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PRELIMINARY REVIEW VISUAL SITE INSPECTION REPORT FOR SOLID WASTE MANAGEMENT UNIT 18 LOAD AND FILL AREA NSA CRANE IN
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TETRA TECH NUS

Preliminary Review/ Visual Site Inspection Report for SWMU 18 – Load and Fill Area

Naval Support Activity Crane
Crane, Indiana

Naval Facilities Engineering Command Midwest

Contract Number N62472-03-D-0057

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PRELIMINARY REVIEW / VISUAL SITE INSPECTION REPORT
FOR
SWMU 18 – LOAD AND FILL AREA

NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Midwest
201 Decatur Avenue Building 1A, Code EV
Great Lakes, Illinois 60088

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

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PREPARED UNDER THE SUPERVISION OF:

TIMOTHY S. EVANS
PROJECT MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

JOHN T. TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

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ABBREVIATIONS AND ACRONYMS

µg/L	Micrograms Per Liter
°F	degrees Fahrenheit
ABG	Ammunition Burning Ground
ASD	Applied Science Division
AST	Aboveground Storage Tank
bgs	below ground surface
CAAA	Crane Army Ammunition Activity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CNIC	Commander Naval Installation Command
CTO	Contract Task Order
DoD	Department of Defense
DON	Department of the Navy
EI	Environmental Indicator
ER	Environmental Restoration
Explosive D	Ammonium picrate (also known as Yellow D)
HEPA	High Efficiency Particulate Air
HMX	High Melting Explosive
IAC	Indiana Administrative Code
IAS	Initial Assessment Study
IDEM	Indiana Department of Environmental Management
IR	Infrared
IRP	Installation Restoration Program
LAP	Load Assembly and Pack
mg/kg	Milligrams Per Kilogram
msl	Mean Sea Level
NAD	Naval Ammunition Depot
NAPEC	Naval Ammunition Production Engineering Center
NAVFAC	Naval Facilities Engineering Command
NCP	National Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NERP	Navy Environmental Restoration Program

NFA	No Further Action
NSA	Naval Support Activity
NSWC	Naval Surface Warfare
PBX	Plastic-bonded Explosive
ppm	Parts Per Million
PR	Preliminary Review
RCRA	Resource Conservation And Reclamation Act
RDX	Royal Demolition Explosive
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RISC	Risk Integrated System of Closure
SP	Special Program
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
TAL	Target Analyte List
TCE	Trichloroethene
Tetra Tech	Tetra Tech NUS, Inc.
TNT	2,4,6-Trinitrotoluene
TPH	Total Petroleum Hydrocarbon
U.S. ACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VSI	Visual Site Inspection
WES	Waterways Experiment Station
WWII	World War II
Yellow D	Ammonium picrate (also known as Explosive D)

EXECUTIVE SUMMARY

This report presents the results of the Preliminary Review (PR) / Visual Site Inspection for Solid Waste Management Unit (SWMU) 18 – Load and Fill Area at Naval Support Activity (NSA) Crane in Crane, Indiana. The scope of the PR/VSI included review of historical records, site reconnaissance, and interviews with facility personnel to assess environmental conditions relating to historical and current activities conducted at SWMU 18. The findings were used to assess whether potential releases of contaminants may have occurred from historical operations and to assess if additional investigation activities are warranted. The PR/VSI also provides the necessary information for Navy and regulatory decision-makers to determine if the site poses an imminent threat to public health or the environment and to determine if it warrants an accelerated response action.

NSA Crane is located in the southern portion of Indiana, approximately 75 miles southwest of Indianapolis and immediately east of Crane Village and Burns City. NSA Crane includes over 3,000 buildings and encompasses 62,463 acres (approximately 98 square miles) in the northern portion of Martin County, extending into neighboring Greene, Davies, and Lawrence Counties. The majority of the facility is covered by forest, with the surrounding acreage either wooded (deciduous trees and shrubs) or farmed land. SWMU 18 is located in the east-central portion of NSA Crane and encompasses approximately 1 square mile. The buildings at SWMU 18 are generally situated along two east-west trending ridges. The ridges are generally cleared and level, whereas the slopes are wooded and are steep, with relief of 150 to 200 feet. Projectile load and fill operations, powder operations, and propellant testing have been conducted at SWMU 18 throughout its operational history, beginning in the early 1940s. Load and fill operations were conducted in the northern portion of SWMU 18, principally in Buildings 101, 102, 103, 104, 105, and 189 and also in Buildings 200 and 198 in the southern portion of SWMU 18. The remaining area of the southern portion of SWMU 18 was related to research and development and testing and was referred to as the Applied Sciences Complex. Current operations within SWMU 18 include renovation, rework, and loading of munitions items, research and development, and testing.

To facilitate a more effective evaluation, due to the large size of SWMU 18 (1 square mile in area with over 100 buildings), SWMU 18 was divided into ten subareas, based on similar operations or use and geographic proximity:

- Subarea A: Building 105 Area;
- Subarea B: Buildings 101, 102, and 103 Area;
- Subarea C: Inert Operation Area;

- Subarea D: Special Program (SP) Area;
- Subarea E Building 104 Area;
- Subarea F: Buildings 2084 and 2085 Area;
- Subarea G: Applied Science Department (ASD) I Area;
- Subarea H: Building 198 Area;
- Subarea I: Building 200 Area; and
- Subarea J: ASD II Area.

Based on the findings of the PR/VSI, the following provides summaries and recommendations for the 10 subareas:

Subarea A - Building 105 Area: Subarea A includes Building 105 and the surrounding area. Buildings 105 was designed and constructed during WWII as a medium-caliber loading facility and included press loading of Explosive D operations. In the late 1960s through 1980s, Building 105 was used for press loading missile warheads, specifically Sidewinder and Sparrow missiles. In the late 1990s the facility was converted to demilitarize Explosive D-loaded projectiles. Potential contaminants at Building 105 include explosives (PBX, Explosive D, HMX, and RDX) and metals. Three recorded releases of Explosive D slurry occurred in 2003 at Building 105. Other chemicals have been reportedly used or stored at the site, including toluene, acids, and oils. The potential for contamination is considered high based on reports of the materials used at the site (principally Explosive D) and historical direct discharge of wastewaters from the site. It is recommended that additional investigation be performed at SWMU 18 Subarea A.

Subarea B – Buildings 101, 102, And 103 Area: Subarea A includes Buildings 101, 102, and 103 and associated structures, which were constructed in 1942 for the purpose of supporting Navy gun ammunition during WWII, principally black powder and smokeless powder operations. NSA Crane public works drawings state that hazardous explosive particles may have accumulated in the ceiling insulation of Buildings 101 and 102. No other contaminant releases have been reported. The potential for contamination is expected to be low, based on the materials stored, handled or used at the site (principally smokeless powder). Although the potential contamination related to other materials used in this subarea (i.e., paints and oils) is also expected to be low, it is recommended that additional investigation be performed at SWMU 18 Subarea B.

Subarea C - Inert Operation Area: Subarea C - Inert Operation Area consists mainly of Buildings 115, 119, 226, 227, and 3331 and is located in the western portion of SWMU 18. Buildings 119, 226, and 227 were originally used for inert processing and storage of projectile tanks and cases. Building 3331 was

built in 1999 and used for Army Strategic Mobility Program container maintenance. No recorded releases were identified for this subarea. Although the potential for contamination is considered to be low to medium, it is recommended that additional investigation be performed at SWMU 18 Subarea C.

Subarea D – SP Area: Subarea J includes Buildings 108, 109, 142, 143, and 2707 and the surrounding area. This area was first designed and constructed during WWII as a 20mm loading and assembly plant. The original plant consisted of Building 143 as the projectile loading building and Building 142 as the final assembly building for the cartridges. Two inert warehouses (Buildings 108 and 109) were built in this area in the early 1940s. Building 142 is currently an active ordnance testing site. Although no releases were identified, releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains. The potential for contamination is considered low to medium. It is recommended that additional investigation be performed at SWMU 18 Subarea D.

Subarea E - Building 104 Area: Subarea E includes Buildings 104, 189, and 2081 and the surrounding area. In addition, two cleared or sparsely vegetated areas were identified within the western portion of Subarea E. Buildings 104 and 189 were designed and constructed during WWII as a medium-caliber loading facility. Press loading operations in the early-1940s involved loading of Explosive D (ammonium picrate). Currently, Building 104 is used for projectile loading and is operated by CAAA. Historical releases have been identified for the Building 104 area. Wastewater from Building 104 was discharged to storm drains that discharged to the hill slopes and ultimately flowed to Boggs Creek. The wastewater effluent reportedly contained runoff from cleaning of projectile casings, phosphate coating of casings, paint booth operations, and the pressing operation vacuum system scrubber. The potential for contamination at Subarea B is considered high based on reports of the materials used at the subarea and historical direct discharge of wastewaters from the subarea. It is recommended that additional investigation be performed at SWMU 18 Subarea E.

Subarea F - Buildings 2084, 2085, And 2540 Area: Subarea F includes Buildings 2084, 2085, and 2540 and the surrounding area. Buildings 2084 and 2085 were originally used for ammunition engineering and inert storage, respectively. Building 2540 was originally used for ordnance engineering and development. Building 2084 is currently vacant, and there is no evidence of sumps, floor drains, or tanks in the building. Building 2085 remains a warehouse for inert storage. No recorded releases were identified for this subarea. The potential for contamination is considered to be low based on the reported use of this subarea. In addition, previous corrective actions addressed potential soil contamination associated with the former fuel oil underground storage tanks (USTs) at Building 199. It is recommended that additional investigation be performed at SWMU 18 Subarea F.

Subarea G – ASD I: Subarea G includes Buildings 190 and 2947, and the surrounding area. Building 190 was constructed during WWII to support loading and pressing operations in Building 198. Building 2947 was constructed in 1972 and operated as an energetics laboratory in support of pyrotechnic research and development projects. The other buildings in the subarea were constructed between the late 1960s and 2002 for support of pyrotechnics projects. Subarea G is currently an active testing site. A considerable amount of Explosive D was reportedly spilled on the driveway near Buildings 189 (Subarea B) and 190 during WWII. No other reports of contaminant releases have been identified for Subarea G. The potential for contamination is considered high based on reports of the materials handled and used at and the potential for historical direct discharge of wastewaters from the site. It is recommended that additional investigation be performed at SWMU 18 Subarea G.

Subarea H - Building 198 Area: Subarea H includes Building 198 and several support buildings/structures. Building 198 was constructed in 1944 as a medium-caliber projectile loading facility. Loading of 5-inch projectiles began in 1944, and Composition A3 processing began in Building 198 in 1945. Building 198 consisted of mechanical mix, chemical storage, press, experimental test, grit shop, machine, and paint areas. Potential contaminants at Building 198 include explosives Explosive D and degreasers related to historical operations and potential contamination related to pyrotechnics. Although no reported releases were identified, direct discharge of wastewaters containing explosives to surface drainages surrounding Buildings 198 is likely to have occurred. Releases may have also occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains. The potential for contamination for Subarea H is considered high based on reports of the materials used at the site (principally explosives) and the potential for historical direct discharge of wastewaters from the site. It is recommended that additional investigation be performed at SWMU 18 Subarea H.

Subarea I - Building 200 Area: Subarea I includes Building 200 and the surrounding area. Building 200 was designed and constructed as a major-caliber loading building in 1944, and operations at Building 200 consisted of automatic loading and packing, assembly, and painting. The building was used for cast loading of insensitive munitions (PBX) and also for loading of pyrotechnics, specifically IR flares. A fire suppression system release of water is the only documented release at Subarea I. The ceiling insulation in Building 200 is suspected to contain potentially hazardous accumulations of explosive particles. No other reports of contaminant releases have been identified. The potential for contamination is considered high based on reports of the materials handled and used at the subarea (principally explosives). It is recommended that additional investigation be performed at SWMU 18 Subarea I.

Subarea J - ASD II Area: Subarea I includes Buildings 2082 and 2083, and the surrounding area. The two main buildings (Buildings 2082 and 2083) were constructed in 1946 for use as inert materials warehouses. The other buildings in the subarea were constructed in the late 1970s to early 2000s for pyrotechnic testing. Flares extruding occurred in Building 3338. The pyrotechnic testing area is currently active. No recorded releases were identified for this subarea. Although the potential for contamination is considered to be low, it is recommended that additional investigation be performed at SWMU 18 Subarea J.

For the additional investigation, it is recommended that the investigations be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

1.0 INTRODUCTION

This report presents the results of the Preliminary Review (PR) / Visual Site Inspection (VSI) for Solid Waste Management Unit (SWMU) 18 – Load and Fill Area at Naval Support Activity (NSA) Crane in Crane, Indiana. Department of Defense (DoD), United States Navy (Navy), and United States Environmental Protection Agency (USEPA) guidance for conducting and documenting PR/VSIs were followed in preparation of this report.

This PR/VSI Report is organized into the following sections:

- Section 1 – Introduction
- Section 2 – Installation Background
- Section 3 – Physical and Environmental Characteristics
- Section 4 – Summary of Data Collection Effort
- Section 5 – Site Characteristics

Reference information (e.g., historical drawings from NSA Crane Public Works Department, historical aerial photographs, and site inspection photographs) are appended to this report.

1.1 PURPOSE

The scope of the PR/VSI included review of historical records, site reconnaissance, and interviews with facility personnel to assess environmental conditions relating to historical and current activities conducted at SWMU 18. The findings were used to assess whether potential releases of contaminants may have occurred from historical operations and to assess if additional investigation activities are warranted. The PR/VSI also provides the necessary information for Navy and regulatory decision-makers to determine if the site poses an imminent threat to public health or the environment and to determine if it warrants an accelerated response action.

1.2 PROGRAMMATIC FRAMEWORK

The regulatory structure for managing Navy environmental sites is guided by federal, state, and local laws, as well as DoD and Navy regulations and guidance. The key legislation, policy, and guidance directing the program includes, but is not limited to, the following:

- Resource Conservation and Recovery Act (RCRA) Corrective Action for Solid Waste Management Units [329 Indiana Administrative Code (IAC) 3.1-9 and 40 Code of Federal Regulations (CFR) 264 Subpart S]
- Hazardous Waste Permit Programs (329 IAC 3.1-13 and 40 CFR 270 Subparts A, B, C, and D)
- Department of the Navy (DON) Environmental Restoration Program (NERP) Manual (2006)

RCRA provides the general regulatory framework for management of solid and hazardous wastes and waste management facilities. RCRA also provides standards for corrective actions to address releases of hazardous waste and hazardous constituents from SWMUs at RCRA-permitted and interim status facilities. DoD is the lead agency for responses to hazardous waste releases at DoD sites following the provisions of Executive Order 12580 to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and National Oil and Hazardous Substances Pollution Contingency Plan (NCP). However, USEPA and states also have authority to impose corrective action under RCRA. As a matter of DON policy, CERCLA is the preferred process for conducting cleanups at facilities which are not subject to RCRA corrective action authorities. NSA Crane is subject to RCRA corrective action under its RCRA Part B permit.

1.3 PROJECT MANAGEMENT

This PR/VSI was coordinated and managed by Naval Facilities Engineering Command (NAVFAC) Midwest, which manages and executes the DON's Environmental Restoration (ER) Program; provides expertise in environmental engineering, technical, contracting, and legal support; and coordinates all DON ER actions. Tetra Tech NUS, Inc. (Tetra Tech) under Contract Task Order (CTO) F201 of Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-03-D-0057, under the DON Installation Restoration Program (IRP) of the overarching DON ER Program. The purpose of the DON ER Program is to reduce the risk to human health and the environment from legacy waste disposal operations and hazardous substance spills at DON activities, including certain oil spills that are not addressed by the CERCLA regulatory framework. The ER program goal is to provide for cost-effective and timely site assessment, planning, and remediation of identified releases consistent with DON ER Program requirements. The IRP was designed to identify and clean up past contamination from hazardous substances, pollutants, and contaminants to protect human health and safety and the environment at Navy and Marine Corps installations.

1.4 PRELIMINARY REVIEW/VISUAL SITE INSPECTION APPROACH

The RCRA implementing guidance describes the PR/VSI as a limited-scope investigation based on existing and available data. The RCRA Facility Assessment (RFA) includes a review of existing information about the facility, a visit to the facility, and if warranted, limited sampling to determine if there is an actual or potential release. This PR/VSI included an existing data assessment and site visit. The Tetra Tech data collection team conducted the on-site portion of the data collection and visual survey from May 12 to 15, 2009.

This PR/VSI is inclusive and makes use of all available data relating to activities and chemical usage at SWMU 18 at NSA Crane, including historical records, field data, anecdotal evidence, interviews with site personnel, and professional knowledge and experience. It is based, in part, on information provided in documents referenced in the appendices and is subject to the limitations and qualifications presented in the referenced documents.

2.0 INSTALLATION BACKGROUND

2.1 LOCATION AND SETTING

NSA 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 2-1). NSA Crane includes over 3,000 buildings and encompasses 62,463 acres (approximately 98 square miles) in the northern portion of Martin County, extending into neighboring Greene, Davies, and Lawrence Counties. The majority of the facility is covered by forest, with the surrounding acreage either wooded (deciduous trees and shrubs) or farmed land.

The terrain of NSA Crane is predominantly rolling, with moderately incised stream valleys throughout and occasional flat areas in the central and northern portions of the facility. Ground surface elevations across NSA Crane range from approximately 500 feet to 850 feet mean sea level (msl).

2.2 INSTALLATION HISTORY

The facility was commissioned in 1941 as the Naval Ammunition Depot (NAD) Burns City to serve as an inland munitions production and storage center for the Navy. Operations at the facility originally included production, testing, and storage of ordnance. The facility was constructed on land publicly acquired under the White River Land Utilization Project (35,000 acres) and land purchased from private ownership (26,830 acres) beginning in 1934. Prior to its acquisition by the Navy, the land was largely used for timber and agriculture (Tetra Tech, 2001). The name of the facility was changed in 1943 to NAD Crane, in 1975 to the Naval Weapons Support Center, and in 1992 to Naval Weapons Support Center (NSWC) Crane. In 2003, NSWC Crane operations fell under the command structure of NSA Crane during regional reorganization by the Navy. DoD ammunition procurement responsibility was transferred to the Army in 1977. The Army assumed ordnance production, storage, and related responsibilities at the facility, which continues to the present.

NSA Crane is the third largest United States naval installation in the world. The base includes over 3,000 buildings and covers more than 63,000 acres. More than 5,000 military and DoD civilian and contractor personnel work at NSA Crane (CNIC, 2010). Currently, NSA Crane hosts several commands and divisions, including NSWC Crane Division which provides material, technical, and logistical support to the Navy for equipment, shipboard weapons systems, and nonexpendable ordnance items. In addition, NSA Crane supports the Crane Army Ammunition Activity (CAAA) with production, renovation, storage, shipment, demilitarization, and disposal of conventional ammunition.

2.3 SWMU 18 DESCRIPTION

SWMU 18 is located in the east-central portion of NSA Crane and encompasses approximately 1 square mile (Figure 2-1). Figure 2-2 presents the SWMU 18 area on a 2005 aerial photograph. SWMU 18 is bounded on the north and south by drainages to Boggs Creek, on the east by Boggs Creek, and on the west by Highway 101. Buildings used by CAAA (and not included in SMWU 18) are located west of Highway 101. Highway 45, which parallels a surface water drainage pathway to Boggs Creek, generally bisects the site into northern and southern areas along two east-west ridges. Access to the southern portion of the site is from Highway 45, and access to the northern portion is from Highway 101. Surface elevations range from approximately 700 feet msl along western areas of the ridges to approximately 515 feet msl along Boggs Creek on the southeastern side of the site. The buildings are generally situated along the two east-west trending ridges (Figure 2-2). The ridges are generally cleared and level, whereas the slopes are wooded and are steep, with relief of 150 to 200 feet.

Projectile load and fill operations, powder operations, and propellant testing have been conducted at the site throughout its operational history, beginning in the early 1940s. Load and fill operations were conducted in the northern portion of SWMU 18, principally in Buildings 101, 102, 103, 104, 105, and 189 and also in Buildings 200 and 198 in the southern portion of SWMU 18. The remaining area of the southern portion of SWMU 18 was related to research and development and testing and was referred to as the Applied Sciences Complex. Current operations within SWMU 18 include renovation, rework, and loading of munitions items, research and development, and testing.

To facilitate a more effective evaluation, due to the large size of SWMU 18 (1 square mile in area with over 100 buildings), it was divided into ten subareas, based on similar operations or use and geographic proximity:

- Subarea A: Building 105 Area
- Subarea B: Buildings 101, 102, and 103 Area
- Subarea C: Inert Operation Area
- Subarea D: Special Program (SP) Area.
- Subarea E: Building 104 Area
- Subarea F: Buildings 2084 and 2085 Area
- Subarea G: Applied Science Department (ASD) I Area
- Subarea H: Building 198 Area
- Subarea I: Building 200 Area
- Subarea J: ASD II Area

Discussions of historical and current site operations within each SWMU 18 subarea are provided in Section 5.

[Note: SWMU 08 – Building 106 Pond – is located within the boundaries of SWMU 18. SWMU 08 is located in the eastern portion of SWMU 18. Operations in SWMU 18 Subarea D were related to operations that occurred at Buildings 106 and 107 within SWMU 08. An RFI has been conducted for SWMU 08 (Tetra Tech, 2008).]

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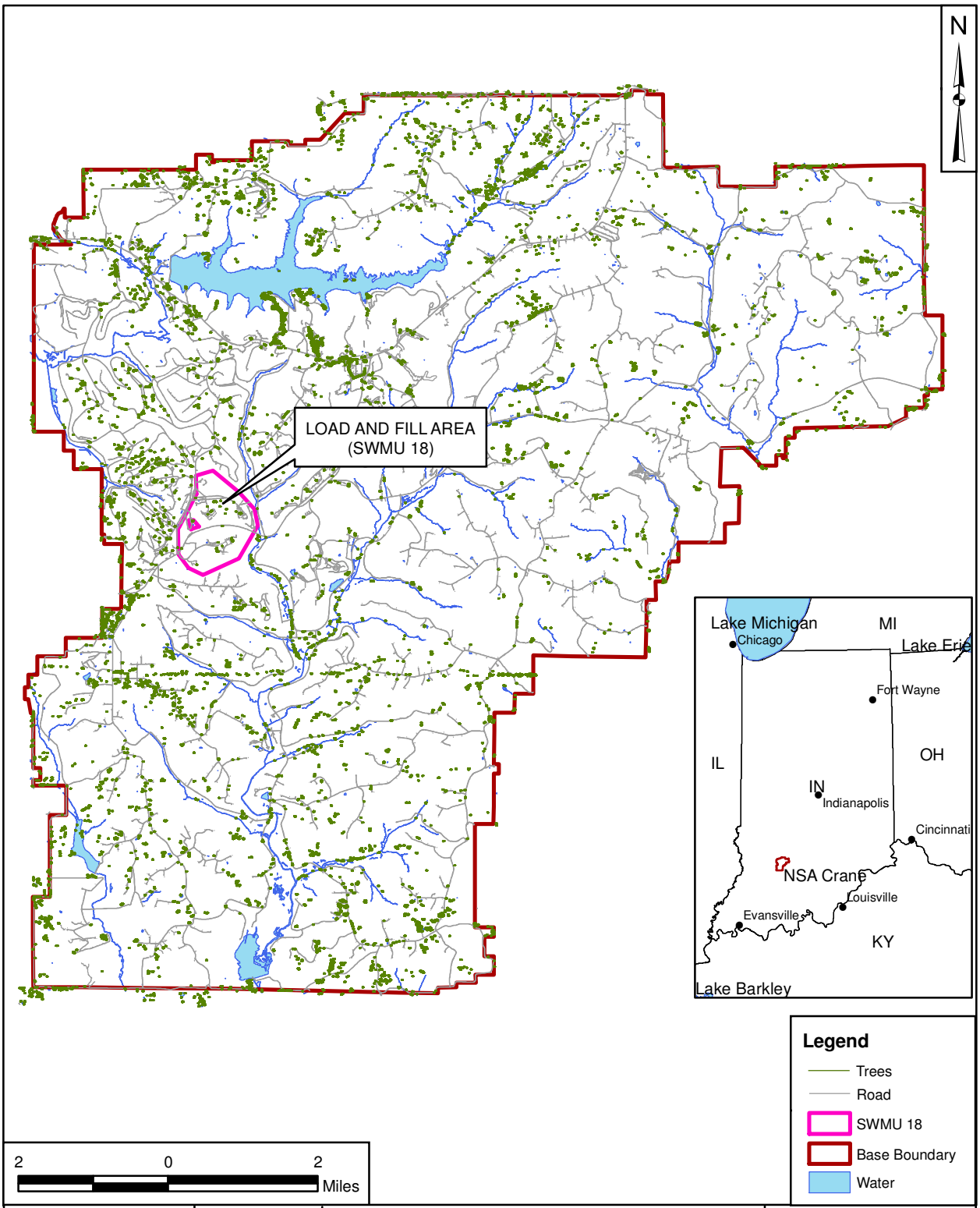

DRAWN BY	DATE			CONTRACT NUMBER
S. STROZ	12/07/10	NAVFAC	BASE AND SITE LOCATION MAP SWMU 18 - LOAD AND FILL AREA NSA CRANE CRANE, INDIANA	F201
CHECKED BY	DATE			APPROVED BY / DATE
J. DUCAR	12/07/10			___ / ___
REVISED BY	DATE			APPROVED BY / DATE
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SCALE AS NOTED				FIGURE NO. FIGURE 2-1 / REV 0

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DRAWN BY S. STROZ	DATE 11/10/10	SWMU 18 SITE LAYOUT
CHECKED BY J. DUCAR	DATE 12/23/10	SWMU 18 - LOAD & FILL AREA
REVISED BY S. STROZ	DATE 12/21/10	NSA CRANE
SCALE AS NOTED		CRANE, INDIANA

NAVFAC

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APPROVED BY ____	DATE ____
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FIGURE NO. FIGURE 2-2	REV 0

3.0 PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

The following sections provide general information for NSA Crane and SWMU 18, including climate, topography, geology, soil and vegetation types, hydrology, hydrogeology, cultural and natural resources, and endangered and special status species.

3.1 CLIMATE

NSA Crane is located in a temperate climate zone that has a wide temperature range between summer and winter. The temperature ranges from an average maximum July temperature of 89 degrees Fahrenheit (°F) to an average minimum January temperature of 26°F. Precipitation is fairly evenly distributed throughout the calendar year; maximum precipitation occurs during the spring and early summer. The average annual precipitation at the facility is 44 inches and consists of 42 inches of rain and 15 inches of snow. Average humidity ranges from 40 to 90 percent in summer and 60 to 90 percent in winter. The annual prevailing wind direction for the region is from the southwest, and the annual average wind speed for the area is about 9.6 miles per hour. The frost line in southern Indiana is approximately 2.5 feet below ground surface (bgs).

3.2 TOPOGRAPHY

The topography of NSA Crane is composed of flat to gently undulating terrain dissected by numerous well-defined drainageways. Elevations at NSA Crane SWMU 18 range from a maximum of 700 feet msl in the western part to a minimum of 510 feet msl in the eastern part of the SWMU. The V-shaped drainages in the north expand to 2,000-foot wide floodplains in the south, and rise approximately 150 to 200 feet to the ridgelines on slopes of 20 to 30 degrees.

3.3 GEOLOGY

The geology at NSA Crane is generally characterized by thin overburden deposits overlying bedrock. The overburden deposits are found from the surface to 65 feet bgs (Nohrstedt et al., 1998) and generally consist of two types: Quaternary-age unconsolidated deposits and unconsolidated residual soil derived from underlying bedrock. With the exception of minor outwash and lacustrine deposits in the northwestern comer of the facility, NSA Crane was unglaciated during the Pleistocene epoch. Bedrock underlying the Crane facility consists of sedimentary rocks from the Lower Pennsylvanian-age Raccoon Creek Group and Upper Mississippian-age Stephensport and West Baden Groups. The sedimentary bedrock beneath NSA Crane dips gently to the west-southwest.

3.3.1 Unconsolidated Deposits

The Quaternary-age deposits consist of alluvial (stream-derived sediments), colluvial (sediments deposited at the foot of a slope via gravity), and glacial outwash deposits (derived from glaciers) consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt.

Soils at NSA Crane were derived from underlying sedimentary rocks of the Lower Pennsylvanian Raccoon Creek Group and the upper Mississippian Stephensport and West Baden Groups and consist of clay, silt, sand, and fragmented and/or partially weathered bedrock.

3.3.2 Bedrock

A generalized stratigraphic column of bedrock at NSA Crane is shown on Figure 3-1, and the surficial geology for NSA Crane is illustrated on Figure 3-2. The Lower Pennsylvanian bedrock (Raccoon Creek Group) primarily consists of interbedded sandstone, siltstone, shale, and coal with a total thickness varying from 0 to more than 300 feet (Fisher, 1996). The underlying Mississippian-age bedrock (Stephensport Group) consists of limestone, shale, and sandstone ranging in thickness from 60 to 70 feet (U.S. ACE WES, 1995; Palmer, 1969). The SWMU 18 area is mapped as being underlain by Mansfield formation of the Raccoon Group. The Mansfield formation consists of alternating beds of dark shale, sandstone, mudstone, siltstone, and discontinuous coal units. Drilling at SWMU 8 (Building 106 Pond), which is located within the eastern portion of SWMU 18, did not encounter Mississippian rocks (Tetra Tech, 2008). The combined thickness of Pennsylvanian shales, sandstones, and coals at SWMU 8 was estimated to be up to 180 feet, with a basal elevation of 520 feet msl. The relief of the unconformity between the Pennsylvanian and Mississippian bedrock has been measured to be as much as 100 feet (Kvale, 1992).

3.4 SOIL AND VEGETATION TYPES

The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and Wellston-Urdothenrts complex along the sideslopes (USDA, 2010). These soil types are well suited to trees, grasses, and shallow-rooted crops but are not well suited for septic tank absorption fields. Soil erosion could occur within all types of soils located at NSA Crane if located on higher slopes along the drainage paths. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

NSA Crane contains old agricultural fields in various stages of biological succession. Openings on dry upland sites contain almost pure stands of grasses, with some clumps of woody plants such as persimmon, sassafras, and sumac. Areas that tend to be wetter have river birch, willow, sycamore, and cottonwood. Hillside communities include hickory, white and black oak, red maple, sugar maple, tulip poplar, ash, and beech (NEESA, 1983). Cleared areas at the facility have various stages of grassland, old field, and scrub/shrub vegetational forms present. Dominant tree species include black oak, white oak, pignut hickory, and yellow poplar. These stands are relatively young, with average tree diameter ranging from 6 to 12 inches. Shrubs are present in these areas, and leaf litter, limbs, and saplings cover the understory.

3.5 HYDROLOGY

NSA Crane is located within the Lower East Fork White watershed, approximately 10 miles northwest of the East Fork White River. The East Fork White River flows approximately 40 miles southwest before joining the Muscatatuck River, which eventually joins the Ohio River.

The surface drainage at NSA Crane has formed a dense dendritic pattern throughout the installation. Six creeks in four drainage basins (I through IV) carry surface water off the installation (Figure 3-3). Drainage from the basin in the extreme eastern part of NSA Crane consists of several small drainageways. The northern and northwestern drainage basins eventually empty into Furst Creek, which flows in a westerly direction and leaves the installation. Rainey Hollow, Sulphur Creek, and Little Sulphur Creek drain the eastern basin. Drainage Basin IV consists of Boggs and Turkey Creeks, which are the primary drainageways and drain the majority of the installation. SWMU 18 lies within this drainage basin.

3.6 HYDROGEOLOGY

Groundwater resources at NSA Crane had been studied to a limited extent prior to the early 1980s (NEESA, 1983). Six exploratory wells had been drilled across NSA Crane prior to the 1980s to evaluate the potential for groundwater use development, and limited water quality studies have been performed. NSA Crane uses water from Lake Greenwood for human consumption, process operations, recreation, and several soil and water conservation ponds. However, the existing lithologies, occurrences of springs and seeps, and well-developed surface drainage indicate the existence of groundwater that is hydraulically connected to the surface environment. Available groundwater data from the 1940s indicates that limited water is located at 141 and 313 feet bgs, with the shallowest water level observed at 85 feet bgs.

The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with the overburden/unconsolidated material and one associated with bedrock. The shallow groundwater is

probably transient; during periods of excessive prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. The shallow groundwater dissipates by percolation into bedrock and into intermittent or perennial streams. The groundwater associated with bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone. The shale beds should be the least permeable of the series and, where underlying a permeable sandstone or limestone, would support a saturated or free-water zone. These shale zones grade laterally to zones of sandstone, so the downward percolating water would be free to move continually downward (NEESA, 1983).

3.7 CULTURAL AND NATURAL RESOURCES

NSA Crane is considered historically significant as the primary ammunition depot for the east coast requirements of the Navy; however, according to the Cultural Resources Survey completed in June of 1992, there were no previously identified historic resources on the installation, and no buildings or structures were listed in local or state inventories or the National Register of Historic Places. The survey did identify a total of 19 historic or prehistoric locations or possible locations that were recorded on state survey forms. In addition, six building locations may have been eligible for listing on the National Register of Historic Places. However, according to the Indiana Department of Natural Resources Historic Preservation and Archaeology Department, no historical or archaeological sites located at NSA Crane are listed on the National Register of Historic Places or the state inventory (Malcolm-Pirnie, 2005).

There are at least 14 caves on NSA Crane, which range in size from small crevices or pits to the 1,500-foot cave that has been mapped as the Aunt Liz Cave. Cave exploration is not permitted for safety reasons and to prevent disturbances of bats that inhabit some of the caves.

Twenty-eight cemeteries are located within NSA Crane's boundaries, ranging in size from single graves to the nearly 700 graves in Salem Cemetery. Many of the early settlers of the area are buried in these cemeteries. Based on mapping from NSA Crane, no cemeteries are present within the boundary of SWMU 18.

NSA Crane is vitally concerned with the conservation of the natural environment, both on and off the installation. The Navy and the DoD have recognized these efforts with awards for excellence in natural resources management. In 1995 and 1996, NSA Crane won the Chief of Naval Operations Award for the best natural resources program. NSA Crane has opened its 800-acre Lake Greenwood to the public for fishing and boating.

NSA Crane provides stewardship to over 63,000 acres of land, of which about 49,000 acres are forested. This is the largest forested tract of land in Indiana under a single ownership. The NSA Crane forest has been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Wildlife research is conducted at NSA Crane by both Purdue University and Indiana University to observe species, number, and overall condition of the wildlife located at NSA Crane. The timber is managed and harvested at NSA Crane to provide income for the installation and associated counties (Malcolm-Pirnie, 2005).

3.8 ENDANGERED AND SPECIAL STATUS SPECIES

Protected species that are known or have the potential to inhabit NSA Crane are listed in Table 3-1.

TABLE 3-1

ECOLOGICAL SPECIES AT NSA CRANE
SWMU 18 – LOAD AND FILL AREA
NSA CRANE, INDIANA

Federal Endangered	Indiana Bat (*Myotis sodalis*)
Federal Threatened	None
State Endangered	Bobcat, osprey, yellow-crowned night heron, and timber rattlesnake
State Threatened	Bald eagle (*Haliaeetus leucocephalus*)
Other Ecological Receptors	Approximately 30 species of mammals including whitetail deer, raccoon, cottontail rabbit, and wild turkey, Giant Canadian Geese, and ruffed grouse. Over 100 species of birds including the bald eagle, wood duck, barn swallow, and marsh hawk. Over 45 species of fish including bluegill, crappie, largemouth bass, and channel catfish. Approximately 20 species of reptiles including the snapping turtle, northern copperhead, and eastern spiny softshell turtle. Approximately 20 species of amphibians, including the bullfrog, spotted salamander, and gray tree frog. Vegetation includes several types of edible mushrooms and ginseng.

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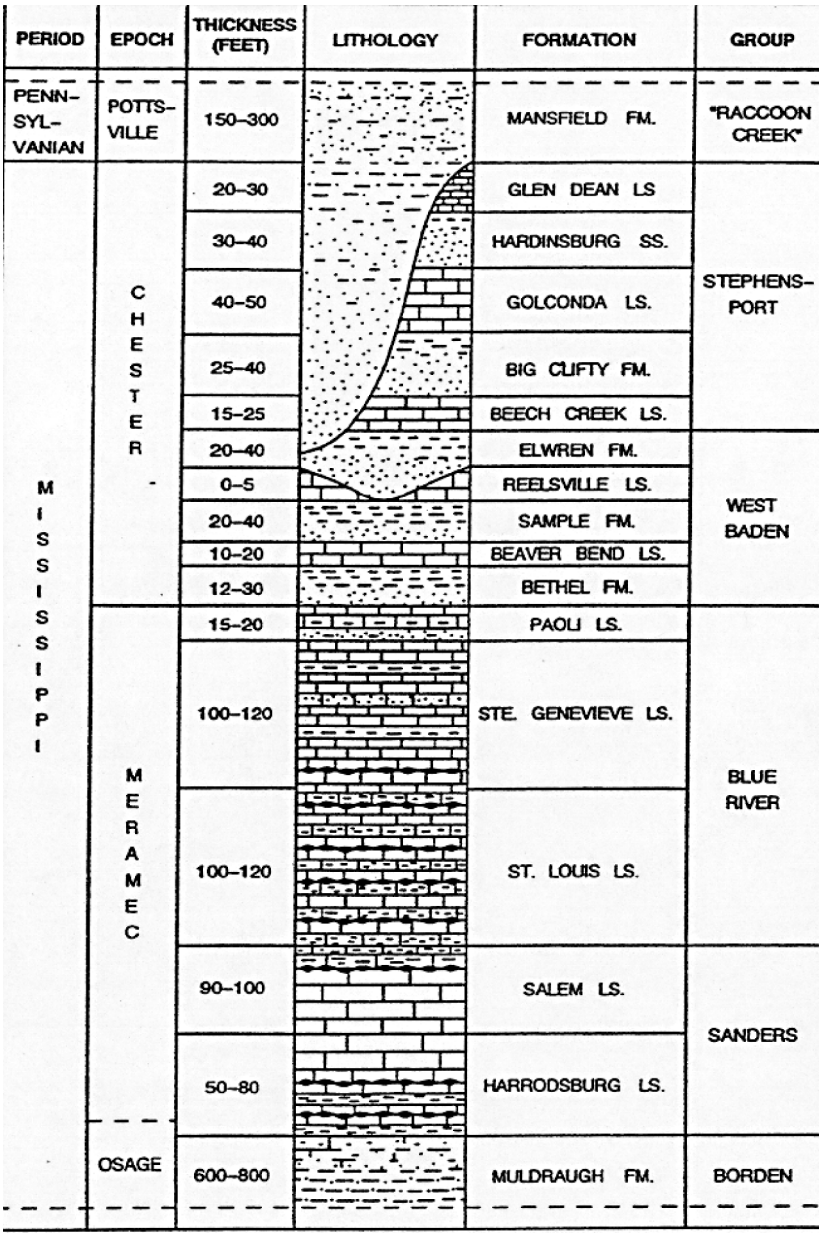

Source: Draft Report, RCRA Facility Investigation
Phase II Groundwater Release Assessment, SWMU 06/09
Demolition Area and Phase III Release
Characterization SWMU 07/09 Old Rifle Range
November 1995 - Figure 13
by William L. Murphy and Roy Wade

DRAWN BY S. STROZ DATE 12/01/10	NAVFAC	GENERALIZED STRATIGRAPHIC COLUMN SWMU 18 - LOAD AND FILL AREA NSA CRANE CRANE, INDIANA	CONTRACT NUMBER CTO F201
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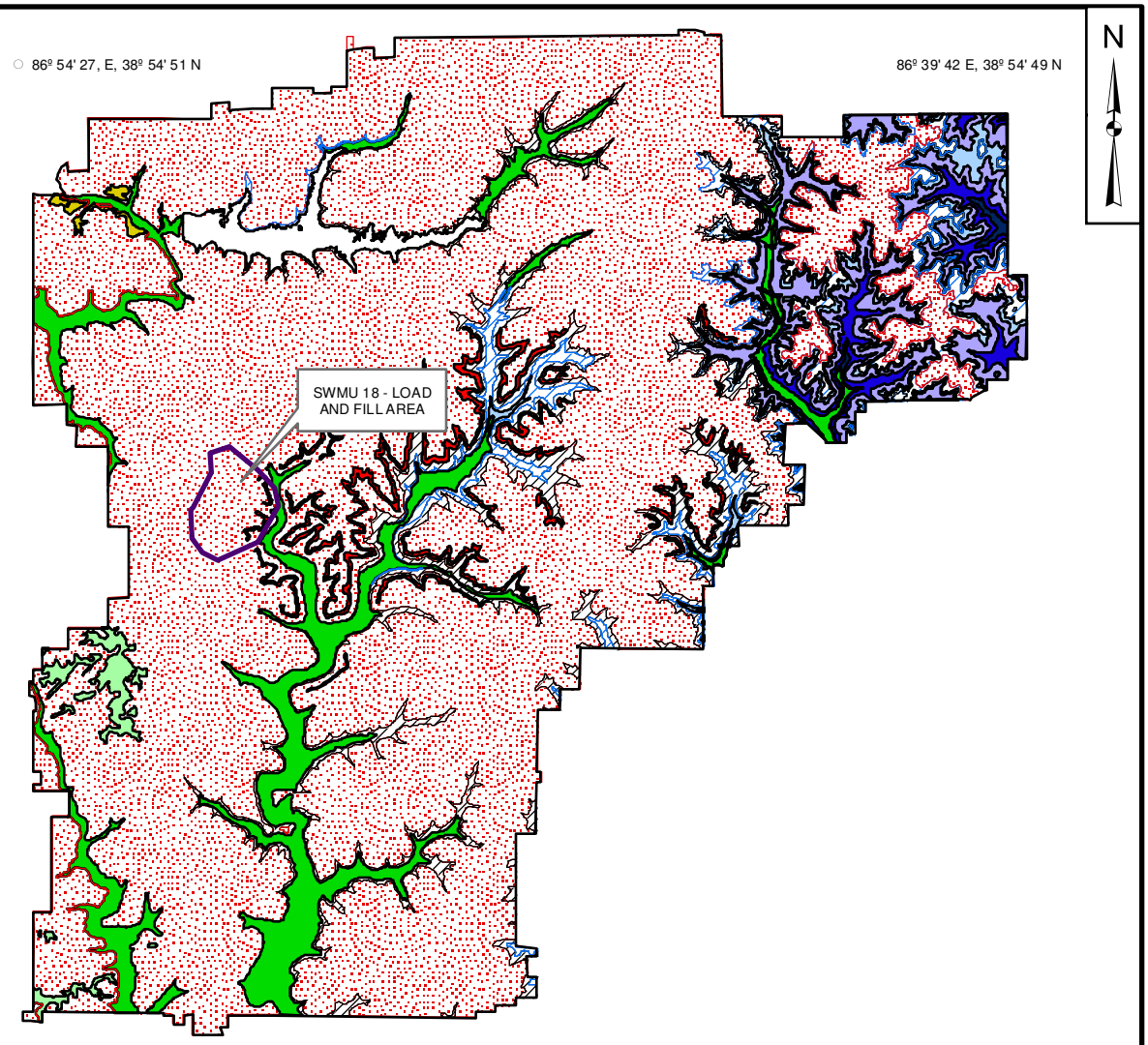

Explanation of Geology

- Qal — *Alluvium*
- Ql — *Loess*
- Qo — *Glacial Outwash*
- P — *Raccoon Creek Group and undifferentiated*
- Ps — *Sandstone-dominated horizon of Lower Pennsylvanian*
- M6 — *Glenn Dean Ls, Hardinsburg Fm, Haney Ls, Indian Springs Shale Mbr, and undifferentiated*
- M5 — *Sandstone member of the Big Clifty Fm*
- M4 — *Beech Creek Ls*
- M3 — *Elwren Fm, Reelsville Ls, upper Sample Fm, and undifferentiated*
- M2 — *Lower part of Sample Fm, Beaver Bend Ls, Bethel Fm, and undifferentiated*
- M1 — *Paoli Ls, Ste Genevieve Ls, and undifferentiated*
- Select Solid Waste Management Units (SWMUs)

0 6,000 12,000 24,000 Feet

(Modified from Blunck, 1995)

DRAWN BY S. STROZ	DATE 12/01/10	SURFICIAL GEOLOGY MAP SWMU 18 - LOAD AND FILL AREA NSA CRANE CRANE, INDIANA	CONTRACT NUMBER F201
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COST/SCHEDULE-AREA			APPROVED BY — DATE —
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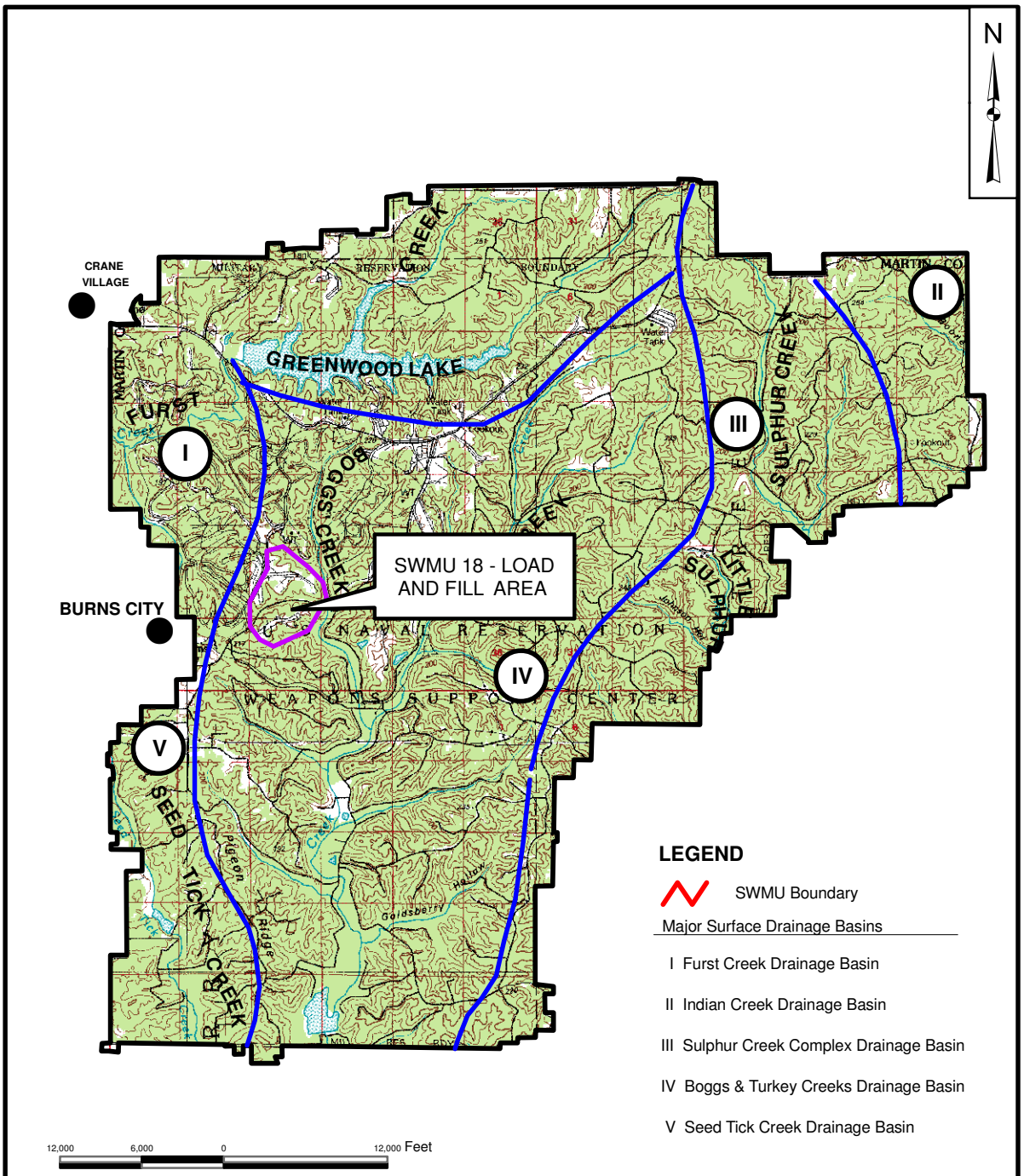

SOURCE: Initial Assessment of Study of Naval Weapons Support Center Crane, Indiana. Naval Energy and Environmental Support Activity, May 1983.

DRAWN BY S. STROZ	DATE 12/01/10	LOCATION AND DRAINAGE BASINS SWMU 18 - LOAD AND FILL AREA NSA CRANE CRANE, INDIANA	CONTRACT NUMBER CTO F201
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COST/SCHEDULE-AREA			APPROVED BY ___ DATE ___
SCALE AS NOTED			DRAWING NO. FIGURE 3-3 REV 0

4.0 SUMMARY OF DATA COLLECTION EFFORT

The PR/VSI involved collecting and reviewing available information about SWMU 18, and data collection activities included review of available documents and interviews with site personnel. The process also included a visual site inspection to assess physical evidence that might indicate the presence of environmental impacts (e.g., ground scarring, stressed vegetation, chemical residue) within the SWMU 18 study area. The PR/VSI was based, in part, on information provided in documents referenced in Appendices A - G.

The following three primary sources of information were researched as part of the data collection effort for this PR/VSI:

- Historical document review
- Visual survey inspection
- Site personnel interviews

These three sources of data are discussed below, along with their relative application to this PR/VSI.

4.1 DOCUMENT REVIEW

Documents reviewed as part the PR/VSI included:

- Previous environmental reports
- Historical facility drawings
- Technical briefing documents
- Historical aerial photographs.

4.1.1 Previous Environmental Reports

Several environmental reports were reviewed to determine previously identified environmental concerns and to identify other potential sources of information for review. The following reports were reviewed for the PR/VSI for information regarding SWMU 18 operational history and specific materials handled or used at buildings located within SWMU 18:

- Installation Assessment of Naval Weapons Support Center, Crane, Indiana, Record of Evaluation (Army, 1978).
- Initial Assessment Study of Naval Weapons Support Center, Crane, Indiana (NEESA, 1983).
- Preliminary Review / Visual Inspection Report of Naval Weapons Support Center, Crane Indiana (A.T. Kearney, 1987).
- Closure Report, Building # 199 (Sverdrup, 1997).
- Storm Water Pollution Prevention Plan (SAIC, 2005).
- Environmental Indicator Investigation Report (Tetra Tech, 2005).

These reports are summarized below.

Installation Assessment Report

The Installation Assessment report (Army, 1978) identified the main areas of potential contamination associated with Building 104. The report identified explosives, such as Composition A and Explosive D (ammonium picrate), and acids and caustics as constituents potentially adversely impacting the environmental media of the site. The report also stated that chemicals were discharged directly to Boggs Creek from the ASD complex, located in the southern portion of SWMU 18. The principal constituents discharged were likely explosives, magnesium oxide, and dyes.

Initial Assessment Study Report

The Initial Assessment Study (IAS), conducted in 1983 by the Naval Energy and Environmental Support Activity (NEESA), identified four buildings within the Load and Fill Area as suspected contamination sites, Buildings 104, 105, 198, and 200. Potential surface contamination was identified for these buildings with constituents of potential concern identified as mercury, chromium, cadmium, ammonium picrate, RDX, HMX, trinitrotoluene (TNT), and trichloroethene (TCE). Additional sampling was recommended for the four buildings.

Preliminary Review/Visual Site Inspection Report

The PR/VSI Report by A.T. Kearney (1987) identified several "units" and other areas of concern. The report indicated that wastes managed at SWMU 18 contained heavy metals and explosives, including lead, chromium, ammonium picrate, RDX, and HMX. The report stated that load and fill operations produced particulate emissions, which would be assumed to migrate to surface waters (Boggs Creek) and percolate to groundwater, and recommended obtaining information on design and operation of the various units identified. The report also recommended sampling of the intermittent stream that runs from Building 104 to Boggs Creek.

Closure Report for Building # 199

The Closure Report for Building 199 (Sverdrup, 1997) documented closure of five heating oil underground storage tanks (USTs) located at Building 199. The report concluded that total petroleum hydrocarbon (TPH) concentrations in soil were "below levels that are usually indicative of environmental soil contamination (i.e., TPH – 100 ppm)." Further discussion of the UST closure is presented in Section 5.7.

Storm Water Pollution Prevention Plan

The Industrial Storm Water Pollution Prevention Plan (SWPPP) (SAIC, 2005) provided information about recent operations and chemicals handled and used at Buildings 104, 105, 198, and 200. The SWPPP identified Building 104 as the main area of concern in SWMU 18. Information from the SWPPP is discussed in Section 5.2, 5.3, 5.5, and 5.8 for Buildings 104, 105, 200, and 198, respectively.

Environmental Indicator Investigation Report

The Environmental Indicator (EI) Investigation Report (Tetra Tech, 2005) provided analytical results for surface soils in several areas of NSA Crane, including SWMU 18. The surface soil sampling was conducted to complete an EI RCRA Information System (RCRIS) code form (CA725) and to evaluate whether, under current industrial land use, human exposure (i.e., worker exposure) is under control. Surface soil was considered to be the only pathway between worker exposure and any possible contamination at the sites investigated. Groundwater was not considered to present an exposure pathway under current land use. For SWMU 18, surface soil samples were collected from around Buildings 104, 105, 198, and 200. The samples were analyzed for energetics (nitroaromatics and nitramines) and Target Analyte List (TAL) metals plus tin. Discussion of the analytical results is presented in Sections 5.1, 5.5, 5.8, and 5.9.

4.1.2 Historical Facility Drawings

Historical architectural and engineering drawings for NSA Crane were reviewed for SWMU 18 to identify the following:

- Chemical use in buildings
- Disposal features (e.g., sumps, sewers, lagoons, ponds, etc.)
- Material handling and processes (e.g., explosives loading)
- Presence of storage tanks.

Information obtained from the historical drawings for individual buildings or areas is discussed in Section 5.0. Representative drawings are provided in Appendix A.

4.1.3 Technical Briefing Documents

Several explosive safety technical briefing documents, prepared in 2008 by Mr. Dale Groh who was formerly employed at the facility, were provided by NSA Crane and included information related to historical operations in various areas of NSA Crane, including areas within SWMU 18. The information obtained from these documents is summarized in discussions for specific buildings in Section 5.0. The technical briefing documents relating to SWMU 18 are provided in Appendix B.

4.1.4 Aerial Photographs

Three historical aerial photographs provided by NSA Crane and dated 1952, 1966, and 1974, were reviewed for information regarding historical operations or potential waste disposal areas. The findings related to the photographs are discussed in Section 5.5. The aerial photographs are provided in Appendix C.

4.2 VISUAL SITE INSPECTION

A visual site inspection of SWMU 18 was conducted from May 12 through 15, 2009, by Tetra Tech and Navy personnel. The objective of the site reconnaissance was to obtain information that could assist in identifying potential contaminant sources and pathways, and to ascertain whether there were any obvious impacts to the environment from current or historical site operations.

The site reconnaissance was performed by Mssrs. Tim Evans and Chris Hook of Tetra Tech. Tetra Tech personnel were accompanied by Mr. Tom Brent (NAVFAC Environmental Restoration Site Manager).

Information obtained from the site reconnaissance for each individual building or area is discussed in Section 5. Representative photographs taken during the site reconnaissance are provided in Appendix D.

4.3 PERSONNEL INTERVIEWS

Tetra Tech requested interviews with individuals who had worked in SWMU 18 or who were familiar with operations activities that occurred in SWMU 18, but only one individual (Mr. Dale Groh) was available for an interview. Mr. Groh began working at NSA Crane in 1968 and was the Explosive Safety Officer for Naval Ammunition Production Engineering Center (NAPEC) from 1977 through 2001. Mr. Groh was familiar with former operations at SWMU 18 and had designed many of the buildings built during his employment. In May 2009, Mr. Dale Groh had provided Tetra Tech Ordnance Briefings that he had prepared. Tetra Tech interviewed Mr. Groh via a telephone call in November 2010 to confirm and clarify information relating to SMWU 18. Information from the interview is provided in Appendix E.

Mr. Tom Brent, the NAVFAC Environmental Restoration Site Manager, provided access to various documents and historical aerial photographs. Mr. Brent provided records of historical interviews with site personnel identified in Appendix A of the 1978 Installation Assessment report; these records are provided in Appendix F. Mr. Brent also provided information from personal knowledge on historical site operations and releases.

Interviews during the visual site inspection in May 2009 were also conducted but were limited to brief, informal discussions with facility personnel present at various buildings.

5.0 SITE CHARACTERISTICS

The following section provides information about SWMU 18, including the history, site description, site use, visual survey observations, potential contaminants, and migration routes and receptors, as well as recommendations for additional investigation. For the PR/VSI, SWMU 18 was divided into the following 10 distinct subareas based on similar operations or use and geographic proximity (Figure 2-2):

- Subarea A: Building 105 Area
- Subarea B: Buildings 101, 102, and 103 Area
- Subarea C: Inert Operation Area
- Subarea D: Special Program (SP) Area
- Subarea E Building 104 Area
- Subarea F: Buildings 2084 and 2085 Area
- Subarea G: Applied Science Department (ASD) I Area
- Subarea H: Building 198 Area
- Subarea I: Building 200 Area
- Subarea J: ASD II Area.

A summary of each SWMU 18 subarea building, including facility name, year constructed, size, historical use, and materials handled is provided in Table 5-1.

5.1 SUBAREA A - BUILDING 105 AREA

The following sections provide site-specific information about Subarea A, which includes Building 105 and the surrounding area (Figure 2-2).

5.1.1 Site Location

Subarea A is located in the northern portion of SWMU 18, off of Highway 101. This area mainly consists of Building 105 and multiple outbuildings (Buildings 184, 1959, 1987, and 2518) (Figure 5-1.1). The area surrounding the buildings is grass covered or paved, with wooded slopes to the north, east, and south. The buildings are located on a northeast-southwest trending ridge at approximately 700 feet msl. The subarea slopes to the north, east, and southeast. Surface drainage flows radially to tributaries on the slopes of the site. The tributaries flow to a stream north of the site, which flows to Boggs Creek, approximately 3,300 feet to the east.

5.1.2 Historical Use

Buildings 105 was designed and constructed during WWII as a medium-caliber loading facility. Press-loading operations began in Building 105 in 1943 with loading of Explosive D (NEESA, 1983). Projectiles up to 16-inch/50 were press loaded in the three major bays of the building. The projectiles were placed on small gauge rail cars and moved into and through the four cells for pressing and drilling. Dying of silk cloth for bag charges was also reported to have occurred in Building 105 during WWII (NEESA, 1983).

In the late 1960s through 1980s, Building 105 was used for press-loading missile warheads, specifically Sidewinder and Sparrow missiles. The charges were smaller PBX charges that were pressed in halves and then glued together.

In the late 1990s the facility, now under CAAA, was converted to demilitarize Explosive D-loaded projectiles. The project was a joint commercial/government effort to convert the Explosive D (ammonium picrate) to ammonium nitrate and picric acid. The project continues to the present. The demilitarization processes in Building 105 include accessing/recovery of the ammonium picrate by CAAA and conversion of ammonium picrate to picric acid and ammonium nitrate by a private contractor. Chemicals reportedly stored at Building 105 for use in or as a product of the conversion process include ammonium picrate, toluene, picric acid, and ammonium nitrate.

5.1.3 Site Features

Building 105 is a 1.5-story building, constructed of metal siding and concrete with an asphalt shingle roof. Site operations at Building 105 consisted of automatic loading and packing, assembly, press loading, and motor rooms. Four 275-ton gas check presses were located above concrete pits in the eastern bay of the building. Washout booths were present in the eastern bay. Wastewater lines and floor drains from Buildings 105 and 2518 were reportedly connected to the sanitary sewer system. Paint spray booths equipped with ventilation were located in the center bay of Building 105. Also located in the center bay was an assembly table with an exhaust hood located above it. Multiple roof penetrations existed from Building 105. Two oil reservoirs were located in the attic of the building.

Two above-ground storage tanks (ASTs), one containing ammonium nitrate and the other nitric acid, were located at the southwestern corner of the building in a concrete secondary containment unit. The four outbuildings surrounding Building 105 include a fan and accumulator building (Building 2518), two fuse detonator magazines (Buildings 1987 and 1959), and an oil and paint locker (Building 184).

5.1.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.1.4.1 Current Conditions

Building 105 is currently a contractor-operated facility used for the conversion of Explosive D to fertilizer (ammonium nitrate). Roof and side ventilation are present at the building. Floor drains in the building have been plugged, and runoff from the roof drains to piping. (NSA Crane Public Works drawing YD156366, dated 1941, shows roof drain piping discharging around the building.)

Multiple covered pits are located in the eastern end of the building. Yellow staining was present throughout the building during the site inspection in May 2009, most notably in the center bay and finish room (i.e., eastern bay).

5.1.4.2 History of Releases

Three recorded releases occurred in 2003 at Building 105 (SAIC, 2005). On February 4, 2003, approximately 54,000 gallons of Explosive D were released outside the building through floor drains, of which approximately 6,750 gallons drained to a ditch. Eighteen days later on February 22, 2003, 700 gallons of Explosive D slurry spilled, and visual evidence showed that the spill left the building. On April 9, 2003, a release of Explosive D slurry occurred through a breech in a seal to a shower drain. Approximately 50 gallons (2-percent concentration) were released to the sanitary sewer.

The EI Investigation (Tetra Tech, 2005) identified five surface soil sample locations (18SB008 through 18SB012) (Figure 5-1.1). The samples were collected to a maximum depth of 18 inches and analyzed for energetics (nitroaromatics and nitramines) and metals. No energetic compounds were detected in the five samples. Of the metals, arsenic was found to exceed the Region 9 industrial RBTL and the IDEM residential RBTL in all five samples. The sample from 18SB008 exceeded the Region 9 residential RBTL for chromium, iron, and vanadium. The sample from 18SB011 exceeded the Region 9 residential RBTL for iron.

5.1.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea A. Potential contaminants at Building 105 include explosives (PBX, Explosive D, HMX, and RDX) and metals (A.T. Kearney, 1987). Other chemicals have been reportedly used or stored at the site, including toluene, acids, and oils.

Wastewaters containing explosives were reportedly released directly to surface drainages surrounding Buildings 105. Releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains.

Figure 5-1.2 presents the contaminant exposure pathway analysis for Subarea A. The potentially impacted media include soil, groundwater, surface water, and sediment. Wastewaters containing contaminants have reportedly discharged directly to the soil and drainages immediately around Building 105. Dust or powders may have been deposited directly to soil or may have been transported from building roofs via downspouts discharging directly to the ground. Potential contaminants to surface water and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. A stream north of the Building 105 area is the closest perennial surface water body, located approximately 340 feet north of the site.

The principal exposure pathways expected at the site are contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered high based on reports of the materials used at the site (principally explosives) and historical direct discharge of wastewaters from the site. One potential source material (Explosive D) is highly water soluble and may migrate to groundwater. Potential contamination related to the oils is considered low based on the low mobility in lubricating oil compounds.

5.1.6 Summary and Recommendation

Subarea A includes Building 105 and the surrounding area. Buildings 105 was designed and constructed during WWII as a medium-caliber loading facility and included press loading of Explosive D operations. In the late 1960s through 1980s, Building 105 was used for press loading missile warheads, specifically

Sidewinder and Sparrow missiles. In the late 1990s the facility was converted to demilitarize Explosive D-loaded projectiles.

Potential contaminants at Building 105 include explosives (PBX, Explosive D, HMX, and RDX) and metals (Kearney, 1987). Three recorded releases of Explosive D slurry occurred in 2003 at Building 105 (SAIC, 2005). Other chemicals have been reportedly used or stored at the site, including toluene, acids, and oils.

The potential for contamination is considered high based on reports of the materials used at the site (principally Explosive D) and historical direct discharge of wastewaters from the site. The principal exposure pathways for the site are direct contact with soil, surface water, and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea A. It is recommended that the investigation be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to an SI to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.2 SUBAREA B - BUILDINGS 101, 102, AND 103 AREA

The following subsections provide site-specific information about Subarea B, which includes Buildings 101, 102, and 103 and the surrounding area (Figure 2-2).

5.2.1 Site Location

Subarea B is located in the northern portion of SWMU 18 along Highway 10 (Figure 5-2.1). For the purpose of the PR/VSI, the area includes the three principal buildings, several small outbuildings and support structures (e.g., storage bunkers), and the adjacent land area. The area around and between the buildings is grass covered, and the remainder of the area is wooded. Paved roads are located to the north and south of the three buildings, and railroad tracks are located south of the buildings. The buildings are located along a ridge at an elevation of approximately 700 feet msl. Surface water runoff in the eastern portion of Subarea B flows toward Boggs Creek and in the western portion of the area flows toward a tributary of Boggs Creek.

5.2.2 Historical Use

The historical use information for Buildings 101, 102, and 103 was principally derived from the Ordnance Briefing Program, dated August 27, 2008 (Groh, 2008a) and the interview with Mr. Dale Groh, former Explosive Safety Officer for NACEP. Additional information was obtained from the IAS (NEESA, 1983), and NSA Crane Public Works site drawings.

