	18.9 J	341 J	171 J	258 J	451 J	68.9 J	75.6 J	23.4 J	34.2 J
MERCURY	2.3	0.024 J	0.008 J	0.049 J	0.021 J	0.026 J	0.02 J	0.006 U	0.041 J	0.029 J	0.014 J
NICKEL	14	5.4 J	4.1 J	17.6 J	17 J	17.4 J	13.6 J	16.4 J	9.5 J	3.2 J	4.3 J
POTASSIUM	NA	1030 J	1230 J	1720 J	1130 J	1570 J	1520 J	1130 J	918 J	866 J	1020 J
SODIUM	NA	35.7 U	42.5 U	58.3 U	122 J	1350 J	67.6 J	100 J	49.9 U	32.6 U	34.5 U
TIN	4700	0.22 U	0.22 U	3 U	3010 J	18.7 J	0.43 U	0.32 U	0.26 U	0.26 U	1.5 U
VANADIUM	7.8	15.9 J	20.4 J	37.1 J	30.8 J	36 J	35.7 J	24.5 J	21.5 J	13.5 J	12.1 J
ZINC	680	16.8 J	9.9 J	50.4 J	43.3 J	63.2 J	32.3 J	28.4 J	19.9 J	14.5 J	15.1 J

Data qualifiers (e.g., U, J) are defined in Appendix H.
HHRA - Human health risk assessment.
mg/kg - Milligrams per kilogram.
NA - No applicable criterion.
µg/kg - Micrograms per kilogram.
Black background indicates values that exceed at least one of the criteria.
Blank cells indicate no data are available.

TABLE 3-21

DESCRIPTIVE STATISTICS FOR POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criteria	Carcinogen?	ERA Criteria	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Nondetects	Mean Concentration	Average of Positive Detects	Sample of Maximum Detect
Volatile Organics (µg/L)										
1,1,1-TRICHLOROETHANE	200	N	76	5/6	13	200	0.3	51	61.2	08SW00402
1,1-DICHLOROETHANE	81	N	47	6/6	1.9	99	---	33.7	33.7	08SW00402
1,1-DICHLOROETHENE	7	N	65	3/6	1.4	7.7	0.3	1.84	3.53	08SW00402
2-BUTANONE	700	N	2200	2/6	1.6 J	7200	0.5	1200	3601	08SW01201
2-HEXANONE	NA		99	1/6	0.9 J	0.9 J	0.5	0.358	0.9	08SW01201
4-METHYL-2-PENTANONE	200	N	170	1/6	530	530	0.5	88.5	530	08SW01201
ACETONE	550	N	1700	5/6	1.5 J	440 J	0.5	77.6	93.1	08SW01201
CHLOROETHANE	4.6	C	NA	6/6	1.6	89	---	34.9	34.9	08SW00402
CIS-1,2-DICHLOROETHENE	6.1	N	970	6/6	6.3	140	---	51.7	51.7	08SW00402
ETHYLBENZENE	130	N	14	1/6	11	11	0.3	1.96	11	08SW01201
TOLUENE	72	N	253	2/6	3	110	0.3	18.9	56.5	08SW01201
TOTAL XYLENES	21	N	27	1/6	57	57	0.3	9.63	57	08SW01201
TRANS-1,2-DICHLOROETHENE	12	N	970	2/6	0.5 J	4.4	0.3	0.917	2.45	08SW00402
TRICHLOROETHENE	1.4	C	47	5/6	4.7	590	0.3	103	124	08SW00402
VINYL CHLORIDE	0.02	C	930	6/6	0.7 J	40	---	12.7	12.7	08SW00402
Semivolatile Organics (µg/L)										
1,4-DIOXANE	6.1	C	22000	4/5	4 J	5	1	3.90	4.75	08SW00401, 08SW00402, 08SW00502
2-METHYLNAPHTHALENE	0.62	N	330	1/4	0.9	0.9	0.05 - 0.052	0.244	0.9	08SW00402
2-METHYLPHENOL	180	N	67	1/2	4 J	4 J	0.98	2.25	4	08SW01201
3&4-METHYLPHENOL	18		62	1/2	7	7	0.98	3.75	7	08SW01201
ACENAPHTHENE	37	N	38	1/4	0.37 J	0.37 J	0.05 - 0.052	0.112	0.37	08SW00402
ACETOPHENONE	61	N	NA	1/5	7	7	0.971 - 1.08	1.8	7	08SW01201
BENZYL ALCOHOL	1100	N	8.6	1/5	3 J	3 J	0.971 - 1.08	1	3	08SW01201
BIS(2-ETHYLHEXYL)PHTHALATE	4.8	C	0.3	2/5	1 J	2 J	0.971 - 1.08	0.905	1.5	08SW01201
NAPHTHALENE	0.62	N	13	1/4	0.34 J	0.34 J	0.05 - 0.052	0.104	0.34	08SW00402
PHENANTHRENE	18	N	3.6	1/4	1.42 J	1.42 J	0.05 - 0.052	0.374	1.42	08SW00402
PHENOL	1100	N	180	1/2	7	7	0.98	3.75	7	08SW01201
Total Metals (µg/L)										
ALUMINUM	50	N	87	5/5	328 J	6780 J	---	1665	1665	08SW01201
ANTIMONY	1.5	N	80	1/5	3.1 J	3.1 J	0.29 - 0.46	0.767	3.1	08SW01201
ARSENIC	0.045	C	148	1/5	20.6 J	20.6 J	0.59 - 0.68	4.37	20.6	08SW01201
BARIUM	260	N	220	5/5	94.8 J	450 J	---	174	174	08SW01201
BERYLLIUM	4	N	3.6	1/5	0.32 J	0.32 J	0.02	0.072	0.32	08SW01201
CADMIUM	1.8	N	0.15	2/5	2.4 J	9.5	0.15 - 0.37	2.45	5.95	08SW01201
CALCIUM	NA		NA	5/5	61600 J	240000 J	---	99640	99640	08SW01201
CHROMIUM	11	N	42	5/5	1.1 J	73.4	---	20.5	20.5	08SW01201
COBALT	73	N	24	5/5	0.48 J	24.8	---	5.5	5.5	08SW01201
COPPER	150	N	1.58	5/5	2 J	184 J	---	39.7	39.7	08SW01201
IRON	300	N	1000	5/5	938 J	31100	---	7494	7494	08SW01201
LEAD	15		1.17	5/5	1.2 J	171	---	40.4	40.4	08SW01201
MAGNESIUM	NA		NA	5/5	8490 J	12400	---	9638	9638	08SW01201
MANGANESE	50	N	NA	5/5	158 J	4310	---	1007	1007	08SW01201
NICKEL	73	N	28.9	5/5	1.3	22.9	---	6.02	6.02	08SW01201
POTASSIUM	NA		NA	5/5	3470 J	6900	---	4316	4316	08SW01201
SELENIUM	18	N	5	1/5	0.63 J	0.63 J	0.19 - 0.22	0.207	0.63	08SW01201

TABLE 3-21

DESCRIPTIVE STATISTICS FOR POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criteria	Carcinogen?	ERA Criteria	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Nondetects	Mean Concentration	Average of Positive Detects	Sample of Maximum Detect
SODIUM	NA		NA	5/5	25200 J	52900 J	---	32520	32520	08SW01201
TIN	2200	N	180	1/1	31.2 J	31.2 J	---	31.2	31.2	08SW01201
VANADIUM	3.6	N	12	1/5	12.8	12.8	1.14	3.02	12.8	08SW01201
ZINC	1100	N	65.7	2/5	93 J	1700 J	12.2 - 16.6	363	897	08SW01201
Dissolved Metals (µg/L)										
ALUMINUM, FILTERED	50	N	87	1/5	113 J	113 J	8.35 - 50.8	30.2	113	08SW00401-F
ARSENIC, FILTERED	0.045	C	148	1/5	5.8 J	5.8 J	0.3 - 0.48	1.32	5.8	08SW01201-F
BARIUM, FILTERED	260	N	220	5/5	81.1 J	234 J	---	123	123	08SW01201-F
CADMIUM, FILTERED	1.8	N	0.15	4/5	0.15 J	0.61 J	0.05	0.283	0.348	08SW00402-F
CALCIUM, FILTERED	NA		NA	5/5	57300	106000 J	---	69440	69440	08SW01201-F
CHROMIUM, FILTERED	11	N	42	2/5	0.73 J	4.5 J	0.54 - 1.7	1.35	2.62	08SW00402-F
COBALT, FILTERED	73	N	24	5/5	0.41 J	8.3	---	2.07	2.07	08SW01201-F
COPPER, FILTERED	150	N	1.58	4/5	1.1 J	2.3 J	1.4	1.5	1.7	08SW00402-F
IRON, FILTERED	300	N	1000	5/5	452 J	7000	---	1960	1960	08SW01201-F
LEAD, FILTERED	15		1.17	5/5	0.14 J	5.5 J	---	1.55	1.55	08SW00402-F
MAGNESIUM, FILTERED	NA		NA	5/5	8040 J	11600	---	9244	9244	08SW01201-F
MANGANESE, FILTERED	50	N	NA	5/5	88.2 J	2960	---	700	700	08SW01201-F
NICKEL, FILTERED	73	N	28.9	5/5	4.7 J	6	---	5.18	5.18	08SW01201-F
POTASSIUM, FILTERED	NA		NA	5/5	2870 J	4730	---	3474	3474	08SW01201-F
SELENIUM, FILTERED	18	N	5	1/5	0.15 J	0.15 J	0.29 - 0.41	0.168	0.15	08SW01201-F
SODIUM, FILTERED	NA		NA	5/5	19300 J	57400 J	---	30140	30140	08SW01201-F
THALLIUM, FILTERED	0.24	N	10	4/5	0.1 J	0.11 J	0.19	0.105	0.108	08SW00402-F, , 08SW00502-F
TIN, FILTERED	2200	N	180	1/1	1.1 J	1.1 J	---	1.1	1.1	08SW01201-F
ZINC, FILTERED	1100	N	65.7	4/5	4.2 J	22 J	3.5	8.91	10.7	08SW00402-F
Field Parameters (mg/L)										
DISSOLVED OXYGEN	NA		NA	1/1	3.88	3.88	---	3.88	3.88	08SW00403
DISSOLVED OXYGEN - METER	NA		NA	4/4	2.64	8.27	---	5.97	5.97	08SW00502
OXIDATION REDUCTION POTENTIAL (MV)	NA		#N/A	5/5	-103	145	---	-0.82	-0.82	08SW00403
PH (S.U.)	NA		#N/A	5/5	7.1	7.42	---	7.21	7.21	08SW00403
SPECIFIC CONDUCTANCE (MS/CM)	NA		#N/A	5/5	0.294	0.42	---	0.333	0.333	08SW00402
TEMPERATURE (C)	NA		#N/A	5/5	5.85	11.4	---	7.13	7.13	08SW00403
TURBIDITY (NTU)	NA		#N/A	5/5	6.9	21	---	14	14	08SW00502

µg/L - micrograms per liter.
C - Celsius.
Data qualifiers (e.g., U, J) are defined in section 3 of the text.
ERA - ecological risk assessment.
HHRA - human health risk assessment.
mg/L - milligrams per liter.
MS/CM - milliSiemens per centimeter.
MV - millivolts.
NA - No applicable criteria.
NTU - nephelometric turbidity units.
S.U. - standard units.

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD004 08SW00401 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00401-F NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00402 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00402-F NORMAL 1/10/2005	DOWNGRAD 03 08SW/SD004 08SW00403 ORIG 10/25/2005	DOWNGRAD 03 08SW/SD004 08SW00403-D DUP 10/25/2005	DOWNGRAD 01 08SW/SD005 08SW00501 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD005 08SW00501-F NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD005 08SW00502 NORMAL 1/10/2005
Volatile Organics (µg/L)											
1,1,1-TRICHLOROETHANE	200	76	21		200		13	12	33		39
1,1-DICHLOROETHANE	81	47	18		99		12	12	30		41
1,1-DICHLOROETHENE	7	65	0.3 U		7.7		0.3 U	0.3 U	0.3 U		1.5
2-BUTANONE	700	2200	0.5 U		0.5 U		1.6 J	1.4 J	0.5 U		0.5 U
2-HEXANONE	NA	99	0.5 U		0.5 U		0.5 U	0.5 U	0.5 U		0.5 U
4-METHYL-2-PENTANONE	200	170	0.5 U		0.5 U		0.5 U	0.5 U	0.5 U		0.5 U
ACETONE	550	1700	0.5 UJ		15 J		7 J	7.3 J	1.5 J		1.8 J
CHLOROETHANE	4.6	NA	9.9		89		43	47	22		44
CIS-1,2-DICHLOROETHENE	6.1	970	12		140		6.3	6.2	22		30
ETHYLBENZENE	130	14	0.3 U		0.3 U		0.3 U	0.3 U	0.3 U		0.3 U
TOLUENE	72	253	0.3 U		3		0.3 U	0.3 U	0.3 U		0.3 U
TOTAL XYLENES	21	27	0.3 U		0.3 U		0.3 U	0.3 U	0.3 U		0.3 U
TRANS-1,2-DICHLOROETHENE	12	970	0.3 U		4.4		0.3 U	0.3 U	0.3 U		0.3 U
TRICHLOROETHENE	1.4	47	7.3		590		0.3 U	0.3 U	8.8		9.2
VINYL CHLORIDE	0.02	930	0.7 J		40		1.4	1.4 J	3.4		8.8
Semivolatile Organics (µg/L)											
1,4-DIOXANE	6.1	22000	5		5				4 J		5 J
2-METHYLNAPHTHALENE	0.62	330	0.05 U		0.9				0.052 U		0.051 U
2-METHYLPHENOL	180	67	0.98 U		1 UR				0.971 UR		1.08 UR
3&4-METHYLPHENOL	18	62	0.98 U		1 UR				0.971 UR		1.08 UR
ACENAPHTHENE	37	38	0.05 U		0.37 J				0.052 U		0.051 U
ACETOPHENONE	61	NA	0.98 UJ		1 U				0.971 U		1.08 U
BENZYL ALCOHOL	1100	8.6	0.98 U		1 U				0.971 U		1.08 U
BIS(2-ETHYLHEXYL)PHTHALATE	4.8	0.3	1 J		1 U				0.971 U		1.08 U
NAPHTHALENE	0.62	13	0.05 U		0.34 J				0.052 U		0.051 U
PHENANTHRENE	18	3.6	0.05 U		1.42 J				0.052 U		0.051 U
PHENOL	1100	180	0.98 U		1 UR				0.971 UR		1.08 UR

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD004 08SW00401 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00401-F NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00402 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD004 08SW00402-F NORMAL 1/10/2005	DOWNGRAD 03 08SW/SD004 08SW00403 ORIG 10/25/2005	DOWNGRAD 03 08SW/SD004 08SW00403-D DUP 10/25/2005	DOWNGRAD 01 08SW/SD005 08SW00501 NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD005 08SW00501-F NORMAL 1/10/2005	DOWNGRAD 01 08SW/SD005 08SW00502 NORMAL 1/10/2005
Total Metals (ug/L)											
ALUMINUM	50	87	402 J		472 J				344 J		328 J
ANTIMONY	1.5	80	0.31 U		0.46 U				0.41 U		0.29 U
ARSENIC	0.045	148	0.59 U		0.68 U				0.6 U		0.65 U
BARIUM	260	220	94.8 J		115 J				97.4 J		113 J
BERYLLIUM	4	3.6	0.02 U		0.02 U				0.02 U		0.02 U
CADMIUM	1.8	0.15	0.17 U		2.4 J				0.15 U		0.37 U
CALCIUM	NA	NA	61600 J		68600 J				61600 J		66400 J
CHROMIUM	11	42	1.1 J		24.6 J				1.1 J		2.5 J
COBALT	73	24	0.5 J		1.2				0.48 J		0.52 J
COPPER	150	1.58	2 J		8.1 J				2.1 J		2.1 J
IRON	300	1000	938 J		2520 J				1270 J		1640 J
LEAD	15	1.17	1.2 J		25.9 J				1.2 J		2.9 J
MAGNESIUM	NA	NA	8540 J		9540 J				8490 J		9220 J
MANGANESE	50	NA	160 J		218 J				158 J		190 J
NICKEL	73	28.9	1.3		3.2				1.3		1.4
POTASSIUM	NA	NA	3490 J		3890 J				3470 J		3830 J
SELENIUM	18	5	0.21 U		0.19 U				0.19 U		0.22 U
SODIUM	NA	NA	25200 J		30400 J				25200 J		28900 J
TIN	2200	180									
VANADIUM	3.6	12	1.14 U		1.14 U				1.14 U		1.14 U
ZINC	1100	65.7	12.3 U		93 J				12.2 U		16.6 U
Dissolved Metals (µg/L)											
ALUMINUM, FILTERED	50	87		113 J		50.8 U				8.6 U	
ARSENIC, FILTERED	0.045	148		0.48 U		0.45 U				0.3 U	
BARIUM, FILTERED	260	220		91.4 J		95.6 J				81.1 J	
CADMIUM, FILTERED	1.8	0.15		0.3 J		0.61 J				0.33 J	
CALCIUM, FILTERED	NA	NA		60200		64400				57300	
CHROMIUM, FILTERED	11	42		1.7 U		4.5 J				0.54 U	
COBALT, FILTERED	73	24		0.54 J		0.65 J				0.41 J	
COPPER, FILTERED	150	1.58		2 J		2.3 J				1.4 J	
IRON, FILTERED	300	1000		910 J		922 J				452 J	
LEAD, FILTERED	15	1.17		1.7 J		5.5 J				0.213 J	
MAGNESIUM, FILTERED	NA	NA		8410 J		9190 J				8040 J	
MANGANESE, FILTERED	50	NA		135 J		164 J				88.2 J	
NICKEL, FILTERED	73	28.9		4.7 J		5.4 J				4.7 J	
POTASSIUM, FILTERED	NA	NA		3070 J		3430 J				2870 J	
SELENIUM, FILTERED	18	5		0.41 U		0.35 U				0.33 U	
SODIUM, FILTERED	NA	NA		23400 J		27000 J				19300 J	
THALLIUM, FILTERED	0.24	10		0.1 J		0.11 J				0.11 J	
TIN, FILTERED	2200	180									
ZINC, FILTERED	1100	65.7		10.5 J		22 J				4.2 J	

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization	HHRA Criteria	ERA Criteria	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD
Sampling Round			01	01	01	01	03	03	01	01	01
Location			08SW/SD004	08SW/SD004	08SW/SD004	08SW/SD004	08SW/SD004	08SW/SD004	08SW/SD005	08SW/SD005	08SW/SD005
Sample Number			08SW00401	08SW00401-F	08SW00402	08SW00402-F	08SW00403	08SW00403-D	08SW00501	08SW00501-F	08SW00502
Sample Code			NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP	NORMAL	NORMAL	NORMAL
Sample Date			1/10/2005	1/10/2005	1/10/2005	1/10/2005	10/25/2005	10/25/2005	1/10/2005	1/10/2005	1/10/2005
Field Parameters (mg/L)											
DISSOLVED OXYGEN	NA	NA					3.88				
DISSOLVED OXYGEN - METER	NA	NA	6.34		2.64				6.61		8.27
OXIDATION REDUCTION POTENTIAL (MV)	NA	NA	-76		-103		145		-91		120.9
PH (S.U.)	NA	NA	7.19		7.1		7.42		7.22		7.12
SPECIFIC CONDUCTANCE (MS/CM)	NA	NA	0.31		0.42		0.294		0.3		0.34
TEMPERATURE (C)	NA	NA	5.92		6.34		11.4		5.85		6.15
TURBIDITY (NTU)	NA	NA	11		18		6.9		13		21

µg/L - micrograms per liter.
C - Celsius
Data qualifiers (e.g., U, J) are defined in section 3 of the text.
DOWNGRAD - Location is a downgradient location
mg/L - milligrams per liter
MS/CM - milliSiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units

Shading Exceeds the minimum of the HHRA or ERA criterion

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD005 08SW00502-F NORMAL 1/10/2005	DOWNGRAD 02 08SW/SD012 08SW01201 ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-D DUP 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F-D DUP 6/5/2005
Volatile Organics (µg/L)							
1,1,1-TRICHLOROETHANE	200	76		0.3 U	0.3 U		
1,1-DICHLOROETHANE	81	47		1.9	1.9		
1,1-DICHLOROETHENE	7	65		1.4	1.5		
2-BUTANONE	700	2200		7200	6600		
2-HEXANONE	NA	99		0.9 J	1.1 J		
4-METHYL-2-PENTANONE	200	170		530	510		
ACETONE	550	1700		440 J	410 J		
CHLOROETHANE	4.6	NA		1.6	1.6		
CIS-1,2-DICHLOROETHENE	6.1	970		100	100		
ETHYLBENZENE	130	14		11	11		
TOLUENE	72	253		110	110		
TOTAL XYLENES	21	27		57	56		
TRANS-1,2-DICHLOROETHENE	12	970		0.5 J	0.3 U		
TRICHLOROETHENE	1.4	47		4.7	4.5		
VINYL CHLORIDE	0.02	930		22	23		
Semivolatile Organics (µg/L)							
1,4-DIOXANE	6.1	22000		1 U	1.03 U		
2-METHYLNAPHTHALENE	0.62	330					
2-METHYLPHENOL	180	67		4 J	3 J		
3&4-METHYLPHENOL	18	62		7	6		
ACENAPHTHENE	37	38					
ACETOPHENONE	61	NA		7	5 J		
BENZYL ALCOHOL	1100	8.6		3 J	3 J		
BIS(2-ETHYLHEXYL)PHTHALATE	4.8	0.3		2 J	1.03 J		
NAPHTHALENE	0.62	13					
PHENANTHRENE	18	3.6					
PHENOL	1100	180		7	6		

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD005 08SW00502-F NORMAL 1/10/2005	DOWNGRAD 02 08SW/SD012 08SW01201 ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-D DUP 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F-D DUP 6/5/2005
Total Metals (ug/L)							
ALUMINUM	50	87		6780 J	8120 J		
ANTIMONY	1.5	80		3.1 J	2.9 J		
ARSENIC	0.045	148		20.6 J	15.8 J		
BARIUM	260	220		450 J	375 J		
BERYLLIUM	4	3.6		0.32 J	0.37 J		
CADMIUM	1.8	0.15		9.5	9.3		
CALCIUM	NA	NA		240000 J	129000 J		
CHROMIUM	11	42		73.4	76.4		
COBALT	73	24		24.8	22.5		
COPPER	150	1.58		184 J	154 J		
IRON	300	1000		31100	25800		
LEAD	15	1.17		171	185		
MAGNESIUM	NA	NA		12400	12000		
MANGANESE	50	NA		4310	3190		
NICKEL	73	28.9		22.9	22.5		
POTASSIUM	NA	NA		6900	5560		
SELENIUM	18	5		0.63 J	0.48 J		
SODIUM	NA	NA		52900 J	50600 J		
TIN	2200	180		31.2 J	27.3 J		
VANADIUM	3.6	12		12.8	14.1		
ZINC	1100	65.7		1700 J	1810 J		
Dissolved Metals (µg/L)							
ALUMINUM, FILTERED	50	87	8.6 U			8.35 U	8.35 U
ARSENIC, FILTERED	0.045	148	0.34 U			5.8 J	5.7 J
BARIUM, FILTERED	260	220	111 J			234 J	233 J
CADMIUM, FILTERED	1.8	0.15	0.15 J			0.05 U	0.07 U
CALCIUM, FILTERED	NA	NA	59300			106000 J	99800 J
CHROMIUM, FILTERED	11	42	0.78 U			0.73 J	0.99 J
COBALT, FILTERED	73	24	0.47 J			8.3	8
COPPER, FILTERED	150	1.58	1.1 J			1.4 U	1.4 U
IRON, FILTERED	300	1000	517 J			7000	7500
LEAD, FILTERED	15	1.17	0.212 J			0.14 J	0.14 J
MAGNESIUM, FILTERED	NA	NA	8980 J			11600	11400
MANGANESE, FILTERED	50	NA	152 J			2960	2780
NICKEL, FILTERED	73	28.9	5.1 J			6	6.1
POTASSIUM, FILTERED	NA	NA	3270 J			4730	4710
SELENIUM, FILTERED	18	5	0.29 U			0.15 J	0.14 J
SODIUM, FILTERED	NA	NA	23600 J			57400 J	55400 J
THALLIUM, FILTERED	0.24	10	0.11 J			0.19 U	0.07 U
TIN, FILTERED	2200	180				1.1 J	0.92 J
ZINC, FILTERED	1100	65.7	3.5 U			6.1 J	5.7 J