Buildings 101, 102, and 103 and the associated structures were constructed in 1942 for the purpose of supporting Navy gun ammunition during World War II (WWII), principally black powder and smokeless powder operations (Table 5-1). Specifically, the types of ammunition items ranged from 5-inch /38 to 16-inch/55.

Black powder and smokeless powder operations were conducted in Building 101, including cartridge tanking and assembly. Building 101 was also used for loading propellant charges for medium-caliber cartridges. The propellant entered the building via a vertical elevator to the loft and was placed in large hoppers. The empty cartridge cases were conveyed underneath the hopper and filled by weight with propellant.

Bag charge and assembly operations were conducted in Building 102. Building 102 was designed to support bag charge loading for major-caliber ammunition, such as 16-inch/50 used by *Iowa*-class battleships. In the early 1970s, after the Vietnam War had ended, the specialized powder-handling equipment used exclusively for Navy major-caliber ammunition was removed, and the building was converted to an equipment test-out facility for the Naval Ammunition Production Engineering Center (NAPEC). Renovation of 16-inch/50 ammunition (including bag charges) was required for President Reagan's strategic plan in the 1980s to support the reactivation of four battleships for the 600-ship Navy program. The CAAA assumed operation of the building and returned it to a bag charge handling facility. With newer fire suppression technology, the building was used in the mid-1980s for renovation of bag charges using 16-inch/50 powder and 16-inch/45 powder to meet loading specifications. Powder stacking machines built in 1933 were used in eth loading process to precisely stack the ammunition grains one on top of the other to meet loading specifications. The powder was dropped from a hopper in the loft down tubes that placed each grain side by side in layers. The layers were then removed by hand and placed in the bag until all of the required layers had been loaded. A trim layer (a few grains at a time) was added to meet the required loading weight prior to the bag being sewn shut. The equipment was removed in the early 2000s, and the building was converted for demilitarization of 30mm depleted uranium ammunition, which continues for that purpose to date. In the demilitarization process, the all-up rounds are delinked

and loaded into a breakdown machine. The machine breaks the cartridge case from the projectile and dumps the propellant from the case, which is then vacuumed to the accumulator building (Building 3349). The projectiles are containerized for further storage. There is no action to disturb the depleted uranium-filled projectile.

Site operations at Buildings 103 included ignition filling and packing activities from approximately 1942 to the late 1980s/early 1990s. Building 103, identified as an igniter loading building, was used to load black powder into a number of ignition devices used with propellant charges. The facility was last used to produce black powder patches that were sewn to each 16-inch/50 bag charge. The building has four separate very small cells that housed a sewing machine and operator. Black powder was remotely dumped into a hopper that was separated from the loading room by a concrete wall. The facility has had no significant changes since it was first constructed during WWII. The facility has been designated for demolition.

5.2.3 Site Features

Based on NSA Crane Public Works drawings reviewed, the first floor of Building 101 was equipped with a grease tank, Vergon Press, hoists, and conveyors. A hopper room and conveyor shaft were located on the second floor. Multiple floor drains were located in each room of the building, and notably under the press tables. Two-foot-deep pits were located at the end of the cartridge conveyor belts in the cartridge assembly room. Drawings from 1992 show a sewer manhole located at the southeastern corner of the building and a drainage ditch east of Building 101. Transformers are located south of this ditch. The building was equipped with exhaust fans and vents in the roof. In particular, a vent was installed over the wire cutters in the southeastern corner of the building. The exhaust fan located near the grease tank was outfitted with a drying rack. A Public Works drawing (PW5179 sheet 038) noted that potentially hazardous explosive materials may have accumulated in the ceiling insulation.

Two outbuildings, an air compressor housing unit (Building 3231), and paint locker (Building 182) are located near Building 101. Building 3214 is located between Buildings 101 and 102, and is referred to as the Office Lunch and Locker Building and is not considered a building of concern.

The first floor of Building 102 consisted of the assembly room, tanking room, spray paint booth, conveyors, hoists, foaming machine, and wax melting plate. A powder storage area was located on the second floor of the building. The spray booth contained roof ventilation and a cast iron drain and settling pump that released to an unknown location. A drainage ditch is located south of Building 102. The foaming machine and paint booth were installed with exhaust hoods. Multiple floor drains are located in

the building. Public Works drawing PWSK1447 notes a "natural outlet to drain pit, 20 feet below pit", referring to a discharge from the building to the hill slope approximately 450 feet south. Another Public Works drawing (PW5179 Sheet 040) noted that potentially hazardous explosive materials may have accumulated in the ceiling insulation. Outbuildings 2137 and 0192 are a meter house and oil and paint storage locker, respectively. Building 3349 is a collector building for Building 102.

Building 103 housed four major areas: powder, sewing, folding and packing, and filling. The primary materials handled were black powder, propellant charges, and igniters. A gravity vent was located in the ceiling; it was replaced in the early 1980s with a continuous aluminum ridge vent. Buildings 110 and 111 were storage bunkers for Building 103.

5.2.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.2.4.1 Current Conditions

Building 101 is currently identified as the Underwater Sound Signal Assembly building. A rubber-lined concrete tank is present on the western end of the building, presumably related to current operations in Building 101. The tank was partially filled with water during the site inspection in May 2009. Floor drains are present throughout the building. Downspouts from the roof drain into pipes in the ground, presumably discharging to surface water drainages. A drainage swale runs parallel to the southern side of the building.

Building 102 is currently used for demilitarization of 30mm depleted uranium ammunition and high-explosive rounds. Smokeless powder from demilitarization is collected in drums and sent to the Ammunition Burning Grounds (ABG) (SWMU 03). The building is constructed of metal with a shingled roof and an area of 7,990 square feet. It was noted during the site visit that the interior floor drains have been plugged, but the roof still drains to the outside ground surface. A paint booth was present in Building 102. Building 3214, the Office Lunch and Locker Building, is an active building with steel construction. Building 192, located on the western end of Building 102, is identified as an oil and paint locker. According to Mr. Dale Groh, Building 3349 is used as a collector building in support of demilitarization activities. Dust control devices were present where the propellant was dumped into bins, but these devices were likely to have been vented to the atmosphere. Single- and double-based propellants are handled in the building.

Building 103 is currently not in use, and has been designated for demolition. A pile of debris, consisting of scrap metal fencing, work benches, and other miscellaneous metal and machinery items was present north of Building 103 during the site visit in May 2009. Two magazines (Building 110 and 111) are located on either side of the north entrance to the building.

5.2.4.2 History of Releases

Notes on NSA Crane Public Works drawings state that hazardous explosive particles may have accumulated in the ceiling insulation of Buildings 101 and 102. No other contaminant releases have been reported.

5.2.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea B. Gun propellants (black powder and smokeless powder) were the principal materials used at Buildings 101, 102, and 103. Oil and paint have also been identified as being used but in small quantities. Black powder is a granular mixture of nitrate, charcoal (a carbon source), and sulfur. Smokeless gun propellants may be single-based (primarily nitrocellulose with additives for flash reduction or stabilization) or multi-based (nitrocellulose mixed with nitroglycerin and nitroguanidine). Dusts or powder from site operations may have been released into the air through roof vents, exhaust fans, and ventilators. Wastewaters containing propellants and possibly oils, paints, or solvents may have been released to floor drains. No information was available regarding where the floor drains discharged.

Figure 5-2.2 presents the contaminant exposure pathway analysis for Subarea B. The potentially impacted media include soil, groundwater, surface water, and sediment. Dust or powders may have been discharged through the roof vents and deposited onto surfaces soil, or may have been transported from building roofs via downspouts discharging directly to the ground surface. Floor drains may have discharged directly to soil or surface water, if not connected to sanitary sewer lines. No surface water is present at the site, but potential contaminants may have been transported from soil to surface water via runoff and erosion, been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water, or been discharged directly to surface water via piping (e.g., the outlet from Building 102 indicated on Public Works drawing PWSK1447). The closest perennial surface water body to this subarea is Boggs Creek, located approximately 4,200 feet east of the area.

The principal exposure pathways for this subarea are direct contact with soil, surface water, and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water. Groundwater is not used at NSA Crane for potable or agricultural purposes.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is expected to be low based on the materials stored, handled, or used at the site (principally smokeless powder). Black and smokeless powder's primary constituent is nitrate, which naturally degrades in the environment, and the potential contamination from these materials is expected to be low. Oils and paints were also used at the site. Potential contamination from these materials is expected to be low due to the small quantities that may have been used.

5.2.6 Summary and Recommendation

SWMU 18 Subarea B includes Buildings 101, 102, and 103 and associated structures, which were constructed in 1942 for the purpose of supporting Navy gun ammunition during WWII, principally black powder and smokeless powder operations.

Notes on NSA Crane Public Works drawings state that hazardous explosive particles may have accumulated in the ceiling insulation of Buildings 101 and 102. No other contaminant releases have been reported.

The potential for contamination is expected to be low based on the materials stored, handled or used at the site (principally smokeless powder). In addition, the potential contamination related to other materials used in this subarea (i.e., paints and oils) is also expected to be low.

Although potential environmental impact in Subarea B is expected to be low, additional investigation is recommended to assess if releases have occurred that may have impacted environmental media.

5.3 SUBAREA C - INERT OPERATION AREA

The following sections provide site-specific information about Subarea C, which includes Buildings 115, 119, 226, 227, and 3331 and the surrounding area (Figure 2-2).

5.3.1 Site Location

Subarea C, which consists mainly of Buildings 115, 119, 226, 227, and 3331, is located in the western portion of SWMU 18, off of Highway 101 and within the area operated by CAAA (Figure 5-3.1). SWMU

08, which consists of Buildings 106 and 107 and Building 106 Pond, is located immediately east of and abutting this subarea. SWMU 11 (Old Storage Building 225) is located west of the area, across Highway 101.

The three main buildings in Subarea C include Buildings 119, 226, and 227. Highway 104 and a railroad track run along the western side of these buildings. The area surrounding the buildings is grass covered or paved. The buildings are located on a north-south trending ridge at approximately 690 feet msl, and the subarea slopes to the west. Surface drainage in the western portion of the subarea is to the western hill slope. Runoff adjacent to the buildings and from roof downspouts is to concrete or unlined drainage swales. Runoff north of Building 226 is conveyed to a drainageway north of the site. Runoff south of Building 226 is conveyed to the drainageway on the western hill slope or to the southern hill slope. In contrast, surface drainage on the eastern side of Buildings 106 and 107 (SWMU 08) flows to a drainageway east of the ridge; ultimately, drainage from the area of north of Building 226 flows to this eastern drainageway. All tributaries from the hill flow to a stream south of the subarea, which flows to Boggs Creek, approximately 4,900 feet east of the subarea.

5.3.2 Historical Use

Buildings 119, 226, and 227 were built in 1941 and 1942 and were originally used for inert processing and storage of projectile tanks and cases. Building 3331 was built in 1999 and used for Army Strategic Mobility Program container maintenance. Other structures of note in the area include a lunch, locker, and boiler house (Building 115) and an acid storage building (Building 2651) that were constructed in 1943 and 1950, respectively.

5.3.3 Site Features

Buildings 119, 226, and 227 were part of operations associated with Buildings 106 and 107 for overhaul of projectile tanks and cases. All of these five buildings were connected by a series of covered walkways. Building 227 was used for storage of dirty projectile cases and tanks. Cases and tanks were transferred to Building 106 for cleaning with caustics, degreasers, and acids and finished in Building 107 with grit blasters, degreasers, and paint. Building 119 was used for clean cases, and Building 226 was used for clean tanks. Finishing and painting also occurred in Buildings 119 and 227. According to Mr. Dale Groh, no explosive materials were handled or stored in Buildings 119, 226, or 227.

Fuel oil ASTs were located at the boiler house (Building 115), and USTs were located east of each of the major buildings. The 3,100-gallon UST for Building 119 was removed in 1992 (NSA Crane Storage Tank

Database, 2001). Roof drains from the buildings emptied to concrete culverts, and ridge vents were located along the roof. A paint disposal trap and paint spray booth were constructed at Buildings 119 and 227. The paint disposal traps were located outside of the buildings, and overflow pipes discharged to nearby concrete swales. Exhaust hoods were located above the paint booth and buffing stations in Building 227. Other areas in Building 227 included a grit blast area, sanders, and heater area. Additional areas in Building 119 included a plastic beading machine, gas drying oven, lathes, and paint booth.

5.3.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.3.4.1 Current Conditions

During the visual survey, concrete swales were observed between the three major buildings, along the western side of the buildings, and leading from a transformer bank in the back of Building 107 to the front of Building 226. Settling basins were located on the northern side of Building 227 and the southern side of Building 119. Roof vents were observed in Buildings 226 and 227. Two ASTs holding fuel oil were located near boiler house (Building 115). A kiln and accumulator were positioned between Buildings 106, 119, and 227.

5.3.4.2 History of Releases

No recorded releases were identified for this area. However, corrective actions have been conducted at SWMU 08 (Building 106 Pond) to address soil and groundwater contamination (Tetra Tech, 2008). TCE was detected in a monitoring well installed near the southeastern corner of Building 227 at concentrations of 0.7 and 1.7 micrograms per liter (µg/L) in 2005.

5.3.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea C. Potential sources of contaminants in Subarea C are related to operations associated with Buildings 106 and 107 for overhaul of projectile tanks and cases. Building 227 was used for storage of dirty projectile cases and tanks. Cases and Tanks were transferred to Building 106 for cleaning with caustics, degreasers, and acids and finished in Building 107 with grit blasters, degreasers and paint. Building 119 was used for clean cases, and Building 226 was used for clean tanks. Finishing and painting also occurred in Buildings 119 and 227. Explosive materials were reportedly not handled or stored in Building 119, 226, or 227. Paint disposal

traps and paint spray booths were constructed in Buildings 119 and 227. The paint disposal traps were located outside of the buildings, with overflow pipes discharged to nearby concrete swales. Additional potential sources of contamination include fuel oil ASTs located at the Boiler House (Building 115) and USTs located east of each of the major buildings (Buildings 119 and 227). The 3,100 gallon UST for Building 119 was removed in 1992.

Figure 5-3.2 presents the contaminant exposure pathway analysis. Potential historical contaminant migration pathways at Subarea C include air, soil, groundwater, and surface water. Wastewaters from painting may have impacted soil and groundwater. During wet weather conditions, sumps likely overflowed into drainage ditches located near the buildings, which could have contaminated soil. Soils present at the site are well drained or moderately well drained, indicating that contaminants could leach from the soil to groundwater. Although this area ultimately drains to Boggs Creek, there is no perennial surface water present at this subarea. However, contaminants may have leached into the tributaries to Boggs Creek, potentially impacting surface water and sediment in these water bodies.

The principal exposure pathways for the site are direct contact with soil, surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the subarea and potential impact to the environment. The potential for contamination is considered to be low to medium. The potential concern is based on former wastewater handling (i.e., to sumps on the exterior of the buildings) and potential discharge to soil and surface water. Potential contaminants may include organic constituents of paints and degreasers. Potential contamination related to the fuel oils is considered low based on the low mobility of fuel oil compounds.

5.3.6 Summary and Recommendation

Subarea C - Inert Operation Area consists mainly of Buildings 115, 119, 226, 227, and 3331 and is located in the western portion of SWMU 18. Buildings 119, 226, and 227 were originally used for inert processing and storage of projectile tanks and cases. Building 3331 was built in 1999 and used for Army Strategic Mobility Program container maintenance.

No recorded releases were identified for this subarea. The potential for contamination is considered to be low to medium.

Although potential environmental impact in Subarea C is expected to be low to medium, additional investigation is recommended to assess if releases have occurred that may have impacted environmental media.

5.4 SUBAREA D – SP AREA

The following sections provide site specific information about Subarea D – Special Program (SP), which includes Buildings 108, 109, 142, 143, and 2707 and the surrounding area (Figure 2-2).

5.4.1 Site Location

Subarea D is located in the center of SWMU 18 and is accessible from Highway 10 via Highway 11. Subarea D includes the four main buildings in the area (109, 142, 143, and 2707), multiple, small, support outbuildings and structures, former Building 108, and the surrounding land (Figure 5-4.1). Grass covers the area directly around and between the buildings, and woodlands cover the remainder of the subarea. The buildings are located on a northwest-southeast-trending ridge at an elevation of approximately 650 feet msl off of Highway 11. The subarea drains to the south and east, discharging to a tributary of Boggs Creek.

5.4.2 Historical Use

This area was first designed and constructed during WWII as a 20mm loading and assembly plant. The original plant consisted of Building 143 as the projectile loading building and Building 142 as the final assembly building for the cartridges. The final assembly effort utilized automated equipment that did not need the use of a powder loft for handling the propellant. Two inert warehouses (Buildings 108 and 109) were built in this area in the early 1940s. Building 108 has since been demolished (Groh, 2008a).

Building 142 was used in the late 1960s and early 1970s by the Marine Corps for mortar assembly. Following the Vietnam War, Building 142 was converted to house electronic test equipment for testing of various types of small ordnance items. The building is separated into different work bays by 12-inch dividing walls.

Following WWII, Building 143 was reworked to support the Navy's Special Programs Office in charge of ballistic missiles. Several additions were constructed to house the engineering staff required by the program. The building and an area to the south were also used in the late 1960s in support of the Rockeye II process, where bomblet penetration tests were conducted to support production conducted by the Navy Ordnance Department.

Building 2707 was constructed in the early 1950s as a lunch and locker room for the 20mm line and was converted to a Quality Evaluation Chemistry Laboratory in the 1970s. Several additions have been constructed through the years, and a service dock has been added.

Building 109 was converted from an inert warehouse to an explosive operating building in the late 1970s. Most of the building was altered to better support the SP program efforts in Building 143. The only remaining unused portion of the building was converted to support the long-term explosive aging program efforts in Building 2707. The aging program is still in place, but the work that was in the portion of Building 109 has been transferred to Building 143. Building 109 is currently scheduled for demolition.

5.4.3 Site Features

Based on NSA Crane Public Works drawings, Building 143 included the use of ordnance test cells, temperature and humidity chambers, x-ray room, dark room, tracer mixing, tracer loading, tetryl loading, and wet accumulators. Multiple floor drains were located in the building, notably in each test cell. Also located in each test cell was a vent exiting through the roof.

Building 142 was used for cartridge assembly operations including the use of explosive test cells (with roof vents), inert storage and degreasing, boxing, assembly, demountable cubicle test cell, and locker rooms. NSA Crane Public Works drawing PW5179 (sheet 076) noted that accumulation of explosive particles may exist in ceiling insulation.

Building 109 is currently inactive and scheduled for demolition. When in use, the building consisted of several areas, including a fabrication unit, packing/shipping, heavy shelf storage area, x-ray storage area, x-ray room, and cutting room. A paint booth was also located in the building.

Building 2707 was an office and lunch building. Building 2870 contained a test room and a console room and was renovated in 1986.

5.4.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.4.5 Current Conditions

Building 142 is currently an active ordnance testing site. The building is constructed of metal and concrete and consists of four interior bays. Bay 2 contains the test cells. All four bays contain floor drains. According to site personnel available during the site inspection, the decontamination liquids and residue from activities at Bay 4 are sent to the ABG. Portable high efficiency-particulate air (HEPA) vacuums are present in Bay 4. Exhaust stacks are present on the roof. The roof drains to piping in the loading area and the rear of the building.

Building 143 is constructed of concrete and metal, with four interior bays. Floor drains were observed in Bays 1 and 3. Test cells in the building exhaust to accumulators in the rear (south) of the building with exhaust fans. A chemical laboratory was formerly located in Bay 4.

Building 109 is a concrete structure. Roof downspouts on Building 109 drain to piping and to the ground surface around the building. No vents or exhaust fans were observed on Building 109.

5.4.6 History of Releases

An NSA Crane Public Works drawing (PW5179 Sheet 076) notes that ceiling insulation may contain potentially hazardous accumulations of explosive particles. No other reports of contaminant releases have been identified for Subarea D.

5.4.7 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea D. The potential source of contaminants at Subarea D are primarily explosives (smokeless powder and C4), related to historical operations for 20mm loading and mortar assembly. Other chemicals that may have been used or stored at the site include paints, degreasers, and those associated with flares.

Although no releases were identified, releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains.

Figure 5-4.2 presents the contaminant exposure pathway analysis for Subarea D. The potentially impacted media include soil, groundwater, surface water, and sediment. Wastewaters containing contaminants may have been discharged directly to the soil and drainages immediately around Building 198. Dust or powders may have been deposited directly to soil or may have been transported from building roofs via downspouts discharging directly to the ground. Potential contaminants to surface water

and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. Boggs Creek is the closest perennial surface water body, located approximately 0.5 mile east of the site.

The principal exposure pathways expected at the site may be contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered low to medium based on reports of the materials used at the site (principally explosives).

5.4.8 Summary and Findings

Subarea D – SP Area includes former Building 108 and Buildings 109, 142, 143, and 2707 and the surrounding area. This area was first designed and constructed during WWII as a 20mm loading and assembly plant. The original plant consisted of Building 143 as the projectile loading building and Building 142 as the final assembly building for the cartridges. Two inert warehouses (Buildings 108 and 109) were built in this area in the early 1940s. Building 142 is currently an active ordnance testing site.

Although no releases were identified, releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains. The potential for contamination is considered low to medium.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea D. It is recommended that the investigation be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to an SI to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.5 SUBAREA E - BUILDING 104 AREA

The following subsections provide site-specific information about Subarea E, which includes Buildings 104, 189, and 2081 and the surrounding area (Figure 2-2).

5.5.1 Site Location

Subarea E is located in the east-central portion of SWMU 18. This subarea consists of three main buildings (104, 189, and 2081) and associated structures (Figure 5-5.1). In addition, two areas north and south of Highway 10 between Building 103 and Building 104 are included in Subarea E. Building 189 is located approximately 1,000 feet north of Building 104, and Building 2081 is located approximately 500 feet northwest of Building 104. The surrounding area is covered by grass. Five sets of railroad tracks terminate near Building 104. The buildings are located on top of a ridge at approximately 650 feet msl. The site slopes to the south, east, and northeast. Boggs Creeks is located in the valley east of the site at an elevation of approximately 510 to 520 feet msl. Surface drainage from the area of Building 104 flows radially to tributaries on the slopes of the subarea. The areas around Buildings 104 and 2081 are grass covered or paved, and the hill slopes surrounding Building 189 are wooded.

5.5.2 Historical Use

Buildings 104 and 189 were designed and constructed during WWII for medium-caliber projectile loading. Press-loading operations began in Building 104 in 1942 with loading of Explosive D (ammonium picrate, also known as Yellow D or LD) (NEESA, 1983). The facility produced the bulk of the 5-inch/38 and 5-inch/54 projectiles fired in the Vietnam War. As part of the loading process, the projectiles were cleaned in a degreaser tub (Detrex or Blakslee) and then painted. One of the two center bays was converted in 1974 to hold an x-ray facility, which was to be used to examine the press-loaded projectiles for cracks in the explosive. The substitution of plastic-bonded explosives (PBX) -106 for Composition A3 occurred in the 1990s, ending the use of Building 104 for press loading. Building 104 operates as a main line operating building for CAAA work. The main operation involves packing of 5-inch/54 and 5-inch/38 high-explosive projectiles. Explosive material is drilled out for the fuse. The scrap powder is collected and destroyed at the ABG (SWMU 03) or Demolition Range (SWMU 09). General ordnance item maintenance (e.g., painting, grit blasting) also occurs at Building 104 (Groh, 2010).

Building 189 was originally constructed to prepare Explosive D for press loading in Building 104. Sifting operations were conducted in Building 189 to eliminate large particles and agglomerations from the explosives powder. The facility was last used to prepare Composition A3 for press loading. A steel crib in the rear (Building 2924) was designed and constructed in the late 1960s as a projectile check-out facility for NAPEC. When the loading of 5-inch projectiles reached high levels of production, Building 189 was returned to the Navy Ordnance Department (now CAAA) for use as a replacement to Building 105 for the blending of Composition A3. Building 189 is identified as the Guided Missile Maintenance Facility in

the IAS (1983), and a 1957 drawing provides plans for a Booster and Sustainer Testing Facility (Public Works drawing PW1263 Sheet 001). The building is currently inactive and has been designated for demolition.

Building 2081, constructed in 1946, has been used as a warehouse to store inert materials.

Based on historical aerial photographs (1952, 1966, and 1974), two cleared or sparsely vegetated areas were identified within the western portion of Subarea E. One suspect area (identified as Area 1) is located approximately 785 feet northwest of Building 2081, and the other (identified as Area 2) is located approximately 990 feet northwest of Building 2924. The history and past usage of these two areas is not documented; however, Mr. Dale Groh (2010) indicated that these areas were borrow pits during WWII at the facility.

5.5.3 Site Features

Building 104 is divided into three interior sections (east, west, and center). The eastern and western sections are separated into three cells for supporting press loading. Drawing PW0347 identified a "washing machine" pit in the central bay of Building 104. This feature appeared to have been filled in prior to the site visit in May 2009. Four degreasers were identified on NSA Crane public works drawings in the eastern (one degreaser), central (two degreasers), and western (one degreaser) sections (Public Works drawings PW1687 and PW211). Floor drains are identified in the drawings for Building 104. Reportedly, wastewater treatment units (carbon adsorption units) were installed in Building 104 to treat the wastewater prior to discharge (A.T. Kearney, 1987). Drawings for these units were not located, and these units were not observed during the site visit. The PR/VSI Report (A.T. Kearney, 1987) indicated that the wastewater treatment unit and the sumps for Building 104 were connected to the sanitary sewer system. A historical drawing (Public Works drawing PW6530 Sheet 004), dated 1997, shows discharges to Building 104 to the stormwater system around Building 104.

Scrap explosive powder generated as a by-product was collected in accumulators in Building 2519. Building 117, near the east wing of Building 104, was used as an equipment room, and Building 118, near the west wing of Building 104, served as an air compressor room. Building 2674, west of Building 104, is a boiler room. Buildings 2081 and 116 were inert storage buildings but are currently inactive. A 30,000-gallon fuel oil UST, identified as Building 2685 on Figure 5-5.1, is located northwest of Building 2674 (boiler house). Vitreous clay pipes and other underground pipes from the buildings flow to catch basins. Three settling basins for stormwater discharges are located near Building 104.

Buildings 189 and 2924 are located approximately 1,000 feet north of Building 104. Building 2506 is located approximately 850 feet north of Building 104. These three buildings are currently not in use. Roof vents are present on Building 189. A blast deflector wall is located on the western side of Building 189, associated with booster or missile testing operations at this subarea. A settling basin at the northeastern edge of the pavement receives stormwater from the trench drains along the edge of the pavement and discharges to the hill slope east of Building 189. An NSA Crane Public Works drawing (Public Works drawing PW1263 Sheet 001) identifies two vitreous clay pipes discharging from Building 189 and running north and northwest. The northern line runs into a settling basin north of the site. The drawing also identifies a 1,000-gallon fuel oil UST near Building 2506, a boiler house.

An area of seeps was identified on the slope south of Building 104 by the Crane escort (Mr. Tom Brent). The area was noted as having differing or distressed vegetation than the surrounding wooded slope.

Two suspect areas to the north and south of Highway 10 were identified as potential areas of concern because both areas exhibited sparse vegetation within a depressed land area. The area north of Highway 10 (identified as Area 1) is rectangular in shape (approximately 50 feet by 150 feet). The area to the south of Highway 10 (identified as Area 2) is circular in shape, with berms surrounding the edge of the depression. The southern area is larger (approximately 1 acre). Both areas are located in wooded areas of SWMU 18.

5.5.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.5.4.1 Current Conditions

Currently, Building 104 is used for projectile loading and is operated by CAAA. Roof downspouts appear to tie in underground, and several stormwater catch basins were observed in and around Building 104. Presumably, the downspout lines and catch basins discharge to three outdoor settling basins were observed on the northeastern and southern edges of the Building 104 area or directly to the ground in the drainages between the railroad tracks on the northwestern side of the area. Three rusting drums were observed on the hill southwest of Building 104. Multiple plugged floor drains and sumps were observed in Building 104 during the site visit. Yellow staining (related to Explosive D) was observed on the floor throughout Building 104. Roof vents were present on Building 104.

Buildings 189, 2081, and 116 are inactive. Building 2081 was not observed during the site visit due to its past use for inert storage only.

No debris or waste was observed in the two unidentified areas along Highway 10 during the 2009 site inspection.

5.5.4.2 History of Releases

Historical releases have been identified for the Building 104 area. Prior to 1979, wastewater from Building 104 was discharged to storm drains that discharged to the hill slopes and ultimately flowed to Boggs Creek (Army, 1979; NEESA, 1983; A.T. Kearney, 1987). The wastewater effluent reportedly contained runoff from cleaning of projectile casings, phosphate coating of casings, paint booth operations, and the vacuum system scrubber used in the pressing operations. Appendix G provides the process flow diagram for Building 104 operations until 1979 (NEESA, 1983). Cleaning and degreasing wastewaters, which may have included acids, caustics, phosphate, and TCE, were discharged to the southern drain. Wastewaters from loading and pressing operations (Explosive D) were discharged to the settling basins and then to the northern and eastern drains. Painting operation wastewaters discharged to either the southern drain or to the northern and eastern drains. The IAS reported that effluent samples collected in 1972 contained RDX, HMX, ammonium picrate, mercury, cadmium, and chromium (NEESA, 1983). A pollution control system was installed in Building 104 during the 1980s to prevent polluted water from paint spray booths, phosphatizing lines, and Explosive D operations from being discharged to the environment (NEESA, 1983). Staining of soil was observed around one settling basin (unspecified) during the PR/VSI in 1987 (A.T. Kearney, 1987).

At Building 189, the IAS reported that "…a considerable amount of Explosive D was spilled on the driveway…" during WWII (NEESA, 1983). It further indicated that "a proposal, dated June 1944, to concrete aprons around the two buildings [Buildings 189 and 190], states 'the accumulation of this powder in the rough surfaces of unpaved driveway areas presents a hazard which cannot be overlooked,' " (NEESA, 1983).

The Industrial SWPPP (SAIC, 2005) identified that water was discharging from a pipe located at the easternmost corner of Building 104 during a site visit in 2003, but the source of the water was not discovered. The Industrial SWPPP also reported that "CAAA personnel stated that the only known spills at Building 104 have been very small fuel spills associated with portable generators." An area of "explosive material seepage" was also noted in the Industrial SWPPP. The area was on the slope south of Building 104. Outfall 021 is located below the area.

The EI Investigation (Tetra Tech, 2005) identified seven surface soil sample locations (218SB001 through 18SB007) (Figure 5-5.1). The samples were collected to a maximum depth of 18 inches and analyzed for energetics (nitroaromatics and nitramines) and metals. HMX and RDX were detected at one location (18SB007) but at concentrations less than the USEPA Region 9 residential and industrial risk-based target levels (RBTL). Of the metals, arsenic was found to exceed the Region 9 industrial RBTL in all seven samples, and five of the seven samples exceeded the Indiana Department of Environmental Management (IDEM) industrial RBTL. The barium and chromium Region 9 residential RBTLs were exceeded in the sample from 18SB005. The chromium RBTL for Region 9 industrial was exceeded by sample 18SS00070002. The sample from 18SB002 exceeded the Region 9 residential iron RBTL.

5.5.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea E. Several potential sources of contaminants are present in the Building 104 area. Explosives [Explosive D (ammonium picrate), Composition A3, and PBX-106] were the principal materials used at Buildings 104 and 189. Perchlorate, associated with rocket motors, may also be of concern for Building 189. Explosive D and perchlorate are both highly water soluble. Degreasers (e.g., TCE) and paints have also been identified as being used in this area. Another possible source of stormwater pollution is an uncovered grit blast accumulator outside Building 104. CAAA personnel stated that pollutants associated with these accumulators include steel shot, paint residues, and possibly heavy metals. Fuel oil was stored and used in the area near Building 2674.

Wastewaters containing explosives, paints, or degreasers were reportedly released directly to surface drainages surrounding Buildings 104 and 189. Releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground surface via roof drains. Releases from the fuel oil tank may have occurred via surficial spills or overflows of the UST or subsurface leaks from the UST.

Figure 5-5.2 presents the contaminant exposure pathway analysis for Subarea E. The potentially impacted media include soil, groundwater, surface water, and sediment. Minor spills of explosive powder may have occurred directly to the ground during transport from Building 189 to Building 104. Dust or powders may have been deposited directly on to soil or may have been transported from building roofs via downspouts discharging directly to the ground. Potential contaminants to surface water and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. Boggs Creek is the closest perennial surface water body,

located approximately 730 feet east of the site. Secondary sources of contamination include sumps, catch basins, and settling basins.

The principal exposure pathways expected at the subarea are contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered high based on reports of the materials used at the site (principally Explosive D and degreasers) and historical direct discharge of wastewaters from the site. Several of the potential source materials (e.g., Explosive D and perchlorate) are highly water soluble and may migrate to groundwater. Constituents associated with degreasing operations (e.g., TCE) also pose potential concern for groundwater due to the typical persistence and recalcitrance of such chemicals in groundwater. Potential contamination related to the fuel oil UST (Building 2685 on Figure 5-5.1) adjacent to Building 2674 is considered low based on the low mobility of fuel oil compounds.

5.5.6 Summary and Recommendation

Subarea E includes Buildings 104, 189, and 2081 and the surrounding area. In addition, two cleared or sparsely vegetated areas were identified within the western portion of Subarea E. Buildings 104 and 189 were designed and constructed during WWII as a medium-caliber loading facility. Press loading operations in the early-1940s involved loading of Explosive D. Currently, Building 104 is used for projectile loading and is operated by CAAA.

Historical releases have been identified for the Building 104 area. Wastewater from Building 104 was discharged to storm drains that discharged to the hill slopes and ultimately flowed to Boggs Creek. The wastewater effluent reportedly contained runoff from cleaning of projectile casings, phosphate coating of casings, paint booth operations, and the pressing operation vacuum system scrubber.

The potential for contamination is considered high based on reports of the materials used at the subarea and historical direct discharge of wastewaters from the subarea. The principal exposure pathways for the site are direct contact with soil, surface water, and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea E. It is recommended that the investigation be conducted in phases.

The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to a Site Investigation (SI) to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.6 SUBAREA F - BUILDINGS 2084, 2085, AND 2540 AREA

The following sections provide site-specific information about Subarea F, which includes Buildings 2084, 2085, and 2540 and the surrounding area located at NSA Crane (Figure 2-2).

5.6.1 Site Location

Subarea F, located in southeastern portion of SWMU 18, consists of three large building (Buildings 2084, 2085, and 2540), several small buildings and support structures (e.g., ASTs), and the adjacent land area (Figure 5-6.1). Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea, which is the hill slope to the north. The buildings are located along a ridge at an elevation of approximately 700 feet msl. Surface water runoff from the area north of Highway 101 drains to the north, and runoff from south of Highway 101 drains to the south. Surface water runoff from the tributaries north and south of the subarea feed tributaries to Boggs Creek.

5.6.2 Historical Use

Buildings 2084 and 2085 were built in 1946 and were originally used for ammunition engineering and inert storage, respectively. Building 2084 has been used for a number of functions through the years, including housing inert materials loading (dummy loads), plastic molding, ordnance engineering and now a general storage function. Building 2540 was built in 1945 and was originally used for ordnance engineering and development. The building is the largest at SWMU 18 and has an area of 29,483 square feet.

5.6.3 Site Features

Buildings 2084 and 2085 are one-story concrete structures, and Building 2540 is constructed of brick. Floor drains were located throughout Building 2084, and the building was connected to a settling basin located southeast of Building 2084 ; the settling basin discharges to the sanitary sewer system. Machinery and operations at Building 2084 consisted of a paint booth, drying oven, vacuum system, sand room, and plaster loading room. Four trenches in the plaster loading room drained to the south side of

the building. The ditches were lined with metal in 1961. A ditch was located on the southern side of the building.

Other structures in the area include Building 3323 (research and development offices), Building 199 (boiler house) with two 30,000-gallon ASTs in secondary containment, and Building 3317 (weather structure). Building 199 is a concrete structure housing three boilers, with drains at the building connected to a nearby sump. In 1997, five fuel oil USTs (four 5,000-gallon and one 10,000-gallon) were removed from behind Building 199 (Sverdrup, 1997). Approximately 345 cubic yards of petroleum-impacted soil were also removed for disposal at the Crane landfill. Sverdrup concluded that TPH concentrations were "below levels that are usually indicative of environmental soil contamination [i.e., TPH – 100 parts per billion (ppm)]," (Sverdrup, 1997). The maximum TPH concentration was 218 milligrams per kilogram (mg/kg) from the bottom of UST # 3 excavation. This concentration is less than the current IDEM Risk Integrated System of Closure (RISC) value of 230 mg/kg for residential use.

Multiple small ancillary buildings (Buildings 2160, 2932, 2933, 2934, 2935, and 2938) supported operations in this subarea, according to Mr. Dale Groh, these buildings did not handle explosives. These buildings have been demolished.

5.6.4 PR/VSI Results

Background research was conducted for Subarea F through a visual survey, document research, and personnel interviews.

5.6.4.1 Current Conditions

Building 2084 is vacant but was recently remodeled. There was no evidence of sumps, floor drains, or tanks at Building 2084. Building 2085 remains a warehouse for inert storage. Building 199 is still in use as the boiler building. Both buildings are constructed of concrete. Stacks were present on the roof of Building 199. The two 30,000-gallon #2 fuel oil tanks with secondary containment were located east of Building 199. An electrical transformer station was present north of Building 199.

5.6.4.2 History of Releases

No recorded released have been identified for this subarea.

5.6.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea F. Potential sources of contamination for this subarea are related to former operations in Building 2084 (plaster loading an painting) and Building 2540 (machine shop with potential for degreaser use). Another potential source of contaminants is related to fuel oil ASTs and former USTs associated with Building 199. Potential contamination related to fuel oils is considered low based on the low mobility of fuel oil compounds. Additionally, previous corrective actions addressed potential soil contamination associated with the former fuel oil USTs. Confirmation soil sampling results for TPH were less than the current IDEM RISC value (230 mg/kg) for residential use. The overall potential for contamination in Subarea F is considered to be low.

5.6.6 Summary and Findings

Subarea F includes Buildings 2084, 2085, and 2540 and the surrounding area. Buildings 2084 and 2085 were originally used for ammunition engineering and inert storage, respectively. Building 2540 was originally used for ordnance engineering and development. Building 2084 is currently vacant, and there is no evidence of sumps, floor drains, or tanks in the building. Building 2085 remains a warehouse for inert storage.

No recorded releases were identified for this subarea. The potential for contamination is considered to be low based on the reported use of this subarea. In addition, previous corrective actions addressed potential soil contamination associated with the former fuel oil USTs at Building 199.

Based on the information presented in this PR/VSI, NFA for the SWMU 18 Subarea F is recommended.

5.7 SUBAREA G – ASD I

The following sections provide site-specific information about Subarea G – ASD I, includes Buildings 190, 2947, 3115, 3347, and 3348 and the surrounding area (Figure 2-2). The ASD was a designation for operations in the Load and Fill Area south of Highway 45 associated with research, development, and testing of pyrotechnics.

5.7.1 Site Location

Subarea G is in the south-central portion of SWMU 18. Subarea G includes Buildings 190, 2947, 3115, 3347, and 3348, several support buildings or structures, and the surrounding land area (Figure 5-7.1). Grass covers the area directly around and between the buildings, and a wooded area covers the

remainder of the subarea. The buildings are located along a north-south trending ridge at an elevation of approximately 650 feet msl. The subarea drains through a ridge to the northeast and feeds a tributary to Boggs Creek.

5.7.2 Historical Use

Building 190 was constructed during WWII to support loading and pressing operations in Building 198. Sifting operations were conducted in Building 198 to eliminate large particles and agglomerations from the explosives, similar to operations in Building 189 in Subarea G (NEESA, 1983).

Building 2947 was constructed in 1972 and operated as an energetics laboratory in support of pyrotechnic research and development projects. The other buildings in the subarea were constructed between the late 1960s and 2002 for support of the pyrotechnics projects. Building 3115 is part of the Missile Effectiveness Branch and Infrared Test Group.

5.7.3 Site Features

Building 190 is located approximately 760 feet west of Building 198. The original facility for Building 198 included Building 190 as a preparation building, Building 2540 as a lunch and locker facility, and Building 2084 as an inert materials warehouse (Groh, 2008b). An access tunnel formerly connected Buildings 2540, 190, and 198. In the late 1960s, the tunnel was converted for use as a burn chamber following an accident at Building 127, outside of SWMU 18.

5.7.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.7.4.1 Current Conditions

Subarea G is currently an active testing area. The ground at that area slopes to the north. A 15-foot-deep storm drain was present near Building 3115, and a swale is present between Building 3347 and Building 3040.

5.7.4.2 History of Releases

The IAS reported,"…a considerable amount of Explosive D was spilled on the driveway…" during WWII (NEESA, 1983). It further indicated that "a proposal, dated June 1944, to concrete aprons around the two buildings [Buildings 189 and 190], states 'the accumulation of this powder in the rough surfaces of unpaved driveway areas presents a hazard which cannot be overlooked,' " (NEESA, 1983). No other reports of contaminant releases have been identified for Subarea G.

5.7.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea G. Potential contaminants at the Building 190 area include explosives [Explosive D (ammonium picrate)] related to historical operations and contamination related to pyrotechnics operations at the site since the late 1960s. Based on similar operations at Building 189, wastewaters containing explosives may have been released directly to surface drainages surrounding Buildings 190. Releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground surface via roof drains. Residue or ash, potentially containing heavy metals, from the accumulator (Building 190) may have been released to the ground surface during handling.

Figure 5-7.2 presents the contaminant exposure pathway analysis for Subarea G. The potentially impacted media include soil, groundwater, surface water, and sediment. Dust or powders may have been deposited directly to soil or may have been transported from building roofs via downspouts discharging directly to the ground. Potential contaminants to surface water and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. Boggs Creek is the closest perennial surface water body, located approximately 0.5 mile east of the site.

The principal exposure pathways expected at the subarea may be contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered high based on reports of the materials used at the site (principally Explosive D) and the potential for historical direct discharge of wastewaters from the site. Explosive D is highly water soluble and may migrate to groundwater.

5.7.6 Summary and Recommendation

Subarea G – ASD I includes Buildings 190 and 2947, and the surrounding area. The ASD was a designation for operations in the Load and Fill Area south of Highway 45 associated with research, development, and testing of pyrotechnics.

Building 190 was constructed during WWII to support loading and pressing operations in Building 198. Building 2947 was constructed in 1972 and operated as an energetics laboratory in support of pyrotechnic research and development projects. The other buildings in the subarea were constructed between the late 1960s and 2002 for support of pyrotechnics projects. Subarea G is currently an active testing site.

A considerable amount of Explosive D was reportedly spilled on the driveway near Buildings 189 and 190 during WW II. No other reports of contaminant releases have been identified for Subarea G.

The potential for contamination is considered high based on reports of the materials handled and used at and the potential for historical direct discharge of wastewaters from the site. The principal exposure pathways for the site are direct contact with soil, surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea G. It is recommended that the investigation be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to an SI to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.8 SUBAREA H - BUILDING 198 AREA

The following sections provide site-specific information about Subarea H, which includes Building 198 and the surrounding area (Figure 5-8.1).

5.8.1 Site Location

Subarea H is located in the southeastern portion of SWMU 18 at the southern terminus of Highway 101 (Figure 2-2). he subarea includes Building 198, several support buildings and structures, and the surrounding land. Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea. The buildings are located on a ridge at an elevation of approximately 700 feet msl. The southern side of the site drains south to Boggs Creek, whereas the northern side of the site feeds a tributary to Boggs Creek.

5.8.2 Historical Use

Building 198 was designed and constructed in 1944 as a medium-caliber projectile loading facility. Explosive D loading of 5-inch projectiles began in 1944, and Composition A3 (combination of RDX and wax) processing began in Building 198 in 1945 (NEESA, 1983).

During the late 1950s, Building 198 began a slow transition to become a pyrotechnic test and development facility. The interior cells (work areas) were changed to better isolate the workroom from any effects of an explosive event in a cell. An illuminating projectile line was installed but was later removed and transferred to another building. In the late 1970s, site approvals were granted to include a model shop in the center wing. The model shop was a machine shop that supported the work at Building 198 and other areas. The model shop expanded and grew to include one of the track wells (the areas of railroad track between the bays). The model shop was later moved to Building 122, outside SWMU 18. A test area once existed behind Building 198 but is no longer used. Building 198 is currently used primarily for the further development of IR decoy flares.

5.8.3 Site Features

Building 198 included mechanical mix, chemical storage, press, experimental test, grit shop, machine, and paint areas. Building 198 is divided into two sections, the model shop and explosive production area (SAIC, 2005). Based on NSA Crane Public Works drawings, exhaust fans were located over two buffing tables and a Blakeslee degreaser and in the 20 press cells. The presses were located in a pit equipped with a drain. Floor drains were present throughout the building.

5.8.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.8.4.1 Current Conditions

Building 198 is constructed of metal and concrete, and exhaust stacks are present on the roof. According to the Industrial SWPPP (SAIC, 2005), all floor drains in the production area have been permanently sealed, and those in the model shop area have removable rubber plugs. According to site personnel present during the site inspection in 2009, fume hoods have with filters been used in the building since the 1960s. Soiled filters are sent to the ABG (SWMU 03) for disposal. The area contains a Type II 90-Day Hazardous Waste Storage Area and a Type I Satellite Accumulation Area (SAIC, 2005). A bank of ground transformers is located northeast of Building 198.

Building 2507 is a pump house that contains the hydraulics used for the presses, and Building 2510 is an accumulator building that collects the vacuum (Explosive D) dust from Buildings 198. Multiple vents are present on Building 198 and 2510. Settling basins are present on the northern and southern sides of the paved area behind (east of) Building 198. Roof downspouts are present on the buildings in the subarea and discharge directly to the ground surface.

5.8.4.2 History of Releases

No reports of contaminant releases have been identified within Subarea H. However, NSA Crane Public Works drawing PW6530 (Sheet 6) from 1998 shows that the interior floor drains discharged to the stormwater conveyance system and discharged to the southern hill slope. The drawing states that the floor drains were to be plugged and the line from the interior connected to the sanitary sewer. The drawing is provided in Appendix A.

The EI Investigation (Tetra Tech, 2005) identified four surface soil sample locations (18SB013 through 18SB016) (Figure 5-8.1) in Subarea H. The samples were collected to a maximum depth of 18 inches and analyzed for energetics (nitroaromatics and nitramines) and metals. No energetic compounds were detected in the four samples. Of the metals, arsenic was found to exceed the Region 9 industrial RBTL and the IDEM residential RBTL in all four samples. The sample from 18SB016 exceeded the Region 9 residential RBTL for chromium. Sample 18SB013 exceeded both the Region 9 and IDEM industrial RBTLs for lead.

5.8.5 <u>Conceptual Site Model</u>

Table 5-1 lists potential contaminants of concern for Subarea H. Potential contaminants at Building 198 include explosives [Explosive D (ammonium picrate)] related to historical operations and potential

contamination related to pyrotechnics. Other chemicals have been reportedly used or stored at the site, including degreasers and oils.

Although no reported releases were identified, direct discharge of wastewaters containing explosives to surface drainages surrounding Buildings 198 is likely to have occurred based NSA Crane Public Works drawings and an operational history similar to Building 104. Releases may have also occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains.

Figure 5-8.2 presents the contaminant exposure pathway analysis for Subarea H. The potentially impacted media include soil, groundwater, surface water, and sediment. Wastewaters containing contaminants may have been discharged directly to the soil and drainages immediately around Building 198. Dust or powders may have been deposited directly to soil or may have been transported from building roofs via downspouts discharging directly to the ground. Potential contaminants to surface water and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. Boggs Creek is the closest perennial surface water body, located approximately 1,600 feet southeast of the site.

The principal exposure pathways expected at the site may be contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination for Subarea H is considered high based on reports of the materials used at the site (explosives and degreasers) and the potential for historical direct discharge of wastewaters from the site. One potential source material (Explosive D) is highly water soluble and may migrate to groundwater. Constituents associated with degreasing operations (e.g., TCE) also pose potential concern for groundwater due to the typical persistence and recalcitrance of such chemicals in groundwater. Potential contamination related to the oils is considered low based on the low mobility of in oil compounds.

5.8.6 Summary and Findings

Subarea H includes Building 198 and several support buildings/structures. Building 198 was constructed in 1944 as a medium-caliber projectile loading facility. Loading of 5-inch projectiles began in 1944, and

Composition A3 processing began in Building 198 in 1945. Building 198 consisted of mechanical mix, chemical storage, press, experimental test, grit shop, machine, and paint areas.

Potential contaminants at Building 198 include explosives [Explosive D (ammonium picrate)] and degreasers related to historical operations and potential contamination related to pyrotechnics. Although no reported releases were identified, direct discharge of wastewaters containing explosives to surface drainages surrounding Buildings 198 is likely to have occurred. Releases may have also occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains.

The potential for contamination for Subarea H is considered high based on reports of the materials used at the site (principally explosives) and the potential for historical direct discharge of wastewaters from the site. The principal exposure pathways for the site are direct contact with soil, surface water, and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea H. It is recommended that the investigation be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to an SI to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.9 SUBAREA I - BUILDING 200 AREA

The following sections provide site-specific information about Subarea I, which includes Building 200 and the surrounding area (Figure 2-2).

5.9.1 Site Location

Building 200 is located in the southwestern corner of SWMU 18. Highway 322 leads to the subarea from Highway 101. The area consists of one principal building (Building 200) and multiple smaller outbuildings and adjacent land area (Figure 5-9.1). Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea. Railroad tracks enter the area from the west and terminate on the northern and southern sides of Building 200. The buildings are located on a ridge at

an elevation of approximately 700 feet msl and are surrounded by fencing. The entire subarea drains to the southeast to a tributary to Boggs Creek.

5.9.2 Historical Use

Building 200 was designed and constructed as a major-caliber loading building in 1944, similar to Building 105 (Subarea A). Site operations at Building 200 consisted of automatic loading and packing, assembly, and paint rooms. The building was used for cast loading of insensitive munitions (PBX) up until 1999. Building 200 has also been used for loading of pyrotechnics, specifically infrared (IR) flares. Building 2504 has been for loading of illuminating flares.

5.9.3 Site Features

The eastern end of the building has four concrete-walled cells, originally used for press loading. Four 275-ton gas check presses were located above concrete pits in the eastern bay of the building. An earthen barricade located outside of the building surrounded the press area.

According to the Industrial SWPPP (SAIC, 2005), Building 200 has been used for weighing reagents for flare composition and load assembly and pack (LAP) of flares. Chemicals used in this building include copolymer, acetone, and comp slurry, and Teflon and copolymer are stored in the building. The chemicals are loaded/unloaded in an outdoor area. A trench drain inside the building collects process water and conveys it to a holding pit on the eastern side of the area. The pit is not connected to the sewer system, and the water is pumped out for disposal. Building 200 is a regulated Hazardous Waste Accumulation Site (Type II less than 90-day storage area).

Five outbuildings surround Building 200, including a condensate pump house (Building 3232), paint locker (Building 2505), two fuse-detonator magazines (Buildings 1982 and 1960), and fan and accumulator building (Building 2504). According to the Industrial SWPPP (SAIC, 2005), Building 2504 is used primarily for mixing and pressing of flare composition. There are no process floor drains in this building. Chemicals used or stored at Building 2504 include magnesium, hexane, acetone, anthracene, Teflon, and copolymer. Spent acetone/hexane solvent is stored temporarily before transport to another storage location. This solvent is not managed as a waste, but as “Material for Reuse.”

A 275-gallon fuel oil UST was located north of the pavement to supply the building generator (NSA Crane Storage Tank Database, 2001). NSA Crane Public Works drawings (PW4876 sheets 002 and 032) identify a similar location for the UST but indicate of volume of 1,000 gallons.

5.9.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.9.4.1 Current Conditions

Building 200 is constructed of concrete. It is currently an Army-operated facility involved in the manufacture of IR flares. Floor drains are present throughout the building. Multiple exhaust hoods, blowers, and vents, as well as a vacuum system and drying room were located in the building. A trench drain exists outside and to the west of the building. A settling basin containing an oily pink liquid is located to the southwest of Building 200. Runoff from the roof drains flow to underground piping that discharges around Building 200.

Miscellaneous drums containing chemicals such as hexane are located behind Building 2505. Multiple vents are located on both Building 200 and Building 2504.

5.9.4.2 History of Releases

The only documented release at Subarea I was a fire suppression system release of water (SAIC, 2005). A NSA Crane Public Works drawing (PW5179 sheet 099) notes that ceiling insulation may contain potentially hazardous accumulations of explosive particles. No other reports of contaminant releases have been identified.

The EI Investigation (Tetra Tech, 2005) identified five surface soil sample locations (18SB017 through 18SB021) (Figure 5-9.1) in Subarea I. The samples were collected to a maximum depth of 18 inches and analyzed for energetics (nitroaromatics and nitramines) and metals. No energetic compounds were detected in the four samples. Of the metals, arsenic was found to exceed the Region 9 industrial RBTL and the IDEM residential RBTL in all five samples. The Region 9 residential RBTL for iron was exceeded in the samples from 18SB017 and 18SB021.

5.9.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea I. Energetic materials, including explosives (Explosive D and PBX) and pyrotechnics (illuminating and IR flares), have been the principal materials

handled and stored at Subarea I. Other chemicals, such as oils and paints, have also been used or stored at the area.

Figure 5-9.2 presents the contaminant exposure pathway analysis for Subarea I. The potentially impacted media include soil, groundwater, surface water, and sediment. Dust or powders may have been discharged through the exhaust fans and ventilators and deposited onto surface soil, or may have been transported from building roofs via downspouts discharging directly to the ground surface. Process wasters containing energetic materials, and possibly oils, paints or solvents, may have been released to floor drains and ultimately to the exterior holding pit east of Building 200. Although the holding pit is pumped out periodically, infiltration of rain or surface runoff may cause overflowing of the pit and discharge of contaminated water. Because this subarea is classified as a Hazardous Waste Accumulation Site, delivery and movement of chemicals occurs regularly. Handling of materials outside the building may have caused releases of materials directly to the ground. Contaminants may have been transported to the surrounding drainage pathways, as evidenced by discoloration of the water in the settling basin southwest of Building 200.

The principal exposure pathways for the site are direct contact with soil, surface water, and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water. Groundwater is not used at NSA Crane for potable or agricultural purposes.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered high based on reports of the materials used at the site (principally explosives). One potential source material (Explosive D) is highly water soluble and may migrate to groundwater.

5.9.6 Summary and Recommendation

Subarea I includes Building 200 and the surrounding area. Building 200 was designed and constructed as a major-caliber loading building in 1944, and operations at Building 200 consisted of automatic loading and packing, assembly, and painting. The building was used for cast loading of insensitive munitions (PBX) and also for loading of pyrotechnics, specifically IR flares.

A fire suppression system release of water is the only documented release at Subarea I. The ceiling insulation in Building 200 is suspected to contain potentially hazardous accumulations of explosive particles. No other reports of contaminant releases have been identified.

The potential for contamination is considered high based on reports of the materials handled and used at the subarea (principally explosives). The principal exposure pathways for the subarea are direct contact with soil, surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Based on the information presented in this PR/VSI, it is recommended that additional investigation be performed at SWMU 18 Subarea I. It is recommended that the investigation be conducted in phases. The initial phase of an RCRA Facility Investigation (RFI) phase of the RCRA process would be similar to an SI to determine if contaminants at present at the subarea at concentrations of potential concern. The subsequent phase(s) of investigation would characterize the nature and extent of contamination for risk assessment and potential remedial evaluation.

5.10 SUBAREA J - ASD II AREA

The following sections provide site specific information about Subarea J – ASD II, which includes Buildings 2082 and 2083 and the surrounding area (Figure 2-2). Subarea J is referred to as ASD II because it is part of the area used for pyrotechnic testing.

5.10.1 Site Location

Subarea J is located in the southern part of SWMU 18, at the southern end of Highway 335. Subarea J consists of Buildings 2082 and 2083, several smaller buildings, and the surrounding land area (Figure 5-10.1). Grass covers the area directly around and between the buildings, and woods cover the remainder of the subarea. The subarea is located along a ridge at an elevation of approximately 650 feet msl. Surface water runoff in the subarea flows to the south and discharges to a tributary of Boggs Creek.

5.10.2 Historical Use

The two main buildings in this subarea (Buildings 2082 and 2083) were constructed in 1946 for use as inert materials warehouses. The other buildings in the subarea were constructed in the late 1970s to early 2000s for pyrotechnic testing. Flares extruding has occurred in Building 3338.

5.10.3 Site Features

Buildings 2082 and 2083 are concrete structures. Other buildings in the subarea include a plastics fabrication lab (Building 3054), red phosphorus testing building (Building 3233), extruder facility (Building 3338), windstream test facility (Building 3087) and windstream control facility (Building 3342).

An area south of Building 198 (Subarea H), located along a small gravel road that extends around the building, is used for testing and initiation of pyrotechnic devices (Building 3008). This area is fenced and the testing occurs in closed metal cages.

A 1,000-gallon fuel oil UST is located in the rear (north) of the equipment building (Building 3054). An aluminum-covered settling basin is located north of Building 3054, and an 8-foot-deep sump is located southeast of the building.

Building 3054 contained a covered drainage trench, exhaust fan, showers, and control room. Building 3087 contained two air compressors, an air dryer, and four 850-gallon ASTs. North of Buildings 2082 and 2083 is the Open Test Burning Area. A sump was located south of Building 3233. Building 3054 was equipped with downspouts, exhaust fans, and heaters.

5.10.4 PR/VSI Results

Background research was conducted through a visual survey, document research, and personnel interviews.

5.10.4.1 Current Conditions

The pyrotechnic testing area is currently active. The flare testing facility (Building 3008) is on a slightly higher elevation than the surrounding ground, and drainage swales are located on the southeast and western sides of the flare testing facility. The swales convey runoff the hill slope to the east. Testing also occurs in Building 3087 and the adjacent structure to the north. A vent is located in one of the buildings near the Burning Area. Floor drains are located in Building 3054, and a settling basin is located north of the building and a sump is located on the southeastern side of the building. An area of flare washers was located in the gravel south of Building 3342.

5.10.4.2 History of Releases

No contaminant releases have been reported within Subarea J – ASD II.

5.10.5 Conceptual Site Model

Table 5-1 lists potential contaminants of concern for Subarea J. Subarea J includes potential contamination related to pyrotechnics, including flare compositions and red phosphorus. Other chemicals have been reportedly used or stored at the site, including fuel oil.

Although no reported releases were identified, direct discharge of wastewaters containing flare constituents (e.g., metals) to surface drainages surrounding the flare testing facility or the outdoor testing area for Building 3087 is likely to have occurred. Discharges of process waters from the red phosphorus facility (Building 3233) may have been discharged to surface drainages. During wet weather conditions, sumps may have overflowed into drainage ditches located near the buildings.

Contaminants may have migrated to environmental media at the site. Figure 5-10.2 presents the contaminant exposure pathway analysis for Subarea J. The potentially impacted media include soil, groundwater, surface water, and sediment. Wastewaters containing contaminants may have been discharged directly to the soil and drainages around Subarea J. Potential contaminants to surface water and sediment may have been discharged directly to surface water, been transported from soil to surface water and sediment via erosion, or been indirectly discharged through leaching of soil to groundwater and diffuse discharge from groundwater to surface water. Boggs Creek is the closest perennial surface water body, located approximately 1,600 feet southeast of the site.

The principal exposure pathways expected at the site may be contact with soil or surface water and sediment by human and ecological receptors. Potential exposure to groundwater is indirect through transport and discharge to surface water.

Table 5-1 includes the estimated probability of releases from the site and potential impact to the environment. The potential for contamination is considered low based on reports of the materials used at the site (principally flares and flare compositions) and the potential for historical direct discharge of wastewaters from the site. Potential contamination related to the oil is considered low based on the low mobility of in fuel oil compounds.

5.10.6 Summary and Recommendation

Subarea J – ASD II includes Buildings 2082 and 2083, and the surrounding area. The two main buildings (Buildings 2082 and 2083) were constructed in 1946 for use as inert materials warehouses. The other

buildings in the subarea were constructed in the late 1970s to early 2000s for pyrotechnic testing. Flares extruding occurred in Building 3338. The pyrotechnic testing area is currently active.

No recorded releases were identified for this subarea. The potential for contamination is considered to be low.

Although potential environmental impact in Subarea J is expected to be low, additional investigation is recommended to assess if releases have occurred that may have impacted environmental media.