TABLE 3-24

RESULTS OF CHEMICALS DETECTED IN POND SURFACE WATER SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD005 08SW00502-F NORMAL 1/10/2005	DOWNGRAD 02 08SW/SD012 08SW01201 ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-D DUP 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F ORIG 6/5/2005	DOWNGRAD 02 08SW/SD012 08SW01201-F-D DUP 6/5/2005
Field Parameters (mg/L)							
DISSOLVED OXYGEN	NA	NA					
DISSOLVED OXYGEN - METER	NA	NA					
OXIDATION REDUCTION POTENTIAL (MV)	NA	NA					
PH (S.U.)	NA	NA					
SPECIFIC CONDUCTANCE (MS/CM)	NA	NA					
TEMPERATURE (C)	NA	NA					
TURBIDITY (NTU)	NA	NA					

µg/L - micrograms per liter.
C - Celsius
Data qualifiers (e.g., U, J) are defined in section 3 of the text.
DOWNGRAD - Location is a downgradient location
mg/L - milligrams per liter
MS/CM - milliSiemens per centimeter
MV - millivolts
NTU - nephelometric turbidity units
S.U. - standard units

Shading Exceeds the minimum

TABLE 3-27

DESCRIPTIVE STATISTICS FOR POND SEDIMENT SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criteria	ERA Criteria	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Nondetects	Mean Concentration	Average of Positive Detects	Sample of Maximum Detect
Volatile Organics (µg/kg)									
1,1,1-TRICHLOROETHANE	1200000	213	3/5	178 J	17300000 J	1.73 - 13.7	4780037	7966726	08SD004011224
1,1-DICHLOROETHANE	51000	0.575	5/5	5 J	1100000 J	--	308056	308056	08SD004011224
1,1-DICHLOROETHENE	12000	19.4	4/5	14 J	1500000 J	1.73	364039	455048	08SD004011224
2-BUTANONE	2200000	42.4	1/5	870 J	870 J	13.7 - 19960	3679	870	08SD012010006
4-METHYL-2-PENTANONE	530000	25.1	1/5	40 J	40 J	13.7 - 19960	3513	40.0	08SD012010006
ACETONE	1400000	9.9	1/5	210 J	210 J	59 - 19960	3551	210	08SD012010006
CARBON DISULFIDE	36000	23.9	1/5	14 J	14 J	1.73 - 19960	3506	14.0	08SD005011224
CHLOROETHANE	3000	NA	3/5	220 J	59880 J	13.7 - 59.3	21036	35048	08SD004010012
CIS-1,2-DICHLOROETHENE	4300	654	4/5	2300	390000 J	1.73	138260	172825	08SD004011224
ETHYLBENZENE	400000	175	1/5	6 J	6 J	13.7 - 19960	3506	6.00	08SD012010006
TOLUENE	520000	1220	5/5	15 J	95000 J	--	31020	31020	08SD004011224
TOTAL XYLENES	27000	433	3/5	15 J	550	15015 - 19960	3618	200	08SD005010012
TRANS-1,2-DICHLOROETHENE	6900	654	2/5	25 J	51000 J	1.73 - 19960	12207	25513	08SD004011224
TRICHLOROETHENE	710	112	4/5	2100 J	27800000 J	1.73	6625220	8281525	08SD004011224
VINYL CHLORIDE	79	202	1/5	54	54	1.73 - 19960	3514	54.0	08SD005011224
Semivolatile Organics (µg/kg)									
2-METHYLNAPHTHALENE	5600	20.2	3/4	14	230 J	4.51	119	158	08SD004010012, 08SD004011224
3&4-METHYLPHENOL	31000	52.4	3/5	280 J	1200 J	91.5 - 119	537	860	08SD004011224
ACENAPHTHENE	370000	6.71	3/4	6 J	120 J	39.5	42.4	50.0	08SD004011224
ACENAPHTHYLENE	370000	5.87	1/4	25 J	25 J	4.51 - 59.5	19.2	25.0	08SD005010012
BENZO(A)ANTHRACENE	620	108	2/4	21 J	74 J	39.5 - 59.5	36.1	47.5	08SD005010012
BENZO(A)PYRENE	62	150	2/4	18	94	39.5 - 59.5	40.4	56.0	08SD005010012
BENZO(B)FLUORANTHENE	620	10400	1/4	100	100	4.51 - 59.5	37.9	100	08SD005010012
BENZO(G,H,I)PERYLENE	50000	170	2/4	28	160	39.5 - 59.5	59.4	94.0	08SD005010012
BENZO(K)FLUORANTHENE	6200	240	1/4	46	46	4.51 - 59.5	24.4	46.0	08SD005010012
BIS(2-ETHYLHEXYL)PHTHALATE	35000	182	5/5	170 J	35000 J	--	8684	8684	08SD004011224
BUTYL BENZYL PHTHALATE	1200000	1970	1/5	210 J	210 J	118 - 401	136	210	08SD005011224
CHRYSENE	62000	166	2/4	27 J	140 J	39.5 - 59.5	54.1	83.5	08SD005010012
DI-N-BUTYL PHTHALATE	610000	1114	2/5	180 J	590 J	91.5 - 401	215	385	08SD004011224
FLUORANTHENE	230000	423	2/4	26 J	110 J	39.5 - 59.5	46.4	68.0	08SD005010012
FLUORENE	270000	77.4	3/4	5 J	130 J	39.5	46.9	56.0	08SD004011224
INDENO(1,2,3-CD)PYRENE	620	200	2/4	18	110	39.5 - 59.5	44.4	64.0	08SD005010012
ISOSAFROLE	NA	NA	1/5	250 J	250 J	91.5 - 401	141	250	08SD005010012
NAPHTHALENE	5600	176	4/4	5 J	360 J	--	156	156	08SD004011224
PHENANTHRENE	230000	204	4/4	33 J	2000 J	--	718	718	08SD004011224
PHENOL	1800000	49.1	1/5	650 J	650 J	91.5 - 401	203	650	08SD004011224
PYRENE	230000	195	2/4	35 J	180 J	39.5 - 59.5	66.1	108	08SD005010012
Inorganics (mg/kg)									
ALUMINUM	7600	NA	1/1	5630	5630	--	5630	5630	08SD012010006
ARSENIC	0.39	9.79	1/1	2.5 J	2.5 J	--	2.50	2.50	08SD012010006
BARIUM	540	NA	1/1	49.1 J	49.1 J	--	49.1	49.1	08SD012010006
BERYLLIUM	15	NA	1/1	0.2 J	0.2 J	--	0.200	0.200	08SD012010006
CADMIUM	3.7	0.99	1/1	2	2	--	2.00	2.00	08SD012010006

TABLE 3-27

DESCRIPTIVE STATISTICS FOR POND SEDIMENT SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Parameter	HHRA Criteria	ERA Criteria	Frequency of Detection	Minimum Concentration	Maximum Concentration	Range of Nondetects	Mean Concentration	Average of Positive Detects	Sample of Maximum Detect
CALCIUM	NA	NA	1/1	2550 J	2550 J	--	2550	2550	08SD012010006
CHROMIUM	210	43.4	1/1	26.5 J	26.5 J	--	26.5	26.5	08SD012010006
COBALT	140	50	1/1	2.9 J	2.9 J	--	2.90	2.90	08SD012010006
COPPER	310	31.6	1/1	32.8 J	32.8 J	--	32.8	32.8	08SD012010006
IRON	2300	NA	1/1	8360 J	8360 J	--	8360	8360	08SD012010006
LEAD	400	35.8	1/1	45.8 J	45.8 J	--	45.8	45.8	08SD012010006
MAGNESIUM	NA	NA	1/1	743 J	743 J	--	743	743	08SD012010006
MANGANESE	180	NA	1/1	79.6 J	79.6 J	--	79.6	79.6	08SD012010006
MERCURY	2.3	0.174	1/1	0.033 J	0.033 J	--	0.0330	0.0330	08SD012010006
NICKEL	160	22.7	1/1	5 J	5 J	--	5.00	5.00	08SD012010006
POTASSIUM	NA	NA	1/1	482 J	482 J	--	482	482	08SD012010006
TIN	4700	NA	1/1	3.9 J	3.9 J	--	3.90	3.90	08SD012010006
VANADIUM	7.8	NA	1/1	13.6 J	13.6 J	--	13.6	13.6	08SD012010006
ZINC	2300	121	1/1	236 J	236 J	--	236	236	08SD012010006
Miscellaneous Parameters (mg/kg)									
PERCHLORATE	0.78	NA	4/4	0.52	1.7 J	--	0.910	0.910	08SD004011224

µg/kg - micrograms per kilogram
Data qualifiers (e.g., U, J) are defined in section 3 of the text.
ERA - ecological risk assessment
HHRA - human health risk assessment
mg/kg - milligrams per kilogram
NA - No applicable criteria

TABLE 3-30

RESULTS OF CHEMICALS DETECTED IN POND SEDIMENT SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization Sampling Round Location Sample Number Sample Code Depth Range Sample Date	HHRA Criteria	ERA Criteria	DOWNGRAD 01 08SW/SD004 08SD004010012 NORMAL 0 - 1 1/10/2005	DOWNGRAD 01 08SW/SD004 08SD004011224 NORMAL 1 - 2 1/10/2005	DOWNGRAD 01 08SW/SD005 08SD005010012 NORMAL 0 - 1 1/10/2005	DOWNGRAD 01 08SW/SD005 08SD005011224 NORMAL 1 - 2 1/10/2005	DOWNGRAD 02 08SW/SD012 08SD012010006 ORIG 0 - 0.5 6/5/2005	DOWNGRAD 02 08SW/SD012 08SD012010006-D DUP 0 - 0.5 6/5/2005
Volatile Organics (µg/kg)								
1,1,1-TRICHLOROETHANE	1200000	213	6600000 J	17300000 J	178 J	13.7 U	1.73 U	1.59 U
1,1-DICHLOROETHANE	51000	0.575	440000 J	1100000 J	200 J	75	5 J	84 J
1,1-DICHLOROETHENE	12000	19.4	320000 J	1500000 J	178 J	14 J	1.73 U	1.59 U
2-BUTANONE	2200000	42.4	19960 UJ	15015 UJ	59.3 U	13.7 U	870 J	79 J
4-METHYL-2-PENTANONE	530000	25.1	19960 UJ	15015 UJ	59.3 U	13.7 UJ	40 J	10 J
ACETONE	1400000	9.9	19960 UJ	15015 UJ	59.3 UJ	59 U	210 J	120 J
CARBON DISULFIDE	36000	23.9	19960 UJ	15015 UJ	59.3 U	14 J	1.73 U	1.59 U
CHLOROETHANE	3000	NA	59880 J	45045 J	59.3 U	13.7 U	220 J	180
CIS-1,2-DICHLOROETHENE	4300	654	290000 J	390000 J	9000	2300	1.73 U	1.59 U
ETHYLBENZENE	400000	175	19960 UJ	15015 UJ	59.3 U	13.7 U	6 J	1.59 UJ
TOLUENE	520000	1220	59880 J	95000 J	178 J	15 J	27 J	13 J
TOTAL XYLENES	27000	433	19960 UJ	15015 UJ	550	15 J	35 J	6 J
TRANS-1,2-DICHLOROETHENE	6900	654	19960 UJ	51000 J	59.3 U	25 J	1.73 U	1.59 U
TRICHLOROETHENE	710	112	5300000 J	27800000 J	24000	2100 J	1.73 U	1.59 U
VINYL CHLORIDE	79	202	19960 UJ	15015 UJ	59.3 U	54	1.73 U	1.59 U
Semivolatile Organics (µg/kg)								
2-METHYLNAPHTHALENE	5600	20.2	230 J	230 J	14	4.51 U		
3&4-METHYLPHENOL	31000	52.4	1100 J	1200 J	119 U	91.5 U	280 J	109 U
ACENAPHTHENE	370000	6.71	39.5 UJ	120 J	24 J	6 J		
ACENAPHTHYLENE	370000	5.87	39.5 UJ	59.5 UJ	25 J	4.51 U		
BENZO(A)ANTHRACENE	620	108	39.5 UJ	59.5 UJ	74 J	21 J		
BENZO(A)PYRENE	62	150	39.5 UJ	59.5 UJ	94	18		
BENZO(B)FLUORANTHENE	620	10400	39.5 UJ	59.5 UJ	100	4.51 U		
BENZO(G,H,I)PERYLENE	50000	170	39.5 UJ	59.5 UJ	160	28		
BENZO(K)FLUORANTHENE	6200	240	39.5 UJ	59.5 UJ	46	4.51 U		
BIS(2-ETHYLHEXYL)PHTHALATE	35000	182	6000 J	35000 J	950	170 J	1300 J	690 J
BUTYL BENZYL PHTHALATE	1200000	1970	401 UJ	302 UJ	119 U	210 J	118 U	109 U
CHRYSENE	62000	166	39.5 UJ	59.5 UJ	140 J	27 J		
DI-N-BUTYL PHTHALATE	610000	1114	401 UJ	590 J	119 U	91.5 U	180 J	109 U
FLUORANTHENE	230000	423	39.5 UJ	59.5 UJ	110 J	26 J		
FLUORENE	270000	77.4	39.5 UJ	130 J	33 J	5 J		
INDENO(1,2,3-CD)PYRENE	620	200	39.5 UJ	59.5 UJ	110	18		
ISOSAFROLE	NA	NA	401 UJ	302 UJ	250 J	91.5 U	118 U	109 U
NAPHTHALENE	5600	176	240 J	360 J	20	5 J		
PHENANTHRENE	230000	204	470 J	2000 J	370 J	33 J		
PHENOL	1800000	49.1	401 UJ	650 J	119 U	91.5 U	118 U	109 U
PYRENE	230000	195	39.5 UJ	59.5 UJ	180 J	35 J		

TABLE 3-30

RESULTS OF CHEMICALS DETECTED IN POND SEDIMENT SAMPLES
SWMU 08 (BUILDING 106 POND AREA)
NSWC CRANE
CRANE, INDIANA

Characterization	HHRA Criteria	ERA Criteria	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD	DOWNGRAD
Sampling Round			01	01	01	01	02	02
Location			08SW/SD004	08SW/SD004	08SW/SD005	08SW/SD005	08SW/SD012	08SW/SD012
Sample Number			08SD004010012	08SD004011224	08SD005010012	08SD005011224	08SD012010006	08SD012010006-D
Sample Code			NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
Depth Range			0 - 1	1 - 2	0 - 1	1 - 2	0 - 0.5	0 - 0.5
Sample Date			1/10/2005	1/10/2005	1/10/2005	1/10/2005	6/5/2005	6/5/2005
Inorganics (mg/kg)								
ALUMINUM	7600	NA					5630	7000
ARSENIC	0.39	9.79					2.5 J	3 J
BARIUM	540	NA					49.1 J	42.1 J
BERYLLIUM	15	NA					0.2 J	0.28 J
CADMIUM	3.7	0.99					2	2
CALCIUM	NA	NA					2550 J	1510 J
CHROMIUM	210	43.4					26.5 J	53.1 J
COBALT	140	50					2.9 J	4.3 J
COPPER	310	31.6					32.8 J	34.1 J
IRON	2300	NA					8360 J	8870 J
LEAD	400	35.8					45.8 J	47.4 J
MAGNESIUM	NA	NA					743 J	698 J
MANGANESE	180	NA					79.6 J	76.7 J
MERCURY	2.3	0.174					0.033 J	0.026 J
NICKEL	160	22.7					5 J	5.9 J
POTASSIUM	NA	NA					482 J	587 J
TIN	4700	NA					3.9 J	7.9 J
VANADIUM	7.8	NA					13.6 J	17 J
ZINC	2300	121					236 J	294 J
Miscellaneous Parameters (mg/kg)								
PERCHLORATE	0.78	NA	0.57 J	1.7 J	0.85	0.52		

µg/kg - micrograms per kilogram.
Data qualifiers (e.g., U, J) are defined in section 3 of the text.
DOWNGRAD - downgradient well.
ERA - ecological risk assessment.
HHRA - human health risk assessment.
mg/kg - milligrams per kilogram.
NA - No applicable criteria.

Shading Exceeds HHRA criteria

Soft Sediment Percent Moisture Analysis

Sample Location	Depth (inches)	Sample Number	Percent Moisture By Weight
08SW/SD004	0 - 12	08SD004010012	83.3
08SW/SD004	0 - 12	08SD004010012	82.2
08SW/SD004	12 - 24	08SD004011224	77.8
08SW/SD004	12 - 24	08SD004011224	76.5
08SW/SD005	0 - 12	08SD005010012	43.8
08SW/SD005	12 - 24	08SD005011224	26.8
08SW/SD005	12 - 24	08SD005011224	29.3

Percent Moisture Average for 0 - 12 inch depth = 69.8
Percent Moisture Average for 12 - 24 inch depth = 52.6

APPENDIX B

IMWP CALCULATIONS

B.1 BUILDING 106 POND EXCAVATION VOLUME CALCULATIONS

B.2 INDUSTRIAL WATER TREATMENT FACILITY DEMOLITION VOLUME CALCULATIONS

B.3 ALLOWABLE CONCENTRATIONS FOR PRETREATED WATER

B.1 BUILDING 106 POND EXCAVATION VOLUME CALCULATIONS

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
SUBJECT:	SWMU 8 - BUILDING 106 POND - SOILS VOLUME CALCULATIONS		
BASED ON:	AutoCAD	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: JJR Date: 4/25/06	APPROVED BY:	DATE:

OBJECTIVE:

The purpose of this calculations is to calculate various volumes associated with the excavation of contaminated soils and sediments from the Building 106 Pond located within SWMU 8 NSWC Crane.

APPROACH:

1. Using the survey and bathymetry measurements collected by TtNUS the week of April 7, 2006 calculate the volume of water within the Building 106 Pond. In addition to the water removed from the pond, water will have to be removed from the excavation during excavation activities and water will be accumulated as a result of dewatering the excavated soils. Present assumptions on quantities of water expected due to soil dewatering and excavation dewatering.

2. Using the survey and bathymetry measurements collected by TtNUS the week of April 7, 2006 calculate the volume of soft sediments within the Building 106 Pond.

3. Using the survey and bathymetry measurements collected by TtNUS the week of April 7, 2006 calculate the volume of soil material below the soft sediments and above the shallow bedrock layer below the Building 106 Pond.

4. Using the survey and bathymetry measurements collected by TtNUS the week of April 7, 2006 calculate the volume of additional soil to be removed to from the Building 106 Pond to establish a stable excavation.

CALCULATIONS

1. Volume of Water To be Treated

Using the survey and bathymetry measurements collected by TtNUS the ground surface and pond bed topography was generated for the Building 106 Pond. This land surface in conjunction with the measured water level in the pond can be used to calculate the volume of water currently in the Building 106 Pond.

Volumes calculated using average end method (average of two consecutive contour areas multiplied by the change in elevation between the contours). Areas taken from AutoCAD.

Elevation	Description and Area of Contour (sf)		Change in Elev. (ft)	Volume (cf)
681	Water elevation	2550		
			1	2,375
680	pond bed contour	2200		
			1	1,966
679	pond bed contour	1731		
			1	1,422
678	pond bed contour	1113		
			1	866

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BY: TWS Date: 4-21-06	CHECKED BY: TJR Date: 4/25/06	APPROVED BY:	DATE:

677	pond bed contour	619		
			1	392
676	bottom of pond bed	164		

Total Volume of Pond Water = 7,020 cf

Total Volume of Pond Water = 52,510 gallons

It is difficult to determine the amount of water that will accumulate within the excavation during excavation activities, the amount of water that will be generated as a result of soil dewatering, and the quantity of water that will be generated due to decontamination activities.

Because the excavation extends below the groundwater table it is estimated that an additional 20% of the original volume will have to be removed from the excavation due to groundwater infiltration.

Total Volume of Water Removed from the Excavation = 10,500 gallons

It is estimated that the Decontamination water generated will equate to approximately 1,000 gallons per day of construction. It is estimated that construction activities will run for 2 weeks.

Total Volume of Water Generated Due to Decontamination Activities = 10,000 gallons

2. Volume of Soft Sediment in the Building 106 Pond

Using the survey and bathymetry measurements collected by TtNUS the ground surface and pond bed topography was generated for the Building 106 Pond. Soft sediment thickness measurements collected during the collection of bathymetry measurements allowed for the development of contours to represent the bottom of soft sediment.

Volumes calculated using average end method (average of two consecutive contour areas multiplied by the change in elevation between the contours). Areas of soft sediment contours are determined by taking the area of the bottom of soft sediment contour and subtracting the area of the top of soft sediment at that same elevation. Measurements presented in this calculation obtained using AutoCAD.

Elevation	Area		Area (sf)	Elevation Change (ft)	Volume (cf)
	Sediment Bottom (sf)	Sediment Top (sf)			
681	2550	2550	0		
				3	1,514
678	2122	1113	1009		
				1	1,039
677	1687	619	1068		
				1	1,063
676	1222	164	1058		
				1	813

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
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BASED ON:	AutoCAD	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: JJR Date: 4/25/06	APPROVED BY:	DATE:

675	568	0	568		
				1	313
674	57	0	57		

Total Volume of Soft Sediment = 4,741 cf
Total Volume of Soft Sediment = 176 cy

Water Generated from Dewatering

The following is a summary of the percent moisture analyses performed on the sediments within the Building 106 Pond.

Sample Location	Depth (inches)	Sample Number	Percent Moisture By Weight
08SW/SD004	0 - 12	08SD004010012	83.3
08SW/SD004	0 - 12	08SD004010012	82.2
08SW/SD004	12 - 24	08SD004011224	77.8
08SW/SD004	12 - 24	08SD004011224	76.5
08SW/SD005	0 - 12	08SD005010012	43.8
08SW/SD005	12 - 24	08SD005011224	26.8
08SW/SD005	12 - 24	08SD005011224	29.3

Percent Moisture Average for 0 - 12 inch depth =	69.8
Percent Moisture Average for 12 - 24 inch depth =	52.6

For the purposes of generating a volume of water through the process of sediment dewatering, it is estimated that 50% of the water will be removed from the material. Therefore, due to the high water content, it is estimated that 1/3 of the original excavated volume will be lost in dewatering.

Based on 69.8 percent moisture, estimated unit weight of top sediment layer =	80 lb/cf
Volume of top sediment layer (50% of soft sediment volume) =	88 cy
Weight of top sediment layer =	190,080 lbs
Assuming 50% wt loss during dewatering, weight of water generated =	95,040 lbs of water
Volume of water generated =	1,523 cf
Volume of water generated =	11,393 gallons

Based on 52.6 percent moisture, estimated unit weight of top sediment layer =	85 lb/cf
Volume of bottom sediment layer (50% of soft sediment volume) =	88 cy
Weight of top sediment layer =	201,960 lbs
Assuming 50% wt loss during dewatering, weight of water generated =	100,980 lbs of water
Volume of water generated =	1,618 cf
Volume of water generated =	12,105 gallons

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
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BY: TWS Date: 4-21-06	CHECKED BY: TJR Date: 4/25/06	APPROVED BY:	DATE:

Volume of Water Generated Through Dewatering = 23,497 gallons
Volume of Soft Sediment after dewatering (2/3rds of the volume removed) = 117 cy

3. Volume of Soils Below Soft Sediment / Above Bedrock

Using the survey and bathymetry measurements collected by TtNUS the ground surface and pond bed topography was generated for the Building 106 Pond. Soil thickness measurements collected during the collection of bathymetry measurements allowed for the development of contours to represent the bedrock layer below the Building 106 Pond.

Volumes calculated using average area end method (average of two consecutive contour areas multiplied by the change in elevation between the contours). The volume of soil within the limits for the pond above the bed rock layer is calculated by assuming a cylinder (vertical walls) defined by the area of the pond extends from the pond bed to the bedrock below the pond. Areas used to calculate soil volumes are determined by taking the area of the pond (2,550 sf) and subtracting out the area of exposed bedrock at that elevation and then subtracting the pond bed layers from the area. Measurements presented in this calculation obtained using AutoCAD.

Elevation	Areas (sf)			Area (sf)	Change Elev. (ft)	Volume (cf)
	Pond	Exposed Bed Rock	Sediment Top			
681	2,550	0	2550	0		
					1	175
680	2,550	0	2200	350		
					1	585
679	2,550	0	1731	819		
					1	1,122
678	2,550	13	1113	1,424		
					1	1,627
677	2,550	101	619	1,830		
					1	1,846
676	2,550	525	164	1,861		
					1	1,660
675	2,550	1092	0	1,458		
					1	1,165
674	2,550	1678	0	872		
					1	708
673	2,550	2006	0	544		
					1	385
672	2,550	2325	0	225		
					1	113
671	2,550	2550	0	0		

Total Volume of Soil and Sediment Above Bed Rock Within Pond Limits (cf) = 9,383
Total Volume of Soil and Sediment Above Bed Rock Within Pond Limits (cy) = 348

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
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BASED ON:	AutoCAD	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: TJR Date: 4/25/06	APPROVED BY:	DATE:

Volume of Soft Sediments (cy) = 176

Volume of Soil above Bedrock / Below Soft Sediment (cy) = 172

Water Generated from Dewatering

It is assumed that the soils below the soft sediments will generated water through the dewatering process that is approximately 10% of the excavated volume.

Volume of water generated (10% excavation volume) (cy) = 17

Volume of water generated (10% excavation volume) (gallons) = 3,464

4. Volume of Additional Excavation for Excavation Slope Stability

Using the survey and bathymetry measurements collected by TtNUS the ground surface and pond bed topography was generated for the Building 106 Pond. Soil thickness measurements collected during the collection of bathymetry measurements allowed for the development of contours to represent the bedrock layer below the Building 106 Pond.

The volume of additional soil excavation required to establish a stable excavation will be calculated by establishing sidewall laybacks of 0.75H to 1V, calculating the total volume of excavation, and then subtracting out the soft sediments and the contaminated soil below the soft sediments and above the bedrock. Measurements presented in this calculation obtained from AutoCAD.

Elevation	Areas (sf)		Area (sf)	Elevation Change (ft)	Volume (cf)
	Total Excavation	Area Taken By Pond			
685	6.40	0.00	6.40		
				1	81.57
684	156.74	0.00	156.74		
				1	565.44
683	3,920.69	2,946.56	974.13		
				1	982.29
682	3,735.74	2,745.30	990.44		
				1	1,003.42
681	3,566.92	2,550.53	1,016.39		
				1	1,109.03
680	3,401.75	2,200.08	1,201.67		
				1	1,355.44
679	3,240.23	1,731.03	1,509.20		
				1	1,732.74
678	3,069.76	1,113.48	1,956.28		
				1	2,090.31
677	2,843.53	619.19	2,224.34		
				1	2,182.71

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
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BASED ON:	AutoCAD	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: TJR Date: 4/25/06	APPROVED BY:	DATE:

676	2,306.02	164.94	2,141.08		
				1	1,880.61
675	1,620.13	0.00	1,620.13		
				1	1,306.02
674	991.91	0.00	991.91		
				1	799.89
673	607.86	0.00	607.86		
				1	427.57
672	247.27	0.00	247.27		
				1	123.64
671	0.00	0.00	0.00		

Total Volume of Soil to be Excavated =	13,008	cf
Total Volume of Soil to be Excavated =	482	cy
Volume of Soft Sediments =	176	cy
Volume of Soil above Bedrock / Below Soft Sediment =	172	cy
Additional Excavation Volume for Slope Stability =	**134**	**cy**

Water Generated from Dewatering

It is assumed that the soils below the soft sediments will generated water through the dewatering process that

Volume of water generated (10% excavation volume) =	13	cy
Volume of water generated (10% excavation volume) =	**2,625**	**gallons**

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
SUBJECT:	SWMU 8 - BUILDING 106 POND - SOILS VOLUME CALCULATIONS		
BASED ON:	AutoCAD	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: TSR Date: 4/25/06	APPROVED BY:	DATE:

VOLUME SUMMARY

Volume of water generated	Dewater Pond =	52,510 gallons
	Dewater Excavation =	10,500 gallons
	Decontamination Water =	10,000 gallons
	Dewater Top Layer of Sediment =	11,393 gallons
	Dewater Bottom Layer of Sediment =	12,105 gallons
	Dewater Remaining Soils =	6,089 gallons
	Volume of Water Generated =	**102,596 gallons**
Volume of Soils for Disposal	Volume of Sediment (after dewater) =	117 cy
	Volume of Soil Between Sediment and Rock =	172 cy
	Volume of Additional Soil for Excavation Setback =	134 cy
	Volume of Soil Excavated to be Disposed Off-site =	**423 cy**
Required Absorption Agent	For Sediment 20% agent by volume =	23 cy
	For Soil 10% agent by volume =	31 cy
	Total Absorption Agent =	**54 cy**
Actual Disposal Volume	Volume of Soil Excavated to be Disposed Off-site =	423 cy
	Total Absorption Agent =	54 cy
	Total Volume to Transport for Disposal =	**477 cy**

B.2 INDUSTRIAL WATER TREATMENT FACILITY DEMOLITION VOLUME CALCULATIONS

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
SUBJECT:	SWMU 8 - FORMER INDUSTRIAL WATER TREATMENT FACILITY DEMOLITION		
BASED ON:	Construction Drawings	DRAWING NUMBER:	
BY: TWS Date: 4-21-06	CHECKED BY: TSR Date: 4/25/06	APPROVED BY:	DATE:

OBJECTIVE:

The purpose of this calculations is to calculate various volumes associated with the demolition of the former Industrial water treatment facility located within SWMU 8 NSWC Crane, adjacent to the Building 106 Pond.

APPROACH:

1. Using the construction drawings for the former Industrial Water Treatment Facility, calculate the volume of anticipated materials to be removed transported offsite for disposal. Construction Drawings provided on pages 4 through 7 of 7.

ASSUMPTIONS

1. Because the former Industrial Water Treatment Facility is still hydraulically connected to the Building 106 Pond, it is assumed that the concrete chambers contain water that will need to be removed and pretreated prior to discharge to the NSWC Crane sanitary system.

2. Because of the nature of the facility's use, it is assumed that the materials removed from the system will need to be disposed of at a landfill (with the exception of water). However, it is also assumed that the materials can be sent to a non-hazardous landfill.

3. Because of the time of construction (1972) it is assumed that the electrical equipment dose not contain PCBs and can be disposed within a non-hazardous landfill. The EMAC contractor must verify this and if equipment is not tagged as not containing PCBs, the EMAC contractor will have to abide by the characterization requirements for the electrical equipment prior to disposing offsite.

CALCULATIONS

1. Volume of Water In Vaults To be Treated

The treatment system contains 3 mixing chambers and a sump that works as a lift station to the sanitary sewer system. Each mixing vault is 4-feet by 4-feet. The normal water depth in each mixing chamber is 4 feet. The sump is 4-feet by 5-feet with a funnel shape bottom and has a normal water depth of approximately 4-feet and 10-inches.

Number of Mixing Chambers =	3 chambers	
Volume in each Chamber (4' x 4' x 4') =	64 cf	
Volume of water in Mixing Chambers =	192 cf	
Number of Sumps =	1 sump	
Volume of Sump (Funnel Portion) =	23 cf	[(1' x 2.5') + (4' x 5')] / 2 x 2'
Volume of Sump (Top Portion) =	57 cf	(4' x 5') x (4.83' - 2')
Volume of water in Sump =	80 cf	

CLIENT:	NAVAL SURFACE WARFARE CENTER, CRANE	JOB NUMBER:	112G00352 - 14.200
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BY: TWS Date: 4-21-06	CHECKED BY: TJR Date: 4/25/06	APPROVED BY:	DATE:

Total Volume of Water = 272 cf
Total Volume of Water = 2035 gallons

2. Volume of Concrete to be Removed

The vault is constructed of reinforced concrete. The following describes the parts of the vault and presents the dimensions of those parts..

Bottom Vault Slab = (20'-2" long by 5'-8" wide by 8" thick)
North Vault Wall = (5'-8" wide by 8'-6" high by 10" thick)
South Vault Wall = (5'-8" wide by 10'-6" high by 10" thick)
East Vault Wall = [(5'-6" wide by 10'-6" high) + (13' wide by 8'-6" high)] by (10" thick)
West Vault Wall = [(5'-6" wide by 10'-6" high) + (13' wide by 8'-6" high)] by (10" thick)
Interior Walls = [(4' long by 5' high by 6" thick)] x (3 walls)
Adjacent concrete Pad = (20'-2" long by 5' wide by 4" thick)
Manhole Bottom Slab = (6' diameter by 1' thick)
Manhole Top Lid Slab = (4'-6" diameter by 6" thick)
Manhole 48" ID = (6' long) x (4'-6" diameter - 4' diameter)

Bottom Vault Slab =	76 cf	3 cy
North Vault Wall =	40 cf	1.5 cy
South Vault Wall =	50 cf	2 cy
East Vault Wall =	140 cf	5 cy
West Vault Wall =	140 cf	5 cy
Interior Walls =	30 cf	1 cy
Adjacent concrete Pad =	34 cf	1.5 cy
Manhole Bottom Slab =	28 cf	1 cy
Manhole Top Lid Slab =	8 cf	0.5 cy
Manhole 48" ID =	20 cf	1 cy
Total Volume of Concrete =	**566 cf**	**21.5 cy**

3. Steel Grating

The concrete vault is covered with steel grating.

Steel Grating Area = (18'-10" long by 4'-4" wide)
Steel Grating Area = 81.6 sf

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BASED ON:	Construction Drawings		DRAWING NUMBER:	
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4. Miscellaneous Equipment

A variety of electrical equipment including but not limited to motors, mixers, electrical panel, conduit, and pumps. It is assumed that this material can be disposed of at a non-hazardous landfill.

Volume of Miscellaneous Equipment = 5 cy (estimated)

5. Former Industrial Water Treatment Facility Shelter

The shelter at the former Industrial Water Treatment Facility is a post and roof type shelter. Eight wooden posts (4 by 4 treated lumber) supports a metal roof.

Volume of Shelter = 5 cy (estimated)

6. Backfill

Following the removal of the former Industrial water treatment facility the hole occupied by the concrete vault and manhole will need to be backfilled. The volume of soil needed to backfill the hole to surrounding grades is estimated to be equal to the volume taken up by the vault plus 20 percent for other voids.

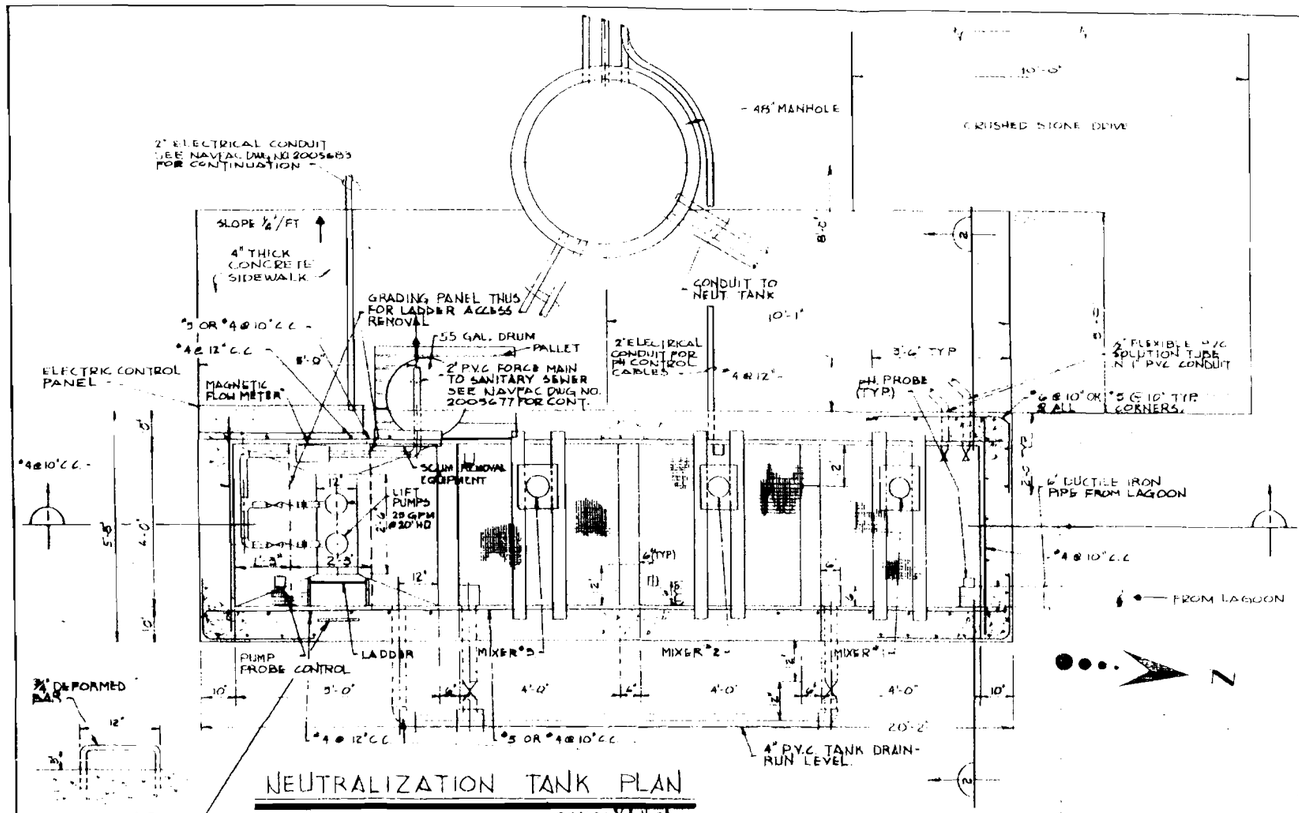
Volume occupied by the Vault = (6'-6" by 5'-8" by 11'-2") + (13'-8" by 5'-8" by 9'-2")
Volume occupied by Manhole = (6' dia by 7'-6")

Volume occupied by the Vault =	1,128 cf
Volume occupied by Manhole =	212 cf
Total Volume =	1,340 cf
Volume of Backfill Needed =	1,340 cf
Volume of Backfill Needed =	50 cy
Volume of Backfill + 20% =	**60** cy

CONCLUSIONS

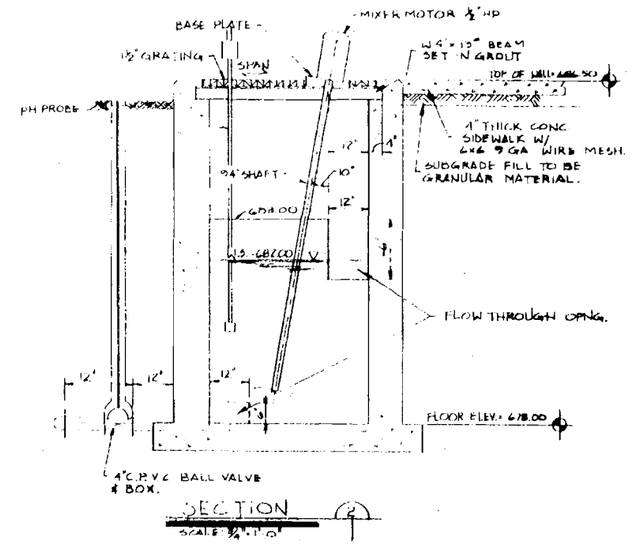
Estimated volume generated in demolition =	32 cy
Add 5 additional cubic yards for miscellaneous piping =	5 cy
Estimated volume generated in demolition =	**37 cy**
Estimated Volume of Backfill Needed =	**60 cy**

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



NEUTRALIZATION TANK PLAN

SCALE: 3/4" = 1'-0"

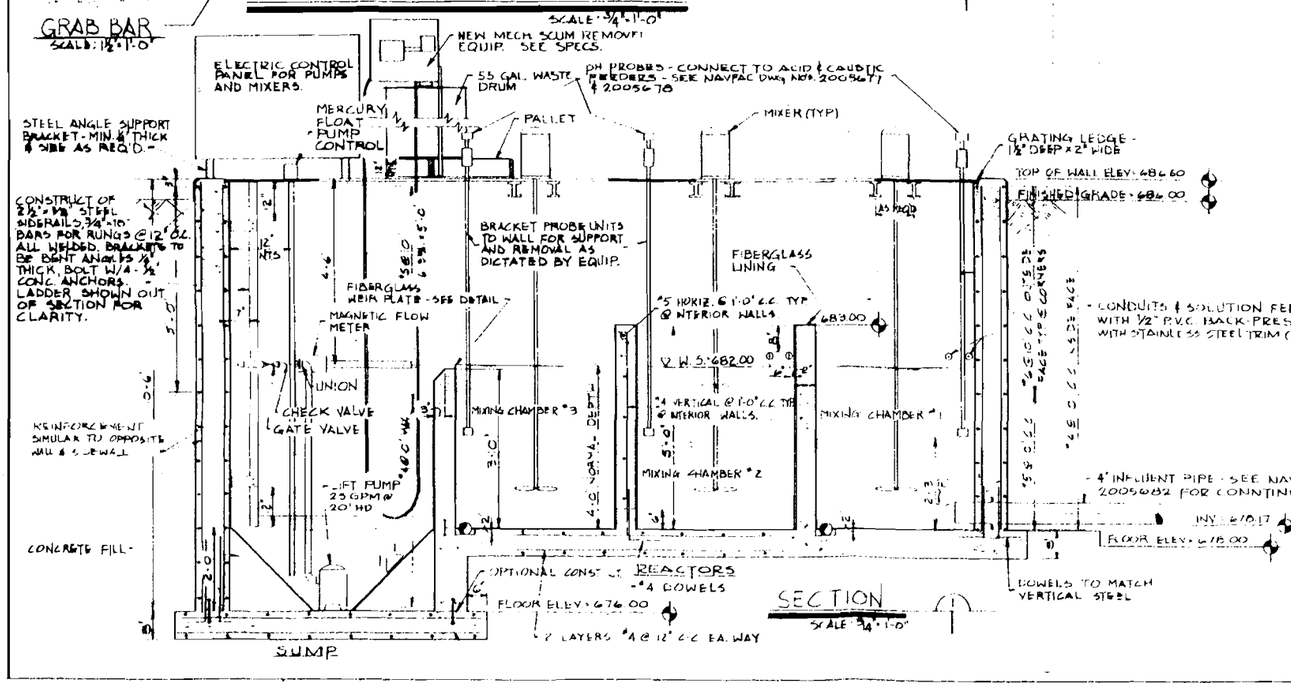


SECTION (2)

SCALE 3/4" = 1'-0"

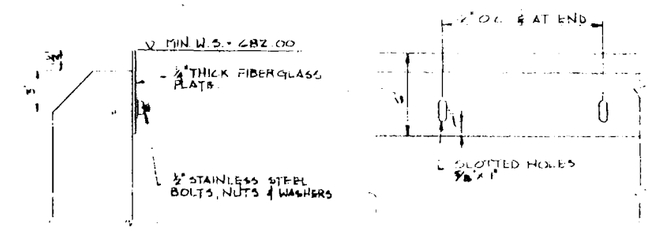
GRAB BAR

SCALE: 1 1/2" = 1'-0"



SECTION

SCALE 3/4" = 1'-0"



WEIR PLATE DETAIL

SCALE: 3" = 1'-0"

LEGEND

W.S. - WATER SURFACE
PVC - POLYVINYL CHLORIDE

NOTE
ALL CONSTRUCTION AND EQUIPMENT ON THIS SHEET IS TO BE NEW.

Don Bauman

SCALE: 3/4" = 1'-0"

CHECK GRAPHIC SCALES BEFORE USING

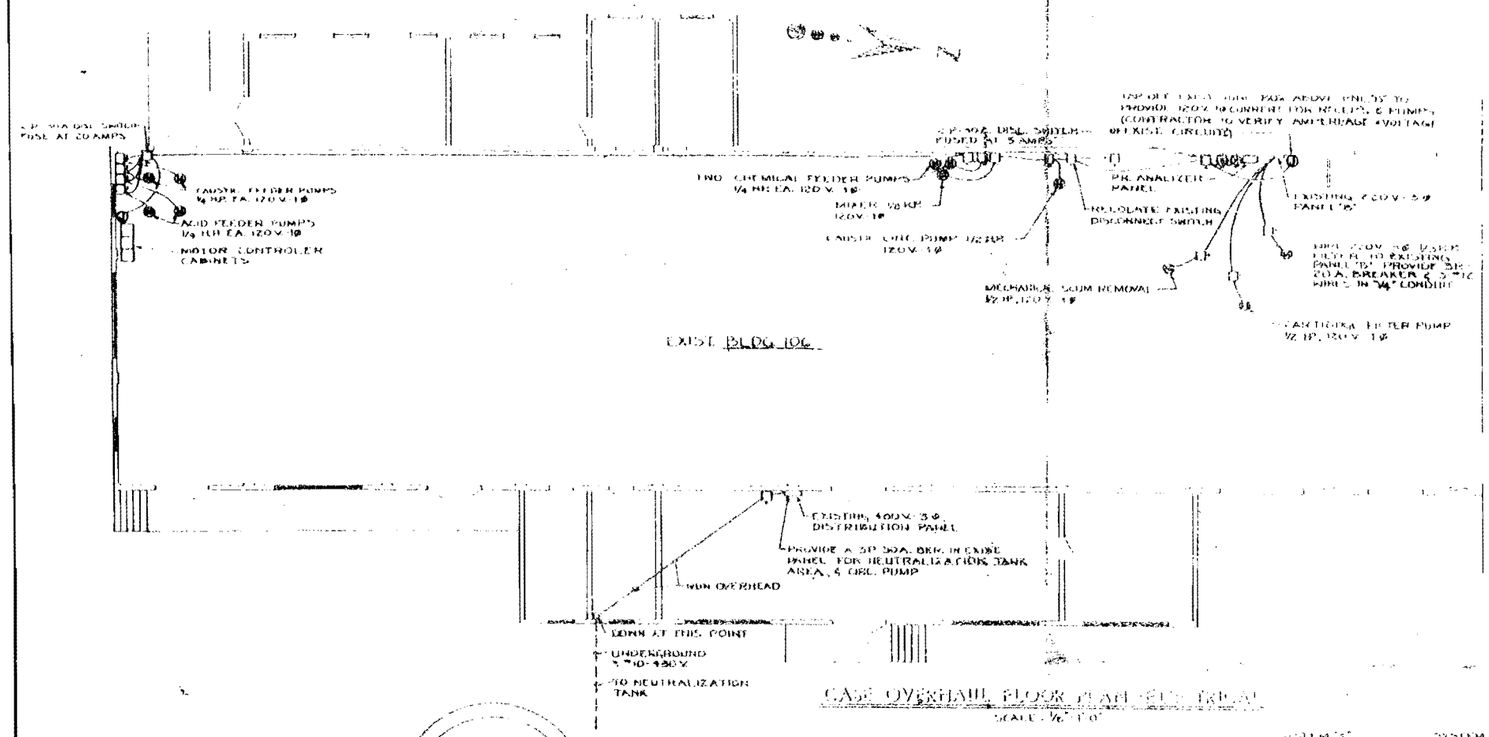
W B INC INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION NAVAL BASE PHILADELPHIA, PA.
SUBMITTED BY R. MILLER DATE 6/29/72	NAVAL AMMUNITION DEPOT CRANE, IND. INDUSTRIAL WASTE TREATMENT FACILITY NEUTRALIZATION TANK PLAN AND SECTIONS
STRUC MEMBER V. D.	
HYDRAULIC AND SANITARY	
APPROVED DATE	SIZE F — CODE IDENT NO 80091 — NAVFAC DRAWING NO 2005681
OFFICER IN CHARGE	CONSTR. CONTR. NO. N62472-72C-0153
APPROVED DATE NORDIV FOR COMMANDER NAVFAC	SCALE AS SHOWN — SPEC. 04-72-0153 — SHEET 3 OF 7