TABLE 5-1
SUMMARY OF SUBAREAS
SWMU 18 - LOAD AND FILL AREA
NSA CRANE, INDIANA

SWMU Subarea[1]	Building No.	Current Building Name[2]	Current User[3]	Current Status Active/Inactive	Building Area (sq ft)	Year of Construction	Roof Vents, Floor Drains, or Sumps/Settling Basins Present?	Historical Building Name/Use[4]	Major Materials Handled/Stored/Used	Probability of Releases	Potential for Environmental Impact	Contaminants of Potential Concern	Media of Potential Concern
A (Building 105)	105	Missile Warhead Loading Plant	CAAA	Active	13,377	1942	Y (RV, FD, SB)	Medium Caliber/Major Caliber Projectile Loading	- Explosives (Explosive D, PBX, HMX, RDX) - Oils - Paint - Dyes	High	Medium	- VOCs - PAHs - Metals - Energetics	- Soil - Surface Water - Sediment - Groundwater
	Support Buildings:												
	112	Condensate Lift Station	NA	NA	38	NA	NA	NA	NA				
	184	Oil and Paint Locker	CAAA	NA	178	1944	NA	Toluene storage	- Toluene				
	1959	Magazine Fuse-Detonator	CAAA	NA	165	1946	NA	NA	NA				
	1987	Magazine Fuse-Detonator	CAAA	NA	611	1945	NA	NA	NA				
	2518	Fan and Accumulator Building	CAAA	NA	1,624	1944	NA	NA	- Explosives (Composition A3, Explosive D, PBX)				
B (Buildings 101, 102, & 103)	101	Underwater Sound Signal Assembly	CAAA	Active	12,502	1942	Y (FD)	Case Filling House; Cartridge tanking and assembly; Demilitarization of propellants	- Propellants (black powder and smokeless powder) - Explosives (TNT) - Fuel Oil	Medium	Low	- VOCs - PAHs - Energetics - Metals	- Soil - Surface Water - Sediment - Groundwater
	102	Production Assembly Building	CAAA	Active	7,990	1942	Y (FD)	Bag charge filling and assembly Medium-caliber loading; Demilitarization of of small arms [20mm])	- Propellants (black powder and smokeless powder) - Depleted uranium - Paint - Solvents				
	103	Ignition Filling Building	CAAA	Inactive; Scheduled for demolition	1,030	1942	Y (RV)	Ignition filling and quilting	- Propellants (black powder)				
	Support Buildings:												
	110	Filled Bag Storage	NA	NA	49	NA	NA	NA	- Propellants (black powder)				
	111	Magazine Black Powder	NA	NA	49	NA	NA	NA	- Propellants (black powder)				
	113	Condensate Lift Station	NSA	NA	284	1942	NA	NA	NA				
	114	Condensate Lift Station	NA	NA	38	NA	NA	NA	NA				
	182	Oil and Paint Locker	CAAA	NA	178	1944	NA	NA	- Paint - Lubricating oil				
	192	Oil and Paint Locker	CAAA	NA	178	1944	NA	NA	NA				
	2137	Meter House	CAAA	NA	205	1944	NA	NA	NA				
	3214	Lunch and Locker	CAAA	Active	2,097	1991	NA	NA	NA				
	3231	Condensate Pump House	NAVFAC	NA	64	1991	NA	NA	NA				
	3349	Collector Building	CAAA	NA	546	2003	NA	NA	- Single-based and double-based propellants				
C Inert Operation Area	119	Ammo Rework	CAAA	NA	10,167	1942	Y (SB)	Inert processing (clean cases)	- Degreasers(?) - Paints - Fuel oil	Medium	Low/Medium	- VOCs - PAHs - Metals - TPH-DRO	- Soil - Surface Water - Sediment - Groundwater
	226	Storage Building Inert-RI	CAAA	NA	10,167	1941	Y (RV)	Inert processing (repaired tanks)	- Fuel oil				
	227	Storage Building	CAAA	NA	10,167	1941	Y (RV, SB)	Inert processing (dirty casings and tanks)	- Degreasers(?) - Paints - Fuel oil				
	3331	Ammo Container Maint	CAAA	NA	5,200	1999	NA	- ASMP Container repair (welding and painting)	- Paints				
	Support Buildings:												
	115	Boiler House	CAAA	NA	5,955	1943	NA	Lunch, locker, and boiler housing	- Fuel oil				
	2651	Acid Storage Building	CAAA	NA	320	1950	NA	Acid & paint storage	- Acid - Paints				
	2676	Pump Oil - Fuel Oil	NA	NA	67	NA	NA	NA	- Fuel oil				
	2676A	Storage Tank Fuel Oil	NA	NA	30,000 gal.	NA	NA	NA	- Fuel oil				
	2676B	Storage Tank Fuel Oil	NA	NA	30,000 gal.	NA	NA	NA	- Fuel oil				
	2676C	Dyke	NA	NA	NA	NA	NA	NA	NA				
	2773	Paint Locker	NA	NA	100	NA	NA	NA	NA				
	2796	Paint Locker	NA	NA	100	NA	NA	NA	NA				
	3308	Lunch and Locker Building	CAAA	NA	3,800	1997	NA	NA	NA				
	3019	NA	NA	NA	NA	NA	NA	NA	NA				

TABLE 5-1
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SWMU 18 - LOAD AND FILL AREA
NSA CRANE, INDIANA

SWMU Subarea[1]	Building No.	Current Building Name[2]	Current User[3]	Current Status Active/Inactive	Building Area (sq ft)	Year of Construction	Roof Vents, Floor Drains, or Sumps/Settling Basins Present?	Historical Building Name/Use[4]	Major Materials Handled/Stored/Used	Probability of Releases	Potential for Environmental Impact	Contaminants of Potential Concern	Media of Potential Concern
D (SP Area)	108	Quality Evaluation Lab	NSWC	Demolished	10,167	NA	NA	Inert Warehouse; Breakdown and Overhaul, Target Loading	- Propellants (smokeless powder) - Explosives (Unspecified comps)	Medium	Low/Medium	- VOCs - SVOCs - Metals - Energetics	- Soil - Surface Water - Sediment - Groundwater
	109	SP Warfare Lab	NSWC	Inactive, cited for Demolition	10,167	1942	NA	Quality Evaluation Laboratory; Inert storage building	- Explosives (unspecified) - Dyes - Flares - Magnesium oxide				
	142	Cartridge Assembly Building	NSWC	Active	18,199	1943	Y (RV, FD)	Cartridge assembly (20mm); Mortar assembly; Explosive test cells	- Propellants (smokeless powder, principally ballastite) - Explosives (Unspecified comps)				
	143	Ordnance Test Facility	NSWC	NA	24,085	1943	Y (RV, FD)	Guided Missile RD&T; 20mm Loading; Ordnance testing (Rockeye II)	- Explosives (not specified)				
	2707	Explosive Sciences Lab	NSWC	Active	10,826	1952	NA	Wet lab, office, lunch and locker	- Various chemicals (unspecified) - Explosives (various, small quantities)				
	Support Buildings:												
	2870	Thruster Test Building	NSWC	NA	486	1966	NA	Storage; Recert. Des. Ord. Hardware	NA				
	99	Qel Inert Storage	NSWC	NA	403	1943	NA	NA	NA				
	186	Ordnance Maintenance Storage	NSWC	NA	178	1944	NA	Locker	NA				
	144A	Compressor House	NA	NA	535	NA	NA	NA	NA				
	100	Qel Explosive Storage	NSWC	NA	403	1943	NA	NA	NA				
	185	Oil and Paint Locker	NSWC	NA	178	1944	NA	Chemical lab principal storage	- Paint - Various chemicals				
	2887	NA	NA	NA	NA	NA	NA	NA	NA				
	3075	Ready Magazine	NSWC	NA	45	1981	NA	NA	NA				
	3076	Ready Magazine	NSWC	NA	45	1981	NA	NA	NA				
	3077	Ready Magazine	NSWC	NA	45	1981	NA	NA	NA				
E (Building 104)	104	Projectile Loading Building	CAAA	Active	23,374	1942	Y (RV, FD, SB)	Small Projectile/Medium Caliber Loading; Ordnance Item Maintenance	- Explosives (Composition A3, PBX, Explosive D) - Degreasers (TCE) - Paints - Acids, caustics	High	High	- VOCs - PAHs - Metals - Energetic - Perchlorate - TPH-DRO	- Soil - Surface Water - Sediment - Groundwater
	189	Explosive D Sifting Building	CAAA	Inactive; Scheduled for demolition	2,088	1944	Y (RV, SB)	Explosive D Sifting; Rocket Booster Testing	- Explosives (Composition A3, Explosive D)				
	Support Buildings:												
	116	Storage Building Inert	NA	Inactive	528	1942	NA	Boiler housing; flammable storage	- Fuel Oil				
	117	Hydraulic Pump Building	CAAA/NSWC	NA	810	1945	NA	NA	- PCBs				
	118	Hydraulic Pump Building	CAAA/NSWC	NA	450	1945	NA	NA	- PCBs				
	183	Oil and Paint Locker	CAAA	NA	178	1944	NA	NA	- Paint - Lubricating oil				
	1768	Valve House	NA	NA	36	NA	NA	NA	NA				
	1985	Magazine Fuse-Detonator	CAAA	NA	611	1946	NA	NA	NA				
	1986	Magazine Fuse-Detonator	CAAA	NA	611	1945	NA	NA	NA				
	2081	Storage Building Inert	CAAA	Inactive	10,167	1946	NA	Inert Storage	NA				
	2506	Boiler House	NSWC	NA	242	1944	NA	NA	- Fuel Oil				
	2519	Accumulator Building	NA	NA	1,363	NA	NA	NA	- Explosives (Composition A3, Explosive D)				
	2552	Heater Building	CAAA	NA	117	1947	NA	NA	NA				
	2674	Boiler House	NAVFAC	NA	1,152	1952	NA	NA	- Fuel Oil				
	2685	Storage Tank Fuel Oil	NAVFAC	NA	NA	1952	NA	30,000 gallon UST	- Fuel Oil				
	2781	Lunch Shelter NE Building 104	CAAA	NA	960	1954	NA	NA	NA				
	2924	Explosive Test Cell	CAAA	NA	310	1970	NA	Designed to test 5" presses; Never used	NA				
	Area 1 (North of H-10)	Not applicable	NA	NA	Not Applicable	Unknown	NA	Unknown - cleared, linear area in historical aerial photographs (1952, 1966 & 1974)	NA	Unknown	Unknown	- Unknown	- Soil (Potential Former Borrow Pits)
	Area 2 (South of H-10)	Not applicable	NA	NA	Not Applicable	Unknown	NA	Unknown - cleared/bermed, oval area in historical aerial photographs (1952, 1966 & 1974)	NA				

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SWMU Subarea[1]	Building No.	Current Building Name[2]	Current User[3]	Current Status Active/Inactive	Building Area (sq ft)	Year of Construction	Roof Vents, Floor Drains, or Sumps/Settling Basins Present?	Historical Building Name/Use[4]	Major Materials Handled/Stored/Used	Probability of Releases	Potential for Environmental Impact	Contaminants of Potential Concern	Media of Potential Concern
F (Buildings 2084, 2085, & 2540)	2084	Ammunition Engineering	NSWC	Vacant	10,168	1946	Y (FD, SB)	Plaster Loading Building; Inert Materials (Dummy) Loading; High-pressure testing; Office Space	- Paint	Low	Low	- VOCs - PAHs - TPH-DRO	- Soil - Surface Water - Sediment - Groundwater
	2085	Storage Building Inert	CAAA	NA	10,167	1946	None	Storage	NA				
	2540	Ordnance Eng. And Development	NSWC	NA	29,483	1945	None	Applied Research Lab; office space	- Chemical(?) room in building - Machine Shop on first floor(?)				
	Support Buildings:												
	199	Boiler House	NAVFAC	Active	3,754	1944	NA	NA	- Fuel oil (USTs removed)				
	3317	Weather Shelter	NSA	NA	325	1989	NA	NA	NA				
	3323	Conventional Ordnance Project	NSWC	NA	5,400	1999	NA	NA	NA				
	2160	NA	NA	Demolished	253	NA	NA	Garage - Farmhouse # 1	NA				
	2932	NA	NA	Demolished	3,776	NA	NA	Simulated Mine	NA				
	2933	NA	NA	Demolished	NA	NA	NA	NA	NA				
	2934	NA	NA	Demolished	NA	NA	NA	NA	NA				
	2935	NA	NA	Demolished	3,548	NA	NA	Mechanical Lab Office	NA				
	2938	NA	NA	Demolished	NA	NA	NA	NA	NA				
	2675	Pump House	NA	NA	91	NA	NA	NA	NA				
	2675A	Storage Tank Fuel Oil	NA	NA	30,000 gal.	NA	NA	NA	- Fuel Oil				
	2675B	Storage Tank Fuel Oil	NA	NA	30,000 gal.	NA	NA	NA	- Fuel Oil				
G (ASD I)	190	Flare Test Building	NA	Scheduled for Demolition	2,088	NA	NA	Explosive D sifting building for Building 198	- Explosives (Explosive D) - Dyes	High	Low	- VOCs - Metals - Energetics - Perchlorate	- Soil - Surface Water - Sediment - Groundwater
	2837	Motor Room	NSWC	Scheduled for Demolition	144	1963	NA	NA	NA				
	2869	Flare Test Cell	NSWC	Scheduled for Demolition	5,049	1966	NA	Lab	NA				
	2947	Quality Evaluation Lab	NSWC	Scheduled for Demolition	2,275	1972	NA	Butler huts; energetics lab	NA				
	3040	Ammo Explosive Toxic Facility	NSWC	NA		1976	NA	Accumulator	NA				
	3071	Magazine, Ready		Scheduled for Demolition	45	NA	NA	NA	NA				
	3108	Interferometer Lab	NSWC	Scheduled for Demolition	460	1984	NA	Interferometer building for tunnel at B-190	NA				
	3115	Velocity and Trajectory Test	NSWC	Scheduled for Demolition	2,120	1985	NA	NA	NA				
	3347	Special Warfare Munitions	NSWC	NA	10,985	2002	NA	NA	NA				
	3348	Explosives Operations	NSWC	Active	5,355	2002	NA	Testing and assembly	- Explosives (C4 primarily)				
H (Building 198)	198	Pyrotechnic Test and Evaluation Facility	NSWC	Active	27,340	1944	Y (RV, FD, SB)	R&D Test Facility; Medium caliber projectile loading	- Explosives (Explosive D) - Pyrotechnics (flare comps) - Paints - Dyes	High	High	- VOCs - Metals - Energetics - Perchlorate	- Soil - Surface Water - Sediment - Groundwater
	Support Buildings:												
	1983	Magazine Fuse-Detonator	NSWC	NA	611	1946	NA	NA	NA				
	1984	Magazine Fuse-Detonator	NSWC	NA	611	1945	NA	NA	NA				
	2507	Pump Building	NSWC	Active	1,889	1944	NA	Pump housing	- Hydraulic oil				
	2508	R & D Test Lab	NSWC	NA	1,889	1944	NA	Pump housing	- Lubricating oil				
	2509	Oil and Paint Ready Locker	NSWC	NA	178	1944	NA	Oil & paint storage	NA				
	2510	R & D Test Support Building	NSWC	Active	1,391	1944	NA	Vacuuming	NA				
	2551	Heater Building	NAVFAC	NA	117	1947	NA	NA	NA				
	2897	NA		NA	NA	NA	NA	Inert storage	NA				
	3109	Chemical Storage	NSWC	NA	441	1984	NA	Flammable storage for B-198	- Flammable materials				

TABLE 5-1
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SWMU 18 - LOAD AND FILL AREA
NSA CRANE, INDIANA

SWMU Subarea[1]	Building No.	Current Building Name[2]	Current User[3]	Current Status Active/Inactive	Building Area (sq ft)	Year of Construction	Roof Vents, Floor Drains, or Sumps/Settling Basins Present?	Historical Building Name/Use[4]	Major Materials Handled/Stored/Used	Probability of Releases	Potential for Environmental Impact	Contaminants of Potential Concern	Media of Potential Concern
I (Building 200)	200	Projectile Loading Building	CAAA	Active	14,765	1944	Y (FD, Sump, SB)	Major Caliber Loading; Cast loading insensitive munitions (PBX); Pyrotechnic (IR Flares) Loading	- Explosives (Explosive D, Composition A3? & A5, PBX) - Fuel oil - Paints - Magnesium, hexane, acetone, anthracene, Teflon, and flare copolymer - Flare copolymer, acetone and comp slurry	High	High	- VOCs - PAHs - Metals - Energetics	- Soil - Surface Water - Sediment - Groundwater
	Support Buildings:												
	2504	Fan and Accumulator Building	CAAA	Active	3,599	1968	NA	Illuminating Flare Loading	- Magnesium plus other flare constituents				
	1982	Magazine Fuse-Detonator	CAAA	NA	611	1945	NA	NA	NA				
	3232	Condensate Pump House	NAVFAC	NA	240	1991	NA	Compressor building	- Hydraulic Oils				
	2505	Oil and Paint Locker	CAAA	NA	178	1944	NA	Paint locker	- Paints				
	1960	Magazine Fuse-Detonator	CAAA	NA	15	1946	NA	NA	NA				
J (ASD II)	2082	Ordnance Maintenance Storage	NSWC	NA	10,167	1946	Y (RV)	Inert storage	NA	Medium	Low	- VOCs - PAHs - Metals - Energetics - Perchlorate	- Soil - Surface Water - Sediment - Groundwater
	2083	Storage Building Inert	NSWC	NA	10,167	1946	Y (RV)	NA	NA				
	3008	Flare Test Facility	NSWC	Active	1 ea.	NA		Burn tests	NA				
	3054	Plastic Fabrication Lab	NSWC	NA	2,097	1978	NA	Office space for Building 3233	NA				
	3071	Ready Magazine	NSWC	NA	45	1982	NA	NA	NA				
	3087	Windstream Test Facility	NSWC	NA	900	1983	NA	Wind tunnel facility	- Petroleum, other chemicals (unspecified)				
	3233	Red Phosphate Testing Building	NSWC	NA	690	1991	Y (RV)	Temporary red phosphorus laboratory	- Phosphorus				
	3338	Extruder Facility	NSWC	NA	2,064	2001	(Y (RV)	Twin-shoe extruding	- Mixed IR Flare comps (magnesium and teflon)				
	3342	Windstream Control Facility	NSWC	NA	2,304	2003	NA	NA	- Flare comps				

Footnotes
(1) Subareas are delineated based on common operations or mission, and topography and drainage areas.
(2) Current building names as provided by CAAA.
(3) CAAA = Crane Army Ammunition Activity Current building names as provided by CAAA.
NA = Information not available
NAVFAC = Naval Facilities
NSWC = Naval Surface Warfare Center
(4) Historical building names or uses from either:
- General Development Map (NSWC Crane, Undated)
- Initial Assessment Study (NEESA, 1983)
- Ordnance Briefings (CAAA, 2008)

Acronyms
ASD = Applied Science Department
ASMP = Army Strategic Mobility Program
FD = floor drains
HMX = high melting explosive
NFA = No Further Action
PBX = polymer-bonded explosive
PCP = pentachlorophenol
QeI = Quality Evaluation Laboratory
RDX = Research Department explosive
RFI = RCRA Facility Investigation
RV = roof vents
SB = settling basin
SP = Special Program
SVOCs - semi-volatile organic compounds
TNT = trinitrotoluene
UST = underground storage tank
VOCs - volatile organic compounds

TABLE 5-2

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA A – BUILDING 105 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea A - Buildings 105 Area
	Site Location	Subarea A is located in the northern portion of SWMU 18, off of Highway 101 (Figure 2-2).
	Site History	Buildings 105 was designed and constructed during WWII as a medium caliber loading facility with loading of Explosive D. Projectiles up to 16”/50 were press loaded. In the late 1960s Building 105 was used for press loading missile warheads, specifically Sidewinder and Sparrow missiles. In the late 1990s the facility, now under CAAA, was converted to demilitarize Explosive D-loaded projectiles by converting the Explosive D (ammonium picrate) to ammonium nitrate and picric acid. Chemicals reportedly stored at Building 105 for use in or as a product of the conversion process include ammonium picrate, toluene, picric acid, and ammonium nitrate.
	Site Area and Layout	This subarea mainly consists of Building 105 and multiple outbuildings (Buildings 184, 1959, 1987, and 2518). The area surrounding the buildings is grass covered or paved with wooded slopes to the north, east, and south. The buildings are located on a northeast-southwest trending ridge at approximately 700 feet msl. The site slopes to the north, east, and southeast. Surface drainage from the site is radially to tributaries on the slopes of the site. The tributaries flow to a stream north of the site, which flows to Boggs Creek, approximately 3,300 feet to the east.

TABLE 5-2

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA A – BUILDING 105 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Site Structures	Building 105 is a 1-1/2 story building, constructed of metal siding and concrete with an asphalt shingle roof. Washout booths were present in the eastern bay. Wastewater lines and floor drains from Buildings 105 and 2518 are reportedly connected to the sanitary sewer system. Paint spray booths equipped with ventilation were located in the center bay of Building 105. Also located in the center bay was an assembly table with an exhaust hood located above it. Multiple roof penetrations exist from Building 105. Two oil reservoirs were located in the attic of the building. Two above-ground ASTs, one containing ammonium nitrate, and the other nitric acid, were located at the southwest corner of the building in a concrete secondary containment. The four outbuildings surrounding Building 105 include a fan and accumulator building (Building 2518), two fuse detonator magazines (Buildings 1987 and 1959), and an oil and paint locker (Building 184) (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea A boundaries are shown on Figure 5-1.2
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors. Subarea A is within a secured, fenced area.
Contaminant Release Profile	Contaminants of Potential Concern	• Explosives (PBX, Explosive D, HMX, RDX, Composition A3) • Toluene • Paint constituents • Dyes • Oils

TABLE 5-2

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA A – BUILDING 105 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Migration Routes/Release Mechanisms	Roof vents, floor drains, and a settling basin are present at Building 105. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater. Wastewaters containing explosives were reportedly released directly to surface drainages surrounding Buildings 105. Releases may have occurred through deposition of explosive dusts or powder from site operations to roofs or the surrounding ground via roof vents and drains.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-2

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA A – BUILDING 105 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea A is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the west-central portion of the subarea. The remainder of the subarea is wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Conversion of ammonium picrate. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-2

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA A – BUILDING 105 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-3

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA B – BUILDINGS 101, 102, & 103 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea B - Buildings 101, 102, & 103 Area
	Site Location	Subarea B is located in the northern portion of SWMU 18 along Highway 10 (Figure 2-2). The area consists of the three principal buildings, several small outbuildings and support structures (e.g., storage bunkers), and adjacent land area.
	Site History	Buildings 101, 102, and 103, and the associated structures, were constructed in 1942 for the purpose of supporting Navy gun ammunition load and fill activities during WWII, principally black powder and smokeless powder operations. Specifically, the types of ammunition items ranged from 5”/38 to 16”/55. Building 101 is currently identified as the “Underwater Sound Signal Assembly” building. Building 102 is currently used for demilitarization of 30mm depleted uranium ammunition and high-explosive rounds. Building 103 is currently not in use and has been designated for demolition.
	Site Area and Layout	Subarea B is situated on top of a ridge at an elevation of approximately 700 feet msl. The area around and between the buildings is grass covered, and the remainder of the area is wooded. Paved roads are located to the north and south of the three buildings. In addition, railroad tracks are located south of the buildings. Surface water runoff in the eastern portion of the area flows toward Boggs Creek, and the western portion of the area flows toward a tributary of Boggs Creek.
	Site Structures	The Subarea consists of the three principal buildings (i.e., 101, 102 and 103) and several small outbuildings and support structures (e.g., storage bunkers). (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea B boundaries are shown on Figure 5-2.1
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.

TABLE 5-3

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA B – BUILDINGS 101, 102, & 103 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Contaminant Release Profile	Contaminants of Potential Concern	• Propellants (black powder, and smokeless black powder) • Explosives (TNT) • Depleted uranium • Fuel Oil constituents • Solvents • Paint constituents
	Migration Routes/Release Mechanisms	Floor drains are present in Buildings 101 and 102, and roof vents are present in Building 103. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater. Hazardous explosive particles may have accumulated in the ceiling insulation of Buildings 101 and 102. No other contaminant releases have been reported.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-3

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA B – BUILDINGS 101, 102, & 103 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the bedrock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea A is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater (Figure 5-1.1).
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and northwestern portion of the subarea. The central and eastern areas are wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Demilitarization of ordnance. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-3

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA B – BUILDINGS 101, 102, & 103 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-4

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA C – INERT OPERATIONS AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea C – Inert Operations Area
	Site Location	Subarea C is located in the western portion of SWMU 18, off of Highway 101 and within the area operated by CAAA (Figure 2-2).
	Site History	The Inert Operation Area includes Buildings 119, 226, and 227 were built in 1941 and 1942 and were originally used for inert storage of projectile tanks and cases. Building 3331 was built in 1999 and used for ammunition container maintenance. Other structures in the area include a lunch, locker and boiler house (Building 115) and an acid storage building (Building 2651), that were constructed in 1943 and 1950, respectively.
	Site Area and Layout	The three main buildings in Subarea C include Buildings 119, 226, and 227. Highway 104 and a railroad track run along the western side of these buildings. The area surrounding the buildings is grass covered or paved. The buildings are located on a north-south trending ridge at approximately 690 feet msl. Surface drainage in the western portion of the site is to the western hillslope. Runoff north of Building 226 is conveyed to drainage north of the site. Runoff south of Building 226 is conveyed to drainage on the western hillslope or to drainage on the southern hillslope. In contrast, surface drainage on the eastern side of Buildings 106 and 107 (SWMU 08) flows to a drainage east of the ridge; ultimately, drainage from the area of north of Building 226 flows to this eastern drainage. All tributaries from the hill flow to a stream south of the subarea, which flows to Boggs Creek.

TABLE 5-4

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA C – INERT OPERATIONS AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Site Structures	Buildings 119, 226 and 227 were part of operations associated with Buildings 106 and 107 for overhaul of projectile tanks and cases. Building 227 was used for storage of dirty projectile cases and tanks. Cases and tanks were transferred to Building 106 for cleaning with caustics, degreasers, and acids, and finished in Building 107 with grit blasters, degreasers, and paint. Building 119 was used for clean cases, and Building 226 was used for clean tanks. Finishing and painting also occurred in Buildings 119 and 227. Fuel oil ASTs were located at the boiler house (Building 115). Underground storage tanks (USTs) were located to the east of each of the major buildings (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea C boundaries are shown on Figure 5-3.1.
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Degreasers (?) • Paint constituents • Fuel oil • Acids
	Migration Routes/Release Mechanisms	Settling basins are present at Buildings 119 and 226. In addition, roof vents are present at Buildings 226 and 227. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.

TABLE 5-4

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA C – INERT OPERATIONS AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regime - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea C is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the northwestern portion of the subarea, west of SWMU 08. The southern and eastern areas are wooded,
	Current Human Receptors	Current human receptors include: NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include warehousing and distribution support activities. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).

TABLE 5-4

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA C – INERT OPERATIONS AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	Some of these species include, but are not limited to, mammals such as white-tailed deer, beaver, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-5

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA D – SP AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea D – Special Program (SP) Area
	Site Location	Subarea D is located in the west-central portion of SWMU 18. The subarea includes Buildings 108, 109, 142, 143, 2707 and the surrounding area (Figure 2-2).
	Site History	The Special Program Area was designed and constructed in 1943 as a 20mm loading and assembly plant. The original plant consisted of Building 143 as the projectile loading building, and Building 142 as the final assembly building for the cartridges. The final assembly effort utilized automated equipment that did not need the use of a powder loft for handling the propellant. Two inert warehouses (Buildings 108 and 109) were also built. Building 108 has since been demolished as a part of the Building 3373 Marine Corps' Military Construction (MILCON) project. After WWII, Building 143 was reworked to support the Navy's Special Programs Office in charge of ballistic missiles. The building and an adjacent area were also used in the late 1960s in support of the Rockeye II process, where bomblet penetration tests were conducted. Building 142 was used in the late 1960s and early 1970s in support of the Marine Corps. After the Vietnam conflict Building 142 was converted to house electronic test equipment that supported tests on many types of small ordnance items. Building 2707 was constructed in the early 1950s as a lunch and locker room for the 20mm line. It was converted to a Quality Evaluation Chemistry Laboratory in the 1970s. Building 365 currently remains vacant of any explosive operations. Building 109 was converted from an inert warehouse to an explosive operating building in the late 1970s. Building 109 is currently scheduled for demolition.
	Site Area and Layout	Subarea J includes the four main buildings in the area (109, 142, 143, and 2707), multiple, small support outbuildings and structures, and the surrounding land. Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea. The buildings are located on a northwest-southeast trending ridge at an elevation of approximately 650 feet msl off of Highway 11. The subarea drains to the south and east, discharging to a tributary of Boggs Creek.

TABLE 5-5

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA D – SP AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Site Structures	Buildings 109, 142, 143, 2707 are the main structures within the subarea. In addition, there are numerous support structures (e.g., Buildings 2870, 185, 3075, etc.) (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea D boundaries are shown on Figure 5-4.1.
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Propellants (smokeless black powder) • Explosives (unspecified) • Dyes • Flares • Magnesium oxides • Various chemicals • Paint
	Migration Routes/Release Mechanisms	Roof vents and floor drains are present at Buildings 142 and 143. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.

TABLE 5-5

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA D – SP AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea D is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and southeastern portion of the subarea. The remaining areas are wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include ordnance research, development, and testing. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.

TABLE 5-5

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA D – SP AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-6

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA E – BUILDING 104 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea E - Buildings 104 Area
	Site Location	Subarea E is located in the eastern-central portion of SWMU 18, west of Boggs Creek (Figure 2-2). This subarea consists of three main buildings (189, 2081, and 104) and associated structures, and adjacent land area.
	Site History	Buildings 104 and 189 were designed and constructed during WWII as a medium-caliber loading facility. Press loading operations began in Building 104 in 1942 with loading of mix fill (black powder and TNT) and Explosive D (ammonium picrate; also known as Yellow D). The facility produced the bulk of the 5”/38 and 5”/54 projectiles fired in the Vietnam conflict.
	Site Area and Layout	The buildings are located on a ridge top of approximately 650 feet msl. The surrounding area is covered by grass. The site slopes to the south, east, and northeast. Boggs Creeks is located in the valley east of the site at an elevation of approximately 510 to 520 feet msl. Surface drainage from the area of Building 104 flows radially to tributaries on the slopes of the site. The area around Buildings 104 and 2081 are grass covered or paved, and the hill slopes surrounding Building 189 are wooded. In addition, based on historical aerial photographs (1966 and 1974) two suspicious, sparsely vegetated areas were identified within the western portion of Subarea E.
	Site Structures	Subarea E consists of the three principal buildings (i.e., 189, 2081, and 104) and several small outbuildings and support structures (e.g., storage bunkers) (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea E boundaries are shown on Figure 5-5.1
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Explosives (Composition A3, PBX, Explosive D) • Degreasers (TCE) • Paint constituents • Acids, caustics • Fuel oil

TABLE 5-6

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA E – BUILDING 104 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Migration Routes/Release Mechanisms	Roof vents and settling basins are present at Buildings 104 and 189. In addition, floor drains are present at Building 104. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Roof vents and settling basins are present at Buildings 104 and 189. In addition, floor drains are present at Building 104. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-6

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA E – BUILDING 104 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea E is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the central and northeastern portion of the subarea. The southern, western, and eastern areas are wooded.
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include ordnance maintenance. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-6

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA E – BUILDING 104 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-7

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA F – BUILDINGS 2084, 2085, AND 2540 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea F - Buildings 2084, 2085 and 2540 Area
	Site Location	Subarea F is located in the southwest portion of SWMU 18. Three large buildings (Buildings 2084, 2085 and 2540) and multiple small outbuildings exist in the subarea (Figure 2-2).
	Site History	Building 2540 was built in 1945 and was originally used for ordnance engineering and development. The building is the largest at SWMU 18. Buildings 2084 and 2085, both were built in 1946 and used for ammunition engineering and storage, respectively. Other structures in the area include a conventional ordnance house (Building3323), boiler house (Building199), and a weather structure (Building 3317). Building 2084 has been used for a number of functions through the years including housing inert materials loading (dummy loads), plastic molding, ordnance engineering and now a general storage function.
	Site Area and Layout	Grass covers the area directly around and between the buildings and wooded area covers the remainder of the subarea. The buildings are located at an elevation of approximately 700 feet msl along a ridge (Figure 5-6). Runoff from the area drains from a ridge on the western edge and along the southeastern sides of the subarea. The runoff feeds a tributary to Boggs Creek. Boggs Creek drains into the East Fork of the White River and then to the Wabash River to the southwest.
	Site Structures	Three large building and multiple small outbuildings exist in the subarea (Table 5-6). A transformer station was built north of Building 199. A 30,000 gallon UST was also located near Building 199. Floor drains were located throughout Building 2084. The building was connected to a settling basin to the southeast and an industrial wastewater treatment facility. Machinery and operations at Building 2084 consisted of a paint booth, drying oven, vacuum system, sand room, and a plaster loading room. Four trenches located in the plaster loading room drained to the south side of the building. The ditches were lined with metal in 1961. A ditch was located on the south side of the building
	Site Boundaries	The SWMU 18 Subarea F boundaries are shown on Figure 5-6.1

TABLE 5-7

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA F – BUILDINGS 2084, 2085, AND 2540 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Paint constituents • Fuel oil • Miscellaneous lab chemicals
	Migration Routes/Release Mechanisms	Floor drains and a settling basin are present at Building 2084. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-7

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA F – BUILDINGS 2084, 2085, AND 2540 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea F is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and southeastern portion of the subarea. The remaining areas are wooded,
	Current Human Receptors	Current human receptors include: NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities are administrative. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-7

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA F – BUILDINGS 2084, 2085, AND 2540 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-8

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA G – BUILDING ASD I AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea G – Applied Science Department (ASD) I Area
	Site Location	Subarea G is located in the south-central portion of SWMU 18. The ASD I subarea includes Buildings 190, 2947, 3115, 3347, 3348 and the surrounding area (Figure 2-2).
	Site History	Building 2947 was constructed in 1972 and operated as an energetics laboratory in support of pyrotechnic research and development projects. The building serves the same function at the present.
	Site Area and Layout	Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea. The buildings are located at an elevation of approximately 650 feet msl along a ridge. The south side of the subarea drains to the south to Boggs Creek. The northern area of the subarea drains through a ridge to the northeast and feeds a tributary to Boggs Creek. Boggs Creek eventually drains into the East Fork of the White River and then to the Wabash River to the southwest.
	Site Structures	Building 2947 is located in the southern portion of Subarea G. Other structures in the subarea include the Special Warfare Munitions Building (Building 3347) and the Explosive Operations Building (Building 3348), both constructed in 2002. The other buildings in the subarea are the flare test cell (Building 2869), velocity and trajectory test facility (Building 3115), interferometer lab (Building 3108), motor room (Building 2837), and ammunition explosive toxic facility (Building 3040) (Table 5-1). A Hazardous Waste Class I and II Areas were present inside Building 2869. Other features of the building included a test tunnel, spectroscopy lab, exhaust hood, and air compressor. Pad mount transformers were installed to the west of Building 2947.
	Site Boundaries	The SWMU 18 Subarea G boundaries are shown on Figure 5-7.1
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Explosives (Explosive D, C4) • Dyes

TABLE 5-8

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA G – BUILDING ASD I AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Migration Routes/Release Mechanisms	There are no known roof vents, floor drains or settling basins/sumps associated with the buildings in this subarea. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-8

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA G – BUILDING ASD I AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea G is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and southeastern portion of the subarea. The remaining areas are wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include research, development and testing of pyrotechnics. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-8

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA G – BUILDING ASD I AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-9

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA H – BUILDING 198 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea H – Building 198 Area
	Site Location	Subarea H is located in the southeastern portion of SWMU 18. The subarea includes Building 198 and the surrounding area (Figure 2-2).
	Site History	Building 198 was designed and constructed as a medium caliber projectile loading facility in 1944. Site operations at Building 198 consisted of mechanical mix, chemical storage, press, experimental test, grit shop, machine, and paint areas. Building 2540 as the Lunch and Locker Facility and Building 2084 as the inert materials warehouse. During the late 1950s Building 198 began a slow transition to a Pyrotechnic Test and Development facility. In the late 1970s, the first of many site approvals was granted to include a "Model Shop" in the center wing. The Model Shop, which was a machine shop, not only supported the work at Building 198 but from other areas also. Building 198 is currently used primarily for the further development of IR decoy flares. A test area once existed behind Building 198, but is no longer used.
	Site Area and Layout	The subarea includes Building 198, several support buildings and structures, and the surrounding land. Grass covers the area directly around and between the buildings, and a wooded area covers the remainder of the subarea. The buildings are located on a ridge at an elevation of approximately 700 feet msl. The south side of the site drains south to Boggs Creek, whereas the northern side of the site feeds a tributary to Boggs Creek.
	Site Structures	Building 198 is the main structure within the subarea. In addition, there are numerous support structures (e.g., Buildings 1983, 1984, 2507, etc.) (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea H boundaries are shown on Figure 5-8.1
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Explosives (Explosive D) • Pyrotechnics (flare comps) • Paints • Dyes • Oils

TABLE 5-9

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA H – BUILDING 198 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Migration Routes/Release Mechanisms	Roof vents, floor drains, and two settling basins are present at Building 198. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-9

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA H – BUILDING 198 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea H is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and southeastern portion of the subarea. The remaining areas are wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include flare development. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-9

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA H – BUILDING 198 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-10

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA I – BUILDING 200 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea I - Buildings 200 Area
	Site Location	Subarea I is located in the southwest corner of SWMU 18. One large building (Building 200) and multiple small outbuildings exist in the area. (Figure 2-2).
	Site History	Building 200 was designed and constructed as a projectile loading building in 1944. The building was used for cast loading insensitive munitions up until 1999. The eastern end of the building has four concrete walled cells originally used for press loading.
	Site Area and Layout	Highways 322 and 321A lead to the subarea, as well as a railroad that fork to either side of the building. Grass covers the area directly around and between the buildings and a wooded area covers the remainder of the subarea. The buildings are located at an elevation of approximately 700 feet msl on a ridge, and are surrounded by fencing (Figure 5-5). The subarea drains to the southeast, which feeds a tributary to Boggs Creek. Boggs Creek drains into the East Fork of the White River and then to the Wabash River to the southwest.
	Site Structures	Site operations at Building 200 consisted of automatic loading and packing, assembly, and paint rooms. A paint spray cabinet with a floor drain and exhaust fan were located in the building. In 1975 a dust collector from Building 142 was installed for use in the paint room. Multiple exhaust hoods, blowers, and vents, as well as a vacuum system and drying room were located in the building. Floor drains were present throughout the building. Four 275-ton gas check presses were located above concrete pits in the eastern bay of the building. An earth barricade located outside of the building surrounded the press area. A transformer vault is located to the north of Building 2504. Five outbuildings surround Building 200, including a condensate pump house (Building 3232), projectile loading plant (Building 2505), two fuse-detonator magazines (Buildings1982 & 1960), and a fan and accumulator building (Building 2504) (Table 5-1).
	Site Boundaries	The SWMU 18 Subarea I boundaries are shown on Figure 5-9.1

TABLE 5-10

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA I – BUILDING 200 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors. Subarea I is within a secured, fenced area.
Contaminant Release Profile	Contaminants of Potential Concern	• Explosives (Explosive D, Composition A3, PBX) • Flare copolymer, acetone, hexane, Teflon, magnesium • Paint constituents • Fuel oil
	Migration Routes/Release Mechanisms	Floor drains, a settling basin and a sump are present at Building 200. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-10

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA I – BUILDING 200 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea I is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the western portion of the subarea. The remaining areas are wooded,
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include flare manufacturing. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	According to a 2009 population estimate, Calvert County had a population of approximately 89,000 residents.
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.

TABLE 5-10

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA I – BUILDING 200 AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

TABLE 5-11

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA J – ASD II AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
Site Profile	Installation Name	Naval Support Activity (NSA) Crane
	Installation Location	Crane, Indiana
	Site Name	Subarea J – Applied Science Department (ASD) II Area
	Site Location	Subarea J is located in the southern portion of SWMU 18. The subarea includes Buildings 2082 and 2083, and the surrounding area (Figure 2-2).
	Site History	Buildings 2082 and 2083 were both constructed in 1946 to be used as inert materials warehouses. Other smaller buildings that are located in the vicinity include a plastics fabrication lab (Building 3054), red phosphate testing building (Building 3233), extruder facility (Building 3338), windstream test facility (Building 3087) and a windstream control facility (Building 3342).
	Site Area and Layout	Subarea J is located in the southern part of SWMU 18 at the end of Highway 335 and consists of Buildings 2082 and 2083, several smaller buildings, and the surrounding land area. Grass covers the area directly around and between the buildings, and wooded area covers the remainder of the subarea. The subarea is located at an elevation of approximately 650 feet msl along a ridge. Surface water runoff in the subarea flows to the south and discharges to a tributary of Boggs Creek.
	Site Structures	Buildings 2082 and 2083 are the main structures within the subarea. In addition, there are numerous support structures (e.g., Buildings 3233, 3054, 3087, etc.) (Table 5-1). A 1,000-gallon fuel oil UST was also located in this subarea. Building 3233 contained a covered drainage trench, exhaust fan, showers, and a control room. Building 3087 contained two air compressors, an air dryer, and four 850-gallon ASTs. North of Buildings 2082 and 2083 is the Open Test Burning Area. A settling basin was located to the north of Building 2083. Building 3054 was equipped with downspouts, exhaust fans, and heaters.
	Site Boundaries	The SWMU 18 Subarea J boundaries are shown on Figure 5-10.1.
	Site Security	Access to NSA Crane is limited to military personnel and approved civilian workers and visitors.
Contaminant Release Profile	Contaminants of Potential Concern	• Flare compositions • Petroleum compounds

TABLE 5-11

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA J – ASD II AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Migration Routes/Release Mechanisms	Roof vents are present at Buildings 2082, 2083, 3233, and 3338. Natural release mechanisms and migration mechanisms for potential contaminants on the site include erosion and surface water runoff. Human activities, such as soil excavation and vegetation removal, may also redistribute contaminants in soil. After release to soil, contamination may serve as a source of contamination to groundwater and possibly result in a complete exposure pathway to human receptors who could in the future consume groundwater.
Physical Profile	Climate	NSA Crane is located in a temperate climate zone displaying a wide temperature range among seasons. The summers are warm and humid, and the winters are generally mild with short periods of very cold weather. The area receives an average of 44 inches of precipitation annually. The prevailing wind is from the southwest.
	Geology	The overburden deposits consist of alluvial, colluvial, and glacial outwash deposits consisting of silt, sand, and gravel; lacustrine deposits consisting of clay, silt, and sand; and loess deposits consisting of clay and silt. Bedrock underlying NSA Crane consists of interbedded sandstone, siltstone, shale, and coal.
	Soil	The soils at SWMU 18 are principally identified as moderately to well-drained Apalona-Udorthents complex along the ridges and the Wellston-Urdothenrts complex along the sideslopes. Both soil series are silt loams derived from loess deposits over bedrock residuum or from weathered bedrock of sandstone, siltstone, or shale.

TABLE 5-11

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA J – ASD II AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Hydrogeology	The groundwater at NSA Crane appears to be divided into two distinct regimes - one associated with overburden and one associated with bedrock. The shallow groundwater is probably transient; during periods of excessive, prolonged rainfall and during the early spring months, there is probably saturated soil and free water above the soil-rock contact. This condition dissipates by percolation into the bedrock and into intermittent or perennial streams. The groundwater associated with the bedrock is stable and probably fluctuates only a minor amount (less than 10 feet) per year. Possibly more than one zone of saturation exists in the bedrock due to the successive beds of sandstone, shale, and limestone.
	Hydrology	Precipitation in the area of Subarea I is conveyed by overland flow to adjacent surface water pathways which drain to Boggs Creek, or percolates into the underlying surface/subsurface soils into groundwater.
Land Use and Exposure Profile	Current Land Use	Industrial in developed areas and undeveloped in the remaining areas. Currently, several facility buildings, roads and parking areas are located in the southern and southeastern portion of the subarea. The remaining areas are wooded.
	Current Human Receptors	Current human receptors include NSA Crane occupational workers, construction/maintenance workers, and visitors/trespassers.
	Current Activities	Current activities include pyrotechnic testing. Other activities also include surface (non-intrusive) grounds crew maintenance (e.g. grass cutting).
	Potential Future Land Use	Potential future land use includes residential.
	Potential Future Human Receptors	Potential future human receptors include residents.
	Potential Future Land Use Related Activities	Residential use.
	Zoning/Land Use Restrictions	No known Zoning/Land Use Restrictions.
	Demographics/Zoning	NSA Crane employs more than 5,000 military and civilian personnel. According to the 2000 census, Martin County had a population of approximately 10,400, which is 0.17% of the population of Indiana. The population per square mile for Martin County is 30.4.

TABLE 5-11

CONCEPTUAL SITE MODEL INFORMATION PROFILE
SUBAREA J – ASD II AREA
NSA CRANE, INDIANA

Profile Type	Information Needs	Preliminary Review/Visual Site Inspection Findings
	Beneficial Resources	Forests at NSA Crane have been important to the re-establishment of deer, turkey, ruffed grouse, and eagles in Indiana. Timber is also harvested at NSA Crane.
Ecological Profile	Habitat Type	Developed land and open wooded areas.
	Ecological Receptors and Species of Special Concern	The habitat of the subarea supports various species including, but not limited to, mammals such as white-tailed deer, coyote, red fox, rabbits, raccoons, and mice; birds such as ducks, geese, wild turkey, bobwhite quail, ret-tailed hawks, and various amphibians, reptiles, fish, and invertebrates. The Indiana bat and bald eagle are the only federally threatened or endangered species at NSA Crane.
General Exposure Profile	Relationship of Contaminant Sources to Habitat and Potential Receptors	Human and ecological receptors may come into direct contact with potential contaminants in soil, surface water/sediment, or groundwater. Ecological receptors may also come into contact with potential contaminants that have been incorporated into the food chain (bioaccumulated in plants and animals).

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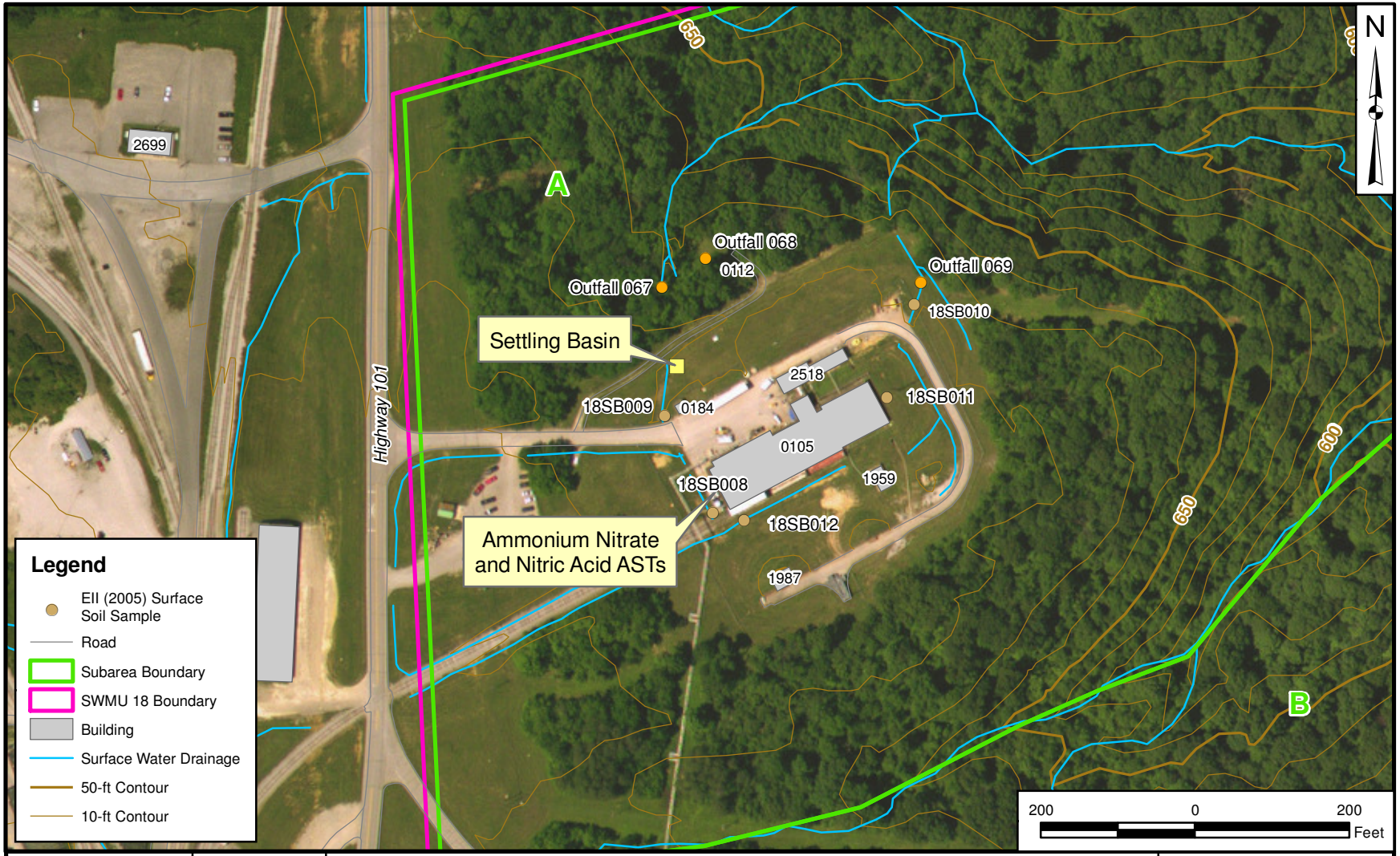

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E. GLICK	02/21/11
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SUBAREA A - BUILDING 105 AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
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APPROVED BY	DATE
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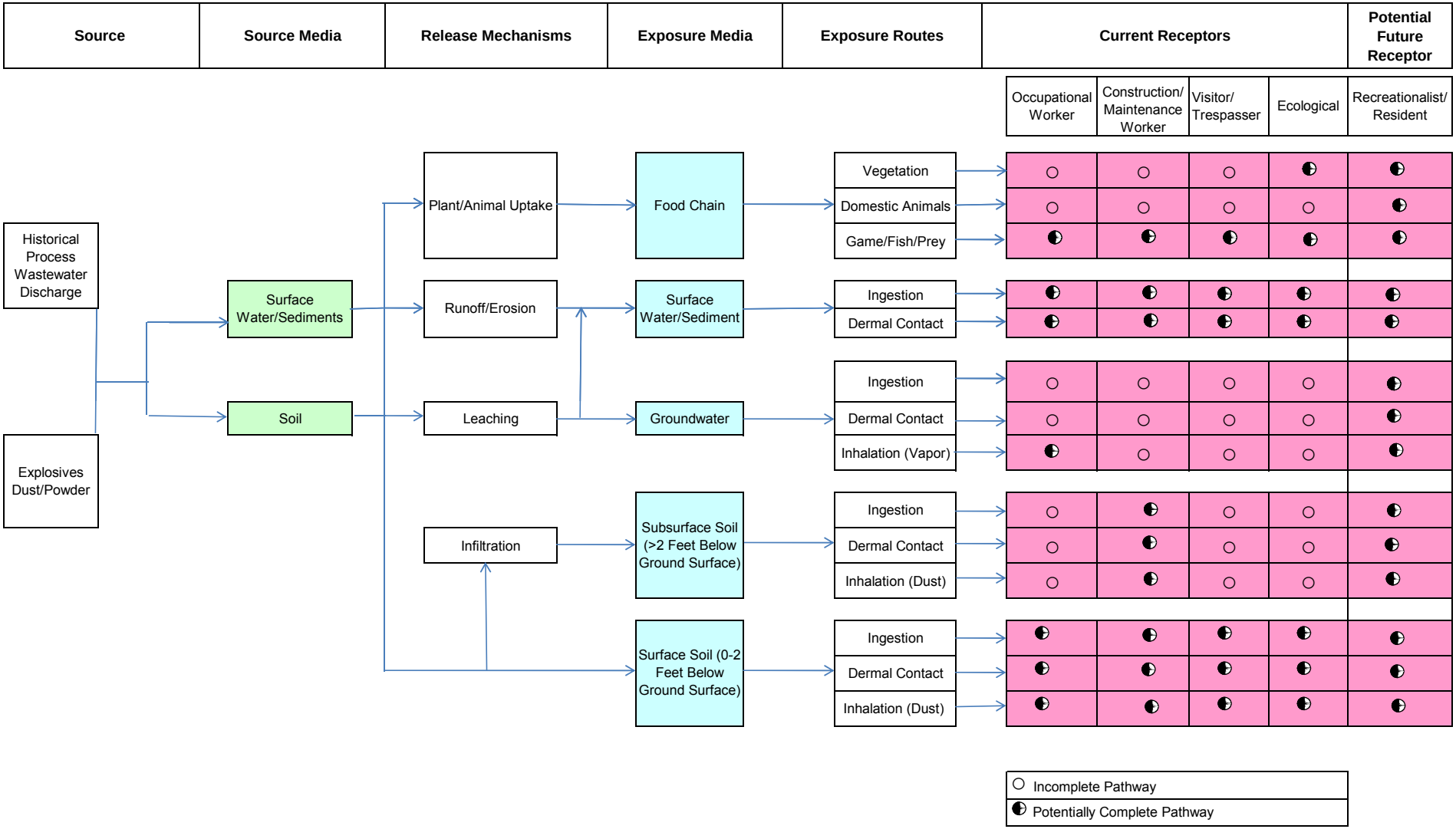
FIGURE NO.	REV
FIGURE 5-1.1	0

FIGURE 5-1.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA A - BUILDINGS 105 AREA

NSA CRANE , INDIANA



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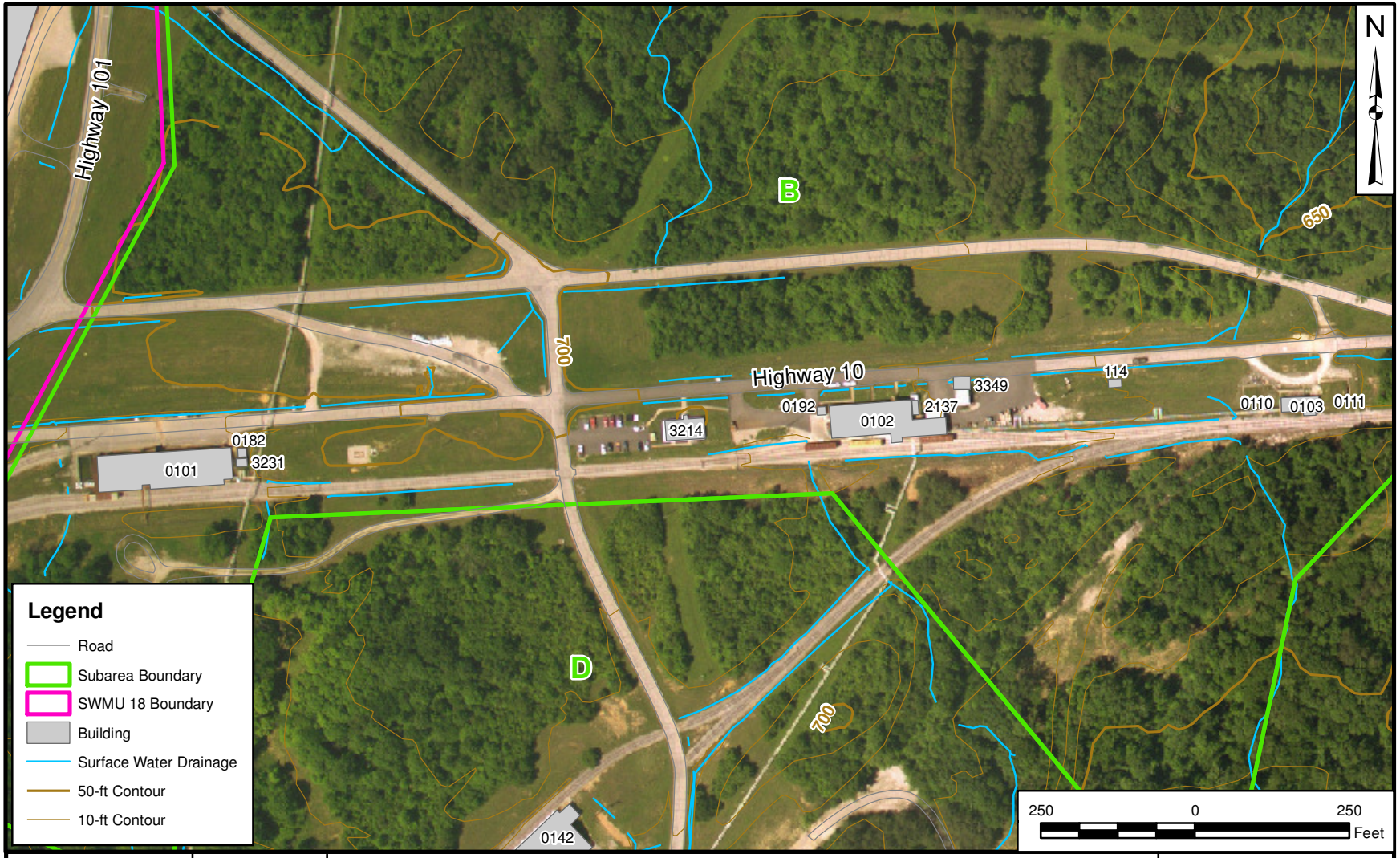

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J. DUCAR	12/27/10
REVISED BY	DATE
K. MOORE	12/27/10
SCALE	
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SUBAREA B - BUILDINGS 101, 102 AND 103 AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
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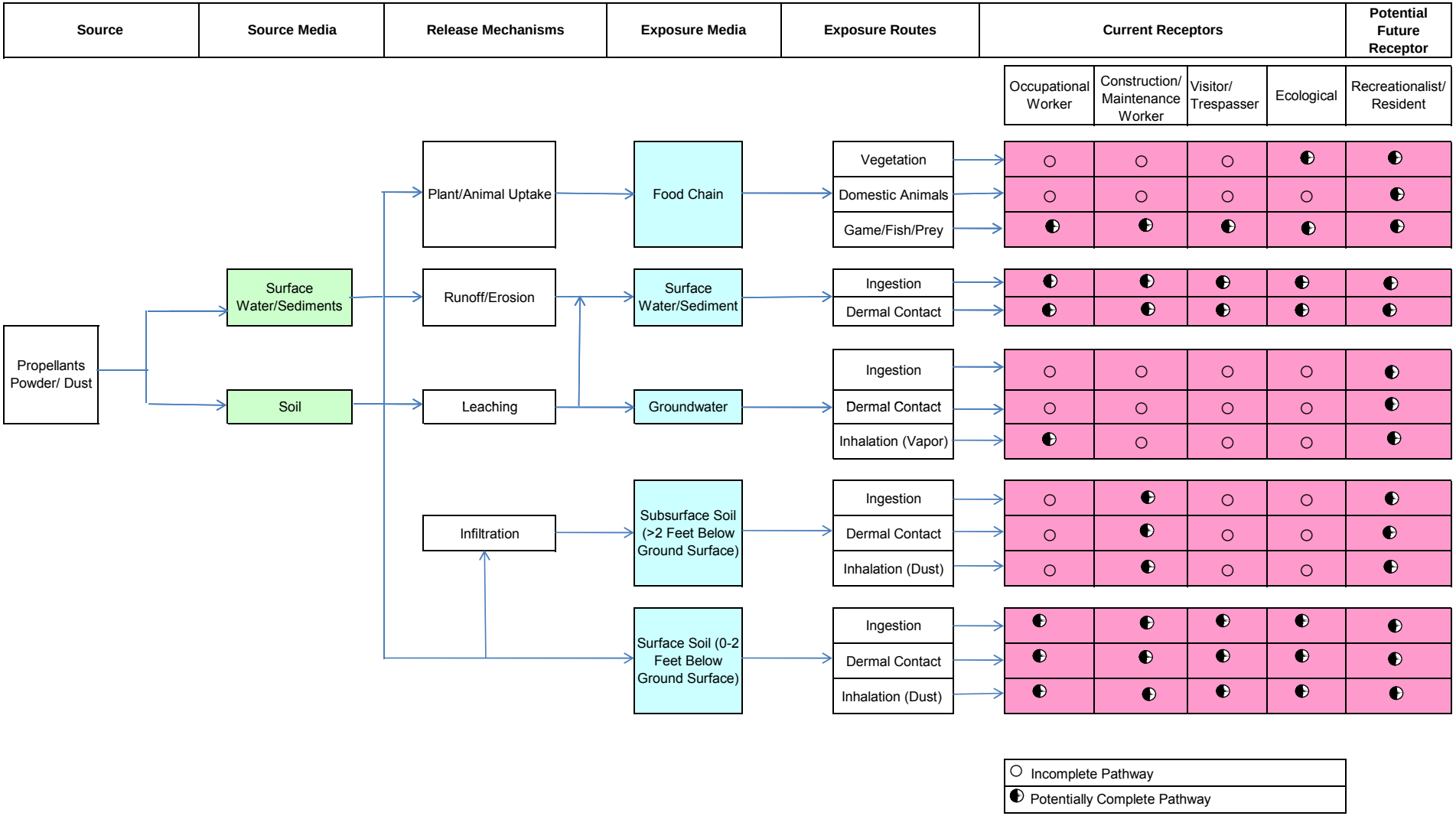
FIGURE NO.	REV
FIGURE 5-2.1	0

FIGURE 5-2.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA B - BUILDINGS 101, 102 & 103 AREA

NSA CRANE, INDIANA



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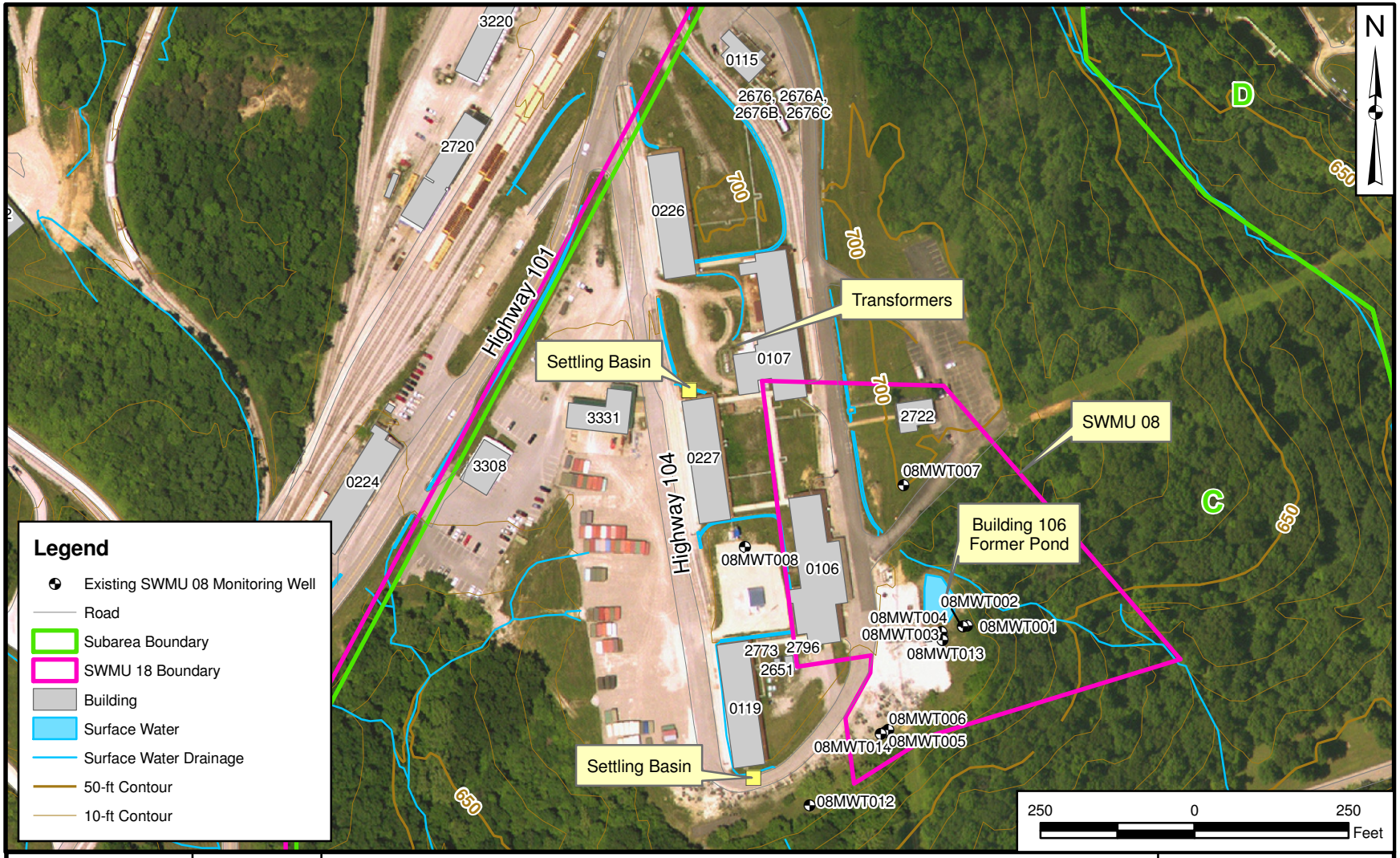


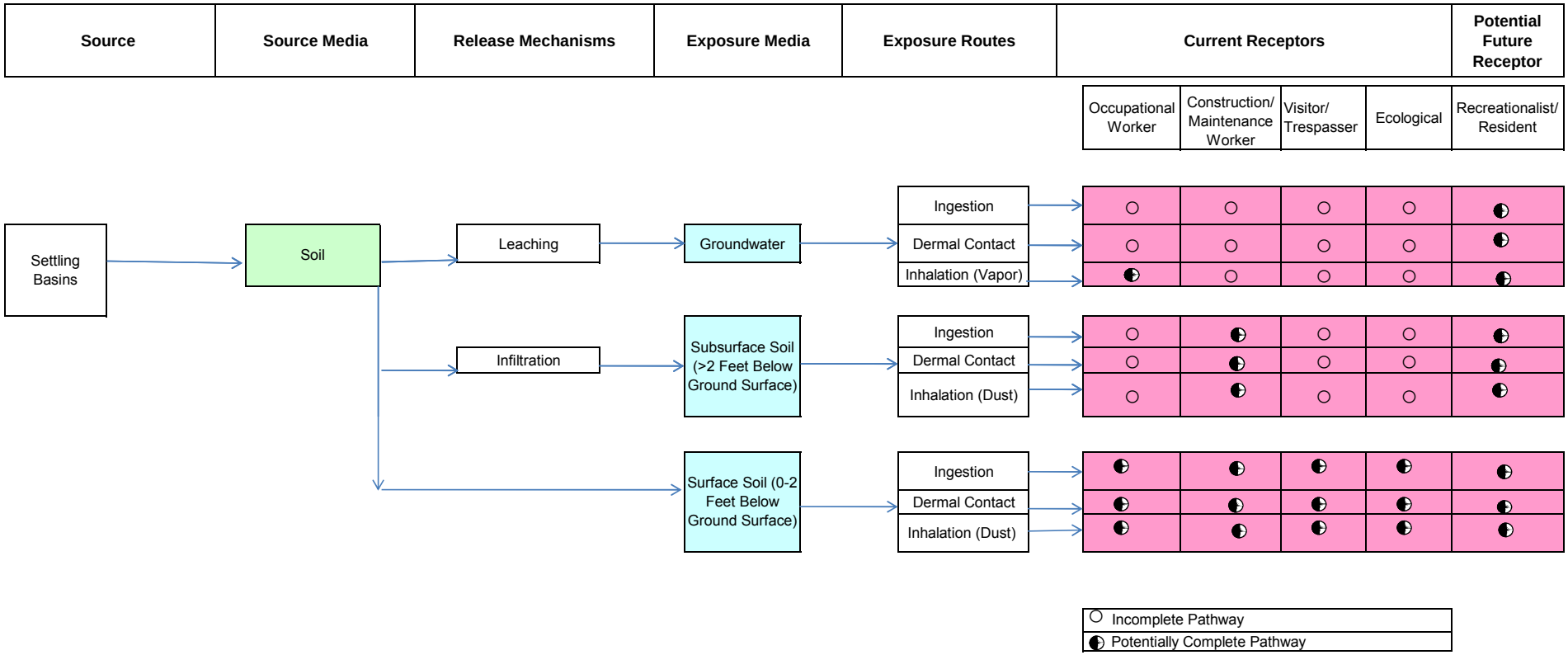
DRAWN BY S. STROZ	DATE 07/17/09	SUBAREA C - INERT OPERATION AREA SWMU 18 - LOAD & FILL AREA NSA CRANE CRANE, INDIANA	CONTRACT NUMBER F201
CHECKED BY J. DUCAR	DATE 12/27/10		APPROVED BY ___ DATE ___
REVISED BY ___	DATE ___		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5-3.1 / REV 0

FIGURE 5-3.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA C - INERT OPERATIONS AREA