SATISFACTORY TO: DATE

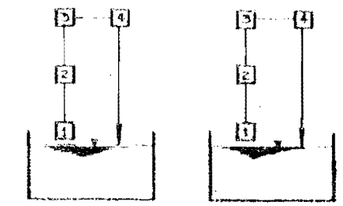
JO 54038046

HALF SIZE

LTR	REVISIONS DESCRIPTION	PREP'D BY	DATE	APPROVED

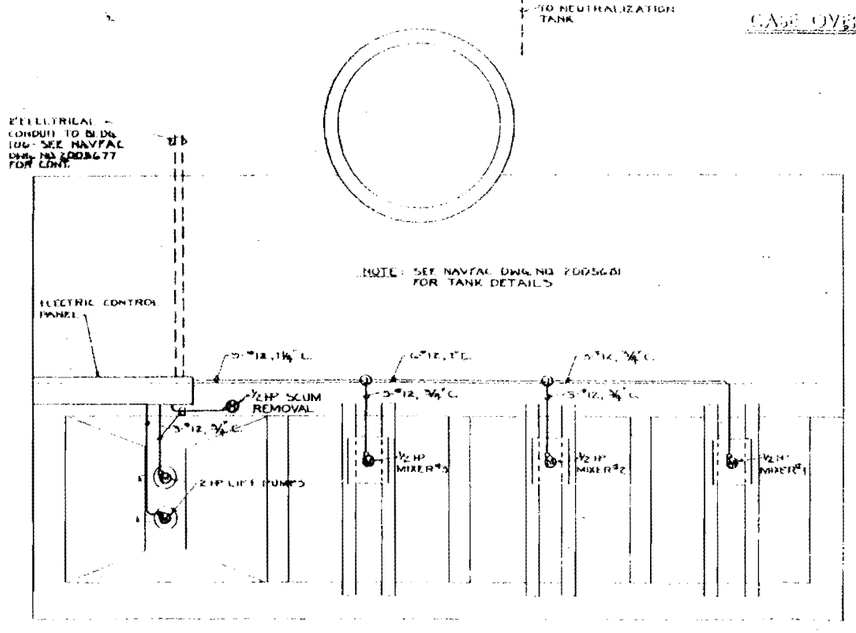


CASE OVERHAUL FLOOR PLAN (SEE TREAT)
SCALE: 1/8" = 1'-0"



ELECTRICAL
SCHEMATIC OF CAUSTIC CONTROL

LEGEND
1 PH SENSOR
2 ANALYZER
3 INDICATING CONTROLLER
4 CAUSTIC METERING



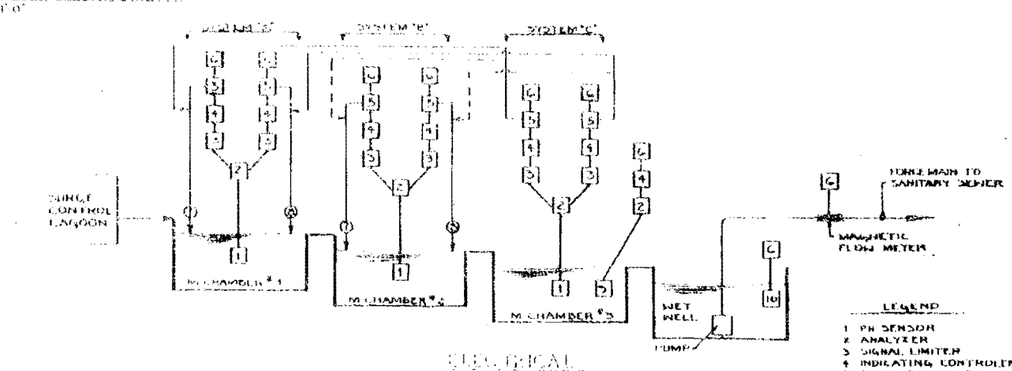
NEUTRALIZATION TANK PLAN
SCALE: 1/4" = 1'-0"

- ELECTRICAL SYMBOLS
- BRANCH CIRCUIT WIRE AND CONDUIT
- BRANCH CIRCUIT WIRING BELOW GRADE
- MOTOR WITH H.P. GIVEN
- DISCONNECT SWITCH
- JUNCTION BOX
- DUPLEX RECEPTACLE

NOTE: MIN. CIRCUIT SHALL BE #12 THHN WIRES IN 3/4" CONDUIT.

VERIFY ALL VOLTAGES & PHASES FOR POWER BY CHECKING AT THE SITE.

NOTE: ALL WORK TO BE DONE IN ACCORDANCE WITH NEC. AND/OR LOCAL CODES



ELECTRICAL
SCHEMATIC OF NEUTRALIZATION CONTROL SYSTEM

LEGEND
1 PH SENSOR
2 ANALYZER
3 SIGNAL LIMITER
4 INDICATING CONTROLLER
5 PROPORTIONAL DRIVER
6 TERMINAL FOR FUTURE REDG. PANEL
7 CAUSTIC METERING
8 ACID METERING
9 CONDUCTIVITY SENSOR
10 HIGH ALARM SENSOR

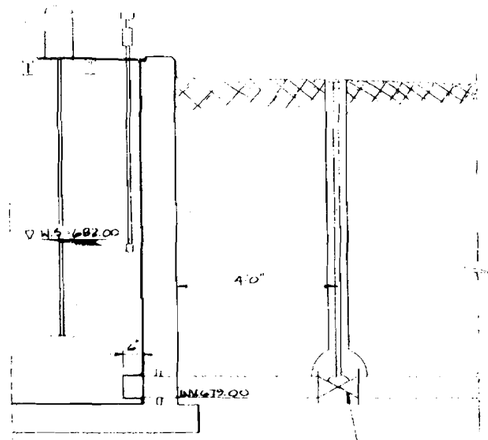
CHECK GRAPHIC SCALES BEFORE USING

W.W. INC. INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION PHILADELPHIA, PA.
SUBMITTED BY: NAME/DATE 8/23/72	NAVAL AMMUNITION DEPOT CRANE, IND.
CHIEF MEMBER V.P.	INDUSTRIAL WASTE TREATMENT FACILITY
APPROVED DATE	ELECTRICAL PLANS AND DETAILS
DIVISION DIRECTOR APPROVED DATE	SIZE F · CODE IDENT NO. 80091 · NAVFAC DRAWING NO. 2005683
HEADQUARTERS NAVFAC APPROVED DATE	CONTR NO. N62472-72-C-0053
	SCALE: AS SHOWN · SPEC. 04-72-0053 · SHEET 7 OF 7

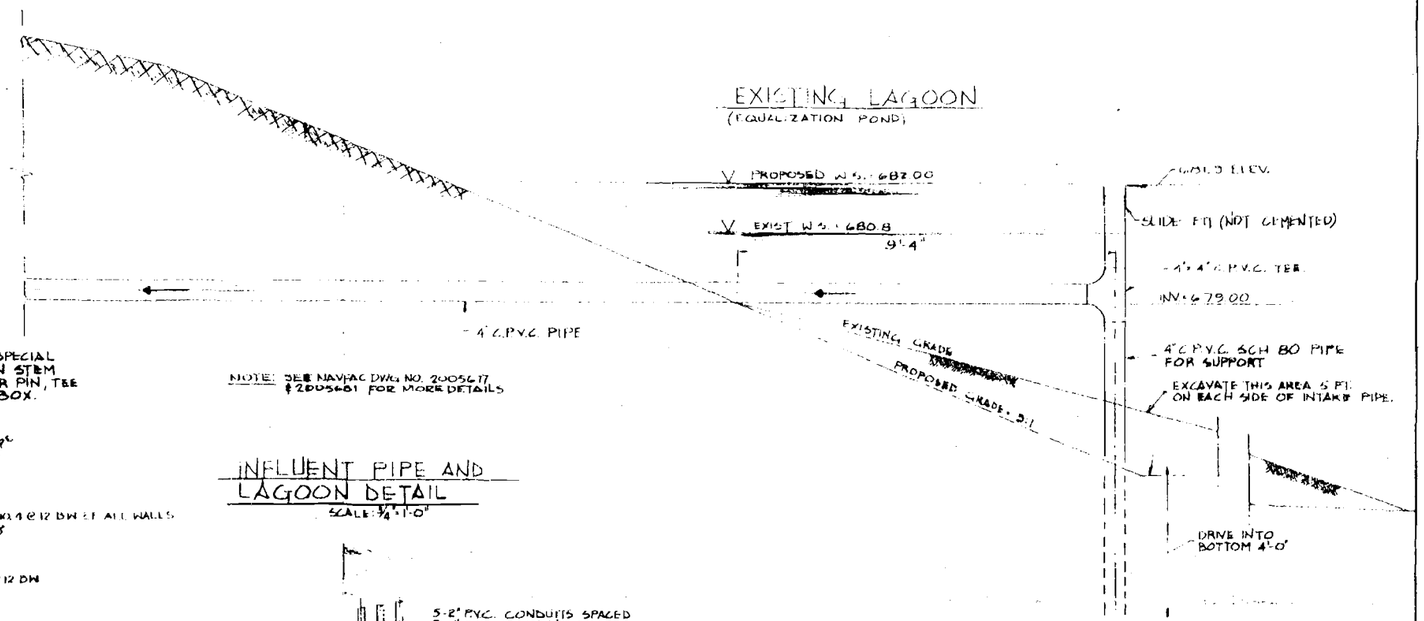
SATISFACTORY TO: DATE

54C38046

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



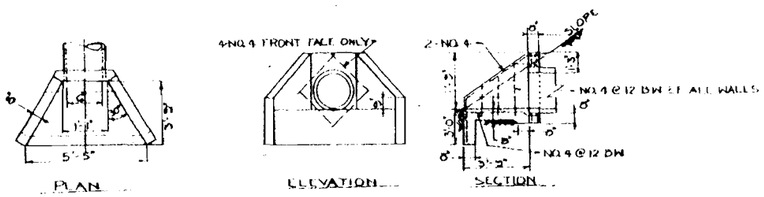
NEUTRALIZATION TANK



NOTE: SEE NAVFAC DWG. NO. 2005677 & 2005681 FOR MORE DETAILS

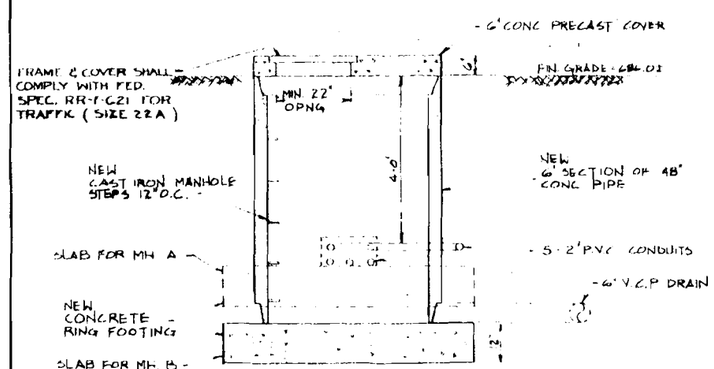
INFLUENT PIPE AND LAGOON DETAIL

SCALE 3/4" = 1'-0"



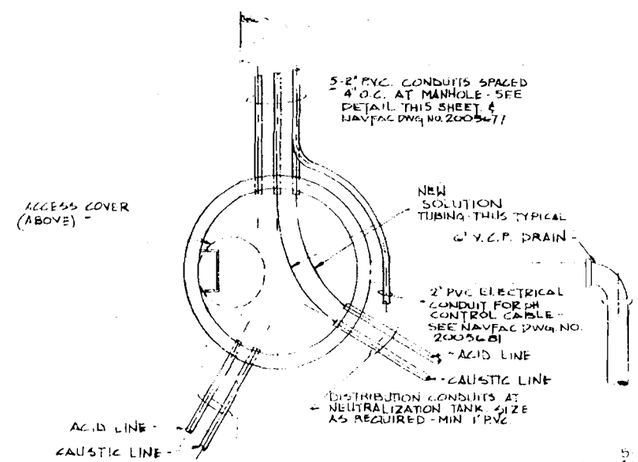
REINFORCED CONCRETE HEADWALL

NOT TO SCALE



CONDUIT PULL MANHOLE SECTION

SCALE 3/4" = 1'-0"



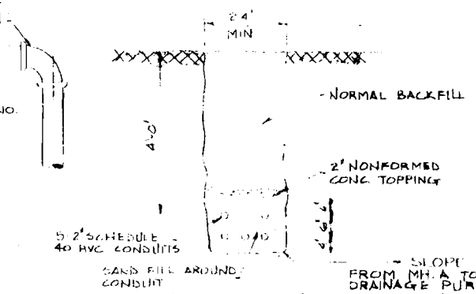
MANHOLE PLAN

SCALE 3/4" = 1'-0"

LEGEND

W.S. - WATER SURFACE

PVC. - POLYVINYL CHLORIDE

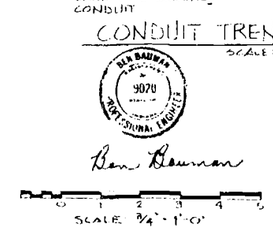


CONDUIT TRENCH DETAIL

SCALE 3/4" = 1'-0"

CONDUITS FOR:

- PH TRANSMITTER SIGNAL AND ALARM WIRES
- 1 - CAUSTIC FEED TUBING - REACTOR #1
- 1 - CAUSTIC FEED TUBING - REACTOR #2
- 1 - ACID FEED TUBING - REACTOR #1
- 1 - ACID FEED TUBING - REACTOR #2



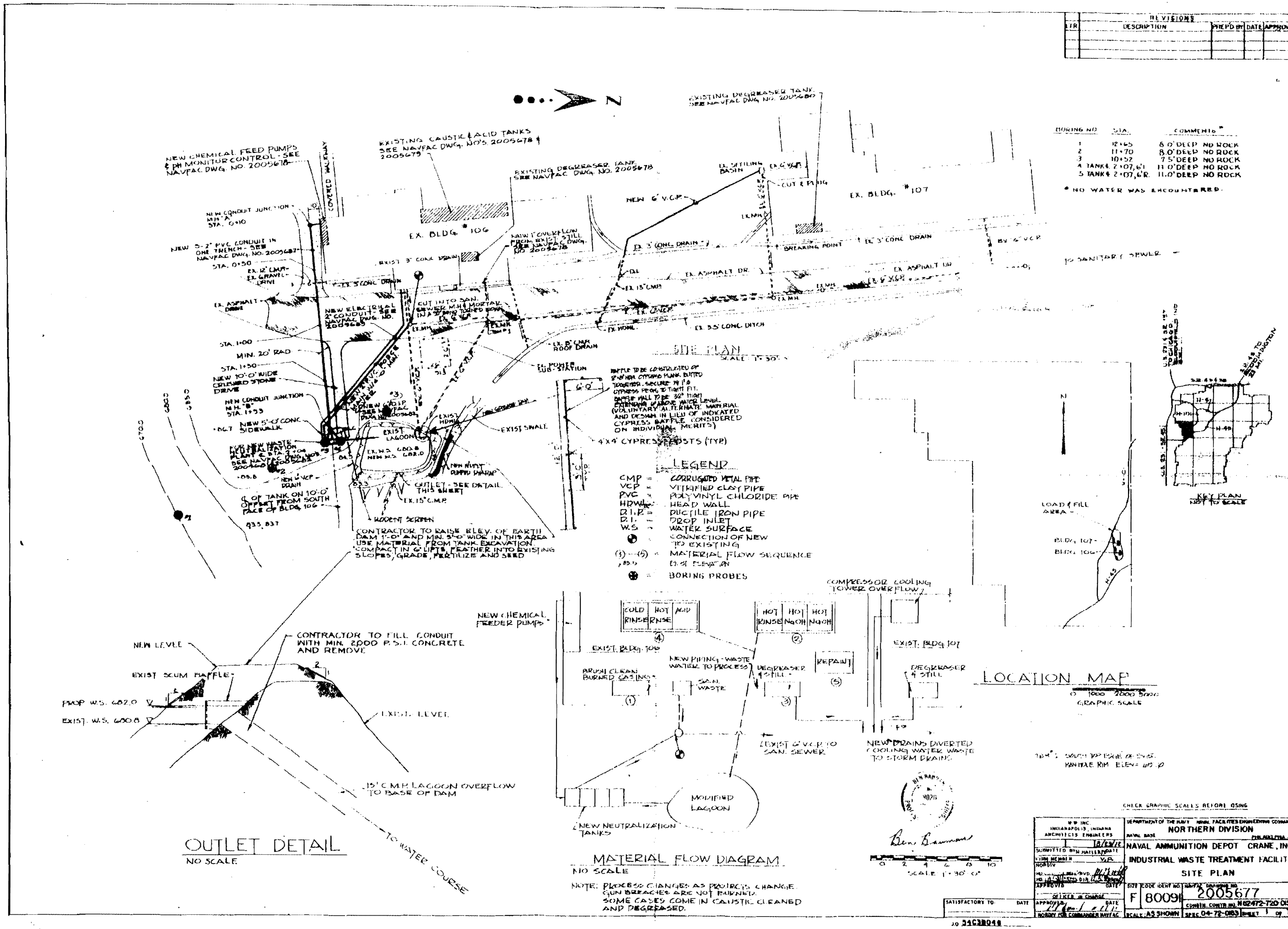
CHECK GRAPHIC SCALES BEFORE USING

H.W. INC. INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION NAVAL BASE PHILADELPHIA, PA.
SUBMITTED BY: HALLER DATE 12/29/72	NAVAL AMMUNITION DEPOT CRANE, IND.
FIRM MEMBER V.P.	INDUSTRIAL WASTE TREATMENT FACILITY
NORDIV	LAGOON OUTLET AND PULL MANHOLE
HOLMES & NARVER INC.	
APPROVED DATE	SITE CODE IDENT NO. F 80091 — NAVFAC DRAWING NO. 2005682
OFFICER IN CHARGE	
APPROVED DATE — NORDIV FOR COMMANDER NAVFAC	CONSTR CONTR NO. N62472-72C-0153
SCALE 3/4" = 1'-0"	SPEC. 04-72-0153 SHEET 5 OF 7

SATISFACTORY TO DATE

JO 54C3B048

HALF SIZE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N
EXISTING DEGREASER TANK SEE NAVFAC DWG NO. 2005680
EXISTING CAUSTIC & ACID TANKS SEE NAVFAC DWG. NO'S 2005678 & 2005679
NEW CHEMICAL FEED PUMPS & PH MONITOR CONTROL - SEE NAVFAC DWG. NO. 2005678
COVERED WALKWAY
EXISTING DEGREASER TANK SEE NAVFAC DWG. NO. 2005678
EX. SETTLING BASIN
NEW 6" V.C.P.
CUT & PLUG
EX. BLDG. # 107
EX. BLDG. # 106
NEW CONDUIT JUNCTION MH "A" STA. 0+10
NEW 5-2" PVC CONDUIT IN ONE TRENCH - SEE NAVFAC DWG. NO. 2005683
STA. 0+50
EX. 12" CMP
EX. GRAVEL DRIVE
EX. ASPHALT DRIVE
EXIST 3" CONC DRAIN
EX. 3' CONC DRAIN
BREAKING POINT
EX. ASPHALT DR.
EX. ASPHALT DR.
EX. 15" CMP
TO SANITARY SEWER
NEW ELECTRICAL 2" CONDUIT - SEE NAVFAC DWG. NO. 2005683
CUT INTO SAN. SEWER MH & MORTAR
EX. 3.5' CONC DITCH
EX. 8" CMP ROOF DRAIN
EX. POWER SUB-STATION
SITE PLAN
SCALE 1" = 30'
STA. 1+00
MIN. 20' RAD
STA. 1+50
NEW 10'-0" WIDE CRUSHED STONE DRIVE
NEW CONDUIT JUNCTION M.H. "B" STA. 1+53
NEW 5'-0" CONC SIDEWALK
EXIST LAGOON
EX. W.S. 680.8
NEW W.S. 682.0
EXIST SWALE
OUTLET - SEE DETAIL THIS SHEET
EX. 15" C.M.P.
RODENT SCREEN
℄ OF TANK ON 10'-0" OFFSET FROM SOUTH FACE OF BLDG. 106
CONTRACTOR TO RAISE ELEV. OF EARTH DAM 1'-0" AND MIN. 5'-0" WIDE IN THIS AREA USE MATERIAL FROM TANK EXCAVATION. COMPACT IN 6" LIFTS, FEATHER INTO EXISTING SLOPES, GRADE, FERTILIZE AND SEED
6'-0"
BAFFLE TO BE CONSTRUCTED OF 2" NOM. CYPRESS PLANK BUTTED TOGETHER. SECURE W/ 1/2" CYPRESS PEGS TO TIGHT FIT. BAFFLE WALL TO BE 30" HIGH EXTENDING 12" ABOVE WATER LEVEL. (VOLUNTARY ALTERNATE MATERIAL AND DESIGN IN LIEU OF INDICATED CYPRESS BAFFLE CONSIDERED ON INDIVIDUAL MERITS)
4"x4" CYPRESS POSTS (TYP)
LEGEND
CMP = CORRUGATED METAL PIPE
VCP = VITRIFIED CLAY PIPE
PVC = POLYVINYL CHLORIDE PIPE
HDWL = HEAD WALL
D.I.P. = DUCTILE IRON PIPE
D.I. = DROP INLET
W.S. = WATER SURFACE
CONNECTION OF NEW TO EXISTING
(1)-(5) = MATERIAL FLOW SEQUENCE
EXIST ELEVATION
BORING PROBES
BORING NO. | STA. | COMMENTS*
1 | 12+65 | 8.0' DEEP NO ROCK
2 | 11+70 | 8.0' DEEP NO ROCK
3 | 10+52 | 7.5' DEEP NO ROCK
4 TANK & | 2+07, 6'L | 11.0' DEEP NO ROCK
5 TANK & | 2+07, 6'R | 11.0' DEEP NO ROCK
* NO WATER WAS ENCOUNTERED.
KEY PLAN
NOT TO SCALE
LOAD & FILL AREA
BLDG. 107
BLDG. 106
LOCATION MAP
0 1000 2000 3000
GRAPHIC SCALE
NEW LEVEE
CONTRACTOR TO FILL CONDUIT WITH MIN. 2000 P.S.I. CONCRETE AND REMOVE
EXIST SCUM BAFFLE
PROP W.S. 682.0
EXIST. W.S. 680.8
EXIST. LEVEE
15" C.M.P. LAGOON OVERFLOW TO BASE OF DAM
TO WATER COURSE
OUTLET DETAIL
NO SCALE
NEW CHEMICAL FEEDER PUMPS
COLD RINSE
HOT RINSE
ACID
HOT RINSE
HOT NaOH
HOT NaOH
COMPRESSOR COOLING TOWER OVERFLOW
EXIST. BLDG. 106
EXIST. BLDG. 107
BRUSH CLEAN BURNED CASINGS
NEW PIPING - WASTE WATER TO PROCESS
SAN. WASTE
DEGREASER & STILL
REPAINT
DEGREASER & STILL
EXIST 6" V.C.P. TO SAN. SEWER
NEW DRAINS DIVERTED COOLING WATER WASTE TO STORM DRAINS
MODIFIED LAGOON
NEW NEUTRALIZATION TANKS
MATERIAL FLOW DIAGRAM
NO SCALE
NOTE: PROCESS CHANGES AS PROJECTS CHANGE. GUN BREACHES ARE NOT BURNED. SOME CASES COME IN CAUSTIC CLEANED AND DEGREASED.
MANHOLE RIM ELEV = 683.0
0 2 4 6 8 10
SCALE 1" = 30'-0"
CHECK GRAPHIC SCALES BEFORE USING
W W INC.
INDIANAPOLIS, INDIANA
ARCHITECTS ENGINEERS
SUBMITTED BY
FIRM MEMBER
NORDIV
APPROVED
OFFICER IN CHARGE
APPROVED
FOR COMMANDER NAVFAC
SATISFACTORY TO
DATE
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
NAVAL BASE
PHILADELPHIA, PA.
NAVAL AMMUNITION DEPOT CRANE, IND.
INDUSTRIAL WASTE TREATMENT FACILITY
SITE PLAN
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO. 2005677
CONSTR. CONTR. NO. N62472-72D-0183
SCALE: AS SHOWN
SPEC. 04-72-0183
SHEET 1 OF 7
J.O. 54C3B046

HALF SIZE

B.3 ALLOWABLE CONCENTRATIONS FOR PRETREATED WATER

TABLE B.3-1

MAXIMUM ALLOWABLE CONSTITUENT CONCENTRATION IN AIR STRIPPER EFFLUENT WATER
NSWC CRANE,
CRANE, INDIANA

Constituent	Wastewater Characterization Maximium (µg/L)
Volatile Organics	
1,1,1-TRICHLOROETHANE	20
1,1-DICHLOROETHANE	10
1,1-DICHLOROETHENE	10
2-BUTANONE	1,500
2-HEXANONE	1
4-METHYL-2-PENTANONE	60
ACETONE	400
CHLOROETHANE	10
CIS-1,2-DICHLOROETHENE	10
ETHYL BENZENE	10
TOLUENE	10
TOTAL XYLENES(4)	10
TRANS-1,2-DICHLOROETHENE	10
TRICHLOROETHENE	30
VINYL CHLORIDE	1
Semivolatile Organics	
1,4-DIOXANE	5
2-METHYLNAPHTHALENE(2)	10
2-METHYLPHENOL	3
3&4-METHYLPHENOL(2)	32
ACENAPHTHENE	10
ACENAPHTHYLENE	10
ACETOPHENONE	2
BENZYL ALCOHOL	10
BIS(2-ETHYLHEXYL)PHTHALATE	10
BENZO(A)ANTHRACENE	1
BENZO(A)PYRENE	1
BENZO(B)FLUORANTHENE	1
BENZO(G,H,I)PERYLENE	1
BENZO(K)FLUORANTHENE	1
BUTYL BENZYL PHTHALATE	1
CHRYSENE	1
DI-N-BUTYL PHTHALATE	1
FLUORANTHENE	1
FLUORENE	1
INDENO(1,2,3-CD)PYRENE	1
ISOSAFROLE	1
NAPHTHALENE	10
PHENANTHRENE	10
PHENOL	10
PYRENE	1

µg/L - microgram per liter.

APPENDIX C

OCCUPATIONAL HEALTH EVALUATION OF DATA FROM NSWC CRANE, BUILDING 106 POND AREA

Occupational Health Evaluation of Data From NSWC Crane Building 106 Pond Area

OBJECTIVE AND PURPOSE:

To summarize the results of an evaluation of analytical data collected from environmental samples of water, sediments and soils media associated with the Pond Area of Building 106 at NSWC Crane. The purpose of this evaluation was to determine (from a worst-case scenario) the potential impact to site personnel who may be performing work tasks associated with these media.

SCOPE:

The scope of this evaluation was focused on considerations from an occupational health perspective. Specifically, this evaluation was directed at determining the worst-case airborne concentrations that could theoretically result based on the highest concentrations of contaminants detected in the various site media associated with the Pond Area of Building 106. These worst-case airborne concentrations were then compared to published occupational exposure limits (i.e., OSHA Permissible Exposure Limits and ACGIH Threshold Limit Values). The data evaluation methodology and approach used in this evaluation is published by the American Industrial Hygiene Association (AIHA), and has been sound, standard practice in the hazardous waste industry for more than 15 years. This AIHA-published process is available online at http://www.aiha.org/1documents/SIGS/EI-tools.pdf.

As a result, the evaluation focused primarily on the inhalation route of exposure. It was assumed that occupational exposures from other routes (i.e., via ingestion and/or skin contact) would be insignificant contributors, as the substances of concern do not represent significant concerns through these routes, and that these avenues should be readily protected through following standard, sound site work practices such as the use of appropriate personal protective equipment, decontamination activities, and through practicing good personal hygiene.

CONCLUSIONS:

Tables 1, 2 and 3 present the details of the data evaluation and the basis for the conclusions reached. These tables illustrate the three perspectives of the evaluation performed. Namely, this involved:

- An evaluation of the potential airborne concentrations that could result from volatile substances released from the pond water - Table 1
- An evaluation of the contaminants in the sediments of the pond, from two perspectives: airborne particulate concentrations that would have to be generated before any inhalation concern would be approached (Table 2), and; airborne concentrations of volatile substances released from the sediments associated with the pond area (Table 3), with comparisons to relevant PELs and TLVs.

A brief explanation of the results expressed in these three tables and conclusions that were then derived are provided in the following paragraphs.

Table 1: Building 106 Pond Area Worst-Case Airborne Analysis for Volatile Substances Detected in Pond Water

This table presents the highest concentration of volatile substances that could theoretically result in the air phase immediately above the water surface level, based on the highest detected concentrations of the volatiles previously detected in the pond water. The results in this table are "worst case" as they:

- Do not take into account the lessening of the airborne concentration that would occur through dispersion and dilution (based on factors such as distance, wind direction and speed, etc.) from directly over the water surface to the breathing zone of an onsite worker
- Are instantaneous maximum concentrations. That is, they represent a very conservative comparison against OSHA PELs and ACGIH TLVs (which generally represent airborne concentrations averaged over periods of a work day, such as the 8-hour [TWA_8] and 15-minute Short Term Exposure Limit [STEL] time weighted average concentration limits)

The evaluation of the data pertaining to the pond water indicate that only one volatile substance represents any reasonable occupational health exposure concern via inhalation: that being vinyl chloride (VC). The data indicate that this substance could be present in airborne concentrations reaching nearly 18 parts per million (ppm). In comparison, the OSHA exposure limits for VC are as follows:

OSHA TWA_8 PEL[1] = 1 ppm
OSHA TWA_8 Action Level[2] = 0.5 ppm
OSHA 15-minute STEL[3] = 5 ppm

As a result, the worst-case airborne concentration is well above all three of these regulatory limits, which will warrant controls to be enacted, such as the specification and use of air monitoring devices, instrument actions levels, and the establishment and implementation of actions that are to be taken if specified monitoring instrument action levels are realized. In the case of VC, it would be appropriate to implement air monitoring with a real-time, direct reading photo-ionization detector (PID) equipped with a probe strength at or above 10.0 electron volts. If readings above daily-established background readings are noted in worker breathing zone areas, work activities in the affected area(s) should be suspended until either a more definitive evaluation can be performed to determine if the reading is indicative of the presence of VC (such as through the use of appropriate colorimetric tubes), or until the readings subside and background levels are regained in worker breathing zone areas. These restrictive actions are necessary because of the very low OSHA PEL and Action Level concentrations specified for VC, and because of the relatively poor responsiveness of a PID to detect this compound. The PID with an appropriate probe strength has a response ratio of only 50% to VC, meaning that it only indicates half of the actual concentration present in the monitored air. A flame ionization detector could be selected as an alternative device, however, it has an even poorer response ratio to VC (of only 35%).

It is noteworthy that the data indicate that aside from VC, inhalation occupational exposure concerns associated with volatile compounds are reduced as long as there is a layer of water in the pond. Therefore, if an airborne concentration of volatile organics is noted through the use of either a PID or an FID, and it is determined that VC is not present in that atmosphere, work could resume with the application of more liberal monitoring instrument action levels. In this case, action levels could be applied based on 1,1-DCE (which the data from the pond water indicate is the next-greatest controlling toxicity substance after VC), as follows:

- PID Action Level based on 1,1-DCE: 7 ppm
- FID Action Level based on 1,1-DCE: 4 ppm

These 1,1-DCE-based action levels assume that instrument readings would not be realized for more than 4 hours of any 8-hour workshift, with the other 4 hours involving no readings above daily-established

---

[1] OSHA TWA_8 PEL: The maximum 8 hour average permissible exposure concentration specified in the OSHA Vinyl Chloride standard. Any exposure above this time-averaged concentration is not only a potential occupational health concern, it is also a violation of the federal regulation.
[2] OSHA TWA_8 Action Level: The 8-hour average exposure concentration at which an employee must be included in air monitoring and medical surveillance programs
[3] OSHA 15-minute STEL: the maximum 15-minute average permissible exposure concentration specified in the OSHA Vinyl Chloride standard. Any exposure above this time-averaged concentration is not only a potential occupational health concern, it is also a violation of the federal regulation.

background levels in worker breathing zone areas. If airborne readings exceed these levels, or if the work shift exceeds 8 hours per day, then further computations would be necessary to determine appropriate modifications or interpretations of these action levels. Also, if a PID is used, a probe strength close to 10 electron volts should be used. Otherwise, the instrument would be less responsive to 1,1-DCE.

Table 2: Building 106 Pond Area Worst-Case Airborne Particulate Analysis Pond Sediments

After the pond has been dewatered, and the sediments have then been exposed, the planned work will involve various excavation activities that will involve disturbing the sediments (e.g., removing the sediments out of the pond and placing them on the surrounding grounds for dewatering and subsequent replacement or removal). As these sediments dry out, handling activities could be expected to result in the creation of airborne particulate releases, including a potential for particle generation in the respirable size ranges.

As a result, the expected nature of these planned site activities warrant an evaluation of the non-volatile substances to determine how much dust would have to be generated before an airborne concentration would be reached that could represent an occupational exposure concern via inhalation. In this type of evaluation, it is important to recognize that generally a concentration of 2.5 mg/m^3 is regarded as a minimum airborne concentration that is visible to the unaided human eye. Therefore, if such an evaluation were to conclude that a health concern would be present at dust concentrations below this "visible" level, that would warrant a need for particulate air monitoring and/or the use of air purifying respiratory protection. Otherwise, dust control and dust avoidance techniques would generally be adequate preventive measures to prevent exposures to non-volatile substances.

As indicated in Table 2, the lowest dust-in-air concentration that would have to be realized before any occupational health concern would be approached would be over 30 mg/m^3, which is a very significant amount of dust, unlikely to be encountered in the planned work. A limited, reasonable degree of the use of dust avoidance/control measures would adequately address this potential exposure concern.

Table 3: Building 106 Pond Area Worst-Case Airborne Analysis for Volatile Substances Detected in Soils

The results of the data evaluation clearly indicate that the most significant potential for occupational health exposures via inhalation exist after the protective layer of water has been removed, exposing the contaminated sediments and creating an avenue for the ready release of volatile contaminants. As indicated in Table 3, that evaluation identified seven volatile substances as contaminants of concern from an occupational health perspective. These include:

- 1,1-Dichloroethane
- 1,1-Dichloroethene (1,1-DCE)
- 1,2-Dichloroethene
- Ethyl chloride
- Toluene
- 1,1,1-Trichloroethane
- Trichloroethylene
- Vinyl chloride (VC)

Of these substances, the controlling toxicity (i.e., the substance with the most significant toxicological concern) would again be VC. Therefore, the same approach with monitoring for exceedances above background levels in worker breathing zones would be warranted, along with the benefits of an activity

such as colorimetric tube analysis to determine if the PID or FID instrument readings are indicating the presence of VC. Otherwise, the appropriate instrument action levels would be as follows:

- PID or FID Action Level based on VC: Any sustained reading in worker breathing zone areas above daily-established background levels.

If it can be determined that the instrument is responding to some substance other than VC, the more liberal action levels previously described (based on 1,1-DCE) would again be appropriate.

- PID Action Level based on 1,1-DCE: 7 ppm
- FID Action Level based on 1,1-DCE: 4 ppm

Also, it is important to note that with regard to the selection of air monitoring instruments, if a PID is selected, the device would need to have a probe strength of at least 11.0 electron volts in order to detect 3 of the 7 volatile contaminants of concern identified with the pond sediments (1,1-dichloroethane, ethyl chloride, and 1,1,1-trichloroethane. It should be noted that this is different than the PID probe strength recommendation for the air monitoring associated with activities that are performed prior to the removal of the pond water.

If real-time monitoring instrument usage indicate that these levels cannot be avoided, then personal air sampling measures would be appropriate to accurately qualify and quantify employee exposures for these volatile compounds. This would need to incorporate appropriate NIOSH and OSHA sampling methodologies for the specified contaminants of concern.

Perimeter Monitoring/Sampling Considerations

The data were also reviewed giving considerations for the need or value for the performance of air monitoring at the site perimeter. As with the onsite air phase evaluations, any discussion on perimeter monitoring should likewise be categorized from two perspectives: particulate monitoring and monitoring for gases/vapors. This evaluation also focused only on the occupational health exposure perspective. That is, this evaluation did not include any consideration for residential or other non-occupational receptor concerns.

With regard to particulate monitoring, the previous discussion summarized that the available data indicate that no reasonable inhalation exposure of solids are of concern at the pond area itself, as long as dust in air concentrations do not reach very excessive levels (i.e., over 30 mg/m^3). Therefore, the likelihood that such concentrations could be reached at the site perimeter, at some distance away from the actual pond activities, is even more remote. Therefore, there is no foreseeable need for any particulate monitoring at the boundaries of the site during the planned activities.

With regard to the volatile substances that have been detected in the water and sediments associated with the pond, the data and the planned activities indicate that the probability for appreciable concentrations to be encountered would be of greatest concern as the pond waters are being removed (exposing the contaminated sediments) and as the sediments are disturbed (through removal and dewatering). As the data presented in Table 3 indicate, there is a potential that concentrations of some volatile substances could greatly exceed established PELs and TLVs. Therefore, it would be appropriate to perform periodic monitoring at the site perimeters with the selected real-time monitoring instruments (i.e., the PID and/or the FID) during the planned activities. This perimeter monitoring should be performed if the previously-specified instrument action levels are exceeded in the work areas. Then, if airborne concentrations are found to be approaching these action levels at the site perimeter areas, then it would be appropriate to interrupt site activities until an appropriate perimeter air sampling approach could be developed and implemented. In that case, air sampling should be performed in accordance with appropriate NIOSH and OSHA air sampling methodologies for the contaminants of concern presented in this document.

Recognizing the basic nature of volatile substances, the probability for appreciable concentrations of volatile substances to be released to the air can be expected to decrease over time and through the manipulation of the media. Initially, this would create opportunities for release of these substances into the air phase, while over time this probability would be expected to decrease through the ongoing dissipation and loss of these compounds form the contaminated media.

Table 1
Building 106 Pond Area
Worst-Case Airborne Analysis for Volatile Substances Detected in Pond Water

CAS NO	CONTAMINANT	Maximum Concentr'n in site soil (ug/l)	Water Solubility (mg/l)	Vapor Pressure (torr)	Henry's Constant (atm m3/mol)	Worker Exposure Limit (ppm)	Saturation Conc. in Air (ppm)	Saturation Conc. in Air (frxn of PEL)
67-64-1	Acetone	440	1.E+6	231.	3.97E-05	500	.3	0.00
98-86-2	Acetophenone	7	6,130.	39.7	1.07E-5	10	6.23E-4	0.01%
75-34-3	1,1-Dichloroethane	99	5,060.	227.	5.62E-03	100	5.62	0.06
75-35-4	1,1-Dichloroethene	7.7	2,250.	600.	2.61E-02	5	2.07	0.41
540-59-0	1,2-Dichloroethene	140	3,500.	201.	4.08E-03	200	5.89	0.03
123-91-1	1,4-Dioxane	5	1.E+6	38.1	4.8E-6	20	2.72E-4	0.00
100-41-4	Ethyl Benzene	11	169.	9.6	7.88E-03	100	.82	0.01
75-00-3	Ethyl Chloride	89	5,680.	1,010.	1.11E-02	100	15.31	0.15
591-78-6	Methyl n-Butyl Ketone	0.9	17,400.	.116	8.47E-7	5	7.61E-6	0.00
108-10-1	Methyl isobutyl Ketone	530	19,000.	19.9	1.38E-4	50	.73	0.01
78-93-3	Methyl Ethyl Ketone	7,200	223,000.	95.3	5.69E-05	200	5.68	0.03
95-48-7	2-Methylphenol	4	26,000.	.299	1.2E-6	5	4.44E-5	0.00
108-39-4	3-Methylphenol	7	22,700.	.138	8.65E-7	5	5.6E-5	0.00
106-44-5	4-Methylphenol	7	21,500.	.11	1.E-6	5	6.47E-5	0.00
91-20-3	Naphthalene	0.34	31.7	.082	4.83E-04	10	0.0	0.00
108-95-2	Phenol	7	82,800.	.35	3.33E-7	5	2.48E-5	0.00
108-88-3	Toluene	110	526.	28.4	6.64E-03	50	7.93	0.16
71-55-6	1,1,1-Trichloroethane	200	1,500.	124.	1.72E-02	350	25.79	0.07
79-01-6	Trichloroethylene	590	1,100.	69.	9.85E-03	50	44.23	0.88
75-01-4	**Vinyl Chloride**	**40**	**8,800.**	**2,980.**	**2.78E-02**	**1**	17.79	**17.79**
1330-20-7	Xylenes	57	168.	8.	6.68E-03	100	3.59	0.04
					Total Vapor		**135.75**	**21.309**

Table 2
Building 106 Pond Area
Worst-Case Airborne Particulate Analysis Pond Sediments

CAS No.	Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)	Problem from Single Compound [5mg/m3)/ELmix]
7429-90-5	Aluminum	5	5,630	222.02	1.13E+03	0.023
7440-38-2	Arsenic	0.01	2.5	1,000.	2.50E+02	0.005
7440-39-3	Barium	0.5	49	2,545.82	9.82E+01	0.002
7440-41-7	Beryllium	0.002	0.2	2,500.	1.00E+02	0.002
7440-43-9	Cadmium	0.005	2	625.	4.00E+02	0.008
18540-29-9	Chrome (hex)	0.01	27	94.34	2.65E+03	0.053
7440-48-4	Cobalt	0.02	2.9	1,724.14	1.45E+02	0.003
7440-50-8	Copper	1	33	7,621.95	3.28E+01	0.001
84-74-2	Dibutyl Phthalate	5	0.59	2.12E+6	1.18E-01	0.000
7439-89-6	Iron (dusts)	5	8,360	149.52	1.67E+03	0.033
7439-92-1	Lead	0.05	46	272.93	9.16E+02	0.018
7439-96-5	Manganese	0.2	80	628.14	3.98E+02	0.008
7439-97-6	Mercury	0.025	0.033	1.89E+5	1.32E+00	0.000
7440-02-0	Nickel	1	5	5.E+4	5.00E+00	0.000
NA	Phthalates	5	35	3.57E+4	7.00E+00	0.000
NA	PNAs	0.2	2	2.5E+4	1.00E+01	0.000
7440-31-5	Tin	2	3.9	1.28E+5	1.95E+00	0.000
7440-62-2	Vanadium	0.05	14	919.12	2.72E+02	0.005
7440-66-6	Zinc	5	236	5,296.61	4.72E+01	0.001
	Dust Exposure Level at Mixture PEL =			**30.740**	**8.13E+03**	**0.163**

Table 3
Building 106 Pond Area
Worst-Case Airborne Analysis for Volatile Substances Detected in Soils

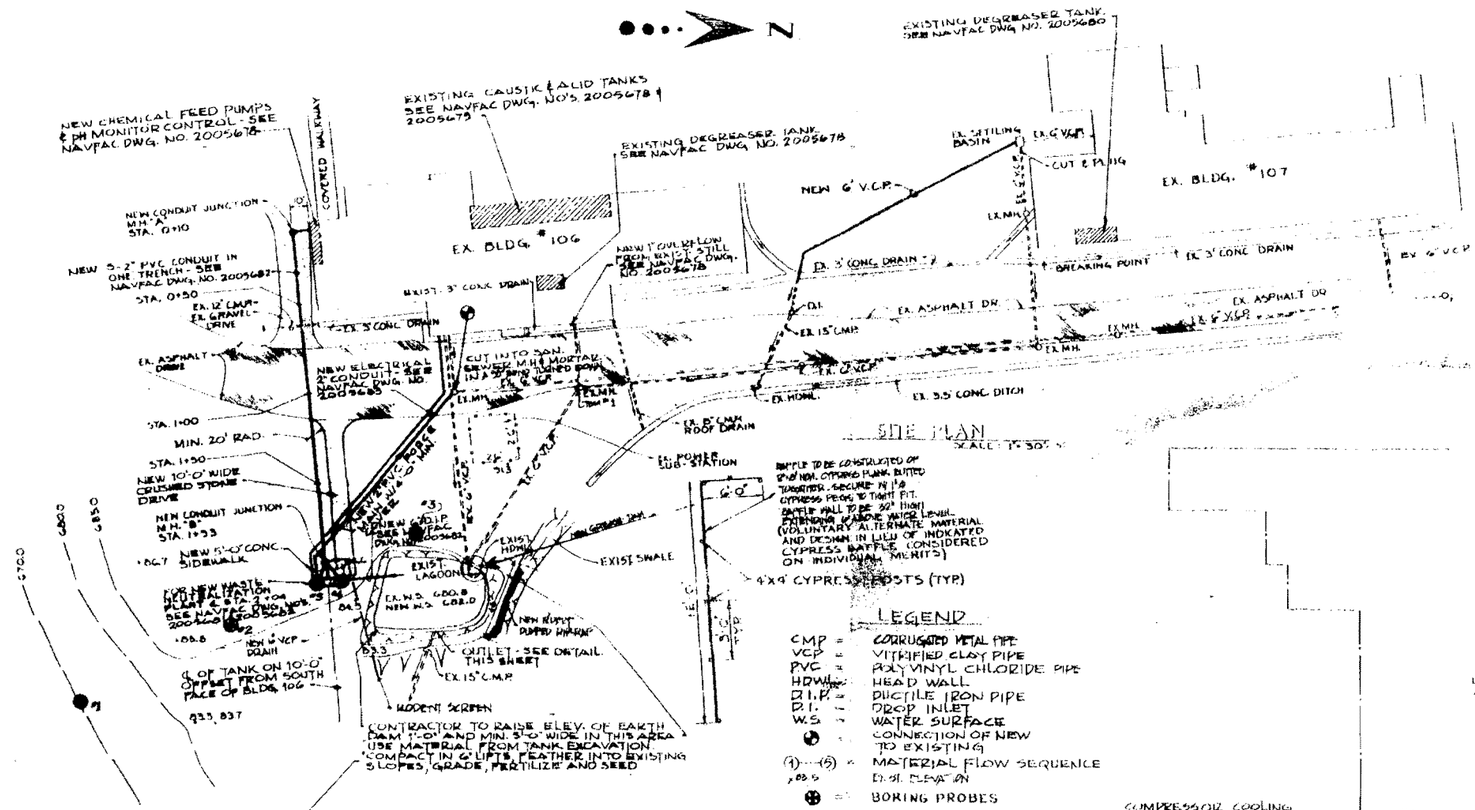
CAS NO	CONTAMINANT	Maximum Concentr'n in site soil (mg/Kg)	Water Solubility (mg/l)	Vapor Pressure (torr)	Henry's Constant (atm m3/mol)	Worker Exposure Limit (ppm)	Saturation Conc. in Air (ppm)	Saturation Conc. in Air (frxn of PEL)
67-64-1	Acetone	0.21	1.E+6	231.	3.97E-05	500	30.42	6.08%
75-15-0	Carbon Disulfide	0.014	1,190.	358.	1.44E-02	4	2.34	58.48%
75-34-3	**1,1-Dichloroethane**	**1,100**	**5,060.**	**227.**	**5.62E-03**	**100**	**123,553.62**	123,553.62%
75-35-4	**1,1-Dichloroethene**	**1,500**	**2,250.**	**600.**	**2.61E-02**	**5**	**365,102.58**	7,302,051.54%
540-59-0	**1,2-Dichloroethene**	**390**	**3,500.**	**201.**	**4.08E-03**	**200**	**27,631.72**	13,815.86%
100-41-4	Ethyl Benzene	0.006	169.	9.6	7.88E-03	100	.04	0.04%
75-00-3	**Ethyl Chloride**	**60**	**5,680.**	**1,010.**	**1.11E-02**	**100**	**46,769.85**	46,769.85%
78-93-3	Methyl Ethyl Ketone	0.87	223,000.	95.3	5.69E-05	200	42.94	21.47%
108-10-1	Methyl isobutyl ketone	0.04	19,000.	19.9	1.38E-4	50	.33	0.66%
91-20-3	Naphthalene	0.36	31.7	.082	4.83E-04	10	.08	0.83%
108-39-4	m-Cresol	1.2	22,700.	.138	8.65E-7	5	.01	0.26%
106-44-5	p-Cresol	1.2	21,500.	.11	1.E-6	5	.02	0.31%
108-95-2	Phenol	0.65	82,800.	.35	3.33E-7	5	.01	0.19%
108-88-3	**Toluene**	**95**	**526.**	**28.4**	**6.64E-03**	**50**	**1,519.25**	3,038.50%
71-55-6	**1,1,1-Trichloroethane**	**17,300**	**1,500.**	**124.**	**1.72E-02**	**350**	**163,122.**	46,606.29%
79-01-6	**Trichloroethylene**	**27,800**	**1,100.**	**69.**	**9.85E-03**	**50**	**90,769.5**	181,539.00%
75-01-4	**Vinyl Chloride**	**0.054**	**8,800.**	**2,980.**	**2.78E-02**	**1**	**70.27**	7,026.59%
1330-20-7	Xylenes	0.55	168.	8.	6.68E-03	100	2.78	2.78%
			Combined Volatile Level (in ppm)				**818,617.74**	**3.69E+5**

Assumption: Carbon in soil (fraction) = 0.02

APPENDIX D

INDUSTRIAL WATER TREATMENT FACILITY (BUILDING 2961)
CONSTRUCTION DRAWINGS

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED

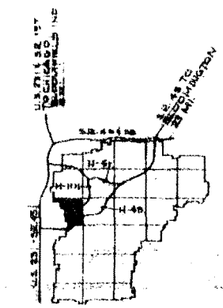


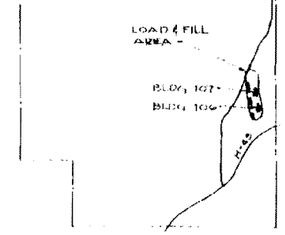
BORING NO	STA.	COMMENTS*
1	12+65	8.0' DEEP NO ROCK
2	11+70	8.0' DEEP NO ROCK
3	10+52	7.5' DEEP NO ROCK
4 TANK &	2+07, 6'L	11.0' DEEP NO ROCK
5 TANK &	2+07, 6'R	11.0' DEEP NO ROCK

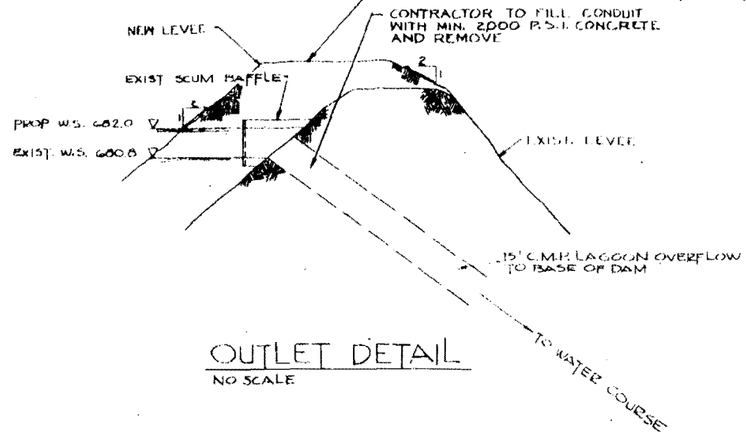
* NO WATER WAS ENCOUNTERED.