NSA CRANE , INDIANA



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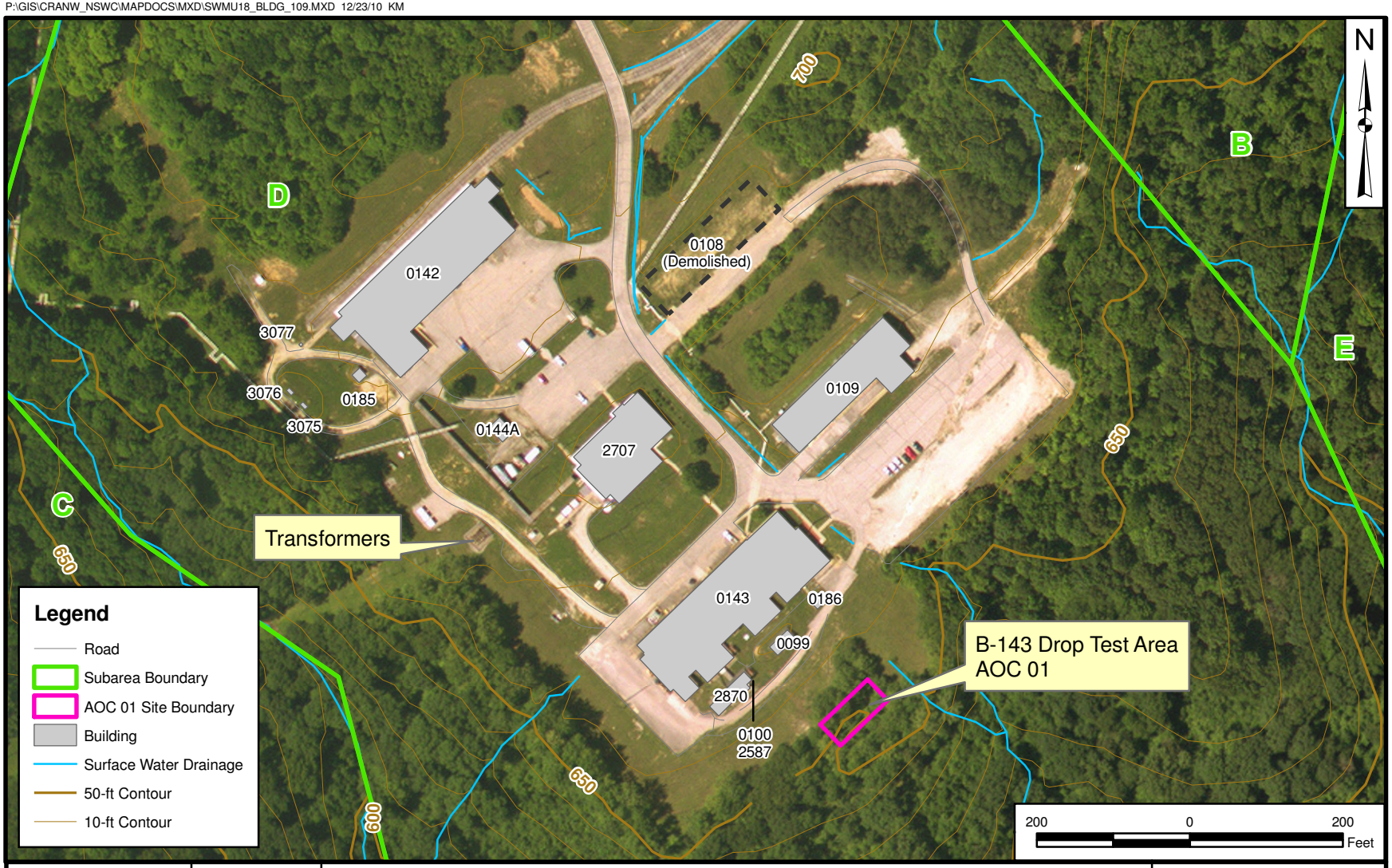

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J. DUCAR	12/27/10
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SUBAREA D - SPECIAL PROGRAMS AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
APPROVED BY	DATE
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APPROVED BY	DATE
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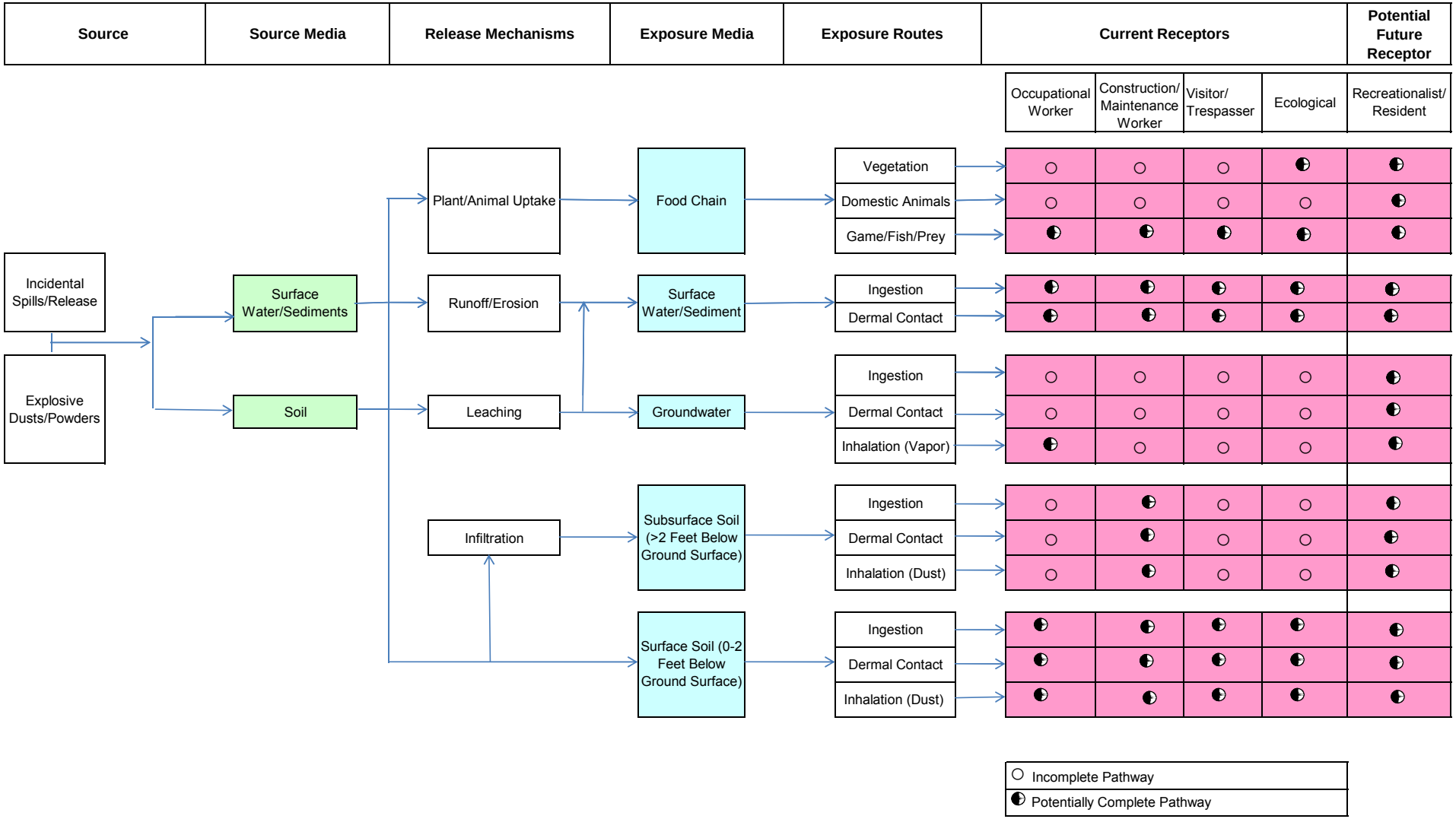
FIGURE NO.	REV
FIGURE 5-4.1	0

FIGURE 5-4.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA D - SP AREA

NSA CRANE , INDIANA



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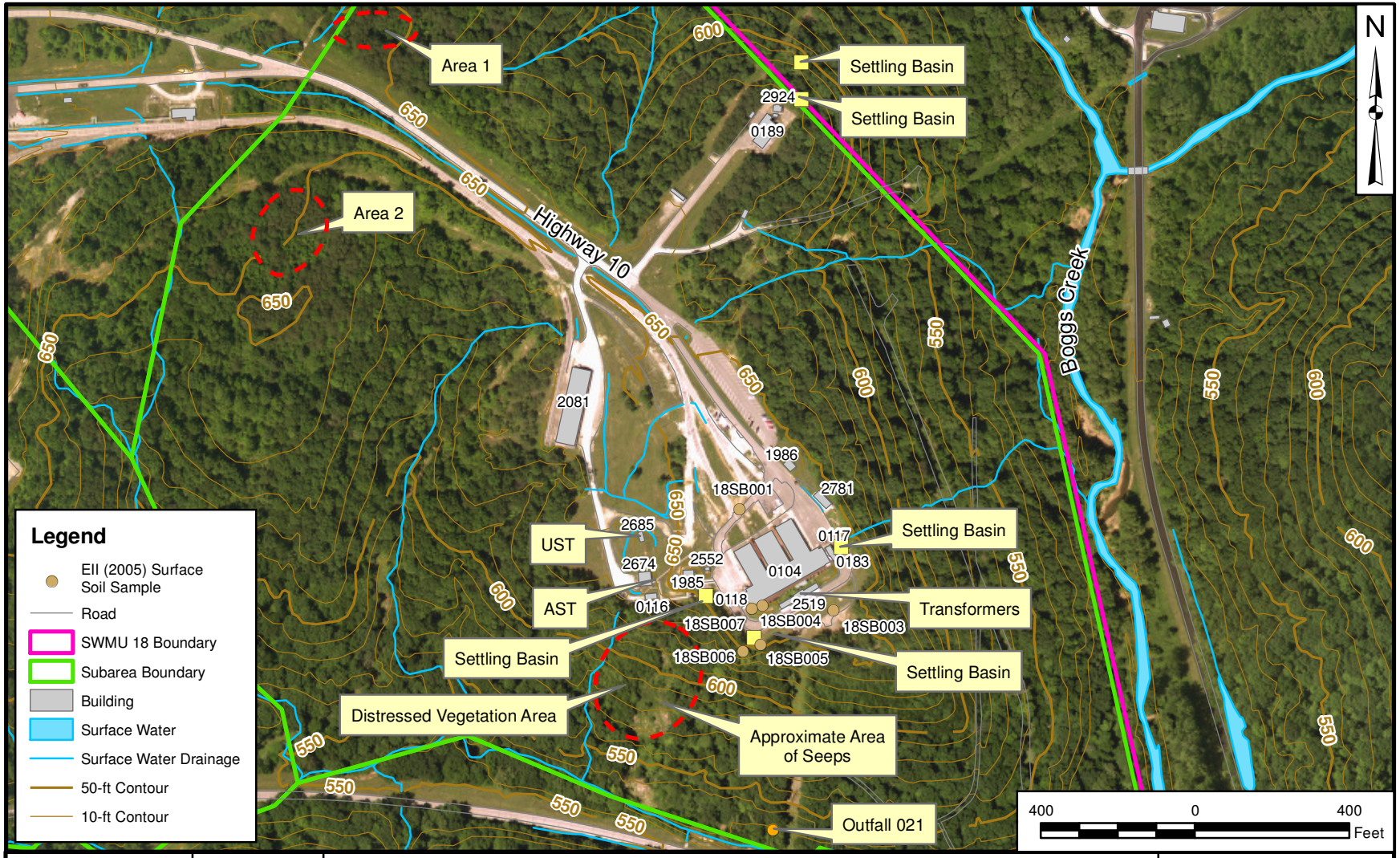

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E. GLICK	02/21/11
REVISED BY	DATE
S. STROZ	02/21/11
SCALE	
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NAVFAC

SUBAREA E - BUILDING 104 AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
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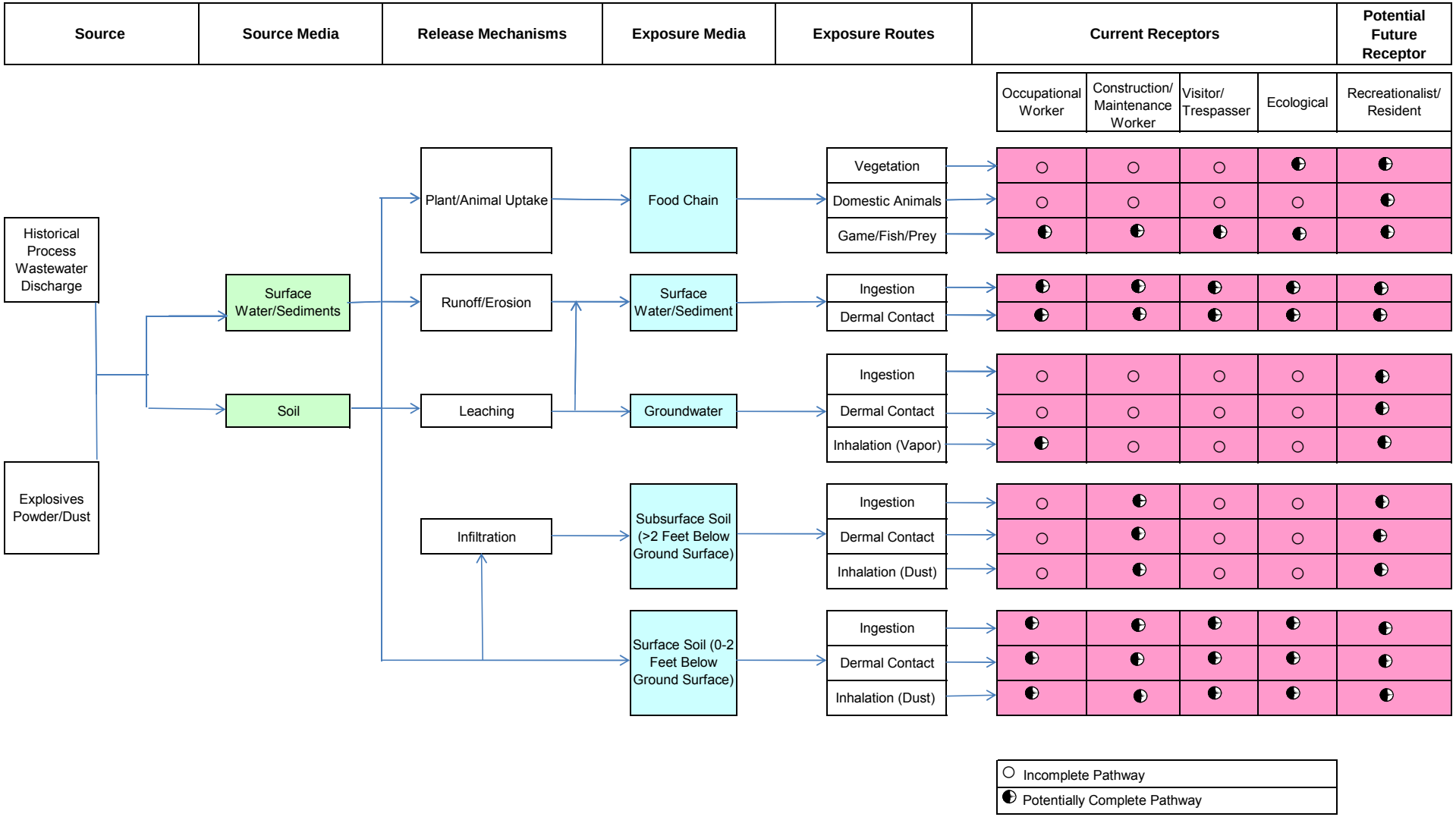
FIGURE NO.	REV
FIGURE 5-5.1	0

FIGURE 5-5.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA E - BUILDING 104 AREA

NSA CRANE , INDIANA



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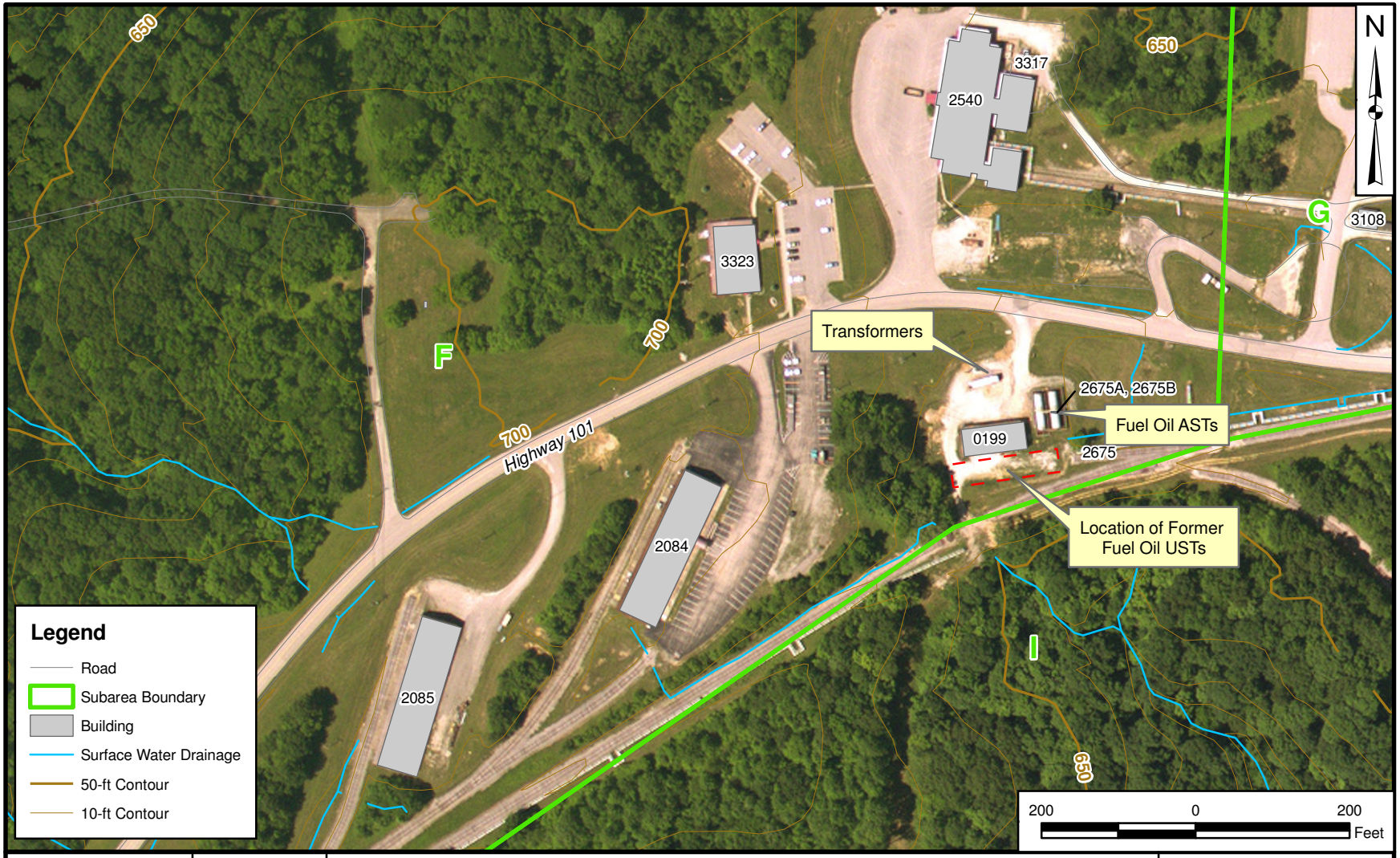

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J. DUCAR	12/27/10
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SUBAREA F- BUILDINGS 2084, 2085 AND 2540

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
APPROVED BY	DATE
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APPROVED BY	DATE
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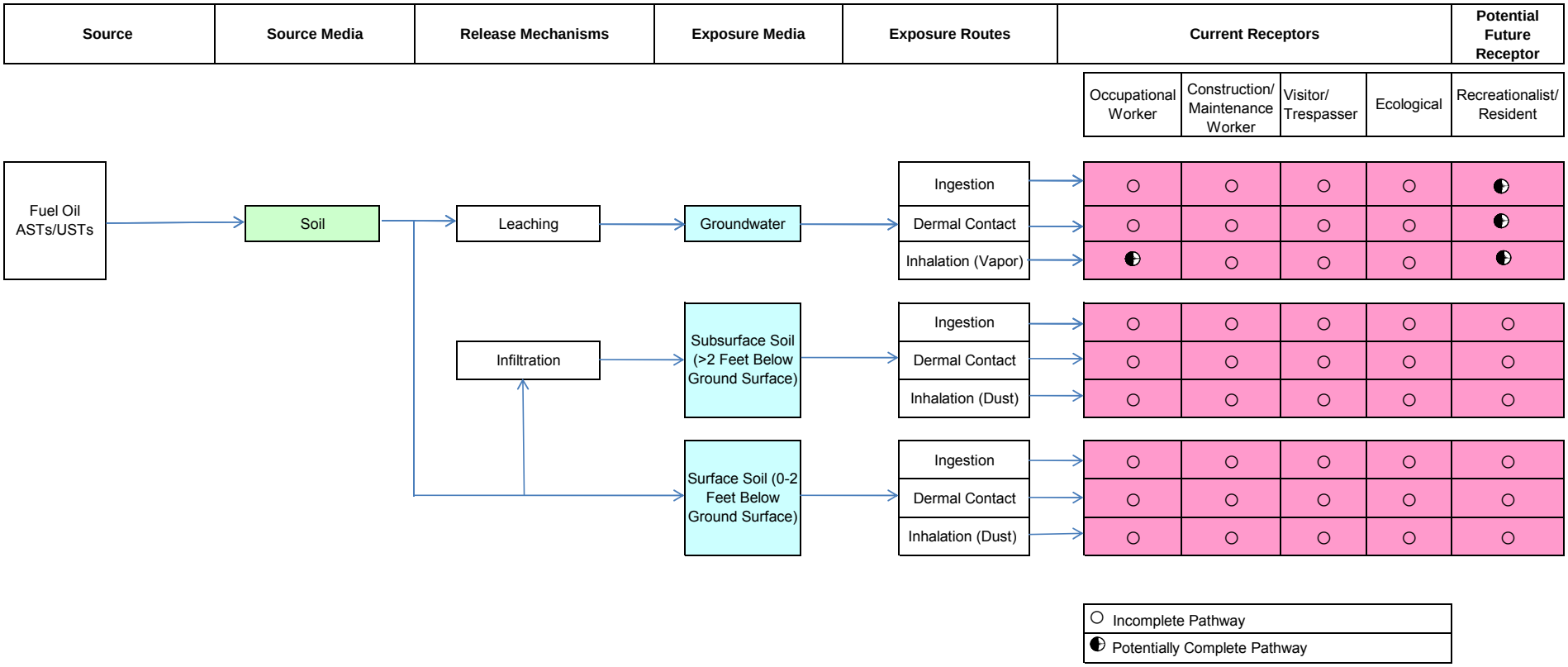
FIGURE NO.	REV
FIGURE 5-6.1	0

FIGURE 5-6.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA F - BUILDINGS 2084, 2085 & 2540 AREA

NSA CRANE , INDIANA



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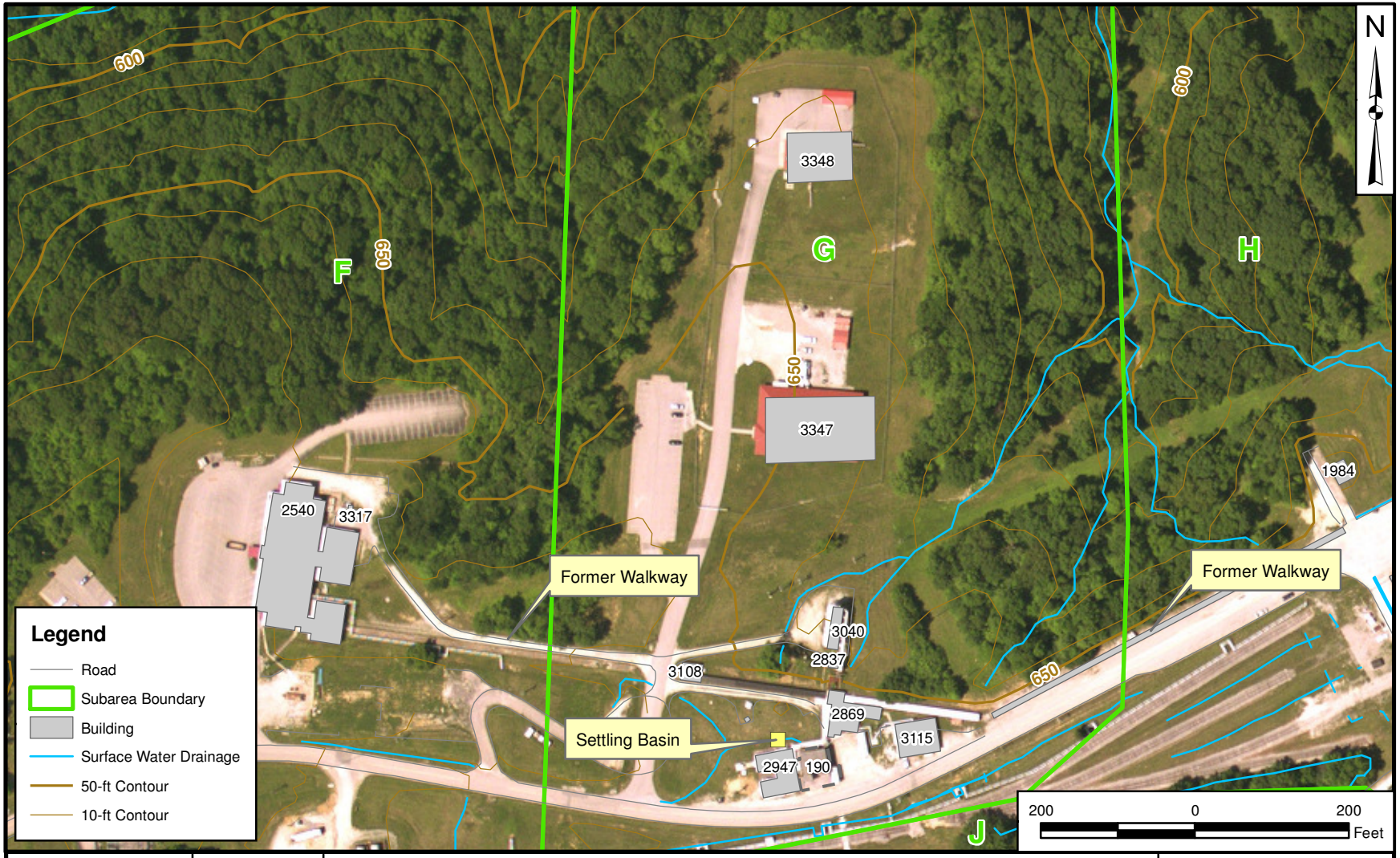

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S. STROZ	07/17/09
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J. DUCAR	12/27/10
REVISED BY	DATE
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SCALE	
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SUBAREA G - APPLIED SCIENCE DEPARTMENT I

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
APPROVED BY	DATE
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APPROVED BY	DATE
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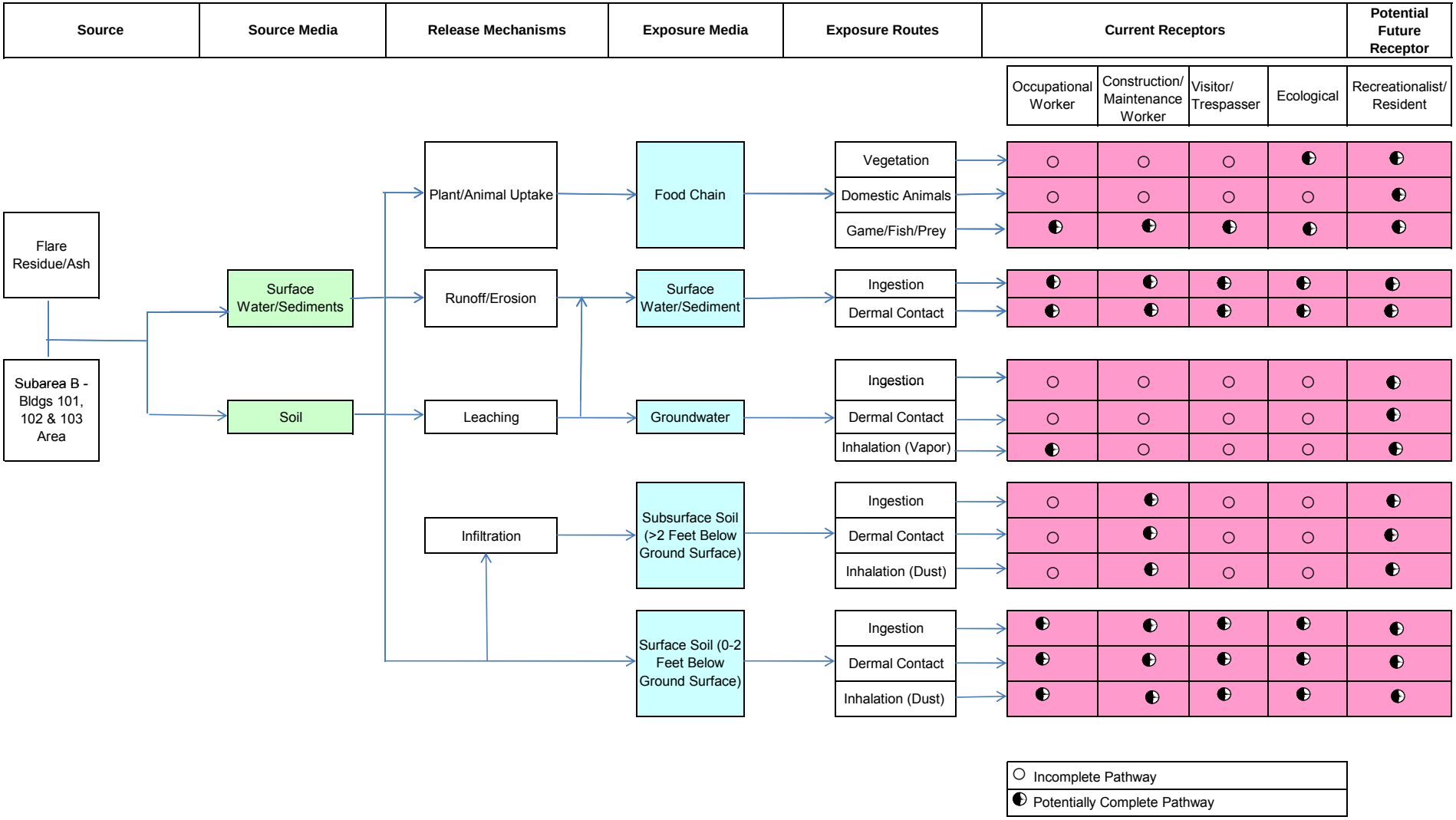
FIGURE NO.	REV
FIGURE 5-7.1	0

FIGURE 5-7.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA G - ASD I AREA

NSA CRANE , INDIANA



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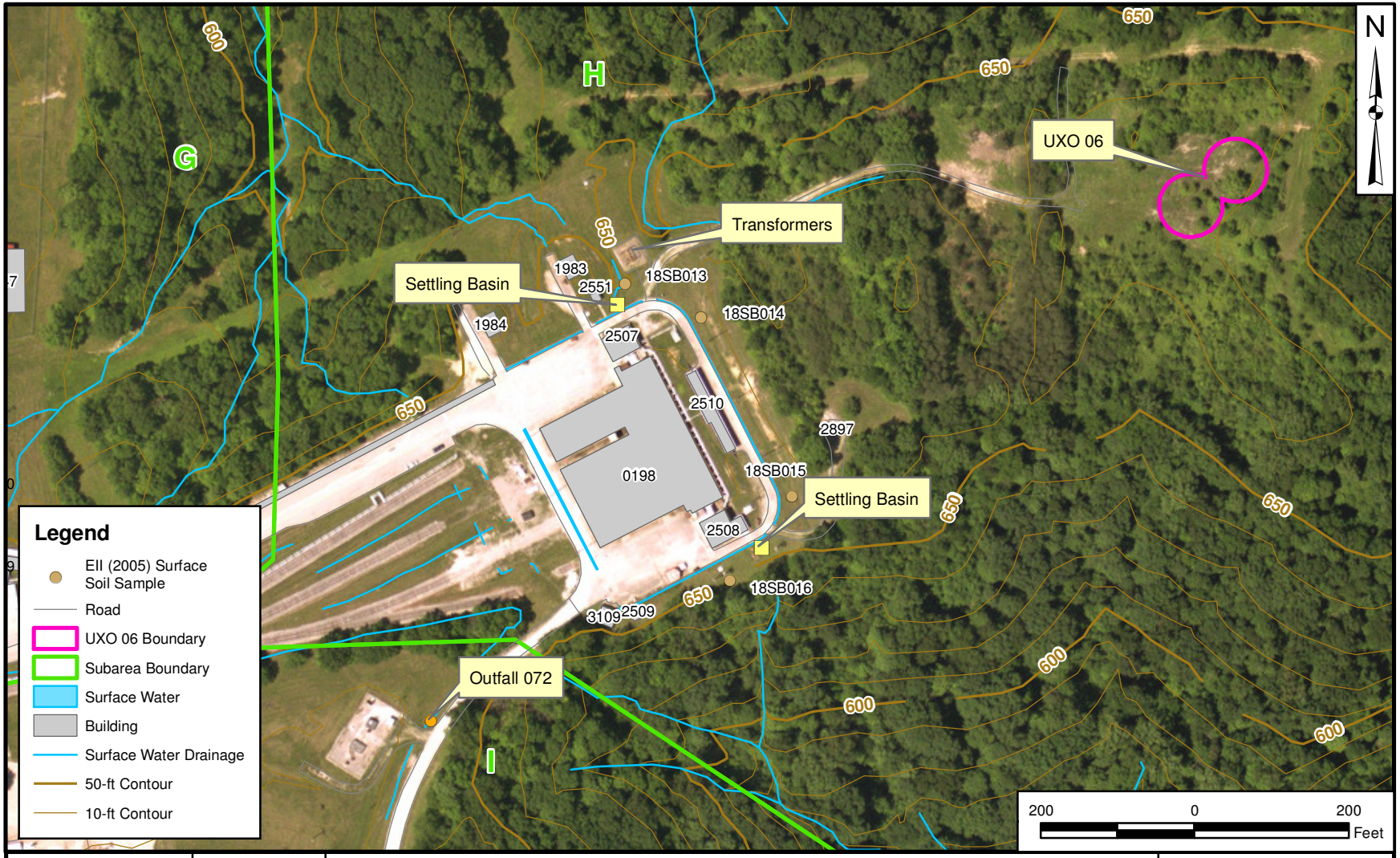

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SCALE	
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SUBAREA H - BUILDING 198 AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

CONTRACT NUMBER	
F201	
APPROVED BY	DATE
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APPROVED BY	DATE
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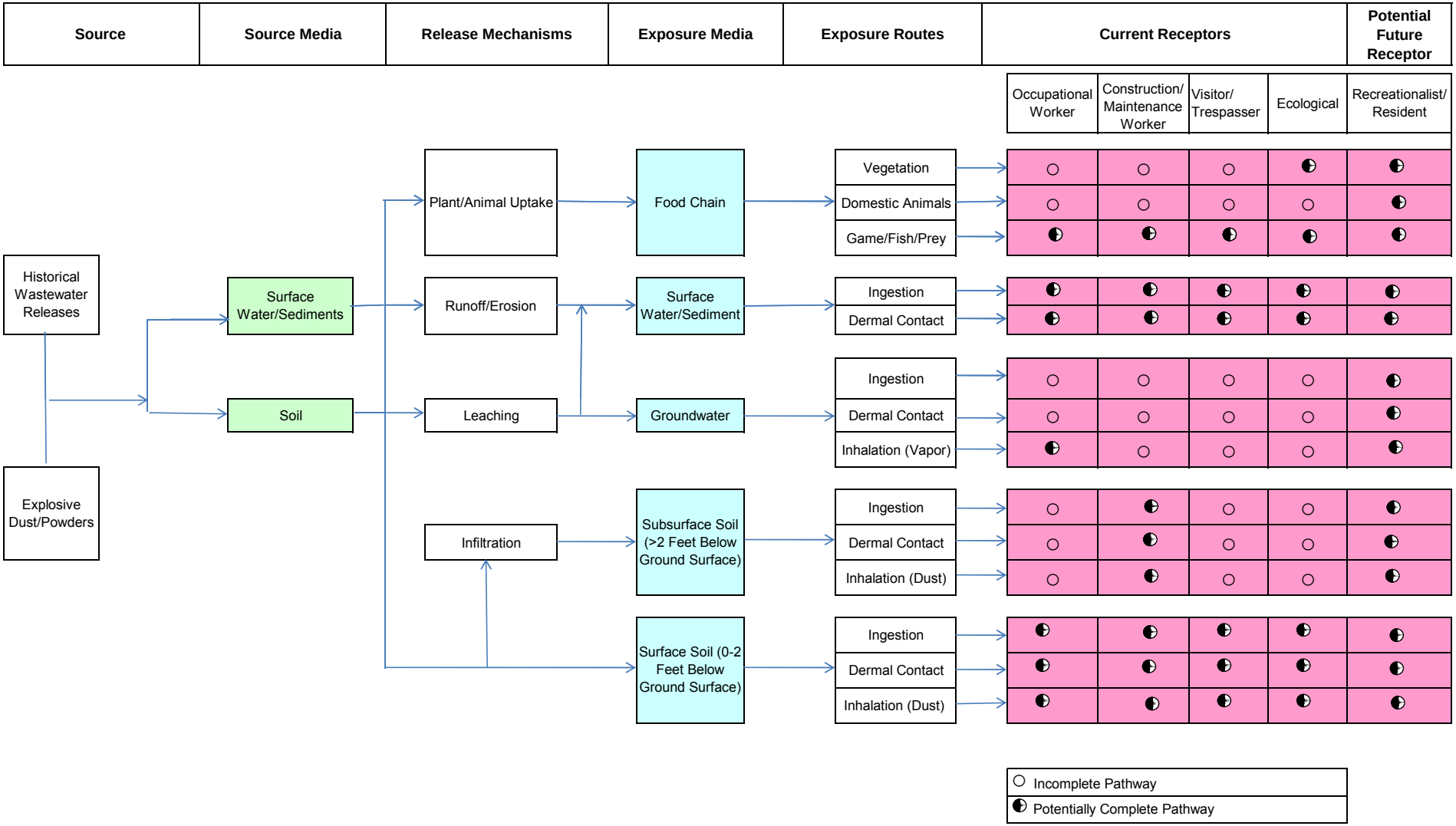
FIGURE NO.	REV
FIGURE 5-8.1	0

FIGURE 5-8.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA H - BUILDING 198 AREA

NSA CRANE , INDIANA



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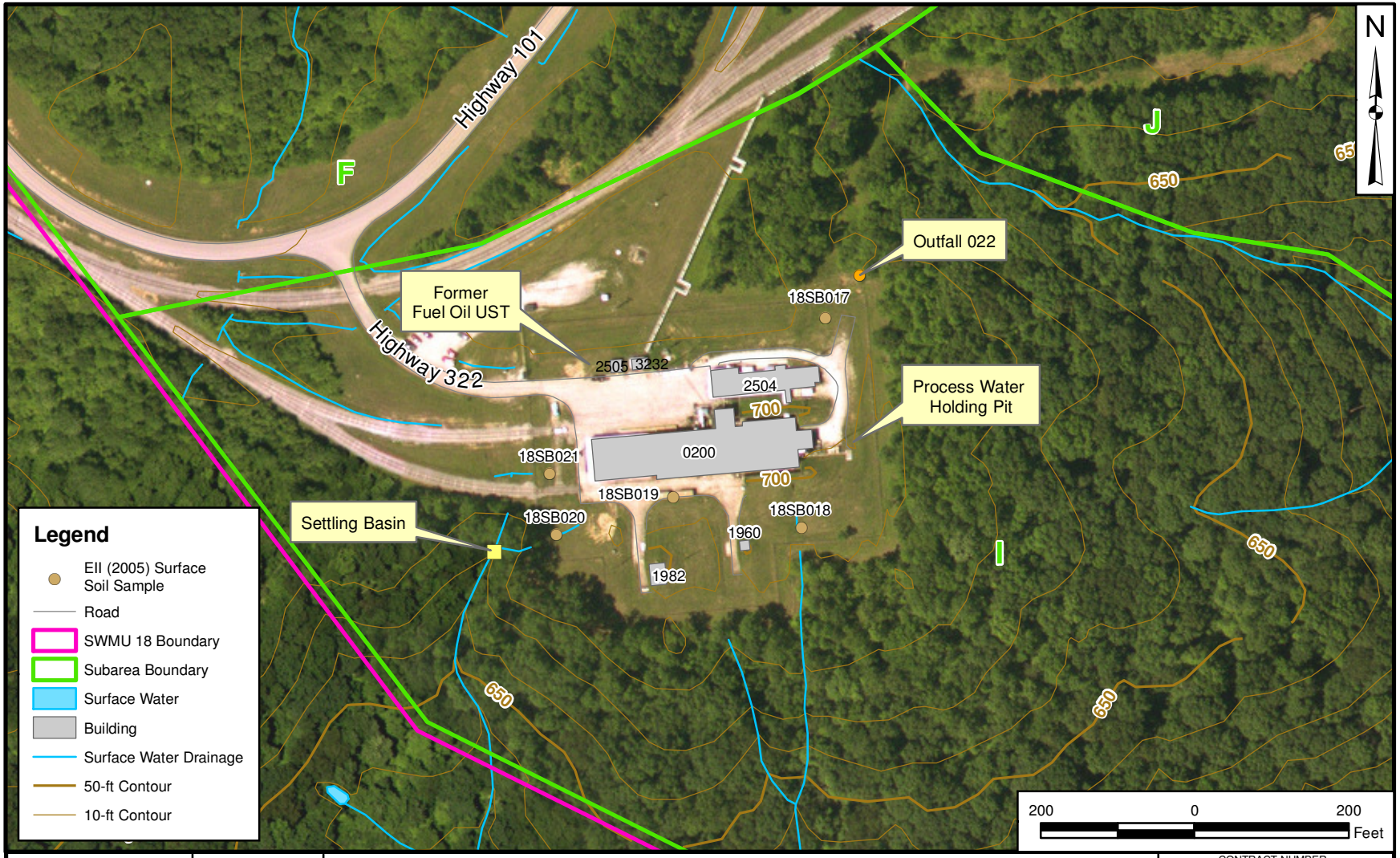

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S. STROZ	07/17/09
CHECKED BY	DATE
J. DUCAR	12/27/10
REVISED BY	DATE
___	___
SCALE	
AS NOTED	

NAVFAC

SUBAREA I - BUILDING 200 AREA

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

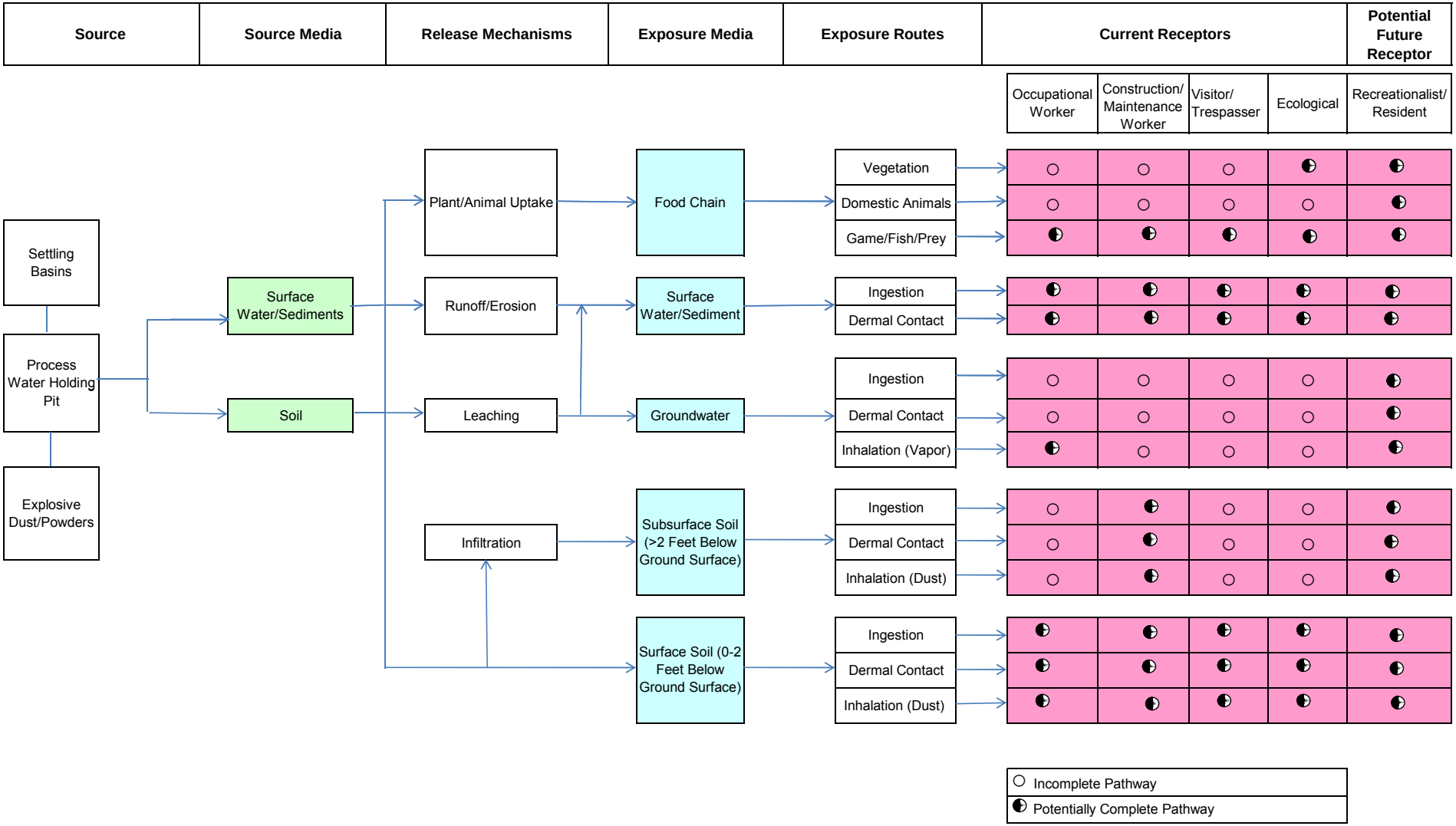
CONTRACT NUMBER	
F201	
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
FIGURE 5-9.1	0

FIGURE 5-9.2

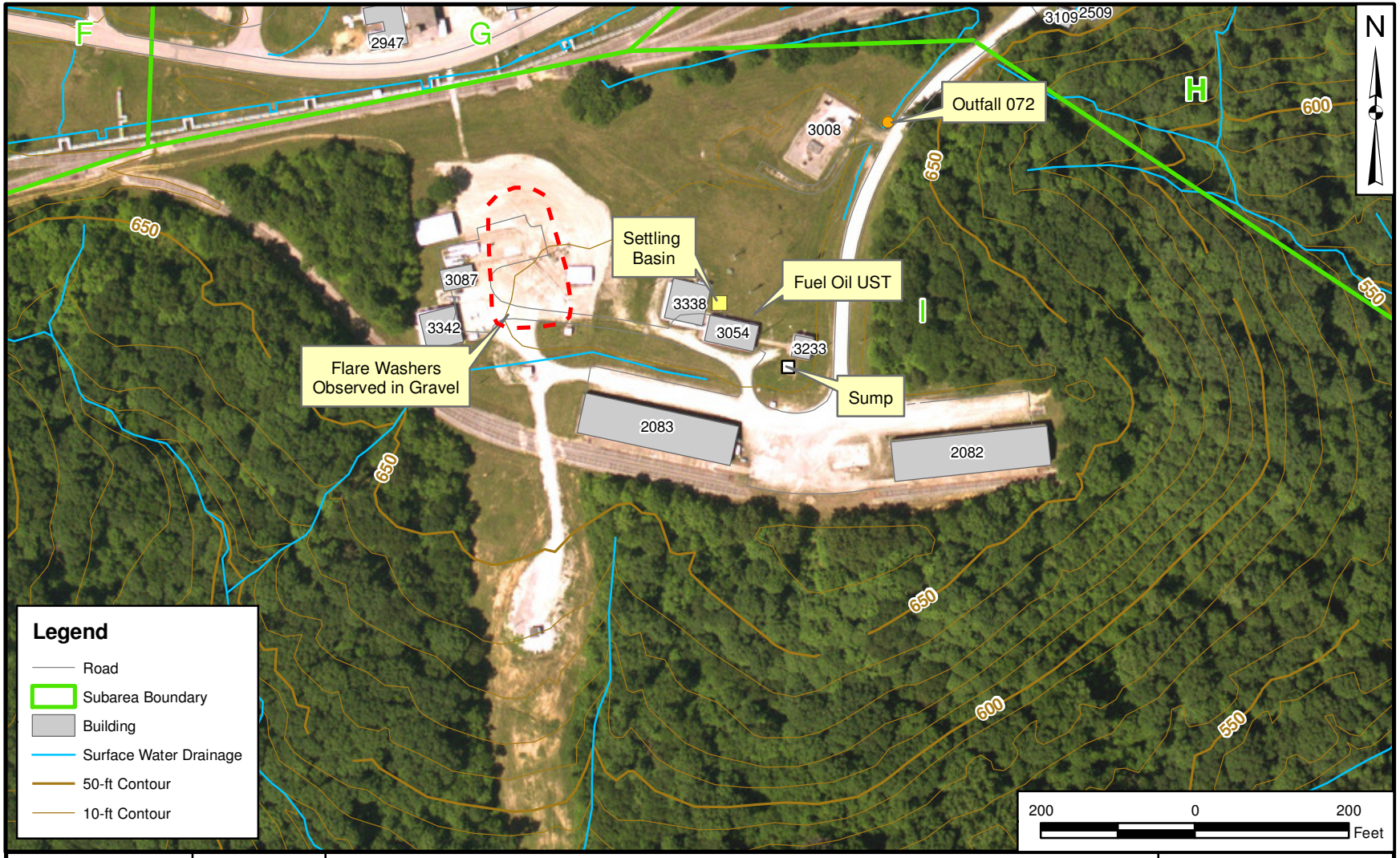
CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA I - BUILDING 200 AREA

NSA CRANE , INDIANA



P:\GIS\CRANW_NSWC\MAPDOCS\MXD\SWMU18_BLDG_2082.MXD 12/23/10 KM



DRAWN BY	DATE
S. STROZ	07/20/09
CHECKED BY	DATE
J. DUCAR	12/27/10
REVISED BY	DATE
___	___
SCALE	
AS NOTED	

NAVFAC

SUBAREA J - APPLIED SCIENCE DEPARTMENT II

SWMU 18 - LOAD & FILL AREA

NSA CRANE

CRANE, INDIANA

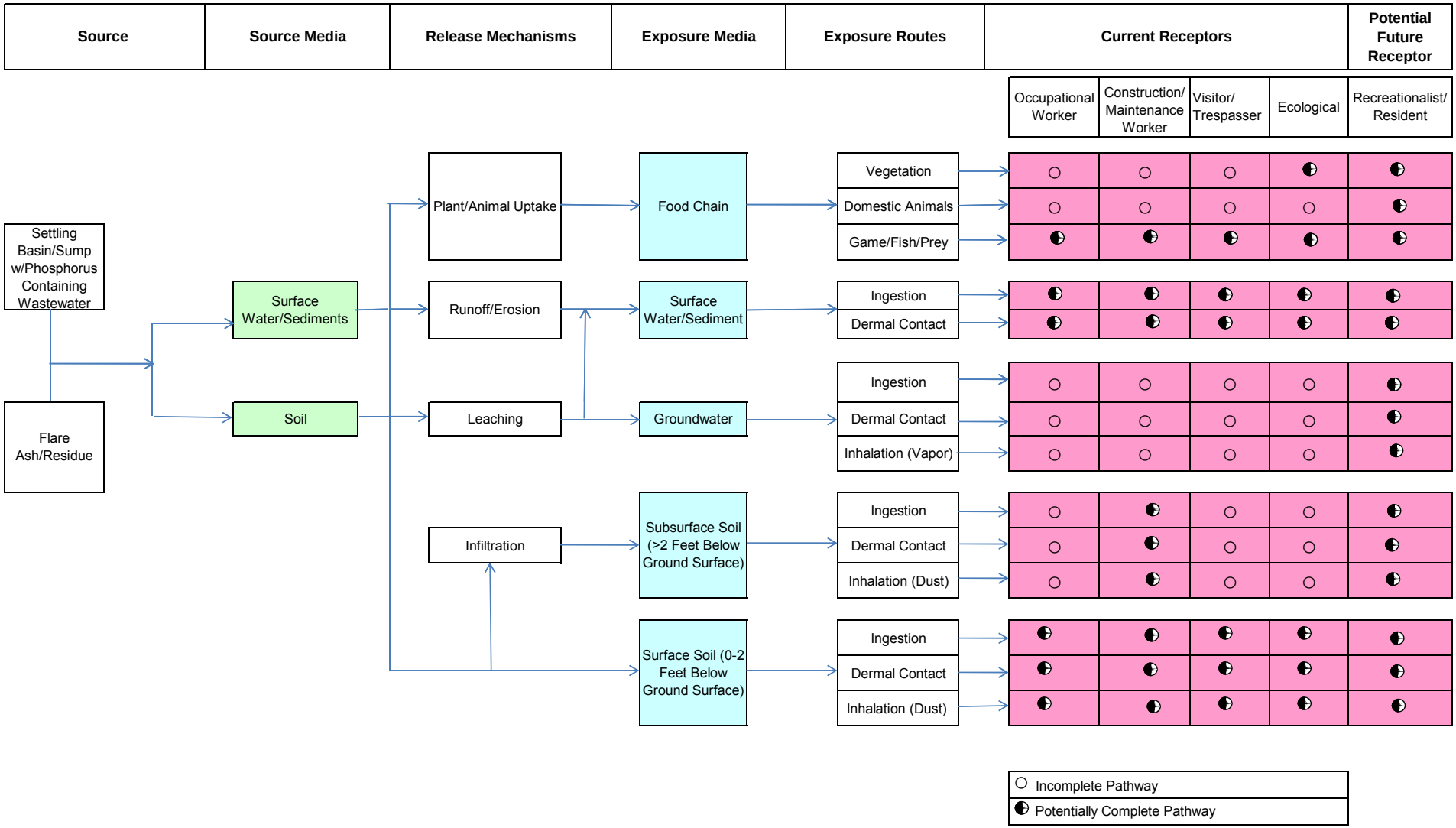
CONTRACT NUMBER	
F201	
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
FIGURE 5-10.1	0

FIGURE 5-10.2

CONTAMINANT EXPOSURE PATHWAY ANALYSIS

SWMU 18 SUBAREA J - ASD II AREA

NSA CRANE , INDIANA



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APPENDIX A

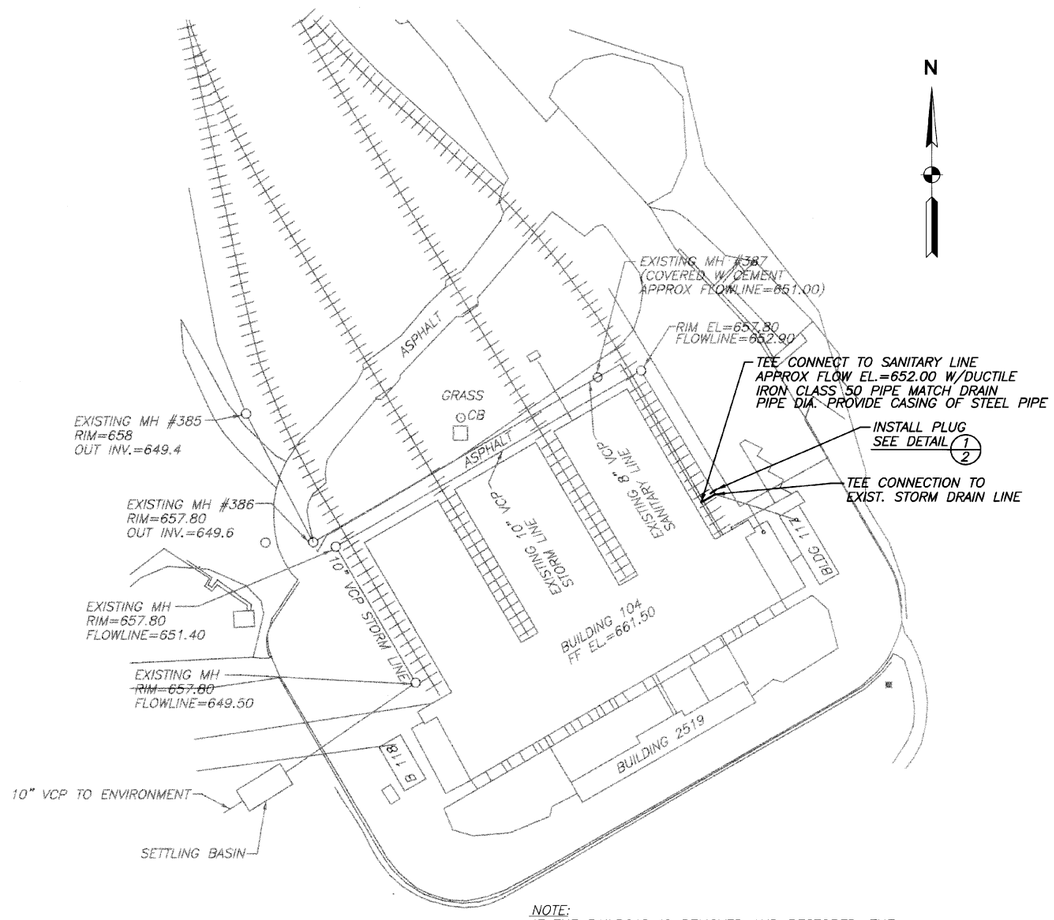
NSA CRANE PUBLIC WORKS DEPARTMENT DRAWINGS

REPRESENTATIVE PUBLIC WORKS DRAWINGS
SWMU 18 - LOAD & FILL AREA
NSA CRANE, CRANE, INDIANA

Subarea	Building	Public Works Drawing No.	Drawing Title	Drawing Date	Comment
A (Building 105)	105	PW6530 (Sheet 004)	Eliminate Illicit Discharges, Buildings 104 and 105	1997	Drawing shows discharge locations of floor drains from Building 105.
		PWSK0421	Pit Drain for 275 Ton Gas Check Press, Building 200 (Bldg 105 Similar)	1953	Drawing shows locations of floor drains in press room.
		PW5179 (Sheet 148)	Facility Energy Improvement, Building No. 105, Mechanical	1987	Drawing shows locations of floor drains.
		YD156366	Explosive "D" Loading Plant	1941	Drawing shows locations of floor drains and of floor drains discharge to sewer system.
B (Buildings 101, 102, & 103)	101	PW5179 (Sheet 038)	Facility Energy Improvement, Building No. 101, Floor Plan	1987	Drawing note states that potentially hazardous accumulations of explosive materials exist in ceiling insulation.
	102	PW5179 (Sheet 040)	Facility Energy Improvement, Building No. 102, Floor Plan	1987	Drawing note states that potentially hazardous accumulations of explosive materials exist in ceiling insulation.
		PWSK1447	Bag Charge & Filling House, Building No. 102	1959	Drawing shows "natural outlet to drain pit" approximately 450 feet south of Building 102.
	103	PW5179 (Sheet 146)	Facility Energy Improvement, Building No. 103, Mechanical	1986	Drawing shows layout of building and ventilator on roof ridge.
C (Inert Operation Area)	119 226 227	PW5133 (Sheet 002)	Replace Heating Systems, Bldgs 119 and 226	1986	Drawing shows fuel oil USTs on eastern sides of Buildings 119, 226, and 227.
	227	PW0488	Paint Disposal Trap at Bldg No 227	1951	Drawing shows schematic of paint booth on interior and settling basin and discharge from paint booth on the exterior.
D (SP Area)	142	PW5179 (Sheet 076)	Facility Energy Improvement, Building No. 142, First Floor Plan, Details, and Elevations	1987	Drawing note states that potentially hazardous accumulations of explosive materials exist in ceiling insulation. Drawing also shows degreasing areas within two bays (Bays # 3 & 4) of the building.

Subarea	Building	Public Works Drawing No.	Drawing Title	Drawing Date	Comment
D (SP Area) (cont.)	142	PW4322 (Sheet 002)	Renovation of Building 142, Floor Plan	1982	Drawing shows locations of floor drains.
		PW2172 (Sheet 001)	Drop Test Facility Near Building 143	1966	Drawing shows location of drop test facility south of Building 143.
E (Building 104)	104	PW211	Alteration to Building No. 104 and Installation of Cleaning Units in Center Wing	1947	Drawing shows the locations of degreaser in center bay.
		PW347	Washing Machine Pit, Bldg No. 104	1949	Drawing shows location of pit in center bay of Building 104.
		PW1687	Lighting Level at Bldg 104	1963	Drawing shows the locations of degreasers in eastern and western bays.
		PW6530 (Sheet 004)	Eliminate Illicit Discharges, Buildings 104 and 105	1997	Drawing shows discharge locations of floor drains from Building 104. Drawing also shows settling basin on southwestern side of Building 104.
	189	PW1263	Proposed Interim Booster & Sustainer Testing Facility, Building # 189	1957	Drawing shows construction plans for booster testing on west side of Building 189; location of fuel oil UST for Building 2506; and, location of settling basins on north side of Building 189.
F (Buildings 2084,2085, & 2540)	2084	PW3269	Sanitary Sewer - Bldg 2084 Plan & Profile, M.H. 91 to 254	1974	Drawing shows sanitary sewer line from Building 2084.
		PW3820 (Sheet 009)	Industrial Waste Treatment Facilities, Building 2084	1978	Drawing shows proposed settling basin southeast of Building 2084 and its connection to sanitary sewer system.
	2540	PW1421	Electrical, Machinery Arrangement and Alteration for Model Shop, Building 2540	1959	Drawing shows layout of machine shop on first floor of Building 2540.
G (ASD I)	No drawings included.				
H (Building 198)	198	PW6530 (Sheet 006)	Eliminate Illicit Discharges, Buildings 198 and 2521	1997	Drawing shows discharge locations of floor drains from Building 198.
		PWSK1398	Exhaust System for 3 Degreasers in Building No. 198	1955	Drawing shows locations of degreasers in each bay of Building 198.

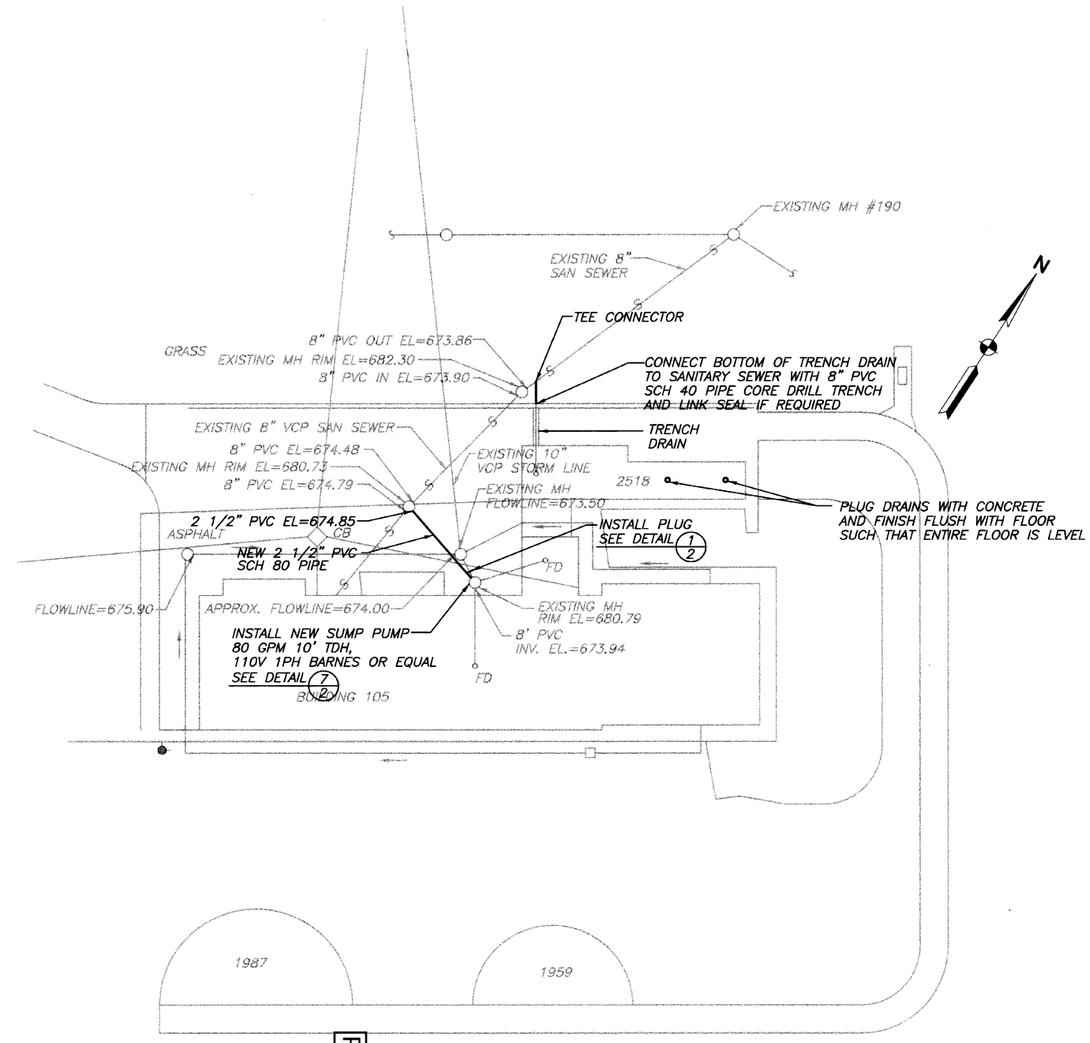
Subarea	Building	Public Works Drawing No.	Drawing Title	Drawing Date	Comment
I (Building 200)	200	PW4846 (Sheet 002)	Modifications to Buildings 200, 1982, and 2504, PBX Loading Facility	1985	Drawing shows locations of 1,000-gallon UST, sewer lines at Building 200, settling basin on western side of site, and trench line and waste sump on the eastern of Building 200.
		PW4846 (Sheet 032)	Modifications to Buildings 200, 1982, and 2504, PBX Loading Facility	1985	Drawing shows 1,000-gallon UST for diesel generator.
		PW5179 (Sheet 099)	Facility Energy Improvement, Building No. 200, Floor Plan & Elevations	1987	Drawing note states that potentially hazardous accumulations of explosive materials exist in ceiling insulation.
		PWSK0421	Pit Drain for 275 Ton Gas Check Press, Building 200 (Bldg 105 Similar)	1953	Drawing shows locations of floor drains in press room.
		YD277610	Major Caliber Projectile Loading Building Plot Plan	1944	Drawing shows locations of floor drains on building interior and settling basins (two) on building exterior (northeast and southwest).
J (ASD II)	3054 3233	PW5174 (Sheet 002)	Temporary Red Phosphorus Facility Resite November 1987, Site Plan and Details	1987	Drawing shows location of former sump for Building 3054, location of pit and fuel oil UST (indicated by pipe) north of Building 3054, and proposed sump for Building 3233.