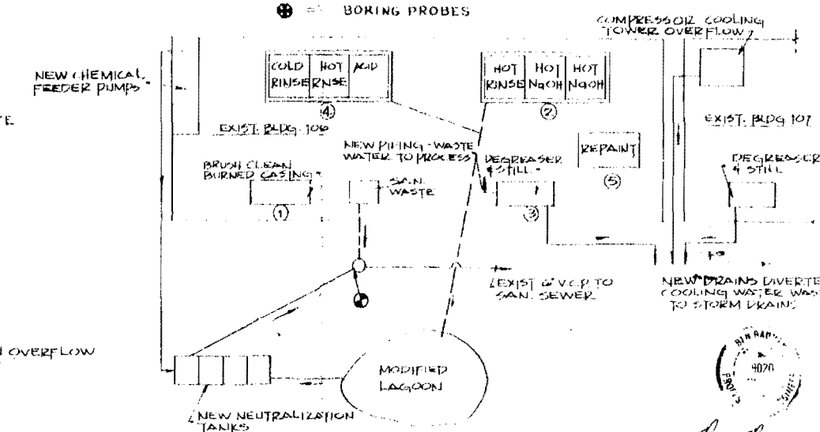
LEGEND

CMP	=	CORRUGATED METAL PIPE
VCP	=	VITRIFIED CLAY PIPE
PVC	=	POLYVINYL CHLORIDE PIPE
HDWL	=	HEAD WALL
D.I.P.	=	DUCTILE IRON PIPE
D.I.	=	DROP INLET
W.S.	=	WATER SURFACE
	=	CONNECTION OF NEW TO EXISTING
(1)---(5)	=	MATERIAL FLOW SEQUENCE
x 0.0	=	EXIST. ELEVATION
	=	BORING PROBES









NOTE: PROCESS CHANGES AS PROJECTS CHANGE. GUN BREACHES ARE NOT BURNED. SOME CASES COME IN CAUSTIC CLEANED AND DEGREASED.

TBM: SOUTH EAST EDGE OF INLET. MANHOLE RIM ELEV. = 695.0

CHECK GRAPHIC SCALES BEFORE USING

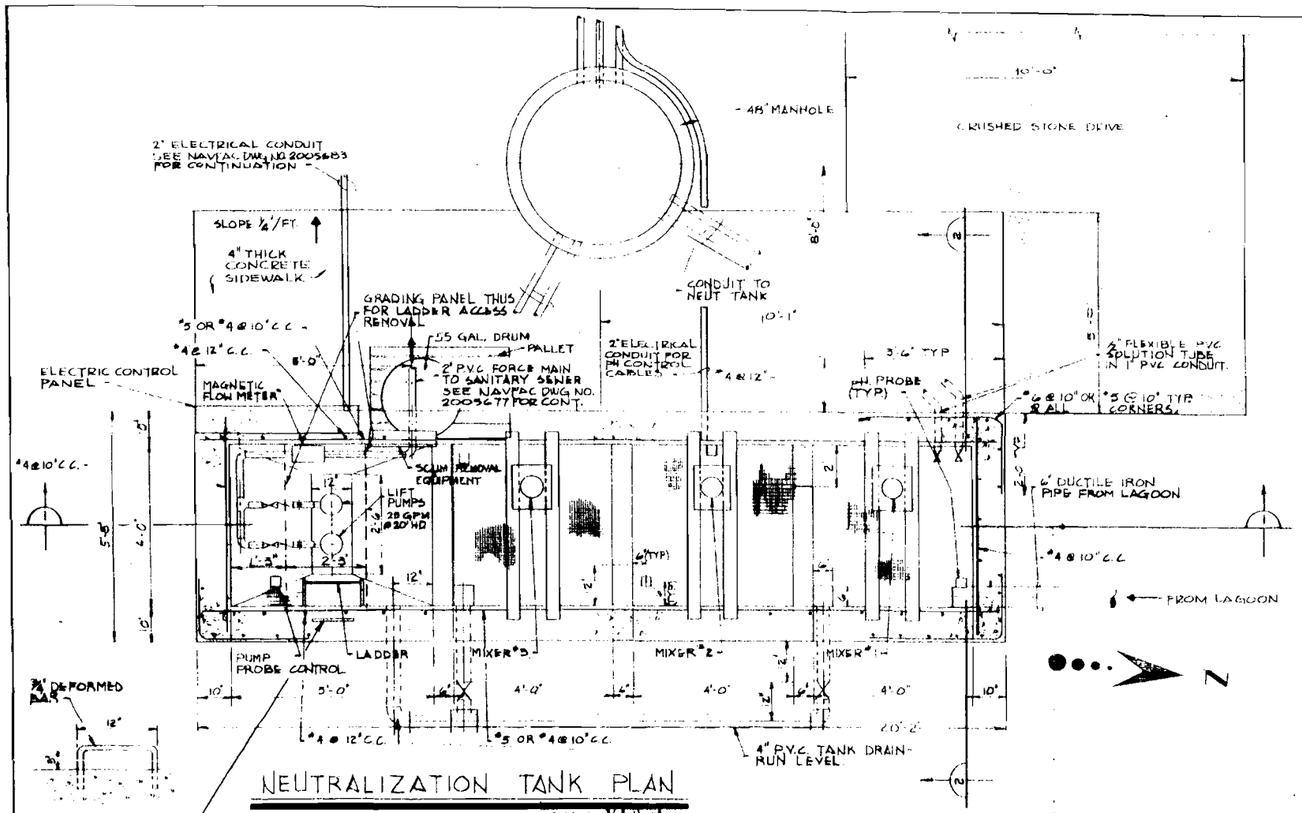
M W INC INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION NAVAL BASE PHILADELPHIA, PA.
10/29/78 SUBMITTED BY: HULLER DATE	NAVAL AMMUNITION DEPOT CRANE, IND.
FIRM MEMBER W.P.	INDUSTRIAL WASTE TREATMENT FACILITY
NORDIV	SITE PLAN
HQ. NAVFAC DIR. APPROVED DATE	
HQ. NAVFAC DIR. APPROVED DATE	SIZE CODE IDENT NO. NAVFAC DRAWING NO.
CHIEF IN CHARGE	F 80091 2005677
APPROVED DATE	CONTR. CONTR. NO. N62472-720-0053
NORDIV FOR COMMANDER NAVFAC	SCALE: AS SHOWN SPEC 04-72-0053 SHEET 1 OF 7

SATISFACTORY TO DATE

J.O. 25C28049

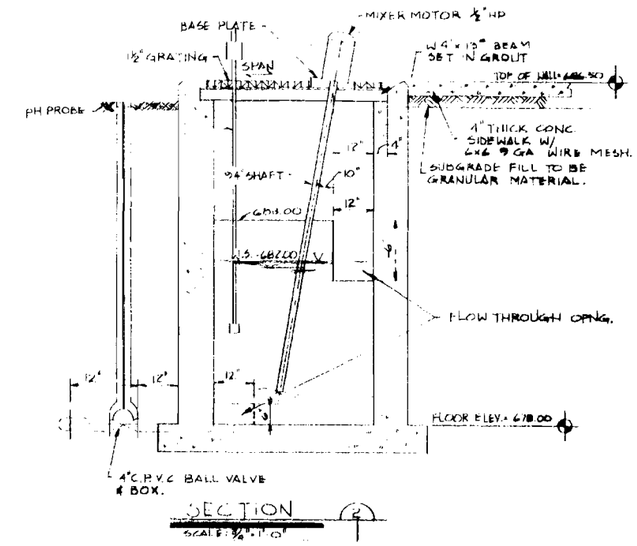
HALF SIZE

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED



NEUTRALIZATION TANK PLAN

SCALE: 3/4" = 1'-0"



SECTION

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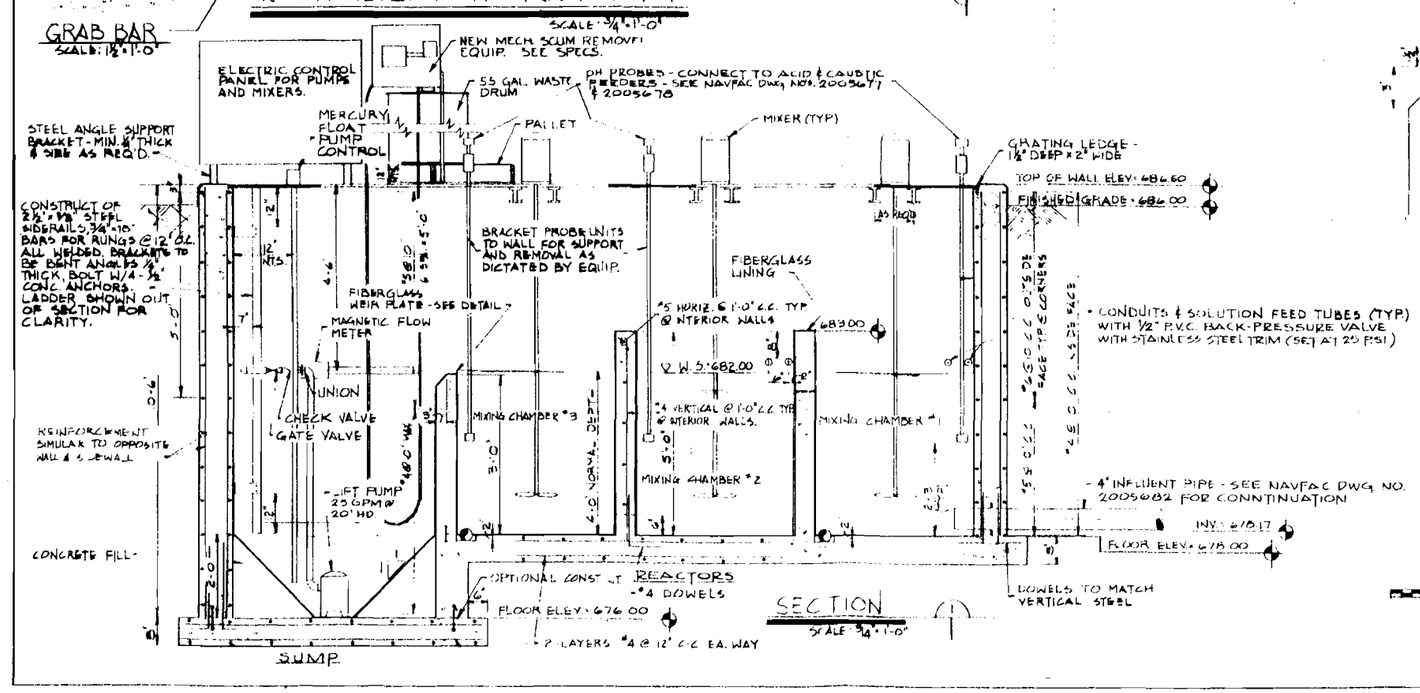
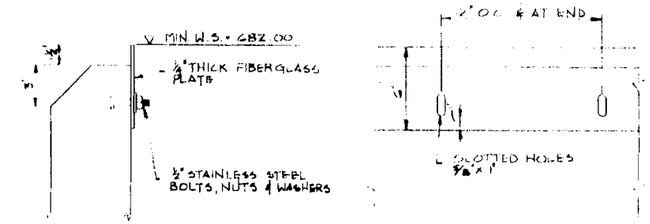


SECTION

SCALE: 3/4" = 1'-0"



WEIR PLATE DETAIL

SCALE: 3" = 1'-0"

LEGEND

W.S. - WATER SURFACE
PVC - POLYVINYL CHLORIDE

NOTE:
ALL CONSTRUCTION AND EQUIPMENT ON THIS SHEET IS TO BE NEW.

• CONDUITS & SOLUTION FEED TUBES (TYP) WITH 1/2" P.V.C. BACK-PRESSURE VALVE WITH STAINLESS STEEL TRIM (SET AT 25 PSI)

CHECK GRAPHIC SCALES BEFORE USING

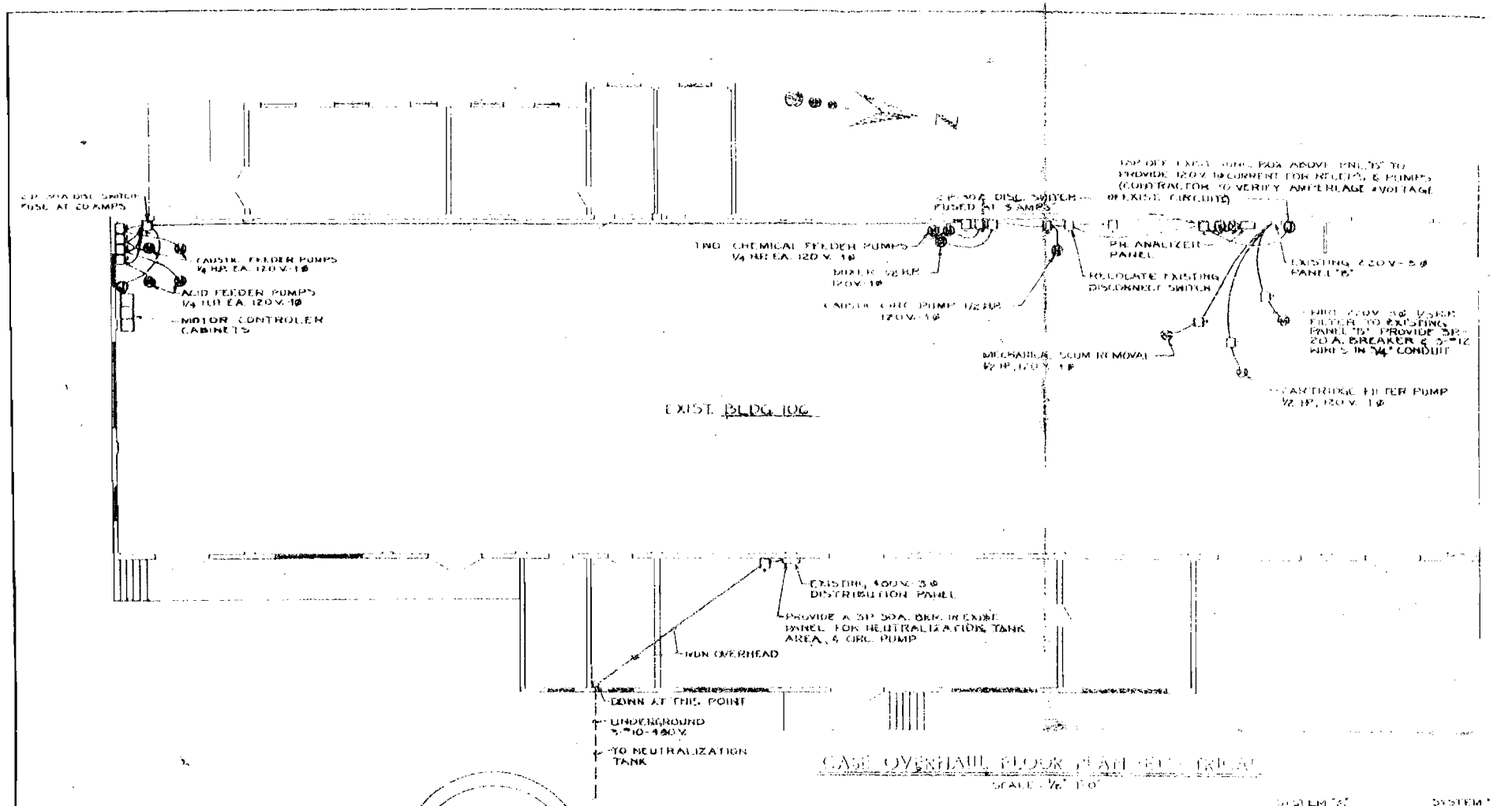
W W INC. INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION NAVAL BASE PHILADELPHIA, PA.
SUBMITTED RYB, HALLER 10/29/72 DATE	NAVAL AMMUNITION DEPOT CRANE, IND. INDUSTRIAL WASTE TREATMENT FACILITY NEUTRALIZATION TANK PLAN AND SECTIONS
FIRM MEMBER V.P.	
NORDIV	
APPROVED DATE	SIZE F CODE IDENT NO 80091 NAVFAC DRAWING NO 2005681
OFFICER IN CHARGE	CONSTR. CONTR. NO. N62472-72C-0153
APPROVED DATE	SCALE AS SHOWN SPEC. 04-72-0153 SHEET 5 OF 7
NORDIV FOR COMMANDER NAVFAC	

SATISFACTORY TO- DATE

JO 54038046

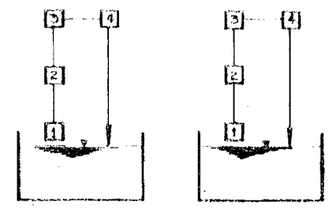
HALF SIZE

REVISIONS				
NO	DESCRIPTION	PREP'D BY	DATE	APPROVED



CAST OVERHAUL FLOOR PLAN ELECTRICAL

SCALE: 1/8" = 1'-0"

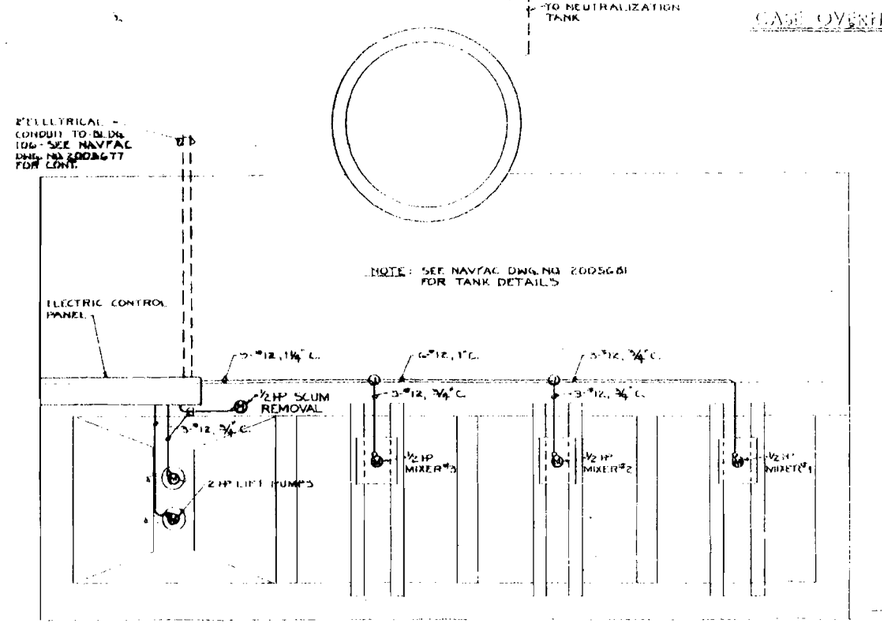


ELECTRICAL

SCHEMATIC OF CAUSTIC CONTROL

LEGEND

1 PH SENSOR
2 ANALYZER
3 INDICATING CONTROLLER
4 CAUSTIC METERING



NEUTRALIZATION TANK PLAN

SCALE: 3/4" = 1'-0"

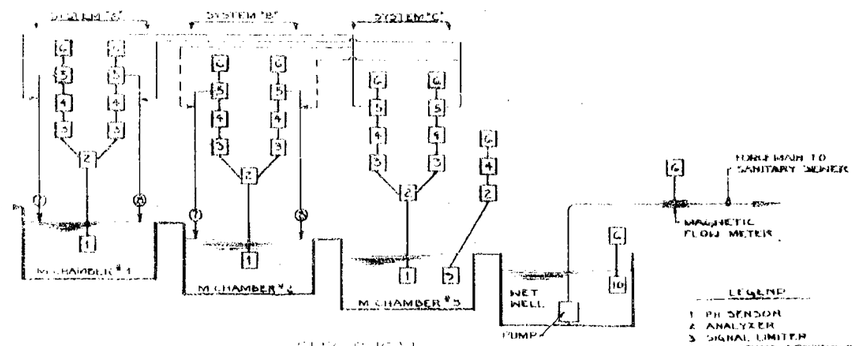
ELECTRICAL SYMBOLS

- BRANCH CIRCUIT WIRE AND CONDUIT
- BRANCH CIRCUIT WIRING BELOW GRADE
- MOTOR WITH H.P. GIVEN
- DISCONNECT SWITCH
- JUNCTION BOX
- DUPLEX RECEPTACLE

NOTE: MIN. CIRCUIT SHALL BE 2 #12 THHN WIRES IN 3/4" CONDUIT.

VERIFY: ALL VOLTAGES & FRAMES FOR POWER BY CHECKING AT THE SITE.

NOTE: ALL WORK TO BE DONE IN ACCORDANCE WITH NEC. AND OR LOCAL CODES



ELECTRICAL

SCHEMATIC OF NEUTRALIZATION CONTROL SYSTEM

LEGEND

1 PH SENSOR
2 ANALYZER
3 SIGNAL LIMITER
4 INDICATING CONTROLER
5 PROPORTIONAL DRIVER
6 TERMINAL FOR FUTURE REQ. PANEL
7 CAUSTIC METERING
8 ACID METERING
9 CONDUCTIVITY SENSOR
10 HIGH ALARM SENSOR

0 1 2 3 4 5
SCALE: 3/4" = 1'-0"

0 4 8 12
SCALE: 1/8" = 1'-0"

CHECK GRAPHIC SCALES BEFORE USING

M W INC
INDIANAPOLIS, INDIANA
ARCHITECTS ENGINEERS

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
PHILADELPHIA, PA.