NOTE:
IF THE RAILROAD IS REMOVED AND RESTORED, THE CONTRACTOR SHALL COORDINATE WITH RAILROAD DISPATCHER AND CONTRACTING OFFICER.

SITE PLAN-BUILDING 104

SCALE: 1"=40'



NOTE: CONTRACTOR SHALL PROVIDE ELECTRICAL CONNECTIONS TO SUMP PUMP.

SITE PLAN-BUILDING 105

SCALE: 1"=30'

PW 6530 Sheet 004

LTR	DESCRIPTION	PREP BY	DATE	APPROVED

REVISIONS

NAVAL FACILITIES ENGINEERING COMMAND DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CRANE, INDIANA

ELIMINATE ILLICIT DISCHARGES
BUILDINGS 104 AND 105

APPROVED

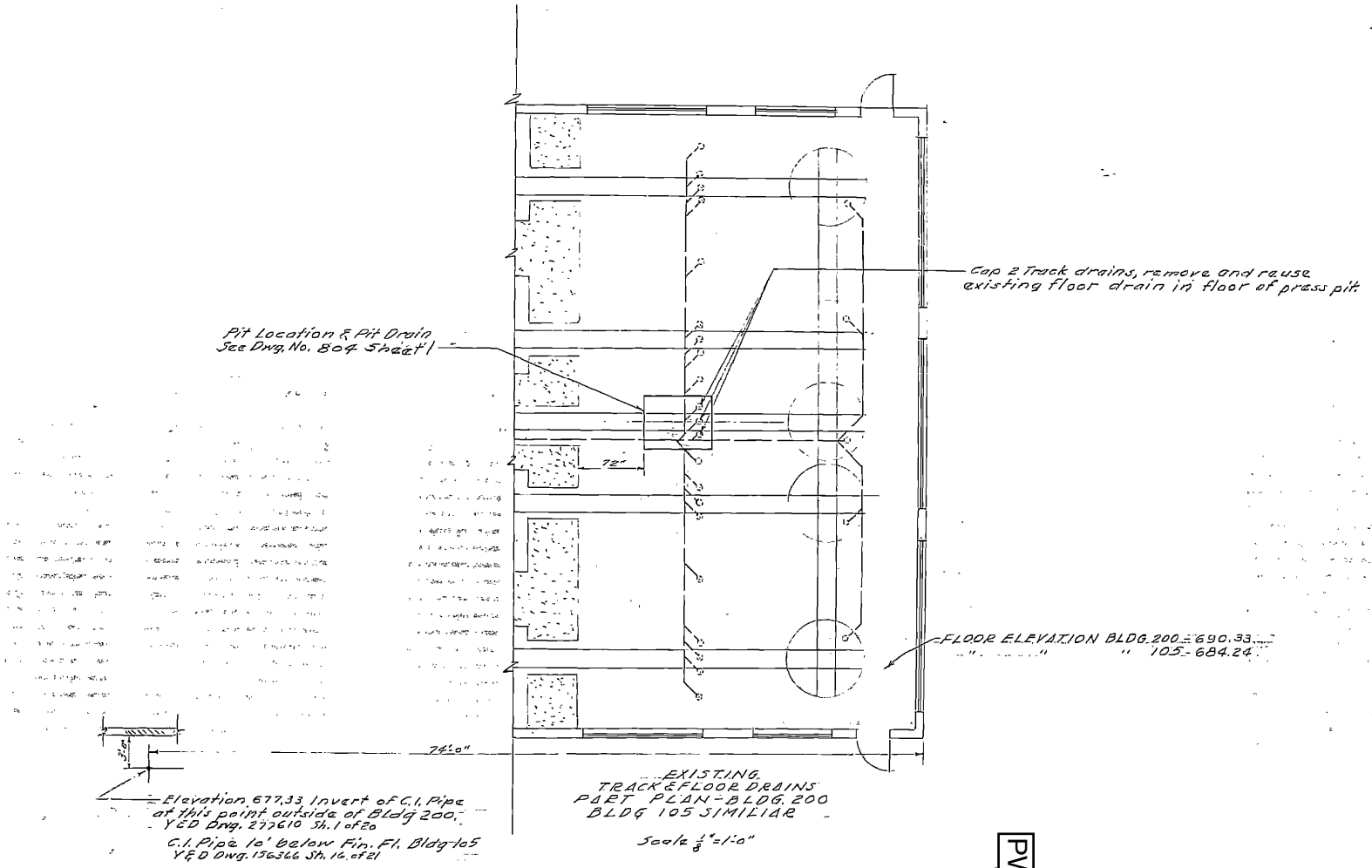
PUBLIC WORKS OFFICER DATE

DATE	7/24/97	
DESIGN	NS	
DRAWN	JNJ	
CHECKED	MHN	
SUPV.	-	

SATISFACTORY TO: DATE
DES 2/25/98
CSE 2-5-98
NAT 2-24-98

SEAL

CODE IDENT. NO. 80091
DRAWING SIZE: D
SCALE:
WR NO. 6-090051
CONTRACT NO. N68950-97-C-3517
SPEC. NO. 97-06-3517
NAVFAC DRAWING NO. 5347245
PW DRAWING NO. 6530
SHEET 4 OF 18



PWSK0421

U.S.N.A.D., CRANE, INDIANA

DRAWN

DESIGN ENG.

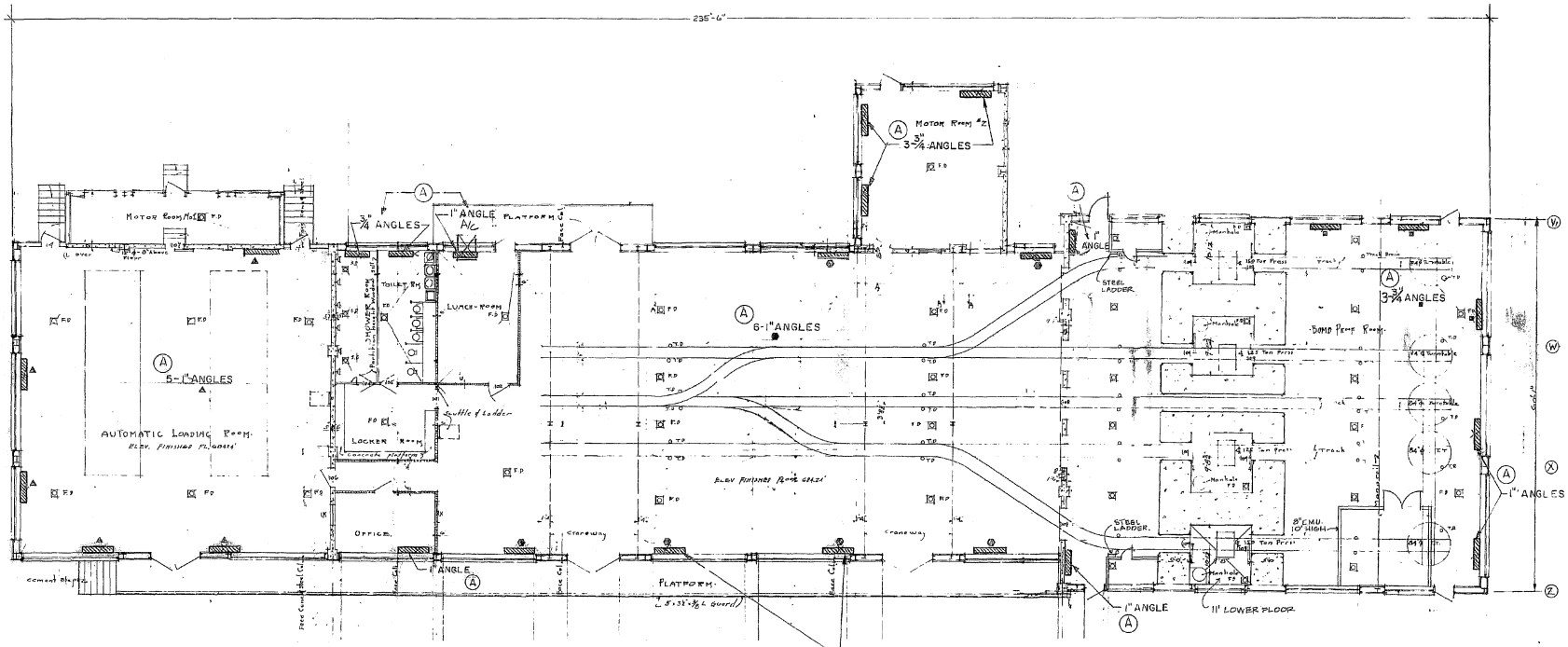
P.W. ENG.

PIT DRAIN FOR 275 TON GAS CHECK PRESS BUILDING 200 (BLDG 105 SIMILIAR)

P.W. Sketch No. 421

Approved W M Robertson for PUBLIC WORKS OFFICER Date 11-4-53

SYM	REVISIONS DESCRIPTION	PREP'D BY	DATE	APPROVED
(A)	REVISED AS BUILT	DRUCASSER	7/85	



REMOVE EXISTING 1½" SUPPLY PIPE TO RADIATORS. INSTALL NEW THERMOSTATIC RADIATOR VALVE. RECONNECT SUPPLY PIPE TO NEW VALVE & RADIATOR. SEE DETAIL TYPICAL FOR 28 RADIATORS

FLOOR PLAN

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

MECHANICAL

WORK DONE FOR THIS BUILDING.

1. INSTALL (25) THERMOSTATIC RADIATOR VALVES

NORTH

GRAPHIC SCALE

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

8' 0 8 16 FT

PW5179 Sheet 148

LINKETT & PAHL Y ARCHITECTS, ENGINEERS AND CONSTRUCTION MANAGERS, INC.
215 WEST BRECKINRIDGE STREET
LOUISVILLE, KENTUCKY 40203
(502)585-4181

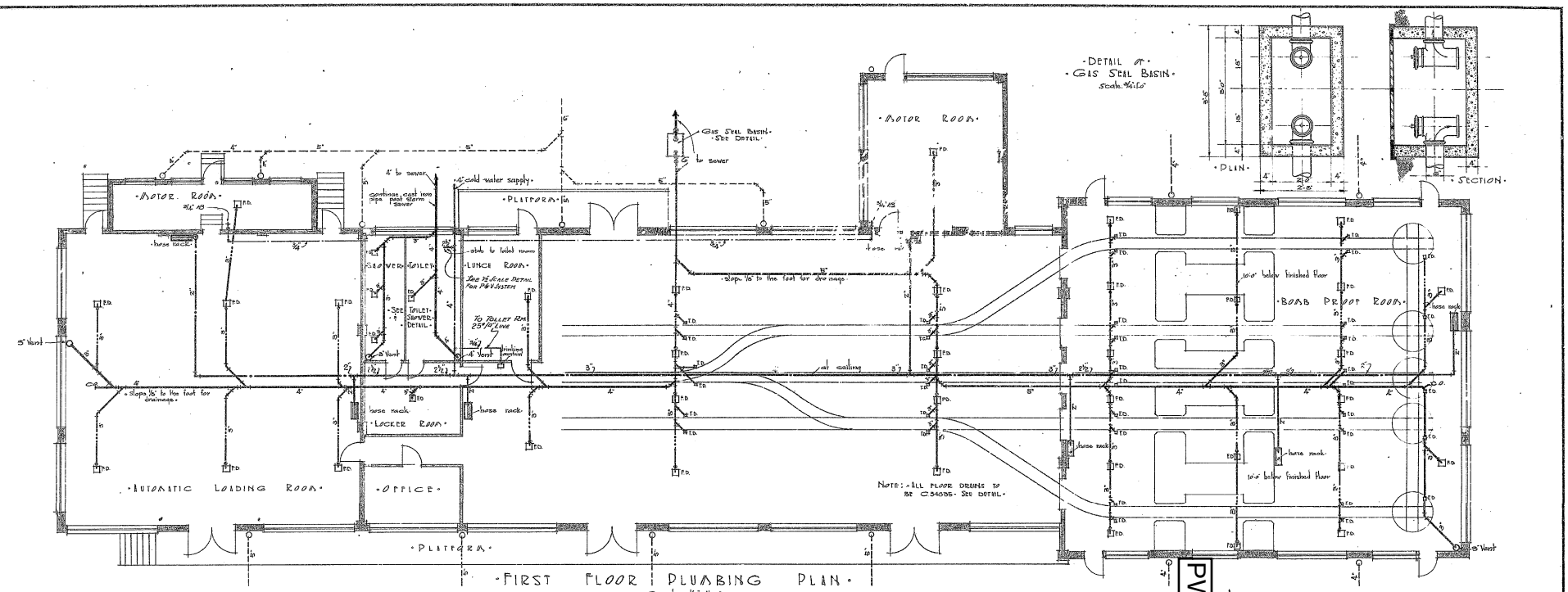
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL BASE NORTHERN DIVISION PHILADELPHIA, PA.
NAVAL WEAPONS SUPPORT CENTER CRANE, IND.

FACILITY ENERGY IMPROVEMENT (P-718)
BUILDING NO. 105
MECHANICAL

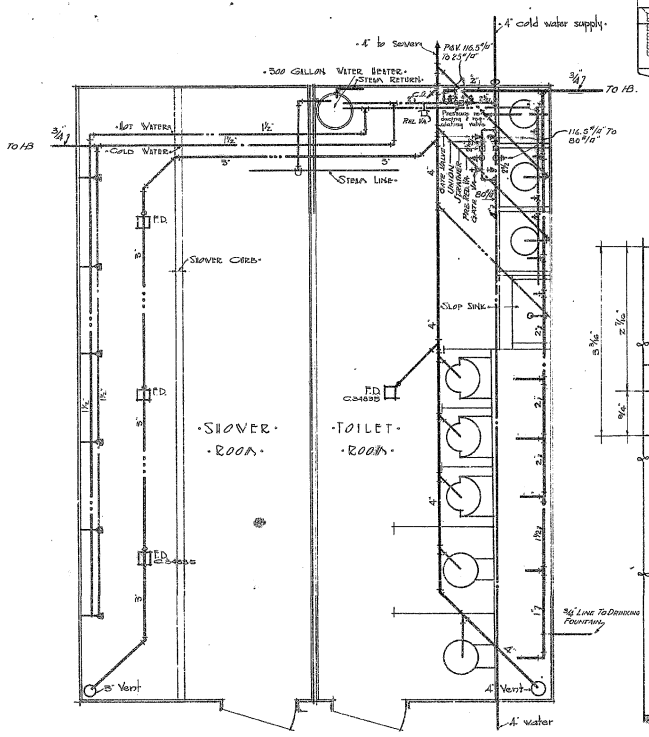
DRAWN BY: [illegible] DATE: [illegible] DIA. SILLIGMAN
CHECKED BY: [illegible] DATE: [illegible]
APPROVED: DATE:
CHIEF ENGINEERING CHARGE
APPROVED: DATE:
NORTHDIVISION COMMANDER NAVFAC

DATE FACILITY OPENED

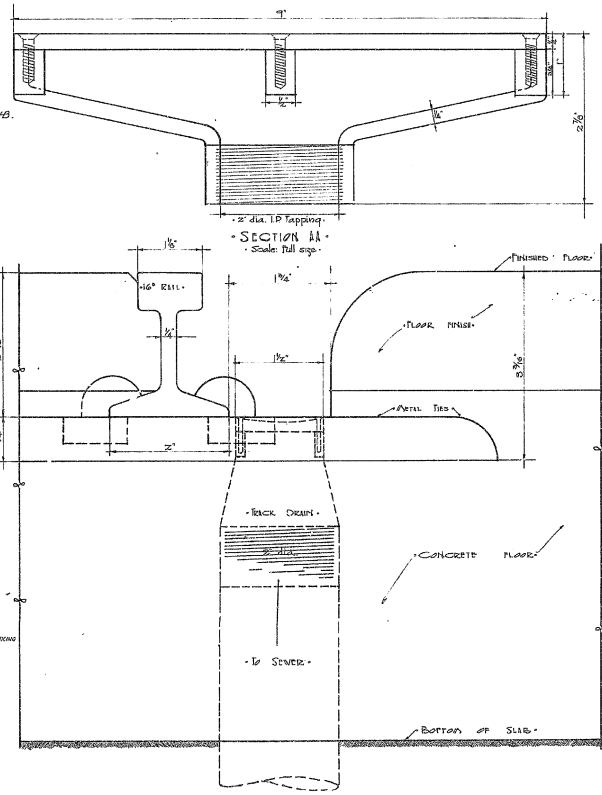
CODE IDENT NO. F 80091
NAVFAC DRAWING NO. 2045274
CONTRACT CONTR. NO. N62472-82-C-0123
SCALE AS SHOWN
SPECS 4-79-0123
PRINT NORTH YES



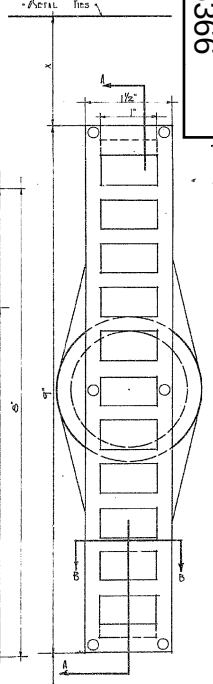
FIRST FLOOR PLUMBING PLAN
Scale: 1/8" = 1'-0"



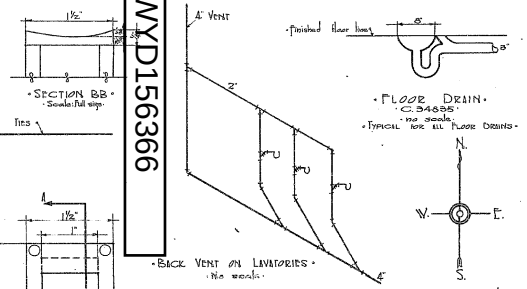
TOILET & SHOWER ROOM DETAIL
Scale: 1/2" = 1'-0"



TRICK DRAIN DETAIL
Scale: Full size



PLAN OF TRICK DRAIN
Scale: Full size



PWYD156366

PLUMBING CODE	
MAIN SEWER	
SECONDARY SEWER TO F.D. ETC.	
COLD WATER	
HOT WATER	
FLOOR DRAIN	F.D.
TRICK DRAIN	T.D.
SHOWER OUTLET	
DOWN SPOUT	

Revision	Date	Brief	By
1	6/24/41	Added H.D. & Pressure Reduction Valves. Changed Fire Line.	

CONTRACT NOy 4469

NAVY DEPARTMENT — BUREAU OF YARDS & DOCKS

Approved ..... For Chief of Bureau

Y. & D. Drawing No. 156366

Drawn by R. W. A.
Traced by S. C. F.
Checked by R. W. A.
Sheet 16 of 21
Engineers Job No. 4005
Engineers Draw. No. 2
Lt. Pl. & W.

U. S. NAVAL AMMUNITION DEPOT
BURNS CITY, INDIANA
EXPLOSIVE "D" LOADING PLANT
FIRST FLOOR PLUMBING PLAN

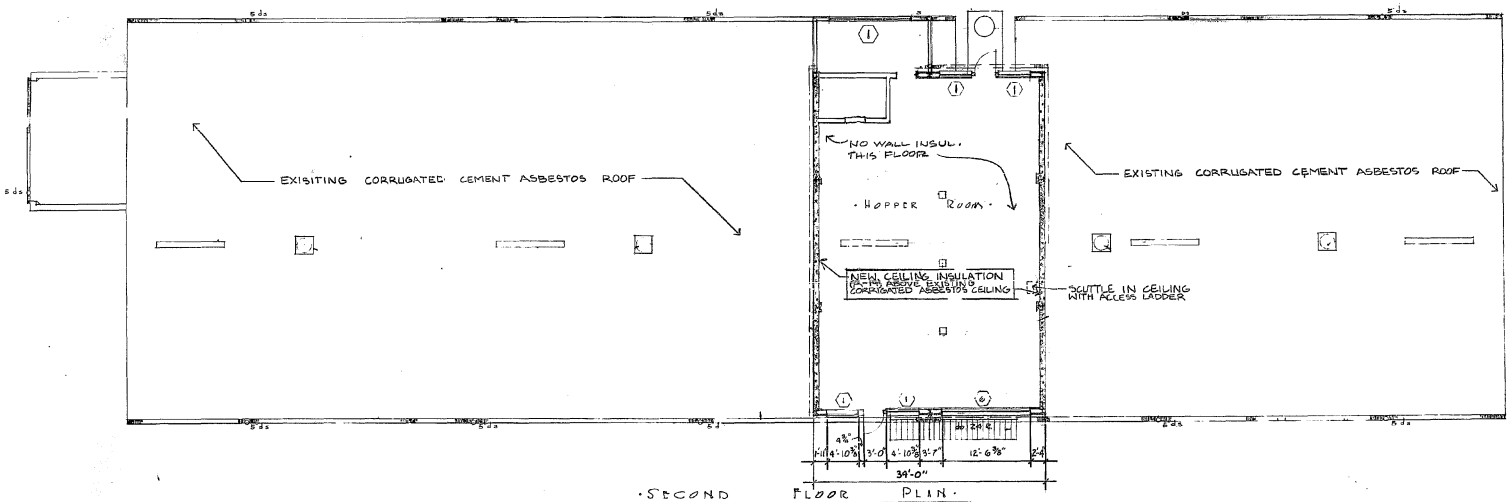
Submitted 5-19-41. Approved 5-21-41

RUSSELL B. MOORE CO.
Consulting Engineers
Indianapolis, Indiana
By ..... Chief Engineer.

By ..... Officer in Charge of Construction

Scale: As Designated

SYM	REVISIONS			
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
(A)	REVISED AS BUILT	W.G. CASSEL	7/83	

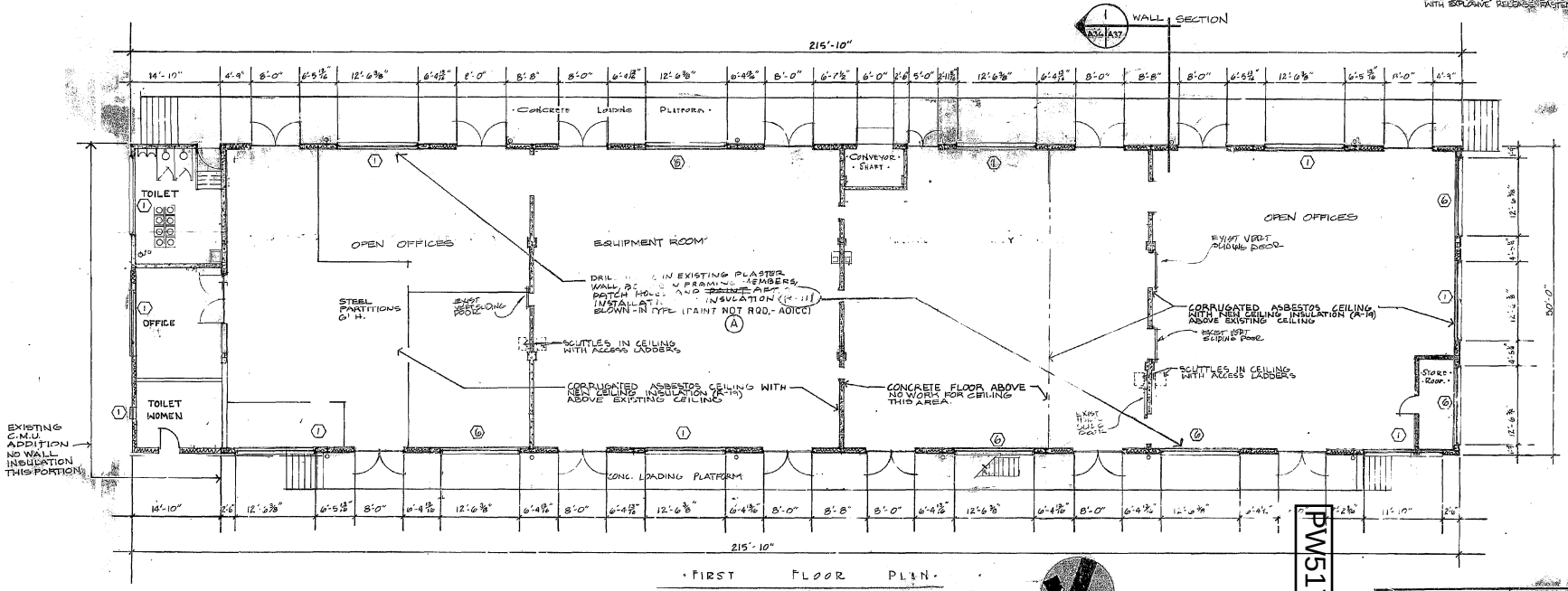


SECOND FLOOR PLAN

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

WORK FOR THIS BUILDING:

- NEW CEILING OR ROOF INSULATION
- NEW CAVITY BLOWN-IN INSULATION FOR WALLS
- REWORK EXISTING WINDOWS AS FOLLOWS
  - (1) EXISTING WINDOWS NOT TO BE DISTURBED OR COVERED
  - (6) EXISTING WINDOW TO BE INSULATED AND COVER WITH CORRUGATED CEMENT-ASBESTOS SIDING TO MATCH EXTERIOR WALL WITH EXPOSED RELEASE FASTENERS



FIRST FLOOR PLAN

SCALE 1/8" = 1'-0"

NOTE:
THIS BUILDING CONTAINS POTENTIAL ASBESTOS ACCUMULATIONS OF EXPLOSIVE PROPORTIONS DURING CEILING INSULATION REMOVAL PROCEDURES.

NORTH

GRAPHIC SCALE

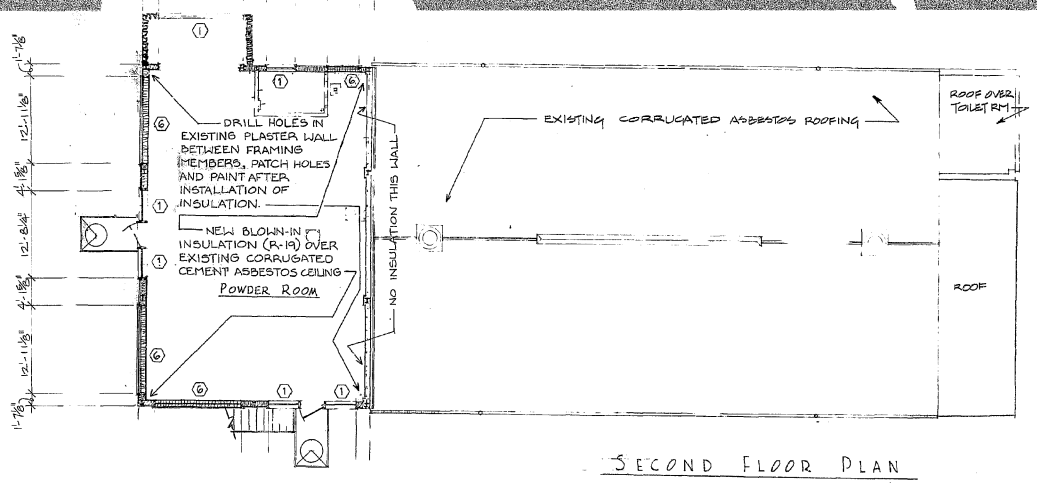
SCALE: 1/8" = 1'-0"

JEAN DONALDSON
REGISTERED ARCHITECT
STATE OF INDIANA

LIBKETT & FARLEY ARCHITECTS, ENGINEERS, AND CONSTRUCTION MANAGERS, INC. 218 WEST BRECKINRIDGE STREET LOUISVILLE, KENTUCKY 40203 (502)585-4181	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NORTHERN DIVISION PHILADELPHIA, PA.		
	NAVAL MATERIAL INDUSTRIAL CENTER CRANE, IND.		
	FACILITIES ENERGY IMPROVEMENTS (P-175)		
	BUILDING NO. 101		
	FLOOR PLANS		
	SIZE: F	CODE IDENT. NO. 80091	NAVFAC DRAWING NO. 2045187
	SCALE: 1/8"=1'-0"	CONTR. / CONTL. NO. N62472-79-C-0-0	
		SHEET 35 of 111 A-36	

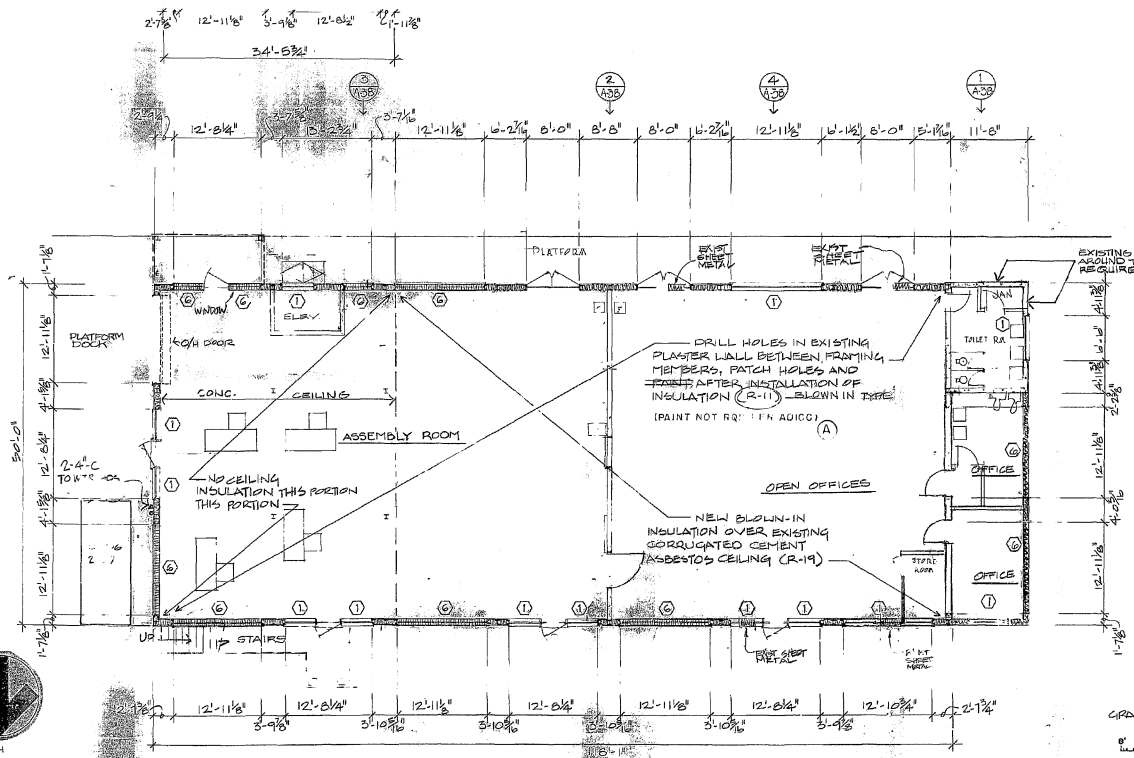
PW5179 Sheet 038

LTR	REVISIONS DESCRIPTION	PREPARED	DATE	APPROVED
(A)	REVISED AS BUILT	MGCASSER	7/03	



SECOND FLOOR PLAN

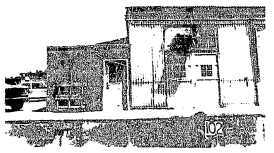
Scale: 1/8" = 1'-0"



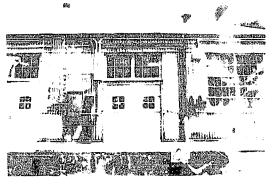
FIRST FLOOR PLAN

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

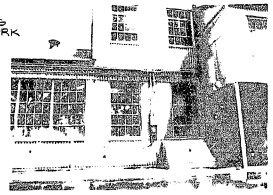
NORTH



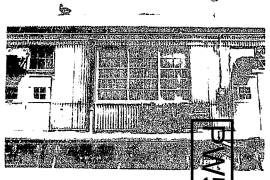
1 A-38 VIEW OF SOUTH ELEVATION
NO SCALE



2 A-38 VIEW OF SOUTH ELEVATION
NO SCALE



3 A-38 VIEW OF SOUTH ELEVATION
NO SCALE



4 A-38 VIEW OF SOUTH ELEVATION
NO SCALE

NOTE:
1. THIS BUILDING CONTAINS POTENTIALLY HAZARDOUS ACCUMULATIONS OF EXPLOSIVE PARTICLES IN EXISTING CEILING INSULATION. SEE SPECIFICATIONS FOR PRECAUTIONS DURING REMOVAL AND DISPOSAL.

WORK FOR THIS BUILDING

- NEW CEILING (OR ROOF) INSULATION
- NEW EXTERIOR WALL INSULATION OF CAVITY BLOWN-IN FILL TYPE
- REWORK EXISTING WINDOWS AS FOLLOWS:
  - (1) EXISTING WINDOW NOT TO BE DISTURBED OR COVERED
  - (6) EXISTING WINDOW TO BE INSULATED AND COVERED WITH CORRUGATED CEMENT-ASBESTOS SIDING TO MATCH EXTERIOR WALLS

GRAPHIC SCALE
SCALE: 1/8" = 1'-0"
0' 4 8 16 FT

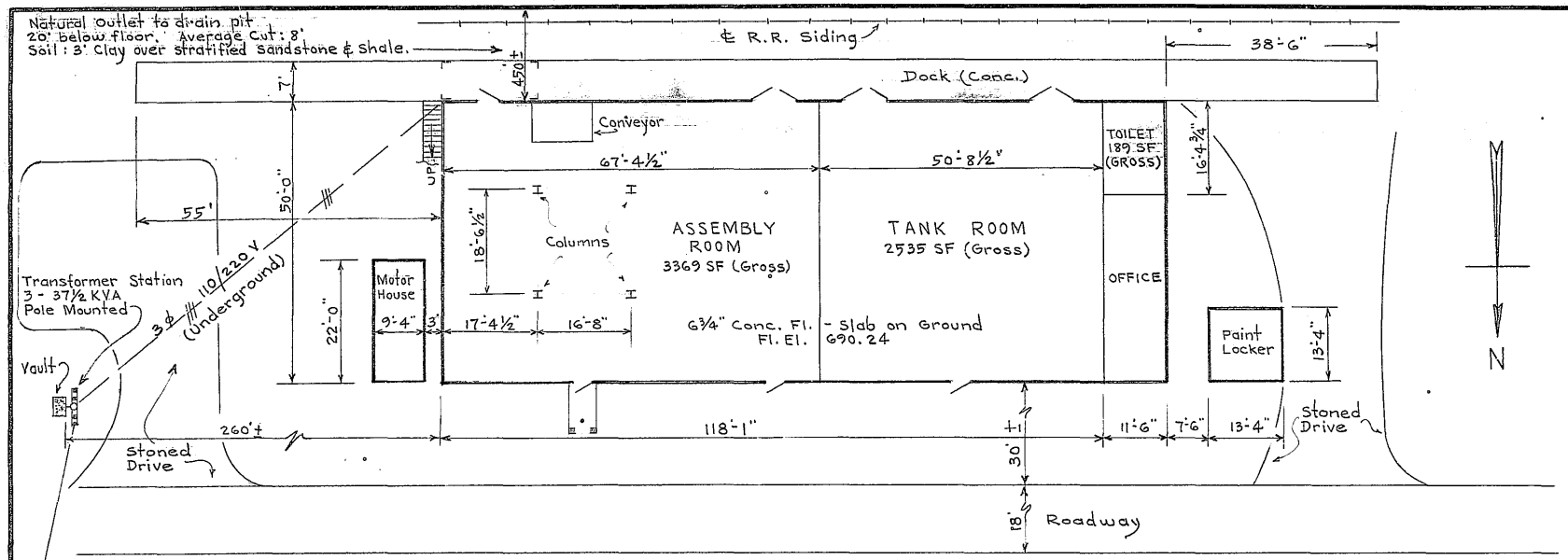
PW 5179 Sheet 040

LUCKETT & FARLEY ARCHITECTS, ENGINEERS, AND CONSTRUCTION MANAGERS, INC.
215 WEST BRECKINRIDGE STREET
LOUISVILLE, KENTUCKY 40203
(502)585-4181
PW 5179

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL BASE NORTHERN DIVISION PHILADELPHIA, PA.
NAVAL WEAPONS SUPPORT CENTER CRANE, IND.
FACILITY ENERGY IMPROVEMENT (P.175)
BUILDING NO. 102
FLOOR PLAN

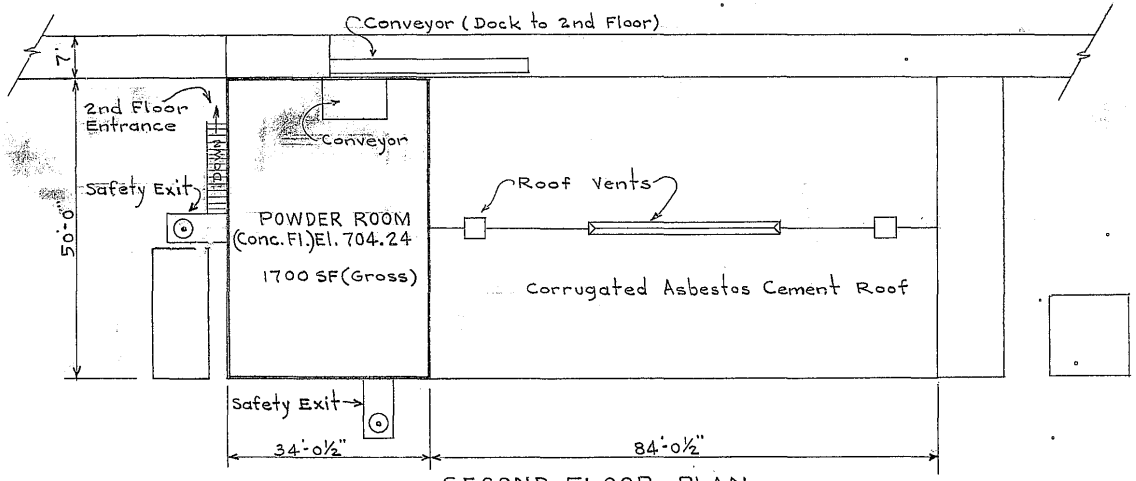
SIZE CODE IDENT. NO. 80091 | NAVFAC DRAWING NO. 2045181
CONSTR. CONTR. NO. N62472-98-D-0023
SCALE 1/8"=1'-0" | STEP 24-11-02 | 24-06-11 | A-36

NORTHDIVE FOR COMMANDER, NAVFAC



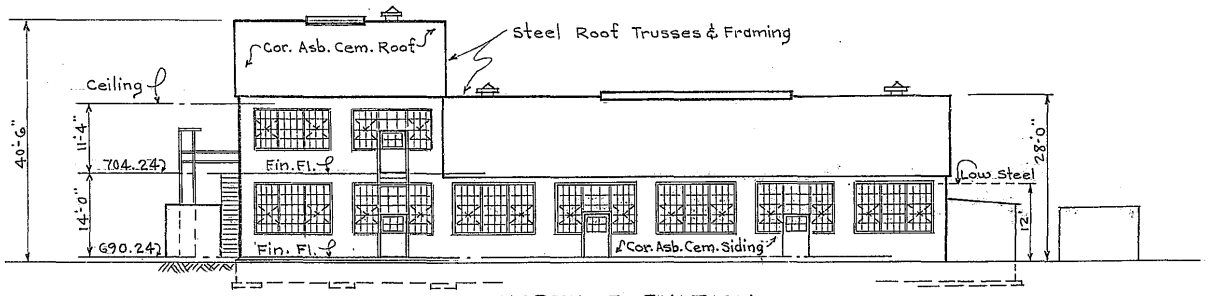
FIRST FLOOR PLAN

Scale 1/16" = 1'-0"



SECOND FLOOR PLAN

Scale 1/16" = 1'-0"



NORTH ELEVATION

Scale 1/16" = 1'-0"

PWSK1447

U. S. N. A. D., CRANE, INDIANA

DRAWN WRR

DESIGN ENG.

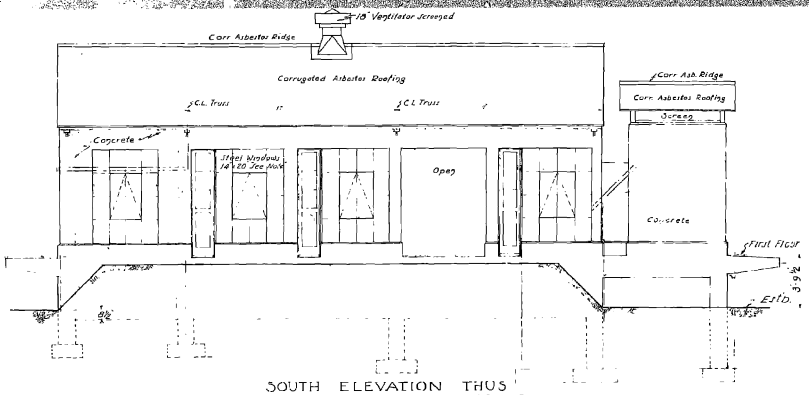
P. W. ENG.

BAG CHARGE & FILLING HOUSE BUILDING NO. 102

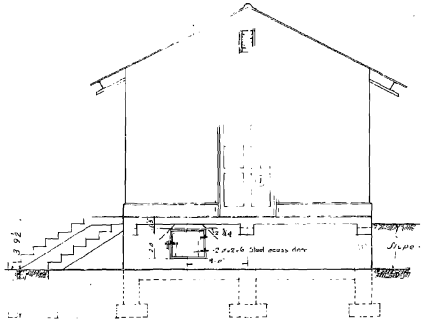
P. W. SKETCH NO. 1447

APPROVED [signature] PUBLIC WORKS OFFICER DATE 9/24/59

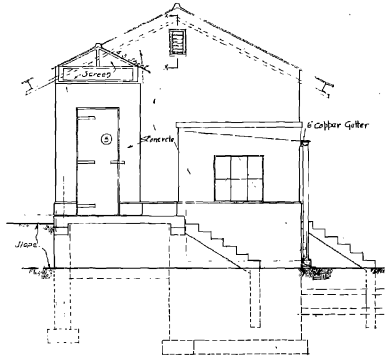
CTR	REVISIONS	PREP'D BY	DATE	APPROVED
	DESCRIPTION			
	REVISED AS BUILT	MAGLASER	7/85	



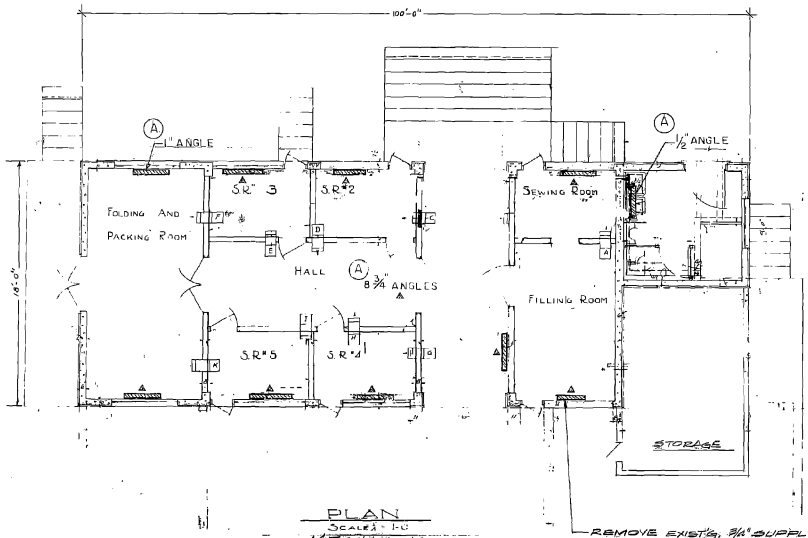
SOUTH ELEVATION THUS
NORTH ELEVATION SIMILAR.
SCALE ¼" = 1'-0"



WEST END ELEVATION
SCALE: ¼" = 1'-0"



EAST END ELEVATION
SCALE: ¼" = 1'-0"



PLAN
SCALE: 1-0
MECHANICAL

REMOVE EXIST'G, 3/4" SUPPLY PIPE TO RADIATOR. INSTALL NEW THERMOSTATIC RADIATOR VALVE. RECONNECT SUPPLY PIPE TO NEW VALVE & RADIATOR. SEE DETAIL (3) TYPICAL FOR 10 RADIATORS.

GRAPHIC SCALE
SCALE: 1/4" = 1'-0"
4' 0 4 8 FT

NORTH

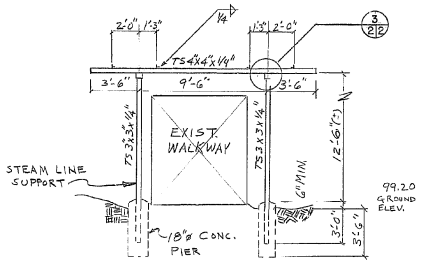
WORK DONE FOR THIS BUILDING

1. INSTALL (10) THERMOSTATIC RADIATOR VALVES.

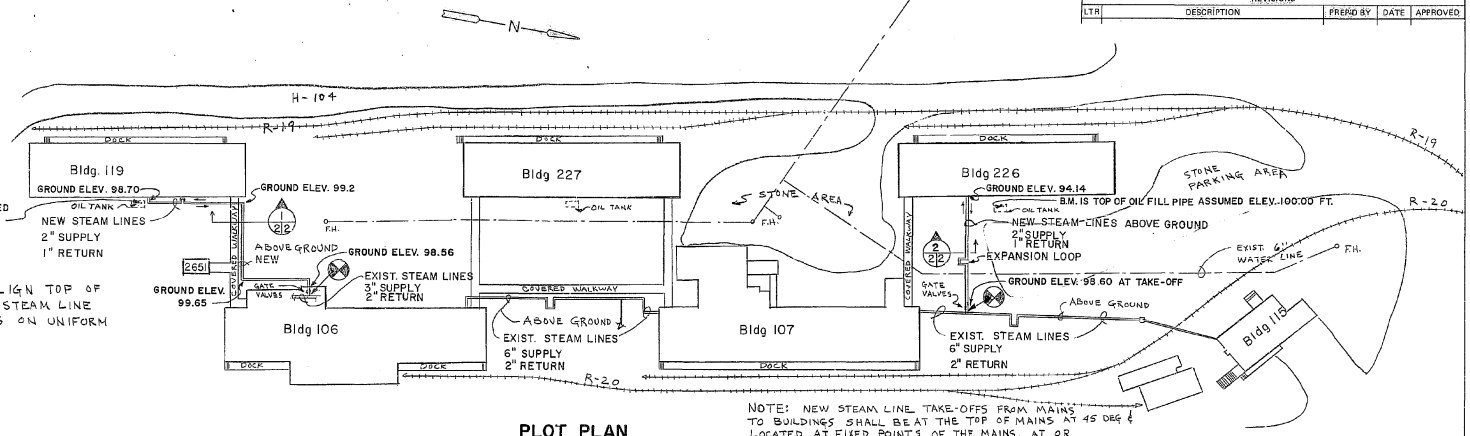
LITCHFIELD & PARTNERS ARCHITECTS ENGINEERS AND CONSTRUCTION MANAGERS, INC. 215 WEST BRECKENRIDGE STREET LOUISVILLE, KENTUCKY 40203 (502)585-5181 PW 5179	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND NAVAL BASE NORTHERN DIVISION PHILADELPHIA, PA. NAVAL WEAPONS SUPPORT CENTER CRANE, IND.
	FACILITY ENERGY IMPROVEMENT (P/79) BUILDING 1123 MECHANICAL
	SIZE F; CODE IDENT NO. 80091; NAVFAC DRAWING NO. 204745; CONTR CONTR NO. N62472-79-C-0123; SCALE AS SHOWN; DATE 24 OCT 79; SHEET 1 OF 1

PW5179 Sheet 146

REVISIONS				
LTR	DESCRIPTION	FREND BY	DATE	APPROVED



SECTION 1/2/2
Scale: 1/4"=1'-0"

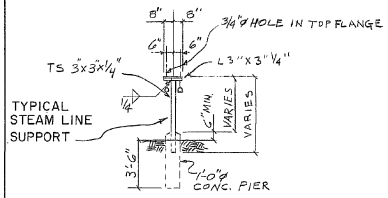


NOTE: ALIGN TOP OF OUTDOOR STEAM LINE SUPPORTS ON UNIFORM SLOPE.

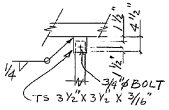
PLOT PLAN
Scale: 1"=50'

NOTE: NEW STEAM LINE TAKE-OFFS FROM MAINS TO BUILDINGS SHALL BE AT THE TOP OF MAINS AT 45 DEG & LOCATED AT FIXED POINTS OF THE MAINS, AT OR NEAR ANCHOR POINTS. INSTALL GATE VALVES AT TAKE-OFFS NEAR MAINS.

POINT OF CONNECTION BETWEEN NEW AND EXISTING PIPING

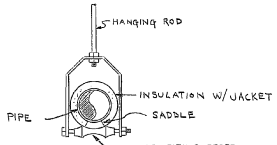


SECTION 2/2/2
Scale: 1/4"=1'-0"

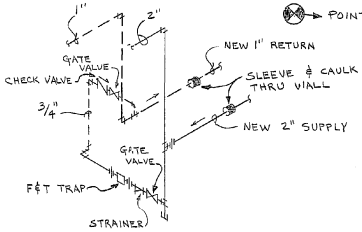


DETAIL 3/2/2
Scale: 3/4"=1'-0"

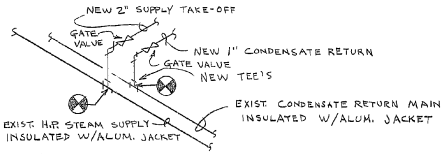
OUTDOOR STEAM LINE SUPPORT



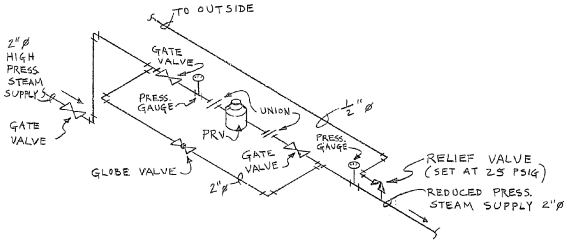
ROLLER HANGER
No Scale



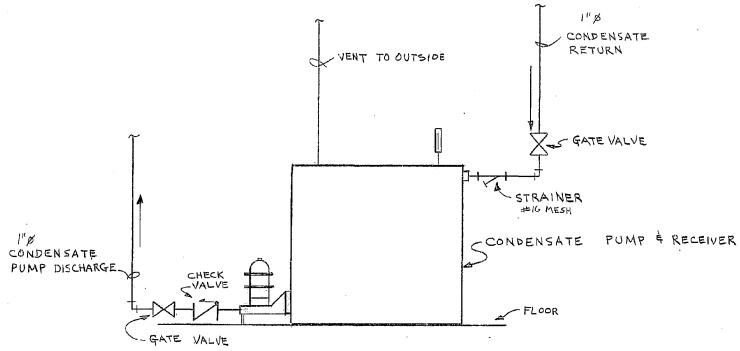
STEAM RISERS
No Scale



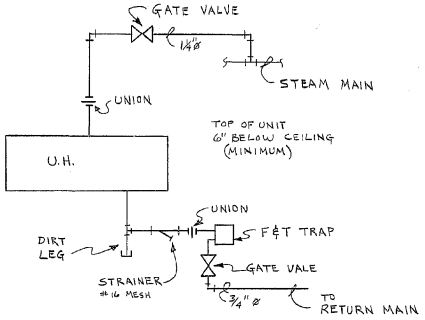
STEAM LINE TAKE-OFFS DETAIL
No Scale



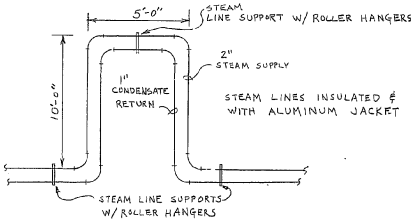
PRESSURE REDUCING VALVE SCHEMATIC
No Scale



TYPICAL CONDENSATE PUMP HOOK-UP
No Scale



TYPICAL VERTICAL UNIT HEATER DETAIL
No Scale



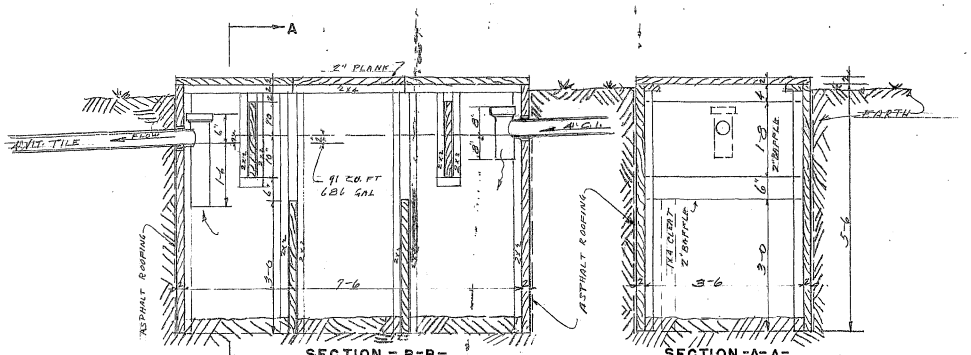
EXPANSION LOOP
No Scale:

PW5133 Sheet 002

SATISFACTORY TO SMCCN-ED DATE 11/8/86	PWO DWG REF	DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND	
SATISFACTORY TO 04 DATE 11/10/86	PWO DRAWING NO. 5133	NAVAL WEAPONS SUPPORT CENTER CRANE, INDIANA	
SATISFACTORY TO 104 DATE 11-7-86	DESIGN D.B. DRAWN D.B. CHECKED SPV.	REPLACE HEATING SYSTEMS BLDGS 119 AND 226	MECH.
	APPROVED DATE 12/16/86 PUBLIC WORKS OFFICER	SIZE F; CODE IDENT. NO. 80091; NAVFAC DRAWING NO. 2106026; CONSTR. CONTR. NO. N62472-87-C-7025	
		SCALE A/S; SPEC. NO. 04-87-7025; SHEET 2 OF 3	

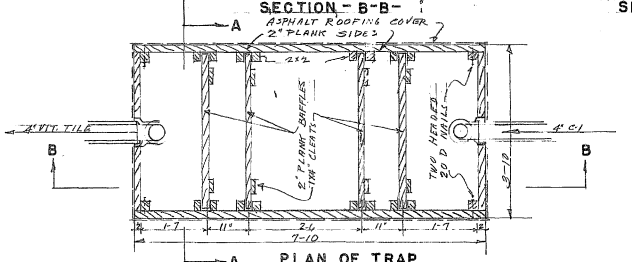
NWSC 1662012-001

©CYB-085-557-058

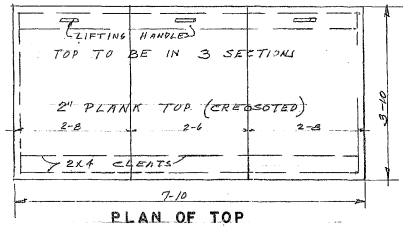


SECTION - B-B-

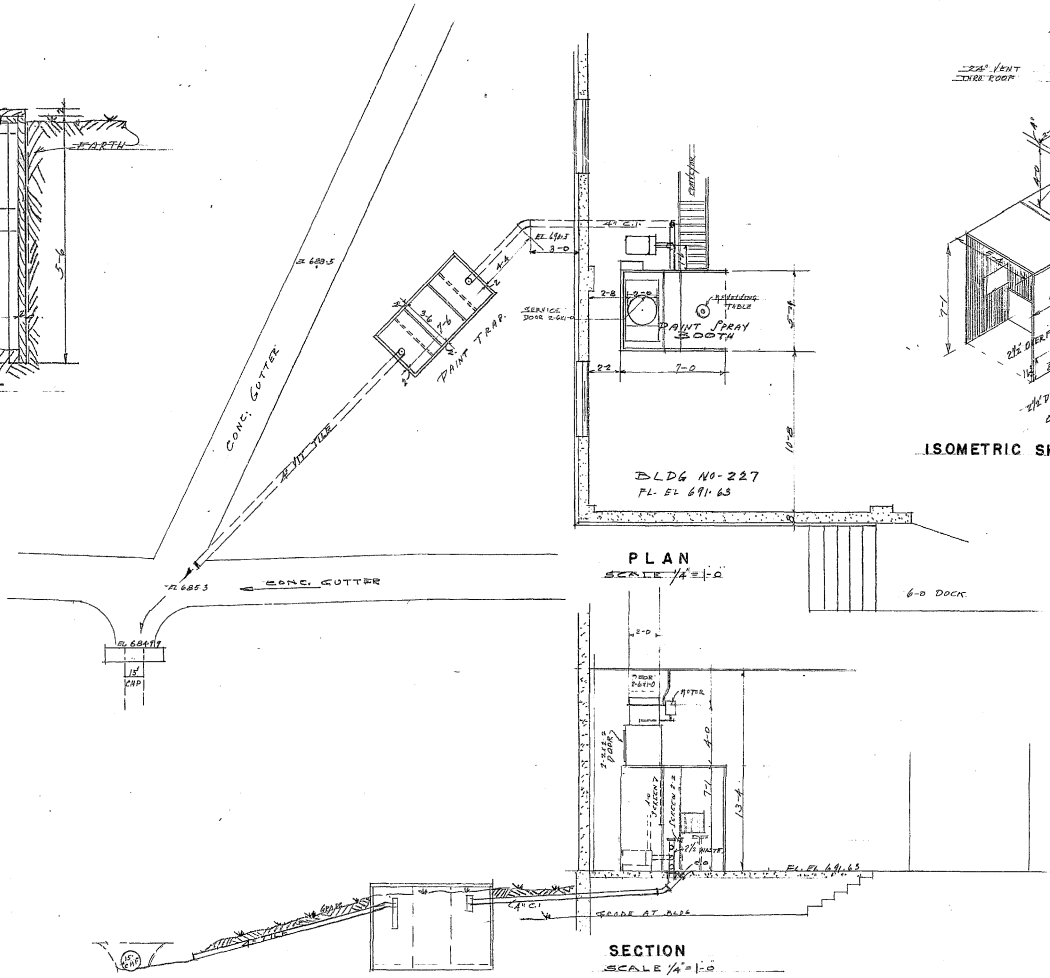
SECTION -A-A-



PLAN OF TRAP
SCALE 3/4"=1-0

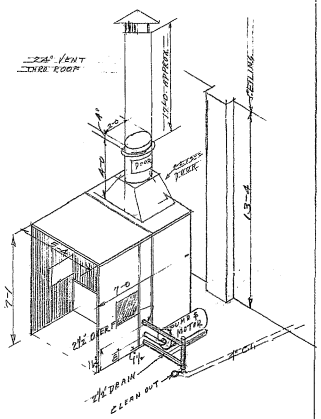


PLAN OF TOP
SCALE 3/4"=1-0

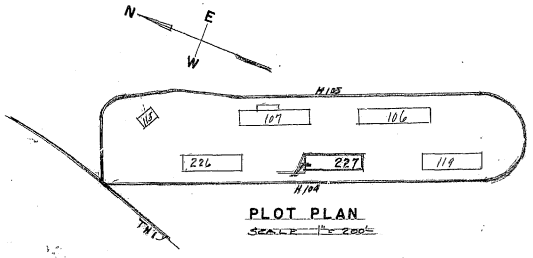


PLAN
SCALE 1/4"=1-0

SECTION
SCALE 1/4"=1-0



ISOMETRIC SKETCH



PLOT PLAN
SCALE 1"=200'

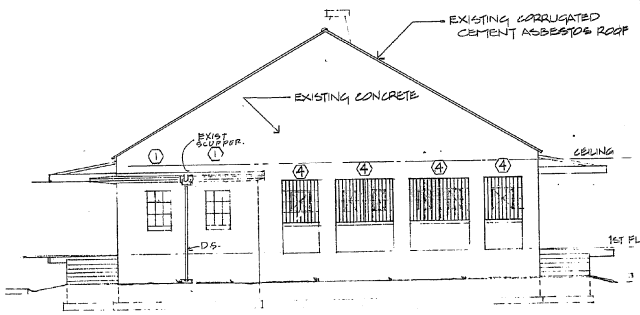
PW0488

DRAWN BY J.J.C.	U. S. NAVAL AMMUNITION DEPOT CRANE, INDIANA
TRACED BY	
CHECKED BY	PAINT DISPOSAL TRAP AT BLDG NO 227
CHIEF DRAW	
IN CHARGE	
WAR RESERVE NO	
P. W. DRAWING NO. 488	APPROVED 31 Jul 1951

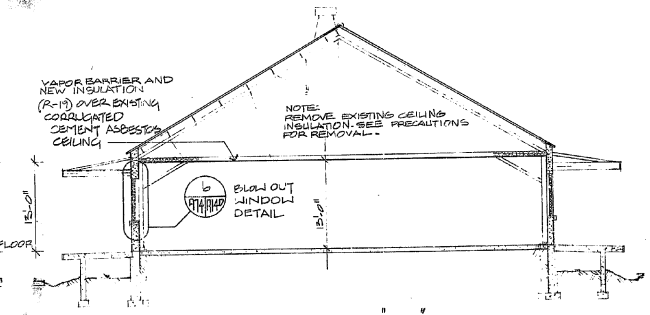
SYM	REVISIONS		
QTR	DESCRIPTION	PREP'D BY	DATE APPROVED
(A)	REVISED AS BUILT	MRC/ASSRA	7/7/95

NOTES FOR THIS BUILDING
- NEW SELF-LIGHT ROOF INSULATION
- PREPARE EXISTING WINDOWS AS FOLLOWS:
  1. EXISTING WINDOW NOT TO BE PICTURED OR COVERED
  4. ~~EXISTING WINDOW TO BE COVERED WITH METAL PANEL SIDING WITH EXPLOSIVE RELEASE FASTENERS~~

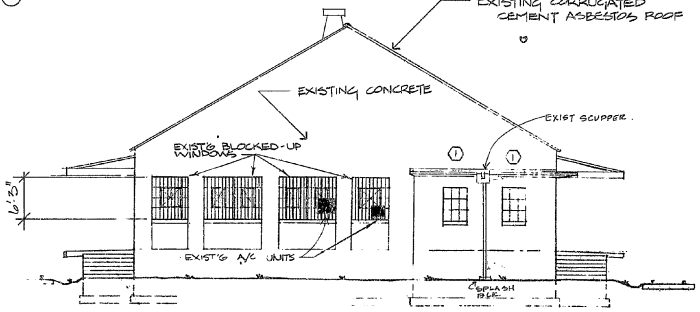
(A) DELETED



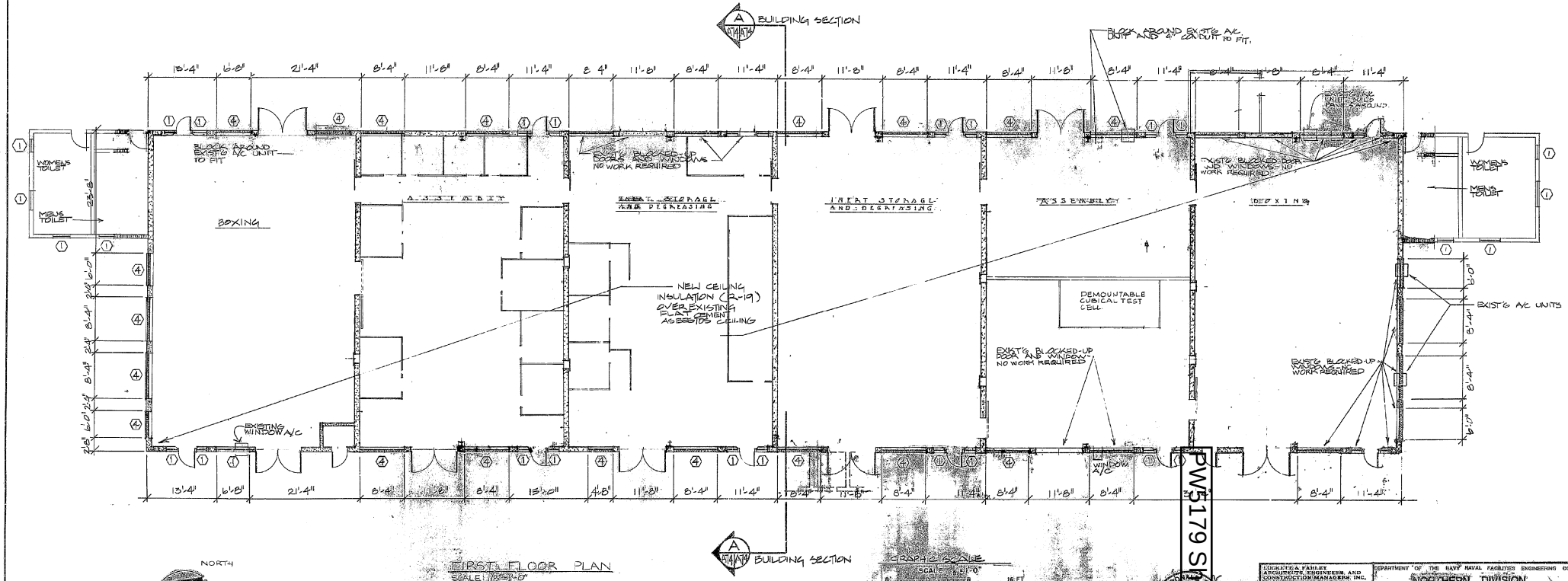
WEST ELEV.
SCALE: 1/8" = 1'-0"



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



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



NORTH

FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

NOTE: THIS BUILDING CONTAINS POTENTIALLY HAZARDOUS ACCUMULATIONS OF EXPLOSIVE PARTICLES IN EXISTING CEILING INSULATION. SEE SPECIFICATIONS FOR PRECAUTIONS DURING REMOVAL AND DISPOSAL.

GRAPHIC SCALE
SCALE: 1/8" = 1'-0"
0 8 16 FT

PW5179 SHEET 076

LUCKETT & FARLEY
ARCHITECTS, ENGINEERS, AND CONSTRUCTION MANAGERS, INC.
216 WEST BRECKINRIDGE STREET
LOUISVILLE, KENTUCKY 40203
(502)585-4181

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
NAVAL STATION, PHILADELPHIA, PA.
NAVAL WEAPONS SUPPORT CENTER CRANE, IND.

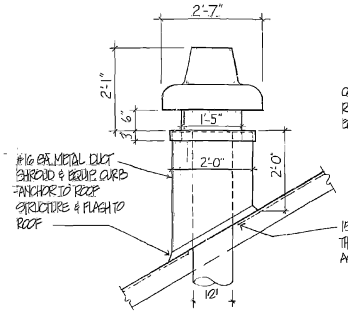
FACILITY ENERGY IMPROVEMENT (#175)
BUILDING NO. 142
FIRST FLOOR PLAN, DETAILS AND ELEVATIONS

SIZE	FSCM NO.	NAVFAC DRAWING NO.
E	80091	1023213
	CONTR. NO.	CONTR. DRAWING NO.
	N62472-79-C-0103	
SCALE 1/8" = 1'-0"		SHEET 7 OF 19

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
A	AS BUILT	D.B.	1-16-84	

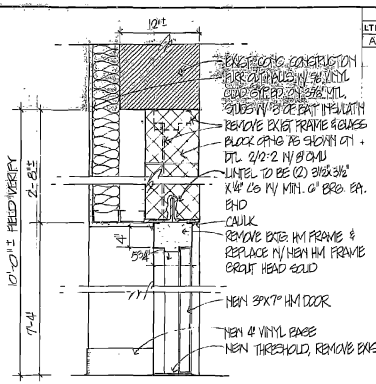
GENERAL NOTES

1. COORDINATE STUD PLACEMENT W/ MECH. DRAWG. SO THAT RELOCATED RADIATORS WILL HAVE SUFFICIENT SUPPORT @ THEIR ANCHORING POINTS - ANCHOR RADIATORS THROUGH GYP. DRYWALL TO HORIZ. BLOCKING BETWEEN STUDS
2. CLEAN & REPAINT ALL RADIATORS IN BAYS 1 THRU 4 (4 RADIATORS PER BAY)
3. PATCH SMALL PENETRATIONS & PAINT THE CLGS. IN BAYS 1 & 3
4. PAINT & LABEL PIPING IN BAYS 1 & 3, SEE SPECS. FOR COLORS & LETTER SIZE
5. FURR OUT NEW & EXIST. WALLS OF BAYS 1 & 3 W/ 5/8" VINYL CLAD GYP. BD. ON 3 5/8" MTL. STUDS @ 16" OC. W/ 3" OF BATT INSUL. - CONT. TO APPROX. 15'-0" (BOT. OF DECK) - RELOCATE RADIATORS AS SHOWN ON MECH.
6. PATCH & SMOOTH CONC. FLOOR IN BAYS 1 THRU 4; CUT & SAND PROTRUSIONS TO PROVIDE SMOOTH SUBSTRATE PRIOR TO INSTALLATION. INSTALL NEW VAT IN BAYS 1 THRU 4 INCLUDING TEST CELLS - DO NOT COVER OVER EXIST. FLOOR DRAINS.
7. INSTALL NEW 4" VINYL COVED BASE IN ALL AREAS WHERE NEW VAT IS TO BE INSTALLED. REMOVE EXIST. BASE ON NEW & EXIST. WALLS OF BAYS 2 & 4 AND REPLACE W/ NEW BASE
8. PAINT ALL WALLS IN BAYS 1 & 3 EXCEPT VINYL CLAD WALLS & INTERIOR WALLS OF TEST CELLS
9. NEW VINYL CLAD WALLS IN BAYS 1 & 3 SHALL MATCH EXIST. VINYL CLAD WALLS IN BAYS 2 & 4 IN SIZE, COLOR, & FINISH
10. VINYL COVE BASE SHALL BE OMITTED ON SOME TEST CELLS WHERE EXIST. STEEL ANGLE PREVENTS INSTALLATION.
11. ALL NEW DOOR FRAMES TO BE 7'-4" x 3'-2" x 5 3/4" HM - SEE DTLS. 2-4/2:2
12. ALL NEW DOORS SHALL BE 3'-0" x 7'-0" x 1 3/4" HM, W/ 24" x 20" FROSTED WIRE GLASS GLASS WINDOW
13. HARDWARE SET FOR ALL DOORS SHALL BE HW-1 (PANIC HARDWARE INSTALLED ON NEW PERSONEL DOOR) (A)

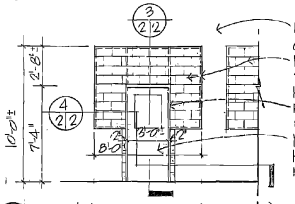


CONFIRM DUCT & CURB REQUIREMENTS FROM EQUIPMENT SHOP DRAWGS.

1/2/2 PENETRATION OF POWER ROOF VENT
SCALE: 3/4" = 1'-0"

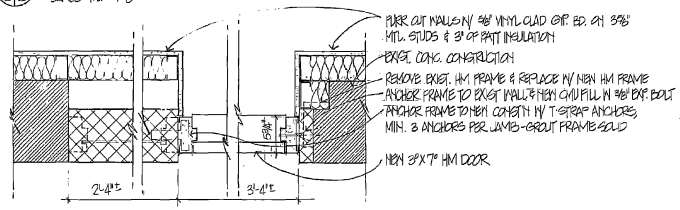


3/2/2 DOOR SECTION (01, 02, 03)
SCALE: 1 1/2" = 1'-0"

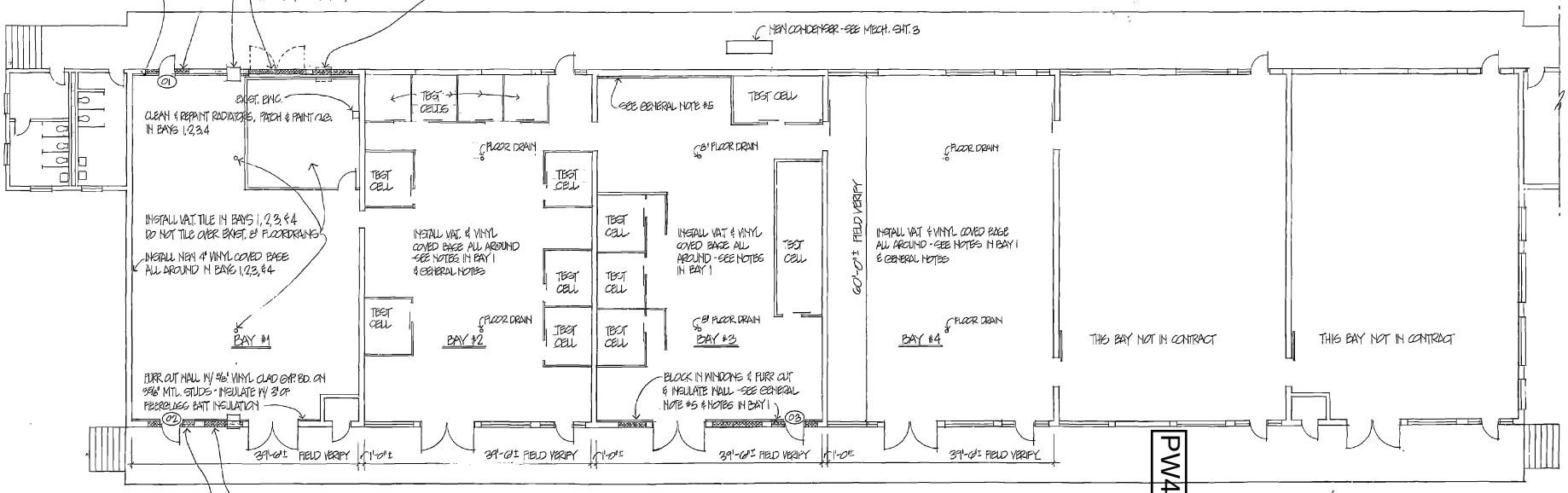


EXIST. RE INFORCED CONC. CONSTN.
REMOVE EXIST. FRAME & GLASS - BLOCK IN OPNG. W/ CMU AS REQUIRED
REMOVE EXIST. DOOR FRAME & REPLACE W/ NEW HM FRAME
NEW 3'-0"x7'-0" HM DOOR TO HAVE 24"x20" FROSTED WIRE GLASS WINDOW

2/2/2 ELEVATION OF DOOR 02, (01 & 03 SIM)
SCALE: 1/4" = 1'-0"



4/2/2 DOOR DETAIL (DOORS 01, 02, 03)
SCALE: 1 1/2" = 1'-0"



FLOOR PLAN OF BUILDING No. 142
SCALE: 1/8" = 1'-0"

SCALE: 1/8" = 1'-0" 0 2'-0" 5'-0" 10'-0" 15'-0"
SCALE: 1/4" = 1'-0" 0 1'-0" 5'-0" 10'-0"
SCALE: 3/8" = 1'-0" 0 1'-0" 2'-0" 4'-0"
SCALE: 1 1/2" = 1'-0" 0 6" 1'-0" 3'-0" 6'-0"
GRAPHIC SCALES

SCHENKEL & SHULTZ, INC.
3203 BLUFF DRIVE
FORT WAYNE, INDIANA

WILLIAM D. HUTCHINSON REGISTERED No. 1081 STATE OF INDIANA

SATISFACTORY TO 3rd
DATE 1-4-
SATISFACTORY TO 04
DATE
SATISFACTORY TO
DATE

PWO DWG REF
PWO DRAWING NO. 4322
DESIGN
DRAWN
CHECKED
SUPV
APPROVED DATE
PUBLIC WORKS OFFICER

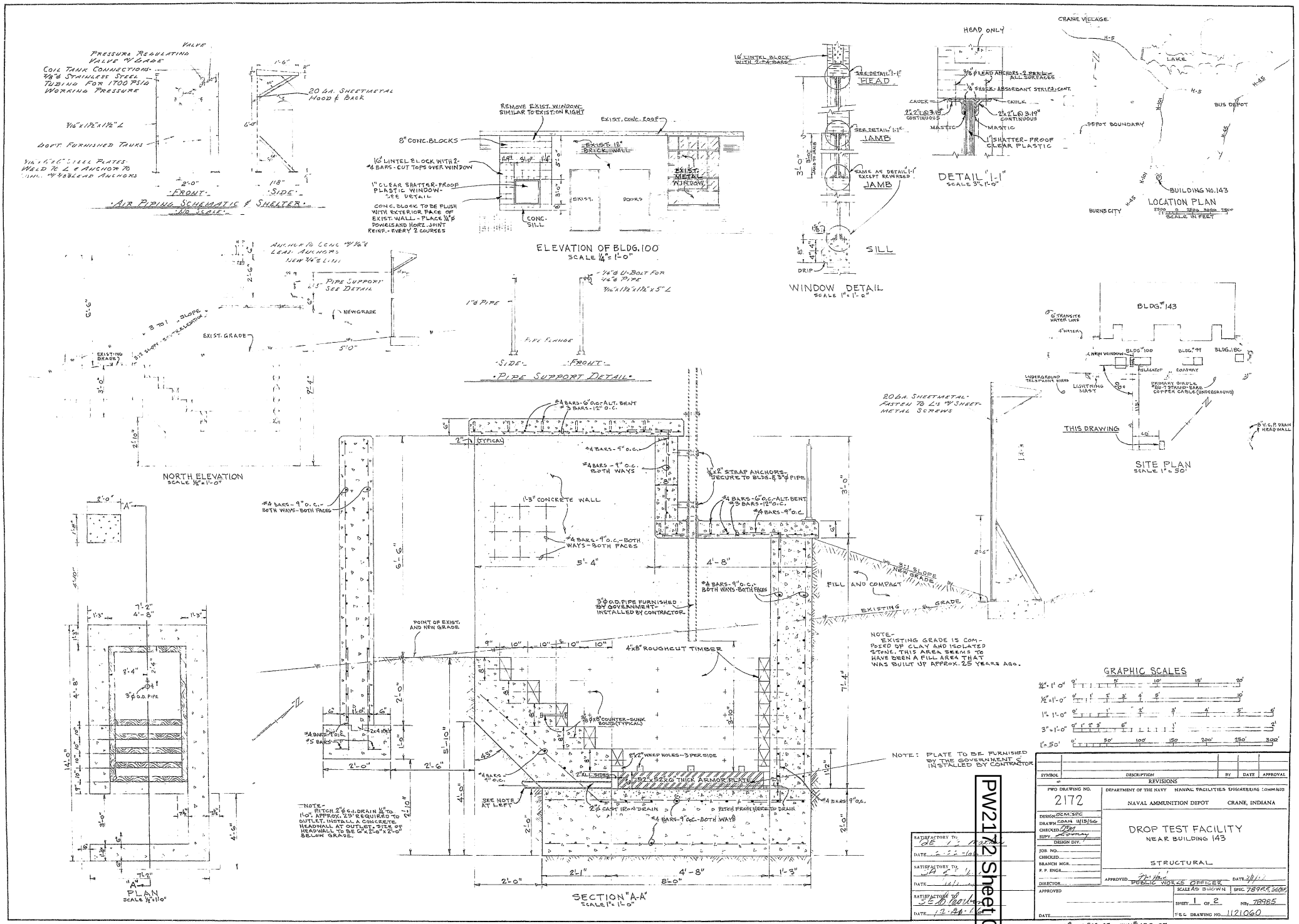
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA

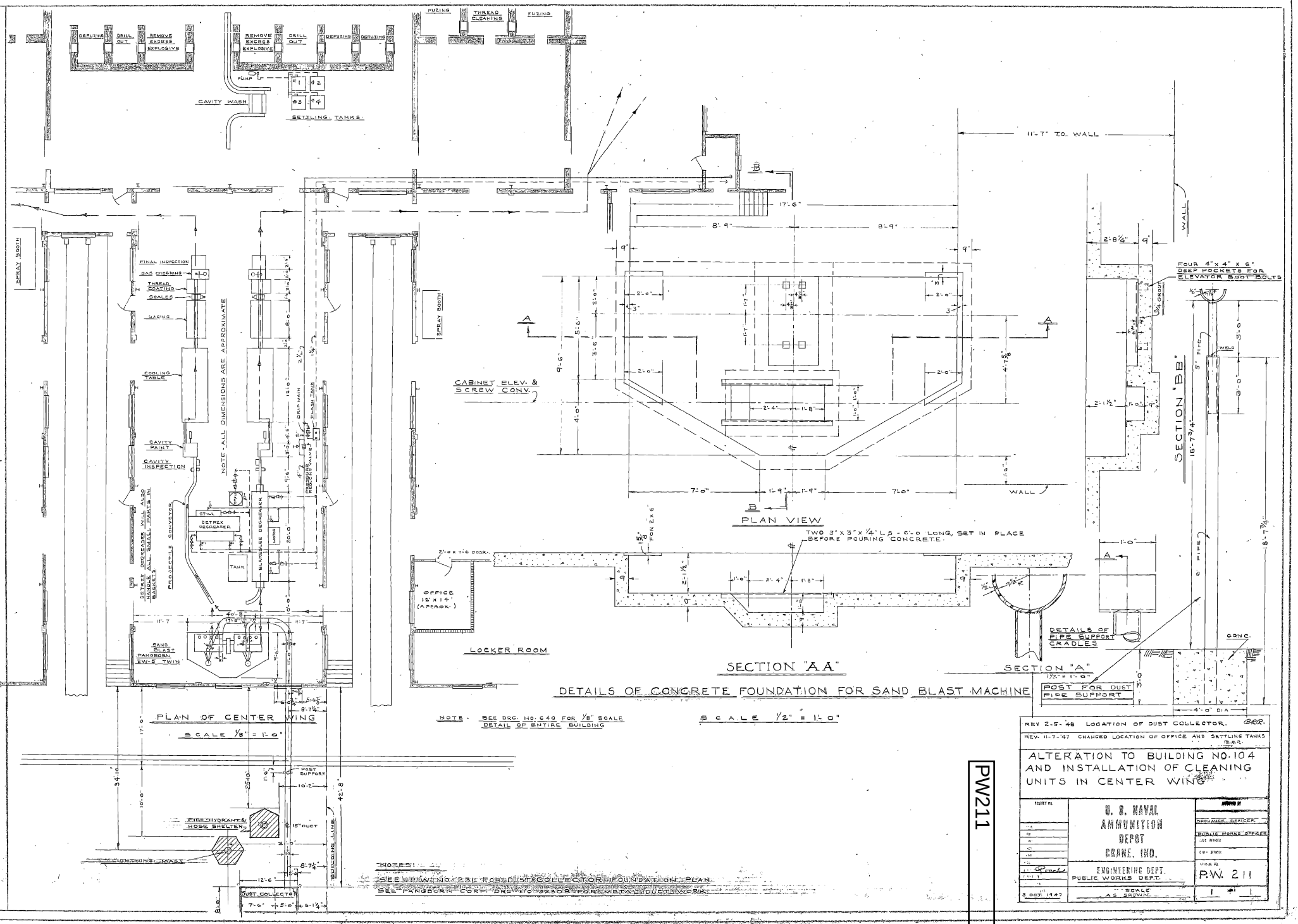
RENOVATION OF BUILDING 142
FLOOR PLAN

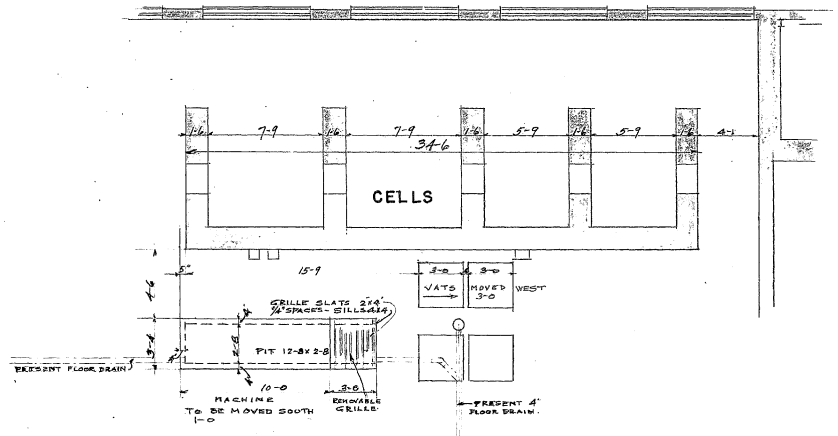
SIZE F | CODE IDENT. NO. 80091 | NAVFac DRAWING NO. 1200022 02
CONSTN. CONTR. NO. N62269-82-C-0202 | NAVFac DRAWING NO. 1200022 02
SCALE: NOTED | ASSOC. NAVFac DRAWING NO. 1216362 | SHEET 02 OF 04

PW4322 Sheet 002

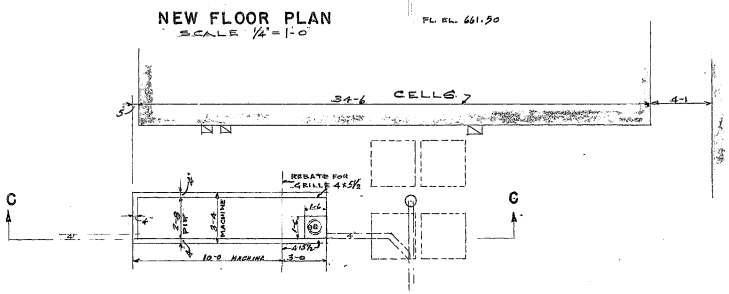
NWSC 1800(12-82)


PRESSURE REGULATING VALVE W/GAGE
COIL TANK CONNECTIONS - 3/8"Ø STAINLESS STEEL TUBING FOR 1700 PSIG WORKING PRESSURE
VALVE
20 GA. SHEETMETAL HOOD & BACK
3/16"x1 1/2"x1 1/2" L
DON'T FURNISHED TANKS
3/16"x6"x6" STEEL PLATES WELD TO L & ANCHOR TO CONC. W/3/8"Ø LEAD ANCHORS
FRONT
SIDE
AIR PIPING SCHEMATIC & SHELTER
NO SCALE
REMOVE EXIST. WINDOW SIMILAR TO EXIST. ON RIGHT
EXIST. CONC. ROOF
8" CONC. BLOCKS
EXIST. 12" BRICK WALL
16" LINTEL BLOCK WITH 2-#4 BARS - CUT TOPS OVER WINDOW
1" CLEAR SHATTER-PROOF PLASTIC WINDOW - SEE DETAIL
CONC. BLOCK TO BE FLUSH WITH EXTERIOR FACE OF EXIST. WALL - PLACE 1/4"Ø DOWELS AND HORZ. JOINT REINF. - EVERY 2 COURSES
EXIST. METAL WINDOW
EXIST.
DOORS
CONC. SILL
ELEVATION OF BLDG. 100
SCALE 1/4" = 1'-0"
16" LINTEL BLOCK WITH 1-#4 BARS
SEE DETAIL "1-1" HEAD
SEE DETAIL "1-1" JAMB
SAME AS DETAIL "1-1" EXCEPT REVERSED JAMB
SILL
DRIP
3/8"Ø LEAD ANCHORS - 2 PER L ALL SURFACES
1/4" BLOCK - ABSORBANT STRIPS - CONT.
CAULK
2"x2"L @ 3.19# CONTINUOUS
MASTIC
1" SHATTER-PROOF CLEAR PLASTIC
HEAD ONLY
DETAIL "1-1"
SCALE 3" = 1'-0"
WINDOW DETAIL
SCALE 1" = 1'-0"
CRANE VILLAGE
LAKE
BUS DEPOT
DEPOT BOUNDARY
BUILDING NO. 143
BURNS CITY
LOCATION PLAN
SCALE IN FEET
ANCHOR TO CONC. W/3/8"Ø LEAD ANCHORS NEW 3/4"Ø LINE
PIPE SUPPORT SEE DETAIL
NEW GRADE
EXIST. GRADE
EXISTING GRADE
3 TO 1 SLOPE
1"Ø PIPE
PIPE FLANGE
1/4"Ø U-BOLT FOR 1 1/4"Ø PIPE
3/16"x1 1/2"x1 1/2"x5" L
SIDE
FRONT
PIPE SUPPORT DETAIL
NORTH ELEVATION
SCALE 1/2" = 1'-0"
BLDG. 143
G TRANSITE WATER LINE
4" WATER
NEW WINDOW
BLDG. 100
BLDG. 99
BLDG. 186
BLACKTOP
COAL YARD
UNDERGROUND TELEPHONE WIRES
LIGHTING MAST
PRIMARY GROUND #6-7 STRAND BARE COPPER CABLE (UNDERGROUND)
THIS DRAWING
V.C.P. DRAIN HEADWALL
SITE PLAN
SCALE 1" = 50'
20 GA. SHEETMETAL FASTEN TO L'S W/ SHEET-METAL SCREWS
#4 BARS - 6" O.C. ALT. BENT
3 BARS - 12" O.C.
#4 BARS - 9" O.C.
#4 BARS - 9" O.C. BOTH WAYS
3/8"x2" STRAP ANCHORS SECURE TO BLDG. & 3"Ø PIPE
1'-3" CONCRETE WALL
#4 BARS - 9" O.C. - BOTH WAYS - BOTH FACES
5'-4"
4'-8"
3:1 SLOPE
NEW GRADE
FILL AND COMPACT
EXISTING GRADE
3"Ø O.D. PIPE FURNISHED BY GOVERNMENT - INSTALLED BY CONTRACTOR
POINT OF EXIST. AND NEW GRADE
4"x8" ROUGHCUT TIMBER
3/8"x8" COUNTER-SUNK BOLTS (TYPICAL)
2"x2" WEEP HOLES - 3 PER SIDE
2" ALL SIDES
1/2"x52"x2'-6" THICK ARMOR PLATE
2"Ø CAST IRON DRAIN
PITCH FROM HERE TO DRAIN
#4 BARS - 9" O.C. - BOTH WAYS
SEE NOTE AT LEFT
#4 BARS - 9" O.C.
#5 BARS
2'-0"
2'-6"
2'-1"
8'-0"
1'-3"
SECTION "A-A"
SCALE 1" = 1'-0"
PLAN
SCALE 1/2" = 1'-0"
NOTE - PITCH 2"Ø C.I. DRAIN 1/4" TO 1'-0". APPROX. 2.5# REQUIRED TO OUTLET. INSTALL A CONCRETE HEADWALL AT OUTLET. SIZE OF HEADWALL TO BE 6"x2'-0"x2'-0" BELOW GRADE.
NOTE - EXISTING GRADE IS COMPOSED OF CLAY AND ISOLATED STONE. THIS AREA SEEMS TO HAVE BEEN A FILL AREA THAT WAS BUILT UP APPROX. 25 YEARS AGO.
NOTE: PLATE TO BE FURNISHED BY THE GOVERNMENT - INSTALLED BY CONTRACTOR
GRAPHIC SCALES
1/4" = 1'-0"
1/2" = 1'-0"
1" = 1'-0"
3" = 1'-0"
1" = 50'
SYMBOL
DESCRIPTION
BY
DATE
APPROVAL
REVISIONS
PWO DRAWING NO. 2172
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL AMMUNITION DEPOT CRANE, INDIANA
DESIGN: DCM:SPC
DRAWN: CAAN 11/13/66
CHECKED: DJW
SUPV: Lowery
DESIGN DIV.
JOB NO.
CHECKED
BRANCH MGR.
F. P. ENGR.
DIRECTOR
APPROVED
DATE
DROP TEST FACILITY
NEAR BUILDING 143
STRUCTURAL
APPROVED PUBLIC WORKS OFFICER
DATE 3/4/11
SCALE AS SHOWN
SPEC. 78985
SHEET 1 OF 2
NDI 78985
TEC DRAWING NO. 1121060
SATISFACTORY TO: DE
DATE
SATISFACTORY TO: DA
DATE
SATISFACTORY TO: SEAD
DATE 12-14-16
PW2172 Sheet 001
W.R.# PW 928-67 EWO# 138-67

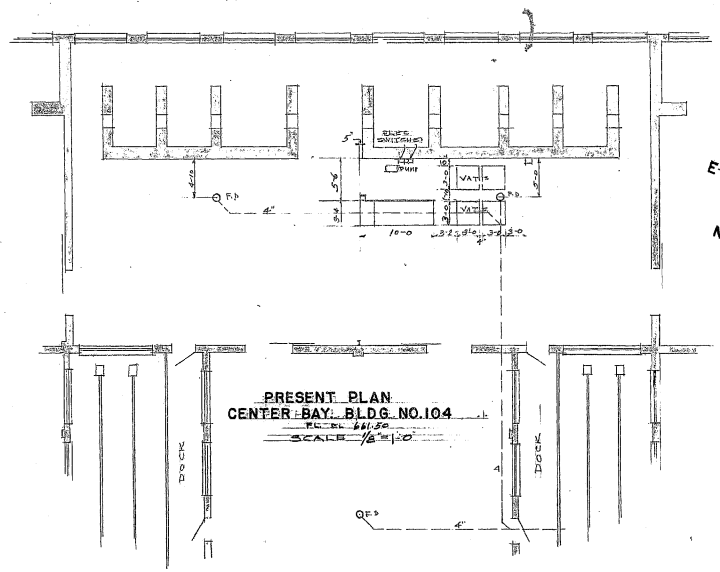

DEFUZING
DRILL OUT
REMOVE EXCESS EXPLOSIVE
CAVITY WASH
SETTLING TANKS
FUZING
THREAD CLEANING
SPRAY BOOTH
FINAL INSPECTION
GAS CHECKING
THREAD COATING
SCALES
GAGING
COOLING TABLE
CAVITY PAINT
CAVITY INSPECTION
NOTE - ALL DIMENSIONS ARE APPROXIMATE
DETREX DEGREASER WILL ALSO HANDLE ALL SMALL PARTS IN BASKETS
PROJECTILE CONVEYOR
STILL
DETREX DEGREASER
TANK
BLAKESLEE DEGREASER
MOTOR
DRIP MAIN
FLUSH TANK
SAND BLAST "FANGBORN" EW-6 TWIN
PLAN OF CENTER WING
SCALE 1/8" = 1'-0"
POST SUPPORT
FIRE HYDRANT & HOSE SHELTER
15" DUCT
LIGHTNING MAST
BUILDING LINE
DUST COLLECTOR
CABINET ELEV. & SCREW CONV.
11'-7" TO WALL
WALL
PLAN VIEW
TWO 3" x 3" x 1/4" L'S - 6'-0 LONG, SET IN PLACE BEFORE POURING CONCRETE
OFFICE 12' x 14' (APPROX.)
LOCKER ROOM
SECTION "AA"
DETAILS OF CONCRETE FOUNDATION FOR SAND BLAST MACHINE
NOTE - SEE DRG. NO. 640 FOR 1/8" SCALE DETAIL OF ENTIRE BUILDING
SCALE 1/2" = 1'-0"
FOUR 4" x 4" x 6" DEEP POCKETS FOR ELEVATOR BOOT BOLTS
SECTION "BB"
DETAILS OF PIPE SUPPORT CRADLES
SECTION "A"
POST FOR DUST PIPE SUPPORT
CONC.
NOTES:
SEE P.W. NO. 231 FOR DUST COLLECTOR FOUNDATION PLAN.
SEE "FANGBORN" CORP. DRG. NO. 7325 OR 7326 FOR METAL DUST WORK.
REV 2-5-48 LOCATION OF DUST COLLECTOR.
REV. 11-7-47 CHANGED LOCATION OF OFFICE AND SETTLING TANKS
ALTERATION TO BUILDING NO. 104 AND INSTALLATION OF CLEANING UNITS IN CENTER WING
U. S. NAVAL AMMUNITION DEPOT CRANE, IND.
ENGINEERING DEPT. PUBLIC WORKS DEPT.
ORDNANCE OFFICER
PUBLIC WORKS OFFICER
P.W. 211
SCALE AS SHOWN
3 OCT. 1947
PW211



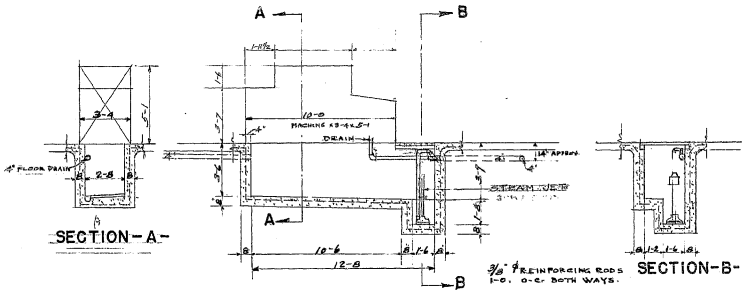
NEW FLOOR PLAN
SCALE 1/4" = 1-0



PLAN OF PIT
SCALE 1/4" = 1-0



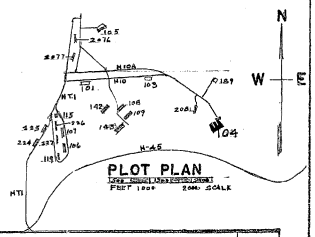
PRESENT PLAN
CENTER BAY, BLDG. NO. 104
FL. EL. 661.50
SCALE 1/8" = 1-0



SECTION-A-

SECTION-C-
SCALE 1/4" = 1-0

SECTION-B-



PLOT PLAN
FEET 1000 ZONE SCALE

WE WILL PROBABLY DRAIN THIS PIT WITH STEAM JET
J.W. STEELE

PW347

REVISION	DATE	BRIEF	BY

DRAWN BY J.J.C.
TRACED BY
CHECKED BY
CHIEF DRAFM.
IN CHARGE

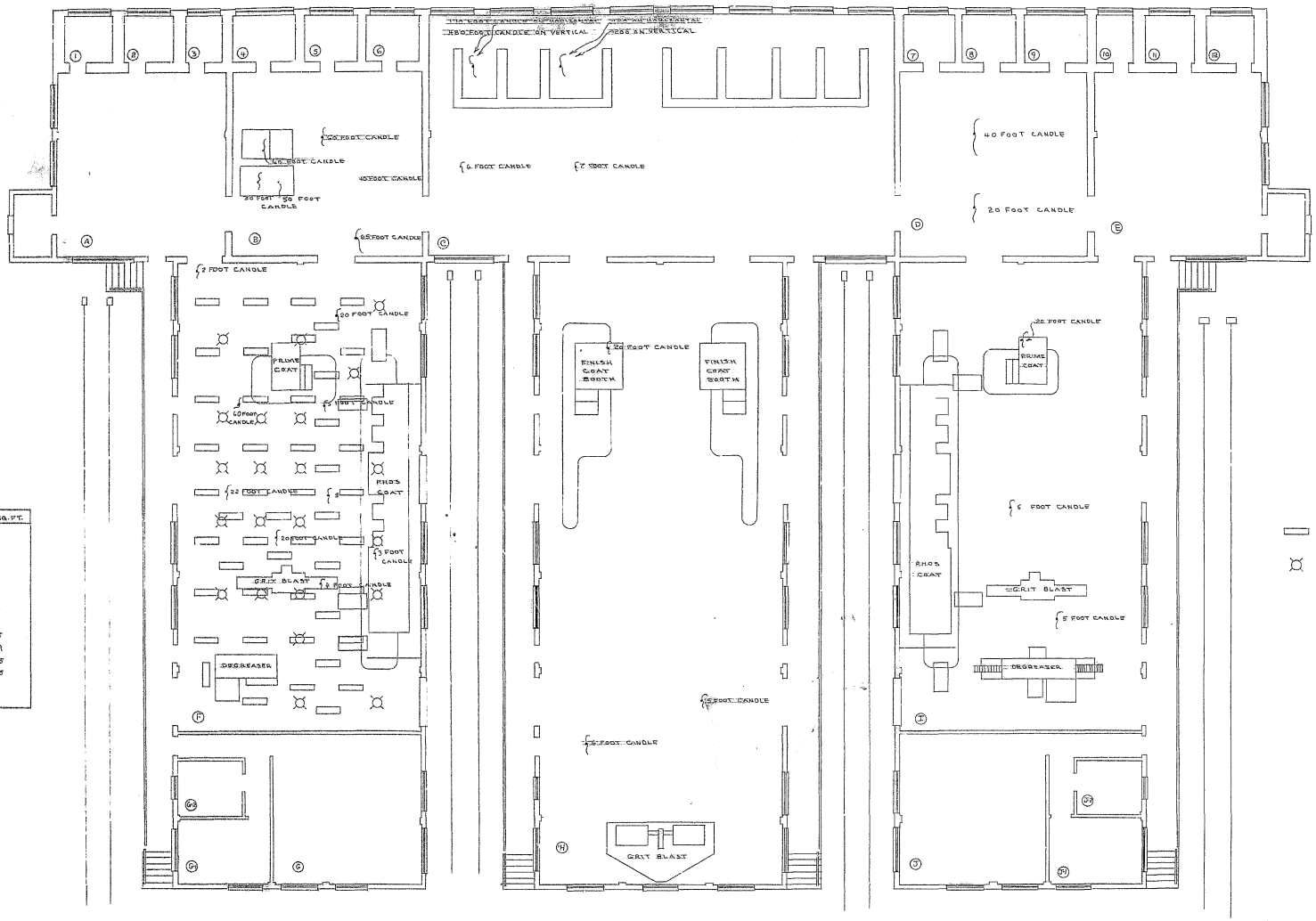
Y. & D. DRAWING NO.

F. W. DRAWING NO. 347

U. S. NAVAL AMMUNITION DEPOT
CRANE, INDIANA

WASHING MACHINE PIT
BLDG NO. 104

APPROVED AS TO DESIGN John W. Steele
APPROVED 16 AUG 1949
APPROVED BY: O.H. Craig



FIRST FLOOR PLAN - BUILDING #104

SCALE 1/8" = 1'-0"

ROOM	AREA SQ. FT.	ROOM	AREA SQ. FT.
(A)	948	1	65
(B)	1046	2	65
(C)	2066	3	49
(D)	1046	4	24
(E)	948	5	69
(F)	2265	6	73
(G)	791	7	73
(G-1)	218	8	69
(G-2)	91	9	25
(H)	4120	10	49
(I)	2265	11	65
(J)	701	12	65
(J-1)	212		
(J-2)	91		

ELECTRICAL LEGEND

NEW 2-40 WATT EXPLOSION-PROOF FLUORESCENT LIGHTING FIXTURES.

EXISTING INCANDESCENT LIGHTING FIXTURES TO BE REMOVED.

SYMBOL	DESCRIPTION	BY	DATE	APPROVAL

REVISIONS

PWO DRAWING NO. 1687

DEPARTMENT OF THE NAVY
NINTH NAVAL DISTRICT
U. S. NAVAL AMMUNITION DEPOT

BUREAU OF YARDS & DOCKS
GREAT LAKES, ILLINOIS
CRANE, INDIANA

DESIGN
DRAWN
CHECKED
SUPV.
DPWO DESIGN DIV.
JOB. NO.
CHECKED
BRANCH MGR.
E. P. ENGR.
DIRECTOR

LIGHTING LEVEL AT BLDG 104

APPROVED PUBLIC WORKS OFFICER DATE

APPROVED FOR BUREAU OF YARDS & DOCKS

DPWO FOR CHIEF OF BUREAU

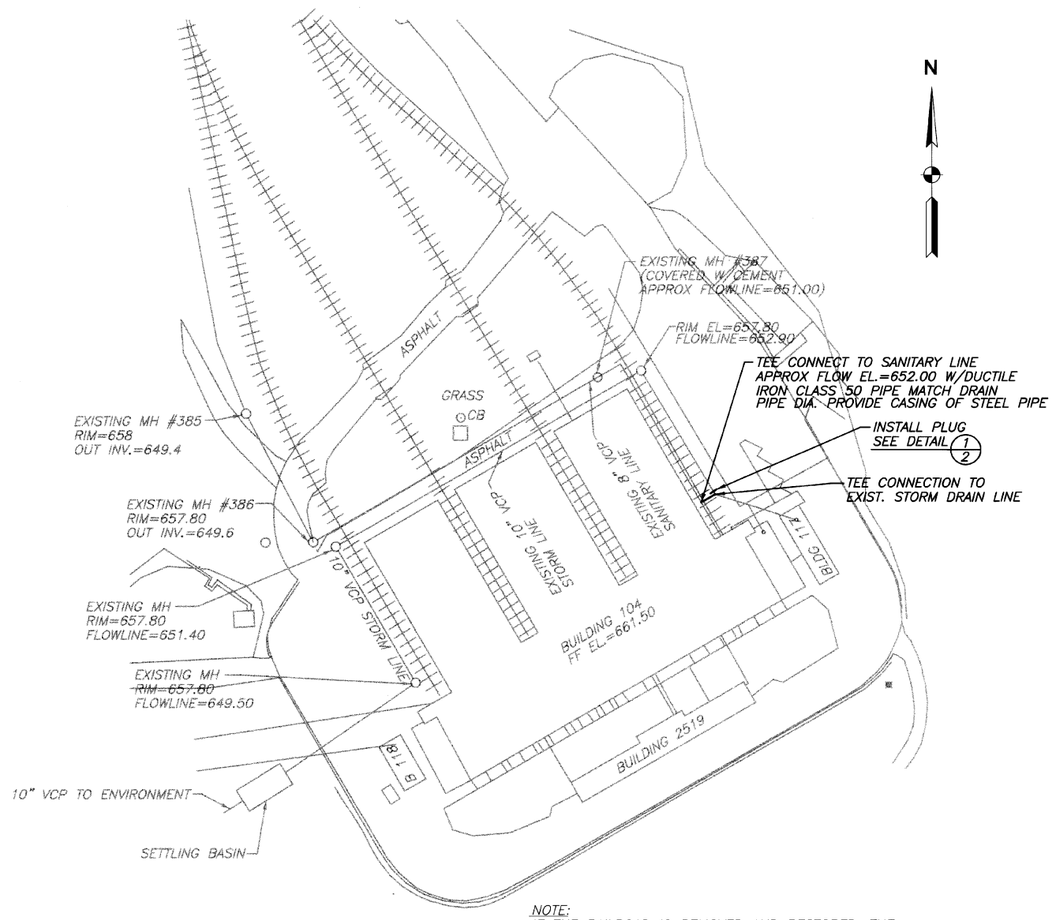
DATE

SCALE SPEC.

SHEET OF NBy

Y & D DRAWING NO.

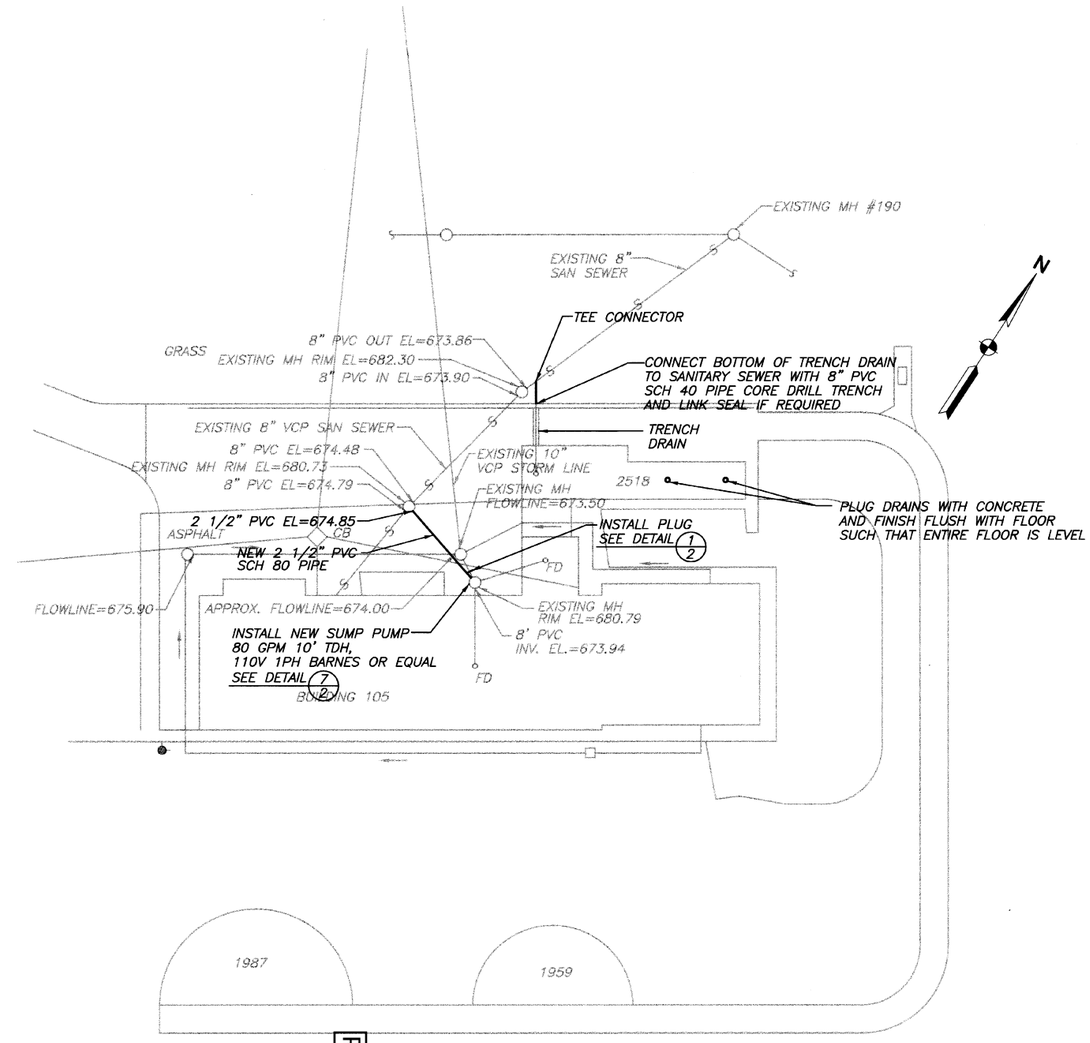
PW1687



NOTE:
IF THE RAILROAD IS REMOVED AND RESTORED, THE CONTRACTOR SHALL COORDINATE WITH RAILROAD DISPATCHER AND CONTRACTING OFFICER.

SITE PLAN-BUILDING 104

SCALE: 1"=40'



NOTE: CONTRACTOR SHALL PROVIDE ELECTRICAL CONNECTIONS TO SUMP PUMP.

SITE PLAN-BUILDING 105

SCALE: 1"=30'

PW 6530 Sheet 004

LTR	DESCRIPTION	PREP BY	DATE	APPROVED

REVISIONS

NAVAL FACILITIES ENGINEERING COMMAND DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
CRANE DIVISION
CRANE, INDIANA

ELIMINATE ILLICIT DISCHARGES
BUILDINGS 104 AND 105

APPROVED

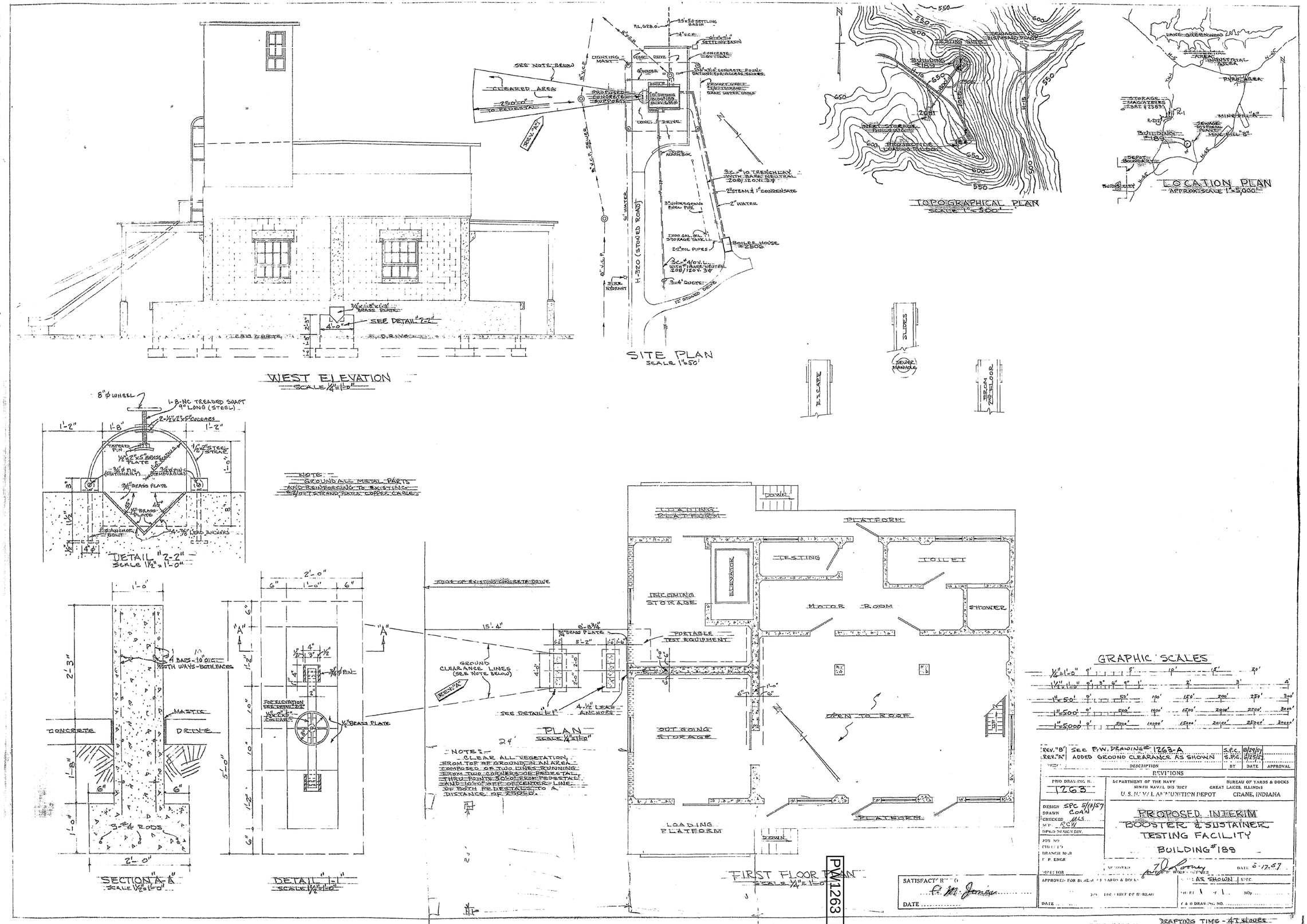
PUBLIC WORKS OFFICER DATE

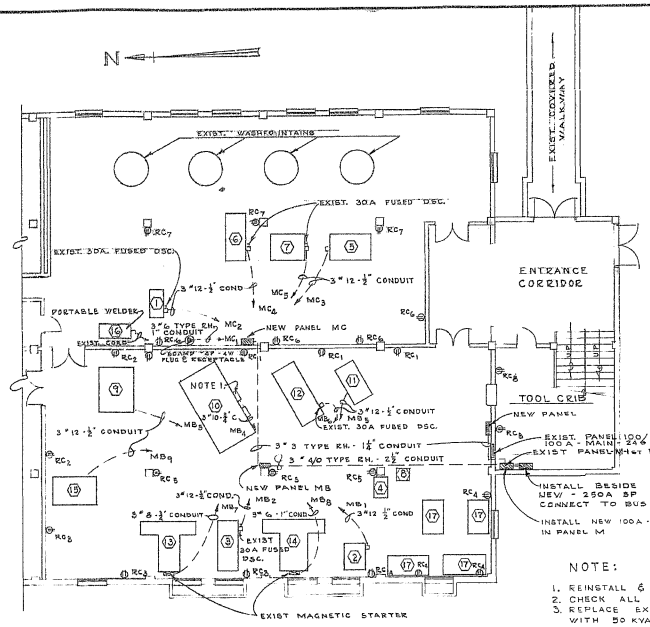
DATE	7/24/97	
DESIGN	NS	
DRAWN	JNJ	
CHECKED	MHN	
SUPV.	-	

SATISFACTORY TO: DATE
DES 2/25/98
CSE 2-5-98
NAT 2-24-98

SEAL

CODE IDENT. NO. 80091
DRAWING SIZE: D
SCALE:
WR NO. 6-090051
CONTRACT NO. N68950-97-C-3517
SPEC. NO. 97-06-3517
NAVFAC DRAWING NO. 5347245
PW DRAWING NO. 6530
SHEET 4 OF 18


WEST ELEVATION
SCALE 1/4"=1'-0"
SEE DETAIL "2-2"
SITE PLAN
SCALE 1"=50'
SEE NOTE BELOW
CLEARED AREA
PROPOSED CONCRETE BUTTRESS
TO PEDESTAL
PROP. ACC.
LIGHTING MAST
CONC. DRIVE
CONCRETE GUTTER
PRIMARY CIRCUIT 2400 VOLTS BARE COPPER CABLE
CONC. DRIVE
3c-#10 TRENCH CAV WITH BARE NEUTRAL 208/120V 3φ
2" STEAM & 1" CONDENSATE
2" WATER
BOILER HOUSE #2506
2-1" OIL PIPES
3c-#4/0 V.L. WITH BARE NEUTRAL 208/120V 3φ
3-4" DUCTS
12' STONED DRIVE
H-320 (STONED ROAD)
R.L. 628.0
25'x50' SETTLING BASIN
TOPOGRAPHICAL PLAN
SCALE 1"=500'
BUILDING #189
NET STORAGE BUILDING
BIO-LOGICAL LOADING TRUCK
LOCATION PLAN
APPROX. SCALE 1"=5,000'
LAKE GREENWOOD
PARK AREA
STORAGE MAGAZINES
MINE FIELD "A"
MINE FIELD "B"
SEWAGE SYSTEM PLANT
DEPOT BOUNDARY
BUILDING #189
ESCAPE
SLIDES
SEWER MANHOLE
SERCM 2ND FLOOR
DETAIL "2-2"
SCALE 1/2"=1'-0"
8" ϕ WHEEL
1-3-NC TREADED SHAFT 9" LONG (STEEL)
2-1/2"x1"x5" COLLARS
TAPERED PIN
1/4"x2"x5" BRASS PLATE
1/2"x4" STEEL STICKS
3/4" PIN (CENTRALLY)
3/4" PIN (EXTENDED BELOW)
3/4" BRASS PLATE
1/2" BRASS PLATE
1/2" ANCHOR BOLT
4-3/4" LEAD ANCHORS
NOTE:
GROUND ALL METAL PARTS AND REINFORCING TO EXISTING 4/0 BET. STRAND, BARE COPPER CABLES
SECTION "A-A"
SCALE 1/2"=1'-0"
4 BARS-10' O.C. BOTH WAYS-BOTTLENECKS
CONCRETE
MASTIC
DRINK
3-#4 RODS
DETAIL "1-1"
SCALE 1/2"=1'-0"
FOR ELEVATION SEE DETAIL 2-2
1/2"x2"x5" COLLARS
1/2" BRASS PLATE
3/4" PIN
EDGE OF EXISTING CONCRETE DRIVE
GROUND CLEARANCE LINES (SEE NOTE BELOW)
SEE DETAIL "E"
4-1/2" LEAD ANCHORS
PLAN
SCALE 1/4"=1'-0"
NOTE:
CLEAR ALL VEGETATION FROM TOP OF GROUND IN AN AREA COMPOSED OF TWO LINES RUNNING FROM TWO CORNERS OF PEDESTAL THRU POINTS 50'-0" FROM PEDESTAL AND 10'-0" OFF OF CENTER LINE OF EACH PEDESTAL TO A DISTANCE OF 250'-0".
LOADING PLATFORM
DOWN
PLATFORM
TESTING
TOILET
ELEVATOR
INCOMING STORAGE
MOTOR ROOM
SHOWER
PORTABLE TEST EQUIPMENT
OPEN TO ROOF
OUTGOING STORAGE
LOADING PLATFORM
PLATFORM
DOWN
FIRST FLOOR PLAN
SCALE 1/4"=1'-0"
GRAPHIC SCALES
SATISFACTORY TO
DATE
PW1263
REV. "B" SEE P.W. DRAWING # 1263-A S.P.C. 8/29/57
REV. "A" ADDED GROUND CLEARANCE AS SHOWN S.P.C. 8/25/57
REVISIONS
PWO DRAWING NO. 1263
DEPARTMENT OF THE NAVY
NINTH NAVAL DISTRICT
U.S. NAVAL AMMUNITION DEPOT
BUREAU OF YARDS & DOCKS
GREAT LAKES, ILLINOIS
CRANE, INDIANA
DESIGN SPC 5/8/57
DRAWN COAN
CHECKED MLS
SUP. RCW
PROPOSED INTERIM BOOSTER & SUSTAINER TESTING FACILITY BUILDING # 189
APPROVED
DATE 5-17-57
APPROVED FOR BUREAU OF YARDS & DOCKS
CHIEF OF BUREAU
DATE
AS SHOWN
SPC
SHEET 1 OF 1
C & O DRAWING NO.
DRAFTING TIME - 41 HOURS
W.R. 4-25-58



ELECTRICAL & EQUIPMENT PLAN

SCALE ⅛" = 1'-0"

NOTE:

1. REINSTALL & RECONNECT CONTROL PANEL ITEM 10
2. CHECK ALL MOTOR FOR PROPER VOLTAGE CONNECTION.
3. REPLACE EXIST 37½ KVA. TRANSFORMER WITH 50 KVA. CENTER TRANS. OF BANK

EQUIPMENT SCHEDULE

ITEM	MACHINE	PROPERTY NO	MFGR.
1	BANDSAW, HORIZONTAL	RR 24501	
2	BANDSAW, TABLE	RR 23795	GROB
3	DRILL, RADIAL	RR 24130	MORRIS
4	DRILL, SINGLE SPINDLE	C 30250	
5	GRINDER, EXTERNAL-INTERNAL	RR 19508	BROWN & SHARPE
6	GRINDER, SURFACE	RR 29244	REED
7	GRINDER, TOOL & BIT	RR 25561	CINCINNATI
8	GRINDER, PEDESTAL	RR 24367	WALKER TURNER
9	JIG BORE	RR 24094	FOSDICK
10	LATHE W/KELLER TRACER	RR 24153	MONARCH
11	LATHE	RR 18943	MONARCH
12	LATHE	RR 24338	MONARCH
13	MILL, VERTICAL	RR 25427	CINCINNATI
14	MILL HORIZONTAL	RR 24119	K & T
15	SHAPER	RR 15641	G E E
16	WELDER	RR 17872	LINCOLN
17	WORK BENCH		

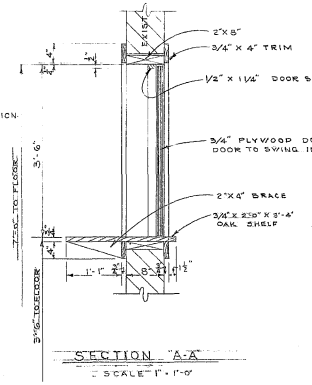
PANEL "MB" SCHEDULE
240 V. AC - 400 AMP MAIN LUGS - 3 Ø - 3W

CIRCUIT	BREAKER RATING	POLE	LOAD
MB_1	15A	3	1 HP SAW
MB_2	30A	3	3 HP DRILLING MACHINE
MB_3	30A	3	3 HP BORING MACHINE
MB_4	70A	3	7 1/2 HP LATHE
MB_5	30A	3	3 HP LATHE
MB_6	40A	3	5 HP LATHE
MB_7	70A	3	10 HP MILLING MACHINE
MB_8	100A	3	15 HP MILLING MACHINE
MB_9	40A	3	5 HP SHAPER
MB_{10}	100A	3	PANEL "MC"
MB_{11}	50A	3	SPARE
MB_{12}	30A	3	SPARE
MB_{13}	30A	3	SPARE
MB_{14}	15A	3	SPARE
MB_{15}	15A	3	SPARE
MB_{16}	15A	3	SPARE

PANEL "MC" SCHEDULE
240 V. AC - 225 AMP MAIN LUGS - 3 Ø - 3W

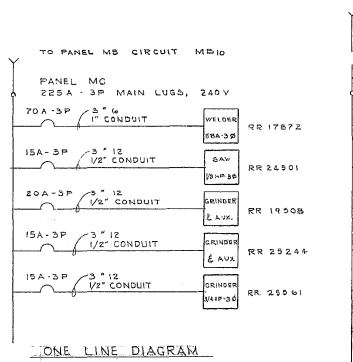
CIRCUIT	BREAKER RATING	POLE	LOAD
MC_1	70A	3	5 HP - WELDER
MC_2	15A	3	1/3 HP SAW
MC_3	20A	3	1 HP, 1/3 HP, 1/4 HP GRINDER
MC_4	15A	3	1 HP, 1/3 HP, GRINDER
MC_5	15A	3	3/4 HP GRINDER
MC_6	20A	3	SPARE
MC_7	15A	3	SPARE
MC_8	15A	3	SPARE
MC_9	15A	3	SPARE

PANEL RC - RECEPTACLE CIRCUITS
100 AMP MAINS - 110/220 V - 20 - 20 AMPERE BREAKERS
8 - 20 AMP CIRCUITS USED.

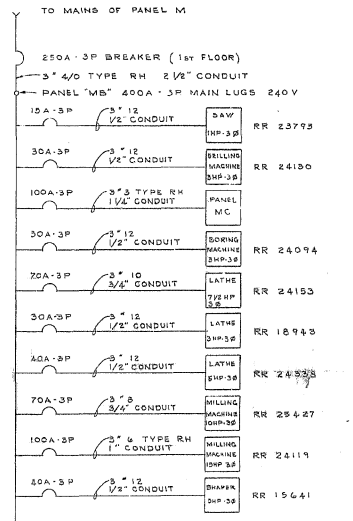


SECTION "A-A"

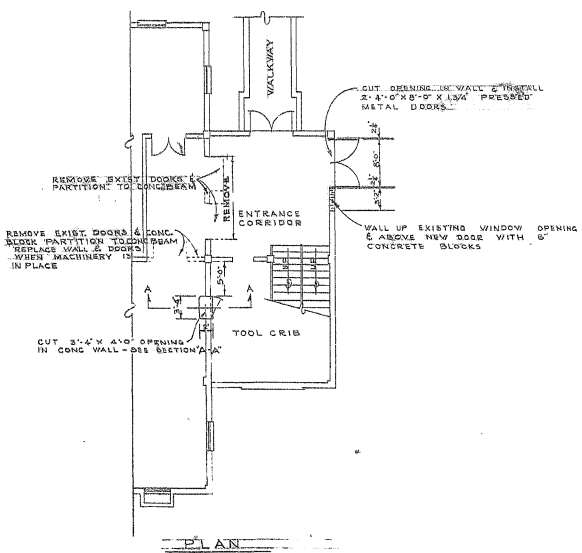
SCALE 1" = 1'-0"



ONE LINE DIAGRAM

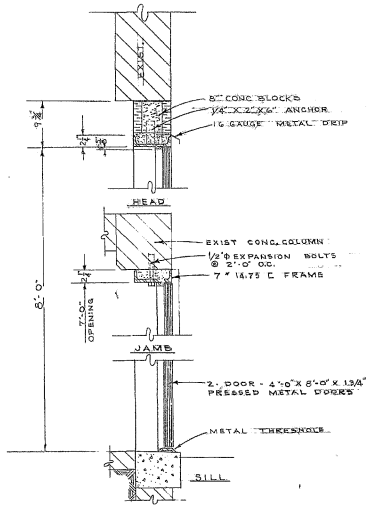


ONE LINE DIAGRAM



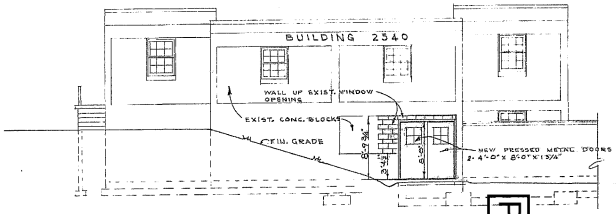
PLAN

SCALE ⅛" = 1'-0"



TYPICAL DOOR SECTION

SCALE 1" = 1'-0"



SOUTH ELEVATION

SCALE ⅛" = 1'-0"

PW1421

SYMBOL	DESCRIPTION	BY	DATE	APPROVAL

REVISIONS

PWO DRAWING NO. 1421

DEPARTMENT OF THE NAVY
NINTH NAVAL DISTRICT
U. S. NAVAL AMMUNITION DEPOT

BUREAU OF YARDS & DOCKS
GREAT LAKES, ILLINOIS
CRANE, INDIANA

DESIGN BEVAULT
DRAWN BEVAULT
CHECKED
SUPV.
PWO DESIGN DIV.
JOB NO.
CHECKED
BRANCH MGR.
E. P. ENGR.
DIRECTOR

ELECTRICAL, MACHINERY ARRANGEMENT AND ALTERATION FOR MODEL SHOP BUILDING "2540

APPROVED PUBLIC WORKS OFFICER DATE

APPROVED FOR BUREAU OF YARDS & DOCKS

PWO FOR CHIEF OF BUREAU

DATE

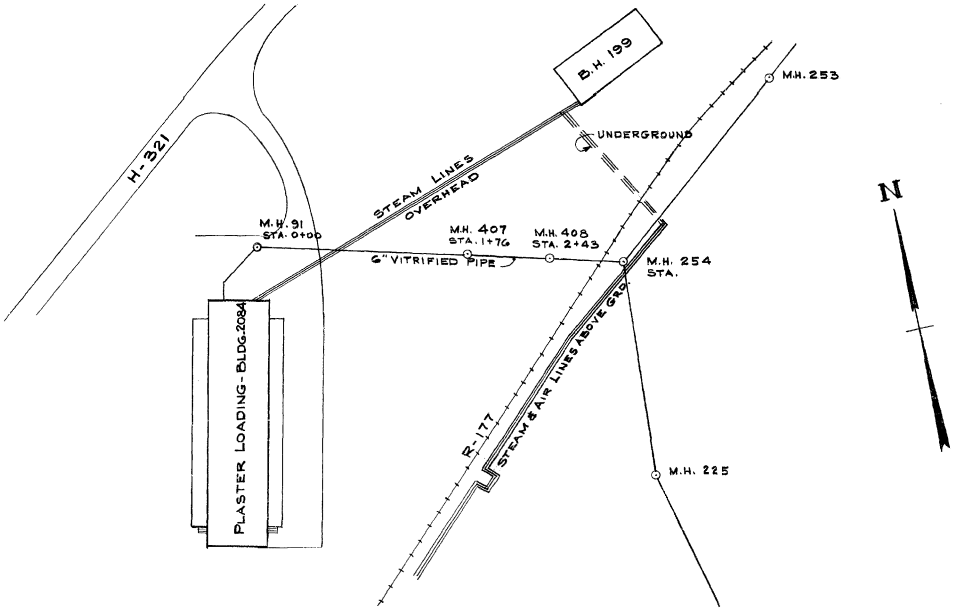
SCALE | SPEC.