NAVAL AMMUNITION DEPOT CRANE, IND.
INDUSTRIAL WASTE TREATMENT FACILITY
ELECTRICAL PLANS AND DETAILS

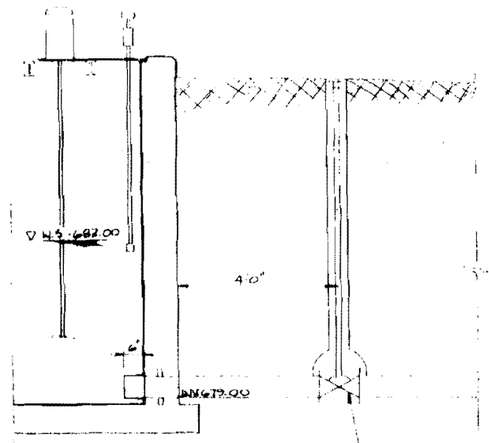
SUBMITTED BY NAVFAC 8/23/82 DATE
LINE MEMBER V.H.
NORDIV
APPROVED DATE
IN LIEU OF IN CHARGE
APPROVED DATE
NORDIV FOR COMMANDER NAVFAC

SIZE F | CODE IDENT NO. 80091 | NAVFAC DRAWING NO. 2005683
CONTR CONTR NO. N62472-72C-0053
SCALE: AS SHOWN SPEC. 04-72-0053 SHEET 7 OF 7

SATISFACTORY TO DATE

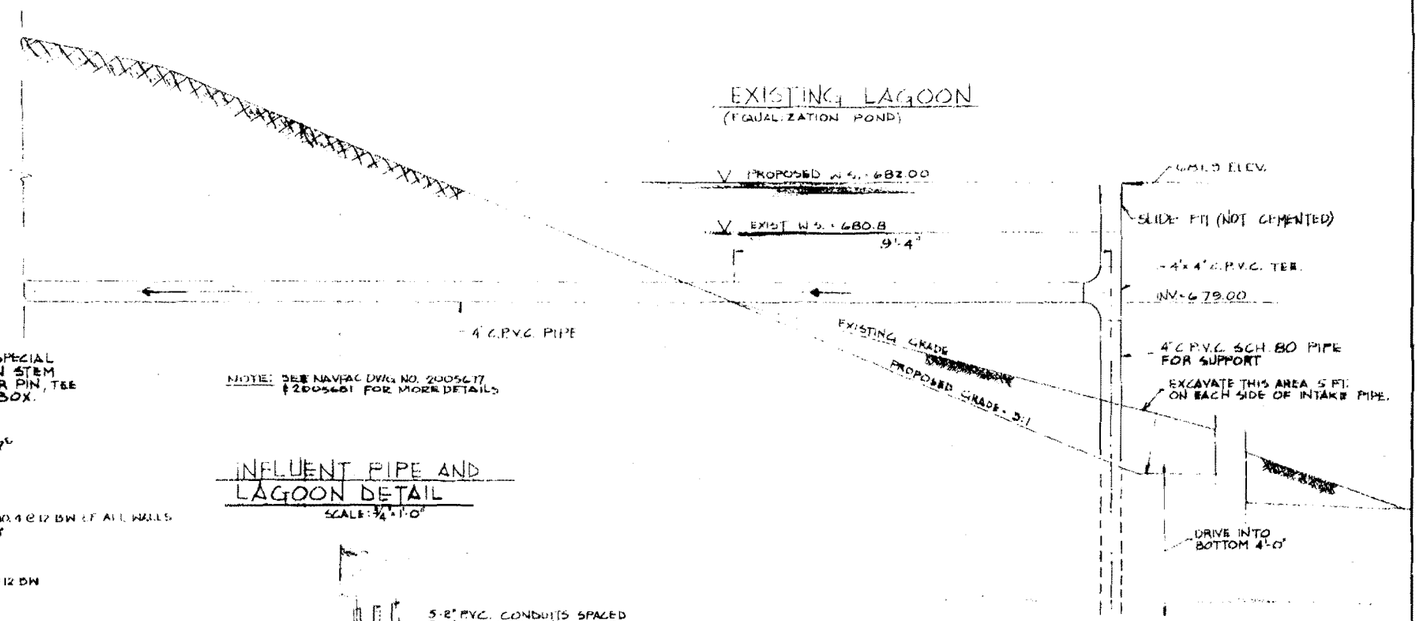
JD 54C38046

REVISIONS				
LTR	DESCRIPTION	PREPD BY	DATE	APPROVED



NEUTRALIZATION TANK

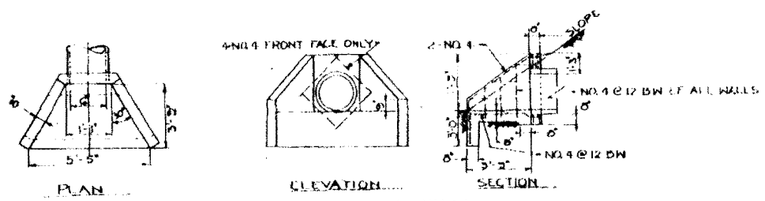
4" BALL VALVE W/SPECIAL C.P.V.C. EXTENSION STEM INCLUDING SHEAR PIN, TEE WRENCH & ROAD BOX.



NOTE: SEE NAVFAC DWG. NO. 2005677 & 2005681 FOR MORE DETAILS

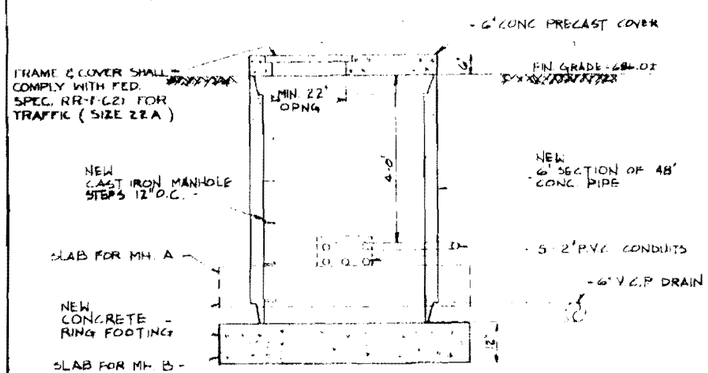
INFLUENT PIPE AND LAGOON DETAIL

SCALE: 3/4" = 1'-0"



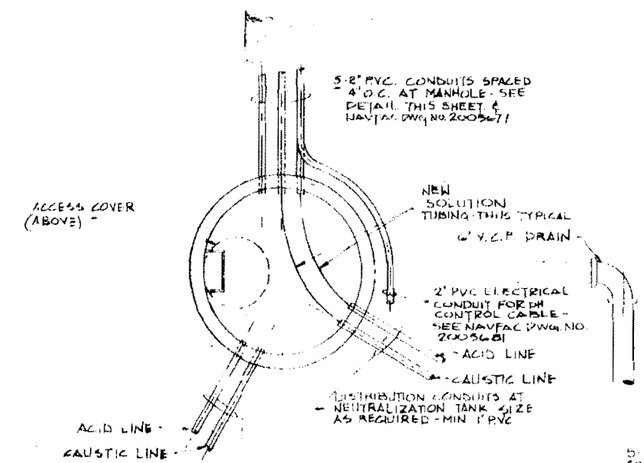
REINFORCED CONCRETE HEADWALL

NOT TO SCALE



CONDUIT PULL MANHOLE SECTION

SCALE: 3/4" = 1'-0"



MANHOLE PLAN

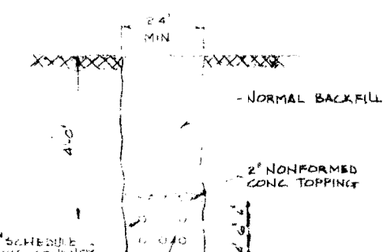
SCALE: 3/4" = 1'-0"

CONDUITS FOR:

- PH TRANSMITTER SIGNAL AND ALARM WIRES
- CAUSTIC FEED TUBING - REACTOR #1
- CAUSTIC FEED TUBING - REACTOR #2
- ACID FEED TUBING - REACTOR #1
- ACID FEED TUBING - REACTOR #2

LEGEND

W.S. - WATER SURFACE
PVC - POLYVINYL CHLORIDE



SLOPE BOTTOM OF TRENCH FROM MH. A TO MH. B FOR DRAINAGE PURPOSES.

CONDUIT TRENCH DETAIL

SCALE: 3/4" = 1'-0"

REGISTERED PROFESSIONAL ENGINEER 9070 BEN BAUMAN

Ben Bauman

0 1 2 3 4 5

SCALE 3/4" = 1'-0"

CHECK GRAPHIC SCALES BEFORE USING

J. W. INC. INDIANAPOLIS, INDIANA ARCHITECTS ENGINEERS	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION NAVAL BASE PHILADELPHIA, PA.
SUBMITTED BY: HALLER DATE 12/29/72	NAVAL AMMUNITION DEPOT CRANE, IND.
FIRM MEMBER V.P.	INDUSTRIAL WASTE TREATMENT FACILITY
NORDIV	LAGOON OUTLET AND PULL MANHOLE
HO-NAVFAC ENGINEERING COMMAND HO DIR.	
APPROVED DATE	SIZE F · CODE IDENT NO 80091 · NAVFAC DRAWING NO. 2005682
DESIGN IN CHARGE APPROVED DATE	CONTR CONTR NO. N62472-72C-0163
NORDIV FOR COMMANDER NAVFAC	SCALE 3/4" = 1'-0" · SPEC 04-72-0183 · SHEET 6 OF 7
SATISFACTORY TO DATE	

JO 54038046

HALF SIZE

APPENDIX E

SUPPLEMENTAL SPECIFICATIONS

SUPPLEMENTAL SPECIFICATIONS
INTERIM MEASURES WORK PLAN
SWMU 8 – BUILDING 106 POND
NSWC CRANE
CRANE, INDIANA

EMAC Contractor Requirements

The EMAC contractor will be responsible for performing the following work:

1. Attend pre-IMWP implementation conference.
2. Submit documentation in accordance with the Environmental Multiple Award Contract (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, including dewatering plan
        - Demolition Plan, including Hazardous Material control, Energy Lockout/Tagout
        - 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)
    - Confined Space Entry Permit (NSWCC 5100/26)
    - 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 sediment and 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 roads, soils dewatering pad, decontamination pad, material storage areas, and water pretreatment system.
7. Grub tree root systems and stumps along with identified sediments and soils. Dispose of root systems and stumps along at a solid or hazardous waste disposal facility dependent on characterization results along with excavated sediments and soils.
8. Excavate, transport, and dispose indicated sediments and soils.
9. Restore Building 106 Pond to indicated grades and revegetate where needed.
10. Restore the former Industrial Water Treatment Facility area to the level of the undisturbed surrounding grade following demolition, and revegetate.
11. Remove all temporary support facilities, leaving perimeter erosion and sediment controls in place until revegetation is complete and as instructed by the Navy.
12. Restore areas used for temporary support facilities (regrading and revegetation).
13. 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.
- Disposal facility name, address, contact name, telephone number, and 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 project CTO Closure Report to be prepared by the Navy.

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 to review 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 OICC, who shall accompany them on any subsequent site inspections. The EMAC contractor shall complete, maintain, and make available to the OICC 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 as 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 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 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 Facility operations. 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, decontamination, dewatering and water treatment 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. 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

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 as indicated. The EMAC Contractor shall carefully conserve any utilities furnished without charge.

The point 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 workmanlike manner satisfactory to the Contracting Officer, 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 NSWC Crane electric shop.

Potable Water – Potable water is not available. EMAC Contractor shall provide potable water for use by all personnel.

Water – A reasonable quantity of water is available at [Building [ ] fire station] at no charge. 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.

Telephone – Telephone service is not available.

Sanitary Facilities - Provide temporary sanitary facilities for use by all personnel in accordance with Part 3.10 Section C of the Basic Contract.

Municipal Waste – Municipal waste storage and disposal is not available.

Sewer – Water resulting from personnel and equipment decontamination, pond dewatering, excavation dewatering, and water from materials handling pad may be discharged to the NSWC Crane sanitary sewer system, subject to approval of the NSWC Crane based on characterization samples of 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 Contractor's Work Plan, and all Federal, State, and local laws and regulations. The Site Superintendent may not act in the dual role as the Project Quality Control 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 - 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 Quality Control (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 be dual hatted with 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 which included the major trades that are part of this IM.
- Alternatively, the above ten year combined experience requirement may be satisfied by providing a professional engineer registered in the State of Indiana having at least two years experience as a Project QC Manager.
- Familiar with the requirements of the U.S. Army Corps of Engineers Safety - 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 Site Health and Safety Specialist (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 effect 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 on similar projects.
- 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,
    - hazardous energy,
    - confined space,
    - health hazard recognition, evaluation and control of chemical, physical and biological agents, and
    - 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 and Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary to ensure the specified quality of work. The Contracting Officer reserves the right to interview the QC Manager at any time in order to verify his/her submitted qualifications.

The OICC and Contracting Officer 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 and Contracting Officer.

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 QC Officer.

Safety and Occupational Health Requirements

The Site Health and Safety Specialist 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 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 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. 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 manual 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 presents 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, who's signatures indicates 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 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 3 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.

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, that are generated by the Navy representatives.

Demolition

The EMAC contractor shall not begin demolition until authorization is received from the OICC. The work includes demolition and salvage of identified items and materials, and removal of resulting debris. The EMAC contractor shall remove debris from Government property daily, unless otherwise directed. Materials that cannot be removed daily shall be stored in areas specified by the OICC.

The EMAC contractor shall maintain existing utilities indicated by the OICC to stay in service and protect the utilities during IMWP implementation against damage during demolition operations. Prior to the start of work, utilities serving the former Industrial Water Treatment Facility will be shut off by the Facility. The EMAC contractor shall verify the shut off of all utilities to the demolition area.

Before, during, and after the demolition work, the EMAC contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site in the event a unsafe situation develops. No structural element will be

allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Use of demolition explosives will not be permitted.

The EMAC contractor shall remove existing aboveground and subsurface structures in the former Industrial Water Treatment Facility in their entirety and backfill any remaining subsurface voids to level of the undisturbed surrounding grades. Excavating, backfilling, and compacting procedures for soils used as backfill material to fill voids, depression, and/or excavations resulting from demolition of structures will be used.

The EMAC contractor shall remove existing utilities and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the OICC. When utility lines are encountered that are not indicated on the drawings provided in Appendix D, the OICC shall be notified prior to further work in that area. Electric meters and related equipment will be delivered to a location on the Facility in accordance with instructions of the OICC.

The EMAC contractor shall salvage shop-fabricated building appurtenances such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railing, steel studs, steel trusses, metal gutters, roofing, siding, and similar items as whole units. Scrap metal shall become the EMAC contractor's property. Scrap metal shall be recycled to the greatest extent possible as part of demolition operations and separate containers will be provided to collect scrap metal and transport to a scrap metal collection or recycle facility.

Motors, motor controllers, operating and control equipment, wiring systems, and components shall be salvaged. Loose items shall be boxed and tagged for identification. Primary, secondary, controls, communication, and signal circuits shall be disconnected at the point of attachment to their distribution system and all conduits shall be capped and sealed to prevent dust, dirt, debris, and moisture from entering.

Incandescent, mercury-vapor, and fluorescent lamps, shall be salvaged and boxed and tagged for identification and protected from breakage. All ballasts shall be checked for PCBs. If ballast containing PCBs are encountered they shall be classified as hazardous waste, labeled, and disposed properly. All fluorescent and mercury vapor lamps shall be classified as hazardous material, labeled, and disposed properly.

Switches, switchgear, transformers, conductors including wire and nonmetallic sheated and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items shall be salvaged and boxed and tagged for identification according to type and size. Transformers and capacitors containing PCBs shall be considered hazardous material, labeled and disposed properly.

Conduit shall be salvaged except where embedded in concrete or masonry. Corroded, bent, or damaged conduit shall be considered scrap metal. Straight and undamaged lengths of conduit shall be sorted according to size and type. Supports, knobs, tubes, cleats, and straps are debris to be removed and disposed. Embedded conduit shall be capped to prevent entrance of dirt, rodents, and water.

Backfilling and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished shall not begin until all demolition in the area has been completed and debris removed. Holes, open basements, and other hazardous openings shall be filled.

Debris and rubbish shall be removed from excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall be followed.

Debris, rubbish, scrap, and other non-salvageable materials resulting from removal operations shall be disposed in compliance with all applicable Federal, State, and local regulations as contractually specified. Removed materials shall not be stored on the project site.

APPENDIX F

POTENTIAL TO EMIT CALCULATIONS

CLIENT NSWC Crane		JOB NUMBER 112G00352; 14.200	Page 1 of 9
SUBJECT SWMU 8 - Building 106 Pond Sediment			
BASED ON SWMU 8 IMWP		DRAWING NUMBER N/A	
VJPlachy	CHECKED BY SWHughes	APPROVED BY	DATE 5/25/2006

Objective: 1. Determine the mass of dry sediment in the Building 106 Pond.
2. Determine the mass of the liquid phase in the Building 106 Pond.
3. Determine assumptions associated with volatile organic compounds (VOCs) and Hazardous Air Pollutants (HAPs) Potential to Emit calculations.

Inputs and Assumptions:

1. During the Interim Measures the Building 106 Pond contaminated media will include: pond water, sediments, and infiltrating groundwater.

2. The Building 106 Pond sediments consist of biological matter, soil, and water. Therefore, using a dry sediment density for calculations will overestimate the sediment mass and the VOCs and HAPs in the sediment.

3. Dry sediment density (ρ_{DRY}) = 110 lb/ft^3 (Source: Pocket Reference, Third Edition, Thomas J. Glover.)

4. Sediment moisture content:

Sample Number	Depth Range	Sample Moisture (wgt%) Total	Average
08SD004010012	0 - 12	83.3	82.75
		82.2	
08SD005010012	0 - 12	43.8	43.8
08SD004011224	12 - 24	77.8	77.15
		76.5	
08SD005011124	12 - 24	26.8	28.05
		29.3	

5. Wet sediment volume (V_{SD}) = 176 yd^3 [Source: SWMU 8 (Interim Measures Work Plan) IMWP Appendix B.1]

6. Sediment analytical is for the dry soil in sediment. Therefore, water from sediment dewatering does not contain VOCs or HAPs.

7. Building 106 Pond Water volume (V_{Pond}) = 52,510 gallons (Source: SWMU 8 IMWP Appendix B.1)

8. Infiltrating groundwater volume (V_{GW}) = 10,500 gallons (Source: SWMU 8 IMWP Appendix B.1)

9. Infiltrating groundwater is less contaminated than Building 106 Pond water. Therefore, including groundwater in the volume of the Building 106 Pond water will conservatively estimate the VOCs and HAPs in the liquid phase.

Inputs and Assumptions (Continued):

10. Average Pond Water Concentration:

Parameter	Average Concentration	HAP?
Volatile Organics (µg/L)		
1,1,1-TRICHLOROETHANE	51.00	Y
1,1-DICHLOROETHANE	33.65	Y
1,1-DICHLOROETHENE	1.77	
2-BUTANONE	1,200.27	
2-HEXANONE	0.15	
4-METHYL-2-PENTANONE	88.33	Y
ACETONE	77.55	
CARBON DISULFIDE	2.80	Y
CHLOROETHANE	34.92	Y
CIS-1,2-DICHLOROETHENE	51.72	
ETHYL BENZENE	1.83	Y
TOLUENE	18.83	Y
TOTAL XYLENES	9.50	Y
TRANS-1,2-DICHLOROETHENE	0.82	
TRICHLOROETHENE	103.33	
VINYL CHLORIDE	12.72	Y
Semivolatile Organics (µg/L)		
1,4-DIOXANE	3.80	Y
2-METHYLNAPHTHALENE	0.23	
2-METHYLPHENOL	2.00	
3&4-METHYLPHENOL	3.50	
ACENAPHTHENE	0.09	
ACENAPHTHYLENE	NA	
ACETOPHENONE	1.40	Y
BENZYL ALCOHOL	0.60	
BENZO(A)ANTHRACENE	**NA**	
BENZO(A)PYRENE	**NA**	
BENZO(B)FLUORANTHENE	**NA**	
BENZO(G,H,I)PERYLENE	**NA**	
BENZO(K)FLUORANTHENE	**NA**	Y
BIS(2-ETHYLHEXYL)PHTHALATE	0.60	
BUTYL BENZYL PHTHALATE	**NA**	
CHRYSENE	**NA**	
DI-N-BUTYL PHTHALATE	**NA**	Y
FLUORANTHENE	**NA**	
FLUORENE	**NA**	
INDENO(1,2,3-CD)PYRENE	**NA**	
ISOSAFROLE	**NA**	
NAPHTHALENE	0.09	
PHENANTHRENE	0.36	
PHENOL	3.50	
PYRENE	**NA**	

Inputs and Assumptions (Continued):

11. Average Sediment Concentration:

Parameter	Average Concentration	HAP?
Volatile Organics (µg/kg)		
1,1,1-TRICHLOROETHANE	4,780,036	Y
1,1-DICHLOROETHANE	308,056	Y
1,1-DICHLOROETHENE	364,038	
2-BUTANONE	174	
2-HEXANONE	**NA**	
4-METHYL-2-PENTANONE	8.00	Y
ACETONE	42.00	
CARBON DISULFIDE	2.80	Y
CHLOROETHANE	21,029	Y
CIS-1,2-DICHLOROETHENE	138,260	
ETHYL BENZENE	1.20	Y
TOLUENE	31,020	Y
TOTAL XYLENES	120	Y
TRANS-1,2-DICHLOROETHENE	10,205	
TRICHLOROETHENE	6,625,220	
VINYL CHLORIDE	10.80	Y
Semivolatile Organics (µg/kg)		
1,4-DIOXANE	**NA**	Y
2-METHYLNAPHTHALENE	118.50	
2-METHYLPHENOL	**NA**	
3&4-METHYLPHENOL	516.00	
ACENAPHTHENE	37.50	
ACENAPHTHYLENE	6.25	
ACETOPHENONE	**NA**	Y
BENZYL ALCOHOL	**NA**	
BENZO(A)ANTHRACENE	23.75	
BENZO(A)PYRENE	28.00	
BENZO(B)FLUORANTHENE	25.00	
BENZO(G,H,I)PERYLENE	47.00	
BENZO(K)FLUORANTHENE	11.50	Y
BIS(2-ETHYLHEXYL)PHTHALATE	8,684.00	
BUTYL BENZYL PHTHALATE	42.00	
CHRYSENE	41.75	
DI-N-BUTYL PHTHALATE	154.00	Y
FLUORANTHENE	34.00	
FLUORENE	42.00	
INDENO(1,2,3-CD)PYRENE	32.00	
ISOSAFROLE	50.00	
NAPHTHALENE	156.00	
PHENANTHRENE	718.00	
PHENOL	130.00	
PYRENE	54.00	

Inputs and Assumptions (Continued):

12. Exemption VOC PTE < 10 tpy (for sources not requiring air pollution control equipment to comply)
    Exemption VOC PTE < 5 tpy (for sources requiring air pollution control equipment to comply)
    http://www.in.gov/idem/permits/guide/air/airoperatingpermits.html#operating

13. Conversion Factors (CF):

8.33	lb	=	1	gallon
3.78	L	=	1	gallon
27	ft^3	=	1	yd^3
100	%	=	1	decimal equivalent
1	µg	=	1E-06	gram
454	g	=	1	lb
0.454	kg	=	1	lb
2,000	lb	=	1	t

14. Acronyms/Terms:

% = percent
Avg = average
CF = conversion factor
ft = feet
ft^3 = cubic feet
GW = groundwater
H_2O = water
HAP = Hazardous Air Pollutant
IMWP = Interim Measures Work Plan
in = inch
lb = pound
PTE = Potential to Emit
ρ = Ro = density
Σ = sigma = sumation
SD = sediment
SWMU = Solid Waste Management Unit
tpy = tons per year
VOC = Volatile Organic Compound
wgt% = weight percent
yd^3 = cubic yard
kg = kilogram
L = liter

Calculations:

1. Calculate the total volume of liquid (V_{Total}) associated with the Building 106 Pond Interim Measures.

$$V_{Total} = V_{Pond} + V_{GW} = 52{,}510 \text{ gallons} + 10{,}500 \text{ gallons} = 63{,}010 \text{ gallons}$$

2. Calculate the average moisture content of sediment for each depth range.

Sample Number	Depth Range	Sample Moisture (wgt%) Total	Sample Moisture (wgt%) Average	Moisture (wgt%) Depth Range
08SD004010012	0 - 12	83.3	82.75	63.3
		82.2		
08SD005010012	0 - 12	43.8	43.8	
08SD004011224	12 - 24	77.8	77.15	52.6
		76.5		
08SD005011124	12 - 24	26.8	28.05	
		29.3		