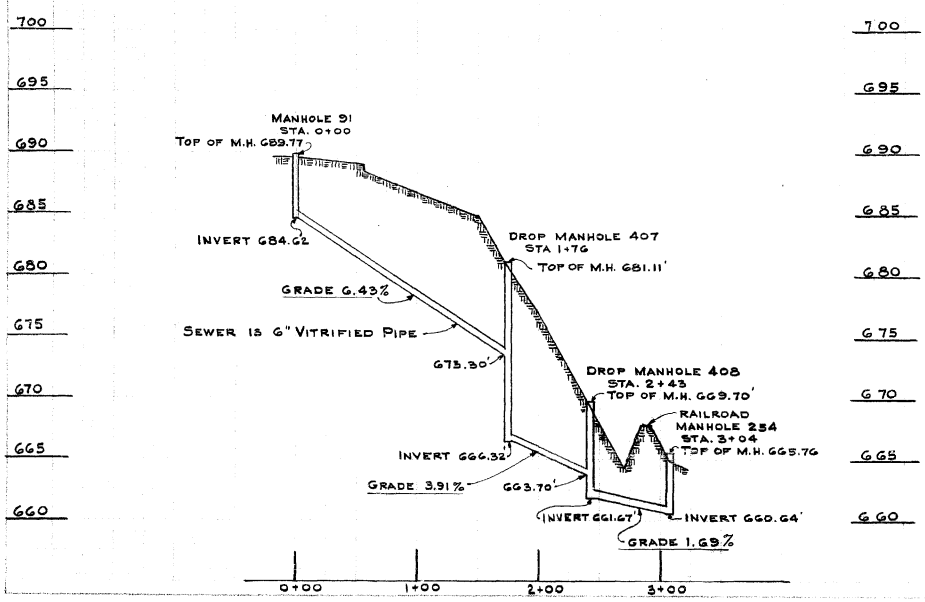
SHEET 1 OF 1 NB

Y & D DRAWING NO.

SATISFACTORY TO

DATE



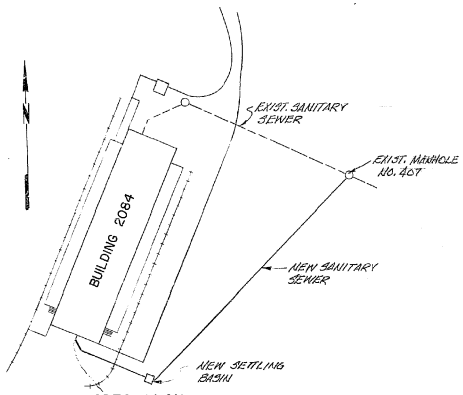


PWO DWG REF	DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
PWO DRAWING NO. 3269	NAVAL AMMUNITION DEPOT, CRANE, INDIANA
DESIGN OCM DRAWN R.G.S. (1-11-74) CHECKED SUPV.	SANITARY SEWER-BLDG.2084. PLAN & PROFILE M.H. 91 TO 254.
APPROVED — DATE	SIZE F — CODE IDENT. NO. 80091 — NAVFAC DRAWING NO.
PUBLIC WORKS OFFICER	CONSTR. CONTR. NO. — SCALE — SPEC. NO. — SHEET 1 OF 1

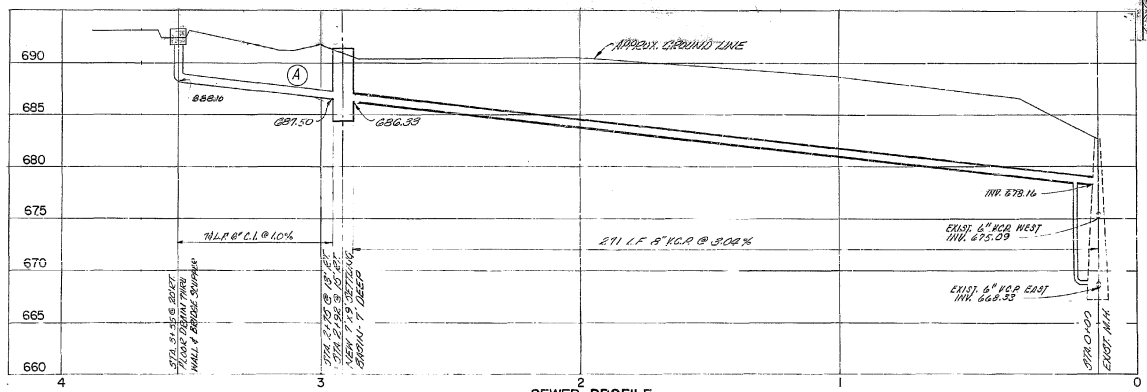
PW3269

P.W. DWG. 3269

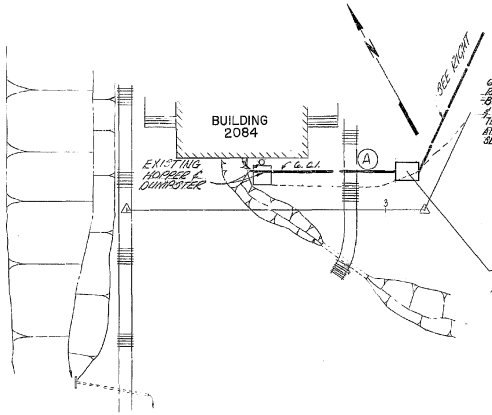
REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
A	REVISED ACCORD. STEEL CASING DELETED.			
B	ELEVATION CHANGED			



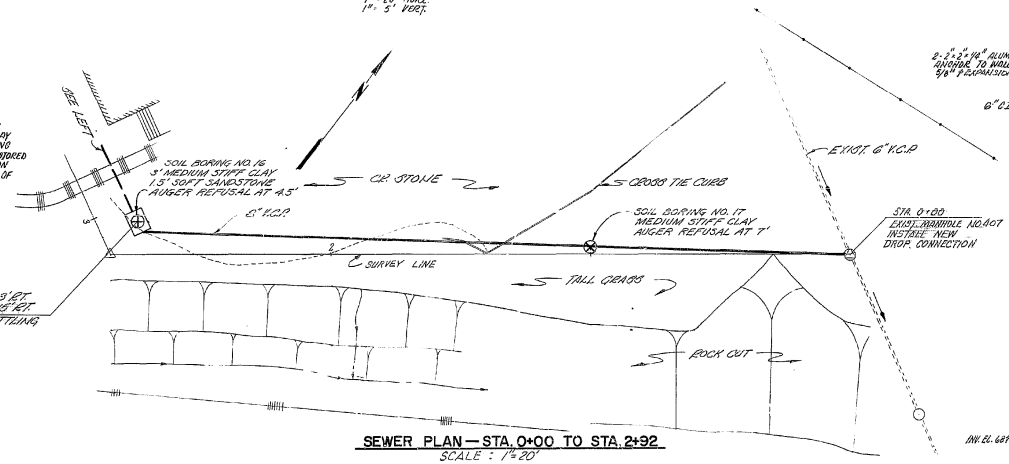
AREA PLAN
SCALE: 1"=50'



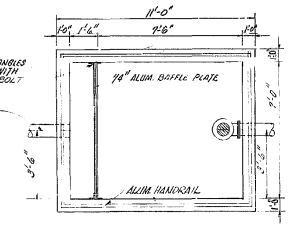
SEWER PROFILE
1" = 20' HORZ.
1" = 5' VERT.



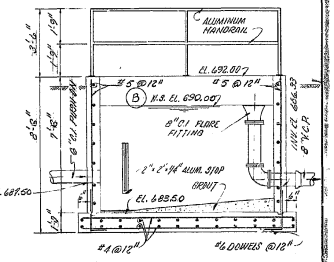
SEWER PLAN — STA. 2+92 TO STA. 3+55
SCALE: 1"=20'



SEWER PLAN — STA. 0+00 TO STA. 2+92
SCALE: 1"=20'

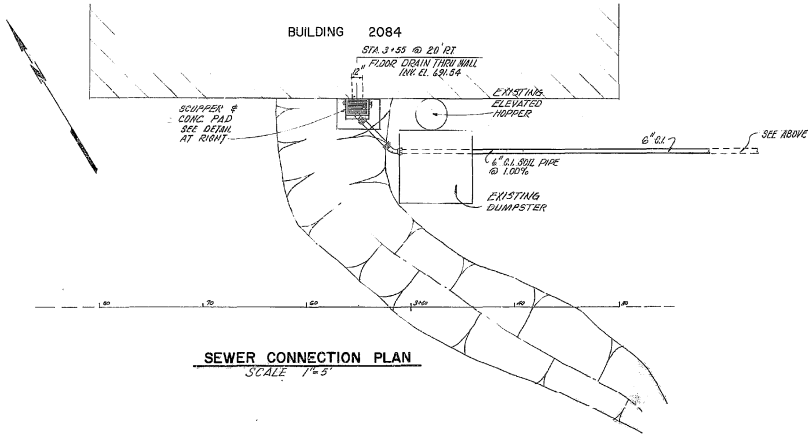


PLAN

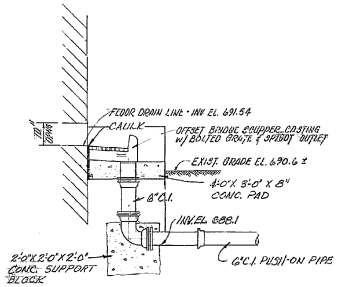


SECTION

SETTLING BASIN DETAILS
SCALE: 3/4"=1'-0"

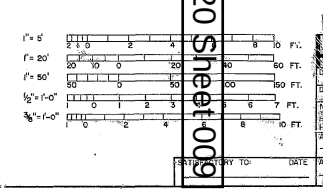


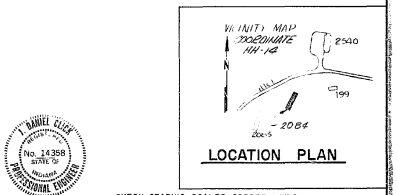
SEWER CONNECTION PLAN
SCALE 1"=5'



SCUPPER DETAIL
SCALE: 1"=2'-0"

TBM: FLOOR AT SOUTH END OF BLDG. 2084 ELEV. 693.20





LOCATION PLAN

CHECK GRAPHIC SCALES BEFORE USING

PW3820 Sheet 009

P.W. 3820

HENRY B. STEEG & ASSOCIATES, INC. ENGINEERS INDIANAPOLIS, INDIANA

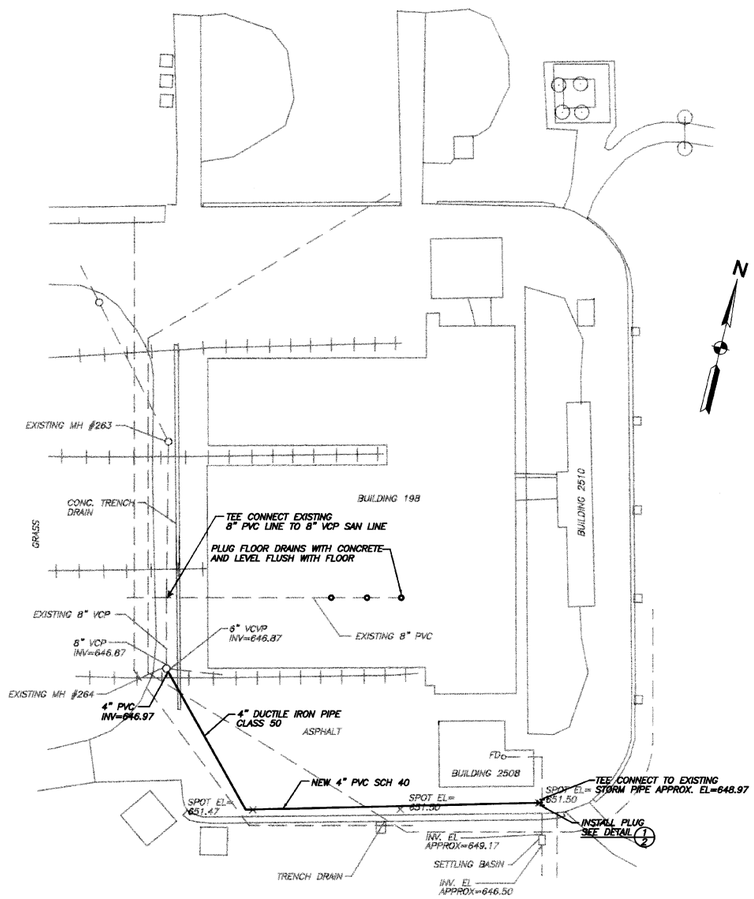
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
NAVAL BASE PHILADELPHIA, PA.

NAVAL AMMUNITION DEPOT CRANE, INDIANA
INDUSTRIAL WASTE TREATMENT FACILITIES
BUILDING 2084
SETTLING TANK & SEWER CONNECTION

DES. R.L.F. CK. J.D.C.
DR. SPAID/R.W. CER. Donald Clark
NORDIV
APPROVED DATE
OFFICER IN CHARGE
APPROVED 3/7/74
NORDIV FOR COMMANDER NAVFAC

SIZE F | CODE IDENT. NO. 80091 | NAVFAC DRAWING NO. 2009991
CONSTR. CONTR. NO. N62472 73 C 0093
SCALE: AS SHOWN | SPEC. 04-73-0093 | SHEET 9 OF 29

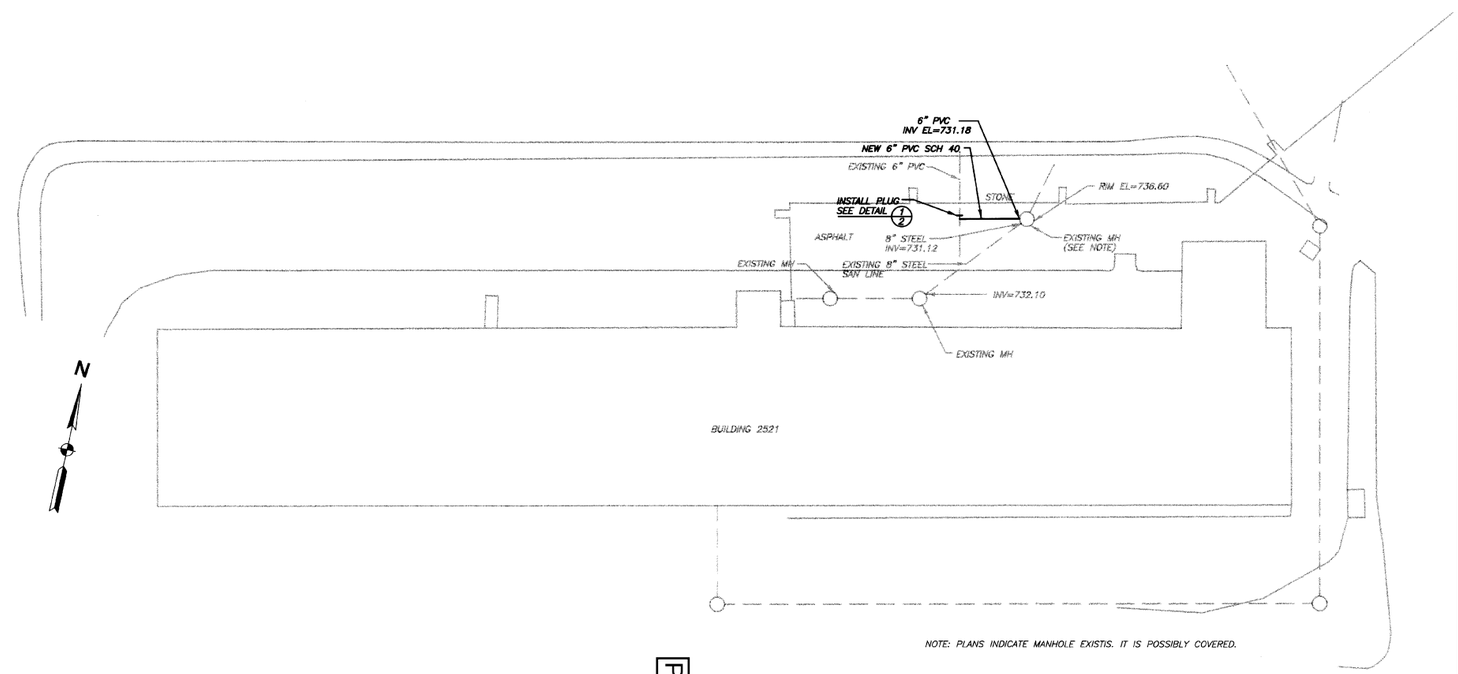
J.O. 54C38099



SITE PLAN-BUILDING 198

SCALE: 1"=40'

1. IF THE RAILROAD TRACK IS REMOVED AND RESTORED, CONTRACTOR SHALL COORDINATE WITH RAILROAD DISPATCHER AND CONTRACTING OFFICER.
2. A 10" I.D. STEEL CASING OF MIN THICKNESS 0.188" SHALL BE INSTALLED UNDER RAILROAD TRACKS. THE CASING SHALL SPAN 15' FROM THE MANHOLE INLET.



NOTE: PLANS INDICATE MANHOLE EXISTIS. IT IS POSSIBLY COVERED.

SITE PLAN-BUILDING 2521

SCALE: 1"=50'

PW 6530 Sheet 006

LTR	DESCRIPTION	PREP BY	DATE	APPROVED

REVISIONS

NAVAL FACILITIES ENGINEERING COMMAND DEPARTMENT OF THE NAVY
NAVAL SURFACE WARFARE CENTER
CRANE, INDIANA

ELIMINATE ILLICIT DISCHARGES
BUILDINGS 198 AND 2521

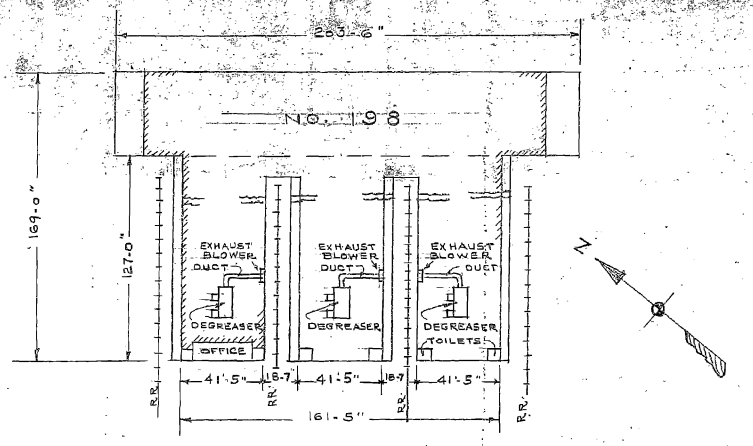
PUBLIC WORKS OFFICER — DATE

DATE	7/24/97	
DESIGN	NS	
DRAWN	JNJ	
CHECKED	MHN	
SUPV.	-	

SATISFACTORY TO: DATE
NFS & MWO 8-25-98
JJ-Fd
JBH
SOB

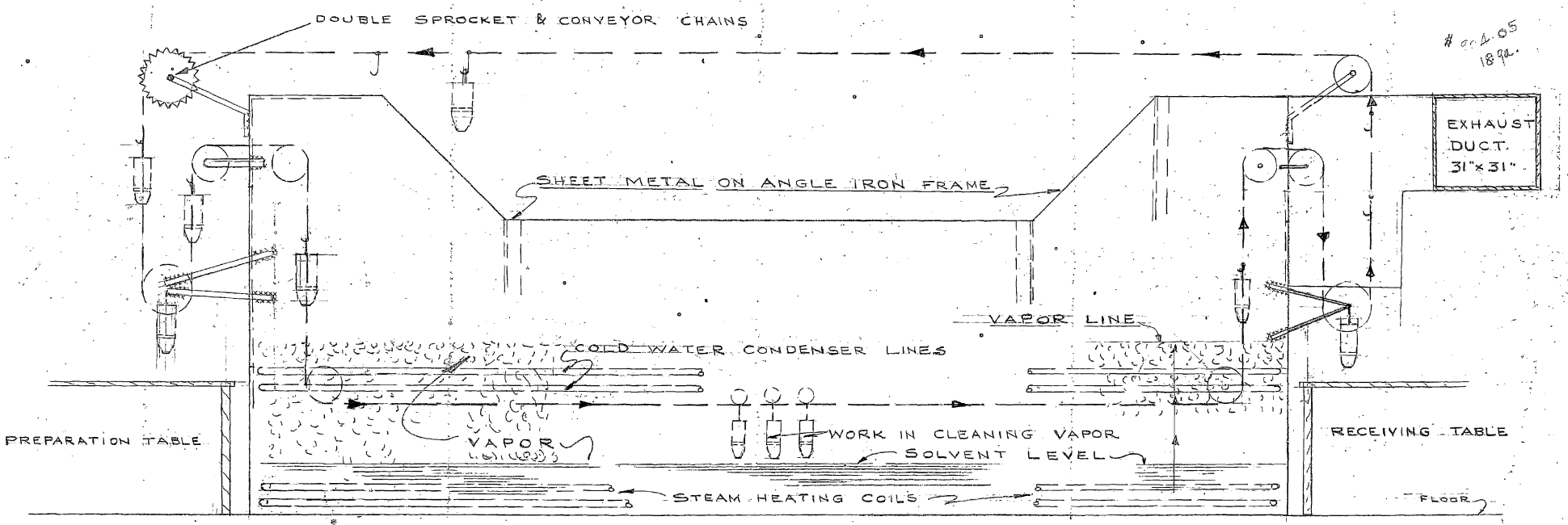
SEAL — APPROVED

CODE IDENT. NO.	80091
DRAWING SIZE:	D
SCALE:	
WR NO.	6-090051
CONTRACT NO.	N68950-97-C-3517
SPEC. NO.	97-06-3517
NAVFAC DRAWING NO.	5347247
PW DRAWING NO.	6530
SHEET 6 OF 18	



PLOT PLAN OF MEDIUM CALIBER PROJECTILE LOADING BUILDING NO. 198

SCALE 1" = 50'-0"



SIDE ELEVATION OF DEGREASER

NO SCALE

PWSK1398

U.S.N.A.D., CRANE, INDIANA.

DRAWN BRR. 6/21/55

DESIGN ENG.

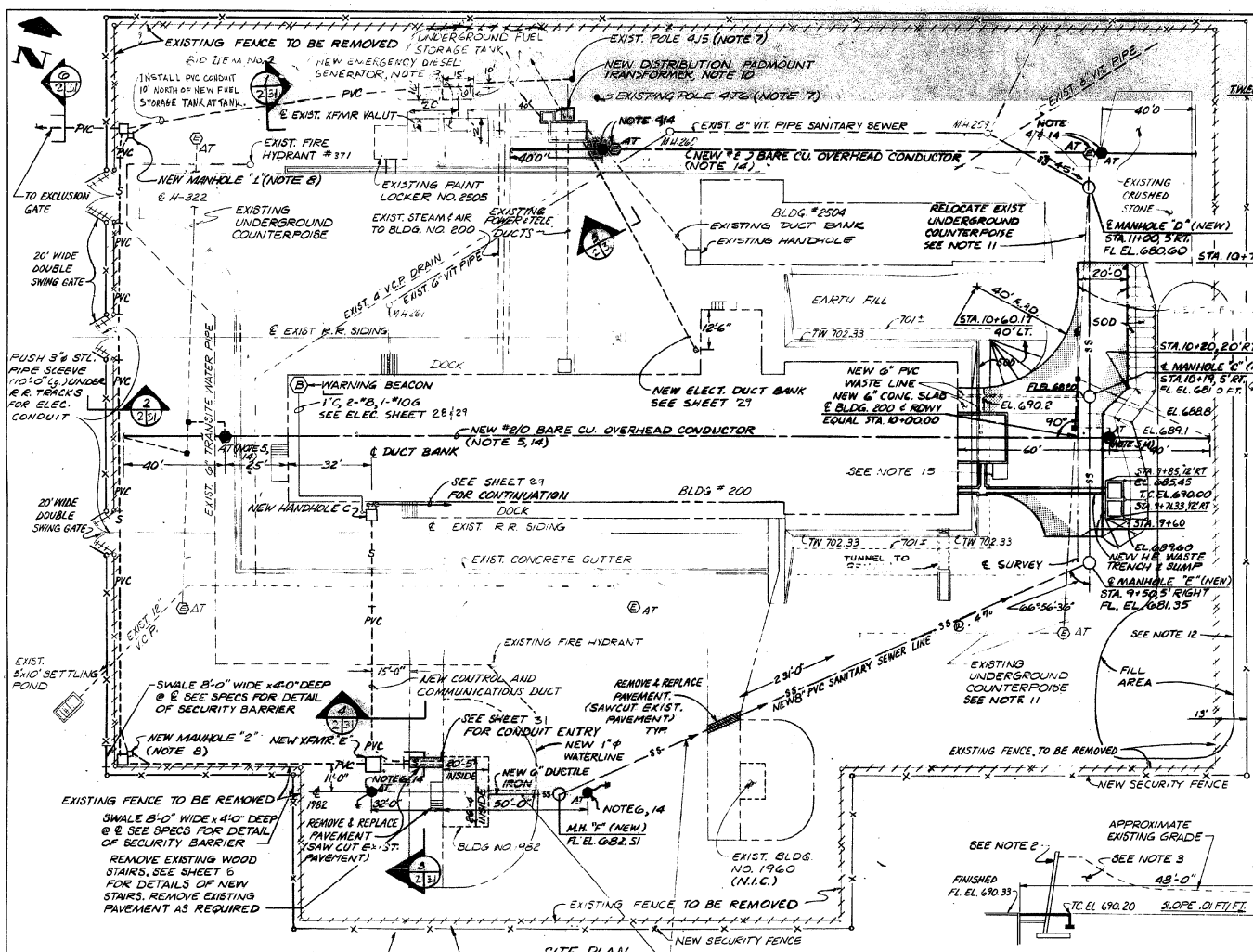
P.W. ENG.

EXHAUST SYSTEM FOR 3 DEGREASERS IN BUILDING NO. 198

P.W. SKETCH NO. 1398

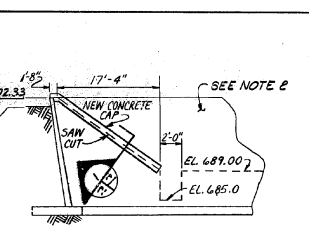
Approved _____ Date _____
PUBLIC WORKS OFFICER

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
A	GENERAL REVISION TO DRAWING	LHW	5-10-85	

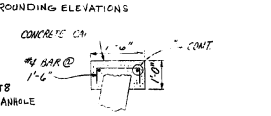


SITE PLAN
SCALE: 1" = 20'-0"

NEW 6" DUCTILE IRON PIPE, NEW 1" ϕ WATERLINE AND NEW 8" ϕ SANITARY SEWER LINE WITH NEW MANHOLES "F" AND "E" SHALL BE PART OF BID ITEM NO. 3. LENGTH OF SEWER EXTENDS FROM M.H. "F" TO M.H. "C" FOR BID ITEM NO. 3. MANHOLE "C" IS PART OF BID ITEM NO. 1 (BASE BID).



ELEVATION (LOOKING EAST)
SINGLE REVETTED BARRICADE (NORTH SIDE SHOWN, SOUTH SIDE SIMILAR)
N.T.S.



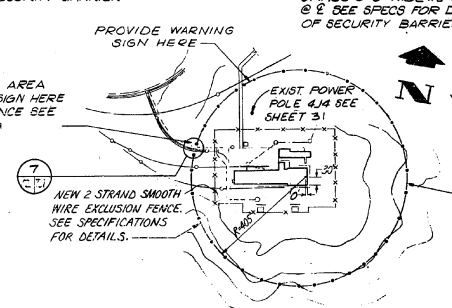
SECTION
N.T.S.

ABBREVIATIONS
F.R.P. – FIBERGLASS REINFORCED POLYESTER
P.V.C. – POLYVINYL CHLORIDE
MIN. – MINIMUM
V.C.P. – VITRIFIED CLAY PIPE
XFMR. – TRANSFORMER
FL.L. – FLOW LINE ELEVATION
T.W. – TOP OF WALL
M.H. – MANHOLE
APPROX. – APPROXIMATE
EXIST. – EXISTING
EL, ELEV. – ELEVATION
N.T.S. – NOT TO SCALE
CU. – COPPER
T.B.R. – TO BE REMOVED

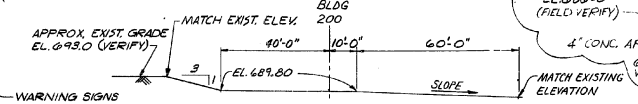
LEGEND
---PVC--- NEW DUCT BANK W/PVC CONDUIT
---S--- NEW DUCT BANK W/STEEL CONDUIT
NEW #2/0 AWG COPPER OH CONDUCTOR
NEW 7/16 GUY WIRE W/15" HELIX ANCHOR
NEW UNDERGROUND GROUND CONNECTION
---SS--- NEW SANITARY SEWER LINE
EXISTING CONSTRUCTION
(E)AT EXISTING AIR TERMINAL
AT NEW AIR TERMINAL

NOTES:
1. SEED AND MULCH ALL NEW BACKFILL SLOPES AND OTHER PREVIOUSLY GRASSED AREAS DISTURBED BY TRENCHING OR SITE GRADING.
2. REMOVE EXISTING REINFORCED CONCRETE RETAINING WALL.
3. REMOVE EXISTING EARTH FILL.
4. CUT OFF EXISTING STEEL MAST AT TOP OF FOUNDATION LEVEL. INSTALL NEW MAST 5 FT. BEHIND EXISTING.
5. CONTRACTOR SHALL INSTALL OVERHEAD GROUNDING CONDUCTORS, NEW LIGHTNING MASTS AND GUYS PER SHT. 30-31. CONTRACTOR SHALL CONNECT NEW LIGHTNING MAST TO EXISTING COUNTERPOISE.
6. CONTRACTOR SHALL INSTALL LIGHTNING MASTS TO PROTECT BLDG. 1982 IN ACCORDANCE WITH THIS SHEET AND SHEET 30&31, SAG WIRE 18" AT 60°F.
7. SEE SHEET 31 FOR DETAILS OF WORK ON THESE POLES AND IN THE XFMR VAULT.
8. DETAILS MANHOLES "1" AND "2" SHOWN ON SHEET 31.
9. [illegible] SHALL INSTALL 210 KW EMERGENCY DIESEL GENERATOR IN ACCORDANCE WITH THIS SHEET, SHEET 32 AND THE APPLICABLE SPE[illegible] (SEE SHEET [illegible])
10. CONTRACTOR SHALL INSTALL DISTRIBUTION PADMOUNT TRANSFORMER IN ACCORDANCE WITH THIS SHEET, SHEET [illegible] AND THE APPLICABLE SPECIFICATION.
11. FIELD LOCATE EXISTING UNDERGROUND COUNTERPOISE. REMOVE PRIOR TO EXCAVATION AND SITE GRADING. RELOCATE CONDUCTOR AFTER FINAL GRADES HAVE BEEN SET. RELOCATED COUNTERPOISE SHALL BE BURIED A MINIMUM OF 18" BELOW FINISH GRADE.
12. PLACE EXCESS EXCAVATED SOIL MATERIAL WITHIN THE LIMITS SHOWN. FILL SLOPES SHALL BE 1½ TO 1 OR FLATTER. SLOPE FILL TO DRAIN FROM THE SITE. STRIP THE TOPSOIL FROM THE DESIGNATED FILL AREA BEFORE PLACING NEW FILL MATERIAL, THEN REPLACE TOPSOIL ON NEW FILL.
13. ANCHOR GENERATOR SET TO CONCRETE FOUNDATION WITH THE QUANTITY, SIZE AND LOCATION OF ANCHOR BOLTS RECOMMENDED BY DIESEL GENERATOR MANUFACTURER. LENGTH OF GENERATOR FOUNDATION SHALL BE APPROX. 16'. WIDTH SHALL BE 12'. PROVIDE A PRE-ENGINEERED METAL BUILDING (8'x 16'x 10' CEILING HEIGHT) TO HOUSE GENERATOR.
14. SEE TABLE 1 ON SHEET 31 FOR SIZE, TYPE OF LIGHTNING MAST.
15. PROVIDE 8" THICK CONCRETE PAD FOR SCRUBBER W/ #4 @ 12" EACH WAY. PAD DIMENSION SHALL BE A MINIMUM OF 1'-0" GREATER THAN EQUIPMENT FOOTPRINT. CONTRACTOR SHALL PROVIDE ALL NECESSARY MATERIAL FOR ANCHORING SCRUBBER TO PAD.

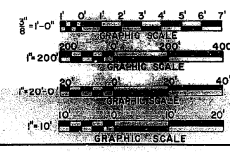
SECTION @ ℄ BLDG 200
SCALE: 1" = 10'-0"

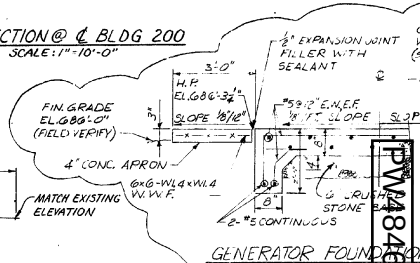


AREA PLAN
SCALE: 1" = 200'-0"

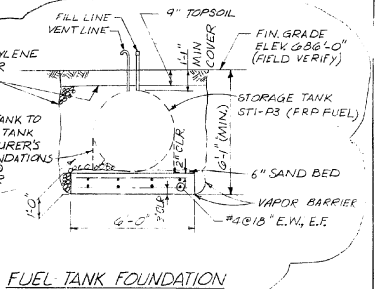


SECTION ON SURVEY ℄
SCALE: 1" = 20'-0"





GENERATOR FOUNDATION
N.T.S. SEE NOTE 13, SEE SHEET NO. 10



FUEL TANK FOUNDATION
SCALE: ¼" = 1'-0" SEE NOTE 13

PW 4846 Sheet 002

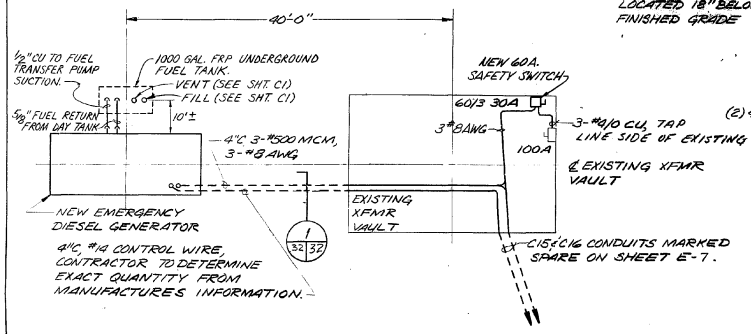
SATISFACTORY TO CHIEF - ES	DATE 11/27/84	PWO DWG REF	DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
SATISFACTORY TO OIC	DATE 11/27/84	PWO DRAWING NO. 4846	NAVAL WEAPONS SUPPORT CENTER CRANE, INDIANA
SATISFACTORY TO OIC	DATE	DESIGN TCN; DRAWN JAP; CHECKED RPL; SUPV. FPS	MODIFICATIONS TO BUILDINGS 200, 1982 AND 2504 PBX LOADING FACILITY
		APPROVED — PUBLIC WORKS OFFICER	SITE PLAN
C-1			SIZE F; CODE IDENT. NO. 80091; NAVFAC DRAWING NO. 2064776
			CONSTR. CONTR. NO. N62472-85-C-7072
			SCALE AS NOTED; SPEC. NO. 04-85-7072; SHEET 2 OF 3

STATE OF INDIANA — THOMAS C. MICHENBERG — NUMBER E-18952 — REGISTERED PROFESSIONAL ENGINEER

NWSC 1088012-82

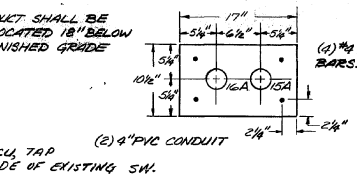
GPO GOVERNMENT PRINTING OFFICE 1982 5-577-164

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
A	GENERAL REVISIONS TO DRAWINGS	ASM	5/85	



DIESEL GENERATOR PLAN

N.T.S.



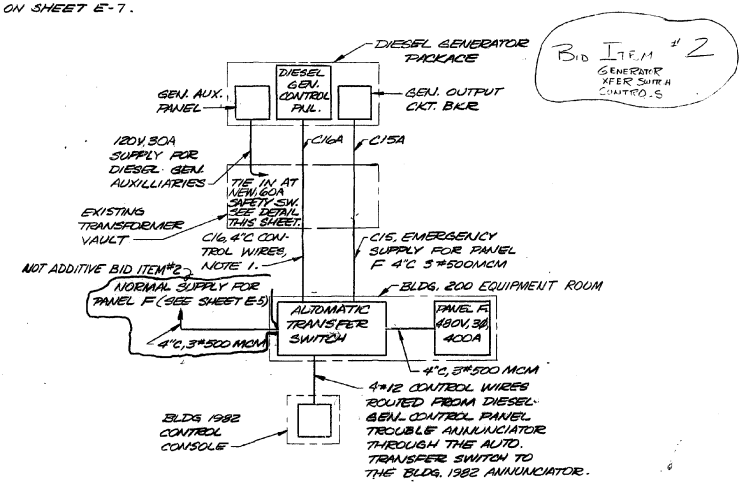
DETAIL

SCALE 1½"=1'-0" 1 32 32

UNDERGROUND CONDUIT SCHEDULE					
NO	SIZE	FROM	TO	CONDUCTORS	SERVICE
15	4"	XFMR VAULT	BLDG. 200	3-#500 MCM.	EMER. POWER
15A	4"	DIESEL GEN.	XFMR VAULT	3-#500 MCM.	EMER. POWER
16	4"	XFMR VAULT	BLDG. 200	#14 CONTROL	GEN. CONTROL (NOTE 1)
16A	4"	DIESEL GEN.	XFMR VAULT	#14 CONTROL	GEN. CONTROL (NOTE 1)

NOTE:

1. CONTRACTOR SHALL DETERMINE ACTUAL QUANTITY OF CONTROL CONDUCTORS FROM MANUFACTURERS INFORMATION.



BID ITEM #2
GENERATOR XFER SWITCH CONTROLS

EMERGENCY GENERATOR RISER DIAGRAM

N.T.S.

1 1/2" = 1'-0" 1' 6" 0 1' GRAPHIC SCALE

1/4" = 1'-0" 5' 0 5' 10' GRAPHIC SCALE

STATE OF MISSOURI JOHN C. MEIER NUMBER E-15475 REGISTERED PROFESSIONAL ENGINEER

E 8

SATISFACTORY TO SAEC11-ESC DATE 11/27/84

SATISFACTORY TO 04 DATE 11/27/84

SATISFACTORY TO 104 DATE 8-31-83

PW4846 S Sept 032

PWO DWG REF

PWO DRAWING NO. 4846

DESIGN VDK
DRAWN FLM
CHECKED JCM
SUPV. FPR

APPROVED DATE 12/1/84
PUBLIC WORKS OFFICER

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA

MODIFICATIONS TO BUILDINGS 200, 1982 AND 2504
PBX LOADING FACILITY

DIESEL GENERATOR ELECT. PLAN & DETAILS
BID ITEM #2

SIZE	CODE IDENT. NO.	NAVFAC DRAWING NO.
F	80091	2064801

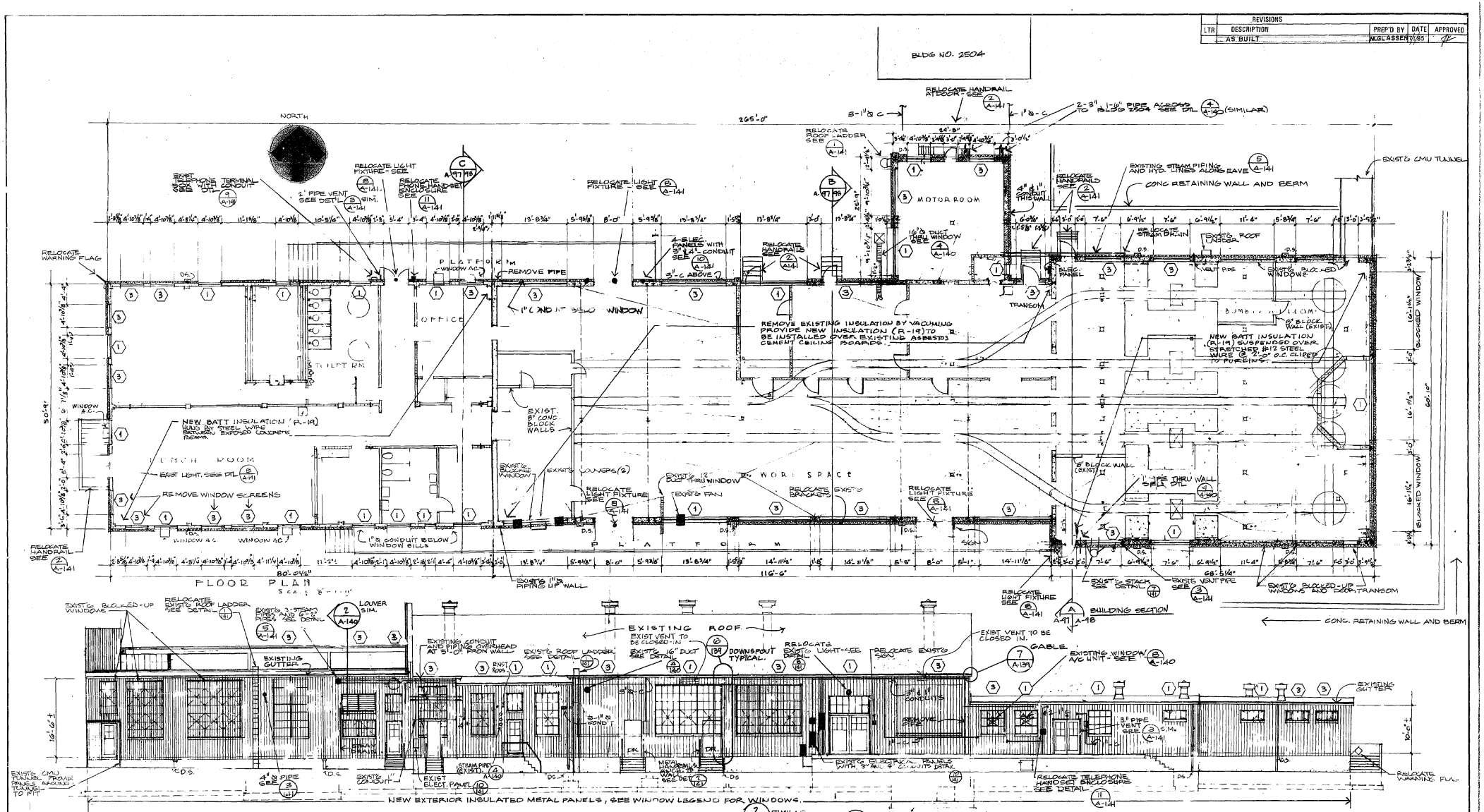
CONSTR. CONTR. NO. N624 72-85-C-7072

SCALE: AS NOTED | SPEC. NO. 04-85-7072 | SHEET 323 OF 356

NWSC 1968013-921

U.S. GOVERNMENT PRINTING OFFICE: 1982 358-168

REVISIONS				
LTR	DESCRIPTION	PREP'D BY	DATE	APPROVED
	AS BUILT	M.GLASSEN	7/85	



NOTE:
THIS BUILDING CONTAINS POTENTIALLY HAZARDOUS ACCUMULATIONS OF EXPLOSIVE PARTICLES IN EXISTING CEILING INSULATION - SEE SPECIFICATIONS FOR PRECAUTIONS DURING REMOVAL AND DISPOSAL.

WORK FOR THIS BUILDING

NEW CEILING (OR ROOF) INSULATION
NEW EXTERIOR WALL INSULATION OF EXTERIOR INSULATED METAL PANEL SIDING.

REWORK EXISTING WINDOWS AS FOLLOWS:
1. EXISTING WINDOWS NOT TO BE DISTURBED OR COVERED
2. EXISTING WINDOW TO BE COVERED WITH METAL PANEL SIDING WITH EXPLOSIVE RELEASE FASTENERS

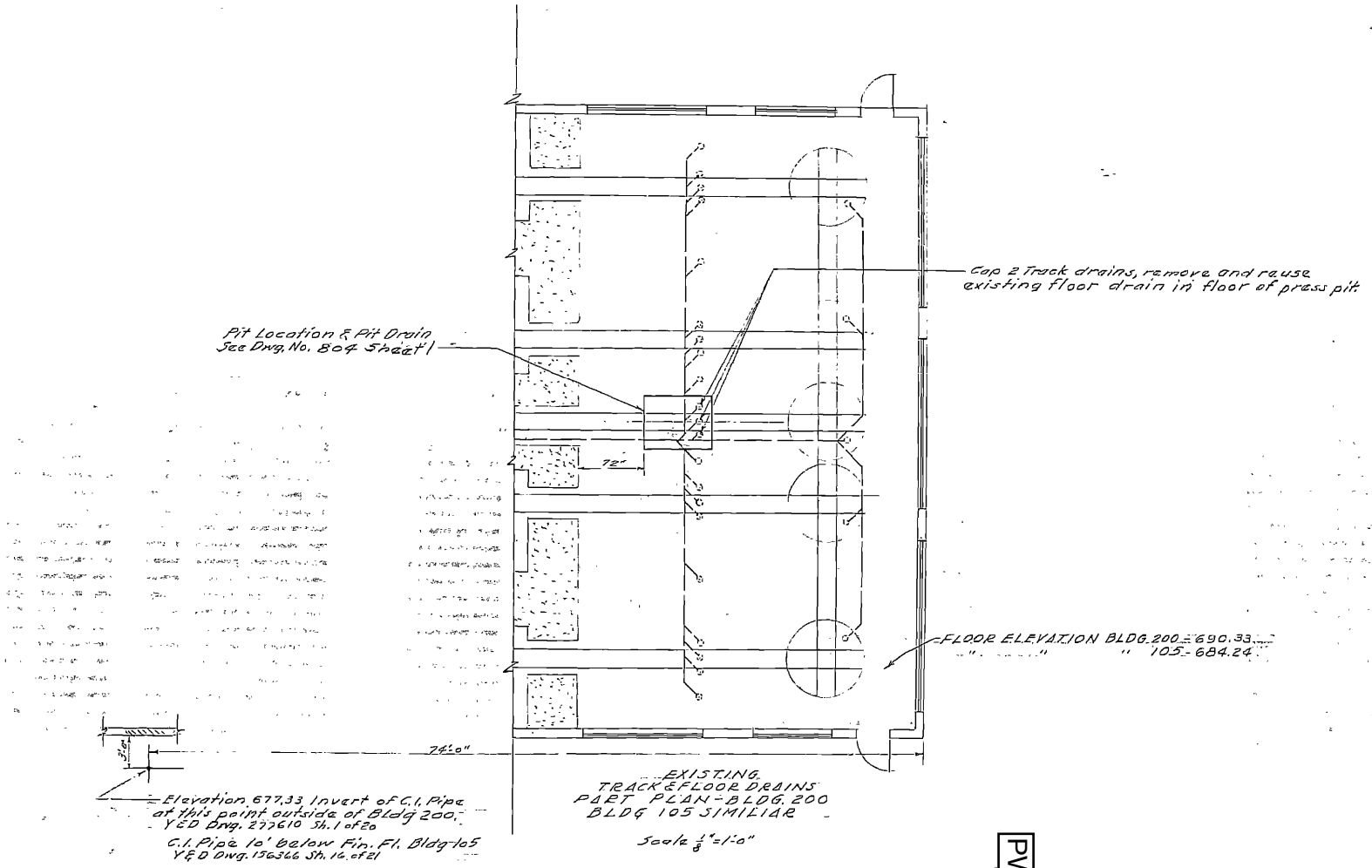
PW/51 Sheet 099

LITTLE & PARTNER ARCHITECTS ENGINEERS AND CONSTRUCTION MANAGERS INC.
216 WEST BROOKBRIDGE STREET
LOUISVILLE, KENTUCKY 40203
(502)585-4181

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL BASE NORTHERN DIVISION PHILADELPHIA, PA.
NAVAL WEAPONS SUPPORT CENTER CRANE, INC.
FACILITY ENERGY IMPROVEMENT (P-175)
BUILDING No. 200
FLOOR PLAN & ELEVATIONS.

SIZE F	CODE IDENT. NO. 80091	NAVFAC DRAWING NO. 2045198	
CONSTR. CONTR. NO. N62472-79-C0103			
SCALE 1/8"=1'-0"	SPEC. 04-79-0103	SHEET 99 OF 117	A-97

NORTHDIV FOR COMMANDER NAVFAC



PWSK0421

U.S.N.A.D., CRANE, INDIANA

DRAWN

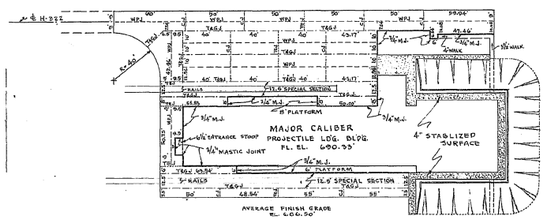
DESIGN ENG.

P.W. ENG.

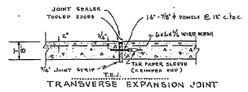
PIT DRAIN FOR 275 TON GAS CHECK PRESS BUILDING 200 (BLDG 105 SIMILIAR)

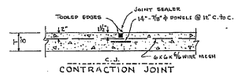
P.W. Sketch No. 421

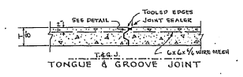
Approved W M Robertson for PUBLIC WORKS OFFICER Date 11-4-53

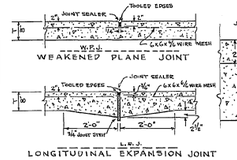


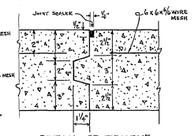
PLAN 8" CONCRETE PAVING
SCALE 1" = 50' 6 x 6 x 1/0 WIRE MESH

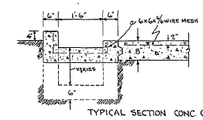


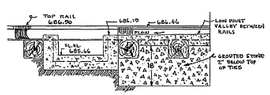


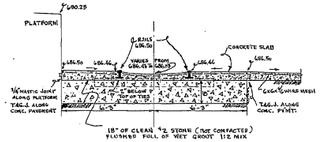


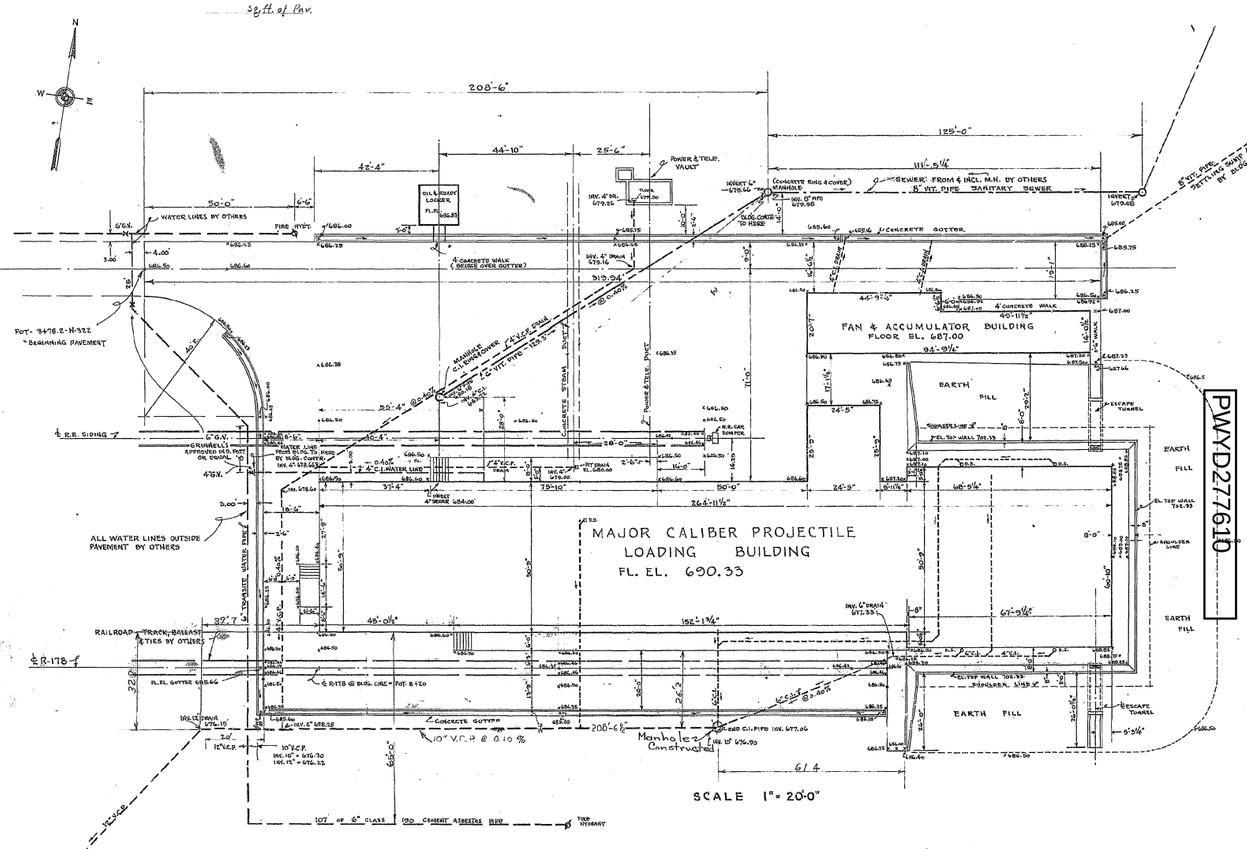


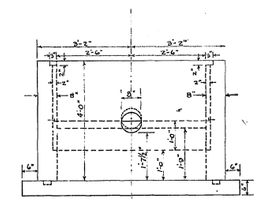




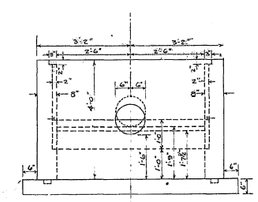








5'x6' SETTLING SUMP - ELEVATION "A" - "A"
6" WALL ACROSS CENTER OF 6' LENGTH - 1'-9" HIGH, 2" x 12" x 9'-4" WOOD BAFFLE SET IN 2" SLOTS IN SIDE WALLS 1'-6" FROM OUTLET WALL - SUMP TO BE COVERED WITH 9 PIECES OF WOOD PLANKING - 2" x 8" x 5'-6" SET IN EXCESS AT TOP OF WALLS
BRICK OR CONCRETE - SCALE 1/2" = 1'-0"



5'x10' SETTLING SUMP - ELEVATION "B" - "B"
2 - 6" WALLS ACROSS SUMP - 5 1st WALL 2'-0" FROM FACE OF INLET WALL - 1'-9" HIGH - & 2nd WALL 3'-6" FROM & 1st WALL NO. 1 - 1'-9" HIGH - 2" x 12" x 9'-4" WOOD BAFFLES SET IN SLOTS IN SIDE WALLS - & 1st BAFFLE SET 5'-0" FROM FACE OF INLET WALL & & 2nd BAFFLE 3'-6" FROM & OF 1st BAFFLE. SUMP TO BE COVERED WITH 15 PIECES OF WOOD PLANKING 2" x 8" x 5'-6" SET ACROSS SUMP IN RECESS ALONG SIDE WALLS
BRICK OR CONCRETE - SCALE 1/2" = 1'-0"

PWYD 277610

Revision	Date	Brief	By
REV. #1	5-7-44	REVISED RAIL SEWER, TRANSFORMER & STEAM PIPE & PRESS. CELL FRAME, WATER LINE TO SHOWS FIRE HYDRANT, NEW ADDITIONAL PLATFORMS, RAILROAD TRACKS & REV. PAVING PLAN	J.C.W.

CONTRACT NOY-6645

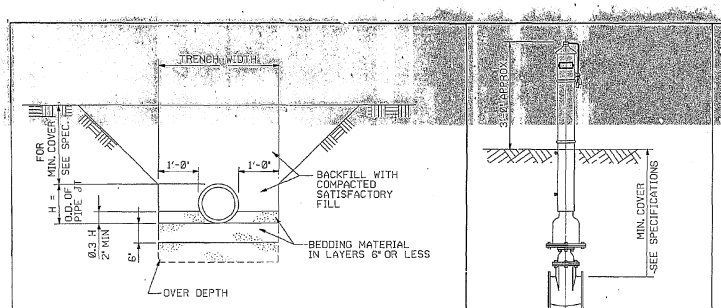
Drawn by J.C.W.
Traced by J.C.W.
Checked by L.W.H.
Sheet 1 of 20
Engineers Job No.
Engineers Drw. No.
Scale AS SHOWN

NAVY DEPARTMENT — BUREAU OF YARDS & DOCKS
Approved _____ Y. & D. Drawing No. 277610
For Chief of Bureau

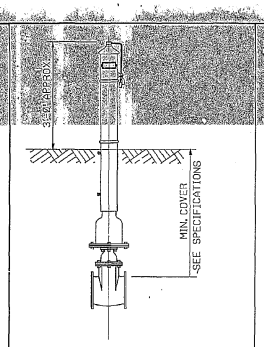
U. S. NAVAL AMMUNITION DEPOT
CRANE, INDIANA
MAJOR CALIBER PROJECTILE LOADING BUILDING
PLOT PLAN
PAVING DETAILS, GUTTERS, DRAINS & SEWERS
WATER SERVICE, SETTLING SUMPS & ETC.

Submitted May 17 1944 Approved May 17, 1944
RUSSELL B. MOORE CO. Consulting Engineers Indianapolis, Indiana — By _____ Chief Engineer
By _____ Officer in Charge of Construction

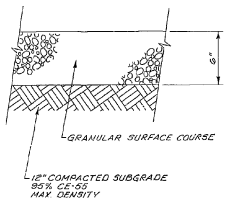
200



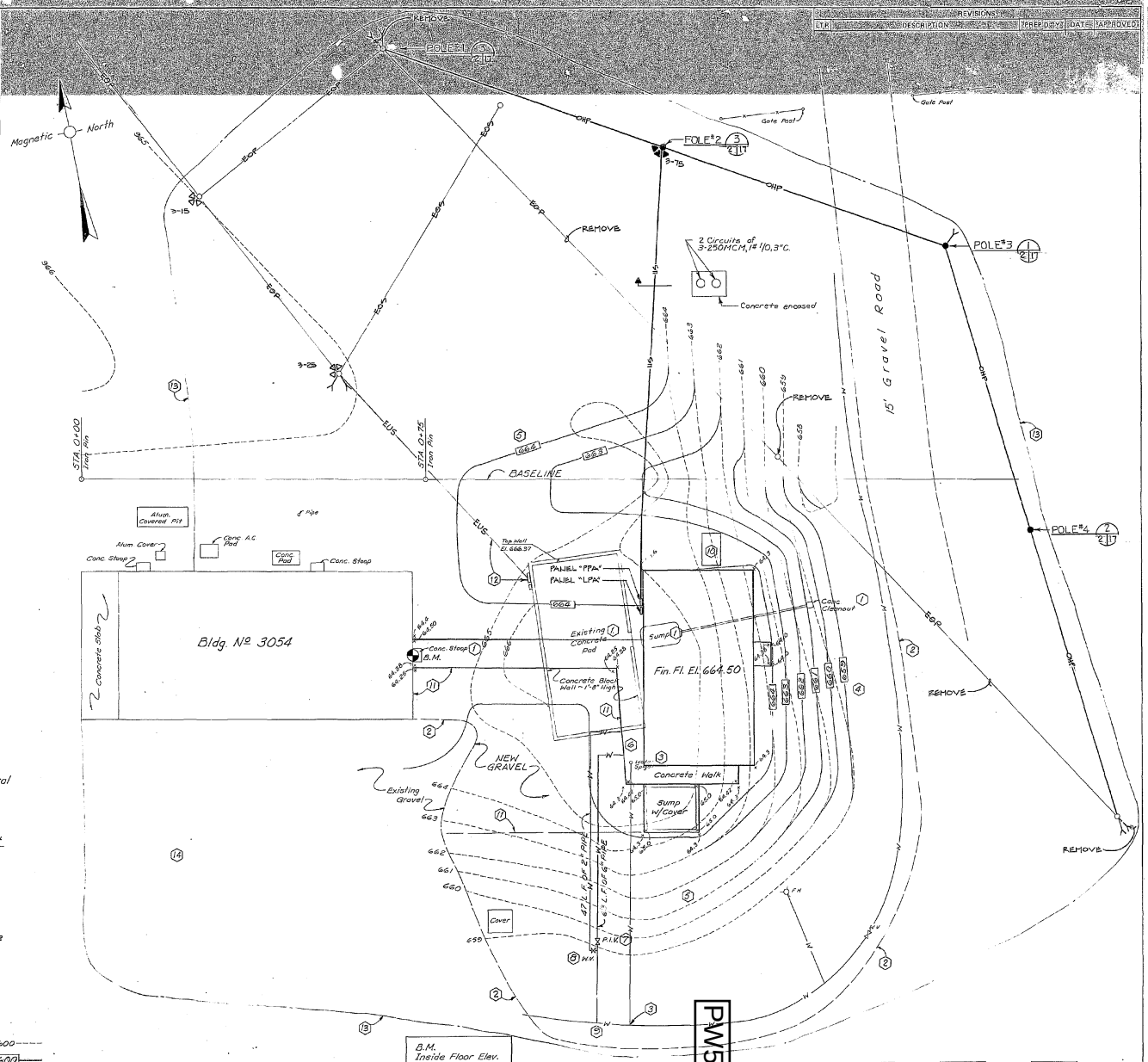
TRENCH SECTION AND PIPE BEDDING
NO SCALE



INDICATOR POST
NO SCALE



TYPICAL SECTION – GRAVEL DRIVE
NO SCALE.



SITE PLAN
SCALE: 1" = 10'

C-1

NOTES:

1. Remove the Following:
   20' × 40' × 8" Concrete Pad And 2' × 3' Concrete Stoop
   120 L.F. of 1'-8" High Concrete Block Wall
   Sump; 5' × 9' × 8' Concrete Tank
   30 L.F. of 6" Drain Line; 3' Deep
   Concrete Cleanout; 2' × 2' × 3'
   Backfill and Compact According to Specifications
2. Limit of Existing Gravel
3. Remove Water Spigot And Service Line. Plug or Cap at 6" Water Main. Backfill And Compact According to Specifications.
4. After Backfilling Operation the Drainage Ditch Shall be Graded to Match Existing Grades And Provide For Positive Drainage.
5. After Backfilling Operations the Area Shall be Graded In Conformance With Surrounding Areas, Tilled And Seeded. Include Topsoil or Nutriment During the Seeding Operation As Necessary to Re-establish a Suitable Stand of Grass.
6. Lay Pipe to Point Which Matches the Location Shown on the Plumbing Plan And the Fire Protection Plan.
7. Locate the Post Indicator Valve a Minimum Distance of 40 Ft. From Building.
8. Tap 2" Waterline Upstream From Post Indicator Valve.
9. Hot Tap to Existing Line. Locate 6" Pipe a Minimum Distance of 10 Ft. From West Building Wall. Terminate As Described in Specifications.
10. Equipment Pad (See H.V.A.C. Plan)
11. Limit of New Graveled Area (See Typical Section For Thicknesses)

BUILDING LAYOUT

	Baseline Sta.	Offset to Right
N.W. Corner	1+22.22	19.50'
N.E. Corner	1+46.22	19.50'
S.W. Corner	1+22.38	61.90'
S.E. Corner	1+46.38	61.62'

(Measurements Made To Face Of Concrete Slab)

12. Remove Existing Electrical Panels. Pull out all Wires Back to Pole and Remove Conduit to Below Grade.
13. Construction Limits
14. Staging Area

SYMBOLS

Existing Topo	----600----
New Topo	—600—
Existing Underground Secondary	—EUS—
Existing Overhead Primary	—EOP—
New Overhead Primary	—OHP—
Existing Overhead Secondary	—EOS—
New Underground Secondary	—US—
Existing Wood Pole	○
New Wood Pole	●
Existing Pole Mounted Transformer	▽
New Pole Mounted Transformer	▼

PW5174 Sheet 002

MASON & HANGER ENGINEERING INC.
ARCHITECTS - ENGINEERS
LEXINGTON, KENTUCKY

JAMES W. WILSON JR. REGISTERED No. 13511 STATE OF INDIANA PROFESSIONAL ENGINEER

SATISFACTORY TO: SOR
DATE: 6-1-88
SATISFACTORY TO: of Rep
DATE: 5/19/88
SATISFACTORY TO: SOR
DATE:

PWO DWG REF
PWO DRAWING NO.
5174

DESIGN: LR · LDC
DRAWN: RG
CHECKED: J.E.
SURV.
APPROVED: DATE

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA

TEMPORARY RED PHOSPHOROUS FACILITY
RESITE NOVEMBER 1987

SITE PLAN AND DETAILS

SIZE: D
CODE IDENT. NO.: 80091
NAVFAC DRAWING NO.: 2 0 5 8 8 4
CONTR. CONTR. NO. N62472-86-C-6342
SCALE: As Noted
SHEET NO.: 01-06-03420
SHEET: 2 OF 2

APPENDIX B

ORDNANCE BRIEFING PROGRAM FOR EXPLOSIVES SAFETY PERSONNEL (GROH, 2008a AND 2008b)

ORDNANCE BRIEFING PROGRAM FOR EXPLOSIVES SAFETY PERSONNEL
27 AUGUST 2008 SESSION

General. The following is presented for the purpose of transferring historical and pertinent timely information to selected explosives safety personnel.

1. **Building 101 Area (101, 102 & 103**). These three buildings were designed and constructed during WWII for the purpose of supporting Navy gun ammunition. Specifically, the ammunition items ranged from 5”/38 to 16”/55.

    a. Building 101 was used for loading 5”/38 propellant charges. The charges are classified by the Navy as semi-fixed in that the propellant is separate from the projectile and mated only when fired. The propellant entered the building via a vertical elevator to the loft (second deck) and was placed in large hoppers. The empty cartridge cases were conveyed underneath the hopper and filled by weight with propellant. A cork or later polyurethane plug was then crimped onto the open end of the case and the finished item was then inserted into a shipping tank and palletized. The building remains relatively the same except having the lightning protection upgraded. It recently was site approved as a General Propellant Processing Building. This designation allows many different processes (including demilitarization) to be run without violating the site approval.

    b. Building 102. Just down the road, Building 102 was designed to support bag charge loading for major caliber ammunition such as 16”/50 used by the Iowa Class Battleships. In the early 1970’s, after the Vietnam conflict had ended, the specialized powder handling equipment used exclusively for Navy major caliber ammunition was removed and the building was converted to an equipment test out facility for the Naval Ammunition Production Engineering Center (NAPEC). When the President Reagan 600 ship Navy goal was established, renovation of 16”/50 ammunition (including bag charges) was required to support the four battleships that were to be a part of the Navy’s ship build-up program. The Crane Army Ammunition Activity gained possession of the building and returned it to a bag charge handling facility. As such, using newer fire suppression technology, the building was used in the mid 1980’s for renovation of bag charges using both 16”/50 powder and 16”/45 powder to meet loading specifications. It is interesting to note that the propellant bags that were involved with the Iowa explosion in 1989 were renovated at Crane. One of the more interesting aspects of the loading process was the use of powder stacking machines built in 1933 and employed to perfectly stack the ammunition grains one on top of the other to meet loading

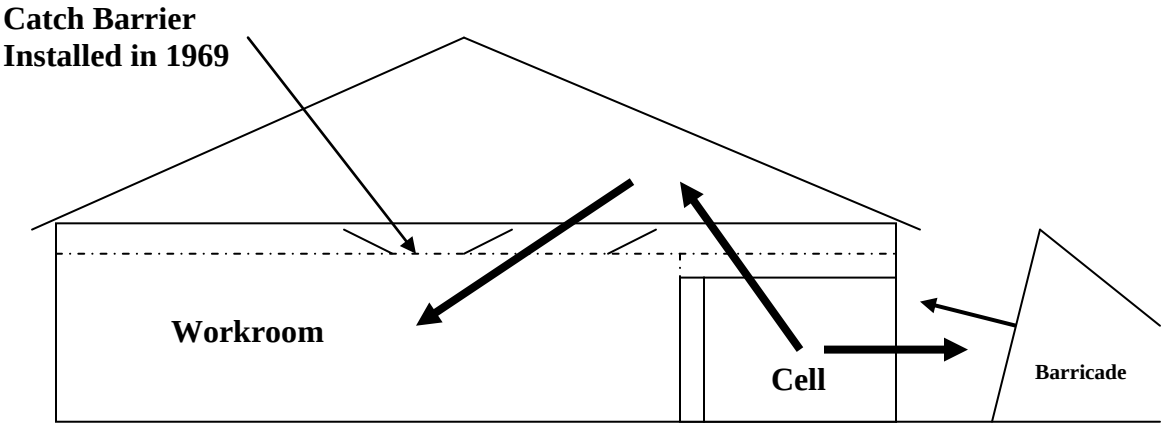
specifications. The powder was dropped from a hopper in the loft down tubes that placed each grain side by side in layers. The layers were then removed by hand and placed in the bag until all of the required layers had been loaded. A trim layer (a few grains at a time) was added on top to meet the required loading weight prior to the bag being sewn shut. It was this trim layer that played heavily into the cause of the Iowa Turret Two Center Gun explosion that killed 47 sailors. The equipment was again removed and the building converted to demilitarize 30mm depleted uranium ammunition in the early 2000's and it continues today for that purpose. An accumulator building was added to support the removal of propellant from the cartridges. The facility was fully site approved for the demilitarization effort. The explosive limits for this building are controlled by the Navy's Building 143 Area. Inhabited Building criteria has been used because the Navy's mission is not considered close enough to the Army's mission to use intraline separation. However, the latest Building 101 site approval was granted using intraline separation, therefore, more leeway may be available for raising the Building 102 explosive limits if required in the future.

c. Building 103. This building, identified as an igniter loading building, was used to load black powder into a number of ignition devices used with propellant charges. Black powder was remotely dumped into a hopper that was separated from the loading room by a concrete wall. The wall was supposed to prevent injury to the operators if the black powder in the hopper ignited. This protection was never validated quantitatively. The facility was grandfathered having no significant changes made since it was first constructed during WWII. The facility was last used to produce the black powder patches that were sewn to each 16"/50 bag charge. The building has four separate very small cells that housed a sewing machine and an operator. This isolation was provided to minimize the loss of personnel should a black powder patch ignite during the sewing effort.
Like the bag charge loading machine, the black powder patch on each charge played prominently into the cause of the Iowa explosion. The facility has been designated for demolition.

d. Building 189. Originally constructed to prepare Explosive D for press loading in Building 104, this facility was last used to prepare Composition A3 for press loading. Preparation included blending different boxes of A3 to achieve a more homogeneous particle size for consistent press density and environmental conditioning to the specified temperature. Blending was accomplished by remote control event though there was no specific reason for such isolation. For that reason, the separation of the blender from the other explosive in process was not reviewed in depth. As the layout was, if the charge in the blender had initiated, there was no adequate separation (substantial structure) that would prevent all of the 11,500 lbs of explosive from becoming involved. The building is no longer used and is slated for demolition. The steel crib cell in the rear was designed and constructed in the late 1960's as a projectile press check-out facility for NAPEC. When the press loading of 5" projectiles reached very high levels of production,

Building 189 was returned to the Navy Ordnance Department (now CAAA) for use as a replacement to Building 105 for the blending of Composition A3.

e. Building 104. This facility was designed and constructed during WWII as a medium caliber projectile loading facility. It consists of one main building with three support buildings and a break area. The facility produced the bulk of the 5”/38 and 5”/54 projectiles fired in the Vietnam conflict. The building has two wings (east and west) that have three cells each for supporting press loading. In late 1968, a number of press explosions occurred. Damage suffered included broken ceiling panels and the destruction of relief walls as well as ear damage suffered by operators in the adjacent workroom. A number of lessons were learned by these explosions that became very apparent with the publication of the tri-service manual “Structures to Resist the Effects of Accidental Explosions” that was unheard of at the time of the Building 104 experiences. The primary problem with the design of the cells walls was that they fell short in height and did not isolate an incident sufficiently to prevent blast pressure from entering the adjacent work room.



Cross Section of a Press Bay of Building 104

Since the blast pressure could break up ceiling panels and the fragments could ricochet off of the barricade wall and re-enter the building, the structure was deemed inadequate to provide personal protection. The Navy funded the raising of the cell walls at every activity but Crane due to the need to maintain production capacity. In this case, because Crane was so good at production, nothing was done to enhance the safety of personnel except for the use of a “catch barrier” beneath the ceiling panels that was effective in stopping the panels from falling on personnel in the workroom. To support 5” loading further, one of two center bays was converted to hold an X-Ray facility that was used to examine the press loaded projectiles for cracks in the explosive. The X-Ray producer was Cobalt 60 in a sealed container. The value of examining pressed explosive loads for cracks in an effort to prevent premature explosions during firing was never proven. The

substitution of PBX-106 for Composition A3 was accomplished in the 1990's which ended the use of Building 104 for press loading. However, the west wing was reconstructed with a steel wall behind the existing concrete cell walls and that steel wall was extended through the roof to better isolate the workroom from the cells. The building has not been formally site approved to date. Certification of the cell wall modifications would be required if the cells were to be approved as a part of the overall site approval. Building 104 has been chosen to remain as a main line operating building for future CAAA work. As such it will be upgraded with the latest lightning protection, heating system and window treatment. Additional egress doors may need to be added.

2. Building 143 Area. This area was first designed and constructed during WWII as a 20mm loading and assembly area. The original plant consisted of Building 143 as the projectile loading building and Building 142 as the final assembly building for the cartridges. The final assembly effort utilized automated equipment that did not need the use of a powder loft for handling the propellant. Two inert warehouses (Buildings 108 and 109) were also provided. Building 108 has since been demolished as a part of the Building 3373 MilCon project.

a. Building 143. After WWII, the need for 20mm ammunition for antiaircraft protection for the fleet ended. As a part of the Navy's Quality Evaluation effort, the building was reworked to support the Navy's Special Programs Office in charge of ballistic missiles. Several additions were constructed to house the engineering staff required by the program. The building and an adjacent area was also used in the late 1960's in support of the Rockeye II process in that bomblet penetration tests were conducted to support production conducted by the Navy Ordnance Department. The functions of this building were planned to be relocated to a proposed MilCon (P-318) that was to be constructed near Building 3285. The latest BRAC, that shifted much of the RDT&E work to other activities, has diminished the need for the MilCon. The ending of the cold war is now being felt in the reduction of SP work since the need for ballistic missile submarines with the latest missiles has also diminished. Building 143 has been formally site approved.

b. Building 142. This building was used in the late 1960's and early 1970's in support of the Marine Corps. After the Vietnam conflict and with the expansion of Quality Evaluation work, Building 142 was converted to house electronic test equipment that supported tests on many types of small ordnance items. The facility has been formally site approved. The building is separated into different work bays by 12" dividing walls. The processes in this building were also planned for relocation to the MilCon P-318.

c. Building 2707. Constructed in the early 1950's as a replacement for a wooden structure hastily built as a lunch and locker room for the 20mm line, this building design is identical to a number of other buildings that support other previous operating lines such as the 40mm area (145/146) and the rocket loading area

(138/136/2520). It was converted to a Quality Evaluation Chemistry Laboratory in the 1970's when Building 2044 was converted from the primary Quality Evaluation Laboratory to an Electronic Warfare support facility. Several additions have been constructed through the years and a service dock added. The service dock was the result of a survey that was conducted of all Navy ordnance chemistry laboratories that revealed a weakness in all labs involving both incoming explosives/hazardous materials and in the handling of explosive hazardous waste. The laboratory was planned to be relocated to Building 365 and an addition was added to that building in preparation. The cost of the relocation, however, makes this alternative questionable. Building 365 remains vacant of any explosive operation.

d. Building 109. This building was converted from an inert warehouse to an explosive operating building in the late 1970's. Most of the building was altered to better support the SP program efforts in Building 143. The only remaining unused end of the building was converted to support the long-term explosive aging program of the group in Building 2707. The aging program is still in place but the work that was in the other end has been transferred to Building 143. Building 109 is planned to be demolished.

3. Other CAAA Buildings in the Same Area.

a. Building 105. This building was designed and constructed as a major caliber projectile loading facility. It consists of three major bays. One bay has four 5 ft. thick concrete walled cells having two 5" thick steel cell doors each used originally for press loading up to 16"/50 projectiles. The projectiles were placed on small gauge rail cars and moved into and through the four cells for pressing and drilling. With the publication of the tri-service manual P-397, calculations prove that if the 154 lb. main charge of a 16"/50 HE round had exploded during pressing, all of the personnel in the work bay would have suffered fatal injuries from blast pressure alone. The integrity of the cell walls, though 5 ft. thick, would also have been in question.
In the late 1960's the Navy Ordnance Department began using Building 105 for press loading Sidewinder and Sparrow missile warheads. These were much smaller PBX charges that were pressed in halves and then glued together. In the late 1990's the facility, now in CAAA custody, was converted to demilitarize Explosive D loaded projectiles. The project was a joint commercial/Government effort to convert the ammonium picrate (Explosive D) to ammonium nitrate and picric acid. The process continues today. It was proven out using bulk Explosive D and then by the use of high pressure metal cutting and explosive washout. It has been progressing with larger and larger loaded projectiles up to 16"/50. This facility has not been formally site approve.

b. Building 3149. This is a relatively new structure designed by the Army for specific support of Quality Assurance Surveillance functions. The design originated in the early 1980's as three different sized buildings. Crane got the

largest one. The original design was approved by the DDESB, therefore, the Crane site approval simply site adapted the design. The problem with the design is that only small charge weights can be handled (420 lbs. Max per Bay or Ready Magazine Cell). The small amount was necessary to enable the center section of the building to be hardened against blast effects to meet inhabited building criteria. This was needed to permit the administrative type personnel to be present when otherwise they would need to be in a separate building protected by inhabited building criteria. The workroom areas are divided into bays with substantial dividing walls. There are six magazine chambers on each end of the building and each is protective to the rest for the same 425 lbs. The maximum credible event for siting purposes is 5,000 lbs. C/D 1.1 but the site could stand a whole bunch more. QAS needs more capability to perform normal work but the current design will be difficult to work with especially since the administrative personnel still remain. It is possible to place an earth covered magazine (of the standard modular design) on the west side of the north end to enable more material to be staged before and after inspection. The primary problem is the time it takes to retrieve material from magazines suitable for inspection (samples) and the scheduling of transportation. The time of inspection is not the problem. Ready service magazines are the answer for such a situation.

c. Building 3333. This is the newest structure in the area having been completed in 2002. It represents the second ASMP Container Building for Crane. The first was Container I, Building 3325. Locating such a large structure where it could be the most efficient for supporting the west side SP&P Magazines was a challenge. The current location was selected because it could be situated on relatively flat land and was close to both good road and good rail. One magazine had to be demolished to make room for the facility and several had to be reduced to storing C/D 1.4 only. The design of the building, identical to Building 3325, is the result of blending the attributes of a Navy Transfer Depot with that of a Container Stuffing Pad. The thought was that it could serve both purposes and relieve the need to maintain Buildings 66 and 600. The concept of operation was quite simple. The dock would be used to receive either closed van trucks or containers on bogeys (single or double axel trailers for one container) having them back up to the dock for loading. Material would then be “cross docked” from railcars into the waiting truck/container. The container trailers would then be moved to a loading area where the container would be removed from the trailer and placed on a flatcar. The concept seemed to work until it was tested during a huge ramp-up required to meet the shipment needs for the Iraq War. Material in CAAA magazines at that time was not bar coded. Instead, MilStd 129 tags and other paperwork had to manually reviewed and paperwork to cover the shipment of the material in the container took hours to generate. This meant that material had to be staged on the open dock areas to such a degree that movement of forklifts could not be accomplished. The stuffing effort then moved to the apron that was not large enough to handle the volume of effort either. CAAA is currently bar coding ammunition but has yet to complete the task. Building 3333 is currently being to support shipment of material by truck. This use brings up

another problem yet to be solved. That one involves staging material on an open dock overnight, a security concern, and the holding of incompatible explosives on the dock for multiple days awaiting the arrival of the truck to transport it. Lexington Blue Grass Depot, with the same mission as Crane, has completed the construction of a shipping building that utilizes substantial dividing walls along the dock to meet the compatibility rules.

Building 3333, like Building 3325, is scheduled to receive a set of ready service magazines in FY09. With the completion of the five chambers, material can be staged for shipment in advance by placement in one of the chambers. The material could then be moved to the dock for loading when the truck arrives. The method of transportation (forklift, truck, trailer etc.) still needs to worked out for this process scheme.

ORDNANCE BRIEFING PROGRAM
FOR
EXPLOSIVES SAFETY PERSONNEL
4 SEPTEMBER 2008 SESSION

General. The following is presented for the purpose of transferring historical and pertinent timely information to selected explosives safety personnel.

1. Demolition Range. The ordnance Demolition Range was established at the end of WWII primarily to handle items no longer needed. It functioned to varying degrees during the 1950's but came into heavy use during the Vietnam conflict for treatment of items found to be unsafe during production. Of particular note was the use of the range for 16"/50 ammunition that failed to have the base fuze fully removed during renovation efforts to support the USS New Jersey. EOD forces were used to perform the work and more than once, the main power line to Crane (which runs to the east of the range) was cut by fragments from exploding projectiles. In 1972, a particularly sad event occurred when two female new hires were killed during a demonstration intended to convince them that working with explosives is potentially hazardous. EOD teamed up with the Navy Ordnance Department to put on the demonstrations that included detonation of a 5" projectile while new hires directly viewed the event through modified 5" gun shields having view windows. During the fatal event, it was determined that the projectile was too close to the witness area, the view windows had not been certified for any protective features and the projectile was detonated on the surface. One fragment passed through one of the view windows and cut down the two women looking through the view port. The gun shields were eventually removed and replaced with an earth covered concrete bunker that featured remote viewing. The Range was first site approved in 1980 following the guidance of OP5 Volume 1 at that time. Through the next twenty years, many changes to Demolition Range requirements have been made by the Department of Defense Explosives Safety Board (DDESB) and Crane complied with each change but no new site plan was introduced for approval.

Two other stories come to mind that reflect the history of the Crane Demolition Range. The first is an event involving a rocket motor that launched itself skyward when the donor charge failed to destroy it. It ended up in the backyard of residence in Odon. The second is a project to rid Crane of experimental rocket motors, grains and other residuals from the original Polaris missile program. The material had been left by Allegany Ballistics (Hercules) and no interest was shown by them to assist in disposal. Much of the material was in the form of all-up rocket motors that could not be broken down. Funding was received to construct a vertical silo with a grating on the top to permit the burning of each rocket upside down.

An updated site approval package was developed and introduced into the review system in 2006. The layouts presented for review were those that Crane believed matched the

latest OP5 Volume 1 and DDESB requirements. However, when the Naval Safety and Security Activity (NOSSA) reviewed the package, it was identified to Crane that the DDESB had just provided new requirements for Demolition Ranges that dealt with the detonation of buried munitions, which Crane had been doing as a matter of accepted practice. A revised site plan, to include all buildings and two ranges, was completed and it was finally approved by the DDESB this summer. The new site plan includes the location of an earth covered ready magazine (modified "E" Box) to support the preparation of charges in Building 2920. The newest DDESB range requirements for exclusion zones is quite liberal compared with previous requirements. The distances are much less than before.

2. Building 198 Area. The entire area was established during WWII as a medium caliber projectile loading facility. The original facility included Building 198 as the loading building, Building 190 as the Explosive D preparation building, Building 2540 as the Lunch and Locker Facility and Building 2084 as the inert materials warehouse.

a. Building 198. During the late 1950's Building 198 began a slow transition to a Pyrotechnic Research and Development building. As such the cells were changed to better isolate the workroom from any effects of an event in a cell. An illuminating projectile line was installed but later removed and transferred to another building. In the late 1970's the first of many site approvals was granted to include a "Model Shop" in the center wing. As the years progressed, the Model Shop took on a life of its own and grew to include one of the track wells. It became apparent that the Model Shop no longer solely supported the work at Building 198 so more and more pressure was brought to bear to have the function moved out of Building 198 and out of the Ordnance Area. It now resides in Building 122. An interesting historical event occurred in Building 198 that resulted in one of the regulations now in OP5. In December of 1968, an R&D employee was killed when a flare ignited during a remote operated pressing cycle. The employee wanted to view what was going on so the interlock switch for the door was gimmicked to permit the cell door to be open. When the flare ignited, the employee, standing in the doorway, was subject to the flash fire that not only burned him but set fire to candles in the workroom thus increasing the severity of the event. The regulation, now greatly misunderstood, calls for an interlock system that will not permit the door to be opened when the equipment is in operation. Many cell door interlocks used today simply stop the equipment if the door is opened. That type of interlock does not meet the intent of the regulation. All of the active cells at Crane now have the same control scheme installed and it is based on following the direction of the regulation. However, because the design calls for a complicated connection to the equipment, the design is seldom used as it was intended. Case in point, for a 5" press, if the door simply stops the equipment or even reverses it, the door can be open when an incident occurs while the press is coming off of the explosive. If the controls are right, the door cannot be opened, even if the button is pressed, until the equipment has been stopped in a safe position. The interlock in this case could be as simple as a limit switch that reads the press full up and in series with the door opening button. Building 198 continues today to be used primarily for the further development of IR decoy flares. It has a full fire suppression

system and workstation deluge protection where beneficial. A test area once existed behind Building 198 but is no longer used.

b. R&D Satellite Buildings. A number of small building have been constructed beginning in the 1970's for development of certain pyrotechnic compositions and devices. They include 3054, 2533, 3338, 3087 and 3342. All are of value since they can be brought on line quickly for specific purposes.

c. Burn Tunnel behind Building 190. The incident at Building 127, in the Pyrotechnic Production Area, pushed the burning of flares to this area. The previous employee access tunnel, between Buildings 198 and 2540, was sectioned off and a hard wall was installed between the burn chamber and the control room. The tunnel is used primarily in support of CAAA flare production.

d. Building 2947. This building was constructed as an energetics laboratory in support of pyrotechnic R&D projects. It remains that function today.

e. Building 2540. Once the administrative and engineering nerve center for the Pyrotechnic R&D effort, it was used as an ordnance support area for all Navy ordnance functions in connection with the same functions in Building 2084. As an initiative of the Ordnance Master Plan, all personnel except those very few that were required to support the Pyrotechnic functions nearby, were relocated to the MilCon facility Building 3373. Those few remaining are housed now in Building 3323. Building 2540 has been turned over to CAAA Depot Operations and is being revamped to take the personnel from Building 2532.

f. Building 3323. This building was constructed to support a NAVSEA program office PM-4. The function was relocated to Building 3373 and is currently being transitioned to Picatinny Arsenal.

g. Building 2084. This building has been used for a number of functions through the years to include housing an inert materials loading (dummy loads) function, a plastic molding function, an ordnance engineering function and now a general storage function. The most interesting aspect of this building is that it is under a 1,250' minimum fragmentation arc from the PBX Loading Facility at Building 200. DDESB approval was granted to be under the arc because the roof was strengthened to prevent fragment penetration and no windows face the PBX facility.

h. Special Warfare Complex. Two buildings were constructed as a part of a Navy MilCon P-315 that was completed in 2002. An engineering building and an ordnance workshop make up the complex. The desire of the project personnel was to have the ordnance workshop as close as possible to the engineering building. An earth covered structure with the rear facing the engineering building was approved by the DDESB. Using the earth covered magazine tables of OP5 Volume 1, the rear facing structure could handle up to 400 lbs. of C/D 1.1 while

generating an inhabited building arc of 250ft. Since then, while trying to upgrade the explosive limits for the workroom of the workshop, the DDESB personnel have trouble treating an earth covered operating building the same as an earth covered magazine. Crane is still awaiting the approval of the updated site plan.

3. Ordnance Test Area. This area was first developed as the Pyrotechnic Test Area (PTA) in the early 1960's to support the development of illumination flares by the Navy R&D Group working out of Building 2540 and Building 198. The area was available mainly because it is in a flood plain that does flood at least once per year making it unsuitable for the construction of magazines during WWII. Building 2797 and two 100 foot towers were the first structures at the site. The towers were used to suspend flares during burning events. Later in the 1960's two 300 foot towers were erected to support the Navy's "Brighteye" illumination round that never became operational. In the 1970's other buildings, (2945, 2888, 2963 and 2995) were constructed to increase the capabilities of the PTA. The emphasis on pyrotechnic testing gave way slowly to the testing of more potent high explosive items. Notable was the QE functional testing of hand grenades that resulted in the death of one employee. Through the 1980's and 1990's additional structures and ready magazines were constructed. The most notable is Building 3328 that was constructed as a result of the Army's abandonment of Savannah Army Depot with the subsequent relocation of a QAS testing facility. Building 3327 mirrors the one it replaced at Savannah and Building 3328 was also constructed with Army money for the testing of high explosive items. Building 3328 was turned over to the Navy for custody since more Navy testing would be involved than Army testing of high output items. Also included in the OTA is the Annex that is south of the OTA main area. It was constructed in the early 1970's for the testing of Rockeye II bomblets for penetration. Earlier testing took place near Building 143 (discussed in an earlier tour) but was relocated to this remote area because of the hazards. Two buildings and a target berm were constructed. The first use as a tester of bomblets was with a horizontal air tube that first armed the bomblet then fired it at a stationary target. Later, the air tube was replaced with a vertical drop tower arrangement using a 5" gun tub with a CONEX box mounted on top. The bomblet would first be armed remotely with an air blast to spin the fuze rotor into position, then it would be remotely dropped down into the gun tub. When the Rockeye II was first tested, personnel would be in the arming chamber when it was "spun up". They would then leave before the bomblet was dropped and initiated. To improve efficiency and safety, the arming step was changed from a contact operation to a remote operation. While testing with the new system, a bomblet detonated just as it was being armed but before being dropped. The CONEX box was totally destroyed. It was found that a flaw existed in the fuze design of the bomblet which could lead to its destruction during the army cycle. If the previous set-up, with the employee present, had still been in use at the time of the explosion, Crane would have suffered another fatality. The lesson here is to constantly strive to remove human contact from the testing of ordnance to the greatest extent possible just in case something unexpected happens. The future of the Ordnance Test Area is uncertain due to the shift in emphasis by Crane to non-ordnance warfare systems. However, the OTA is still needed for ordnance systems that are a part of a total warfare scheme that Crane actively supports. An assessment of

OTA capabilities and needs was recently completed and presented to Crane management to assist in determining just what could and should be done with the area.

4. Rocket Range. This area just north of Lake Gallimore was developed during WWII for the testing of small rockets. It too suffers from being in a flood plain and is flooded at least once per year. Its location near earth covered magazines makes it impossible to be formally site approved unless the surrounding magazines are heavily derated. Expanded use of this range is curtailed because site approval is difficult to obtain. It also is a part of the OTA assessment previously discussed. There is a scheme in the assessment that could be used to gain site approval by increasing the limits of a score of magazines around the OTA while derating a much smaller number around the Rocket Range. The explosive limits of magazines around the OTA are based on inhabited building criteria to Navy testing buildings while it may be possible to use intraline separation instead.

5. Building 181 Area. The building that is the namesake of this area no longer exists having been demolished several years previous. It was designed and constructed during WWII as a chemical decontamination building. During WWII, NAD Crane was designated a storage facility for Navy chemical weapons. At that time, the chemical was mustard gas contained in arial bombs. The structure was of unique design with many small rooms for work with items and with support rooms for showers etc. It remained dormant after the end of WWII when the mustard gas bombs were removed from Crane storage.

Because of two train derailments during the Vietnam conflict in which bombs exploded, an area was needed for the purpose of sawing open completed bombs in an investigative effort to determine the extent of cavitation within the explosive. It was theorized by experts on behalf of the railroads, that TNT crystals within such cavities were super sensitive to the shock of transportation, thus generating the hazard that resulted in the explosions. The saw was installed in Building 181 with the remote control room located in Magazine 1441 down the road. Many bombs were sawed but no results indicated a special hazard existed in the cavities that were predictable in the bombs. They looked like geodes when cut open.

After the bomb sawing effort, the facility again remained dormant and run down until a need existed in the early 1980's with the Navy for a remote location to support the abusive testing of lithium batteries. The Navy acquired the facility from CAAA who had received it as a part of the license for the transfer of buildings from Crane Ordnance. The Navy completely rebuilt the facility into a showplace for abusive testing of lithium batteries. Some of the external test facilities still remain. With the completion of the Lithium Test Facility in the Industrial Areas and the completion of needed tests on a now well-understood technology, the Building 181 Area was no longer needed. It was demolished as a part of the footprint reduction effort.

6. Mustard Gas Burial Site. Now for one of the most interesting historical features of Crane's past. The mustard gas burial ground was a site located between magazines 1407 and 1409 on the southeast corner of the base. It had a storied beginning. Some accounts described it as a dumping ground for mustard gas bombs that were found leaking when the bulk of the items were shipped from Crane at the end of WWII. Another more

interesting account attributes the burial ground as a repository of leakers delivered by a black work handling crew passing through the area at the end of WWII. What was not known for sure was the number and condition of the rounds buried there. Because it was a burial ground, and because such disposal was accepted prior to the environmental protection initiatives of the 1970's, other chemicals were dumped there including radioactive thorium and cleaning agents.

In the early 1970's interest to dig up and dispose of the mustard gas rounds grew to a point where John Fitch, the Crane industrial hygienist, along with a Public Works backhoe operator, were locally authorized to begin digging up the site. The excavation effort began in the spring when its generally wet in this part of the country. The effort was moving along finding seven empty but partially contaminated arial bomb skins and three partially filled skins in the various pits excavated. Work suddenly stopped with the potential hazards of the effort moving to actual hazards with the PW tractor operator burned by the mustard gas residuals. At the same time, the ground became a quagmire of mud from constant rain. The effort was abandoned and the ground fenced with a second exclusion fence for safety. The "three bears" and "seven dwarfs," as they became known, were packaged and stored in Magazine 1403.

A second initiative to excavate the burial ground was begun in 1978 by the Safety Office. The Army Tech Escort group was contacted to determine any interest in performing the work. They declined but granted the Navy the right to pursue the effort with their forces. EOD Group II was contacted and it was decided that they would participate with the effort as a "Training Exercise" using the latest self-contained "moon suits" for protection from the mustard gas. At their direction, special equipment and materials suitable for the destruction of residual mustard gas was assembled at the site and work began in the Fall of 1980. Using the ten items already above ground for testing the effectiveness of the decontamination equipment, the processes were validated. Excavation continued finding very few more rounds than those first unearthed. All rounds were sawed into two pieces, placed in a steam/HTH solution vat and then the hardware was burned out using thermite grenades. No Mustard gas was detected on the hardware which was packed into metal containers, crushed at DRMO and buried in the Crane landfill. The vat was emptied of HTH into the excavations and after removal of the thorium (it was drummed and stored for relocation to a certified radioactive landfill), the total area was scanned for metal objects and then the holes were closed.

The story of its beginning read more like the most boring version of all those versions imagined. It appears though the rounds were the result of an initiative to transfer the arial bombs in storage to trains that would take them to another depot. During the transfer, it was determined that a small number of rounds were leaking and not safe to transport. Those rounds were taken to the site, opened and the contents dumped into holes filled with decontaminant. Most of the rounds were found completely empty. Only three were found to be partially filled and probably resulted from either haste or the natural tendency of mustard to crust over not permitting the liquid to leave the bomb easily. These rounds were probably thrown into the pits and left. Over the years, little to no deterioration of the mustard occurred. The total cost of the exhumation and decontamination project was $100,000. An after action report was filed with headquarters and the interest in the burial ground subsided until the Environmental Protection Agencies became interested in old burial grounds. It was proposed to again excavate the area to ensure all mustard gas

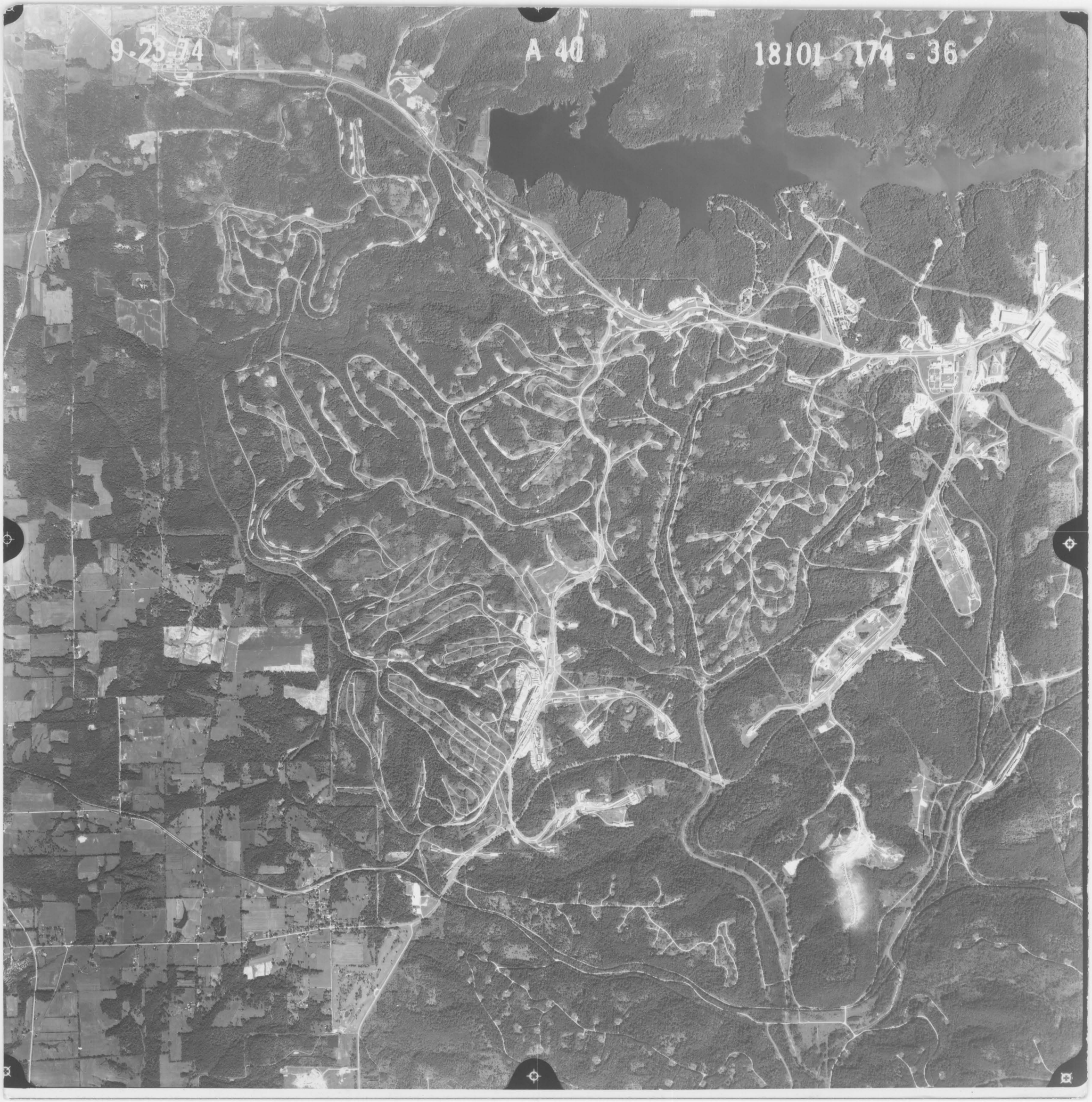
had been removed. This interest has not gone away. Even with the after action report in their hands, the legacy of the Mustard Gas Burial Ground remains alive and well today. Ground water sampling continues to reveal contamination, but the chemicals measured are more likely those of the other burial efforts and not the result of the first users of the site.

APPENDIX C

HISTORICAL AERIAL PHOTOGRAPHS

1952 Aerial Photograph

10-5-66
CMH-2GG-102
OFFICIAL USE ONLY


9-23-74
A 40
18101 - 174 - 36

APPENDIX D

SITE INSPECTION PHOTOGRAPHS (MAY 12-15, 2009)

SUBAREA A – BUILDING 105 AREA

Date:	View:	Photographer:
5/15/09	SE	Tetra Tech

Ammonium nitrate and nitric acid ASTs on southwestern side of Building 105.

Date:	View:	Photographer:
5/15/09	W-SW	Tetra Tech

Concrete drainage channel on northern side of Building 105.

Date:	View:	Photographer:
5/15/09	N	Tetra Tech

Exhaust fans on northeastern side of Building 105.

Date:	View:	Photographer:
5/15/09	SE	Tetra Tech

Drainage on southeastern side of Building 105.

SUBAREA A – BUILDING 105 AREA

Date:	View:	Photographer:
5/15/09	--	Tetra Tech

Terra cotta drainage pipe at Building 105.

Date:	View:	Photographer:
5/15/09	--	Tetra Tech

Plugged floor drain with standing liquid in Building 105.

Date:	View:	Photographer:
5/15/09	--	Tetra Tech

Steel floor of chemical storage room at Building 105.

Date:	View:	Photographer:
5/15/09	--	Tetra Tech

Yellow staining on floor in center bay of Building 105.

SUBAREA B – BUILDINGS 101, 102, & 103 AREA

Date:	View:	Photographer:
5/13/09	S	Tetra Tech

Rubber-lined concrete basin on western side of Building 101.

Date:	View:	Photographer:
5/13/09	--	Tetra Tech

Propellant hopper in Building 101.

Date:	View:	Photographer:
5/13/09	W	Tetra Tech

View of Building 102 (white building in background). Building 3349 in photo center.

Date:	View:	Photographer:
5/13/09	E	Tetra Tech

View of Building 103 and magazines (front – Building 110; rear – Building 111).

SUBAREA C – INERT OPERATION AREA

Date:	View:	Photographer:
5/13/09	N	Tetra Tech

View of Buildings 226 (background) and 227 (foreground).

Date:	View:	Photographer:
5/13/09	S	Tetra Tech

View of northern end of Building 227. Settling basin visible in left center of photo. Drainage flows to left corner of photo. Building 119 in background right.

Date:	View:	Photographer:
5/13/09	E	Tetra Tech

View of settling basin on southern end of Building 119.

Date:	View:	Photographer:
5/13/09	S	Tetra Tech

View of roof vents on Building 106. Kiln unit for Building 106 to left, and drainage pipe from Building 106 to right.

Date:	**View:**	**Photographer:**
5/13/09	SW	Tetra Tech

Building 109 (right). Building 143 in background.

Date:	**View:**	**Photographer:**
5/13/09	NW	Tetra Tech

Exhaust fan for test cell in Building 142.

Date:	**View:**	**Photographer:**
5/13/09	NW	Tetra Tech

Test cell exhaust units at rear (southeastern side) of Building 143.

Date:	**View:**	**Photographer:**
5/13/09	S	Tetra Tech

Building 143 at photo left. Approximate location of former drop test area at photo center background (left of center lightning rod).

SUBAREA E – BUILDING 104 AREA

Date:	View:	Photographer:
5/14/09	SE	Tetra Tech

View of central and eastern wing of Building 104.

Date:	View:	Photographer:
5/14/09	E	Tetra Tech

View upslope to Building 104. Underground storage tank (Structure 2685) in the foreground.

Date:	View:	Photographer:
5/14/09	E	Tetra Tech

View of settling basin east of Building 104.

Date:	View:	Photographer:
5/14/09	E	Tetra Tech

View of cement swale east of Building 104.

SUBAREA E – BUILDING 104 AREA

Date:	View:	Photographer:
5/14/09	N	Tetra Tech

View of Building 189.

Date:	View:	Photographer:
5/14/09	NE	Tetra Tech

View of roof vents on Building 189.

Date:	View:	Photographer:
5/14/09	N	Tetra Tech

Settling basin northeast of Building 189.

Date:	View:	Photographer:
5/14/09	N	Tetra Tech

Rocket motor blast deflector on western side of Building 189.

SUBAREA E – BUILDING 104 AREA

Date:	View:	Photographer:
5/12/09	W	Tetra Tech

Area 1, north of Highway 10.

Date:	View:	Photographer:
5/12/09	E	Tetra Tech

Area 1, north of Highway 10. Area 1 within wood line.

Date:	View:	Photographer:
5/12/09	SE	Tetra Tech

Area 2, south of Highway 10. Earthen berm visible in background.

Date:	View:	Photographer:
5/12/09	S	Tetra Tech

Metal grating at eastern end of Area 2, south of Highway 10.

SUBAREA F – BUILDINGS 2084 AND 2085 AREA

Date:	View:	Photographer:
5/12/09	NE	Tetra Tech

Swale behind Building 2084. Building 3323 visible in background.

Date:	View:	Photographer:
5/12/09	W	Tetra Tech

Rear (southern side) of Building 199. Location of former fuel oil USTs.

Date:	View:	Photographer:
5/12/09	S	Tetra Tech

30,000 gallon fuel oil ASTs at Building 199.

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

Drainage swale along Highway 101 north of Building 199. Building 2540 visible in background.

Date:	**View:**	**Photographer:**
5/12/09	E	Tetra Tech

Accumulators (Building 3040)

Date:	**View:**	**Photographer:**
5/12/09	SE	Tetra Tech

Motor room (Building 2337) in left of photo. Rear (northern side) of Building 2869 in background.

Date:	**View:**	**Photographer:**
5/12/09	W	Tetra Tech

Drainage west of near Building 2837. Building 3108 in background.

Date:	**View:**	**Photographer:**
5/12/09	NW	Tetra Tech

Storm drain (approximately 15 feet deep) east of Building 3115.

SUBAREA H – BUILDING 198 AREA

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

View of eastern side of Building 198 (left) and southern side of Building 2508 (right). Roof vents visible on buildings.

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

Settling basin southeast of Building 2508.

Date:	View:	Photographer:
5/12/09	E	Tetra Tech

Interior of settling basin north of Building 2551.

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

Vents on rear of Building 198.

Date:	View:	Photographer:
5/12/09	NW	Tetra Tech

Exhaust fans from Building 2510.

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

Spent munitions storage.

Date:	View:	Photographer:
5/12/09	N	Tetra Tech

Downspouts from Building 2508 discharging to ground.

Date:	View:	Photographer:
5/12/09	SE	Tetra Tech

Explosive hazardous waste storage near Building 2508.

SUBAREA I – BUILDING 200 AREA

Date:	View:	Photographer:
5/12/09	E	Tetra Tech

Front (northern side) of Building 200.

Date:	View:	Photographer:
5/12/09	E	Tetra Tech

Process water pit east of Building 200.

Date:	View:	Photographer:
5/12/09	S	Tetra Tech

Interior of settling basin southwest of Building 200.

Date:	View:	Photographer:
5/12/09	E	Tetra Tech

Vents on rear (southern side) of Building 200

SUBAREA J – ASD II

Date:	View:	Photographer:
5/13/09	S	Tetra Tech

Flare Test Facility (Building 3008).

Date:	View:	Photographer:
5/13/09	W	Tetra Tech

Building 2082(left) and Building 2083 (center).

Date:	View:	Photographer:
5/13/09	E	Tetra Tech

Rear (southern side) of Building 2082.

Date:	View:	Photographer:
5/13/09	W	Tetra Tech

Drainage swale and Building 3342.

Date:	View:	Photographer:
5/13/09	W	Tetra Tech

Testing area adjacent to Building 3087 (Windstream Test Facility).

Date:	View:	Photographer:
5/13/09	--	Tetra Tech

Cap/front washer of IR flare in gravel in Subarea I.

Date:	View:	Photographer:
5/13/09	W	Tetra Tech

Covered pit (foreground) north of Building 3054.

Date:	View:	Photographer:
5/13/09	N	Tetra Tech

Sump south of Building 3233.

APPENDIX E

PERSONNEL INTERVIEW NOTES

TETRA TECH

INTERVIEW QUESTIONNAIRE

Individual Questioned:	Dale Groh	Project:	SWMU 18 Preliminary Review
Association with Military/Civilian:	Civilian	Project No.:	112G01851
Telephone No.:	812-854-3601	Email address:	
Interview completed by Tetra Tech personnel:	Tim Evans	Date:	11-18-10 @ 1300-1400

(1) What was your job description? What area/building(s) did you work in? What time periods did you work for Crane?

- Began working for NAPEC in 1968
- Explosive Safety Officer from 1977 on
- Has been with SAIC since 2001

- Was in every building in Load & Fill Area at least once a year
- In charge of building changes

(2) What are the current and/or past uses of the buildings?

a) What materials were handled in and around these buildings?
b) What operations/processes were done there?

- See attached interview notes for each area

(3) What were the disposal practices for processes completed in the building(s)?

- **None known**

(4) Any known:

a) processes

- See attached interview notes for each area, if applicable

b) USTs/ASTs

- See attached interview notes for each area, if applicable

c) wastewater processing (O/W separators, septic, floor drains)

- See attached interview notes for each area, if applicable

d) transformers

- See attached interview notes for each area, if applicable

e) vats/pits/sumps/lagoon/trenches

- See attached interview notes for each area, if applicable

f) emissions/discharges

- See attached interview notes for each area, if applicable

g) spills/releases (date, location, material)

- See attached interview notes for each area, if applicable

h) environmental work

- See attached interview notes for each area, if applicable

Interview Questionnaire (cont.)

i) waste generated (waste water, storm water, hazardous, non-hazardous, other)

- See attached interview notes for each area, if applicable

(5) Are there any historical records or maps available?

- 1952 aerial photo of Highway -10 area (attached)

Questionnaire Completed by		**Questionnaire Completed by Tetra Tech via Interview**	
Print:		**Print:**	Tim Evans
Signature:		**Signature:**	
Date:		**Date:**	11-18-10

Interview Notes

Mr. Groh's comments regarding specific buildings:

BUILDING	COMMENTS
101	- Currently used for demil of propellants
102	- Currently used for demil of small arms (30mm) - Was never a "Cast HE fill plant"
103	- Operations ceased in late 1980s/early 1990s
3349	- Single- & double-based propellants used in building - Also supports demil operations
104	- Used by CAAA for General Maintenance of Ordnance Items (e.g., painting, grit blasting) - Propellants, TNT, & PBX never used in building – in general, never mixed propellants with explosives in same building
189	- Scheduled for demolition - NAPEC = Naval Ammunition Product Engineering Center
2924	- Designed to test 5" presses but never used
Area 1 & 2 (north & south of H-10/Area B)	- No knowledge of any activity - Aerial photo from 1935 – areas = open fields (farmland) - Aerial photo from 1952 – areas = disturbed (photo e-mailed to Tim Evans) - Will check with other personnel for possible activities in areas
105	- Also used historically for PBX pressing and machining for 16" & 14" in 1970s & 1980s - Propellants never handled in building
2518	- Comp A3 handling moved to Building 189
119, 226, & 227	- Referred to as "Inert Operation Area" - Used for inert processing; refurbished boxes & cans (but inert items) - No energetics (propellants or explosives) ever handled in buildings
3331	- Used for welding, painting, etc. ASMP containers - Handle paints
200	- Similar to Bldg 105 - Pyrotechnics = IR flares - Cast loading of PBX also historically done
2054	- Illuminating Flare Loading (magnesium plus other flare comps) historically done - Comp A5 handled also
2084	- Office Also had high pressure testing; plastic molding
Area G	- Currently used for flare testing
190	- Area G currently used for flare testing - Building 190 still up but inactive
2869	- Active
2947	- Energetics lab
3040	- Active - Structure is bag house for flare tests (ash); may be magnesium + heavy metals in soil under and around structure
3115	- Inactive - Was offices
3348	- Active - Testing & Assembly - Explosives handled, C4 primarily
198	- Had machine shop - Also did plastic molding
2897	- Inert storage (Quonset hut)

Interview Notes (cont.)

BUILDING	COMMENTS
Area I	- Pyrotechnic Testing area
2082	- Historically inert storage - Never had explosives and never was fab shop
2083	- Used by Army
3008	- Active - Burn tests
3054	- Office space for Bldg 3233 - Never handled phosphorus or PBX
3087	- Windstream Test Facility – done outside
3233	- Temporary red phosphorus laboratory
3338	- Twin-shoe extruder - Mixed IR comps (magnesium + Teflon)
3342	- Flare comps
108	- Only used as inert storage
109	- Only explosives were C4 (for aging testing)
142	- Explosive Test Cells - Historically, 20mm cartridge assembly & Marine Corps mortar assembly - Propellant handled = ballastite
143	- had drop test facility behind it
2707	- Has small quantities of explosives stored too
185	- Is Chem Lab Principal Storage - Was Oil & Paint locker - Haz materials stored in building

Chronologic Use of Load & Fill Area:

1940s – Ordnance loading
1950s – Flare R&D
To 1980s – RD&T

TETRA TECH

INTERVIEW QUESTIONNAIRE

Individual Questioned:	Dale Groh	Project:	SWMU 18 Preliminary Review
Association with Military/Civilian:	Civilian	Project No.:	112G01851
Telephone No.:	812-854-3601	Email address:	
Interview completed by Tetra Tech personnel:	Tim Evans	Date:	12-2-10

FOLLOW-UP QUESTIONS TO 11-18-10 INTERVIEW:
(RESPONSES PROVIDED AS RECEIVED VIA E-MAIL)

1) What does the demil process for 30mm depleted uranium entail?

Answer: The all up rounds are delinked, and loaded into a breakdown machine that breaks the cartridge case from the projectile, dumps the propellant from the case which is then vacuumed to the accumulator building and the projectiles are containerized for further storage. There is no action to disturb the depleted uranium filled projectile.

2) What is the "track well" in Building 198?

Answer: There were two RR tracks positioned between the three wings when the building was first constructed. Neither is in use today. One was filled in to increase the floor area of the Model Shop.

3) What is the "washing machine" in Building 104?

Answer: There has been no such machine in the building while I have been employed at Crane (1968). I have no idea of its use.

4) Were there red phosphorus activities in Building 3233?

Answer: Building 3233 was established as a prototype lab for red phosphorus containing items. I believe it was used for a time for that function.

5) What was the dust control measures for Buildings 101 & 102?

Answer: There were dust control devices where the propellant was dumped into the bins in the loft areas. The specifics are not known to me but most probably they were exhausted to the atmosphere.

Interview Questionnaire (cont.)

6) Were degreasers used in Buildings 101 & 102?

Answer: Not to my knowledge. There was no call for such equipment since both buildings dealt with new production and the metal parts came to the buildings ready for loading.

7) Were TNT & NG in the smokeless powders handled in Buildings 101 & 102?

Answer: TNT is not a part of the smokeless powder process. NG is in double base propellant.

Questionnaire Completed by		**Questionnaire Completed by Tetra Tech via Interview**	
Print:		**Print:**	Tim Evans
Signature:		**Signature:**	
Date:		**Date:**	12-2-10

APPENDIX F

HISTORICAL INTERVIEW RECORDS

INSTALLATION	REPORT CODE
NWSC, Crane, IN	II A3

PURPOSE/AREA OF INTEREST

Laboratory Facilities, Testing

PERSON CONTACTED	TITLE/POSITION	YRS AT INSTALLATION	TELEPHONE
[illegible]	PRESENT Supervisory Engineering Technician PREVIOUS Applied Science Laboratory	30 years	1350

QUESTIONS

F

Comp with heavy metals?

Testing at Lake Greenwood

INDIVIDUAL COMMENTS

95 testing smoke - fl - phosphorus signal - waste water burning ground for burning (open burn D.P. 2213)- listing of items on pyro or explosives.

Talk to Mr. John Fitch for contamination breakdown from test items.

No knowledge

About 1957-58 - information in Proof Testing Branch.

Acceptance Testing - mk 72 - phos signal
mk 25 - " "

Went to Applied Science Lab in 1959.

1. Barrell - used to test flares - water taken to ammo burning ground (BG) for disposal by Mr. Souerdike.

All burnout signals and hardware/metals/paper - ammo B.G. for disposal.

2. First tested at Lake Greenwood about 1958. Fired from beside old 1866 (boat landing ramp) into lake.

3. Dodohara's sign - R&D observation point on Lake G: 3.06 miles from point to dam or west end of Lake G.

INTERVIEWER	DATE
BANE/DODAHARA	21 Sep 77

4. Actually tested flares etc., over the whole length of Lake Greenwood, munitions were expected from vicinity of Captain's Quarters (A) right on road into Lake Greenwood (About 1957-58).

5. Did acceptance testing on MK25 Marine Location Marker (A1 Case) was replacing MK7.2 (had wood case).

6. Recreation Area Boat Dock - testing was QA, QE and R&D.

7. Capt's Quarters - Probably all PA (1959 through early 60's).

8. Bldg 2541 vicinity - (Pump House) into Lake Greenwood - R&O testing very small amts (8 or 10 units per time. QA testing used larger quantities.)

9. Lake Greenwood Dam Area - QA tested on map as 75 units MK25 per day. Acceptance testing - recovered hardwood (EOD).

INSTALLATION	REPORT CODE
Crane	II C 1,2,3

PURPOSE/AREA OF INTEREST

Ranges, testing

PERSON CONTACTED	TITLE/POSITION	YRS AT INSTALLATION	TELEPHONE
	PRESENT Manage Fleet Support	11 years	
	PREVIOUS General Engineering	4 years	

QUESTIONS

Pyrotest range

Range 2167

Greenwood Lake

Rocket Range

Lake 333

Rifle Range

Demo Range

INDIVIDUAL COMMENTS

It was rumored that lake at intersection 161 and 30 may have been used for testing. (Cartoins pond: TJB 6/15/09)

Pyro Test Area (QE Test Area)

Used mostly for pyrotechnic testing.

A drop test tower is located near area.

Range 2167 or Pyro Control Test Range

Used for Quality Assurance Testing.
Lead Chromate contamination can be seen on the surface.
Trees near area are dying - reason unknown.
Range is used about 2/3 of the time.
30 to 60 rounds are fired when in use.

INTERVIEWER	DATE
LEIBEL/COLLINS	9/20/77

INSTALLATION	REPORT CODE
Crane	II C 1,2,3 II D 1,2,3

PURPOSE/AREA OF INTEREST

CBR Burial sites

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	TELEPHONE
	Public Works	8 years	1588

QUESTIONS

INDIVIDUAL COMMENTS

Haven't started an "H" cleanup.

There are other agents.

Areas where soil sterilant was used.

Three test ranges (dosen't include lakes).

Marker dye and flow testing in Oberlin Lake.

Greenwood Lake?

Never used waste lagoons - There are small waste sumps - Presently do have a lagoon but never used.

INTERVIEWER

LEIBEL

DATE

9/19/77

INSTALLATION	REPORT CODE
CRANE	IIC 1, 2, 3

PURPOSE/AREA OF INTEREST: Ranges, testing -ROCKET RANGE-

PERSON CONTACTED	TITLE/POSITION	YRS AT INSTALLATION	TELEPHONE
G. Litherland	PRESENT: Manager, Fleet Support Br. PREVIOUS:	11 years	x 1282

QUESTIONS

Other personnel at site contacted

Steve Schawtz Engr tech 9 yrs
Mike Fish Jr 5 yrs
Gary [illegible] Chemist 9 yrs

INDIVIDUAL COMMENTS

- During WW2, 2.75 Rockets were fired on range
- Should not have UXO's in Area
- Range has been active since base opened
- Area floods from dam during spring
- Shape charges such as Mine sweeper cable cutters etc Are fired occassionally

Note! Greenwood lake was utilized upto 8 years Ago for Marine location marker testing. Testing was Conducted from boat ramp. Lake 333 near Demo Area was constructed for testing once the lake testing was stopped.

INTERVIEWER: Lebel / Collins

DATE: 9/20/77

INSTALLATION	REPORT CODE
NWSC, Crane, IN	

PURPOSE/AREA OF INTEREST

Test areas

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	TELEPHONE
John Fitch			1847

QUESTIONS

Test areas?

INDIVIDUAL COMMENTS

1. Behind building 143 - functional testing of bomblets.

2. Building 198 - functional testing of flares
   tunnel - flare burning
generates MgO (magnesium oxide) Bag house construction to collect MgO dust.

3. Rocket Range used for bomb cool off.

4. Old Rifle Range - testing.

5. Pyrotechnic test area -

6. Old Pyrotechnic test area - functional testing of pyrotechnics, phosphorus, dye markers 2939 and 2940 FLS Offices.

Drop pyrotechnics in barrel of water, check burning time, etc.

INTERVIEWER	DATE
BANE	21 Sep 77

INSTALLATION	REPORT CODE
Crane	

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	TELEPHONE
	Ordnance Equip Inspector	26 years	

QUESTIONS

Trees around 2167 are dying. He believes as a result of pesticide control program.

Lead chromate is a result of testing of March 1-3 flare. Approx 100 have been tested.

INDIVIDUAL COMMENTS

2167 test range Process Control Test Area.

Pyro test area.

Bldg 190 light-tunnel. (Demolished. Part of SWMU 18 - TJB 6/15/09)

Demo area tested boosters.

Greenwood test area - Smoke flares

Period of use - maybe two years.

Rocket range tested 7.2 rockets - used early 60's.

Near tank from there, a road to right which has Aberlain Lake used for testing dye F totals markers mid 50's.

INTERVIEWER	DATE
LEIBEL/REED	9/28/77

INSTALLATION	REPORT CODE
NWSC, Crane, IN	II A 3

PURPOSE/AREA OF INTEREST

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	TELEPHONE

QUESTIONS	INDIVIDUAL COMMENTS
1. Test areas used personally?	1. a) 2167 Process Control Test Area - 55 gal drums of salt ~~unless~~ water fresh water used to test flares (MK1-3) - explode and scatter dye (lead chromate $PbCrD_4$). Tested about 100 fully loaded munitions about a month ago. b). Bldg. 190 - "Light Tunnel" - tested target flares (MK 27,28) and illuminating flares (MK 24, 25). c). Pyro test area.
2. When was Lake Greenwood used?	2. Mid 60's.
3. What rockets tested at Rocket Range? When?	3. 7.2 rockets, dummy loaded/Early 60's.
4. Other test area? What tested?	4. a). Lake Oberlin; used mid/late 50's. Tested submarine floatation flares (red and green dye markers). b). Demolition area - MK44 boosters tested several years ago, left no duds.

INTERVIEWER	DATE
BANE/MAGNESS/LEIBEL	21 Sep 77

INSTALLATION	REPORT CODE
NAD	

PURPOSE/AREA OF INTEREST
II-A. also II-C

PERSON CONTACTED	TITLE/POSITION PRESENT PREVIOUS	YRS AT INSTALLATION	TELEPHONE
[illegible]	Ordnance Equip Sp	26 yrs	1353

QUESTIONS
Test Ranges?

INDIVIDUAL COMMENTS
1) 2167 ~~Bruce~~ Central Test Area
2) Pyro Test
3) Bldg 190 Life Tunnel Target flares M98 MK24E 1.5 [illegible]
4) Demo Area - Boosters / MK44 no duds seen
5) Greenwood Lake MK-73 / MK 25
Smoke Luminating - Mid 60's
small quantity on Greenwood
6) Bldg 120 - ~~[illegible]~~ mod.
7) Rocket Range - no duds 7.2 in
early 60's
8) Lake ~~Overhead~~ Oberlin - submarine
floatation marker. mid/late 50's
red or yellow/green

See Tape

INTERVIEWER
Rick Magness

DATE
2 Sep 77

APPENDIX G

BUILDING 104 PROCESS FLOW DIAGRAM (NEESA, 1983)

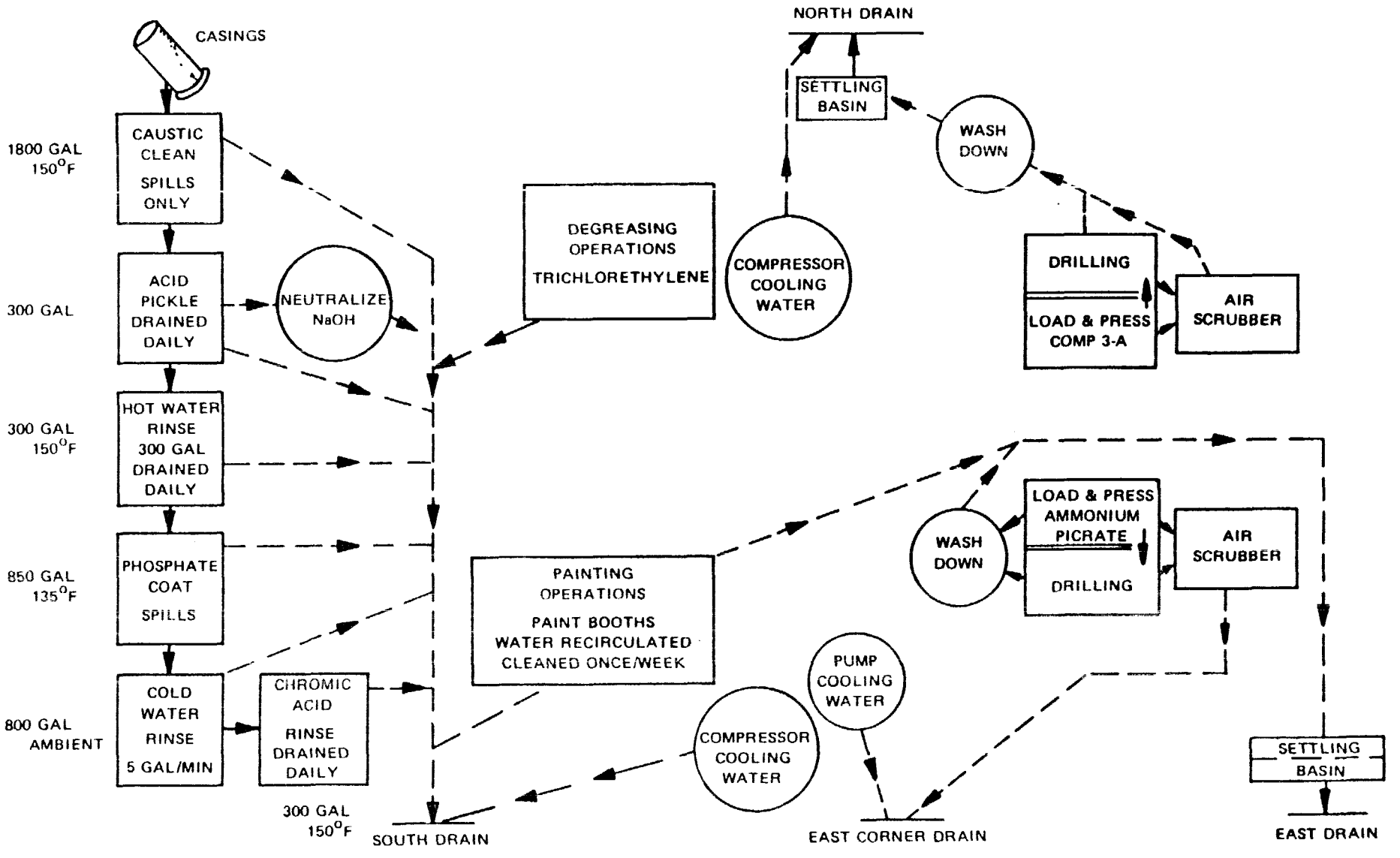


Figure 6.1-11 Bldg. 104, Medium Calibre Projectile Loading 5" Projectile Process Flow Diagram Until 1979

(Initial Assessment Study, NEESA, 1983)