Example calculation for sediment depth range 0 - 12 inches:

$$SDAvg_{0\text{-}12} = (\Sigma \text{ Avg wgt\%}) / (\text{number of samples}) = (82.75 + 43.8) \text{ wgt\%} / (2) = 63.28 \text{ wgt\%}$$

3. Calculate the average moisture content of sediment.

$$SD_{Avg} = (\Sigma \text{ Depth Range Avg wgt\%}) / (\text{number of depth ranges})$$

$$= (63.3 + 52.6) / (2) = 57.95 \text{ wgt\%}$$

4. Calculate the avg wgt% of solids in the sediment ($wgt\%_{SD}$):

$$wgt\%_{SD} = 100 - SD_{Avg} = 100 - 57.95 \text{ wgt\%} = 42.05 \text{ wgt\%}$$

Calculations (Continued):

5. Calculate the density of the pond sediment ($\rho_{PD\text{-}SD}$).

$$\rho_{Pond\text{-}SD} = (\rho_{DRY}) * (wgt\%_{SD}) * (CF_{\%\text{-}decimal})$$

$$= 110 \ lb/ft^3 * 42.05 \ wgt\% * \left| \frac{1 \ \text{decimal equivalent}}{100 \ \%} \right| = \boxed{46.26 \ lb/ft^3}$$

6. Calculate the mass of sediment (SD_{Total}) being remediated from Building 106 Pond:

$$SD_{Total} = \rho_{Pond\text{-}SD} * V_{SD} * CF_{ft^3\text{-}yd^3} = \left| \frac{46.26 \ lb}{ft^3} \right| 176 \ yd^3 \left| \frac{27 \ ft^3}{1 \ yd^3} \right| = \boxed{\mathbf{219{,}828 \ lb}}$$

7. Calculate the volume of liquid ($H_2O_{Total\text{-}gallon}$) being remediated from Building 106 Pond:

$$H_2O_{Total\text{-}gallon} = [(V_{pond} + V_{GW})] = \left| 52{,}510 + 10{,}500 \right| gallons = 63{,}010 \ gallons$$

$$H_2O_{Total\text{-}liter} = H_2O_{Total\text{-}gallon} * CF_{Liter\text{-}gallon}$$

$$= \left| 63{,}010 \right| gallons \left| \frac{3.78 \ L}{1 \ gallon} \right| = \boxed{\mathbf{238{,}178 \ L}}$$

8. Calculate the potential to emit for the liquid (PTE_{liquid}):

Parameter	HAP?	Average Concentration	VOCs		HAPs	
			(lb)	(tpy)	(lb)	(tpy)
Volatile Organics (µg/L)						
1,1,1-TRICHLOROETHANE	Y	51.00	0.03	0.00002	0.03	0.00002
1,1-DICHLOROETHANE	Y	33.65	0.02	0.00001	0.02	0.00001
1,1-DICHLOROETHENE		1.77	0.001	0.000001		
2-BUTANONE		1,200.27	0.63	0.0003		
2-HEXANONE		0.15	0.0001	0.0000001		
4-METHYL-2-PENTANONE	Y	88.33	0.05	0.00003	0.05	0.00003
ACETONE		77.55	0.04	0.00002		
CARBON DISULFIDE	Y	2.80	0.001	0.000001	0.001	0.000001
CHLOROETHANE	Y	34.92	0.02	0.00001	0.02	0.00001
CIS-1,2-DICHLOROETHENE		51.72	0.03	0.00002		
ETHYL BENZENE	Y	1.83	0.001	0.000001	0.001	0.000001
TOLUENE	Y	18.83	0.01	0.00001	0.01	0.00001
TOTAL XYLENES	Y	9.50	0.005	0.000003	0.005	0.000003
TRANS-1,2-DICHLOROETHENE		0.82	0.0004	0.0000002		
TRICHLOROETHENE		103.33	0.05	0.00003		
VINYL CHLORIDE	Y	12.72	0.01	0.00001	0.01	0.00001

CLIENT NSWC Crane		JOB NUMBER 112G00352; 14.200	Page 7 of 9
SUBJECT SWMU 8 - Building 106 Pond Sediment			
BASED ON SWMU 8 IMWP		DRAWING NUMBER N/A	
✓JPlachy	CHECKED BY SWHughes	APPROVED BY	DATE 5/25/2006

Calculations (Continued):

Parameter	HAP?	Average Concentration	VOCs (lb)	VOCs (tpy)	HAPs (lb)	HAPs (tpy)
Semivolatile Organics (µg/L)						
1,4-DIOXANE	Y	3.80	0.0020	0.000001	0.002	0.000001
2-METHYLNAPHTHALENE		0.23	0.0001			
2-METHYLPHENOL		2.00	0.0010	0.000001		
3&4-METHYLPHENOL		3.50	0.0018	0.000001		
ACENAPHTHENE		0.09	0.00005	0.00000003		
ACENAPHTHYLENE		NA				
ACETOPHENONE	Y	1.40	0.001	0.000001	0.001	0.000001
BENZYL ALCOHOL		0.60				
BENZO(A)ANTHRACENE		NA				
BENZO(A)PYRENE		NA				
BENZO(B)FLUORANTHENE		NA				
BENZO(G,H,I)PERYLENE		NA				
BENZO(K)FLUORANTHENE	Y	NA				
BIS(2-ETHYLHEXYL)PHTHALAT		0.60				
BUTYL BENZYL PHTHALATE		NA				
CHRYSENE		NA				
DI-N-BUTYL PHTHALATE	Y	NA				
FLUORANTHENE		NA				
FLUORENE		NA				
		VOCs in liquid:	0.90	0.0005		
				HAPs in liquid:	0.15	0.0001

CLIENT NSWC Crane		JOB NUMBER 112G00352; 14.200	Page 8 of 9
SUBJECT SWMU 8 - Building 106 Pond Sediment			
BASED ON SWMU 8 IMWP		DRAWING NUMBER N/A	
BY VJPlachy	CHECKED BY SWHughes	APPROVED BY	DATE 5/25/2006

Calculations (Continued):

$$PTE_{Liquid} = [Conc_{parameter}\ (\mu g/L)] * CF_{\mu g\text{-}gram} * CF_{gram\text{-}lb} * [V_{Pond}\ (L)]$$

Example Calculation for 1,1,1-TRICHLOROETHANE

$$= \frac{51.00\ \mu g}{L} \cdot \frac{1E\text{-}06\ g}{1\ \mu g} \cdot \frac{1\ lb}{454\ g} \cdot 238{,}178\ L = 0.03\ lb$$

9. Calculate the potential to emit for the solid (PTE_{solid}):

Parameter	HAP?	Average Concentration	VOCs (lb)	VOCs (tpy)	HAPs (lb)	HAPs (tpy)
Volatile Organics (µg/kg)						
1,1,1-TRICHLOROETHANE	Y	4,780,036	1,051	0.53	1,051	0.53
1,1-DICHLOROETHANE	Y	308,056	68	0.03	68	0.03
1,1-DICHLOROETHENE		364,038	80	0.04		
2-BUTANONE		174	0.04	0.00002		
2-HEXANONE		NA				
4-METHYL-2-PENTANONE	Y	8	0.002	0.000001	0.002	0.000001
ACETONE		42	0.01	0.00001		
CARBON DISULFIDE	Y	2.80	0.001	0.000001	0.001	0.000001
CHLOROETHANE	Y	21,029	5	0.003	5	0.003
CIS-1,2-DICHLOROETHENE		138,260	30	0.02		
ETHYL BENZENE	Y	1.20	0.0003	0.0000002	0.0003	0.0000002
TOLUENE	Y	31,020	7	0.004	7.00	0.004
TOTAL XYLENES	Y	120	0.03	0.00002	0.03	0.00002
TRANS-1,2-DICHLOROETHENE		10,205	2	0.001		
TRICHLOROETHENE		6,625,220	1,456	0.73		
VINYL CHLORIDE	Y	10.80	0.002	0.000001	0.002	0.000001
Semivolatile Organics (µg/kg)						
1,4-DIOXANE	Y	NA				
2-METHYLNAPHTHALENE		118.50	0.026	0.00001		
2-METHYLPHENOL		NA				
3&4-METHYLPHENOL		516	0.11	0.0001		
ACENAPHTHENE		37.50	0.01	0.00001		
ACENAPHTHYLENE		6.25	0.001	0.000001		
ACETOPHENONE	Y	NA				
BENZYL ALCOHOL		NA				
BENZO(A)ANTHRACENE		23.75	0.005	0.000003		
BENZO(A)PYRENE		28	0.006	0.000003		
BENZO(B)FLUORANTHENE		25	0.005	0.000003		
BENZO(G,H,I)PERYLENE		47	0.01	0.000005		
BENZO(K)FLUORANTHENE	Y	11.50	0.003	0.000002	0.003	0.000002
BIS(2-ETHYLHEXYL)PHTHALAT		8,684	1.91	0.001		
BUTYL BENZYL PHTHALATE		42	0.01	0.00001		
CHRYSENE		41.75	0.01	0.00001		
DI-N-BUTYL PHTHALATE	Y	154	0.03	0.00002	0.03	0.00002
FLUORANTHENE		34	0.01	0.00001		
FLUORENE		42	0.01	0.00001		
		VOCs in sediment:	2,699	1.36		
				HAPs in sediment:	1,131	0.57

Calculations (Continued):

$PTE_{Liquid} = [Conc_{parameter}\ (\mu g/kg)] * CF_{\mu g\text{-}kg} * CF_{kg\text{-}lb} * CF_{lb\text{-}g} * [V_{SD}\ (lb)]$

Example Calculation for 1,1,1-TRICHLOROETHANE

$$= \frac{4{,}780{,}036\ \mu g}{kg} \cdot \frac{1E\text{-}06\ g}{1\ \mu g} \cdot \frac{0.454\ kg}{1\ lb} \cdot \frac{1\ lb}{454\ g} \cdot 219{,}828\ lb$$

= 1,051 lb

10. Calculate the total potential to emit for the VOCs associated with the IMWP ($PTE_{Total\text{-}VOC}$):

$PTE_{Total\text{-}VOC} = PTE_{Liquid\text{-}VOC} + PTE_{sediment\text{-}VOC}$

= 0.90 lb + 2,699 lb = **2,700 lb**

= 0.0005 t + 1.36 t = **1.36 t**

11. Calculate the total potential to emit for the HAPs associated with the IMWP ($PTE_{Total\text{-}HAP}$):

$PTE_{Total\text{-}HAP} = PTE_{Liquid\text{-}HAP} + PTE_{sediment\text{-}HAP}$

= 0.15 lb + 1,131 lb = **1,131 lb**

= 0.0001 t + 0.57 t = **0.57 t**

12. Are the total annual VOC < 10 tpy?

$PTE_{Total\text{-}VOC} < 10$ tpy ?

1.36 t < 10 tpy ?

Total project VOCs ARE LESS THAN the 10 tpy exemption limit (for sources not requiring air pollution control equipment to comply).

13. Are the total annual VOC < 5 tpy?

$PTE_{Total\text{-}VOC} < 5$ tpy ?

0.57 t < 5 tpy ?

Total project VOCs ARE LESS THAN the 5 tpy exemption limit (for sources requiring air pollution control equipment to comply).

APPENDIX G

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.

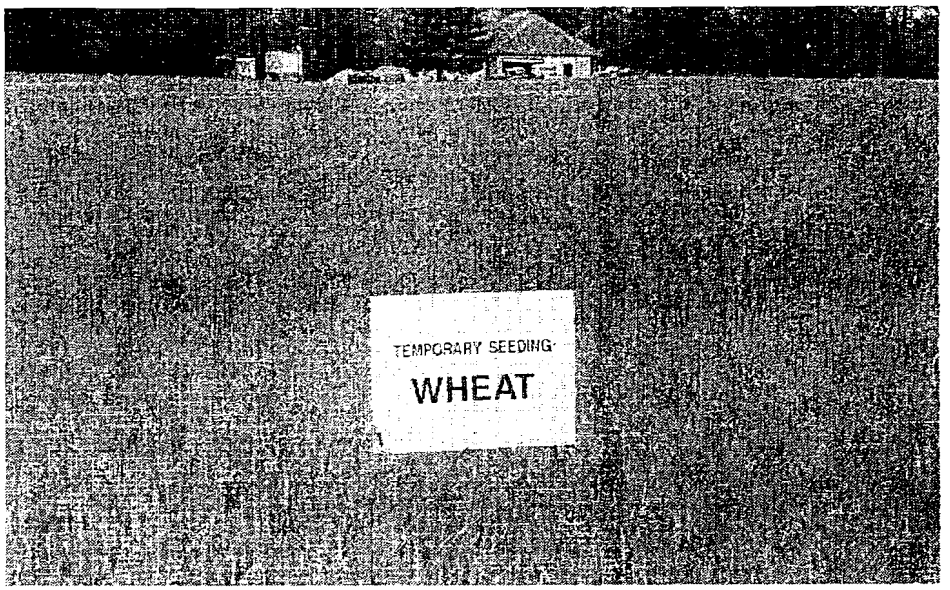


Exhibit 3.11-A. A temporary seeding of wheat to reduce erosion on a future home lot.

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.

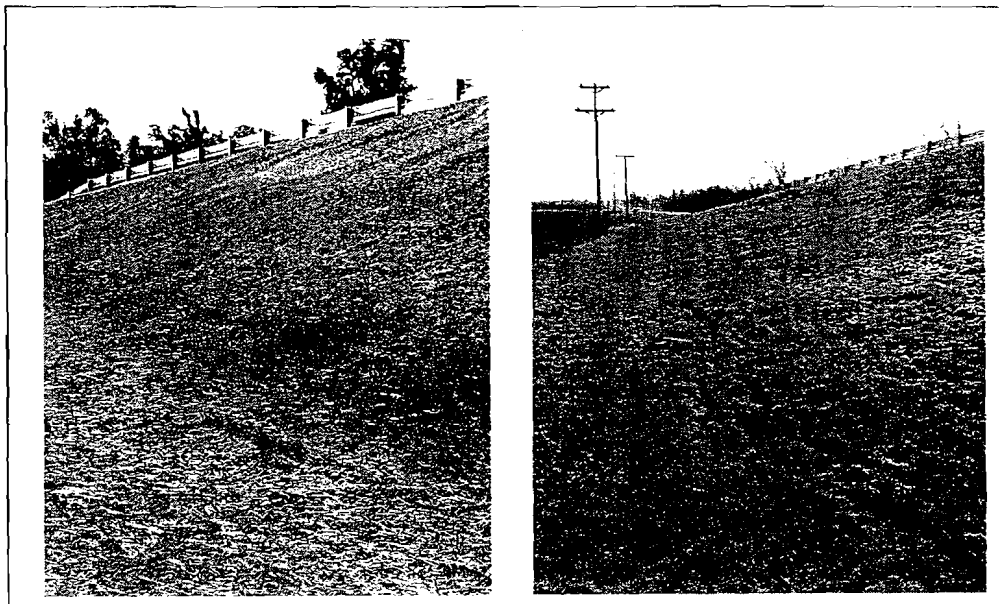


Exhibit 3.12-A. A road right-of-way (left) newly permanent seeded and mulched and (right) 6 mo. later.

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.)

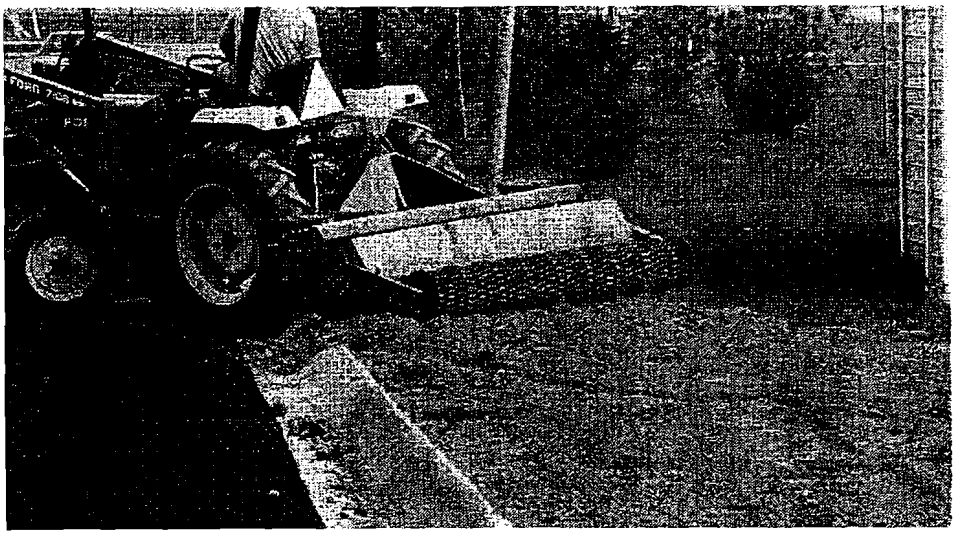


Exhibit 3.12-B. Preparing the seedbed with a combination roto-tiller and cultipacker.

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.

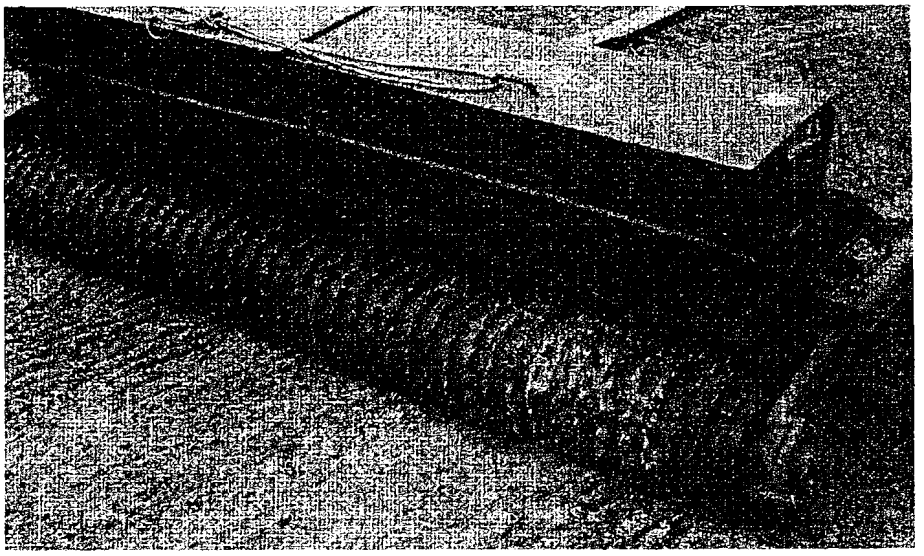


Exhibit 3.12-D. A cultipacker-seeder.

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.

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

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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.

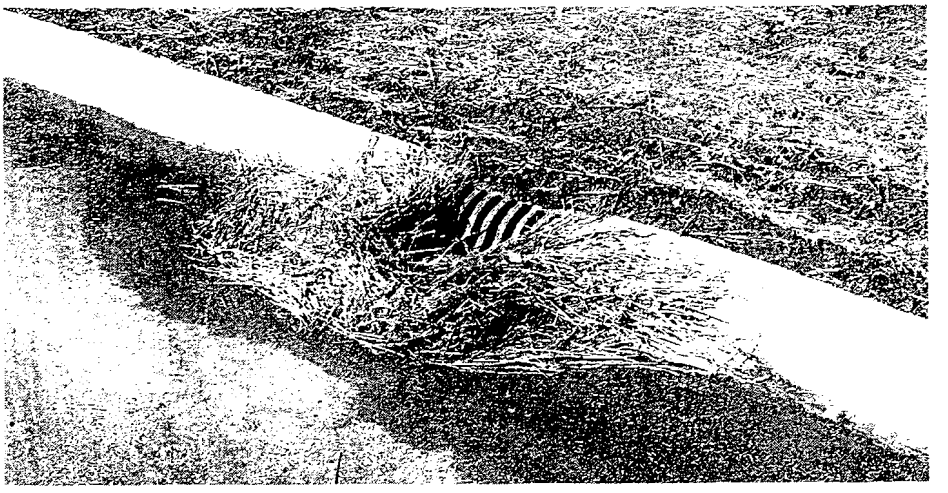

Exhibit 3.15-C. This unanchored straw mulch flowed with runoff to the storm drain. While acting somewhat as an inlet protection filter, it would have been more effective keeping soil from eroding off the site.

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.

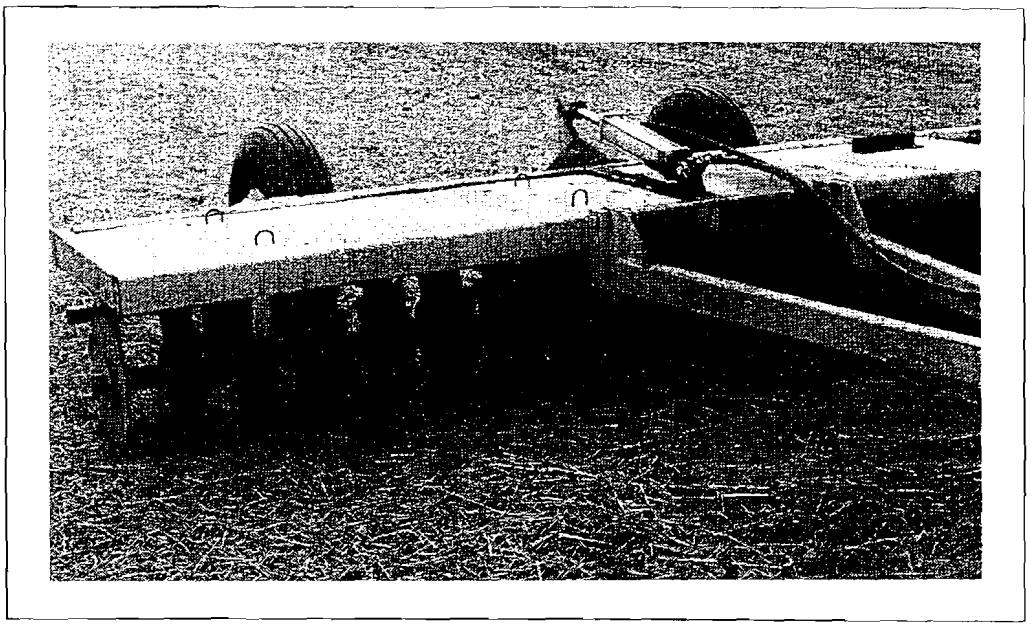

Exhibit 3.15-E. A crimper can be used to anchor mulch into the soil more securely.

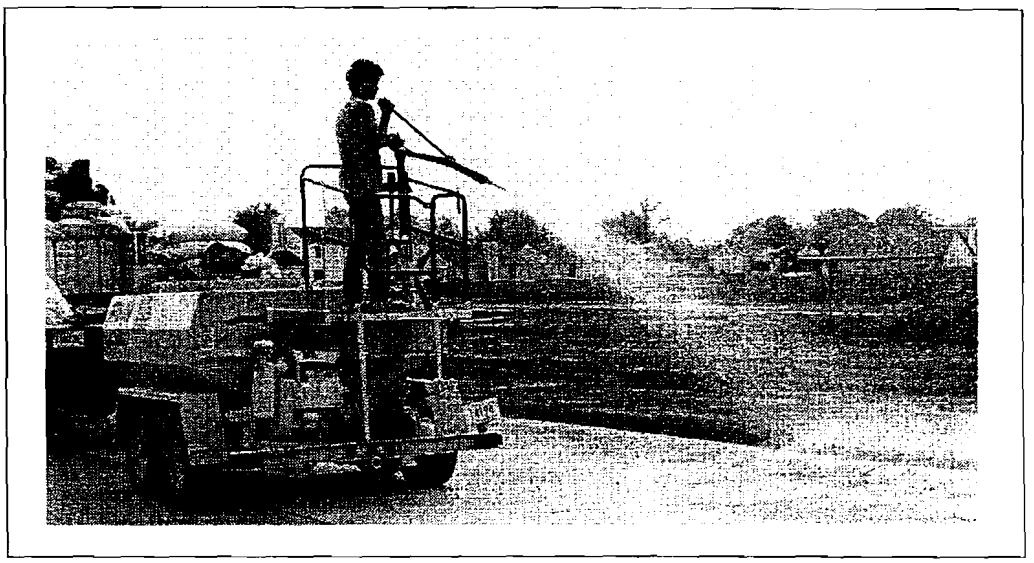

Exhibit 3.15-F. Hydroseeding the roadside in a new subdivision.

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.